EXECUTIVE SUMMARY

INTRODUCTION AND ENVIRONMENTAL ASSESSMENT CONTEXT

Introduction

HD Mining International Ltd. (HD Mining; the Proponent) proposes to develop the Murray River Coal Project (the Project) as a 6 million tonne per year (6 Mtpa) underground metallurgical coal mine. The Project is located 12.5 km southwest of the town of Tumbler Ridge, British Columbia (BC; Figure 1). The coordinates are W 120°57'48"-121°7'38", N 54°59'42"-55°5'4"

The Project is situated on Crown land within the Peace River Regional District (PRRD) and within the boundary of Treaty 8, one of the 11 numbered treaties negotiated between Canada and First Nations between 1871 and 1921. Road access to the Project is from Highway 52 (Heritage Highway), and the existing Murray River Forest Service Road (FSR). HD Mining's Murray River property consists of 57 coal licences covering an area of 160 km^2. The proposed underground mine and surface facilities are within 19 of the licence areas in the southeast portion of the licence block with a total area of 37.45 km^2.

This document represents the Application for an Environmental Assessment Certificate / Environmental Impact Statement (Application/EIS) for the Murray River Coal Project and is intended to satisfy provincial and federal requirements under the BC *Environmental Assessment Act* (BC EAA 2002) and *Canadian Environmental Assessment Act*, *2012* (CEAA, 2012).

Development of the Project would represent the first underground metallurgical coal mine using longwall mining in BC, and it would be the only currently operating longwall mine in Canada. HD Mining is well-positioned to develop the Project, given its experience with longwall mining in China. HD Mining is committed to training Canadian citizens in the use of underground longwall mining methods.

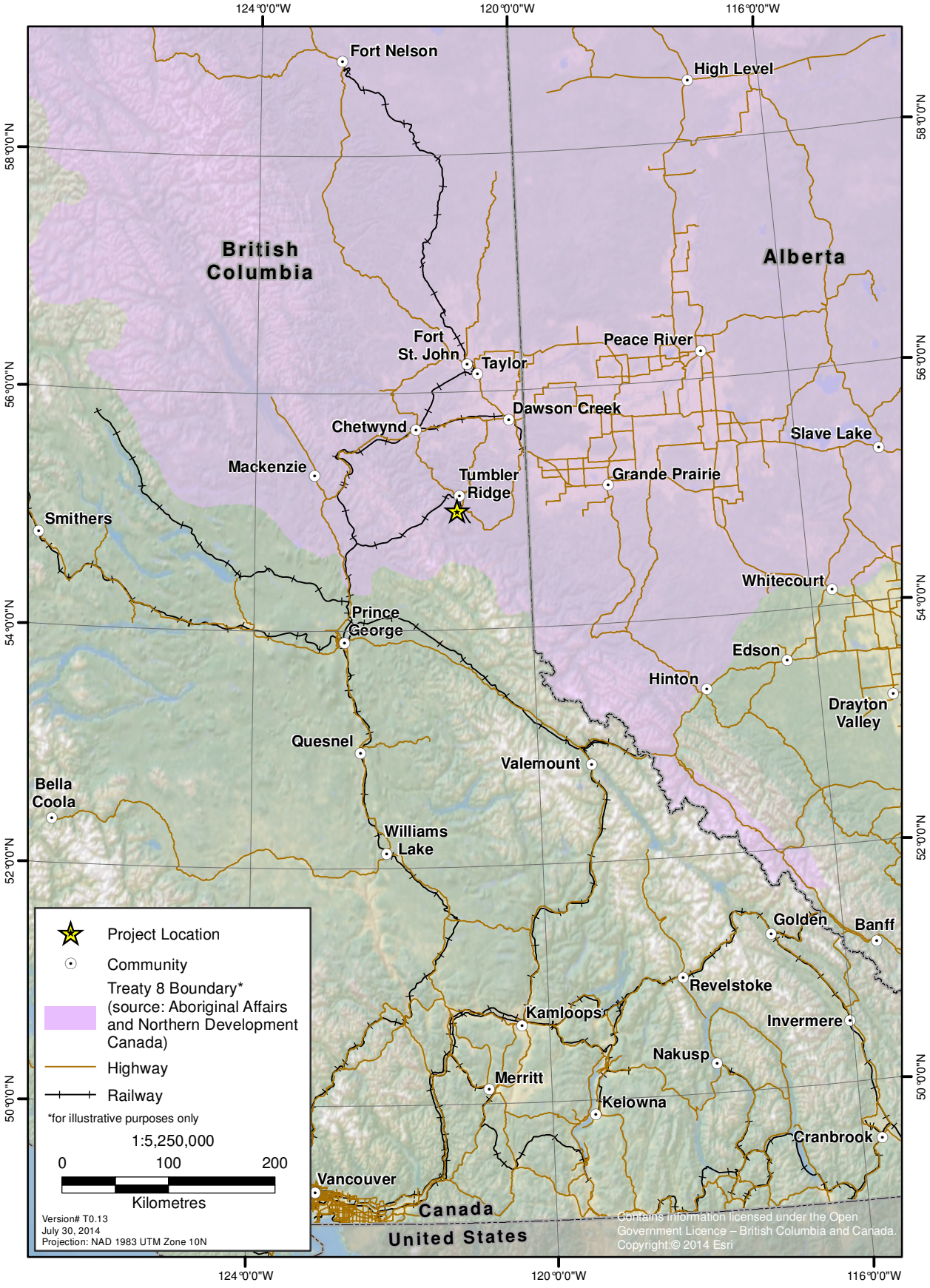
The Project will provide substantial and long-lasting economic benefits to local communities, BC, and Canada. The Project is also expected to create no significant adverse environmental effects, as a result of careful Project facilities siting and HD Mining's mitigation measures, commitments, and management framework. HD Mining believes that the approval of this Application/EIS for the Project should receive due consideration from the regulatory agencies.

The Project's economic local, provincial, and national economic benefits will extend for well over 35 years; these benefits include:

- direct Project employment of approximately 18,264 person-years in BC, during both Construction and Operation of the Project;
- a contribution of approximately $7.9 billion of direct, indirect, and induced economic benefit generated by the Project in BC; and
- total tax revenue (federal and provincial) of approximately $1.2 billion from economic activity in BC, and $2.1 billion for all of Canada.

Figure 1

Project Location



Key benefits of the Project design include the following.

- underground mining will produce limited waste rock, and the mine will have a small surface footprint compared to an open pit mine of equivalent production rate;
- project infrastructure and disturbance will be limited to areas of low elevations (outside of core caribou habitat) and in areas of pre-existing disturbance;
- roads and utilities infrastructure (e.g., power, natural gas, rail) already exist and minimal expansion of this infrastructure will be required to support the Project; and
- dewatering of flotation tailings will allow co-mingling of coarse and fine coal rejects in a single facility so there will be no subaqueous tailings storage, reducing closure liability.

Key improvements to Project design that resulted through the course of the pre-Application/pre-EIS planning stage of the environmental assessment (EA) process include:

- changing an overland conveyor over the Murray River to a second decline with an underground conveyor that goes under the Murray River:
  - this design change reduces potential effects associated with wildlife avoidance of an overland conveyor, eliminates a river crossing of the overland conveyor, and avoids a known archaeological site; it will also result in a better and safer mine plan; and
- adding geomembrane liners under the Coarse Coal Rejects piles as part of the seepage collection system will reduce the potential effects to the aquatic receiving environment.

Provincial Context

The Project is subject to the BC EAA (2002) because the proposed production capacity of the mine exceeds the threshold of 250,000 tpa of metallurgical coal for a new coal mine pursuant to section 3(1) of the Reviewable Projects Regulation (B.C. Reg. 370/2002). The British Columbia Environmental Assessment Office (BC EAO) issued a Section 10 order on June 28, 2012 confirming an EA for the Project is required. A Section 11 Order was subsequently issued by the BC EAO on December 14, 2012, which establishes the scope, procedures, and methods for the EA of the Project, and provides direction to HD Mining related to consultation with government agencies, Aboriginal groups, and the public. The BC EAO issued the Application Information Requirements (AIR) for the Project on September 3, 2013 after consultation with government agencies, Aboriginal groups, and holding a 30-day public comment period. This Application has been prepared to include the information requested in the AIR.

Federal Context

The Project is subject to the CEAA, 2012 as the Project is a "designated project" under Section 16(d) of the Regulations Designating Physical Activities (RDPA; SOR/2012-147) and the production rate will exceed the threshold for a coal mine of 3,000 tonnes per day (tpd). The Canadian Environmental Assessment Agency (CEA Agency) issued a Notice of Commencement on May 31, 2013 that confirmed a federal assessment of the Project is required in accordance with the CEAA, 2012, and that the assessment was to be undertaken as a standard type of EA, to be coordinated with the

provincial process. The CEA Agency issued the EIS Guidelines (CEA Agency 2013) for the Project on July 30, 2013 after holding a 30-day public comment period. This Application has been prepared to include the information requested in the EIS Guidelines.

Organization of the Application/EIS

The document is organized as follows:

Chapter 1 – Introduction, Project Background, and Regulatory Framework

This chapter states the purpose of the Application/EIS, provides information that denotes that the Application/EIS meets the information requirements set out for the Project by the BC EAO and CEA Agency, summarizes the structure of the Application/EIS, provides an overview of the Project, its purpose, benefits, location and regional setting, and describes the regulatory framework considered for the Project.

Chapters 2 through 5 – Information Distribution/Consultation, Project Description and Alternatives, and Effects Assessment Methodology

These chapters summarize the Aboriginal, public, and government agency information distribution and consultation undertaken for the Project, outline the proposed Project description and potential Project alternatives, and describe the methods used to assess potential adverse effects.

Chapters 6 through 19 – Assessment of Potential Effects, Significance of Residual Effects, and Cumulative Effects on Valued Components

These chapters describe the existing biophysical, economic, health, heritage, and social environments, identify specific Valued Components (VCs) as derived from baseline data collection and stakeholder engagement, assess the potential effects of the Project on these VCs, evaluate the significance of potential residual effects from the Project, and evaluate potential cumulative effects for each residual effect.

Chapter 20 – Assessment of Aboriginal and Treaty Rights and Related Interests

This chapter identifies the Aboriginal groups named with specific interests in the Project, provides information on each group pertaining to ethnography, language, land use, governance, economy, health, communities, and traditional land use, and describes treaty and Aboriginal rights and interests that could be affected by the Project.

Chapter 21 – Federal Cumulative Effects Assessment

Consistent with EIS Guideline requirements, this chapter summarizes the cumulative effects assessments previously presented in Chapters 6-19.

Chapters 22 and 23 – Accidents and Malfunctions and Effects of the Environment on the Project

These chapters identify potential risk scenarios (e.g., accidents and major environmental events such as storms or wildfire), discuss potential environmental effects associated with these scenarios, and present information related to the Project's ability to manage and mitigate these events.

Chapters 24 and 25 – Environmental Management and Monitoring Plans and Compliance Reporting

These chapters describe the context for how mitigation and monitoring measures would be implemented during execution of the Project, and the system that would be in place to ensure compliance.

Chapter 26 – Conclusions

The conclusions for the Application/EIS summarize HD Mining's understanding of the EA process to minimize environmental, economic, social, heritage, and health effects and effects on Aboriginal and treaty rights and interests while striving to develop a project that will promote employment and sustainable resource development. The conclusions also include a request that an EA Certificate be issued for the Project.

Appendices to the Application/EIS provide supporting technical studies and other pertinent documentation relevant to the effects assessment of the Project.

PROJECT OVERVIEW

HD Mining

HD Mining holds 57 coal licences that comprise the Murray River property. HD Mining is a private corporation and was incorporated in BC in 2011.

HD Mining contact information is provided below:

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Email: jody.shimkus@hdminingintl.com

Mineral Tenures and Resources

The Murray River property is located within the Peace River Coalfield (PRC), an area with a history of metallurgical grade coal open pit mining. HD Mining is proposing to access deeper zones of the coal field (500 to 1,000 m below surface) using underground mining methods.

HD Mining assembled a team of coal mining experts to review the exploration data and develop a resource estimate. The results of this analysis were compiled by No. 173 Prospecting Party of China National Administration of Coal Geology (July 2011). Mineral resources include:

- total coal resource: 688 Mt;
- measured resource: 193 Mt;

- indicated resource: 121 Mt; and
- inferred resource: 374 Mt.

Bulk Sample

As part of the exploration of the Murray River property, HD Mining received a Mines Act permit (Mines Act Permit CX-9-44) from the BC Ministry of Energy and Mines (BC MEM) to mine a 100,000-t bulk sample to test the coal for use as a coking coal and perform coal washability testing. HD Mining completed site preparation activities at the Decline Site and Shaft Site in 2012 and 2013, and mining of the Service Decline began in January 2014. Permitted infrastructure associated with the bulk sample includes:

- Shaft Site:
  - a shaft,
  - topsoil storage,
  - a waste rock pile, and
  - water management facilities, including a sedimentation pond and discharge structure to M20 creek (*Environmental Management Act* [EMA] Permit #106666);
- Decline Site:
  - a decline portal,
  - a decline conveyor,
  - a truck load-out,
  - topsoil storage, and
  - water treatment facilities, including a sedimentation pond and discharge exfiltration galleries (EMA Permit #106666).

Project Phases

The Application/EIS assesses the potential impacts of the development of the full mine for four phases:

- Construction: 3 years;
- Operation: 25 year mine life;
- Decommissioning and Reclamation: 3 years (includes project decommissioning, abandonment and reclamation activities as well as temporary closure and care and maintenance); and
- Post-closure: 30 years (includes ongoing reclamation activities and post-closure monitoring).

Mine Layout and Components

The proposed Project site general layout is shown in Figure 2. The site is divided into five areas: Decline Site, Shaft Site, Coal Processing Site, Secondary Shafts Site, and Underground Mine. Table 1 summarizes the main Project components relative to these five areas.

Figure 2
General Project Layout

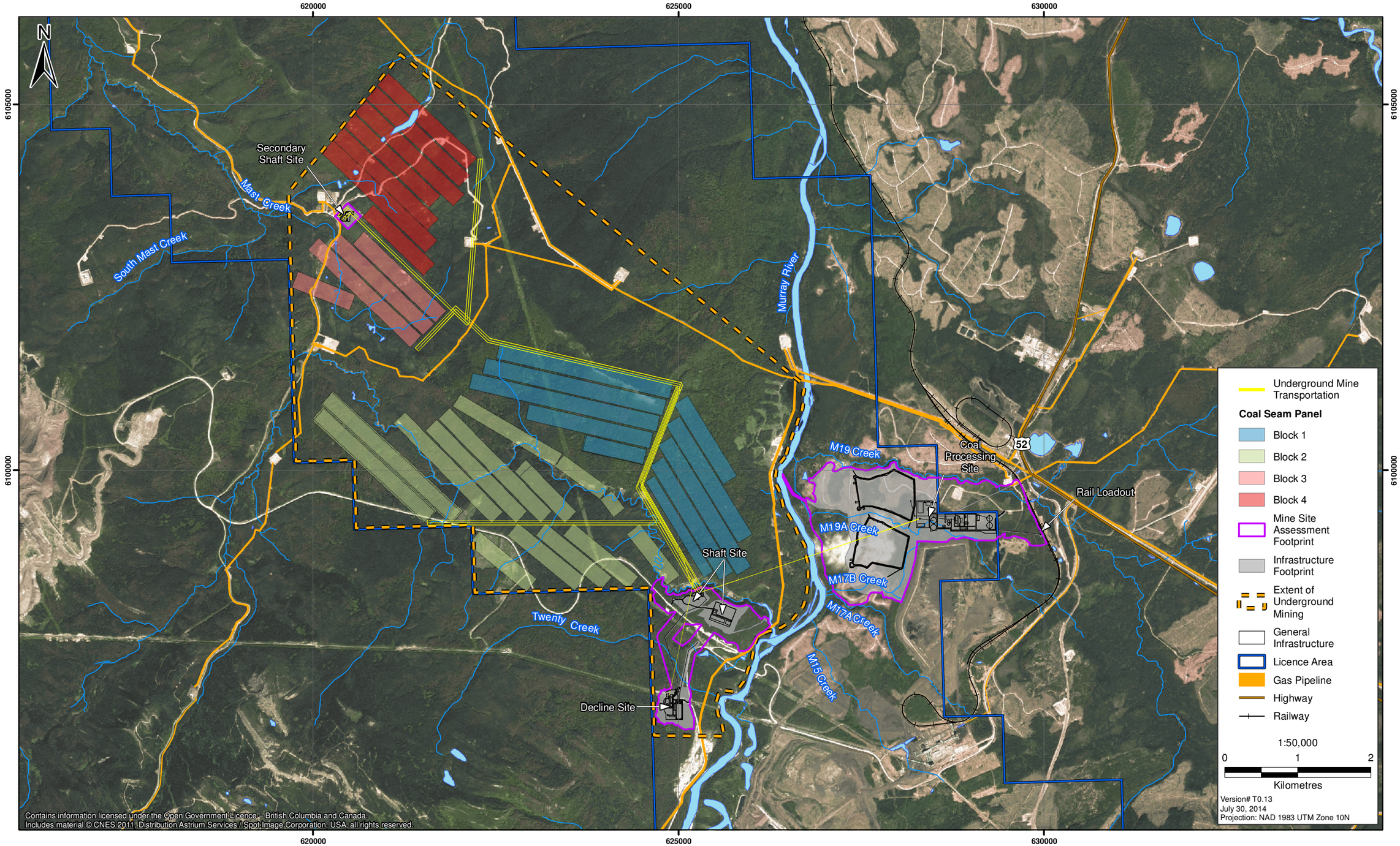

Table 1. Project Components

Project Component	Underground Mine	Decline Site	Shaft Site	Coal Processing Site	Secondary Shafts Site
Underground mine and associated works (e.g., main access shaft, ventilation shaft for return air, ramps, portals, tunnels)	X	-	-	-	-
Waste rock storage facilities	-	-	X	-	-
Overburden and soil storage areas	-	X	X	X	X
Coal rejects storage area	-	-	-	X	-
Equipment and fuel storage areas and facilities	X	X	X	X	-
Maintenance, administration, and warehouse facilities	X	X	-	X	-
Coal handling and preparation facilities (e.g., washing plant)	-	-	-	X	-
Coal conveyors	X	-	-	X	-
Rail loadout	-	-	-	X	-
Contact water collection ditches, sedimentation pond(s), and water management structures, including a discharge pipeline	-	X	X	X	-
Non-contact water diversion ditch network and sedimentation pond(s)	-	X	X	X	-
Water supply facilities (e.g., groundwater extraction well)	-	X	-	X	-
Sewage treatment and disposal facilities	-	X	-	X	-
Electricity transmission line connecting to the existing BC Hydro grid and related infrastructure	-	X	-	-	-
Natural gas pipeline connecting to existing infrastructure and related sub-station infrastructure	-	-	-	X	-

The Project is well situated to make use of existing local facilities and infrastructure, including roads (Highway 52, Murray River FSR), power (a BC Hydro 230-kV line runs through the property), natural gas (Pacific Northern Gas has a tie-in near Highway 52), and rail (CN Rail line is adjacent to the Coal Processing Site).

Underground Mine

Initially, two declines and a shaft will be constructed to provide access to the coal seams from surface. The decline being constructed for the Bulk Sample (Decline Site) will continue to be used for the full mine development. It will serve as the main entry for personnel and materials, as well as a fresh air intake. The shaft planned for the Bulk Sample (Shaft Site) will also continue to be used for the full mine development, serving as the return air shaft for ventilation. A new Production Decline will be constructed from the east side of the Murray River (Coal Processing Site) down toward the base of the shaft. The Production Decline will be the primary means of hauling coal to the surface for processing. It will also provide secondary egress, an alternative route for transport of personnel and

materials, and serve as a fresh air intake. Later in the mine life, two more ventilation shafts will be sunk (Secondary Shafts Site): one for fresh intake air and another one for return air.

Longwall mining is designed to maximize extraction rates while maintaining worker safety. This mining method is not currently used in Canada, but has been used for many years at coal mines around the world. There is currently only one other operating underground coal mine in BC (i.e., the Quinsam Mine near Campbell River), which utilizes a room-and-pillar method.

The longwall mining layout includes individual panels that are typically 800 m to 3,000 m long and 220 m wide. The longwall face is mined in retreat fashion back towards mainline tunnels. The cavity that is created behind the longwall face is called the gob. For safety reasons, personnel and equipment do not access the gob.

A coal shearer continually cuts the coal from the coalface while hydraulic shields are used to hold the roof up near the active coal face to allow safe mining. Shields are sophisticated pieces of equipment, with remote control or automated operation, requiring electronic control and monitoring. Once the work area has moved forward it is acceptable, in fact desirable, that the roof collapses, creating the gob.

There are five coal seams that will be targeted for mining: D, E, F, G/I, and J (depth increases alphabetically). The underground area has been divided into four large coal Blocks, with each Block consisting of 10 to 30 panels in all levels of coal seams. The current underground mine layout includes a total of 84 panels. Where multiple seams are planned to be mined vertically, mining will begin at the shallowest seam (e.g., D Seam), and work downwards. The majority of production is planned in the F and J seams.

The 6 Mtpa raw coal mining capacity for the Project will be achieved by simultaneously mining two longwall working faces throughout the 25-year life-of-mine. Conveyors will transport the coal from the mining face through the mine and up the Production Decline to the Coal Preparation Plant (CPP).

Key components of safely operating an underground coal mine include ventilation, coal bed gas drainage, spontaneous combustion and explosion management, and fire safety. These are strictly regulated under the Health, Safety and Reclamation Code for Mines in British Columbia, under which the Project will operate. Further details regarding the design of the mine in relation to these components are outlined in Chapter 3 of the Application/EIS.

It is recognized that at this stage of Project planning, there is a high degree of uncertainty associated with estimating groundwater inflow rates into the underground mine. Through two different means of analysis, inflow rates have been estimated to range between 1,890 m^3/d and 13,150 m^3/d. It is believed that these estimates bracket the range of long-term average inflow rates that may be encountered underground. The underground pumping systems have been sized for the upper end of this range, and water balance/water quality modelling has evaluated this range through sensitivity analysis.

Groundwater inflows to the mine will be managed in a consistent manner. A central water sump and a main water pump station will be constructed in the Underground Operation Hub. Approximately 2,075 m^3/d of seepage from the mine sump will be circulated back within the mine through a sprinkler system and for general fire water and dust suppression purposes. Groundwater inflow that is in excess of underground demand will be pumped to surface via water pipes in the Production Decline.

Mining activity will result in deformation and displacements of the overlying material, which will propagate up to the surface causing subsidence. The areal extent of the planned mining is quite large and the mineable seams are overlain by a number of roads, power lines, gas lines, and watercourses. HD Mining has built mitigation measures into the mine plan to minimize the potential for effects on the environment and to other land users as a result of subsidence. These mitigation measures take the form of "exclusion zones" within which mining is not permitted to protect surface features and infrastructure. The surface features protected by exclusion zones include mining licence boundary, rivers and major watercourses, natural gas production well-heads, and gas pipelines. It is anticipated that potential effects to power lines and roads can be mitigated without requirement for exclusion zones.

Within the current mine plan, the total coal resource held within the exclusion zones will be about 304 Mt, or about 50% of the total coal resource. The current mine plan is a conservative approach to minimize adverse effects on existing infrastructure. Throughout the mine life, HD Mining will monitor subsidence, and based on those results, will work to optimize the mine plan and maximize extraction. HD Mining will establish a communication protocol to engage other tenure holders and address potential overlaps and conflicts in advance of mining activity.

Decline Site

The Decline Site will be the primary marshalling area for underground workers, as the Service Decline is the main access for personnel and materials to the underground mine. Some infrastructure has been established at the Decline Site to support Bulk Sample activities; however many facilities will need to be expanded or built to support the full mine life. Key facilities at the Decline Site will include:

- Service Decline portal and hoist house;
- equipment assembly and maintenance shops;
- an electrical substation; and
- office/administration buildings complex and mine dry.

Shaft Site

A lined waste rock storage pad has been constructed at the Shaft Site as part of Bulk Sample activities. The pad is large enough to support the anticipated volume of waste rock for both Bulk Sample and Construction. Most waste rock will be hauled up the Service Decline and transported by truck to the Shaft Site. Some waste rock will also be generated from the Production Decline at the Coal Processing Site that will also be stored at the Shaft Site.

One key benefit of underground mining is that after establishing access to the coal seams, very limited waste rock is generated. As a result, the waste rock pile is planned to be reclaimed early in Operation.

The main ventilation fans will be installed at the Shaft Site adjacent to the shaft head. Two explosion-proof contra-rotating axial fans will be installed, one for primary operation and another one for backup. The underground mine is also designed with an air reversing ventilation system in case of a mine fire.

The coal bed gas drainage system will vent to the surface at the Shaft Site. There is uncertainty with predicting methane emissions associated with underground coal mining, and limited data available to compare these values to other underground coal mines in Canada. HD Mining will carry out monitoring at the site once Construction begins. Depending on the volume of methane emitted, mitigation measures will be put in place to ensure methane emissions are minimised. Possible mitigation measures include flaring, catalytic oxidiser systems, or capture and use. Good practice post-drainage techniques can typically capture 50% to 80% of the total gas from a longwall district.

Coal Processing Site

Key facilities at the Coal Processing Site include:

- Coal Preparation Plant (CPP);
- Coarse Coal Reject (CCR) piles;
- rail loadout; and
- water management infrastructure.

Coal Preparation Plant

Raw coal will enter the CPP, be crushed, and then flow through a series of sizing processes, including: vibrating screens, heavy media cyclones, teetered-bed separator, flotation cells, centrifuges, and press filters. Four streams of material will be produced through the CPP:

1. Clean coal will be transported to the clean coal storage area, and will then be directed to the rail loadout.
2. Middling coal will be transported to the middling storage area, and will then be directed to the rail loadout.
3. Flotation clean coal will be temporarily stored at the flotation clean coal storage. This material will be dried – by evaporation during the summer, and via a drying plant during the winter months – then directed to the clean coal storage area.
4. Rejects – two streams of rejects will be generated (coarse and fine); they will be commingled and conveyed to the coal rejects pile and stockpiled.

Raw coal and clean coal stockpiles will be designed with a 3-day turnover time under full 6 Mtpa operation.

Coal Rejects Piles

The commingled rejects from the CPP will be directed to a coarse coal reject area. Material will be transported to the CCR on an extensible conveyor, and then re-worked by dozers in 8- to 10-m lifts. Two piles within the CCR site are currently planned (CCR North and CCR South), with the toe of the piles set back from riparian areas of M19, M19A, and M17B creeks. CCR North will store rejects from the first 14 years of mining and CCR South will store rejects from the remaining 11 years.

To manage and mitigate potential metal leaching / acid rock drainage (ML/ARD) from coarse and fine rejects, a geomembrane liner is planned for both piles. Drainage pipe and a 2-m thick blanket drain of coarse reject material will be used to promote drainage within the pile and direct it to seepage collection ponds. Ditching around the toe of the piles will collect surface runoff. Potentially acid-generating and non-potentially acid-generating rejects will be co-deposited using blending. The reducing environment in the piles, with high moisture and organic carbon content and low permeability, will limit the availability of oxygen for the oxidation of sulphides, and likely promote selenium attenuation and retention in the pile. Material from seams D and E has the highest potential for ML/ARD. These seams are predominantly scheduled to be mined in the first five years of the current mine plan. This material will be placed at the toe of the CCR North pile, and subsequently will be encapsulated with net neutralizing reject and waste rock, reducing the potential for ML/ARD.

Rail Loadout

The rail loadout will support mine production of 4.8 Mtpa saleable coal. Instead of a looped rail loadout similar to what is utilized by Peace River Coal and Teck, a single linear track (5.5 km) is planned that parallels the existing CN Rail line. The track will be constructed within the existing CN Rail right-of-way. Approximately one train per day will be loaded during full Operation. Each train will have the capacity to carry 116 rail cars and will be driven by five locomotives.

Water Management Infrastructure

A water balance and water quality prediction model has been developed for the Project to help inform the development of a water management plan. Opportunities to maximize capture and reuse of contact water have been incorporated in the water management plan.

During Operation, the CPP has a daily water demand of 1,818 m^3/d. Water from the CCR runoff/seepage collection system will drain into a collection sump and will be preferentially pumped as make-up water to the CPP. Excess water, beyond the CPP need, will be pumped into the CPP pond.

The CPP pond will also receive water pumped to the surface from the underground mine, and surface runoff from the CPP area. Depending on the time of year, and the underground inflow rate, the CPP pond may be in either a positive balance status (i.e., excess water from the pond is discharged into the Murray River) or a negative balance status (i.e., water is required from the Murray River as make-up to the CPP). Positive balance occurs during spring/summer, when snowmelt runoff from the CCR piles combines with excess underground inflows to provide sufficient input to the wash plant. Discharge rates from the CPP pond to Murray River are expected

to increase over time (consistent with inflow rates), and range from 800 to 4,800 m^3/d. Negative balance occurs during the fall/winter. Withdrawal rates are estimated to range from 1,200 to 2,100 m^3/d during the first 10 years of mining, decreasing over time.

Intake works will be required at the Murray River to provide up to 2,100 m^3/d of make-up water to the CPP during periods of the year when the CPP pond cannot supply the required demand. The intake works will be located on the right bank of the river at the same location as proposed discharge outfall. Simultaneous intake and discharge at the river is not anticipated. Intake works will include screening that is consistent with DFO guidelines to prevent entrainment or impingement of fish (DFO 1995). A buried pipe will carry water from the river up to one of the CCR runoff/seepage collection ponds at the toe of CCR North, and then on to the CPP.

During periods with excess water in the CPP pond, the water will be discharged to Murray River. Prior to discharge, water will be treated to remove TSS to meet permit criteria. Current water quality predictions show that the CPP pond water can be discharged to Murray River without treatment for dissolved parameters.

The total suspended solids (TSS) sources will largely be coal-based (underground inflow, CCR seepage, stockpile runoff). It is anticipated that suspended solids in the water column will be fine grained, and will not be readily settled by gravity. The TSS treatment facility will include flocculent dosing and a thickener. Underflow from the thickener will be fed into the CPP slurry mix tank feeding the fine reject filter press, and will end up in the CCR piles. Treated effluent will flow in a buried pipe back down to Murray River, discharging to the river from the right bank.

Modelling work has been completed to illustrate that even under very low flow conditions the Murray River has sufficient dilution and mixing capacity to accept the anticipated discharge from the Project without having adverse effects on the receiving environment.

Secondary Shaft Site

The Secondary Shaft Site, which covers 6.25 ha, will be constructed 15 years into Operation. Facilities will include two shafts (intake air and return air), and associated ventilation fans and electrical equipment.

Roads and Access

The existing road network will be used to access the site, including the Murray River FSR, Mast Road, and the access from HWY 52 to the Coal Processing Site. HD Mining will secure road use agreements to support this use.

Utilities

Electricity

BC Hydro has an existing 230-kV power line that runs within 1.3 km of the Decline Site. HD Mining has engaged BC Hydro to develop a tie-in to this system.

HD Mining will construct a 1.3-km 230-kV line from the BC Hydro tie-in to a substation/distribution hub at the Decline Site, which will direct power around surface sites and to an underground substation, where it will be distributed to each working area along roadways/gateways.

Power to the Shaft Site will be connected to a secondary substation via a 10-kV line from the main power substation at the Decline Site.

Power to the Coal Processing Site will be routed through the underground mine and up the Production Decline to a substation located on the surface near the portal.

The total annual power requirement is about 152 x 10^6 kWh.

Diesel generators will provide for emergency backup power in the case of a BC Hydro power outage.

Natural Gas

HD Mining has engaged Pacific Northern Gas (PNG) to supply natural gas from their existing network. A short pipeline (approximately 800 m) will be installed to supply the CPP for coal drying and boilers. Natural gas will also be required to run the boilers at the Decline Site. A natural gas tank is located in the Decline Site with the capacity to supply 15 days of mine operation consumption. The tank will be refilled through regular truck delivery.

The total annual natural gas requirement is estimated to be about 18.4 Mm^3/year.

Fuel Storage and Handling

The total annual diesel requirement is estimated at about 468,400 litres (L).

Diesel storage tanks will be installed at the Decline Site to serve the diesel equipment and vehicles on site. In addition, a fuel station, equipped with a 15,000-L horizontal storage tank, will be constructed at the Decline Site to support the diesel vehicles in the underground mine and surface operation.

Two separate 30-m^3 buried tanks will be installed at the CPP site for the flotation reagents storage of kerosene and octanol respectively.

Project Development

Construction

HD Mining is currently advancing development of a Bulk Sample on site. Permitted Bulk Sample activity has included site preparation at the Decline Site and Shaft Site, and will extend through to completed construction of the Service Decline and the Ventilation Shaft.

The Construction phase for full mine development includes establishment of all site surface infrastructure, as well as the underground mine development to the point that longwall mining can commence. The total Construction period will be approximately three years (including six months site preparation and mobilization).

Underground Activities

Total underground mine construction will require approximately three years. Because the Service Decline and Ventilation Shaft will be completed during the Bulk Sample period, the Production Decline and Underground Operation Hub will be excavated first and are scheduled to be completed within 14 months. Following that, the connection will be established between the Production Decline, Service Decline, Ventilation Shaft, and Underground Operation Hub. This will provide more space for further mine development.

The Block 1 mainline tunnels in coal seams J and F will be constructed once access is available. Development activity will then focus around the first two longwall panels (J1201 and D1101). Once the two panels are developed and ready to be mined, this will mark the end of the Construction phase and the start of Operation.

Surface Activities

Site preparation work during Construction will largely focus on the Coal Processing Site, including establishing ditches and sedimentation ponds, and clearing the land surface within the CPP site and the CCR North footprint areas. Topsoil and subsoil will then be stripped from the surface and stored in stockpiles around the perimeter of the site. This material will be used for reclamation purposes during Decommissioning and Reclamation.

The construction of the CPP will commence along with the underground mine development. It will include: a screening/crushing plant; thickeners; flotation and filtration plant; drying plant; a variety of conveyors and transfer towers; maintenance workshop; raw coal storage stockpiles; clean coal and middlings stockpiles; flotation clean coal stockpiles; top soil stockpiles; power substation and distribution building; rail loadout and more. The total Construction period will be approximately 25 months.

Workforce

During underground mine construction, at peak activity, about 450 people will be employed. The average construction work force will be approximately 270 people. It is expected that workers will be sourced from different geographic regions, including local residents in BC, residents from elsewhere in Canada, and temporary foreign workers. Underground mining activities will initially be undertaken by temporary foreign workers who are experienced with underground longwall mining. Surface construction of the CPP, CCR, and rail loadout will be conducted by various local contractors.

Operation

Operation of the underground mine and coal processing plant will be for 25 years.

Underground Activities

Longwall mining will begin in Block 1 and will progressively move through Blocks 2, 3, and 4. The panels in each block will be excavated in accordance with the mine production plan. Two longwall working faces will be operated simultaneously to generate production of 6 Mtpa of raw coal.

Surface Activities

Raw coal will be processed through the CPP to produce saleable coal (4.8 Mtpa) and rejects (1.2 Mtpa).

CPP rejects will be directed to a CCR area on an extensible conveyor, and then re-worked by dozers. The piles will grow over time. The CCR North pile will be used for the first 14 years of Operation and the CCR South pile will serve the next 11 years.

The coal products will be directed to the rail loadout by a series of belt conveyors, where they will be discharged into the train for shipment to markets.

Workforce

It is anticipated that the Project will provide approximately 780 direct jobs during Operation; approximately 643 workers for the underground mine and 137 workers on surface. The Project will run three eight-hour shifts per day, two operation shifts, and one maintenance shift. The underground mine and surface operation will be operated 330 days per year.

There is currently a shortage of skilled underground mine workers in the Canadian mining sector. There are also no operating underground longwall mines in Canada. As a result, there is a shortage of trained and experienced workers to safely undertake longwall coal mining. It is anticipated that temporary foreign workers (TFWs) will be required to fill a portion of the positions during full mine operation. It is the goal of HD Mining that over time, the skills of the TFWs will be transferred to local Canadians; however acquiring the skills and knowledge will take time. HD Mining has committed to a training and transition plan to train Canadian workers in the operation and maintenance of longwall mines and to reduce the need for TFWs over a 10-year period.

Decommissioning and Reclamation

HD Mining has prepared a conceptual closure and reclamation plan that is consistent with requirements of the BC *Mines Act* (1996) and the Health, Safety and Reclamation Code for Mines in British Columbia (the Code; BC MEMPR 2008).

The end land use objective is to revegetate the site to re-establish average pre-mining land capability to applicable end land use objectives, which are: to achieve a forest cover or a natural vegetative cover of herbs and shrubs that replicate naturally occurring ecosites at similar elevations, climatic and riparian conditions. Reclamation on the CCR piles will support current end land uses including wildlife habitat, trapping, hunting, recreational, and forestry activities.

General strategies for Decommissioning and Reclamation include removing machinery, equipment, reagents, fuel, lubricants, and infrastructure that is no longer in use, re-contouring the landscape, re-establishing watercourses, re-distributing soils salvaged during Construction, and re-vegetation.

Key reclamation areas for the Project include the waste rock pile at the Shaft Site, the CCR piles at the Coal Processing Site, and the mine portals. Closure covers are planned for the waste rock and CCR piles to reduce the potential for ML/ARD and long-term liabilities. Progressive reclamation of

these piles will occur as soon as possible during the mine life. This will include the waste rock pile in early Operation, CCR North mid-mine life, and CCR South at the end of mine life.

Upon closure, the entrances to the mine will be sealed and backfilled to prevent humans and animals from entering them. The underground will be allowed to flood. Based on the predicted groundwater inflow rates from the groundwater model developed for the Project, it is estimated that it will take approximately 50 years for the underground workings to flood with water and another 40 years for the water table to return to the pre-mining groundwater level.

Total closure cost is estimated at $20 million.

Post-closure

Ongoing monitoring will be the major activity occurring during Post-closure. Project components (e.g., the waste rock pile, the CCR piles, and portals) will be checked for stability, re-vegetation success, and seepage water quality. The recovery of the water table above the underground mine will also be tracked. The frequency of monitoring is expected to decrease over time as components are observed to be stable.

SCOPE OF PROJECT AND ASSESSMENT

Scope of Project

Section 2.1 (Part B) of the Section 11 Order issued by the BC EAO defines the scope of the Project for the purposes of the provincial EA. Section 6 of the EIS Guidelines issued by the CEA Agency defines the scope of the Project for the purposes of the federal EA.

Provincially, the scope of the Project consists of on-site and off-site components and activities, listed above in Table 1 and as shown in Figure 1. Federally, the scope of the Project consists of the same on-site and off-site Project components and activities in addition to federal decisions.

Federal decisions that may be required include:

- Authorization under Section 35 of the *Fisheries Act* (1985b) – related to water management structures;
- Approval under Section 5 of the *Navigation Protection Act* (1985c) – related to water management structures in Murray River;
- Explosives Magazine License under the *Explosives Act* (1985a) – though this is planned to be contracted to a local supplier;
- Radio Licence under the *Radiocommunications Act* (1985d) – for the on-site radio communication system; and
- Radioisotope Licence under the *Nuclear Safety and Control Act* (1997) – for some flow meters and instrumentation in the CP coal preparation plant.

Scope of Assessment

Based on Section 3 (Part C) of the Section 11 Order, the provincial scope of the assessment for the Project considers:

- potential adverse environmental, social, economic, health, and heritage effects, including potential cumulative effects, and the practical means to prevent or reduce to an acceptable level, any such potential adverse effects; and
- potential adverse effects on the First Nations' Treaty 8 rights and other interests, and to the extent appropriate, ways to avoid, mitigate, or otherwise accommodate such potential adverse effects and to properly uphold the Crown's obligations with respect to treaty rights.

The federal scope of assessment includes "establishing the factors" (i.e., Valued Components) to be considered, and the "scope of those factors" (i.e., the assessment boundaries). Valued Components (VCs) included in the EA, based on input received from Aboriginal groups, government agencies, and the public are identified in Table 2.

Table 2. Selected Valued Components for the Murray River Coal Project

Assessment Category	Valued Components
Environment	
Atmospherics	• Air
Hydrogeology	• Groundwater
Surface Water and Aquatic Resources	• Surface water • Sediment • Aquatic resources
Fish and Fish Habitat	• Fish (including Bull Trout and Arctic Grayling) • Fish habitat
Terrain	• Terrain stability
Terrestrial Ecology	• Ecologically valuable soil • Forested ecosystems • BC CDC listed ecosystems • Harvestable plants • Rare plants and lichens and associated habitat
Wetlands	• Wetlands
Wildlife and Wildlife Habitat	• Woodland caribou • Rocky Mountain elk • Moose • Mountain goat • Grizzly bear • Furbearers (fisher as a representative species) • Bats • Raptors • Waterfowl • Songbirds (black-throated green warbler as a representative species) • Amphibians (western toad as a representative species)

(continued)

Table 2. Summary of Selected Valued Components for the Murray River Project (completed)

Assessment Category	Valued Components
Economic	• Employment and income • Economic activity
Social	• Health Care Services • Emergency Services • Educational Services • Child Care Services • Community Infrastructure • Housing • Crime and Other Social Problems • Social Integration
Non-traditional Land Use	• Harvesting • Recreational Use • Industrial Use • Navigation
Current Use of Lands and Resources for Traditional Purposes	• Fishing Opportunities and Practice • Hunting and Trapping Opportunities and Practices • Gathering Opportunities and Practices • Habitations, Trails, Burial Sites and Cultural Landscapes
Heritage	• Archaeological and heritage sites
Human Health	• Drinking water • Air quality • Noise • Country foods

Spatial Boundaries

The scope of the factors (VCs) to be included in the EA is defined by setting spatial boundaries, which include the following:

- The Infrastructure Footprint is defined as the area of land or water associated with the proposed sites for all physical structures and activities that comprise the Project.
- The Mine Site Assessment Footprint or Project Assessment Footprint is defined as an area that extends a short distance beyond the Infrastructure Footprint and provides a conservative area assumed to be functionally lost due to Project activities. The Assessment Footprint is intended to allow for minor adjustments in the realized footprint disturbances between completion of the EA and ground disturbance during physical activities related to Project development.
- The Local Study Area (LSA) is defined as the Project footprint and a surrounding area within which there is a reasonable potential for immediate direct and indirect effects on a specific VC due to an interaction with a Project component(s) or activities. VC-specific LSAs are developed and defined in Chapters 6 through 19 of the Application/EIS.

- The Regional Study Area (RSA) is defined as the spatial area beyond which potential effects of the Project are not anticipated to occur. VC-specific RSAs are developed and defined in Chapters 6 through 19 of the Application/EIS.

Temporal Boundaries

For the purposes of the Application/EIS, the temporal boundaries are:

- Construction: 3 years;
- Operation: 25 year run-of-mine life;
- Decommissioning and Reclamation: 3 years (including project decommissioning, abandonment and reclamation activities as well as temporary closure and care and maintenance); and
- Post-closure: 30 years (includes ongoing reclamation activities and post-closure monitoring).

ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

Chapter 4 of the Application/EIS describes the processes and criteria that HD Mining and its consultants have used to evaluate alternative means and identify the preferred alternatives for the Project. It describes the main decisions that HD Mining has made to construct and operate the Project in a manner that minimizes adverse environmental, cultural, and socio-economic effects and maximizes beneficial effects.

Table 3 lists the major Project components and sub-components evaluated in the alternatives assessment based on the requirements outlined in the AIR and EIS Guidelines. The alternatives assessment methods generally follow the suggested CEAA, 2012 guidance on "*Addressing Purpose of and Alternative Means under the Canadian Environmental Assessment Act, 2012*". For each Project component, two or more options were identified. A screening assessment was completed to scope out unfeasible options based on technical and economic criteria. Where more than one feasible alternative was identified, further consideration was given to compare each alternative and evaluate how relevant Valued Components may be adversely (or beneficially) affected.

Over the course of the EA process, one major Project design change was HD Mining's decision to construct the Production Decline from the east side of Murray River down to the coal seams. This decision represents a fundamental change to the Project design, because it creates a new access from the surface down to the coal. This has important and beneficial implications for the underground mine design in terms of options for secondary egress, ventilation, and movement of personnel/ equipment. From an "alternative means" perspective, this decision had important implications related to the selection of raw coal transport and coal reject storage options, which also had subsequent implications to the selection of water management options.

Through the chronology of options evaluation and decision making, HD Mining believes that the current Project configuration minimizes environmental impacts, optimizes construction and operating costs, and meets the logistical requirements of successfully operating a mine. The preferred configuration is the basis of the Project Description (Chapter 3) and the subsequent environmental impact assessment.

Table 3. Major Project Components and Sub-components Considered for Screening

Major Considerations	Mining Method	
	Underground Access (Bulk Sample)	
Primary Project Components	Product Transport	
	Coal Reject Storage	
	Raw Coal Transport	
Secondary Project Components	Project Access and Transport	
	Explosives	
	Power	Primary Power Supply
		Back-up Power Supply
	Coal Processing	Heating Resources for Coal Drying
		Flotation Tailings
	Ventilation	
	Water Management	Water Source
		Sewage Effluent Discharge
		Contact Water Treatment Method
		Treated Water Discharge Location
	Employment	
	Accommodation	
	Non-hazardous Solid Waste	

CONSULTATION AND ENGAGEMENT ACTIVITIES

Government Agency Engagement

HD Mining has consulted with government agencies primarily through the EA Working Group, established by the BC EAO in August 2012. Members of the Working Group include representatives from provincial and federal government agencies, local government, and First Nations. HD Mining has also met separately with provincial and federal government agencies to review and discuss the results of baseline studies. HD Mining hosted a site visit for EA Working Group members on October 3, 2012. The Working Group has reviewed and provided comments on proposed VCs, the draft AIR, baseline studies, and proposed mitigation measures. Comments raised at Working Group meetings and individual meetings with government agencies and HD Mining's responses to the comments are summarized in the Application/EIS. HD Mining will continue to consult with government agencies as members of the Working Group during the Application/EIS review stage, including providing them with copies of the Application/EIS, providing written responses to agency comments on the Application/EIS, and attending EA Working Group meetings to address questions and discuss information presented in the Application/EIS.

Public Engagement

Tumbler Ridge is the closest community to the Project, and it is the location of planned employee housing. Other communities near the Project include Chetwynd, Dawson Creek, and Fort St. John.

HD Mining has consulted with the public, local government, and tenure holders with interests in the Project area since 2011. HD Mining developed a Public Consultation Plan, posted to the BC EAO website on January 16, 2013. The public had an opportunity to review and comment on the draft AIR during a 30-day public period held from May 21, 2013 to June 20, 2013. One comment was submitted on the draft AIR. HD Mining participated in BC EAO-hosted open houses held in Dawson Creek and Tumbler Ridge in June 2013 to provide information on the Project.

HD Mining has met with representatives of the District of Tumbler Ridge and the District of Chetwynd to keep these communities apprised of the Project. HD Mining has also met with forestry companies, construction companies, wind power companies, backcountry guides, guide outfitters, and trappers to discuss the potential effects of the Project on their tenures and interests.

The CEA Agency held a 20-day public comment period on the Summary of the Project Description (commencing April 15, 2013), and a 30-day public comment period on the Draft Environmental Impact Statement (dEIS) Guidelines (commencing May 31, 2013). No comments were submitted by the public.

HD Mining conducted 22 interviews with service providers and local government officials, as well as seven interviews with local government officials, guide outfitters, trappers, and a forestry company to discuss their interests and concerns related to the proposed Project.

Communications with the public are documented and summarized in the Application/EIS, as are the issues raised by local governments, tenure holders, and the public, along with HD Mining's responses to these issues.

HD Mining will continue to consult with the public during the Application/EIS review stage, as outlined in the Public Consultation Plan. The Application/EIS will be available on the BC EAO's website, and HD Mining will advertise future open houses and the public comment period for the review of the Application/EIS.

Aboriginal Engagement and Consultation

HD Mining has engaged with Aboriginal groups since November 2009 through written Project notification, face-to-face meetings with Band Councils and staff, correspondence, community information sessions, site visits, and by seeking input on key EA documents (draft Application Information Requirements, draft First Nations Consultation Plan, proposed VCs). First Nations engagement activities have been conducted according to the First Nations Consultation Plan (Rescan 2013), approved and posted by the BC EAO on the e-PIC website on October 8, 2013.

The BC EAO's Section 11 Order specifies that the proposed Project lies in (or is in the vicinity of) the traditional use territories of the West Moberly First Nations (WMFN), Saulteau First Nations (SFN), and McLeod Lake Indian Band (MLIB). The Section 11 Order delegates procedural aspects of engagement with these First Nations to HD Mining.

In addition, CEA Agency's EIS Guidelines require HD Mining to also hold meetings with, provide information to, and collect the views of the Blueberry River First Nations (BRFN) and Horse Lake First Nation (HLFN). The EIS Guidelines identify additional Aboriginal groups to whom HD Mining

is required to provide information and from whom HD Mining is required to solicit views with respect to the proposed Project. Additional Aboriginal groups include Doig River First Nation, Fort Nelson First Nation, Halfway River First Nation, Prophet River First Nation, Sucker Creek First Nation, Kelly Lake Métis Settlement Society, and Métis Nation British Columbia.

The BC EAO invited the WMFN, SFN, Halfway River First Nation, Fort Nelson First Nation, Prophet River First Nation, Doig River First Nation, BRFN, and MLIB to be members of the Working Group when it was established in August 2012. Representatives from MLIB, WMFN, and SFN have toured the Project site.

HD Mining's consultation activities were developed to provide Aboriginal groups with the information that they require to determine how the Project may interact with their Aboriginal and treaty rights and interests, and to solicit information from Aboriginal groups about such rights and interests in the Project area. Individual meetings with Chiefs and Councils and other representatives of the WMFN, SFN, MLIB, BRFN, and HLFN established engagement expectations and agreements for ongoing communication and participation in the EA process.

HD Mining funded the hiring of an independent, third-party reviewer on behalf of MLIB, SFN, and WMFN. To date, the third-party reviewer has: 1) held a community scoping meeting with the three First Nations to identify issues of concern; 2) provided HD Mining with a summary of issues, concerns, and interests arising from the community scoping meeting; 3) provided comments on the dAIR; 4) participated in Working Group meetings; and 5) reviewed Project baseline reports.

HD Mining will continue to consult with Aboriginal groups during the Application/EIS review stage, according to the Aboriginal Consultation Plan, and will provide Aboriginal groups with copies of the Application/EIS and written responses to their comments, and will attend the EA Working Group meetings to address questions and present Project information. HD Mining will notify Aboriginal groups about the public comment period on the Application/EIS. Comments from Aboriginal groups, HD Mining's responses to the comments, and consultations undertaken with Aboriginal groups on the Application/EIS will be summarized in a forthcoming Aboriginal Consultation Report.

SUMMARY OF ENVIRONMENTAL EFFECTS ASSESSMENT

Air Quality Effects

Setting

Air quality is an important environmental factor in ensuring the protection of local vegetation, wildlife, and human health. The Project activities will result in emissions of criteria air contaminant (CACs), dust, and greenhouse gases (GHG). The change in ambient air quality due to CAC and dust emissions needs to be assessed to ensure conservation of the environment and compliance with federal and British Columbia (BC) regulations. Anthropogenic climate change, driven by GHG emissions, is a global issue with implications for both human and natural systems. There are no standards associated with GHG emissions; however, there are reporting regulations and federal reduction targets.

The air quality monitoring program was undertaken in 2011 and consisted of dustfall monitoring to establish understanding of the baseline levels. All samples collected were below the lower BC MOE limit of 1.7 mg/dm^2/day. Meteorology data were collected from 2011 to 2013.

Assessment

The activities associated with the Project have the potential to generate CACs, dust deposition, and GHG emissions. Emissions associated with each component and activity during Operations has been determined and an emission inventory was compiled. The emission rates from the emission inventory were used in a CALPUFF dispersion model to determine the magnitude of the effect of Project operations on CAC emissions and dust deposition. The results were then compared to relevant standards and objectives. Effects of increased GHG emissions were assessed by comparing project GHG emissions with sector, provincial, and federal emission totals. After the application of mitigation measures, the following residual effects are predicted to occur for the air quality VC:

- increased TSP, PM_{10}, and $PM_{2.5}$ emissions (CACs);
- increased dust deposition; and
- increased GHG emissions.

It was determined that the effects of increases in CACs, dust deposition, and GHG emissions on air quality are considered to be not significant.

A cumulative assessment was carried out in order to assess the potential combined impacts of the Murray River Project with other projects in the area. Four projects were identified as potentially having a cumulative effect: Roman Mine, Quintette Mine, Trend Mine, and Hermann Mine. The cumulative effects of increases in CACs and dust deposition on air quality are concluded to be not significant.

Groundwater Effects

Setting

Hydrogeological data specific to the Project have been collected since 2011 to characterize groundwater flow regimes, surface water and groundwater interactions, and groundwater quality at the site. The groundwater flow system in the Project area is characterized by groundwater flowing from the upper foothills towards the Murray River. On the west side of Murray River, the M20 Creek basin behaves as an intermediate catchment basin; the watersheds of Twenty Creek and other minor tributaries within the extent of underground mining behave as local catchment basins. On the east side of Murray River, the small watersheds containing M19A, M17B, and M19 creeks behave as local catchment basins for shallow groundwater flow in the Coal Processing Site and adjacent areas.

Groundwater is recharged by greater precipitation at higher elevations (due to the orographic effects), while valley bottoms constitute groundwater discharge zones. Documented seasonal variations in groundwater levels have been as high as 2 m within the baseline study area.

Stream flow is dominated by groundwater discharge (often referred to as base flow) during low flow seasons in winter. During freshet seasons, streams may be recharging groundwater, particularly along reaches at higher elevations. Stream reaches at lower elevations are predominantly situated in groundwater discharge zones. Groundwater likely supports wetlands found along the flood plains of the Murray River during non-peak flow periods.

Groundwater throughout the local study area is slightly basic (mean pH of 7.2 to 8.4). Calcium and bicarbonate tend to be the dominant ions in the shallow groundwater (less than 50 mbg), and sodium and bicarbonate dominate in the deeper groundwater. Total dissolved solid trends upwards with depth.

Concentrations of dissolved barium, iron, lithium, and manganese have consistently exceeded the provincial water quality guidelines for the protection of freshwater aquatic life or raw drinking water supply in samples collected from a number of wells.

Assessment

A three-dimensional numerical groundwater flow and contaminant transport model was developed and calibrated to baseline conditions. The model was then used to simulate the effects of underground mining and surface storage of CCR on groundwater flow patterns and solute transport.

Dewatering of the underground mine during Operations may result in lowering of the water table in the range of 1 to 15 m, which will have associated changes in flow directions, hydraulic gradients, and baseflow discharge to local streams. While predicted drawdown will be outside the range of natural variability in some areas, there are no groundwater users (drinking water, agriculture or industry) in the area. Following the end of the mine life, the workings will be flooded, and the water table will rebound, eventually returning to near pre-mine conditions.

Imprinted within the area of water table drawdown, surface subsidence is also predicted to occur, ranging from 1 to 9 m, depending on the number of coal seams mined vertically. The changes in topography associated with subsidence are anticipated to have less influence on groundwater tables than mine dewatering; however, localized changes may be observed in some areas.

At the Coal Processing Site, the two CCR piles will result in reduced recharge to the groundwater system in the local area between the footprints of the two piles; however, the resultant change in groundwater quantity is very small.

The CCR piles are designed with a geomembrane liner, overdrains, and seepage collection systems. This mitigation results in very limited potential for loss of contact water to groundwater during Operation. For the purposes of the assessment, it has been conservatively modelled that 5% of the water infiltrating through the piles (6 mm/year under North Pile and 7 mm/year under South Pile) and leaks through imperfections in the liner and into the groundwater system. During Post-closure, infiltration through the closure cover (4 mm/year) continues to be collected by the seepage collection system, and then is allowed to exfiltrate to groundwater. Flow path and solute transport analyses show that seepage would stay in shallow groundwater beneath and downgradient of each CCR pile, discharging to M19 and M19A creeks a short distance downslope.

No residual cumulative effects to groundwater quantity and quality are identified from other human actions.

Surface Water and Aquatic Resources Effects

Setting

Surface water hydrology is a key component of the physical and biological environment because it is linked to other ecosystem components, including surface water quality, fish and fish habitat, and aquatic resources. Water quality constitutes the physical, chemical, biological, and aesthetic characteristics of water that are, in turn, determined by a variety of regional and local factors including rock weathering, surface transport, biological activity, and anthropogenic influences. Aquatic resources refer to the (non-fish) biological communities residing within the water column and sedimentary system compartments of the freshwater environment.

The 2010 to 2013 hydrometric program was carried out to characterize the spatial and temporal variation in flows in the baseline study area. The climate of the region is a major control on its hydrologic characteristics. Streamflow tends to peak between May and July, driven by snowmelt in May and rainfall in June and July. Low flows occur during the winter and early spring. Many streams, especially in smaller catchments, have almost no flow from November to March. Drainage basins in northeastern BC typically exhibit characteristics of both snowmelt (nival) and rainfall (pluvial) hydrologic regimes. These are referred to as mixed-regime or hybrid-regime basins (Eaton and Moore 2010). Glacial contributions to runoff are minimal or nonexistent in the Rocky Mountain foothills.

The 2010 to 2013 surface water quality and aquatic resources program was carried out to characterize the spatial and temporal variation in the baseline study area. Water quality was closely tied to the seasonal fluctuations of water flow. During the winter low flow (November to March), streams had elevated alkalinity, conductivity, hardness, anions (chloride, fluoride, and sulphate) and some metals (total boron, molybdenum, selenium, and uranium). In contrast during freshet (typically May), increased streamflow elevated suspended sediments (TSS and turbidity), which was associated with elevated nutrients (total nitrogen, total Kjeldahl nitrogen [TKN], phosphorus), total organic carbon (TOC), and metal levels. The increased levels likely reflect the increased runoff and re-suspension of sediments during freshet and the associated particle-bound nutrients, TOC, and metals.

Project area sediments were primarily sand and sites generally had consistent metal and polycyclic aromatic hydrocarbons (PAH) concentrations. Periphyton communities were variable (biomass and density), diverse (high Simpson's genus diversity), and dominated by diatoms. Benthic invertebrate communities were also diverse with high richness, and common taxa included pollution-sensitive taxa (Ephemeroptera, Plecoptera and Trichoptera) and Chironomidae. Periphyton tissue metals were generally highest in streams associated with the Shaft and Decline Sites (west bank of Murray River).

Assessment

Surface water quantity and quality were identified as two key sub-components of the surface water VC because they are linked to other ecosystem components, including surface water quality, fish and fish habitat, aquatic resources, terrestrial ecosystems, wetlands, navigation, and land use.

A water balance and water quality model was developed to estimate Project-related changes to water quantity and water quality. Effects on water quality and water quantity were then used to assess Project-related effects on sediment quality and aquatic resources. The predictive water models included Project design mitigations and the results of groundwater modelling.

After considering mitigation measures, residual effects on surface water due to a change in water quantity and water quality and on aquatic resources due to a change in water quality were identified. No residual effects on sediment quality were identified.

The residual effects on surface water due to a change in water quantity as a result of Project activities are predicted to be not significant (minor). Minor streamflow changes are anticipated to be confined to M17B, M19A, and M20 creeks. Predicted effects at the downstream end of the LSA (i.e., Murray River downstream of confluence with M19 Creek) are negligible.

The residual effects on surface water due to a change in water quality as a result of Project activities are predicted to be not significant (minor). Water quality modelling predicted minor increases in selenium concentrations in M19A Creek under winter low flow conditions beginning in Decommissioning and Reclamation and extending into Post-closure. Selenium loadings are associated with discharge to ground of CCR seepage beginning at the end of Operation; during Operation, this seepage is reclaimed to the CPP. A change in water quality at the downstream end of the LSA (i.e., Murray River downstream of confluence with M19 Creek) was not predicted.

The residual effects on aquatic resources due to a change in water quality as a result of Project activities are predicted to be not significant (minor). Minor increases in selenium tissue concentrations in M19A are likely; however, exposure to increased aqueous selenium concentrations is limited to periods of low biological activity.

Project-related residual effects were carried forward to the cumulative effects assessment. Potential interactions with other human actions were considered in the cumulative effects assessment. Reduced flows during low flow periods in M20 Creek due to the Project were determined to counteract predicted increases in flow from the Hermann Mine Application/EIS; therefore, no adverse cumulative effect was identified. No interactions with other human actions were identified for potential cumulative effects due to a change in water quality in M19A Creek.

Fish and Fish Habitat Effects

Setting

The Murray River contains relatively high fisheries values and supports regionally important Arctic Grayling and Bull Trout populations. Bull Trout are a fish species of special concern ('blue-listed') in BC. Arctic Grayling are currently not at risk in BC, and are included on the provincial 'yellow-list'. In addition to Arctic Grayling and Bull Trout, native fish species commonly present downstream of Kinuseo Falls include Burbot, Finescale Dace, Lake Chub, Longnose Dace, Longnose Sucker, Mountain Whitefish, Northern Pike, and Slimy Sculpin.

Three non-native sport-fish species have been introduced to the Murray River system in recent decades, including Brook Trout (*Salvelinus fontinalis*), Rainbow Trout (*Oncorhynchus mykiss*), and Westslope Cutthroat Trout.

Fish distribution in tributary streams within the Mine Site Assessment Footprint and LSA is heavily influenced by the presence of permanent barriers to fish migration (i.e., waterfalls). Permanent barriers to fish migration are present in M17, M19, M20, and Twenty creeks. These features delineate upper and lower stream reaches, and habitat use by fish in tributary streams. Fish habitat use in tributary streams, such as M17, M19, and Twenty creeks, may also be restricted by ephemeral flow conditions. Surface flow typically declines through the summer, low flow period resulting in fragmented habitat or dewatering of the stream bed. Natural stranding mortality may occur with further reductions in surface flow.

The fish community of M17, M19, and M20 creeks is similar, and includes Arctic Grayling, Bull Trout, Burbot, Longnose Sucker, Mountain Whitefish, and Slimy Sculpin. Only Brook Trout, Mountain Whitefish, and Rainbow Trout have been documented in Twenty Creek. Wetland environments are typically populated by Finescale Dace and Lake Chub. Beaver dams appear to restrict fish movement from M19 Creek into M19A Creek, as no fish were captured in M19A Creek during baseline surveys.

For tissue metals, mean mercury concentrations in Slimy Sculpin tissues were highest at Murray River mainstem sites and lowest at tributary stream sites. Mercury concentrations in Slimy Sculpin from all Murray River sites and all sampling years were lower than the Health Canada guideline of 0.50 mg/kg WW for maximum total mercury in fish tissue (CCME 1999; Health Canada 2011).

Mean selenium concentrations measured in Slimy Sculpin were higher at tributary sites and lower at Murray River mainstem sites. Selenium concentrations (converted to units of mg/kg dry weight [DW]) in whole-body Slimy Sculpin were compared with the draft BC selenium guideline of 4 mg/kg DW for fish muscle (Beatty and Russo 2012) with multiple exceedances observed in the Murray River.

Assessment

Fish and fish habitat VCs (sub-components Bull Trout and Arctic Grayling) were assessed for a range of potential Project-related residual effects. This process identified four potential key effects, which included: direct mortality, erosion and sedimentation, change in water quality, and habitat loss. Water quality model predictions indicate the potential for elevated selenium in M19A Creek during winter months in Decommissioning and Reclamation and Post-closure. These water quality predictions were used to evaluate potential for bioaccumulation in fish tissue. Although the beaver dams currently restrict fish movement from M19 Creek into M19A Creek, a breach in the beaver dams could provide access for fish to establish populations in M19A Creek. However, in the event the beaver dams are breached, the only available potential overwintering habitat will drain and be lost. Thus, the loss of potential overwintering habitat will eliminate the possibility for adult fish to be exposed to potentially elevated selenium during the winter months.

Potential effects were also considered in relation to loss of fish habitat due to reduction flow in M20 Creek as a result of dewatering of the underground mine. The results of the groundwater modelling were input to the water balance model to assess change in flow in M20 Creek. These results indicate

that over the period of Operation, baseflow conditions (e.g., winter months) in M20 Creek may see reductions of between 2 to 16% (Base Case of 9%). Between April and August, freshet and summer flow conditions overprint the reduction in baseflow such that the annual changes are generally less than 1%. Slimy Sculpin are the only documented fish species that utilize M20 Creek for all life history stages and on a perennial (year-round) basis. Arctic Grayling and Bull Trout may use M20 Creek in an ephemeral manner; moving from the Murray River to M20 Creek sporadically during suitable flow conditions (e.g., early summer) for opportunistic feeding forays. Habitat and habitat use during important or critical life history stages (e.g., spawning, egg incubation) of Arctic Grayling and Bull Trout have not been documented in M20 Creek. Given the above characterization of fish habitat within M20 Creek, the seasonality and periodicity of fish habitat use, and the periodicity of potential changes in streamflow, residual effects to fish and fish habitat in lower M20 Creek are unlikely.

After accounting for mitigation and management, it was concluded that Project activities will not result in residual effects to fish and fish habitat. Mitigation and management methods include the implementation of best management plans (e.g., Selenium Management Plan, Water Management Plan, Erosion and Sediment Control Management Plan) and adherence to standards and best practices (e.g., Fisheries and Oceans Canada's best practices, operating window for instream work, site isolation, riparian re-vegetation, fishing prohibition, water quality maintenance, and dust suppression). Serious harm to fish or fish habitat related to the Construction, Operation, Decommissioning and Reclamation, and Post-closure phases of the Project are not anticipated.

Terrain Effects

Setting

Terrain and soil baseline studies were completed between 2010 and 2014 and included terrain and soil mapping, slope analysis, and the assessment of terrain stability, hazards, and constraints. The work involved review of background information, preliminary mapping, field surveys, data analysis, reassessment of produced maps, and preparation of assessment reports.

Undulating landscapes, defined as a sequence of smooth, non-linear rises and hollows, occur over approximately 25% of the LSA. Rolling topography (similarly smooth, but linear sequences of elongated rises and valleys that repeat in a wave-like pattern across the landscape) compose 5% of the surveyed area. Only about 10% of the LSA consists of irregularly shaped terrain with steep slopes such as ridges and hummocks.

Terrain stability hazards that exist within the LSA include slow mass movement, rapid mass movement, and active fluvial processes. The majority of these hazards are associated with the Murray River and its banks. Terrain characteristics or features that are likely to pose a challenge to the construction, operation, or maintenance of infrastructure or access include gullying, seepage areas, and wetlands.

Assessment

It is expected that the development of the Murray River Project will affect terrain stability in the LSA. The main effects will result from soil disturbances associated with construction of Project infrastructure and with subsidence predicted within the extent of underground mining.

Mitigation will involve the implementation of best management practices and soil and overburden management plans, employment of professional engineers to plan and oversee all construction work, minimization of the spatial and temporal extents of soil disturbance, and avoidance of the areas classified as potentially unstable.

It is expected that the underground coal extraction will be associated with changes in surface morphology and will generate horizontal tensions within the surficial mineral deposits. These phenomena will potentially affect terrain stability.

The residual effects of Project development may include mass movement of the surficial deposits, altered intensity of active fluvial processes, and soil erosion. Most of these effects will be associated with subsidence and lateral stress on surficial geological strata induced by underground mining. Some will result from soil disturbances, especially during Project Construction and Decommissioning and Reclamation, and from salvage, storage, and re-distribution of soil. It is assumed that most of the anticipated changes in terrain stability will affect ecosystems that historically were characterized by some level of geohazard risk and thus are neutral or display limited sensitivity to the potential of increased instability. Overall, it is expected that the residual effects of the Project on terrain stability will be not significant (moderate).

Residual effects to terrain stability may interact with similar effects contributed by a number of past, current, and future projects and activities within the RSA in an additive manner. However, overall, the cumulative effects on terrain stability in the RSA are expected to be not significant (moderate).

Terrestrial Ecology Effects

Setting

Terrestrial ecology baseline studies were undertaken from 2010 to 2012. The goal of the baseline studies was to characterize the terrestrial ecology within the LSA to guide Project planning, management, and environmental assessment.

The Project is situated within the Central Canadian Rocky Mountain Ecoregion, the Sub-boreal Interior Ecoprovince, and the Hart Foothills Ecosection (Demarchi 2011). The Hart Foothills are situated along the east side of the Rocky Mountains and consist of rounded mountains and wide valleys generally lower than the Rocky Mountains to the north and south.

The Murray River RSA overlaps nine provincial BEC units including six forested units, two parkland units, and one alpine unit. Forested units cover 207,108 ha (92%) of the RSA, and alpine and parkland units cover 20,470 ha (9%).

A total of 113 ecosystems (unique combinations of BEC unit and site series) were mapped in the RSA, including the non-forested and undescribed ‘00’ sites series. Forested ecosystems occur on more than 80% of the RSA, and Mesic, Slightly Dry to Moist, and Moist Forests were the most common.

Due to considerable mining activity locally, almost 12% the terrain in the LSA has been anthropogenically modified. Many of these areas have compacted surficial layers. Typical surficial material texture varies between silt loams and clay loams, and coarse fragment content varies

between 0 and 75%. Coarse fragments usually consist of gravels and cobbles that are rounded (e.g., near gravel pits) or angular (e.g., near waste rock disposal sites). Rapid mass movement and the evidence of localized erosion were occasionally recorded on steeper slopes.

Valleys in the LSA are similar to those in the RSA. They are generally wide and often deeply incised by rivers and streams (e.g., the Murray River, Wolverine River, and Flatbed Creek). Floodplain forests dominate the banks of larger rivers and streams in the LSA. A variety of ecosystems occupy the hilly landscapes, including moderately dry forests, moist forests, and slightly dry to moist forests. Only a small proportion of the LSA consists of irregularly shaped, steeper landscapes such as ridges and hummocks, which also contain many of the drier ecosystem types (barren and moderately dry forest). In contrast, most of the dry ecosystem (barren, dry to mesic forest, dry to mesic herb, and dry to mesic shrub) within the RSA occur at higher elevation within the alpine and subalpine areas (BAFA and ESSFwvp).

Forested ecosystems comprise more than 80% of the LSA, dominated by Mesic, Slightly Dry to Moist, and Moist Forests. Forested ecosystems (structural stages 4 through 7) collectively account for nearly 70% of the LSA, dominated largely by mature forests (structural stage 6), which comprise 38% of the LSA. Shrub- and herb-dominated ecosystems (structural stages 2 and 3, respectively) comprise 18% of the LSA, and sparsely vegetated/bryoid-dominated ecosystems (structural stage 1) comprise less than 1% of the LSA. The remainder (12%) of the LSA is covered by non-vegetated ecosystems.

Eight provincially blue-listed ecological communities were identified within the LSA, covering 3,265 ha. These include BWBSmw 112 *(Populus balsamifera - Picea glauca / Alnus incana - Cornus stolonifera),* BWBSmw/110 *(Picea glauca / Gymnocarpium dryopteris - Aralia nudicaulis),* BWBSmw/111 *(Picea glauca / Ribes triste / Equisetum* spp.), BWBSwk1/101 *(Picea glauca - Abies lasiocarpa / Vaccinium membranaceum / Pleurozium schreberi),* BWBSwk1/103 *(Picea glauca – Pinus contorta / Shepherdia canadensis / Eurybia conspicua),* BWBSwk1/110 *(Picea glauca / Ribes triste / Equisetum* spp.), SBSwk2/02 *(Pinus contorta / Vaccinium membranaceum / Cladina* spp.), and ESSFmv2/*06 (Abies lasiocarpa / Alnus* spp. / *Equisetum* spp.).

A total of 1,650 field identifications representing 510 species were made during the rare plant and lichen surveys. Rare plant or lichen species found include the lichens *Bryoria furcellata* (a new discovery for BC), *Cladonia coccifera* (red listed; S1: G5), *Collema tenax* var. *expansum* (globally rare), *Hypogymnia dichroma* (new to science), *Leptogium tenuissimum (*red listed; S2?; GNR*)* and *Usnea cavernosa (*blue listed; S2S3*)* the moss *Mielichhoferia elongata* (globally rare),as well as the vascular plants *Cardamine parviflora* (blue listed; S2S3; G5), *Carex tenera* (blue listed; S2S3: G5TNR), and *Drymocallis arguta* (red listed; S1S3; G5T5) and *Botrychium crenulatum* (blue listed; S2S3; G3).

Assessment

Terrestrial ecology was selected as a VC because of its key role in the maintenance of wildlife habitat, nutrient cycling, productivity, biodiversity, and carbon sequestration. Furthermore, it is recognized that Aboriginal groups place value on all ecosystems and their interconnections and as such all vegetated ecosystems that may interact with the Project are included in this assessment. Terrestrial ecosystems provide habitat for culturally important and harvestable plants, lichens, and at-risk components of regional, provincial, federal, or global biodiversity.

For this assessment, terrestrial ecology was categorized into the following sub-components:

- ecologically valuable soil;
- forested ecosystems;
- rare ecosystems;
- harvestable plants; and
- rare plants and lichens and associated habitat.

Project-related effects on terrestrial ecology VCs were characterized through a risk model. The risk model identifies the probability and the consequence or value of that VC (i.e., the relative importance of the ecosystem function). The effects to rare plants and those due to potential subsidence were assessed separately from the risk model. Six potential effects were identified:

- high-impact surface disturbance;
- dust effects, edge effects;
- introduction and/or spread of invasive plant species;
- windthrow;
- fragmentation; and
- alteration of hydrological connectivity.

The Project is expected to result in the loss of 313 ha and the degradation of 182 ha of ecologically valuable soil. Most of the direct effects on ecologically valuable soils will occur during Construction as a result of development activities associated with the construction of infrastructure.

Project activities represent a high risk to 356 ha, a medium risk to 428 ha, a low risk to 1,708 ha and no risk to 9,579 ha of forested ecosystems within the LSA. The majority of the high risk is associated with the loss of mature forested ecosystem spatial extent and function as a result of physical vegetation clearing, soil salvage, and site preparation for the mine components (e.g., Coal Processing Site, Secondary Shaft Site) within BWBSmw BEC unit.

Construction activities are expected to result in the loss of 51 ha of rare ecosystems. The majority of the effects to harvestable plants will occur as a result of clearing activities within the Mine Site Assessment Footprint, which will remove approximately 287 ha of potential harvestable plant habitat. Project activities associated with Construction will result in the loss of one red-listed species, *Drymocallis arguta* s. str. (tall cinquefoil) and two blue-listed species *Cardamine parviflora* (sand bittercress) and *Botrychium crenulatum* (dainty moonwort). Edge and/or dust effects may result in the alteration of habitat of the rare lichen species, *Collema tenax* var. *expansum* and *Hypogymnia dichroma*. The rare vascular plant species *Carex tenera* may also be affected by changes in ecosystem moisture regime due to subsidence.

Residual effects were identified for loss and alteration of ecologically valuable soils, forested ecosystems, rare ecosystems, harvestable plants, and rare plant and/or lichen habitat. These effects were assessed as not significant.

Residual Project-related effects were carried forward to a cumulative effects assessment. The total cumulative loss of ecologically valuable soils and forested ecosystems within the CEA boundary is 16,449 ha (466 ha from the Project).

The total cumulative alteration of forested ecosystems within the CEA boundary is 49,190 ha (164 ha from the Project).

The total cumulative loss on British Columbia Conservation Data Centre (BC CDC) listed ecosystems is 2,366 ha (45 ha from the Project). The total cumulative alteration on BC CDC listed ecosystems is 8,753 ha (24 ha from the Project).

Implementation of relevant environmental management plans including Air Quality and Dust Control, Site Preparation and Soil Salvage, Erosion and Sediment Control, Invasive Plants, and Subsidence will avoid and minimize adverse effects to terrestrial ecology VCs during Construction, Operations, Decommissioning and Reclamation, and Post-closure.

No significant Project-related effects were identified; significant residual cumulative effects were assessed for forested ecosystems, rare ecosystems, and rare plants and lichens and associated habitat as a result of the history of substantial mining, forestry, oil and gas exploration, and other human development activity in the region.

Wetlands Effects

Setting

Wetlands are regarded as important ecosystems within BC, Canada, and internationally, because they provide critical habitat for fish, birds, and other wildlife. Many wildlife species in BC use wetland habitat at some point in their life cycle, and many red- and blue-listed species are wetland-dependent. Wetlands provide habitat for rare plants as well as plants of cultural and/or economic importance. They also play a key role in the maintenance of hydrologic cycles, wildlife habitat, nutrient cycling, water quality, biodiversity, and carbon sequestration.

A total of 394.8 ha of wetlands were characterized in the LSA. Bogs and swamps accounted for the largest area of wetlands accounting for 298.8 ha (76%) of all wetlands. Fens were the least common wetland class in the LSA at 4% of all wetlands.

Assessment

The assessment for wetlands included effects of the Project on wetland extent and wetland function. Project footprint analysis assessed and quantified Project interactions resulting in loss of wetland extent and function. Wetland function was assessed using a risk-based approach to determine Project effects; under this approach, risk is defined as the probability that an adverse event will occur, multiplied by the consequences of an adverse event (Sayers, Hall, and Meadowcroft 2002). To calculate the probability rating, six possible Project effects on wetlands were assessed: hydrological connectivity, fragmentation, edge effect, dust, sedimentation and water quality, and invasive species. Consequence (the value of each wetland) was assessed on five components including: rare/

listed species or ecosystems, hydrological function, biochemical function, functional diversity (ecological function), and habitat function.

Direct interaction with Project components is expected to result in the loss of 28.6 ha of wetlands (7% of all wetlands in the LSA). Risk of wetland loss indicates that 8.4 ha (2%) are at high risk of loss, 11.1 ha (3%) are at moderate risk of loss, and 54.3 ha (14%) are at low risk of loss. Potential wetland loss due to subsidence was not included in the risk model due to uncertainty. In total, 44.4 ha of wetland (12.2% of all wetlands in the LSA) fall within the Subsidence Footprint.

Residual effects are expected on wetland functions due to Project activities. Increased selenium concentrations in M19A Creek may accumulate in wetlands downstream of the Coal Processing Site; however, effects on wetland vegetation are not expected.

The probability of effects on hydrological functions, biochemical functions, functional diversity, or habitat function will be minimized through adherence to the mitigation and management strategies described within the Management and Monitoring Plans (Chapter 24).

Alteration of wetland function is rated moderate in magnitude. As shown in the probability and consequence model, 81.3 ha (23%) of wetlands in the LSA are at high and moderate risk of loss and effects on function or due to subsidence. The residual effects were assessed as not significant (moderate).

Cumulative effects for the Project and projects within the RSA were assessed. A residual cumulative effect on the loss of wetland extent and alteration of function is expected due to additive losses in the region. This effect is expected to be not significant, because the loss and alteration of wetlands associated with the projects in the RSA is expected to be of moderate magnitude, far future in duration, occur at multiple frequencies, be regional in extent, only reversible in the long-term, and the likelihood of occurrence and confidence are high.

Wildlife Effects

Setting

Wildlife baseline studies for the Project were described for an RSA, which was chosen to reflect natural land or administrative boundaries and include wildlife species that could, conceivably interact with the Project in the course of a season or lifetime. Eleven wildlife species, or groups of species, were chosen as Valued Components for inclusion in baseline studies and effects assessment, including: 1) mountain caribou; 2) rocky mountain elk; 3) moose; 4) mountain goat; 5) grizzly bear; 6) furbearers; 7) bats; 8) raptors; 9) waterbirds; 10) songbirds; and 11) amphibians. VCs were chosen based on: 1) species at risk or conservation status; 2) species or groups requiring enhanced consideration under provincial or federal standards; 3) keystone, indicator, or umbrella species; and 4) species of cultural, social, or economic importance to First Nations.

Field surveys were conducted from 2010 to 2013 for ungulate species, furbearers, bats, raptors, waterbirds, songbirds, and amphibians.

Habitat suitability mapping was conducted for caribou (the Quintette herd; winter, growing, and calving seasons), moose (winter and growing seasons), mountain goat (winter and growing seasons), elk (winter and growing seasons), grizzly bear (denning, spring, summer, and fall seasons), (birthing and living seasons), and songbirds (black-throated green warbler; summer season).

The Project is at low elevation; based on collar information on Quintette caribou, this herd is predominately located in fir forests, parkland areas, and the alpine during summer. Habitat use is generally limited to areas above 1,300 m.

Like caribou, the low elevation of the Project means that little to no modelled mountain goat habitat overlapped the LSA or Project footprint. All ungulate species expected to occur within the RSA were observed during baseline surveys: woodland caribou, mule deer, white-tailed deer, elk, mountain goat, and moose.

The Project is located in the Hart Grizzly Bear Population Unit. Spring habitat includes low elevation forests and wetlands and overlaps with the Project location and the Murray River Resource Management Zone. Habitat for denning, summer, and fall, generally falls at higher elevation than the Project location.

Staging surveys (spring and fall) recorded 35 species of waterbirds, including dabbling ducks (7 species), diving and sea ducks (10 species), loons and grebes (6 species), riverine birds (3 species), geese and swans (2 species), and shorebirds (7 species). Common species were mallard, lesser scaup, ring-necked duck, Canada goose, Barrow's goldeneye, hooded merganser, and American green-winged teal. Five species of conservation concern were detected: harlequin duck, horned grebe, red-necked phalarope, surf scoter, and western grebe. Harlequin duck and horned grebe are both provincially yellow-listed, red-necked phalarope and surf scoter are blue-listed, and western grebe is red-listed.

Surveys identified 60 species of songbirds (685 birds), with the most abundant being yellow-rumped warbler, Swainson's thrush, warbling vireo, Wilson's warbler, and white-throated sparrow.

Amphibian surveys detected four species: western toad, Columbia spotted frog, wood frog, and long-toed salamander. Three breeding sites for western toads were found in the LSA. Most wetlands containing amphibians were small (~0.5 ha), had sluggish water flow with muddy or gravelly banks and a mix of emergent vegetation such as horsetails, sedges, and aqueous graminoids within the wetted area, with an open tree canopy.

Assessment

Wildlife and wildlife habitat (i.e., mountain caribou, rocky mountain elk, moose, mountain goat, grizzly bear, furbearers, bats, raptors, waterbirds, songbirds, and amphibians) were assessed as VCs for a number of potential Project-related residual effects.

Moose (habitat loss and alteration, and disruption of movement), grizzly bear (disruption of movement), and fisher (habitat loss and alteration, and disruption of movement) were wildlife VCs assessed for residual effects due to the Project.

In order to mitigate for residual effects to wildlife and wildlife habitat from the Project environmental management plans have been developed, including wildlife, waste, and noise management plans (Chapter 24). Effects due to habitat loss and alteration, disruption of movement, and direct mortality (vehicle collisions) are addressed in the Wildlife Management Plan (Section 24.12) and Subsidence Management Plan (Section 24.15). Effects due to sensory disturbance are addressed in the Noise Management Plan (Section 24.3). Effects due to attractants are addressed in the Waste Management Plan (Section 24.13) and the Wildlife Management Plan (Section 24.12). Effects due to indirect mortality (increased access) are addressed in the Site Access Management Plan (Section 24.17). Effects due to chemical hazards are addressed in the Water Management Plan (Section 24.6), the Selenium Management Plan (Section 24.10), and Air Quality and Dust Control Management Plan (Section 24.2). With mitigation and monitoring, no significant Project-related residual effects are expected.

Identified residual effects were also carried forward to the cumulative effects assessment and assessed within the RSA, which stretches an average of 25 to 30 km away from the Project. Past, present, and future projects within the RSA that interacted with the VCs were identified and included in the assessment, including road networks, mining and forestry operations, and other industrial and urban areas. Projects outside the RSA were excluded due to no interaction with the wildlife VCs. Cumulative effects due to the Murray River Project were assessed as not significantly contributing to negative effects on wildlife. The analysis took into account that the Project has a relatively small footprint area, is at low elevation, outside of key habitat areas for caribou, and will produce little noise being an underground mine. In addition, the Project will lead to little traffic increase on Highway 52, and no changes in the quality of water in the Murray River are predicted.

All cumulative residual effects to wildlife and wildlife habitat will be addressed in the Project-specific mitigation and management plans. It is also assumed that the proponents of other projects and activities within the CEA boundary will implement mitigation and management plans similar to those identified for the Murray River Project. No significant cumulative residual effects are expected.

Economic Effects

Economic effects of mine development are generally considered a key benefit of any project as they provide jobs, tax revenues, and business opportunities that contribute to community, regional, and provincial prosperity. The assessment of economic effects examined the potential adverse economic effects of the proposed Project in relation to the labour market and economic activity.

Setting

The largest communities in the LSA are Tumbler Ridge (population 2,710), Fort St. John (population 18,609), Chetwynd (population 2,635), and Dawson Creek (population 11,583). The LSA also contains the Indian Reserves of West Moberly Lake IR 168A (population 247), East Moberly Lake IR 169 (population 324), and McLeod Lake IR 1 (population 73).

In 2011, the LSA had 21,390 people in the labour force, of that 1,325 (6.2%) were unemployed. Aboriginal workers comprised 1.1% (225) of the total LSA labour force. In the non-Aboriginal communities, the unemployment rate ranged from 5.6% to 9.7%, whereas the Aboriginal

communities had higher unemployment rates of 17.9% to 25.0% in 2011. In comparison, BC had an unemployment rate of 7.8%. Income was relatively higher in the non-Aboriginal communities compared to the Aboriginal communities. Key industries in the LSA include resource-based industries (mining), retail trade, construction, manufacturing, health care, and social services,

The economic activities within the LSA are diversified. Tumbler Ridge is the central service hub for the mines currently active in the area, and also serves as a centre for tourism, including for outdoor recreation and the emerging "dinosaur tourism" industry. The District of Chetwynd has a diverse economy that includes agriculture (ranching), energy (oil and gas, wind), forestry, mining, and tourism. Dawson Creek's economic base includes agriculture, energy (oil and gas), forestry, mining, and tourism. The oil and gas industry is a significant driver of the Fort St. John economy. It is one of the main employers in the city and has stimulated a range of other supporting businesses such as construction, trucking, and pipeline operations (FSJ 2012). Fort St. John also has strong agricultural and forestry industries.

The WMFN relies on logging, an industrial contracting business, and trapping for employment opportunities and for generating revenues to the community (T8TA 2005-2012b). Past economic activity in the areas has been primarily in the forestry, retail trade, mining, and oil and gas sectors. Agriculture and tourism are also important to the WMFN (PRCI 2010).

The main economic activities that support the SFN/East Moberly Lake community are from a cattle ranch and farm, silviculture, gravel extraction and sales (T8TA 2005-2012a), and mining contracting. Agriculture and tourism are important to the SFN. The non-wage economy, which consists of activities such as trapping, hunting, and fishing are also key, both economically and culturally (PRCI 2010). Forestry, construction, as well as heavy industrial support and supply, have also grown in importance in recent years (4Evergreen Resources LP 2013).

MLIB owns several companies. Duz Cho Logging, established in 1988, is the main business operator and the major employer on the reserve (MLIB 2012). In 2002, the MLIB also established Duz Cho Construction with services that include project site development, road access, and reclamation for the oil and gas, wind energy, and mining industries. Further, in 2004, MLIB acquired 80% of Summit Pipeline Services, which specializes in the repair and construction of oil and gas pipelines (MLIB 2012).

Assessment

The Project is expected to result in two adverse economic effects: 1) decrease in employment and income at Decommissioning and Reclamation; and 2) increased competition for labour and wage inflation. The effect of the decrease in employment and income is expected to occur at the Decommissioning and Reclamation phase of the Project. The effect of increased competition for labour and wage inflation is expected to occur during Construction and Operation.

The two adverse economic effects will be mitigated through a set of plans, programs, and strategies including the Recruitment, Training, and Employment (RTE) Plan, Procurement Strategy, Workforce Transition Plan, and continued engagement with First Nations and communities. Despite the implemented mitigation measures, residual effects are predicted for each VC, although both are assessed as not significant.

Increased competition for labour and wage inflation was carried forward for the cumulative effects assessment because of the potential for interaction with other projects. Several coal mines that are in the development stage in the region may contribute to the competition for skilled labour and, therefore, adversely affect the ability of businesses and industry to secure the necessary workforce and result in inflation pressures on wages. The residual cumulative effect is rated not significant. The closures of other projects in the region are not expected to coincide with Decommissioning and Reclamation of the Project; consequently, a cumulative effect for decrease in employment and income at Decommissioning and Reclamation is not predicted.

Social Effects

Setting

Social baseline studies were undertaken between 2010 and 2013, with study methods including a combination of secondary (desktop review) and primary data collection (interviews).

The PRRD, where the Project is located, has a relatively young (median age 34) and quick-growing population (population growth of 11% 2001-2011). The District's economy relies strongly on natural resource use (oil, natural gas, and hydroelectricity), and its communities have historically experienced population changes associated with resource development.

Housing shortages are common across the LSA communities, with vacancy rates close to zero in many communities and housing values and rents increasing. Workers in the LSA often commute or live in temporary accommodations such as camps, movable dwellings, or hotels. Aboriginal community members have been moving from regional centres back to reserves as a result of increased housing costs, with some reserves experiencing overcrowded housing as a result.

Community services such as schools, health care, and emergency services are more heavily concentrated in the non-Aboriginal regional centres of Fort St. John and Dawson Creek, as well as Chetwynd and Tumbler Ridge. Size and breadth of service offering tends to vary with population size. Many of these community services are experiencing shortages in personnel as they attempt to keep pace with population growth. Aboriginal communities such as the WMFN and SFN reserves have limits to their existing community services (e.g., child care), with more extensive community services available off-reserve (e.g., emergency services) or offered on-reserve on a rotating basis (e.g., specialized health care). Education levels are below provincial averages.

Some Aboriginal communities have flagged social issues associated with resource development as issues of concern, and northeastern BC communities have expressed a desire to maximize the benefits of resource development to mitigate the potential adverse social effects (Halseth and Sullivan 2002; Markey and Heisler 2011; Shandro et al. 2011).

Assessment

Social VCs (health care, emergency services, educational services, child care services, community infrastructure, housing, and other social problems, and social integration) were identified through consultation with Aboriginal groups, governments, and the public/stakeholders. These VCs were then assessed for a range of potential Project-related effects. Project-specific mitigation measures, as

well as local and provincial initiatives to increase access to local services, are expected to address anticipated effects to access to and quality of health care, response ability of fire services, quality of ambulance services, crime, and social integration.

One residual social effect on childcare in the LSA is predicted. Project-related population growth and increased employment in these communities will increase demand on already limited childcare services, thereby reducing available childcare spaces. HD Mining plans to work with local government on a study to identify property for a new childcare facility.

Non-traditional Land Use Effects

Setting

The proposed Project is located within the boundaries of the Dawson Creek LRMP, which guides resource management activities on Crown land within the Dawson Creek Forest District in northeastern BC (Dawson Creek LRMP Working Group 1999). The LRMP was approved by the Province in March 1999 and encompasses 2.9 million ha of land.

Land and resource interests within the land use baseline LSA and RSA include: parks and protected areas, Crown granted tenures (e.g., coal, mineral, guide outfitting, trapping, oil and gas, energy, commercial recreation), and public recreation. The Murray River runs through the LSA and RSA. It is the only navigable watercourse within the Project area based on an assessment of the navigability pursuant to the *Navigation Protection Act* (1985c).

There are no provincial or federal parks or protected areas located within the LSA or near Project infrastructure. Provincial parks and protected areas in the RSA include part of Bearhole Lake Provincial Park and Protected Area. Three trails border the LSA: Mt. Hermann, Barbour Falls, and Nesbitt's Knee Falls. In addition to these three trails, there are fourteen trails within the RSA. Other public use includes fishing, hunting, boating, and snowmobiling.

The Project is overlapped by Wildlife Management Units (WMU) 7-20, 7-21, and 7–22. Seventy-five percent of the Land Use baseline LSA falls within WMU 7-21. WMU 7-20 overlaps 24% of the RSA. WMU 7-22 overlaps less than 1% of the RSA at its westernmost edge.

Four guide outfitting tenures overlap the RSA. Guide outfitting licence 701254 overlaps the majority of the LSA, and over half of the RSA. There is one main base camp associated with this licence (commercial recreation license 0318950, located along Kinuseo Creek on the southern boundary of the RSA). Alpine Valley Outfitters operates guide outfitter licence 701258, which overlaps the northwestern part of the RSA, and the northwestern corner of the LSA. They also have four hunting camps within the portion of their tenure that overlaps the RSA (commercial recreation license 8013764). Tracks BC and High Prairie Outfitters Ltd. operate guide outfitter licence 701245, which overlaps a small northwestern section of the RSA. Fredlund Guide Services operates guide outfitter licence 701249, which overlaps a small area of the southeast corner of the RSA.

Three registered traplines, TR0721T006, TR0721T003, and TR0721T005 overlap the LSA. The boundaries of the RSA overlap an additional seven registered traplines. There are two trapline cabins located in the LSA (*Land Act* tenure number 8002864).

There are nine forest tenures within the LSA. Along with Canfor's TFL 48, West Fraser Mills Ltd. holds forest licence A13840 located in the southeastern and northeastern sections of the LSA. The southeastern edge of the LSA encompasses a Community Forest Agreement held by the Tumbler Ridge Community Forest Corp. The LSA is covered by Tembec's Pulpwood Agreement. Babcock Mountain Sawmills Ltd. holds an occupant licence to cut and a licence of occupation (8014205, for log handling/storage) in the LSA.

There are two coal leases and 47 coal licences within the LSA. HD Mining holds 27 of the 47 coal licences in the LSA. The remaining 20 coal licences are held by 0541237 B.C. Ltd. (nine licences), Peace River Coal Inc. (nine licences), and Teck Coal Ltd. (two licences).

The LSA contains 32 petroleum and natural gas leases, which are held by ten companies. Canadian Natural Resources Ltd. holds about 60% of the leases. Within the LSA, five companies hold nine oil and gas pipeline tenures. One pipeline (8008555 held by Westcoast Energy Inc.) borders the Project footprint on the west side of the Murray River.

Two wind power companies hold two tenures in the LSA. Finavera Wind Energy Inc. holds a general area licence (8015353), while Wind Prospect British Columbia Inc. holds an investigative licence (8015574) split into one area and four sites. None of these tenures overlap with the Project footprint.

Assessment

Harvesting, recreational use, industrial use, and navigation were selected as VCs for the effects assessment. Key effects assessed included change to the quality of experience of the natural environment, change to the distribution and abundance of resources, damage to infrastructure, and change to the navigation of the Murray River. The effects were assessed for each of the Project phases.

No potential effects are expected on public use and navigation. Measures to mitigate potential effects on harvesting include implementing a Wildlife Mitigation and Monitoring Plan, Noise Management Plan, and Subsidence Management Plan. Measures to mitigate potential effects on industrial use include implementing a Subsidence Management Plan.

A residual effect on a change in harvest locations for guide outfitter licences 701254 and 701258 and traplines TR0721T003 and T0R0721T005 due to a change in abundance and distribution of wildlife is predicted. A residual effect is also predicted on industrial use due to economic impacts on overlapping tenure holders from subsidence. The two residual effects are rated as not significant (minor).

The two residual effects were carried forward into the cumulative effects assessment. With respect to subsidence, there are no other present or reasonably foreseeable future projects that are expected to interact with the Murray River Project. This residual effect was not carried forward into the cumulative effects assessment.

With respect to harvesting, present or reasonably foreseeable future projects that have the potential to cumulatively interact with guide outfitter licences 701254 and 701258 and traplines TR0721T003 and TR0721T005. For example, guide outfitting licence 701254, which overlaps nine past, present,

and future projects, in addition to the Murray River Project, may be more likely to experience cumulative effects compared to guide outfitting licence 701258, which overlaps four additional projects. However, the magnitude of the cumulative effect may be influenced by the size of the guide outfitter or trapline licence and the cumulative residual effects on habitat of harvested wildlife species. The cumulative effect on harvest locations was determined to be not significant.

Current Use of Lands and Resources for Traditional Purposes Effects

Setting

Current use of lands and resources for traditional purposes by Aboriginal people includes fishing, hunting and trapping, plant gathering, and utilization of camps/cabins, trails, burial sites, and cultural landscapes. The chapter focuses on current uses of land and resources by SFN, WMFN, MLIB, BRFN, HLFN, Doig River First Nation, Fort Nelson First Nation, Halfway River First Nation, Prophet River First Nation, Kelly Lake Métis Settlement Society, Métis Nation BC, and Sucker Creek First Nation.

Secondary and primary research was conducted to gather information on current use by the Aboriginal groups identified above. An ethnographic literature review and a desk-based Traditional Knowledge and Traditional Use (TK/TU) study was conducted to provide regional context on broader cultural and land use trends and, where available, detail site-specific current uses in the vicinity of the Project. HD Mining distributed a draft of the desk-based ethnographic research report to SFN, MLIB, and WMFN for review and comment. The ethnographic literature review and the TK/TU Study is appended in Appendix 17-A of the Application/EIS.

The SFN knowledge and use study (Saulteau First Nations Knowledge and Use Study Specific to HD Mining International Ltd.'s Proposed Murray River Coal Mine Project) is appended in Appendix 17-B of the Application/EIS.

HD Mining also sought information on the potential impacts of the Project on current Aboriginal use by preparing a plain language summary of the proposed Project for each Aboriginal group. The summary described the Project and outlined HD Mining's understanding of Aboriginal and treaty rights and related interests as related to the Project, VCs of potential interest to each Aboriginal group, and HD Mining's proposed approach to assess potential impacts of the Project on Treaty 8 First Nations' Aboriginal and treaty rights and related interests. Each summary was provided to SFN, WMFN, MLIB, BRFN, HLFN, Doig River First Nation, Fort Nelson First Nation, Halfway River First Nation, Prophet River First Nation, Kelly Lake Métis Settlement Society, Métis Nation BC, and Sucker Creek First Nation for review and comment.

SFN identified a number of site-specific subsistence uses, including game kill locations, fish catch sites, plant and firewood gathering sites, and a drinking water collection site, in the vicinity of the Project (Appendix 17-B) including:

- 44 values within 250 m of the Project;
- 20 further values within 5 km of the Project; and
- 91 further values within 25 km of the Project.

SFN also reported the existence of cultural and spiritual values within the vicinity of the Project, including a general trapping area, a medicine plant gathering area, and a sacred place within 250 m of the Project (Appendix 17-B: Saulteau First Nations Knowledge and Use Study).

MLIB, WMFN, BRFN, HLFN and Kelly Lake Métis Settlement Society report hunting in the Tumbler Ridge area. HLFN reports fishing near Kinuseo Falls and other areas in the Murray River.

To date, Doig River First Nation, Fort Nelson First Nation, Halfway River First Nation, Prophet River First Nation, and Sucker Creek First Nation did not provide comments on the plain language summary and have not provided information to HD Mining regarding its members' current use of the Project area. These Aboriginal groups have not raised any issues or concerns with respect to the Project. Métis Nation BC responded to the plain language summary "to clarify Métis rights, traditional knowledge, MNBC structure, geography, mobility, and community to assist the proponent in developing methods [to assess Project effects on Métis rights]." Métis Nation BC have raised a concern that the Project could put local Métis Aboriginal rights and traditional land uses at risk. To date, HD Mining has not obtained information regarding Métis Nation BC members' current use of the Project area.

Assessment

The VCs included in the assessment were fishing opportunities and practices, hunting/trapping opportunities and practices, plant-gathering opportunities and practices, and use of habitations, trails, cultural and spiritual sites. The assessment focused on key effects related to: 1) a change in access or ability to access or use land use areas; 2) a change in the quality of experience of the natural environment; 3) a change in harvesting success; and 4) a change to the perceived quality of resources. The effects were assessed for each of the Project phases.

Measures to mitigate potential effects included implementing a Wildlife Mitigation and Monitoring Plan, Noise Management Plan, Closure and Reclamation Plan, and Subsidence Management Plan. HD Mining will work with the SFN to confirm the location of habitations and the sacred site within the Project footprint and to develop appropriate avoidance and/or other mitigation measures.

The following residual effects were identified: 1) reduced quality of experience while fishing (SFN and HLFN), hunting (SFN, WMFN, and KLMSS), gathering (SFN), and while using habitations, trails, and cultural and spiritual sites (SFN); 2) reduced harvesting success in preferred areas for moose (MLIB, WMFN, BRFN, HLFN, SFN and KLMSS), grizzly bear (SFN and KLMSS) and fisher (SFN and KLMSS), and blueberries, firewood, and medicinal plants (SFN); and 3) perceived reduction in quality of resources harvested in the LSA, including fish (SFN and HLFN), wildlife (SFN, WMFN and KLMSS), and plants and berries (SFN) All residual effects are rated as not significant (moderate).

The residual effects were carried forward into the cumulative effects assessment. The following cumulative residual effects were identified: 1) Cumulative reduction in quality of experience while fishing (SFN and HLFN), hunting (SFN, WMFN, and KLMSS), gathering (SFN), and while using habitations, trails, and cultural and spiritual sites (SFN); 2) Cumulative reduction in harvesting success in preferred areas for moose (MLIB, WMFN, BRFN, HLFN, SFN and KLMSS), grizzly bear

(SFN and KLMSS) and fisher (SFN and KLMSS), and blueberries, firewood, and medicinal plants (SFN); and 3) Reduced perceived quality of resources harvested in additional locations in the LSA, including fish (SFN and HLFN), wildlife (SFN, WMFN and KLMSS), and plants and berries (SFN). All cumulative residual effects are rated as not significant (moderate).

Health Effects

Setting

Human health is affected by several physio-chemical environmental components, namely by the quality of drinking water, the quality of air that people breath, the quality of foods (especially country foods for Aboriginal people) and noise. Therefore, baseline study results for these four components were included to describe the environmental baseline conditions that can affect baseline human health.

Baseline water quality exceeded the drinking water quality guidelines for three parameters: pH; lead; and dissolved aluminum. Human health is not likely to be negatively affected by baseline drinking water quality at these two sites (M20-04 and M17-02) since the exceedances are very small (4% to 6%), the exceedances are only periodic, there are no water licenses for these water bodies, and there are no known permanent drinking water users of these potential surface water sources.

All collected dustfall samples from five locations at the Project are below the lower British Columbia Ministry of Environment (BC MOE) limit of 1.7 mg/dm^2/day. Dustfall collected during May and June is significantly higher than other 30-day periods. Some exceedances of $PM_{2.5}$ and PM_{10} have occurred at regional monitoring stations; however, these monitoring stations are located in more urbanized areas than the Project site and therefore $PM_{2.5}$ concentrations would likely be lower across the Project site.

The problem formulation stage of the risk assessment identified several metals as contaminants of potential concern (COPCs) based on screening (relative to guidelines) of soil, sediment, and surface water baseline data collected from the country foods LSA. The following ten COPCs were screened into the assessment: aluminum; arsenic; barium; cadmium; chromium; copper; mercury; nickel; selenium; and silver.

Overall, the country foods baseline predicted no unacceptable risk to people from the consumption of moose, snowshoe hare, grouse, trout, and berries. Based on the measured and predicted levels of metals in these foods, the amounts currently consumed by the country foods harvesters are within the recommended maximum weekly intake. Thus, country foods harvesters may safely continue to eat these country foods.

Natural background noise sources observed at the Murray River monitoring stations included birds, mammals, wind, rain, and thunder. Anthropogenic noise sources that were observed included aircraft, road vehicles, trains, and mining activities.

Assessment

Four VCs were selected for the human health effects assessment: drinking water; air quality; country foods; and noise.

The potential for Project-related effects to human health was assessed by determining the potential for changes in air quality, drinking water quality, country foods quality, or noise and considering how these potential changes could affect human health. Quantitative information was used wherever possible in the assessment, including the outputs from the air quality, water quality, soil quality, and noise predictive models.

After considering mitigation measures, no residual effects on human health due to drinking water quality, air quality, country foods quality, or noise were identified though predictive, quantitative assessments. Based on the quantitative modelling conducted to support the environmental assessment, effects on human health due to potential Project-related changes on water quality, air quality, country foods quality, or noise are not predicted. Given that no Project-related residual effects were identified, no significance determination was conducted and no residual effects on human health were carried forward to the cumulative effects assessment.

Heritage Effects

Setting

The heritage effects assessment considered three components: protected archaeological sites; protected paleontological sites; and protected historical sites.

There are 86 known archaeological sites within the RSA. Of these, 72 are prehistoric sites, 12 are historic sites, and two contain both prehistoric and historic features. The prehistoric archaeological sites show a range of past activities. Most of these sites have low artifact density and few features and are related to use of the landscape for activities such as hunting and resource gathering.

Lithic scatters (scatters of stone tools and stone waste chips) are the most common archaeological site types found in the RSA, with 67 sites containing lithic material. These sites range in size from isolated lithic finds to sites containing over 500 artifacts. At 25 of the lithic sites formed tools or expedient tools (e.g., retouched flakes) were identified, while at the rest only debitage was located. Materials typically used for making stone tools in the region are chert, obsidian, quartzite, chalcedony, and basalt. One of these lithic sites was located beneath a rock-shelter, which could have been used as a campsite or as protection from the elements. Two of the lithic scatter sites were found in association with trails.

There are no protected built heritage sites and no legally protected paleontological sites within the RSA.

Assessment

Potential effects on archaeology and heritage resources can occur where there is disturbance to the ground or trees at or near the resource, or where a project results in increased human presence around the resource. The most significant potential direct effect to archaeology and heritage resources is direct disturbance during Construction. Project activities associated with the movement, excavation, or disturbance of soil have the highest potential for interactions between the Project and archaeological sites. Another potential direct effect to archaeology and heritage resources is

subsidence occurring above the underground longwall mining areas. Subsidence will occur primarily during Operation. The effect of subsidence to archaeology and heritage resources depends on whether any resources are situated above the areas targeted for underground longwall mining.

There are two known archaeological sites within the LSA, and an additional seven within 500 m of the LSA. Both sites within the LSA are located within the underground mine exclusion zone, therefore the potential for adverse effects have been reduced through Project design. Additional mitigation measures for these two sites and the seven within 500 m of the LSA have been created to ensure avoidance and reduce the potential adverse effects to negligible levels. There are currently no known paleontological sites within the LSA.

Potential effects to as-yet unknown archaeological and paleontological sites, if present, will be mitigated through the measures outlined in the Archaeological Resources Plan (Chapter 24.15) including the education of Project personnel and the use of the heritage chance find procedure. Once mitigation and management measures have been conducted and/or established prior to anticipated Project effects, the residual effects on heritage resources will be reduced to negligible and not significant, and therefore, there will be no cumulative heritage effects.

Potential Effects to Aboriginal and Treaty Rights and Related Interests

Setting

The Project lies within Treaty 8. Treaty 8 was signed in 1899, with modifications on several occasions that eventually added WMFN and SFN in 1914 and MLIB in 2000. Treaty 8 promises its signatories the right to "pursue their usual vocations of hunting, trapping, and fishing throughout the tract surrendered heretofore described, subject to such regulations as may from time to time be made by the Government of the country, acting under the authority of Her Majesty, and saving and excepting such tracts as may be required or taken up from time to time for settlement, mining, lumbering, trading, or other purposes."

The Aboriginal groups included in the assessment of potential effects to Treaty rights and related interests are:

- West Moberly First Nations (WMFN);
- Saulteau First Nations (SFN);
- McLeod Lake Indian Band (MLIB);
- Blueberry River First Nations (BRFN);
- Horse Lake First Nation (HLFN);
- Doig River First Nation (DRFN);
- Fort Nelson First Nation (FNFN);
- Halfway River First Nation (HRFN);
- Prophet River First Nation (PRFN);
- Sucker Creek First Nation (SCFN);

- Kelly Lake Métis Settlement Society (KLMSS); and
- Métis Nation British Columbia (MNBC).

Effects

Effects to Aboriginal and Treaty rights were defined as Project-related limitations on the ability of Aboriginal groups to practice Aboriginal and Treaty rights. For each Aboriginal group, the consultation record and publically available materials were drawn on to develop an understanding of each Aboriginal group's Aboriginal and Treaty rights, identify potential effects, and develop measurable parameters. Effects were assessed by examining the potential of Project-related residual environmental effects to affect measurable parameters for each Aboriginal group. In accordance with the wishes of Aboriginal groups, the assessment did not characterize and evaluate potential effects in detail (including assessment of significance), but identified areas of potential infringement to inform Crown-Aboriginal group consultation and accommodation processes.

The Project is not expected to create adverse effects to Aboriginal and Treaty rights and related interests for DRFN, FNFN, HRFN, PRFN, SCFN, or MNBC.

The Project may affect Aboriginal and Treaty hunting rights with respect to the quantity of populations of game (WMFN, SFN, MLIB, BRFN, HLFN), experience of the environment while hunting and trapping (WMFN, SFN, MLIB, BRFN, HLFN), and perceived quality of harvested resources (WMFN, SFN, KLMSS).

The Project may affect SFN's fishing rights due to reduced quality of fishing experience associated with Project-related noise and visual changes and reduced perceived quality of fishing resources.

The success of SFN's gathering activities in the LSA may be affected due to loss and alteration of harvestable plants in the LSA. SFN members may perceive reduced quality of resources gathered in the LSA, despite a prediction of no residual effects on country foods.

SFN cultural, spiritual and ceremonial resources could be adversely affected by Project activities during Construction and Operation. Depending on their locations, a SFN sacred site, medicinal plant gathering area, and general trapping area may be adversely affected during site clearing and/or SFN access to the sites may be restricted during the life of the Project. The Project may adversely affect SFN cultural continuity related to teaching of children, due to sensory disturbance.

If SFN habitations (a previous cabin and a camping site) overlap with the Project footprint, the habitations could potentially be adversely affected due to site clearing activities during Construction. SFN members access to these sites will be restricted.

HD Mining will address potential effects by:

- working with Aboriginal groups to facilitate their participation in ongoing monitoring, during pre-mine, during Construction and Operations, and during post-mine periods;
- working to maintain Aboriginal groups' continuity of use via ongoing monitoring to prevent the creation of "avoidance areas" for Aboriginal peoples;

- engaging in ongoing communication with Aboriginal groups, including translation of technical reports for Aboriginal membership;
- working with SFN prior to Construction to identify land use sites utilized by SFN members for cultural, spiritual, and ceremonial uses, and sites that may provide visual contact with the Project. Should such site be determined, the Proponent will work with SFN to develop appropriate accommodation measures; and
- working with SFN prior to Construction to identify the locations of the previous cabin and campsite. The Proponent will work with SFN to develop appropriate avoidance and/or other accommodation measures.

Effects of Potential Accidents or Malfunctions

Potential accidents/malfunctions assessed in the Application/EIS include:

- accidental discharge of off-specification effluent;
- failure of the coarse coal reject (CCR) pile;
- failure of the underground mine stability;
- failure of water diversion channels;
- fires or explosions on the surface;
- fires or explosions underground;
- fuel spills;
- hazardous material spills;
- unintended leakages from containment ponds;
- motor vehicle accidents;
- power outages;
- sediment releases in watercourses; and
- natural gas pipeline failure.

The results of this analysis are presented in Chapter 22 of the Application/EIS, and are summarized in Table 4. With the application of appropriate mitigation measures, risk associated with the various scenarios was rated as moderate or lower.

Effects of the Environment on the Project

Potential effects of the environment assessed in the Application include:

- extreme weather events (lightning, heavy precipitation, extreme temperatures, flooding, drought and wind);
- natural seismic events and associated effects such as liquefaction or subsidence;
- fire; and
- slope stability and mass wasting events (e.g., debris flows/torrents. rock fall, snow avalanche).

Table 4. Summary of Risks for Accidents and Malfunctions Scenarios

Scenario	Effects	Severity	Likelihood	Risk	Confidence
1. Effluent from treatment plants	Minor, reversible effects to surface water and aquatic resources, fish and fish habitat, wildlife and wildlife habitat, social, and human health VCs	Low	High	Moderate	High
2. Failure of CCR pile	Moderate, reversible effects to surface water, aquatic resources, and fish after clean-up efforts	Moderate	Moderate	Moderate	High
3. Failure of underground mine stability	No moderate effects to Project VCs	-	-	-	-
4. Failure of water diversion channels	Moderate, reversible effects to surface water and aquatic resources and terrain VCs	Moderate	Not Likely	Low	Medium
5. Fires or explosions – surface	Moderate or greater, significant effects to atmospherics, fish and fish habitat, terrain, terrestrial ecology, wetlands, wildlife, economics, social, heritage, and human health VCs from forest fires	Extreme	Not Likely	Moderate	Low
6. Fires or explosions - underground	No moderate effects to Project VCs	-	-	-	-
7a. Fuel spill (into water)	Moderate, reversible effects to surface water and fish	Moderate	Not Likely	Low	Medium
7b. Fuel spill (onto land)	Moderate, reversible effects to wetlands and groundwater	Moderate	Low	Moderate - Low	High
8a. Hazardous material spill (into water)	Moderate, reversible effects to surface water and fish	Moderate	Not Likely	Low	Medium
8b. Hazardous material spill (onto land)	Moderate, reversible effects to wetlands and groundwater	Moderate	Low	Moderate - Low	High
9. Leakage from containment ponds	Moderate, reversible effects surface water and fish	Moderate	Not Likely	Low	High
10. Motor vehicle accidents	Moderate, significant effect due to serious injury or fatality	Extreme	Not Likely	Moderate	High
11. Power outage	No moderate effects to Project VCs	-	-	-	-
12. Sediment release	Moderate, effects to surface water, fish, and terrain stability	Moderate	Not Likely	Low	Medium

(continued)

Table 4. Summary of Risks for Accidents and Malfunctions Scenarios (completed)

Scenario	Effects	Severity	Likelihood	Risk	Confidence
13a. Pipeline failure – explosion	Moderate or greater, significant effects to atmospherics, fish and fish habitat, terrain, terrestrial ecology, wetlands, wildlife, economics, social, heritage, and human health VCs from forest fires	Extreme	Not Likely	Moderate	Low
13b. Pipeline failure – no explosion	No moderate effects to Project VCs	-	-	-	-

The results of this analysis are presented in Chapter 23 of the Application/EIS.

The Project is located in an area that currently experiences a wide range of weather/climatic conditions. In particular, winters can be fairly harsh, making working conditions difficult. However, this is common to the region, and the Project has been designed with these parameters in mind. Climate change predictions suggest a trend toward warmer temperatures, increased rain (vs. snow), higher low flow conditions in streams/creeks, and dampened freshet flood conditions as a result of smaller snowpack and earlier melt. These changes are generally expected to be positive for the Project.

The likelihood of earthquake or substantial slope stability or mass wasting events influencing the Project is considered to be very low. The region is subject to forest fire risk, which has the potential to influence the Project. Mitigation measures to reduce the chance of infrastructure loss and/or damage due to wildfires will include: establishing setbacks; maintaining adequate water supply and firefighting supplies on site; and staff training on fire response.

MITIGATION MEASURES

Tables 5 to 9 summarize the results of the effects assessments identifying the residual effects, mitigation measures, and significance determination for both Project-specific and cumulative effects. The mitigation measures outlined in the tables will be implemented and monitored through an Environmental Management System (EMS), which is described in Chapter 24 of the Application/EIS. Management plans outlined within the system include:

- Air Quality and Dust Control;
- Noise;
- Site Preparation and Soil Salvage;
- Erosion and Sediment Control;
- Water Management;
- Metal Leaching and Acid Rock Drainage;
- Flocculent;
- Explosives and Nitrogen;

- Selenium;
- Invasive Plants;
- Wildlife;
- Waste Management;
- Archaeological Resources;
- Subsidence;
- Recruitment, Training and Employment;
- Site Access;
- Spill Response; and
- Emergency Response.

Table 5. Summary of Residual Effects, Mitigation, and Significance for Environmental VCs

Residual Effects	Project Phase	Mitigation Measures	Significance	
			Project	Cumulative
Air Quality (Chapter 6)				
Increase in TSP, PM_{10}, $PM_{2.5}$	Operation	Emission reduction measures Fugitive dust reduction measures	Not Significant (moderate)	Not Significant (moderate)
Dust deposition	All phases	Emission reduction measures Fugitive dust reduction measures	Not Significant (minor)	Not Significant (minor)
Increase in greenhouse gas emissions (GHGs)	All phases	Emission reduction measures and methane liberation reduction measures	Not Significant (minor)	Not Applicable
Groundwater (Chapter 7)				
Groundwater Quantity: change in water levels, gradients and flow direction related to the underground mine	Operation, Post-closure	Groundwater flow into the mine will be collected and managed	Not Significant (moderate)	Not Residual
Groundwater Quantity: change in water levels, gradients and flow direction related to surface subsidence	Operation, Post-closure	Subsidence Management Plan	Not Significant (moderate)	Not Residual
Groundwater Quantity: change in water levels, gradients and flow direction related to the CCR piles	Operation, Post-closure	Liners under the Coarse Coal Rejects (CCR) piles, seepage collection drain systems, closure covers at Post-closure	Not Significant (minor)	Not Residual
Groundwater Quality: change groundwater quality related to seepage from the CCR piles	Operation, Post-closure	Liners under the CCR Piles, seepage collection drain systems, closure covers at Post-closure	Not Significant (minor)	Not Residual

(continued)

Table 5. Summary of Residual Effects, Mitigation, and Significance for Environmental VCs (continued)

Residual Effects	Project Phase	Mitigation Measures	Significance	
			Project	Cumulative
Surface Water and Aquatic Resources (Chapter 8)				
Change in surface water quantity in M20, M17B, and M19A creeks	All phases	Water Management Plan	Not Significant (minor)	Not Residual
Change in surface water quality (elevated Se concentrations) in M19A Creek	Decommissioning and Reclamation, Post-closure	Erosion and Sediment Control Management Plan; Water Management Plan; ML/ARD Management Plan; Selenium Management Plan	Not Significant (minor)	Not Residual
Change to aquatic resources from surface water quality (elevated Se concentrations) in M19A Creek	Decommissioning and Reclamation, Post-closure	Erosion and Sediment Control Management Plan; Water Management Plan; ML/ARD Management Plan; Selenium Management Plan	Not Significant (minor)	Not Residual
Fish and Fish Habitat (Chapter 9)				
No residual effects identified		Water Management Plan; Erosion and Sediment Control Plan; ML/ARD Management Plan; Selenium Management Plan	-	-
Terrain Stability (Chapter 10)				
Increased risk of geohazards (mass movement of surficial materials, active fluvial processes, or soil erosion) resulting from subsidence.	All phases	Monitoring of subsidence will allow for identification of new areas of instability and the appropriate management response	Not Significant (moderate)	Not Significant (moderate)
Terrestrial Ecology (Chapter 11)				
Loss and alteration of ecologically valuable soil	All phases	Minimize loss of soil quality and quantity by adhering to the Site Preparation and Soil Salvage Plan	Not significant (moderate)	Not Significant (moderate)
Loss and alteration of forested ecosystems	All phases	Minimize loss and adaptively manage effects through an ecosystem-based approach	Not significant (moderate)	Significant (major)
Loss and alteration of rare ecosystems	Construction, Operation	Minimize loss and adaptively manage effects through an ecosystem-based approach	Not significant (moderate)	Significant (major)
Loss and alteration of harvestable plants	Construction, Operation	Minimize clearing; dust abatement; invasive plant control	Not significant (minor)	Not significant (moderate)

(continued)

Table 5. Summary of Residual Effects, Mitigation, and Significance for Environmental VCs (completed)

Residual Effects	Project Phase	Mitigation Measures	Significance	
			Project	Cumulative
Terrestrial Ecology (Chapter 11; *cont'd*)				
Loss and alteration of rare plants and lichens and associated habitat	Construction, Operation	Minimize clearing; dust abatement; invasive plant control	Not significant (moderate)	Significant (major)
Wetlands (Chapter 12)				
Loss of extent	Construction, Operation	None	Not significant (moderate)	Not significant (moderate)
Alteration of function	Operation to Post-closure	Air Quality and Dust Control Plan, Access Management Plan, Erosion and Sediment Control Plan, Selenium Management Plan, Aquatic Effects Monitoring Plan, Spill Response Plan, and Invasive Plant Management Plan	Not Significant (moderate)	Not Significant (moderate)
Wildlife and Wildlife Habitat (Chapter 13)				
Moose: Habitat Loss and Alteration	Construction, Operation	Reducing footprint to smallest possible size, speed limits, avoiding salt licks, limiting noise disturbance	Not Significant (minor)	Not Significant (minor)
Moose: Disruption of Movement	Construction, Operation	Reducing footprint to smallest possible size, speed limits, avoiding salt licks, limiting noise disturbance	Not Significant (minor)	Not Significant (minor)
Grizzly Bear: Disruption of Movement	Construction, Operation	Reducing footprint to smallest possible size, speed limits, avoiding salt licks, limiting noise disturbance	Not Significant (minor)	Not Significant (moderate)
Fisher: Habitat Loss and Alteration	Construction, Operation	Reducing footprint to smallest possible size, speed limits, avoiding salt licks, limiting noise disturbance	Not Significant (minor)	Not Residual
Fisher: Disruption of Movement	Construction, Operation	Reducing footprint to smallest possible size, speed limits, avoiding salt licks, limiting noise disturbance	Not Significant (minor)	Not Residual

As part of the bulk sample program, HD Mining has begun implementation of their EMS. These plans will continue to be adjusted and augmented over time to support additional permitting requirements and new Project phases/activities, and to incorporate learnings from continual improvement.

Table 6. Summary of Residual Effects, Mitigation, and Significance for Economic VCs

Residual Effects	Project Phase	Mitigation Measures	Significance	
			Project	Cumulative
Employment and Income (Chapter 14)				
Decrease in Employment and Income at Decommissioning and Reclamation	Decommissioning and Reclamation	Recruitment, Training and Employment Plan, Procurement Strategy, and Workforce Transition Plan	Not Significant (moderate)	Not Residual
Economic Activity (Chapter 14)				
Increased Competition for Labour and Wage Inflation	Construction, Operation	Recruitment, Training and Employment Plan and Procurement Strategy	Not Significant (moderate)	Not Significant (moderate)

Table 7. Summary of Residual Effects, Mitigation, and Significance for Social and Land Use VCs

Residual Effects	Project Phase	Mitigation Measures	Significance	
			Project	Cumulative
Families (Chapter 15)				
LSA community members may have reduced access to child care services	Construction, Operation	HD Mining will share information about its projected workforce needs with elected officials and childcare service providers	Not Significant (minor)	Not Significant (minor)
Children in child care facilities may experience decreased quality of child care services	Construction, Operation	HD Mining will share information about its projected workforce needs with elected officials and childcare service providers	Not Significant (minor)	Not Significant (minor)
Harvesting (Chapter 16)				
Change in harvest locations for guide outfitters licences 701254 and 701258 and trappers TR0721T003 and TR0721T005	Construction, Operation	Wildlife Management Plan, Noise Management Plan, Subsidence Management Plan	Not significant (minor)	Not significant (minor)
Industrial Land Use (Chapter 16)				
Economic impact on overlapping tenure holders	Operation, Decommissioning and Reclamation	Longwall exclusion zone, regular communication with overlapping tenure holders, Subsidence Management Plan	Not significant (minor)	Not Residual
Current Use of Lands and Resources for Traditional Purposes (Chapter 17)				
Reduced quality of experience while fishing (SFN and HLFN), hunting (SFN, WMFN, and KLMSS), gathering (SFN), and while using habitations, trails, and cultural and spiritual sites (SFN)	Construction, Operation, Decommissioning and Reclamation	Noise Management Plan; Provision of information about expected noise characteristics and timing to Aboriginal groups; Commitment to undertake a visual impact assessment ("visual simulation"), develop visual quality objectives with Aboriginal groups, and engage in monitoring	Not significant (minor)	Not significant (moderate)

(continued)

Table 7. Summary of Residual Effects, Mitigation, and Significance for Social and Land Use VCs (completed)

Residual Effects	Project Phase	Mitigation Measures	Significance	
			Project	Cumulative
Reduced harvesting success in preferred areas for moose (MLIB, WMFN, BRFN, HLFN, SFN and KLMSS), grizzly bear (SFN and KLMSS) and fisher (SFN and KLMSS), and blueberries, firewood, and medicinal plants (SFN)	Construction, Operation, Decommissioning and Reclamation	Wildlife Mitigation and Monitoring Plan, Noise Management Plan, Subsidence Management Plan; Provision of information regarding expected effects to harvestable resources in the vicinity of the Project to Aboriginal groups	Not significant (moderate)	Not significant (moderate)
Perceived reduction in quality of resources harvested in the LSA, including fish (SFN and HLFN), wildlife (SFN, WMFN and KLMSS), and plants and berries (SFN)	Construction, Operation, Decommissioning and Reclamation	Regular communication and sharing of information, including results of the proposed environmental monitoring programs; Inclusion of Aboriginal groups in ongoing monitoring programs	Not significant (moderate)	Not significant (moderate)

Table 8. Summary of Residual Effects, Mitigation, and Significance for Health VCs

Residual Effects	Project Phase	Mitigation Measures	Significance	
			Project	Cumulative
Health (Chapter 18)				
No residual effects identified		Air Quality and Dust Control; Noise Management Plan; Water Management Plan; Selenium Management Plan	-	-

Table 9. Summary of Residual Effects, Mitigation, and Significance for Heritage VCs

Residual Effects	Project Phase	Mitigation Measures	Significance	
			Project	Cumulative
Heritage Resources (Chapter 19)				
No residual effects identified		Archaeological Resources Plan; Chance Find Procedure	-	-

PROPOSED SIGNIFICANCE DETERMINATION

The effects assessment was a process that reduced a detailed list of potential interactions between Project components and VCs into a list of 146 potential effects, and then, after mitigation, to a focused list of 32 residual effects. Of the residual effects, 14 were assessed to be not significant (moderate), and 18 were assessed to be not significant (minor). No Project-specific significant adverse effects were identified (see Tables 5 to 9).

The 32 residual effects were also evaluated for potential cumulative effects. Through the cumulative effects assessment, three significant residual cumulative effects were identified related to forested ecosystems, rare ecosystems, and rare plants. This conclusion is reflective of the high level of past/ present activity in the region, and is consistent with findings of other assessments completed regionally.

SUMMARY AND PATH FORWARD

This document represents the Application for an Environmental Assessment Certificate / Environmental Impact Statement (Application/EIS) for the Murray River Coal Project and is intended to satisfy provincial and federal requirements under the BC EAA (2002) and CEAA, 2012 (2012).

In this Application/EIS, HD Mining has reported the findings of the assessment with respect to the potential effects of the Project on the baseline environmental, economic, social, heritage, and health setting. The effects assessment reflects the feedback provided during the pre-Application/pre-EIS stage of the environmental assessment process by Aboriginal groups, provincial and federal government agencies, and the public. In conducting the assessments, HD Mining has been supported by technical specialists who have applied rigorous analytical procedures and expert professional judgement to the assessment analysis.

The Project will provide substantial and long-lasting economic benefits to local communities, BC, and Canada. As a result of careful Project facilities siting, and HD Mining's mitigation measures, commitments, and management framework, the Project is expected to create no Project-specific significant adverse environmental effects. HD Mining believes that the approval of this Application/ EIS for the Project should receive due consideration from the regulatory agencies.

Review and approval of the Application/EIS is one key milestone for the Project on the way to Construction and Operation. Moving forward, HD Mining will engage the Mine Review Committee (MRC) in the coordinated authorizations process to apply for the multiple project-specific provincial authorizations required to progress the Project, including authorizations under the *Mines Act* (1996), the *Environmental Management Act* (2003), and the *Water Act* (2006). HD Mining anticipates that some permit applications will be submitted during the Application/EIS review period, and that where appropriate, the MRC will work to conduct review of the permits in parallel with the Application/EIS review. Through consultation with the MRC, permit applications will be developed in phases, with specific applications for permits, licences, and other authorizations being effectively bundled together to allow for a coordinated review by the various natural resource agencies involved.

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