February 2015

TECHNICAL PROPOSAL

Yancoal Canada Resources Company Ltd. Southey Project

Submitted to:
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Yancoal Canada Resources Company Ltd.
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Saskatoon, Saskatchewan
S7K 1N1

REPORT

Report Number: 12-1362-0197(WP-024)/DCN-060a

Golder Associates

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LIST OF ABBREVIATIONS AND ACRONYMS

Term	Definition
the Agency	Canadian Environmental Assessment Agency
CAPEX	capital expenditure
CEAA	*Canadian Environmental Assessment Act*
CN	Canadian National
CP	Canadian Pacific
D&R	decommissioning and reclamation
DEM	digital elevation model
DFO	Fisheries and Oceans Canada
EAB	Environmental Assessment Branch
EIS	Environmental Impact Statement
ELC	ecological landscape classification
EPP	Environmental Protection Plan
EPCM	Engineering, Procurement, and Construction Management
ERCB	Energy Resource Conservation Board
ERP	Emergency Response Plan
ETS	electrical terminal station
EUB	Alberta Energy Utilities Board
HRIA	Heritage Resource Impact Assessment
HRSG	heat recovery system generator
HSSE	Health, Safety, Security, and Environment
HVAC	heating, ventilation, and air conditioning
K_2O	potassium oxide
KCl	potassium chloride
LSA	local study area
MEE	multiple effect evaporators
$MgCl_2$	magnesium chloride
MIEPR	*Mineral Industry Environmental Protection Regulations*
MOE	Ministry of Environment
MOP	muriate of potash
MVR	mechanical vapour recompression
n/a	not applicable
NaCl	sodium chloride
Na_2CO_3	$NaHCO_3$ and sodium carbonate
$NaHCO_3$	nahcolite
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
NTS	National Topographic Systems
OH&S	occupational health and safety
OHSA	Occupational Health and Safety Association
OPEX	operational expenditure
PM	particulate matter

Term	Definition
Prairie Evaporite	Prairie Evaporite Formation
the Project	Yancoal Southey Project
R.M.	rural municipality
RSA	regional study area
SARA	*Species at Risk Act*
SEAA	*The Saskatchewan Environmental Assessment Act*
SEARP	Saskatchewan Environmental Assessment Review Panel
SLRU	Saskatchewan Land Resource Unit
SO_2	sulphur dioxide
SPRR	Saskatchewan Parks and Renewable Resources
SSD	surficial stratified deposits
TDS	total dissolved solids
TMA	tailings management area
TOR	Terms of Reference
TSP	total suspended particulate
TVR	thermal vapour recompression
VC	valued component
W2M	west of the second meridian
WHMIS	Workplace Hazardous Materials Information System
Whiting	Whiting Equipment Canada, Inc.
WSA	Saskatchewan Water Security Agency
WTP	water treatment plant
Yancoal	Yancoal Canada Resources Company Limited
Yanzhou Coal	Yanzhou Coal Mining Company Limited
YCSN	Yancoal Southey North

UNITS OF MEASURE

Term	Definition
%	percent
°C	degrees Celsius
cm	centimetre
dBA	A-weighted decibels
ha	hectare
kg	kilogram
km	kilometre
km^2	square kilometre
km/h	kilometres per hour
kV	kilovolt
L	litres
L_{eq}	energy equivalent continuous sound pressure level
m	metres
masl	metres above sea level
mbgs	metres below ground surface
m^2	square metres
m^3/h	cubic metres per hour
mg/L	milligram per litre
mbgs	metres below ground surface
mm	millimetres
Mm^3	million cubic metres
MMT	million metric tonnes
MPa	megapascal
MVA	megavolt ampere
Mt	million tonnes
Mtpa	million tonnes per annum
MW	megawatts
$PM_{2.5}$	particulate matter concentrations less than 2.5 micron
PM_{10}	particulate matter concentrations less than 10 micron
t	tonne
t/m^3	tonnes per cubic metre
tpy	tonnes per year
V	volt
wt	weight

1.0 INTRODUCTION

Yancoal Canada Resources Company Limited (Yancoal) is engaged in the evaluation and development of the Yancoal Southey Project (the Project). Yancoal has identified a world-class potash deposit and intends to develop the resource in an ecologically sustainable, economically efficient, and socially responsible manner.

Canadian potash exports have provided an increasingly important role in maintaining and expanding global crop yields. This has become a necessity due to a combination of increasing population levels, rising levels of income in developing countries, poor harvests in key producing regions due to floods and drought and, more recently, the demand for biofuels. These factors have led to a steady increase in the global demand for fertilizer. Global consumption of potash is projected to see continued growth. The long-term demand for potash is strong and is projected to continue as populations continue to increase, incomes in developing countries rise, and areas of arable land decrease.

In addition to the demand for increased global food production noted above, the anticipated benefits of the Project are extensive. Approximately 2,200 workers will be required at the peak of construction. During the construction phase, the local and regional economies will benefit from creation of jobs, purchase of local supplies and services, payment of taxes to the municipalities, and improvement of roads. After mining commences, the long-term benefits will include royalty payments to the Government of Saskatchewan, job creation, taxes paid to the municipality, ongoing purchase of supplies and services, and housing development opportunities. Based on current scoping analyses, it is projected there will be a strong long-term demand for potash produced from low-cost producers.

1.1 Project Proponent

Yancoal is a wholly owned subsidiary of Yanzhou Coal Mining Company Limited (Yanzhou Coal). Yanzhou Coal's main business is in coal mining, coal chemical and fertilizer production, power generation, and equipment manufacturing. Yanzhou Coal is an international, diversified mining corporation listed on the stock exchanges of New York, Shanghai, Sydney, and Hong Kong.

In August 2011, Yancoal established an office for the Project in Saskatoon, Saskatchewan, which is located at:

Unit 300 – 211 4th Avenue South
Saskatoon, Saskatchewan
S7K 1N1

The main contact person for the Project is Mr. Jiqiu (JQ) Han, President of Yancoal. Mr. Han can be reached at (306) 668-5558 or by e-mail at j.han@yancoal.ca.

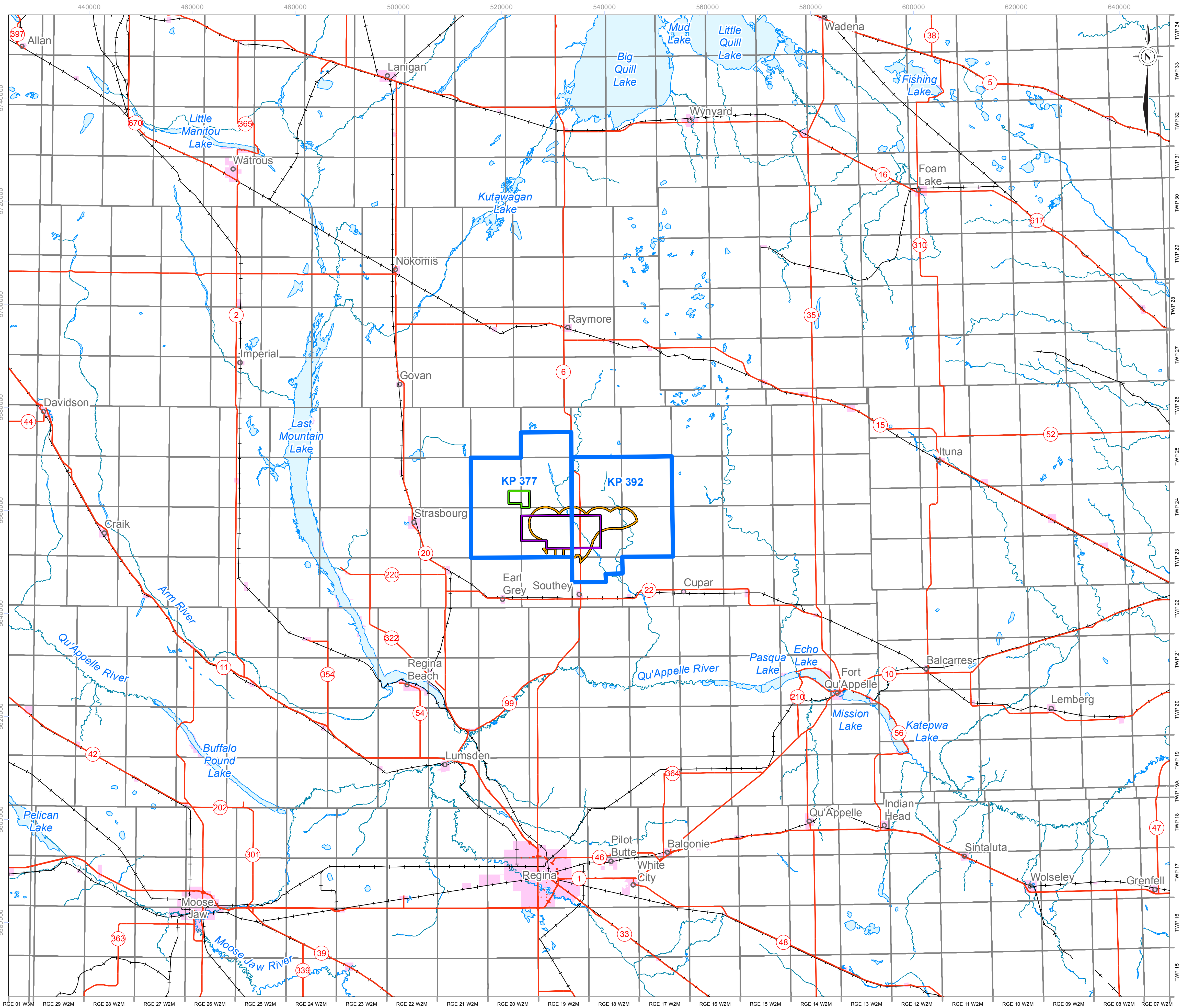
1.2 Project Location and Environmental Setting

The Project will be located in central Saskatchewan, approximately 60 kilometres (km) north of Regina within the Rural Municipality (R.M.) of Longlaketon (Figure 1.2-1). An existing network of municipal grid roads, provincial highways, and rail lines provides access to the Project within the region. The Project is located east of secondary Highway 641 and north of secondary Highway 731. The community of Earl Grey is located approximately 21 km southwest of the Project, the community of Strasbourg lies approximately 23 km west, and the community of Southey is approximately 28 km southeast. A Canadian Pacific (CP) rail line is located approximately 20 km west of the Project, and a Canadian National (CN) rail line is located approximately 32 km north of the Project. The Project (including the core facilities area and the 100-year mining area) encompasses approximately 143.2 square kilometres (km^2) (14,319.8 hectares [ha]) located in Townships 24 and 25 and Ranges 17, 18, 19, and 20 West of the Second Meridian (W2M).

The Project is located east of Last Mountain Lake and north of the Qu'Appelle Valley in a transitional area between the Moist Mixed Grassland and Aspen Parkland Ecoregions of the Prairie Ecozone in Saskatchewan (Acton et al. 1998). Specifically, the Project will be located in central Saskatchewan on the Strasbourg Plain (K15) Landscape Area of the Mixed Grassland Ecoregion (Acton et al. 1998). The landscape within the Moist Mixed Grassland is characterized by intermittent areas of prairie, woodland, and shrubland on a broad, mostly level plain with the occasional deep valley, such as the Qu'Appelle Valley (Flory 1980; Acton et al. 1998). The Aspen Parkland Ecoregion is characterized by hummocky landscapes where woodlands or wetlands occur in lower areas associated with pot and kettle topography and grasslands occurring on upper slopes (Acton et al. 1998). Native mixed-grass vegetation is limited to hummocky morainal areas, and is interspersed with cropland.

The Project is located in a region with a semi-arid continental climate, with warm summers and cold, dry winters and prone to extreme weather at any time of the year. Approximately 79 percent (%) of the mean annual precipitation in the region falls as rain; the remaining 21% occurs as snowfall (Environment Canada 2014a, b).

West Loon Creek receives flow from two tributaries within KP377 and originates beyond the northern boundary of KP377. East Loon Creek flows through KP392 and joins West Loon Creek approximately 2 km south of the two permit areas to form Loon Creek, which flows south into the Qu'Appelle River. The northwest portion of KP377 drains towards Last Mountain Lake, although during most years the runoff may be stored within an unnamed waterbody near Duval, Saskatchewan. Last Mountain Lake is located approximately 40 km west, while the Qu'Appelle River is located about 30 km south of the Project. Last Mountain Lake is part of the Qu'Appelle River drainage.



LEGEND

- COMMUNITY
- HIGHWAY
- RAILWAY
- TOWNSHIP AND RANGE BOUNDARY
- URBAN MUNICIPALITY
- PERMIT BOUNDARY
- CORE FACILITIES AREA
- 65 YEAR MINE FIELD
- INDICATED RESOURCE BOUNDARY

REFERENCE

POTASH DISPOSITION © 2012, GEOLOGICAL ATLAS OF SASKATCHEWAN, MINISTRY OF ENERGY AND RESOURCES SASKATCHEWAN
CANVEC © NATURAL RESOURCES CANADA
NTS MAPSHEET: 62L/M, 72I/J/O/P
NAD83 UTM ZONE 13

15 0 15
SCALE 1:750,000 KILOMETRES

PROJECT
YANCOAL
YANCOAL SOUTHEY PROJECT

TITLE
LOCATION OF THE PROJECT

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0197	FILE No.	
DESIGN	MT	03/12/14	SCALE AS SHOWN	REV. 0
GIS	LMS	29/12/14	FIGURE: 1.2-1	
CHECK	MT	30/12/14		
REVIEW	GM	30/12/14		

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1.3 Project Overview

The Project is a Greenfield potash mine that will extract potash ore (sylvinite) from the Patience Lake, Belle Plaine, and Esterhazy Members of the Saskatchewan Prairie Evaporite Formation. The Project will be a solution mine located 60 km north of Regina within Subsurface Mineral Permits KP377 and KP392 with an area of 78,203 ha.

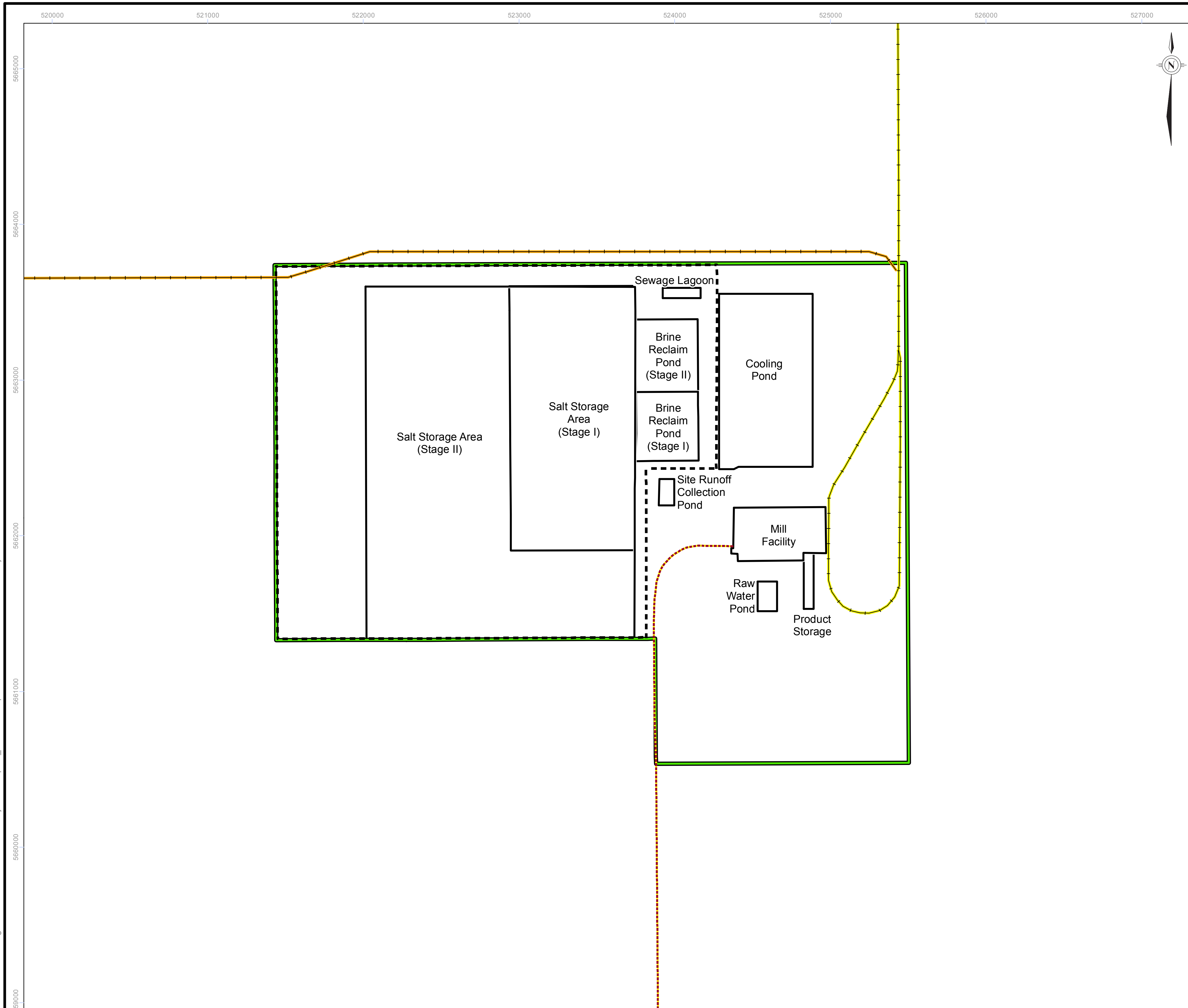
Development of the Project is planned in several phases. The construction phase is anticipated to begin in May of 2016, or as soon as the relevant Project regulatory permits and approvals are in place. The operations phase will begin in 2019 and, at the proposed production rate, will remain in operation for up to 100 years. Activities following operations will include those necessary to complete reclamation and closure.

The core facilities area and supporting infrastructure will be built during the construction phase (approximately 39 months). The core facilities area will include the processing plant, administration buildings, maintenance building, equipment and parts storage, tank farm, raw water pond, process upset pond, tailings management area (TMA), product storage, rail loadout, security, and parking. The general layout for the Project site is shown on Figure 1.3-1.

During the operations phase solution mining begins and potash from the Project is processed. Operations will begin following construction and are anticipated to continue for up to 100 years. The Project will employ primary and secondary solution mining techniques. Primary mining involves the injection of hot water into the sylvinite beds to dissolve the potash; the brine solution is then extracted and transported by pipeline to the process plant. Secondary mining involves the injection of sodium chloride (NaCl) rich brine into the cavern created during primary mining, to selectively dissolve additional potash from the material left in the cavern. This brine solution is extracted and returned to the process plant via pipeline.

The processing plant will be designed for a production capacity of 2.8 million tonnes of potash per year (Mtpa). Hot water or brine will be pumped via pipeline from the core facilities area to the well pads within the mine well field where the liquid will be injected into the caverns and then returned to the processing plant by pipeline using the same pipeline corridor. Potash processing will include the following:

- injection and solution recovery;
- evaporation and crystallization;
- product drying and screening;
- product compaction; and
- product storage and shipping.



LEGEND

- CORE FACILITIES AREA
- PROPOSED RAIL SPUR TO CN
- ALTERNATE RAIL SPUR TO CP
- PROPOSED ACCESS ROAD
- TAILINGS MANAGEMENT AREA
- PROPOSED SITE INFRASTRUCTURE

REFERENCE

INFRASTRUCTURE DERIVED FROM AMEC DRAWING NO. 100110-2000-DD10-GAD-0002 REV. B
TMA DESIGN REVISED BY GOLDER, 2014
CANVEC © NATURAL RESOURCES CANADA
NAD83 UTM ZONE 13

500 0 500
SCALE 1:25,000 METRES

PROJECT
YANCOAL SOUTHEY PROJECT

TITLE
GENERAL SITE LAYOUT

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0197	FILE No.
DESIGN			SCALE AS SHOWN REV. 0
GIS	LMS	29/12/14	FIGURE: 1.3-1
CHECK	MT	30/12/14	
REVIEW	GM	30/12/14	

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Progressive reclamation for the Project will be completed during operations where possible. Final reclamation and closure activities will be completed once mining operations have ceased.

Support infrastructure for the Project will include water (provided by SaskWater), power (provided by SaskPower), natural gas (provided by TransGas), communication services (provided by SaskTel), road access, and rail access. Access to the core facilities area will be from Highway 6 via an upgraded road to be constructed. Two options considered for rail access are a rail spur line to the CP rail line (located approximately 20 km west of the Project) or a spur line to the CN rail line (located approximately 32 km north of the Project).

1.4 Schedule

The Project schedule has been defined by Project phases (Table 1.4-1). The main Project phases and estimated timelines are indicative of the overall Project design and planning throughout 2013 and 2014. The schedule may change pursuant to finalizing Project design and because of the regulatory approval process. The Proponent will advise of changes, as appropriate. Construction of the mine will take approximately 39 months and the mine is expected to be in operation for up to 100 years. A decommissioning and reclamation (D&R) period will follow the end of mining.

Table 1.4-1: Yancoal Project Schedule

Project Phase	Year																										
	2013				2014				2015				2016				2017				2018				2019		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Environmental Impact Assessment																											
Baseline Study	■	■	■	■																							
EIS Preparation					■	■	■	■	■	■	■																
EIS Review and Approval											■	■	■														
Construction Approvals													■														
Construction/Operation																											
Construction														■	■	■	■	■	■	■	■	■	■	■	■	■	■
Wellfield Development																		■	■	■	■	■	■	■	■	■	■
Begin Operations																											■

EIS = environmental impact statement

2.0 REGULATORY FRAMEWORK

This section is intended to describe the regulatory framework within which the Environmental Impact Statement (EIS) for the Project will be completed.

2.1 Federal Process

The federal environmental assessment requirements are detailed within the *Canadian Environmental Assessment Act* (*CEAA*; 2012). Under Section 8 of the *CEAA*, a Project Description is required to initiate the screening process through which the Canadian Environmental Assessment Agency (the Agency) will determine if a federal environmental assessment is required for all designated projects. Designated projects are defined under the *Regulations Designating Physical Activities* for the *CEAA* (2012). Based on our understanding of the Project, submission of a Project Description to the Agency will not be required because the Project is not listed in the *Regulations Designating Physical Activities.*

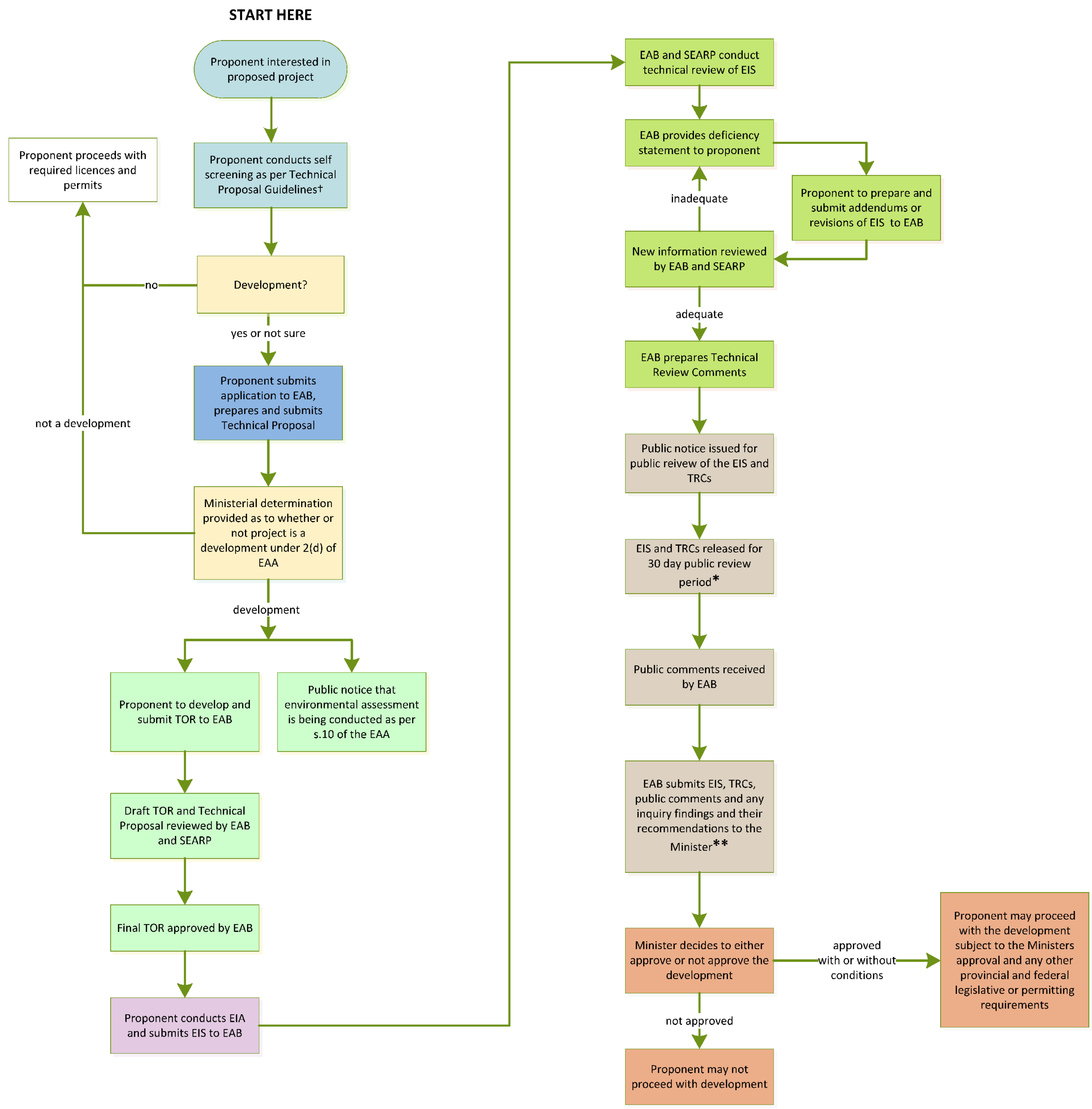
Other federal legislation, such as the *Navigation Protection Act* (2012), the *Fisheries Act* (2012), the *Species at Risk Act* (*SARA* 2002), and the *Migratory Birds Convention Act* (1994) will be considered. Transport Canada, Fisheries and Oceans Canada (DFO), and Environment Canada will be contacted directly should the Project require further review by or discussion with, these agencies.

2.2 Provincial Process

A flow chart of the provincial environmental assessment process is presented in Figure 2.2-1. The provincial environmental assessment process begins with the submission of a Technical Proposal to the Environmental Assessment Branch (EAB) of the Ministry of Environment (MOE) to determine if the Project is considered a "development". A "development", as defined in *The Environmental Assessment Act* (*SEAA*; 2013), is any project, operation, or activity, or any alteration or expansion of any project, operation, or activity, which is likely to:

- have an effect on any unique, rare, or endangered feature of the environment;
- substantially use any provincial resource and, in so doing, pre-empt the use or potential use of that resource for any other purpose;
- cause the emission of any pollutants or create by-products, residual, or waste products, which require handling and disposal in a manner that is not regulated by another act or regulation;
- cause widespread public concern because of potential environmental changes;
- involve a new technology that is concerned with resource use and that might induce significant environmental change; or
- have a significant effect on the environment or necessitate a further development, which is likely to have a significant effect on the environment.

The Saskatchewan Environmental Assessment Process



Key

- Proposal Development
- Application
- Screening
- Scoping
- Impact Assessment
- Review
- Public Comment
- Decision by Minister

TPG – Technical Proposal Guidelines
EAB – Environmental Assessment Branch
EAA – The Environmental Assessment Act
TOR – Terms of Reference
SEARP – Saskatchewan Environmental Assessment Review Panel
EIA – Environmental Impact Assessment
EIS – Environmental Impact Statement
TRCs- Technical Review Comments

* Any person may: make a written submission to the minister within 30 days from the date when the minister first gives notice or if the minister considers it appropriate, within an additional period of 30 days.

**Minister may require public meetings or public inquiry into all or any aspect of the development at any time prior to making a decision about the development

†Changes to a development with prior Ministerial Approval require review by EA Branch

REFERENCE
MINISTRY OF ENVIRONMENT, GOVERNMENT OF SASKATCHEWAN, 2014

PROJECT: YANCOAL SOUTHEY PROJECT

TITLE: **ENVIRONMENTAL ASSESSMENT PROCESS**

Golder Associates, Saskatoon, Saskatchewan

PROJECT	12-1362-0197		FILE No.
DESIGN	MT	03/12/14	SCALE AS SHOWN — REV. 0
GIS	LMS	29/12/14	
CHECK	MT	30/12/14	**FIGURE: 2.2-1**
REVIEW	GM	30/12/14	

If a project is considered a "development", then the proponent is required to draft Terms of Reference (TOR) for the preparation of the EIS. The TOR outlines the required scope of the environmental assessment, identifies the key effects to be studied, and provides a set of criteria to judge the completeness of the EIS by regulatory agencies. It is expected that the Project will be considered a '"development" under *SEAA*; as such, the draft TOR for this Project has been included in Appendix A.

The MOE will coordinate an inter-ministry review of the EIS using a standing panel of representatives from provincial departments and agencies, which is known as the Saskatchewan Environmental Assessment Review Panel (SEARP). If the EIS does not contain all required information, the MOE will issue Technical Review Comments and direct the proponent to complete additional studies, or to provide additional information to address deficiencies. Once a revised EIS is submitted and deemed satisfactory by MOE, the EIS will be made available for public review and comment.

Following the completion of the public review period, the MOE will make a recommendation to the Minister of Environment for a decision on whether the Project can proceed. The MOE may or may not include approval conditions on a decision to allow the Project to proceed. Once approval is granted, the necessary regulatory permits and authorizations can be obtained.

2.3 Regulatory Permitting

Regulatory permitting (i.e., licensing) occurs after EIS approval and includes the submission of specific applications and supporting design and project management documentation seeking specific construction and operating approvals. Federal and provincial permits, licences, approvals, and authorizations that may be required for the Project are listed in Table 2.3-1.

Table 2.3-1: Federal and Provincial Acts and Regulations that May be Required for the Project

Jurisdiction	Related Regulations	Permits Required
Federal Acts		
Canadian Emission Reduction Incentives Agency Act, S.C., 2005, c. 30	■ n/a	■ n/a
Canadian Environmental Assessment Act, 2012, S.C., 2012, c.19, s.52	■ Regulations Designating Physical Activities, SOR/2012-147. ■ Prescribed Information for the Description of a Designated Project Regulations, SOR/2012-148. ■ Cost Recovery Regulations, SOR/2012-146.	■ n/a
Canadian Environmental Protection Act, 1999, C-15.1	■ Environmental Emergency Regulations, SOR/2003-307. ■ Federal Above Ground Storage Tank Technical Guidelines, P.C. 1996-1233. ■ Federal Halocarbon Regulations, 2003 SOR/2003-289. ■ Federal Underground Storage Tank Guidelines. ■ Inter-provincial Movement and Hazardous Waste Regulations, SOR/2002-301. ■ National Pollutant Release Inventory and Municipal Wastewater Services May 2003. ■ Ozone-depleting Substances Regulations, 1998 SOR/99-7.	■ n/a
Canadian Wildlife Act, R.S.C., 1985, c. W-9	■ Wildlife Area Regulation, C.R.C., c. 1609.	■ n/a
The Fisheries Act, R.S.C., 1985, c. F-14 (amended 2012)	■ Fisheries Act Regulations, SOR/2013-191.	■ Authorization For Work that May Result in Serious Harm to Fish (Section 35 [2] [b])
Migratory Birds Convention Act, S.C., 1994, c. 22	■ Migratory Bird Regulations, 2010 C.R.C., c. 1035.	■ n/a
Navigation Protection Act, R.S., 2012, C. N-22	■ n/a	■ n/a
Species at Risk Act, S.C. 2002, c. 29	■ n/a	■ n/a
Transportation of Dangerous Goods Act, 1992, C.34	■ Transportation of Dangerous Goods Regulations, SOR/2001-286.	■ n/a

Table 2.3-1: Federal and Provincial Acts and Regulations that May be Required for the Project (continued)

Jurisdiction	Related Regulations	Permits Required
Provincial Acts		
The Clean Air Act, S.S. 1986-87-88, C-12.1	■ The Clean Air Regulations, R.R.S c. C-12.1 Reg 1.	■ Permit to Construct ■ Permit to Operate
The Environmental Assessment Act, S.S. 1979-80, E-10.1	■ n/a	■ Environmental Assessment Approval
The Environmental Management and Protection Act, R.R.S. 2010, c. E-10.22	■ The Environmental Spill Control Regulations, R.R.S c.D-14 Reg 1. ■ The Hazardous Substances and Waste Dangerous Goods Regulations, R.R.S., c. E-10.2, Reg 3. ■ The Water Regulations, 2002, R.R.S. c. E-10.21 Reg 1. ■ Halocarbon Control Regulations, c. E-10.21 Reg 2. ■ Used Oil Collection Regulations, R.R.S., c. E-10.2 Reg 8.	■ Hazardous Substances and Waste Dangerous Goods Permit to Construct (Section 10). ■ Hazardous Substances and Wastes Dangerous Goods Permit to Operate (Approval to Store - Section 9). ■ Approval to Construct - Water Works. ■ Approval to Operate - Water Works. ■ Permit to Construct - Aquatics Habitat Protection Permit.
Forest Resources Management Act, 1996, F-19.1	■ The Forest Resources Management Regulations, 1999, F-19.1 Reg 1.	■ Forest Product Permit.
The Fire Prevention Act, S.S. 1992, F-15.001	■ The Saskatchewan Fire Code Regulations, F-15.001 Reg 1. ■ The Fire Insurance Fees and Reporting Regulations, F-15.001 Reg 2.	■ n/a
The Fisheries Act (Saskatchewan), S.S. 1994, F-16.1	■ The Fisheries Regulations, 1994, F-16.1.	■ n/a
The Heritage Property Act, S.S. 1979-80, H-2.2	■ The Heritage Property Regulations, Sask. Reg 279-80.	■ n/a
The Highways and Transportation Act, S.S. 1987, H-3.01	■ The Controlled Access Highways Regulations, H-3 Reg 7. ■ The Highways and Transportation Regulations, H-3.01 Reg 1. ■ The Erection of Signs Adjacent to Provincial Highways Regulations, 1986.	■ Approach Permit. ■ Oversize/Overweight permits. ■ Roadside Permit. ■ Off-premise Sign Application. ■ On-premise Sign Application.

Table 2.3-1: Federal and Provincial Acts and Regulations that May be Required for the Project (continued)

Jurisdiction	Related Regulations	Permits Required
Provincial Acts		
The Saskatchewan Employment Act S-15.1 2014	■ Part III Occupational Health and Safety.	■ n/a
The Provincial Lands Act, S.S. 1978, P-31	■ Saskatchewan Wetland Conservation Corporation Land Regulations, 1993, P-31, Reg 14. ■ Crown Resource Land Regulations, P-31, Reg 17. ■ Provincial Lands Regulations, SR145/68.	■ n/a
The Water Security Agency Act, S.S. 2006, W-8.1th	■ Saskatchewan Watershed Authority Regulations, R.R.S., c. S-35.03 Reg 1.	■ Water Rights Licence.
The Weed Control Act, 2010, S.S. W-11.1	■ Weed Control Regulations, W-11.1, Reg 1.	■ n/a
The Wildlife Act, S.S. 1998, c. W-13.12	■ Wildlife Regulations, W-13.1, Reg 1. ■ Wildlife Management Zones and Special Areas Boundaries Regulations, 1990, W-13.1 Reg 45. ■ Wildlife-Landowner Assistance Regulations, 1981, W-13.1, Reg 48. ■ Wild Species at Risk Regulations, W-13.1 Reg 1.	■ n/a

n/a = not applicable.

3.0 PROJECT ALTERNATIVES

As part of overall Project planning and development, Yancoal has undertaken trade-off studies, based on available information, to evaluate Project options such as the location of the Project and mining method. Additional trade-off studies are being completed as the Project progresses in development.

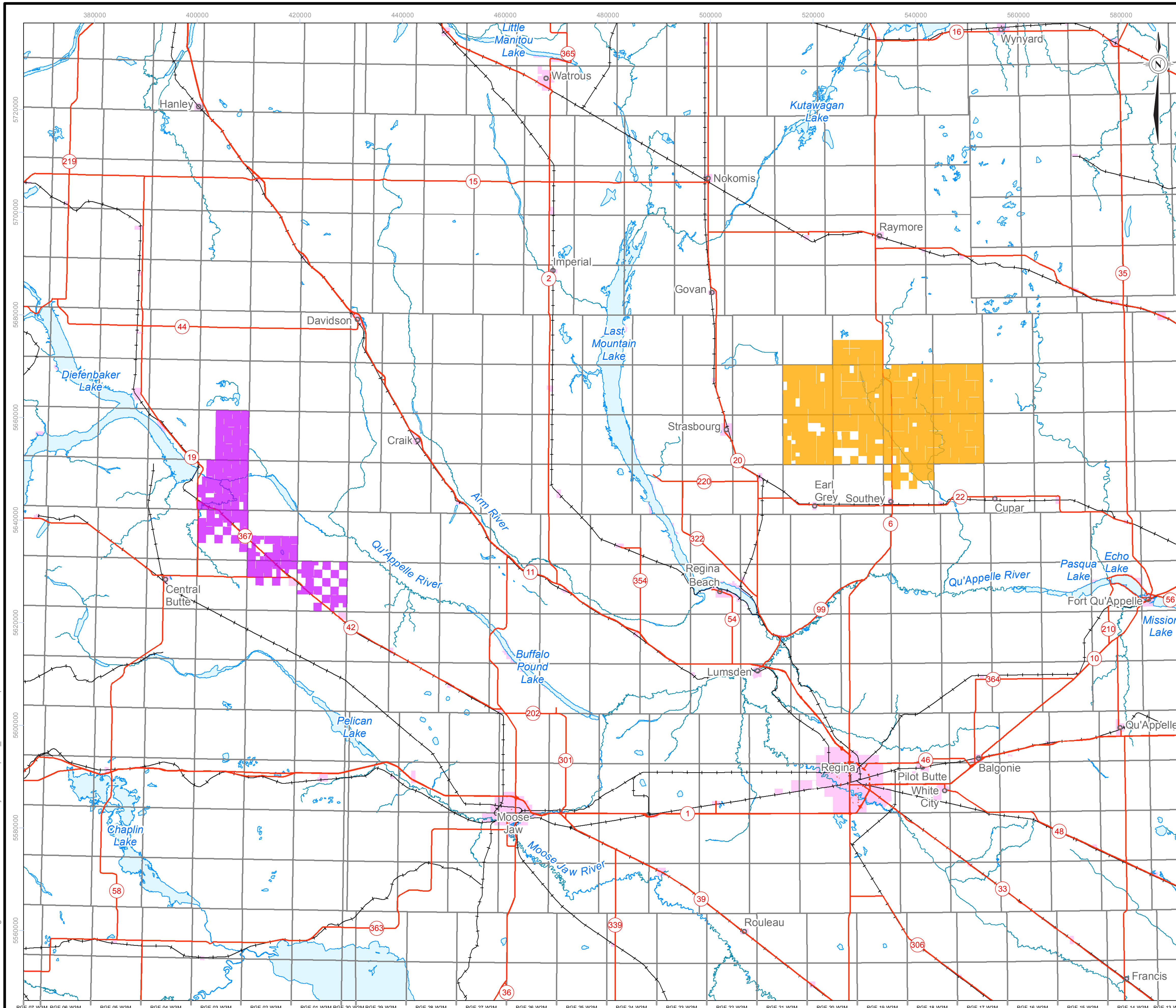
3.1 Project Location

The Project will be located within subsurface mineral permit areas KP377 and KP392. Two areas initially were considered for development during the early stages of exploration (Figure 3.1-1). Focus Area 1 is located approximately 60 km north of Regina, Saskatchewan and includes subsurface mineral permits KP377 and KP392 within an area of 78,203 ha. Focus Area 2 is located approximately 110 km northwest of Regina and includes subsurface mineral permits KP363 and KP483 within an area of 30,873 ha. A trade-off study was completed to select one focus area to advance to the scoping study stage.

Exploration wells were drilled to gather information on the potash resource and existing geology in both areas. Additional factors considered as part of the trade-off study included the following:

- mining and processing methods and feasibility;
- mine life;
- mine ramp-up duration;
- capital expenditure;
- water supply;
- utility supply (e.g., natural gas and power);
- rail access;
- road access;
- environment;
- mineral and surface rights; and
- operations safety.

Both focus areas have similar challenges regarding the existing infrastructure that is available. Focus Area 1 has enough available land excluding heritage sensitive land to support up to 100 years of mine life, while Focus Area 2 will have limited available land that may not be sufficient to support the desired mine life. In addition, the environmental approval process for Focus Area 2 could be more difficult and take more time because of the greater potential for occurrence of protected wildlife and plant species. Focus Area 1 will require more effort for engagement because there are more First Nations communities near Focus Area 1 than Focus Area 2.



LEGEND

- COMMUNITY
- HIGHWAY
- RAILWAY
- TOWNSHIP AND RANGE BOUNDARY
- URBAN MUNICIPALITY
- FOCUS AREA #1
- FOCUS AREA #2

REFERENCE

FOCUS AREAS PROVIDED BY AMEC, 2014
CANVEC © NATURAL RESOURCES CANADA
NTS MAPSHEET: 62L/M, 72I/J/O/P
NAD83 UTM ZONE 13

15 0 15
SCALE 1:750,000 KILOMETRES

PROJECT

YANCOAL
SOUTHEY PROJECT

TITLE

LOCATION CONSIDERED FOR THE YANCOAL PROJECT

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0197	FILE No.	
DESIGN	MT	03/12/14	SCALE AS SHOWN	REV. 0
GIS	LMS	29/12/14	**FIGURE: 3.1-1**	
CHECK	MT	30/12/14		
REVIEW	GM	30/12/14		

In conclusion, by considering all the factors related to environment, Focus Area 1 has fewer environment risks compared to Focus Area 2. Focus Area 1 was also selected to advance through a scoping study because it is more than twice the size of Focus Area 2; given the results of the exploration drilling, Focus Area 1 conceivably has twice as much resource potential.

Six potential locations for the plant site and well field were evaluated within Focus Area 1. The following criteria were used to assess the locations and to select the preferred location for the plant location:

- the location must be within the permit area;
- the location should not be in an area of high grade reserves to avoid sterilizing the reserves;
- the location should have surficial materials consisting of clays to provide a proper foundation for the TMA;
- the location should allow for future expansion; and
- the location should attempt to avoid the diversion of drainage systems (i.e., streams or creeks) to limit potential effects on the environment.

The preferred option is described in Section 4.0.

3.2 Mining Method

The preferred mining method for the Project is solution mining; however, both conventional and solution mining methods were evaluated. The following section outlines the considerations for potash mining methods.

3.2.1 Conventional Mining

Conventional potash mining uses underground mining practices, where sylvinite ore is cut with machines and transported to the surface for processing. Conventional mining involves the construction of mineshafts and underground mine workings. Conventional mining requires that workers are sent underground to facilitate mining operations.

Depth of mining generally corresponds with how much ground stress will be encountered when mining takes place in the potash bearing member. This is important in conventional mining because the required protective measures (i.e., bolting) for ground control are proportional to the ground stress. Conventional mine operating costs can increase dramatically with the number of measures required to ensure ground stability.

The processing plant for a conventional mine must receive raw sylvinite ore as mine feed. Crushing and conventional flotation is used for potash benefaction for most potash operations in Saskatchewan.

3.2.2 Solution Mining

Solution mining involves the dissolution of sylvinite with water. Wells are drilled into the potash-bearing members. Water, and later brine, is pumped down the wells and dissolves potassium chloride (KCl) and NaCl in the sylvinite ore. Brine is returned to surface and is conveyed to the process plant through pipelines. It is possible to mine multiple members using solution mining. No underground workers are required, as the sylvinite is accessed by drilling from surface.

For a solution mine, feed comes to surface as Potassium Chloride/Sodium Chloride (KCl/NaCl) brine and is separated by mechanical evaporation and crystallization.

3.2.3 Mining Method Selection

The shallowest potash member at the Yancoal deposit is at an average depth of 1,280 metres (m). Conventional potash mines operate at depths of 1,300 m in Belarus, at 1,400 m in Germany and, more recently, York Potash in the United Kingdom is planning to mine polyhalite at 1,400 to 1,600 m (York Potash 2011). However, the deepest conventional potash mine in Saskatchewan is between 1,100 and 1,200 m deep. At this depth considerable ground stress is encountered, which has a negative effect on mining (Agrium 2014).

In solution mining, the caverns can be much deeper than conventional mine openings; therefore, the depth of the deposit is not a concern for solution mining.

Solution mining is the preferred mining method for the Project.

3.3 Process Technology

Mechanical evaporation followed by crystallization is the selected process for producing potash from the brines produced by solution mining. Mechanical evaporation recovers hot water from the process, which is reused in solution mining. The recycling of hot water to the mining caverns improves the use of water and heat of the Project. The following three mechanical evaporation technologies are available:

- Multiple Effect Evaporation (MEE) uses steam energy to evaporate water from the brine in a series of evaporator effects.
- Mechanical Vapour Recompression (MVR) uses electrical energy from compressors or fans to evaporate water from the brine in parallel evaporators.
- Thermal Vapour Recompression (TVR) is similar to MEE except that a TVR plant uses a thermo compressor to recompress a portion of the vapour from the first effect and recycles it to the first effect heat exchangers. The remaining vapour from the first effect is used to drive the remaining stages of the MEE.

The MEE technology was selected for the Project primarily because it has a higher tolerance to magnesium chloride ($MgCl_2$) in the brine.

3.4 Additional Trade-off Studies

3.4.1 Comparison of Vertical and Horizontal Solution Mining Caverns

The solution mining technologies and economics of vertical and horizontal potash solution mining caverns were evaluated. Currently, vertical solution mining caverns are used in Saskatchewan at Mosaic Belle Plaine and K+S Legacy (currently under development), and in Michigan at Mosaic Hersey. Horizontal caverns are used in Utah at Intrepid Potash's Moab operations as well as in NaCl, nahcolite ($NaHCO_3$), and trona ($NaHCO_3$ and sodium carbonate [Na_2CO_3]).

There are two basic types of potash solution mining, non-selective (also known as primary) and selective (also known as secondary). Non-selective potash solution mining uses fresh water to dissolve NaCl and KCl from the ore. Non-selective mining requires a blanket material to control the vertical growth of the cavern during solution mining. Selective potash solution mining uses a saturated NaCl brine to dissolve only the KCl from the ore. Selective mining does not require a blanket material to prevent vertical growth of the cavern during solution mining because only the KCl is dissolved.

Selective solution mining requires a higher grade of KCl to ensure that the NaCl crystals do not surround the KCl crystals and prevent brine from contacting the KCl. The need for higher grade of KCl probably reduces the number of KCl beds that can be mined successfully using selective mining and lowers the overall resource utilization. Since selective solution mining only dissolves KCl, NaCl is not produced. This eliminates the need to process, market, dispose of, or store NaCl on the surface.

The study looked at two variations of the Belle Plaine Method, which use non-selective and selective solution mining techniques, and four methods that only use non-selective solution mining techniques.

The Belle Plaine Method of solution mining is proven in Saskatchewan at Mosaic Belle Plaine and, more recently, at K+S Legacy. Some of the selective solution mining techniques using horizontal caverns that were studied for this Project have been adapted from potash solution mining in other locations (e.g., Intrepid Potash in New Mexico and Utah) while the remainder has been adapted from solution mining of other minerals (e.g., White River nahcolite mining in Piceance Creek Basin, Colorado). None of the selective solution mining only techniques has been proven effective for Saskatchewan ores.

Yancoal decided to progress with the proven method of potash solution mining in Saskatchewan. This method, described as the Belle Plaine method, is the base case for this study. The process is described further in Section 4.0.

3.4.2 Surface Cooled Crystallization Trade-Off Study

Cooling ponds take advantage of Saskatchewan's climate to precipitate KCl from brines by cooling the brine, as the ambient temperature is less than the brine temperature. As the brine cools, KCl is precipitated, which settles to the bottom of the pond. An alternative to cooling ponds is surface cooled crystallizers, which use colder fluids to remove heat from the brine and achieve a lower end temperature similar to that achieved in a cooling pond.

Due to the lower capital expenditure (CAPEX) requirement for a cooling pond versus a surface cooled crystallizer, a cooling pond was used for the prefeasibility design.

3.4.3 Combined Heat and Power Plant Trade-Off

Three options were considered as part of a trade-off study, and are described below:

- Case 1 – low pressure boilers supply steam to the process and the site's electrical power is drawn from the SaskPower grid.
- Case 2 – high-pressure boilers supply steam to a backpressure steam turbine. The steam turbine would supply approximately 70 megawatts (MW) of power to the site. The low-pressure steam downstream of the turbine would be used in the process.
- Case 3 – simple cycle natural gas turbine produces 70 MW of site power with a heat recovery system generator (HRSG) and an auxiliary boiler provides the balance of steam to the process.

Case 1 was determined to be the preferred option for the Project.

3.4.4 Dryer Technologies

Rotary dryers were compared with fluid bed dryers; both technologies are proven in potash mills in Saskatchewan. The CAPEX, operational expenditure (OPEX), operability, maintainability, and the advantages and disadvantages of the two drying systems were compared. The analysis of the two drying systems does not clearly identify one as the better dryer. Fluid bed dryers were selected to move forward into the prefeasibility design.

3.4.5 Construction Accommodations

Preliminary investigation has shown that Regina, the largest community in proximity to the Project does not have sufficient accommodations to accommodate the anticipated construction workforce required for the Project and other construction projects that may occur near Regina on a similar timeframe. While smaller communities located closer to the Project may have accommodations and infrastructure to accommodate a portion of the workforce, it is unlikely this would be sufficient during peak construction periods. As such, a construction camp will be located as near to the construction site as practical.

3.4.6 Water Supply

Potential sources for provision of a water supply for the project included both potential groundwater and surface water.

The Manville Aquifer is the most promising of the bedrock aquifers if a high total dissolved solids water supply were found to be acceptable, however, due to its highly variable nature, numerous deep water wells would likely be required to provide for the Project's water requirements.

The majority of Quaternary aquifers in the study areas are of limited extent and thickness and do not have the potential to provide the proposed water supply. Regionally, the Hatfield Valley Aquifer system in the area of Focus Area 1 is a potential source of groundwater; however, additional investigations would be required to determine the current extent of allocation for the aquifer and better determine the ability of the aquifer to deliver the proposed pumping rates.

It is uncertain that a single groundwater source could be allocated to provide and sustain the proposed water supply.

For potential surface water supplies, the most likely option to be suitable for water supply would be a waterbody as opposed to a streamflow source. Potential surface water supplies were identified within the project area, and surface water was identified as the preferred water supply option. Discussions with Saskatchewan Water Security Agency indicated that a regional supply pipeline from Buffalo Pound Lake is preferred for a surface water supply. The Water Security Agency and SaskWater will evaluate pipeline route options for the regional supply pipeline.

4.0 PROJECT DESCRIPTION

4.1 Introduction

This section provides a description of the Project based on information available at this stage of the pre-feasibility study and environmental assessment process. The EIS will contain additional details of Project activities and components, where required, to support a comprehensive assessment of the potential effects from the Project on the biophysical and socio-economic environments.

4.2 Mineral Resource Review

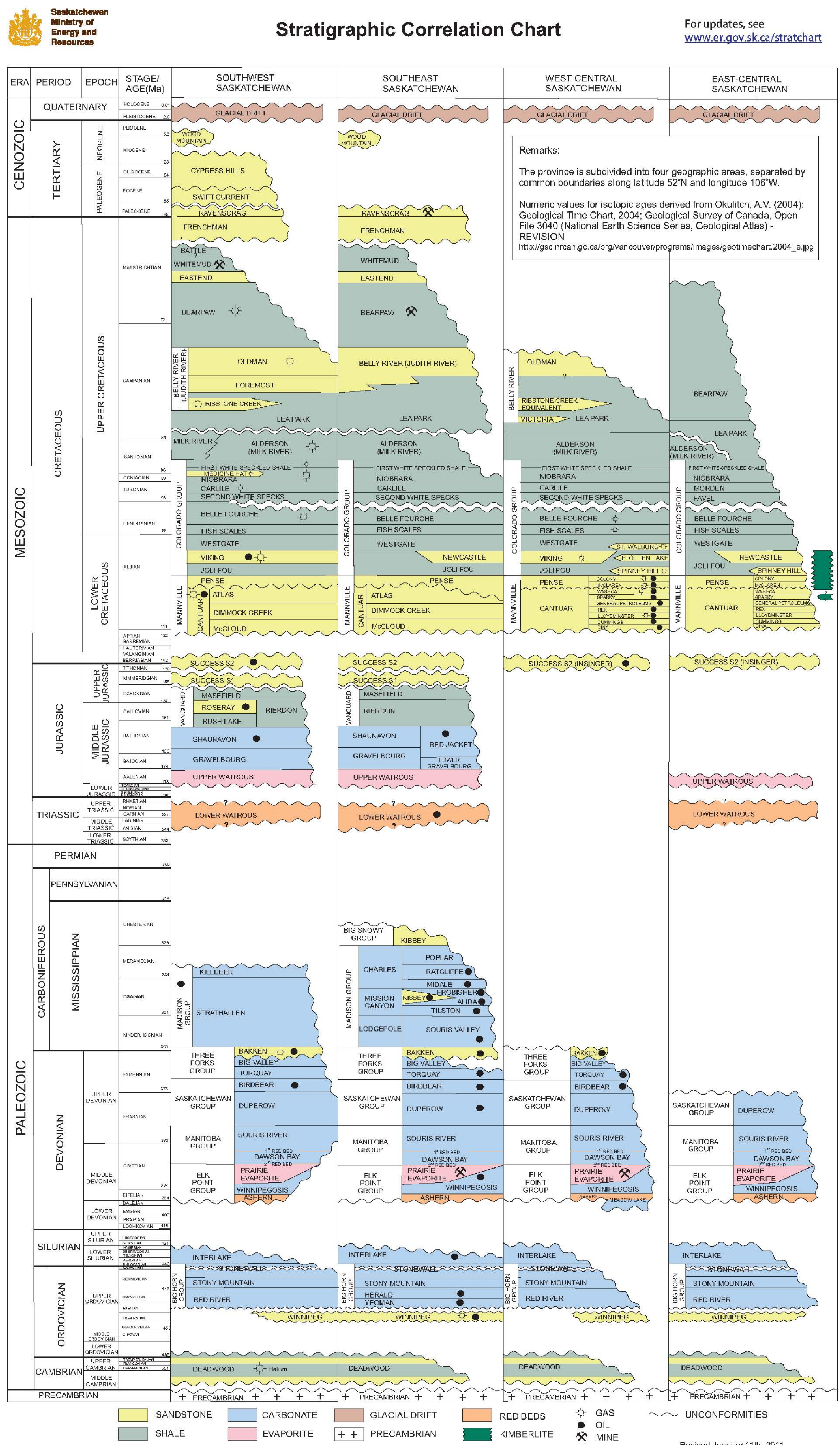
The Project is located in the southern region of the Saskatchewan potash basin, which hosts the Prairie Evaporate Formation. This Formation can be mapped from central Alberta to Manitoba, North Dakota, and Montana and contains the Patience Lake, Belle Plaine, and Esterhazy Members. The Project is contained within the Elk Point Basin, which is a primary sedimentary feature located predominantly in Alberta and Saskatchewan.

4.2.1 Mineral Formations

A modified version of the Saskatchewan Industry and Resources Regional Subsurface Stratigraphic Correlation Chart is shown on Figure 4.2-1 and provides a representation of the regional geological markers encountered within the southeastern Saskatchewan potash belt.

The key Mesozoic and Paleozoic formations were interpreted from the 2012 and 2013 drilling results for the Project area. The average depths and lithology descriptions for these formations are summarized below in Table 4.2-1. Formations deeper than the Prairie Evaporite were not penetrated by the exploration drilling and have not been interpreted at this time.

The Prairie Evaporite Formation is divided into three principal potash-bearing members and one auxiliary member. In ascending stratigraphic order, they are the Esterhazy Member, the Belle Plaine Member, and the Patience Lake Member. These beds are generally flat-lying and are formed of interbedded sylvite, halite, carnallite, clays, and minor amounts of anhydrite. The auxiliary potash member, the White Bear Member, is situated between the Belle Plaine and the Esterhazy members.



PROJECT

YANCOAL

YANCOAL SOUTHEY PROJECT

TITLE

SASKATCHEWAN STRATIGRAPHIC CORRELATION CHART

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0197	FILE No.	
DESIGN	MT	03/12/14	SCALE AS SHOWN	REV. 0
GIS	LMS	29/12/14	**FIGURE:**	
CHECK	MT	30/12/14	**4.2-1**	
REVIEW	GM	30/12/14		

REFERENCE

MINISTRY OF ENERGY AND RESOURCES, GOVERNMENT OF SASKATCHEWAN, 2014

Table 4.2-1: Project Area Formations

Era	Formation Name	Average Depth (mbgs) in Project Area	Lithology Description
MESOZOIC	Second White Speckled Shale	389	black calcareous shale and mudstone with accumulations of fish-skeletal debris
	Lower Colorado Group	423	noncalcareous, grey and black shales with interbedded sandstone lenses
	Viking Sandstone	517	relatively well-washed, fine to coarse grained sandstone
	Manville	559	interbedded sands and shales
	Upper Watrous	660	massive anhydrite bed
PALEOZOIC	Bakken Shale	726	calcite cemented, quartzose sandstone, and siltstone with black, organic rich shales
	Torquay	754	grey to red dolomite, shale, and anhydrite
	Birdbear	805	upper unit is comprised of non-argillaceous limestone and dolomites, lower unit is mainly dolomite with interbedded evaporites
	Souris River	1,026	dolomites and limestone with intervals of anhydrite and halite
	Upper Harris Halite	1,078	halite, average thickness of 3.6 m within Project area
	Lower Harris Halite	1,114	halite, average thickness of 2.4 m within Project area
	Upper Davidson Halite	1,120	halite, average thickness of 50.4 m within Project area
	First Red Beds	1,195	red and grey/green dolomitic mudstones
	Duperow	847	pale colored limestone and dolomites with anhydrite and argillaceous dolomites
	Dawson Bay	1,207	split into 6 units – dolomitic mudstone, fossiliferous limestone, dolomitic mudstone, bituminous limestone, dolomite, anhydrite, and halite
	Second Red Beds	1,248	grey and reddish brown, dolomitic mudstone, locally mottled
	Prairie Evaporite	1,253	generally halite with potash members consisting of varying amounts of sylvite, carnallite, anhydrite, and insolubles

mbgs = metres below ground surface; m = metres

The three Potash Members (i.e., Patience Lake, Belle Plaine, and Esterhazy), as well as the Salt Back (i.e., above the Patience Lake) and the Interbed (i.e., between Patience Lake and Belle Plaine) are considered the key stratigraphic intervals for the Project that will have the greatest influence on potential for solution mining in the area.

4.2.2 Mineral Resource and Grade

Mineral resources and KCl grades have been determined for the Project through an exploration program that included both drillholes (with core samples), and an advanced 3-D seismic survey to determine the continuity of the deposit between drillholes. The potash mineral resource was classified based on the radius from the cored drill holes, the thickness and grade of the selected solution mine interval, and the loss factors that account for unknown geologic anomalies.

The Project currently has an in-situ sylvinite tonnage of 5,089 million metric tonnes (MMT). The Yancoal Project currently has defined Mineral Resources (minable sylvinite tonnage) totalling 1,529 MMT and is comprised of the following:

- measured resource: 227.0 MMT;
- indicated resource: 653.0 MMT; and
- inferred resource: 649.1 MMT.

Depending on ultimate production, this would indicate an initial mine life of 65 year. Additional area is being evaluated and is anticipated to provide sufficient resource to extend the mine life to 100 years.

4.3 Construction

4.3.1 Facilities and Infrastructure Required During Construction

Existing infrastructure at the site is limited and major utilities are a significant distance from site. It is assumed permanent access to water, power, natural gas, and high-speed telecommunications will not be available for the beginning of construction activities; temporary utilities will be provided.

Existing road upgrades are required to connect to Highway 6 and a rail spur is needed to connect to the CN or CP rail lines. Existing roads are expected to be adequate to support early construction activities.

Construction of on-site infrastructure will include the installation of permanent buried services and temporary construction infrastructure. The buried services will be installed and tested in parallel with construction earthworks, and will require coordination with the earthworks program to ensure efficient installations.

Temporary construction infrastructure will include construction power distribution, lighting, health, safety, security, and environment (HSSE) facilities, firewater supply, communication infrastructure, fuel storage facilities, waste management facilities, storage facilities, construction offices, and common lunchroom and washroom facilities for the workforce. Aggregate and concrete supply facilities will be established, including borrow pits, crusher, and batch plant. Where possible, the design of temporary construction infrastructure will use permanent infrastructure that can be installed early in the Project to support the main plant construction workforce.

The Project site has a large quantity of clay that could be used as borrow material. It is anticipated that the excavated material will be managed, characterized, and stockpiled on-site for re-use. Suitable fill material will be used to construct dykes for ponds and for general site fill.

Construction infrastructure installations will be scheduled in the priority sequence to support the main construction. This would include facilities such as HSSE facilities, communications links, and cold storage for early receipt of material for concrete work, laydown areas for steel, potable water supply, and wastewater treatment. Construction infrastructure can be mobilized and demobilized in stages to minimize the cost of construction infrastructure over the construction period. Temporary infrastructure will be demobilized as permanent facilities become available for use during construction.

Preliminary investigation has shown that Regina does not have sufficient accommodations to accommodate the incoming construction workforce. As such, a construction camp will be located as near to the construction site as practical. The number of workers required during construction is described in Section 4.11.

An inventory of all hazardous substances and waste dangerous goods for storage will be established and kept current during construction. Contractors will be contractually obligated to follow Workplace Hazardous Materials Information System (WHMIS) guidelines and to establish inventories of all hazardous substances; all workers on site will be required to have WHMIS training. Appropriate storage areas will be constructed, maintained, and monitored for all hazardous substances and waste dangerous goods. These areas will include containment and may include secure storage. Policies and procedures related to handling spills of hazardous substances will be established and enforced. When the use of nuclear materials is required, only workers who are licensed to handle and store nuclear materials will be involved. Scheduling of the transport, storage, and use of hazardous substances will aim to minimize the amount on site at any given time.

Arrangements will be made with approved waste handling firms to remove and dispose of hazardous waste. All hazardous waste will be transported, stored, handled, and disposed of in accordance with statutory requirements and the Project's environmental policies.

Fuel will be stored on-site in above ground storage tanks. These tanks will be installed and operated in compliance with provincial and federal regulatory requirements. Secondary containment will include double-walled tanks for smaller tanks, and single-walled tanks with liners, and berms or dykes for larger tanks. These fuel tanks will be located at the construction site and will supply all fuel requirements for the construction equipment.

Detailed environmental management and construction plans will be developed with the contractor prior to commencement of construction. These plans will be customized for the specific activity provided by the contractor, as well as for general overall construction environmental controls that will be developed by Yancoal, their Engineering, Procurement, and Construction Management (EPCM) contractor, and by the environmental consultant.

4.3.2 Environmental Design Features for Construction

The EPCM contractor, in conjunction with the Yancoal environmental team, will manage the environmental program during construction. Management and monitoring of the environmental program will be based on the site-specific permit requirements for the Project.

Diesel and gasoline will be stored in accordance with applicable regulations. Spill control kits will be maintained at the fuel storage area. Contaminated soil from spills will be stored in sealed containers, removed from site by a licensed contractor, and transported to an appropriate disposal facility. Waste material generated on-site during construction may include metal, wood, plastics, miscellaneous waste, and domestic garbage. In addition, waste lubricating oil and filters from vehicle maintenance, oil rags, and paint will require appropriate disposal. A licenced waste contractor will be engaged to provide appropriate waste containers on-site, and to remove waste materials to licenced recycle and disposal facilities.

Environmental management and construction plans will be developed for the Project prior to construction. These will include plans for erosion and sediment control, spill response and control, invasive species (e.g., weeds) management, and waste management. Training on the environmental management and construction plans will be provided for all employees and contractors on-site.

4.4 Mining

Solution mining, a proven technology in Saskatchewan for over 40 years, is a general term most often referring to the dissolution of water-soluble minerals, such as NaCl or KCl, using borehole wells to inject water into mineral-bearing geological formations and removing the resulting saturated brine. The solution mining techniques for the Project will be similar to the mining techniques used at the Mosaic Belle Plaine potash mine (Section 3.4.1).

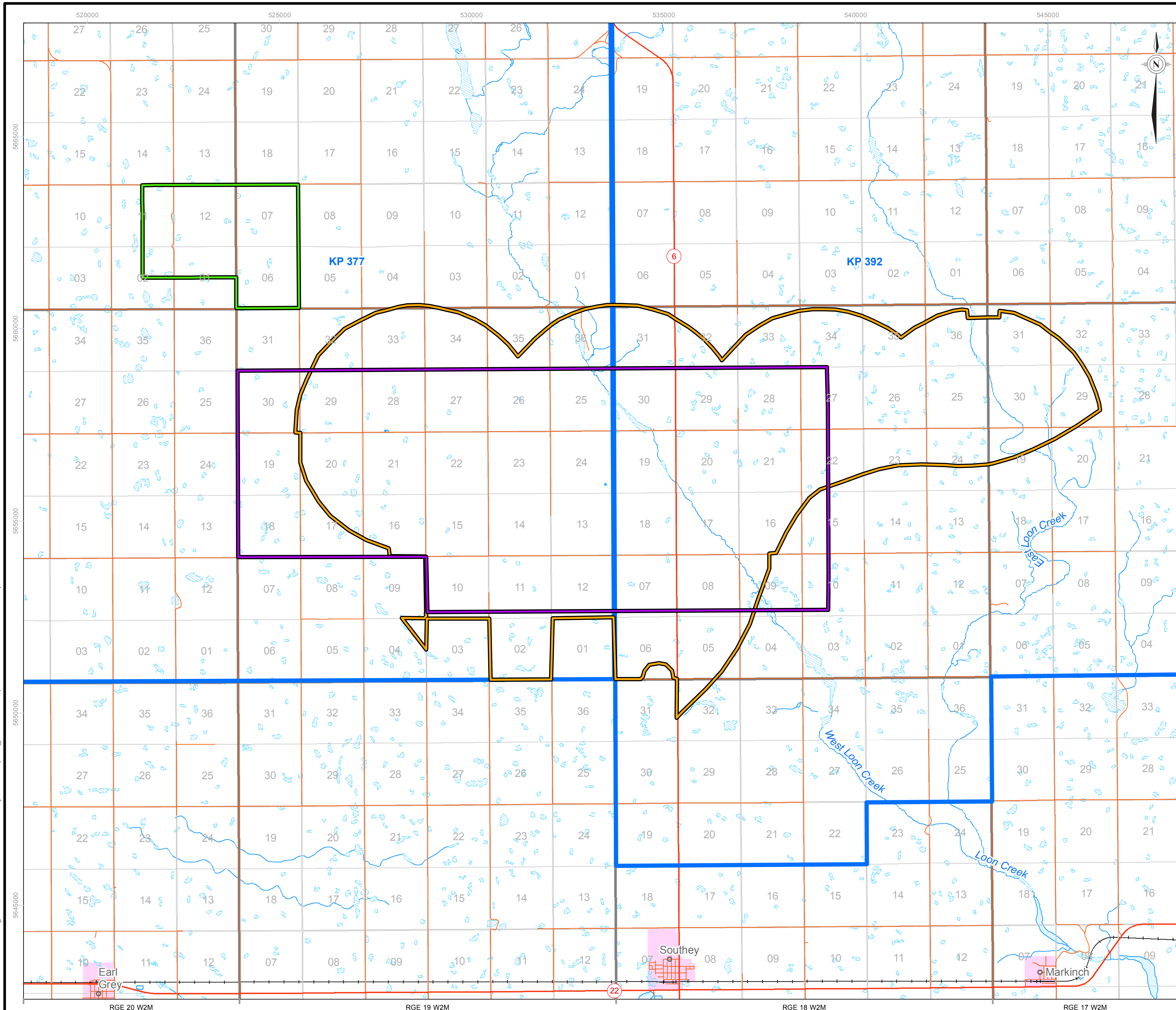
4.4.1 Mine Plan

The Project is designed to produce 2.8 Mtpa. At this production rate the current mine life is 65 years. Expansion of the assumed resource is anticipated to result in a significantly longer mine life. For assessment purposes in this EIS, a 100-year mine life is assumed. A primary mining production target of 2.0 Mtpa of potash product per year can be met with approximately 35 caverns in production. The primary mining phase per cavern (i.e., after cavern development) is estimated to be completed after 4.3 years for three-bed mining and 2.5 years for two-bed mining. The replacement rate is estimated to be nine caverns (i.e., 18 wells) per year.

Mining is planned to start from the northwest section of the mine boundary, then migrate to the east. All three potash beds will be mined for most caverns; however, the Esterhazy bed will not be mined in some areas because of high carnallite concentrations. The conceptual mine wellfield layout is shown on Figure 4.4-1.

Upon completion of the primary production phase, the injection fluid will be changed to brine-saturated in NaCl and the oil blanket will be recovered. Secondary mining can be conducted as a continuous or an intermittent batch operation. As the KCl is dissolved and its concentration in solution increases, the NaCl grade at saturation will be slightly reduced, precipitating some NaCl within the cavern. During secondary mining, KCl on the walls and on the roof of the cavern will be mined. NaCl within the cavern remains essentially in-place in the walls of the cavern. With the addition of secondary mining, the cavern life is estimated at 6.8 to 6.9 years for three-bed mining and 4.1 years for two-bed mining.

Secondary mining production is not possible until primary mining has been completed in the first 35 caverns, which will be available for secondary recovery 4.22 years after start-up. Production from 35 caverns operating in secondary mining mode will increase muriate of potash (MOP) production to 2.6 million tonnes (Mt). The target production from secondary mining of 0.8 Mt will be reached after the second group of caverns transfers from primary to secondary mining. Forty-nine caverns are required to produce 0.8 Mtpa from secondary mining. This projection is based on a flow rate for the secondary caverns similar to that assumed for the primary caverns.



LEGEND

- COMMUNITY
- HIGHWAY
- ROAD
- RAILWAY
- TOWNSHIP AND RANGE BOUNDARY
- SECTION BOUNDARY
- URBAN MUNICIPALITY
- PERMIT BOUNDARY
- CORE FACILITIES AREA
- 65 YEAR MINE FIELD
- INDICATED PROJECT BOUNDARY

REFERENCE

INFRASTRUCTURE DERIVED FROM AMEC DRAWING NO. 100110-2000-DD10-GAD-0002 REV. B
BASE DATA: CANVEC © NATURAL RESOURCES CANADA
NAD83 UTM ZONE 13

2 0 2
SCALE 1:100,000 KILOMETRES

PROJECT
YANCOAL
YANCOAL SOUTHEY PROJECT

TITLE
CONCEPTUAL MINE FIELD

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0197	FILE No.
DESIGN	MT	04/12/14	SCALE AS SHOWN REV. 0
GIS	LMS	30/12/14	
CHECK	MT	30/12/14	FIGURE: 4.4-1
REVIEW	GM	30/12/14	

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4.4.2 Well and Pad Layout

The pad layout is based on the assumption that up to 14 caverns will be developed from a single pad. This requires 28 wells from a pad as illustrated on Figure 4.4-2. Directional drilling is assumed and included in the production drilling cost estimate. A pillar of unmined material is required between caverns to maintain isolation of the caverns and to support the overlying strata. The cavern dimensions and pillar sizes have been selected to control cavern closure during mining. The pillar dimension has been set at 80 m, the cavern radius is 75 m, and the spacing between the wells is 80 m. These cavern dimensions are based on stress analysis and site-specific data. The cavern dimensions are similar to those at Mosaic's Belle Plaine mine, which has an 80 m separation between wells and a cavern radius of at least 70 m. These dimensions result in a cavern spacing of 310 m by 230 m. The design base cavern shape and pillar dimension is shown on Figure 4.4-3.

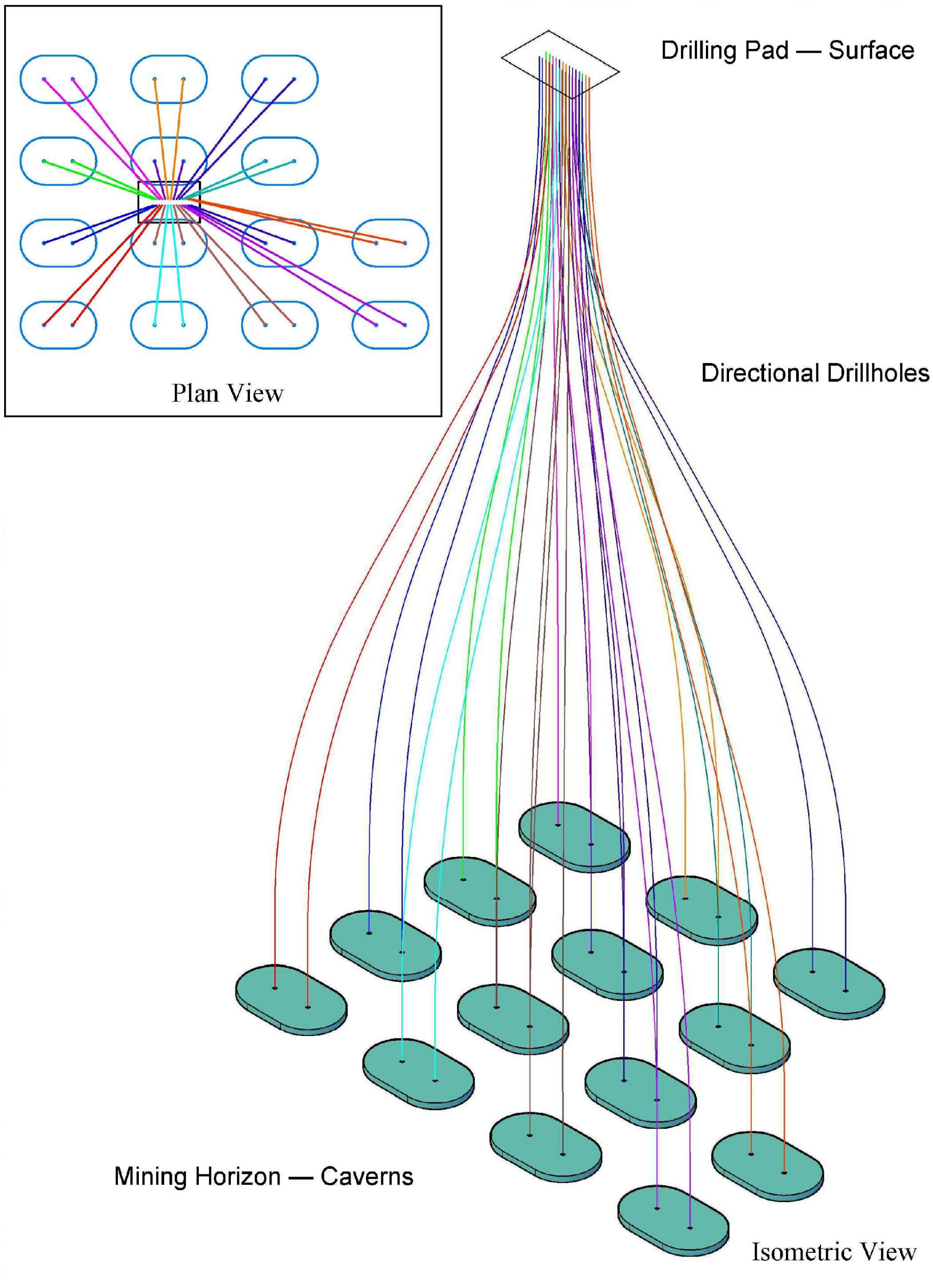
4.4.3 Mine Well Field Piping Design

Mine well field pipelines will be installed below ground with a nominal depth of cover of 2.4 m. Double-walled pipe for secondary containment will not be used on any of the pipelines, unless they are required in critical crossing areas based on site-specific analysis to meet environmental conditions. All pipelines will be insulated to maintain the required temperature for the process with the exception of the cold water and the early brine return pipelines.

The pumps and the main isolation valves can be activated remotely from the central control centre in the mill. The system will have the capability of monitoring the system's operating pressures, temperatures, and flows from the control room.

The brine-holding pond at each cluster site will be designed to provide a storage facility for draining the product lines during scheduled maintenance and for disposing of the brine when servicing the wellheads. An oil-holding tank, complete with injection pumps, will be located at each wellfield cluster pad. The oil tank will be surrounded by a containment dyke.

Leak detection, monitoring, cathodic protection, and appropriate pipeline isolation will be provided. Leak detection and monitoring of the well field pipelines will be based on flow and pressure measurements. Flow meters will be located along the pipeline. An imbalanced flow between two monitoring points and a drop in pressure from the normal established pressure pattern will signify that a leak has developed and an alarm will be activated.



REFERENCE
DRAWINGS PROVIDED BY AMEC

PROJECT
YANCOAL
兖煤加拿大资源有限公司

YANCOAL
SOUTHEY PROJECT

TITLE

TYPICAL CAVERN WELL TRAJECTORY FOR 14 CAVERNS DEVELOPED FROM ONE PAD

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0197
DESIGN	MT	03/12/14
CADD	BDS	03/12/14
CHECK	MT	30/12/14
REVIEW	GM	30/12/14

FILE No.
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FIGURE: 4.4-2

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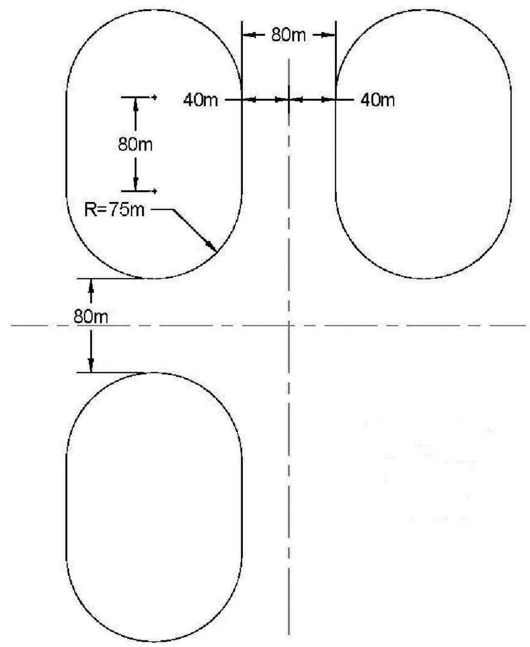

REFERENCE
DRAWINGS PROVIDED BY AMEC

PROJECT

YANCOAL
兖煤加拿大资源有限公司

YANCOAL
SOUTHEY PROJECT

TITLE

DESIGN BASE CAVERN SHAPE AND PILLAR DIMENSION

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0197	FILE No.			
DESIGN	MT	03/12/14	SCALE	AS SHOWN	REV.	0
CADD	BDS	03/12/14				
CHECK	MT	30/12/14				
REVIEW	GM	30/12/14				

FIGURE: 4.4-3

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4.4.4 Solution Mining Methodology

The solution mining method uses two wells that penetrate the potash beds vertically at a separation of 80 m. A large, thin cavern is developed first, surrounding these two wells in the halite bed below the Belle Plaine Member or the Esterhazy Member, depending on whether two or three beds, respectively, are to be mined. Solution mining of the potash proceeds in vertical slices with the vertical growth controlled by an oil cap. The oil cap is raised at each mining level.

4.4.5 Cavern Development

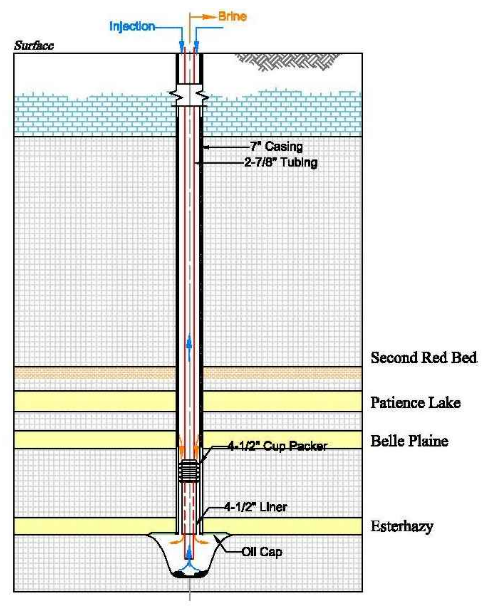
The steps in developing and in mining a cavern containing the Patience Lake, Belle Plaine, and Esterhazy Members are shown in Figure 4.4-4. These steps include the following:

- Step 1 - sump development;
- Step 2 - connection and roof development;
- Step 3 - primary mining in the Belle Plaine and Esterhazy members; and
- Step 4 - secondary mining in the Patience Lake Member.

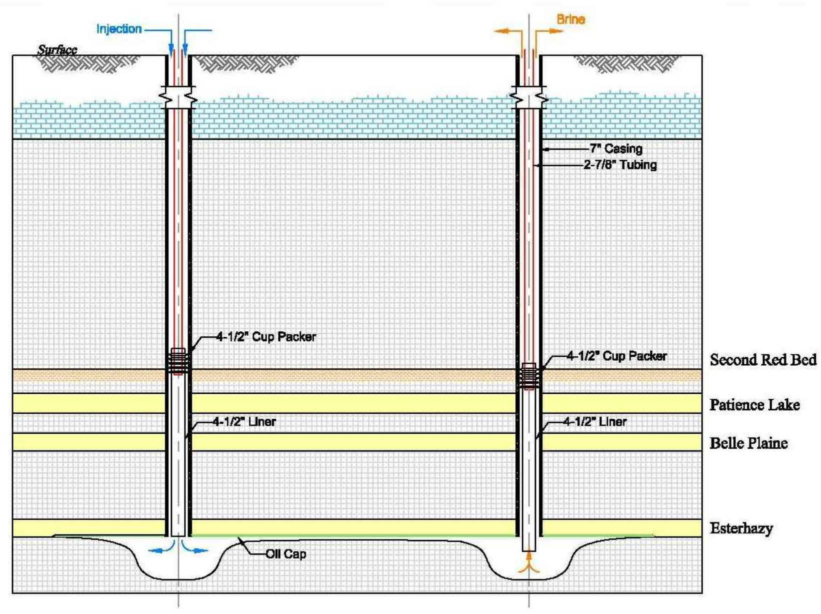
The initial step is the creation of a sump at each well below the Belle Plaine or Esterhazy member potash horizon, then expanding the diameter of each cavern by the injection of water and oil. The oil, being lighter than the water, floats to the top to inhibit vertical growth of the cavern and causes the cavern to grow laterally. During initial sump development, water is injected in the tubing and recovered from the annulus. Subsequently, during sump and sump-connection phases, water is injected in the annulus of each well and saturated salt brine is recovered in the tubing located near the bottom of the sump.

Roof development follows immediately after the two caverns connect. The roof is expanded by injecting water into one well and recovering the brine from the other. To maintain symmetry in the cavern shape, the flow is reversed with the tubular repositioned so that production is always from the lowest point in the sump. When the roof has been expanded from 60% to 70% of its target dimension, the oil cap is raised by perforating the casing and a layer of potash and halite is dissolved. The process is repeated until the floor of the Belle Plaine or Esterhazy Member is encountered, depending on whether the cavern is located in a two- or three-bed zone, respectively.

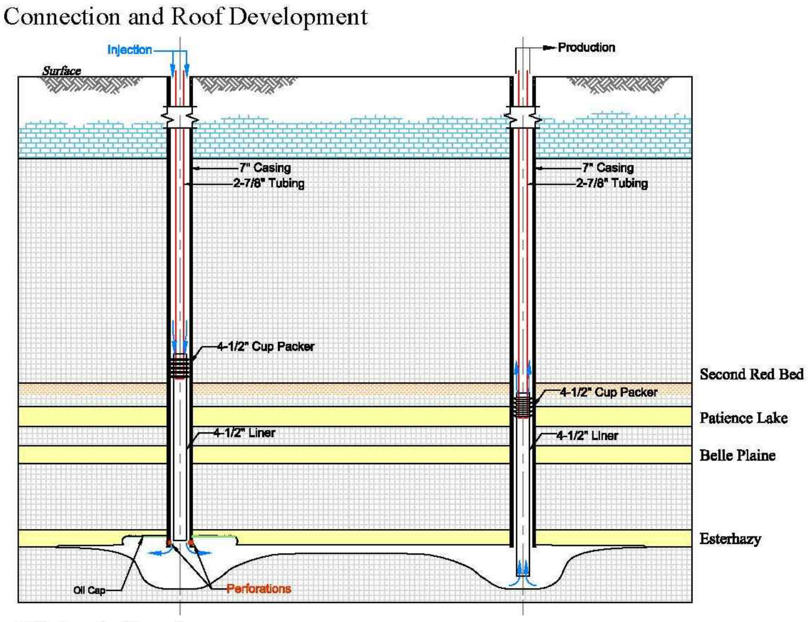
The steps are the same for mining two seams except that the sump is created at the bottom of the Belle Plaine Member instead of the Esterhazy Member.



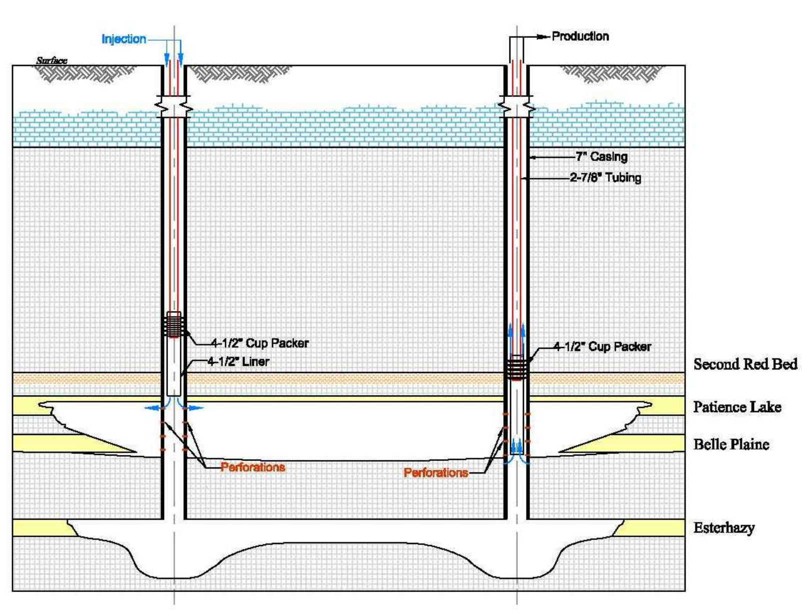
a) Sump—Step 1



b) Cavern Connection and Roof Development



c) Primary Mining in Esterhazy



d) Secondary Mining in Patience Lake

REFERENCE
DRAWINGS PROVIDED BY AMEC

PROJECT
YANCOAL
兖煤加拿大资源有限公司
YANCOAL SOUTHEY PROJECT

TITLE
MINING STEPS FOR THREE-BED MINING AT THE YANCOAL POTASH PROJECT

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0197	FILE No.
DESIGN	MT	03/12/14	SCALE NTS REV. 0
CADD	BDS	03/12/14	FIGURE: 4.4-4
CHECK	MT	30/12/14	
REVIEW	GM	30/12/14	

4.4.6 Primary Mining

After roof development, primary mining is initiated by injecting freshwater at an elevated temperature into one well and retrieving the production brine from the other well. Primary mining will progress in lifts, with occasional additions of oil to maintain the oil blanket. Each lift will be approximately 1 to 1.5 m thick. When a lift has been completed, the casing is perforated and the new lift is solution-mined. Injection will alternate between the two cavern wells so that a symmetrical cavern develops.

Once primary mining is completed in the Esterhazy Member, tubing and casings are raised and cement plugs are installed to isolate the existing cavern from both wells

4.4.7 Interbeds

The mine plan does not include mining of the low-grade interbedded material between the roof of the Esterhazy Member and the floor of the Belle Plaine Member, and the roof of the Belle Plaine Member and the floor of the Patience Lake Member. To skip these lower and upper interburdens, salt can be separated hydraulically from the bases of the Belle Plaine and Patience Lake members, respectively. Hydraulic pressure can be applied through perforations focused at the layer of mudstone or insolubles at the base of the Belle Plaine Member or of the Patience Lake Member, these mudstone or insoluble layers form separation planes between the salt interburdens and the overlying members. Solution mining above the overlying members can proceed once these separations have been initiated.

4.4.8 Secondary Mining

Upon completion of the primary production phase, the injection fluid will be changed to brine saturated in NaCl and the oil blanket will be recovered. Secondary mining can be conducted as a continuous or an intermittent batch operation. The NaCl grade at saturation will be slightly reduced, precipitating some NaCl within the cavern as the KCl is dissolved and its concentration in solution increases. The KCl on the walls and on the roof of the cavern will be mined during secondary mining. NaCl within the cavern essentially remains in-place in the walls of the cavern. At 29% secondary mining, the cavern life is estimated to be from 6.8 to 6.9 years for three-bed mining and 4.1 years for two-bed mining.

During later stages of secondary mining, the solution mining cavern may develop communication with the permeable Dawson Bay Formation above the cavern roof or, possibly, communication with an adjacent cavern. This communication could limit the cavern's ability to maintain enough pressure to lift production brine to the surface. In this instance, a submersible pump can be installed in the production well to assist lifting the production brine to the surface

4.4.9 Environmental Design Features for Mining

Environmental design features have been integrated into the mine plan and mining methods to reduce or limit effects on the biophysical and socio-economic environments. The design involves directional drilling from a centralized pad, resulting in a pad that incorporates the development of up to 14 caverns, reducing surface disturbance.

Seismic surveys were used to detect and avoid geological anomalies, structures, faults, and tight folds. Pillars will be left between the caverns to increase stability during mining and reduce the potential of subsidence. The cavern layout will be refined as additional modelling is completed to optimize potash recovery and to limit the potential effect of subsidence on surface development. Where possible, existing roads will be used to provide access to the well pads to reduce the amount of new road construction required for the Project.

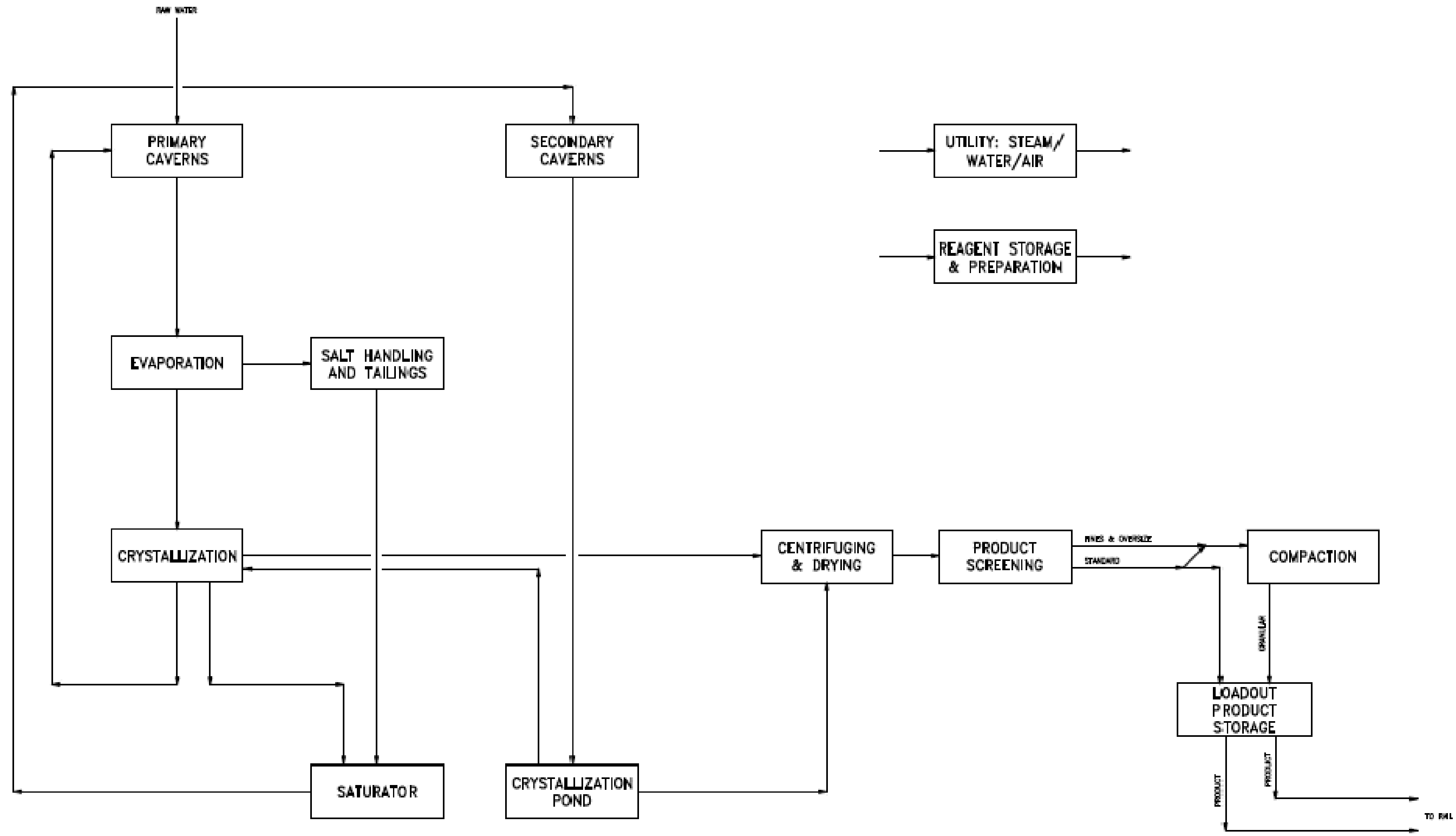
4.5 Processing

4.5.1 Overview

The process plant is composed of the following main components:

- evaporation;
- crystallization;
- centrifuging and drying;
- product screening;
- compaction;
- pond crystallization;
- loadout and storage;
- salt handling; and
- reagent storage and preparation.

The process plant will be designed for a primary production mining target of 2.0 Mtpa of potash product. Production during secondary mining will increase overall production to 2.8 Mtpa of potash product. The processing plant is designed to produce 40% granular and 60% standard product with a K_2O grade of 62%. A simplified schematic diagram of the process is illustrated on Figure 4.5-1.



REFERENCE

DRAWINGS PROVIDED BY AMEC

PROJECT

YANCOAL 兖煤加拿大资源有限公司

YANCOAL
SOUTHEY PROJECT

TITLE

SIMPLIFIED BLOCK DIAGRAM SHOWING THE PRODUCTION OF POTASH FROM PRIMARY AND SECONDARY CAVERNS

Golder Associates
Saskatoon, Saskatchewan

PROJECT	12-1362-0197		FILE No.	
DESIGN	MT	03/12/14	SCALE AS SHOWN	REV. 0
CADD	BDS	03/12/14	**FIGURE: 4.5-1**	
CHECK	MT	30/12/14		
REVIEW	GM	30/12/14		

4.5.2 Process Details

4.5.2.1 Evaporation and Crystallization

Brine from the wellfield is pumped to the process plant for processing. Brine from primary mining is directed to the evaporation circuit. In the evaporation circuit, water is evaporated using a five-effect evaporation train and the hot condensate from effects two through five will be sent to the injection tank for use in primary mining. Recycling the hot condensate back to the primary caverns improves water and heat efficiencies. During evaporation, a portion of the NaCl is precipitated out of the cavern fluid. Evaporation leaves a high-temperature brine enriched in KCl that is sent to the KCl crystallizer circuit by way of the clarifier. The precipitated NaCl is separated from the brine (i.e., the brine is sent to the clarifier) and then it is re-slurried with reclaim brine and pumped to the TMA.

Crystallization of KCl is performed in a four-stage draft tube baffle crystallizer circuit. Brine from the clarifier is fed to the first stage of crystallization. Product slurry is carried through the crystallization circuit by mother liquor. The final product from the fourth stage crystallizer is transferred to the centrifuge and drying circuit. Brine from the fourth effect crystallizer is sent to the brine tank for recirculation through the evaporation/crystallization circuit. In each stage, the brine is cooled by flashing the brine to a lower pressure and KCl starts to precipitate as the brine cools.

A portion of the mother liquor is bled from the fourth effect crystallizer and is sent to the brine injection tank for deep well disposal. The $MgCl_2$ purge stream controls the $MgCl_2$ level in the mother liquor.

Three natural gas-fired boilers will supply steam for the process. A cooling tower will provide cooling for the evaporation and crystallization areas.

4.5.2.2 Cooling Pond

During secondary mining, brine from the secondary caverns is pumped into the cooling pond. The brine cools in the cooling pond because the ambient temperature is less than the brine temperature. The brine is directed through a series of channels resulting in KCl crystallizing and settling to the bottom of the pond.

The KCl is harvested from the pond as slurry using dredges. Pumps on the dredges pump the slurry to a pair of thickening tanks located at the northwest corner of the cooling pond. These tanks provide surge capacity and thicken the slurry to approximately 40% solids. Then the slurry is pumped to the cooling pond product centrifuges for debrining.

Depleted secondary brine from the cooling pond overflow is pumped to the fourth stage barometric condensers on both crystallizer trains and preheated before being returned to the secondary caverns.

4.5.2.3 Centrifuging and Drying

Product debrining is accomplished in two stages. Four product centrifuges and two cooling pond product centrifuges are used to debrine the slurry to approximately 95% solids. Concentrate from the product and cooling pond product centrifuges re-circulates to the process, while solid cake proceeds to drying. Two fluid bed dryers create a product stream with approximately 0.2% moisture. Dryer off-gas dust is recovered and returned to the crystallization circuit.

Each dryer has a set of cyclones, one wet scrubber, and one stack. The cyclone and scrubber are located before the stack to recover dust from the air before being released to the environment. Slurry from the scrubber is returned to the process.

4.5.2.4 Product Screening

Dried product from the product dryers is fed to a series of multi-deck product screens. The product is separated into three size fractions: standard product, oversize, and undersize. The standard product is fed to a product cooler before being conveyed to loadout or to product storage. The oversize and undersize fractions and a portion of the standard fraction (i.e., its tonnage varies depending on market conditions) are fed to the compaction plant.

Dust from the product screening area is collected and sent to two dust control baghouses located in the compaction area. Dust from the baghouses is returned to the process (e.g., re-compacted to create product, or dissolved and sent to the crystallizers).

4.5.2.5 Compaction and Product Treatment

The compaction circuit generates granular-sized product through compaction, flake breaking, and screening. Oversize material from the screens is crushed and rescreened; the material that meets specifications proceeds to the glazing circuit. Fine material returns to the compactors. The glazing process increases the surface hardness of the material giving it greater durability for handling and transport. A small amount of water is added to the product prior to the product being fed to a dryer/cooler. After exiting the glazing dryer/cooler, the product is screened prior to transport or storage. Oversize product from the glazing screens is crushed and rescreened, and the fines are returned to compaction. Dust from compaction is collected and sent to two baghouses. Dust from the baghouses is returned to the process (e.g., re-compacted to create product, or dissolved and sent to the crystallizers).

4.5.2.6 Product Storage and Loadout

Granular and standard products are conveyed to the product storage building via belt conveyor and are transferred to separate storage areas within the product storage building. Potash is reclaimed from the piles in the building using a portal reclaimer and then conveyed to the product loadout building. Standard product is screened to remove any oversize material and granular product is screened to remove any oversize and undersize material. Anticaking agent is applied to the standard and granular product before loading the product into railcars for shipping.

4.5.2.7 Salt Handling

A portion of the cake from the NaCl centrifuges is used to saturate the secondary brine before it is returned to the secondary caverns. The remainder is sent to the repulp tank. Reclaimed brine is added to the repulp tank to dilute the slurry to a suitable percent of solids for pumping to the TMA.

4.5.2.8 Reagent Storage and Preparation

Anticaking and Dedusting Agents

An anticaking agent is applied to the product before shipping to prevent coalescence of the product during transport. The anticaking agent is made by mixing together anticaking oil and dedusting oil. The anticaking and dedusting oils are brought to the site by bulk tanker trucks and stored in separate tanks. The two oils are mixed together in a batch process before it is applied to the product.

Flocculant

Flocculant is added to the clarifiers to enhance the settling of the solids. Flocculant is brought to site in tote bags and mixed in a vendor-supplied make down system. The flocculant is mixed using water and then it is diluted with reclaim brine before it is added to the clarifier. Using reclaimed brine for dilution results in lower water consumption.

Ammonia

Aqueous ammonia is added to neutralize the hydrochloric acid that is generated in the product dryers, which otherwise can be corrosive to components in this area. The aqueous ammonia is delivered by bulk tanker and stored in a vendor-supplied tank; it is added to the dryer off-gas streams just before the product dryer scrubbers.

Antifoaming Agent

Antifoaming agent is added to the brine tank before the evaporation. The presence of organic material can cause foaming in the evaporators, which could have a negative effect on the vacuum systems. The antifoaming agent is added to minimize the amount of foaming. The antifoaming agent is delivered to site in liquid chemical totes.

Hydrochloric Acid

Inhibited hydrochloric acid at 2% concentration is used to clean scale off the heat transfer surfaces in the evaporators. The hydrochloric acid is brought to site in totes.

Cooling Tower Chemicals

Sulphuric acid, anti-scale, and bleach are added to the basin of the cooling tower to control pH, scale, and algae growth. These reagents are delivered to site in liquid chemical totes.

Boiler Chemicals

Chemicals typically added to boiler water include corrosion inhibitors and chemicals required for internal boiler treatment. The equipment required for the addition of the boilers chemicals is vendor-supplied.

4.5.3 Environmental Design Features for Processing

Environmental design features have been integrated into the design process for the Project to reduce or limit potential effects on the biophysical and socio-economic environments. For example, the pond crystallization process will use Saskatchewan's relatively cool climate to increase the crystallization capacity and to reduce energy requirements compared to adding additional evaporator/crystallization trains. Liquid, solid spills, and wash-down within the processing facilities will be contained within the mill facility or the engineered site area. Salvageable product spills will be recycled to the process feed.

The process plant will use cyclones, baghouses, and wet scrubbers to reduce air and dust emissions so that acceptable working environment is achieved and government standards are met. The dryer burners will be high efficiency, low nitrogen oxides (NO_x) burners to limit the amount of NO_x present in the exhaust stream.

Several vent pick-up inlets will be provided for collecting dust at all critical transfer points and from dryer exhausts. Dust control systems will discharge to proven scrubber systems in areas where ore is handled (e.g., product screening, storage, and loadout). Particulate matter (PM) in the form of dust will be controlled and all conveyors between buildings will be enclosed.

Some NaCl remains in the caverns following the secondary mining process, which reduces the amount of on-surface salt disposal.

The Project design will include conventional insulation, baffles, and noise suppressors on equipment. Most stationary equipment will be housed inside buildings, reducing the amount of noise.

A storm water pond will be built to prevent suspended solids from entering the environment and to capture water for process use. A process upset pond will be built to prevent the release of solution from the evaporation circuit into the environment during a power outage.

4.6 Tailings Management Area

4.6.1 Waste Salt Storage

The TMA will consist of a salt storage area, a brine reclaim pond, and surface diversion works (Figure 1.3-1). The Project core facilities area and waste salt storage area will be designed based on the digital elevation model (DEM) obtained from the 2013 LiDAR topographic data.

The volume of tailings produced by solution mining is lower than conventional underground mining; because the caverns are developed by solution methods, insoluble components of the potash beds are not brought to surface. In addition, less salt per tonne of product will be brought to surface as compared to a conventional mine. Based on a production rate of 2.8 Mtpa, salt tailings are expected to be generated at a rate of 3.24 Mtpa over the 100-year life of the Project. This would result in the production of 323 Mt of salt tailings. At a placed dry density of 1.45 tonnes per cubic metre (t/m^3), approximately 211 million cubic metres (Mm^3) of salt tailings will be stockpiled over the operating life of the Project.

Salt tailings stockpile stability is governed primarily by the pile height, shear strength of the underlying soils, and the degree to which soil pore water pressures are generated in response to the surcharge load of the stockpile. Preliminary stability analysis indicates that pile heights of 40 to 70 m are feasible for a 3H:1V side slope configuration based on currently available information. Detailed slope stability analysis for the salt pile will be completed to determine the optimal salt pile height for the Project. The final design of the waste salt storage area will provide for flexibility to expand the storage area in stages through modifications to the footprint or increasing the pile height should additional storage be required.

Containment berms and dykes will be constructed around the tailings management area to contain salt tailings and decanted brine, as well as to divert surface water. Topsoil will be stripped during construction below the dyke footprint and stockpiled for future use. The dykes will be constructed of low permeability clay obtained from excavation of the brine reclaim pond or general site earthworks. The containment dykes of the brine return channels surrounding the salt storage area will be keyed into native materials to a depth as required to control potential surface expression of brine by lateral migration through potentially jointed oxidized clay or shallow stratified deposits. A cutoff wall will be required on the north side of the salt storage area, where the Saskatoon Group aquifer is present, to control migration where the area is close to the TMA boundary. Deep seepage to the stratified intertill sand within the footprint of salt storage area will be contained by means of amended soil cutoff walls extending to competent till materials, as required.

The TMA will have a perimeter dyke to contain the solid NaCl and the decanted brine, as well as to divert fresh water around the perimeter of the TMA. The dykes will be designed to reduce the potential for shallow lateral brine migration by keying them into competent soils or other measures. The slurry from the re-pulp tank is pumped to the salt storage area. The solids (primarily NaCl) will settle out in the salt storage area. The salt storage area will be graded to allow the brine to drain from the salt storage area and flow to the brine reclaim pond by gravity. The reclaim brine will be added to the repulp tank to dilute the slurry to a suitable percent solid for pumping. Reclaim brine will be pumped to the reagent area for dilution in the flocculant mixing system. Excess reclaim brine will be pumped to the brine injection tank for deep well disposal.

Monitoring programs for the waste salt storage area will be incorporated into the design and will include key attributes of pile stability and brine migration.

4.6.2 Brine and Surface Water Management

A water management plan is required to isolate potentially salt contaminated water within the core facilities area from fresh water runoff. The topography in the area is gently sloping toward the south and slightly to the west. A diversion channel is required to intercept waterflows from upland areas along the north and east borders of the core facilities area. The highest elevation of the diversion channel invert will be located at the northeast corner of the core facilities area. From this point, the flow in the diversion channel will be directed either westward or southward.

Surface water diversion works will be constructed on the up gradient sides of the salt storage area to intercept the natural drainage flow and to convey runoff around the facility. The surface water diversion will be designed to convey the runoff associated with the 300 millimetre (mm) 24-hour design storm event. Erosion protection of the surface water diversion channel will be provided by replacing topsoil and hydro seeding to establish grass cover within the diversion channel (a tackifier may be used to increase the temporary soil stability prior to establishment of permanent root systems).

Contaminated areas will be enclosed by a perimeter containment berm to contain and collect local runoff and wastewater for final disposal through deep well brine injection. Surface water diversion channels along the perimeter of the core facilities area are designed to collect and redirect external drainage currently entering to the core facilities area. Salt storage area internal channels (i.e., brine return channels) are designed to collect and redirect runoff originated from precipitation and brine discharges on the tailings areas to the brine reclaim pond. The TMA will be graded to drain free brine to the brine reclaim pond by gravity. Internal salt tailings dykes and ditches may be required to direct surface flow to the collection ditch during early stages of deposition.

The brine reclaim pond will be constructed to provide containment of brine over the operating and decommissioning life of the mine. The brine reclaim pond is designed to allow sufficient storage capacity to contain brine decant from the salt pile during normal operations, runoff resulting from the design storm event, and a 0.9 m freeboard to accommodate wind-induced setup and wave run-up on the sides of the pond slopes. Normal operating levels in the ponds are associated with practical operational requirements under normal climatic conditions. The total brine reclaim pond depth is the summation of the required depth for normal operation plus depth for major storms plus freeboard.

Monitoring instrumentation will be required to enable groundwater sampling and monitoring of the brine plume migration within the sub-surface stratigraphy. Provisions for monitoring the brine reclaim pond will facilitate collection of geophysical electro-magnetic survey, groundwater chemistry, and hydraulic head monitoring.

4.6.3 Brine Deep Well Injection

Natural surface water flow will be diverted around the core facilities area to allow the fresh water to remain part of the natural water cycle, while brine will be contained within the TMA and then disposed of through deep-well injection. It is assumed that all runoff generated within the TMA footprint would be redirected to the brine reclaim pond to be used as process make-up water or be disposed of through deep-well injection into the Deadwood formation. Deep well injection requirements will be developed as part of the waste salt management plan over the life of the Project. It is anticipated that injection wells will be added progressively over the life of the Project as the footprint of the waste salt storage area develops and additional capacity is needed to dispose of excess brine. An evaluation of the capacity of potential deep injection horizons will be completed to select suitable zones for brine disposal.

4.6.4 Environmental Design Features for the Tailings Management Area

Environmental design features have been integrated into the TMA to prevent or to limit the effects of the Project on the natural environment. A containment system will be designed to control migration of brine from the salt storage area to underlying aquifers and control the horizontal migration of brine, as required. Site characterization studies will be conducted to locate optimally the waste salt storage area in a location that provides natural containment. Information collected from baseline field studies and transport modelling will be used to develop a containment strategy to control brine migration from the salt storage area.

Compliance monitoring and environmental monitoring will be implemented to verify that appropriate management practices are being used to confirm the design criteria for operational site monitoring programs and, ultimately, the reclamation and abandonment objectives and planning procedures.

4.7 Site Infrastructure

4.7.1 Permanent Buildings

Permanent buildings will be constructed to facilitate the daily operation of the Project. Major buildings required for the Project are described below and shown on Figure 1.3-1.

- **Process Plant** - This will be the largest building on site and will contain the evaporation, crystallization, centrifuging, drying, product screening, and compaction areas. The process plant will be a multi-storey building consisting of a combination of concrete and structural steel floors. The process plant will contain most of the KCl processing equipment, as well as offices and control room. Emergency response equipment will be stored in the process plant to optimize response time.
- **Administration Building and Dry Facilities** – This will be a one or two story complex that will consist of office space, dry facilities, safety and first aid facilities, lab facilities, and security facilities.
- **Mill Warehouse** – This building will be used for storage of supplies and equipment.
- **Maintenance Shop** - The maintenance shop will provide space to rebuild and repair process equipment. This building will house the process control room, additional office space, and lunch room facilities for plant workers.
- **Product Storage** - The product storage building will be a wood glulam beam structure and will be designed to store 125,000 tonnes (t) of product. The product storage building is designed for the granular and the standard product.

- **Rail Loadout** - This building will contain the equipment required to load the product into rail cars and will be arranged to limit traffic across the rail lines.

4.7.2 Hazardous Substance Storage

Hazardous substances will be stored in several locations on the site. The fuel tank farm will be located adjacent to the process plant and will contain a 4,000 litres (L) hydrochloric acid mixing tank and a 1,454 L hydrochloric acid holding tote. The tank farm houses a 1,454 L anti-foaming agent holding tote. A 24,000 L oil tank will be located north of the tank farm. A 14,000 L hydrous ammonia tank will be located at the northwest corner of the plant.

The transfer house will contain an 80,000 L anticaking oil storage tank, a 55,000 L dedusting oil storage tank, and a 26,000 L anticaking agent mix holding tank.

A 170,000 L injection oil tank will be stored at each cluster house. The cooling tower pump house will contain a 1,454 L anti-scale holding tote, a 1,454 L bleach holding tote, and a 1,454 L sulphuric acid holding tote. Additional totes will be stored in the warehouse. Used oil will be stored in a 10,000 L tank in the cold storage building along with other hazardous materials.

Pure ethylene glycol will be transported to site by tanker and pumped to the glycol storage tank located in the boiler house. Glycol from the storage tank is pumped to the glycol mix tank where it is mixed with treated water to obtain a 50/50 glycol water mix. The locations for pumping stations for diesel and gasoline equipment are yet to be determined.

At all locations, the hazardous substances will be contained with an adequately sized containment berm or contained in a double-walled environmental tank, depending on the hazardous material. The hazardous substance will be pumped and properly disposed off-site in the event of a leak or spillage. All hazardous substances storage facilities will be designed and permitted in compliance with the MOE requirements.

4.7.3 Other Buildings

In addition to major buildings as listed above, the following buildings will be located on-site:

- cluster house;
- boiler house;
- transfer house;
- mobile equipment repair shop;
- cold storage building;
- raw water pumphouse;
- brine reclaim pond pumphouse;
- cooling pond pumphouse;
- multiple-cell cooling tower; and
- electrical substation.

4.7.4 Environmental Design Features for Site Infrastructure

Environmental design features that have been integrated into the site plan to prevent or limit effects from the Project on the biophysical environment include the following:

- the plant will be designed to reduce usage of energy and water:
  - heat will be recovered, where possible, to reduce the thermal and electrical load on the plant; and
  - control systems will be used to optimize energy usage.
- the plant will be ergonomically designed to reduce exposure to dust and noise and to optimize accessibility;
- double-walled diesel storage tanks will be used for the fuel that is required to operate the back-up generators, firewater pumps, and fuel dispensing for on-site vehicles;
- the fuel storage and dispensing system will consist of double-walled tanks and all fuel dispensing will be performed over concrete containment pads, and in accordance with applicable regulations; and
- the compact plant layout will limit the area that is disturbed by the Project.

4.8 Supporting Infrastructure

4.8.1 Water Supply

Water requirements for the Project are assessed under steady state operating conditions at the maximum planned production of 2.8 Mtpa, with primary and secondary solution mining in operation. Raw water will be used in solution mining, process, and utility requirements within the plant, cooling water, and fire suppression. During normal operations, the maximum average requirement for water is 1,658 cubic metres per hour (m^3/h).

The Saskatchewan Water Security Agency (WSA) will provide raw water for the Project from Buffalo Pound Lake. Yancoal applied to the WSA for the water supply required for the Project, and a positive response has been received, providing preliminary assurance that the water allocation is available and can be supplied without affecting other users of the Buffalo Pound Lake Reservoir.

The raw water supply to site will be through a buried 760 mm diameter coated carbon steel pipeline approximately 101 km long, extending from Buffalo Pound Lake to the Yancoal core facilities area. SaskWater will be responsible for the design, construction, and operation of the water pipeline to the Yancoal core facilities area. Raw water supply to site will enter the Yancoal property from the southwest. Further evaluation of the water supply to site will occur in the feasibility phase of the Project, which will determine a higher level of accuracy regarding the pipeline routing, length, pump sizing, pipe sizing, and booster pumphouse requirements.

The raw water pond storage capacity will be sized to accommodate the site's raw water demands and firewater demands as follows:

- raw water maximum 48-hour surge capacity for process raw water demand of 1,500 m^3/h;
- fire suppression water dedicated capacity of 908 cubic metres (m^3); and
- minimum pond capacity is 72,908 m^3.

The pond design incorporates an average winter ice depth of 0.3 m with the operation of an aerator/bubbler system to maintain an open surface, primarily around the pond intake structure.

The following design features help to conserve water on site:

- The brine from primary mining is processed by mechanical evaporation, which results in the water in the brine being collected as condensate and being recirculated to the primary caverns. This reduces the volume of fresh water required for primary mining.
- The cooling pond brine is used in secondary mining.
- The cooling pond brine is used for cooling in the crystallization condensers before being pumped to the secondary caverns. This reduces the amount of cooling water required in the process.
- Brine from the brine reclaim pond is recirculated and used in the process.

Potable water for the core facilities area will be delivered through an on-site water treatment plant (WTP) after it is drawn from the raw water pond. The WTP and potable water storage tank will be located at the process plant facilities. From the potable water storage tank, the potable water will be distributed through the mill and to the administration building.

SaskWater will be the proponent of the water pipeline project and will be responsible for all regulatory approvals required for providing the new water supply pipeline to the site, including requirements for an environmental assessment if required.

4.8.2 Electrical Power

Electrical power will be supplied by SaskPower through a new 230-kilovolt (kV) overhead transmission line from the SaskPower Condie switching station or through a 230-kV line from the existing Condie to Wolverine line, approximately 18 km west of the Project. The supply line will terminate at the Yancoal-owned Electrical Terminal Station (ETS) located south of the core facilities area.

The ETS feeds the two main 50-megavolt ampere (MVA) power transformers located near the boiler house through buried high-voltage power cables. These transformers step down the voltage to 25 kV for primary distribution.

Power is distributed to electrical rooms in all areas of the plant, ancillary buildings, and the wellfield from the main 25 kV switchgear, located near the boiler house. Electrical rooms accommodate unit substations or switchgear connected to nearby outdoor transformers. Unit substations and outdoor transformers step down the voltage to utilization levels of 600 volt (V) or 4.16 kV.

SaskPower will be the proponent responsible for all regulatory approvals required for providing the new electrical service to the site, including the environmental assessment, if required.

4.8.3 Natural Gas

The natural gas supply to site will require the installation of a new buried 400 mm diameter carbon steel yellow-jacketed high-pressure pipeline. Natural gas supply to site will run approximately 95 km from a tie-in point southeast of Regina. The supply pipeline will enter the Yancoal property from the south and extend to the natural gas regulator station, which is located southwest of the administration building and parking lot.

The supply is provided with two pressure systems from the natural gas regulator station. A higher-pressure system will supply the mill buildings' boiler house facility. A low-pressure system, reduced at the regulator station, is distributed through buried carbon steel yellow-jacketed pipelines to the loadout building, maintenance shop, and administration building.

TransGas will be the proponent responsible for all regulatory approvals required for providing the new natural gas service to the site, including the environmental assessment, if required.

4.8.4 Steam

The main boiler system creates steam from condensate or make-up water to drive the main processing plant. Steam is used to heat propylene glycol through a shell and tube heat exchanger.

For this Project, four natural gas boilers work in parallel to provide the steam for each of the process trains. The boilers pull condensate from the condensate tank and heat it to create 99% saturated steam at 7.8 megapascal (MPa). All four boilers have a common intake, but each has an individual economizer that uses heat from the exhaust stack to preheat the outside air before it contacts the burner. The boilers have a main burner and pilot burner system that is regulated to ensure high efficiency and minimal pollutant through a perfect burn. Each boiler has its own exhaust stack.

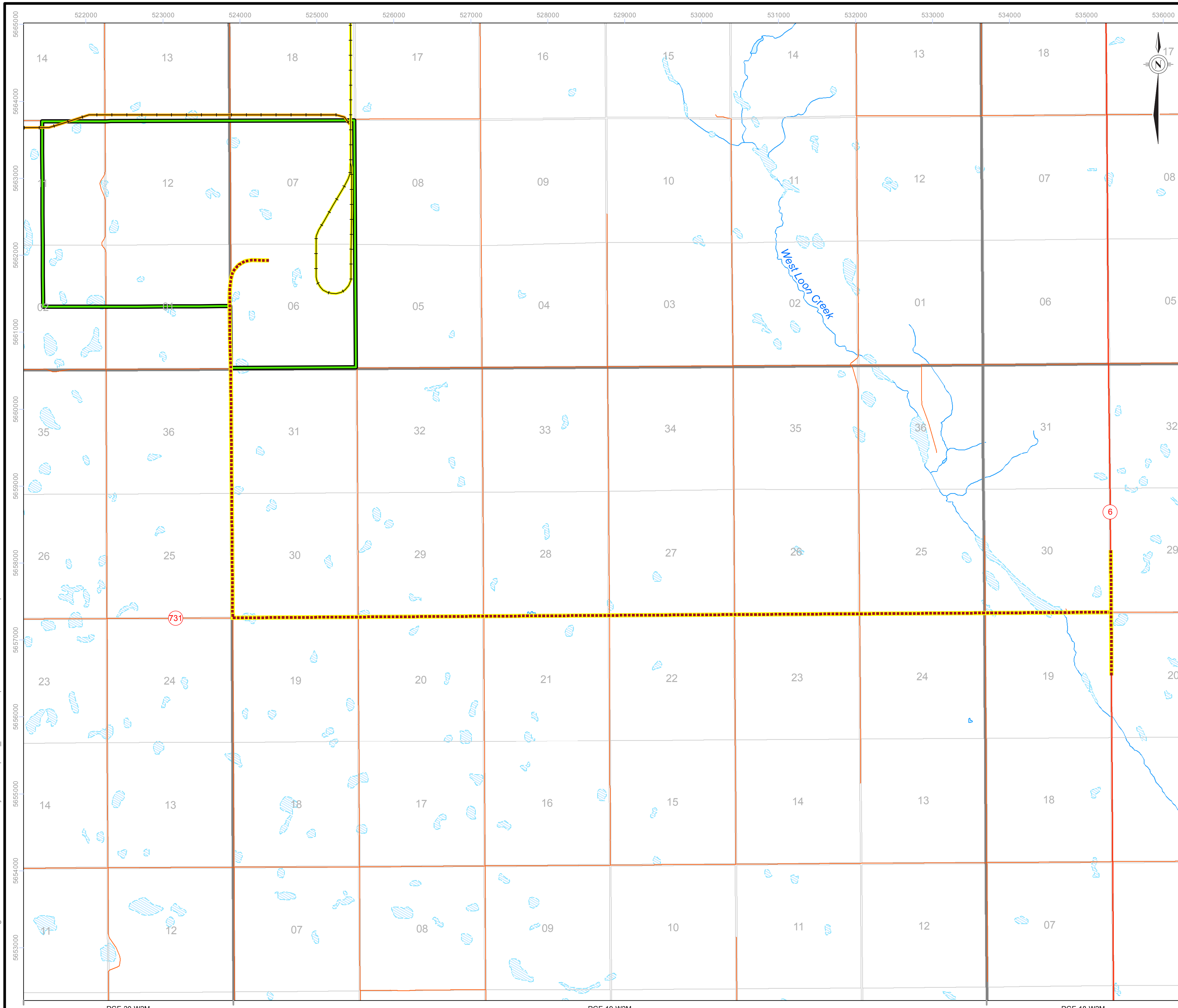
4.8.5 Telecommunications

SaskTel is expected to be the telecommunications service provider. SaskTel will own and maintain all telecommunications infrastructure up to the site telecommunications distribution system. SaskTel will be the proponent responsible for all regulatory approvals required for providing the new telecommunication services to the Project, including the environmental assessment, if required.

4.8.6 Roads

The main vehicle access to the Project site will be from Highway 6, turning east onto rural grid road 731 for approximately 5.6 km, and turning north onto an existing secondary grid road for approximately 1.6 km before entering the south boundary of the core facilities area. The site access is shown on Figure 4.8-1.

Highway 6 is an existing asphalt-surfaced all-season road under the jurisdiction of the Ministry of Highways and Infrastructure. The highway requires the addition of new turning lanes and acceleration and deceleration lanes at the turnoff to grid road 731. Grid road 731 is an existing gravel-surfaced primary grid road under the jurisdiction of the local rural municipality. The grid road requires upgrades to bring it to a full width, asphalt-surfaced, all-season road from the Highway 6 turnoff to the Project access road turnoff.



LEGEND

- HIGHWAY
- ROAD
- TOWNSHIP AND RANGE BOUNDARY
- SECTION BOUNDARY
- CORE FACILITIES AREA
- PROPOSED RAIL SPUR TO CN
- ALTERNATE RAIL SPUR TO CP
- PROPOSED ACCESS ROAD

REFERENCE

INFRASTRUCTURE DERIVED FROM AMEC DRAWING NO. 100110-2000-DD10-GAD-0002 REV. B
TMA DESIGN REVISED BY GOLDER, 2014
CANVEC © NATURAL RESOURCES CANADA
NAD83 UTM ZONE 13

1 0 1
SCALE 1:50,000 KILOMETRES

PROJECT
YANCOAL
SOUTHEY PROJECT

TITLE
PROPOSED SITE ACCESS

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0197	FILE No.	
DESIGN	MT	04/12/14	SCALE AS SHOWN	REV. 0
GIS	LMS	29/12/14	FIGURE: 4.8-1	
CHECK	MT	30/12/14		
REVIEW	GM	30/12/14		

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The core facilities area access road from the turnoff at grid road 731 is an existing gravel-surfaced, secondary grid road, servicing local farming operations and farmyards. The core facilities area access road requires upgrades to bring this road to full-width, asphalt-surfaced, all-season road conditions.

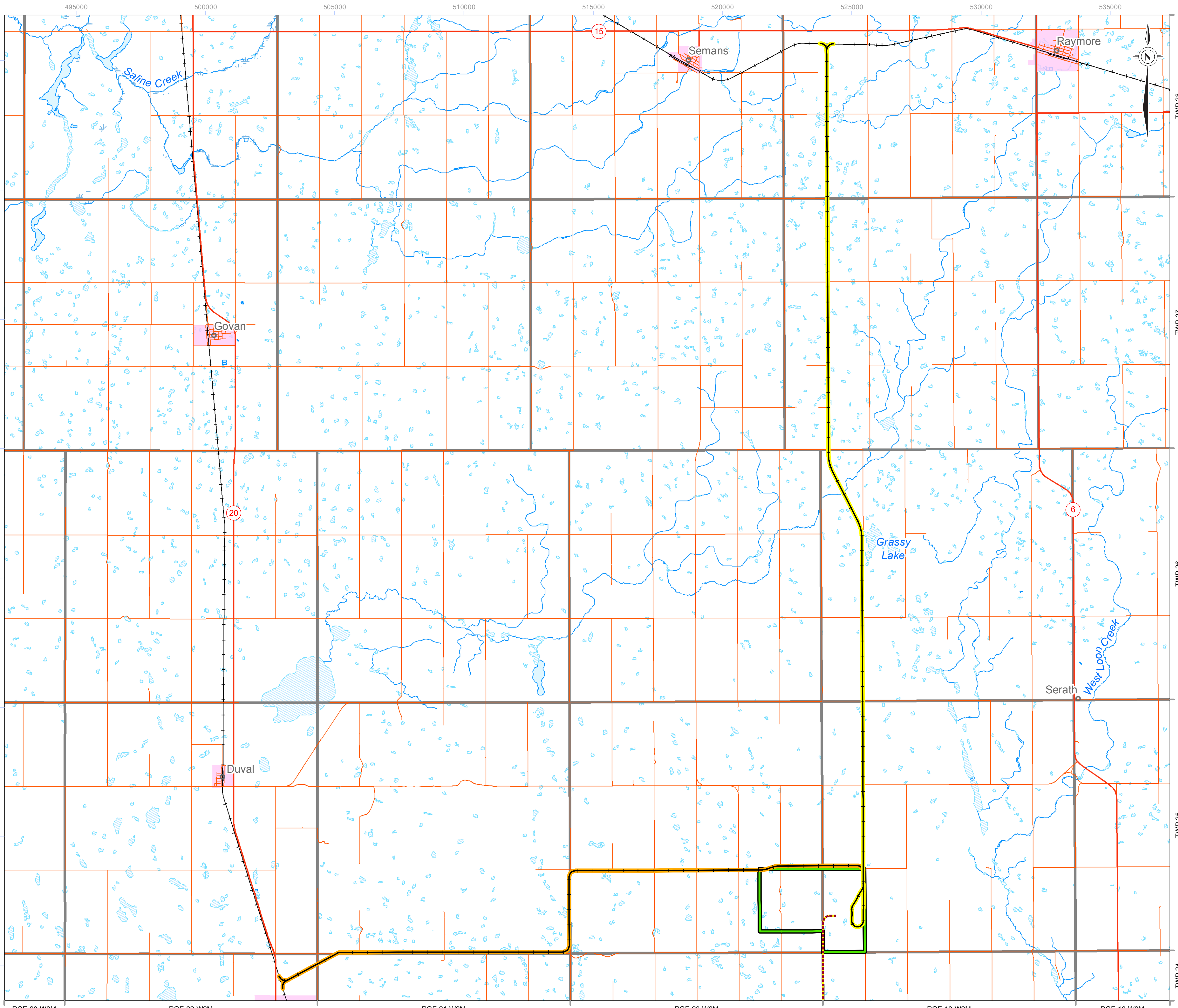
Vehicles and workers coming to the site will use the main parking lot and access the site through the controlled access point at the main security gate. All vehicular access to site (i.e., that is not through the main parking lot) will access the site through the main security gate on the northwest side of the administration building. All other gated access points around the property will remain closed and locked.

The core facilities area road layout accommodates general site traffic for operating and maintaining the property. The road layout considers anticipated vehicle and equipment turning geometrics and clearances, while maintaining safe traffic flow and access. Core facilities area roads are divided into main access roads, service roads, and utility roads. Access roads to the well pads for mining will be developed off existing grid roads, to the extent possible, to reduce surface disturbance. Yancoal will work with the local rural municipality for road improvements and new access roads.

4.8.7 Rail

The railway route is designed to transport potash from the plant to a port facility on the west coast. The CP Lanigan line is located west of the Project and roughly follows Highway 20. The CN Watrous line is located north of the plant and roughly follows Highway 15. Both lines are reasonably accessible and are about the same distance from the project. For both options, the off-site rail line is expected to be 25 to 35 km in length (Figure 4.8-2). The railway spur will be a single track designed to handle the incoming and outgoing traffic. At this phase of the study, there are no plans for railway bridges on-site. The tracks will be developed to provide safe operation and storage of the unit trains. Carloads are anticipated at maximum 120,000 kilograms (kg) loading.

On-site rail is designed to store one decoupled unit train of empty railcars and one decoupled unit train of full railcars. The trackage layout on site provides for loading railcars from either of the storage tracks to either of the two loadout bays in the loadout facilities. There is sufficient track length provided on site to couple a full unit train on the property before it leaves the site.



LEGEND

- COMMUNITY
- HIGHWAY
- ROAD
- RAILWAY
- TOWNSHIP AND RANGE BOUNDARY
- URBAN MUNICIPALITY
- PROPOSED ACCESS ROAD
- PROPOSED RAIL SPUR TO CN
- ALTERNATE RAIL SPUR TO CP
- CORE FACILITIES AREA

REFERENCE

PERMIT BOUNDARY: POTASH DISPOSITION © 2012, GEOLOGICAL ATLAS OF SASKATCHEWAN, MINISTRY OF ENERGY AND RESOURCES SASKATCHEWAN
INFRASTRUCTURE DERIVED FROM AMEC DRAWING NO. 100110-2000-DD10-GAD-0002 REV. B
BASE DATA: CANVEC © NATURAL RESOURCES CANADA
NAD83 UTM ZONE 13

3 0 3
SCALE 1:150,000 KILOMETRES

PROJECT

YANCOAL
SOUTHEY PROJECT

TITLE

RAIL CONNECTION OPTIONS

Golder Associates
Saskatoon, Saskatchewan

PROJECT		12-1362-0197	FILE No.
DESIGN	MT	04/12/14	SCALE AS SHOWN REV. 0
GIS	LMS	29/12/14	
CHECK	MT	30/12/14	
REVIEW	GM	30/12/14	FIGURE: 4.8-2

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One unit train will consist of approximately 170 railcars and 3 locomotives with a maximum unit train length of 2,500 m. On-site track maximum speed is 25 kilometres per hour (km/h), with final speed considerations dependant on track slope.

There will be approximately 11 km of on-site rail lines, including the following:

- yard track (empty and full): 6,000 m;
- yard track (run-around): 3,100 m; and
- single track (staging): 1,700 m.

4.8.8 Environmental Design Features for Supporting Infrastructure

Environmental design features have been incorporated into the supporting infrastructure design process to reduce or eliminate potential environmental effects from the Project. The existing road network in the area will be used where possible to limit surface disturbance from new road construction. In addition, new or upgraded roads required for access to the core facilities area will be paved to reduce fugitive dust emissions from road traffic. Where possible, roads, railroads, and utility lines (e.g. water, power, and gas) will be routed along existing utility corridors to limit effects on undisturbed areas.

4.9 Domestic and Industrial Waste Management

4.9.1 Domestic and Non-hazardous Industrial Waste

Domestic waste generated on-site during the life of the Project includes food wastes, wastes from construction, operations and administration offices, and sanitary sewage. Garbage and food wastes will be collected in containers designed to limit wildlife attraction. Recyclable materials will be sorted and collected in appropriate containers. All domestic wastes will be collected and transferred to appropriate off-site disposal facilities by a licensed contractor. Bins and receptacles will be allocated around the site in appropriate areas (i.e., cardboard recycling bin in the warehouse, metal recycling bin in the machine shop, and garbage bins outside office areas). Sanitary sewage will be collected from washroom and toilet areas into lift stations and pumped to a two-cell sewage lagoon treatment system. The sewage lagoon will be managed according to MOE and municipal requirements.

Non-hazardous wastes that will be generated during mine and processing operations typically will include paper, cardboard, plastics, rubber, wood, metal, and other inert materials. Yancoal will establish a recycling program for these wastes to reduce the amount of material that ultimately transferred to the off-site landfill. Appropriate waste containers will be provided where materials are generated and the materials will be segregated at source for recycling. The material will then be transferred to offsite recycling companies. Inert wastes will be collected and transferred to an off-site, permitted landfill for final disposal by a licensed contractor.

4.9.2 Hazardous Industrial Waste

All storage and handling of hazardous materials and hazardous waste will meet the requirements of *The Hazardous Substances and Waste Dangerous Goods Act* (2004) and *Transportation of Dangerous Goods Act* (1992), including employee training, storage facility design and operation, labelling and material control (e.g., WHMIS). Hazardous industrial waste expected to be generated at the site during operations includes waste hydrocarbons, chemicals, glycols, solvents, oil, fuel, acid, reagents, antifreeze, and batteries. These materials will be kept in cold storage. At all locations, the hazardous substances will be contained either with an adequately sized containment berm or contained in a double-walled environmental tank depending on the hazardous material. A licensed contract will be negotiated for disposal of hazardous waste.

Most of the hazardous and contaminated waste is anticipated to be generated from the maintenance shop, which services plant equipment, and the equipment repair shop, which services the mobile equipment. If a major spill occurs, the cleanup, treatment, and disposal of the contaminated waste and soil will be handled by a specialized subcontractor who is certified to dispose of the substance spilled. Batteries will be recycled by a provincially recognized recycler.

A Waste Management Plan will be developed in accordance with regulatory requirements and will include collecting wastes in suitable containers and storing them for shipment off-site to recycling or disposal facilities using a licensed contractor. Where suppliers will accept them, empty containers used to ship these materials to site will be returned to the supplier. Those that cannot be returned will be shipped to recycle or disposal facilities.

4.9.3 Environmental Design Features for Waste Management

The following environmental design features will be integrated into the waste management procedures for the site to protect the biophysical and socio-economic environments:

- a recycling program will be implemented and recycling receptacles will be made accessible for site workers;
- a waste management program will be implemented;
- storage facilities for non-hazardous and hazardous wastes will meet appropriate regulatory requirements and site workers will be properly trained;
- disposal of hazardous wastes will be handled by a licensed contractor and hauled to an approved facility; and
- spill response materials will be located around the Project site.

4.10 Health, Safety, Security and Environment Management System

Yancoal will develop HSSE Management Systems that will conform to regulatory requirements and will endorse the principles of continual improvement. These programs are described below.

In addition, the EPCM contractor will be required to prepare a site-specific construction HSSE program and will include the following:

- corporate HSSE policies and procedures of the owner;
- corporate HSSE policies and procedures of the EPCM contractor;
- Occupational Health and Safety Association (OHSA) requirements;
- HSSE risk assessment of the site;
- environmental permit requirements and site regulations; and
- current industry best practices.

4.10.1 Occupational Health and Safety Plans

Yancoal's Occupational Health and Safety Plan (OH&S) will be developed in conformance to regulatory requirements, notably, *The Saskatchewan Employment Act* (2014) and *The Energy and Mines Act* (1982-83). Safe working conditions will be in effect from the commencement of construction and in consultation with the Saskatchewan Construction Safety Association.

All contractors will be required to have safety programs that are approved by the Saskatchewan Construction Safety Association. Contractors will be required to be registered with Workers Compensation Board. Basic elements of the OH&S program will be training, on-site job observations, safety program audits and monitoring, incident reporting, safety meetings and hazardous awareness, random drug and alcohol testing for contractors and employees, and the proper use of equipment.

4.10.2 Environmental Protection Plans

Yancoal will develop an Environmental Protection Plan (EPP), which will be developed in conformance to regulatory and corporate requirements. The EPP is a document that outlines site-specific environmental protection practices or procedures to be implemented during each phase of the Project. The plan will include environmental mitigation, environmental monitoring, training, auditing, and the concept of continual improvement. The EPP will be based on regulatory requirements as established by MOE during all stages of construction, operation, and decommissioning and reclamation.

4.10.3 Emergency Response

An Emergency Response Plan (ERP) will be developed to provide rapid and competent response to incidents that may occur. Requirements of *The Energy and Mines Act* and *The Saskatchewan Employment Act (Part III Occupational Health and Safety)* will form the principles of the ERP. Continual employee and contractor training will be foremost in the ERP. Rapid site response to fire, medical emergencies, hazardous material incidents, and natural incidents (e.g., extreme weather events) will be fundamental to the ERP. The ERP will be developed in conjunction with local and regional first responders including fire, medical, and hazardous materials response agencies.

Spill response procedures will be developed in conjunction with a qualified spill response contractor. Appropriate spill response materials (e.g., absorbent pads or booms) and equipment will be located on-site at strategic locations. Employees will be trained to implement spill response procedures.

4.10.4 Employee Education and Training

Employee education and training will be provided by Yancoal. An employee-training program will be established to provide employees with the training necessary to complete their job in a safe and technically competent manner. Supervisor job observations will be implemented as part of the safety program. Technical training will be provided to workers in technical positions (e.g., engineering and environment) so that jobs tasks are completed as required.

4.10.5 Community Relations

Community relations workers will be involved in all aspects of the environmental assessment process, construction, and ongoing operational aspects of the Project. Yancoal has been communicating actively with the local public, and First Nations and Métis communities through face-to-face meetings and open houses. Yancoal will continue to update local communities with the Project's progress so they have an opportunity to provide input.

4.11 Human Resources

A Human Resources Plan will be developed prior to the commencement of construction. Given the current labour market in Saskatchewan and the number of construction and operational workers that are required, labour likely will need to be sourced from outside of Saskatchewan. The Human Resources Plan will be subject to continual monitoring, as labour conditions in the province change.

Based on other recent projects in Saskatchewan and Western Canada, the site will be constructed on a managed open shop basis and will not be exclusively union or non-union. Industry standards, accommodation, and hours of work will be adapted to either labour arrangement. Labour relations guidelines and site-specific regulations will be developed before construction begins so any potential labour concerns are minimized. These guidelines will address items such as hiring other contractors' workers, drug and alcohol policy, rotations and hours of work, general site and HSSE rules, and other pertinent policies. The labour relations guidelines and regulations will be included in the tender packages with appropriate contract language to provide suitable enforcement.

It is anticipated there will be approximately 2,200 workers required during the peak of construction. These will include equipment operators, electrical, carpentry, heating, ventilation, and air conditioning (HVAC), specialized welding, safety, environmental, procurement, and administration. About 300 full-time jobs will be created for operations. These jobs are typical for a large industrial operation and include drilling, heavy equipment operators, process operators, instrumentation, environmental, safety, training, engineering, administration, and management.

4.12 Decommissioning and Reclamation

A Project-specific D&R Plan will be developed during Project planning. The D&R Plan provides a framework for the decommissioning of facilities and infrastructure at the Project site in such a way that the environment and the public will be protected over the long-term. Geotechnical, geochemical, and hydrogeological considerations will be integrated into the D&R Plan.

The main objective of the D&R Plan for the Project will be to return lands disturbed by Project activities to a condition that is physically stable, safe, and environmentally sustaining in keeping with the land use and landscape of the day. A financial assurance mechanism will be put in place at the time of licensing of the Project to limit the financial risk to society for the financial burden associated with the implementation of the D&R Plan.

During regulatory permitting for the Project, a D&R Plan will be submitted in keeping with industry best practice and in consultation with the regulatory agencies. The D&R Plan will provide the technical details, costing and financial assurance mechanism for decommissioning the Project, and will seek compliance with Section 12(a) and 14(2),(a),(b),(c) of the *Mineral Industry Environmental Protection Regulations* (*MIEPR*) of *The Environmental Management and Protection Act* (2002).

A site-specific conceptual D&R Plan will be presented in the EIS that provides a preliminary outline of how the Project infrastructure and the residual waste materials will be decommissioned and the associated lands reclaimed. Information on the following topics will be included in the conceptual D&R Plan:

- decommissioning objectives;
- approach;
- a description of site-specific decommissioning and reclamation activities; and
- a discussion on some limiting factors associated with the decommissioning and reclamation of a long-lived potash production facility and consideration of how these factors can be addressed.

It is understood that MOE is working to establish decommissioning and reclamation requirements specific to the potash mining industry. Once these requirements are in place, the D&R Plan will be revised accordingly.

5.0 EXISTING ENVIRONMENT

This section provides an overview of existing environmental conditions for the biophysical and socio-economic components that may be influenced by the Project. The overview is focused on those biophysical and socio-economic components that are likely to be valued and important to society (e.g., air quality, surface water quality, listed plant and wildlife species, heritage resources, and employment). The information in the existing environment overview was acquired through field surveys and literature reviews.

Data collected during baseline studies will be used to complete a technical assessment of the potential interactions between the Project and the environment and to predict the potential incremental and cumulative effects from the Project and other developments. The following components will be included in the assessment:

- atmospheric and acoustic environment;
- geology and hydrogeology;
- surface water resources (e.g., hydrology, water quality, fish, and fish habitat);
- terrestrial resources (e.g., terrain and soils, vegetation, and wildlife);
- cultural resources (e.g., heritage resources and traditional and non-traditional land use); and
- socio-economics.

5.1 Atmospheric and Acoustic Environment

5.1.1 Overview of Existing Conditions

The climate in the Project region has been classified as a semi-arid moisture region according to the Thornthwaite (1948) temperature and precipitation method of climate classification for the years from 1961 to 1990 (Fung 1999). The region experiences warm summers and cold, dry winters, prone to extremes at all times of the year. The mean annual temperature is 3.1 degrees Celsius (°C), but temperatures generally are below zero from November to March. January is the coldest month with a daily mean of -14.7°C while July is the warmest month with a daily mean of 18.9°C.

The annual average precipitation is 389.67 mm, of which 79% falls as rain and the remaining balance occurring as snowfall. The highest precipitation rate is in June with a long-term average of 70.93 mm. February has the least precipitation with a long-term average of 9.41 mm.

The region experiences uniform wind speeds over the year with mean monthly values ranging from 15.97 to 20.39 km/h. May typically has higher average wind speeds (average speed of 20.39 km/h); while July usually has the lowest wind speeds (average speed of 15.97 km/h). Winds most frequently come from the southeast, followed by the west and northwest.

Existing sources of air emissions and air-borne dust include traffic on public roads, rail transportation, agricultural activity, and residential activity. Wind can generate air-borne dust from fields and roads. Air emissions include SO_2, NO_X, and PM. Sulphur dioxide (SO_2) and NO_X are emitted directly from the combustion of fossil fuels (e.g., diesel and gasoline). Particulate matter (PM) is emitted directly from combustion, formed as a secondary process in the atmosphere after combustion, and results from material handling (e.g., potash transfer system) and road dust.

Existing sources of noise include agricultural and residential activity and road traffic.

5.1.2 Baseline Studies

For the purposes of air quality dispersion modelling, the MOE has delineated five zones in the province: Northern, North Central, Central, Southwestern, and Southeastern. The MOE has developed the regional meteorological datasets for use in air dispersion modelling and the background concentrations of air contaminants for each zone. The Project is located in the Southeastern zone and so this will be used as the study area for air quality.

In Saskatchewan, there are no provincial noise requirements or standard methods for conducting baseline noise surveys. For the purpose of this Project, the use of the Alberta Energy Resource Conservation Board (ERCB) Directive 38: *Noise Control Directive* (Directive 038) methods (EUB 2007) is recommended. In accordance with ERCB Directive 038 (EUB 2007), the acoustic environment local study area (LSA) is defined as a 1.5 km buffer around the Project footprint. The acoustic environment regional study area (RSA) extends 5.0 km in all directions from the Project footprint. This definition of the acoustic environment RSA includes the entire area over which direct effects on the acoustic environment associated with the Project, or cumulative effects associated with the Project in combination with other noise sources could be readily detectable (Drew and South 2009).

5.1.2.1 Atmospheric Environment

Air quality baseline data will be collected at or near the Project site (e.g., core facilities and mining areas). Saskatchewan Ambient Air Quality Standards (Government of Saskatchewan 1996) will be applied to areas beyond the Project boundary (e.g., the Project fenceline). Air quality “inside the fence” is not considered ambient and is administered through provincial OH&S regulations.

Baseline air quality and meteorological data will be used as inputs to the air dispersion model that forms the basis of the assessment. The focus will be on the data collection and modelling of air quality compounds that are relevant to the potash mining industry, specifically particulate matter including total suspended particulate (TSP), particulate matter having a nominal aerodynamic diameter of 10 microns or less (PM_{10}), and particulate matter having a nominal aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$). The assessment would also require baseline information on additional compounds including data on ambient concentrations of SO_2 and nitrogen dioxide (NO_2). Monitoring of these parameters will continue for the life of the Project.

Air quality predictions, including the ground level concentrations and deposition rates of trace gases and PM, are linked closely to other environmental assessment disciplines such as surface water quality, fish habitats, soils, vegetation, and wildlife habitat.

Baseline data collection provides the standard against which future predictions and modelling can be put into the correct context. Comparison to baseline data is the most objective way to determine the contributions of the Project emissions to the over-all emissions load in a particular air-shed.

The objectives of the air quality baseline study are the following:

- to provide representative baseline concentrations of PM and trace gases; and
- to provide context for potential direct and indirect effects from the Project on air quality and surface water and terrestrial environments.

5.1.2.2 Acoustic Environment

Noise is typically considered a perception issue and therefore the focus of noise studies is normally on human response. The Project is in an area of extensive agricultural development, and therefore, noise effects on wildlife are anticipated to be small relative to baseline conditions. The focus of the noise baseline study will be on human exposure.

In Saskatchewan, there are no provincial noise requirements or standard methods for conducting baseline noise surveys. For the purpose of this Project, the use of ERCB Directive 38 methods (EUB 2007) is recommended. By including in the study a wider range of noise sensitive land uses than cited in the ERCB method, the baseline noise study will be consistent with Health Canada noise guidance (Health Canada 2010).

The baseline noise study was completed in the spring and summer of 2014 and determined the ambient noise levels at locations considered sensitive to noise from the human perspective (e.g., residences, parks, campgrounds, schools, hospitals, nursing homes, and spiritual areas [e.g., churches and First Nation's sites]). The baseline study measured ambient noise levels over one 24-hour continuous period at four locations, all of which were residences.

5.2 Geology and Hydrogeology

5.2.1 Overview of Existing Conditions

The near-surface geology of southern Saskatchewan is the result of multiple glacial advances and retreats occurring from approximately 20,000 to 14,000 years ago, during which a blanket of glacial "drift" was deposited over much of the bedrock surface. Drift deposits consist of till interbedded with stratified deposits of silt, sand, and gravel and can be present at thickness up to 300 m (Maathuis 1992).

The ground surface within the KP 377 and KP 392 permit areas is mainly a ridged moraine formation that generally is drained to the west and south with water collecting in the Last Mountain Lake area and the Qu'Appelle Valley. The topography within the KP 377 and KP 392 permit areas is hummocky with ground surface elevations varying between approximately 550 and 590 metres above sea level (masl) as the general trend.

5.2.1.1 Geology

The surficial geology of southern Saskatchewan is the result of multiple glacial advances and retreats, taking place between approximately 14,000 and 20,000 years ago. Because of these events, a layer of glacial deposits, consisting of till interbedded with stratified deposits of silt, sand, and gravel, overlies much of the bedrock in the southern half of the province. Surficial stratified deposits (SSD) were deposited mainly by postglacial streams and lakes. The texture of the SSD grades progressively from sand and gravel in the apex of the deltas to clay in the deeper parts of the basins (Simpson 2004).

Thick Cretaceous age deposits of highly over-consolidated silt and clay shale comprise the underlying bedrock throughout the region. The extent of these shale deposits is great and they are considered a reliable geological datum (Saskatchewan Agriculture 1986). Due to the thickness and low permeability of these shale deposits, the top boundary is taken to be the base of regional groundwater near surface flow systems (Maathuis and van der Kamp 1988). The outcropping of these shale deposits is minimal and is associated with river valleys and other erosional features.

The Cretaceous bedrock surface is highest in the southwest and northeast of the RSA. The Project is located within a trough trending northwest-southeast corresponding to the Hatfield Valley erosions buried features. The bedrock surface is lowest beneath the Hatfield Valley reaching elevation as low as 300 masl.

5.2.1.2 Bedrock Geology

The basement rock in the RSA is igneous and of Precambrian age, existing at depths greater than approximately 1,900 metres below ground surface (mbgs). Table 5.2-1 provides a summary of the bedrock geology in the study area.

Several processes altered the bedrock topography within the study area (Simpson 2000). These included preglacial erosion and deposition, glacio-fluvial and glacial erosion. Preglacial rivers flowing from the Rocky Mountains eastward across Saskatchewan created channel features within the bedrock surface. Glacial action and meltwater created moraine features and glacial meltwater channels, especially within the Qu'Appelle Valley. The Bearpaw Formation and Judith River Formation or the Pierre Shale make up the bedrock surface and are encountered approximately from 350 to 450 masl below permit areas KP 377 and KP 302. The Pierre Shale Formation is encountered at approximately the same depth below permit area KP 392. In the study area, the Judith River Formation is present in the southeast and has an approximate thickness of 65 m, but is laterally discontinuous.

Table 5.2 -1: Bedrock Geology of the Regional Study Area

Hydrologic Group	Geologic Age	Stratigraphic Unit	Lithology
Confining Layer	-	Bearpaw shale Formation/Pierre Shale Formation	Shale with minor Sandstone
Upper Cretaceous	Late Cretaceous	Milk River, Judith River (Belly River), Medicine Hat, Viking Formations	
Confining Layer	-	Joli Fou Formation	
Mannville	Early Cretaceous	Mannville Group	Sandstone, Shale, Mudstone
Confining Layer	-	Vanguard shale	Limestone, Carbonate, Dolomite, Shale, Argillite, Anhydride
Jurassic	Jurassic	Vanguard, Shaunavon, Gravelbourg and Watrous Formation	
Confining Layer	Triassic	Watrous shale and evaporates	
Madison	Mississippian	Big Snowy Group; Charles, Mission Canyon and Lodgepole Formations	
Confining Layer	-	Three Forks Group	
Saskatchewan	Late Devonian	Birdbear and Duperow Formations	
Manitoba	Middle Devonian	Souris River, First Red Beds, Dawson Bay and Second Red Beds Formations	
Elk Point	Middle Devonian	Prairie Evaporite, Ratner, Winnipegosis and Ashern Formations	
Silurian	Silurian - Ordovician	Interlake Formation and Big Horn Group	Sandstone, Shale, Siltstone, Limestone, Dolomite
Deadwood	Ordovician - Cambrian	Winnipeg and Deadwood Formations	Limestone, Shale, Sandstone
Confining Layer	Precambrian	-	-

"-" = not applicable

5.2.1.3 Quaternary Geology

The sediments in southern Saskatchewan consist of multiple layers of Quaternary glacial till and stratified drift underlain by Tertiary/Quaternary fluvial deposits. The fluvial deposits, overlying the bedrock within the study area, are referred to as the Empress Group and Wynyard Formation. Above this, in ascending order are the glacial drift deposits of the Sutherland Group and Saskatoon Group

Wynyard Formation

The Wynyard Formation sands and gravels are Tertiary in age and, where it exists, lie between the bedrock surface and Sutherland Group. This formation was deposited pre-glaciation. Most boreholes indicate that the formation is deposited over the Pierre Shale and is hydraulically connected to the Empress Group sediments. The Tertiary Wynyard formation appears in the northeastern corner of the study area at an elevation of approximately 475 masl.

Empress Group

Above the bedrock of the Upper Cretaceous is the Empress Formation, which marks the start of the Tertiary period and extends into the Quaternary period. The Empress Group, where it exists, is located between the bedrock surface and the Sutherland Group and was deposited pre- and pro-glaciation. The Empress Group, a fluvial deposit, commonly includes quartzite, dark minerals, and chert gravel in the lower preglacial unit (Tertiary). The upper proglacial unit (Quaternary) contains sands and gravels. The lower unit is an infill in bedrock surface valleys and the upper unit can occur in bedrock surface valleys and as a blanket feature on the bedrock surface uplands. The preglacial derivation of the Empress Group is commonly noncalcareous while the proglacial unit is usually calcareous. Its thickness, where it exists, can be up to 85 m and is comprised of stratified gravel, sand, silt, and clay sediments. The Empress Group may be encountered at elevations ranging from 400 to 500 masl with the study area.

Sutherland Group

The Sutherland Group is the lowermost till found stratigraphically below the Saskatoon Group. The Sutherland Group sand and gravel unit is an intratill aquifer that intermittently exists across the study area. The Sutherland Group has a maximum thickness of 165 m, which occurs in the northeast corner of the study area in the Touchwood Hills area.

Saskatoon Group

The Saskatoon Group lies stratigraphically between the Sutherland Group and the ground surface. It is the most continuous stratigraphic unit in the area. The maximum thickness of the Saskatoon Group is 175 m, which occurs northeast of the KP 392 permit area in the Touchwood Hills.

The Saskatoon Group can be broken down to several sub-groups. In ascending order these sub groups are:

- intertill sands and gravels;
- Lower Floral Formation till;
- Floral sands and gravels (Saskatoon Group intratill aquifer or Riddell Member);
- Upper Floral Formation till;
- Battleford Formation till;
- SSD; and
- alluvium.

5.2.1.4 Hydrogeology

In the study area, aquifers may be composed of poorly sorted or well-sorted gravel and/or sand, and aquitards may be composed of glacial till, lacustrine silt, and clay deposits, or marine silt and clay bedrock deposits. Hydrogeology in the study area involves the interactions among surficial sands and gravels, inter and intra till granular sediments and preglacial valley fills. Intertill granular sediments are those present between the till units of the Saskatoon and Sutherland Groups. Intratill granular sediments are within the Saskatoon and Sutherland Group till units.

The main aquitards in the study area are the clayey tills of the Saskatoon and Sutherland Groups that confine the stratified intertill and intratill sand and gravel deposits; the clay shale of the Bearpaw Formation or Pierre Shale that confine the lower surface of the Empress Group stratified sand and gravel deposits where present, and the clay of the Lea Park Formation which confines the Judith River Formation silts and sands.

Bedrock Aquifers

Mannville Group/Blairmore Formation

Above the Jurassic units lies the Lower Cretaceous Mannville Group (also known as the Blairmore Formation). The Mannville Group exists across the southern portion of Saskatchewan and is well known for hosting heavy oil deposits in the Lloydminster region. The Mannville Group is a complex arrangement of filled-in channels, blanket sands, and interbedded shale.

Lower Colorado Group Viking Formation

Although the Lower Colorado Group is composed mainly of shale deposits, the Viking Formation is a shaley sandstone sequence that can contain granular sandy units. These sandstone and sandy units may act as a local aquifer, although their extent and continuity within the study area is not well defined.

Montana Group Judith River Formation

Above the Lower Colorado Group is the Lea Park Formation, which is overlain by the Judith River Formation. It is comprised of nonmarine, interbedded very fine-grained sand, silt, and clay. The Judith River Formation pinches out in the western portion of the study area where the Lea Park Formation and Bearpaw Formation are referred to collectively as the Pierre Shale. The Judith River Formation has an average thickness of 20 m where present, and an approximate depth ranging from 100 m to 150 mbgs where present.

Tertiary/Quaternary Aquifers

Wynyard Formation Aquifer

The Wynyard Formation aquifer is Tertiary in age and deposited stratigraphically above the Pierre Shale. It consists of gravel, sand, and silt where present and can range in thickness up to 15 m. It is hydraulically connected to the Empress Group sands and gravels and is often indistinguishable without detailed lithological descriptions.

Empress Group Aquifers

The aquifers belonging to the Empress Group primarily are of fluvial origin and lie just above the bedrock surface within local bedrock depressions and valleys incised within the bedrock surface. Other Empress Group aquifers occur in bedrock depressions and generally are localized. The Empress Group ranges from 50 to 250 mbgs where it occurs in the study area, and it can be as thick as 85 m near the towns of Nokomis and Cupar.

The Hatfield Valley aquifer is the most significant groundwater resource of the Empress Group and has resulted from the infilling with fluvial deposits of an expansive bedrock valley that runs southeast from the Alberta to Manitoba borders through central Saskatchewan. The Hatfield Valley aquifer directly underlies the KP 377 permit area and all but the southeastern portion of the KP 392 permit area, averaging 30 km in width. The sediments that comprise the Hatfield Valley are medium to medium-coarse sand and gravels with minor amounts of silt and clay. The Empress Group aquifer is the most used source of groundwater in the study area.

Sutherland Group Aquifer

The Sutherland Group aquifer is located within the tills of the Sutherland Group as stratified sand and silt beds. Due to a lack of deeper wells, the Sutherland Group aquifer is not as well defined as the Saskatoon Group aquifers, but it does cover more than half of the study area. The Sutherland Group aquifer is found around 50 to 125 mbgs. The Sutherland Group aquifer is the most dominant aquifer beneath the Touchwood Hills in the study area, where aquifers can reach thicknesses of up to 30 m.

Saskatoon Group Aquifers

Intertill Aquifer

Where present, the Intertill aquifer overlies the Sutherland Group till and is overlain by the Saskatoon Group till. Within the eastern portion of the study area, the Intertill aquifer is present at thicknesses up to 75 m near the Touchwood Hills and is usually found 25 to 75 mbgs. Isolated deposits of the Intertill Aquifer occur in and around the KP 377 and KP 392 permit areas.

Saskatoon Group Aquifer (Intratill)

Saskatoon Group aquifers refer to aquifer systems located within the Saskatoon Group till. These aquifer systems are present as isolated deposits within the study area. They consist of sand and gravel units within the Saskatoon Group tills and can range up to 40 m in thickness east of the permit areas. The Saskatoon Group aquifer (or Riddell Member) can be characterized by fossilized bone, wood, and shells (Sauer and Christiansen 1996).

Surficial Stratified Deposits/Alluvium Aquifer

Surficial Stratified Deposits sand is the uppermost unit present in the study area and predominately found near Last Mountain Lake and the Qu'Appelle Valley. Groundwater in surficial aquifers originates as precipitation that has infiltrated down from the ground surface to the water table. Recharge occurs seasonally, mainly during spring snowmelt and during intensive or prolonged rainfall. Surficial Stratified Deposits roughly follow the Qu'Appelle Valley and its floodplains.

Alluvium is loose, unconsolidated soil and sand deposited by fluvial processes. Along with the SSD, it is the uppermost unit present in the study area and is found in the Qu'Appelle Valley.

5.2.2 Baseline Studies

The primary objectives of the baseline studies are to compile existing geologic and hydrogeologic information, to develop a conceptual geologic and hydrogeologic model to be used in the development of a numerical groundwater flow model for the Project and surrounding area. The regional geologic and hydrogeologic model will provide the basis for the assessment of the regional groundwater resources, and for siting key Project components (i.e., salt management area, brine reclaim ponds, water supply, and site infrastructure). The LSA for hydrogeology is mainly focused on KP 377 and 392 permit areas and encompasses townships 23 to 26 and ranges 16 to 21 W2M.

The RSA for hydrogeology was defined at a scale to encompass Townships 20 to 31 and within Ranges 11 to 24 W2M. The area includes predominate surficial features such as Last Mountain Lake and the Qu'Appelle Valley. The northern and eastern boundaries were selected to be approximately parallel the Quill Lakes and Assiniboine River watershed boundaries. The western and southern boundaries were selected to coincide with Last Mountain Lake and the Qu'Appelle Valley, respectively. These features represent zones of groundwater discharge. Hydrologic and hydrogeological systems will operate independently west and south of these natural barriers. The scale of the RSA was set large enough that any modeling boundary conditions are unlikely to affect the subsequent development of a local scale groundwater flow model within the KP3 377 and 392 permit areas.

Geological and engineering data collected through stratigraphic and geotechnical drilling completed in 2013 and 2014 will support the integration of site -specific data into the regional geologic and hydrogeologic model, which will form the foundation of key waste management facilities design and the numerical groundwater flow model. The numerical model will be used as a tool to assess the groundwater flow pathways in connection with the site.

Data collected from water monitoring instrumentation will be used to better define groundwater flow patterns near the core facilities area. This data will be used in support of solute transport and fate analyses. Groundwater samples will be collected and submitted for analytical testing to provide baseline groundwater chemistry data for the site.

5.3 Surface Water Environment

5.3.1 Overview of Existing Conditions

The Project is located within the Qu’Appelle River drainage in southern Saskatchewan. Last Mountain Lake is located approximately 40 km to the west of the Project and the Qu’Appelle River is located about 30 km to the south of the Project. The Qu’Appelle River flows from the Qu’Appelle Dam at Lake Diefenbaker eastward into the province of Manitoba. In Manitoba, the Qu’Appelle flows into the Assiniboine River, this in turn flows into the Red River and Lake Winnipeg. All of these rivers are a part of the Hudson Bay drainage system.

Most of the surface water environment study area (including KP377 and KP392 permit areas) is located within the Loon Creek drainage area, although small areas are part of the Last Mountain Lake drainage area and the Jumping Deer Creek drainage area. Loon Creek and Jumping Deer Creek both flow south to the Qu’Appelle River. The northwest portion of KP377 drains towards Last Mountain Lake, although most years the runoff may be stored within an unnamed waterbody near Duval, Saskatchewan. Last Mountain Lake is part of the Qu’Appelle River drainage. West Loon Creek receives flow from two tributaries within and originating beyond the northern boundary of KP377. East Loon Creek flows through KP392 and joins West Loon Creek, approximately 2 km south of the two permit areas, combining to form Loon Creek.

The semi-arid prairie region is subject to great variation in flows between years and within individual years. No long-term streamflow monitoring stations are currently in operation within the study area, thus streamflow stations in the surrounding region must be used to characterize the hydrology within the study area. Due to the temporary nature of flows in streams in the southern prairie region, flows were monitored only between the months of March and October. April flows are the highest, as snowmelt runoff occurs most often during April, although occasionally peak flows have occurred in late March or early May. Flows in summer and fall are usually much lower and flow drops off to zero in most years.

Surface water quality is influenced by factors such as natural conditions in groundwater quality and quantity, hydrology, and sediment and soil chemistry. Land use activities (e.g., agriculture) influence surface water quality through air emissions, changes in drainage patterns, and soil chemistry. In turn, changes to surface water quality can affect aquatic and terrestrial organisms, human health, and traditional and non-traditional land use activities (e.g., fishing, trapping, and hunting).

No information was available regarding known species or populations of fish within West Loon Creek, East Loon Creek, or their tributaries within the permit areas. Although no fish are known to occur in Loon Creek downstream of the focus area, the stream is a tributary to the Qu'Appelle River that is known to support at least 18 species of fish (Saskatchewan Parks and Renewable Resources [SPRR] 1991), including the chestnut lamprey (*Ichthyomyzon castaneus*), a species of special concern under the *SARA* (2002). Small- and large-bodied fish species may extend their distribution from the Qu'Appelle River northward to make use of habitat in West Loon and East Loon creeks during spring runoff or during wet periods when stream flows are prolonged.

5.3.2 Baseline Studies

For the purpose of the surface water environment baseline studies, the study area has been separated into a RSA and LSA. The RSA is defined by the maximum expected spatial extent of direct and indirect effects from the Project, while the LSA is defined by the maximum expected spatial extent of the Project's direct effects. The LSA includes the land surface area directly affected by the Project construction, operation, and decommissioning.

5.3.2.1 Hydrology

The hydrology baseline investigations in 2013 collected site-specific topography, weather, and hydrology data to provide a baseline for assessing environmental effects. Additionally, historical weather data will be used in modelling of wet, average, and dry climate scenarios for the site water balance and water management planning, and streamflow data will be used as design basis for various engineered conveyance and cross-drainage structures related to Project development.

Streamflow stations were installed at five locations on West Loon, East Loon, and Loon creeks during the baseline study period in 2013. At each streamflow station, water level changes over time were monitored continuously. This data is then converted to discharge values using stage-discharge rating equations developed for the station.

The objectives of the hydrology baseline program are to collect sufficient baseline information to assist with Project water management planning and to document the existing conditions in the RSA and LSA, which will support the assessment of the Project's potential environmental effects. This hydrological information may be used as a design basis for various engineered conveyance and cross-drainage structures related to Project development.

5.3.2.2 Surface Water Quality

Surface water and sediment samples were collected in the spring, summer, and fall of 2013 within the surface water study area from West Loon Creek, East Loon Creek, Loon Creek, and two unnamed waterbodies. Water quality parameters such as temperature, specific conductivity, dissolved oxygen, and pH were measured in the field. Water samples were submitted for laboratory analysis to provide data on conventional parameters, major ions, nutrients, total metals, and dissolved metals. Sediment samples were submitted for laboratory analysis of moisture content, particle size, nutrients, and total metals. The field and analytical results will be compared to existing guidelines for surface water quality and drinking water for the protection of aquatic life, wildlife health and livestock watering, recreational use and aesthetics, and human health.

5.3.2.3 Fish and Fish Habitat

Field surveys were completed in the spring, summer, and fall 2013 to determine the extent of the fish habitat and the likelihood of occurrence of fish species. Fish inventory surveys were completed within West Loon Creek, East Loon Creek, Loon Creek, and three unconnected land-locked waterbodies. Non-lethal sampling methods of capture included minnow traps and backpack electrofishing. Detailed habitat assessments were completed at each location where fish were captured or observed during the 2013 field season.

5.4 Terrestrial Environment

5.4.1 Overview of Existing Conditions

The Project is located within the Strasbourg Plain landscape area of the Moist Mixed Grassland Ecoregion (Acton et al. 1998). The Strasbourg Plain is a large, moderately sloping hummocky morainal area with frequent glacial kettles. The Moist Mixed Grassland is characterized by a patchy landscape of prairie, woodland, and shrubland, with a warm and subhumid continental climate (Acton et al. 1998). The Moist Mixed Grassland Ecoregion is a broad, mostly level plain with the occasional deep valley, such as the Qu'Appelle Valley (Acton et al. 1998; Flory 1980). This ecoregion is predominantly cultivated land. The Moist Mixed Grassland is characterized by mid-grasses including species of wheatgrass and needle grasses (Acton et al. 1998). Woodland and shrubland predominantly occur in depressions or the periphery of wetlands.

Native grassland in the Strasbourg Plain Landscape Area typically is limited to hummocky terrain, where it is interspersed with cultivated areas. Extensive areas of saltgrass, alkali grass, sedges, and rushes occur in wet and saline area in the northern part of the Strasbourg Plain, and these areas limit crop production. Wetlands are typically surrounded by willows and aspen.

Numerous bird species have the potential to occur within the terrestrial study area. Woodland and wetland habitats generally support greater numbers and species richness of birds than modified grassland and cultivated areas. Native grassland habitat has a higher potential to support species at risk including Sprague's pipit (*Anthus spragueii*), ferruginous hawk (*Buteo regalis*), and short-eared owl (*Asio flammeus*). Bobolink (*Dolichonyx oryzivorus*), vesper sparrow (*Pooecetes gramineus*), and savannah sparrow (*Passerculus sandwichensis*) are commonly found in modified grassland areas. Woodland areas may provide suitable habitat for birds such as American robin (*Turdus migratorius*), tree swallow (*Tachycineta bicolor*), eastern kingbird (*Tyrannus tyrannus*), and great horned owl (*Bubo virginianus*). Wetlands may provide suitable habitat for species such as horned grebe (*Podiceps auritus*), yellow rail (*Coturnicops noveboracensis*), dabbling ducks (e.g., mallard [*Anas platyrhynchos*] and blue-winged teal [*Anas discors*]), American coot *(Fulica americana*), and red-winged blackbird (*Agelaius phoeniceus*). Horned larks (*Eremophilia alpestris*) may be found in cultivated areas.

Wildlife species most likely to be observed within the Moist Mixed Grassland Ecoregion include white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), porcupine (*Erethizon dorsatum*), white-tailed jackrabbit (*Lepus townsendii*), Richardson's ground squirrel (*Spermophilus richardsonii*), thirteen-lined ground squirrel (*Ictidomys tridecemlineatus*), and northern pocket gopher (*Thomomys talpoides*) (Acton et al. 1998). Moose (*Alces alces*) populations have been increasing in southern Saskatchewan; however, the species is typically more common within the Aspen Parkland Ecoregion. Amphibians and reptiles such as wood frog (*Rana sylvatica*), boreal chorus frog (*Pseudacris maculata*), eastern garter snake (*Thamnophis sirtalis sirtalis*), Canadian toad (*Bufo hemiophrys*), and tiger salamanders (*Ambystoma tigrinum*) may be found in the focus area (Acton et al. 1998).

5.4.2 Baseline Studies

5.4.2.1 Terrain and Soils

The baseline field program was completed in September October, 2013. The western half of the baseline study area overlaps the Dark Brown soil zone and the eastern half overlaps the Black soil zone. There are 25 soil associations mapped in 44 simple map units and 58 compound map units in the baseline study area, based on provincial digital soil mapping data (Saskatchewan Land Resource Unit [SLRU] 2004). As such, soil survey locations were selected so that representative locations within each soil association were characterized and sampled. Metal and metalloid chemistry were analyzed on composite mineral soil samples that were collected to a depth of 15 centimetres (cm) (e.g., where most plant roots are concentrated).

The baseline program recorded the dominant surface expressions throughout the area as undulating and rolling. Slopes were commonly between 2% and 5% and the steepest slopes (10% to 15%) were recorded in areas associated with steep valleys.

5.4.2.2 Vegetation

Detailed vegetation inventory, biodiversity, listed plant, and weed field surveys were completed during May, June, and August, 2013 to capture an inventory of early and of late flowering species. Field survey information will be used to characterize and map vegetation types (ecological landscape classification [ELC] map units; habitats), compile a vegetation inventory of observed species in each vegetation map unit defined in the ELC map, and document listed, weed, and traditional use species found in the baseline study area. All field data were used to help ground-truth, classify, and describe the ELC map units.

Detailed vegetation surveys were completed to obtain site-specific, descriptive information on the nature and characteristics of plant communities within the ELC. Surveys for provincial and federal listed plant species were also completed to document their occurrence. In addition, surveys were completed to document the distribution and type of invasive species present in the study area.

5.4.2.3 Wildlife and Wildlife Habitat

Wildlife baseline surveys were performed to determine the presence and distribution of furbearers, carnivores, ungulates, upland breeding birds, waterbirds, raptors, and amphibians in the baseline study area. Data from these baseline studies will be used to assess the potential effects from the Project on wildlife populations. The wildlife baseline studies will describe population status and distribution of wildlife species, including listed wildlife species, and identify habitat features that are important to wildlife.

5.5 Heritage Resources

5.5.1 Overview of Existing Conditions

Heritage resources include all of Saskatchewan's historic and pre-contact archaeological sites, architecturally significant structures, and paleontological resources. Because of public and Aboriginal interest in heritage resources, there are linkages to traditional land use, non-traditional land use, and socio-economics.

The database for previously recorded heritage resources maintained by the Heritage Conservation Branch reveals that 163 archaeological sites have been documented on the National Topographic Systems (NTS) mapsheets encompassed by the Project (i.e., 72P/01, 72P/02, 72I/15, 72I/16). However, most occur along the Qu'Appelle River and Last Mountain Lake approximately 20 km south of the heritage resources study area. Two recorded heritage resources are located within the LSA.

5.5.2 Baseline Studies

Baseline studies for heritage resources completed in October 2013 included the collection of historical information and a field assessment of lands contained within Permit Boundaries KP 377 and KP 392. The objectives of the heritage resources baseline studies are to document and describe the known heritage resources and heritage resource potential that exists within the Heritage Study Area.

There are no expected effects on heritage resources outside the construction footprint of the various Project components. As a result, an RSA for heritage resources has not been defined and all discussion will remain at the LSA scale for heritage resources. The LSA includes lands contained within the Project Permit Boundaries KP377 and KP 392, and supporting infrastructure. Since the LSA encompasses areas that are considered to be heritage sensitive, the Heritage Conservation Branch required that a baseline Heritage Resources Impact Assessment (HRIA) be conducted (Friesen 2013, pers. comm.). The heritage baseline study was conducted under Archaeological Resource Investigation Permit No. 13-208.

5.6 Traditional and Non-Traditional Land Use

5.6.1 Overview of Existing Conditions

The primary land use near the Project is agriculture, including crop and livestock production. The most common crops produced include canola, wheat, and alfalfa. These practices have greatly modified the natural landscape near the Project. Non-traditional land use includes agriculture, recreation, industrial, residential, or commercial uses or activities.

Traditional land use includes use of the land by Aboriginal people for activities such as hunting, trapping, fishing, and gathering plants, as well as other ceremonial purposes. Numerous animals have been documented as being used for traditional purposes (e.g. hunting and trapping); this includes deer, elk, moose, muskrats, coyote, fox, beaver, and rabbit. Game birds that are hunted typically include sharp-tailed grouse, geese, and ducks. The most common plants used for traditional purposes (e.g., food, medicinal, spiritual) include sage, sweetgrass, Seneca root, Saskatoon berries, chokecherries, raspberries, and gooseberries.

5.6.2 Baseline Studies

The traditional and non-traditional land use study area corresponds to the boundaries of the R.M.s of Longlaketon and Cupar. This area was selected because the core facilities area, 65 year mine field, and the indicated resource boundary are located within these R.M.s, and the area of land within these R.M.s will provide a general understanding of current land use activities in Project area.

Baseline studies included site visits, interviews, and review of government databases, Statistics Canada reports, and secondary sources. These resources were used to determine historical land uses as well as current land use practices.

Traditional land use data was acquired primarily through face-to-face surveys with Elders and other First Nations community members familiar with the Project area. A total of 15 First Nations and Métis communities were identified as potentially having an interest in the Project, and each community was invited to participate in traditional land use information gathering. The Elders and community members were selected from First Nations communities that expressed interest in participating in traditional land use information sharing. The data from these meetings will be incorporated into the baseline studies for other environmental components (e.g., vegetation, wildlife, heritage resources, and socio-economics), and used to support the assessment of effects from the Project on land use activities such as agriculture, hunting, and trapping.

5.7 Socio-Economic Environment

5.7.1 Overview of Existing Conditions

The estimated population in Saskatchewan on January 1, 2014 was 1,117,503 people, an increase of 1.83% from January 1, 2013. The largest communities near the Project are the Towns of Southey and Strasbourg, with populations of 778 and 752, respectively. The unemployment rates are generally low, at 2.7% (2006). The highest unemployment rate in the LSA was 20.0% in the Town of Govan. Regina is the closest urban centre to the Project and is located approximately 58 km south. Regina had a 2011 population of 193,100, and is growing, with an increase of 7.7% since 2006. In 2006, the labour force participation rate was 70.6% and the unemployment rate was 5.0%, just below the provincial average of 5.6%.

The region within and around the permit areas is rural in nature, with agriculture being an important economic activity and land-use. Agriculture continues to be a vital part of the provincial economy, particularly in rural areas, although other natural resources are now increasing in importance to the Saskatchewan economy, thereby decreasing the reliance on agriculture.

5.7.2 Baseline Studies

The RSA for the socio-economic environment is defined as the province of Saskatchewan. The LSA includes communities within approximately 50 km of the Project. The LSA includes 6 R.M.s, 29 hamlets, 9 Indian Reserves, 1 city, 9 towns, 13 villages, 11 resort villages, and 9 organized hamlets.

Socio-economic data for the RSA and LSA were collected from secondary data sources. These include government agencies (e.g., Statistics Canada, Aboriginal Affairs, and Northern Development Canada), local community or development plans (e.g., Regina Official Community Plan Working Paper), local community websites, and other print and electronic sources for the area. The types of data collected include recent demographic trends, information about community infrastructure and services, and local history. Data collected are used to measure Project's effects on the socio-economic environment.

6.0 ENGAGEMENT

6.1 Engagement Approach

The Project engagement program encompasses several elements: local communities (including interested members of the public), First Nations and Métis communities, municipal representatives, regulatory agencies, and adjacent landowners. Yancoal has initiated early contact with the local public, First Nations and Métis communities, rural municipalities and regulatory agencies. Plans are in place to continue to engage with these stakeholders and groups during the environmental assessment, as well as during the permitting process. While Yancoal plans to keep lines of communication open with all stakeholders, timing of engagement activities is connected to Project milestones such as submission of the Technical Proposal and submission of the EIS.

The objective of the community information sessions is to foster an understanding of the Project and provide an opportunity for people in the area to show support or identify concerns about the potential effects of the Project. Information collected during these sessions will be included in the EIS for the Project, along with indication description of how the concerns were addressed. Community information sessions were held in November 2013 to introduce the surrounding communities to the Project and the representatives from Yancoal. The outcome of these community information sessions is described in Section 6.2. Planning for a second round of community information sessions is currently underway to correspond with the submission of the Technical Proposal. A third round of information sessions will be planned to coincide with the submission of the EIS to MOE.

First Nations and Métis community engagement activities are to establish a solid foundation for engagement activities that will occur throughout the environmental assessment process and Project development, and to identify specific issues that will be of interest locally so they can be addressed. Discussions with First Nations and Métis communities are used to establish the groundwork for collecting baseline data related to Traditional Knowledge and Land use in the Project area, which will be included in the EIS. Engagement activities for First Nations and Métis communities include face-to-face meetings with the various Chiefs and Councils, and Regional Métis Directors. Yancoal will continue to provide First Nations and Métis communities updates on the project throughout the environmental assessment process.

Meetings with local R.M.s and the councils of towns, villages, or organized hamlets is to engage local governments and communities in the Project area. These meetings include introducing the Project and representatives from Yancoal, as well as discussing potential Project-specific details and potential effects from the Project. Introductory meetings have been held with four R.M.s to provide preliminary information about the Project. It is understood that a potential new mining project in a rural region will generate a lot of interest as the Project proceeds; keeping the local municipal representatives informed about the Project is an important step in establishing a relationship with the community. Yancoal will continue to meet with R.M.s and community councils throughout the environmental assessment and Project permitting process. Yancoal will meet with government and regulatory agency staff throughout the environmental assessment, and will initiate a meeting to discuss the Project proposal and request feedback from regulators.

The neighbour relations program are to establish relationships with the landowners and residents nearest to the Project, and to provide opportunities to present findings of the environmental assessment directly to these people. Local landowners will have specific concerns and questions associated with living and owning land near the Project. As such, the neighbour relations program provides Yancoal the opportunity to engage these people and discuss specific Project details and potential environmental and socio-economic effects. Information gathered from the neighbour relations program will be documented in the EIS.

6.2 Preliminary Engagement Activities

6.2.1 Local Communities

In November 2013, Yancoal held three Community Information Sessions in the communities of Southey, Cupar, and Strasbourg, Saskatchewan (Table 6.2-1). The purpose of the information sessions was to provide an opportunity to introduce representatives from Yancoal and the Project to the local public. Information panels were available at each location to provide information about Yancoal, the Project, the solution mining process, and the environmental assessment process. Attendees were encouraged to read the panels and to ask questions of the Yancoal and Golder representatives. Information handouts were provided to each attendee which included Yancoal's contact information should people have additional questions following the community information sessions.

Table 6.2-1: Schedule of Community Information Sessions

Location of Community Information Session	Date	Time
Southey Town Hall, Southey	Tuesday, November 5, 2013	4:00 to 8:00 p.m.
Cupar Community Hall, Cupar	Wednesday, November 6, 2013	4:00 to 8:00 p.m.
Strasbourg Lower Hall, Strasbourg	Thursday, November 7, 2013	4:00 to 8:00 p.m.

The community information sessions were advertised in two local newspapers, as well as posters placed at various locations in each of the communities. Advertising was placed in Section A of the Regina Leader-Post from Thursday, October 31 through Thursday November 7, 2013. Advertising also was placed in the Last Mountain Times for the week of October 29, 2013. Posters advertising the location and time of the community information sessions were placed at 12 locations in the 3 communities approximately one week in advance of the community information sessions.

A total of 175 people attended the three community information sessions. The most common questions or comments received were about the Project timeline, general effects and benefits to the communities, methods used to engage the public, the location of the Project, and the potential employment opportunities.

6.2.2 First Nations and Métis Communities

In June and early July 2013, Project information was provided to 15 First Nation and Métis communities, including the following:

- Day Star First Nation;
- Kawacatoose First Nation;
- Muskowekwan First Nation;
- George Gordon First Nation;
- Piapot First Nation;
- Muscowpetung First Nation;
- Pasqua First Nation;
- Standing Buffalo First Nation;
- Little Black Bear First Nation;
- Star Blanket First Nation;
- Okanese First Nation;
- Peepeekisis First Nation;
- Carry the Kettle First Nation;

- Métis Western Region 3; and
- Métis Eastern Region 3.

In late 2013 and early 2014, each community received copies of the information handouts and the information panels that were provided at the first round of community information sessions. A commitment was made to meet with each interested First Nation and Métis community to provide additional information about the Project as new information became available. A summary of the discussions that have occurred to date is provide in Appendix B.

Future meetings will occur in each interested community to present the information provided in the Technical Proposal, describe the environmental assessment process, and present the findings of the environmental assessment. As with the public engagement activities, questions and concerns raised during the meetings will be recorded and documented within the EIS.

6.2.3 Government and Regulatory Agencies

In May 2013, representatives from Yancoal and Golder met with the MOE, the Water Security Agency, and SaskWater to introduce Yancoal and the Project. In June 2013, Yancoal met with the R.M. of Cupar No. 218. In July 2013, Yancoal met with the R.M.s of Longlaketon No. 219, Mount Hope No. 279, and Touchwood No. 248. The purpose of these meetings was to introduce representatives from Yancoal and to provide introductory information about the Project.

In April 2014, subsequent meetings occurred with the R.M.s of Cupar No. 218 and Longlaketon No. 219, and the MOE to provide an update on the status of the Project. It is Yancoal's intent to request time at R.M. Council meetings to coincide with the submission of the Project Proposal, as well as the submission of the EIS. Workshops and meetings will be planned to discuss the Project Proposal, the EIS, and request feedback from regulators.

6.3 Summary

Overall, most of the engagement activities have resulted in positive feedback. Stakeholders are interested in the Project and want to be involved in the engagement process. All have expressed an interest for additional information as the Project progresses. Questions and concerns brought forward during the community information sessions and meetings with First Nations and Métis communities, were related to the Project timeline, general effects and benefits to the communities, the methods used to engage the public, the location of the Project, the source of the water required for the mine, and potential employment opportunities.

Yancoal is committed to providing Project details to adjacent landowners, the public, and First Nations and Métis communities as they become available. Following submission of the Technical Proposal, these stakeholders will be notified about activities and events associated with the environmental assessment for the Project and invited to provide input.

7.0 KEY ISSUES AND POTENTIAL ENVIRONMENTAL EFFECTS

The intent of this section of the Technical Proposal is to present a summary of the key environmental issues and to link these key issues to the pathways through which Project components or activities (e.g., footprint disturbance, mining activities, and water and waste management plans) may affect the biophysical and socio-economic environments. This evaluation was completed to identify high-level risks to the biophysical and socio-economic environments that may result from Project components or activities. Key issues through which the Project could affect the environment have been identified from a number of sources including:

- a review of the Project Description (Section 4.0) and completion of an initial site screening review completed by the environmental and engineering teams for the Project to scope potential environmental effects;
- socio-economic issues defined during initial scoping and other engagement activities with the public (i.e., local communities, landowners, and other concerned members of the public), First Nations and Métis communities , and governmental and regulatory agencies;
- scientific knowledge and experience with other potash mines in Saskatchewan;
- professional experience of potential interactions between the Project components and the socio-economic characteristics and structures of the regional and local communities; and
- issues identified by the MOE in recent TOR or Project Specific Guidelines for other proposed potash mine projects.

The identification of key environmental issues builds on Project scoping and strategic planning meetings and focuses the assessment on the Project interactions likely to lead to residual environmental effects on the biophysical and socio-economic environment.

The intent of this section is to identify key environmental issues associated with the Project that may lead to residual environmental effects after implementing environmental design features. Environmental design features are developed through an iterative process between the Project engineering and environmental assessment teams and are used to remove the Project interaction, limit (mitigate) effects of the Project, or increase benefits. Environmental design features can include Project design considerations and environmental best practices, management policies and procedures, and social programs.

The key environmental issues identified for the Project include:

- protection of surface water resources;
- protection of groundwater resources related to tailings management;
- ground subsidence;
- air quality;
- cumulative effects; and
- socio-economic effects.

Project interactions and associated potential environmental effects are summarized in Table 7.0-1 and Table 7.0-2; environmental design features are provided. A summary of the potential effects related to each key issue and the approach for assessing these potential effects in the EIS are provided in the following sections. The environmental assessment approach for the Project is provided in the draft TOR (Appendix A).

Table 7.0-1: Potential Effects on the Biophysical Environment

Project Activity/Component	Potential Environmental Effect(s)	Environmental Components	Key Environmental Design Features
Project site Transportation and utility corridors (road, rail, electrical, natural gas, water)	■ Loss or degradation of local soil, cropland, vegetation, and wildlife habitat. ■ Indirect effects (e.g., presence of buildings, people, lights, smells, and on-site vehicles) may change wildlife behaviour and movement. ■ Alteration of local surface drainages and potential changes to fish and wildlife habitat. ■ Disturbance or destruction of archaeological or heritage sites.	■ Surface Water Environment ■ Terrestrial Environment ■ Cultural Environment	■ The Project site will be located in an area that has largely been disturbed by agricultural practices. ■ The layout of the Project site will be as compact as possible to limit the area that is disturbed. ■ Directional drilling from a centralized pad will limit the surface footprint in the well field. ■ Pre-Project field surveys will be completed to identify sensitive habitat locations for avoidance or mitigation. ■ Appropriate construction practices will be put in place for working in sensitive locations. An environmental monitor will be on-site during construction activities in potentially sensitive areas. ■ Activity Restriction Guidelines (MOE 2003) will be adhered to if listed plant or wildlife species are encountered during construction. ■ Management options for archaeological or heritage materials discovered during construction activities will be developed in consultation with the Saskatchewan Heritage Resources Branch. ■ Access roads, railway lines, and utility corridors will be located along existing corridors, where practical, to reduce disturbance to undisturbed areas.

Table 7.0-1: Potential Effects on the Biophysical Environment (continued)

Project Activity/Component	Potential Environmental Effect(s)	Environmental Components	Key Environmental Design Features
Site Water Management	■ Site water runoff and associated soil erosion from the core mine facilities area can affect local surface drainages and result in potential changes to surface water quality, and fish and wildlife habitat.	■ Surface Water Environment ■ Terrestrial Environment	■ A site water management plan will be developed to contain water on-site. ■ Best management practices during construction will be implemented to reduce erosion and limit sediment transport. ■ Freshwater will be routed around the site and returned to pre development watercourses to reduce the amount of water entering the site. ■ All runoff within the site will be contained and directed to the brine reclaim pond for deep well injection. ■ The brine reclaim pond will be capable of storing runoff of 300 mm in a 24-hour period from the contributing watershed.
Tailings Management Area (salt storage, brine reclaim ponds, and injection wells)	■ Vertical and lateral seepage of brine from the TMA may cause changes to groundwater quality, which may affect local surface water quality, and fish and wildlife habitat. ■ Deep well brine injection has the potential to result in leakage of brine though confining layers to fresh-water aquifers.	■ Hydrogeologic Environment ■ Surface Water Environment ■ Terrestrial Environment	■ Site selection was based on site-specific geologic information. ■ The TMA is designed to control migration of brine from the TMA to underlying aquifers and control the vertical and lateral migration of brine. ■ A containment system will be designed to control deep migration of brine from the TMA to underlying aquifers and horizontal migration of brine, as required. ■ Monitoring programs will be put in place to monitor brine movement. ■ Deep well injection of excess brine is a proven practice used to manage brine and prevent release to surface waters and fresh-water aquifers.

Table 7.0-1: Potential Effects on the Biophysical Environment (continued)

Project Activity/Component	Potential Environmental Effect(s)	Environmental Components	Key Environmental Design Features
Solution Mining	■ Ground subsidence can result in changes to local surface drainage patterns, flows, and water levels in lakes, streams, and wetlands, which can change fish and wildlife habitat.	■ Surface Water Environment ■ Terrestrial Environment	■ Pillars will be left between the caverns to increase stability during solution mining. ■ Using secondary mining helps to reduce total subsidence, as more of the material (i.e., NaCl) stays in the cavern.
Air and noise emissions (e.g., stacks, mobile equipment, fugitive dust)	■ Changes to air emissions and dust deposition may affect local soil, cropland, vegetation, wildlife health, fish and wildlife habitat, and surface water quality. ■ Noise emissions from the Project may change wildlife behaviour and movement.	■ Atmospheric Environment ■ Acoustic Environment ■ Surface Water Environment ■ Terrestrial Environment	■ Emission controls on stationary emission sources. ■ Dust control systems will be used. ■ Compliance with stack emission and ambient air quality standards. ■ Project design will use conventional insulation, baffles, and noise suppressors on equipment. ■ Stationary equipment will be housed inside buildings, reducing the amount of noise released into the environment.
Decommissioning, closure and reclamation	■ Residual ground disturbance after closure may result in permanent alteration of local drainage patterns, soil, vegetation, and wildlife habitat.	■ Surface Water Environment ■ Terrestrial Environment	■ The decommissioning plan will incorporate technologies as they become available and feasible to reduce the decommissioning period and the associated duration of salt storage at surface.
	■ Long-term seepage from the TMA may cause local changes to groundwater quality, which may affect surface water quality, and fish and wildlife habitat.	■ Hydrogeologic Environment ■ Surface Water Environment ■ Terrestrial Environment	■ Site selection was based on site-specific geologic information. ■ The TMA is designed to control long-term migration of brine from the TMA to underlying aquifers and control the vertical and lateral migration of brine.

TMA = tailings management area; NaCl = sodium chloride; mm = millimetres

Table 7.0-2: Potential Effects on the Socio-Economic Environment

Project Activity	Potential Environmental Effect(s)	Environmental Components	Key Environmental Design Features
Project footprint Transportation and utility corridors (road, rail, electrical, natural gas, water)	■ loss or alteration of current land use and ability to contribute to local economy ■ alteration of the rural landscape(e.g., aesthetic value)	■ Land use ■ Household incomes ■ Quality of life	■ layout of the Project site will as compact as possible to limit the area that is disturbed ■ Directional drilling from a centralized pad will limit the surface footprint in the well field.

Construction/ Operation	■ workforce and procurement requirements of the Project may increase:
	  ■ education and training for Project-related trades and careers
	  ■ employment
	  ■ labour incomes
	  ■ economic activity
		■ Household incomes
		■ Community well-being
			■ enhancement of employment benefits generated by the Project
			■ enhancement of education and training opportunities generated by the Project
			■ procurement of goods and services locally and regionally

Construction/ Operation	■ Project activities may modify local transportation infrastructure and affect traffic (e.g., changing road and rail access to the site) through increased municipal road maintenance requirements, altered travel routes, and an increase in traffic volume	■ Human safety ■ Quality of life ■ Quality of road infrastructure	■ worker transportation options will be explored to reduce commuter traffic. ■ upgrades to the local grid road system and highways

Table 7.0-2: Potential Effects on the Socio-Economic Environment (continued)

Project Activity	Potential Environmental Effect(s)	Environmental Components	Key Environmental Design Features
Construction/ Operation	■ influx of workers required by the Project may cause: ■ increased pressure on community infrastructure, and possible deterioration of services (e.g., health, education) ■ lack of integration of new workers into community ■ increased pressure on housing sector ■ increase in recreational hunting or fishing activity in nearby areas, with possible effects on wildlife or fish populations	■ Community facilities and infrastructure ■ Social cohesion ■ Community well-being ■ Outdoor recreational opportunities ■ Surface Water Environment ■ Terrestrial Environment	■ establishment of first-aid clinic at the Project site ■ a construction camp will be established close to the Project site to reduce the pressure on local housing and accommodations ■ worker transportation options will be explored to reduce commuter traffic. ■ upgrades to the local grid road system and highways
Construction/ Operation	■ potential changes to air, soil, vegetation, and surface water quality from Project air emissions and dust deposition, with possible effects on human health or visual aesthetics ■ changes in ambient noise levels and nuisance to human populations	■ Human health ■ Visual aesthetics ■ Quality of life	■ emission controls on stationary emission source ■ dust control systems will be used. ■ compliance with stack emission and ambient air quality standards ■ Project design will use conventional insulation, baffles, and noise suppressors on equipment ■ stationary equipment will be housed inside buildings, reducing the amount of noise released into the environment

7.1 Protection of Surface Water Resources

Surface water quality is influenced by factors such as natural conditions in groundwater quality and quantity, hydrology, and sediment and soil chemistry. Developments can influence surface water quality through changes in groundwater quality and quantity, drainage patterns, and soil erosion. In turn, changes to surface water quality can affect aquatic and terrestrial populations, and human use. The EIS will provide an assessment of the potential effects from the Project on the local and regional drainage system, which may affect aquatic and terrestrial valued components (VCs).

One of the primary issues of concern for potash production is the availability of water. Demand on the groundwater and surface water sources in Saskatchewan is growing from a variety of industrial, agricultural, and municipal users. The water supply to site will be via a buried pipeline extending from Buffalo Pound Lake to the Yancoal core facilities area.

7.2 Protection of Groundwater Resources Related to Tailings Management

Potential exists to affect groundwater quality from the vertical and lateral seepage of brine from the TMA and from deep well brine injection, resulting in leakage of brine through confining layers. Design features will be implemented to prevent lateral long-term seepage of brine from the TMA into groundwater. During the life of the Project, there is potential for migration of brine solution from the TMA to aquifers. Extensive site characterization will determine the thickness and hydrogeologic properties of the soils beneath the storage areas. Hydrogeological modelling will be completed to assess potential vertical migration of brine. An assessment of the target zones for brine disposal will be completed to determine which geolgocial formations have adequate capacity to accept the brine solution from the Project, and sufficient separation from fresh-water aquifers.

7.3 Ground Subsidence

Solution mining can cause ground subsidence, which could negatively affect surface facilities, local surface water quality, and fish and wildlife habitat. Most effects from subsidence are related to anticipated topographic changes on the land surface overlying the mining works. Subsidence may result in topographic changes within the mining boundary concurrent with mining and continue through post-mining as the caverns continue to close due to pillar creep and the weight and nature of overlying strata. Subsidence is a very slow process with changes to the topography and watershed boundaries potentially taking hundreds of years to occur.

Subsidence likely would be localized, with small changes in drainage area boundaries, drainage areas, and flow pathways near the mine well field area. Subsidence near the mine well field area may have small effects on storage of water on the landscape. For example, some depressions may increase in volume due to differential settlement, and flow pathways and contributing areas to those depressions may be modified.

Monitoring and mitigation of subsidence is challenging in that this phenomenon is a gradual process that takes place over a long period. Because of the inherent uncertainty associated with subsidence, Yancoal will implement a monitoring program to reduce uncertainty of effects related to hydrology and subsidence. In addition, results of the monitoring program will be used to test effects predictions of subsidence, as well as the performance and adequacy of mitigation, any adaptive management initiatives.

7.4 Air Quality

Construction, operation, and closure of the Project will result in changes to air quality from air (e.g., SO_2 and NO_x) and dust (e.g., PM and TSP) emissions. Potential pathways through which the Project can modify air quality include emissions from stacks, mobile equipment, and fugitive dust from access roads, scrubbers, storage piles, dust collection vents, rail load out points, boilers, heaters, and dryers. Air and dust emissions can cause changes to the quality of soils, vegetation, surface water quality, and fish and wildlife habitat, which could subsequently affect fish, vegetation, and wildlife populations. As such, environmental design features (e.g., emission controls on stationary emission sources, and dust control systems) will be incorporated into the design of the Project to limit potential effects. Compliance with regulatory emission requirements will be maintained. Results from baseline studies and air dispersion modeling will be used in the EIS to assess changes caused by the Project on air, surface water and soil quality, and vegetation, fish, and wildlife populations.

7.5 Cumulative Effects

Cumulative effects represent the sum of all natural and human-induced influences on the biophysical, cultural, and socio-economic environments through time and across space. Some changes may be human-related, such as increasing industrial and mineral development, and some changes may be associated with natural phenomena, such as extreme rainfall events, and periodic harsh and mild winters. Cumulative effects will be assessed where incremental effects of the Project could overlap with effects from other existing, approved, and reasonably foreseeable developments. If significant adverse cumulative effects are identified, then the opportunity for technically and economically feasible additional mitigation will be considered and applied to the assessment.

7.6 Socio-economic Effects

Potential socio-economic effects from the Project will be assessed through predicting positive and negative changes to employment, training opportunities, economic activity, services, and physical infrastructure. For example, workforce and procurement requirements of the Project may increase employment and business opportunities, education and training, and economic activity in nearby communities. Conversely, the influx of workers required by the Project may increase pressure on community infrastructure, and possible deterioration of services (e.g., health and education). Environmental design features will continue to be developed through information gathered from key informant interviews, First Nations and Métis engagement activities, and through an economic assessment using an input/output model.

Report Signature Page

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APPENDIX A

Terms of Reference

February 2015

TERMS OF REFERENCE

Yancoal Canada Resources Company Ltd. Southey Project

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Report Number: 12-1362-0197 (WP024 DCN-060B)

Distribution:

Yancoal Canada Resources Company Ltd.
Ministry of Environment - Environmental Assessment Branch
Golder Associates Ltd.

INTRODUCTION

Yancoal Canada Resources Company Limited (Yancoal) is engaged in the evaluation and development of the Yancoal Southey Project (the Project). The Project is a Greenfield potash mine that will extract potash ore (sylvinite) from the Patience Lake, Belle Plaine, and Esterhazy Members of the Saskatchewan Prairie Evaporite Formation. The Project will be a solution mine located 60 km north of Regina and is located in the Rural Municipality (R.M.) of Longlaketon within Subsurface Mineral Permits KP377 and KP392.

An existing network of municipal grid roads, provincial highways, and rail lines provides access to the Project within the region. The Project is located east of secondary Highway 641 and north of secondary Highway 731. The community of Earl Grey is approximately 21 km southwest of the Project, the community of Strasbourg is approximately 23 km west, and the community of Southey is approximately 28 km southeast. The Project (including the core facilities area and the 100-year mining area) encompasses approximately 143.2 square kilometres (km^2) (14,319.8 hectares [ha]) of land located in Townships 24 and 25 and Ranges 17, 18, 19, and 20 West of the Second Meridian (W2M).

Development of the Project is planned in several phases. The construction phase is anticipated to begin in May of 2016, or as soon as the relevant Project regulatory permits and approvals are in place. The operations phase will begin in 2019 and operations for up to 100 years. Activities following operations will include those necessary to complete reclamation and closure.

The core facilities area and supporting infrastructure will be built during the construction phase (approximately 39 months). The core facilities area will include the processing plant, administration buildings, maintenance building, equipment and parts storage, tank farm, raw water pond, process upset pond, tailings management area (TMA), product storage, rail loadout, security, and parking.

During the operations phase, solution mining begins and potash from the Project is processed. Operations will begin following Project construction and is anticipated to continue for up to 100 years. The Project will employ both primary and secondary solution mining techniques. Primary mining involves the injection of hot water into the sylvinite beds to dissolve the potash; the brine solution is then extracted and transported by pipeline to the processing plant. Secondary mining involves the injection of sodium chloride (NaCl) rich brine into the cavern created during primary mining, to selectively dissolve additional potash from the material left in the cavern. This brine solution is extracted and returned to the processing plant via pipeline.

The processing plant will be designed for a production capacity of 2.8 million tonnes of potash per year (Mtpa). Hot water or brine will be pumped via pipeline from the core facilities area to the well pads within the mine well field, where the liquid will be injected into the caverns and then returned to the processing plant by pipeline using the same pipeline corridor. Potash processing will include the following:

- injection and solution recovery;
- evaporation and crystallization;
- product drying and screening;
- product compaction; and
- product storage and shipping.

Progressive reclamation for the Project will be completed during operations where possible. Final reclamation and closure activities will be completed once mining operations have ceased.

REQUIREMENT FOR AN ENVIRONMENTAL IMPACT STATEMENT

The provincial environmental assessment process begins with the submission of a Technical Proposal to the Environmental Assessment Branch (EAB) of the Ministry of Environment (MOE) to determine if the Project is considered a “development”. A “development”, as defined in The Environmental Assessment Act (SEAA; 2013), is any project, operation, or activity, or any alteration or expansion of any project, operation, or activity, which is likely to:

- have an effect on any unique, rare, or endangered feature of the environment;
- substantially use any provincial resource and, in so doing, pre-empt the use or potential use of that resource for any other purpose;
- cause the emission of any pollutants or create by-products, residual, or waste products, which require handling and disposal in a manner that is not regulated by another act or regulation;
- cause widespread public concern because of potential environmental changes;
- involve a new technology that is concerned with resource use and that might induce significant environmental change; or
- have a significant effect on the environment or necessitate a further development, which is likely to have a significant effect on the environment.

If a project is considered a “development”, then the proponent is required to draft the Terms of Reference (TOR) for the preparation of the Environmental Impact Statement (EIS). The TOR outlines the required scope of the environmental assessment, identifies the key effects to be studied, and provides a set of criteria to judge the completeness of the environmental assessment by regulatory agencies.

Based on similar projects that have been submitted to the EAB and received approval to proceed, it is expected that the Project will be considered a “development” under SEAA. As such, this draft TOR for the Project has been prepared.

Requirement for Federal Environmental Assessment

Under Section 8 of the Canadian Environmental Assessment Act, only designated projects are subject to the screening process through which the Canadian Environmental Assessment Agency will determine if a federal environmental assessment is required. Designated projects are defined under the Regulations Designating Physical Activities (2012, amended in October 2013). The proposed Project is not included on the designated project list in the Schedule to the Regulations Designating Physical Activities; as such a federal environmental assessment is not required. However, federal legislation such as the *Navigation Protection Act* (2012), the *Fisheries Act* (2012), the *Species at Risk Act* (*SARA 2002*), and the *Migratory Birds Convention Act* (1994) will be considered and the appropriate federal agency will be contacted directly should the Project require further review or discussion.

SCOPE OF THE ENVIRONMENTAL ASSESSMENT

The scope of the environmental assessment considers all physical works or activities related to the Project during all phases, including construction, operation, and decommissioning and reclamation. The EIS will contain a more detailed Project description to support an inclusive comprehensive assessment of the Project's potential effects on the biophysical and socio-economic environments and design features incorporated into the Project to reduce potential effects. Specifically, the assessment considers the following Project components:

- mining operations (i.e., mine plan and mining method);
- potash processing (i.e., evaporation, crystallization, drying, product screening, compaction, pond crystallization, storage and salt handling);
- tailings management (salt storage, brine and site water management);
- site infrastructure;
- supporting infrastructure (i.e., water supply, electrical power, natural gas, telecommunications, access roads, and a railway spur);
- management of domestic and industrial waste;
- decommissioning and reclamation;
- health, safety, and environmental management systems; and
- human resources.

The scope of the assessment is based on a 100 year mine life with a production target 2.8 Mtpa of potash product. A description of ancillary developments (i.e., water supply, power, natural gas, and communications) anticipated as a result of the proposed Project will be provided. An assessment of the potential effects from each ancillary development will be considered in the environmental assessment based on the screening reports provided by the applicable utility providers. All other regulatory requirements would be the responsibility of the utility provider.

The scope of the environmental assessment includes anticipated effects of the environment on the Project and associated environmental design features and mitigation. In addition to incremental Project effects, the scope of the assessment includes all potential effects on valued components (VC) of the biophysical and socio-economic environments from the Project, by itself and in combination with other past, present and reasonably foreseeable future developments (i.e., cumulative effects). Monitoring and follow-up programs that will be established with respect to biophysical and socio-economic effects are also included in the scope of the assessment.

TERMS OF REFERENCE

Yancoal has prepared the following TOR to outline the information that will be obtained as part of the environmental assessment, and how this information will be presented and evaluated in the Environmental Impact Statement. Information from several sources (e.g., the public and provincial agencies) was compiled in the TOR to reflect the concerns and issues that have been identified for the Project and for similar developments. These TOR should not be considered as either exhaustive or restrictive, as concerns other than those already identified could arise during the completion of the environmental assessment. For clarity and ease of reference, these TOR are presented in the same order as the Yancoal Southey Project EIS Table of Contents. The complete EIS Table of Contents for the Project is provided in Appendix A.

ENVIRONMENTAL IMPACT STATEMENT ORGANIZATION AND CONTENT

The environmental assessment investigates the risks and benefits of the Project in the context of the existing biophysical and socio-economic conditions. In addition to identifying potential risks and specifying appropriate mitigation designs and policies, the EIS will also incorporate conceptual plans for decommissioning and reclamation of the site. The EIS considers a number of components, including issue scoping (e.g., Purpose of the Project, need for the Project, and Project concerns), baseline studies, effects predictions, determination of significance, and recommended monitoring and follow-up programs. Although the environmental assessment will evaluate all potential Project environment interactions, the intent is to focus the effects assessment on those interactions with the greatest potential to result in significant effects to the biophysical and socio-economic environments.

The EIS is organized into a main document (including associated appendices) and annexes. The EIS is reviewed by a wide audience, including technical specialists, non-technical subject-matter experts, the general public, First Nations and Métis Communities. As such, the EIS will be written to satisfy a wide range of technical knowledge, be clear and concise, consistent and accurate, and transparent in describing methods, assumptions, and drawing conclusions.

The assessment of potential effects on the biophysical and socio-economic environments is organized by discipline; that is, all information pertaining to a discipline (i.e., study areas, existing environment, residual effects assessment, uncertainty, and monitoring and follow-up) is provided within the discipline section. Sections of the main document may be supported by appendices and annexes.

Appendices may be included in each major section of the main document. Appendices are not stand alone documents. For example, the Existing Environment section of the EIS will provide an understanding of water chemistry levels in the aquatic receiving environment. The text within the main document interprets and summarizes the data, whereas, the data to support the discussion is provided in the appendix. The annexes are stand-alone technical documents and include reports of previous studies that were completed during baseline studies and Project development. These documents provide important pieces of supporting information for review by technical subject-matter experts. For example, stand-alone Baseline Reports, which are summarized within each discipline section (i.e., Existing Environment sections) of the main document.

The following sections of the TOR describe the information that will be presented within each chapter of the EIS. Sufficient information will be provided for each so that informed conclusions can be reached regarding the potential for effects on the biophysical and socio-economic environments.

EXECUTIVE SUMMARY

The Executive Summary will describe the key Project elements and key findings of the Environmental Impact Statement, with particular reference to the overall conclusions of the assessment, and a clear rationale relating those conclusions to the predicted effects and the environmental design features proposed to mitigate them. Specifically, the Executive Summary will describe the Project, the Project location and environmental setting, and the conceptual decommissioning, reclamation, and monitoring plan. The Executive Summary will focus on items of known or expected public concern, results of the residual effects assessment, determination of significance, and monitoring and follow-up programs. A summary of commitments made by Yancoal throughout the Environmental Impact Statement will also be included. The Executive Summary will be written in non-technical language, and avoid the use of scientific jargon.

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TABLES

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1.0 INTRODUCTION

1.1 Proponent

This section will provide a general description of Yancoal Canada Resources Company Limited (Yancoal). The legal name and address of Yancoal along with the details (i.e., address, telephone, and email) for the Project contact person will be presented. General corporate information for the consultants that were hired to aid Yancoal during the preparation of the Environmental Impact Statement (EIS) will also be provided.

1.2 Project Location

A detailed description and coordinate locations of the Project area will be provided. Maps showing the location of the proposed Project relative to other land uses and developments will be presented. This section will also provide a discussion of the land disposition (e.g., privately owned, leased from the provincial or federal government), and identify if the Project is subject to any type of land claims agreements, the details of which will also be provided.

1.3 Project Overview

A brief overview will be provided to familiarize the reader with the Project and present a framework or structure for the organization of the information that will follow. A description of the intended scope of work and summary of the specific components and/or activities involved with completing the Project will be provided.

1.4 Project Schedule

The anticipated schedule of each Project phase (i.e., construction, operation, and decommissioning and reclamation) will be described, including the following:

- anticipated Project lifespan;
- anticipated timing/scheduling and duration of each phase; and
- anticipated schedule for submitting regulatory permitting applications at each phase.

The discussion will be supplemented with a Gantt chart showing Project milestones.

1.5 Need for the Project and Benefits

The "need for" the project is defined as the problem or opportunity that the proposed project is intending to solve or satisfy; that is, "need for" establishes the fundamental justification or rationale for the project (Canadian Environmental Assessment Agency 2007). The "benefit of" the project outlines what is to be achieved by carrying out the project.

A rationale for the need for the Project will be provided. The rationale will describe Yancoal’s motivation and understanding of how the proposed Project meets the global needs for potash, as well as the potential benefits to local communities and Saskatchewan in general.

2.0 REGULATORY FRAMEWORK

An overview of the regulatory requirements for the Project will be provided. The overview will contain a summary of the potential permits/approvals/licenses/authorizations that are required prior to the construction and operation phase of the Project. A list of applicable federal, provincial, and municipal Acts and Regulations will also be presented. Letters of approval that have been issued by provincial and federal government agencies will also be included.

3.0 ENVIRONMENTAL SETTING

A high-level description of the landscape (e.g., ecoregion, ecozone, general description of topography) will be presented. The purpose of the environmental setting will be to provide context so that the reader can understand where the Project is situated with respect to the main existing environmental features. Detailed information collected during the baseline programs will be provided as supporting information to the EIS in the form of Annexes.

4.0 PROJECT ALTERNATIVES

This section will describe the various technically and economically feasible ways the Project can be implemented or carried out. Alternative components, activities, management systems, environmental design features, or mitigation considered during the Project planning will be described in enough detail to clearly illustrate the differences, advantages and disadvantages of each option. This section will discuss the criteria (environmental, engineering and economic) used to evaluate the design alternatives, and provide an explanation of why they were selected or rejected. The criteria used to evaluate alternative design options will reflect the potential concern for both short-term (during operations) and long-term (post-decommissioning) environmental effects. Economic, social, and/or environmental considerations that were relevant to the selection of the preferred alternative will be described. The alternatives analysis will also include a discussion on how engagement with the public, and First Nations and Métis communities completed by Yancoal were considered in determining the preferred Project alternative.

5.0 PROJECT DESCRIPTION

5.1 Introduction

This section defines the scope of the environmental assessment, and presents details of the Project to support the assessment of the potential Project effects on the environment. Detailed descriptions of the Project components and activities (e.g., mining, processing, site infrastructure, and waste management) completed throughout the construction and operation phases of the Project will be provided. Environmental design features and mitigation that will be implemented to reduce or eliminate the effects of the Project on the environment will also be discussed. A conceptual decommissioning and reclamation plan will be described. Information and technical data will be provided in sufficient detail to enable an accurate assessment of the potential environmental effects of the proposed Project. Specifically, the following information will be provided in this section.

5.2 Mineral Resource Review

This section will provide details on the mineral formation, key stratigraphic boundaries determined for the Project, and the nature, depth, and thickness of the potash-bearing beds. Seismic surveys and drilling programs will be briefly discussed, and the mineral resource estimates (i.e., measured resource, indicated resource, and inferred resource) provided.

5.3 Construction

This section will discuss the temporary facilities and infrastructure that may be required during construction. Temporary facilities and infrastructure may include:

- contractor buildings;
- equipment maintenance area;
- parking;
- laydown areas;
- security facilities;
- hazardous substances and waste dangerous goods storage;
- sewage management facilities;
- storage warehouses;
- first aid trailer;
- lunchroom/washroom;
- temporary water and power supply; and
- site water management infrastructure.

This section will also describe industry standards, best management practices, environmental design features, and/or mitigation that will be implemented during construction to reduce or eliminate potential effects to the environment (e.g., traffic, noise, air emissions, and soil erosion).

5.4 Mining

This section will provide a general understanding of the mining components necessary to mine the potash-bearing beds of the Prairie Evaporite Formation. The conceptual mining plan for the Project will be described, including the anticipated mine life, the conceptual development sequence and layout of the mine plan, and the yearly average extraction rates. The mining method selected for the Project and any technical issues and/or new technologies specific to the Project will be described.

The estimated direct physical footprint of the mine area will be provided, as well as drawings showing the locations of all structures and related infrastructure. Conceptual design descriptions of components and infrastructure associated with mining (e.g., mine plan, well and pad layout, well field piping), will be included.

This section will also provide a summary of the associated mining phases, including:

- cavern development (sump development, cavity connection, roof area development);
- primary mining;
- secondary mining; and
- cavern closure.

Industry standards, best management practices, environmental design features, and/or mitigation that will be implemented during mining to reduce or eliminate potential effects to the environment will be included.

5.5 Processing

This section will describe process details, and any technical issues and/or new technologies specific to the Project. A general overview of the process, as well as a simplified processing diagram, will be provided. Conceptual design descriptions of components and infrastructure associated with potash processing will be provided, including:

- evaporation and crystallization;
- centrifuging and drying;
- product screening;
- compaction;
- pond crystallization;
- loadout and storage;
- salt handling; and
- reagent storage and preparation.

Environmental design features integrated into the plan to prevent or limit the effects of the Project on the environment will also be included (e.g., water usage reduction, greenhouse gas emission reduction, energy/power conservation).

5.6 Tailings Management Area

This section will describe the different tailings waste products, and the overall tailings management system, including the tailings preparation circuits within the plant site, the tailings delivery system, and the tailings management facility. It will also include a description of the containment system, including perimeter dykes techniques used to maintain their stability and containment. The management and disposal plan for brine waste will be presented, including expected volumes and the number and types of deep disposal wells to be used for deep well injection of brines. An evaluation of the capacity potential of deep injection to a suitable disposal zone will also be provided. Industry standards, best management practices, environmental design features, and/or mitigation that will be implemented to reduce or eliminate potential effects to the environment from the tailings management area (TMA) will be discussed.

5.7 Site Infrastructure

This section will discuss the major above-ground buildings proposed for the Project during operations. Major above-ground buildings may include:

- process plant;
- maintenance shop,
- warehouse;

- administration buildings, and dry facilities;
- product storage and loadout buildings; and
- powerhouse building.

Hazardous substance storage on-site will also be described, including:

- the type, volume, storage (location and method), handling, and mitigation practices (e.g., capacity for containing spills) of all potentially hazardous materials used on site;
- a list of storage locations for reagents, including expected volumes and concentrations of reagents to be stored on site; and
- construction of fuel storage facilities (e.g., diesel backup power generators building) including a justification for the fuel storage container type selected, on-site fuel transport and handling procedures.

In addition to the major buildings described above, a number of other buildings may be required throughout the site. A brief description of these buildings will be provided, and may include:

- various pump houses (e.g., raw water pump house, brine pond pump house, and crystallization pond pump house);
- a cluster house at each wellhead grouping in the well field;
- an equipment storage shed; and
- a separate gas-insulated switchgear.

Industry standards, best management practices, environmental design features, and/or mitigation that will be implemented to reduce or eliminate potential effects to the environment from site infrastructure will be discussed.

5.8 Supporting Infrastructure

Support infrastructure for the Project will include water, power, natural gas, communications, road access, and rail access. SaskWater, SaskPower, TransGas, and SaskTel will be the utility providers of water, power, natural gas, and telecommunication services, respectively, for the Project. The off-site infrastructure required to support the Project will be discussed, and a screening assessment completed by each of the utility providers will be included as a supporting appendix to the EIS. The on-site and supporting infrastructure owned by Yancoal (e.g. access roads, rail spur) will be described.

New roads or upgrades to existing roads may be required to access the site; as such a Traffic Impact Assessment will be completed for the construction and operation phases of the Project. This section will also provide the anticipated type, size, and frequency of traffic and loads that public roads will be subjected to, as well as proposed mitigation for access and safety concerns. The proposed railway spur route designed to transport the potash production from the site to port facilities will be described, as well as rail car requirements. Industry standards, best management practices, environmental design features, and/or mitigation that will be implemented to reduce or eliminate potential effects to the environment from supporting infrastructure will be discussed.

5.9 Domestic and Industrial Waste Management

The sources, types, and quantities of domestic, non-hazardous industrial, and hazardous industrial wastes (excluding mine waste, such as tailings and brine) predicted to be generated by the Project will be provided in the EIS. The process for the collection, handling, and disposing of these wastes to be generated will be described. Industry standards, best management practices, environmental design features, and/or mitigation that will be implemented to reduce or eliminate potential effects to the environment from domestic and industrial wastes will be discussed.

5.10 Health, Safety, Security, and Environmental Management System

A summary of Yancoal's health, safety, security and environmental (HSSE) management system will be provided. Yancoal will develop programs in conformance to regulatory requirements, notably, *The Saskatchewan Employment Act* (2014) and *The Energy and Mines Act* (1982-83). A brief description of the purpose and key elements of programs will be provided, including:

- occupational health and safety plans;
- environmental protection plans;
- emergency response plans;
- employee education and training plans; and
- community relations plans.

5.11 Decommissioning and Reclamation

A Project-specific conceptual decommissioning and reclamation plan will be developed to provide a framework for decommissioning facilities and infrastructure on the site, in such a way that the environment and the public will be protected over the long-term. This section will present a conceptual description of the decommissioning and reclamation activities, including:

- decommissioning and reclamation objectives;
- approach to conceptual decommissioning planning;
- proposed decommissioning and reclamation methods;
- post-decommissioning monitoring and contingency planning; and
- estimated cost and financial assurance.

The operational decommissioning and reclamation plan will be prepared to comply with Section 12(a) and 14(2), (a), (b) and (c) of the *Mineral Industry Environmental Protection Regulations* (1996) of the *Environmental Management and Protection Act* (2002). A conceptual reclamation plan will also be provided as a supporting appendix. This section will propose criteria for abandoning the Project and associated infrastructure, and commitments for the monitoring of decommissioning success prior to the final abandonment. Detailed plans for decommissioning, reclamation, and abandonment will be developed in consultation with regulatory agencies during licensing.

Section 14 of the *Mineral Industry Environmental Protection Regulations* requires submission and approval of a plan to decommission the site, and an assurance fund to provide for site decommissioning. Financial assurances will be established in consultation with MOE during permitting of the Project.

5.12 Human Resources

This section will identify the peak construction workforce and number of permanent mine and process plant employees required for operation, and the potential needs to be met by local recruitment. The estimate of the human resource requirements for the Project includes direct and indirect employment requirements.

5.13 Accidents, Malfunctions, and Unplanned Events

Potential accidents, malfunctions and unplanned events that may occur during construction, operation, and decommissioning of the Project will be identified. Environmental design features, mitigation practices, and emergency response plans to manage these events will be identified.

5.14 Effects of the Environment on the Project

Potential effects that the natural environment may have on the Project (e.g., short term weather events such as drought or flooding, and wildfire), and the environmental design features that will be put in place to limit effects will be described in this section.

6.0 ENGAGEMENT

6.1 Introduction

At an early stage of the Project Yancoal recognized the need to engage the general public, First Nations and Métis communities, and regulatory agencies. As such, during the preliminary planning phase of the Project, Yancoal initiated contact with the local public, First Nations and Metis communities, and regulatory agencies (including municipal and provincial governments). Yancoal will continue to engage with these communities and groups throughout the environmental assessment and permitting process. A description of all engagement activities (names of groups, locations, dates, and formats) that have been conducted in support of the Project will be provided and summarized in tables for the following broad categories of stakeholders:

- public (local communities, and other concerned members of the public);
- landowners;
- government and regulatory agencies (e.g., municipal and provincial); and
- First Nations and Métis communities.

6.2 Engagement Approach

The public engagement program encompasses several elements: local communities (including interested members of the public), First Nations and Métis communities, municipal government representatives, regulatory agencies, and adjacent landowners. Yancoal has initiated early contact with the local public, First Nations and Métis communities, rural municipalities and regulatory agencies, and plans are in place to continue to engage with these stakeholders and groups throughout the environmental assessment and permitting process. While Yancoal plans to keep the lines of communication open with all stakeholders, timing of engagement activities is connected to Project milestones such as the submission of the Technical Proposal and submission of the EIS.

6.2.1 Public Engagement

Community information sessions will be held to foster an understanding of the Project and provide an opportunity for people in the area to show support or identify concerns about the potential effects of the Project. The information collected during these sessions will be included in the EIS for the Project, along with an indication of how the concerns will be addressed. Community information sessions were held in November 2013 to introduce the surrounding communities to the Project and the representatives from Yancoal. Yancoal will continue to provide the public with updates on the Project throughout the environmental assessment process; specifically at Project milestones such as submission of the Technical proposal and the submission of the EIS to MOE, Environmental Assessment Branch.

6.2.2 First Nations and Métis Communities

First Nations and Métis community engagement activities to date have been focused on establishing a foundation for engagement activities that will occur throughout the environmental assessment process and Project development. They have also been used to identify specific issues that will be of interest locally, so that appropriate materials and preparations can be completed to address these issues more fully. The discussions with First Nations and Métis communities are used to establish the basis for collecting baseline data related to Traditional Knowledge and Land Use in the Project area, which is to be included in the EIS. Engagement activities for First Nations and Métis communities include attending face-to-face meetings with the various Chiefs and Councils, and Regional Métis Directors. Yancoal will continue to provide updates on the Project to First Nations and Métis communities throughout the environmental assessment process; specifically at Project milestones such as submission of the Technical proposal and the submission of the EIS to MOE, Environmental Assessment Branch.

Project information has been provided to 15 First Nation and Métis communities including the following:

- Day Star First Nation;
- Kawacatoose First Nation;
- Muskowekwan First Nation;
- George Gordon First Nation;
- Piapot First Nation;
- Muscowpetung First Nation;
- Pasqua First Nation;
- Standing Buffalo First Nation;
- Little Black Bear First Nation;
- Star Blanket First Nation;
- Okanese First Nation;
- Peepeekisis First Nation;

- Carry the Kettle First Nation;
- Métis Western Region 3; and
- Métis Eastern Region 3.

6.2.3 Municipal and Provincial Regulatory Agencies

Meetings held with local Rural Municipalities (R.M.s) and the councils of towns, villages, or organized hamlets are intended to engage the local government and communities in the Project area. These meetings include introducing the Project and representatives from Yancoal, discussing potential Project-specific details and the potential effects from the Project. Introductory meetings have been held with four R.M.s to provide preliminary information about the Project. It is anticipated that a potential new mining project in a rural region will generate a lot of interest as the Project proceeds; keeping local municipal representatives informed about the Project is an important step in establishing a relationship with the community. Yancoal will continue to meet with R.M.s and community councils throughout the environmental assessment process; specifically at Project milestones such as submission of the Technical proposal and the submission of the EIS to MOE, Environmental Assessment Branch.

Yancoal will meet with government and regulatory agency staff throughout the environmental assessment process. In particular, Yancoal will initiate a meeting to discuss the Technical Proposal and request feedback from the regulators.

6.2.4 Adjacent Landowners

The purpose of neighbour relations program is to establish relationships with the landowners and residents nearest to the Project, and to provide an opportunity to present findings of the environmental assessment directly to these people. Local landowners will have very specific concerns and questions associated with living and owning land near the Project. As such, the neighbour relations program provides Yancoal the opportunity to engage with these people and discuss Project-specific details and potential environmental and socio-economic effects. Information gathered from the neighbour relations program will be documented in the EIS. Yancoal will provide adjacent landowners with updates on the Project throughout the environmental assessment process.

6.3 Engagement Activity

This section will describe the engagement activities completed throughout the Project development. A discussion of the results and feedback received will be provided, along with how this information will be addressed by Yancoal. Future communication and engagement activities, including schedules and linkages to Project milestones and the environmental assessment process will be described.

7.0 ENVIRONMENTAL ASSESSMENT APPROACH

7.1 Introduction

This section describes the approach that will be used for analyzing effects, and classifying and determining the environmental significance of residual effects from the Project on the biophysical and socio-economic components in the EIS.

The assessment approach is based on ecological, cultural, and socio-economic principles, and environmental assessment best practices. The approach considers how each key element of the Project may interact with the existing environment and result in a potential environmental effect on one or more of the biophysical and socio-economic components. Although all potential Project-environment interactions will be evaluated, the intent is to focus the assessment on those interactions with the greatest potential to result in significant residual environmental effects to the biophysical and socio-economic components. The approach will be applied to the analysis and assessment of the environmental effects from the Project using information from the Yancoal Southey Project Technical Proposal, Project description information, baseline studies, and engagement activities.

Key elements of the environmental assessment include:

- identify valued components (VCs);
- determine spatial and temporal boundaries;
- identify all potential interactions and environmental effects the Project may have on biophysical and socio-economic VCs;
- describe Yancoal's plans to mitigate potential environmental effects from the Project due to construction and operation activities;
- classify and determine the significance of residual environmental effects (i.e., anticipated environmental effects remaining after consideration of appropriate mitigation); and
- outline monitoring and follow-up programs that may be required.

7.2 Valued Components, Assessment Endpoints, and Measurement Indicators

7.2.1 Selection of Valued Components

Valued components (VCs) represent physical, biological, cultural, social, and economical properties of the environment determined to be important by the proponent, government agencies, First Nations and Métis communities, and the public. The value of a component not only relates to its role in the ecosystem, but also to the value placed on it by society.

The selection of VCs is a process that reflects a balanced and knowledgeable synthesis of a wide range of information including the design of the Project, the environmental setting where the Project is located, and an understanding of concerns and issues associated with the development of the Project. A preliminary evaluation was completed at the Project concept stage to identify key interactions between the Project and various components of the biophysical and socio-economic environments. This evaluation identified key issues to support the initial VC selection process. This preliminary evaluation also provided a basis for understanding the interactions that are present for each of the major phases of the Project (i.e., construction, operations, and decommissioning and reclamation, as well as accidents and malfunctions) and how anticipated events can be mitigated.

The selection of VCs will consider the following factors:

- presence, abundance, and distribution within, or relevance to, the Project area;
- potential for interaction with the Project and sensitivity to effects;

- species conservation status or concerns;
- previous and on-going engagement with First Nation and Métis communities; and
- previous and on-going engagement with the R.M., and the general public.

The VCs selected for this assessment will be drawn from the following categories:

- atmospheric environment;
- hydrology;
- groundwater;
- surface water quality;
- fish and fish habitat;
- soils;
- vegetation, including listed plant species;
- wildlife, including listed wildlife species (e.g., burrowing owl);
- cultural and heritage resources; and
- socio-economics (e.g., employment and economy, community services and infrastructure, and land use).

7.2.2 Assessment Endpoints and Measurement Indicators

Assessment endpoints are qualitative expressions used to determine the significance of effects on VCs and represent the key properties of VCs that should be protected for future human generations (i.e., incorporates sustainability). For example, maintenance or suitability of water quality, self-sustaining and ecologically effective wildlife populations, and continued opportunities for traditional and non-traditional use of these ecological resources may be assessment endpoints for surface water, wildlife, and traditional and non-traditional land use.

Assessment endpoints are typically not quantifiable and require the identification of one or more measurement indicators that can be directly linked to the assessment endpoint. Measurement indicators represent properties or attributes of the environment and VCs that, when changed, could result in, or contribute to, an effect on assessment endpoints. Measurement indicators may be quantitative (e.g., measured concentrations of metals in surface water) or qualitative (e.g., discussion of movement and behaviour of wildlife from disturbance to habitat and travel corridors). Measurement indicators also provide the primary factors for discussing the uncertainty of effects on VCs and, subsequently, are key variables for study in follow-up and monitoring programs.

The significance of effects from the Project on a VC is evaluated by linking changes in measurement indicators to effects on the assessment endpoint. Valued components, assessment endpoints, and measurement indicators that will be used in the EIS are presented in Table 7.2-1.

Table 7.2-1: Valued Components, Assessment Endpoints and Measurement Indicators

Valued Component	Assessment Endpoint	Measurement Indicator
Atmospheric Environment	■ Compliance with regulatory air emission guidelines and standards	■ carbon monoxide (CO) ■ sulphur dioxide (SO_2) ■ nitrogen oxides (NO_x) ■ particulate matter (PM) ■ greenhouse gases (GHGs): ▪ carbon dioxide (CO_2) ▪ methane (CH_4)
Groundwater	■ Continued suitability of groundwater for human use	■ Groundwater chemistry ■ Groundwater levels ■ Vertical and horizontal migration
Hydrology	■ Surface water quantity for human use	■ Spatial and temporal distribution of water ■ Surface topography, drainage boundaries waterbodies, and water pathways
Surface Water Quality	■ Continued suitability of surface water for human use	■ Surface water quality (i.e., physical analytes, chemical properties)
Fish and Fish Habitat	■ Self-sustaining and ecologically effective fish populations	■ Spatial and temporal distribution of water ■ Surface topography, drainage boundaries, waterbodies, and water pathways ■ Surface water quality (i.e., physical analytes, chemical properties) ■ Fish habitat quantity and fragmentation ■ Fish habitat quality ■ Abundance and distribution of fish species
Soil	■ Soil capability to support agriculture and other plant communities	■ Soil quality (i.e., physical, biological, and chemical properties) ■ Soil quantity and distribution
Plant Populations and Communities	■ Self-sustaining and ecologically effective plant populations and communities	■ Quantity, arrangement, and connectivity (fragmentation) of plant communities ■ Abundance and distribution habitat for listed plant species ■ Traditional and non-traditional use plants ■ Presence of weed and invasive plant species
Wildlife ■ Upland Breeding Birds ■ Waterbirds ■ Raptors	■ Self-sustaining and ecologically effective wildlife populations	■ Habitat quantity, arrangement, and connectivity (fragmentation) ■ Habitat quality ■ Survival and reproduction ■ Abundance and distribution of wildlife VCs
Heritage Resources	■ Protection of heritage resources	■ Archaeological and sacred sites

Table 7.2-1: Valued Components, Assessment Endpoints and Measurement Indicators (continued)

Valued Component	Assessment Endpoint	Measurement Indicator
Socio-economics ■ Employment and Economy ■ Community Services and Infrastructure ■ Education and Training ■ Traffic and Transportation Infrastructure ■ Quality of Life ■ Traditional and Non-Traditional Land Use	■ Sustainability of social and economic properties, and the protection of human health	■ Employment ■ Labour income ■ Tax revenue ■ Gross domestic product ■ Project workforce requirements ■ Potential changes in the demand for housing, accommodations, social, health, emergency and protective services, and physical infrastructure ■ Commitments regarding employment training ■ Project traffic volumes ■ Commitments regarding safety measures and reducing traffic ■ Changes in land use ■ Changes in aesthetics ■ Changes in noise and air quality

7.3 Environmental Assessment Boundaries

Environmental assessment boundaries define the geographic and temporal scope or limits of the analysis and determination of significance of effects from the Project on the environment. Because the responses of physical, biological, cultural, and economic properties to natural and human-induced disturbance will be unique and occur across different scales, a multi-scale approach will be used for describing baseline conditions (existing environment) and predicting effects from the Project on VCs.

7.3.1 Spatial Boundaries

The spatial boundaries for analyzing and predicting effects from the Project should be appropriate for capturing the processes and activities that influence the geographic distribution and movement patterns specific to each VC. Effects assessment areas will be designed to capture the maximum spatial extent of potential effects from the Project and other previous, existing, and reasonably foreseeable future developments (if applicable). The rationale for the effects study area for each VCs will be provided in the discipline section.

7.3.2 Temporal Boundaries

The environmental assessment will be designed to evaluate the short- and long-term changes from the Project on the biophysical and human environments. The duration of effects may extend beyond specific phases of the Project, and is dependent of the physical and/or biological properties of each VC. The temporal boundary of the Project is defined as having the following phases:

- construction (2016 to 2019);
- operations (2019 to 2119); and
- decommissioning and reclamation starting in 2119 onward.

The temporal boundaries for each VC will consider the phases of the Project, and the predicted duration of effects from the Project on the VC. The temporal boundaries considered for each VC will be provided in the discipline section.

7.3.3 Assessment Cases

For VCs that require cumulative effects analysis, the concept of assessment cases is applied to the associated spatial boundary of the assessment in order to estimate the incremental and cumulative effects from the Project and other developments (Table 7.3-1). The approach incorporates the temporal boundary for analyzing the effects from previous, existing, approved, and reasonably foreseeable developments before, during, and after the anticipated life of the Project. Analyzing the temporal changes to the biophysical and human environments is fundamental to predicting the cumulative effects from development on VCs that move over large areas, such as moose, fish, and traditional land users. The assessment cases for the Project will be described in this section.

Table 7.3-1: Contents of Each Assessment Case

Base Case	Application Case	Reasonably Foreseeable Development Case
Range of conditions from little or no development to previous and existing developments[a] before the Project	Base Case plus the Project	Application Case plus reasonably foreseeable developments

[a] Includes approved projects.

7.4 Screening of Project Interactions and Mitigation

This section identifies and evaluates the interactions between Project components or activities, and the corresponding potential environmental effects to VCs. The process begins with the identification of all potential interactions for the Project through a pathway analysis. To provide a robust assessment of potential environmental effects, each interaction is initially considered to have a linkage to a change in the environment and associated potential environmental effects on VCs. Each potential interaction is evaluated to determine if mitigation can be developed and incorporated to remove the interaction, or limit the potential environmental effect.

Mitigation includes Project design elements, environmental best practices, management policies and procedures, and social programs. Mitigation practices are developed through an iterative process between Yancoal and the environmental assessment team, and involves a hierarchical approach that includes the following practices:

- avoid (e.g., avoid locating the Project within sensitive habitat);
- minimize (limit) (e.g., reduced vehicle speeds to limit wildlife collisions);
- reclaim or restore (e.g., reclaim land following operations); and
- off-set (e.g., restore or rehabilitate habitat in an area not otherwise affected by a project).

The Project team will focus primarily on options to avoid or minimize environmental effects. If avoidance, actions to limit, or actions to reclaim environmental effects cannot be identified, then off-setting options will be considered.

Pathway analysis is a screening step that is largely a qualitative assessment, and is intended to focus the effects analysis on project interactions that require a more comprehensive assessment of effects on VCs. Pathways are determined to be primary, secondary (minor), or to have no linkage, using scientific and traditional knowledge (if available), logic, and experience with similar developments and environmental design features. Each potential pathway is assessed and described as follows:

- **No linkage** – Analysis of the potential pathway reveals that there is no linkage, or the pathway is removed by environmental design features or mitigation, such that the Project would not be expected to result in a measurable environmental change.
- **Secondary** – Pathway could result in a measurable minor environmental change, but would have a negligible residual effect on a VC. Therefore, the pathway is not expected to contribute to effects of other existing, approved, or reasonably foreseeable projects to cause a significant effect.
- **Primary** – Pathway is likely to result in environmental change that could contribute to residual effects on a VC.

Knowledge of the biophysical or socio-economic components and associated hierarchy of mitigations are applied to each interaction to determine the expected Project-related change to the environment, and whether there is potential for a residual effect on a VC. Interactions that are avoided through engineered design are not analyzed further because the mitigation eliminates the potential for a residual effect on a VC to occur (e.g., determined to have no linkage). Some interactions could result in a minor environmental change, but have a negligible residual effect on a VC (e.g., secondary pathway). Such interactions are also not evaluated further. Interactions determined to have no linkage to VCs, or those that are considered to be secondary, are not predicted to result in environmentally significant effects on VCs. Primary interactions that are anticipated to result in a residual effect to a VC require further analysis to determine the significance of the residual effect.

7.5 Residual Effects Analysis

In the EIS, the residual effects analysis considers all primary interactions that are likely to result in measurable environmental changes and residual effects to VCs (i.e., after implementing mitigation). This section will provide the general approach to analyzing Project-specific (incremental) effects for biophysical and socio-economic components. Where possible and appropriate, the analysis is quantitative, and may include data from field studies, scientific literature, government publications, and personal communications.

Cumulative effects represent the sum of all natural and human-induced influences on the physical, biological, cultural, and socio-economic components of the environment through time and across space. Some changes may be human-related, such as increasing agricultural development, and some changes may be associated with natural phenomena, such as extreme rainfall events. Where information is available, the cumulative effects assessment estimates or predicts the contribution of effects from the Project and other reasonably foreseeable developments on VCs, in the context of natural changes in the system. The cumulative effects assessment will be VC dependent, and associated with the spatial and temporal boundaries defined for each VC.

Not every VC requires an analysis of cumulative effects. The key is to determine if the effects from the Project and one or more additional existing, approved, and/or reasonably foreseeable developments/activities overlap (or interact) with the temporal or spatial distribution of the VC. For some VCs, Project-specific effects are important; however, there is little or no potential for cumulative effects because there is little or no overlap with other developments (e.g., soils). For other VCs that are distributed or travel over large areas, and can be influenced by a number of developments (e.g., moose), the analysis of cumulative effects can be necessary and important. Socio-economic components also must consider the potential cumulative effects of the Project and other developments and human activities.

Results for predicted incremental effects will be concisely and clearly presented with appropriate tables and figures. If applicable, cumulative effects from the Project and other developments will also be assessed and presented. Supporting data from existing conditions, scientific literature, and monitoring programs, where applicable, will be used.

7.6 Prediction Confidence and Uncertainty

Most assessments of effects embody some degree of uncertainty. The uncertainty section of the EIS will identify the key sources of uncertainty, and discuss how uncertainty was addressed to increase the level of confidence that effects will not be worse than predicted. Where possible, a strong attempt will be made to reduce uncertainty in the EIS to increase the level of confidence in effects predictions. Where appropriate, uncertainty may also be addressed by additional mitigation, which would be implemented as required. Each discipline section will include a discussion of how uncertainty has been addressed and provide a qualitative evaluation of the resulting level of confidence in the effects analyses and determination of significance.

7.7 Determination of Significance

Definitions for residual effects criteria will be provided, as well as an overview of the approach and method used to classify effects and predict environmental significance. Residual effects criteria used in the determination of significance include direction, magnitude, geographic extent, duration, reversibility, frequency, and likelihood. Environmental significance is used to identify predicted effects that have sufficient magnitude, duration, and geographic extent to cause fundamental changes to a VC (i.e., after implementing mitigation). It is difficult to provide definitions for residual effects criteria and environmental significance that are universally applicable to each VC. Consequently, specific definitions will be provided within each VC section of the EIS.

7.8 Monitoring and Follow-up

Monitoring programs will be proposed to deal with the uncertainties associated with success of mitigation and residual effects predictions. In general, monitoring is used to test (verify) effects predictions and determine the effectiveness of mitigation. Monitoring will be completed by qualified individuals and is used to implement adaptive management during the life of the Project. This section presents the concepts of adaptive management and different types of monitoring.

8.0 DISCIPLINE SECTIONS

Sections 8 to 20 of the EIS will present the results of the environmental assessment on a discipline-specific basis for the biophysical, cultural, and socio-economic environments at or near the Project. Topics covered within each of these discipline-specific sections include study areas, summary of the existing environment and baseline studies, pathways analysis, environmental effects assessment, residual effects assessment, cumulative effects assessment, and monitoring and follow-up. The major environmental disciplines evaluated in the EIS are as follows:

- Section 8 Atmospheric and Acoustic Environment;

- Section 9 Hydrogeologic Environment (including geology and hydrogeology);
- Section 10 Hydrologic Environment (including hydrology);
- Section 11 Surface Water Environment (including surface water quality);
- Section 12 Fish and Fish Habitat;
- Section 13 Soils;
- Section 14 Vegetation;
- Section 15 Wildlife (including wildlife habitat);
- Section 16 Heritage Resources;
- Section 17 Land use (including traditional and non-traditional land use);
- Section 18 Economy;
- Section 19 Infrastructure and Community Services; and
- Section 20 Population and Health (including quality of life).

9.0 ENVIRONMENTAL MANAGEMENT, MONITORING AND FOLLOW-UP

This section will provide a summary of the environmental management, monitoring and follow-up programs that Yancoal will put in place for the Project.

10.0 CORPORATE COMMITMENTS

This section will provide a discussion of Yancoal's corporate commitments through the development of a commitment register table, and the proposed structure for on-going reporting to the MOE Environmental Assessment Branch and other government and regulatory agencies.

11.0 REFERENCES

CEAA (*Canadian Environmental Assessment Act*). 2012. Government of Canada.

Canadian Environmental Assessment Agency. 2007. Operational Policy Statement. Addressing Need for, Purpose of, Alternative to and Alternative Means under the Canadian Environmental Assessment Act. Canadian Environmental Assessment Agency. Available at: http://www.ceaaacee.gc.ca/default.asp?lang=En&n=5C072E13-1. Accessed: October 23, 2014.

APPENDIX A

Environmental Impact Statement Table of Contents

January 2015

YANCOAL SOUTHEY PROJECT

Environmental Impact Statement

Submitted to:
Submitted to:
Mr. Stan Qin
Yancoal Canada Resources Company Limited
Unit 300, 211 - 4th Avenue
Saskatoon, Saskatchewan
S7K 1N1

REPORT

Report Number: 12-1362-0197

YANCOAL
兖煤加拿大资源有限公司
Golder Associates

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FIGURES

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APPENDICES

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APPENDIX B

Summary of Discussions with First Nations and Métis Communities

Table B1: Summary of Discussions with First Nations and Métis Communities

Community	Date	Type of Communication	Summary of Communication
Day Star First Nation	June 18, 2013	Face to Face Meeting - Lyle Bear, Phil Anaquod (Golder Associates) - Chief Lloyd Buffalo	Meeting took place in Chief's office. Information about the Project was provided. The Chief inquired about meetings with other First Nations and asked where the water supply for the Project would come from. The offer for Yancoal to meet with Chief and council members was extended; the Chief did not give any indication if he wanted to meet further with Yancoal.
	January 13, 2014	Face to Face Meeting - Phil Anaquod (Golder Associates) - Chief Lloyd Buffalo	The purpose of this discussion was to provide an update on the status of the Project. The Chief is interested in meeting with Yancoal in the future; however, this may be a joint interest with their business group KDM that represents three First Nations (Kawacatoose, Day Star, and Muskowekwan). The Chief indicated that they are interested in learning about potential business opportunities.
Kawacatoose First Nation	June 18, 2013	Face to Face Meeting - Lyle Bear, Phil Anaquod (Golder Associates) - Sanford Strongarm (council member), Glen Worm, Yvette Machiskinic, Dean Kay, and four other band members	Councilman Sanford Strongarm was the main spokesperson and did not make many statements about the information other than saying that he would provide the information to the Chief and Council at the next council meeting. Councilman Sanford Strongarm did indicate that a meeting with Yancoal might fall under their duty to consult guidelines. Contact information was left with the meeting attendees for future correspondence or if any questions or concerns came up following the meeting.
	December 7, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates)	A meeting time was scheduled; however, the Band administrator failed to mention to the Golder Representatives that the meeting was to be held in Calgary, Alberta. Golder representatives were not able to attend the meeting in Calgary, and will re-schedule for another time.
	January 13, 2014	Face to Face Meeting - Phil Anaquod (Golder Associates) - Clare Nashacappo	Project information sheets and information panels from the Community Information Sessions were provided to Clare to include in all councillor portfolios for review. Clare will be in touch with Golder regarding a potential opportunity to meet again in January if Chief and Council are interested and available.
Muskowekwan First Nation	June 18, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Jaime Wolfe	An introduction to the Project was provided, along with information sheets to share with Chief and council. Me. Wolfe inquired about the water supply for the project. Mr. Wolfe indicated that following a discussion with the Chief, someone would be in touch if there was further interest.
	December 2, 2013	Face to Face Meeting - Lyle Bear, Phil Anaquod (Golder Associates) - Emest Moise , Calvin Wolf, Leon Wolf, and receptionist	The purpose of this meeting was to provide information about the status of the Project. The information sheet and a copy of the information panels prepared for the Community Information Sessions was provided to each attendee. Interest was expressed in participation in a traditional land use study as well as a face-to-face meeting with Yancoal. General concerns about the Project were identified, such as the environment, the water source, and the concern over the number of mines coming up in the area.
	December 12, 2013	Face to Face Meeting - Jiqiu Han, Stan Qin and Lei Niu (Yancoal) - Chief Reginald Bellerose, Bill, Darren and Alison Boulding	On December 12, 2013, the Chief of Muskowekwan and three others visited the Yancoal office. There was an exchange of information on Yancoal and its project, information about Muskowekwan First Nation, Treaty Land Entitlement regulations, and Muskowekwan First Nation's intention to acquire nine quarters of Yancoal's potash permits. Yancoal advised its intention to corporate with local community including the First Nations, to promote local growth; however the sale or exchange of potash permits is subjects to Yancoal's head quarter board's approval as a publicly listed company. Yancoal agreed with the Chief that both sides would keep the communication discussion open on a mutual benefit base.

Table B1: Summary of Discussions with First Nations and Métis Communities (continued)

Community	Date	Type of Communication	Summary of Communication
George Gordon First Nation	June 18, 2013	Face to Face Meeting - Lyle Bear, Phil Anaquod (Golder Associates) - Chief and Council	A brief presentation about Yancoal and the Project was provided by representatives from Golder Associates Ltd. to the George Gordon First Nation Chief and Council. Information sheets were left with each member in attendance. Discussion items included at this meeting included the corporate social responsibility of Yancoal, land and the Treaty Land Entitlement process, interest in the potash mining process, and the approach to Elders providing input into baseline studies. Chief Longman indicated that they would be interested in a Face-to-Face meeting with Yancoal.
	December 2, 2013	Face to Face Meeting -Lyle Bear and Phil Anaquod (Golder Associates) -Chief and Council	The purpose of the meeting was to provide information about the status of the Project; it was clearly stated that this meeting was not related to Duty to Consult. The Project information sheet and a copy of the panels prepared for the Community Information Sessions was provided to everyone in attendance. Concerns identified during the meeting included the effects on traditional lands used for hunting by all the mining activity in the area; existing exploration permits (do they have expiry dates), and their relation to treaty land entitlement land; completion of the EIS; water usage; general environmental concern air quality; and water seepage. The Band is also interested in employment and business opportunities should they arise from the Project. The Band would like to develop a relationship and on-going communication with Yancoal early in the Project and would like to schedule a face-to-face meeting.
	February 26, 2014	Face to Face Meeting - Phil Anaquod, Brad Novecosky (Golder Associates) - Yatong (Mandy) Chen, Jiqiu Han, Lei Niu, Yanxin Liang (Yancoal) - Chief Shawn Longman, Linda Okanee, Ashley Whitehawk, John McNab, Howard Anderson, Donna Anderson, Kim Sinclair, Marcie Bitternose, Garth Geddes, Pauline Anderson, Bryan McNab, and approximately 20 other observers	The purpose of this formal face-to-face meeting was to introduce Yancoal and provide an update on the Project. Concerns raised at this meeting regarding the Treaty Land Entitlement Process, specifically concerns are with minerals, as George Gordon First Nation would like to expand their reserve but need the mineral rights to do so.
	June 30, 2014	Face to Face Meeting - Jiqiu Han, Jianqiang Ma, Xianwen (Stan) Qin, Leina Liao (Yancoal) - Chief Longman, John Mcnab, Byron Bitternose, Herman Blind, Dave Noffman	George Gordan First Nation explained the Treaty Land Entitlement process and discussed current expansion on surface land acquisition. Proposed win-win corporation with Yancoal. Yancoal indicated willingness to keep in touch, but at a very early stage of exploration and any decisions are made through headquarters and require stakeholder involvement.
Piapot First Nation	June 17, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Harold Kaiswatum	An introduction to the Project was provided, along with information sheets to share with Chief and council. An invitation was extended for a face-to-face meeting with Yancoal if there was any interest. Mr. Kaiswatum indicated that the next council meeting is scheduled for July 30 and he will be in contact if there is any interest in meeting with Yancoal.
	December 3, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Chief Jeremy Fourhorns, Vern Anaskan, Lorne Carrier, Murry Ironchild, Harold Kaiswatum, Conrad Obey, Linda Obey Lavallee, George Toto , Randall Lavellee, Della Chicoose	The purpose of this meeting was to provide information about the status of the Project, the information sheet, and a copy of the panels prepared for the Community Information Sessions was provided to all attendees. An invitation was extended to the Piapot First Nation to have Elders from their community participate in the traditional land use information gathering. Discussion occurred regarding the type of mine Yancoal is proposing, where the water would come from for the Project, and environmental concerns surrounding water and air quality. The Band expressed interest in opportunities for community involvement and development with Yancoal, and are interested to know what they can expect from Yancoal as a corporate entity working in the area in addition to potential employment, training and business opportunities. Again, an invitation to meet with Yancoal was extended; however, there was no commitment at this time.
Muscowpetung First Nation	June 25, 2013	Face to Face Meeting - Phil Anaquod (Golder) - Byron Toto - Chief Cappo	The purpose of this meeting was to provide information about the project and leave copies of the Project information sheet. Mr. Toto indicated that he would pass the information on to the rest of the council at their next meeting in a couple of days. Met Chief Cappo in Fort Qu'Appelle and introduced the Project. Chief Cappo mentioned that the council would be having a meeting on July 4th and might be able to provide time on the agenda for a presentation.
	July 4, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Chief Cappo, Keith Pratt, Myke Agecoutay, Byron Toto, Kamao Cappo, Stanley Fella Poitras, Kim Pratt	This meeting was intended as an introduction to the Yancoal project to discuss the Project information sheet that was previously delivered to the Band office and as a follow-up to Chief Cappo's suggestion of attending the council meeting. The meeting did not proceed as the Council indicated that they would not be meeting with industry at the current time, and have no interest for any meetings.

Table B1: Summary of Discussions with First Nations and Métis Communities (continued)

Community	Date	Type of Communication	Summary of Communication
Pasqua First Nation	June 13, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Chief Peigan	The purpose of this meeting was to provide information about the Project, including providing the Project information sheet. The Chief briefly went over the fact sheet and asked a few questions about the Project. The invitation to meet with Yancoal in the future was extended to the Chief. The Chief indicated that sometime in July or August may work for a meeting.
	November 29, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Chief Peigan	The purpose of this meeting was to provide an update on the status of the Project, provide copies of the information sheet and the information panels prepared for the Community Information Sessions. Phil indicated that in the future Golder would like permission to interview community elders. Chief Peigan indicated that they would be open to meeting with Yancoal in the future.
	February 25, 2014	Face to Face Meeting - Brad Novecosky, Phil Anaquod (Golder Associates) - Yatong (Mandy) Chen, Jiqiu Han, Lei Niu (Yancoal) -Chief Peigan, Lindsay Cyr, Lyle Peigan, Beverly Chicoose, Roberta Soo-Oyewaske, Leroy Obey	Face to face meeting to introduce Yancoal and provide status updates on the Project. Information discussed included the Project schedule, opportunities for Pasqua First Nation to be involved in the Project, water supply, and land requirements. Chief Peigan asked to be kept informed on the status of the Project.
	June 16, 2014	Email Meeting Request	Roberta Soo-Oyewaske emailed Yancoal requesting to have a meeting between Yancoal, Pasqua First Nation and their partner Clean Harbor. Yancoal responded that mid to late August would work the best for Yancoal to meet.
	August 25, 2014	Face to Face Meeting - Chairman Jianqiang Ma, Jiqiu Han, Leina Liao (Yancoal) - Chief Todd Peigan, Roberta Soo-Oyewaste, Kirk Duffee, Brian McDonald, Dean Evanger, Tony Lin, Robert Wright	The focus of this discussion was on opportunities for Pasqua First Nation to establish a business relationship with Yancoal and to determine when and how they may be able to become involved in the Project. Pasqua First Nation has a number of services that may be of interest including their partnership with Clean Harbours (construction camp services), and an employment service. Pasqua First Nation proposed that Yancoal consider an alternate water supply option and invite Yancoal for a tour. Yancoal indicated that the Project was still in the early stages; however, would keep Pasqua First Nation informed about the Project.
Standing Buffalo First Nation	June 27, 2013	Information Delivery - Phil Anaquod (Golder Associates)	Stopped in at Standing Buffalo Band office; however, the Chief and Council were not available. The Project information sheet and contact information was left with the reception to provide to the Chief. This council may not be available until after August 02, 2013 as they are preparing for an election.
Little Black Bear First Nation	June 27, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates)	Met with Holly Bellegarde, a member in council for the Little Black Bear band to provide information about Yancoal and left the information sheet. Holly Bellegarde indicated she was involved in lands and resources, she would discuss the information with the Chief and they would be in touch if they had any questions or concerns.
	November 27, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Krista Bellegarde	The purpose of this meeting was to provide information about the Project, and provide copies of the Project information sheet and information panels from the Community Information Sessions. It was explained that the Project is still in the early planning phase. Chief and Council will be provided a summary of the information at the next Chief and Council Meeting scheduled for December 3, 2013. The Band will be in touch if there are any questions following the meeting.
Star Blanket First Nation	June 17, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - James Starblanket	Information about the project was provided and the Project information sheet and contact information were left with Mr. Starblanket to discuss with the Chief. Mr. Starblanket indicated that if there was interest in meeting with Yancoal in the future the Chief would be in contact.

Table B1: Summary of Discussions with First Nations and Métis Communities (continued)

Community	Date	Type of Communication	Summary of Communication
Okanese First Nation	June 17, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Sandra Walker	The purpose of this meeting was to introduce the Project and leave the Project information sheet for the Chief's file.
	June 27, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Daniel Walker	Met briefly with Daniel Walker to follow-up on the Project information sheet left previously. Mr. Walker indicated that he would provide the information to the rest of the Council in early July and if there was interest in further information they would be in contact.
	December 2, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates)	Council meeting was cancelled upon Phil's arrival at the Band Office and rescheduled for December 9, 2013.
	December 9, 2014	Face to Face Meeting - Phil Anaquod (Golder Associates)	This meeting was again cancelled by Okanese First Nation.
	March 2, 2014	Information Delivery - Phil Anaquod (Golder Associates)	Project information sheet and a copy of the information panels prepared for the Community Information Sessions were left with reception for the Chief's business file. Contact information was also provided in case any the Chief had any questions or concerns.
Carry the Kettle First Nation	July 3, 2013	Phil Anaquod contacted Chief Kennedy by Text Message	Phil Anaquod provided a brief introduction the Project through text messaging. Chief Kennedy expressed interest in the Project and in meeting to receive additional information. A meeting date and time was requested; however, no response was received.
Métis Nation Eastern Region 3	June 13, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Bev Worsley	The purpose of this meeting was to provide the information sheet about Yancoal and the Project. Ms. Worsley indicated that if Yancoal is interested in meeting with the Métis Nation Eastern Region 3, they have to provide some resources to bring the local presidents in for the meeting. Métis Nation Eastern Region 3 will not meet with Yancoal unless resources to attend the meeting are provided.
	December 3, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Bev Worsley	Information about the Project was presented, including the information sheet and a copy of the information panels prepared for the Community Information Sessions. Ms. Worsley did not have any questions at this time; however, did indicate that the Métis Nation East Region 3 would participate in information gathering (e.g., Elder interviews).
Métis Nation Western Region 3	June 25, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Lela Arnold	The purpose of this meeting was to introduce the Project, and provide the Project information sheet. An invitation to meet directly with Yancoal was extended. Ms. Arnold indicated that Métis Nation Western Region 3 would be interested in meeting with Yancoal and that they will be having their annual meeting in September, which would be a good opportunity for Yancoal to present to the whole region. Contact information was provided in case any additional questions or concerns came up following the meeting. Representatives were not able to attend the meeting in September.
	December 3, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Lela Arnold	The purpose of the meeting was to provide information about the status of the Project and was not related to Duty to Consult. The information sheet and information panels prepared for the Community Information Sessions were provided. The areas of concerns for the Métis Nation Western Region 3 are in regards to employment and potential business opportunities going forward. Phil indicated that there would be an opportunity for the Métis Nation Western Region 3 to participate in a traditional land use study as part of the EIS in 2014 and that traditional Métis Elders would be invited to participate. An invitation to participate in a face-to-face meeting with Yancoal was also extended. Lela indicated that members do not have the resources to travel to attend meetings and would like to know if there would be any form of accommodation provided.

Table B1: Summary of Discussions with First Nations and Métis Communities (continued)

Community	Date	Type of Communication	Summary of Communication
Peepekisis First Nation	June 17, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Allan Bird, Richard Ironquill	Information about the Project was provided and the Project information sheet and contact information were left with Mr. Bird to pass on to the council at the next council meeting scheduled for the following week. Information about the Project was also provided to Mr. Ironquill later in the day. An invitation was extended to meet with Yancoal in the future if the band was interested.
	November 27, 2013	Face to Face Meeting - Phil Anaquod (Golder Associates) - Chief Mike Koochicum, Stuart McNab, Richard Ironquill, Francis Deiter, Vanessa Starr, Martine Desnomie	The purpose of this meeting was to provide an update on the status of the Project, and leave copies of the information sheet and the information panels prepared for the Community Information Sessions. Phil indicated that in the future Golder would like permission to interview community elders. Councillors identified that they did not consider this meeting as part of the Duty to Consult. Questions were raised regarding how close Yancoal is working to the Peepeekisis First Nation, and payments to private landowners for accessing their land. The Chief and Council indicated their interest in meeting with Yancoal in the future.
	February 25, 2014	Face to Face Meeting - Brad Novecosky, Phil Anaquod (Golder Associates) - Yatong (Mandy) Chen, Jiqiu Han, Lei Niu (Yancoal) - Chief Koochicum, Vanessa Starr	The purpose of this meeting was a formal face-to-face meeting to introduce Yancoal and provide an update on the status of the Project. Items discussed at this meeting included potential for employment opportunities, investment in Yancoal, and environmental concerns related to pipelines.

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