

Parkland County

Acheson/ Big Lake Area Master Drainage Plan Amendment Application Document

Prepared by:

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Project Number:

6845-036-00 (60114652)

Date:

August 2011

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August 3, 2011

Parkland County
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Dear Keith Bobey:

Project No: 60114652 (6845-036-00)

Regarding: Acheson/ Big Lake Area Master Drainage Plan Amendment Application

AECOM is pleased to submit the final Application Document to Parkland County. The final Application Document was updated to address Statements of Concern received from Parkland County's application to Alberta Environment.

Sincerely,
AECOM Canada Ltd.

Melanie Markiwsky, P.Eng.
Melanie.markiwsky@aecom.com

MM:sw
Encl.

Distribution List

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Revision Log

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3	Melanie Markiwsky	March 2011	FINAL
4	Kristin St. Louis	August 2011	FINAL with SOC Revisions

AECOM Signatures



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PERMIT TO PRACTICE
AECOM CANADA LTD.

Signature

Date Aug 3, 2011

PERMIT NUMBER: P10450

The Association of Professional Engineers,
Geologists and Geophysicists of Alberta.

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Appendix A. Master Drainage Plan Amendment

1. Introduction

In recent years, the Acheson/Big Lake Area has experienced significant commercial, industrial and residential development. A number of new developments have been approved with the completion of appropriate stormwater management studies. However, the cumulative effects of these individual developments prompted the need to develop the Parkland County Acheson/ Big Lake Area Master Drainage Plan Amendment, completed by AECOM in March 2011.

The Acheson/Big Lake Area Master Drainage Plan Amendment, as found in Appendix A, quantifies the effectiveness of the existing drainage systems in place, proposes drainage upgrades required to address existing drainage and accommodate additional development, and develops an overall drainage plan to allow development to proceed.

The key issues within the development area are:

- Within the Acheson Industrial Area, Zones 1, 3, and a portion of Zone 5 use Morgan Creek as a stormwater outlet. As the development continues, there is a concern over the effectiveness of Morgan Creek as an outlet. Landowners within Osborne Acres have expressed concerns over the flooding in the area and Wagner Natural Area Society has expressed concerns over the erosion of Morgan Creek; erosion issues in Morgan Creek need to be considered and addressed.
- There is a lack of adequate stormwater outlets within the Acheson Industrial Area, Zones 5, 6, 7 and 8, south of Highway 16A. Routing the stormwater runoff to the south is not feasible.
- The Wagner Natural Area and the associated groundwater recharge area must be given particular attention. Any development within the recharge area could potentially disrupt the flow of groundwater or lower the water level and have an adverse impact on the Wagner Natural Area.
- The existing Alberta Transportation Stormwater Management Facility, located immediately to the northwest of the Highway 16/Highway 60 interchange, is currently at full capacity during high intensity rainfall events. A large amount of development is routed through the Alberta Transportation Stormwater Management Facility; including runoff from the WinAlta and TransAmerica stormwater management facilities. If additional developments are routed to the facility, these developments should implement 100% on-site stormwater retention and only discharge following the rainfall event. The opportunity to divert stormwater runoff from the additional developments around the Alberta Transportation Stormwater Management Facility should be investigated.
- Prior to commencing development of areas that contain potential wetlands appropriate protection and/or compensation must be provided as required by the appropriate government legislation. In order to identify and classify the potential wetlands in the study area, Alberta Environment required that a wetlands inventory be conducted.

In order to protect the Province's water resources, all water resources, including stormwater, are governed and regulated under the *Water Act*, Alberta RSA 2000, Chapter W-3 for as outlined in Section 2 the Act, "*The purpose of this Act is to support and promote the conservation and management of water, including the wise allocation and use of water,*"

Prior to proceeding with commercial, industrial or residential developments, in addition to meeting other regulatory requirements, a land developer must establish plans for the management of stormwater runoff. Stormwater management plans often require the construction of stormwater management facilities. Section 36 (1) of the *Water Act* states "*Subject to subsection (2), no person may commence or continue an activity except pursuant to an approval unless it is otherwise authorized under this Act.*" In many instances, the construction of stormwater management facilities are considered to be activities under the *Water Act* and trigger the need to obtain a *Water Act* approval prior to construction.

Therefore, Parkland County is now applying under the Water Act, to Alberta Environment, for a fenceline approval that will apply to any future proposed developments in the study area. This document, hereon referred to as the Application Document, summarizes the August 2011 Parkland County Acheson / Big Lake Area Master Drainage Plan Amendment's overall drainage plan and stormwater management criteria that are to be followed when developing in the Acheson/ Big Lake Area. The Master Drainage Plan Amendment supports this Application Document and therefore is included as Appendix A.

Parkland County anticipates that the fenceline approval, if issued, will require the criteria outlined in the Application Document to be followed as development of the area proceeds. The fenceline approval will eliminate the need for developers to apply for separate approvals under the Water Act and will assist in ensuring construction of stormwater management works or improvements in the area are completed in an organized fashion.

Parkland County will, as part of their development process, ensure that requirements outlined in the fenceline approval are met. If a developer proposes any stormwater management works or improvements that are in contravention of the fenceline approval, the developer will be required to obtain support from Parkland County as well as an amendment to the fenceline approval from Alberta Environment.

As part of Alberta Environment's application review process, the application and supporting documentation will be available for public scrutiny, giving interested stakeholders the opportunity to bring forward issues. A Notice of Application that provides information on where the application and supporting documents can be obtained, and where any statements of concern (SOC) may be sent, was published in local newspapers. The Notice of Application Public Notice 30 day SOC filing period ended on April 17, 2011. The Parkland County Acheson / Big Lake Area Master Drainage Plan Amendment has been updated to address the SOC's received prior to the April 17, 2011 SOC filing deadline date.

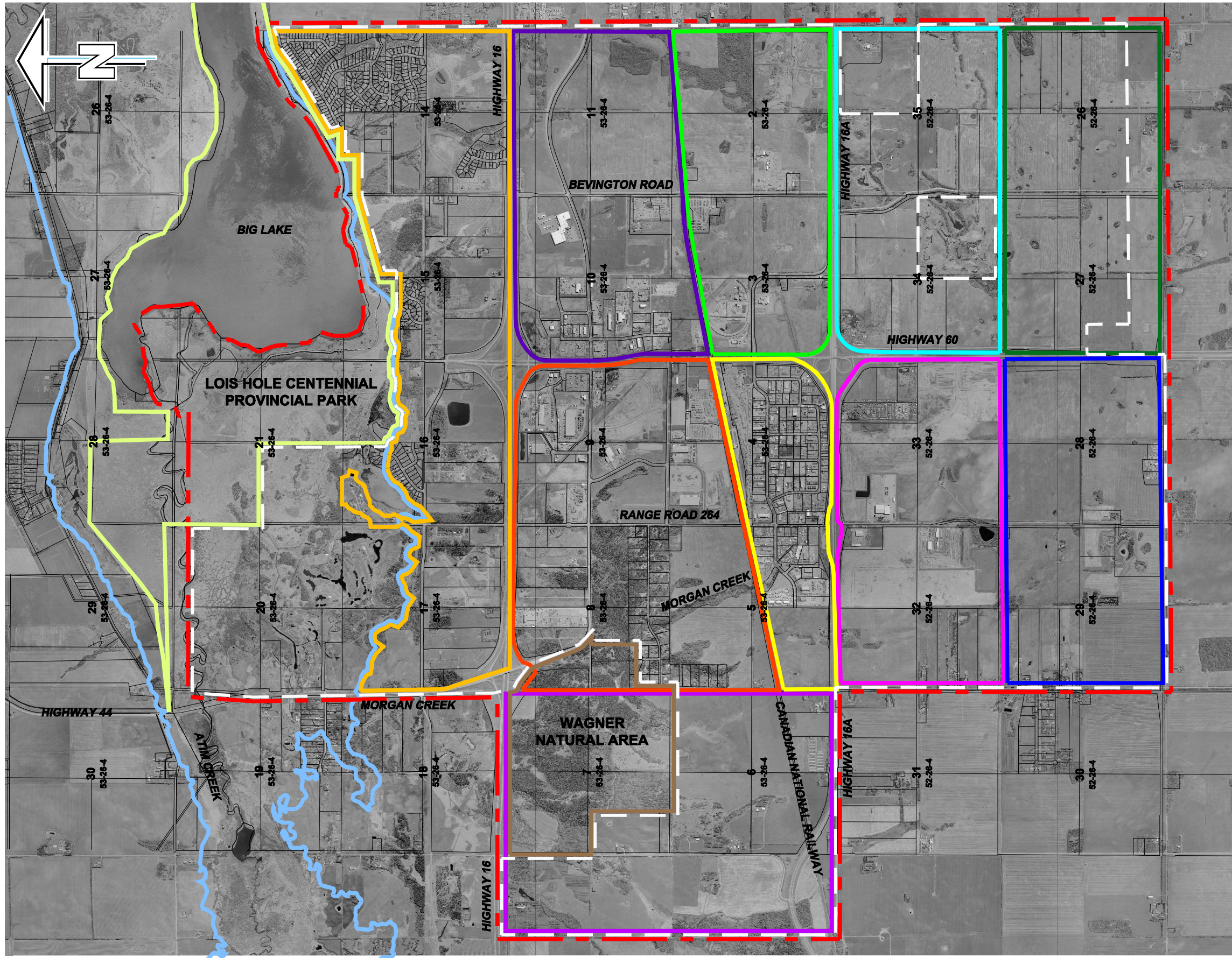
2. Study Area

The study area is within Parkland County, located west of the City of Edmonton and east of Spruce Grove. The study area is bordered by Atim Creek and Big Lake to the north, the City of Edmonton to the east, the Stony Plain Indian Reserve to the south, and the City of Spruce Grove to the west. The total study area is approximately 66.6 km².

As shown in Figure 2.1, the study area is comprised of the Acheson Industrial Area, the lands included in the Big Lake Area Structure Plan, the Wagner Natural Area and the lands south of the Wagner Natural Area to Highway 16A. The lands north of Highway 16 contain a number of existing and proposed estate residential areas. The Wagner Natural Area is a protected natural area by the Alberta Government. Lands south of the Wagner Natural Area are mainly undeveloped. The Acheson Industrial Area is divided into 8 zones. The majority of Zone 3 is fully developed, however, if any lands within this zone re-develop, they will have to follow guidelines outlined in this Application Document. Zones 1, 2, and 4 are partially developed, and there is some development beginning in Zone 5. Zones 6 - 8 are undeveloped or currently used for agricultural purposes.

The existing land use plan is shown on Figure 2.2. For the purposes of developing the full build-out ultimate master drainage plan for both the Application Document and the Acheson/ Big Lake Area Master Plan – Amendment, the Parkland County Planning Department recommended that the Acheson fringe areas of the study area be considered as being industrial zoned lands, as shown in Figure 2.3.

The Atim Creek / Big Lake Overlay, identified in Section 10.3 of Parkland County's Land Use Bylaw No. 20-2009, was used to create the boundary between the environmental area (Lois Hole Centennial Provincial Park / Environmental Area) and residential area (Big Lake Area Structure Plan) that lie north of Highway 16 and east of Highway 44; refer to Figure 2.2. This Overlay is defined as the 1:100 year Flood Plain for Big Lake plus 1 m consistent with the Big Lake Basin Study 2007 completed by Sameng Inc. The Overlay restricts land use in the area north of the 1:100 year boundary, regardless of the underlying land use district. Therefore, the lands north of this boundary were assumed to be Environmental Reserve and were not considered to be developable lands. The existing small residential area within the NW ¼ of 16-53-26-W4M that extends into the 1:100 boundary was constructed prior to the recognition of the boundary by Parkland County and Alberta Environment.



LEGEND

STUDY AREA

FENCELINE
APPROVAL BOUNDARY

WAGNER NATURAL AREA

LOIS HOLE CENTENNIAL
PROVINCIAL PARK

ACHESON INDUSTRIAL
AREA ZONES

ZONE 1

ZONE 2

ZONE 3

ZONE 4

BIG LAKE AREA STRUCTURE PLAN

ACHESON WEST AREA

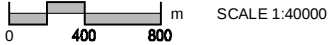
BIG LAKE FLOOD DELINEATION
(1:100 YEAR FLOOD)

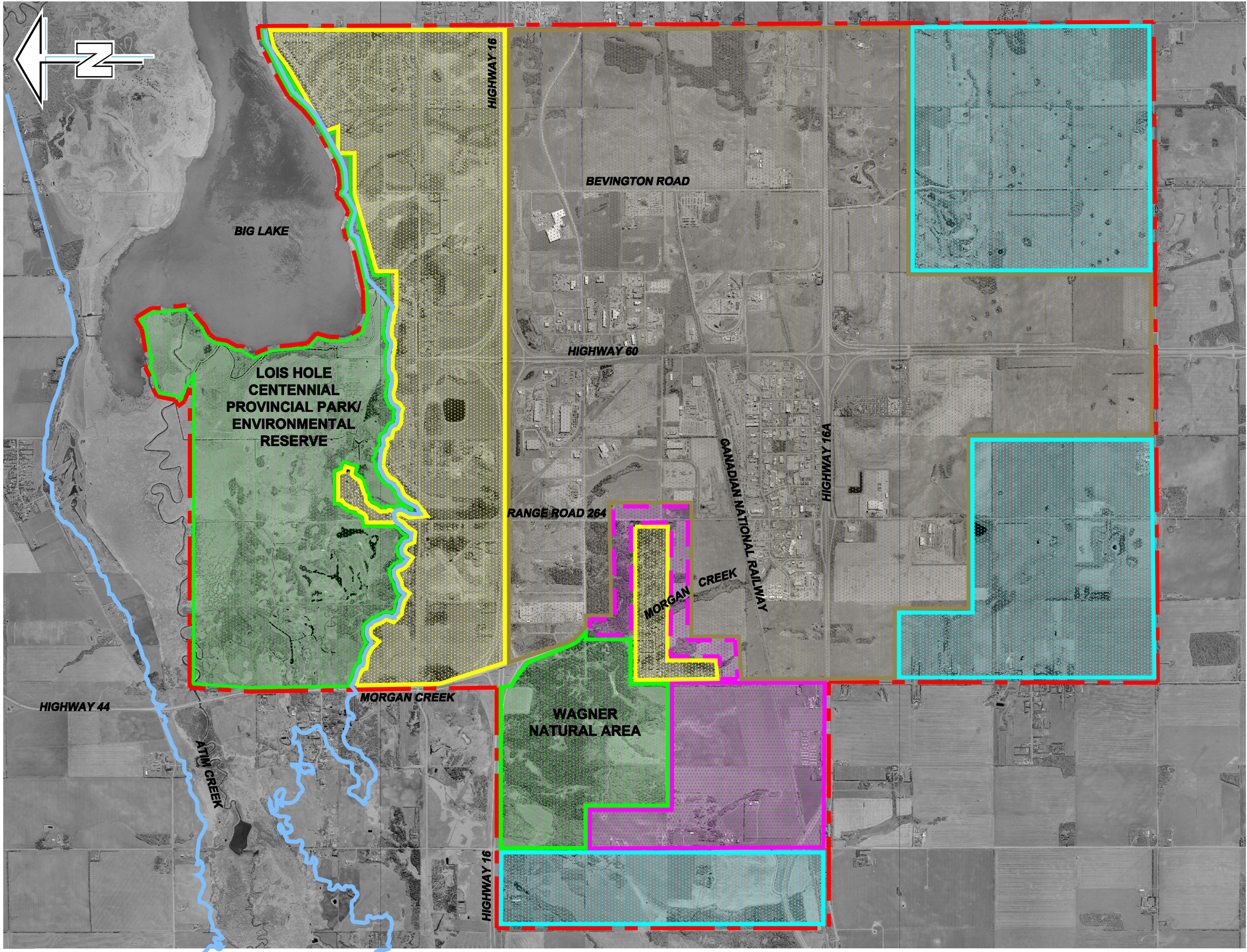
ZONE 5

ZONE 6

ZONE 7

ZONE 8



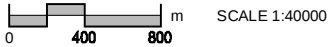


LEGEND

- STUDY AREA
- BIG LAKE FLOOD DELINEATION (1:100 YEAR FLOOD)
- RESIDENTIAL AREA (MODIFIED TO FOLLOW BIG LAKE 1:100 YEAR FLOOD DELINEATION)
- ENVIRONMENTAL AREA (MODIFIED TO FOLLOW BIG LAKE 1:100 YEAR FLOOD DELINEATION)
- AGRICULTURAL (BUFFER) AREA
- AGRICULTURAL AREA
- INDUSTRIAL/COMMERCIAL AREA
- FRINGE AREA

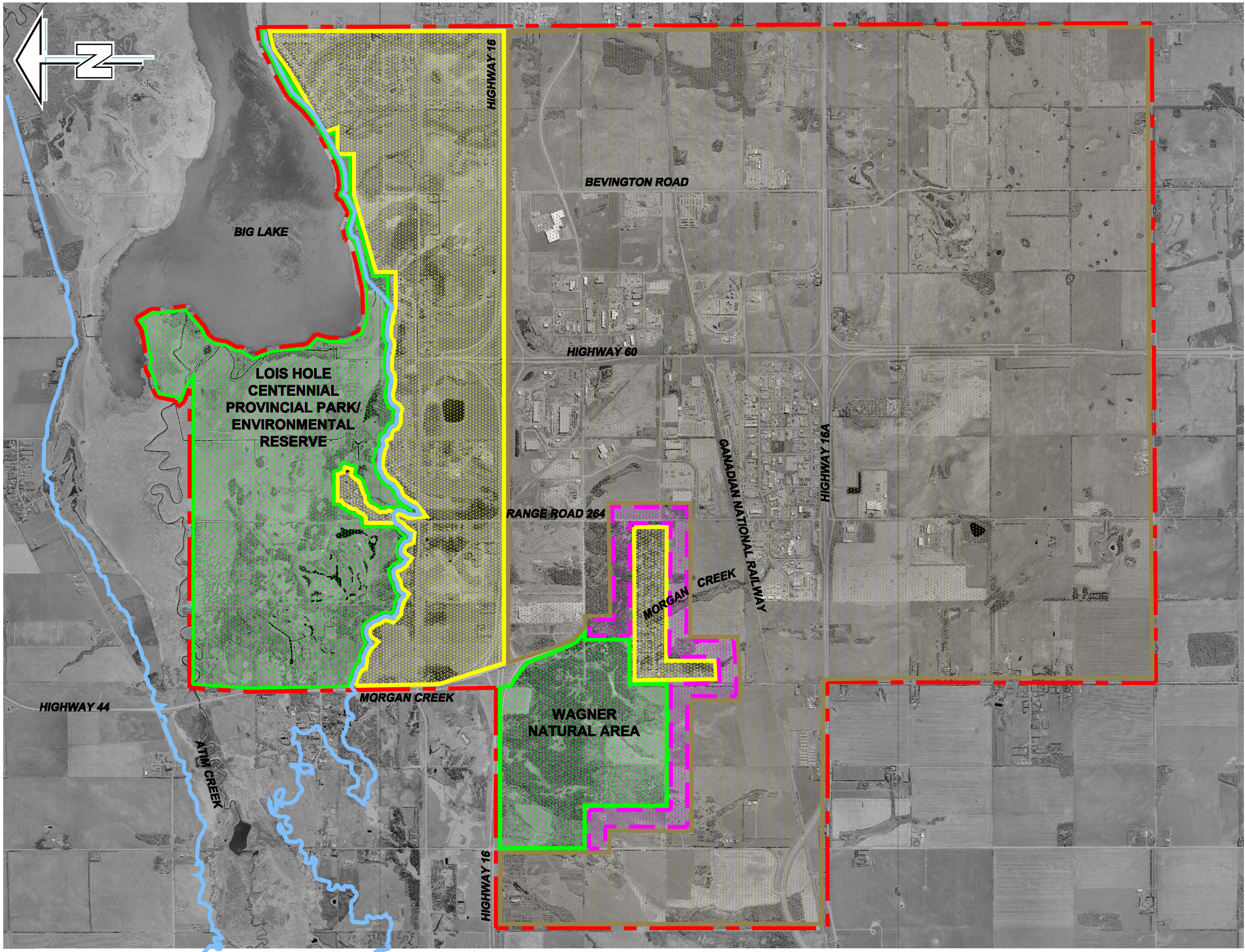
NOTE

LAND USE PLAN BASED ON 2007 MUNICIPAL DEVELOPMENT PLAN - BYLAW 37 - 2007. (JULY 2010 CONSOLIDATION)



Parkland County
Acheson/Big Lake Area Master Drainage Plan
Amendment Application Document

Existing Land Use
Figure 2.2



LEGEND

- STUDY AREA
- BIG LAKE FLOOD DELINEATION (1:100 YEAR FLOOD)
- RESIDENTIAL AREA (MODIFIED TO FOLLOW BIG LAKE 1:100 YEAR FLOOD DELINEATION)
- ENVIRONMENTAL AREA (MODIFIED TO FOLLOW BIG LAKE 1:100 YEAR FLOOD DELINEATION)
- AGRICULTURAL (BUFFER) AREA
- INDUSTRIAL/COMMERCIAL AREA

0 400 800 m
SCALE 1:40000

3. Stormwater Master Drainage Plan

3.1 General Design Criteria

The following design criterion must be followed by the developer in producing stormwater management plans.

- Stormwater management facilities (SWM Facilities) will be designed to contain a 100-year rainfall event.
- Areas south of Highway 16A will provide storage for 100% of the 100-year 24-hour rainfall event, once the piped storm system is constructed.
- SWM Facilities located in basins that utilize gravity outlets will provide 0.6 m of freeboard and be designed with emergency spillways.
- SWM Facilities located in basins that utilize pumped outlets will provide 1.0 m of freeboard to compensate for a lack of an emergency spillway.
- The maximum allowable discharge rate of stormwater management facilities is 1.2 L/s/ha or 2.5 L/s/ha, dependant on the downstream drainage course.
- Each SWMF must have a control outlet structures and must have the ability to be completely shut off in the event of a spill to prevent any contamination downstream.
- Existing wetlands must be identified and classified by a qualified aquatic biologist.
- SWM Facilities will be required to show that the Alberta Environment requirement of the removal of 85% of sediments with a particle size of 75 µm or greater is met.
- Rooftop and parking lot storage shall be utilized where practical in order to reduce required storage volumes.
- Green technologies should be encouraged to reduce the volume of runoff generated.

3.2 Master Drainage Plan

Ten separate stormwater drainage basins were delineated based on natural contours as well as land ownership, as shown on Figure 3.1. Within the study area boundary, the following areas are not being developed and will not be included in the fenceline approval:

- Wagner Natural Area;
- The Ranch Golf Club;
- Lois Hole Centennial Provincial Park;
- ¼ section south of Highway 16A, along the east study area boundary; and
- Lands along the south study area boundary.

The lands along the south study area boundary will be managed by Alberta Transportation and incorporated in a separate stormwater management plan/ basin.

The lands not included in the fenceline approval are not contained in any of the drainage basins shown on Figure 3.1.

The ultimate drainage plan for Parkland County was developed around natural drainage patterns as much as possible. However, this was not always feasible due to certain drainage issues, such as the concern over the capacity of Morgan Creek, as well as the areas south of Highway 16A which generally do not have a definable drainage route. Other factors impacted the development of the ultimate drainage plan as well, such as developing within the Wagner Natural Area groundwater recharge zone, and existing system limitations.

Stormwater management facilities for existing developments were not re-evaluated. These developments have implemented stormwater management plans and already control runoff to rates approved at the time of development.

3.2.1 Basin 1 – Zones 5 to 8

Basin 1, south of Highway 16A, consists of all the areas within Zones 5 to 8. There is no definitive overland drainage route within the area and stormwater runoff generated in this zone appears to drain into a large number of wetland pothole depressions scattered about the area. Future catchments were defined based on the existing property lines and SWM Facilities were proposed at the lowest point within each catchment. Twenty-eight (28) new SWM Facilities have been proposed for this area, in addition to the three (3) existing SWM Facilities, to service approximately 1,910 ha of industrial development. The three (3) developments located north of Highway 16A are not serviceable in all explored scenarios. Excluding these developments, the serviceable area decreases to 1,764 ha. It is being proposed that discharge from the SWM Facilities from this basin be routed to Big Lake. Discharge from the facilities will only be permitted after the rainfall event, as this area does not naturally drain to Big Lake.

Figure 3.2 and Figure 3.3 show the proposed SWM Facilities and the pipe layout for each of the proposed alternatives.

Based on the design criteria summarized in Section 3.1, the SWM Facilities were designed for the 100-year 24-hour rainfall event with no discharge. Table 3.1 summarizes the maximum storage volumes for the proposed stormwater management facilities in Basin 1.

Table 3.1 Basin 1 Hydraulic Results – 100-year 24-hour Rainfall

Basin	Runoff Volume (m ³)	Maximum Discharge Rate* (m ³ /s)	Storage Volume (m ³)
1-1	70,400	0.078	70,400
1-2	71,200	0.079	71,200
1-3	71,400	0.070	71,400
1-4	71,600	0.079	71,600
1-5 (Leder)	99,000	0.134	99,000
1-6	71,000	0.078	71,000
1-7	141,000	0.156	141,000
1-8 (Genesis)	64,200	0.073	64,200
1-9	71,300	0.079	71,300
1-10	144,700	0.161	144,700
1-11	14,800	0.018	14,800
1-12 (ING)	67,500	0.077	67,500
1-13 (Crown)	70,500	0.078	70,500
1-14 (AB Tran)	45,400	0.052	45,400
1-15	129,100	0.143	129,100
1-16	68,000	0.075	68,000
1-17	72,100	0.082	72,100
1-18	67,800	0.075	67,800
1-19	71,600	0.078	71,600
1-20	58,700	0.064	58,700
1-21	70,500	0.078	70,500
1-22	35,700	0.039	35,700
1-23	70,700	0.078	70,700
1-24	73,300	0.079	73,300
1-25	37,200	0.040	37,200
1-26	35,100	0.039	35,100
1-27	73,800	0.078	73,800
1-28	37,900	0.040	37,900

*Discharge based on 1.2 L/s/ha and only permitted following the rainfall event.

Discharge from the facilities will only be permitted after the rainfall event, and in order to not exceed downstream capabilities, the maximum allowable rate of 1.2 L/s/ha was adopted for Basin 1. A collection system will convey the discharge from the SWM Facilities to a common outfall that will daylight north of Highway 16A. Two possible outfall alignments were identified:

- along Highway 60 (Range Road 263); and
- along Bevington Road (Range Road 262).

It is proposed that the storm sewer system for Basin 1 be constructed in two stages. The first stage will accommodate Stage 1 and Stage 2 of development to 2029. The second stage will accommodate Stage 3, future development, beyond 2030.

The system proposed to service Stage 1 and Stage 2 includes several SWM Facilities that are proposed to be pumped into the gravity system which allows the collection system to be approximately 6 m to 12 m shallower than if they were to drain by gravity.

Stage 3 is a relatively deep system if it operates by gravity, therefore, further consideration was given to Stage 3 as a low pressure system. Two sets of alternatives were therefore developed:

- one with all stages of the collection system draining by gravity; and
- the other with Stage 1 and Stage 2 collection systems draining by gravity, and Stage 3 collection system draining through a low pressure system.

The six alternatives for the storm sewer system are:

- Gravity Collection System and Gravity Outfall along Highway 60
- Gravity Collection System and Forcemain along Highway 60
- Gravity Collection System and Forcemain along Bevington Road
- Stage 1 and 2 Gravity Collection System, Stage 3 Low Pressure System and Gravity Outfall along Highway 60
- Stage 1 and 2 Gravity Collection System, Stage 3 Low Pressure System and Forcemain along Highway 60
- Stage 1 and 2 Gravity Collection System, Stage 3 Low Pressure System and Forcemain along Bevington Road

It should be noted that the alignment along Bevington Road does not have a gravity outfall option. A gravity outfall will not daylight based on the existing topography.

3.2.1.1 Downstream System

To convey the flow from Basin 1 after the rainfall event, the downstream systems will require some drainage improvements.

Highway 60 Alignment

Two routes have been identified for the Basin 1 flow to reach Big Lake when discharging along Highway 60.

- Option 1 is the existing drainage route at the Highway 16/60 interchange. The flow crosses the Highway 16/60 interchange on the west side of Highway 60. The flow is conveyed overland, ultimately discharging into Big Lake.
- Option 2 is a proposed route that would involve installing new culverts under Highway 16 to allow the flow to be routed on the east side of Highway 60, ultimately discharging into Big Lake.

New culverts will need to be installed for both Option 1 and Option 2. Ditches along each outfall drainage option, may need to be improved in order to handle the increased volume and flow velocity from Basin 1. Option 1 also requires consideration to the Alberta Transportation Pond and a bypass control structure that will allow the discharge from Basin 1 to not enter the facility. Figure 3.4 shows the proposed Highway 60 outfall alignment routes and required improvements.

Bevington Road Alignment

Overall, flow from the outfall alignment along Bevington Road is proposed to be routed along the existing drainage path. The flow in the forcemain outfall will be conveyed for 1,840 m north of Highway 16A. The forcemain would then daylight and flow would continue north through ditches, and across Highway 16, ultimately discharging into Big Lake. This route requires that new culverts be installed under Township Road 531A and Highway 16. Figure 3.5 shows the proposed route and the required improvements.

This fenceline application is being submitted requesting approval for both the Highway 60 and Bevington Road outfall alignments for Basin 1. Which alignment is ultimately chosen to be used will depend on which right of way route is secured first, as well as, on the location or where first development proceeds within Basin 1. Once the ultimate Basin 1 outfall alignment route has been chosen, Parkland County will notify Alberta Environment and will request that the appropriate fenceline approval amendment be made.

3.2.2 Basin 2 – Morgan Creek

Basin 2 consists of all the future areas that will drain to Morgan Creek. Five new SWM Facilities (2-1 to 2-5) have been proposed for this area to service approximately 156 ha of future industrial and residential development. Figure 3.7 shows the ultimate stormwater management plan for Basin 2.

The ponds will provide storage up to the 100-year rainfall event and outflow will be controlled to 2.5 L/s/ha while discharging during the rainfall event, with the exception of SWMF 2-5 (Conzor) which will be controlled to 1.2 L/s/ha in accordance with the Acheson Industrial Development Subdivision SW 5-53-26-W4, Appeal Decision (2010). Table 3.2 summarizes the maximum storage volumes for the proposed stormwater management facilities in Basin 2.

Table 3.2 Basin 2 Hydraulic Results - 100 year 24 hour Rainfall

Basin	Runoff Volume (m ³)	Maximum Discharge Rate (m ³ /s)	Storage Volume (m ³)
2-1*	88,300	0.21	70,200
2-2	7,400	0.02	5,700
2-3	16,900	0.04	13,500
2-4	13,900	0.03	11,300
2-5 (Conzor)	36,500	0.04**	31,400

*Basin 2-1 is split by Morgan Creek. The required storage will be provided in two SWMFs; one east of Morgan Creek and one west of Morgan Creek.

**Discharge based on 1.2 L/s/ha.

The total flow from the existing and proposed developments that discharge into the reach of Morgan Creek between Highway 16 and Highway 16A must not exceed 1.4 m³/s, as this is the bankfull capacity of Morgan Creek. SWM Facilities 2-3 and 2-4 are excluded from this requirement as they discharge into Morgan Creek well downstream of Highway 16. The West Acheson SWMF currently discharges at a peak rate of 0.98 m³/s, while the future developments of Sub-Basins 2-1 and 2-2 are proposed to discharge at peak rates of 0.21 and 0.02 m³/s, respectively. Added together these SWM Facilities will discharge at a combined rate of 1.2 m³/s. The remaining areas of Basin 2 include Osborne Acres (including the agricultural buffer around it) and Basin 2-5 (Conzor Developers). Osborne Acres currently releases stormwater runoff uncontrolled; therefore, these peak flows will not coincide with the peak flows from the upstream industrial developments. SWMF 2-5 (Conzor) was also not considered in determining the peak rate, since it is proposed to discharge into a tributary of Morgan Creek and consequently does not affect the reach of Morgan Creek that was analysed.

3.2.2.1 Downstream System

Stormwater management facilities in Basin 2 will outlet at four locations. The outfall locations area shown on Figure 3.7. SWM Facilities 2-1 and 2-2 will likely discharge directly to Morgan Creek by gravity. SWM Facilities 2-3 and 2-4 will discharge to a ditch running west along Highway 16 until a 1,200 mm culvert conveys the flow across Highway 44 and into Morgan Creek. SWMF 2-5 (Conzor) will discharge through an existing culvert under the CN Railway and into a tributary of Morgan Creek. As detailed in Section 3.2.2, the bankfull capacity of Morgan Creek will not be exceeded and the discharge will be adequately conveyed.

The drainage infrastructure along Highway 44 was considered to determine whether the existing capacity is capable of conveying the proposed flow from Morgan Creek, and subsequently, Ellis Industrial, West Acheson, Basin 2-1, 2-2 and 2-5 SWM Facilities.

As reported in the Water Management Plan for Upper Big Lake Basin, UMA 2000, the culverts at the interchange of Highway 16/44 are 2,400 mm in diameter, a 1,900 x 1,700 mm arch, and 2,400 mm in diameter (upstream – downstream). The capacity of a 2,400 mm diameter culvert is approximately 10.0 m³/s and the arch culvert has a capacity of approximately 5.0 m³/s. The total flow proposed to be routed through the existing culverts at Highway 16/44 interchange is approximately 1.2 m³/s. The culverts therefore, have existing capacity to convey the proposed flow.

It should be noted that although the Basin 2-1 SWM Facility was modelled as discharging to Morgan Creek, it is preferable for the SWM Facility in the east half of Basin 2-1 to discharge north through the existing drainage course into Basin 4. Figure 3.7 indicates both possible drainage routes.

3.2.3 Basin 3 – Acheson West Area

Basin 3 is located to the south and west of the Wagner Natural Area and is approximately 522 ha. Basin 3 is in very close proximity to the Wagner Natural Area making the stormwater management plan for this area extremely important.

The Wagner Natural Area is a very sensitive natural area that is a conservation area protected under the *Alberta Wilderness Areas, Ecological Reserves and Natural Areas Act*. The Wagner Natural Area is extremely sensitive to changes in water level; whether it is from groundwater recharge or surface runoff.

H. von Hauff (2004) developed a regional groundwater flow model in an attempt to define the recharge area for the Wagner Natural Area as part of her Master's Thesis. A sensitivity analysis was also performed on the calibrated model and the outline of all practical permutations of the groundwater recharge area is shown on Figure 3.6. This means that all infiltration that occurs in the outlined area eventually discharges at the Wagner Natural Area.

All of Basin 3 is assumed to be industrial development and is proposed to be serviced by six SWM Facilities. The ponds will provide storage up to the 100-year rainfall event and outflow will be constricted to 1.2 L/s/ha. Figure 3.7 shows the ultimate stormwater management plan for Basin 3. Table 3.3 summarizes the maximum storage volumes for the proposed stormwater management facilities in Basin 3.

Stormwater runoff should be infiltrated within Basin 3 as much as possible. The Wagner Natural Area is very dependent on groundwater. Best management practices, further detailed in Section 3.3, to promote infiltration should be implemented when possible. Implementing best management practices will decrease the amount of runoff generated and achieves to simulate pre-development conditions. However, it is likely that SWM Facilities will be required within Basin 3 and these should be designed to further promote infiltration. Developers will need to undertake the necessary soil investigations, under the supervision of a Professional member experienced in hydrogeology, to determine the infiltration capacity of the site. These parameters will help determine the best design for the SWMF, such as the appropriate storage depth that will allow the SWMF to be located within a permeable soil layer. Pumping of groundwater will not be permitted in any capacity in Basin 3.

The reduced discharge rate for Basin 3 significantly increases the duration that the stormwater remains in the SWMF. Compared to the maximum allowable discharge rate of 2.5 L/s/ha, discharging at 1.2 L/s/ha approximately doubles the drawdown duration, allowing more time for the stormwater to infiltrate.

As the drawdown duration is quite prolonged, there is a concern for subsequent rainfall events. If another rainfall event were to occur while the SWM Facilities were still drawing down and the capacity was not available, the SWM Facilities must have the ability to release stormwater at a higher rate to prevent flooding. The control outlet will therefore, be designed such that it can be opened further to increase the discharge rate and allow the SWMF to drawdown quicker, increasing the capacity available for a subsequent rainfall event.

Table 3.3 Basin 3 Hydraulic Results - 100 year 24-hour Rainfall

Basin	Runoff Volume (m ³)	Maximum Discharge Rate* (m ³ /s)	Storage Volume (m ³)
3-1	123,100	0.14	107,300
3-2	103,100	0.12	90,200
3-3	72,100	0.08	63,200
3-4	55,500	0.06	48,900
3-5	106,300	0.12	93,200
3-6	105,800	0.12	93,100

*Discharge based on 1.2 L/s/ha.

As shown on Figure 3.6, a portion of Basin 1 is also within the groundwater recharge zone of Wagner Natural Area. These SWM Facilities are designed to retain the stormwater through the rainfall event with no discharge and also discharge at a lower rate, detailed in Section 3.2.1. These design parameters will promote increased infiltration as described for Basin 3.

3.2.3.1 Downstream System

Nearly all of Basin 3 naturally drains through the Wagner Natural Area. Approximately half of sub-basin 3-6 is the only portion that does not. Stormwater management facilities in Basin 3 will outlet at three locations. This area drains to an 1,800 mm culvert that conveys surface runoff north across Highway 16 and ultimately to Atim Creek. The stormwater management plan for Basin 3 is shown on Figure 3.7.

3.2.4 Basins 4 – 10

All SWM Facilities proposed in Basin 4 – Basin 10 will provide storage up to the 100-year rainfall event and the outflow will be controlled to 2.5 L/s/ha while discharging during the rainfall event. The stormwater outfall drainage routes for Basin 4 – Basin 10 are able to convey general surface drainage by gravity; however, some SWM Facilities in Basin 7 and Basin 8 may require pumping due to lack of grade on individual sites.

The proposed drainage concepts and outfalls for Basin 4 – Basin 10 are summarized in Table 3.4 and shown on Figures 3.7 and 3.8.

Table 3.4 Basins 4 - 10 Summary of Stormwater Management Concept

Basin	Total Drainage Area (ha)	Undeveloped Area (ha)	Number of Proposed SWMFs	Number of Proposed Ultimate Discharge Locations	Drainage Route and Receiving Waterbody
4	432	295	13 ^t	2	All the proposed SWM Facilities south of Highway 16 will be routed by roadside ditches and a natural channel to an existing 750 mm culvert under Highway 16, which will convey the runoff north. From there the runoff from these ponds and the runoff from the proposed SWM Facilities north of Highway 16, will be routed east, through Walker Lake, which is the natural drainage course for the area. SWMF 4-11 will discharge directly to Atim Creek.
5	170	77	3	3	All the industrial development are routed through the Kalwin Pond before being discharged across Highway 16 and into the Walker Lake ditch, which ultimately routes surface runoff to Big Lake. The SWMFs north of Highway 16 will also discharge into the Walker Lake ditch.
6	165	146	4	2	All the SWM Facilities will drainage overland and ultimately be conveyed by a ditch flowing north along Range Road 263 and be

Basin	Total Drainage Area (ha)	Undeveloped Area (ha)	Number of Proposed SWMFs	Number of Proposed Ultimate Discharge Locations	Drainage Route and Receiving Waterbody
					routed to Big Lake.
7	335	261	5	1	The areas of this basin located south of Highway 16 are very flat and may require pumping due to a lack of grade. Discharge will enter Big Lake. The areas north of Highway 16 ultimately discharge overland to a defined channel just south of Parkland Avenue which provides natural drainage directly to Big Lake.
8	540	540*	7	1	Some of the areas in the southern portion of the basin (south of the Canadian National Railway) do not show a defined drainage channel and may require discharge by pumping due to a lack of grade. Drainage is proposed to be routed north to Highway 16 where a number of existing culverts will convey the flow north and into a natural drainage channel. This natural drainage channel flows directly to Big Lake.
9	45	45	1	1	This area will continue to drain to a ravine, which flows directly to Big Lake.
10	20	20	1	1	This area will continue to drain to a ravine, which flows directly to Big Lake.

[†]There are an additional 2 approved SWM Facilities (to the proposed 13) yet to be constructed in this basin.

*No information could be found regarding an existing SWMF in a residential neighbourhood; therefore, for the purpose of this Application Document, the area was assumed to be undeveloped and assessed as Basin 8-7.

Table 3.5 summarizes the maximum storage volumes for the proposed stormwater management facilities in Basins 4-10.

Table 3.5 Basins 4 - 10 Hydraulic Results 100-year 24 hour Rainfall

Basin	Runoff Volume (m ³)	Maximum Discharge Rate (m ³ /s)	Storage Volume (m ³)
4-1	52,500	0.12	42,100
4-2	18,000	0.04	14,600
4-3	44,100	0.10	35,500
4-4	16,200	0.04	12,800
4-5	14,700	0.04	11,300
4-6	28,900	0.07	22,900
4-7	15,100	0.04	11,700
4-8	14,300	0.03	11,700
4-9	14,900	0.04	11,500
4-10	11,400	0.04	9,000
4-11	37,300	0.12	29,600
4-12	7,000	0.02	5,500
Legend II	n/a	0.035	4,600
5-1	22,600	0.08	17,500
5-2	13,000	0.04	10,300
5-3 (Fath)	28,500	0.07	22,500
6-1	47,400	0.16	34,500
6-2 (Lake Ridge Gardens)	18,400	0.06	14,500
6-3	12,200	0.04	8,500
6-4	30,800	0.10	21,500
7-1	53,400	0.13	42,200
7-2	28,400	0.07	22,400
7-3	104,000	0.25	82,500

Basin	Runoff Volume (m ³)	Maximum Discharge Rate (m ³ /s)	Storage Volume (m ³)
7-4	31,200	0.07	25,100
7-5	28,600	0.10	20,500
8-1	64,900	0.15	52,000
8-2	185,200	0.44	147,300
8-3	67,900	0.16	54,100
8-4	16,800	0.04	13,400
8-5	42,500	0.10	33,900
8-6	38,900	0.13	27,000
8-7	75,300	0.27	53,600
9-1	33,200	0.11	24,100
10-1	14,500	0.05	10,500

3.2.4.1 Downstream System

Table 3.4 summarizes the receiving waterbody for each of the stormwater management facilities. The outfalls are shown on Figures 3.7 and 3.8.

Each of the stormwater management facilities will be discharging at the 2.5 L/s/ha rate which should not have any impact to the downstream system. The facilities are proposed to be routed through ditches or natural drainage courses that currently route the pre-development flow. For Basins 4 through 10, there are 11 ultimate outfall locations proposed. There have been no flooding concerns in the downstream drainage routes. The proposed SWM Facilities will be discharged at the pre-development rate of 2.5 L/s/ha, therefore the downstream systems will have capacity to convey the flow.

3.3 Water Quality and Best Management Practices

The primary purpose of stormwater management facilities is to collect the runoff generated by developments and control the outflow to the receiving watercourse to allowable discharge rates. Alberta Environment requires that a minimum of 85% of sediments with a particle size of 75 µm or greater be removed from stormwater runoff. Stormwater quality enhancement can be provided by preserving and enhancing existing wetlands, creating wetlands, constructing wet ponds, and constructing dry ponds, all listed in decreasing value of contribution to the preservation of natural conditions.

Several stormwater best management practices can be incorporated into the design to reduce runoff quantity, improve runoff quality, and increase groundwater recharge:

- Green Infrastructure such as eco-roofs, constructed wetlands, bioswales, vegetated curb extensions, and bioretention cells.
- Reducing Impervious Surfaces by constructing country lanes, or using permeable pavement, porous turf, interlocking paving blocks, or by regulating street widths and driveway lengths.
- Development and Building Design such as on-lot infiltration systems, rainfall harvesting, preservation of existing vegetation, and minimizing building footprints.

Developers will be required to show that the proposed SWMF design will meet the Alberta Environment sediment removal of 85% of sediments with a particle size of 75 µm or greater.

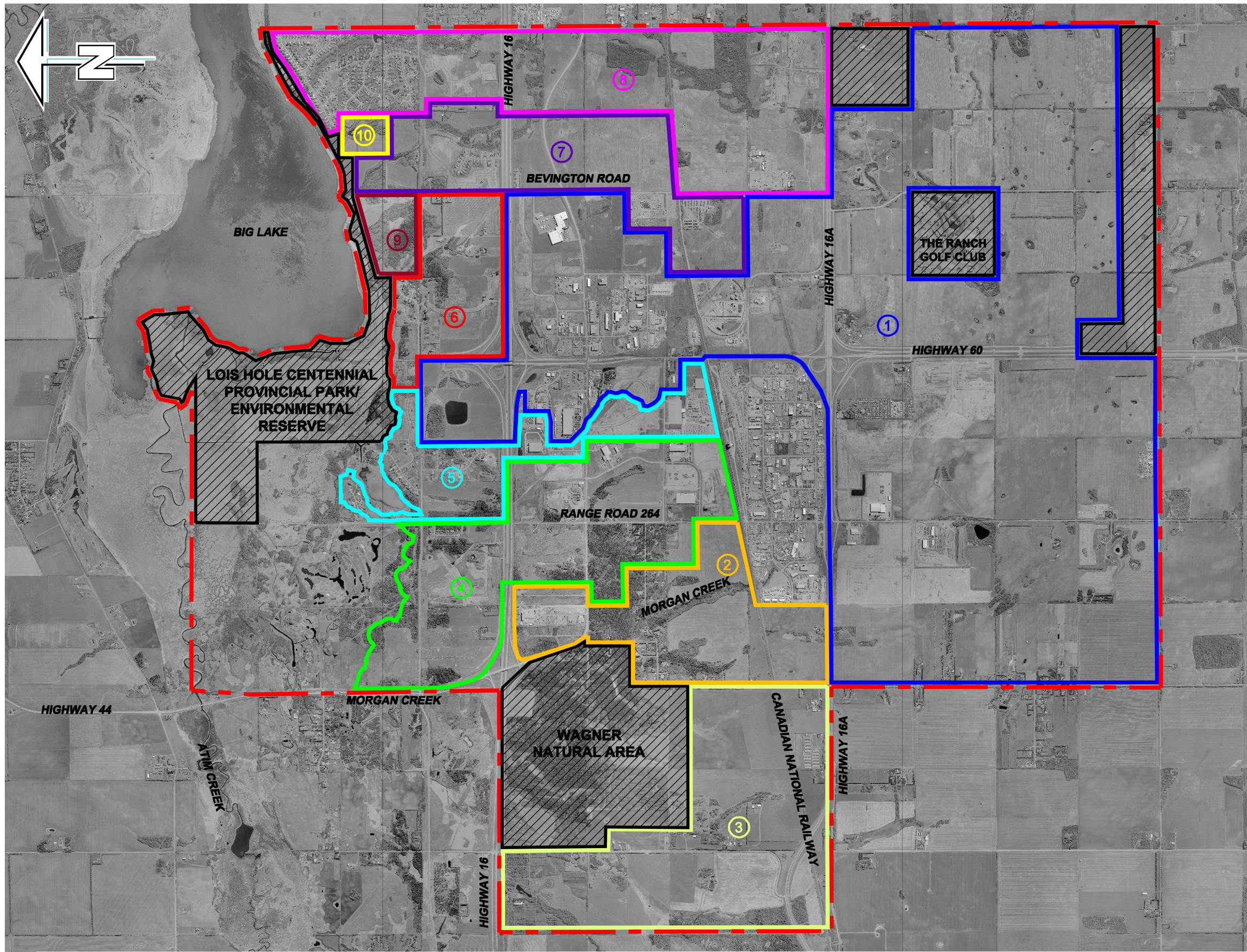
Sections 5.4 and 5.5 of the Parkland County Acheson / Big Lake Area Master Drainage Plan Amendment, expands on both possible Water Quality enhancements and Best Management Practices in greater detail.

3.4 Wetland Inventory and Classification

The Acheson/ Big Lake Area Wetland Inventory and Classification report, completed by AECOM in March 2011, covers all of the wetlands in this study area.

The completion of the Wetland Inventory and Classification was achieved through a desktop review of existing literature, mapping of wetlands for preliminary identification and classification purposes, and finally field ground-truthing of 41% of the mapped wetlands. The wetland report is found as an appendix of the Parkland County Acheson / Big Lake Area Master Drainage Plan Amendment in Appendix A of this document.

The inventory is *not* a substitute for a wetland impact assessment. As further discussed in Section 4.0, where a wetland is to be impacted by proposed development, an appropriate assessment must be conducted.

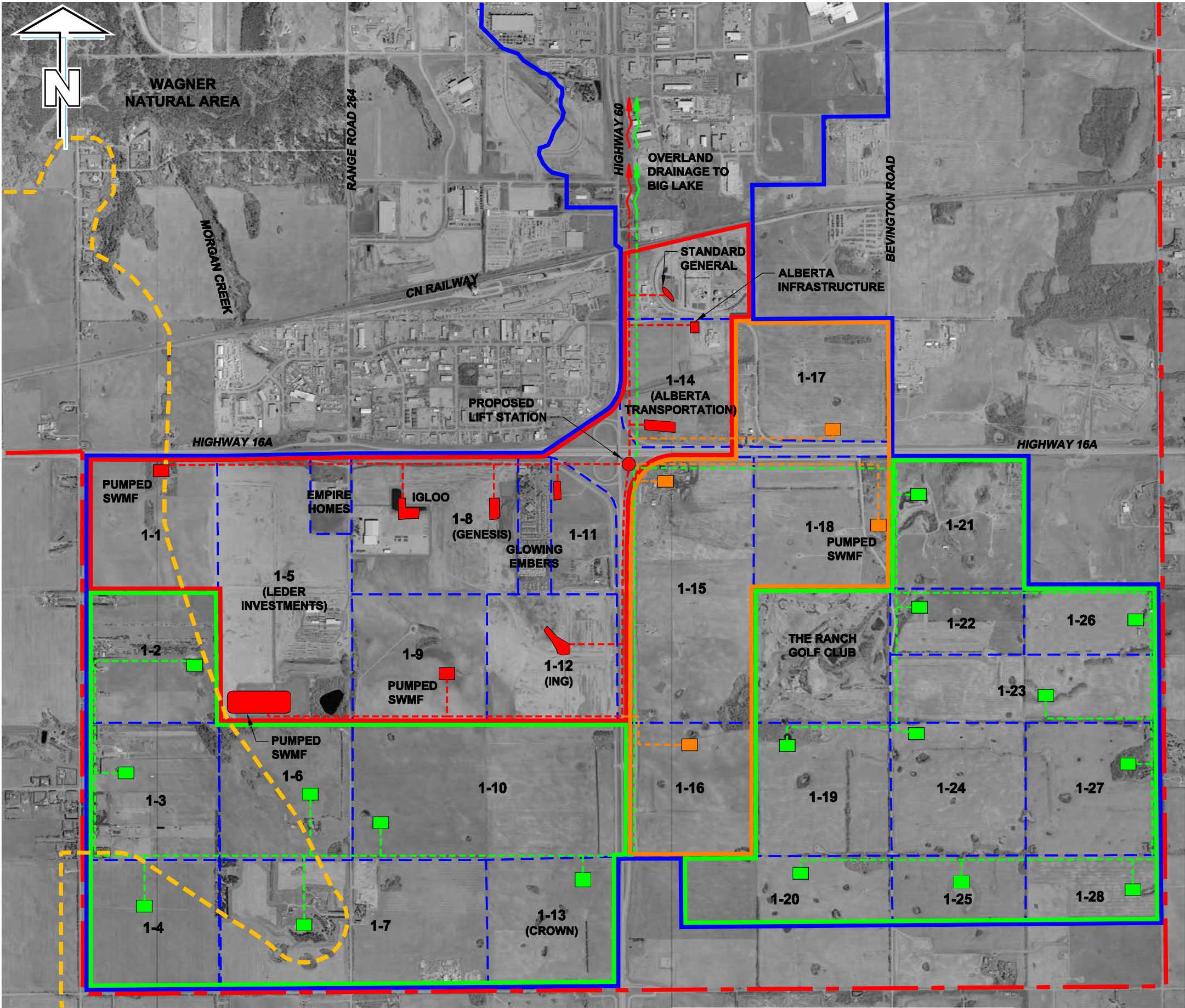


LEGEND

- STUDY AREA
- PROPOSED DRAINAGE BASIN
- UNDEVELOPED AREA



Parkland County
 Acheson/Big Lake Area Master Drainage Plan
 Amendment Application Document
Ultimate Stormwater Management Plan
Proposed Drainage Basins
Figure 3.1



LEGEND

STUDY AREA

DRAINAGE BASIN 1

SUB-BASIN BOUNDARY

STAGE 1 BOUNDARY

STAGE 2 BOUNDARY

STAGE 3 BOUNDARY

STAGE 1 PIPE

STAGE 2 PIPE

STAGE 3 PIPE

WAGNER NATURAL AREA RECHARGE BOUNDARY

1-10

SUB-BASIN NAME

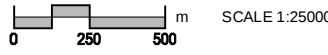
OVERLAND DRAINAGE

STAGE 1 SWMF

STAGE 2 SWMF

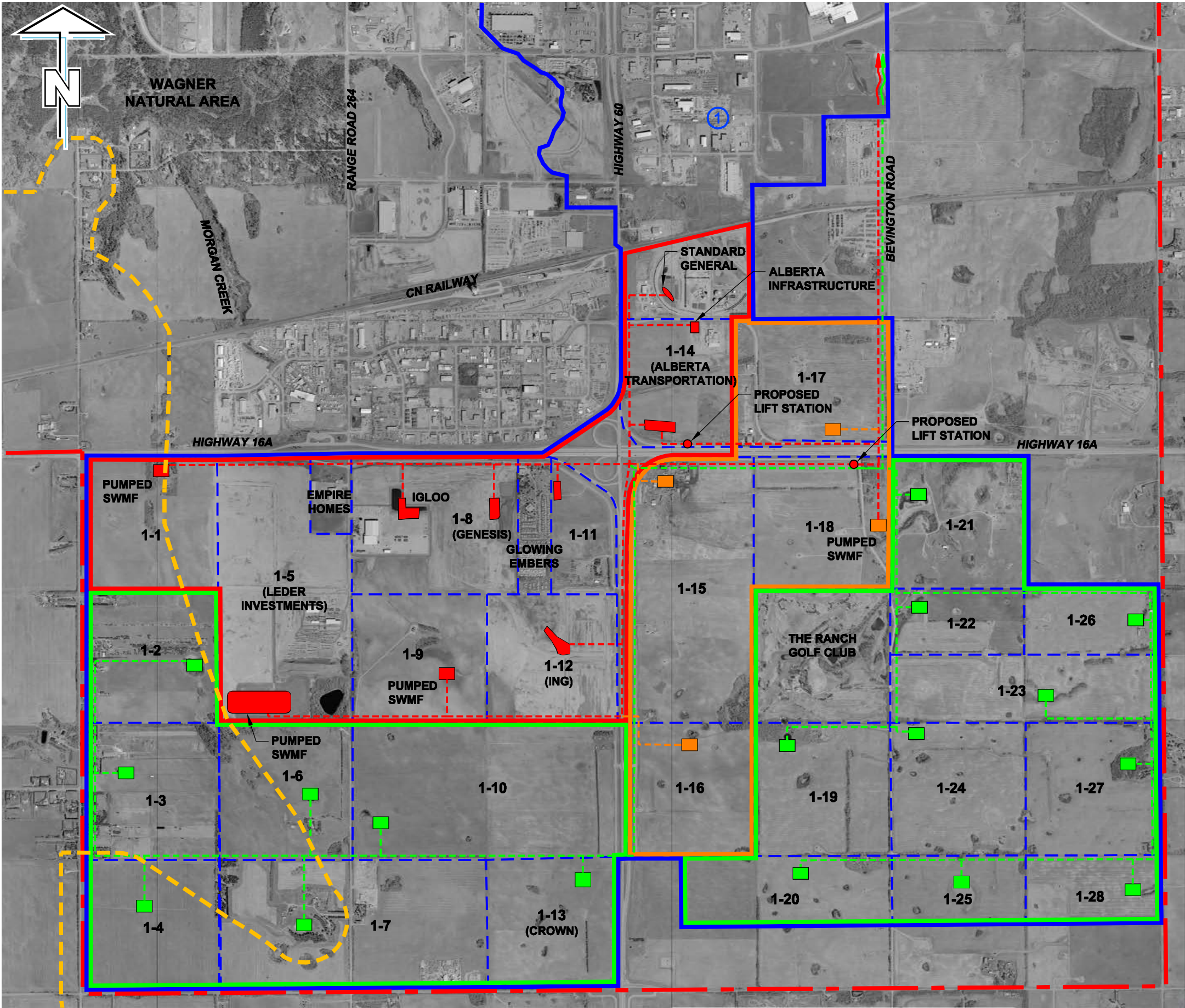
STAGE 3 SWMF

STAGE 1 LIFT STATION
(VALID FOR ALTERNATIVES 3 AND 3A)



Parkland County
Acheson/Big Lake Area Master Drainage Plan
Amendment Application Document
Basin 1 Highway 60 Outfall
Alignment
Figure 3.2





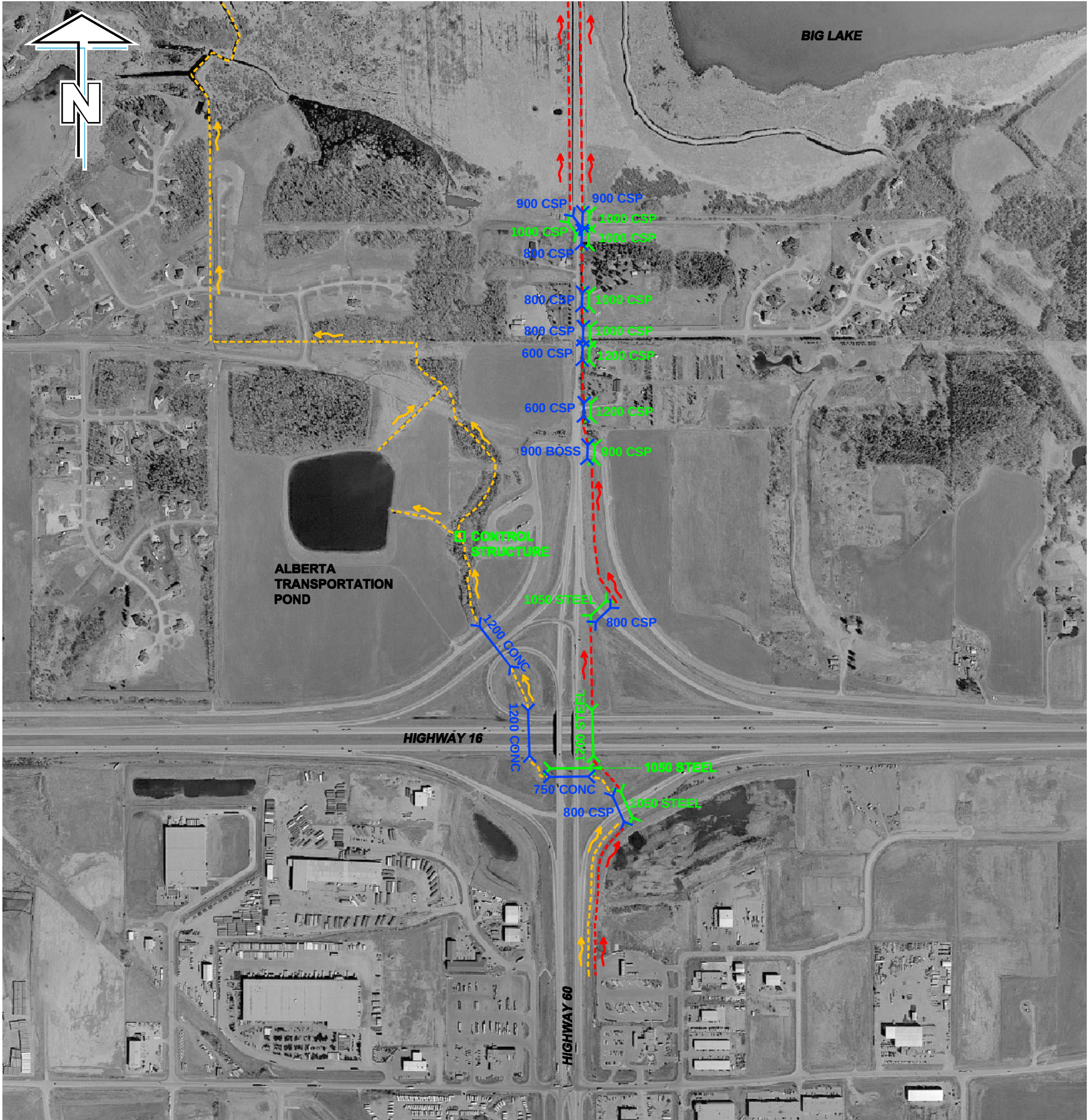
LEGEND

- STUDY AREA
- DRAINAGE BASIN 1
- SUB-BASIN BOUNDARY
- STAGE 1 BOUNDARY
- STAGE 2 BOUNDARY
- STAGE 3 BOUNDARY
- STAGE 1 PIPE
- STAGE 2 PIPE
- STAGE 3 PIPE
- WAGNER NATURAL AREA RECHARGE BOUNDARY
- 1-10 SUB-BASIN NAME
- OVERLAND DRAINAGE
- STAGE 1 LIFT STATION
- STAGE 1 SWMF
- STAGE 2 SWMF
- STAGE 3 SWMF



Parkland County
Acheson/Big Lake Area Master Drainage Plan
Amendment Application Document
Basin 1 Bevington Road Outfall
Alignment
Figure 3.3





LEGEND

OUTFALL DRAINAGE ROUTE - OPTION 1

OUTFALL DRAINAGE ROUTE - OPTION 2

EXISTING CULVERT

PROPOSED CULVERT

800 CSP

1000 CSP

DRAINAGE FLOW DIRECTION - OPTION 1

DRAINAGE FLOW DIRECTION - OPTION 2

PROPOSED CONTROL STRUCTURE



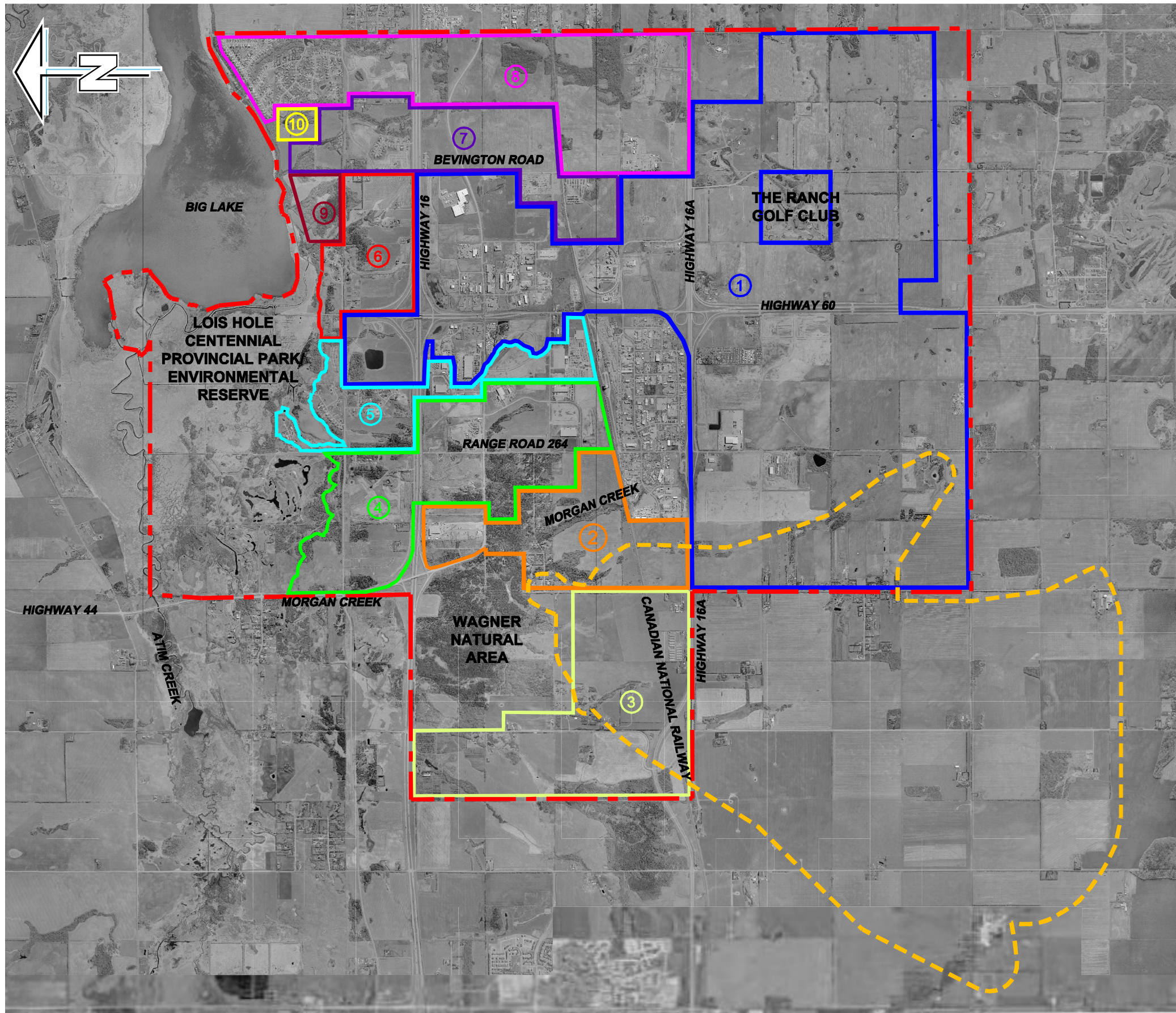


LEGEND

- | | | | |
|----------|----------------------------------|--|-----------------------------------|
| | OUTFALL DRAINAGE ROUTE - STAGE 1 | | DRAINAGE FLOW DIRECTION - STAGE 1 |
| | OUTFALL DRAINAGE ROUTE - STAGE 3 | | DRAINAGE FLOW DIRECTION - STAGE 3 |
| | EXISTING CULVERT | | PROPOSED LIFT STATION |
| | PROPOSED CULVERT | | |
| 800 CSP | EXISTING CULVERT DIAMETER (mm) | | |
| 1000 CSP | PROPOSED CULVERT DIAMETER (mm) | | |



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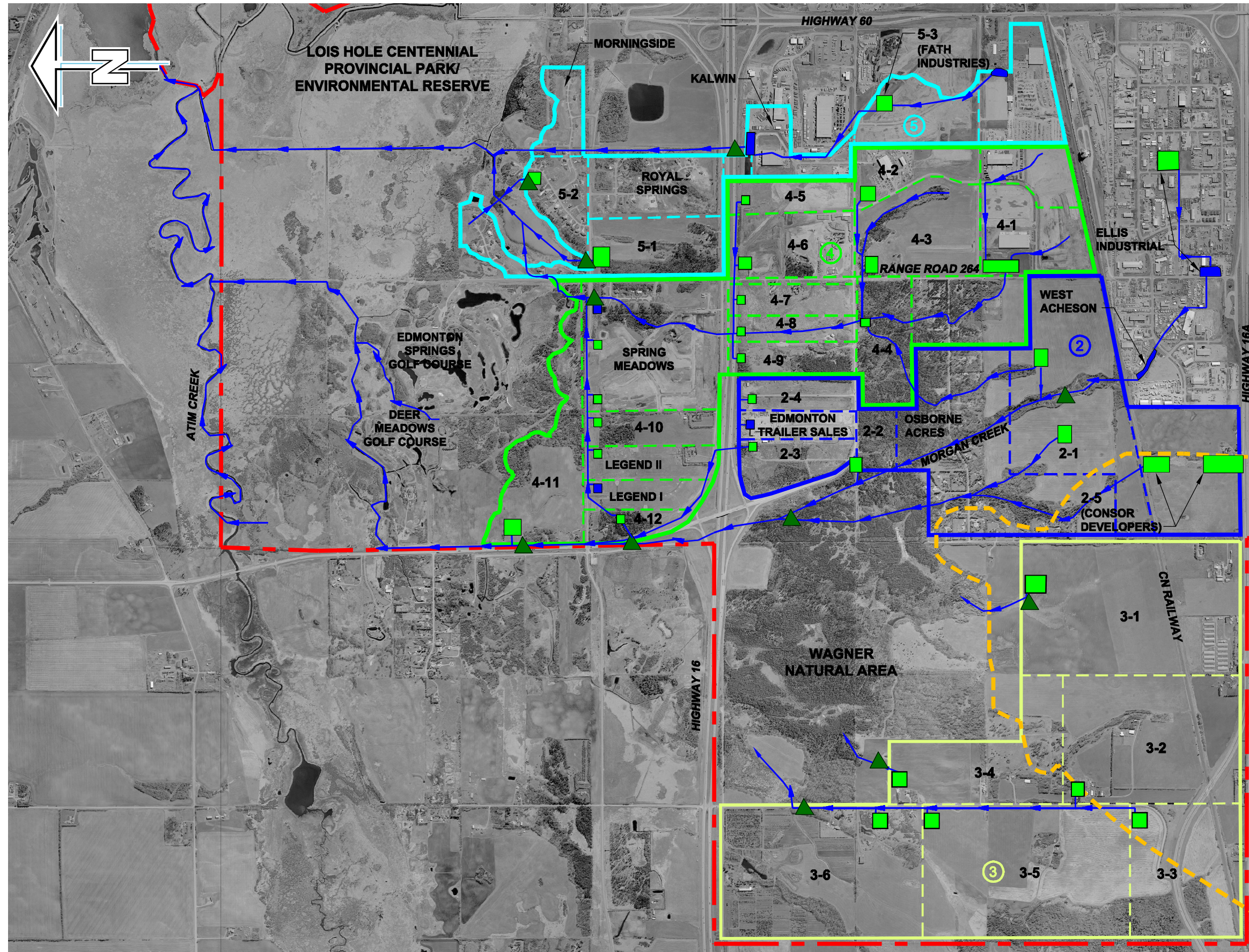
STUDY AREA

WAGNER NATURAL AREA
GROUNDWATER RECHARGE ZONE

①

PROPOSED DRAINAGE BASIN

Parkland County
 Acheson/Big Lake Area Master Drainage Plan
 Amendment Application Document
 Wagner Natural Area
 Groundwater Recharge Zone
 Figure 3.6



LEGEND

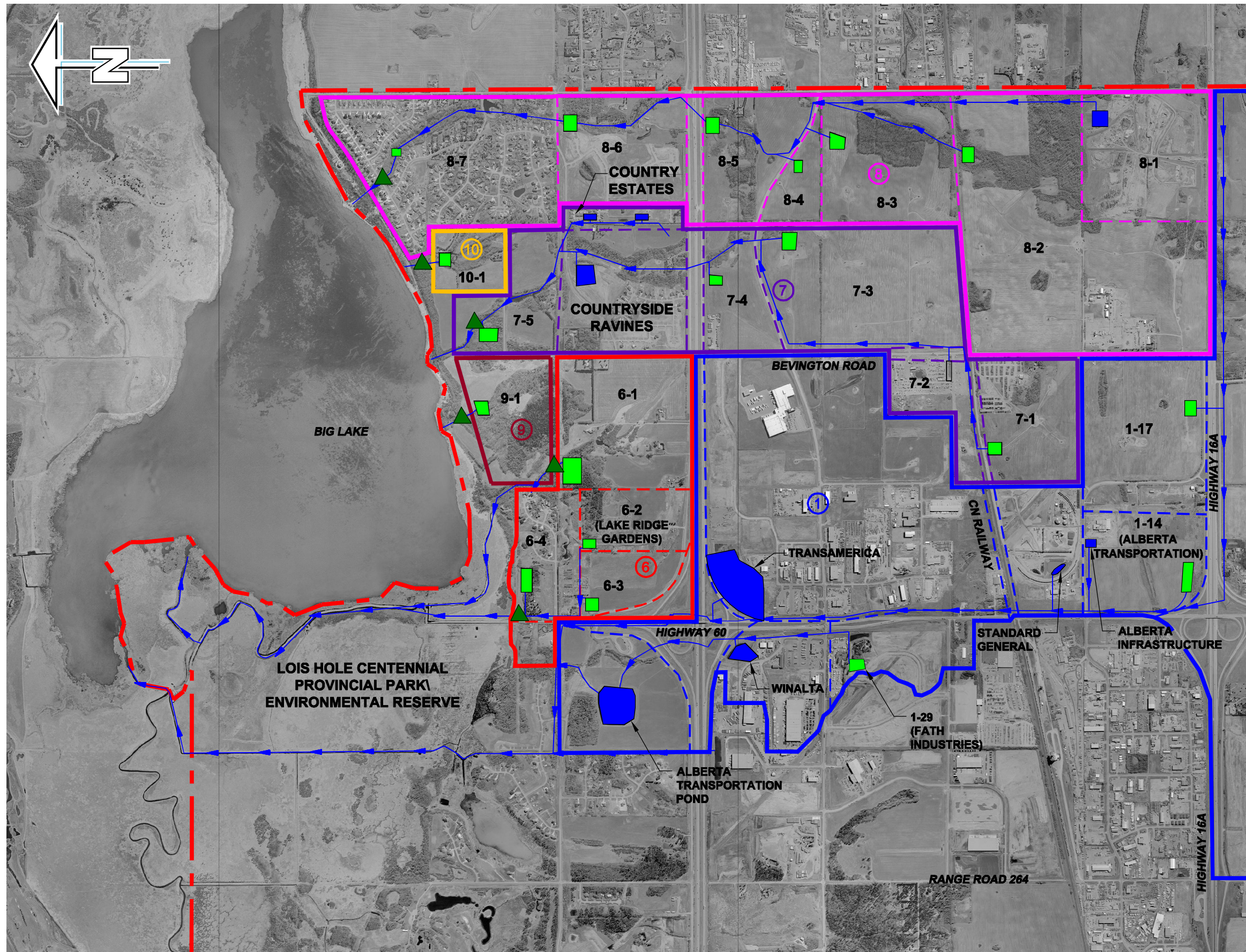
- STUDY AREA
- DRAINAGE PATH
- SUB-BASIN BOUNDARY
- WAGNER NATURAL AREA
GROUNDWATER RECHARGE
ZONE
- 1-10** SUB-BASIN NAME
- ▲ PROPOSED OUTFALL /
ULTIMATE DISCHARGE LOCATION
- EXISTING STORMWATER
MANAGEMENT FACILITY
- PROPOSED STORMWATER
MANAGEMENT FACILITY
- 2 PROPOSED DRAINAGE
BASINS

NOTE

THE EAST HALF OF BASIN 2-1 WAS MODELLED AS DRAINING TO MORGAN CREEK. HOWEVER, IT IS PREFERABLE TO DRAIN THE EAST HALF OF BASIN 2-1 TO BASIN 4 THROUGH THE EXISTING DRAINAGE ROUTE TO HELP PREVENT EROSION IN CREEK.

0 250 500 m
 SCALE 1:25000

Parkland County
 Acheson/Big Lake Area Master Drainage Plan
 Amendment Application Document
Ultimate Stormwater Management Plan
Drainage Basin 2 to 5
Figure 3.7



LEGEND

- STUDY AREA
- DRAINAGE PATH
- SUB-BASIN BOUNDARY
- 1-10** SUB-BASIN NAME
- ▲ PROPOSED OUTFALL / ULTIMATE DISCHARGE LOCATION
- EXISTING STORMWATER MANAGEMENT FACILITY
- PROPOSED STORMWATER MANAGEMENT FACILITY
- 1 PROPOSED DRAINAGE BASINS

0 250 500 m
 SCALE 1:25000

4. Implementation

The fenceline approval will include all the proposed developments within the study area. Parkland County will be the approval holder. As developers buy property and submit proposed development plans to Parkland County, the following procedures will occur:

- Developer will submit a Stormwater Management Plan based on the design criteria developed in the Acheson/Big Lake Area Master Drainage Plan Amendment, AECOM, March 2011.
- Parkland County will review and confirm that the proposed stormwater management plan follows the Master Drainage Plan Amendment.
- Parkland County will issue a stormwater management approval to the developer for the proposed SWMF as part of the Development Approval process.
- Parkland County will ensure conformance to the plans and accept the work when certified complete.
- Developer will provide Parkland County with as-built drawings once construction is complete.

Parkland County will also administrate activities surrounding wetlands.

Under the Water Act, any alteration or destruction of a naturally occurring wetland requires mitigation and/or compensation. Also, any permanent, naturally occurring wetland could be claimed crown land by Alberta Sustainable Resource Development (SRD). Although the AECOM report, Acheson/ Big Lake Area Wetland Inventory and Classification, March 2011, provides a general guideline for the existing wetland conditions, each developer will be required to further assess the existing wetlands at the time of development.

If a wetland is to be impacted by a proposed development, the developer will need to submit a request to Alberta SRD to determine whether the wetland is provincial land, before any alteration to the wetland is undertaken. A separate approval from Alberta SRD may be required if the wetland is claimed as provincial land.

In the case that a wetland is to be impacted by proposed development, the developer must conduct an appropriate assessment. The assessment is to be conducted by a Qualified Wetland Aquatic Environment Specialist (QWAES) to address mitigation and/or compensation to the current provincial standard. Proof of completion of any required wetland mitigation and/or compensation is to be provided to Parkland County prior to disturbing the wetland(s).

Parkland County will provide a summary of the work approved under the fenceline approval to Alberta Environment on a yearly basis, including any wetland disturbance and compensations. If any development deviates from the stormwater management plan outlined in the Application Document, Parkland County will need to submit an application for an amendment to the fenceline approval. This will need to be done by either Parkland County directly, or by the developer on behalf of Parkland County (the approval holder). It is understood that submission for an amendment may require that the proposed development be publically advertised, as stipulated in the Water Act.

Appendix A

Master Drainage Plan Amendment