



Kaiser Area Structure Plan (ASP) Technical Background Report



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REPORT

Kaiser Area
Structure Plan
(ASP) Technical
Background
Report

0925.0017.01

January 2017

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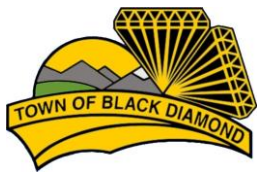
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1.0 BACKGROUND

The Area Structure Plan (ASP) for the Kaiser Area was originally created in 1992. **Figure 1- Location Map** shows the location of the Kaiser Area and extents.

Since the ASP was created in 1992, there have been several land use amendments to the plan, particularly on lots adjacent to Centre Street. Several land use re-designations have increased the residential density, while another re-designation along Centre Street has introduced a commercial land use, all which have changed the original direction presented in the ASP.

In a related process, the Town has revised the vision, goals, land use concept and policy through a separate public engagement process. These changes impact the stormwater, water, sanitary, and transportation servicing plans that were originally outlined in the Kaiser ASP. Wetland and environmental standards and requirements have also changed significantly since the original ASP was completed 23 years ago.

An update to the Technical Background Information provided in the 1992 ASP is therefore required to ensure the Town has the correct information when preparing a plan for the area and reviewing proposed plans for future developments. The revised plans for the area also needed to take into consideration the analysis and recommendations for Scenario 3 of the 2016 Joint Growth Strategy that was recently completed for Black Diamond and Turner Valley.

2.0 INTRODUCTION

The following Kaiser ASP Technical Background report will provide a summary of the analysis that was completed of the existing system and the expected infrastructure required to service the Kaiser area, based on the concept that was created following the public and landowner engagement process and discussions with the Town of Black Diamond administration. The Technical Background Report was created to provide more information on the analysis and assumptions that were made when revising the Kaiser ASP document.

- **Desktop Wetland Mapping-** A summary and classification of wetlands within the area.
- **Environmental Site Assessment- Phase 1-** A summary of the findings from the desktop review and potential environmental risks based on information that is accessible to the public and documents that were permitted to be released under FOIP (Freedom of Information and Protection of Privacy) Act.
- **Sanitary and Water Servicing-** Identification of the sanitary trunkmain mains and water feeder mains required for the Kaiser Area as well as required infrastructure

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for the development of parcels located between Centre Avenue and 1st Avenue SE and between 3rd Street SE and 6th Street SE.

- **Stormwater-** A summary of the infrastructure required to ensure the release rates from the Kaiser area do not change between pre and post development.

More information on the local storm mains required on 1 Avenue SE have also been provided as the lots to the north and south were previously developed without a clear understanding of the storm infrastructure requirements for the Kaiser area.

The analysis does not identify or include upgrades to the infrastructure to accommodate flows from adjacent areas. The area will need to be revisited when a Master Drainage Plan is created for the Town.

- **Transportation-** A summary of the road infrastructure upgrades and access requirements to service the proposed developments for the parcels located between Centre Avenue and 1st Avenue SE and between 3rd Street SE and 6th Street SE. Conceptual road alignments servicing the Kaiser Study area and cross sections with multi-modal elements are identified.

Unless otherwise specified within the Plan, the boundaries or locations of any symbols or areas shown on a map are approximate only and shall be interpreted as such. They are not intended to define exact locations except where they coincide with clearly recognizable physical features or fixed boundaries, such as property lines or roads and utility rights-of-way.



Figure 1 – Location Map

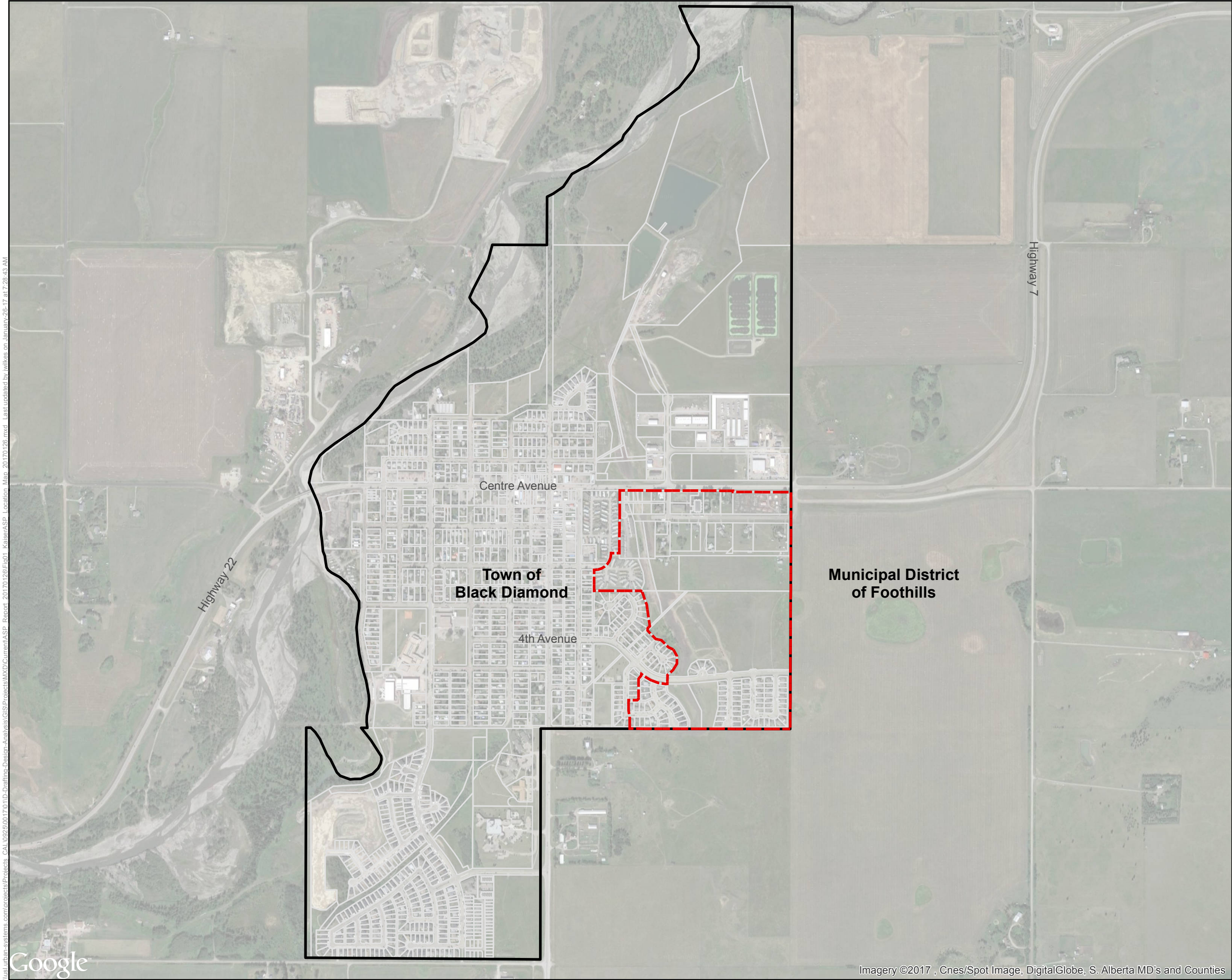
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Town of Black Diamond
Kaiser ASP

Location Map

- Legend**
-  Legal/Cadastral
 -  Kaiser ASP Boundary
 -  Town of Black Diamond

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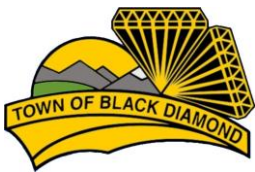
FIGURE 1

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3.0 PHASE 1 ESA-SUMMARY AND RECOMMENDATIONS

A Phase 1 Environmental Site Assessment was conducted on behalf of the Town of Black Diamond for a portion of the quarter section, NW-9-20-2-W5, Black Diamond, AB. This portion covers an area of 42.4 ha and consisted of approximately 127 parcels plus numerous road plans. The 2016 Phase 1 ESA Report outlines the analysis that was completed. The following outlines the summary and recommendations are presented in this Report.

Historical uses of the property (based on historical air photographs, legal land titles, interviews, and other documents) include agriculture and housing since at least 1950. Since then, developments include modifications of farmsteads and homestead acreages primarily in the northern portion, to higher density subdivisions and mobile home parks on the western and southern portions of the study area. Developments also include a curling club, a daycare, a commercial wood sales lot, and more recent condominium buildings. A natural watercourse in the western portion of the study area has been heavily impacted over the past 70 years. It has been re-aligned, channelized, narrowed, removed in segments, and historical riparian areas have been excavated. **Figure 2- Site Conditions** shows the existing channel, the utilities, wetlands and other site information.

From the reviews of the information gathered for this site assessment, there are several areas of potential environmental concern which are listed in Table 3.1 below. An assessment of environmental risk, given the information available, is used to help prioritize each issue.

Twenty four (24) water wells were identified to be within the Kaiser study area. These should all be properly decommissioned prior to any earthworks under the *Water Act* and *Water (Ministerial) Regulation* while following requirements under the *Environmental Protection and Enhancement Act* (EPEA) to protect groundwater resources. Where septic fields were used, soil shall be assessed for salinity and metal contaminants. Remediation to appropriate guidelines established by Alberta Environment and Parks will be required. The most recent version of Alberta Environment and Park's Salt Contamination Assessment & Remediation Guidelines (most recent copy at the time of this study was completed in 2001), shall be followed to determine generic soil quality criteria depending on the intended land use and fate of the in-situ soil. Remediation or risk management should follow additional site-specific assessment of salinity or sodicity affected soil and various management options are presented in the aforementioned document.

The Canadian Western Natural Gas Company Ltd. pipeline was abandoned in place according to ESAR records. The natural gas pipeline will be regulated by the *Pipeline Act* which is expected to require development setbacks and prohibit the construction of

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permanent dwellings within the right-of-way. The *Municipal Government Act*, or the specific right-of-way agreement is expected to also have established requirements with respect to setback distances from pipelines and activities in the right-of-way. The environmental condition of the land in the pipeline right-of-way is currently governed by requirements in the *Conservation and Reclamation Regulation* under the EPEA.

Based on the review of information collected for this Phase 1 ESA, no additional investigation is recommended for the short-term but will be required at land use re-designation and when noted elements of concern are encountered. This may take the form of surficial sampling of soils for salinity and metals where septic fields may have been used. Salinity problems and expanding-type clay soils in the long-time agricultural area can also be determined through surficial soil sampling and testing; their presence may have implications for construction. Properties with older buildings and structures may require hazardous materials survey and testing of building construction materials and items.



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Table 3.1: Areas of Potential Environmental Concern (APEC), Constituents of Concern, and Assessment of Risk

APEC NO.	AREA DESCRIPTION	LOCATION	ASSOCIATED PARTY	IDENTIFIERS	PROBABLE ACTIVITY	POTENTIAL CONSTITUENTS OF CONCERN	RISK LEVEL
1	Farmstead and homestead yards	North portion of study area	Various owners: properties that do not have sanitary or water service	Multiple	Septic field or tank	Salinity or metal-contaminated soil	Low
2	Farmsteads, homes, open fields	North and central portions of study area	Various owners	Plan 2945HJ, Block 2, Lot 1; Plan 6234FF, Parcel B; Plan 2945HJ, Block 8; Plan 9310427, Block 3, Lot 1; Plan 9012124, Block 3, Plan 9110637; Block 1, Lot1, and others.	Waterwells	Physical hazard, environmental constraints	Low
3	Previously cultivated open fields	Central portion of the study area	Non-attributable	Plan 9012124, Block 3; Plan 9812496, Block 7; 5-2-20-9-NW 30.9 ha 1100 feet south of the north boundary east of Plan 5533EF.	Naturally occurring or septic field or irrigation. Pesticide application.	Saline or sodic soils. Potentially, soils are expanding clays like montmorillonite or vermiculite and naturally occurring; not a health or environmental hazard. Pesticides remaining in soil that contain persistent organic compounds or mercury.	Low
4	Parcels with old buildings and structures built prior to 1980	North portion of the study area	n/a	Multiple, uncertain	Building construction	Hazardous materials: lead, PCB's, asbestos, mercury	Low
5	Canadian Western Natural Gas Company Ltd. Pipeline ROW	South portion of subject property	Canadian Western Natural Gas Company	Plan GL 46	Pipeline	Potential past spills or releases. Physical hazard that pipe is still present.	Low
6	Piles on margins of open fields	Central portion	Unknown	5-2-20-9-NW 30.9 ha	Dumping	Fill, construction debris and solid waste	Low

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4.0 WETLAND ASSESSMENT

The desktop wetland inventory was conducted using available data from Alberta Environment and Parks (AEP), Ducks Unlimited Canada, and other free sources. The constraints analysis takes into consideration the 2001 Town of Black Diamond Municipal Development Plan (MDP; Bylaw Number 01-14), the 2002 MD of Foothills/Town of Black Diamond/Town of Turner Valley Inter-municipal Development Plan (IDP; Bylaw Number 02-05), the 2014 Alberta Wetland Policy, and the provincial *Water Act*.

It should be noted that the information provided is for conceptual purposes only and that in order to support regulatory applications further detailed study (including ground-based vegetation and soils surveys) will be required.

4.1 Methods

AEP's Alberta Merged Wetland Inventory (AMWI) and Grassland Vegetation Inventory (GVI), Duck's Unlimited Canada's Canadian Wetland Inventory (CWI) and historical aerial imagery from Google Earth were used to identify and delineate any wetlands within the ASP area. Where available, wetlands identified by the afore-mentioned data sources were incorporated into the inventory directly. Further delineation was required to capture wetlands not included within existing available wetland inventory data. These wetlands were identified by visual evidence of (seasonal) inundation over a number of years apparent in the aerial imagery.

Any wetlands observed were classified according to the Alberta Wetland Classification System (AWCS) as well as the Stewart and Kantrud Wetland Classification System (S&K). Each wetland was assessed using the historical aerial imagery and classifications were determined based on permanence on the landscape and an estimation of vegetation type within each wetland.

4.2 Results

Only one wetland was identified on the east boundary of the ASP area (see **Figure 2 – Site Conditions**) through the desktop analysis. This wetland is classified as a temporary graminoid marsh (AWCS) or Class II (S&K) wetland with a total surface area estimated at 0.52 ha. Approximately 0.26 ha of the wetland occurs within the ASP area with the remainder occurring on the neighbouring property to the east. This wetland is to be protected.

There is a small area in the centre of the property that shows a change in vegetation due to either the presence of water (wetland) or anthropogenic ground disturbance. Future wetland work including field surveys will confirm wetland presence.

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It should also be noted that there exists a mapped watercourse which flows generally south to north for approximately 1 km along the west boundary of the property (see **Figure 2 – Site Conditions**). The watercourse is identified in previous iterations of the Kaiser ASP and development setbacks are provided.

4.3 Constraints

The 2001 MDP and 2002 IDP encourage identifying and evaluating the ecological significance of natural features such as low lying wetland areas and waterbodies and discourage the grading or alteration of unique landscape areas. Further ground-based biophysical study (Wetland Impact Assessment or Biophysical Impact Assessment) is required prior to development (i.e. at land use re-designation or subdivision) to determine the significance of wetlands on the property and to assess their value to the municipality and the Province. Mitigation should be provided to minimize environmental impacts of proposed future development. Protection of the wetland on the East boundary is required. If plans for removal of other wetlands on the property are approved by the municipality, the proponents of the development (i.e., land developers) must obtain approvals under the provincial *Water Act* and *Public Lands Act* prior to removal. Further wetland/biophysical work can be used to support the application process.

Applications to remove wetlands will be reviewed by AEP and approvals will align with objectives of the 2014 Alberta Wetland Policy or the most recent wetland policy for the province. The Alberta Wetland Policy is focused on the maintenance of wetland value on the landscape. Relative value of wetlands is determined by proponents and, if removal is approved, replacement (i.e., monetary compensation) is required at ratios ranging from 1:1 for low value wetlands to as much as 8:1 for the highest value wetlands.

Alberta Environment and Parks (AEP) Public Lands will need to conduct a determination of Crown land claim ability for wetlands on the property. The determination is based on permanence with the Crown claiming the beds and shores of waterbodies that are permanent on the landscape. A request to Public Lands should be made for the Crown-determination prior to development.

Figure 2 – Site Conditions

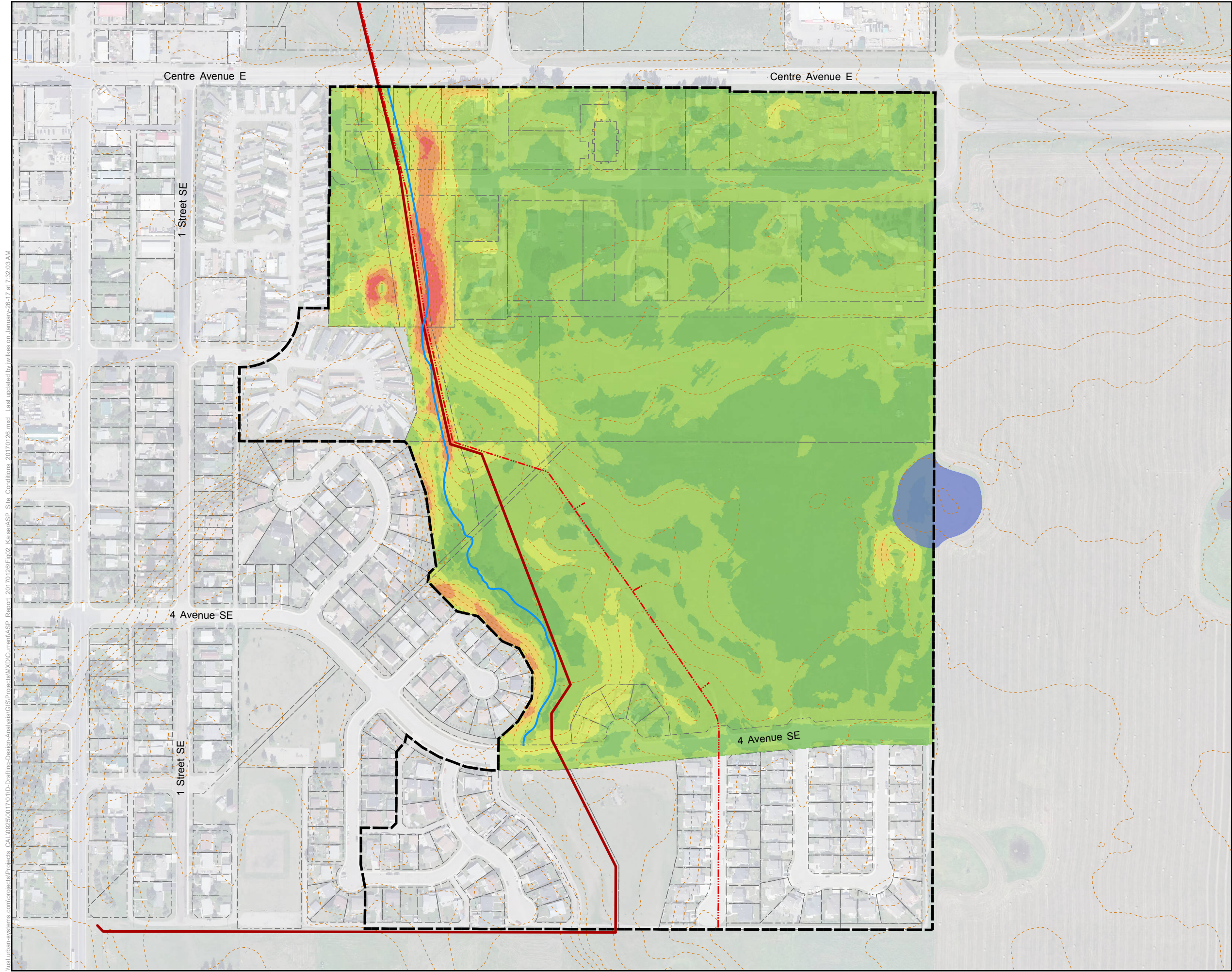
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Town of Black Diamond
Kaiser ASP

Site Conditions

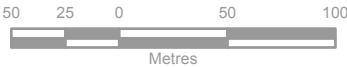
Legend

- Contours
- Watercourse
- Sanitary Main
- Sanitary West End Trunkmain
- Wetland
- Legal/Cadastral
- Kaiser ASP Boundary

Slope (% Rise)

- | | |
|--------|---------|
| 0 - 2 | 15 - 22 |
| 2 - 7 | 22 - 30 |
| 7 - 15 | > 30 |

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5.0 TRANSPORTATION- SUMMARY AND RECOMMENDATIONS

The following is a summary of the recommendations provided in the 2016 Kaiser Transportation Impact Assessment.

5.1 Road Network

5.1.1 *EXISTING NETWORK*

The proposed development is bounded by Highway 7 to the north and 4 Avenue SW (a collector road) to the south. In the future, it is anticipated that 6th Street will be extended south of 1st Avenue SE, to connect to 4 Avenue SE and will border the Kaiser Area on the east side. The extension of 6th Street SE, is not required for the development of the Kaiser area.

5.1.2 *INTERNAL DAILY VOLUMES*

The estimated traffic volumes for the Kaiser's internal road network range from 500 to 2,200 vehicle per day (vpd). Based on the forecasted daily traffic, it can be assumed that a series of collectors and residential corridors should be implemented within the study area. **Figure 3** – illustrates the estimated daily volume on the internal road network.

Figure 3 – Transportation Daily Volume

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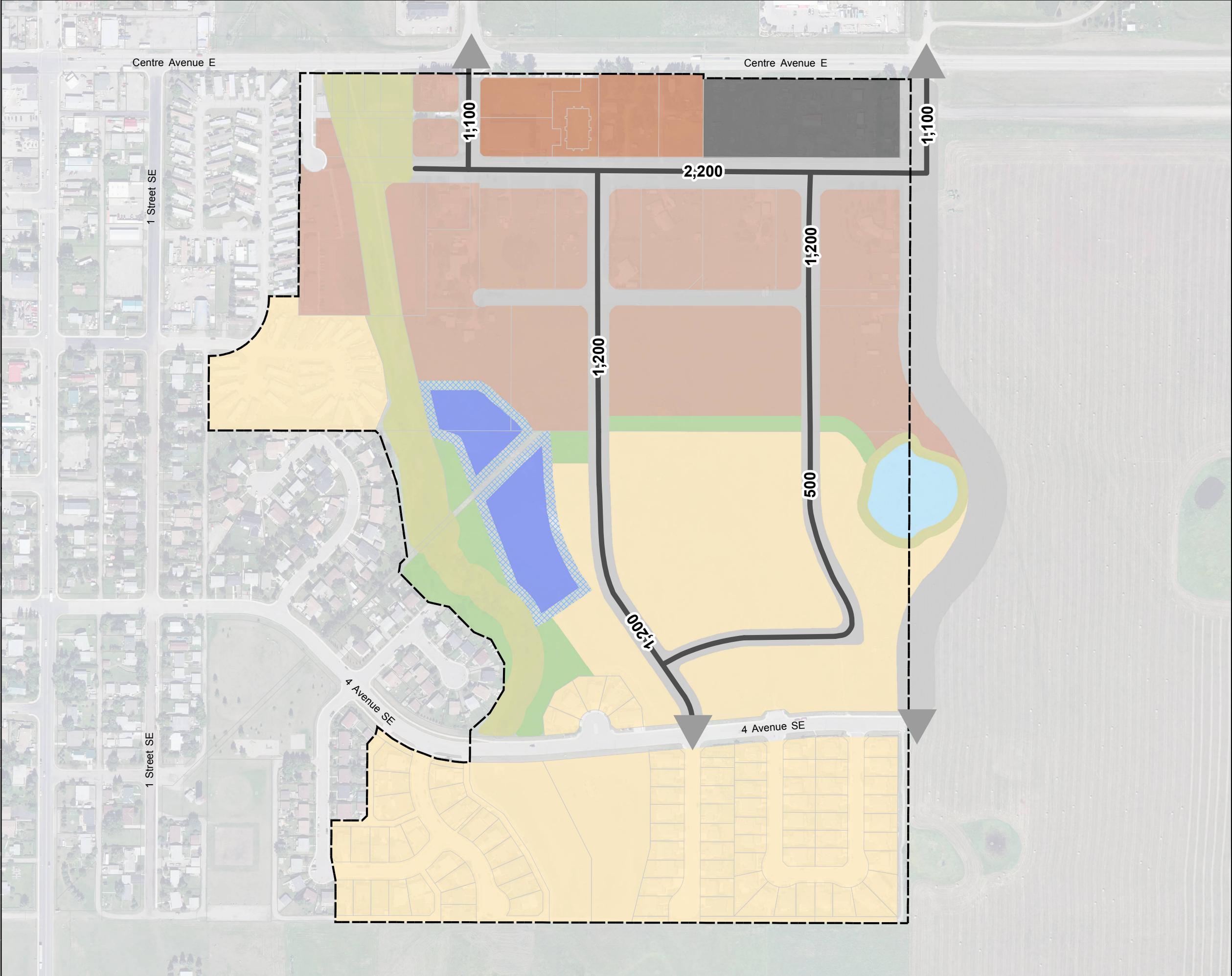
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Town of Black Diamond
Kaiser ASP

Transportation
Daily Traffic Volume

- Legend
- Road Centrelines
 - Low Density Residential
 - Medium Density Residential
 - High Density Residential
 - Commercial
 - Environmental Reserve
 - Municipal Reserve
 - Pond Area
 - Pond
 - Wetland
 - Road
 - Kaiser ASP Boundary

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FIGURE 3

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5.1.3 INTERNAL ROAD CLASSIFICATION

Kaiser will consist of collector corridors, measuring 22.5m to 25.2m. These roads provide connections to the regional road network, as well as to key internal focal points.

The remaining road network will be a residential 16.0m corridor providing direct and laneway access to the residential units.

Figure 4 - Transportation Road Classification

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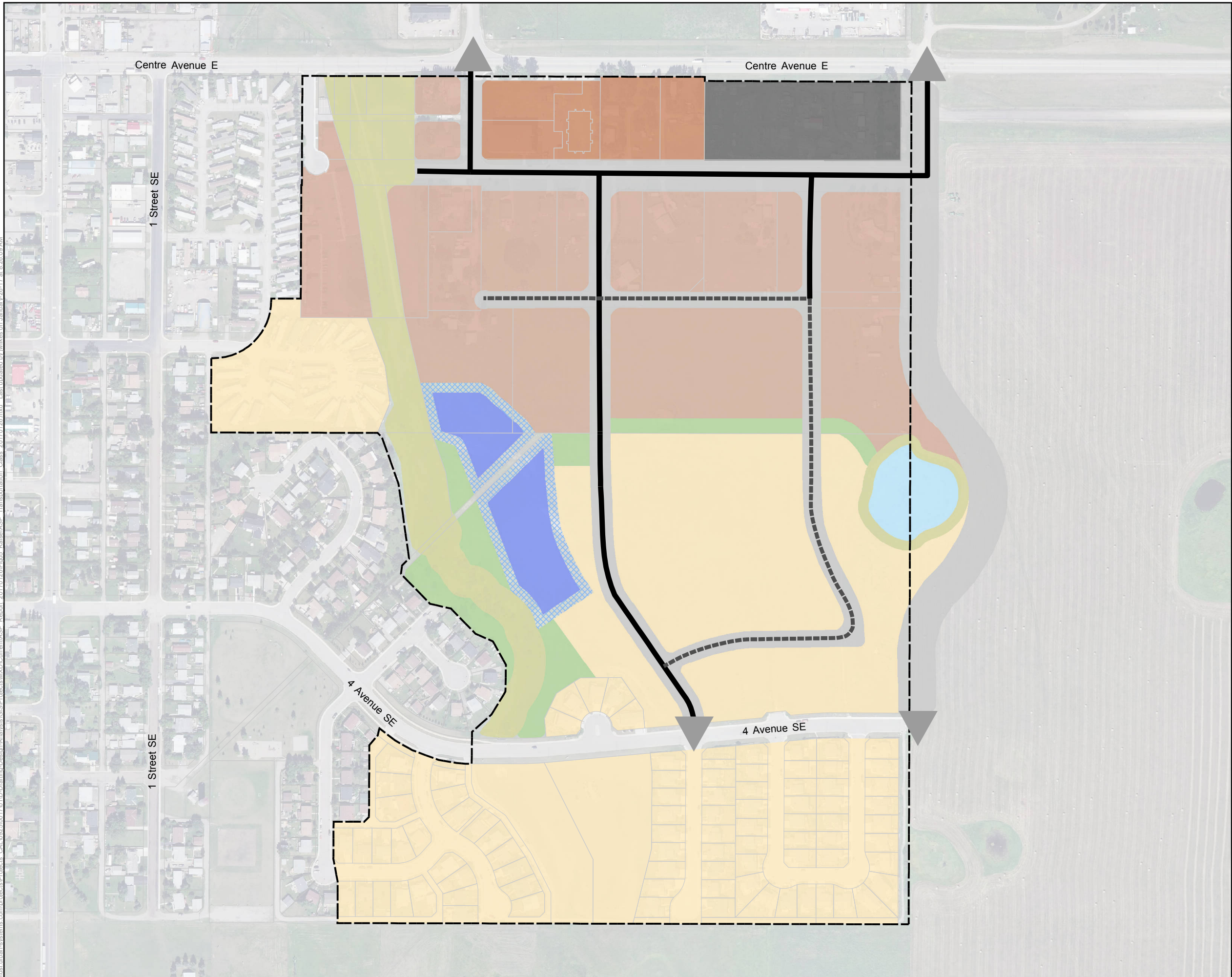
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








Town of Black Diamond

Kaiser ASP

Transportation Road Classification

Legend

-  Collector Street
-  Local Road
-  Low Density Residential
-  Medium Density Residential
-  High Density Residential
-  Commercial
-  Environmental Reserve
-  Municipal Reserve
-  Pond Area
-  High Water Level
-  Wetland
-  Road
-  Access Points
-  Kaiser ASP Boundary

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FIGURE 4

5.1.4 PROPOSED ROAD CROSS SECTION

Figures 5 to 7 illustrate the collector and residential road cross section for the Kaiser study area that address the Town's preference for multiple modes of transportation.

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Figure 5 - Collector Street Parking Both Sides (25.2m)

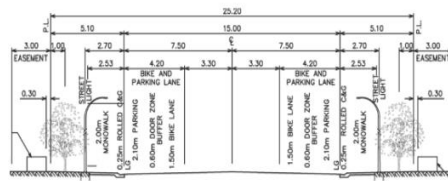
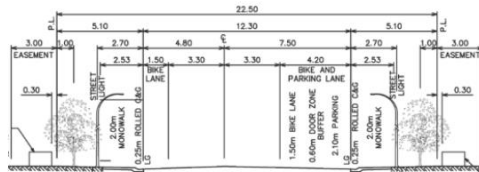


Figure 6 – Collector Street Parking One Side (22.5m)



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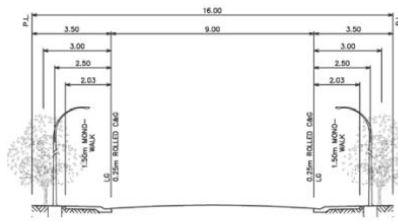
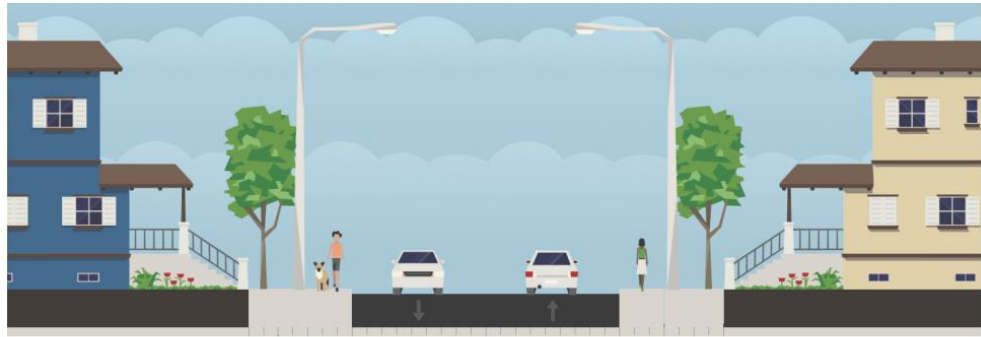
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Figure 7 – Residential Street (16.0m)



5.2 Multi-Modal Considerations

5.2.1 TRANSIT SERVICE

A walkable catchment is typically a five minute commute from one location to next. The five minute walking duration translates to an approximate 400m walking distance. To be considered a transit friendly community, 95% of the residents must have a walking distance to a transit stop of less than 400m. Transit stop locations should also be placed every 100m to 200m.

5.2.2 PEDESTRIAN AND CYCLIST FACILITIES

Additional considerations should be made to provide attractive and convenient access to active transportation infrastructure. The Kaiser development should provide a more refined/dense network for pedestrians and cyclists to ensure walking and cycling remains safe and attractive.

The proposed collector cross section from the City of Calgary Design Guidelines for Subdivision Servicing illustrates on-street cycling lanes.

5.3 Recommendations & Conclusions

The transportation evaluation for the Kaiser study explored potential roundabout and signalization treatments at intersections along provincial highways to improve the operational performance. Understanding the context of Highway 22 and Highway 7, both corridors currently provide regional and local connectivity and

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includes existing commercial, retail, institution, and residential uses fronting onto the highway.

Future improvements should take into consideration the importance of the existing businesses for the economy of Black Diamond and required parking to ensure viability of these businesses.

The long term vision that was outlined in the 2016 Joint Growth Strategy for Turner Valley and Black Diamond, showed the potential for traffic to be redistributed to future corridors. This long term vision must be considered during the immediate horizon as Kaiser develops.

5.3.1 *BACKGROUND 25 YEAR – INTERSECTION IMPROVEMENTS*

3 Street SW and Highway 22 will require improvements to support the forecasted traffic growth along the highway. Alberta Transportation previously evaluated this location and recommended a traffic signal to improve the operational requirements. East-west traffic is the dominant movement along the highway corridor with residential traffic entering the highway corridor.

Understanding the considerations involved with intersection treatment, a roundabout is recommended in lieu of the signal to preserve existing development and minimize impacts to the approach, as lane configuration and geometric are determined. It should be understood that the main function of Highway 22 and Highway 7 is providing “through” connections. A roundabout can typically accommodate larger design vehicles as specified by the Province. Assuming redevelopment on this area will be limited, a roundabout is more than capable of handling the peak hour flows based on the existing land uses.

5.3.2 *FUTURE 25 YEAR WITH DEVELOPMENT – INTERSECTION IMPROVEMENTS*

Assuming the improvements from the background scenario are completed – the analysis that included the Kaiser development triggered a required upgrade at **3 Street SE and Highway 7**. A traffic signal is recommended at this location understanding the future developments adjacent to this location.

A Tim Hortons and a car wash were recently constructed adjacent to the intersection at Highway 7 and 3 Street SE. Based on the proposed retail/commercial and future Kaiser development, a signalized treatment may provide a better long term solution, understanding the capacity requirements and peak hour demand flows.

Table 5.1 – Assumed Approved Baseline Intersection Configurations

Intersection	Background 25 Year	Future 25 Years
3 Street SW and Highway 22	Roundabout	NIL
3 Street SE and Highway 7	NIL	Signal

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6.0 UNDERGROUND UTILITIES

6.1 Stormwater

The Kaiser ASP area generally slopes from southeast to northwest. Stormwater drainage for the lands is currently provided by a dry watercourse (ditch) that is located along the west edge of the proposed development. The ditch is identified by the Province of Alberta as a mapped watercourse. The north half of the plan area is currently developed with commercial, high density residential, and low density country residential. The south half is mostly cultivated agricultural land with some existing residential development.

The catchment parameters and capacities of the watercourse and downstream system are not known. Post-development flow rates in this area must be restricted to pre-development rates. Outfalls to the watercourse will be required to conform to all federal and provincial regulations including the code of practice as established by the Alberta Water Act. A catchment area analysis or a capacity analysis has not been conducted for this watercourse.

6.1.1 PRE-DEVELOPMENT CONDITIONS

In order to mitigate downstream flooding, erosion, and other consequences of urbanization on downstream watersheds, it is recommended that the stormwater flows from the Kaiser area be limited to pre-development flow rates. A 100 year peak unit discharge was determined using streamflow data for Sheep River at Black Diamond¹. For the purposes of design in Kaiser, the peak unit discharge to mimic pre-development flow rates is 4 l/s/ha.

See Figure 8 – Wetland and Pre-Development Catchment Areas for a delineation of pre-development catchment areas. The wetland on the east edge of the plan area has a catchment area of approximately 2.64 ha. This catchment area crosses over the east boundary of Kaiser into lands that are currently within the MD of Foothills.

The previously developed portion of the ASP area is primarily drained by roadside ditches that drain to the watercourse. A single lot adjacent to Centre Avenue W is currently developed with an existing culvert that discharges uncontrolled flows into the north ditch of Centre Ave, and then west to the watercourse.

¹ City-wide Stormwater Targets Study, City of Calgary, 2013

Figure 8 – Wetland and Pre-Development Catchment Areas

REPORT

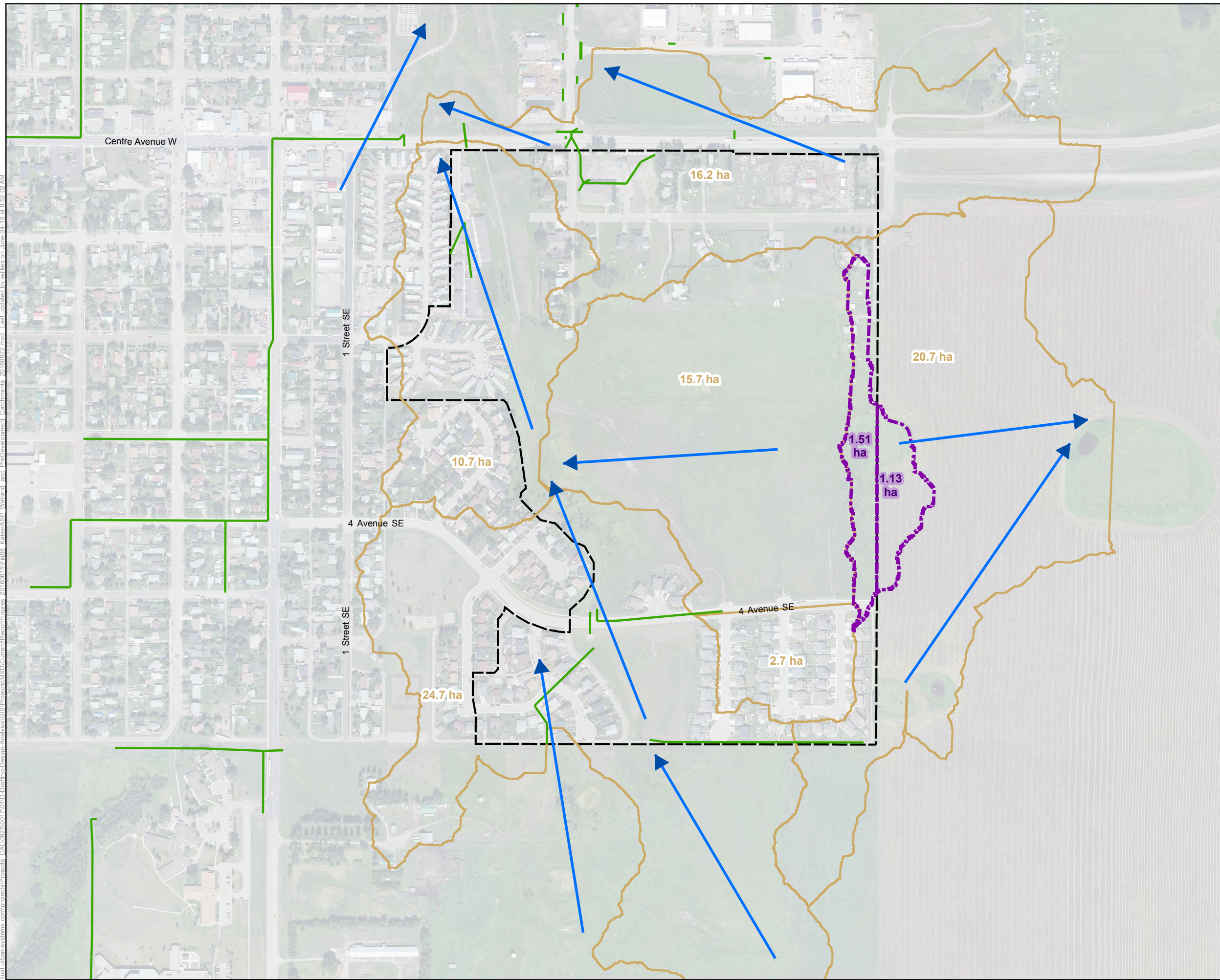
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Town of Black Diamond

Kaiser ASP

Wetland and Pre-Development Catchment Areas

Legend

- Storm - Main (Existing)
- Flow Direction
- Catchments (Pre-Development)
- Wetland Catchment Area
- Kaiser ASP Boundary

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Coordinate System:
NAD 1983 3TM 114

Scale:
1:5,000

Data Sources:

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FIGURE 8

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6.1.2 *POST-DEVELOPMENT CONDITIONS*

All stormwater drainage from the Kaiser area is collected by the watercourse on the west edge of the site. As the full drainage area for this watercourse is not well understood, and an assessment of its peak flow capacity has not been made, all post-development conditions for the Kaiser area aim to mimic pre-development peak flows. This has been done to minimize any additional flows to the watercourse, and ultimately the Sheep River.

See **Figure 9** – for the proposed post-development catchment area.

Figure 9 – Storm Infrastructure

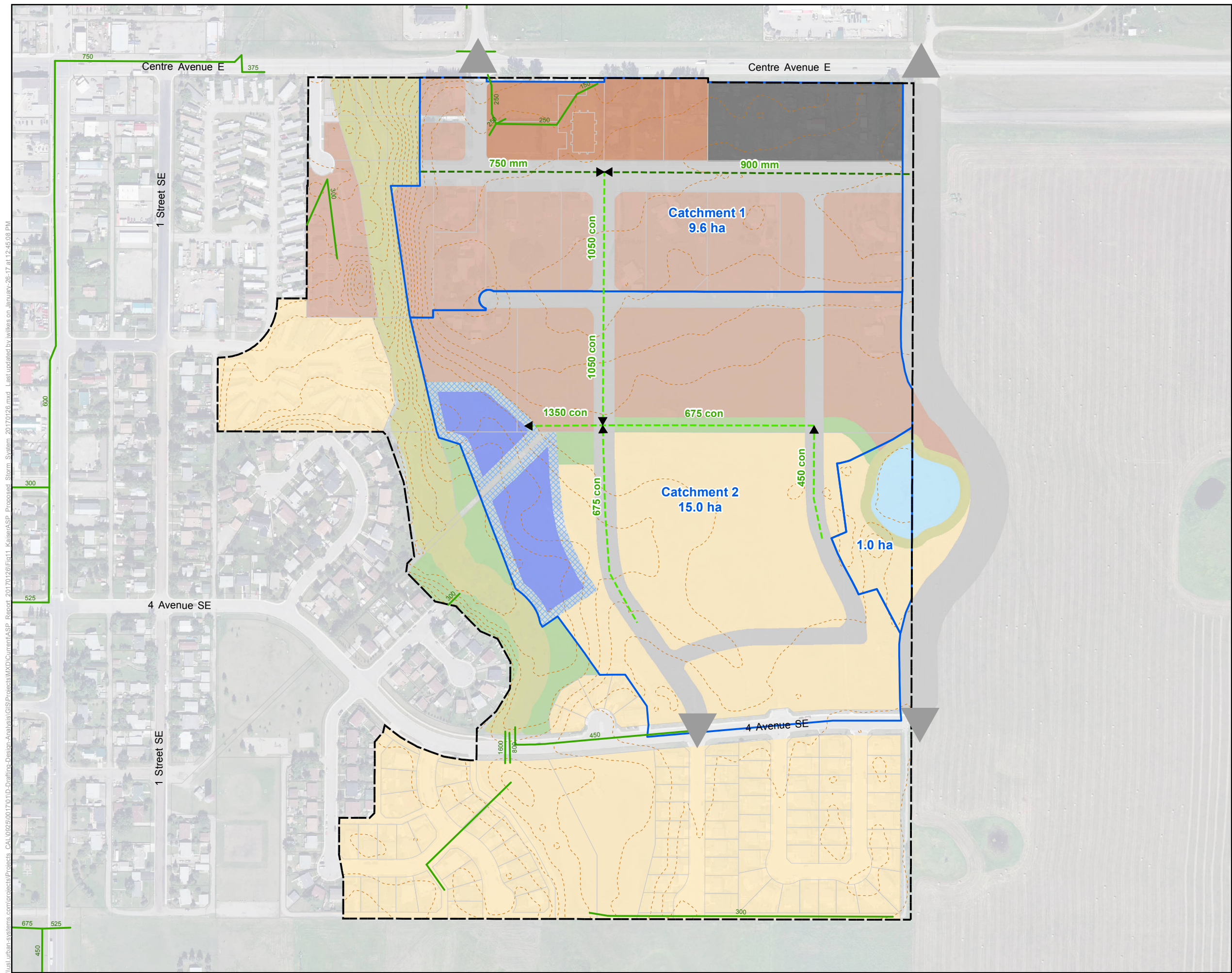
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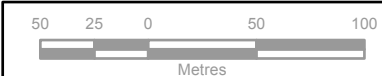
Town of Black Diamond
Kaiser ASP

Storm Infrastructure

Legend

- Local Storm Mains - Proposed
- Storm Trunk Mains - Proposed
- Storm Main - Existing
- Catchments
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Environmental Reserve
- Municipal Reserve
- Pond Area
- High Water Level
- Wetland
- Road
- Access Points
- Kaiser ASP Boundary

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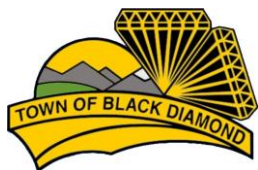
FIGURE 9

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6.1.3 WETLAND

The wetland on the east edge of the Kaiser area is proposed to be left undisturbed, and therefore avoiding an application under the Water Act. The wetland will be fully protected in its natural state and will not be a part of post-development stormwater system. At detailed design, further analysis will be required to determine how the wetland is going to be maintained. A water balance analysis should be conducted on the wetland to establish the pre-development hydroperiods and the average annual pre-development runoff volume the wetland was receiving. This will provide the basis for evaluating post-development impacts and establishing the post-development stormwater volume inputs to ensure that pre- and post-development hydroperiods are matched. The source of stormwater can be from overland drainage or from a stormwater pond. Only highly treated stormwater can be diverted to the wetland to ensure that there are no adverse impacts to wetland health.

6.1.4 STORMWATER MANAGEMENT FACILITY

Post-Development flows from Catchments 1 and 2 will be attenuated with a stormwater management facility sized to match the pre-development flow rate.

Using the total allowable release rate of 4 L/s/ha and assuming an imperviousness of 65%, a wet pond has been estimated using the parameters indicated in Table 6.1. The exact pond volume and location will need to be determined at a future design stage as part of the submission of a stormwater management report.

As part of this analysis, a wet pond has been sized in order to illustrate the approximate magnitude of such a facility. The storm pond was sized using the wetpond design guidelines from the City of Calgary Stormwater Management and Design Manual (2011). The pond volume was set to control the statistical 1 in 100 year peak storm event. It has been assumed that the outfall of the storm pond is in a free flow condition and not subject to backflow from the watercourse. At this time, the 1 in 100 year flood way and flood fringe of the watercourse is unknown and further analysis will be required to assess the watercourse capacity. This assumption should be verified at detailed design.

Refer to the Province of Alberta document *Stepping Back from the Water* for guidelines on setbacks from the watercourse, and to ensure that reduction of the riparian zone does not have downstream flood impacts.

A potential pond location is presented in **Figure 9** – The pond may be treated as an interconnected pond, or as two separate ponds depending on the presence of other conflicting utilities in the area, as well as development staging. If two ponds are constructed, two separate outfalls will need to be constructed into the watercourse, with associated applications under the Water Act.

Table 6.1 – Preliminary Wet Pond Design Criteria

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PARAMETER	VALUE
Active Storage Depth	2.0 m
Freeboard Depth	0.5 m
Maximum Release Rate	95.2 l/s
Unit Area Release Rate	4 l/s/ha
Elevation of outlet pipe to watercourse	1184.0 m
Elevation of High Water Level	1187.0 m
Elevation of Normal Water Level	1185.0 m
Pond Area at High Water Level	0.9 ha

The storm trunkmain sizes are provided on **Figure 9 – Storm Infrastructure**. Storm trunkmains have been sized to accept 80 l/s/ha unit area release rate. Multi-family and commercial parcels within this catchment area are expected to attenuate flows to this release rate prior to entering the storm sewers. These parcels may consider trap lows, tank storage, or other attenuation methods suitable to commercial or mid- and high density residential development.

All development in this area is encouraged to promote infiltration and evaporation of stormwater prior to entering the minor system. At a minimum, downspouts from roof leads are to be disconnected from the underground stormwater network, and 300 mm of topsoil shall be placed on lawns, greenspaces, and other permeable areas. Other low impact development methods to promote infiltration and evaporation of stormwater are encouraged, such as rain gardens, bioswales, and green roofs.

The stormwater infrastructure for the Kaiser area has been sized only for the Kaiser area. Oversizing of the infrastructure is expected to be required to accommodate future growth to the east.

6.1.5 CATCHMENT 3

Catchment 3, includes existing developed lands within the Kaiser ASP area. Lands within this catchment release unrestricted and untreated stormwater flows to the watercourse.

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6.1.6 STORMWATER QUALITY

The water quality of stormwater runoff that is discharged to both the watercourse and the wetland shall meet requirements as indicated in the Stormwater Management Guidelines for the Province of Alberta, Alberta Environment and Parks (formerly Alberta Environmental Protection), January 1999. For the purposes of this report, it has been assumed that water quality is to be provided by mechanical separation using oil-grit separators. Further detailed design may consider other methods, if required.

6.1.7 WATERSHED MANAGEMENT AND LOW IMPACT DEVELOPMENT

In 2008, the Bow River Basin Council finalized the Phase 1 of the Bow River Basin Watershed Management. Subsequently, the Town of Black Diamond, along with other municipalities in the basin, joined the Bow River Basin Watershed Plan. The intent of the plan is to protect and enhance the watershed, recommend changes in policy, practice and regulation; and serve as a catalyst for proactive action by land, water and resource managers. The Phase 2 of the Bow River Watershed Management Plan was completed in 2012. It is focused on wetland and riparian area protection, source water protection and land use decisions in support of watershed protection.

The Phase 1 of the Plan focuses on surface water quality and contains a number of reach-specific water quality objectives and targets. The following are important recommendations based on the main objectives outlined in the Plan:

- Development of effective impervious targets based on the overall goal of trying to achieve pre-development runoff rates and volumes entering the Bow River.
- Evaluation and implementation of stormwater treatment options or technologies to protect the river water quality.
- Requirement that all new residential and commercial developments incorporate elements of low impact development and stormwater best management practices into the overall design.
- Performance monitoring to assess whether the changes in development practices are having an actual impact on water quality.
- Development of appropriate riparian setbacks policies for new developments.

As part of the Town of Black Diamond's participation with this plan, low impact development should be implemented in new developments. Low impact development (LID) practices are intended to reduce stormwater runoff volume, reduce stormwater peak discharge rates for more frequent rainfall events, and to reduce environmental impacts on the natural environment by enhancing stormwater quality through the removal of major contaminants in urban stormwater

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runoff. LID measures should be designed to meet specific targets set out by the regulator and form an important part of the stormwater management strategy to reduce stormwater runoff to predevelopment rates, volumes and quality. LID measures implemented in the Kaiser area should promote the movement and management of stormwater through natural processes (i.e. infiltration, evapotranspiration and evaporation).

As with most engineered stormwater management infrastructure, there are maintenance requirements to protect the design life and performance of the LIDs. Designers and engineers should include a reasonable factor of safety in the design in order to increase the design life and prevent failure of the design post-construction. Also, design considerations should be made to reduce undesirable interference whether by people or animals, destruction and/or removal of the LID infrastructure. Maintenance measures over the life cycle of the design should be discussed with the Town of Black Diamond's Public Works department and approved prior to implementation. These measures should also be clarified in reports and operation and maintenance manuals.

6.2 Sanitary

As outlined in the 2016 Joint Growth Strategy report for Turner Valley and Black Diamond, it is our understanding that the Westend Regional Wastewater Commission Lagoon system will be upgraded to a mechanical tertiary treatment plant in order to meet high quality effluent standards currently being reviewed as part of the Foothills Regional Wastewater Collaborative Study and that full build out of the Westend Wastewater Commission lagoon system will include the development within the Kaiser area.

Sanitary underground infrastructure in the Kaiser area consists of two gravity main alignments running through the middle of the Kaiser area. According to the WRSSC Westend Sanitary Trunkmain Relocation Conceptual Servicing Report (Urban Systems, 2014), the existing main has spare capacity of 14 L/s, while the 450mm diameter Westend trunkmain has spare capacity of 235 L/s. To increase the amount of developable area, a portion of the existing 250mm gravity main in the middle of the Kaiser area will be removed connect to the Westend trunkmain. This is not expected to have an impact to the upstream and downstream system.

Kaiser area sanitary flow will be conveyed to both the existing 250mm gravity main that will remain within the Kaiser area and the 450mm Westend trunkmain. This is in line with the WRSSC report, which states that "the growth attributed to Black Diamond is proposed to be serviced by utilizing remaining capacity within the existing sanitary sewer line and then directing the remainder into the gravity portion of the Westend trunkmain." The Kaiser area is anticipated to contribute net 7.8 L/s to the existing 250mm gravity main (reducing capacity from 14.0 L/s to 6.2 L/s), and 20.2 L/s to the Westend trunkmain (reducing capacity from 235.0 L/s to 218.4 L/s).

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The Kaiser area may be split into four catchments. Each catchment will connect into either the existing 250mm gravity main or the Westend trunkmain. These connections will be established as described below. Minimum upstream connection capacities were determined based on minimum slope per City of Calgary design guidelines, a Manning's n of 0.012, 86% pipe capacity, and minimum size of main required. It was identified in the 2016 Joint Growth Strategy for Black Diamond and Turner Valley, that there is a potential for additional growth directly to the east and northeast of the Kaiser area. Therefore, there is a potential for future developments in these areas to tie to the proposed Kaiser infrastructure. The anticipated locations for the tie-in for future growth is shown in **Figure 10-Sanitary Infrastructure**. However, the associated oversizing required to accommodate this additional growth within the Kaiser area was not calculated. This will need to be determined once more detailed information is obtained for these growth areas in the future. For now, sanitary infrastructure within the Kaiser Area has only been sized for the Kaiser area development.

6.2.1 CATCHMENT A

Catchment A will be serviced by the existing connection to the existing 250mm gravity main. The existing main in 1 Ave SE extends approximately 70m east of 3rd St SE. The proposed diameter of the sanitary main required for this area is expected to be 200mm. Estimated peak wet-weather flows from Catchment A are approximately 10.2 L/s (based on the below assumptions for per-capita flow, Harmon's peaking factor, inflow and infiltration). The full construction of a sanitary main in 1 Ave SE will provide a possible connection for lands to the east of the Kaiser area. The minimum spare capacity upstream of this connection is approximately 12.3L/s, however, there may be provision for further flow accommodation.

6.2.2 CATCHMENT B

Catchment B will be serviced by a new 200mm gravity main running east to west through the catchment and a new connection to the Westend trunkmain. The full construction of a sanitary main for Catchment B will provide a possible connection for lands to the east of the Kaiser area. Estimated peak wet-weather flows from Catchment B are approximately 9.9 L/s (based on the below assumptions for per-capita flow, Harmon's peaking factor, inflow and infiltration). The minimum spare capacity upstream of this connection is approximately 15.4 L/s.

Figure 10 – Sanitary Infrastructure

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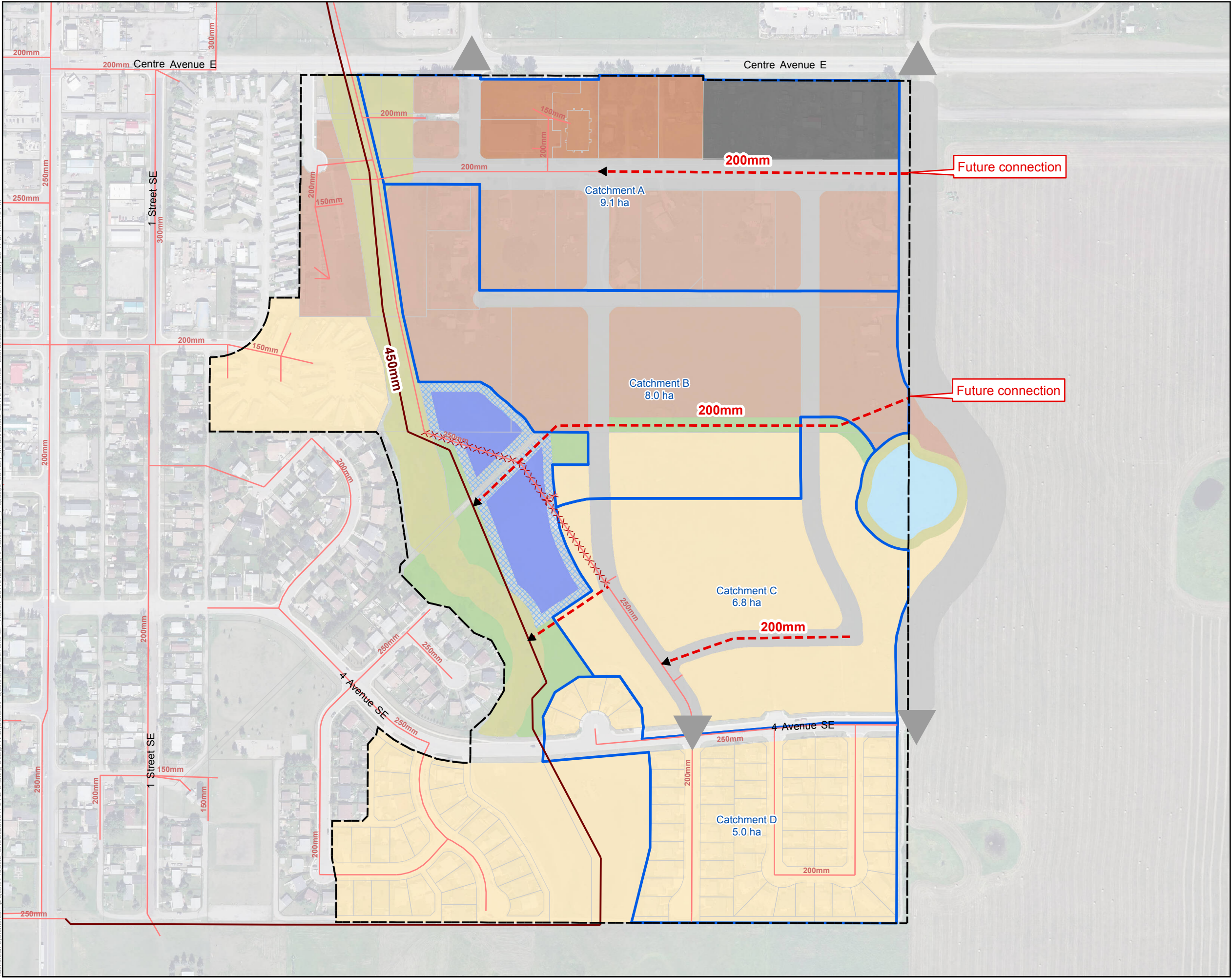
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Town of Black Diamond

Kaiser ASP

Sanitary Infrastructure

Legend

- Gravity Main - Proposed
- Gravity Main - Existing
- Gravity Main - Existing (To be removed)
- Westend Sanitary Trunk
- Catchments
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Environmental Reserve
- Municipal Reserve
- Pond Area
- High Water Level
- Wetland
- Road
- Access Points
- Kaiser ASP Boundary

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Coordinate System: NAD 1983 3TM 114

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Data Sources:
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FIGURE 10

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6.2.3 CATCHMENT C

Catchment C will be serviced by a new 200mm gravity main connection to the Westend trunkmain. Estimated peak wet-weather flows from Catchment C are approximately 7.1 L/s (based on the below assumptions for per-capita flow, Harmon's peaking factor, inflow and infiltration).

6.2.4 CATCHMENT D

Catchment D includes the existing contribution of 59 units and 5.25 ha of land. Catchment D will be serviced by a connection to the existing 250mm gravity main and to the Westend Trunkmain connection. Estimated peak wet-weather flows from Catchment D are approximately 5.0 L/s (based on the below assumptions for per-capita flow, Harmon's peaking factor, inflow and infiltration).

ASSUMPTIONS:

- Commercial population density (per commercial projections from Joint Growth Strategy, O2 2015): 24.1 p/ac (60 p/ha)
- Average Daily Sanitary Per Capita Flow: 264 Lpcd (per Black Diamond and Turner Valley Joint Growth Strategy, Urban Systems 2016)
- Mountainview Manor (1 Ave SE & 3 St SE) units: 72
(<http://www.westernwheel.com/Condos-attracting-city-dwellers-20130626>)
- Population density of 2.4 based on 2011 StatsCan census data for Black Diamond
- Inflow and infiltration taken to be 0.28 L/s/ha
- Harmon's peaking factor used to estimate peak wet-weather flow
- Existing flow in 250mm gravity main taken to be 14 L/s (Westend Forcemain Gravity Line Conceptual Servicing Report, Urban Systems 2014)

6.3 Water

Water distribution to the Kaiser area would be accommodated by tying into the existing distribution system. The current water supply from Turner Valley is designed to accommodate a population of 3,986 from Black Diamond (MPE Engineering Ltd. 2015). The current population of Black Diamond is estimated at 2,373, thereby allowing a population growth of 1,613 within Black Diamond.

The existing distribution system is comprised of a 1.0 million gallon treated reservoir, pump station, and watermains. There are existing water stubs for tying into the south developed portion of the study area, one 200mm stub is available in the north area for tying-in for new development. There also exists a 250mm distribution main to the north, across Highway 7, which may be used for looping of the water system.

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In order to model the proposed distribution system required, the Kaiser area was split into the same four catchments discussed above in the sanitary analysis section and shown on Error! Reference source not found.. Only the main lines through the area were modelled, as shown in Error! Reference source not found.; the minor distribution pipes in the Kaiser area were not included in this study. Based on the catchment populations as discussed above, a demand of 315 Liters per capita per day from the Joint Growth Strategy (O2, 2015) was assigned to each catchment.

According to the Fire Underwriters Survey Report (2013), required fire flow is 56 L/s for residential development and 150 L/s for commercial and industrial. Under the current conditions the existing system cannot provide the required fire flow for commercial development.

In order to strengthen the system the watermain will need to be looped through the study area, as shown in Error! Reference source not found.. For this looping, a 250 mm water main is required through the center of the Kaiser area, combined with a secondary 200 mm main along the east road. Due to the additional fire flow required for the industrial area north of the highway, it is proposed to oversize these mains. The cost sharing requirements for the oversizing and looping will be outlined in an update to the Town's Offsite Levy Bylaw.

The Kaiser area is split into two separate pressure zones, as shown on Error! Reference source not found.. A pressure-reducing valve (PRV) would be required and installed at the connection north of the highway in order to move the industrial area to pressure zone 2.

6.3.1 ASSUMPTIONS:

- Commercial population density (per commercial projections from Joint Growth Strategy, O2 2015): 24.1 p/ac (60 p/ha)
- Average Daily Demand (ADD) Per Capita Flow: 315 Lpcd (per Black Diamond and Turner Valley Joint Growth Strategy, Urban Systems 2016)
- Average to Maximum Daily Demand Ratio: 1:2.2 (per Black Diamond and Turner Valley Joint Growth Strategy, Urban Systems 2016)
- Maximum Daily Demand to Peak Hour Ratio: 1:2 (per Black Diamond and Turner Valley Joint Growth Strategy, Urban Systems 2016)
- Mountainview Manor (1 Ave SE & 3 St SE) units: 72
(<http://www.westernwheel.com/Condos-attracting-city-dwellers-20130626>)
- Population density of 2.4 based on 2011 StatsCan census data for Black Diamond

Figure 11 – Proposed Water System

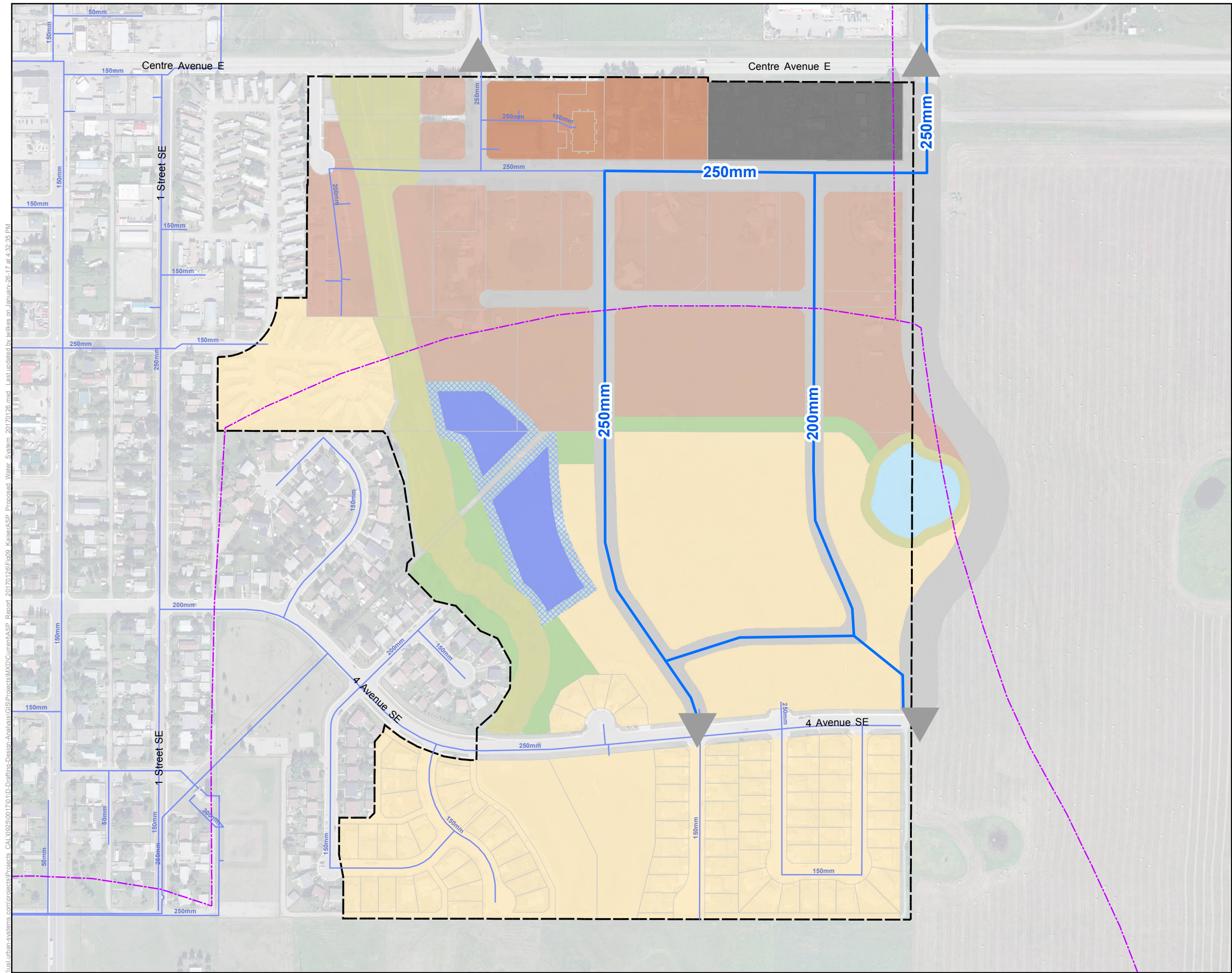
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Town of Black Diamond

Kaiser ASP

Proposed Water System

Legend

- Watermain - Proposed
- Pressure Zone Boundary
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Environmental Reserve
- Municipal Reserve
- Pond Area
- High Water Level
- Wetland
- Road
- Access Points
- Kaiser ASP Boundary

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FIGURE 11

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7.0 PHASING

Development phasing boundaries are based on existing development conditions, and infrastructure considerations. **Figure 12 - Land Use Concept Phasing** indicates the development phasing. Phasing will generally occur from south to north within the ASP area.

Phase 1 lands are located directly north of 4 Avenue SE and are currently undeveloped. The stormwater facility in this phase will need to be constructed prior to any future development within the Kaiser Area. The looping of the watermain from the industrial area, south to 4 Avenue and installation of a PRV will also need to be constructed in concurrence or prior to the build out of Phase 1. A temporary secondary access will be required to meet the Fire Access Standards.

Phase 2 lands are located east of 2 Avenue SE and are undeveloped. Development of the Phase 2 lands will involve the logical extension of the roads and utilities that were constructed as part of Phase 1.

Phase 3 lands are located directly south of Highway 7, the existing areas consists primarily of some higher density residential and commercial uses in the adjacent to Highway 7/Centre Avenue and acreage residential development in the remaining portion of Phase 3. This phase will include the logical extension of the services that were installed as part of Phases 1 and 2 and connection to the existing services in 1 Avenue.

Figure 12 – Phasing

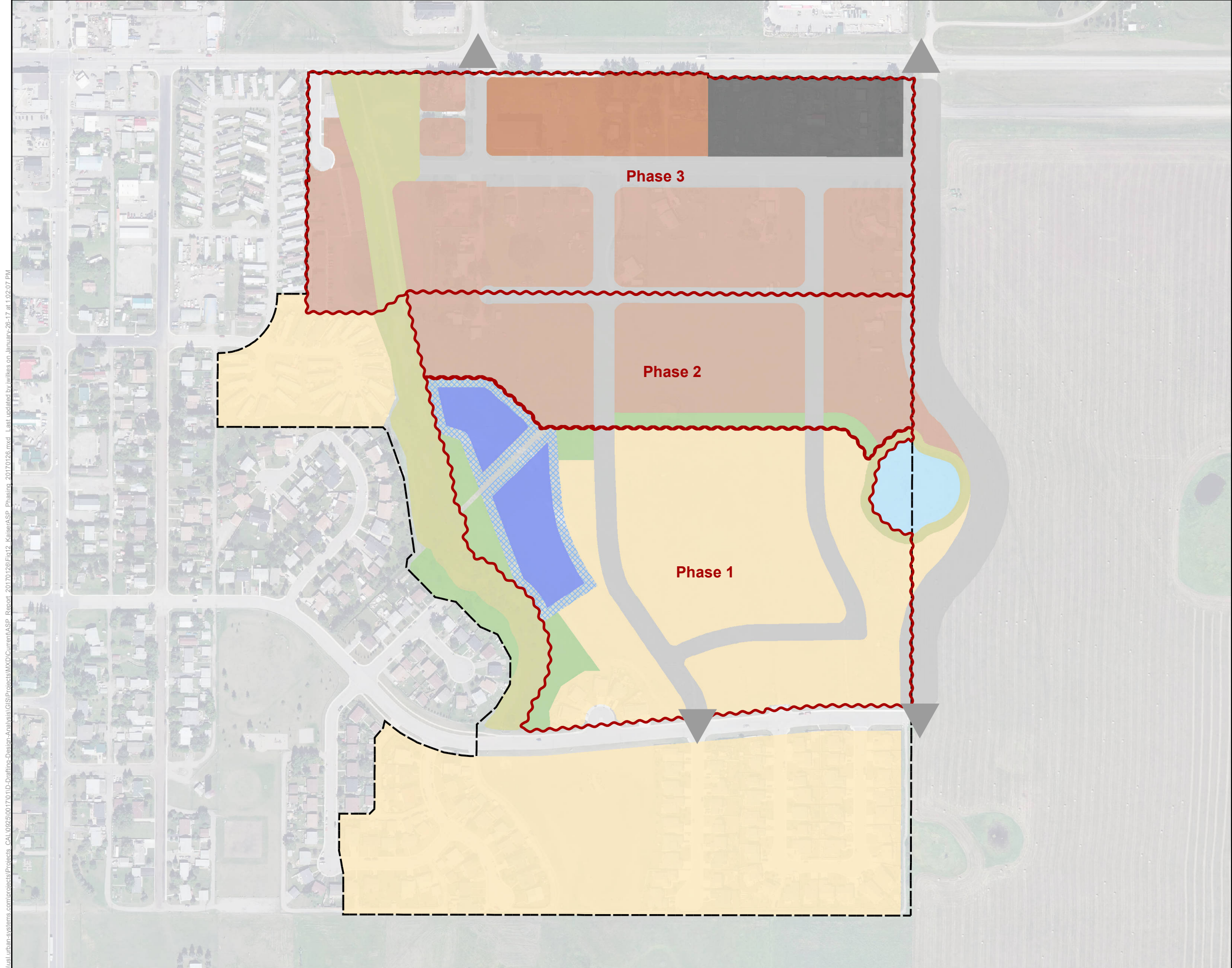
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Town of Black Diamond

Kaiser ASP

Phasing

Legend

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Environmental Reserve
- Municipal Reserve
- Pond Area
- High Water Level
- Wetland
- Road
- Access Points
- Kaiser ASP Boundary

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FIGURE 12

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8.0 PREVIOUS ITERATIONS OF THE KAISER ASP

Figure 13 - Previous ASP Concept below shows the previous concept plan for the Kaiser area. The following changes were made to the plan for the most recent version of the Kaiser ASP to take into consideration stakeholder input:

- Removal of the east/west collector in the middle of the plan
- Realignment of the north/south road to minimize the quantity of sanitary sewer that will need to be removed for development
- Less detail was provided for the residential area to allow for more flexibility with the design

Figure 13 - Previous ASP Concept



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8.1 Policies

The policies are recommended for development to ensure that sanitary, storm and water utilities are provided at standards acceptable to the Town of Black Diamond:

ENVIRONMENTAL POLICIES

1. Environmental Reserve shall be dedicated on both sides of the watercourse and the wetland to the satisfaction of the Town of Black Diamond and Alberta Environment and Parks in accordance with the MDP, IMDP, and the MGA. The extent of environmental reserve should be determined by a Municipal Environmental Impact Statement (MEIS) to determine the significance of habitat, ecology, geo-technical stability, floodplain, and open space/trail system requirements.
2. Requirements for applications for land use re-designation or subdivision approval should include but not be limited to detailed biophysical impact assessment and/or wetland impact assessment, stormwater/watershed management plans, provision of wetland replacement funds (i.e., monetary compensation), wetland consent from neighbouring landowners that share the wetland boundary, and public notice/consultation.
3. A Municipal Environmental Impact Statement (MEIS) should be submitted with all development and subdivision applications in accordance with the MDP and IMDP, and/or
4. Recognizing the environmental and social importance of the natural wetland, wetland hydrology should be analysed in a MEIS, and engineering design should be required to maintain the overland flow and hydrology of the wetland.

TRANSPORTATION POLICIES

1. Access to the Kaiser ASP area shall be in accordance with plans agreed by the Town of Black Diamond and Alberta Transportation.
2. The design of intersections at Highway 7 providing access to the Kaiser ASP area shall be approved by the Town of Black Diamond and the Province of Alberta.
3. At Land Use Re-designation or subdivision, a Transportation Impact Assessment associated with the development shall be provided at the developer's cost to the Town, and where applicable, Alberta Transportation's satisfaction.
4. The internal road network shown on the Land Use Concept is preliminary and shall be refined at the Land Use Re-designation stage.
5. The design of the road network shall provide the following:
 - a. Describe connections
 - b. Interconnected pedestrian system
6. Lanes for rear lot access shall be provided for residential development that occurs on high volume roadways.

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8.1.1 GENERAL SERVICING POLICIES

1. Urban development within the Plan area shall be serviced with Town water, sanitary, sewer and stormwater systems, as well as gas, cable, telephone, and electricity.
2. Easements and rights of way shall be provided to accommodate Town utilities as necessary.
3. Easements, rights of way, public utility lots and road right of ways may be required, at the discretion of the Development Authority, to be dedicated or registered across undeveloped land to ensure orderly and sequential development.
4. The water, sanitary sewer and storm sewer systems shall be designed to serve the ultimate development of the Plan area as well as any external connections.

WATER SERVICING

1. Alberta Environment and Parks approval will be required prior to the extension of the water system.
2. The water distribution system shall be designed to deliver water in adequate quantities at adequate pressure for both peak consumption conditions and fire flows.
3. Looping shall be provided for redundancy.
4. A Hydraulic Network Analysis Report will need to be submitted to the Town prior to development approval. This report shall contain information on operating pressures under peak hourly demand conditions, fire flow availability during Maximum Day Demand conditions, as well as, information on nodal demands and boundary conditions. Note that the Town will need to provide boundary conditions in order for this analysis to be conducted.
5. Pressure reducing valves shall be required.
6. For residential areas, demand should be 315 L/cap/day, Maximum Daily Demand Ratio to Average Daily Demand should be 2:2:1 and Peak Hour Ratio to Average Daily Demand should be 4:1.
7. The Town reserves the right to request oversizing and discuss compensation.

SANITARY SERVICING

1. Alberta Environment and Parks approval will be required prior to the extension of the sanitary system.
2. The sanitary sewer design system should be based on an average daily dry weather flow of 264 L/d/c with a Maximum Daily Flow ratio of 2.2 and a Peak Hour Flow ratio of 5.0, plus inflow and infiltration of 0.28 L/s/ha.

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3. A sanitary report and calculations will need to be submitted prior to land use re-designation or subdivision will include all sanitary flow calculations.
4. The Town reserves the right to request oversizing and discuss compensation.

STORMWATER MANAGEMENT

1. All stormwater outfalls to the watercourse shall conform to federal and provincial regulations including the Code of Practice as established by the Alberta Water Act.
2. A catchment area and capacity analysis of the watercourse shall be conducted prior to detailed design of outfalls. The stormwater management facility shall not be subject to backwater in the event of a 1 in 100 year flood.
3. Post-development stormwater flows from the Kaiser area are limited to a pre-development flow rates of 4 l/s/ha.
4. The location and catchment area of the stormwater facility is shown conceptually on **Figure 9 – Storm Infrastructure**. Alternate and more cost effective alignments may be considered. Impact to the watercourse and natural open space shall be minimized.
5. The wetland on the east edge of the Kaiser area shall be left undisturbed. The wetland shall be fully protected in its natural state and will not be a part of post-development stormwater system. To maintain the hydrologic cycle of the wetland, pre and post-development hydro-periods for the wetland shall be maintained.
6. All development in this area is encouraged to promote infiltration and evaporation of stormwater prior to entering the minor system by incorporating elements of low impact development and stormwater best management practices. At a minimum, downspouts from roof leaders should be disconnected from the underground stormwater network, and 300 mm of topsoil should be placed on lawns, greenspaces, and other permeable areas.
7. Other low impact development methods to promote infiltration and evaporation of stormwater are encouraged, such as rain gardens, bioswales, and green roofs.
8. The water quality of stormwater runoff that is discharged to both the watercourse and the wetland shall meet Alberta Environment's water quality standards.
9. As part of any future development applications, the Applicant shall submit a Stormwater Management Plan consistent with the overall design of the stormwater management system for the area.

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10. Maintenance of all stormwater infrastructure over the life cycle of the design shall be discussed with the Town of Black Diamond's Public Works department and approved prior to implementation. These measures should be summarized in an operations and maintenance manual.
11. The Town reserves the right to request oversizing and discuss compensation.

SHALLOW UTILITIES

1. All cable, telephone and electricity for servicing development shall be underground.