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The MULTISAR Team includes Neal Wilson, Shannon Burnard, Alberta Environment and Parks (AEP), Alberta Conservation Association (ACA), the Prairie Conservation Forum (PCF) and Ducks Unlimited. Megan McGlynn, summer wildlife technician for Antelope Creek Habitat Development Area, completed the wildlife inventories with assistance from MULTISAR (Amanda MacDonald, Julie Landry-DeBoer, Adam Moltzahn, and Phil Rose (ACA)). Additional wildlife surveys were completed by Joel Nicholson and Mecah Saudi. Megan McGlynn completed the wildlife report. Range surveys were conducted by a number of rangeland technicians working under contract for the Alberta Fish and Game Association. Keefer Ecological Services Ltd. collated the range inventory data and completed the range analysis and summary report. Kristen Rumbolt Miller compiled both reports into this Habitat Conservation Strategy report. Thank you to Ross Adams (AEP), Joel Nicholson (AEP), and Carson McCormick (DUC) for their input and for being a part of the Antelope Creek Habitat Development Area team. Katheryn Taylor (PCF) and Brad Downey (ACA) coordinated the MULTISAR project and provided input into this strategy.

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The MULTISAR Program is a collaborative effort between:

Alberta Conservation Association
Conserving Alberta's Wild Side

Alberta Environment and Parks

PRAIRIE CONSERVATION FORUM

Cows and Fish

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EXECUTIVE SUMMARY

The Grassland Natural Region of Alberta is home to 75% of Alberta's species at risk. Conservation efforts to maintain and enhance wildlife habitat and rangelands for both species at risk and cattle production are the primary objectives of MULTISAR and the Habitat Conservation Strategy (HCS). The management goals, objectives and implementation of the strategy are based on a collaborative process involving the stakeholders on the MULTISAR Habitat Conservation Strategy Team. The Antelope Creek Habitat Development Area HCS team will work together to balance the needs for healthy rangelands and quality fish and wildlife habitats through managed grazing and habitat improvement projects.

The Antelope Creek Habitat Development Area is located just over 10 km west of Brooks in the Dry Mixedgrass Natural Subregion of Alberta. The property encompasses approximately 5,500 acres and is managed as a partnership between the Alberta Fish and Game Association (AFGA), Wildlife Habitat Canada (WHC), Ducks Unlimited Canada (DUC) and Alberta Environment and Parks (AEP). The partnership was established in 1986 and is a success story that demonstrates that it is possible for ranching, oil and gas operations, and wildlife to co-exist on the same property.

Wildlife surveys were completed on the ranch in June 2019 and May 2021 to provide baseline data and identify key wildlife habitats to aid in the development of management recommendations. Surveys included multi-species (point count) surveys, as well as targeted surveys for burrowing owls, raptors, sharp-tailed grouse, amphibians, and wetland birds. A total of 86 wildlife species were recorded on the ranch, of which 20 are considered to be species at risk at the provincial or federal level. Significant observations included a pair of ferruginous hawks, which were recorded on the ranch for the first time, chestnut-collared longspur, western grebe, Sprague's pipit, and loggerhead shrike. Based on the information gathered, wildlife management objectives are focused on eight priority species or groups of species. They are the burrowing owl, ferruginous hawk, grassland birds, loggerhead shrike, plains spadefoot, pronghorn, Richardson's ground squirrel, and wetland bird species.

Rangeland surveys were conducted on native pastures on the property from 2015 to 2018 to provide baseline data and determine sustainable livestock grazing capacities to aid in the development of management recommendations. These surveys included 230 vegetation inventories (detailed transects) with associated range health assessments, and an additional 88 range health (visual) assessments. Based on these assessments, range health on the Antelope Creek Habitat Development A rea was rated as 18% *high healthy*, 30% *healthy*, 34% *high healthy with problems*, 13% *low healthy with problems*, and 4% *unhealthy*. Twenty seven (27) plant communities were identified on the property, including 17 reference plant communities and 10 conditional communities. A total of 136 vascular plant species were observed on the property, of which four are classified as noxious and prohibited noxious weeds species.

Based on the results of the wildlife surveys and the range and riparian health assessments, management recommendations were developed for the Antelope Creek Habitat Development Area with the goal of contributing to multi-species conservation and rangeland sustainability. The primary management recommendation for the ranch is for the maintenance of its healthy rangeland. Additional recommendations include tolerating Richardson's ground squirrels where possible, due to their importance to the area's species at risk, weed control, fence reflectors where fences border or cross wetlands, and salting away from sensitive habitats.

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INTRODUCTION

The Antelope Creek Habitat Development Area is located in the Dry Mixedgrass Natural Subregion, one of four Natural Subregions within the Grassland Natural Region of Alberta. The Grassland Natural Region is home to a wide array of plant and animal species, including 75% of Alberta's species at risk (derived from the "General Status of Alberta Wild Species 2010" (AEP 2010) (refer to the "Species Designations" document on the USB flash drive included with this report). "Species at Risk" is a general term used to describe plant and animal species that have a low or declining population and are sensitive to human and/or natural disturbances. Special management measures may be required to prevent them from disappearing from the province or to assist in their recovery. Many of these species depend on native grasslands for their survival; however, only 48% of grasslands in Alberta's Grassland Natural Region have been retained since the province was settled (PCF 2019). What remains is under continuous pressure from the single or cumulative effects of agricultural, industrial, urban and sub-urban developments and human recreation, all of which have placed great limitations on the habitats that support prairie species at risk. The majority of the remaining natural prairies are now privately managed and are primarily used for livestock production. Efforts to maintain and enhance wildlife habitat for species at risk and rangeland sustainability can only be successfully achieved through a voluntary and collaborative approach with landowners and leaseholders. MULTISAR[1] strives to achieve multi-species conservation at a landscape level by collaborating with ranchers to find management solutions that mutually benefit the grassland ecosystem, designated species at risk and their ranching operation. This Habitat Conservation Strategy (HCS) is the result of detailed plant and wildlife inventories and range and riparian health assessments, which provide the data to support the range management recommendations and habitat improvement projects listed in this report and ultimately contribute to multi-species conservation and rangeland sustainability in the Grassland Natural Region of Alberta.

The MULTISAR HCS contains specific management goals that balance the conservation needs of multiple species of fish and wildlife, including species at risk, with the need for sustainable rangelands. The management objectives and implementation of the strategy are based on a collaborative process involving the stakeholders that comprise the MULTISAR HCS Team.

The Antelope Creek Habitat Development Area HCS Team includes Neal Wilson, Shannon Burnard, AEP, ACA, PCF, and DUC, who will work together to achieve healthy rangelands and fish and wildlife habitats through managed grazing and habitat improvement projects.

1.1 Project Goals and Objectives

The goals of the Antelope Creek Habitat Development Area Habitat Conservation Strategy are:

- To adopt a collaborative process in the development of the strategy;
- To maintain or enhance habitat for multiple wildlife species including species at risk;

[1] MULTISAR stands for Multiple Species At Risk and reflects its multiple partners: agricultural producers, Alberta Conservation Association, Alberta Environment and Parks, Prairie Conservation Forum, Cows and Fish, and others. Species at risk (SAR) is a general term for plants and animals that may be declining or are naturally rare in Alberta.

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- To demonstrate effective management of range resources that will provide mutual benefits to both the prairie ecosystem and the ranching operation;
- To establish sustainable grazing practices that are economically viable and desirable for ranching;
- To utilize an adaptive management process[2] in the implementation of the strategy.

The following objectives will assist in achieving the goals:

- Determination and refinement of range sites and habitats on the ranch based on the Grassland Vegetation Inventory (GVI);
- Completion of detailed wildlife inventories of the ranch;
- Completion of a detailed range inventory and range health assessment of the ranch;
- Delineation and mapping of range sites, habitats and watercourses, as well as man-made features such as water developments, fence lines, roads and trails which will be used as a management planning tool for the strategy;
- Interpretation and analysis of wildlife inventories and habitat for the selection of key species as priority for management. The strategy will identify which habitats require maintenance and which sites or areas of the ranch may benefit from enhancements;
- Establishment of grazing recommendations based on the range inventory and wildlife objectives that will help establish range health goals that are acceptable to the land managers. These objectives may include such actions as developing additional water sources, cross-fences and/or salting locations, all of which can promote desired cattle distribution, improve water quality and improve wildlife habitat;

1.2 Purpose and Application of the MULTISAR HCS

The MULTISAR HCS is intended as a planning tool for the development and maintenance of sustainable wildlife habitat and forage production for livestock. The MULTISAR HCS includes:

- Identification and conservation of priority wildlife species and associated habitats, sensitive range sites, plant communities and rare plant occurrences;
- Guidance to Neal Wilson and Shannon Burnard, DUC, ACA, PCF, and AEP in the maintenance or enhancement of wildlife habitat and range health;
- Guidance to Neal Wilson and Shannon Burnard, DUC, ACA, PCF and AEP for the establishment of sustainable stocking rates for livestock grazing on the Antelope Creek Habitat Development Area land;
- Guidance and information for pre-site assessments on Antelope Creek Habitat Development Area land for potential industrial development;
- An adaptive management process which assesses the responses of the strategy and determines through monitoring if the strategy is succeeding as planned or requires changes to achieve the desired outcome.

[2] For the purpose of this report, adaptive management encourages the testing of assumptions or concepts in fish & wildlife and range management, observing the response or outcome and adjusting the management approach where necessary.

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2.0 STUDY AREA

2.1 Selection Rationale

In 2019 MULTISAR was approached by the Antelope Creek Habitat Development Area Management Committee to assist summer wildlife technician, Megan McGlynn, with conducting wildlife surveys on the property. In 2020, AEP tasked MULTISAR with compiling the results of the wildlife surveys with the rangeland survey results (completed from 2015 to 2018 by Keefer Ecological Services Ltd.) into this Habitat Conservation Strategy report. On its own, Antelope Creek Habitat Development Area would be a suitable candidate for a Habitat Conservation Strategy as it is located in a priority area for multiple species at risk and has high value for individual species at risk and as a demonstration or educational site.

2.2 Description and Location

The Antelope Creek Habitat Development Area was established in 1986 through a partnership including the then Alberta Fish and Wildlife Division, Alberta Fish and Game Association (AFGA), Wildlife Habitat Canada (WHC) and Ducks Unlimited Canada (DUC) under a joint miscellaneous lease issued to the AFGA. This partnership demonstrates that it is possible for ranching, oil and gas operations and wildlife to co-exist on the same property.

The Antelope Creek Habitat Development Area is located within the Dry Mixedgrass Natural Subregion, one of four subregions within the Grassland Natural Region of Alberta (Figure 1). The Dry Mixedgrass Natural Subregion makes up 47.5% of the Grassland Natural Region (Adams et al. 2013). It is an expanse of level to gently undulating semi-arid prairie, broken in places by coulees, valleys, badlands and dune fields. The warm, dry climate supports grasses, shrubs and herbs that are adapted to summer droughts (Natural Regions Committee 2006). Approximately 60% of the Dry Mixedgrass prairie remains in a native state today (PCF 2021).

The property encompasses approximately 5,500 acres and is located 10 km west of Brooks within the County of Newell in Township 19 and Range 16, west of the 4th Meridian. The property is bordered to the east by San Francisco Lake. There are also 36 constructed wetlands on the ranch which are managed by DUC, in addition to many ephemeral wetlands and canals that connect managed basins. The ranch consists of 4,950 acres of native grassland, which is the largest habitat type on the ranch, representing approximately 90% of the property. Figure 2 shows the names and location of pastures on the Antelope Creek Habitat Development Area.

2.3 Land Use

The primary land use on the Antelope Creek Habitat Development Area is cattle grazing. Grazing primarily takes place on the ranch between May and October, with cattle being rotated throughout the pastures during this time. The ranch also includes tame pastures under flood and pivot irrigation, constructed and natural wetlands, irrigation canals, and a significant industrial footprint from oil and gas. The Antelope Creek Habitat Development area is accessed via Cassils Road to the south. Due to the extensive industrial activity on the property, there is a vast network of roads and trails throughout the ranch. Non-motorized recreation, such as hunting, hiking, and birdwatching, is also permitted and encouraged on the property and there are designated parking areas for public access.

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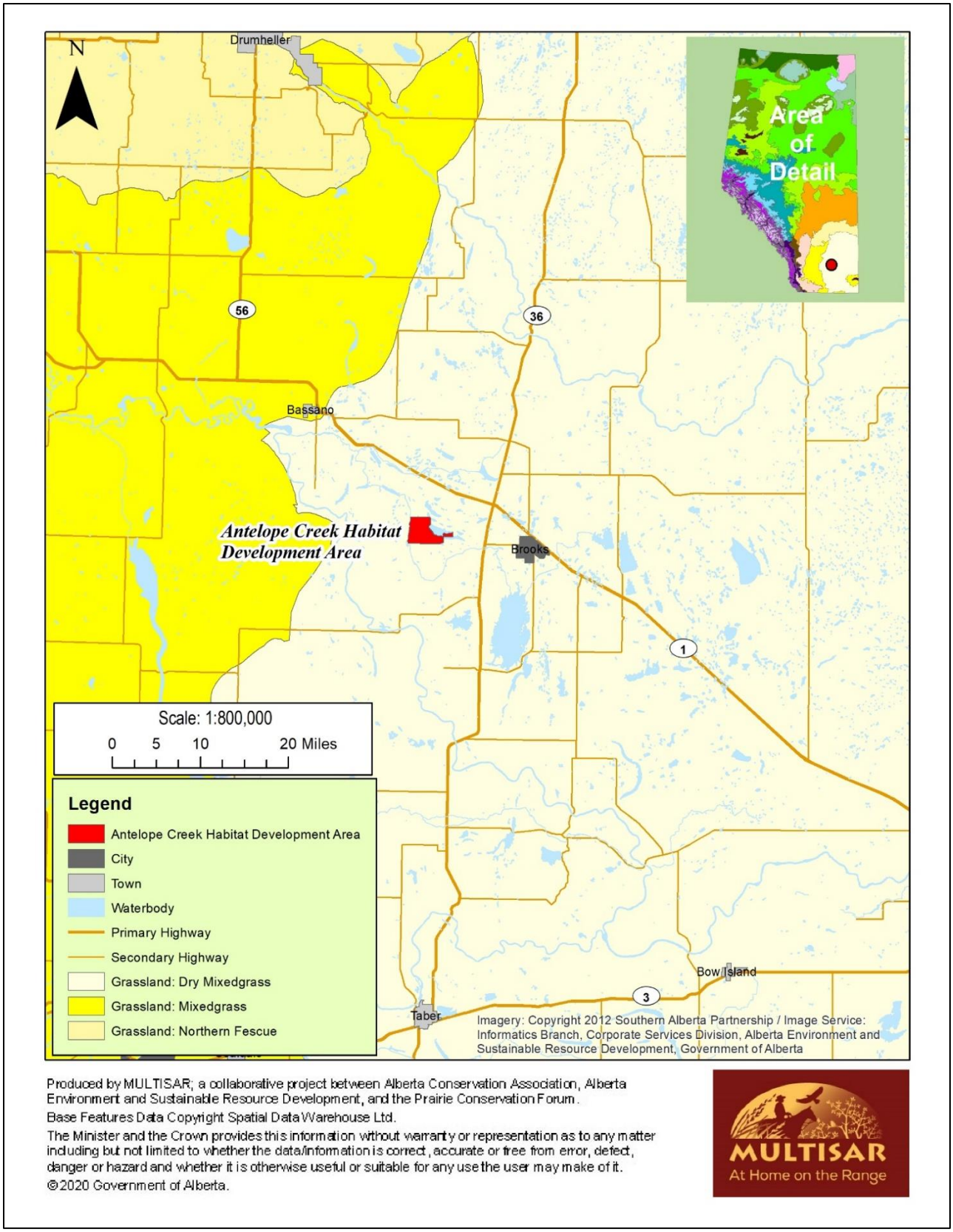

Figure 1. Location of the Antelope Creek Habitat Development Area within the Natural Subregions of Alberta.

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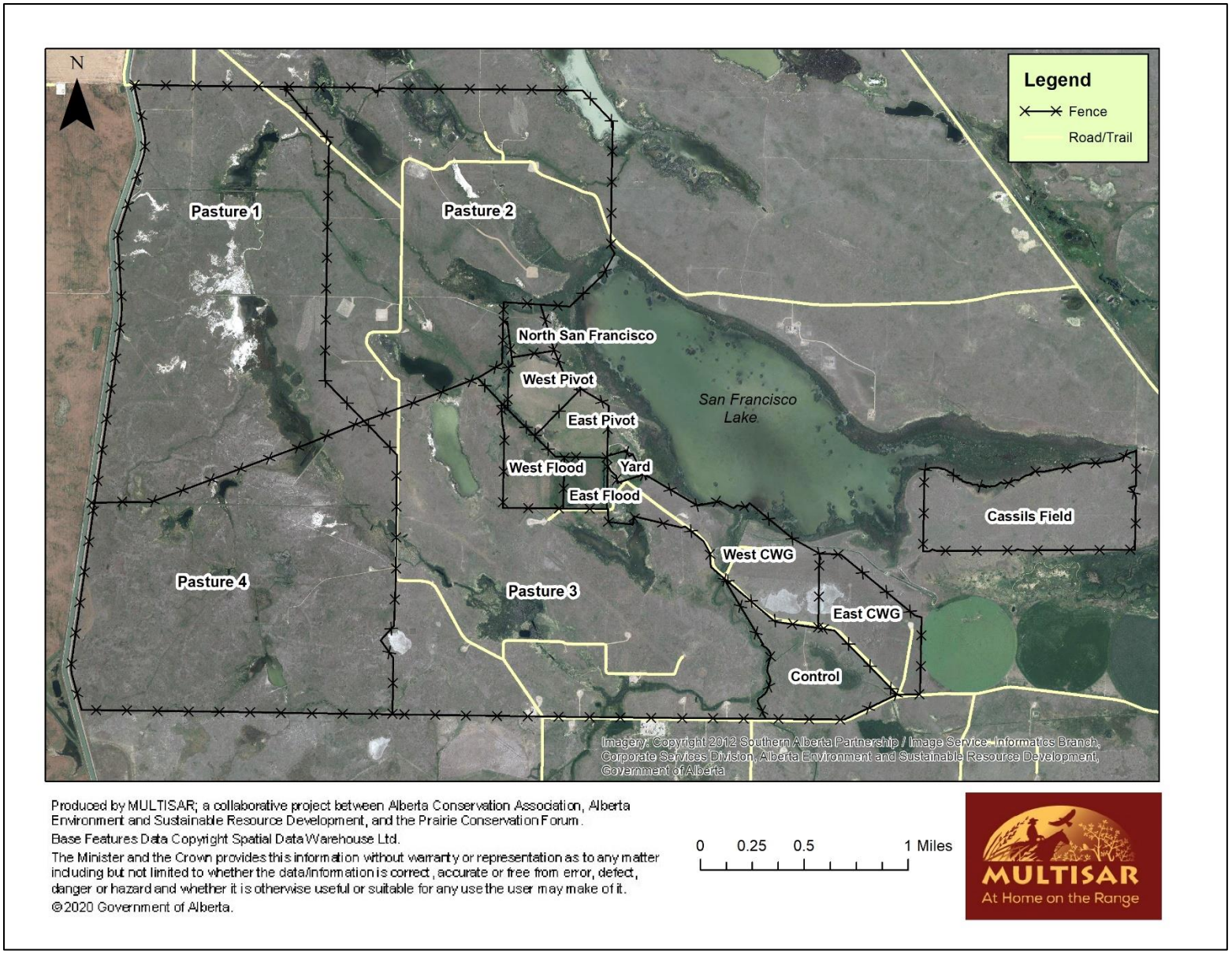

Figure 2. Names and locations of pastures on the Antelope Creek Habitat Development Area.

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2.4 Climate

The Dry Mixedgrass Natural Subregion has the warmest summers, longest growing season and lowest precipitation of any Natural Subregion in Alberta (Natural Regions Committee 2006). Summers are short, with warm to hot days, and cool nights, and winters are long and cold (Adams et al. 2013). The mean daily maximum of the warmest month in the Dry Mixedgrass Natural Subregion is 26.2°C, while the mean daily minimum of the coldest month in this subregion is -17.7°C (Natural Regions Committee 2006). The Dry Mixedgrass Subregion has an average of 1690 effective growing degree days (Natural Regions Committee 2006). Chinooks do occur in the Dry Mixedgrass, but are less frequent than in the Mixedgrass and Foothills Fescue Natural Subregions (Natural Regions Committee 2006). Mean annual precipitation for the Dry Mixedgrass is 333 mm, 72% of which falls during the growing season (Natural Regions Committee 2006). Additional climate data is available for two weather stations in the vicinity of the Antelope Creek Habitat Development Area and is listed in Table 1.

Table 1. Climate data from nearby weather stations[3].

Station	Elevation (m)	Mean Daily Temp. (°C)	Total Precipitation (mm)	Mean Precipitation as Rain (%)	% of Precipitation from May to September	Effective Growing Degree Days (EGDD >5°C)
Brooks Hort. Centre	758	4.2	348.0	74.8	64.2	1713
Brooks N	759	N/A	354.2	72.9	62.4	N/A

2.5 Historic Wildlife Information

Prior to conducting field work, a search of AEP's Fish and Wildlife Management Information System (FWMIS) was conducted. In total, FWMIS contained over 2,130 entries of previously recorded wildlife observations for the ranch, ranging from 1949 to 2017, largely from the various wildlife research projects and industrial pre-development surveys conducted on the property over the years. Notable records include several burrowing owl nests, of which the last active nest recorded on the ranch was in 2004; plains spadefoot, which were recorded at several breeding wetlands on the property in 2007; several observations of loggerhead shrike; and two observations of trumpeter swans at San Francisco Lake. There were also numerous observations of grassland bird species, including the Sprague's pipit and chestnut-collared longspur. Historic observation locations for the burrowing owl, plains spadefoot, loggerhead shrike, and trumpeter swan are shown in Figure 3.

2.6 Historic Rare Plant Information

A search of AEP's Alberta Conservation Information System (ACIMS 2020) was conducted and contained two previously recorded rare plant observations for the Antelope Creek Habitat Development Area. Dwarf woolly-heads *(Psilocarphus brevissimus)* were recorded at two separate areas in Pasture 4 in 2010 (Figure 4). This species is a species of *Special Concern* in Canada and is ranked by ACIMS as S2[4]. Dwarf woolly-heads occur on the drying edges of temporary wetlands (Environment Canada 2016). Approximately 1500 plants were observed along the edge of an ephemeral wetland, approximately 20 m x 15 m in size. An additional 280 plants were recorded adjacent to a semi-permanent wetland to the north, in an area

[3]: Adams et al. 2013

[4] Known from 20 or fewer occurrences or vulnerable to extirpation due to other factors

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approximately 10 m x 20 m in size. Habitat loss, fragmentation, and degradation is a primary conservation concern for this species. Prolonged periods of drought is also thought to be a limiting factor for dwarf woolly-heads (Environment Canada 2016).

2.7 Grazing Management Information

Neal Wilson and Shannon Burnard are the current managers of the Antelope Creek Habitat Development Area and have been managing the ranch since 2005. Currently, the ranch sustains 285 cow/calf pairs and the ranch employs a complimentary, deferred rotational grazing system. For native pastures, the season of use is staggered to avoid grazing fields during the same period each year. Irrigated pastures and pastures dominated by crested wheat grass are grazed early in the season to defer grazing on native pastures until later in the growing season. Native pastures are typically grazed with an on date of July 1st - 15th and an off date of October 15th - 28th. Flood irrigated fields have been reserved for wildlife use only in recent years. In an effort to help manage crested wheat grass on the ranch, crested wheat grass is skim grazed in the spring between May 15th and June 1st. Total livestock use of native pastures was 1766 AUMs in 2017, 1603 AUMs in 2018 and 1684 AUMs in 2019 (Baker and Rushton 2020).

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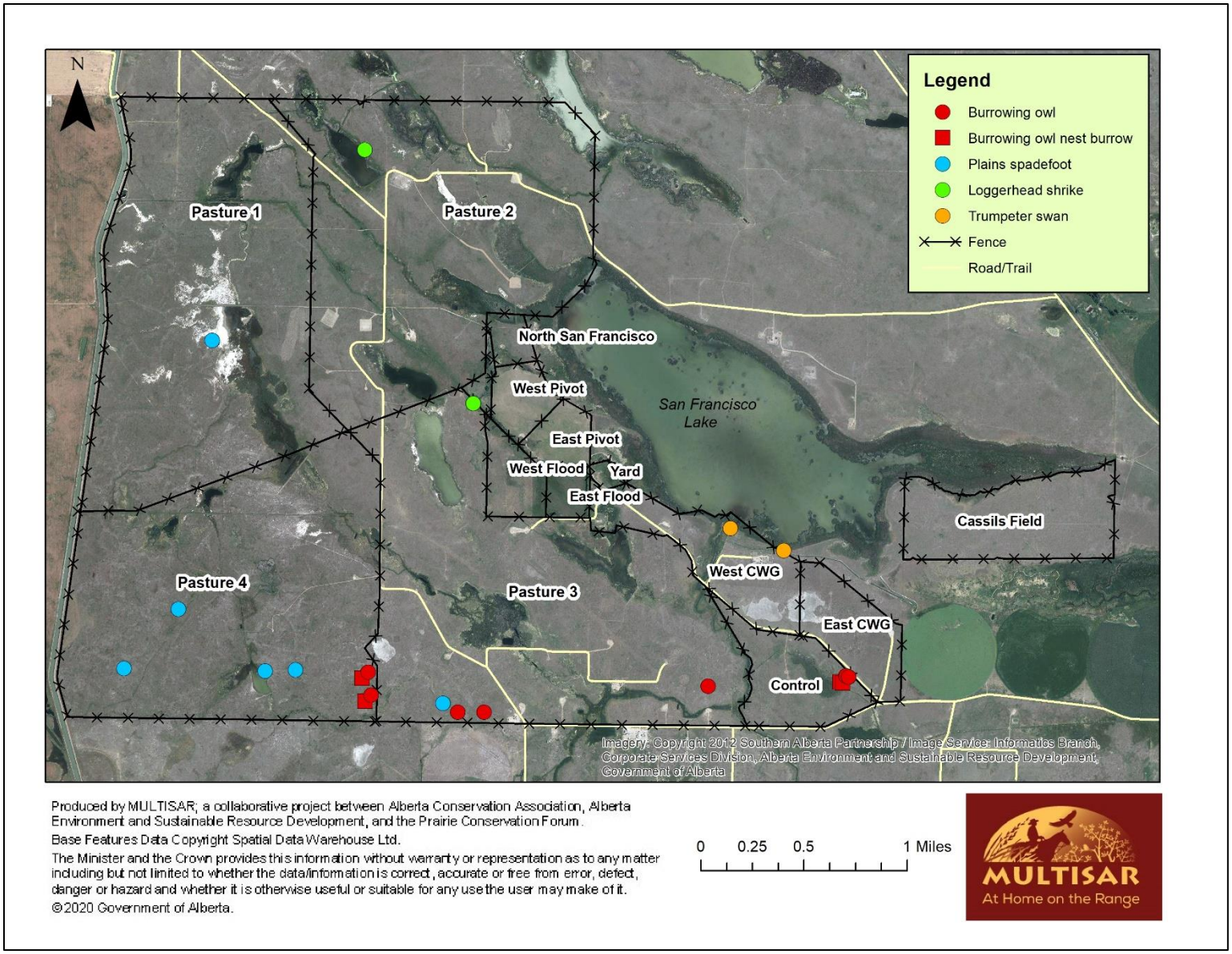

Figure 3. Historic burrowing owl, plains spadefoot, and loggerhead shrike observations for the Antelope Creek Habitat Development Area.

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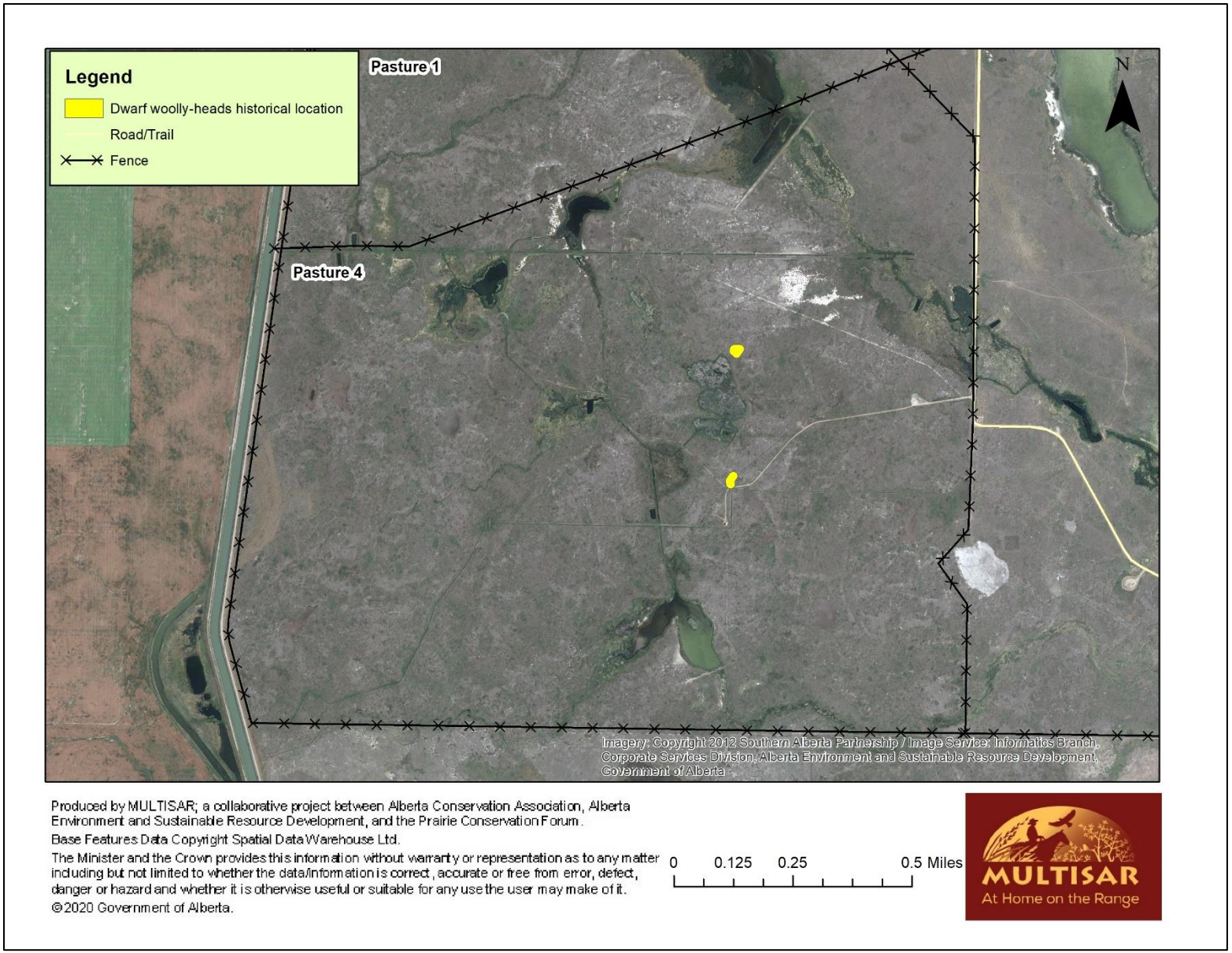

Figure 4. Historic rare plant occurrences for the Antelope Creek Habitat Development Area.

3.0 METHODS

3.1 Wildlife Surveys

Wildlife surveys were completed on the Antelope Creek Development Area to provide detailed baseline data on wildlife occurring on the property and to aid in the development of wildlife management recommendations. Wildlife surveys in 2019 were conducted by Megan McGlynn, the seasonal wildlife technician for Antelope Creek Ranch, as well as several wildlife biologists from MULTISAR. Wildlife surveys in 2021 were conducted by two AEP biologists. The detailed wildlife inventories incorporated various survey methods including multi-species (point count[5]) surveys, as well as targeted surveys for burrowing owls, raptors, amphibians, and other wetland species. The methods for all wildlife surveys conducted on the property are detailed in the following sections.

3.1.1 Multi-Species Surveys

3.1.1.1 Multi-Species Wildlife Point Mapping Procedure

Prior to conducting surveys in the field, the ranch's fence lines and pastures were mapped using geographical information system (GIS) software (ArcMap 10.3.1). Grassland Vegetation Inventory (GVI)[6] range site polygons were applied to maps as the survey units for the multi-species wildlife survey points.

Wildlife points with a radius (survey distance) of 100 m and 50 m were placed within each polygon that would accommodate a point of this size without overlap of neighboring polygons or fence lines. Mapping wildlife survey points within the boundaries of GVI polygons helps ensure that the observer, when in the field, records wildlife observed only within a single GVI polygon. This allows for later correlations between wildlife and the range health and vegetation communities of that particular GVI polygon. Figure 5 shows the location and survey distances of all multi-species wildlife points surveyed on the Antelope Creek Habitat Development Area in 2019 and 2021.

3.1.1.2 Multi-Species Survey Field Methodology

Multi-species wildlife surveys on the ranch were conducted on June 24th, 2019 and May 26th and 27th, 2021 in the early morning from sunrise up to 11:00 am, when the wind was less than 20 km/hour, and there was no rain or snow. Surveyors walked to their assigned, pre-determined wildlife survey points and waited one to two minutes prior to beginning the count. This allowed for birds to settle down and acclimate to the presence of the surveyor. Surveyors then completed a five-minute wildlife survey in which all birds, mammals, amphibians and reptiles seen or heard within the applicable survey distance were recorded. Table 2 shows the survey distances used in the multi-species surveys and the distance (from surveyor) categories in which wildlife were recorded. While at the survey location, a Robel pole measurement was also taken following protocols by Robel et al. (1970). These visual obstruction readings are useful for assessing grassland nesting cover for birds.

[5] A point count is when an observer records all species seen or heard from a fixed location within a set distance and duration of time.

[6] GVI is a biophysical and land-use inventory by the Government of Alberta. It is comprised of ecological range sites based on soils information for areas of native vegetation (e.g. sandy, limy, gravel, etc.) and general land use for areas of non-native vegetation (e.g. crop (irrigated)).

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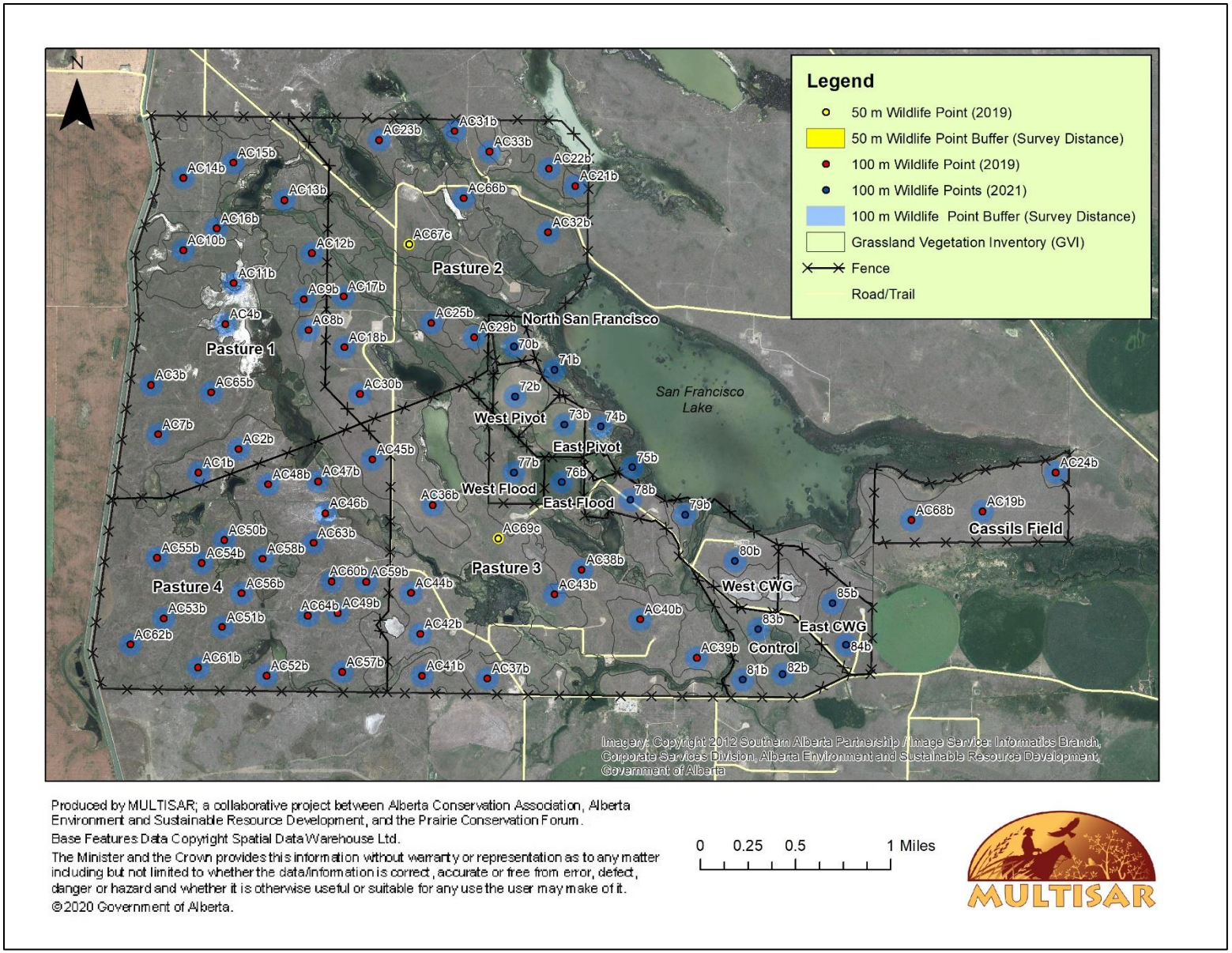

Figure 5. Multi-species wildlife survey point locations completed on the Antelope Creek Habitat Development Area in 2019 and 2021.

Table 2. Description of sampling distance categories used in multi-species (point count) wildlife surveys.

Point Size (radius – m)	Distance (from surveyor) Categories in Which Species Were Recorded (m)
100 m	Within 50 m 50 – 100 m
50 m	Within 50 m

Between survey locations, wildlife encountered that were not observed at previous locations, were recorded incidentally and a GPS location was taken. Habitats, such as wetlands, dugouts, canals, drainages, and tree and shrub complexes, were visually assessed for their suitability for wildlife. GPS locations were taken when habitat features, such as nests, dens, leks, or breeding sites, were encountered.

3.1.2 Targeted Surveys

Targeted surveys were conducted in conjunction with multi-species surveys in key habitats for wildlife that may not have been detected during multi-species surveys. Surveys for each species and species group followed protocols outlined in Alberta Environment and Park's Sensitive Species Inventory Guidelines document (GOA 2013), which is included on the USB drive provided with this report.

3.1.2.1 Burrowing Owl Survey

An electronic playback survey for burrowing owls was conducted during multi-species surveys in areas of suitable habitat. A wildlife caller was used to broadcast a burrowing owl call to the area while the surveyor looked and listened for responding owls. If an owl was located, the surveyor attempted to locate the nest burrow, at which time additional information was recorded (number of owls present, sign, site photos, GPS location, etc.).

3.1.2.2 Raptor Nest Survey

Treed and shrubby areas on the ranch were searched for the presence of raptor nests. Where new and/or historic raptors nests were identified and determined to be active, site photos and a GPS location were taken and the number of individuals present (adults and young) was recorded.

3.1.2.3 Amphibian and Wetland Species Survey

Surveyors walked the shorelines of all water bodies encountered, looking and listening for the presence of wildlife, including amphibians, waterfowl, and shorebirds. Water bodies searched on the ranch included permanent and ephemeral wetlands, dugouts, irrigation canals, and the western shoreline of San Francisco Lake.

3.2 Vegetation Inventories and Range Health Assessments

3.2.1 Range and Habitat Mapping Procedure

Range inventories were completed by summer technicians contracted by Alberta Fish and Game Association during the summers of 2015, 2016, 2017, and 2018. Rangeland inventory data was compiled, analyzed, and summarized in a final report by Keefer Ecological Services Ltd. The Grassland Vegetation Inventory (GVI) was used as the basic survey units for the rangeland assessments. Contrary to what its name implies, GVI is not so much a vegetation inventory, as it is a biophysical and land-use inventory. At its core, it is comprised of ecological range sites based on soils information for areas of native vegetation

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and general land use for areas of non-native vegetation, namely those associated with agricultural, industrial, and residential developments. Each GVI polygon can be split (deciled) to include one dominant, and up to three subdominant range sites. These maps were then used as the basic unit of interpretation for vegetation, range site and habitat descriptions and provided detailed site information for delineation of polygons and site selection for detailed transects and range health assessments.

Field observations and ground-truthing determined if the GVI polygons needed to be merged, split, or revisions, made to the dominant or subdominant ecological range site types. Polygons bisected by fences were split and each side assessed separately to account for any differences in management. A description of what constitutes each ecological range site is included on the USB provided with this report. The extent of each range site was mapped and tabulated using the dominant range site category. For the purposes of summarizing the data on a map, the extent of the subdominant range sites is not represented. Table 3 is a breakdown of the size of each range site. All polygons with the same dominant ecological range site were combined to arrive at the total acreage. Figure 6 shows the extent of each ecological range site on the Antelope Creek Habitat Development Area.

Table 3. Acreages of each ecological range and anthropogenic land use site on the Antelope Creek Habitat Development Area.

Ecological Range Sites	Area (ac)	Area (%)
Blowout (BlO)	2842.3	57.4
Dugout	1.9	0.04
Industrial	21.7	0.4
Lentic	610.8	12.3
Loamy (Lo)	710.9	14.4
Overflow (Ov)	78.8	1.6
Riparian	81.6	1.7
Roads	48.0	1.0
Saline Lowland (SL)	332.5	6.7
Subirrigated (Sb)	221.7	4.5
Total	**4950.2**	**100**

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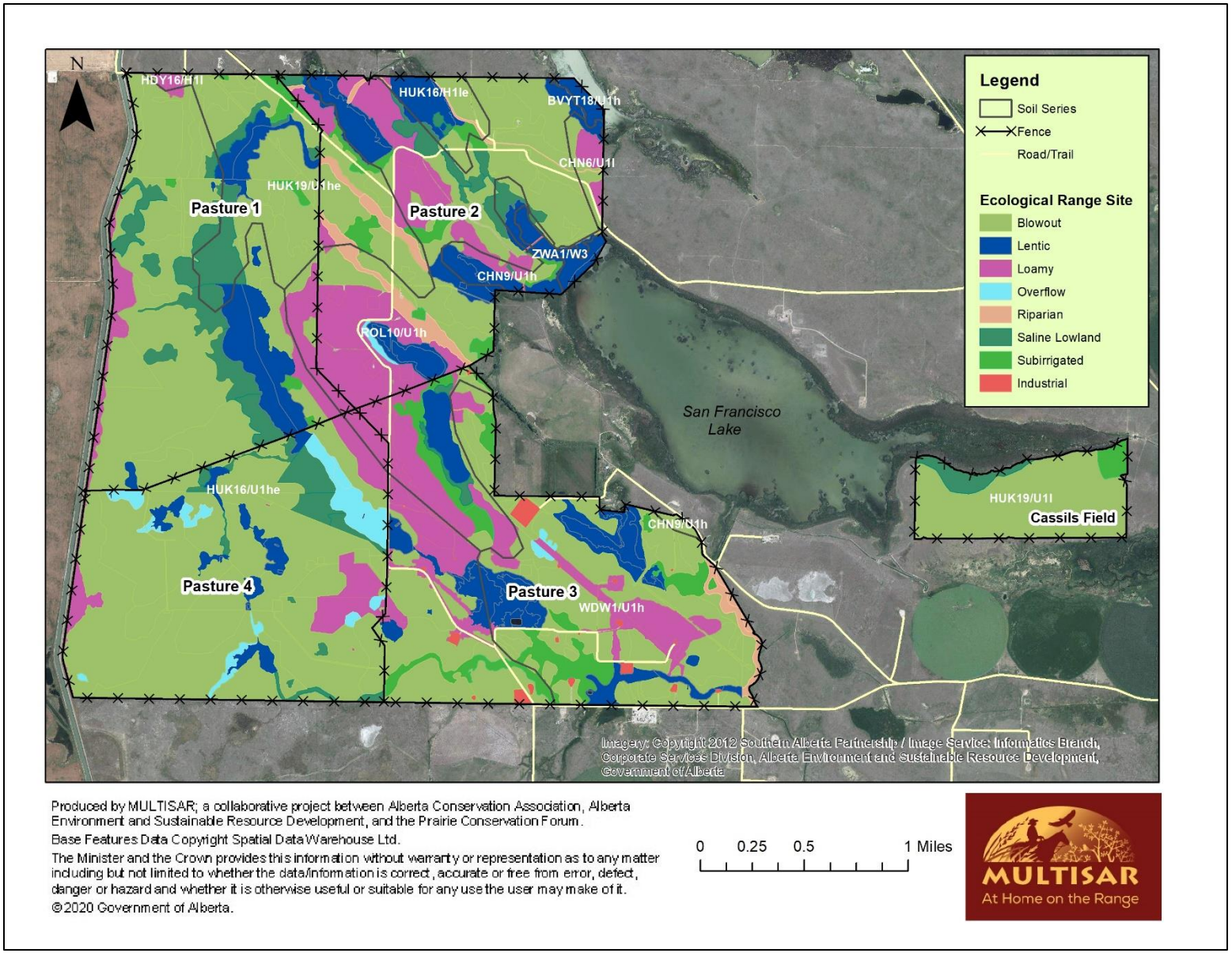

Figure 6. Ecological range sites and soil types on the Antelope Creek Habitat Development Area.

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3.2.2 Correlation of Soils and Range Sites

The Dry Mixedgrass Natural Subregion is dominated by Brown Chernozemic and Solonetzic soils which are predominantly derived from glacial till parent material (Adams et al. 2013). Soils on the Antelope Creek Habitat Development Area are dominated by brown solodized solonetz soils and to a lesser extent, solonetzic brown chernozemic soils, developed from glacial till and glaciolacustrine parent material. Minor amounts of orthic brown chernozem and brown solod soils are present on the ranch as well. The dominant and subdominant soil series and associated ecological range sites for the property are outlined in Table 4. Soil series types on Figure 6 (previous page) are labelled with a combination of the dominant and subdominant (if applicable) soil series followed by any additional modifiers relating to landform. See the Alberta Soil Information Viewer (AGRASID) for more information.

Table 4. Dominant/subdominant soil series and associated ecological range sites on the Antelope Creek Habitat Development Area.[7]

Soil Series	Name	Order	Soil Subgroup	Parent Material	Ecological Range Site	Productivity Rating
CHN	Chin	Chernozemic	Orthic Brown Chernozem	Medium glaciolacustrine	Loamy	Normal vegetation response
HDY	Halliday	Solonetzic	Brown Solod	Glacial till	Blowout Loamy	Limited by moisture or soluble salts adversely affecting plant growth
HUK	Hemaruka	Solonetzic	Brown Solodized Solonetz	Glacial till	Blowout	Limited by moisture or soluble salts adversely affecting plant growth
ROL	Ronalaine	Chernozemic	Solonetzic Brown Chernozem	Glacial till	Loamy	Normal vegetation response
WDW	Wardlow	Solonetzic	Brown Solodized Solonetz	Medium glaciolacustrine	Blowout	Limited by moisture or soluble salts adversely affecting plant growth

[7] Adams et al. (2013); ASIC (2016)

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3.2.3 Field Data Collection

The range surveys included vegetation inventories (detailed transects) and range health assessments. Inventory data collection and analysis on Antelope Creek Habitat Development Area from 2015-2019 is based on the *Rocky Mountain Forest Reserve Allotments and Grazing Leases Range Inventory Contractor Certification Manual* (AEP 2019), and the *Range Health Assessment for Grassland, Forest and Tame Pasture Field Workbook* (Adams et al. 2016).

Detailed transects were established on representative range sites in each field. The transects were established by positioning a 50-meter tape on the ground at each site, with GPS coordinates recorded at the start and end points. Plant composition and community type was determined using a Daubenmire frame (0.1 m^2). Foliar cover for grasses, forbs and shrubs were estimated and recorded on the provincial standard Vegetation Inventory Prairie MF5 Form (refer to the "Range Health Forms" document on the USB included with this report). Foliar cover of shrubs was also recorded using a 1 m^2 frame. The average cover of each species was calculated and expressed as a percent value. In addition, a 1 m^2 frame was placed at the start of the transect for photo reference and a 0.25 m^2 frame was used to collect litter values.

The relative composition and abundance of the individual species, in conjunction with the range site description were used to determine the range plant community. *The Range Plant Communities and Range Health Assessment Guidelines for the Dry Mixedgrass Natural Subregion of Alberta: Second Approximation* (Adams et al. 2013) were used to determine the plant community for the individual polygons. Where a corresponding reference community could not be determined in the guide, it was recorded based on key indicator species and coded as 'conditional'.

Range health assessments were completed in conjunction with the detailed transects. Criteria outlined in the *Rangeland Health Assessment Field Workbook* (Adams et al. 2016) was used to assign a range health score at a point along the transect. Range health assessments were also conducted without detailed inventories if the plant community and range site matched those of another part of the same polygon or a separate polygon in the same pasture. Range health assessments were performed in one of two ways: by placing a 50 m transect in representative areas and recording the dominant plant species at each 0.5 m mark, or by visually estimating and recording the dominant plant species at each location using plots. In the second method, the approximate percent cover of the 8 to 10 most abundant plant species was estimated using three Daubenmire frames placed 15-20 paces apart.

3.2.4 Data Summary, Storage and Retrieval

Vegetation composition and site description data collected on the MF5 forms was entered into the ECOSYS (Ecological Information System) database. Range health data was summarized in Microsoft Excel and linked to range health points and GVI polygons using GIS. The information stored in these databases is available for retrieval and will become part of the baseline data required for planning, range management and monitoring.

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4.0 RESULTS

4.1. Wildlife Surveys

A total of 644 wildlife observations were recorded on the Antelope Creek Habitat Development Area in 2019 and 2021 and entered into the FWMIS database. Overall, 86 different wildlife species were observed on the ranch, 20 of which are considered species at risk at either the provincial and/or federal level. Of the species observed, 78 were bird species, seven were mammals, and one amphibian was recorded. All wildlife species recorded on the ranch in 2019 and 2021 are listed in Appendix A and were mapped using GIS. Each species was placed into one of four categories based on the highest threat level assigned to it at either the provincial[8] or federal level[9,10] (refer to the "Species Designations" document on the USB drive included with this report for more information):

1) *Endangered/At Risk*,
2) *Threatened/May Be at Risk*,
3) *Special Concern/Sensitive*, and
4) *Secure*.

Of the 20 species at risk recorded on the ranch, three were *Endangered/At Risk* species, which included the ferruginous hawk, chestnut-collared longspur, and western grebe. In the *Threatened/May be at Risk* category, four species were observed, the loggerhead shrike, Sprague's pipit, short-eared owl and barn swallow. In the *Special Concern/Sensitive* category, 14 species were recorded on the ranch, including the Baird's sparrow, white-faced ibis, and common yellowthroat. The results of the various wildlife surveys completed on the ranch are detailed in the following sections. All wildlife observations on the Antelope Creek Habitat Development Area were mapped according to risk category[11] and are shown in Figure 7 and on the map sheet included at the back of this report. Notable species at risk observations observed on the ranch in 2019 and 2021 are shown in Figure 8.

4.1.1 Multi-Species Surveys

Multi-species wildlife surveys were completed across the ranch at a total of 71 locations. Species at risk were recorded at 28 (39%) of these sites. *Endangered/At Risk* wildlife were recorded at 8 (11%) of survey locations; *Threatened/May Be At Risk* species were observed at 18 (25%) of the sites; while *Sensitive/Special Concern* species were found at 14 (20%) of the sites. Secure species were found at 69 (97%) of survey locations. The most common species observed on the ranch was the savannah sparrow (*Secure*), which was recorded at 59 (83%) of the survey points. The wildlife recorded at each survey location can be found on the USB drive included with this report. A list of wildlife found within each pasture can be found in Section 5: Discussion of Wildlife and Range Results by Field.

[8] AEP 2020, GOA 2017
[9] GOC 2019
[10] A species may have different risk statuses assigned to it through legislation at the provincial and/or federal levels. For example, the ferruginous hawk is designated an *Endangered* species in Alberta (Alberta Wildlife Act), however, at the federal level, it is considered *Threatened* (Species at Risk Act (SARA)). Since an *Endangered* designation is a higher threat level than *Threatened*; MULTISAR places the ferruginous hawk into the *Endangered/At Risk* category.
[11] Locations where more than one species was observed are colored to reflect the species with the highest risk status present at that location. For example, a location where both a Baird's sparrow (*Special Concern/Sensitive*) and a thick-billed longspur (*Threatened/May be at Risk*) were observed, will be appear orange (*Threatened/May be Risk*).

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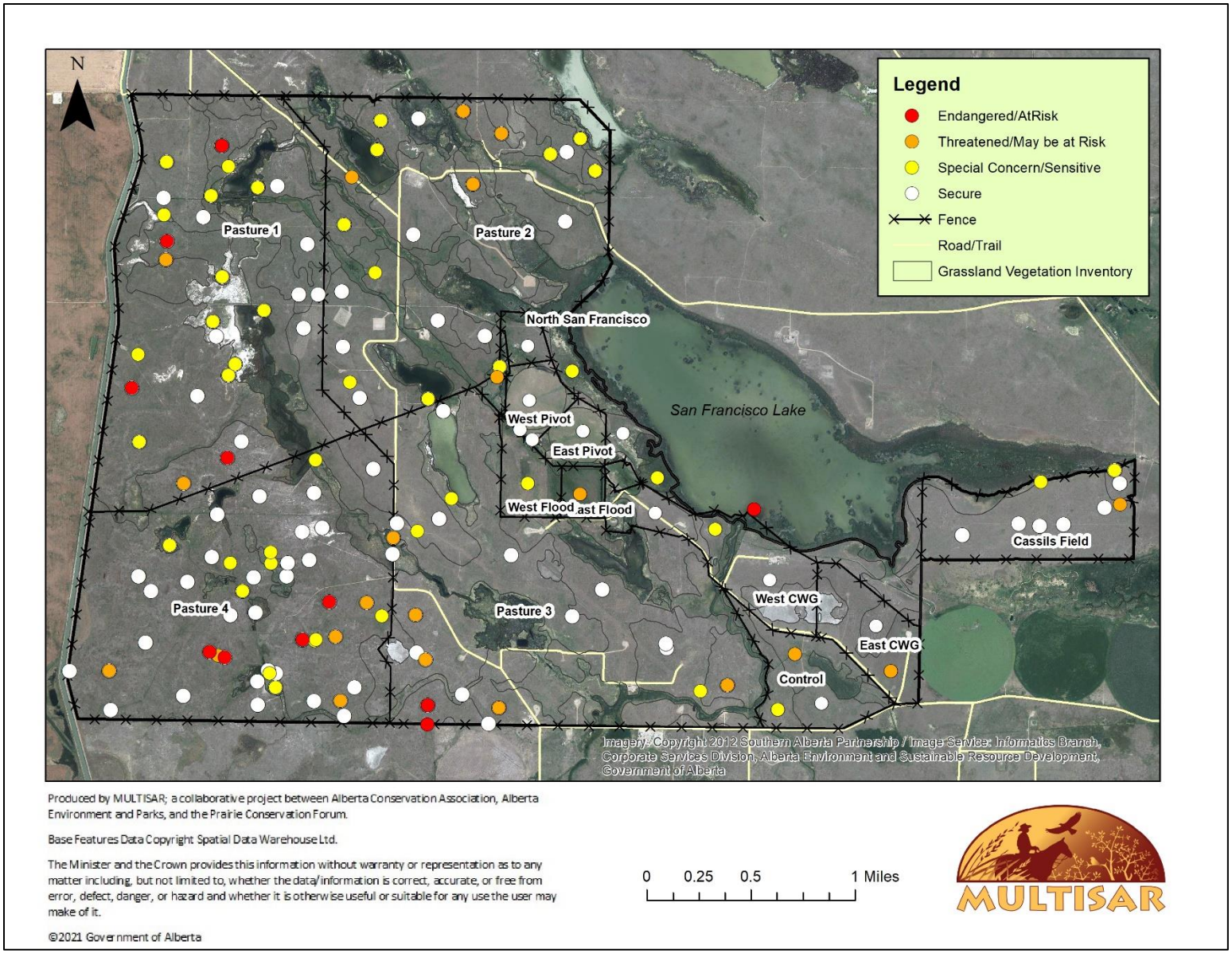

Figure 7. Species at risk observations on the Antelope Creek Habitat Development Area in 2019 and 2021.

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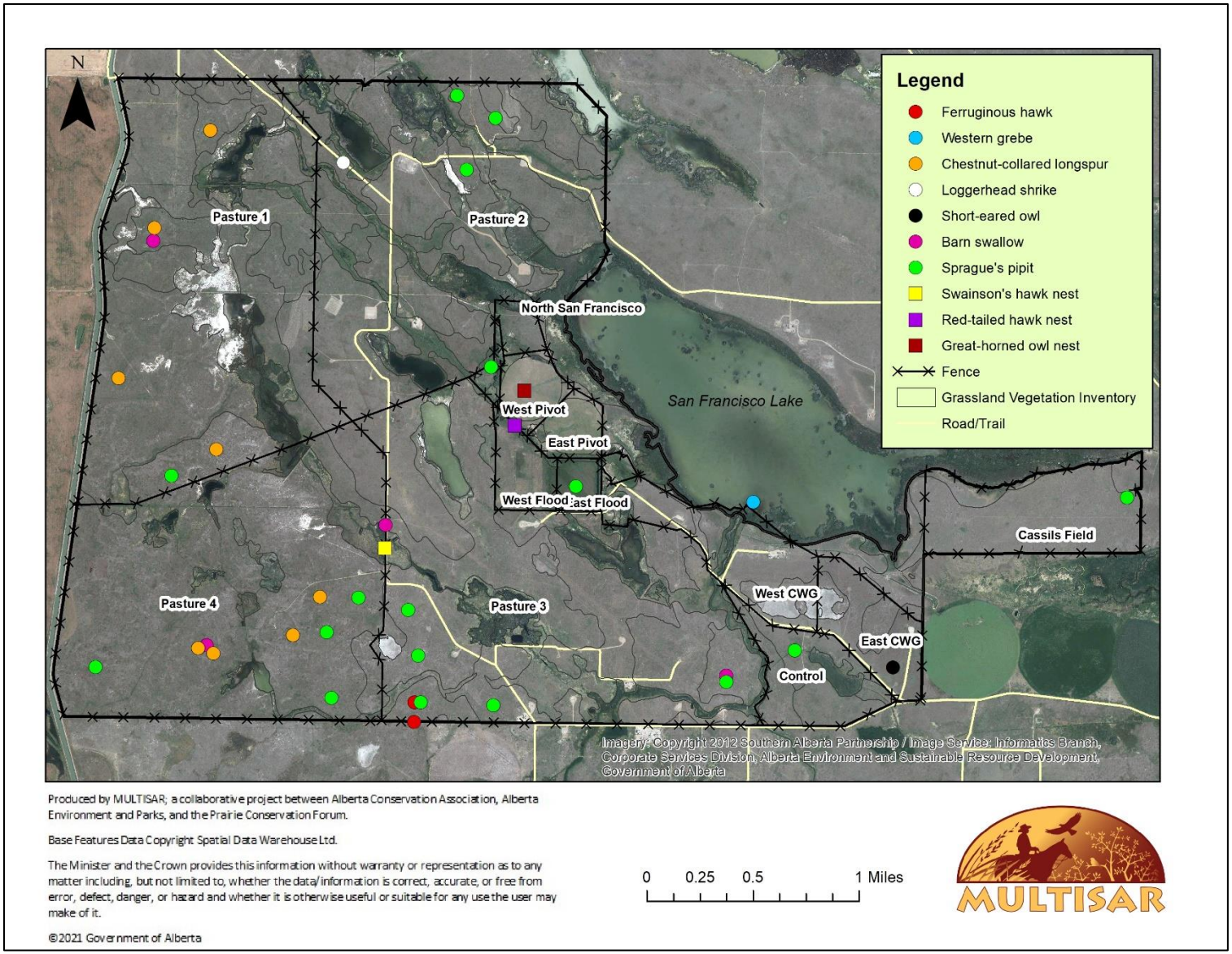

Figure 8. Notable species at risk and habitat features (nests, dens, leks, etc.) observed on the Antelope Creek Habitat Development Area in 2019 and 2021.

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4.1.2 Targeted Surveys

4.1.2.1 Burrowing Owl

Although the Antelope Creek Habitat Development Area lies within burrowing owl range, no burrowing owls were observed during the playback surveys conducted during the 2019 wildlife surveys. Burrowing owls require relatively short grass heights and abandoned badger or Richardson's ground squirrel burrows in which to nest. Taller grass heights are found across much of the ranch, with areas of shorter grass occurring in areas that have experienced increased grazing pressure. These areas are more suitable for nesting burrowing owls and typically support more ground squirrels which excavate the burrows they require. Areas of tall, dense vegetation, like those found in the ranch's many ephemeral wetland areas, are suitable for supporting populations of small mammals, such as mice and voles, which are preferred prey for burrowing owls. While the ranch may not currently support nesting owls, it may provide hunting and foraging habitat for burrowing owls in the area.

4.1.2.3 Raptors

Six raptor species were recorded on the Antelope Creek Habitat Development Area in 2019 and 2021, including a pair of *Endangered* ferruginous hawks near the southern boundary of Pasture 3. No previous records exist within the provincial FWMIS database for this species on the ranch. Preferred habitat for ferruginous hawks includes native grasslands with an abundance of their primary prey, the Richardson's ground squirrel. Areas of increased grazing pressure, such as the southwest corner of Pasture 3, often have the shorter grass heights preferred by Richardson's ground squirrel, which would be attractive to the area's ferruginous hawks.

Three raptor nests were found on the ranch in 2019 and 2021. A Swainson's hawk nest was located in a tree along a gravel road located on the eastern boundary of Pasture 4 in 2019. Swainson's hawks have been recorded nesting on, and adjacent to the ranch in the past. A great-horned owl nest and red-tailed hawk nest were also documented on the ranch. Both nests were located in the West Pivot Field and were documented during the 2021 surveys. Several northern harriers and a short-eared owl were also observed on the ranch during the wildlife surveys. An additional three raptor species have been reported by ranch management as occurring on the ranch, including the American kestrel, prairie falcon, and Cooper's hawk (McGlynn 2019).

4.1.2.4 Amphibians

The boreal chorus frog was the single amphibian species detected on the ranch during the wildlife surveys, with numerous individuals heard calling from wetlands across the property. The many wetlands on the property provide suitable amphibian habitat for this common species, as well as for the tiger salamander (species of *Special Concern*) and plains spadefoot (*May be at Risk*), which were not detected in 2019 and 2021. All of these species depend upon ephemeral wetlands in which to breed. No nighttime auditory surveys for amphibians were conducted in 2019 or 2021. The plains spadefoot are most easily detected by their breeding calls after heavy rainfall events. They exist underground for much of their life until adequate moisture brings them to the surface to breed in ephemeral wetlands. The plains spadefoot has been recorded as breeding on the ranch as breeding calls were detected at several locations within Pastures 1, 3, and 4, during the 2007 wildlife study, indicating that there are suitable breeding wetlands for the plains spadefoot on the property.

4.1.2.5 Wetland Species Survey

A total of 45 wetland affiliated bird species were observed during the 2019 and 2021 wildlife surveys. Observations include 16 species of waterfowl, 11 shorebirds, three songbirds, five grebe species, two species of tern, three gull species, two heron species, as well as the American white pelican, double-crested cormorant, and sora. Nine of these species are considered species at risk, including the black tern, white-faced ibis, and black-crowned night heron. The abundance of both ephemeral and permanent wetlands

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found on the Antelope Creek Habitat Development Area, as well as San Francisco Lake, provide habitat for a wide diversity of avian species.

4.1.2.6 Mammals

While no surveys were conducted specifically for mammals in 2019 and 2021, several mammal species were recorded during multi-species surveys and incidentally. In total, seven mammals were detected which included the pronghorn, mule deer, white-tailed deer, white-tailed jackrabbit, raccoon, Richardson's ground squirrel, and coyote. There are also records of long-tailed weasel, American badger, red fox, and muskrat occurring on the ranch (Carpenter and Nicholson 2007).

4.2 Vegetation Inventories and Range Health Assessments

4.2.1 Detailed Vegetation Inventory and Range Health Assessments

A total of 318 range health assessments, including 230 detailed transects, were completed on the Antelope Creek Habitat Development Area. From this survey work, a total of 27 plant communities were identified on the property (Figure 9), 17 of which were identified as reference or successional plant communities in the Dry Mixedgrass Range Plant Community Guide. Plant communities observed that were not listed in the guides were labeled as conditional and could potentially serve as guidelines for new plant communities. Ten (10) conditional plant communities were identified on the Antelope Creek Habitat Development Area. A total of 136 vascular plant species were identified on the property during range surveys (Appendix B).

Appendix C lists the descriptions for the coded plant communities from the Dry Mixedgrass Range Plant Community Guide.

4.2.2 Ecological Range Sites and Plant Communities

Outlined earlier in Table 4 and Figure 6 (Section 3.2.1) is a breakdown of the extent of each ecological range site on the Antelope Creek Habitat Development Area. The most prevalent ecological range site on the Antelope Creek Habitat Development Area was blowout, occupying 2,842 acres or 57% of the property. The most common plant community associated with blowout sites was a disturbed ***Western Wheat Grass – Sedge – Needle and Thread*** conditional community ***(DMGA16_d)*** that, while still retaining a significant component of native species, is shifting towards Kentucky bluegrass. This community covered 521 acres. An intact ***Western Wheat Grass – Sedge – Needle and Thread (DMGA16)*** community covered 361 acres, while a ***Needle and Thread – June Grass – Blue Grama Grass (DMGA35)*** community occupied 251 acres. Crested wheat grass is prevalent on the ranch, occurring on nearly 10% of native pastures.

Loamy was the next most common ecological range site occupying 711 acres or 14% of the property. The most common plant community associated with loamy sites was a ***Needle and Thread – June Grass – Blue Grama Grass (DMGA3)*** community covering 342 acres.

Lentic areas accounted for 12% of the Antelope Creek Habitat Development Area. The majority of lentic sites could not be assigned a published plant community.

Seven percent (7%) or 333 acres of the property is classified as saline lowlands. The most common plant community found on this range site was a ***Foxtail Barley – Kentucky Bluegrass – Western Wheat Grass (DMGB7)*** community which occurred on 96 acres. This was also the most common plant community found on both subirrigated (222 acres) and overflow (79 acres) range sites, with these sites covering 4% and 2% of the property, respectively.

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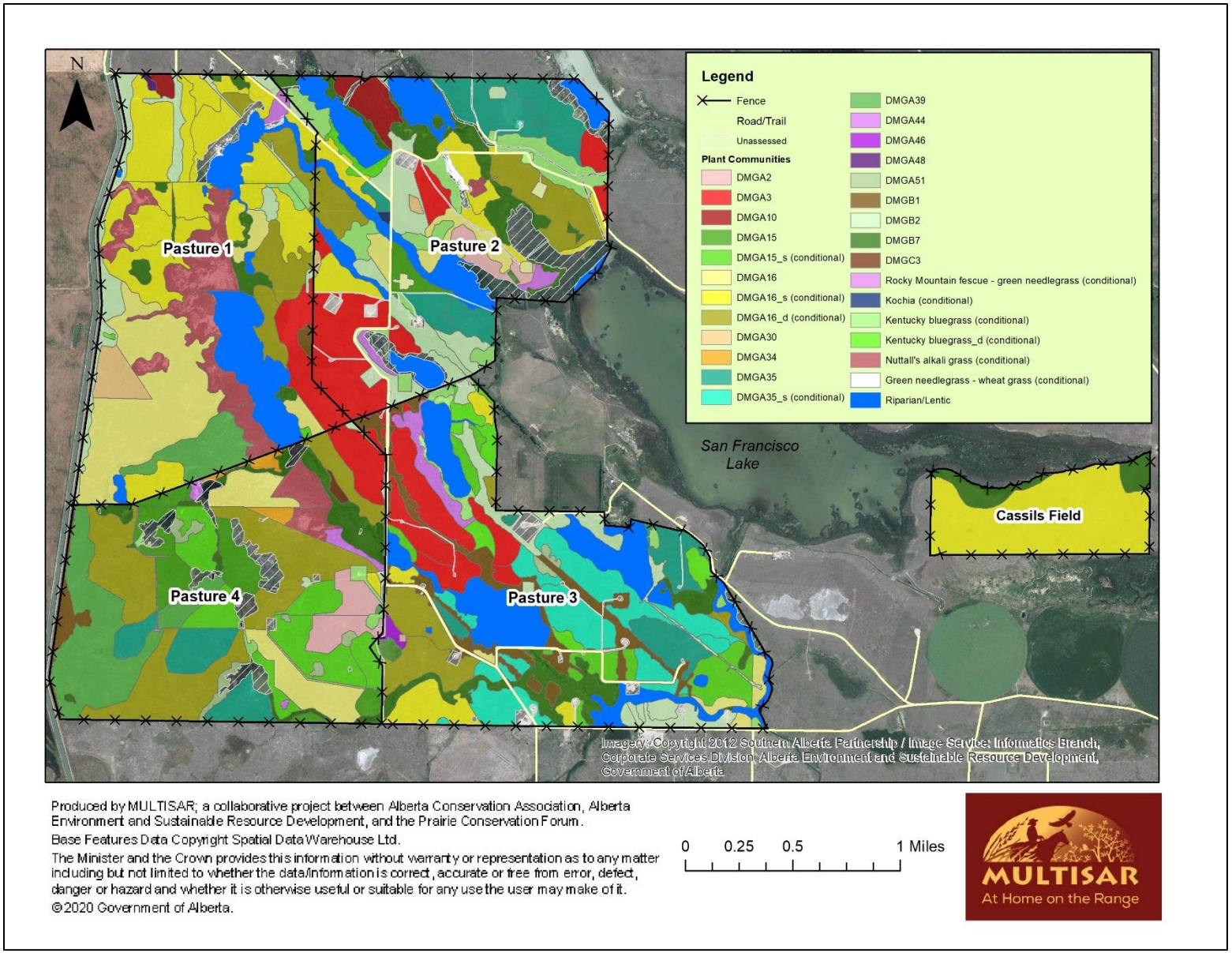

Figure 9. Plant communities found on the Antelope Creek Habitat Development Area.

4.2.3 Carrying and Grazing Capacities

The range plant community guides provide suggested stocking rate values for each predetermined plant community, called an ecologically sustainable stocking rate (ESSR), which reflects the maximum number of livestock a particular plant community can support (Adams et al. 2013). When the ESSR is multiplied by the area of a plant polygon, the result is a carrying capacity, reported in AUMs. Carrying capacity sometimes needs to be adjusted to consider limiting factors such as grazing distribution, multiple use, and range health. This adjustment (reduced value) results in the grazing capacity, which is also reported in AUMs.

An AUM is defined as the amount of dry matter or forage that one animal unit (AU) uses in one month. The standard AU grazing animal is a 1,000 lb cow with or without an unweaned calf up to six months of age. This value was set from the past when cattle were smaller bodied size. Because today's grazing animal is larger, adjustments must be made to this standard to compensate for a larger animal consuming more forage. A 1,300 lb cow was used in AUM calculations for Antelope Creek Habitat Development Area. Similarly, smaller animals such as weaned calves and yearlings consume less forage, and therefore are adjusted down. Weaned calves are often adjusted to 0.5 AUs, yearling steers or heifers are adjusted to 0.75 AUs and bulls are adjusted to 1.5 AUs. The document "Animal Unit Equivalents" on the USB included with this report outlines some adjustments (or Animal Unit Equivalents) that are made for varying sized animals.

The recommended grazing capacity for the Antelope Creek Habitat Development Area is 1104 AUMs (Table 5). Please note that the calculated AUMs reflect an optimal grazing period for tame grasses (spring) and for native forage (mid/late summer to early fall). If a different grazing period is employed, there may need to be an adjustment in stocking rates. Native pastures on the Antelope Creek Habitat Development Area were stocked at 1766 AUM in 2017, 1603 AUM in 2018, and 1684 AUM in 2019. Additional AUMs are available on the ranch in tame pasture and irrigated fields which are not included in the grazing capacity calculations.

Table 5. Calculated grazing capacities for native pastures on the Antelope Creek Habitat Development Area.

Field	**Area (ac)**	**Grazing Capacity (AUM)**
Cassils	247.58	54.11
Pasture 1	1186.87	250.95
Pasture 2	1147.40	257.80
Pasture 3	1239.80	328.70
Pasture 4	1128.52	212.84
Total	4950.17	1104.4

Some polygons were excluded from grazing capacity calculations for Antelope Creek Habitat Development Area. The majority of these excluded polygons were riparian plant communities that, unlike upland plant communities, do not have published stocking rate recommendations. Given that some level of livestock use is inevitable, it is reasonable to include riparian areas in the overall grazing capacity, so a conservative stocking rate of 0.25AUM/ac (equivalent to 190lb/acre forage consumption) was assigned in lieu of plant-community specific stocking rates (Baker and Rushton 2020). Also excluded from calculations were non-range features such as gravel roads, sites significantly affected by recent or ongoing industrial disturbance, active disturbance and reclaimed disturbances that are not ecologically stable. These features are significant across the Antelope Creek Habitat Development Area and account for approximately 100 acres. While it

is likely that they provide some forage for livestock, sustainable stocking rates are expected to be low and exclusion of these sites does not have a significant impact on overall grazing capacity for native pastures.

Range health and litter scores were used to determine if the appropriate ecologically sustainable stocking rate (ESSR) would be average, at the high end, or at the low end of the recommended range. Conditional communities were provided with a composition description and an assigned ESSR to the nearest applicable community.

The Antelope Creek Habitat Development Area is on the western margin of the Dry Mixedgrass Natural Subregion and production data suggests that the ranch occupies an area that is transitional to the Mixedgrass Natural Subregion. As a result, some plant communities on the ranch are more productive than comparable communities in drier parts of the Dry Mixedgrass and it was necessary to adjust recommended ESSRs upwards to accurately reflect local plant community productivity. Long term production from the Antelope Creek Habitat Development Area 4 Range Reference Area suggest 50% higher average productivity than guidebook values for blowout (Blo), overflow (Ov), sub-irrigated (Sb) and saline lowland (SL) range sites. To account for early season skim grazing of crested wheat grass, polygons with crested wheat grass communities (DMGB1 and DMGB2) were assigned 0.5AUM/ac which is above the suggested ESSR range. Skim grazing during early spring, when crested wheat grass is green and palatable, but most native upland grasses are still dormant, provides more available forage as crested wheat grass can be grazed more heavily without degrading adjacent native plant communities. This adjustment is considered appropriate only under adaptive management where grazing impacts are closely monitored to ensure that livestock are removed prior to the point when native grasses become palatable. Livestock can then be returned to the pasture later in the growing season when native species are better able to tolerate grazing (Baker and Rushton 2020).

4.2.4 Range Health

Range heath is a measurement defined as the ability of rangelands to perform key functions. The five functions of healthy rangelands are: productivity, site stability, capture and beneficial release of water, nutrient cycling, and plant species diversity (Adams et al. 2016). Range health assessments measure five indicators to quantify how well the rangeland is functioning in each category. The first category determines the integrity and ecological status of a community, which considers plant species composition, and rates how close the present plant community is to the reference plant community. The reference plant community (late seral stage) represents the ideal plant community that will perform the best in cycling of organic matter and nutrients, capturing and retaining moisture, providing the highest plant biodiversity, and producing the most forage given challenging environmental conditions. Early seral stages and lower rated range health communities tend to be less stable, more prone to weed invasion and less able to bounce back after increased grazing pressure. The second category, when measuring range health, looks at the community structure to ensure there is high diversity. Communities with varied canopy structure tend to be more efficient at nutrient cycling and energy flow and they provide more diverse habitat for wildlife and plants in addition to the highest possible forage production. The abundance or absence of plant residue to indicate the level of hydrologic function and nutrient cycling in the community is the third category measured. Carry over and litter benefit a community by capturing moisture, reducing soil erosion and reducing runoff and evaporation. Erosion features (fourth category) are observed to determine stability of a site. Good vegetative cover and minimal bare soil are ideal in a community to prevent erosion. Lastly, noxious weeds observed in a community are recorded. Weed invasion is more likely on rangelands with poorer health. For more information on range health indicators refer to the *Range Health Assessment for Grassland, Forest and Tame Pasture Field Workbook* (Adams et al. 2016).

A range health score ranking in the healthy category indicates that all the key functions of the rangeland are being performed and are functioning properly. This suggests that current management (stocking levels, grazing distribution, etc.) is in line with the capacity of the rangeland and grazing will be optimal. A rating of healthy with problems states that not all of the key functions are being performed. This suggests that these areas should be monitored, and perhaps minor adjustments should be made to management practices to ensure recovery to a healthy class. An unhealthy score means that few of the key functions are being performed and urgent action is required to significantly alter management practices. However, there are some significant wildlife species that thrive in varying range conditions and depending on management goals alterations may or may not be required.

The acreage and percentage of the Antelope Creek Habitat Development Area that was rated in each of the five range health categories is listed below in Table 6. Unassessed areas, such as non-grazing and riparian areas, are excluded from calculations. Figure 10 displays the range health ratings for each distinct ecological range site and plant community. It is important to keep in mind that the health of rangelands is assessed at one point in time. Trends in the overall health of the rangeland ecosystem can only be established with several assessments conducted over a span of many years. Appendix D shows the litter amounts for each of the five assessed pastures.

Table 6. Proportions of the Antelope Creek Habitat Development Area in MULTISAR's five range health categories.

Category	Acres	% of Ranch
High Healthy (86-100%)	767.5	18.1%
Healthy (75-85%)	1282.8	30.2%
High Healthy with Problems (61-74%)	1460.0	34.4%
Low Healthy with Problems (50-60%)	570.1	13.4%
Unhealthy (<50%)	166.7	3.9%

4.2.5 Rare Plants

No rare plant species were reported on the Antelope Creek Habitat Development Area during range surveys.

4.2.6 Weeds

Prohibited noxious, noxious, and problematic weeds are harmful to the range, because they compete for moisture, nutrients, and space with desirable native forage plants. In Alberta, landowners or occupants are required to control or destroy noxious weeds depending on their status under the *Weed Control Act* (Alberta Queens Printer 2010). Prohibited noxious weeds must be destroyed and noxious weed species must be controlled or kept from spreading. As with all vegetation management, an effective weed management program requires continual monitoring and control methods to be successful. This summary of noxious weeds found on the Antelope Creek Habitat Development Area should not be construed as a comprehensive weed survey of the ranch. Weed and invasive plants species were recorded incidentally as encountered.

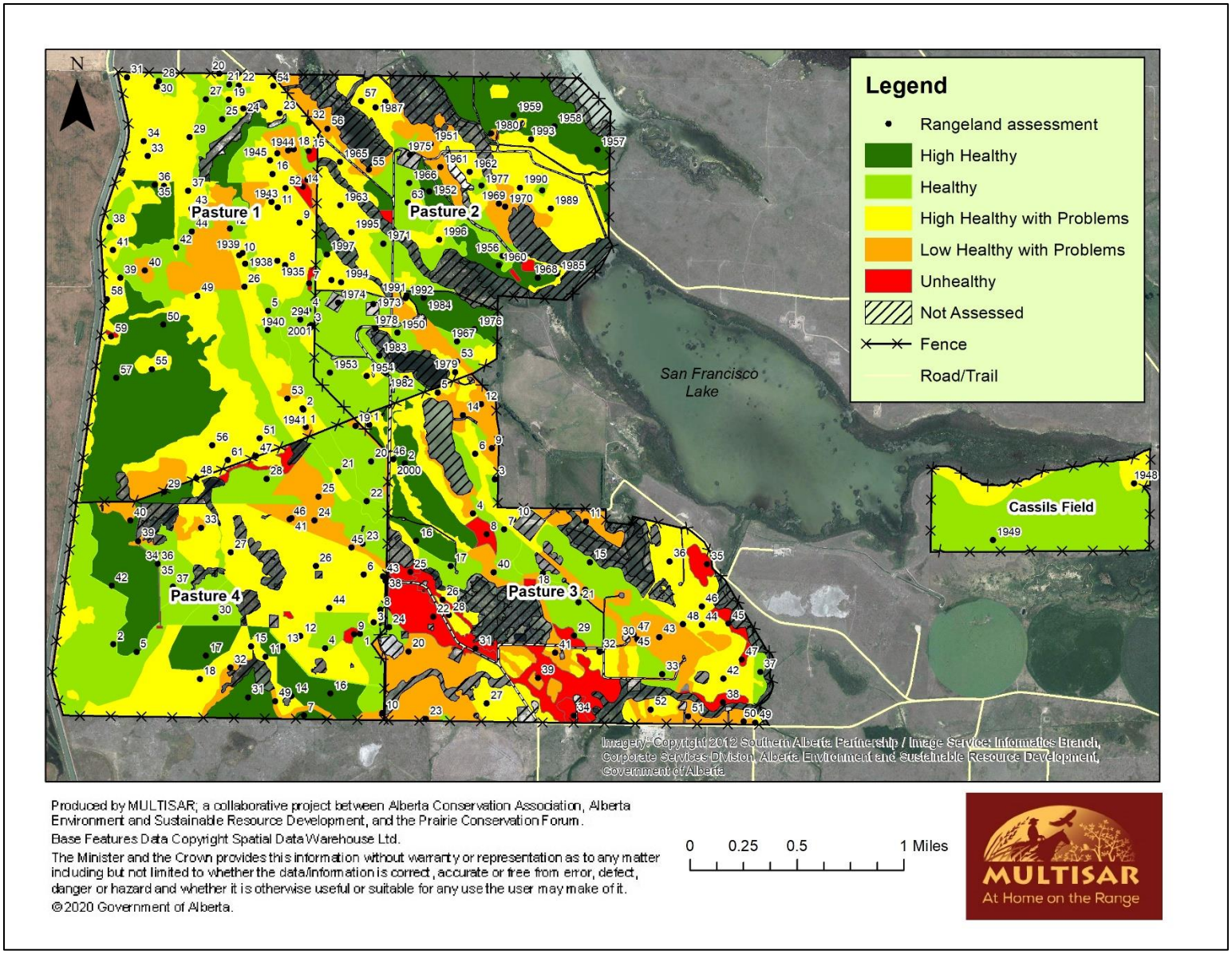

Figure 10. Range health ratings on the Antelope Creek Habitat Development Area.

Weeds were observed in each pasture on the Antelope Creek Habitat Development Area. In total, four noxious weed species were observed on the ranch during the range surveys: Canada thistle, downy brome, perennial sow-thistle, and tall buttercup. Generally, range sites with above normal soil moisture from subsurface or above ground sources will have more problems with noxious weeds. Depressional areas on the property are commonly invaded by weeds such as Canada thistle and perennial sow-thistle (Baker and Rushton 2020). An inventory of non-native invasive plant species was completed in 2013 and compiled into the *Invasive Plant Management Plan for Antelope Creek Habitat Development Area 2014-2024* (Michalsky et al. 2014). Please refer to this report for a complete list of invasive plants occurring on the ranch.

4.2.7 Poisonous Plants

Poisonous plants on the range can contribute to illness and decreased productivity in livestock and cause an economic loss to the industry. Most poisonous plants seen on the rangeland can be classified two ways: those that are native to the range and increase with heavy grazing and those that invade overgrazed and disturbed land. However, some species such as locoweeds and larkspur, are part of the normal range plant community (Merck Veterinary Manual 2018).

Livestock poisoning by plants can usually be traced back to range management issues rather than the presence of poisonous plants. Hungry livestock tend to graze abnormally, especially when corralled or moved onto new range and are more likely to consume poisonous plants (Merck Veterinary Manual 2018). Overgrazed rangelands, early season grazing, and drought conditions can increase the prominence of some poisonous species and livestock may ingest these in the absence of other preferred forage (Campbell et al. 1961).

It is important to understand the life cycle of poisonous plants present on your range. Not all poisonous plants are unpalatable, or always kill or are harmful when ingested. Some plants can be useful forage or toxic depending on the time of year (i.e. sweet-clovers) or can constitute a part of an animal's diet and are only poisonous to livestock when they are consumed in large quantities too quickly (i.e. greasewood and silky perennial lupine) (Merck Veterinary Manual 2018). In addition, the amount of toxin in a plant can vary depending on the growth stage of the plant (Majak et al. 2008)

It is also important to note that many plants that could be poisonous to livestock have desirable characteristics on the rangeland. Showy milkweed, for example, is effective at stabilizing disturbed ground along waterways. Locoweeds and milk vetches (and other legumes) are capable of fixing free nitrogen in the soil and stabilizing erodible and infertile soils (Tannas 2004).

Two poisonous vetch species were found on the Antelope Creek Habitat Development Area during range surveys: narrow-leaved milk vetch and timber milk vetch. Narrow leaved milk vetch is found in open prairies and on roadsides. It accumulates selenium from the soil and if ingested by livestock, can cause selenium poisoning. Selenium poisoning is rare however, as its offensive odor makes the plant largely unpalatable to livestock (Majak et al. 2008). Timber milk vetch occurs in grassland habitat and contains miserotoxin which is toxic to cattle. Like narrow-leaved milk vetch it is largely unpalatable and a mature animal would have to ingest 4 kg for a lethal dose (Majak et al. 2008).

5.0 Wildlife and Range Results by Field

5.1 Pasture 1

Pasture 1 is a 1,187-acre pasture located on the northwest portion of Antelope Creek Habitat Development Area. The most common range site in this field is blowout (761 acres), followed by saline lowland (174 acres), loamy (93 acres), and subirrigated (21 acres). Riparian communities occur on 134 acres in this pasture.

Blowout range sites in Pasture 1 are predominately vegetated by a ***Western Wheatgrass-Sedge-Needle and Thread (DMGA16)*** plant community, which is the most common plant community in the field, occupying 608 acres. This community is one of the more productive plant communities on blowout range sites (Adams et al. 2013). Crested wheat grass communities occur on 86 acres in this pasture in a ***Crested Wheat Grass-Needle and Thread/Silver Sagebrush (DMGB2)*** community.

The average range health score in Pasture 1 was 74.9% (healthy). Forty four percent (44%, 508 acres) of assessed areas in Pasture 1 rated high healthy but with problems, followed by high healthy (24%, 275 acres), healthy (22%, 255 acres), and low healthy with problems (10%, 119 acres). Unhealthy areas accounted for less than 1% (9 acres) of the pasture.

The most common reason for the reduction in range health in this pasture was that some plant communities demonstrated a shift away from the reference plant community. In some cases, plant communities showed a minor reduction in native wheatgrass and needlegrass cover. Invasive introduced grasses, such as Kentucky bluegrass and crested wheat grass, were also present at some sites. Several areas also showed decreased site stability with the presence of human-caused bare ground and signs of microerosion. Additionally, the presence of noxious and prohibited weeds contributed to lower scores in some areas. Overall, litter amounts were fairly consistent throughout the sites, with most sites demonstrating litter within the healthy range, or being slightly reduced (Appendix D).

The range health map shows that cattle may concentrate in the central area of this pasture, between the two large wetlands to the north and south.

The recommended grazing capacity for Pasture 1 is 250.95 AUMs.

Pasture 1 was the most diverse pasture on the Antelope Creek Habitat Development Area during the 2019 wildlife surveys, with 51 different wildlife species recorded, including 13 species considered to be at risk (Table 7). Fifteen (15) multi-species wildlife surveys were completed in this pasture, during which, the savannah sparrow was the species most frequently recorded, with 35 observations. This species was also the most common species found on the ranch overall in 2019. The savannah sparrow is one of the most common grassland birds found on the prairies and prefers areas of tall grasses including hay fields, tame pasture, wetland fringes, and upland native grasslands. Additional grassland birds recorded in Pasture 1 included the chestnut-collared longspur, Sprague's pipit, and upland sandpiper, all of which are species at risk in Alberta. The chestnut-collared longspur prefers shorter grass heights and low levels of litter that are often found in areas that have experienced heavier grazing pressure from cattle. Conversely, the Sprague's pipit prefer areas with moderate to tall grasses and high levels of litter, typically found in areas that have experienced light to moderate grazing pressure. The upland sandpiper prefers areas of moderate gazing intensity and like many other grassland species, will utilize a range of grassland habitat (short, intermediate, and tall vegetation) for various parts of their life cycle, including foraging, nesting, and brood rearing. This variation in vegetation heights, or patchiness, is providing the diversity of habitats required by different grassland birds and other wildlife present in this field.

Table 7. Wildlife species observed in Pasture 1 in 2019.

American robin	Clay-colored sparrow	Richardson's ground squirrel
American coot	Common yellowthroat	Ring-billed gull
American crow	Double-crested cormorant	Ruddy duck
American golden plover	Eastern kingbird	Savannah sparrow
American white pelican	Forster's tern	Solitary sandpiper
Barn swallow	Gadwall	Sprague's pipit
Black tern	Green-winged teal	Swainson's hawk
Black-billed magpie	Horned lark	Tree swallow
Black-necked stilt	Killdeer	Upland sandpiper
Blue-winged teal	Lesser scaup	Vesper sparrow
Boreal chorus frog	Mallard	Western meadowlark
Brewer's blackbird	Marsh wren	White-faced ibis
Brown thrasher	Mule deer	Willet
Brown-headed cowbird	Northern shoveler	Wilson's phalarope
California gull	Pronghorn	Wilson's snipe
Canvasback	Redhead	Yellow-headed blackbird
Chestnut-collared longspur	Red-winged blackbird	

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

Twenty seven (27) of the 51 wildlife species recorded in the field were wetland associated species. The majority of the wetland species observed in Pasture 1 were recorded at the two large wetlands in the central portion of the pasture, which are providing habitat for a wide variety of species, including waterfowl, shorebirds, gulls, terns, and many others. The black-necked stilt and white-face ibis, both of which were observed in this field, are *Sensitive* in Alberta and are two species that have been expanding northwards into Alberta in recent years. While they are becoming more widespread in the province, their localized distribution makes them vulnerable to wetland disturbances and loss (AEP 2015). The two tern species recorded in this field, the black tern and Forester's tern, are also at risk in Alberta due to threats from the loss and alteration of wetland habitats.

5.2 Pasture 2

Pasture 2 is a 1,147-acre pasture located on the north east portion of the Antelope Creek Habitat Development Area. The dominant range sites in this field are blowout (455 acres) and loamy (270 acres). Riparian and lentic areas account for 287 acres.

The most common plant communities are a Western Wheatgrass-Sedge-Needle and Thread (DMGA16) community occurring on blowout range sites, followed by a Needle and Thread-June Grass-Blue Grama (DMGA3) community on 139 acres of well drained loamy range sites, and Needle and Thread-June Grass-Blue Grama Grass (DMGA35) community occurring on 137 acres. A conditional Kentucky bluegrass community occurs on 104 acres. Crested wheat grass (DMGB2) communities occur on 98 acres and the Foxtail Barley-Kentucky Bluegrass -Western Wheatgrass (DMGB7) community occurs on 70 acres.

The average range health score for Pasture 2 was 75.1% (healthy). Thirty five percent (35%, 293 acres) of assessed areas in Pasture 2 rated high healthy but with problems, followed by healthy (30%, 251 acres), high healthy (22%, 183 acres), and low healthy with problems (12%, 95 acres). Unhealthy areas accounted for 1% (5 acres) of the pasture.

As in Pasture 1, reduced range health scores in Pasture 2 were primarily a result of plant communities that have shifted away from the reference plant community. Range health marks were also lost due to the presence and distribution of prohibited noxious and noxious weeds.

The southwest corner is the most heavily utilized area of the pasture. Litter in this area was greatly reduced. The overall litter score for the pasture is high healthy (Appendix D).

The recommended grazing capacity for the Pasture 2 is 257.8 AUMs.

Forty-seven (47) wildlife species were observed in Pasture 2 during the 2019 wildlife surveys, including ten species at risk (Table 8). Fourteen multi-species wildlife survey points were completed in this field. As in Pasture 1, the most common species recorded in this field was the savannah sparrow, with 33 observations. Notable species at risk observations in this field include a loggerhead shrike, which was observed in the northwest corner of the pasture. This species is *Threatened* in Canada and are a species of *Special Concern* in Alberta, primarily due to the loss of native grassland habitat. Loggerhead shrikes are predatory songbirds, but lack the talons that other predatory birds have to grasp their prey. Shrikes therefore rely on impaling prey on thorns, such as those of the thorny buffaloberry, or on barbed wire. Although they require open grassland habitat for hunting, loggerhead shrikes are a shrub nesting species, with thorny buffaloberry being a preferred shrub for nesting. Other shrub associated songbirds observed in Pasture 2 include the least flycatcher and the eastern kingbird, both of which are considered *Sensitive* in Alberta.

Table 8. Wildlife species observed in Pasture 2 in 2019.

American coot	Horned lark	Ruddy duck
American robin	Killdeer	Savannah sparrow
American white pelican	Least flycatcher	Sora
Baird's sparrow	Lesser scaup	Sprague's pipit
Black-billed magpie	Lincoln's sparrow	Swainson's hawk
Black-crowned night heron	Loggerhead shrike	Vesper sparrow
Blue-winged teal	Long-billed curlew	Western meadowlark
Brewer's blackbird	Mallard	White-faced ibis
California gull	Marsh wren	White-tailed deer
Canada goose	Northern harrier	Willet
Canvasback	Northern shoveler	Wilson's phalarope
Clay-colored sparrow	Raccoon	Wilson's snipe
Common yellowthroat	Richardson's ground squirrel	Yellow-headed blackbird
Eastern kingbird	Ring-billed gull	
Gadwall	Ring-necked duck	

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

5.3 Pasture 3

Pasture 3 is a 1,239-acre pasture located on the south east portion of the Antelope Creek Habitat Development Area. The most common range sites in this field are blowout (484 acres) and loamy (245 acres). Riparian and lentic areas cover 215 acres.

The most common plant communities in Pasture 3 are a ***Needle and Thread-June Grass-Blue Grama Grass (DMGA35)*** community which occurs on 253 acres, a ***Western Wheatgrass-Sedge-Needle and Thread (DMGA16)*** occurring on 156 acres, a ***Needle and Thread-June Grass-Blue Grama Grass*** (***DMGA3)*** community which occurs on 117 acres, a ***Crested wheat grass*** (***DMGB1)*** community occurring

on 93 acres, a ***Foxtail Barley-Kentucky Bluegrass-Western Wheatgrass (DMGB7)*** community occurring on 87 acres, a ***Crested Wheat Grass-Needle and Thread/Silver Sagebrush (DMGB2)*** community occurring on 85 acres, and a ***Western Wheatgrass-Needle and Thread-June Grass (DMGA15)*** community occurring on 75 acres. 46 acres in this pasture are considered non-rangeland roads or industrial development, 60 acres are a conditional Kentucky bluegrass community, and 62 acres are riparian.

Pasture 3 had the lowest average range health score of the assessed pastures on the Antelope Creek Habitat Development Area with an average score of 63.8% (low healthy with problems). Twenty nine percent (29%, 276 acres) of assessed areas in Pasture 3 scored high healthy but with problems, followed by low healthy with problems (28%, 264 acres), healthy (20%, 186 acres), unhealthy (16%, 148 acres), and high healthy (8%, 75 acres). The polygons that received a healthy score are generally loamy sites.

Range health marks in Pasture 3 were lost primarily on community composition for the same reasons discussed in Pasture 1, reduction in plant community structure and the presence and distribution of noxious and prohibited noxious weeds. The overall litter score is healthy (Appendix D).

The recommended grazing capacity for the Pasture 3 is 328.7 AUMs.

Thirty-five (35) wildlife species were recorded in Pasture 3 during the 2019 wildlife surveys, including eight species considered to be at risk (Table 9). Ten multi-species wildlife survey points were completed in this pasture. The most commonly recorded species was once again the savannah sparrow, with 25 observations. Notable observations in this pasture included a pair of ferruginous hawks that were recorded near the southwest corner of the field. Ferruginous hawks are *Endangered* in Alberta and this is the first time that this species has been recorded on the Antelope Creek Habitat Development Area. Ferruginous hawks prefer large tracts of native grassland with an abundance of their preferred prey, the Richardson's ground squirrel, which account for over 90% of their diet. The Richardson's ground squirrel prefers areas of shorter grass heights, which are often areas that have experienced moderate to heavy grazing pressure, resulting in lower range health scores. These areas tend to have higher densities of ground squirrels than healthier areas of the range where vegetation is taller and denser. Areas of reduced range health in the southern portion of Pasture 3 are providing suitable habitat for Richardson's ground squirrels, which are likely providing the area's ferruginous hawks with the prey populations they require.

Table 9. Wildlife species observed in Pasture 3 in 2019.

American avocet	Common yellowthroat	Richardson's ground squirrel
American coot	Ferruginous hawk	Ring-billed gull
American white pelican	Forster's tern	Ring-necked duck
Baird's sparrow	Gadwall	Ruddy duck
Barn swallow	Horned lark	Savannah sparrow
Black-billed magpie	Killdeer	Sprague's pipit
Black-crowned night heron	Lesser scaup	Vesper sparrow
Blue-winged teal	Mallard	Western meadowlark
Boreal chorus frog	Northern harrier	White-tailed jackrabbit
Bufflehead	Northern shoveler	Willet
Canada goose	Redhead	Wilson's snipe
Canvasback	Red-winged blackbird	

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

5.4 Pasture 4

Pasture 4 is a 1,129-acre pasture located in the south west portion of the Antelope Creek Habitat Development Area. The majority (74%; 831 acres) of this pasture consists of blowout range sites. Riparian areas occupy 46 acres of the field, while industrial non-use areas account for 13 acres.
The most common plant communities found in Pasture 4 are a ***Western Wheatgrass-Sedge-Needle and Thread (DMGA16)*** plant community occurring on 351 acres and a ***Western Wheatgrass-Needle and Thread-June Grass (DMGA15)*** community occurring on 222 acres, both occurring on blowout range sites. A ***Foxtail Barley-Kentucky Bluegrass-Western Wheatgrass (DMGB7)*** community was the third most common community found in the pasture, occupying 62 acres on overflow and saline lowland range sites.

The average range health score for Pasture 4 is 73.4% (high healthy with problems). Thirty six percent (36%; 379 acres) of assessed polygons within Pasture 4 rated healthy, followed by 33% (347 acres) high healthy with problems, and 22% (234 acres) high healthy. Eight percent (8%) scored low healthy with problems and less than one percent (5 acres) rated unhealthy.

Reduced range health scores in this pasture were largely a result of plant communities moving away from the reference plant community. Some sites also demonstrated a reduction in plant community structure, as well as a presence of noxious weeds. Overall, most sites displayed litter amounts that are representative of healthy blowout range sites (Appendix D). The north east portion of this pasture experiences the highest grazing pressure as litter levels were reduced in this area.

The recommended grazing capacity for Pasture 4 is 212.84 AUMs.

Forty-six (46) different wildlife species were recorded in Pasture 4 in 2019, including 12 species at risk (Table 10). A total of 20 multi-species wildlife survey points were completed in this field, during which, the species most commonly recorded was the horned lark (29 observations), followed closely by the savannah sparrow and western meadowlark, with 27 and 26 observations, respectively. Other grassland bird species recorded in Pasture 4 include the chestnut-collared longspur, Sprague's pipit and Baird's sparrow. Like the Sprague's pipit, the Baird's sparrow, which is a species of *Special Concern*, prefers moderate to tall grass heights and high levels of litter, typical of areas that have experienced light to moderate grazing pressure.

Over half (28) of the species recorded in this field were wetland associated species. The sora, a secretive species of rail that is more frequently heard than seen, was observed at two wetlands within the pasture. Soras are *Sensitive* in Alberta and are most common in wetlands with an abundance of emergent vegetation such as cattail, bulrush, sedges and rushes, amongst which it spends most of it's time. The pied-billed grebe is another *Sensitive* wetland species that was observed in Pasture 4 in 2019. Like the sora, the pied-billed grebe is fairly secretive and inhabits wetlands with an abundance of emergent vegetation. Both species are at risk due to the loss and degradation of wetland habitats.

A Swainson's hawk nest was located in a tree along a gravel road located on the eastern boundary of Pasture 4. Swainson's hawks have been recorded nesting on, and adjacent to the ranch in the past. Hawk nests may be used by varying raptor species, including the ferruginous hawk, from year to year and existing nests may be used for years or even decades. As suitable nesting sites in the grasslands are a limiting factor for the ferruginous hawk, it is important to monitor the condition of this, and any other nest trees on the ranch, to ensure that cattle are not negatively impacting the health of the tree. This will help ensure this nest remains a viable option for raptors returning to the area to nest. Refer to Section 7.0 *Management Recommendations* for more information.

Table 10. Wildlife species observed in Pasture 4 in 2019.

American coot	Coyote	Ring-billed gull
American white pelican	Double-crested cormorant	Savannah sparrow
American wigeon	Eastern kingbird	Sora
Baird's sparrow	Gadwall	Spotted sandpiper
Barn swallow	Green-winged teal	Sprague's pipit
Black tern	Horned lark	Swainson's hawk
Black-billed magpie	Killdeer	Upland sandpiper
Blue-winged teal	Lesser scaup	Vesper sparrow
Boreal chorus frog	Mallard	Western meadowlark
Brewer's blackbird	Marbled godwit	White-faced ibis
Brown-headed cowbird	Marsh wren	Willet
California gull	Northern harrier	Wilson's phalarope
Canada goose	Pied-billed grebe	Wilson's snipe
Chestnut-collared longspur	Red-necked grebe	Yellow-headed blackbird
Cinnamon teal	Red-winged blackbird	
Common yellowthroat	Richardson's ground squirrel	

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

Although there were no burrowing owls recorded on the ranch in 2019, there are two historic records of burrowing owl nest burrows in the southeast corner of Pasture 4 from 2004. As mentioned in Section 4.1.2, burrowing owls require relatively short grass heights and abandoned badger or Richardson's ground squirrel burrows in which to nest. On the Antelope Creek Habitat Development Area these areas are typically found where there has been increased grazing pressure by livestock. These areas typically support more ground squirrels, which excavate the burrows that burrowing owls require. Areas of tall, dense vegetation, like those found in the ranch's many ephemeral wetland areas, are suitable for supporting populations of small mammals, such as mice and voles, which are preferred prey for burrowing owls. These areas on the ranch may provide foraging habitat for the area's burrowing owls.

There are also several historic records of the plains spadefoot in Pasture 4. The wetlands in this field provide suitable breeding habitat for this species, which is *May be at Risk* in Alberta. The plains spadefoot spends most of its life underground, emerging only to breed after large rainfall events or to feed.

5.4 Cassils Field

Cassils Field is a 248 acre field located on the east side of the Antelope Creek Habitat Development Area. The pasture is bordered to the north by San Francisco Lake and Cassils Marsh is located to the south, just beyond the pasture boundary. The majority (86%, 212 acres) of the field consists of a blowout range site. A saline lowland and subirrigated range site can be found in the north of the pasture and accounts for 22.2 acres and 13.3 acres, respectively.

The dominant plant community on the blowout range site is a ***Western Wheat Grass–Sedge–Needle and Thread (DMGA16_S)*** community which encompasses 86% of the field (212 acres) and rated healthy. This plant community is one of the most productive communities occurring on blowout range sites (Baker and Rushton 2020). A ***Foxtail Barley–Kentucky Bluegrass–Western Wheat Grass (DMGB7)*** plant community can be found in the saline lowland (22.2 acres) and subirrigated (13.3 acres) range sites located in the north portion of the field. ***DMGB7*** is characteristic of depressional areas along the edges of wetlands that hold water for some part of the year and can tolerate some alkalinity and salinity (Adams et al. 2013). These areas, totaling 35.5 acres, rated high healthy with problems.

The average range health score for Cassils Field is 78.5%, which is the highest score of the assessed pastures. Scores were reduced in the integrity and ecological status category as the plant communities showed minor alterations from the reference plant community due to grazing or other disturbance. One of the expected plant layers was also absent or significantly reduced resulting in a lowered score in the community structure category. Litter levels in the field rated high healthy.

The recommended grazing capacity for Cassils Field is 54.11 AUMs.

During the 2019 wildlife surveys, 16 different wildlife species were recorded in the Cassils Field, including three species at risk (Table 11). Three multi-species wildlife survey points were completed in the pasture. The species most commonly encountered during wildlife surveys was the yellow-headed blackbird, with 12 observations. Due to the proximity of San Francisco Lake to the north and Cassil's Marsh to the south, approximately one third of species documented in this field were wetland associated species. The common yellowthroat, sora, marsh wren, red-winged blackbird and yellow-headed blackbird all prefer wetland habitats with emergent vegetation such as cattails and bulrushes.

Table 11. Wildlife species observed in Cassils Field in 2019.

American crow	Mallard	Sprague's pipit
Black-billed magpie	Marsh wren	Vesper sparrow
Brown-headed cowbird	Red-winged blackbird	Western meadowlark
Clay-colored sparrow	Ring-billed gull	Yellow-headed blackbird
Common yellowthroat	Savannah sparrow	
Horned lark	Sora	

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

5.5 Control

Thirteen species of wildlife were recorded in the Control Field in 2021, including two species at risk (Table 12). Three multi-species wildlife survey points were completed in this field. The most common species during the wildlife surveys was the Canada goose with seven observations. A great-blue heron was observed in this field. Although not uncommon in Alberta, the great-blue heron is *Sensitive* in the province, largely due to the fact that entire provincial population is dependent on less than 100 nesting colonies (AEP 2015).

Table 12. Wildlife species observed in the Control Field in 2021.

Brewer's blackbird	Richardson's ground squirrel	Western meadowlark
Brown-headed cowbird	Savannah sparrow	White-tailed deer
Canada goose	Sprague's pipit	Yellow-headed blackbird
Clay-colored sparrow	Tree swallow	
Great-blue heron	Vesper sparrow	

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

5.6 East CWG

Nine species of wildlife were recorded in the East CWG Field in 2021, none of which were species at risk (Table 13). Two multi-species wildlife survey points were completed in this pasture where the most common wildlife species encountered was the red-winged blackbird and Brewer's blackbird with three observations each.

Table 13. Wildlife species observed in the East CWG Field in 2021.

Brewer's blackbird	Northern pintail	Tree swallow
Horned lark	Red-winged blackbird	Western kingbird
Marbled godwit	Savannah sparrow	Western meadowlark

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

5.7 West CWG

Eleven wildlife species were documented in the West CWG Field in 2021, including one species at risk, the American white pelican (Table 14). Three multi-species wildlife survey points were completed in this field. The yellow-headed blackbird was the species recorded most frequently, with 11 observations.

Table 14. Wildlife species observed in the West CWG Field in 2021.

American white pelican	Lesser scaup	Savannah sparrow
Brown-headed cowbird	Northern harrier	Western meadowlark
California gull	Mallard	Yellow-headed blackbird
Canada goose	Richardson's ground squirrel	

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

5.8 East Flood

During the 2021 wildlife surveys, thirteen wildlife species were observed in the East Flood Field, including two species at risk; the sora and the Sprague's pipit (Table 15). A single multi-species wildlife survey point was completed in this field. The most commonly recorded species was the Richardson's ground squirrel and the savannah sparrow with four observations each.

Table 15. Wildlife species observed in the East Flood Field in 2021.

American robin	Rough-legged hawk	Western meadowlark
Brown-headed cowbird	Savannah sparrow	Willet
Common tern	Sora	Yellow-headed blackbird
Red-winged blackbird	Sprague's pipit	
Richardson's ground squirrel	Swainson's hawk	

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

5.9 West Flood

A total of 14 wildlife species were documented in the West Flood Field in 2021 (Table 16). Two species at risk were observed; the eastern kingbird and the white-faced ibis. One multi-species wildlife survey point was completed in this field. The most common species recorded was the white-faced ibis, a *Sensitive* species in Alberta, with four observations. The white-faced ibis inhabits a variety of wetland habitats, from cattail and bulrush marshes, to mudflats, to brackish wetlands where it feeds on aquatic invertebrates and small vertebrates, such as amphibians.

Table 16. Wildlife species observed in the West Flood Field in 2021.

American robin	Red-tailed hawk	Western kingbird
Black-billed magpie	Red-winged blackbird	Western meadowlark
Common grackle	Richardson's ground squirrel	White-faced ibis
Double-crested cormorant	Swainson's hawk	Yellow warbler
Eastern kingbird	Tree swallow	
Least flycatcher	Vesper sparrow	

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

5.10 East Pivot

Six wildlife species were recorded in the East Pivot Field in 2021, none of which were species at risk (Table 17). One multi-species wildlife survey point was completed in this field. The Richardson's ground squirrel was the most common species recorded with seven individuals observed.

Table 17. Wildlife species observed in the East Pivot Field in 2021

Franklin's gull	Red-winged blackbird	Savannah sparrow
Killdeer	Richardson's ground squirrel	Western meadowlark

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

5.11 West Pivot

Six species of wildlife were documented in the West Pivot Field in 2021, none of which were species at risk (Table 18). One multi-species wildlife survey point was completed in this field, with the most common species recorded being the Richardson's ground squirrel, with six observations. Two raptor nests were found in this field in the tree row spanning the southwest fence line; a red-tailed hawk nest with one adult present, and a great-horned owl nest with two young of the year present.

Table 18. Wildlife species observed in the West Pivot Field in 2021.

Baltimore oriole	Red-tailed hawk	Western kingbird
Great-horned owl	Richardson's ground squirrel	Western meadowlark

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

5.12 North San Francisco

A total of five wildlife species were recorded in the North San Francisco Field in 2021 (Table 19). No species at risk were documented. One multi-species wildlife survey point was completed in this field. The most common species recorded was the Richardson's ground squirrel, with ten observations.

Table 19. Wildlife species observed in the North San Francisco Field in 2021.

Double-crested cormorant	Red-winged blackbird	Yellow-headed blackbird
Red-tailed hawk	Richardson's ground squirrel	

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

5.13 Shoreline

Thirteen species of wildlife were documented along the shoreline of San Francisco Lake in 2021, including two species at risk; the common yellowthroat and the western grebe (Table 20). Three multi-species wildlife points were completed here in 2021. The most common species observed was the common yellowthroat with ten individuals recorded. The common yellowthroat is *Sensitive* in Alberta and bis typically found where there are willows, cattails, and bulrushes, such as along the edge of San Francisco Lake. In addition, a western grebe was observed near the boat launch. Western grebes are colonial water birds and are *At Risk* in Alberta. They typically nest along shallow margins of medium to large wetlands and lakes where there is emergent vegetation. While nesting activity was not observed at the time of survey, the margins of San Francisco Lake potentially provides suitable nesting habitat for this species.

Table 20. Wildlife species observed along the shoreline of San Francisco Lake in 2021.

Black-billed magpie	Marsh wren	Savannah sparrow
Blue-winged teal	Northern pintail	Western grebe
Brown-headed cowbird	Northern shoveler	Western meadowlark
Common yellowthroat	Red-winged blackbird	
Mallard	Richardson's ground squirrel	

*red = *Endangered/At Risk* species, orange = *Threatened/May be at Risk* species, yellow = *Special Concern/Sensitive* species, and white = *Secure* species.

6.0 Wildlife Habitats and Priority Species

6.1 Habitat Associations

The following sections describe the habitats present on the Antelope Creek Habitat Development Area and their association and importance to wildlife and species at risk.

6.1.1 Native Grassland

Antelope Creek Habitat Development Area is located within the Dry Mixedgrass Natural Subregion of the Grassland Natural Region of Alberta where only 43% of native grasslands remains (Adams et al. 2013). Native grasslands contain a diversity of vegetative communities, which are important to many species of wildlife. Declines in native prairie habitats are one of the leading factors influencing the decline of many species at risk, as many species require intact native grasslands to survive. Antelope Creek Habitat Development Area maintains numerous large pastures comprised of native grasslands that support a diversity of wildlife. Species such as the Sprague's pipit, Baird's sparrow, and many other grassland birds, rely on native prairie in which to nest, breed and forage in. Other groups of species, including mammals, amphibians and reptiles also rely on native grasslands for some or all of their life cycles.

6.1.2 Tame Pasture and Hay Land

Tame pasture and hay land can offer indirect benefits for wildlife by providing early season grazing for livestock to defer use of native grassland. Tame pastures comprised of a variety of grass and forb species are preferred over fields comprised of just a single species as they provide a varied structure and are likely to be used by a more diverse assemblage of species. Where possible, native prairie should be restored, however, if this is impractical, then tame permanent cover comprised of a diversity of grass species can still provide important wildlife habitat.

6.1.3 Riparian and Wetland Areas

Riparian areas are the lands adjacent to creeks, rivers and wetlands, where the soils and vegetation are strongly influenced by the presence of water (Cows and Fish 2017). They are productive areas of unique habitat that provide water, shelter and food for numerous species of wildlife. It is estimated that approximately 80% of Alberta's wildlife utilize riparian areas during at least some part of their life cycle (Fitch et al. 2003). Riparian areas typically support trees and/or shrubs, which are used for roosting by bats and for nesting by a variety of birds, including Swainson's and ferruginous hawks. On the Antelope Creek Habitat Development Area, riparian zones include the areas surrounding San Francisco Lake and the numerous wetlands, drainages, and canals found across the ranch. Ungulates and other wildlife, also use these areas for foraging and cover.

Wetlands can be classified as permanent or ephemeral (temporary) and both provide important habitat for species at risk. On the Antelope Creek Habitat Development Area, there are 36 constructed wetlands that are managed by Ducks Unlimited Canada, San Francisco Lake, and numerous other permanent and ephemeral wetlands. Ephemeral wetlands are essential to breeding amphibians such as the plains spadefoot, tiger salamander, and boreal chorus frog, as these temporary wetlands typically do not have fish species that prey upon amphibians and their eggs. All wetlands are critical to the numerous species of waterfowl that migrate through and breed on the prairies. Ephemeral wetlands are especially important in the early spring when waterfowl return, as they are often the only water bodies free from ice at this time of the year. Permanent basins become more important to waterfowl and other water birds later in the season when ephemeral wetlands have dried up. Ephemeral wetland areas with tall, dense vegetation are also preferred habitat for small mammals, such as mice and voles, and are often used as hunting grounds by raptors, such as the burrowing owl, northern harrier and short-eared owl. On the Antelope Creek Habitat Development Area, the fringes of permanent wetlands are vegetated with emergent aquatic vegetation such as cattail, bulrush, sedge, and rush species. These areas of dense vegetation provide the cover required by species such as the sora and Virginia rail.

6.1.4 Shrub Communities

Shrub communities provide essential habitat for numerous species of wildlife on the Antelope Creek Habitat Development Area. Low-growing shrubs, such as snowberry, provide thermal and nesting cover for birds and small mammals. Taller shrubs, such as willow, provide cover and browse for ungulates, as well as nesting, perching and foraging habitat for songbirds, like the common yellowthroat. Thorny buffaloberry, primarily found along canals on the ranch, provides nesting habitat for the loggerhead shrike. The thorns of the thorny buffaloberry are also used by shrikes to impale their prey. Silver sagebrush, which is found across the ranch, is especially important for pronghorn, as it is their primary forage. Sagebrush communities are also preferred habitat for several grassland bird species, such as the Brewer's sparrow and lark bunting, both of which are *Sensitive* species in Alberta.

6.2 Selection of Priority Wildlife Management Species

Many of the recommendations for the Antelope Creek Habitat Development Area are based on the habitat requirements of the species that MULTISAR have determined to be priorities for management on the property. These are species, or groups of species, that are at risk of disappearing in Alberta and for which the ranch provides key wildlife habitat. The priority management species (or groups of species) selected for the Antelope Creek Habitat Development Area include: burrowing owl, ferruginous hawk, grassland birds, loggerhead shrike, plains spadefoot, pronghorn, Richardson's ground squirrel, and wetland associated birds. The habitat requirements and management issues for each priority species/group of species are summarized in Table 12.

Table 21. Habitat requirements and considerations for priority management species selected for the Antelope Creek Habitat Development Area.

Species	Status[12]	Habitat Requirements	Management Issues/Importance
Burrowing owl	"*Endangered*" under the Alberta Wildlife Act and the Species at Risk Act (Canada)	► Nest in burrows created by Richardson's ground squirrels and badgers. ► Open grassland with short or sparse vegetation around burrow; taller vegetation for foraging.	► Currently experiencing downward population trend throughout their range due to the loss, degradation and fragmentation of native prairie. ► Provide natural pest control of grasshoppers, mice, voles, etc.).
Ferruginous hawk	"*Endangered*" under the Alberta Wildlife Act	► Open grassland habitat containing their primary prey, the Richardson's ground squirrel. ► Elevated nesting sites (cliffs, trees, poles).	► Loss of native habitat and availability of suitable nesting sites negatively impact population sizes. ► Important as a natural pest control (Richardson's ground squirrels).
Grassland Birds (including Sprague's pipit[1], chestnut-collared longspur[1],[2] thick-billed longspur[1], long-billed curlew[4], upland sandpiper[5], Baird's sparrow[4], Brewer's sparrow[5], grasshopper sparrow[5], etc.)	Various listings including: [1] "*Threatened*" under the Species at Risk Act (Canada) [2] "*At Risk*" under the General Status of Alberta Wild Species 2015 [3] "*May be at Risk*" under the General Status of Alberta Wild Species 2015 [4] "*Special Concern*" under the Species at Risk Act (Canada) [5]"*Sensitive*" under the General Status of Alberta Wild Species 2015	► Open native grasslands with varying grass heights. ► Exact requirements depend on the species. ► Nesting usually occurs from early May through mid-July.	► Some species are currently experiencing declines throughout their range. ► Loss of native habitat has been correlated to declines of many of the species.

[12] The status listed for each species is the highest threat level assigned to it at either the provincial or federal level. For a complete list of all designations for each species, refer to the "Species Designations" document on the USB drive included with this report.

Species	Status[12]	Habitat Requirements	Management Issues/Importance
Loggerhead shrike	"*Threatened*" under the Species at Risk Act (Canada)	► Open grasslands interspersed with shrubs or trees. ► Perch sites in which to hunt from and thorns or barbed wire to impale prey.	► Loss and fragmentation of native habitats negatively impact population sizes. ► Susceptible to pesticide contamination through ingestion of insect prey (grasshoppers, crickets, etc.).
Plains spadefoot	"*May be at Risk*" under the General Status of Alberta Wild Species 2015	► Ephemeral wetlands and sandy, friable soils.	► Major habitat loss due to wetland drainage and cultivation of suitable habitat. ► Decreased availability of suitable wetlands for breeding negatively impacts population sizes.
Pronghorn	"*Sensitive*" under the General Status of Alberta Wild Species 2015	► Flat open prairie with Sagebrush.	► Habitat fragmentation, severe winters, drought and road mortality all negatively impact population sizes. ► Fence lines that are too low (bottom wire <18" off the ground) act as a movement barrier as antelope only cross under fences.
Richardson's ground squirrel	"*Secure*" under the General Status of Alberta Wild Species 2015	► Short grass prairie. ► Heavily grazed areas. ► Prefer sandy, well drained soils.	► Ecologically important species to the grassland ecosystem. ► Creates suitable habitat (i.e. burrows) for other wildlife and is a key food source. ► Pest management control can severely impact these species and be extremely costly. ► Natural predators are a more economical way to regulate ground squirrel populations.
Wetland associated birds (including the American white pelican[1], black tern[1], black-	[1]"*Sensitive*" under the General Status of Alberta Wild Species 2015	► Ephemeral and permanent wetlands. ► Ample emergent vegetation for nesting, foraging, and cover.	► Loss and alteration of wetland habitats is biggest threat. ► Some populations rapidly decreasing locally and federally.

Species	Status[12]	Habitat Requirements	Management Issues/Importance
crowned night heron[1], black-necked stilt[1], common yellowthroat[1], pied-billed grebe[1], sora[1], white-faced ibis[1], etc.)		► Open mudflats for foraging.	

7.0 Management Recommendations

A number of general and pasture-specific management recommendations have been made for the Antelope Creek Habitat Development Area. These management recommendations are based on the results of the range inventories and health assessments, as well as on the wildlife inventories and the species at risk for which the ranch provides key habitat. All recommendations are based on the HCS goals and objectives listed in Section 1.1 of this report; chiefly, to employ a collaborative process to maintain or improve habitat for wildlife, including species at risk, in a manner that is mutually beneficial to the prairie ecosystem and the ranching operation. Where possible, MULTISAR will try to provide assistance to the Antelope Creek Habitat Development Area in implementing management recommendations they wish to undertake.

7.1. General Recommendations

The primary management recommendation for the Antelope Creek Habitat Development Area is for the maintenance and/or improvement of its functioning prairie ecosystem. Nearly half of the rangeland on the ranch scored healthy and high healthy. These areas are interspersed with a few areas of lower range health. Maintaining or enhancing the patchwork of different vegetation types, structure, and litter levels in each pasture will provide an array of habitat types for all wildlife species. The greatest management concern for the Antelope Creek Habitat Development Area is the invasion and spread of invasive plant species, primarily crested wheat grass, into its native rangeland. Currently, the ranch is employing management practices in an effort to curb the spread of crested wheat grass on the property, including early spring skim grazing. The following range management principles will also help to maintain and improve rangeland health and in doing so, help ensure reliable and renewable forage production for livestock, as well as quality habitat for wildlife on the ranch.

1. **Balance livestock demands in each pasture with the production of available forage**, taking into account the recommended carrying capacity and adjusting rates to cow size and timing of year. Accurate stocking rate records are a valuable tool in maximizing beef production while maintaining healthy rangeland and help determine the effectiveness of any grazing recommendations.

2. **Avoid grazing rangeland during vulnerable periods.** One of the most vulnerable periods for native, perennial grasses is early spring during April and May. Early spring is the critical time for perennial plants to utilize root reserves to initiate leaf growth. Grazing plants at this time sets them back and reduces vigour. Minimizing detrimental effects of early spring grazing on native rangeland, sensitive riparian areas, and breeding wildlife can be accomplished by grazing these areas later in summer (after July 15th) and into fall. Recognizing that spring deferral of grazing

native rangeland is not a viable option for some ranching operations, certain grazing management practices such, utilizing tame pastures during April and May as much as possible and rotational[13] grazing strategies on pastures with native range can be employed to minimize negative impacts.

3. **Distribute livestock grazing impact in each pasture.** One of the most effective ways of improving livestock distribution is developing additional water sources for livestock. Placement of salt blocks and mineral supplements are another tool useful for distributed livestock. It is recommended to place salt blocks and mineral supplements away from all landscape features that may provide specific habitat for wildlife, such as wetlands, drainages, treed and shrubby areas, and any other watering sites. This will help to distribute livestock away from these sensitive wildlife habitats and help maintain and improve water quality on the property. If possible, place salt blocks on tame grass patches within a given pasture to reduce grazing pressure on native grasslands.

4. **Provide effective rest after grazing.** This allows the rangeland to recover from the stresses of grazing and accumulate litter. Temporarily taking select pastures out of grazing rotation, for 1 to 2 years, provides the effective rest needed to accumulate litter.

The following is a list of additional general recommendations for the Antelope Creek Habitat Development Area.

1. Repair or replace existing fences where needed. The Antelope Creek Habitat Development Area has already altered its fences to wildlife friendly specifications (bottom wire height of 18 inches (approximately 45 cm) and top wire at a height of 40 inches (approximately 100 cm). It is recommended that upon replacing any additional fencing on the property, wildlife friendly fencing should continue to be utilized to aid in pronghorn passage to and from the property. MULTISAR also recommends that, where possible, gates be left open in fields that are not in use during the winter months to prevent pronghorn from becoming trapped within pastures after high snowfall events.

2. Monitor browse of willows and other preferred woody species when livestock are present in fields containing shrubs to ensure that livestock browse is not excessive. Restrict access to those treed and shrubby areas on the property experiencing livestock damage via fencing and appropriate salt block placement.

3. Maintain native grassland cover on the property. Native grasslands contain a diversity of vegetative communities which are important to many species of wildlife. Declines in native prairie habitats are one of the leading factors influencing the decline of many species at risk, as many species require intact native grasslands to survive. On a global scale, temperate grasslands, which includes the Great Plains of North America, are considered the most endangered ecosystem according to the International Union for Conservation of Nature (Peart 2008). Furthermore, native temperate grasslands are the least protected and the most altered terrestrial biome in the world, with only 4.6% being conserved within protected areas (Carbutt et al. 2017).

4. Control of invasive species (see Section 7.1.1).

7.1.1 Weed Control

Noxious and prohibited noxious weeds impact the livestock industry by lowering yield and quality of forage, interfering with grazing, poisoning animals, increasing costs of managing and producing livestock,

[13] See 'Grazing Systems' document on the USB.

and reducing land value. They also impact wildlife habitat and forage, deplete soil and water resources, and reduce plant and animal diversity. Numerous mechanical and cultural control options have been developed to manage noxious rangeland weeds, including; mowing, prescribed burning, timely grazing, and perennial grass reseeding or inter-seeding. In addition, several herbicides are registered for use on rangelands and most biological control programs focus on rangeland weed control. Furthermore, the landholder's preference for a weed control option should also be taken into consideration. Four noxious weed species were observed on the Antelope Creek Habitat Development Area during range surveys (Section 4.2.6).

The most successful strategy for controlling noxious weeds in native rangeland will be adapted to the life cycle and characteristics of each weed species. Local expertise and the necessary approvals for noxious weed control may need to be obtained from the Eastern Irrigation District. Weeds, like perennial sow-thistle and tall buttercup, which are isolated to a few plants or small patches, can be controlled by mechanical means such as hand-pulling or with herbicides such as Restore™ or Milestone™. Both Restore™ and Milestone™ are systemic, post-emergence broadleaf herbicides that are absorbed through the root system and distributed throughout the rest of the plant, causing death. Results of one successful application can be evident for two years. They have proven low environmental impact, which has been confirmed through risk assessments for toxicological, eco-toxicological, and environmental fate effects. There are no grazing restrictions for these herbicides except if grazing lactating dairy cows, at which point there is a seven-day waiting period after application. A herbicide for downy or Japanese brome in rangeland situations has yet to be developed and registered in Canada. Mowing or grazing this annual, grassy weed to reduce seed production has shown positive results. To be effective, the grazing or mowing of downy and Japanese brome must be done in early spring, a practice that can be detrimental on the health and vigour of native, perennial grasses. The negative effect of early spring grazing was outlined in the previous section. After careful consideration, if early spring grazing is chosen as a control measure for downy or Japanese brome, it should be only prescribed for two to three consecutive years. Grazing on these pastures should then be deferred until late spring or summer for four to five years following this treatment.

In general, applying proper herbicides at recommended concentrations is key to preventing damage to non-target vegetation. For more information on weed control, consult your local Agricultural Fieldman or Certified Pesticide Dispenser.

7.2. Pasture-Specific Recommendations

Management recommendations were made for specific pastures on the ranch based on the assessment of the wildlife inventories and the range and riparian inventories and health assessments conducted in each field. These recommendations are listed in Table 13 along with the benefits that the rangeland, wildlife and Antelope Creek Habitat Development Area may experience by implementing these recommendations. The species/groups of species listed are those that may directly (or indirectly) benefit from implementing these recommendations or habitat enhancements[14].

Table 22. Pasture-specific recommendations for the Antelope Creek Habitat Development Area.

Pasture	Recommendation	Benefits	Species that may Benefit
All Pastures	Place salt/mineral away from sensitive habitats, including all water sources (wetlands, dugouts, etc.), as	Improved livestock distribution.	Plains spadefoot Tiger salamander

[14] Habitat enhancements are projects that, when implemented, improve habitat for wildlife. Habitat enhancements may include off-site water for livestock, wildlife-friendly fencing, installation of a hawk nesting platform, etc.

Pasture	Recommendation	Benefits	Species that may Benefit
	well as treed and shrubby areas. *Priority 1* Prevent removal of thorny buffaloberry from along canals and other areas of the ranch. *Priority 1* When pastures are not in use, leave gates open, especially in winter, as high snow may prevent pronghorn from crossing, even with a bottom wire placed 18 inches above ground. *Priority 1*	Reduction in cattle impact to sensitive habitats will result in improved wildlife habitat. Improved water quality and potential weight gains in cattle. Thorny buffaloberry is a preferred shrub of the loggerhead shrike. Preventing removal of these shrubs will provide nesting habitat for this species. Allows pronghorn to pass underneath fences and through pastures unhindered, facilitating safe movement across ranch.	Waterfowl and other aquatic birds Burrowing owl Grassland birds Ferruginous hawk Loggerhead shrike Pronghorn
Pasture 1	Place salt/mineral away from large wetlands in the central area of the pasture, as grazing appears to be heaviest here. *Priority 1*	Improved livestock distribution. Reduction in cattle impact to wetlands. Improved water quality and potential weight gains in cattle.	Plains spadefoot Tiger salamander Waterfowl and other aquatic birds Grassland birds
Pasture 2	Avoid placing salt/mineral in the southwest corner of the pasture, as this area was the most heavily utilized (litter greatly reduced) in the pasture. *Priority 1* Place reflectors along top wire where fences cross or border wetlands. *Priority 2*	Improved livestock distribution and improved range health in southwest corner of the field. May help minimize waterfowl-fence collisions when birds are flying to/from wetlands.	Grassland birds Waterfowl and other aquatic birds
Pasture 3	Refrain from controlling Richardson's ground squirrel populations if they are not causing excessive damage. *Priority 1*	Ground squirrels create suitable habitat (i.e. burrows) for burrowing owls, which have been observed in this pasture historically. They are also a key food source for a number of species, including species at risk such as the	Burrowing owl Ferruginous hawk

Pasture	Recommendation	Benefits	Species that may Benefit
		ferruginous hawk, which was observed in this field.	
Pasture 4	Monitor the condition of the nest tree located along the eastern boundary of the pasture for impact from livestock (rubbing, soil compaction, root exposure, etc.). If tree is being impacted, place temporary or permanent fencing/panelling around tree. *Priority 1* Place reflectors along top wire where fences cross wetlands in the northeast portion of the pasture. *Priority 2* Refrain from controlling Richardson's ground squirrel populations if they are not causing excessive damage. *Priority 1*	Prevents damage or loss of nest tree by impacts from lingering cattle, while still providing shade for livestock. Provides nesting opportunities for the ferruginous hawk, which will help provide control of ground squirrels. One breeding pair of ferruginous hawks will consume roughly 500 ground squirrels in one breeding season. May help minimize waterfowl-fence collisions when birds are flying to/from wetlands. Ground squirrels create suitable habitat (i.e. burrows) for burrowing owls, which have nested in this pasture historically. They are also a key food source for a number of species, including species at risk, such as the ferruginous hawk.	Ferruginous hawk Waterfowl and other aquatic birds Burrowing owl
Cassils Field	Place salt/mineral away from depressional areas in the northern portion of the pasture. *Priority 1* Place reflectors along top wire where fences border wetlands to the north and south. *Priority 2*	Improved livestock distribution. Reduction in cattle impact to wetlands. May help minimize waterfowl-fence collisions when birds are flying to/from wetlands.	Plains spadefoot Tiger salamander Waterfowl and other aquatic birds

8.0 Recommendations for Industrial Development

8.1 Application of Industrial Recommendations

Industrial developments have the potential to impact native habitats and affect wildlife, including species at risk, through habitat fragmentation, promoting invasive species, and increasing human activity (ASRD & ACA 2006). Appropriate site selection and application of these industrial guidelines and/or standards will reduce these impacts. While the Antelope Creek Habitat Development already has a significant industrial footprint from oil and gas activity, this section of the HCS provides further direction to determine compatible activities on appropriate parts of the landscape.

Important habitat features identified on the Antelope Creek Habitat Development Area include native grasslands, tree and shrub communities, San Francisco Lake, and permanent and ephemeral wetlands. These areas are considered inherently sensitive, or where they have been confirmed as having high wildlife habitat importance, they have been identified and mapped as 'key habitats". Key habitat sites are locations that are used annually by wildlife for breeding, nesting or denning. On the Antelope Creek Habitat Development Area they include:

1. Permanent and ephemeral wetlands: These water bodies carry out several important functions within the prairie ecosystem including; breeding, rearing, and/or overwintering sites for the plains spadefoot.

Some important wildlife production habitats are not as closely associated with recognizable landscape features, but are used by species that demonstrate high fidelity to their nest or den areas over several years. These are considered "semi-permanent key habitats". They are generally used from year to year, but changes in mates, prey densities, weather, disturbance or loss of nesting structures may result in them no longer being used. On the Antelope Creek Habitat Development Area these sites may include:

1. Nesting trees: nest sites for raptors, including the ferruginous hawk.
2. Burrowing owl burrows: nest burrows.

For the MULTISAR project, semi-permanent key habitats are treated as being active for two years from the last confirmation of use as defined by the burrowing owl and ferruginous hawk recovery teams (Alberta Ferruginous Hawk Recovery Team 2009).

"Seasonal key habitats" are sites used by wildlife for a breeding season, by species that generally do not return to the exact location to nest in subsequent years. Seasonal sites apply for species such as the short-eared owl, long-billed curlew, upland sandpiper, Sprague's pipit, chestnut-collared longspur, and loggerhead shrike, which generally occur in native habitats being managed appropriately.

Pre-development surveys, at the appropriate time of year as per the Sensitive Species Inventory Guidelines (GOA 2013b), should be conducted prior to the start of any new project to determine if habitat features, such as nests, dens, leks, breeding ponds, etc. are present, in which case the appropriate buffer should be applied (GOA 2021). Buffers and timing restrictions have been developed on all public lands following the Master Schedule of Standards and Conditions (GOA 2021). It is suggested that recommendations on private land match those identified on public land.

On the Antelope Creek Habitat Development Area, the recommended setback distances for key species and/or their habitats from industrial developments have been identified according to the Master Schedule of Standards and Conditions (GOA 2021). On the Antelope Creek Habitat Development Area, these habitat

features include ephemeral and permanent wetlands. Setback distances for wetlands in Alberta range from 15 m for temporary wetlands, up to 100 m for large, permanent waterbodies (GOA 2021).

8.2 Mechanism of Protection on Private and Public Lands

This MULTISAR Habitat Conservation Strategy is designed to apply recommendations on the Antelope Creek Habitat Development Area to aide in the conservation of multiple species at risk. On private land, this is facilitated through the voluntary participation of the landowners and acceptance of the MULTISAR Plan through agreement by all partners.

On public land, this MULTISAR Plan should be referred to in management discussions between AEP and the lessee. It can be recognized through a Protective Notation (PNT) placed by AEP. The terms of this PNT would need to be reviewed by all participants. This would serve to "flag" the government and industry to the presence of the MULTISAR Plan for the ranch and to ensure that any new developments will consider this conservation strategy. The following process should be followed for proposed new industrial developments on MULTISAR HCS lands:

Developments on public land are applied for and approved under the Enhanced Approval Process (GOA 2013a). Industrial activity should be designed in consideration of existing policy, guidelines and standards for key habitats, semi-permanent key habitats, and seasonal habitats identified (GOA 2021). Though developers do not need to apply through the EAP process on private lands, the same recommendations on pre-development surveys, timing, setbacks and minimal disturbance principals should be applied. The Landscape Analysis (LAT) tool can be utilized by industry to determine what recommendations apply to their specific project (GOA 2017). The landholder is encouraged to promote use of these tools in determining mitigation practices on private land.

8.3 Access Road and Trails

Access to new developments is a key concern to the landowner, lessee and other members of the MULTISAR team. New roads and trails can cause vegetation and soil disturbance, habitat fragmentation, and wetland degradation or loss. It is recommended that new developments be accessed, whenever possible, through existing trails/roads. Access routes should be determined through consultation with the landowner/lessee. Access routes on public land require applications to follow the Master Schedule of Standards and Conditions (GOA 2021). On private land, if new trails are required, it is recommended that they follow these specifications:

1. Access routes/roads should be low grade to aid in the reclamation process.
2. Avoid accessing sites during wet conditions. If sites must be accessed during wet conditions, two track low grade access routes should be filled with gravel to avoid rutting or widening of the disturbance.
3. Access routes should be as short as possible.
4. Where possible, access routes should not occur through ephemeral/permanent wetlands, or along the edge of coulees or badlands.
5. Access routes should avoid permanent, semi-permanent and seasonal key wildlife areas.

8.4 Reclamation

On public land, it is recommended that reclamation follow the Master Schedule of Standards and Conditions (GOA 2021). The avoidance of native plant communities, where possible, should be the initial pre-

development consideration. During production and reclamation phases, all equipment into the site should be cleaned to reduce the chance of introducing invasive plant species to the area, particularly in native grassland pastures. At the end of each project on the ranch, development sites should be reclaimed to their previous state. For smaller projects, such as pipelines, within the relatively unaltered native prairie, it is recommended that natural recovery be allowed when considered appropriate to reduce the potential of introducing invasive plant species. For larger projects or areas where natural recovery is not appropriate, certified pure live seed should be planted so as not to introduce invasive species, such as crested wheat-grass, Kentucky bluegrass or smooth brome. It is recommended that monitoring be conducted to ensure reclamation decisions were suitable and successful.

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APPENDIX A. WILDLIFE SPECIES OBSERVED ON THE ANTELOPE CREEK HABITAT DEVELOPMENT AREA IN 2019 AND 2021

Common Name	Scientific Name
Amphibians	
Boreal chorus frog	*Pseudacris maculata*
Birds	
American avocet	*Recurvirostra americana*
American coot	*Fulica americana*
American crow	*Corvus brachyrhynchos*
American golden-plover	*Pluvialis dominica*
American robin	*Turdus migratorius*
American white pelican	*Pelecanus erythrorhynchos*
American wigeon	*Anas americana*
Baird's sparrow	*Ammodramus bairdii*
Baltimore oriole	*Icterus galbula*
Barn swallow	*Hirundo rustica*
Black tern	*Chlidonias niger*
Black-billed magpie	*Pica hudsonia*
Black-crowned night heron	*Nycticorax nycticorax*
Black-necked stilt	*Himantopus mexicanus*
Blue-winged teal	*Anas discors*
Brewer's blackbird	*Euphagus cyanocephalus*
Brown thrasher	*Toxostoma rufum*
Brown-headed cowbird	*Molothrus ater*
Bufflehead	*Bucephala albeola*
California gull	*Larus californicus*
Canada goose	*Branta canadensis*
Canvasback	*Aythya valisineria*
Chestnut-collared longspur	*Calicarius ornatus*
Cinnamon teal	*Anas cyanoptera*
Clay-colored sparrow	*Spizella palida*
Common yellowthroat	*Geothlypis trichas*
Double-crested cormorant	*Phalacrocorax auritus*
Eared grebe	*Podiceps nigricollis*
Eastern kingbird	*Tyrannus tyrannus*
Ferruginous hawk	*Buteo regalis*
Franklin's gull	*Leucophaeus pipixcan*
Forster's tern	*Sterna forsteri*
Gadwall	*Anas strepera*
Great-blue heron	*Ardea herodias*
Great-horned owl	*Bubo virginianus*
Green-winged teal	*Anas crecca*
Horned grebe	*Podiceps auritus*
Horned lark	*Ermophila alpestris*
Killdeer	*Charadrius vociferous*
Least flycatcher	*Empidonax minimus*
Lesser scaup	*Aythya affinis*
Lincoln's sparrow	*Melospiza lincolnii*
Loggerhead shrike	*Lanius ludovicianus*

Common Name	Scientific Name
Birds cont.	
Long-billed curlew	*Numenius americanus*
Mallard	*Anas playrhynchos*
Marbled godwit	*Limosa fedoa*
Marsh wren	*Cistothorus palustris*
Mourning dove	*Zenaida macroura*
Northern harrier	*Circus cyaneus*
Northern pintail	*Anas acuta*
Northern shoveler	*Anas clypeata*
Pied-billed grebe	*Podilymbus podiceps*
Redhead	*Aythya americana*
Red-necked grebe	*Podiceps grisegena*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-billed gull	*Larus delawarensis*
Ring-necked duck	*Aythya collaris*
Rough-legged hawk	*Buteo lagopus*
Ruddy duck	*Oxyura jamaicensis*
Savannah sparrow	*Passerculus sandichensis*
Short-eared owl	*Asio flammeus*
Solitary sandpiper	*Tringa solitaria*
Sora	*Porzana carolina*
Spotted sandpiper	*Actitis macularius*
Sprague's pipit	*Anthus spraugeii*
Swainson's hawk	*Buteo swainsoni*
Tree swallow	*Tachycineta bicolor*
Upland sandpiper	*Bartramia longicauda*
Vesper sparrow	*Pooecetes gramineus*
Western grebe	*Aechmophorus occidentalis*
Western kingbird	*Tyrannus verticalis*
Western meadowlark	*Sturnella neglecta*
White-faced ibis	*Plegadis chihi*
Willet	*Cataptophorus semipalmatus*
Wilson's phalarope	*Phalaropus tricolor*
Wilson's snipe	*Gallinago gallinago*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Yellow warbler	*Setophaga petechia*
Mammals	
Coyote	*Canis latrans*
Mule deer	*Odocoileus hemionus*
Pronghorn	*Antilocapra Americana*
Raccoon	*Procyon lotor*
Richardson's ground squirrel	*Spermophilus richardsonii*
White-tailed deer	*Odocoileus virginianus*
White-tailed jackrabbit	*Lepus townsendii*

**Red = Endangered/At Risk species, orange = Threatened/May be at Risk species, yellow = Special Concern/Sensitive species, no colour = Secure species*

APPENDIX B. VASCULAR PLANTS OBSERVED ON THE ANTELOPE CREEK HABITAT DEVELOPMENT AREA FROM 2015-2019.

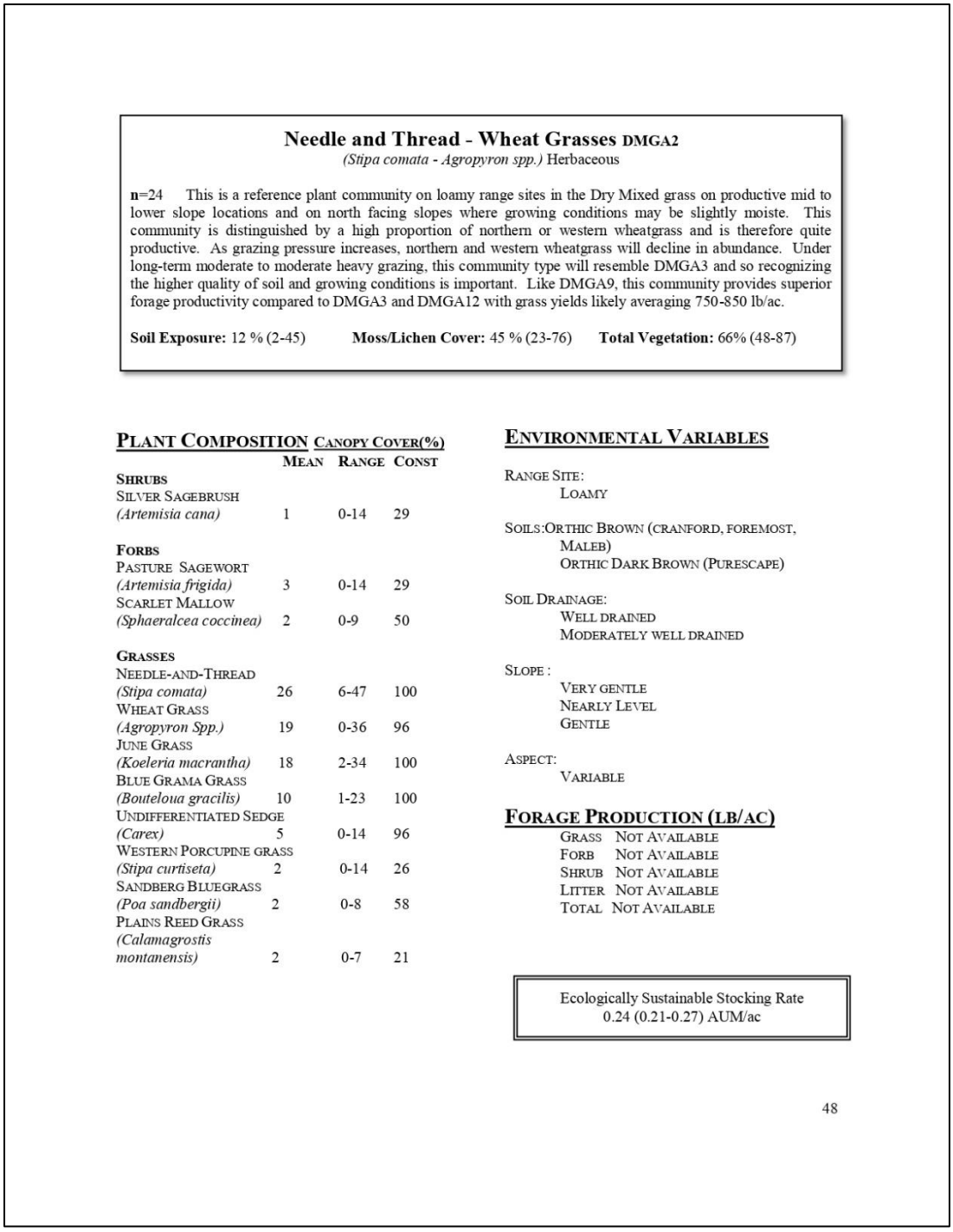
Scientific Name	Common Name
Grasses and Grass-Likes	
Alkali bluegrass	*Poa juncifolia*
Awned sedge	*Carex atherodes*
Awned wheat grass	*Agropyron subsecundum*
Awnless brome	*Bromus inermis*
Blue grama	*Bouteloua gracilis*
Bluebunch wheat grass	*Agropyron spicatum*
Canada bluegrass	*Poa compressa*
Creeping red fescue	*Festuca rubra*
Creeping spike-rush	*Eleocharis palustris*
Crested wheat grass	*Agropyron pectiniforme*
Downy brome	***Bromus tectorum***
Early bluegrass	*Poa cusickii*
Fowl bluegrass	*Poa palustris*
Foxtail barley	*Hordeum jubatum*
Green needle grass	*Stipa viridula*
Hay sedge	*Carex siccata*
June grass	*Koeleria macrantha*
Kentucky bluegrass	*Poa pratensis*
Low sedge	*Carex stenophylla*
Mat muhly	*Muhlenbergia richardsonis*
Meadow foxtail	*Alopecurus pratensis*
Needle spike-rush	*Eleocharis acicularis*
Needle-and-thread	*Stipa comata*
Northern wheat grass	*Agropyron dasystachyum*
Nuttall's salt-meadow grass	*Puccinellia nuttalliana*
Plains bluegrass	*Poa arida*
Plains muhly	*Muhlenbergia cuspidata*
Plains reed grass	*Calamagrostis montanensis*
Prairie sedge	*Carex prairea*
Quack grass	*Agropyron repens*
Redtop	*Agrostis stolonifera*
Rocky Mountain fescue	*Festuca saximontana*
Rough hair grass	*Agrostis scabra*
Russian wild rye	*Elymus junceus*
Salt grass	*Distichlis stricta*
Sandberg bluegrass	*Poa sandbergii*
Sedge species	*Carex*
Sheep fescue	*Festuca ovina*
Short-awned foxtail	*Alopecurus aequalis*
Showy sedge	*Carex spectabilis*
Slender wheat grass	*Agropyron trachycaulum*
Slough grass	*Beckmannia syzigachne*
Small-fruited bulrush	*Scirpus microcarpus*
Sun-loving sedge	*Carex pensylvanica*
Thread-leaved sedge	*Carex filifolia*

Grass and Grass-Likes cont.	
Tufted hair grass	*Deschampsia cespitosa*
Water sedge	*Carex aquatilis*
Western porcupine grass	*Stipa curtiseta*
Western wheat grass	*Agropyron smithii*
Wire rush	*Juncus balticus*
Forbs	
Alfalfa	*Medicago sativa*
Alsike clover	*Trifolium hybridum*
Annual hawk's-beard	*Crepis tectorum*
Aster species	*Aster*
Bastard toadflax	*Comandra umbellata*
Biennial sagewort	*Artemisia biennis*
Brittle prickly-pear	*Opuntia fragilis*
Broomweed	*Gutierrezia sarothrae*
Bull thistle	*Cirsium vulgare*
Canada goldenrod	*Solidago canadensis*
Canada thistle	***Cirsium arvense***
Common blue lettuce	*Lactuca pulchella*
Common dandelion	*Taraxacum officinale*
Common goat's-beard	*Tragopogon dubius*
Common knotweed	*Polygonum arenastrum*
Common pepper-grass	*Lepidium densiflorum*
Common yarrow	*Achillea millefolium*
Creeping white prairie aster	*Aster falcatus*
Curled dock	*Rumex crispus*
Cushion cactus	*Coryphantha vivipara*
Cut-leaved anemone	*Anemone multifida*
Flixweed	*Descurainia sophia*
Fremont's goosefoot	*Chenopodium fremontii*
Gaillardia	*Gaillardia aristata*
Golden aster	*Heterotheca villosa*
Golden bean	*Thermopsis rhombifolia*
Goosefoot	*Chenopodium pratericola*
Gumweed	*Grindelia squarrosa*
Meadow hawkweed	*Hieracium caespitosum*
Horseweed	*Erigeron canadensis*
Kochia	*Kochia*
Lamb's-quarters	*Chenopodium album*
Late goldenrod	*Solidago gigantea*
Low everlasting	*Antennaria aprica*
Low goldenrod	*Solidago missouriensis*
Moss phlox	*Phlox hoodii*
Mountain goldenrod	*Solidago spathulata*
Narrow-leaved hawkweed	*Hieracium umbellatum*
Narrow-leaved milk vetch	*Astragalus pectinatus*
Northern fairy candelabra	*Androsace septentrionalis*
Oak-leaved goosefoot	*Chenopodium salinum*
Pasture sagewort	*Artemisia frigida*
Perennial sow-thistle	***Sonchus arvensis***
Prairie cinquefoil	*Potentilla pensylvanica*
Prairie coneflower	*Ratibida columnifera*
Prairie groundsel	*Senecio canus*

Forbs cont.	
Prairie onion	*Allium textile*
Prairie sagewort	*Artemisia ludoviciana*
Prairie selaginella	*Selaginella densa*
Prickly-pear	*Opuntia polyacantha*
Purple milk vetch	*Astragalus dasyglottis*
Purple prairie-clover	*Petalostemon purpureum*
Rush skeletonweed	*Chondrilla juncea*
Samphire	*Salicornia europaea*
Northern fairy candelabra	*Androsace septentrionalis*
Scarlet butterflyweed	*Gaura coccinea*
Scarlet mallow	*Sphaeralcea coccinea*
Shining arnica	*Arnica fulgens*
Silverweed	*Potentilla anserina*
Silvery cinquefoil	*Potentilla argentea*
Skeletonweed	*Lygodesmia juncea*
Slender blue beardtongue	*Penstemon procerus*
Slender hawkweed	*Hieracium triste*
Small-leaved everlasting	*Antennaria parvifolia*
Stinkweed	*Thlaspi arvense*
Summer-cypress	*Kochia scoparia*
Tall blue lettuce	*Lactuca biennis*
Tall buttercup	***Ranunculus acris***
Timber milk vetch	*Astragalus miser*
Tufted white prairie aster	*Aster ericoides*
Tumbling mustard	*Sisymbrium altissimum*
Undifferentiated milk vetch	*Astragalus*
Undifferentiated phlox	*Phlox*
Velvety goldenrod	*Solidago mollis*
Water smartweed	*Polygonum coccineum*
Western bluebur	*Lappula occidentalis*
White sweet-clover	*Melilotus alba*
Winter-fat	*Eurotia lanata*
Woolly cinquefoil	*Potentilla hippiana*
Wormseed mustard	*Erysimum cheiranthoides*
Yellow false dandelion	*Agoseris glauca*
Yellow sweet-clover	*Melilotus officinalis*
Shrubs	
Common wild rose	*Rosa woodsii*
Nuttall's atriplex	*Atriplex nuttallii*
Prairie rose	*Rosa arkansana*
Silver sagebrush	*Artemisia cana*
Snowberry (buckbrush)	*Symphoricarpos occidentalis*
Thorny buffaloberry	*Shepherdia argentea*
Willow species	*Salix species*

Prohibited Noxious and Noxious Species (Alberta Weed Control Act 2010)

APPENDIX C. PLANT COMMUNITIES FOUND ON THE ANTELOPE CREEK HABITAT DEVELOPMENT AREA PREVIOUSLY IDENTIFIED IN THE DRY MIXEDGRASS NATURAL SUBREGION[15]



Needle and Thread - Wheat Grasses DMGA2
(Stipa comata - Agropyron spp.) Herbaceous

n=24 This is a reference plant community on loamy range sites in the Dry Mixed grass on productive mid to lower slope locations and on north facing slopes where growing conditions may be slightly moiste. This community is distinguished by a high proportion of northern or western wheatgrass and is therefore quite productive. As grazing pressure increases, northern and western wheatgrass will decline in abundance. Under long-term moderate to moderate heavy grazing, this community type will resemble DMGA3 and so recognizing the higher quality of soil and growing conditions is important. Like DMGA9, this community provides superior forage productivity compared to DMGA3 and DMGA12 with grass yields likely averaging 750-850 lb/ac.

Soil Exposure: 12 % (2-45) **Moss/Lichen Cover:** 45 % (23-76) **Total Vegetation:** 66% (48-87)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
SHRUBS			
SILVER SAGEBRUSH *(Artemisia cana)*	1	0-14	29
FORBS			
PASTURE SAGEWORT *(Artemisia frigida)*	3	0-14	29
SCARLET MALLOW *(Sphaeralcea coccinea)*	2	0-9	50
GRASSES			
NEEDLE-AND-THREAD *(Stipa comata)*	26	6-47	100
WHEAT GRASS *(Agropyron Spp.)*	19	0-36	96
JUNE GRASS *(Koeleria macrantha)*	18	2-34	100
BLUE GRAMA GRASS *(Bouteloua gracilis)*	10	1-23	100
UNDIFFERENTIATED SEDGE *(Carex)*	5	0-14	96
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	2	0-14	26
SANDBERG BLUEGRASS *(Poa sandbergii)*	2	0-8	58
PLAINS REED GRASS *(Calamagrostis montanensis)*	2	0-7	21

ENVIRONMENTAL VARIABLES

RANGE SITE:
LOAMY

SOILS:ORTHIC BROWN (CRANFORD, FOREMOST, MALEB)
ORTHIC DARK BROWN (PURESCAPE)

SOIL DRAINAGE:
WELL DRAINED
MODERATELY WELL DRAINED

SLOPE :
VERY GENTLE
NEARLY LEVEL
GENTLE

ASPECT:
VARIABLE

FORAGE PRODUCTION (LB/AC)
GRASS NOT AVAILABLE
FORB NOT AVAILABLE
SHRUB NOT AVAILABLE
LITTER NOT AVAILABLE
TOTAL NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.24 (0.21-0.27) AUM/ac

48

[15] Adams et al 2013

Needle and Thread - June Grass - Blue Grama Grass DMGA3
(Stipa comata - Koeleria macrantha - Bouteloua gracilis) Herbaceous

n=400 This is a reference plant community on well drained loamy range sites in the Dry Mixedgrass. This is perhaps the most common grassland community type in the brown soil zone and corresponds with the community that Coupland(1961) described as the Stipa-Bouteloua faciation. This type is considered the late seral to reference plant community for these soils given the dominance of mid-grasses like Needle-and-Thread and the presence of northern and western wheatgrass (Coupland 1950, 1961, 1973). Coupland (1961) challenged the interpretation of previous studies (Clark et al. 1942, Hubbard 1950) that described this as a Bouteloua- Stipa community implying a "short grass" prairie designation. Coupland (1961) concluded that the loamy soils in the brown soil zone would normally support mixed grass communities. Early studies were likely carried out after decades of heavy grazing had reduced the prominence of midgrasses. Coupland observed the prairie decades later when midgrass vegetation was beginning to re-establish dominance. In terms of grazing management, heavy grazing pressure will first lead to a decline in wheatgrass cover and eventually needle-and-thread will be replaced by more grazing resistant species like blue grama, Sandberg bluegrass and sedges. Forage production data presented below is a 10 year average from the now defunct Hays rangeland reference area with this community type and a Maleb soil series.

Soil Exposure: 12 % (0-59) **Moss/Lichen Cover:** 42 % (0-98) **Total Vegetation:** 62% (20-92)

PLANT COMPOSITION

	CANOPY COVER(%) MEAN	RANGE	CONST
SHRUBS			
SILVER SAGEBRUSH *(Artemisia cana)*	1	0-13	28
FORBS			
PASTURE SAGEWORT *(Artemisia frigida)*	4	0-28	89
SCARLET MALLOW *(Sphaeralcea coccinea)*	1	0-23	38
GRASSES			
NEEDLE-AND-THREAD *(Stipa comata)*	40	4-85	100
JUNE GRASS *(Koeleria macrantha)*	13	0-44	100
BLUE GRAMA GRASS *(Bouteloua gracilis)*	11	0-51	95
UNDIFFERENTIATED SEDGE *(Carex)*	6	0-25	94
WESTERN WHEAT GRASS *(Agropyron smithii)*	6	0-38	80
PLAINS REED GRASS *(Calamagrostis montanensis)*	1	0-15	52
SANDBERG BLUEGRASS *(Poa sandbergii)*	1	0-22	47
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	2	0-29	30

ENVIRONMENTAL VARIABLES

RANGE SITE:
LOAMY

ELEVATION (M):
793 (741-921)

SOILS:
ORTHIC BROWN: (ANTONIO, BINGVILLE, CRANFORD, CHIN, FOREMOST, MALEB, WILDHORSE)
SOLONETZIC BROWN (RONALAINE)

SOIL DRAINAGE:
MODERATELY WELL DRAINED
WELL DRAINED
RAPIDLY DRAINED

SLOPE :
GENTLE
VERY GENTLE
NEARLY LEVEL

ASPECT:
VARIABLE

FORAGE PRODUCTION (LB/AC)

GRASS	479 (301-598)
FORB	22 (1-59)
TOTAL	501
LITTER	338 (131-600)

Ecologically Sustainable Stocking Rate
0.20 (0.16-0.22) AUM/ac

Blue Grama Grass - Needle and Thread DMGA10

(Bouteloua gracilis - Stipa comata) Herbaceous

n=19 This is a mid-seral plant community on loamy range sites in the Dry Mixed grass on productive mid to lower slope locations and on north facing slopes where growing conditions may be slightly moister. This community is the product of moderate-heavy to heavy grazing pressure that has resulted in a major reduction in wheatgrass cover. Increased soil exposure and reduced litter cover will coincide with changes in the plant community. When this plant community has an extensive/continuous distribution on the landscape, it signals the need for reduced stocking and improved range management practices. Wildlife managers may wish to see this community as a scattered/patchy distribution in conjunction with communities like DMGA2, thus providing greater structural diversity for species like breeding birds. The production data for this plant community is summarized from a site located at Onefour.

Soil Exposure: 9% (1-28) **Moss/Lichen Cover:** 41 % (13-73) **Total Vegetation:** 65% (46-90)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
FORBS			
PURSH'S PLANTAIN *(Plantago patagonica)*	1	0-4	79
PASTURE SAGEWORT *(Artemisia frigida)*	1	0-6	74
WINTER-FAT *(Eurotia lanata)*	1	0-4	75
SCARLET MALLOW *(Sphaeralcea coccinea)*	1	0-4	74
PRICKLY PEAR CACTUS *(Opuntia polyacantha)*	1	0-15	11
GRASSES			
BLUE GRAMA GRASS *(Bouteloua gracilis)*	18	7-60	100
NEEDLE-AND-THREAD *(Stipa comata)*	7	2-14	100
THREAD-LEAVED SEDGE *(Carex filifolia)*	1	0-24	11
SANDBERG BLUEGRASS *(Poa sandbergii)*	3	0-15	100
UNDIFFERENTIATED SEDGE *(Carex)*	2	0-7	68
WESTERN WHEAT GRASS *(Agropyron smithii)*	2	0-8	68
JUNE GRASS *(Koeleria macrantha)*	1	0-4	89

ENVIRONMENTAL VARIABLES

RANGE SITE:
LOAMY
BLOWOUT

SOILS: ORTHIC BROWN (COMREY, PINHORN,MALEB, CRANFORD)
BROWN SOLOD (GEM)
BROWN SOLODIZED SOLONETZ (HEMARUKA)

ELEVATION (M):
938 (863-975)

SOIL DRAINAGE:
WELL DRAINED
MODERATELY WELL DRAINED

SLOPE :
MODERATE
VERY GENTLE
NEARLY LEVEL

ASPECT:
NORTHERLY

FORAGE PRODUCTION (LB/AC)

GRASS 724 (453-1124)
FORB 85 (28-151)
SHRUB NOT AVAILABLE
LITTER 469 (316-757)
TOTAL 764

Ecological Sustainable Stocking Rate
0.15 (0.12-0.17) AUM/ac

53

Wheat Grass - Needle and Thread - June Grass DMGA15

(Agropyron Spp. - Stipa comata - Koeleria macrantha) Herbaceous

n=11 This is a late seral to reference plant community for blowout range sites in the Dry Mixedgrass. This particular community occurs on soils that are in mid to latter phase of the solonetzic soil development process (centre and right of centre in the soil development sequence in Fig. 4). Solonetzic features persist, but like DMGA16 and DMGA35, internal drainage has improved. Consequently needle-and-thread grass can persist as a dominant species and the amount of soil exposure is diminished when compared to communities like DMGA17, DMGA34 and DMGA39. Silver sagebrush may occur in only trace amounts in this community type.

Soil Exposure: 13 % (1-43) **Moss/Lichen Cover:** 53 % (1-76) **Total Vegetation:** 53% (30-87)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
SHRUBS			
SILVER SAGEBRUSH *(Artemisia cana)*	1	0-8	18
FORBS			
PASTURE SAGEWORT *(Artemisia frigida)*	11	0-27	91
SCARLET MALLOW *(Sphaeralcea coccinea)*	1	0-5	55
GRASSES			
UNDIFFERENTIATED WHEAT GRASS *(Agropyron spp.)*	24	11-41	100
NEEDLE-AND-THREAD *(Stipa comata)*	22	6-38	100
JUNE GRASS *(Koeleria macrantha)*	14	0-23	91
UNDIFFERENTIATED SEDGE *(Carex)*	10	3-25	100
BLUE GRAMA GRASS *(Bouteloua gracilis)*	4	0-16	73
SANDBERG BLUEGRASS *(Poa sandbergii)*	3	0-13	64
PLAINS REED GRASS *(Calamagrostis montanensis)*	3	0-11	64
WESTERN PORCUPINE GRASS *(Stipa curitseta)*	2	0-12	27

ENVIRONMENTAL VARIABLES

RANGE SITE:
BLOWOUT

SOILS:
BROWN SOLOD (KARLSBAD, ROSEMARY, HALLIDAY)
BROWN SOLODIZED SOLONETZ (HEMARUKA, WARDLOW, PATRICIA)
ORTHIC BROWN (FOREMOST)
DARK BROWN SOLODIZED SOLONETZ

ELEVATION:
770-825 M

SOIL DRAINAGE:
MODERATELY WELL DRAINED
WELL DRAINED

SLOPE :
VERY GENTLE
NEARLY LEVEL

FORAGE PRODUCTION (LB/AC)

GRASS NOT AVAILABLE
FORB NOT AVAILABLE
SHRUB NOT AVAILABLE
LITTER NOT AVAILABLE
TOTAL NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.16 (0.14-0.18)AUM/ac

57

Western Wheat Grass - Sedge - Needle and Thread DMGA16

(Agropyron smithii- Carex - Stipa comata) Herbaceous

n=33 This is a late seral to reference plant community for blowout range sites in the Dry Mixedgrass. This particular community occurs on soils that are in the latter phase of the solonetzic soil development process (represented by the centre and right side of the soil development sequence in Fig. 4). While minor solonetzic features may persist in the soil profile, needle-and-thread grass and moss/lichen cover are abundant and soil exposure is low. This community, along with DMGA15 and DMGA35, will be among the more productive of plant communities on blowout range sites. Silver sagebrush may occur in only trace amounts in this community type.

Soil Exposure: 10 % (1-30) **Moss/Lichen Cover:** 49 % (1-90) **Total Vegetation:** 69% (50-93)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
FORBS			
PASTURE SAGEWORT *(Artemisia frigida)*	7	0-28	97
SCARLET MALLOW *(Sphaeralcea coccinea)*	3	0-13	79
GRASSES			
WESTERN WHEAT GRASS *(Agropyron smithii)*	34	12-58	100
UNDIFFERENTIATED SEDGE *(Carex)*	12	1-29	100
NEEDLE-AND-THREAD *(Stipa comata)*	10	0-23	97
BLUE GRAMA GRASS *(Bouteloua gracilis)*	9	0-36	97
JUNE GRASS *(Koeleria macrantha)*	8	0-40	91
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	4	0-21	55
UNDIFFERENTIATED BLUEGRASS *(Poa spp.)*	1	0-14	36
SALT GRASS *(Distichlis stricta)*	1	0-9	33
SANDBERG BLUEGRASS *(Poa sandbergii)*	1	0-11	36
PLAINS REED GRASS *(Calamagrostis montanensis)*	1	0-9	30

ENVIRONMENTAL VARIABLES

RANGE SITE:
BLOWOUT

ELEVATION (M):
770

SOILS: BROWN SOLODIZED SOLONETZ (HEMARUKA, WARDLOW, PATRICIA)
BROWN SOLOD (KARLSBAD, ROSEMARY, HALLIDAY)

SOIL DRAINAGE:
WELL DRAINED
MODERATELY WELL DRAINED
IMPERFECTLY DRAINED

SLOPE :
VERY GENTLE
NEARLY LEVEL
LEVEL

FORAGE PRODUCTION (LB/AC)

GRASS	NOT AVAILABLE
FORB	NOT AVAILABLE
SHRUB	NOT AVAILABLE
LITTER	NOT AVAILABLE
TOTAL	NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.15 (0.13-0.17)AUM/ac

58

Sandberg Bluegrass - Northern Wheat Grass DMGA30

(Poa sandbergii - Agropyron dasystachyum) Herbaceous

n=3 This community type is a mid-seral plant community on moderately well drained to imperfectly drained solonetzic soils in the Dry Mixedgrass. The blowout type in question is representative of the solonetzic soils in Fig. 4 that occur to the left of centre in the image, including brown solonetz and brown solodized solonetz. The higher proportion of Sandberg's bluegrass in relation to the reference plant community for this type (DMGA39) is likely due to past heavy grazing pressure. Silver sagebrush, if present, occurs at low levels of canopy cover. Conservative stocking rates are recommended for this type to foster range recovery, and because of the especially dry growing conditions imposed by the hardpan character of the surface soil.

Soil Exposure: 38% (13-57) **Moss/Lichen Cover:** 27 % (1-77) **Total Vegetation:** 56% (47-63)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
FORBS			
PASTURE SAGEWORT *(Artemisia frigida)*	11	8-15	100
WINTER-FAT *(Eurotia lanata)*	9	0-27	33
MOSS PHLOX *(Phlox hoodii)*	1	0-4	33
GRASSES			
SANDBERG BLUEGRASS *(Poa sandbergii)*	28	22-39	100
NORTHERN WHEAT GRASS *(Agropyron Dasystachyum)*	23	9-40	100
JUNE GRASS *(Koeleria macrantha)*	15	0-31	67
LOW SEDGE *(Carex stenophylla)*	4	0-13	33
WESTERN WHEAT GRASS *(Agropyron smithii)*	2	0-5	33
UNDIFFERENTIATED SEDGE *(Carex)*	2	0-3	67
BLUE GRAMA GRASS *(Bouteloua gracilis)*	1	0-3	33

ENVIRONMENTAL VARIABLES

RANGE SITE:
BLOWOUT

SOILS:
BROWN SOLODIZED SOLONETZ (STEVEVILLE, HEMARUKA)

SOIL DRAINAGE:
IMPERFECTLY DRAINED
MODERATELY WELL DRAINED

SLOPE :
VERY GENTLE
NEARLY LEVEL
LEVEL

FORAGE PRODUCTION (LB/AC)

GRASS	NOT AVAILABLE
FORB	NOT AVAILABLE
SHRUB	NOT AVAILABLE
LITTER	NOT AVAILABLE
TOTAL	NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.08 (0.06-0.10)AUM/ac

66

Silver Sagebrush/Northern Wheat Grass - June Grass DMGA34

(Artemisia cana / Agropyron dasystachyum - Koeleria macrantha) Herbaceous

n=72 This community type is the late seral to reference plant community on moderately well drained to imperfectly drained solonetzic soils of loam to clay loam texture, termed blowout range sites with characteristic eroded pits in the soil surface. This is similar to the Bouteloua-Agropyron community described by Coupland (1950, 1961) a product of the special character of blowout conditions. Parent materials are developed from lacustrine material or glacial till, both of which may be rich in marine shales. Needle-and-thread grass, normally dominant in most Dry Mixed Grass plant communities, is not well suited to the impermeable subsoils, where northern and western wheatgrass are more successful (Weaver 1942, Coupland 1961). Silver sagebrush is normally part of this community providing an important source of structure. Productivity data summarized below is the average of 22 years at Cressday and Sage Creek rangeland reference sites. Grazing resistant species like Sandberg bluegrass will increase in abundance while canopy cover and composition of Northern and Western wheatgrass will decline. Conservative stocking rates are recommended for this type given the especially dry growing conditions imposed by the hardpan character of the surface soil.

Soil Exposure: 28% (0-56) **Moss/Lichen Cover:** 45 % (1-88) **Total Vegetation:** 56% (29-98%)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
SHRUBS			
SILVER SAGEBRUSH *(Artemisia cana)*	2	0-27	60
FORBS			
PASTURE SAGEWORT *(Artemisia frigida)*	6	0-25	99
SCARLET MALLOW *(Sphaeralcea coccinea)*	1	0-5	53
GRASSES			
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	23	5-73	100
JUNE GRASS *(Koeleria macrantha)*	9	0-38	100
BLUE GRAMA GRASS *(Bouteloua gracilis)*	6	0-30	94
NEEDLE-AND-THREAD *(Stipa comata)*	5	0-11	90
SANDBERG BLUEGRASS *(Poa sandbergii)*	4	0-35	93
WESTERN WHEAT GRASS *(Agropyron smithii)*	2	0-20	57
PLAINS REED GRASS *(Calamagrostis montanensis)*	2	0-16	60
UNDIFFERENTIATED SEDGE *(Carex)*	2	0-8	83

ENVIRONMENTAL VARIABLES

RANGE SITE:
BLOWOUT

SOILS: BROWN SOLOD (HALLIDAY)
SOLODIZED SOLONETZ (STEVEVILLE, HEMARUKA, WARDLOW)

ELEVATION (M):
995 (964-1046)

SOIL DRAINAGE:
MODERATELY WELL DRAINED
WELL DRAINED

SLOPE :
VERY GENTLE
NEARLY LEVEL
LEVEL

ASPECT:
VARIABLE

FORAGE PRODUCTION (LB/AC)

GRASS 378 (187-551)
FORB 100 (27-231)
TOTAL 478
LITTER 307 (119-571)

Ecologically Sustainable Stocking Rate
0.09 (0.08-0.12)AUM/ac

Needle and Thread - June Grass - Blue Grama Grass DMGA35

(Stipa comata - Koeleria macrantha - Bouteloua gracilis) Herbaceous

n=87 This is a late seral to reference plant community for blowout range sites in the Dry Mixedgrass. This particular community occurs on soils that are in the latter phase of the solonetzic soil development process which are represented towards the right side of the soil development sequence in Fig. 4. While minor solonetzic features may persist in the soil profile, needle-and-thread grass and moss/lichen cover are abundant and soil exposure is low. This community, along with DMGA15 and DMGA16, will be among the more productive of plant communities on blowout range sites. Silver sagebrush may occur in only trace amounts in this community type.

Soil Exposure: 6 % (0-49) **Moss/Lichen Cover:** 47 % (3-90) **Total Vegetation:** 66% (23-96)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
FORBS			
PASTURE SAGEWORT *(Artemisia frigida)*	4	0-24	80
SCARLET MALLOW *(Sphaeralcea coccinea)*	5	0-22	89
MOSS PHLOX *(Phlox hoodii)*	1	0-6	40
GRASSES			
NEEDLE-AND-THREAD *(Stipa comata)*	33	5-59	100
JUNE GRASS *(Koeleria macrantha)*	12	0-39	99
BLUE GRAMA GRASS *(Bouteloua gracilis)*	11	0-29	100
UNDIFFERENTIATED SEDGE *(Carex)*	7	0-37	92
WESTERN WHEAT GRASS *(Agropyron smithii)*	6	0-25	74
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	3	0-16	46
PLAINS REED GRASS *(Calamagrostis montanensis)*	1	0-10	46
SANDBERG BLUEGRASS *(Poa sandbergii)*	1	0-9	48

ENVIRONMENTAL VARIABLES

RANGE SITE:
- BLOWOUT
- LOAMY

ELEVATION (M):
- 773 (745-792)

SOILS:
- SOLONETZIC BROWN (RONALAINE, CECIL, KARLSBAD)
- ORTHIC BROWN (MALEB, RANIER, FOREMOST, CAVENDISH)

SOIL DRAINAGE:
- WELL DRAINED
- MODERATELY WELL DRAINED

SLOPE :
- VERY GENTLE
- NEARLY LEVEL

ASPECT:
- VARIABLE

FORAGE PRODUCTION (LB/AC)

- GRASS NOT AVAILABLE
- FORB NOT AVAILABLE
- SHRUB NOT AVAILABLE
- LITTER NOT AVAILABLE
- TOTAL NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.15 (0.16-0.20)AUM/ac

71

Wheat Grass - Sandberg Bluegrass DMA39

(Agropyron - Poa sandbergii) Herbaceous

n=26 This community type is the late seral to reference plant community on moderately well drained to imperfectly drained solonetzic soils termed blowout range sites with characteristic eroded pits in the soil surface. The blowout type in question is representative of the solonetzic soils in Fig. 4 that occur to the left of centre in the image, including brown solonetz and brown solodized solonetz. Soil exposure is fairly high due to the presence of eroded soil pits. The cover of needle-and-thread grass is low due to its relative intolerance of the impermeable soil (Weaver 1942, Coupland 1961). This is similar to the Bouteloua-Agropyron community described by Coupland (1950, 1961) but with Sandberg's bluegrass as the major subdominant species. Needle-and-thread grass, normally dominant in most Dry Mixedgrass plant communities, is not well suited to the impermeable subsoils, where northern and western wheatgrass are more successful. This blowout community type has a relatively high level of soil exposure averaging 30% and silver sagebrush, if present, occurs at low levels of canopy cover. Conservative stocking rates are normally recommended for this type given the especially dry growing conditions imposed by the hardpan character of the surface soil.

Soil Exposure: 30 % (0-83) **Moss/Lichen Cover:** 17 % (0-63) **Total Vegetation:** 46% (4-91)

PLANT COMPOSITION

	CANOPY COVER(%) MEAN	RANGE	CONST
SHRUBS			
SILVER SAGEBRUSH (*Artemisia cana*)	1	0-11	23
FORBS			
PASTURE SAGEWORT (*Artemisia frigida*)	4	0-13	88
NUTTALL'S ATRIPLEX (*Atriplex nuttallii*)	1	0-11	42
PRICKLY PEAR CACTUS (*Opuntia polyacantha*)	1	0-12	23
WINTER-FAT (*Eurotia lanata*)	1	0-9	20
GRASSES			
WESTERN WHEAT GRASS (*Agropyron smithii*)	34	1-85	100
SANDBERG BLUEGRASS (*Poa sandbergii*)	10	0-26	96
JUNE GRASS (*Koeleria macrantha*)	5	0-18	81
BLUE GRAMA GRASS (*Bouteloua gracilis*)	4	0-18	65
UNDIFFERENTIATED SEDGE (*Carex*)	3	0-11	77
NORTHERN WHEAT GRASS (*Agropyron dasystachyum*)	3	0-18	27
NEEDLE-AND-THREAD (*Stipa comata*)	2	0-10	50

ENVIRONMENTAL VARIABLES

RANGE SITE:
- BLOWOUT

SOILS:
- BROWN SOLODIZED SOLONETZ (WARDLOW, HEMARUKA, STEVEVILLE)
- BROWN SOLONETZ
- SOLONETZIC BROWN (RONALAINE)

ELEVATION (M):
- 954 (846 - 1020)

SOIL DRAINAGE:
- IMPERFECTLY DRAINED
- MODERATELY WELL DRAINED
- WELL DRAINED

SLOPE :
- NEARLY LEVEL
- VERY GENTLE, LEVEL

ASPECT:
- VARIABLE

FORAGE PRODUCTION (LB/AC)

GRASS	NOT AVAILABLE
FORB	NOT AVAILABLE
SHRUB	NOT AVAILABLE
LITTER	NOT AVAILABLE
TOTAL	NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.11 (0.10-0.13)AUM/ac

75

Salt Grass - Western Wheat Grass DMGA44

(Distichlis stricta - Agropyron smithii) Herbaceous

n=6 This is a mid to late seral plant community on saline lowland range sites in the Dry Mixedgrass subregion. This community appears to be a sucessional community to DMGA20 that is associated with Saline Lowland 1. A past disturbance history seems to be evident in this community type due to the presence of Kentucky bluegrass, common pepper-grass and foxtail barley. Soil exposure is relatively high and total vegetation can be highly variable.

Soil Exposure: 31 % (2-79) **Moss/Lichen Cover:** 1 % (0-4) **Total Vegetation:** 68% (36-98)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
SHRUBS			
SNOWBERRY *(Symphoricarpos occidentalis)*	2	0-10	17
FORBS			
NEVADA BULRUSH *(Scirpus nevadensis)*	2	0-11	17
LINEAR-LEAVED PLANTAIN *(Plantago elongata)*	2	0-7	33
COMMON PEPPER-GRASS *(Lepidium densiflorum)*	1	0-5	33
GRASSES			
SALT GRASS *(Distichlis stricta)*	35	20-69	100
WESTERN WHEAT GRASS *(Agropyron smithii)*	16	0-33	67
BLUE GRAMA GRASS *(Bouteloua gracilis)*	9	0-32	33
SANDBERG BLUEGRASS *(Poa sandbergii)*	6	0-17	67
ALKALI BLUEGRASS *(Poa juncifolia)*	3	0-15	17
KENTUCKY BLUEGRASS *(Poa pratensis)*	2	0-15	17
NEEDLE-AND-THREAD *(Stipa comata)*	2	0-8	50
FOXTAIL BARLEY *(Hordeum jubatum)*	2	0-11	17

ENVIRONMENTAL VARIABLES

RANGE SITE:
SALINE LOWLAND

SOILS:
ORTHIC REGOSOL(BULLPOUND)

SOIL DRAINAGE:
WELL DRAINED
MODERATELY WELL DRAINED

SLOPE :
NEARLY LEVEL
VERY GENTLE
GENTLE

ASPCET: N/A

FORAGE PRODUCTION (LB/AC)

GRASS	NOT AVAILABLE
FORB	NOT AVAILABLE
SHRUB	NOT AVAILABLE
LITTER	NOT AVAILABLE
TOTAL	NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.12 (0.10-0.13) AUM/ac

80

Needle and Thread - Blue Grama Grass - Wheat Grass DMGA46

(Stipa comata - Bouteloua gracilis - Agropyron Spp.) Herbaceous

n=20 This is a late seral plant community on loamy range sites in the Dry Mixed grass on productive mid to lower slope locations and on north facing slopes and is associated with the reference plant community DMGA2. It also has a more general distribution on modal sites with moist loamy range sites including soil series like Cranford, Maisinasin and Pinhorn. Moderate grazing pressure may have reduced the amount of wheatgrass cover in the plant community making blue grama grass more abundant.

Soil Exposure: 7 % (0-27) **Moss/Lichen Cover:** 43 % (2-83) **Total Vegetation:** 65% (40-75)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
FORBS			
PASTURE SAGEWORT *(Artemisia frigida)*	4	0-15	80
SCARLET MALLOW *(Sphaeralcea coccinea)*	2	0-8	80
COMMON DANDELION *(Taraxacum officinale)*	2	0-7	65
GRASSES			
NEEDLE-AND-THREAD *(Stipa comata)*	24	11-64	100
BLUE GRAMA GRASS *(Bouteloua gracilis)*	20	5-45	100
WESTERN WHEAT GRASS *(Agropyron smithii)*	19	11-40	100
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	6	0-13	85
SANDBERG BLUEGRASS *(Poa sandbergii)*	5	0-15	90
JUNE GRASS *(Koeleria macrantha)*	4	0-10	80
LOW SEDGE *(Carex stenophylla)*	2	0-5	95
PLAINS REED GRASS *(Calamagrostis montanensis)*	2	0-14	45

ENVIRONMENTAL VARIABLES

RANGE SITE:
LOAMY - MOIST

SOILS:
MASINASIN, CRANFORD)
ORTHIC DARK BROWN (LUPEN, PURESCAPE)

SOIL DRAINAGE:
WELL DRAINED
MODERATELY WELL DRAINED

SLOPE :
GENTLE NEARLY
VERY GENTLE
LEVEL

ASPECT:
NORTHERLY

FORAGE PRODUCTION (LB/AC)

GRASS	NOT AVAILABLE
FORB	NOT AVAILABLE
SHRUB	NOT AVAILABLE
LITTER	NOT AVAILABLE
TOTAL	NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.2 (0.18-0.23)AUM/ac

82

Blue Grama Grass - Needle and Thread DMGA48

(Bouteloua gracilis - Stipa comata) Herbaceous

n=19 This is a mid-seral plant community associated with DMGA2 on moist loamy range sites. This plant community is the product of heavy grazing pressure. The cover of both wheatgrass and needle-and-thread grass are diminished with an increase in soil exposure. Recovery of this plant community back towards DMGA46 or DMGA47 or DMGA2 may take many years. Other disturbance species are more abundant including plantain and dandelion.

Soil Exposure: 16 % (0-40) **Moss/Lichen Cover:** 31% (0-74) **Total Vegetation:** 60% (39-78)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
FORBS			
PASTURE SAGEWORT *(Artemisia frigida)*	5	0-20	95
SCARLET MALLOW *(Sphaeralcea coccinea)*	3	0-9	89
PURSH'S PLANTAIN *(Plantago patagonica)*	2	0-30	68
COMMON DANDELION *(Taraxacum officianale)*	1	0-9	37
GRASSES			
BLUE GRAMA GRASS *(Bouteloua gracilis)*	28	10-75	100
NEEDLE-AND-THREAD *(Stipa comata)*	24	9-42	100
SANDBERG BLUEGRASS *(Poa sandbergii)*	5	0-15	68
WESTERN WHEAT GRASS *(Agropyron smithii)*	3	0-10	79
JUNE GRASS *(Koeleria macrantha)*	3	0-12	79
NORTHERN WHEAT GRASS *(Agropyron dasystachyum)*	3	0-10	68
LOW SEDGE *(Carex stenophylla)*	1	0-3	89
THREAD-LEAVED SEDGE *(Carex filifolia)*	2	0-12	32

ENVIRONMENTAL VARIABLES

RANGE SITE:
- LOAMY-MOIST

SOILS:
- BROWN SOLOD (HALLIDAY)
- BROWN SOLODIZED SOLONETZ (HEMARUKA)
- ORTHIC DARK BROWN (PURESCAPE)

SOIL DRAINAGE:
- RAPIDLY DRAINED
- WELL DRAINED
- MODERATELY WELL DRAINED

SLOPE :
- VERY STRONG
- STRONG NEARLY
- MODERATE
- VERY GENTLE
- LEVEL

FORAGE PRODUCTION (LB/AC)

GRASS	NOT AVAILABLE
FORB	NOT AVAILABLE
SHRUB	NOT AVAILABLE
LITTER	NOT AVAILABLE
TOTAL	NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.15 (0.13-0.17)AUM/ac

84

Western Wheat Grass – Foxtail Barley DMGA51
*(Agropyron smithii - Hordeum jubatum)*Herbaceous

n=5 This is a disturbed plant community on overflow range sites in the Dry Mixedgrass. This community has been found in the Foremost Plain but can likely be found across the Dry Mixedgrass on Overflow and Saline Lowland sites. Foxtail Barley is an indicator of saline soils.

Soil Exposure: 18% (0-50) **Moss/Lichen Cover:** 3% (0-11) **Total Vegetation:** 80% (46-100)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
SHRUBS			
PRAIRIE ROSE *(Rosa arkansana)*	3	0-20	14
FORBS			
GUMWEED *(Grindelia squarrosa)*	3	0-14	57
AMERICAN VETCH *(Vicia americana)*	1	0-2	71
COMMON DANDELION *(Taraxacum officinale)*	1	0-7	43
CURLED DOCK *(Rumex crispus)*	1	0-3	43
COMMON TALL SUNFLOWER *(Helianthus nuttallii)*	1	0-7	29
GRASSES			
WESTERN WHEAT GRASS *(Agropyron smithii)*	21	4-35	100
FOXTAIL BARLEY *(Hordeum jubatum)*	3	0-14	43
CANADA BLUEGRASS *(Poa compressa)*	3	0-20	14
UNDIFFERENTIATED SEDGE *(Carex)*	1	0-7	43
LOW SEDGE *(Carex stenophylla)*	1	0-8	29
ROUGH HAIR GRASS *(Agrostis scabra)*	1	0-9	29
KENTUCKY BLUEGRASS *(Poa pratensis)*	1	0-4	29

ENVIRONMENTAL VARIABLES

RANGE SITE:
OVERFLOW
SALINE LOWLAND

SOILS: ORTHIC BROWN (BUNTON, PURPLE SPRINGS)
REGO BROWN (VENDISANT)
ORTHIC REGOSOL (WESTON-AA)

ELEVATION (M): 800-900

SOIL DRAINAGE:
RAPIDLY DRAINED
WELL DRAINED
MODERATELY WELL DRAINED

SLOPE :
NEARLY LEVEL
LEVEL

ASPECT:
VARIABLE

FORAGE PRODUCTION (LB/AC)

GRASS NOT AVAILABLE
FORB NOT AVAILABLE
SHRUB NOT AVAILABLE
LITTER NOT AVAILABLE
TOTAL NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.2 (0.15-0.25) AUM/ac

85

Crested Wheat Grass DMGB1

*(Agropyron pectiniforme)*Herbaceous

n=6 This is a tame pasture plant community on mostly loamy range sites in the Dry Mixedgrass. Production can be extremely variable based on soils, row spacing, age of pasture and inputs.

Soil Exposure: 32% (10-51) **Moss/Lichen Cover:** 1% (0-1) **Total Vegetation:** 68% (49-90)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
FORBS			
COMMON DANDELION *(Taraxacum officinale)*	1	0-2	80
SCARLET MALLOW *(Sphaeralcea coccinea)*	2	0-4	60
PASTURE SAGEWORT *(Artemisia frigida)*	3	0-7	40
GRASSES			
CRESTED WHEAT GRASS *(Agropyron pectiniforme)*	47	30-82	100
NEEDLE-AND-THREAD *(Stipa comata)*	2	0-10	17
JUNE GRASS *(Koeleria macrantha)*	1	0-5	17
SANDBERG BLUEGRASS *(Poa sandbergii)*	1	0-4	17

ENVIRONMENTAL VARIABLES

RANGE SITE:
LOAMY

SOILS:
ORTHIC BROWN

ELEVATION (M):
VARIABLE

SOIL DRAINAGE:
WELL DRAINED
MODERATELY WELL DRAINED

SLOPE :
VERY GENTLE
NEARLY LEVEL
LEVEL

ASPECT:
VARIABLE

FORAGE PRODUCTION (LB/AC)

GRASS	2504
FORB	NOT AVAILABLE
SHRUB	NOT AVAILABLE
LITTER	NOT AVAILABLE
TOTAL	NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.5 (0.3-0.7) AUM/ac

100

Crested Wheat Grass - Needle and Thread / Silver Sagebrush DMGB2

(Agropyron pectiniforme- Stipa comata / Artemisia cana) Herbaceous Shrub

n=9 This is a tame pasture plant community on mostly loamy range sites in the Dry Mixedgrass. This community is the product of a crested wheatgrass tame pasture that has been moderately grazed and not been rejuvenated recently. Common throughout the dry Mixedgrass natural subregion.

Soil Exposure: 23% (1-79) **Moss/Lichen Cover:** 9% (1-29) **Total Vegetation:** 88% (79-100)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
SHRUBS			
SILVER SAGEBRUSH *(Artemisia cana)*	6	0-17	67
FORBS			
COMMON DANDELION *(Taraxacum officinale)*	3	0-10	67
SCARLET MALLOW *(Sphaeralcea coccinea)*	2	0-4	89
PASTURE SAGEWORT *(Artemisia frigida)*	2	0-6	67
GRASSES			
CRESTED WHEAT GRASS *(Agropyron pectiniforme)*	30	4-81	100
NEEDLE-AND-THREAD *(Stipa comata)*	9	0-33	89
UNDIFFERENTIATED SEDGE *(Carex)*	5	0-16	56
JUNE GRASS *(Koeleria macrantha)*	4	0-13	67
WESTERN WHEAT GRASS *(Agropyron smithii)*	3	0-9	67
BLUE GRAMA GRASS *(Bouteloua gracilis)*	1	0-5	67
SANDBERG BLUEGRASS *(Poa sandbergii)*	1	0-4	67

ENVIRONMENTAL VARIABLES

RANGE SITE:
- LOAMY
- OVERFLOW
- BLOWOUT

SOILS: ORTHIC BROWN
- SOLONETZIC BROWN

ELEVATION (M):

SOIL DRAINAGE:
- WELL DRAINED
- MODERATELY WELL DRAINED

SLOPE :
- VERY GENTLE
- NEARLY LEVEL
- LEVEL

ASPECT:
- VARIABLE

FORAGE PRODUCTION (LB/AC)

GRASS	603
FORB	NOT AVAILABLE
SHRUB	NOT AVAILABLE
LITTER	NOT AVAILABLE
TOTAL	NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.25 (0.2-0.35) AUM/ac

101

Foxtail Barley – Kentucky Bluegrass - Western Wheat Grass DMGB7

(Hordeum jubatum – Poa pratensis - Agropyron smithii) Herbaceous

n=5 This plant community is found on varying range sites that are characteristic of an influx or presence of water during at least part of the year. The community has been located in depressional areas or along the edges of sloughs and can tolerate some alkalinity and salinity. Foxtail barely is an early successional species and increaser that takes advantage of newly exposed soils due to water level reduction or disturbance.

Soil Exposure: 19 % (1-60) **Moss/Lichen Cover:** 1 % (0-2) **Total Vegetation:** 79% (33-98)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
FORBS			
CREEPING WHITE PRAIRIE ASTER *(Aster falcatus)*	5	0-24	40
UNDIFFERENTIATED SENICIO *(Senecio)*	2	0-11	20
KOCHIA *(Kochia scoparia)*	2	0-7	25
PERENNIAL SOW-THISTLE *(Sonchus arvensis)*	1	0-4	40
GRASSES			
FOXTAIL BARLEY *(Hordeum jubatum)*	26	15-38	100
KENTUCKY BLUEGRASS *(Poa pratensis)*	13	0-32	80
WESTERN WHEAT GRASS *(Agropyron smithii)*	11	0-31	60
TUFTED HAIR GRASS *(Deschampsia cespitosa)*	4	0-14	80
WIRE RUSH *(Juncus balticus)*	3	0-12	40
NUTTALL'S SALT MEADOW GRASS *(Puccinellia nuttalliana)*	3	0-13	40
SALT GRASS *(Distichlis stricta)*	3	0-13	20
PRAIRIE SEDGE *(Carex prairea)*	2	0-9	20
UNDIFFERENTIATED SEDGE *(Carex)*	1	0-7	40

ENVIRONMENTAL VARIABLES

RANGE SITE:
- SUBIRRIGATED
- OVERFLOW
- SALINE LOWLAND

SOILS:
- ORTHIC BROWN (ANTONIO, BINGVILLE)

SOIL DRAINAGE:
- WELL DRAINED
- IMPERFECTLY DRAINED
- POORLY DRAINED

SLOPE :
- VERY GENTLE
- NEARLY LEVEL
- STRONG

FORAGE PRODUCTION (LB/AC)

GRASS	NOT AVAILABLE
FORB	NOT AVAILABLE
SHRUB	NOT AVAILABLE
LITTER	NOT AVAILABLE
TOTAL	NOT AVAILABLE

Ecologically Sustainable Stocking Rate
0.1 (0.06-0.12) AUM/ac

106

Silver Sagebrush/Western Porcupine Grass - Wheatgrass DMGC3

*(Artemisia cana / Stipa curtiseta – Agropyron Spp.)*Shrub Herbaceous

n=8 This type occupies non-saline overflow sites and very productive loamy range sites in the Dry Mixedgrass. In the case of overflow sites, both the site and overflow are likely are non-saline given the cover of both western porcupine grass and needle-and-thread grass. The presence of such vigorous and productive cover of western porcupine grass is an indicator of productive, dark brown chernozemic soils (Smoliak, Personal comm.). This is a minor type and somewhat rare in soil correlation area 1. Though silver sagebrush may be present at a low canopy cover (1-2%) it provides valuable structure for wildlife with plants ranging in height from 0.5 to 0.75 m. Note that total vegetation cover is very high and with very little exposed soil.

Soil Exposure: 2 % (0-5) **Moss/Lichen Cover:** 20 % (2-69) **Total Vegetation:** 90% (71-98)

PLANT COMPOSITION CANOPY COVER(%)

	MEAN	RANGE	CONST
SHRUBS			
SILVER SAGEBRUSH (*Artemisia cana*)	4	0-7	75
FORBS			
PRAIRIE SAGEWORT *(Artemisia ludoviciana)*	1	0-2	75
PASTURE SAGEWORT *(Artemisia frigida)*	1	0-3	63
GRASSES			
WESTERN PORCUPINE GRASS *(Stipa curtiseta)*	44	21-77	100
NEEDLE-AND-THREAD *(Stipa comata)*	8	0-24	75
NORTHERN WHEATGRASS *(Agropyron dasystachyum)*	7	0-19	88
UNDIFFERENTIATED SEDGE *(Carex)*	5	0-17	88
JUNE GRASS *(Koeleria macrantha)*	5	0-17	88
SUN-LOVING SEDGE *(Carex pensylvanica)*	5	0-24	38
BLUE GRAMA GRASS *(Bouteloua gracilis)*	3	0-9	88
WESTERN WHEAT GRASS *(Agropyron smithii)*	2	0-9	50
PLAINS REED GRASS *(Calamagrostis montanensis)*	1	0-5	75

ENVIRONMENTAL VARIABLES

RANGE SITE:
OVERFLOW
LOAMY

SOILS: ORTHIC BROWN (COMREY, CHIN, BUNTON, PINHORN)

ELEVATION (M):
1025 (1022 - 1028)

SOIL DRAINAGE:
MODERATELY WELL DRAINED
WELL DRAINED

SLOPE :
GENTLE
MODERATE
VERY GENTLE
NEARLY LEVEL

ASPECT:
VARIABLE

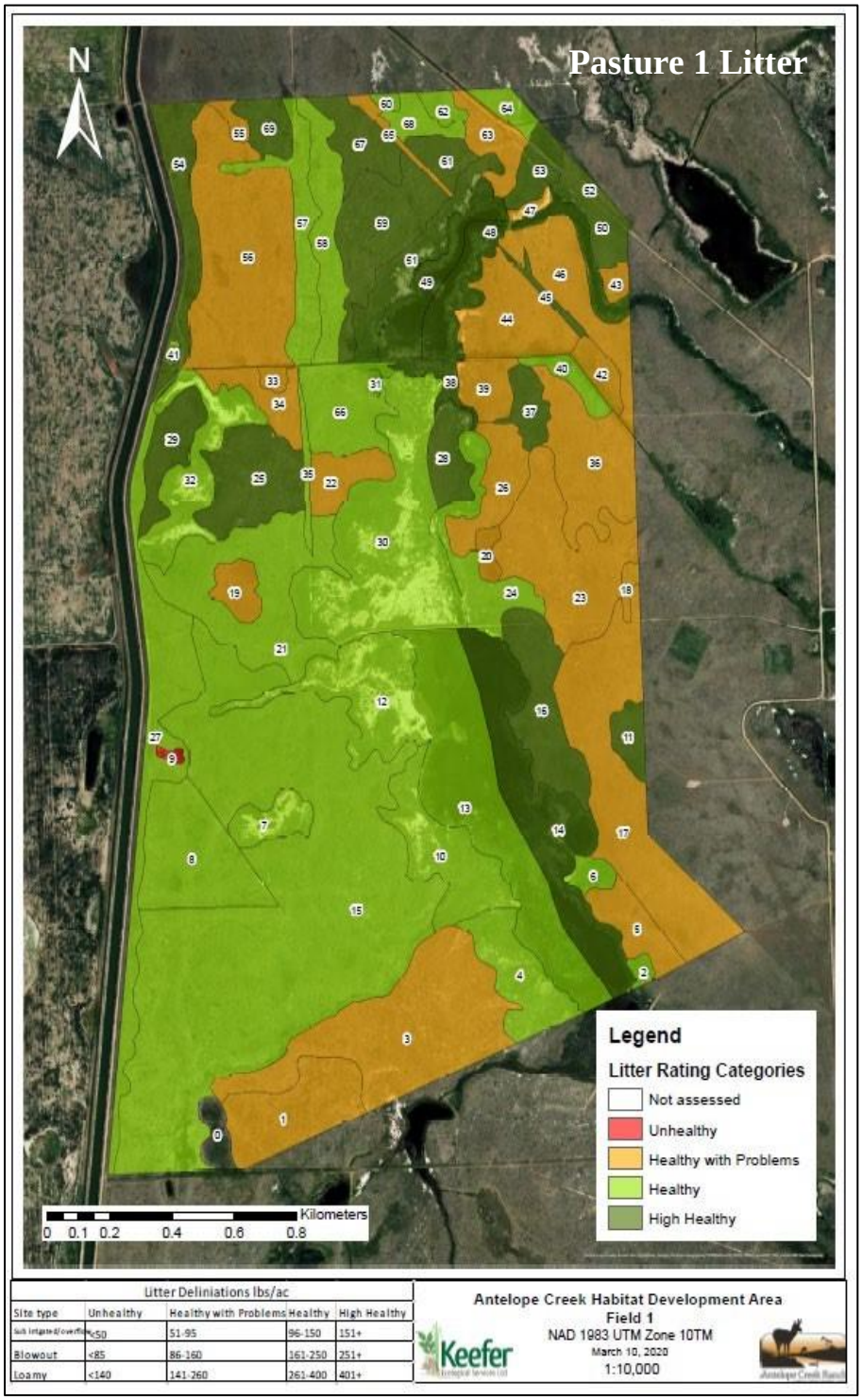
FORAGE PRODUCTION (LB/AC)

GRASS	NOT AVAILABLE
FORB	NOT AVAILABLE
SHRUB	NOT AVAILABLE
LITTER	NOT AVAILABLE
TOTAL	NOT AVAILABLE

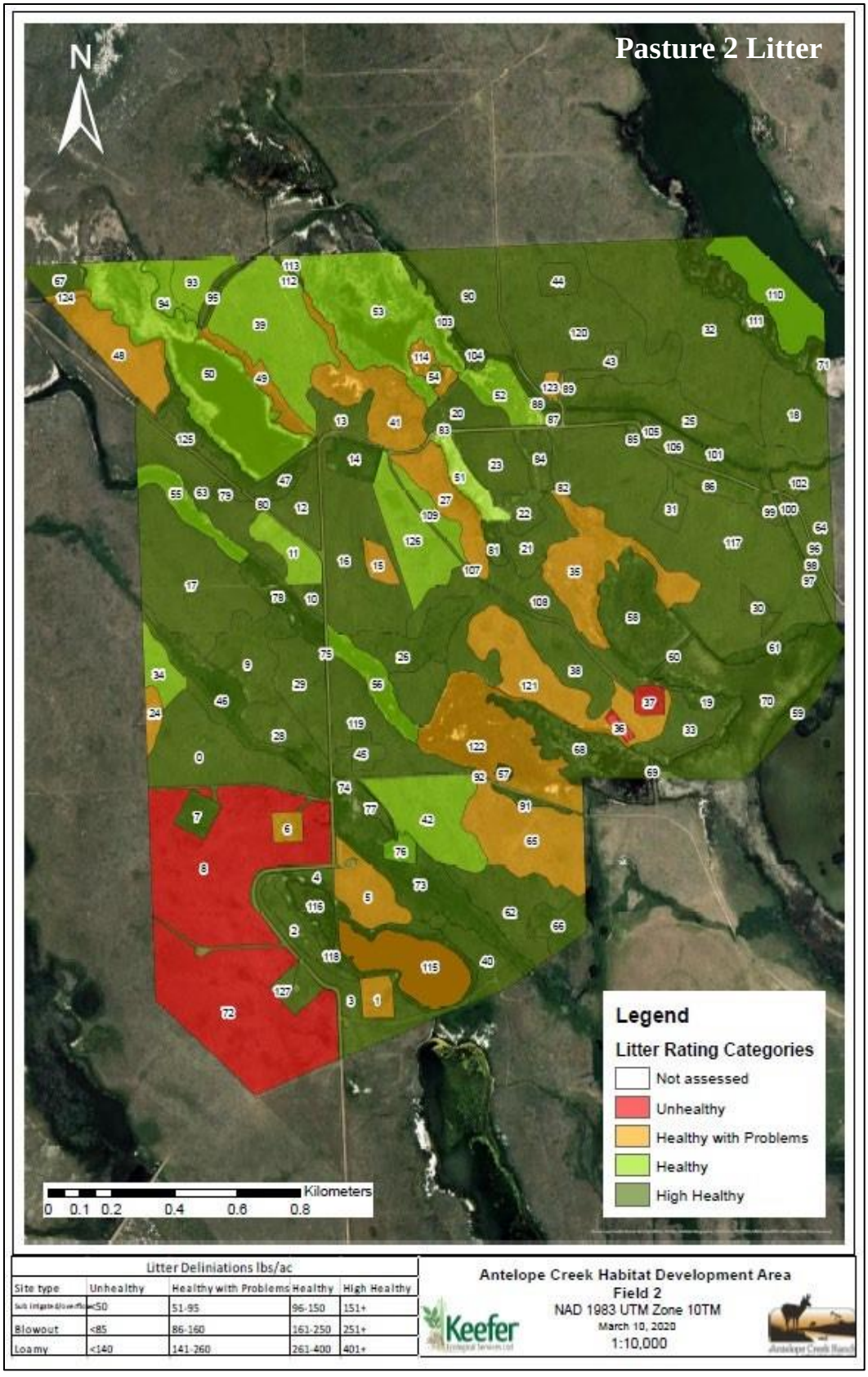
Ecologically Sustainable Stocking Rate
0.3 (0.25-0.35)AUM/ac

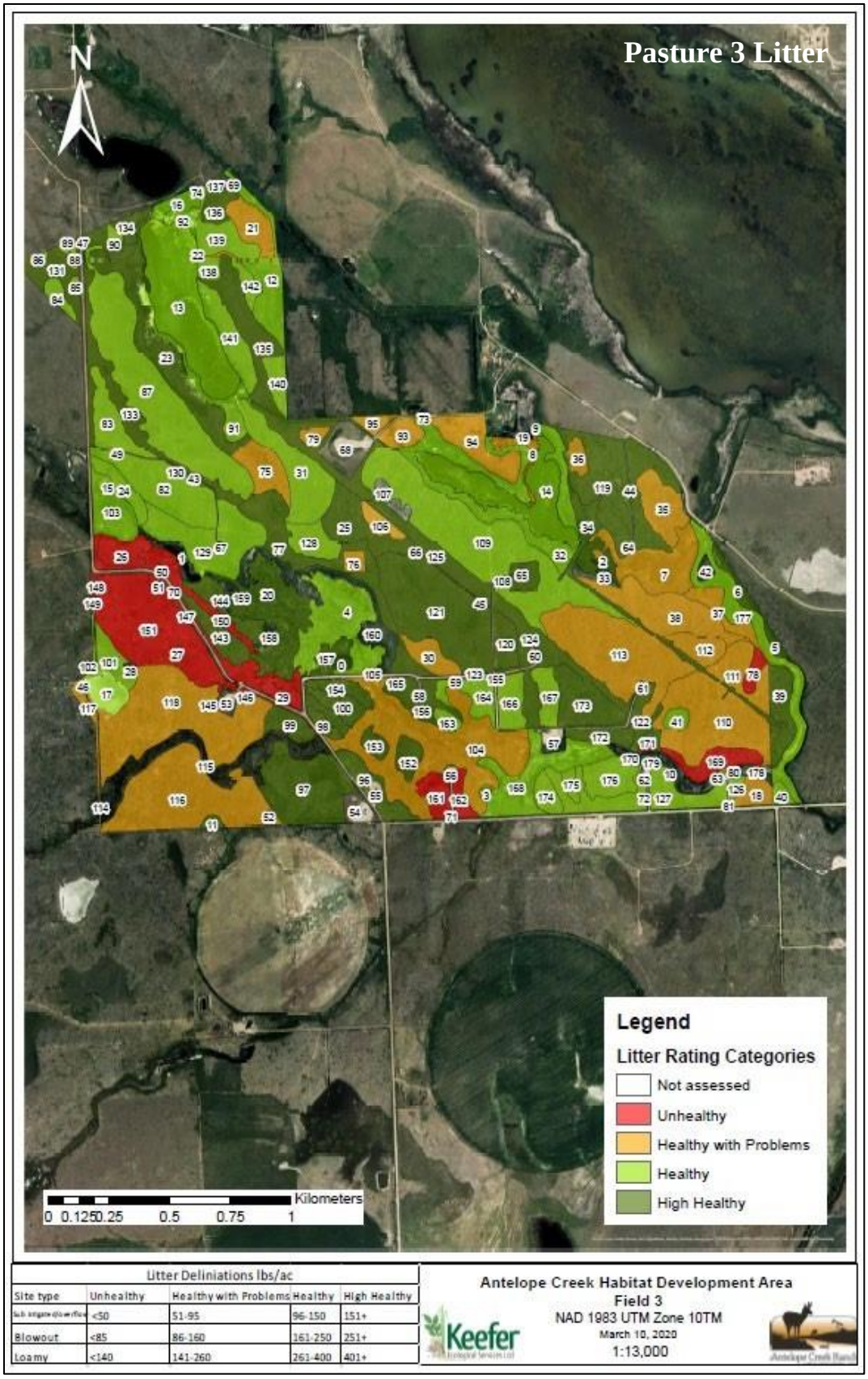
108

APPENDIX D. LITTER AMOUNTS FOR PASTURES 1 TO 4 ON THE ANTELOPE CREEK HABITAT DEVELOPMENT AREA[16].



[16] Baker and Rushton 2020

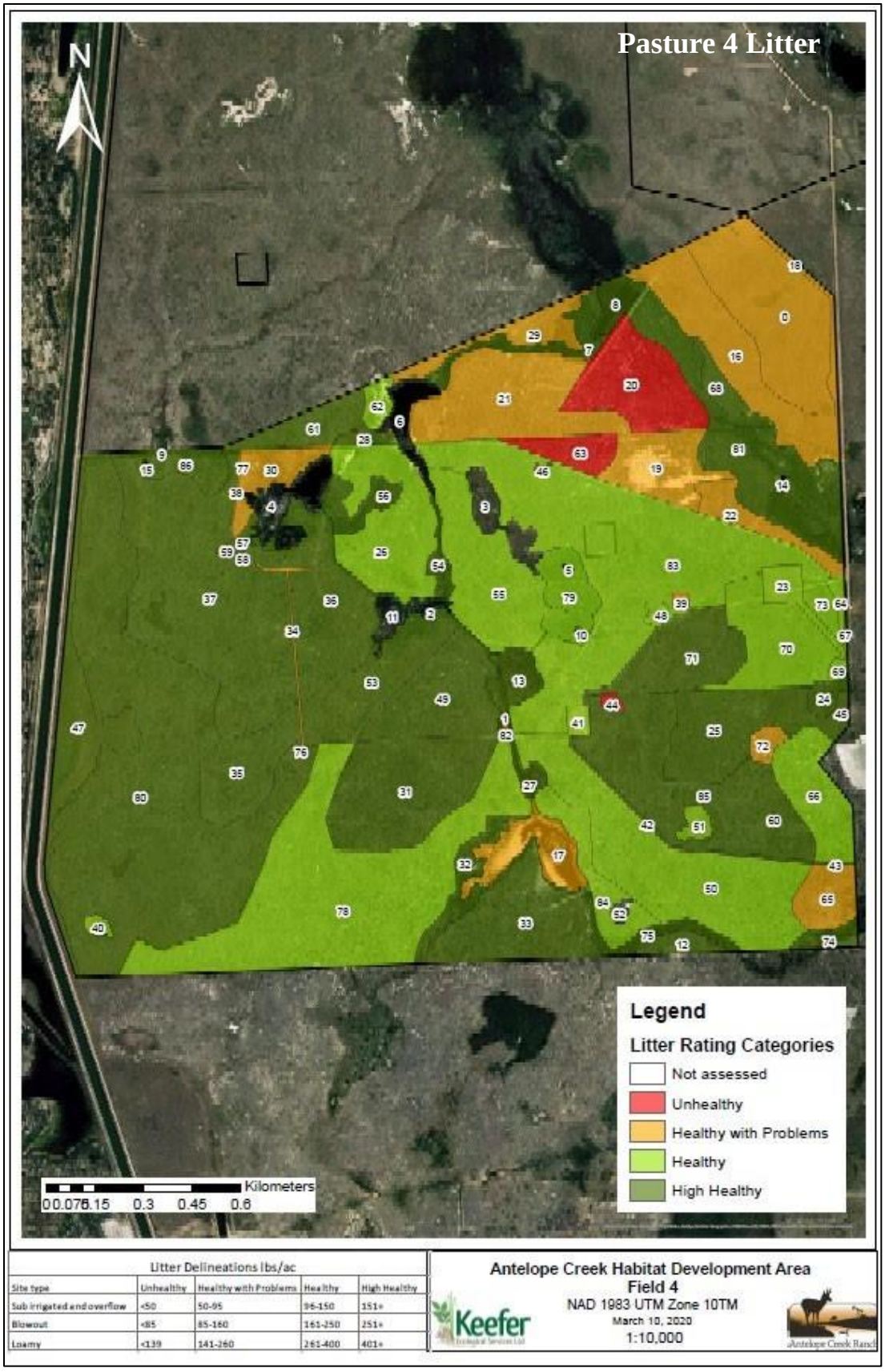

Pasture 2 Litter
N
Legend
Litter Rating Categories
Not assessed
Unhealthy
Healthy with Problems
Healthy
High Healthy
Kilometers
0 0.1 0.2 0.4 0.6 0.8
Litter Deliniations lbs/ac
Site type | Unhealthy | Healthy with Problems | Healthy | High Healthy
Blowout | <85 | 86-160 | 161-250 | 251+
Loamy | <140 | 141-260 | 261-400 | 401+
Antelope Creek Habitat Development Area
Field 2
NAD 1983 UTM Zone 10TM
March 10, 2020
1:10,000
Keefer



Litter Deliniations lbs/ac				
Site type	Unhealthy	Healthy with Problems	Healthy	High Healthy
[illegible]	<50	51-95	96-150	151+
Blowout	<85	86-160	161-250	251+
Loamy	<140	141-260	261-400	401+

Antelope Creek Habitat Development Area
Field 3
NAD 1983 UTM Zone 10TM
March 10, 2020
1:13,000

Keefer



Litter Delineations lbs/ac

Site type	Unhealthy	Healthy with Problems	Healthy	High Healthy
Sub irrigated and overflow	<50	50-95	96-150	151+
Blowout	<85	85-160	161-250	251+
Loamy	<139	141-260	261-400	401+

Antelope Creek Habitat Development Area
Field 4
NAD 1983 UTM Zone 10TM
March 10, 2020
1:10,000

Keefer Ecological Services Ltd

Antelope Creek Ranch