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To:	Rocky View County	Date:	September 5, 2024
Attention:	Andrew Chell, RPP, MCIP	Project No.:	28627
Reference:	Updated Bearspaw ASP Runoff Assessment	Design Memo No.:	1
From:	Bianca Duncan, P.Eng.		

1.0 Introduction

Rocky View County (RVC) has retained ISL Engineering and Land Services Ltd. (ISL) to update the existing Bearspaw-Glenbow Master Drainage Plan (MDP) (WorleyParsons, 2010) as part of the amendments to the Draft Bearspaw Area Structure Plan (ASP) (RVC, 2024). The intent of the MDP updates is to assess stormwater conditions resulting from the proposed land use changes and provide updated stormwater management recommendations that align with the Draft Bearspaw ASP. The purpose of this memorandum is to assess the proposed land use changes against existing conditions and provide an initial high-level stormwater runoff assessment on how the revised land use deviates from the original MDP findings with the intent of flagging any impacts to the MDP the revised land use creates.

2.0 Watershed Characteristics

The Bearspaw-Glenbow MDP (WorleyParsons, 2010) identifies three major sub-watersheds within the study boundary: West Nose Creek, Bighill, and the Bow River sub-watersheds. They are each broken down into several minor sub-watersheds. The minor sub-watersheds within the Nose Creek watershed are denoted with an “N” and the those within the Bighill and Bow River watersheds are denoted with a “B”. **Figure 2.1** shows the minor sub-watersheds located within the ASP boundary.

3.0 Land Use Changes

3.1 Existing Land Use

The Bearspaw-Glenbow MDP (WorleyParsons, 2010) identifies six distinct types of development within the drainage study area. Of those six types, five of them are found within the sub-watersheds located in the Bearspaw ASP area. They are listed and described below.

- **Acreage Neighbourhood:** majority of existing developments that consist of residential lands in a rural setting. This development type correlates closest to the Country Residential land use.
- **Benchlands:** areas located along the escarpment of the Bow River. May consist of clustered and acreage developments.
- **Cluster Neighbourhoods:** consists of clustered developments covering 50% to 70% of the developable area. The remaining area is open space. Each cluster consists of 25 to 75 lots.
- **Northern Foothills Rangeland:** generally undeveloped ranch land. This development type correlates closest to the Agricultural land use.
- **Open Space:** represents the Glenbow Ranch Provincial Park Boundary and will be primarily undeveloped.
- **Transition Areas (1 to 4):** consist of high-density residential development.
- **Transition Area 5:** consists of an aggregate resource extraction area.

A figure showing the existing ASP land use as per the Bearspaw-Glenbow MDP (WorleyParsons, 2010) is shown in **Figure 3.1**.



3.2 Proposed Land Use

The Draft Bearspaw ASP (RVC, 2024) identifies five distinct land use types within the ASP boundary. They are listed and described below.

- **DC-34 Aggregate Resource Extraction:** consists of an aggregate resource extraction area.
- **Built-Out:** areas within the ASP that have been built out to its maximum density and are generally 1.98 acres or less in size.
- **Community Core:** central gathering place for the community and will consist of modest commercial development.
- **Future Development Area:** consists primarily of lands within the Country Residential and Agricultural land use district. These lands are not to be further developed as per the policy of the Draft Bearspaw ASP.
- **Country Residential:** residential lands in a rural setting on small parcels that are minimum 2 acres in size.

A figure showing the future ASP land use as per the Draft Bearspaw ASP (RVC, 2024) is shown in **Figure 3.2**.

4.0 Stormwater Assessment

4.1 Runoff Coefficients and Percent Impervious

Table 4.1 shows the percent impervious values that were utilized in the analysis for this memo. The percent impervious values are from Table B in the Bearspaw-Glenbow MDP (WorleyParsons, 2010). Most of the values are from Scenario 1 since the population forecast associated with Scenario 1 in the MDP most closely aligned with the population forecast in the Draft 2024 Bearspaw ASP. However, some values were used from Scenario 2 and 3 to better align with the expected impervious resulting from development that occurs within the County (i.e. the runoff coefficient for Country Residential is closer to 20%, hence the highest impervious value was used). The associated runoff coefficients were calculated from the percent impervious values and are also shown in **Table 4.1**. The runoff coefficient for the Future Development area was calculated based on the existing land uses within the area. The Future Development Area’s percent impervious was derived from the runoff coefficient.

Table 4.1 Runoff Coefficients (C)

Development Type from MDP	Equivalent Development Type in ASP and LUB	% Impervious (I)	Runoff Coefficient (C)
Acreage Neighbourhood	Country Residential	10	0.14
Cluster Neighbourhood	Built-Out Area	101	0.96
-	Community Core	101	0.96
Benchlands	-	10	0.14
Transition Areas 1 to 4	-	20	0.23
Transition Area 5	Aggregate Resource Extraction	35	0.37
Open Space	-	0	0.05
Northern Foothills Rangeland	Agricultural	0	0.05
-	Future Development Area	4	0.09



4.2 Preliminary Runoff Assessment

4.2.1 West Nose Creek Sub-Watersheds

Table 4.2 and **Table 4.3** show the percent change in the land’s percent impervious and runoff from existing MDP conditions to future ASP conditions. Overall, there will be a significant decrease in runoff as the lands will not be developed as much as originally planned in the Bearspaw-Glenbow MDP (WorleyParsons, 2010).

Table 4.2 West Nose Creek Sub-Watershed Change in Impervious

Sub-Watershed	Area (ha)	Existing Weighted I	Future Weighted I	Percent Change in Impervious	Overall Change in Development Type
N-1	5,224	22.42	2.97	-87%	High-Density to Undeveloped
N-4	1,977	9.95	8.03	-19%	Decrease in Aggregate Resource Footprint
N-5	952	9.72	7.55	-22%	Decrease in Aggregate Resource Footprint
N-6	533	14.72	16.12	10%	Low-Density to High-Density

Table 4.3 West Nose Creek Sub-Watershed Change in Runoff

Sub-Watershed	Area (ha)	Existing Weighted C	Existing Runoff Factor (CxA)	Future Weighted C	Future Runoff Factor (CxA)	Percent Change in Runoff	Overall Change in Development Type
N-1	5,224	0.25	1,315	0.08	401	-70%	High-Density to Undeveloped
N-4	1,977	0.14	276	0.12	242	-13%	Decrease in Aggregate Resource Footprint
N-5	952	0.14	131	0.12	112	-14%	Decrease in Aggregate Resource Footprint
N-6	533	0.18	97	0.20	104	7%	Low-Density to High-Density

4.2.2 Bighill Sub-Watersheds

Table 4.4 and **Table 4.5** show the percent change in the land’s percent impervious and runoff from existing MDP conditions to future ASP conditions. Overall, there will be a significant decrease in runoff as the lands will not be developed as much as originally planned in the Bearspaw-Glenbow MDP (WorleyParsons, 2010).

Table 4.4 Bighill Sub-Watershed Change in Impervious

Sub-Watershed	Area (ha)	Existing Weighted I	Future Weighted I	Percent Change in Impervious	Overall Change in Development Type
B-4	612	59.68	4.45	-93%	High-Density to Undeveloped
B-5	411	13.90	2.55	-82%	High-Density to Undeveloped
B-6	235	35.43	10.00	-72%	High-Density to Low-Density
B-7	72	10.00	10.00	0%	No Changes



B-8	35	10.00	10.00	0%	No Changes
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Table 4.5 Bighill Sub-Watershed Change in Runoff

Sub-Watershed	Area (ha)	Existing Weighted C	Existing Runoff Factor (CxA)	Future Weighted C	Future Runoff Factor (CxA)	Percent Change in Runoff	Overall Change in Development Type
B-4	612	0.59	359	0.09	55	-85%	High-Density to Undeveloped
B-5	411	0.18	72	0.07	30	-58%	High-Density to Undeveloped
B-6	235	0.37	87	0.14	33	-62%	High-Density to Low-Density
B-7	72	0.14	10	0.14	10	0%	No Changes
B-8	35	0.14	5	0.14	5	0%	No Changes

4.2.3 Bow River Sub-Watersheds

Table 4.6 and **Table 4.7** show the percent change in the land’s percent impervious and runoff from existing MDP conditions to future ASP conditions. In some areas, there will be a decrease in runoff as the lands will not be developed as much as originally planned in the Bears paw-Glenbow MDP (WorleyParsons, 2010). However, in other areas, there will be a significant increase in runoff. These areas are primarily located in the southeastern region within the ASP boundary and were originally to be developed to Transition Areas or Acreage Neighbourhood (Country Residential) as per the MDP. In the Draft ASP, large portions of these areas are designated as Built-Out areas and the Community Core. These development types are associated with high levels of imperviousness resulting in higher levels of runoff.

Table 4.6 Bow River Sub-Watershed Change in Impervious

Sub-Watershed	Area (ha)	Existing Weighted I	Future Weighted I	Percent Change in Impervious	Overall Change in Development Type
B-12	28	10.00	10.00	0%	No Changes
B-13	34	10.00	10.00	0%	No Changes
B-14	17	10.00	10.00	0%	No Changes
B-15	26	10.00	10.00	0%	No Changes
B-16	232	6.39	6.26	-2%	No Changes
B-21	1,015	26.48	6.18	-77%	High-Density to Undeveloped
B-28	427	21.31	6.76	-68%	High-Density to Undeveloped
B-30	678	11.57	11.60	0%	No Changes
B-32	13	10.00	101.00	910%	Low-Density to High-Density (Built-Out)
B-33	276	13.71	62.36	355%	Low-Density to High-Density (Community Core)
B-34	274	15.75	89.59	469%	Low-Density to High-Density (Built-Out)
B-35	82	10.44	20.79	99%	Low-Density to High-Density (Built-Out)



B-36	32	10.00	10.00	0%	No Changes
B-37	21	10.00	101.00	910%	Low-Density to High-Density (Built-Out)
B-38	936	10.59	37.39	253%	Low-Density to High-Density (Built-Out)
B-39	32	14.91	10.00	-33%	High-Density to Low-Density
B-40	20	20.00	10.00	-50%	High-Density to Low-Density

Table 4.7 Bow River Sub-Watershed Change in Runoff

Sub-Watershed	Area (ha)	Existing Weighted C	Existing Runoff Factor (CxA)	Future Weighted C	Future Runoff Factor (CxA)	Percent Change in Runoff	Overall Change in Development Type
B-12	28	0.14	3.93	0.14	3.93	0%	No Changes
B-13	34	0.14	4.77	0.14	4.77	0%	No Changes
B-14	17	0.14	2.33	0.14	2.33	0%	No Changes
B-15	26	0.14	3.60	0.14	3.60	0%	No Changes
B-16	232	0.11	24.96	0.11	24.68	-1%	No Changes
B-21	1,015	0.29	292.81	0.11	107.23	-63%	High-Density to Undeveloped
B-28	427	0.24	103.71	0.11	47.35	-54%	High-Density to Undeveloped
B-30	678	0.15	104.42	0.15	104.62	0%	No Changes
B-32	13	0.14	1.85	0.96	12.70	585%	Low-Density to High-Density (Built-Out)
B-33	276	0.17	47.79	0.61	168.58	253%	Low-Density to High-Density (Community Core)
B-34	274	0.19	52.59	0.86	234.81	347%	Low-Density to High-Density (Built-Out)
B-35	82	0.14	11.69	0.24	19.36	66%	Low-Density to High-Density (Built-Out)
B-36	32	0.14	4.44	0.14	4.44	0%	No Changes
B-37	21	0.14	2.96	0.96	20.29	585%	Low-Density to High-Density (Built-Out)
B-38	936	0.15	135.95	0.39	361.86	166%	Low-Density to High-Density (Built-Out)
B-39	32	0.18	5.89	0.14	4.47	-24%	High-Density to Low-Density
B-40	20	0.23	4.53	0.14	2.76	-39%	High-Density to Low-Density

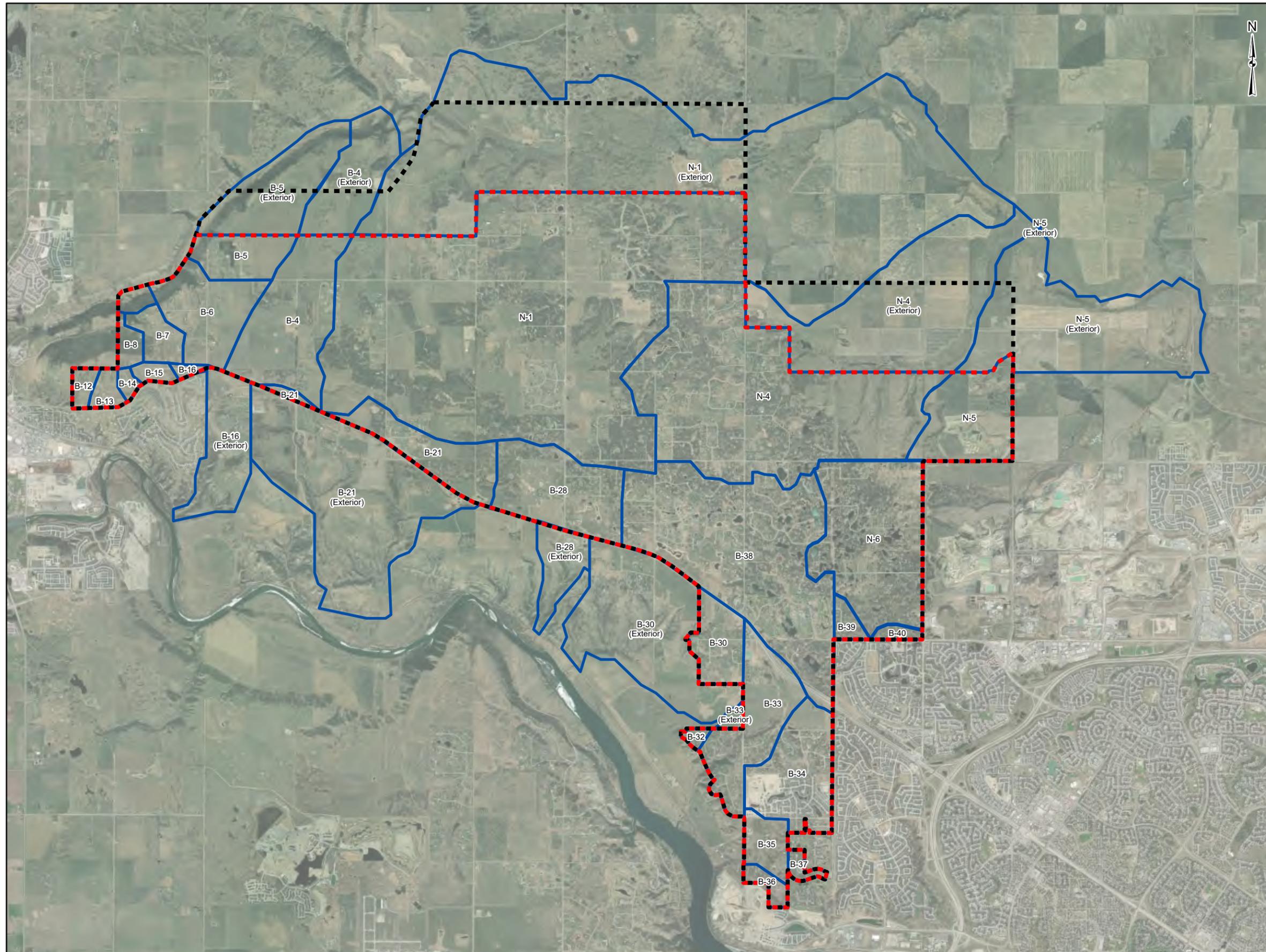
5.0 Summary of Findings

Based on ISL’s review of the Bearspaw-Glenbow MDP (WorleyParsons, 2010) and comparison of the original MDP findings to the updated land use in the Draft Bearspaw ASP (RVC, 2024), ISL has the following findings:

- The anticipated land use outlined in the Bearspaw-Glenbow MDP (WorleyParsons, 2010) assumes that the study area would be developed further and to a higher-density than the proposed land use in the Draft Bearspaw ASP (RVC, 2024). As a result, the recommendations of the MDP would be more conservative since they are assuming higher runoff flows than proposed conditions and hence would be acceptable to use with the revised ASP changes.



- There are areas where the runoff and percent impervious have substantially increased. This primarily occurs within the southeast region of the ASP boundary where the Built-Out and Community Core areas are located. In Tables 4.6 and 4.7, the runoff and percent impervious changes for the Built-Out areas are shown in bold and the runoff and percent impervious changes are shown in bold and red text for the Community Core areas.
- The Built-Out areas are already developed and ASP policy restricts further development in these areas. Because the Built-Out areas are existing, development should already meet MDP stormwater release conditions as well as general County stormwater guidelines. As a result, no further modelling or changes to stormwater guidelines is required for the Built-Out areas.
- The Community Core has not yet been fully developed. The percent impervious and runoff will substantially increase from the original assumptions of the MDP. Further modelling may be required as part of the stormwater management plan for the Community Core at time of subdivision or development permit, to further refine stormwater management facility (SWMF) sizing. Stormwater facilities will be required to support development and attenuate runoff flows to meet MDP release rate conditions. The MDP release rate conditions are outlined below.
 - 0.99L/s/ha for 1:100-year runoff ARI event
 - 0.07L/s/ha for 1:2-year runoff ARI event
 - 50mm average annual volume



LEGEND

- - - Proposed ASP Boundary
- - - Existing ASP Boundary
- Bears Paw-Glenbow MDP Sub-Watersheds

TITLE
**BEARSPAW-GLENBOW MDP
 SUB-WATERSHEDS**

PROJECT
 BEARSPAW MDP UPDATE
 CLIENT
 ROCKY VIEW COUNTY

DATA SOURCES
 World Imagery: Southern Alberta, Maxar

PROJECTION
 CANA83 3TM114

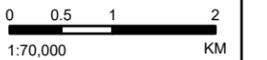
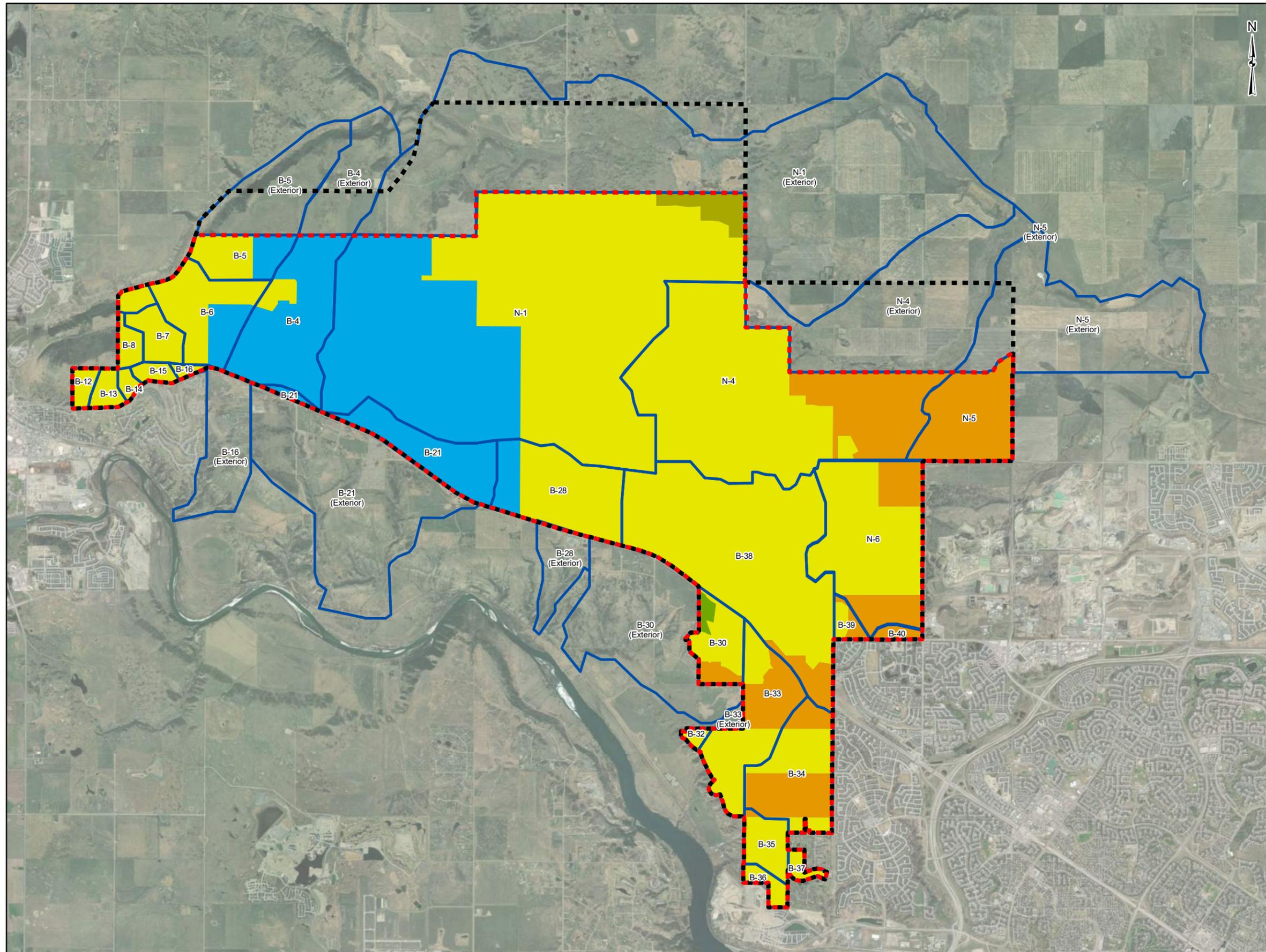


FIGURE 2.1
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 AUTHOR mwong

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LEGEND

- Proposed ASP
- Existing ASP
- Bears paw-Glenbow MDP Sub-Watersheds
- Existing Land Use**
- Benchlands
- Cluster Neighbourhood
- Country Residential
- Northern Foothills Rangeland
- Transition

TITLE
**EXISTING LAND USE FROM
 BEARSPAW-GLENBOW MDP**

PROJECT
 BEARSPAW MDP UPDATE
 CLIENT
 ROCKY VIEW COUNTY

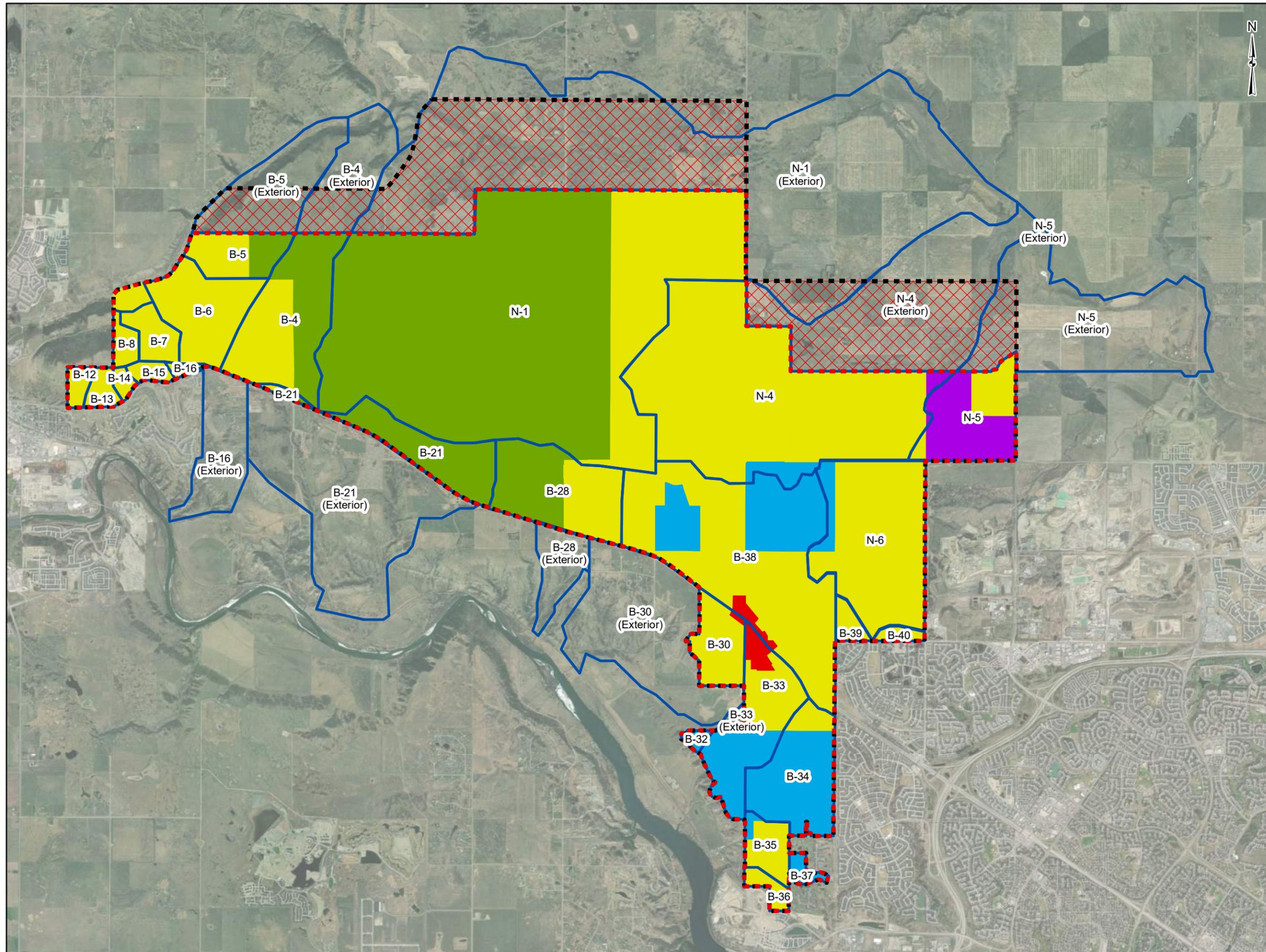
DATA SOURCES
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FIGURE 3.1
 DATE 2024-09-05
 PROJECT NO. 28627
 AUTHOR BDuncan

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LEGEND

- Proposed ASP
 - Existing ASP
 - Bears paw-Glenbow MDP Sub-Watersheds
- Future Land Use**
- Built Out
 - Community Core
 - Country Residential
 - DC-34 Aggregate Resource
 - Future Development
 - To Be Removed From Plan

TITLE
FUTURE BEARSPAW ASP LAND USE

PROJECT
BEARSPAW MDP UPDATE
CLIENT
ROCKY VIEW COUNTY

DATA SOURCES
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

PROJECTION
CANA83 3TM114



FIGURE 3.2
DATE 2024-09-05
PROJECT NO. 28627
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