ENVIRONMENTAL IMPACT ASSESSMENT FOR THE DIRECT TRANSFER COAL FACILITY

Submitted to:

Port Metro Vancouver

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EXECUTIVE SUMMARY

Background

Fraser Surrey Docks (FSD), located on the Fraser River in Surrey, BC, is the largest multi-purpose marine terminal on the west coast of North America. FSD has been operating in the same community since 1962. It handles containers, forest products, steel, bulk agricultural products and other items.

FSD is proposing to construct a Direct Transfer Coal Facility (DTC or the Project) on the existing terminal site to facilitate the transhipment of coal at a time of infrastructure constraint on the west coast of North America.

FSD's existing business has decreased significantly since 2009 and management is looking for opportunities to serve new customers. As a result, FSD is proposing to construct the Project, allowing it to potentially add 25 new high paying jobs directly at FSD to the community; an additional 25 full-time Project-related jobs at FSD's partner companies; and allow FSD to maintain its existing workforce of 230 full time employees. FSD directly contributes to the 4,000 jobs currently in Surrey that relate to port activity on the Fraser River.

In June 2012 FSD submitted a Project Application to Port Metro Vancouver (PMV) seeking approval of the proposed Project. As part of the Project review process, FSD has undertaken a range of studies to evaluate the potential environmental effects of the Project. These studies have been planned in consultation with PMV, and in response to feedback received from the general public, First Nations, local municipalities and other stakeholders through the public engagement activities conducted by both PMV and FSD. The consultation materials provided in Appendix VII have been made publically available via the FSD and PMV websites.

This Environmental Impact Assessment (EIA) assembles and integrates the Project studies and information that have been made available to date and includes updates where appropriate. It also contains new Project analysis undertaken by SNC-Lavalin, Levelton Consultants Ltd., Triton Consultants Ltd., Soleil Environmental Consulting Ltd. and Dr. Leonard Ritter (Professor Emeritus of Toxicology in the School of Environmental Sciences at the University of Guelph), and outlines additional mitigation measures that have been designed in response to input from PMV and local stakeholders including First Nations, government agencies (such as Fraser Health Authority, Vancouver Coastal Health Authority, Metro Vancouver), municipalities, the general public and others.

The scope of the Project includes:

- The development of a coal handling facility at FSD, including new rail within the Port Authority Rail Yard (PARY);

- The transfer of coal from rail onto barge; and
- The barge transport of coal from the Project site to Texada Island.

The scope of the Project does not include:

- Physical works and activities undertaken during or preceding the loading of coal onto rail cars;
- The transport of coal from the mine site to PARY/FSD; and
- The transport of coal during and after the coal is unloaded at Texada Island.

FSD is aware that climate change is a concern of the general public and the burning of coal is a greenhouse gas contributor. As the main function of the Project is to handle the transfer of unburned coal from rail to barge, the EIA does not include the assessment of the ultimate use of coal, nor does it include the mining of the coal. For this reason, the effects *of and on* climate change have been excluded from the scope of this assessment.

Construction

The DTC includes construction and installation works on the current FSD lease area and the adjacent PARY licence area. The primary construction components are:

i. Realignment of existing rail track in the FSD and PARY areas;

ii. Installation of new rail track in the FSD and PARY areas;

iii. Installation of a coal rail car unloading facility, including receiving pits, enclosures and conveyor systems;

iv. Installation of a covered conveyor system for coal transport;

v. installation of a covered barge loading conveyor and barge winching system;

vi. Installation of a dust suppression system throughout the conveyor system and unloading facility, including equipment for treatment and disposal of any wastewater generated; and

vii. Installation of necessary utility connections.

Operations

The Project operations will consist broadly of:

i. Receiving and unloading coal trains at FSD

    a. In year 1 of Project operations, FSD is expected to receive approximately 160 coal trains, or approximately one train every two days;

b. In years 2 to 5 of Project operations, FSD is expected to receive approximately 320 coal trains, or approximately one train each day;

ii. Conveying the coal cargo from the train unloading pits to waiting barges via the new Project infrastructure;

iii. Transporting the coal from the Project site to Texada Island via barges:

a. In year 1 of Project operations, approximately 320 loaded barge movements are expected, or approximately two loaded movements every two days; and

b. In years 2 to 5 of Project operations, approximately 640 loaded barge movements are expected, or approximately two loaded movements each day.

Enhanced Risk Mitigation Measures

FSD's original Project permit application included a set of mitigation measures for each Project activity. In the course of Project planning over the past year, FSD has responded to comments and direction from PMV as well as comments received through the consultation process. Design changes and mitigation measures have been implemented to effect a more robust management of potential environmental issues. Since the last round of public consultation, which concluded in June 2013, the following three primary design modifications and mitigation measures have been added:

Elimination of coal stockpile: Earlier Project plans included the presence of an emergency coal stockpile on the Project site. This has been eliminated.

Dust suppression on rail cars: Re-application of dust suppression agents on the coal rail cars will be undertaken approximately halfway between the mine and the Project site. The re-application of dust suppression agents on the coal rail cars will be undertaken by Burlington Northern Santa Fe Railway Company (BNSF).

Dust suppression for barged coal: Further dust suppression agents will be added to the coal surface immediately prior to barge transfer (as it enters the surge bin). This application is expected to maintain effective dust control for the entire barge movement.

Regulatory Context

FSD is located mainly on federal land under the jurisdiction of the Vancouver Fraser Port Authority (VFPA), doing business as Port Metro Vancouver. The direct transfer of coal from rail to barge and the movement of coal-laden barges down the Fraser River from FSD to the mouth of the river is within federal PMV jurisdiction.

PMV has a requirement to perform a duty or function conferred on it under an Act of Parliament (the Canada Marine Act, and the Port Authorities Operations Regulations under it) to permit the Project to be carried out.

Environmental Assessment

PMV is conducting an environmental review of the proposed Project in order to identify potential adverse environmental effects of the Project, and to assess the significance of such effects prior to making a decision as to whether or not the proposed Project can proceed. The proposed Project is *not* a designated project listed in the "Regulations Designating Physical Activities" as promulgated under the *Canadian Environmental Assessment Act*, 2012 (CEAA 2012) and therefore an environmental assessment under the Act is not required. However, as the authority to grant project approval on federal land is designated to PMV, being a Federal Authority as defined by CEAA 2012, PMV is required to undertake a determination that in carrying out the Project there are no significant adverse environmental effects, as per section 67 of CEAA 2012.

In conducting its environmental review, PMV considers many factors, including the following:

- The environmental effects of the Project and their significance;
- Malfunctions or accidents, including spill prevention and spill response that may occur in connection with the proposed Project;
- Any cumulative environmental effects that are likely to result from the proposed Project in combination with other projects or activities that have been or will be carried out;
- Comments from the public that are received as part of the assessment process,
- Comments from First Nations that are received as part of Consultation for the Project; and
- Technically and economically feasible measures that would mitigate any significant adverse environmental effects of the proposed Project.

In the course of conducting the environmental review, PMV identified that an EIA was required in order to inform the review prior to making any decision regarding the proposed Project. As discussed above, this EIA is not a requirement of CEAA 2012 or the British Columbia *Environmental Assessment Act* (BCEAA); however, the EIA required by PMV includes elements of a CEAA and BCEAA-style EIA consistent with best practices when conducting an environmental assessment of a project.

Other Acts

Fisheries and Oceans Canada (DFO) does not have a legislated requirement to conduct an environmental review of the proposed Project and as such does not have a regulatory decision making role. The proposed Project was referred to DFO for their review under the *Fisheries Act*. DFO determined that a *Fisheries Act* Authorization will not be required.

Transport Canada does not have a legislated trigger or requirement to conduct an environmental review of the proposed Project. Transport Canada administers a number of Acts (laws) related to transportation. Two Acts specific to this proposed Project include the *Railway Safety Act* and the *Canada Transportation Act*.

While the provincial health authorities do not have a regulatory decision making role, the Fraser Health Authority and the Vancouver Coastal Health Authority have expressed their interest in the potential human health effects as a result of the Project.

Local governments do not have any legislated triggers or requirements to conduct an environmental review of the Project. FSD and PMV have been consulting with local municipalities regarding the Project since October 2012 and feedback received has been and will continue to be considered by PMV in the Project review process. FSD is currently working with Metro Vancouver to obtain an Air Emissions Permit for the Project, although the permit is not a requirement for the construction or operation of the facility.

Consultation

FSD and PMV have engaged in consultation with First Nations, federal and provincial agencies, municipalities, local residents, businesses and other stakeholders since September 2012. The feedback received as part of the consultation process has centred on six key issues:

- Dust/Air Quality;
- Noise;
- Marine Traffic Safety;
- Impact on Vehicle Traffic;
- Emergency Response; and
- Marine Environment (habitat and fishing access).

Each of these areas of concern is addressed in this EIA.

The following agencies have reviewed an initial draft of the EIA, and will have additional opportunity to provide additional comment during the public comment period:

- BC Ministry of Environment;
- Ministry of Forests, Lands and Natural Resource Operations;
- Fraser Valley Health Authority;
- Vancouver Coastal Health Authority;
- Health Canada;
- Environment Canada;
- Fisheries and Oceans Canada; and
- Transport Canada.

EIA Methodology

The methodology for this EIA has been adapted from guidance to environmental assessment under CEAA and BCEAA. The environmental effects methodology for the Project followed these general steps:

i. Description of the Project activities;

ii. Establishment of assessment boundaries;

iii. Identification and description of the existing environment within the assessment boundaries;

iv. Identification and description of interactions between Project Activities (construction and operation) and environment/social values;

v. Description of the mitigation measure(s);

vi. Identification of any residual environmental effects after the application of mitigation measures; and

vii. Determination of the significance of residual effects and likelihood of occurrence.

Environmental Context

The Project is situated in an urban area between the Fraser River and River Road/South Fraser Way on the border of Surrey and North Delta. The Project will be constructed on the FSD lease land and PARY, which is entirely on federal land. The current land use on the Project site is industrial, and has been in operation as a port facility since the early 1930's.

FSD has been in operation at the site for more than 50 years and it is surrounded by many similar businesses in this area of the Fraser River that are part of the overall road, rail, and shipping infrastructure that serve this region. Proposed rail and barge transportation associated with the Project occur in well-established commercial corridors. The Project is surrounded by other commercial and industrial land uses and local residential Surrey and Delta neighbourhoods.

The assessment reflects work undertaken over the course of 2012 and 2013. FSD has also consulted with multiple municipal, provincial and federal agencies, First Nations, local residents, community groups and other stakeholders to seek feedback on various issues of environmental and social concern.

Air Quality

The effects of coal dust and fugitive dust emissions are identified as potential environmental health concerns during the construction and daily operations of the Project. Other sources of air emissions include operation of marine vessels, non-road engines, diesel fuel combustion, heavy- and light-duty vehicles, industrial facilities, and front end loaders.

Air quality assessment work has been underway since 2012, primarily through review of other air quality assessment work such as trackside monitoring studies in the Lower Fraser Valley and ambient air quality studies near existing port and coal handling facilities and throughout the Fraser Valley. The work has also included an evaluation of dust suppression methods.

A range of mitigation measures have been introduced to address potential Project effects on air quality. During construction, mitigation measures will include:

- Utilize a comprehensive water-based dust suppression system;
- Grade the construction site in phases, timed to coincide with the actual construction in that area;
- Minimize of the amount of clearing required to conduct the works;
- Minimize the generation of road dust (e.g. minimize the time that unpaved surfaces are exposed and use watering and/or sweeping);
- Use wind fencing in construction areas that are frequently subjected to high winds;
- Prohibit burning as a means of disposal of any organic or construction materials;
- Implement on site vehicle restrictions (e.g. limit the speed of vehicles travelling on unpaved access / haul roads);
- Cover vehicles when transporting bulk fine materials to the Project area; and

- Clean paved areas on a routine basis to prevent accumulation and mobilization of dust.

During operations, industry best practices will be observed and supplemented by additional measures introduced to minimize fugitive coal dust. To minimize fugitive coal dust at FSD, water (with dust suppression chemicals) will be delivered to the coal handling area through a combination of misting sprays, large nozzle sprays, large volume sprays, and/or agricultural sprinkler piping. FSD will use recycled coal drainage wastewater augmented by clean freshwater (supplied by the City of Surrey) for dust suppression. In addition, dust control measure for the rail cars will be applied by BNSF and the mine site operators. These will include:

- Applying a 'body agent' at the mine site to help bind coal particles to reduce dust losses;
- A secondary 'body agent' as required to reduce coal oxidation;
- Profiling the coal when loaded into 'bread loaf shape' to prevent wind erosion;
- Addition of 'topping agent' when coal is loaded into the railcar at the mine site to act as a sealant to prevent dust losses;
- Reapplication of 'topping agent' approximately at midpoint of the rail movement from the mine site to FSD to address concerns regarding potential degradation of the topping agent during transit; and
- Spraying empty railcars (with recycled water) at the FSD terminal after unloading to ensure coal remnants are removed to prevent dusting during return trips to the mine site.

To prevent fugitive dusting during barge transit and barge loading, dust control will consist of:

- Avoiding operation of barges in wind conditions greater than 40 kilometres per hour (km/h);
- Adding water (with dust suppression chemicals) as necessary to loaded barges at the FSD berth face;
- Coating of coal with binding agent and surfactant during the barge loading process; and
- Profiling coal when loading onto the barge to reduce wind erosion and turbulence.

With the application of these mitigation measures, particulate matter emissions from fugitive dust sources are localized around the facility and predicted air quality impacts are low. With the mitigation planned for the facility the fugitive dust sources are predicted to have low impact on air quality in the area. There are predicted exceedences noted for the 24-hour averaged PM_{10} and annual NO_2 when combining the impacts from the proposed Project, current agricultural goods operations and ambient background concentrations. The predicted 24-hour averaged PM_{10} exceedences are located on the facility fenceline inland, while the predicted annual NO_2 exceedences are receptors located over the Fraser River. While the modelling results are likely to be conservative by nature, monitoring after facility commissioning is recommended to validate that air quality exceedences will not occur.

Construction and operational activities are likely to result in localised air quality impacts. Construction related impacts are expected to be short-term, temporary, and can include fugitive dust and combustion emission from vehicles, which are typical of construction. Air quality impacts from traveling barges along the Fraser River were considered to be low to negligible. No significant adverse effects on air quality are likely to occur as a result of this project.

Soil

The Project area is human-dominated and currently developed for industrial and urban use and little to no natural cover exists. Given the existing soil conditions of the property, the effects on soil are considered to be negligible to low; however, there is the potential to encounter contaminated soil during the construction of the Project.

Potential effects on soil during the construction and operation of the proposed Project may include:

- Contamination of soil due to an accidental spill of hazardous material such as fuel, oil or lubricant during construction or operation;
- Erosion of soil stockpiles during as a result of improper installation of sediment and erosion controls; and
- Contamination of soil from an accidental spill of untreated wastewater during operation.

FSD has developed a Soil Management Plan to mitigate for any potential effect of the Project during construction and operation. The plan will include measures for removal of non native fill and focus on appropriate storage of suspect and non-suspect soils and on characterizing excavation spoil destined for off site disposal.

Given current land uses and the limited amount of natural cover, in addition to the mitigation measures identified above, effects on soil and sediment quality due to Project construction and operation are not anticipated.

Water Resources

The Project is located within the Lower Fraser Watershed extending from Hope, BC to the mouth of the river which is approximately 34 kilometres (km) from FSD. Watercourses in the vicinity of the Project are minor tributary streams draining into the Fraser River (including Gunderson Slough). The streams at their lower reach have been highly modified from their natural condition in terms of drainage patterns and water quality due to the degree of urbanization in the immediate area. The surface flows for these watercourses into the Fraser River are mainly through drainage channels and culverts. Road run-off is a contributor to surface flow at the lower reaches.

FSD is aligned over the Fraser River Junction which is estimated at 9 square kilometres (km^2). The aquifer is shallow and unconsolidated, comprising of sand and gravel deposits. The Fraser River Junction Aquifer is not a local source of drinking water. The Newton Upland Aquifer is an upland sand and gravel aquifer underlying the City of Surrey. The aquifer is directly adjacent to the Project on the east side of River Road/South Fraser Way and is lightly developed (low demand relative to productivity), with low vulnerability to contamination.

The potential effects on surface and groundwater during the construction and operation of the proposed Project may include:

- Introduction of hazardous material such as gasoline and diesel fuel, hydraulic fluids or lubricant into local watercourses during construction or operation. Other examples of hazardous materials that are most likely to be associated with the project include: dry concrete products and concrete wastewater, solvents and waste oils;
- Sedimentation of existing watercourses during site preparation and clearing, grading or other construction works;
- Accidental spill of unburned coal product, untreated wastewater or chemical additives (i.e., binding agents) into local watercourses during operation; and
- Contamination of groundwater in the event of an accidental release of untreated wastewater through accidental spill on permeable soil within the Project boundaries.

In order to address these potential effects, FSD will implement management plans addressing:

- Construction
  - Surface Water Quality
  - Sediment Control
  - Hazardous Materials Management
  - Spill Response
- Operation:
  - Run-off Management

- Water Treatment
- Water Quality Monitoring
- Emergency Spill Prevention and Response

The construction impacts from sedimentation and introduction of hazardous materials into local watercourses, including the Fraser River, are expected to be mitigated if the environmental measures discussed above are implemented and monitored on a regular basis. Any in-stream works planned during construction will be conducted in accordance with a BC *Water Act*, Section 9 approval or notification granted from the Resource Stewardship Division of the BC Ministry of Forests, Lands and Natural Resource Operations. No residual effects on water quality are anticipated during construction.

Wastewater from coal handling will be recycled through the water management system as much as possible during operation. In addition, stormwater quality for the Project will be monitored prior to discharge. With the implementation of management plans for water treatment, water quality monitoring, Run-off and emergency spill prevention as well as the mitigation measures identified above, no significant residual effects on water quality, including the Fraser River are expected.

The effects on surface and groundwater are not expected to extend beyond the Project footprint, and will not last beyond construction. With the application of proposed mitigation measures, it is expected that the potential effects on surface and ground water can be fully mitigated. No adverse residual effects are expected following the implementation of the proposed mitigation measures.

Fish and Fish Habitat

The Lower Fraser River has a diverse and abundant fish population, including six of seven salmonids species native to the Fraser River: Chum, Coho, Chinook, Sockeye, Pink, Cutthroat trout and Rainbow trout. There are at least 15 fish species of special conservation status found in the Lower Fraser.

Fish habitat in the Project area includes Shadow Brook, where no spawning habitat is present, Colliers Creek with spawning habitat of moderate to low quality, Manson Canal with rearing cover for fish a tributary to Armstrong Creek, and a watercourse at the Bekaert property with no spawning habitat present.

The potential effects on fish and fish habitat during the construction and operation of the proposed Project may include:

- Mortality of *fish, including at-risk species,* resulting from an accidental spill of hazardous material such as fuel, oil, lubricant into the aquatic environment during construction or operation;
- Mortality of *fish, including at-risk species,* resulting from an accidental spill of unburned coal product or untreated wastewater into the aquatic environment during operation;
- Mortality or disturbance of *fish, including species at risk,* from the effects of pile driving activity;
- Permanent loss of 0.10 hectares of aquatic and riparian habitat to accommodate new rail and infrastructure;
- Alteration, destruction or disturbance of *fish habitat* resulting from an accidental spill of hazardous material into the aquatic environment during construction or operation; and
- Alteration, destruction or disturbance of *fish habitat* resulting from an accidental spill of unburned coal product or untreated wastewater into the aquatic environment during operation.

Mitigation measures that will be applied to address potential effects on fish and fish habitat include:

- Restoration works at Shadow Brook (estimated at 1,206 square metres [m^2] or 0.12 hectares) to offset losses to riparian and aquatic habitat amounting to approximately 0.10 hectares as a result of track installation, in-filling of watercourses and infrastructure installation;
- Steel Pile installation will be consistent with the *Best Management Practices for Pile Driving and Related Operations – BC Marine and Pile Driving Contractors Association* (BC Marine, 2003);
- Conferring with DFO (and other agencies with jurisdiction) to determine the preferred timing and methods of the pile driving program;
- Maintaining emergency spill equipment available whenever working near or on the water;
- Positioning water borne equipment in a manner that will minimize damage to fish habitat. Where possible, alternative methods will be used (e.g. anchors instead of spuds);
- Vibratory pile driving is anticipated at Berth 2 and as a result, ongoing hydrophone monitoring is unlikely to be required by the regulatory agencies. FSD will commit to hydrophone monitoring at project start up, and on a selected basis thereafter (depending on site-specific conditions and observations) to confirm pressure levels are ≤30 kilopascal (kPa) at a distance of >1 meter from any pile being driven;

- The environmental monitor, with the support from FSD, will coordinate with the pile driving contractor to create fish exclusion zones (by installing an appropriate protective netting or geotextile material suspended in the water column around pile driving area, followed by fish salvage and relocation);
- Bubble curtains (with frames acceptable to DFO) over the wetted length of the pile may be required to mitigate impacts on aquatic life – these are used to dampen overpressure (shock) waves;
- Spill prevention will be addressed throughout the operation, through routine inspections and maintenance of the track, receiving pits and conveyors; and
- Prior to barge loading, personnel will confirm the barges are empty of debris and in good condition.

Effects that may occur during construction, such as sedimentation or hazardous spill would be infrequent and localized as the Project will occur on the existing footprint of FSD and PARY. With the implementation of sediment and erosion control measures, as well as good machinery operation and maintenance, the effects from construction on fish and fish habitat are negligible to low. There is permanent loss of 0.10 hectares of aquatic and riparian habitat loss for which FSD has plans to re-plant native riparian vegetation on site. This planting plan is considered an improvement over existing conditions.

The Project barges will be operated by an experienced marine carrier (Lafarge) than has been operating in the Fraser River for over 40 years. FSD and the barge operator have worked together to develop a set or risk mitigation processes in order to minimize the potential for a barge accident and resulting coal spill. However, trace elements and PAH in unburned coals proposed for handling at FSD would not be considered harmful to aquatic life because these constituents are generally not bioavailable under typical environmental conditions. For example, acidic pH (2.0 to 3.0) and basic pH (11.0) can result in leaching of selected metals from the coal matrix. These acidic and basic conditions are not expected in the receiving environment. Additionally, the lower sulphur content (<1%) coal proposed for handling on site produces a more pH neutral run-off (Davis & Boegly 1981b, Tiwary 2001,Cook & Fritz 2002 in Ahrens and Morrisey, 2005), which would minimize leaching potential.

Given that standard operating procedures focus very highly on incident prevention and a spill into the aquatic environment is considered unlikely, residual effects on fish or fish habitat are not expected from the operation of the proposed Project.

Vegetation and Wildlife

The Project is in the Coastal Western Hemlock Eastern Very Dry Maritime (CWHxm1) biogeoclimatic variant subzone. Remnant ecosystems on the east side of River Road/South Fraser Way exist on the Delta Ravine slopes. These ecosystems are not directly affected by the Project footprint.

Only a limited number of wildlife have been recently documented in or near the Project, due in large part to the high development and industrial activity in the area. Little natural habitat remains to support wildlife. Species documented in this area include common wildlife such as:

- Streambank lupine (*Lupinus rivularis*);
- Amphibians (such as northwestern salamander, green frog and bullfrog);
- Forest-dwelling migratory and resident songbirds birds in adjacent forest;
- Raptors (diurnal and nocturnal); and
- Mammals such as coyote and small mammals.

The potential effects on vegetation and wildlife, and at-risk species during the construction and operation of the proposed Project include:

- Habitat loss and fragmentation where changes to watercourses are anticipated;
- Habitat degradation in the event of an accidental spill during construction;
- Changes to wildlife movement where changes to watercourses are anticipated;
- Sensory disturbance from noise, odours, vibration and lighting during construction and operation;
- Sensory disturbance from potential coal dust during operation; and
- Wildlife mortality as a result of collision from rail cars during operation.

Mitigation measures to protect wildlife and vegetation, particularly near Shadow Brook and other watercourses include:

- Schedule vegetation clearing activities outside of the breeding bird season (March 1 to August 1) to avoid contravention of the BC *Wildlife Act* and *Migratory Birds Convention Act*;
- Nest surveys if the breeding bird season cannot be avoided;
- Pre-clearing and construction listed plant surveys, with an emphasis on streambank lupine which may be present in the existing track alignment;

- Installing temporary fencing (e.g. snow fence) around the riparian zone of Shadow Brook to prevent personnel and machine access into the area; and
- Noxious weed control.

Noise and Vibration

Noise was identified as a key concern for community stakeholders during community engagement activities carried out by FSD in May 2013 (FSD, 2013a). Common concerns regarding noise included the increase in train noise, including whistles, noise created by operations (specifically unloading of coal), and noise during evening hours.

Pile driving is expected to be the loudest construction activity. The duration of the installation of the 12 steel piles is scheduled for a period of two weeks (FSD, 2013b and FSD, 2013c). Effects of vibration due to this activity also have the potential to disturb aquatic life.

A Preliminary Environmental Management Plan (EMP) has been developed by Triton for FSD to address noise-related stakeholder concerns. The EMP, which will be finalized prior to the commencement of construction, includes a Noise Management Plan and Pile Driving Plan and identifies measures to mitigate noise effects from construction and operation. Two example noise mitigation measures are:

- Pile driving will be completed using Best Management Practices for Pile Driving and Related Operations – BC Marine and Pile Driving Contractors Association (BC Marine, 2003); and
- Use of an electric rail positioner, rather than a locomotive, when moving the rail cars through the unloading facility, as locomotives are typically prone to noisy stopping and starting.

It is expected that the Project will result in no significant adverse noise or vibration effects on aquatic life and surrounding communities.

Light

As no new high mast or low mast lighting is expected for the Project, the effects of light from construction and operation are considered low to negligible. Following the application of mitigation measures designed to reduce or manage light exposure, no residual effects are predicted.

Vessel Traffic

The potential effects associated with increased vessel traffic from the Project include the potential of accidents such as collisions and impacts at FSD, as well as interruption of commercial and recreational fisheries. Mitigation measures to address these potential effects include public notification of barge operations, regular tug inspections, and tug selection (1,200 to 1,600 horsepower) in accordance with prevailing weather conditions. The Project's barge operator, Lafarge Canada, has also been operating on the Fraser River for over 40 years and is familiar with the relevant risk factors and mitigation techniques. With the application of these and other mitigation measures, no significant adverse effects are expected.

Road and Rail Traffic

During the public consultation process, concerns were raised regarding the potential for increased rail traffic to affect access to emergency care, as well as interactions between rail traffic and general road traffic. FSD has proposed related mitigation measures for the Project's construction phase, such as scheduling required movements on public roadways around peak volume periods and notifying the public and municipalities in advance regarding potential construction phase traffic impacts. During operations, coal rail movements will be scheduled to avoid peak traffic times in the Lower Mainland, although the rail schedule may vary. In addition, potential interactions with emergency services vehicles will be governed by standard railroad management practices that have been in place for decades, are in accordance to Transport Canada regulations and consistent with the management of other rail traffic in the region. No significant adverse effects associated with rail and road traffic are predicted.

Recreational and Commercial Fishing

During years two to five of operations, the Project would increase Fraser River vessel traffic (barge and other vessels) by approximately 1.5 percent (%) with an additional 1280 total movements per year, or640 inbound and 640 outbound from the FSD site. An increase in Fraser River traffic has the potential to affect recreational and commercial fishing activities, but the Project is not expected to introduce any new marine risk factors on the barge route. Existing marine operations are conducted safely and without incident. Fishing and pleasure vessels currently account for a 1.1% of the total volume on the Fraser River. FSD has proposed several risk mitigation measures to reduce effects on recreational and commercial fishing activities, including:

- Notification of the coal barge schedule to Fraser River users and public;
- FSD and Lafarge will monitor designated fishing windows and where possible, work to schedule traffic around those windows;
- Pre-emptively notify fishing groups if conflict is expected; and
- Review of potential barge movement impacts on a regular basis and work with stakeholders to help minimize impacts.

With these mitigation measures in place, no significant adverse effects on recreational or commercial fishing are predicted.

Particulate emissions associated with coal dust (and combustion sources) will be localized around the facility and are predicted to have low impact on air quality in the area. Air dispersion modelling results indicate that Metro Vancouver AAQO will generally not be exceeded, with the only exceedances (for PM10 and NO2) predicted at the facility fenceline or over the Fraser River, where sensitive receptors would not be expected. The highest concentrations Particulate Matter (PM) occur along the facility fenceline, with concentrations quickly diminishing as emissions disperse further away from the FSD facility. Predicted $PM_{2.5}$ and PM_{10} concentrations[1], including at the nearest residential receptor, were less than the municipal, provincial, national and international World Health Organization air quality objectives / guidelines. In addition, the $PM_{2.5}$ concentrations were estimated to be below the Metro Vancouver planning objective of 6 microgram per cubic metre (µg/m^3). The air quality objectives have been derived based on the best available scientific evidence and, if achieved, are considered protective of health effects in the general public, including for sensitive sub-populations. Additionally, monitoring of actual rail transport of coal has demonstrated that at a distance of 10 metres (m) from tracks, dust concentrations would be indistinguishable from normal ambient dust levels (SENES, 2012).

Similarly, the maximum predicted carbon monoxide (CO), nitrogen dioxide (NO_2), and sulphur dioxide (SO_2) concentrations associated with the Project (from diesel emissions and combustion sources) are less than, or in the case of NO_2, approximately equal to, the health-based municipal, provincial, national and international ambient air objectives.

Based on the above, and the conservative nature of the air dispersion modelling and resulting predicted air concentrations, fugitive dust and diesel emissions associated with the Project are not predicted to have significant adverse effects on ambient air quality in the area of the Project. Additionally, based on predicted air concentrations for all sensitive receptors, including the nearest residential receptor, being below the ambient air objectives that have been derived to be protective of human health, including for sensitive sub-populations, fugitive dust and diesel emissions associated with the Project are not predicted to be associated with adverse health effects for the general public.

A draft Air Quality Management Plan (Levelton, 2013b) has been developed to monitor air quality to determine the baseline and to continue the monitoring program following the initiation of the Project to ensure mitigation measures are effective and air quality objectives are met. As part of the monitoring program, Levelton will conduct continuous air quality and meteorological monitoring, as well as air quality site visits on a monthly basis. Quarterly reports will be prepared and will include any corrective action. The reports will be submitted to PMV, and FSD will also post the reports on their website.

[1] PM_{10} and $PM_{2.5}$ provide a measure of the potential for fugitive dust from the coal handled/transported as part of the Project to impact air quality

Coal Dust – Potential Health Effects

Dr. Leonard Ritter, Professor Emeritus of Toxicology at the University of Guelph, conducted a review of the potential health effects of coal dust. Coal dust has been studied for decades in miners with high daily exposures to coal dust, and although these studies confirm that prolonged and high exposure levels to coal dust over many, many years can lead to serious adverse health outcomes, exposure to coal dust associated with the Project bears no similarity to the exposure conditions and risks known to be linked to serious adverse health outcomes in miners. Although no ambient guidelines/objectives are available for coal dust specifically, Worksafe BC's occupational exposure limits (Time Weighted Average) range from 400 or 900 $\mu g/m^3$, depending on the type of coal. Levelton (2013a) predicted coal dust and combustion particulate matter levels associated with the Project at the nearest residential receptor to be 1.4 $\mu g/m^3$ (Levelton, 2013b) (conservative PM_{10} estimate, which includes contribution from combustion emissions); the predicted coal dust levels are approximately 286 to 643 times lower than the occupational limits recently established by Worksafe BC for coal dust. In this regard, occupational exposure limits are set on the basis of exposure for 8 hrs /day, 5 days/week and over an entire working lifetime which are not expected to result in adverse health effects. Although occupational exposure limits are not explicitly derived to be protective of sensitive subpopulations, the limits for coal dust are based on the available epidemiological data. In the derivation of threshold levels (i.e., levels below which adverse effects would not be expected), health agencies typically apply a ten-fold uncertainty factor to account for intraspecies variability; this factor is applied to account for potential sensitive subpopulations, such as children and/or the elderly. Estimated coal dust levels associated with the Project are far greater than ten-times lower than the occupational exposure limits, and thus would remain below the limits even if a ten-fold uncertainty factor for intraspecies variability, to accommodate sensitive subsets of the population such as children or the elderly.

The International Agency for Research on Cancer (IARC) (1997) indicates that there have been no epidemiological studies on cancer risks in relation to coal dust, with the exception of limited occupational exposure studies evaluating high level exposures to coal miners to coal mine dust. The findings of the occupational studies have been inconsistent, and IARC indicates that there is no consistent evidence supporting an exposure-response relationship.

Additionally, the carcinogenicity of coal dust has been tested in animal studies using rodents exposed via inhalation or injection. In these studies, the incidence of tumours did not increase compared to control animals (IARC, 1997). Upon review, the IARC has not concluded that coal dust is a human carcinogen. Rather, IARC has concluded that there is inadequate evidence of carcinogenicity of coal dust in humans or in experimental animals.

Based on the above, as well as the results of those monitoring studies (referenced earlier) indicated that, at a distance of 10 m from tracks (SENES 2012 as cited in Ritter 2013), dust concentrations associated with rail transport of coal would be indistinguishable from normal ambient dust levels, Dr. Ritter concluded that coal dust associated with the Project do not pose a risk of adverse health effects in neighbouring communities. SNC-Lavalin has thoroughly reviewed Dr. Ritter's work and supports the same conclusion.

Cumulative Effects

Cumulative effects are changes to the environment that are caused by an activity in concert with other past, present and future human activities. The focus of the cumulative effects assessment will be the potential for residual air quality effects to interact cumulatively with other sources of air emissions in the project area. While other components of the project resulted in some residual effects, no measurable cumulative interaction is considered likely, and the Project's relative contribution to cumulative effects (e.g. vessel traffic) is insignificant.

The results of the air quality assessment indicate that, when considered with existing and future related project activities, and the application of mitigation measures described above, there will be no significant cumulative effects associated with the Project.

Conclusion

Based on the results of this effects assessment and consistent with the conclusions reached by Levelton and Triton, SNC-Lavalin has concluded that the Project is not likely to cause significant adverse environmental, socio-economic, or health effects, taking into account the implementation of the main risk mitigation measures described above, in addition to mitigation measures, construction and operation management plans, best management and standard practices described in the EIA.

The environmental review, as governed by PMV, is intended to foster sustainable development by ensuring that projects are constructed and operated in a manner that minimizes adverse environmental, socio-economic, and health effects. The effects of the Project, as provided in this EIA, have been assessed using methods that reflect standard approaches of environmental and socio-economic practitioners. After consideration of the potential residual effects, and taking into account engineering design and identified mitigation measures, the Project can be constructed and operated without significant adverse effects.

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Engineering Drawings

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ACRONYMS

AAQO	(Metro Vancouver) Ambient Air Quality Objectives
AAR	Association of American Railroads
AC	Alternating Current
ACGIH	American Conference of Governmental Industrial Hygienists
AIS	Automatic Information System
AQG	Air Quality Guidelines
AQMP	(draft) Air Quality Management Plan
ARM	Ambient Ratio Method
As	Arsenic
ASTM	American Society for Testing and Materials
BACT	Best Available Control Technologies
BC	British Columbia
BC AQMG	Guidelines for Air Quality Dispersion Modelling in British Columbia
BC AQO	British Columbia Air Quality Objectives
BCEAA	British Columbia *Environmental Assessment Act*, 2002
BIALAQS	Burrard Inlet Area Local Air Quality Study
BNSF	Burlington Northern Santa Fe Railway Company
BTU	British Thermal Unit
°C	Degree Celsius
CBIA	Central Burrard Inlet Area
CCME	Canadian Council for Ministers of the Environment
Cd	Cadmium
CDC	Conservation Data Centre
CEAA	*Canadian Environmental Assessment Act*, 2012

CEPA	*Canadian Environmental Protection Act*, 1999
cm	Centimetre(s)
CN	Canadian National Railway Company
CO	Carbon Monoxide
Delta	Corporation of Delta
DPM	Diesel Particulate Matter
COHb	Carboxyhaemoglobin
Surrey	City of Surrey
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPR	Canadian Pacific Railway
CWS	Canada-wide Standards
dB	Decibels
DEM	Director of Engineering and Maintenance
DFO	Fisheries and Oceans Canada
DNV	Det Norske Veritas (Canada) Limited
DO	Dissolved Oxygen
DPM	Diesel Particulate Matter
DTC	Direct Transfer Coal Facility or the Project
DTRRIP	Deltaport Terminal, Road and Rail Improvement Project
DWT	Deadweight Tonnage
EIA	Environmental Impact Assessment
EMA	*Environmental Management Act*, 2003
EMP	Environmental Management Plan
ERC	Emergency Response Commander
ERL	Effects Range Low

ERP	Emergency Response Plan
°F	Degree Fahrenheit
FN	First Nation
FREMP	Fraser River Estuary Management Plan
FSD	Fraser Surrey Docks
FSP	Fire Safety Plan
FVRD	Fraser Valley Regional District
GE	General Electric
GVRD	Greater Vancouver Regional District
h	Hour
Hg	Mercury
HEC	Human Equivalent Concentration
IARC	International Agency for Research on Cancer
IDC	IDC Distribution Services Ltd
ISQG	Interim Sediment Quality Guidelines
kPa	Kilopascal
kg/MT	Kilogram per Metric Tonne
km	Kilometre(s)
km/h	Kilometre(s) per Hour
km^2	Square Kilometre(s)
L	Litre(s)
lb	Pound(s)
LEL	Lowest Effect Level
LWD	Large Woody Debris
m	Metre(s)

m^2	Square Metre(s)
m^3	Cubic Metre(s)
MFLNRO	Ministry of Forests, Lands and Natural Resource Operations
mg	Milligram
mg/L	Milligram per Litre
mg/m^3	Milligram per Cubic Metre
MLM	MainLine Management Inc.
mm	Millimetre(s)
MMM	MMM Group
MMTA	Million Mega tonnes per Annum
MoE	Ministry of Environment
MoTI	Ministry of Transportation and Infrastructure
MSDS	Material Safety Data Sheet
MT	Metric Tonne(s)
MTPA	Million Tonnes per Annum
NMP	Noise Management Plan
NAAQO	National Ambient Air Quality Objectives
NOAEL	No Observed Adverse Effect Level
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
O_3	Ozone
ORP	Oxidation Reduction Potential
PAH	Polycyclic Aromatic Hydrocarbon
PARY	Port Authority Rail Yard
Pb	Lead

PDP	Pile Driving Plan
PEP	Provincial Emergency Program
PM	Particulate Matter
PMV	Port Metro Vancouver
ppm	Parts per million
RACT	Reasonably Available Control Technology
RCMP	Royal Canadian Mounted Police
RCTP	Run-off and Collection Treatment Plan
RfC	Reference Concentration
SCRP	Spill Containment and Response Plan
Se	Selenium
SFPR	South Fraser Perimeter Road
SO_2	Sulphur Dioxide
SOP	Standard Operating Procedure
SMP	Soil Management Plan
SRY	Surrey Rail Yard
SRP	Spill Response Plan
SWQSCP	Surface Water Quality and Sediment Control Plan
TDS	Total Dissolved Solids
TEU	Twenty-foot Equivalent Units
TLV	Toxicity Reference Value
TRV	Threshold Limit Value
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
µg	Microgram

$\mu g/m^3$	Microgram per Cubic Metre
U	Uranium
UP	Union Pacific Railroad
USEPA	United States Environmental Protection Agency
VFD	Variable Frequency Drives
VFPA	Vancouver Fraser Port Authority
VWPP	Vegetation and Wildlife Protection Plan
WHO	World Health Organization
WMP	Water Management Plan

1.0 INTRODUCTION

Fraser Surrey Docks (FSD), located on the Fraser River in Surrey, British Columbia (BC), is estimated to be the largest multi-purpose marine terminal on the west coast of North America (Figure 1-1). FSD has been an integral and responsible part of the community since 1962. It currently handles containers, forest products, steel, dry bulk agricultural products and other items.

FSD is proposing to construct a Direct Transfer Coal Facility (DTC or the Project) on the existing terminal site to facilitate the transhipment of coal at a time of infrastructure constraint on the west coast of North America. The scope of the Project includes:

- The development of a coal handling facility at FSD, including new rail within the Port Authority Rail Yard (PARY);
- The transfer of coal from rail onto barge; and
- The barge transport of coal from the Project site to Texada Island.

The scope of the Project does not include:

- Physical works and activities undertaken during or preceding the loading of coal onto rail cars;
- The transport of coal from the mine site to PARY/FSD; and
- The transport of coal during and after the coal is unloaded at Texada Island.

FSD is aware that climate change is a concern of the general public and the burning of coal is a greenhouse gas contributor. As the main function of the Project is to handle the transfer of unburned coal from rail to barge, the EIA does not include the assessment of the ultimate use of coal, nor does it include the mining of the coal. For this reason, the effects *of and on* climate change have been excluded from the scope of the EIA.

In June 2012 FSD submitted a Project Application to Port Metro Vancouver (PMV) seeking approval of the proposed Project (Appendix I). As part of the Project review process, FSD has undertaken a range of studies to evaluate the potential environmental effects of the project. Materials provided in Appendix VII have been made publicly available via the FSD and PMV websites. These studies have been planned in consultation with PMV, and in response to feedback received from the general public, First Nations, local municipalities and other stakeholders through the public engagement activities conducted by PMV and FSD.

FSD's original Project permit application included a set of risk mitigation measures for each Project activity. In the course of Project planning over the past year, FSD has responded to comments and direction from PMV as well as comments received through the consultation process. Design changes and mitigation measures have been implemented to effect a more robust management of potential environmental issues. Since the last round of public consultation, which concluded in June 2013, the following three primary risk mitigation measures have been added:

Elimination of coal stockpile: Earlier Project plans included the presence of an emergency coal stockpile on the Project site. This has been eliminated.

Dust suppression on rail cars: Re-application of dust suppression agents on the coal rail cars will be undertaken approximately halfway between the mine and the Project site. The re-application of dust suppression agents on the coal rail cars will be undertaken by Burlington Northern Santa Fe Railway Company (BNSF).

Dust suppression for barged coal: Further dust suppression agents will be added to the coal surface immediately prior to barge transfer (as it enters the surge bin). This application is expected to maintain effective dust control for the entire barge movement.

This Environmental Impact Assessment (EIA) assembles and integrates the studies and information that have been made available to date, updates them in some areas as appropriate, and assesses additional measures that have been designed in response to agency, First Nations, and public input.

Figure 1-1: Fraser Surrey Docks Location

1.1 Proponent Identification

The Project proponent is Fraser Surrey Docks Limited Partnership. The proponent is responsible for all aspects of the Project including design, staging, scheduling, and operations.

Project enquiries should be directed to:

Jurgen Franke, P.Eng.
Director, Engineering & Maintenance
Fraser Surrey Docks Limited Partnership
11060 Elevator Road
Surrey, BC, V3V 2R7
Phone: (604) 582-2244
Fax: (604) 495-1195
Email: community@fsd.bc.ca

1.2 Project Overview

1.2.1 Project Location

The Project is located along the Fraser River in Surrey, BC at 11060 Elevator Road (Figure 1-1). The geographic coordinates are approximately 49° 10' 42.5172 N, 122° 55' 1.7106" W. The current FSD lease area (approximately 53.38 hectares) is the proposed location of land-based unloading and transfer of coal. The transport of coal from FSD to Texada Island will be via the Fraser River and the Strait of Georgia.

1.2.2 General Project Description

DTC consists of several key components which include construction and installation works on the current FSD lease area and the adjacent PARY licence area. While the majority of works are land-based, certain in water works will also be required during the construction phase. River and marine operations will also continue for the life of the Project. The primary construction components are:

i. Realignment of existing rail track in the FSD and PARY areas;

ii. Installation of new rail track in the FSD and PARY areas;

iii. Installation of a coal rail car unloading facility, including receiving pits, enclosures and conveyor systems;

iv. Installation of a covered conveyor system for coal transport;

v. installation of a covered barge loading conveyor and barge winching system;

vi. Installation of a dust suppression system throughout the conveyor system and unloading facility, including facilities for treatment and disposal of any wastewater generated; and

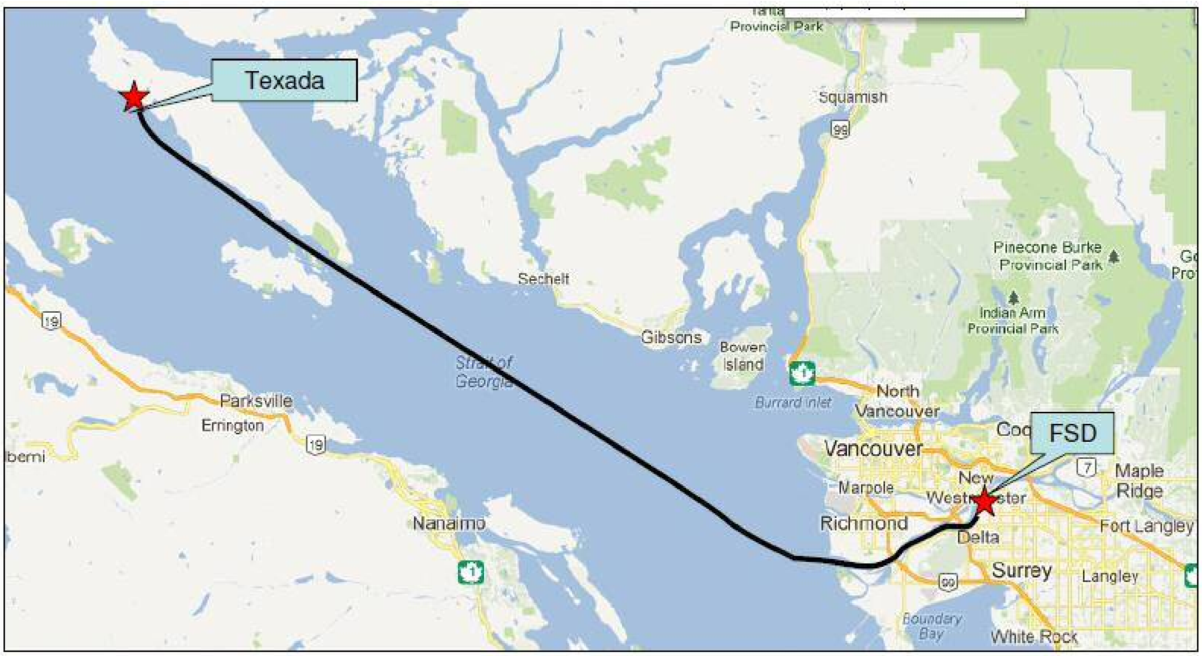
vii. Installation of necessary utility connections.

Coal will be received at FSD via bottom unloading rail cars. The rail cars will dump their cargo in the covered unloading facility from which coal will be transferred via a covered conveyor system to the existing FSD berth face. As coal moves through the conveyor system, it will be treated with a binding and dust-suppressing agent to minimize the potential effects to air quality from fugitive coal dust.

The coal will continue through the conveyor system and will be loaded onto barges. The barges will then travel to Texada Island via the Fraser River and Strait of Georgia (Figure 1-2).

It is anticipated that the Project will transfer 2 million metric tonnes (MT) of coal in the first year of operations, and 4 million MT thereafter.

The barges will be unloaded to the existing coal storage and loading facility at Texada Island, where the coal will be stored and eventually loaded onto deep sea vessels for export. The unloading of coal at the existing Texada Island coal storage and loading facility are not in the scope of this EIA.



Maps intended to overview of routes taken. They may not be completely to scale nor considered navigational aids

Figure 1-2: General Route from FSD to Texada Island

1.2.3 Project Background and Rationale

FSD's existing business has decreased significantly since 2009 and management is looking for opportunities to serve new customers. For example, FSD handled cargo from 60 barges and 234 vessels in 2011, whereas in 2005 FSD serviced 128 barges and 579 vessels at its existing facility. Likewise, rail switch movements have decreased from 5,578 in 2005 to 3,436 in 2011. To facilitate new business, FSD is proposing to construct the coal handling facility on the existing FSD terminal site and the adjacent PARY.

The proposed Project is expected to add 25 new high paying jobs at FSD to the community, a further additional 25 jobs by our partners and allow FSD to maintain its existing workforce of 230 full time employees. Currently, the FSD workforce directly contributes and helps to support the 4,000 jobs in Surrey that relate to Port activity within the Fraser River.

The Project would help alleviate a severe infrastructure capacity constraint on the North American west coast, using an existing marine terminal site and existing rail links. While pursuing these business development goals, FSD recognises its responsibility to protect the local environment and minimise the impact of its operations and has designed the Project around these priorities.

1.3 Jurisdiction and Regulatory Framework

1.3.1 Context

In June 2012 FSD submitted a Project Application to PMV seeking approval of the proposed Project. As part of the Project review process, FSD and the Project's third-party experts have undertaken a range of studies to evaluate the potential environmental effects of the Project, in order help to facilitate PMV's environmental review.

1.3.2 Federal review – Port Metro Vancouver

FSD is located on federal land under the jurisdiction of the Vancouver Fraser Port Authority (VFPA), doing business as Port Metro Vancouver. The direct transfer of coal from rail to barge and the movement of coal-laden barges down the Fraser River from FSD to the mouth of the river is within federal PMV jurisdiction.

1.3.2.1 *Canadian Environmental Assessment Act*

PMV has a requirement to perform a duty or function conferred on it under an Act of Parliament (the *Canada Marine Act*, and the Port Authorities Operations Regulations under it) to permit the Project to be carried out.

As the authority to grant project approval on federal land is designated to PMV, as a Federal Authority as defined by CEAA 2012, PMV is required to undertake a determination that in carrying out the Project there are no significant adverse environmental effects, as per section 67 of *the Canadian Environmental Assessment Act*, 2012 (CEAA 2012). The proposed Project is *not* a designated project listed in the "Regulations Designating Physical Activities" as promulgated under CEAA 2012 and therefore an environmental assessment under the Act is not required.

Under CEAA 2012, the environmental effects taken into account can include effects on:

- Fish and fish habitat;

- Aquatic species;
- Migratory birds;
- Health and socio-economic conditions;
- Physical and cultural heritage;
- Current use of lands and resources for traditional purposes; and
- Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

1.3.2.2 PMV Environmental Review

In order to fulfill its obligations under section 67 of CEAA 2012, PMV implements its Environment Policy. The PMV Environment Policy requires all projects, physical works and activities that may have an environmental effect on air, land and water, and human and ecological health, undergo an environmental review by PMV.

Under this policy, PMV is conducting an environmental review of the proposed Project in order to identify potential adverse environmental effects of the Project, and to assess the significance of such effects prior to making a decision as to whether or not the proposed Project can proceed.

In conducting its review, PMV considers many factors, including the following:

- The environmental effects of the project and their significance;
- Malfunctions or accidents, including spill prevention and spill response, that may occur in connection with the proposed Project;
- Any cumulative environmental effects that are likely to result from the proposed Project in combination with other projects or activities that have been or will be carried out;
- Comments from the public that are received as part of the assessment process;
- Comments from First Nations that are received as part of Consultation for this project; and
- Technically and economically feasible measures that would mitigate any significant adverse environmental effects of the proposed Project.

In the course of conducting the environmental review, PMV identified that an EIA was required in order to inform the review prior to making any decision regarding the proposed Project. The EIA is not a requirement of CEAA 2012 or the British Columbia *Environmental Assessment Act* (BCEAA); however, the EIA is a requirement by PMV as part of their environmental review.

The EIA includes elements of a CEAA- and BCEAA-style EIA that is consistent with best practices when conducting an environmental assessment of a project.

To satisfy the requirement by PMV, FSD has assembled this EIA through the integration of studies and information that have been made available to date (by FSD and PMV technical staff), conducts updates to them in some areas as appropriate, and introduces additional measures that have been designed in response to agency, First Nations, and public input.

1.3.2.3 Fisheries and Oceans Canada

Fisheries and Oceans Canada (DFO) does not have a legislated requirement to conduct an environmental review of the proposed Project and as such does not have a regulatory decision making role. The proposed Project was referred to DFO for their review under the *Fisheries Act*. DFO provided comments in respect of the works around Shadow Brook watercourse. DFO determined that a *Fisheries Act* Authorization will not be required.

1.3.2.4 Transport Canada

Transport Canada does not have a legislated trigger or requirement to conduct an environmental review of the proposed Project. Transport Canada administers a number of Acts (laws) related to transportation. Two Acts specific to this proposed Project include the *Railway Safety Act* and the *Canada Transportation Act*.

Railway Safety Act

Transport Canada is responsible for regulating the safe movement of trains along federally regulated rail corridors in accordance with the *Railway Safety Act*. The Act provides for the safety and security of the public and personnel, and the protection of property and the environment, in railway operations. Under the Act, railway companies are responsible for managing risk related to safety matters by using safety management systems and other means at their disposal.

Transport Canada does not have the authority to limit rail traffic on federally regulated rail lines, provided that railway companies adhere to all safety requirements.

Pursuant to the *Railway Safety Act*, Transport Canada does not regulate the transportation of coal products shipped through the rail transportation system. Product owners are responsible for determining the specific measures required to mitigate environmental risks associated with the rail transport of coal.

Canada Transportation Act

Under the *Canada Transportation Act*, when emergency vehicles require passage, a railway company is expected to clear the train from at-grade crossings as quickly as possible. In order to ensure this is undertaken, a Transport Canada Rail Safety Inspector will monitor the crossing and contact the railway to ensure that operations are being conducted in accordance with the Canadian Rail Operating Rules.

In addition, Transport Canada can order a railway company to undertake any measure it deems reasonable to ensure that the railway company is in compliance with the noise and vibration provisions of the *Canada Transportation Act*.

1.3.2.5 Other Federal Agencies

Environment Canada and Health Canada do not have legislated requirements to conduct an environmental review of the proposed Project but will be included in the EIA review.

1.3.3 Other Jurisdictions and Roles

1.3.3.1 BC *Environmental Assessment Act*

The proposed physical works and activities of the Project, including marine works, marine transportation activities, land side works, and railway transportation activities do not exceed the thresholds identified for such works and activities in the Reviewable Projects Regulation under BCEAA, and therefore the Project does not require a review under BCEAA.

1.3.3.2 Health Authorities

The proposed Project is adjacent to Surrey, BC and the marine transportation component of the Project transects the municipalities of New Westminster, Surrey, Delta and Richmond. The railway that services FSD passes through White Rock, Surrey, and Delta. As such, the Fraser Health Authority and the Vancouver Coastal Health Authority have expressed an interest in the potential ecological and human health effects as a result of the Project.

While the provincial health authorities do not have a regulatory decision making role, the proposed Project was referred to them for review on May 14, 2013. In addition, PMV and the health authorities met to discuss the project and the review process on March 18, June 3, July 24, and August 28. On September 12, representatives from the Fraser Health Authority and Vancouver Health Authority met with SNC-Lavalin, Soleil Environmental, Dr. Len Ritter, Triton, and Levelton as well as PMV consultants, to have a dialogue in the absence of FSD and PMV, with the purpose to gain perspective on:

- the concerns of the health authorities, and
- the opinions of the consulting experts and professional consultants on the proposed project.

The draft EIA has been reviewed by Fraser Health Authority, Vancouver Coastal Health Authority and other agencies (such as BC Ministry of Environment, BC Ministry of Forests, Lands and Natural Resource Operations, Metro Vancouver, Health Canada, Environment Canada, Fisheries and Oceans Canada and Transport Canada) and will have the opportunity to review the final EIA during the public comment period.

1.3.3.3 Local Government

Local governments do not have any legislated triggers or requirements to conduct an environmental review of the Project and they do not have decision making roles with respect to the project. Nevertheless, the proposed Project was referred to local governments as described in Section 4.

1.3.3.4 Metro Vancouver

Metro Vancouver does not have a legislated trigger to conduct an environmental review of the Project but was included in the referrals for review and comment. Metro Vancouver does issue Air Emissions Permits under delegation of the provincial *Environmental Management Act* (EMA), Section 31, such that the "the Greater Vancouver Regional District (doing business as Metro Vancouver) may provide the service of air pollution control and air quality management and, for that purpose, the board of the regional district may, by law, prohibit, regulate and otherwise control and prevent the discharge of air contaminants".

FSD is currently working with Metro Vancouver to obtain an Air Emissions Permit for the Project.

1.3.3.5 City of Surrey

The project site is within the boundaries of the City of Surrey (Surrey), and while local bylaws and standards do not apply to federal lands, FSD will work with Surrey to identify how the proposed Project will align with applicable Surrey Bylaws and Standards, such as Noise By-Law 7044 and Emergency & Disaster By-Law 12559.

2.0 PROJECT DESCRIPTION

The following section provides a detailed description of the proposed DTC infrastructure, including Project schedule and activities associated with the construction and operation phases. The Project components are discussed in detail in Section 2.1 below.

2.1 Project Components

DTC will be located on the existing FSD marine terminal facility in Surrey, BC (Figure 2-1). The Project includes construction and installation of direct coal transfer infrastructure, primarily consisting of new rail track and a coal conveyor system, on the current FSD lease area and the adjacent PARY licence area. While the majority of works are land-based, certain in-water works, such as pile driving, will be required during the construction phase. River and marine operations will also continue for the life of the Project.

Project drawings (total of 33) can be found in Attachments after Appendix XIII. Drawings FSD-DTB-181013-01, -07 and -10 provide an overview of the project site and facility layout. Drawing FSD-DTB-181013-17 provides detail on in-water works.

2.1.1 On site Components

The following section describes the on site Project components to be installed / adjusted during the Project construction phase:

- Realignment of approximately 2,040 feet (622 metres [m]) of existing rail on the FSD site and the adjacent PARY site;
- Approximately 3,250 feet (990 m) of additional rail track on FSD's existing site and the adjacent PARY site;
- Two new bottom dump rail car receiving pits and associated concrete foundations inside a new rail receiving shed;
- A new covered conveyor system, surge bin, and associated support footings and electrical connections, to transport coal directly from the receiving pits to barges at the FSD berth face;
- A new Water treatment facility including two settlement basins with associated piping and pumps;

- A new dust monitoring and weather station on the Terminal adjacent to the proposed location of the Barge Loader (Figure 5-4);
- A new binding and suppressant application system for the treatment of dust;
- A new electric rail car positioner (indexer) on a concrete rail beam;
- A new land-based barge winching system; and
- 12 new steel piles alongside the existing Berth 2 and 3.

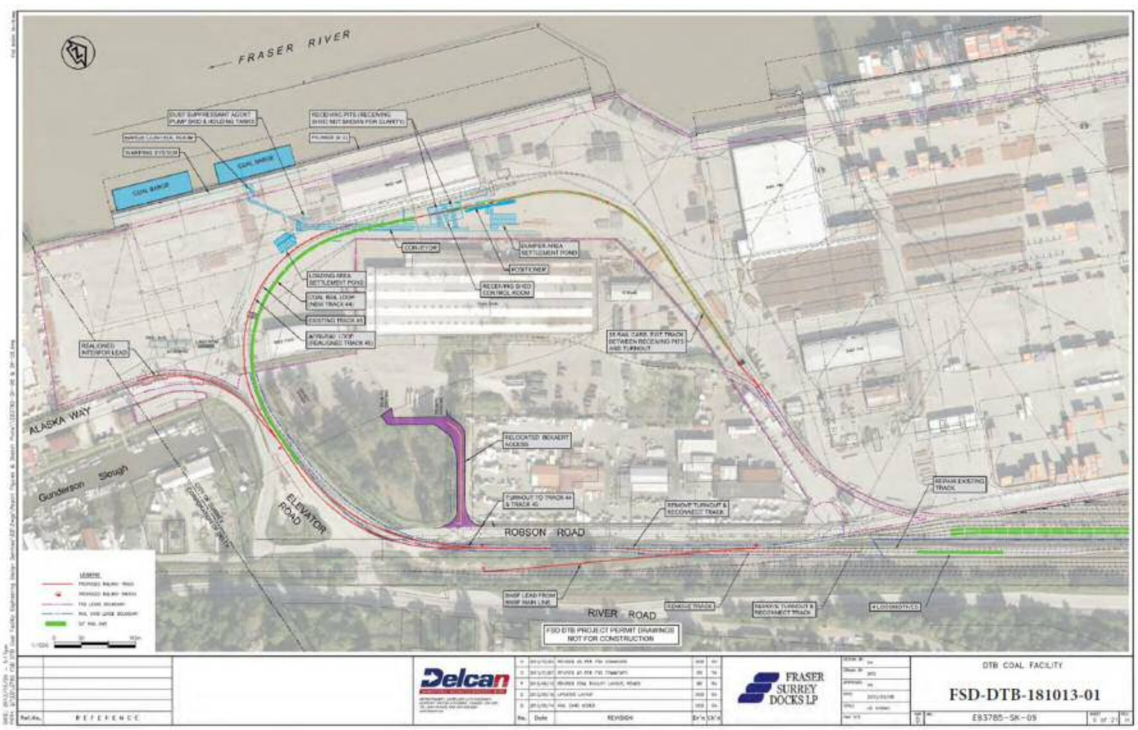


Figure 2-1: General Project Layout and Site Overview

See also Attachments for the full package of Engineering Drawings.

2.1.2 Off site Components (Transportation)

The following section describes the off site components of the Project on the PARY and adjacent to the Bekaert Canada property (Drawings FSD-DTB-181013-06, -07, -08 and -09). These project components are related to rail transportation and roads.

2.1.2.1 Port Authority Rail Yard

Realignment and installation of rail tracks comprises the bulk of the off site works, which will occur on the PARY property. This will include:

- Realignment of approximately 1400 feet (427 m) of existing rail and single turn out;
- Installation of approximately 860 feet (261 m) new rail and two turn outs; and
- Installation of a dust monitoring station.

Further expansion works for the PARY that will be required to be completed before Project volumes exceed 2 million MT include:

- Installation of 5,400 feet (1,645 m) of new single segment rail track;
- Installation of 1,900 feet (580 m) of new rail in the form of switches, crossovers and slough tracks;
- A dust monitoring station adjacent to the PARY (Figure 5-4);
- Extension of two existing tracks, each by approximately 400 feet (122 m); and
- A new turn out from the BNSF main line into the western end of the PARY, approximately 985 feet (300 m).

2.1.2.2 Bekaert Canada

Currently, access to the adjacent Bekaert Canada property is via Elevator Road. The Project proposes to install new rail track parallel to the existing rail and to Elevator Road which will impact access to the Bekaert Canada property. The Project includes a proposed relocation of the Bekaert access (near the intersection of Robson Road and Elevator Road). The current modification design includes a new 8.0 m wide road adjacent to the western boundary of the Western Clean Wood property that would form a T-junction with Robson Road (Drawing FSD-DTB-181013-06 and -07).

Ongoing river-based activities that will occur for the life of the Project include the final stage of the conveyance system as the coal is transferred onto the waiting barge(s).

2.2 Proposed Project Schedule

Construction of the facility is expected to take approximately six months, followed by a start-up and commissioning period of approximately two months. Construction would be expected to start shortly after receipt of the Project permit from PMV.

It is expected that FSD would be able to manage more than 2 million MT on an annualized basis, within one year of operations start up.

The proposed construction timeline is as follows:

- Pre-permit - Design and Permits:
  - Finalize detailed design: 1 month; and
  - Obtain building permit, including Consultant's review: 1 month.
- Months 1 to 6 – Equipment procurement:
  - Order and procure necessary equipment, including winching system, rail indexer, unloading pits, electrical components, rail pieces, etc.
- Months 1 to 7 – Construction:
  - Following receipt of building permits, construct foundations/footings for indexer, unloading pits, conveyors;
  - Construct water treatment ponds; and
  - Construct Bekaert Canada access road.
- Months 2 to 7 – Equipment Installation:
  - Install winching system, indexer, conveyor system, and unloading pits once the necessary foundation and footings have been installed; and
  - Install new pilings.
- Months 4 to 8 – Install Electrical and automation systems:
  - Install electrical system, automation and controls and environmental monitoring system.
- Months 6 to 8 – Commissioning:
  - Testing and commissioning of individual components.
- Months 6 to 8 – Safety and Environmental Training:
  - Training for operators regarding best practices, safety and environmental mitigation measures.
- Month 8 – Commencement of full operations.

2.3 Project Construction

As noted in Section 2.2, from the permit issuance date, the duration of Project construction is expected to be approximately eight months in length and includes six months of active construction followed by approximately two months of Project start up.

Construction activities will include the following:

- Site preparation and clearing, grading, excavation of the unloading pits;
- Construction of foundations/footings for the indexer, conveyors, and unloading pits;
- Construction of the wastewater drainage system and water treatment ponds;
- Installation of the barge winching system, indexer, conveyor system, and barge loading conveyor;
- Installation of associated electrical systems, automation and controls and environmental monitoring system;
- Installation of 2390 feet (729 m) of new rail;
- Realignment of 640 feet (195 m) of existing rail;
- (riparian) habitat restoration; site traffic management; and
- Construction waste management.

2.3.1 Fraser Surrey Docks Lease Area

- Pavement stripping and excavation to 1.2 m below grade in preparation for new rail installation (up to 9,650 m^3 of excavated materials).
- Coal Rail Loop (New Track 44): Installation of 2,390 feet (729 m) of new rail track and one switch on FSD, creating a new rail loop for the Project operations.
- Agri Rail Loop (Realigned Track 45) and Existing Track 45: Realignment of 640 feet (195 m) of existing rail track on FSD, with such track to be used for the agribulk unloading operations.
- Receiving Pits: Installation of an approximate 600 square metres (m^2) rail car receiving shed, which will house the two bottom dump rail car receiving pits and which will be enclosed, except for openings at the east and west end in order for the coal cars to enter and exit the shed.

- Receiving Pits: Inside the rail receiving shed, installation of two shallow, bottom dump rail car receiving pits directly beneath the new rail track. Excavation for these pits will be no deeper than 3.05 m (up to 885 m^3 excavated materials).
- Positioner: Installation of an electric rail indexer and associated utilities, located on the rail loop directly to the east of the new receiving pits/rail car receiving shed.
- Conveyor: Installation of eight fully covered conveyor segments. The transfer points between each conveyor segment will be fully enclosed and equipped water sprayers. One of the transfer points will act as a 100 MT surge bin and will also be covered and equipped with water sprayers and "binding agent". The conveyor segments will have a combined length of 1,330 feet (405 m).
- Installation of a covered 45 m barge loader with lufting and slewing capacity and spill trays snorkel/nozzle arrangement, linking the on dock conveyor system to barges at the existing Berth 2.
- Receiving Pits: Installation of sprinklers and spray curtains for dust control within the rail car receiving shed.
- Receiving Shed Control Room: Installation of an electrical control room housed within a 19 m^2 modular building to the east of the receiving shed and fastened to the ground with 10 millimetre (mm) wire rope, shackle and turnbuckle fastened to eye bars.
- Loader and Dumper Area Settlement Ponds (Primary/Secondary Settlement Pond and Secondary Settlement Pond): Installation of a wastewater management system (collection and treatment) comprised of an oil/water interceptor, two stage settling sump with overflow pumps for wastewater collection and treatment for the site.
- Installation of 12 steel piles of 24 inches in diameter along the wharf at existing Berth 2.
- Warping System: Installation of one winch and warping/mooring with pivot fairlead and two sheaves at existing Berth 2 to facilitate barge moorage.
- Barge Control Room: Installation of an electrical control room housed within a 19 m^2 modular building to the east of the barge loader and fastened to the ground with 10 mm wire rope, shackle and turnbuckle fastened to eye bars. For clarification, the Project includes two electrical control rooms and two electrical substations.
- Removal and relocation of the exiting non-commercial vehicle access gate, card swipe and Security Kiosk, used by employees, customers, contractors and visitors, at Elevator Road.

2.3.2 Port Authority Rail Yard Licence Area

- Coal Rail Loop (New Track 44): Installation of approximately 860 feet (262 m) of new rail track, as part of the rail loop for the Project.
- Agri Rail Loop (Realigned Track 45) and Existing Track 45: Realignment of approximately 1,400 feet (427 m) of existing rail Track 45 and switch with turnoff to Interfor, with such track connected to the Agri-bulk track.
- Realignment of the existing entrance for Bekaert along the western boundary of Western Cleanwood.
- Turnout to Track 44 and Track 45: Installation of a new rail switch, connecting the west end of existing PARY Track 45 (west lead or Canadian National Railway Company (CN) main lead extension) to the new coal rail loop Track 44 and the realigned Track 45.
- BNSF Lead from BNSF Main Line: Installation of a new rail lead and two switches between the BNSF existing main rail line and existing PARY Track 45 (west lead or CN main lead extension). Includes the removal of a 200 foot (61 m) segment of rail and switch on the west end of the FRHC28 track (equipment/run around tracks).
- Remediation maintenance work in order to bring existing PARY track FRHC28 (equipment/run around tracks) to operational standard. This is a 500 foot (152 m) segment on the east end of the FRHC28 track (equipment/run around tracks) east of the new BNSF lead.

2.3.3 PARY licence area prior to exceeding 2 million MT

- New Track 90: Installation of 5,400 feet (1,646 m) of new rail track (Track 90) between the CN lead and Track 91.
- Extension of Track 94: Extension of existing Track 94 by approximately 400 feet (120 m) to the east to meet existing crossovers on existing Track 93.
- Extension of Track 95: Extension of existing Track 95 by approximately 400 feet (120 m) to the east to meet existing crossovers on existing Track 93.
- Connection from Track 90 and Track 91 to CN Lead: Installation of 200 feet (60 m) of new track in order to connect between the existing Track 90 and the CN lead. This work will be outside the current PARY license area.

2.4 Project Operation

The duration of Project operation is expected to last over five years. FSD operations will include:

- Receiving rail cars loaded with sub-bituminous coal;
- Transfer of coal along a conveyance system to waiting barges;
- Collection of coal drainage wastewater and discharge following appropriate treatment; and
- Transportation of coal-loaded barges from FSD to Texada Island.

The application of binding and dust-suppressing agents to control fugitive dust will occur:

- At the mine site prior to coal train departure (by the mine operator);
- On the rail line mid-way between the mine site (by the rail operator); and
- At FSD at the Surge Bin on the conveyance system before barge loading (by FSD).

The Project site will have on site wastewater collection and treatment facilities.

2.4.1 Coal Description

The predominant product to be handled through the facility will be sub-bituminous thermal coal. Sub-bituminous coal is a chemically stable natural occurring mineral of the carbon family.

Coal falls into four main groups based on age and a variety of chemical and physical features, including but not limited to the amount of volatile matter, fixed carbon and % moisture and oxygen. The four main groups of coal are:

- Lignite;
- Sub-bituminous;
- Bituminous; and
- Anthracite.

There are different classification systems for coal around the world. Canada follows the system used by the American Society for Testing and Materials (ASTM) (Ting and Laman, n.d. as cited in Triton, 2013a). Lignite is the youngest and lowest ranking coal, with heating values of <6,300 British Thermal Units per pound (BTU/lb) to 8,300 BTU/lb. BTU is a unit of energy and is roughly the amount of energy needed to heat one pound of water by one degree Fahrenheit (°F).

Sub-bituminous coal generally has a volatile content of >31% and heating values between 8,300 and 11,500 BTU/lb. Volatile content in coal refers to material that will burn off with heating. Sub-bituminous coal contains less sulphur (generally <1%) and as a result is cleaner burning than other coals, which is important to air quality. Bituminous coal has an approximate carbon content of 14% to >31% and heating values of 10,500 to ≥14,000 BTU/lb. Finally, anthracite has the lowest volatile content, ranging from <2% to 8% with heating values of >14,000 BTU/lb (Miller, 2005; EPA updated 2011, Ting and Laman, n.d. as cited in Triton, 2013a).

Thecoal proposed to be received at the FSD facility is a low sulphur sub-bituminous coal, with as received samples from the supplier containing 0.29% sulphur, 32.82% volatile matter and providing 9,125 BTU/lb (Triton, 2013a).

2.4.2 Coal Delivery and Handling

The FSD terminal will receive 125 to 135 bottom-dump car unit BNSF trains operated by four 4,500 horsepower diesel engines (two at the front and two at the rear of the unit train). Loaded rail cars will be received in the covered receiving shed, where unloading pits are designed to accommodate the unloading (dumping) of two railcars simultaneously. FSD estimates that the Project will handle 2.0 million MT tons of coal in the first year of operations, with the volume increasing to 4.0 million MT in years two through five.

Coal burning will not be undertaken at the FSD facility. Only unburned coal treated with water and non-toxic dust suppressants will be received by rail and then delivered by barge off site to an existing coal-handling facility at Texada Island.

2.4.3 Operations Traffic

FSD estimates that in the first year of operations, there will be a total of 160 unit train deliveries to FSD, with the number doubling to 320 in years two through five. This would be approximately one train arriving/leaving from FSD every two days in the first year, and one train arriving/leaving per day in years two through five, summarized in Table 2-1 below. Trains carrying cargo are expected to arrive at FSD between 0400 hours (h) to 0800h and empty trains are scheduled to depart between 1700h and 2100h. When trains will not adhere to this schedule, FSD will post the amended schedule on their website 48 hours prior to the specific operations. FSD is currently working with the rail carriers to better schedule arrival and departure times.

Table 2-1: Estimated Annual Train Movement Resulting from the Project

Year	Coal Trains Arriving at FSD (trains/year)	Empty Trains Departing FSD (trains/year)	Total Train Movement (trains per year)
1	160	160	320
2-5	320	320	640

2.4.4 Electric Rail Indexer (Positioner)

The indexer is a mechanical trolley that will run on independent tracks parallel to the rail tracks immediately after, or upriver, of the Receiving Shed for approximately three car lengths (187’) (See Attachments: Drawings FSD –DTB-181013-10 and FSD-DTB-181013-15). The trolley consists of a large rectangular frame mounted lengthwise on its own tracks with a hydraulically operated arm and clasp located perpendicularly just off center of the frame. The indexer will be powered by three electric motors geared to a pinion traveling on rack mounted parallel to the indexer tracks. The indexer will have local and remote control operability; local for maintenance purposes and remote control from within the receiving control room (located overtop of the rail unloading pits inside of the rail receiving shed) for operations. The indexer, designed to index, or pull a sum of 55 loaded bottom dump cars, by having the operator request the Indexer to pull the cars forward (or reverse if required) two or one car length, depending on the operation. In normal operations the indexer will re-position the rail cars in two car lengths, corresponding with the two bottom dump receiving pits. In normal operating conditions, the system will be capable to operate in automatic, in such when the two cars siting above the two bottom dump receiving pits are empty, the operator will request the Indexer to pull the block of rail cars forward two car lengths with the push of a single button on the control panel. In response, the indexer will first confirm all safety inhibitors are met (i.e. no e-stops or safety latches are engaged), automatically through the use of sensors locate the rail car knuckle closest to the rail receiving shed, extend the hydraulic arm and firmly latch the clasp over top of the rail car knuckle. The indexer will travel forward exactly two car lengths, pulling the entire block of rail cars forward, and landing the next two loaded cars directly over top of the two bottom dump receiving pits. It will then automatically release the clasp, with draw its arm, and travel back downstream to the end of the track adjacent to the Receiving Shed to await further command. This entire process is completed without the use or aid of a locomotive.

As the indexer is located downstream of the Receiving Shed and the direction of rail car movements, it can only become part of the operations once two rail cars have been extended past the Receiving Shed. The process starting at the beginning of the shift is as follows:

1. With the yard locomotive, a block of 22 loaded railcars will be pushed clockwise on Track 44 towards the rail receiving shed.
2. The lead two loaded rail cars will be positioned directly over top of the bottom dump rail receiving pits.
3. The bottom doors of the two cars overtop of the bottom dump rail receiving pits will be opened via an automated process, depositing the coal into the two pits.
4. Once the two lead cars are visually confirmed empty by the operator residing in the rail receiving control room directly above the two cars and pits inside of the Receiving Shed, the operator will request the locomotive to push the block of rail cars forward the length of another two cars.
5. As at this point there will be two full rail cars being emptied into the two corresponding bottom dump rail pits (car three and four of 22) and two empty rail cars sitting in the rail car wash station adjacent and in reach to the indexer (cars one and two of 22), the locomotive will be decoupled from the block of cars and return to the yard to retrieve the next block of 22 loaded rail cars.
6. Once cars three and four are confirmed empty by the operator, the operator will request the indexer to index the next two loaded cars (five and six) into the pit (as described above), further clockwise on the rail loop. The two lead cars will be pulled by the indexer, off of the rail car wash pit after being sprayed with water, with the bottom dump doors closing via an automatic process. Cars five and six will be located over top of the pits.
7. The operation will continue to dump cars as previously described until cars 19 and 20 are overtop of the pits. At this point the yard locomotive will push the second block of 22 loaded cars clockwise on Track 44 towards the rail receiving shed. The lead car of the second block of 22 cars will be coupled to the back of the last loaded car of the previous block of 22 cars (or car 22). The locomotive will then decouple and return to the rail yard to access the rail loop from the opposite side.
8. At this point there will be a total of 44 cars on the rail loop; 18 empty cars on the loop past the rail Receiving Shed, two cars in the Receiving Shed unloading (cars 19 and 20), and 24 loaded cars on the loop waiting to enter into the Receiving Shed (ref drawing FSD-DTB-181013-07). As the locomotive is circling around to access the empty lead car (car one) on the other side of the rail loop, operations continue unloading with the indexer continuously pulling through two cars at a time as required.

9. By the time the locomotive has circled around (counter clockwise) and reached the lead empty car (car one), operations will have emptied cars 1 and 2 of the second attached block (or cars 23 and 24 of both blocks). The empty cars 1 and 2 of the second attached block (or cars 23 and 24 of both blocks) will be sitting in the rail car wash station adjacent and in reach to the indexer.
10. The locomotive will be carefully coupled to the lead empty car (car one), and the first block of 22 cars will be decoupled from the second block of 22 cars (car 22 decoupled from car 23). The locomotive will return the empty block of 22 cars to the rail yard.

This process (steps 7 to 10) will continue until the entire unit train has been emptied, and all the empty cars returned to the rail yard (note that depending on the number of cars in the unit train, the last block of loaded cars may not equal 22 cars, but sum of the remaining cars greater than five blocks of 22 cars).

2.4.5 Coal Conveyance

Coal will be deposited into the receiving pits and moved along a series of conveyor segments and transfer points, with final deposition on the waiting barge(s). It is estimated that a full 135-car unit train will be unloaded onto two 8,000 deadweight tonnage (DWT) barges in less than 8 hours.

Once the coal transfer process has commenced (i.e. a coal-loaded train has been received at FSD), the conveyance system will be manned and monitored at all times.

2.4.6 Dust control

There will be a number of dust control methods utilized during the transfer of coal from rail to barge at the FSD. Such dust control methods during operations include the application of water, dust suppressing agents, and/or incorporating physical barriers into the Project design (i.e. fencing, enclosures, walls, etc.).

Aside from dust control methods incorporated at the facility, one or more of the following dust control methods will be used at various stages of transportation, from pre-departure at the mine site through to the final storage site at Texada Island. These dust control methods are standard practice implemented by the mine site, rail transporters and storage facility.

Dust control methods are described in Appendix III (Dust Control) and Appendix VI (Environmental Management Plans) and are listed below.

2.4.6.1 Wetting

Wetting keeps coal moist and prevents dust generation, while fogging/misting removes airborne dust particles. Water will be delivered to the coal handling area through a combination of misting sprays, large nozzle sprays, large volume sprays, and/or agricultural sprinkler piping (Drawing FSD-DTB-130513-32). FSD will use recycled coal drainage wastewater or clean freshwater (supplied by Surrey) for dust suppression on site to wet down, as required:

- Barge loader;
- Coal conveyor transfer points;
- Receiving building pits,
- Rail receiving shed, entry and exit; and
- Railcar, equipment, and pavement cleaning.

The activation and the application rate of the water spray will be set up to operate automatically based on throughput. Should it be noted that there is insufficient or excess water being applied (observed through the creation of dust or the decreased viscosity of the material, respectively) during the transfer process, the amount of water can be controlled or adjusted manually. For example, if it is noticed that there is too much water in the product (i.e. decreased viscosity), the operator will have the ability to manually shut down any of the suppression systems remotely from either of the two control rooms. Water systems can also be shut off locally. Alternatively, if it is found to be too dusty, the amount of dust suppression agent applied can be increased manually and remotely (as well as locally if required) from either of the two control rooms.

A water management system will be implemented to manage all wastewater during Project operation. Appendix VI contains the FSD Water Management Plan (WMP) developed by Omni (2013) which outlines the details of the water management system. Triton (2012) also developed a water management plan for track extension/reconstruction at Shed 1, FSD, dated June 13, 2012.

2.4.6.2 Dust Suppressing Agents

Mine site to Fraser Surrey Docks

Dust suppressing agents are used at all stages of the coal transfer process. The mine site operators apply a primary “body agent” that helps bind coal particles. A secondary “body agent” will be applied to assist in preventing oxidation. A list of topping agents acceptable for use by BNSF is found in Table 2-2. Material Safety Data Sheets (MSDS) for these agents can be viewed in Appendix II.

BNSF will apply a "topping agent" during the coal loading process at the mine site. The "topping agent" will be applied once the coal is loaded into the railcar at the mine site, pre-departure. This topping agent will acts as a cover and sealant, and is designed to prevent coal dust from leaving the railcar. This is current practice at the mine site. BNSF will load coal in accordance with their coal loading template (Appendix II), which includes contouring the coal into a bread loaf shape to reduce the potential for wind erosion (See Attachments: Drawing FSD-DTB-181013-16).

In accordance with the coal industry "best practice" of re-spraying of coal with the topping agent, BNSF rail cars will be re-sprayed approximately halfway between the mine and FSD (the location of the re-spray site is yet to be determined). All the agents used in this process are not expected to result in any adverse health or ecological impacts by the methods proposed for application. In addition the formulations used by BNSF do not contain carcinogens, have relatively low toxicity, are biodegradable and do not persist in the environment. Details of the products used by BNSF and their components along with handling, disposal and toxicological profiles are provided in the MSDS (Appendix II).

Table 2-2: BNSF Acceptable Topper Agents and Application Rates (BNSF, 2013)

Topper Agents (1)	Concentration Rate per Car (2)	Total Solution Applied per Railcar (3)
Nalco Dustbind Plus	2.0 gal	20 gal
Midwest Soil-Sement	1.25 gal	18.75 gal
AKJ CTS-100	1.36 gal(4)	15 gal
AKJ CTS-100C	1.36 gal(4)	15 gal
Rantec Capture 3000	2.5 lbs	20 gal
MinTech Min Topper S+0150	1.1 gal	20 gal

(1) For Topper Application only.
(2) The amount of topper agent mixed into a solution for each Railcar. These concentration rates were established during testing. c
(3) The amount of topper agent applied to each Railcar.
(4) 1.36 gallons of concentrate (CTS-100C) mixed with 13.64 gallons of water.

Fraser Surrey Docks to Texada Island

For the barge transport from FSD to Texada Island, FSD has committed to the application of a combination of two products to coal at the FSD site prior to barge departure in order to minimize potential dust emissions during the barge journey and at the FSD facility.

The General Electric (GE) products will be re-applied on site at FSD at the conveyor transfer point in the surge bin with spray nozzles located 360 degrees around the product flow (See Appendix II for MSDS and statement on the effectiveness of GE products). This technique will allow all to the coal surface to be treated rather than just the top layer of coal on the barge, providing greater effectiveness.

The activation and the application rate of the dust suppressing agents will be set up to operate automatically based on throughput. Should it be noted that there is insufficient or excess suppression agent being applied (observed through the creation of dust or the decreased viscosity of the material, respectively) during the transfer process, the amount of suppressing agent can be controlled or adjusted manually.

The GE products are expected to maintain dust control effectiveness for the entire barge movement, in a range of climatic environments (e.g., during a rainfall event).

2.4.6.1 Dust Limiting Design

All coal when loaded into the rail cars will be profiled to reduce the possibility for wind erosion and dispersion. The coal will be profiled into a rounded “bread loaf” shape eliminating sharp angles that could catch wind (See Attachments: Drawing FSD-DTB-181013-16).

All conveyors at FSD (eight segments) will be covered on three sides (with the conveyor itself providing the coverage on the fourth, bottom side) and conveyor transfer points (three transfer points) will be completely enclosed. Points of transfer will incorporate chutes, baffles, belts skirting, shrouds and/or drop height limiting designs (i.e. lufting) to limit dust.

The barge loader and snorkel arrangement will be used to profile the coal that has been loaded onto the barge in a slightly rounded (not peaked) shape, to reduce the chance of wind catching the coal and creating airborne fugitive dust particulate while en route to Texada Island.

To provide real-time air quality readings, two permanent air quality monitoring stations will be positioned on and around the Project, with one located on the southwest fenceline of the facility (within 10 m of the barge loader) and one located east of the facility. Details of the locations of the monitoring stations are outlined in the draft AQMP (Levelton, 2013b) included in Appendix VIII.

Appendix III provides specific details for dust control for each stage of conveyance.

2.4.7 Barge Loading

Barge loading operations will be conducted at existing FSD Berth 2 and Berth 3. Dust control will applied prior to barge loading. Dust control is managed through the coal conveyance system and dust control measures system described above (See Attachments: Drawings FSD-DTB-181013-13, FSD-DTB-181013-14, FSD-DTB-181013-18, FSD-DTB-181013-25, and FSD-DTB-181013-26). Transport from FSD to Texada Island will be via coastal barges, with approximately 9 compartments, transversely framed. Barges are 8,000 DWT in capacity, with the dimensions of 284 feet (86 m) long x 72 feet (22 m) wide x 16 foot (5 m) draft and a 20 foot (6 m) load height on average (DNV, 2012). The barge sidewalls will be a minimum of 7.9 feet (2.4m) tall (See Attachments: Drawing FSD-DTB-181013-16).

It was noted that barges will be loaded, to a maximum of 85% capacity (6,800 MT) for transit between FSD and Texada Island. During loading, coal barges are expected to be at berth at FSD for between 5 and 24 hours (with an average of 15 hours).

2.4.8 Barge Operation

As part of the operations phase, barges loaded with coal will be transported from FSD to Texada Island. This component will require tug boats to move the loaded barges along the Fraser River and into the marine waters of the Strait of Georgia. Once unloaded at Texada Island, the empty barges will be towed back to FSD along the reverse route. The unloading of coal at the Texada Island coal storage and loading facility are not in the scope of this EIA. Figure 1-2 shows the approximate route the barges will travel between FSD and Texada Island.

The route is an already established barge route to/from Texada Island. While on the river, barges will be towed in a single barge configuration. Transit speeds will be approximately 6.3 knots (over ground).

FSD estimates that in the first year of operations there will be 320 fully-loaded barges traveling to Texada Island, with the number doubling to 640 barges in years two through five. It is expected that in the first year, on average there will be two barges arriving and departing FSD every second day; in years two to five, there will be an average of two barges arriving and departing FSD every day. However, most of the barges expected to be used for the Project operations are currently being operated by Lafarge, FSD’s barge operator on the Fraser River and in the Strait of Georgia. These barges are currently being transported empty between the Fraser River Lafarge cement plant and Texada Island. By utilizing these currently empty barges to transport coal to Texada Island, FSD will be able to significantly reduce the net increase in barge traffic from the figures stated below. Table 2-3 summarizes the estimated annual barge movements between FSD and Texada Island (if empty barges are not utilized).

Table 2-3: Estimated Annual Barge Movement Along The Transfer Route

Year	Coal Loaded barges to Texada Island (barges/year)	Empty barges to FSD (barges/year)	Total Barge movements between FSD and Texada Island (barges/year)
1	320	320	640
2-5	640	640	1280

Note: Whenever possible (i.e. weather permitting), towing two barges in tandem will occur in the section between Texada Island and the mouth of the Fraser River (or the reverse), potentially reducing the estimated tug movements in the Strait of Georgia.

2.4.9 Spill Control and Emergency Response

FSD has been in operation for over 50 years at the existing site the largest marine terminal on the west coast. FSD's barge partner, Lafarge, has been operating barges on the Fraser River and in the Strait of Georgia for over 40 years and intends to draw on its significant experience in order to prevent and, where applicable, manage the effects from any spill incidents.

Spill control has been identified as a concern for stakeholders, namely requesting identification of emergency response procedures for coal related incidents at FSD or during barge transit. FSD has provided several emergency response procedures for the coal transfer process including:

I. Spill Response Plan (SRP) for Coal that outlines procedures for small and large scale coal spills (Appendix IV);

II. Lafarge Marine Practice, PRA-01-01-001 (Appendix V); and

III. FSD Temporary Coal Offloading Facility Preliminary Environmental Management Plan (EMP) For Construction and Operations (Appendix VI).

The EMP, and other environmental management plans will be finalized by FSD and its contractors prior to the start of construction.

FSD and Lafarge have worked together to develop appropriate emergency response protocols. Emergency response is based on the current contract with Lafarge and Quantum Environmental emergency response preparedness for barge operations.

Emergency response is prioritised in the following steps:

1. **Human safety**: ensure the wellbeing of the surrounding public, emergency responders, and staff.
2. **Containment**: ensure vessel is secure to mitigate further damage or spillage and if relevant, employ containment tactics to surround and recover lost cargo.
3. **Assessment**: review shoreline impacts using adapted Shoreline Clean-up Assessment Tactics, in close consultation with Environment Canada, and review marine impacts in consultation with DFO.
4. **Clean up**: following consultation with regulators and other stakeholders, undertake dredge or other clean up operations. This activity would likely be done with specialised clean up agencies.
5. **Resumption of business for users of the Fraser River**: once it is deemed safe to do so, open route in Fraser River so users can resume business in a timely manner.

Spills will be reported to the Provincial Emergency Program (PEP). The lead emergency response commander (ERC), or delegate, is responsible for contacting the PEP in the event a spill exceeds the reportable spill quantities.

The Lafarge Marine Practice, found in Appendix V, contains several procedures for accidental events when working in the marine environment, including Spill Containment and Response Plan (SCRP). Other procedures for accidental events include: general collision, drift grounding, fire/explosion, impact as FSD (incident between ship, barge or other vessel moored at berth), power grounding, striking, structural failure/floundering.

FSD plans on posting spill prevention plans, including guidelines for daily use and overnight fuel storage, and developing designated waste storage areas for oils, solvents, concrete and other potentially hazardous products. Hazardous materials management and SRP is outlined in detail in Triton (2013b), “Preliminary EMP for Construction and Operations” (or “Project EMP”).

During coal transfer operations, the conveyance system will be manned at all times. The barge loader is proposed to be mounted on a radial arm, allowing for deposition of coal onto the barge.

2.4.10 Wastewater Drainage and Discharge

Coal drainage wastewater will be generated on site in the process areas (i.e. areas that may accumulate coal due to normal operations and will be washed regularly). It will be collected separately from the overall site drainage system, in one of the two proposed gravity-driven settlement ponds (Drawing FSD-DTB-130513-31), and where possible the water will be recycled (i.e. re-used for flushing the dumper, rinsing rail cars, spraying conveyor belts, and general wash down).

In the event of heavy rainfall, there is potential for a surplus of drainage wastewater. FSD has proposed three options of handling surplus wastewater in such cases. The first option (preferred by FSD) is to discharge directly into the Metro Vancouver sanitary sewer system which enables FSD to meet discharge quality standards without the addition of chemicals (i.e., flocculants). The preliminary application for this permit was submitted to Metro Vancouver on August 7, 2013. The second option is to discharge directly to the Fraser River, which may require the use of chemicals to adjust pH and remove solids to meet discharge quality standards. If option 2 is chosen, a BC Ministry of Environment (MoE) discharge permit will be sought by FSD. The third option is to discharge via an infiltration field, which would divert the water through a set of perforated pipes located in the ground and into the ground water. In the case of the second and third options, wastewater will go through a treatment process and a stringent monitoring and testing process to ensure the water meets discharge quality standards.

2.4.10.1 Dust Suppressing Agents

All of the components of the binding and suppressing agents utilized will comply with the substance notification requirements under the *Canadian Environmental Protection Act* (CEPA) and will not contain carcinogens. In addition, any water containing these products can be sent to the sanitary sewer according to local regulations, guidelines or agreements. This is due to the component profile of the products given that no adverse impacts are expected should water containing the products is discharged to the sanitary sewage system.

The products are soluble in water which facilitates coverage and the components of the products are rapidly dispersed and do not persist in the environment. The proposed use of these products should not result in carry over to the Fraser River and in the event of a spill of coal the residual amounts are not expected to adversely impact water quality. Suspended solids and the physical effects of any coal spill would be of greater concern and as discussed elsewhere a coal spill is unlikely to occur given the configuration of the barges and other transport precautions being implemented.

2.5 Project Decommissioning

Improvements are considered permanent structures and decommissioning of the Project is not anticipated. In the case that the Project is to be decommissioned, the proponent shall engage appropriate regulatory agencies to plan decommissioning activities.

Decommissioning of the Project is not discussed further in the EIA.

2.6 Economics and Labour Force

FSD currently employs 230 full-time equivalent employees. The Project is expected to provide 25 additional full-time positions at FSD and 25 further positions through rail, barge and Texada Island operations once fully operational, as well as additional indirect employment.

2.7 Alternative Means of Carrying out the Project

FSD has designed the Project using existing infrastructure wherever possible in order to minimize interruption to the surrounding environment. Several alternatives to the currently proposed Project design have been considered, including for the following elements:

- Dust and air quality management systems, including fugitive dust mitigation strategies;
- Noise reduction and control methods;
- Marine traffic safety; and
- Vehicle impacts, including rail and barge traffic configuration and equipment specifications.

Industry best practices have been employed, where practical, throughout the Project design and operational plans.

After a detailed review of the alternative options, FSD and its partners concluded that other designs did not offer the level of risk mitigation that the current design allows for. Examples of alternative design components that were reviewed are presented below.

2.7.1 Project Siting

The location of the Project, on the existing terminal footprint and to use two existing but underutilized berths, was chosen to minimize the impact on existing operations at FSD and in the surrounding area and therefore minimizing the impact to residents in the surrounding community in terms of air, noise, light and traffic. Eliminating the requirement of operational shifts in cargo storage areas also eliminated potential increases in internal traffic.

2.7.2 Emergency Stockpile

In its original Project application, FSD identified the requirement of an emergency stockpile at the FSD facility to use as a contingency in the case of a supply chain failure. The emergency stockpile would be used in the event a train arrived and no barges were available for the direct transfer of coal. After discussions with stakeholders, the requirement for an emergency stockpile has been removed from the current proposal due to increased challenges in dealing with wastewater treatment, and dust and diesel emissions control.

FSD believes that supply chain failure can be managed by utilizing additional barges, berth space, and/or or adjusting the rail supply timing, without the need for stockpile contingency at present. Berth 2 can accommodate three 8,000 DWT barges and Lafarge also has berth capacity at their Richmond facility that can accommodate 8,000 DWT barges.

2.7.3 Dust Control

2.7.3.1 Drop Height

Rotary dumper operations, although often considered more efficient from an operational perspective, were considered to produce higher level of dust emissions than a bottom dump. The drop height of the coal was substantially reduced and better controlled in a bottom dump operation. Drop heights were also reviewed in conjunction with the configuration of the system at transfer points and barge loader. The system has been designed in such a way as to minimize drop heights wherever possible.

2.7.3.2 Covered Conveyors

Uncovered conveyors were considered as an option to transport coal within the FSD terminal. However, increased challenges in dealing with wastewater treatment, and dust emissions control were identified with this option that are not expected to occur with covered conveyors.

2.7.3.3 Additional Dust Control Measures

A number of fugitive dust mitigation options were reviewed during the development of the Project for coal during barge transport. Options included:

- Applying a tarpaulin to existing barges;

- Using deep welled hopper barges;
- Covering flat deck barges with a permanent tarpaulin;
- Covering barges with permanent covering;
- Enclosing barges with a permanent covering; and
- Use of transhipper or lake vessel.

As noted below in Table 2-4, these alternative dust control measures were all considered less optimal than the application of binding and suppressing agents to the coal prior to barge departure from FSD.

Table 2-4: Consideration of Dust Control Alternatives

Marine Transit Dust Control Alternative	Primary Reason(s) for Not Being Chosen
Applying a tarpaulin to existing barges	The installation of tarpaulins by personnel was considered too dangerous, and too difficult to maintain and achieve the desired effectiveness. Tarps prone to deterioration and would not last long.
Using deep welled hopper barges	Coal would remain exposed albeit below the barge walls so consistent effectiveness could not be maintained. Coal from hopper barges could not be safely reclaimed at the Texada Facility. Furthermore, barges would have to be significantly smaller which increases movements.
Enclosing barges with a permanent covering	Loading into cover barges presents significant challenges in terms of efficiency, practicality and effectiveness. Additional infrastructure would have to be installed to load and receive coal from covered barges which could not be accommodated. Furthermore, barges would have to be significantly smaller which increases movements.
Use of transhipper or lake vessel	The use of transhippers requires economies not practical or feasible for the proposed Project. Additional infrastructure would have to be installed to load and receive coal from covered barges which could not be accommodated.

2.7.3.4 Binding Agent

Consultation with stakeholders, review of effectiveness in suppressing dust, safety concerns, operating costs, and project design changes were discussed relating to alternative options for mitigating dust during marine transit. After review, it was concluded that the addition of "binding and suppressing agent(s)" would provide proven effectiveness in preventing fugitive dust during barge transport. The effectiveness of the binding and suppressing agents was further supported by a letter dated November 14, 2013 from GE to Mr. Jeff Scott (President and CEO of Fraser Surrey Docks) indicating that "*the effectiveness of [GE] product….can be achieved*" when used "*in accordance to how they were intended to be applied*" and at facilities that are designed to GE's technically designed standards such as at the proposed DTC facility (GE, 2013). See Appendix II for the letter.

This was also considered the best option when comparing technical feasibility, safety, cost, and impact on design and operation. See Section 2.4.5.2 for more detail and Appendix II for MSDS of binding and suppression agents.

3.0 CONSULTATION

3.1 Overview of Consultation Program

This section summarizes FSD's consultation activities to date. As a part of the permitting process, FSD has engaged the public, First Nations, municipal governments, and other stakeholders regarding the DTC through a community engagement program.

Phase 1 of community engagement began in September 2012. At that time, FSD consulted with municipal and provincial officials, First Nations representatives, local residents, businesses and other stakeholders. PMV has led the First Nations consultation process, although there has been much direct interaction, including meetings, between FSD and First Nations groups. Phase 2 continued with activities ongoing from Phase 1, with the addition two open house forums which occurred in May 2013.

Public consultation and public outreach materials produced by (or for) FSD are found in Appendix VII. These materials include the following:

- Community Update (Fall 2012)
- Phase 1 – Engagement Summary Report (September 10, 2012 to May 12, 2013)
- Discussion Guide and Feedback Form (May 13 – June 7, 2013)
- Phase 2, Engagement Summary Report (May 13, 2013 to July 31, 2013)
- Frequently Asked Questions: FSD Direct Transfer Coal Facility (September 2013)

3.2 Overview of Information Distribution

3.2.1 Information Materials Distributed

A number of communications media were used during public notifications. Materials that were distributed to stakeholders included a community update advising neighbours of the Project permit application to 3,135 residents in September 2012. A list of the mail drop routes is found below.

V3V (Figure 3-1)

- LC0022: 361;
- LC0023: 313;
- LC0027: 298; and
- LC0031: 219.

V4C (Figure 3-2)

- LC0094: 290;
- LC0086: 289;
- LC0092: 374; and
- LC0095: 379.

V3M (New West) (Figure 3-3)

- LC0003: 297; and
- LC0005: 315.

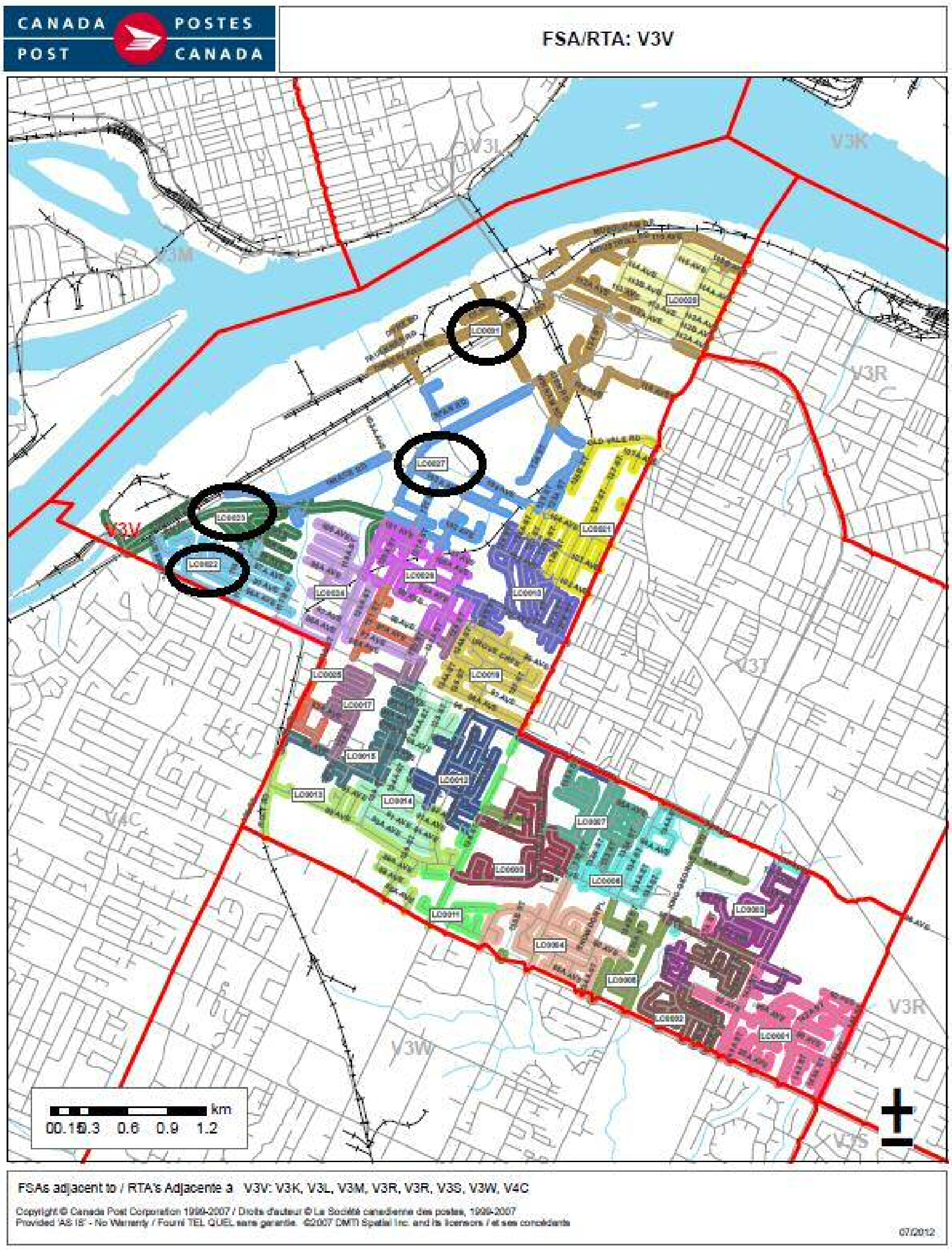


Figure 3-1: Mail Route for Information Distribution (V3V)

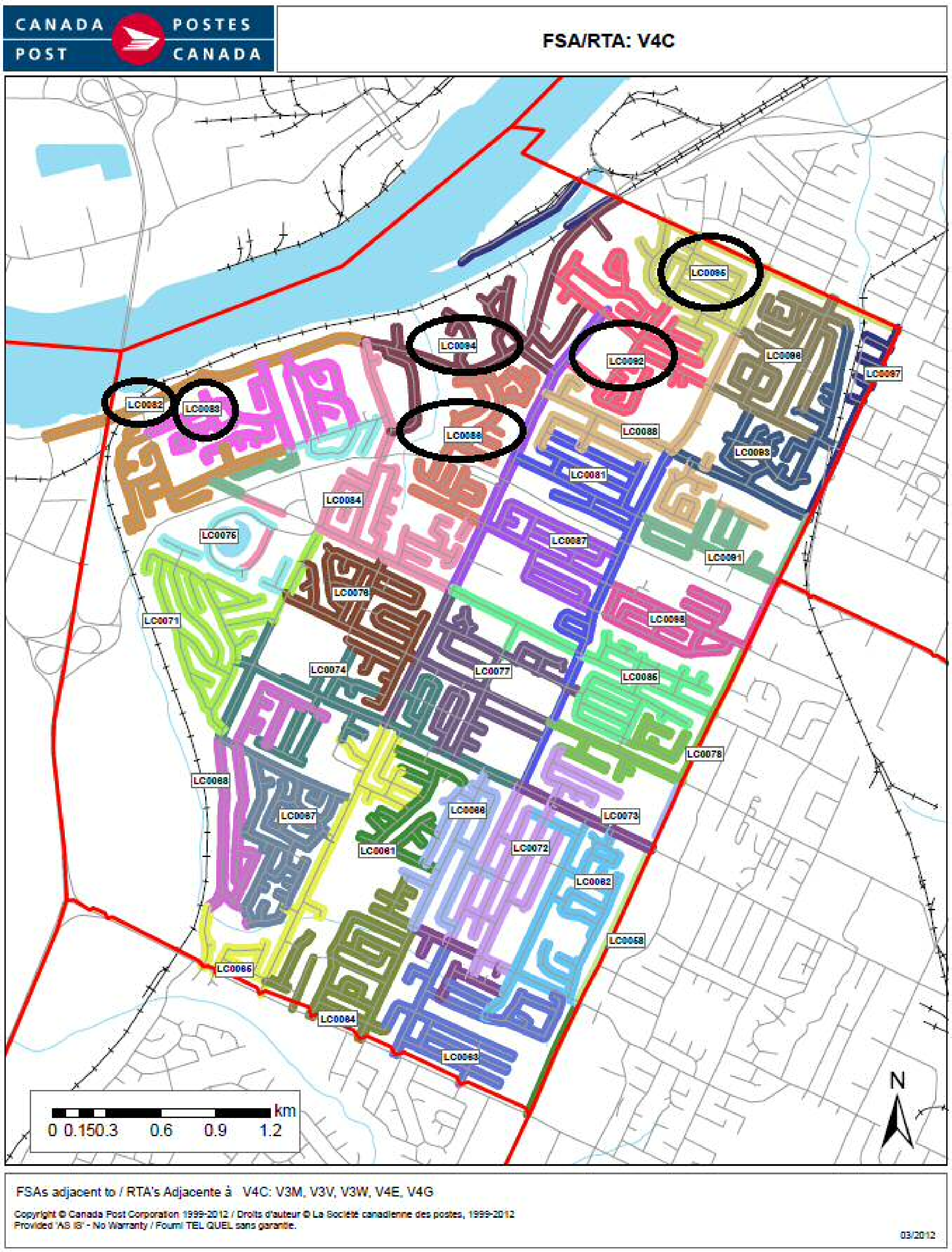


Figure 3-2: Mail Route for Information Distribution (V4C)

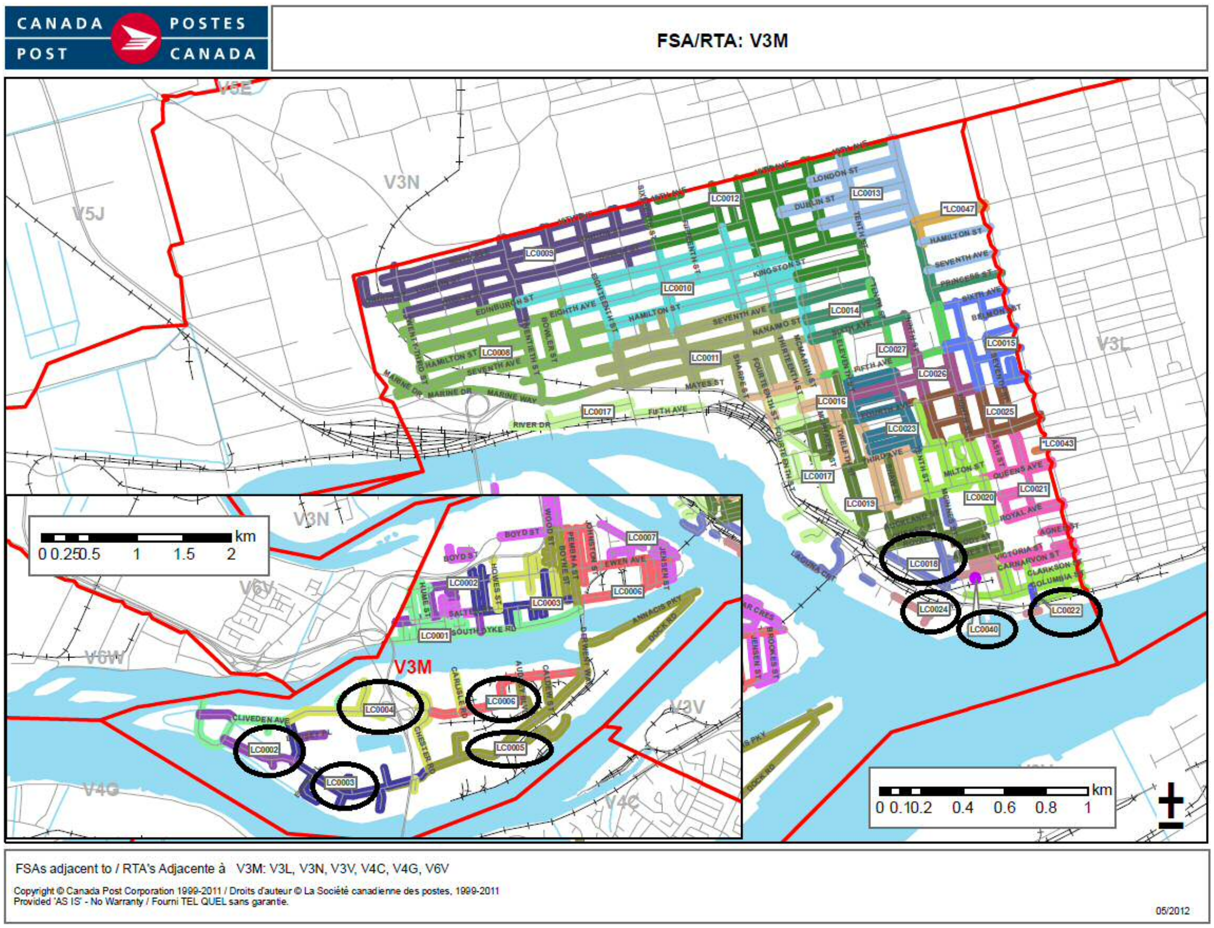


Figure 3-3: Mail Route for Information Distribution (V3M)

Additionally, a total of 8,955 mail drop invitations to planned Open Houses that were delivered to the community; reminder emails; tweets (108 followers); postings on Project website (http://www.FSD.bc.ca/company/community.htm); and advertisements relating to Open House invitations were posted in five different local newspapers on two occasions. A discussion guide and attached feedback form were also distributed to the community to provide a means of identifying concerns to FSD.

3.2.2 Notifications

Notifications of engagement were completed via a mailed community update and mail drop invitations (3,135 community updates and 8955 postcards distributed to neighbouring communities in Surrey and New Westminster during Phase II), invitation and reminder emails, Twitter, and newspaper advertisements.

3.2.3 Communication Mechanisms

Means of engagement included distribution of newsletters/brochures, a discussion guide and feedback form, posting on the Project website (http://www.FSD.bc.ca/company/community.htm), and direct interaction through meetings, presentations, and open house discussions.

3.2.4 Consultation Activities

Activities undertaken by FSD to consult with the various stakeholders include:

- Briefing calls with, and presentations to, elected officials and adjacent businesses;
- A community newsletter (mailed week of Sept. 10, 2012);
- The Project website (www.FSD.bc.ca/index.php/company/community-outreach);
- A Fraser River Stakeholder meeting completed in August 2012. Participants included representatives of the Fraser River Pilots, Council of Marine Carriers, Lafarge, FSD, Transport Canada (represented by Compliance, Navigable Waters), BC Chamber of Shipping, PMV, and Det Norske Veritas (Canada) Limited (DNV) [Facilitation Team]);
- Two open house forums (May 23 and 25, 2013);
- Meeting with stakeholders and community groups; and
- Direct communication via e-mail or phone.

Stakeholder activities undertaken by FSD are summarized in Appendix VII, in addition to Phase 1 and 2 community engagement summary reports dated March and August 2013.

3.2.5 Issues Identification

Following the two open houses, public feedback was received in the form of feedback forms (52), emails (38), phones calls (11) and letters (2). The six key issues of concern included:

i. Dust/Air Quality (relating to the potential to affect human health);

ii. Noise;

iii. Marine Traffic Safety;

iv. Impact on Vehicle Traffic;

v. Emergency Response; and

vi. Marine Environment (habitat and fishing access).

Additional comments/concerns were raised surrounding pile driving, lighting, climate change, port growth, economic impacts, health, and the consultation process.

3.2.6 First Nations Considerations

The First Nation Consultation for the project is being led by PMV. As the First Nations consultation program is ongoing, PMV intends to release a report summarizing that consultation upon complete of the Project review process.

Based on feedback from PMV, and the engagement activities with First Nations described above, the issues identified by First Nations have been primarily related to fish habitat and access to fishing. FSD's proposed activities and risk mitigation strategies regarding these issues have been addressed in Sections 5 and 6.

4.0 EIA METHODOLOGY

4.1 Scope of Project

The DTC consists of several key components which include construction and installation works on the current FSD lease area and the adjacent PARY licence area. The primary construction components are:

i. Realignment of existing rail track in the FSD and PARY areas;

ii. Installation of new rail track in the FSD and PARY areas;

iii. Installation of a coal rail car unloading facility, including receiving pits, enclosures and conveyor systems;

iv. Installation of a covered conveyor system for coal transport;

v. installation of a covered barge loading conveyor and barge winching system;

vi. Installation of a dust suppression system throughout the conveyor system and unloading facility, including equipment for treatment and disposal of any wastewater generated; and

vii. Installation of necessary utility connections.

The Project operations will consist broadly of:

i. Receiving and unloading coal trains at FSD:

   a. In year 1 of Project operations, FSD is expected to receive approximately 160 coal trains, or approximately one train every two days; and

   b. In years 2 to 5 of Project operations, FSD is expected to receive approximately 320 coal trains, or approximately one train each day.

ii. Conveying the coal cargo from the train unloading pits to waiting barges via the new Project infrastructure;

iii. Transporting the coal from the Project site to Texada Island via barges:

   c. In year 1 of Project operations, approximately 320 loaded barge movements are expected, or approximately two loaded movements every two days; and

   d. In years 2 to 5 of Project operations, approximately 640 loaded barge movements are expected, or approximately two loaded movements each day.

It is anticipated that the Project will transfer 2 million MT of coal in the first year of operations, and 4 million MT thereafter.

4.2 Scope of the EIA

A critical step in the EIA process is the identification of the issues, values (environmental and social) and concerns related to the Project. Identification of these values serves to scope the EIA and the potential effects of the Project.

Identification of the values that may be affected by the FSD Project involved the review of the Project construction and operation activities; the existing environmental and social values expressed through public consultation, First Nations consultation and agency review; and through professional judgement. The public and First Nations values have been informed by the consultation and engagement process for this Project.

The scope of the EIA focuses on effects for which a reasonably direct causal link can be demonstrated between some aspect of the Project and the resulting effect.

The main function of the Project is to handle the transfer of coal from rail cars to barge. For this Project, the scope of the EIA includes the development of a coal handling facility at FSD, including new rail within the PARY, the transfer of coal from rail onto barge, and the barge transport of coal from the Project site.

The scope of the EIA does not include physical works and activities undertaken during or preceding the loading of coal onto rail cars, the transport of coal from the mine site to PARY/FSD, or during and after the coal is unloaded at Texada Island. Neither the mining of the coal, nor the ultimate use of the coal, are within the scope of this EIA.

4.3 Spatial and Temporal Boundaries

The Project is located on the foreshore of the Fraser River in Surrey, British Columbia (BC) at approximately 49° 10' 42.5172 N, 122° 55' 1.7106" W (Figure 1-1). The current FSD lease area (approximately 53.38 hectares), and the adjacent PARY licence area is the proposed location of the unloading and transfer of coal from rail to barge.

4.4 General Methodology

An environmental effects assessment is used to examine potential impacts and benefits during the planning stages of a project, allowing for refinements in project design and development of mitigation measures to manage the environmental and social effects. The environmental effects methodology for the Project followed these general steps:

a) Description of the Project activities;

b) Establishment of EIA boundaries;

c) Identification and description of the existing environment within the EIA boundaries;

d) Identification and description of interactions between Project Activities (construction and operation) and environment/social values;

e) Description of the mitigation measure(s);

f) Identification of any residual environmental effects after the application of mitigation measures; and

g) Determination of the significance of residual effects and likelihood of occurrence.

4.5 Residual Effects and Characterization

A residual effect is defined as an effect that remains after the implementation of mitigation measures. A summary of residual effects is found in Section 14. In order to determine the significance of a residual effect, the effect must be characterized. The attributes generally used to describe the residual effects for this Project may include, as appropriate:

Context refers the current and future sensitivity and resilience of the environmental or social value to change resulting from the Project.

Magnitude refers to the size or severity of the residual effect.

Extent refers to the geographic scale over which the residual effect is expected to occur.

Duration refers to the length of time the residual effect persists.

Reversibility refers to the reversibility of the environmental or social value the physical work or activity ceases.

Frequency refers to how often the residual effect occurs and is often related to the frequency of the physical work or activity causing the residual effect.

4.6 Determination of Significance

The potential for significant adverse residual effects is a key consideration in granting a Project Approval by PMV. The significance of a residual effect is determined by drawing on the information compiled from a review of relevant literature, data collected through field studies, consultation with experts, and use of professional judgment to render a determination of the overall significance of effect. The context of the existing environment is taken into account when determining the significance of the residual effect. For example, if the surrounding environment is a highly developed area, then the significance of the effect on the value is likely to be lower than if the effect took place in pristine habitat.

For this Project, significance of the residual effects is defined taking into account the level of effect for each characterizing attribute of the residual effect.

A **non-significant residual effect** is considered to have a negligible to moderate measurable change to an environmental or social value during the life of the Project, with no loss in value. Monitoring programs, compensation, and or recovery initiatives may not be required. Non-significant effects generally are of low magnitude, small geographic extent (i.e., confined to the Project footprint or local study area), are of short to medium-term duration. Non-significant effects are also reversible and occur at a low frequency.

A **significant residual effect** is once that has a high level of measurable change to an environmental or social value during the life of the Project. The change would likely require a long-term monitoring program and recovery initiative. Significant effects are of higher magnitude, large geographic extent (i.e., extends beyond the footprint or measurable at a regional level) and are often irreversible, or of long duration or high frequency.

4.6.1 Likelihood of Occurrence

The likelihood of residual effect to occur is taken into account after the significance determination. Likelihood refers to the probability that a residual effect (significant and non-significant) would occur during the life of the Project.

4.7 Cumulative Effects

Cumulative effects are changes to the environment that are caused by an activity in concert with other past, present and future human activities (Hegmann *et al*., 1999). PMV integrates potential cumulative impacts into the significance analysis of relevant environmental and social components, as identified by PMV, the Proponent, or other stakeholders, First Nations, and government agencies. PMV considers potential cumulative impacts through:

- An examination of background information on relevant environmental and social components including:
  - approved land use plans that designate appropriate activities on the land base; and
  - historical data, trends and comprehensive baseline studies that set out the current conditions and factor in effects of prior developments;
- An identification of potential impacts of the proposed Project on relevant environmental and social components;
- An identification of potential overlapping impacts due to other existing developments, even if not directly related to the proposed Project;
- An identification of predicted impacts from future developments that are reasonably foreseeable and sufficiently certain to proceed;
- An assessment of the potential for residual adverse effects, taking into account the mitigation measures proposed for the proposed Project; and
- An assessment of the significance of any residual effects after mitigation.

PMV evaluates the cumulative impacts of the proposed Project on environmental and social components based on past, present and the following reasonably foreseeable project and/or activities. Of particular relevance to scoping the cumulative effects assessment are the criteria for evaluating relevance of evidence pertaining to the assessment of cumulative effects. The following criteria must be met for cumulative environmental effects to be considered:

- There must be an environmental effect of the project being proposed;
- That environmental effect must be demonstrated to operate cumulatively with the environmental effects from other projects or activities;

- It must be known that the other projects or activities have been or will be carried out and are not hypothetical; and
- The cumulative environmental effect must be likely to occur.

It is therefore necessary to evaluate predicted residual effects of the reviewable project to determine whether any cumulative interaction with the residual effects of other projects and activities is considered likely to occur. If no cumulative interaction is considered likely, those residual effects need not be carried forward into a cumulative effects assessment. The availability of information about the residual effects of other projects and activities should also be considered in the cumulative effects assessment.

Other predicted residual effects of the reviewable project may be negligible and thus not warrant detailed consideration in a cumulative effects assessment. This may be the case for residual effects whose relative contribution to cumulative effects may be so small as to be insignificant.

5.0 ENVIRONMENTAL EFFECTS ASSESSMENT

Environmental values for the Project are described in this section. The information provided is a summary of the technical subject matter assessment work and environmental management planning completed by FSD over the course of 2012 and 2013. Existing information from the technical documents for other projects in the area (e.g., South Fraser Perimeter Road); air quality assessment; watercourse assessment; vegetation assessment; government databases; and field study also contribute to this section.

In addition, FSD has also consulted with multiple regulators, First Nations, stakeholders, local residents and community groups to seek feedback on various issues of environmental and social concern. Such environmental issues of concern include:

- Air Quality;
- Soil;
- Water Resources;
- Fish, Fish Habitat and Species with Special Status; and
- Vegetation and Wildlife, and Species with Special Status.

The Socio-economic Effects Assessment describes the following socio-economic and socio-community topics and effects in more detail (See Section 6.0):

- Noise and Vibration effects;
- Light effects;
- Increased Vessel Traffic;
- Rail Traffic, effects on Road Transportation and Emergency Response; and
- Effects on Recreational and Commercial Fishing.

The Health Effects Assessment, including Human Health and Ecosystem Health Assessment are discussed in Section 7.0.

5.1 Project Area

The Project is located on the border between Surrey and the Corporation of Delta (Delta). The City of New Westminster is north of the Project on the opposite bank of the Fraser River.

The Project area is in the Lower Fraser Watershed extending from Hope, BC to the mouth of the river which is approximately 34 kilometres (km) from FSD. The Fraser Valley Regional District (FVRD) and Metro Vancouver Regional Districts are located in this watershed which, combined, have the highest population density in the entire Fraser River System (FBC, 2013).

Barge traffic will take an existing route from FSD to Texada Island in the Strait of Georgia (Figure 1-2). The Strait located between the Lower Mainland and Vancouver Island. It is a deep, inland basin approximately 200 km long and 40 km wide. Water depths are reported at over 400 m in some locations. The south part of the Strait of Georgia is influenced by freshwater discharge from the Fraser River, but in general the ecosystems found in the Strait are strongly dependent with the Pacific Ocean (VENUS, 2013).

In terms of ecozones, the Project is in the Coastal Western Hemlock Eastern Very Dry Maritime (CWHxm1) biogeoclimatic variant subzone (HectaresBC, 2013). The CWHxm boundary extends east toward Chilliwack on the south side of the Fraser Valley and west to the Sunshine Coast (MoTI, 2006). The low elevation of the Project location is characteristic of the CWH biogeoclimatic zone, in addition to the cool meso thermal climate. Summers are generally cool, and the winters mild (CFCG, 2013).

The Lower Fraser Valley Airshed, extending from Hope to Horseshoe Bay, encompasses the Project (BC Air Quality, 2013). There are 27 stations in the airshed which monitor for air pollutants such as carbon monoxide (CO), particulate matter ($PM_{2.5}$ and PM_{10}) and ozone (O_3), among others. A 20 km x 20 km area around the FSD facility was subject to air dispersion modelling for the Project (Levelton, 2013).

5.2 Air Quality

This section discusses the findings of the Air Quality Modelling and Assessment Studies completed by Levelton in 2012 and 2013.

Note to reader: *The Levelton (Levelton, 2012) report was recently revised to incorporate updated air quality dispersion modelling results that are described herein. The updated work from Levelton is found in Appendix VIII (Levelton, 2013a).*

Air quality assessment works that have previously been conducted in the region which are considered to be relevant to the Project under assessment include:

- ***Trackside Monitoring Studies*** in the Lower Fraser Valley;

- ***Ambient Air Quality Monitoring Studies*** nearby existing port and coal handling facilities (Westshore in Delta, BC and Neptune Terminal in North Vancouver) and throughout the Lower Fraser Valley***; and***
- ***Additional Studies and Information.***

Levelton also conducted an air dispersion modelling assessment for the Project, which is summarized below.

5.2.1 Overview

Levelton (2013a) modelled Project and agricultural handling emissions from FSD, which included CO, nitrogen oxides (NO_x), suphur dioxide (SO_2), PM_{10} and $PM_{2.5}$, and added these results to the background air quality. Project emissions from the facility included combustion sources (rail and tugs) and fugitive dust sources (rail cars within the rail yard, unloading of coal from trains, movement of coal through the facility, loading of coal onto barges, coal on barges at the berth and transport of coal by barge). Project emissions near the facility originating from rail and barge transport (both combustion and fugitive dust) were also included in the assessment. Agricultural handing emissions included: rail unloading, headhouse, material transfer, storage shed, ship loading and front-end loaders.

Air quality and weather information was collected from a total of 26 air quality monitoring stations located in Metro Vancouver and the FVRD, with 25 of the stations continuously collecting data (Metro Vancouver, 2011). Additional information was compiled from a series of portable air quality stations to investigate suspect problem areas and through visual air quality assessments.

Within the Lower Fraser Valley, long-term regional trends from 1992 to 2011 indicated an overall reduction of the annual average concentrations and short-term peak concentrations of nitrogen dioxide (NO_2), SO_2, CO and $PM_{2.5}$ (Metro Vancouver, 2011). Conversely, over the same time period, O_3 has been slightly increasing.

5.2.2 Study Area

FSD identified that dust emissions in the form of coal dust may originate from handling dry bulk coal, primarily during transfer points (FSD, 2013a). FSD identified eight points of emission:

- Rail Car unloading - Dual dumper pit operation – ASHROSS Pit #1;
- Transfer point – Quad Conveyors to out feed conveyors CC1A and CC1B;
- Transfer Point – Out feed conveyors CC1A and CC1 B into Surge Bin;

- Transfer point – Surge bin on to Feed conveyor CC3;
- Transfer point – Feed conveyor CC3 to Barge Loader; and
- Barge Loader Conveyor to Barge.

Meteorological modelling was conducted using the CALMET model for a 35 km by 35 km domain and air dispersion modelled was conducted using the CALPUFF model for a 20 km by 20 km domain centered on the FSD facility by Levelton (2012), as shown in Figure 5-1.

Fenceline and gridded receptors are indicated by the blue crosses, while the sensitive receptors are indicated by the red crosses. In total, the modelling domain contains over ten thousand receptors where ambient air concentrations were predicted which included 637 sensitive receptors for: hospitals, schools, senior care residences and day care centers.

The geographic extent to which the transportation emissions were assessed included barge related emission extending approximately 2 kilometres (km) from the berth and rail related emissions extending approximately 1.5 km from the rail yard.

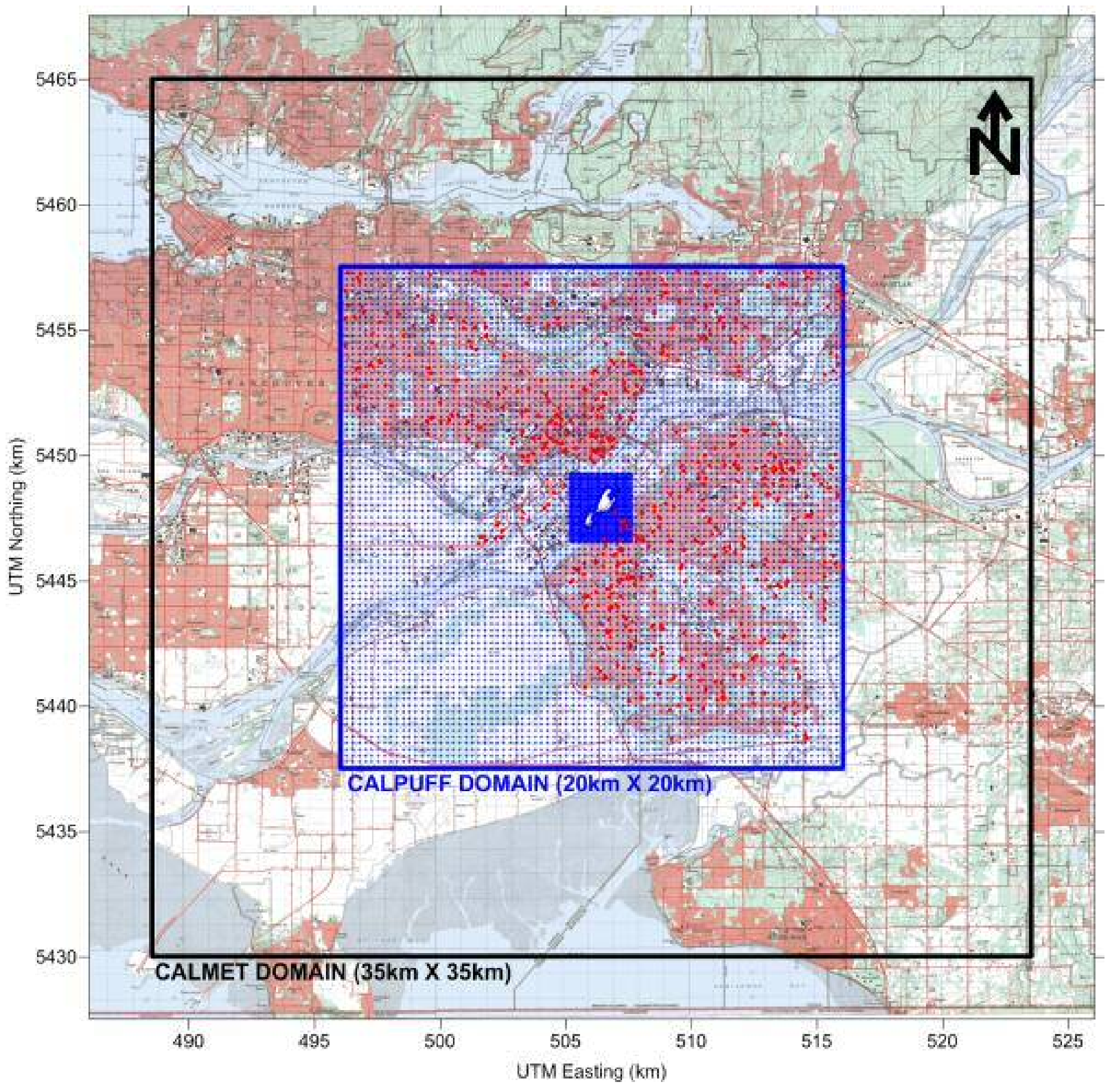


Figure 5-1: CALMET and CALPUFF Modelling Domain with Receptor Locations (Levelton, 2013a)

5.2.3 Review of Air Quality Assessments in the Region

5.2.3.1 Trackside Monitoring Studies

A study was commissioned by Environment Canada (Environmental Protection Service) and the BC MoE to evaluate sampling and analytical methods to monitor coal dust emissions from in-transit unit coal trains (ESL, 1985). Four types of sampler instruments (two high volume and two low volume samplers) were used to sample airborne particulates and particulates re-suspended from the passage of coal trains. High volume samplers provided the most accurate method for determining concentrations of airborne particulates and general sources of particulates and re-suspended dust from passage of coal trains. Continuous measurements of airborne particulates were also considered using an integrating nephelometer. Limitations of the instrument were identified, including issues with particulates greater than 0.5 microns.

Upon completion of initial evaluation of sampling and analytical methods, Environment Canada (Environmental Protection Service) and the BC MoE commissioned a supplementary monitoring program designed to address deficiencies in methodologies used to collect and analyse particulate matter samples for coal dust content (ESL, 1986). Sampling techniques and parameters were tested near rail tracks to monitor coal dust emissions from in-transit coal trains.

Four major sources of airborne particulates were identified in samples near the tracks. These include diesel smoke from passing locomotives, coal emissions from dusting coal trains, coal and soil dust re-suspended from turbulence by passing rail vehicles, and background particulates due to urban and industrial sources (ESL, 1986).

ESL (1986) recommended a sampling system that included both dustfall (near ground) and high volume sampling in communities likely to be affected by coal dust emissions from in transit coal trains, and that sampling methods be similar to automatic air samplers (ESL, 1986). Air shed complexity was identified as a factor in interpreting emission sources (ESL, 1986).

SENES (2012) summarized the findings of the ESL reports for the Deltaport Terminal, Road and Rail Improvement Project (DTRIPP) concluding that at a distance of 10 m from the tracks $PM_{2.5}$ would be reduced to a level that would fall within 'noise levels' of $PM_{2.5}$ sampling instruments and thus would be indistinguishable from background concentrations. The ESL studies are considered to be the best available evidence of coal dust impacts from rail within the Lower Fraser Valley (SENES, 2012).

5.2.3.2 Ambient Air Quality Monitoring Studies

From June 1, 2002 through August 24, 2002, air quality was monitored at three sites in the Tsawwassen area to determine fine PM PM_{10} and $PM_{2.5}$ levels in the Tsawwassen area (GVRD, 2002). Results were compared to the established standards and/or objectives and to other areas in the Greater Vancouver Regional District (GVRD). In general, results indicated PM_{10} and $PM_{2.5}$ levels in the Tsawwassen area were well below the guidelines and similar to other areas in the GVRD.

From 2004 to 2006, the GVRD completed an ambient air quality study of the Ladner and Tsawwassen area to determine levels in the study area and compare the results to the established standards and/or objectives, as well as to other areas in the GVRD (GVRD, 2006). A mobile air quality monitoring station was rotated between four sites, to continuously monitored air quality parameters during the sampling periods, including NO_2, sulphur dioxide (SO_2), CO and $PM_{2.5}$. The air quality results in the study area met all the GVRD objectives and were generally lower than that in surrounding areas. Air quality within the Delta study area was considered to be generally good (GVRD, 2006).

Air quality and weather information was collected from a total of 26 air quality monitoring stations located in Metro Vancouver and the FVRD, with 25 of the stations continuously collecting data (Metro Vancouver, 2011). Additional information was compiled from a series of portable air quality stations to investigate suspect problem areas and through visual air quality assessments. This report identifies fine particulate matter ($PM_{2.5}$) as a pollutant of concern thought to significantly contribute to health effects related the respiratory and cardiovascular systems. This pollutant is associated with emissions from diesel fuel combustion (car, truck, marine, rail, and non-road engines).

Within the Lower Fraser Valley, long-term regional trends from 1992 to 2011 indicated an overall reduction of the annual average concentrations and short-term peak concentrations of NO_2, SO_2, CO and $PM_{2.5}$ (Metro Vancouver, 2011). Conversely, over the same time period, O_3 has been slightly increasing.

As part of its 2005 Air Quality Monitoring Plan, Metro Vancouver completed an air quality monitoring program for the Burrard Inlet Area Local Air Quality Study (BIALAQS) from July 2008 to June 2010 (Metro Vancouver, 2012). Using 12 monitoring sites and one mobile monitoring unit, information was collected on air pollutants in the Central Burrard Inlet Area (CBIA) including $PM_{2.5}$, SO_2, and NO_2. Results for the CBIA were compared with data collected from the existing Lower Fraser Valley network. The results for the CBIA showed elevated levels of SO_2 (with the largest source of SO_2 attributable to marine vessels). CBIA concentrations of $PM_{2.5}$ were periodically elevated, black carbon was slightly elevated, and vanadium and nickel (components of the combustion process that occurs in ocean going vessels) levels were also reported to be elevated, while CO and NO_2 were similar to the Lower Fraser Valley.

Recommendations from Metro Vancouver (2012) included review of the ambient air quality objectives for SO_2 (the more stringent World Health Organization (WHO) SO_2 guidelines were exceeded several times), implement measures to reduce SO_2 emissions from marine vessels, regularly review SO_2 excursions mitigation for the Chevron Refinery, and additional assessment of $PM_{2.5}$, black carbon, and SO_2 monitoring.

As part of the BIALAQS, Environment Canada completed speciation analysis on $PM_{2.5}$ over three sampling periods (Environment Canada, 2012). Analysis was completed on samples collected from seven CBIA sites and two outside the CBIA (Abbotsford and Burnaby South). It was confirmed that the

CBIA does have unique air quality compared to the Lower Fraser Valley, including $PM_{2.5}$ composition. It was suggested that efforts to reduce $PM_{2.5}$ in the CBIA should consider reduction of SO_2. Future studies should include speciation monitoring and over a longer period of time.

5.2.3.3 Additional Studies and Information

BNSF and Union Pacific (UP) railway companies were involved in an assessment of coal dust suppressants in the Powder River Basin (Montana) over a seven month period (Anon, 2010). The trial tested the effectiveness of four coal dust suppressing agents used in a 'body' treatment (coating the coal before being loaded into the rail cars) and five coal dust suppressing agents that were 'topical' treatments (applied after the coal was loaded in to the rail cars), with two of the coal dust suppressing agents used as both a 'body' and a 'topical' treatment. Dust from the trains was monitored either using a passive dust collector or a trackside monitor. Results indicated that 'topical' treatment significantly reduced the amount of fugitive coal dust, whereas the 'body' treatment showed a limited reduction in fugitive coal dust. Additionally, it is noted that effectiveness could be dependent on load profiling and the quality of the application of the 'topical' treatment. The above reference provides context as to the effectiveness of dust suppressant agents as tested during the study conducted by BNSF and UP.

Cheminfo (2005) provided guidance on applying both water and chemical suppressants at different stages of construction to reduce dust emissions. Design considerations, including site planning, building materials, vehicle traffic congestion, distances travelled for delivery of construction material are discussed in detail. A number of options for reducing fugitive dust emissions were identified, including separate stages of site preparation, materials storage, material handling and transfer systems, road surfaces, fabrication processes, and demolition processes. Monitoring and record-keeping options are discussed.

Major pollutants identified from construction and demolition activities include particulate matter, volatile organic compounds, nitrogen oxides and sulphur dioxide (Cheminfo, 2005). Water and chemical dust suppressants are identified as mitigation measures to reduce fugitive dust, with chemical dust suppressants being more effective in suppressing dust, and need to be applied less frequently than water application.

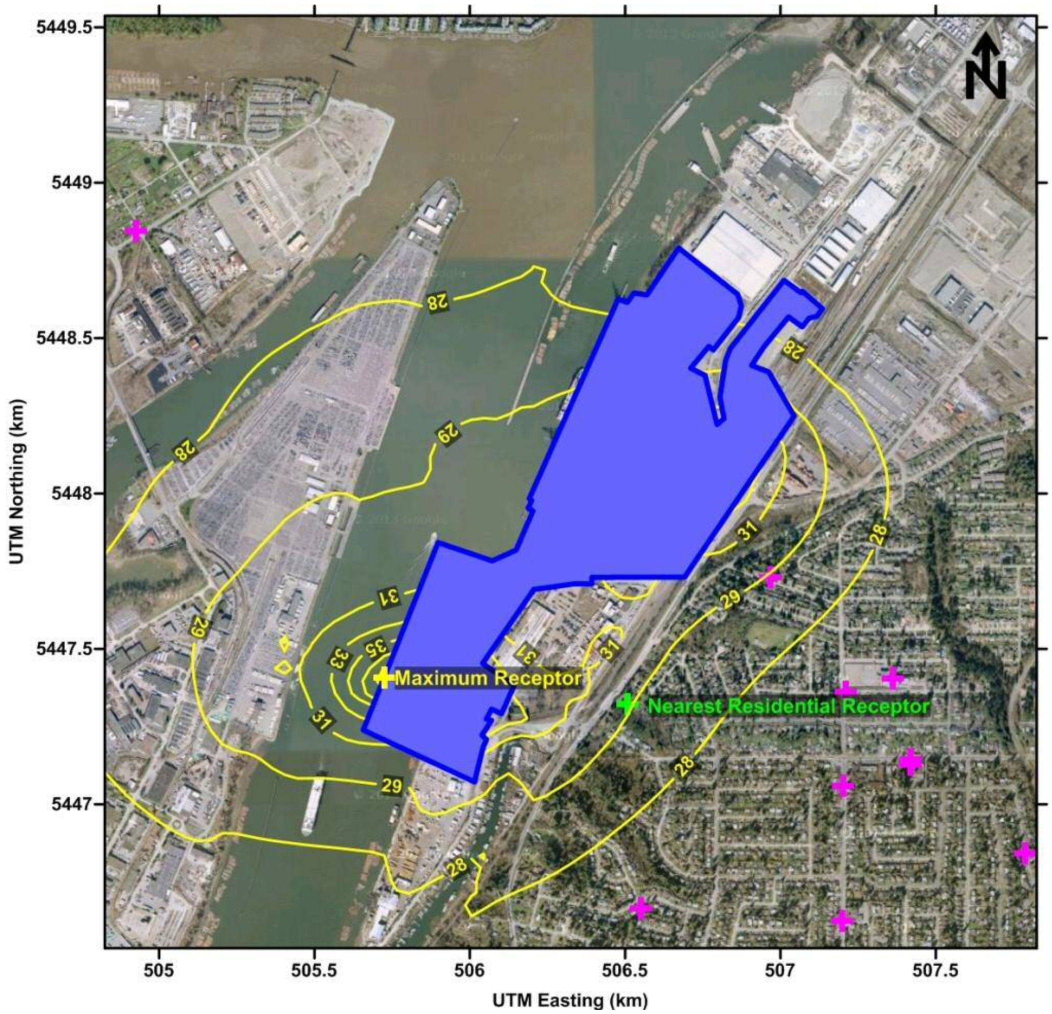
Retired Assistant Vice President and Chief Engineer-Systems Maintenance and Planning at BNSF Railway Company, William VanHook, completed a verified statement relating to measures taken by BNSF to measure and understand the impact of coal dust on the safety and reliability of coal transportation (Powder River Basin) and to adopt mitigation measures to reduce those impacts (VanHook, 2012; Appendix). The VanHook statement is found in Appendix XIV.

Retired Assistant Vice President VanHook described that compliance with safe harbour provisions effectively reduced in-transit coal dust losses through aerodynamic load profiling and application of topper agents. Studies carried out by third parties (Simpson Weather and Associates, and Conestoga-Rovers and Associates) on behalf of BNSF investigated load profile grooming, topper applications, body treatment chemicals and compaction technologies as part of the coal dust study (VanHook, 2012). Aerodynamic load profiling, while effective in removing some coal dust losses, did not produce consistent or sufficient reductions in coal dust alone when in transit. Topper agents, which form a pliable crust over the top of loaded coal, were found to have substantial reductions in coal dust losses in transit. Results of laboratory and field testing identified reductions in coal dust losses in transit while having no effect heat generation capacity of coal or adverse effects on boilers at electric generating facilities. Body treatment chemicals and compaction technologies were tested, and found no significant reduction in coal dust losses during transit (VanHook, 2012).

5.2.4 FSD Air Quality Modelling and Assessment Studies

Air quality modelling and assessment was conducted by Levelton (2013a) which predicted ambient air concentrations from Project and agricultural handling related emission which were then included to the background ambient air concentrations. Results from the air quality assessment are shown in Table 5-3 (at the end of Section 5.2). It should be noted that air dispersion modelling techniques and practices followed are considered to be conservative as they consider the combined effects of conservative emissions and meteorological conditions which results in the maximum predicted concentrations all within the context of atmospheric physics in the model that errs toward conservative estimates of the modelled design concentration.

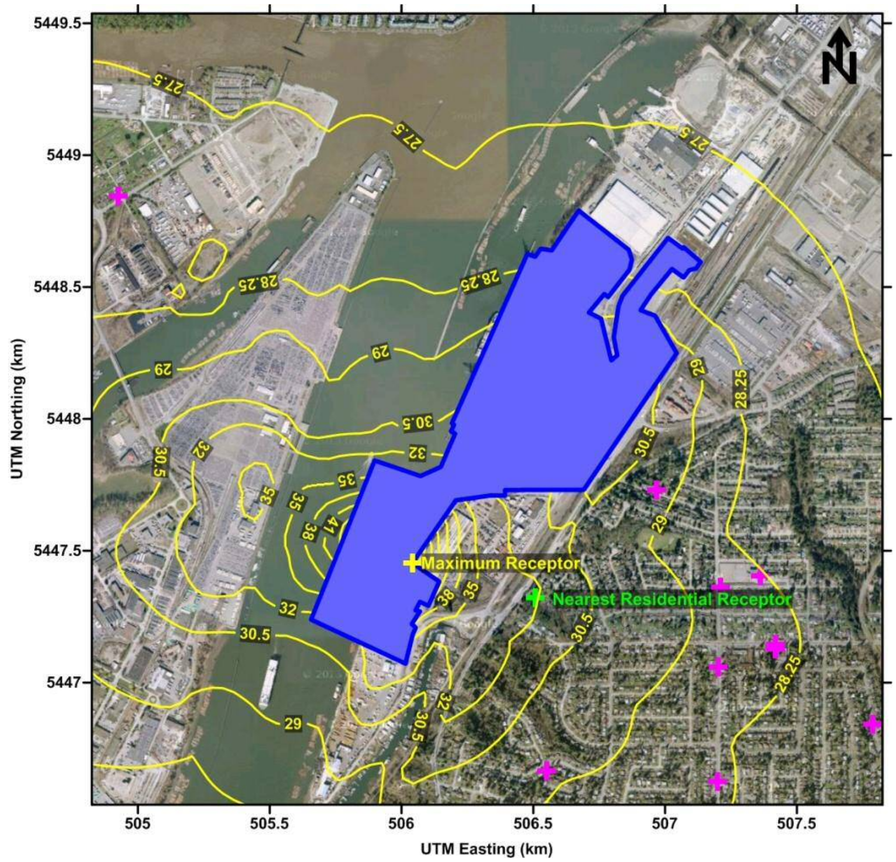
The results of the assessment indicated that for most air contaminant (CO, NO_2, SO_2, PM_{10}, and $PM_{2.5}$) and averaging periods under consideration that the maximum predicted concentrations including background were below Metro Vancouver Ambient Air Quality Objectives (AAQO). There are predicted exceedences noted for 24-hour averaged PM_{10} and annual NO_2 when combining the impacts of the proposed Project, current agricultural goods operations, and ambient background concentrations. The predicted 24-hour averaged PM_{10} exceedences are located on the facility fenceline inland (see Figure 5-3), while the predicted annual NO_2 exceedences (see Figure 5-2) are receptors located over the Fraser River.



Contours shown: *27, 28, 29, 31, 33, 35 and 37 microgram per cubic metre (µg/m^3).*
Facility: *Shown in (blue) and the fenceline shown in (dark blue).*
Receptors shown: *Maximum Receptor (yellow), Sensitive Receptors (purple) and Nearest Residential receptor (green).*

Figure 5-2: Annual NO_2 (Maximum Predicted Concentration including Background)

Figure 5-3 shows the maximum 24-hour PM_{10} predictions with background. Results for other air contaminants and averaging periods are similar with maximum concentrations occurring at or near the facility fenceline and decreasing rapidly within a short distance from the facility. As mentioned above, the model predictions are considered to be conservative and long-term human exposure in this area would not be likely. The draft Air Quality Management Plan (AQMP) (Levelton, 2013b) contains a commitment to monitor PM_{10}, $PM_{2.5}$ and NO_2, which would verify actual concentrations and, if necessary, additional monitoring and/or mitigation measures could be implemented. The draft AQMP is found in Appendix VIII.



Contours shown: *27.5, 28.25, 29, 29.5, 30.5, 32, 38, 41, 44 and 47 µg/m³.*
Facility: *Shown in (blue) and the fenceline shown in (dark blue).*
Receptors shown: *Maximum Receptor (yellow), Sensitive Receptors (purple) and Nearest Residential receptor (green).*

Figure 5-3: Maximum 24-hour PM_{10} (Maximum Predicted Concentration including Background)

FSD proposes to utilize barges that are hauling product from Texada Island to Richmond that are currently returning empty (FSD, 2013b).

The effects of tugboat emissions may be offset by the incorporation of already-running tugboats. FSD has also developed and implemented an anti-idling policy and locomotive shut-down procedures to mitigate air emissions relating to idling unit locomotive trains (Appendix III). Compliance of FSD's anti-idling policy in accordance with FSD's standard operating procedures are monitored by FSD's yard crews and noted in the Rail Yard Foreman Daily Activity Log. Noncompliance will trigger a Notice of Safety and Environmental Standards Letter to be sent by FSD's Environmental Sustainability Committee to the rail carrier to ensure corrective action is taken.

An air quality monitoring program has been proposed to provide real-time air quality and meteorological data during construction and operations from two monitoring locations: one located on FSD's site and another off site in the general vicinity of the nearest residential receptor location, as indicated in Figure 5-4.

The meteorological station will include an anemometer, rain gauge and temperature/relative humidity sensor. A pre-project baseline monitoring program is proposed to sample particulate matter, dustfall and NO_2. The monitoring will continue through the construction period.

Dust complaint management forms and dust complaint management tracking has been developed for community input during construction and operation of the Project. Information regarding the management program will be made available via FSD's website.

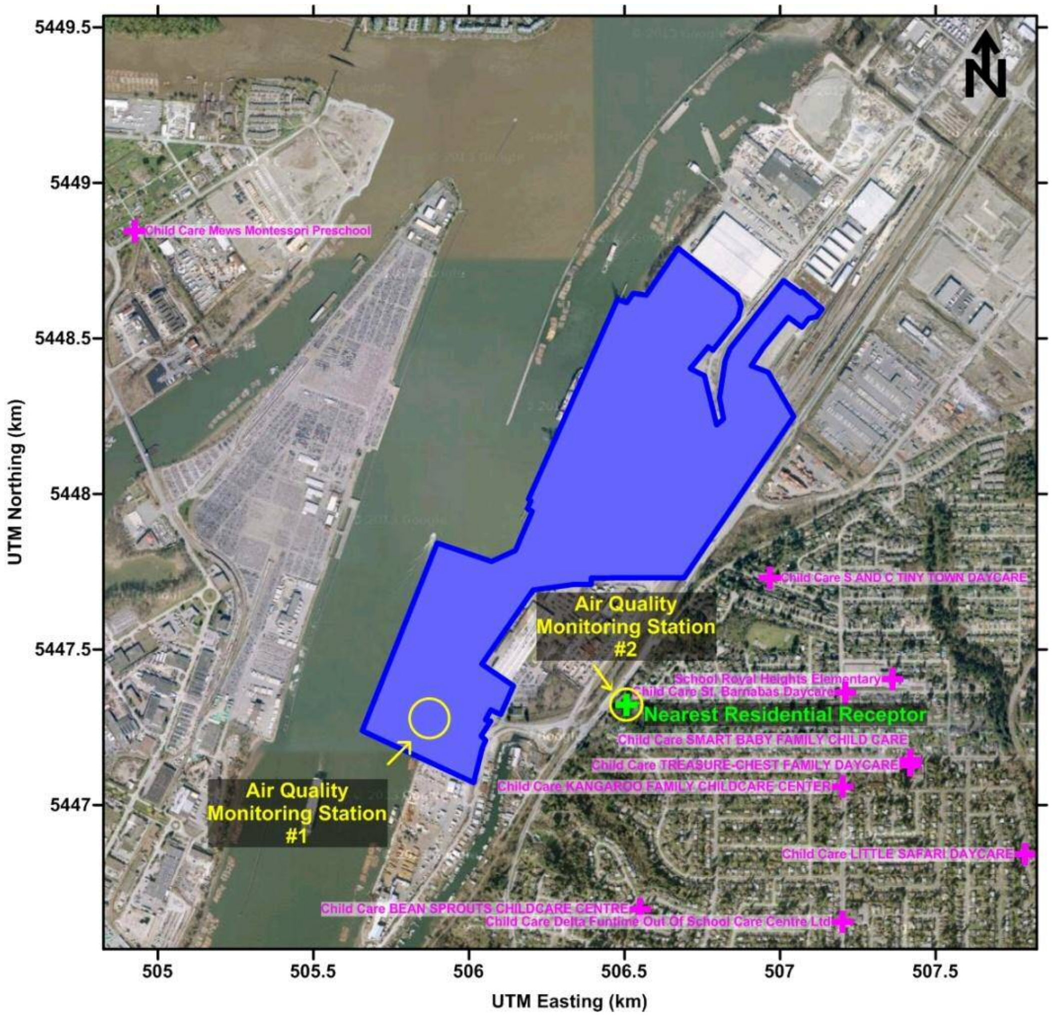


Figure 5-4: Proposed Air Quality Monitoring Locations

5.2.5 Potential Effects and Mitigation

The effects of coal dust and fugitive dust emissions are identified as potential environmental health concerns (Section 7) during the construction and daily operations of the Project / Facility.

Major pollutants identified from construction and demolition activities include particulate matter as a high priority environmental risk (Cheminfo, 2005). Possible construction activities that may result in fugitive dust include; excavation, pile driving, sand blasting, clearing, grubbing, aggregate handling, stockpiling, crushing, grading, compacting, paving, demolition, and the use of construction vehicles (Levelton, 2013b).

During operation, contributing emissions sources identified largely include areas where coal is in transit (VanHook, 2012). Fugitive dust emissions from operational activities include rail transit, rail cars within the rail yard, coal receiving pit, material handling by conveying system, loading coal on barges, coal on barges while at the berth, and coal barges in transit. Combustion emissions from operation activities include rail and tug emissions. Table 5-1 below summarizes the emission sources related to the Project and Table 5-2 summarizes the emission sources related to the agricultural handling operations considered in the assessment.

Other sources of air emissions include operation of marine vessels, non-road engines, building heating, diesel fuel combustion, heavy- and light-duty vehicles, industrial facilities, and front end loaders (Metro Vancouver, 2012 and Triton, 2013a).

Table 5-1: FSD Project Emission Sources

Air Contaminant	Contributing Emissions Sources
CO	Combustion Sources: *Tug boats and locomotives*
NO_2	Combustion Sources: *Tug boats and locomotives*
SO_2	Combustion Sources: *Tug boats and locomotives*
PM_{10}	Combustion Sources: *Tug boats and locomotives* Fugitive Dust Sources: *Rail and Barge transit, rail cars within the rail yard, unloading of rail cars, movement of coal through the facility, loading of coal onto barges, and coal on barges at the berth.*
$PM_{2.5}$	Combustion Sources: *Tug boats and locomotives* Fugitive Dust Sources: *Rail and Barge transit, rail cars within the rail yard, unloading of rail cars, movement of coal through the facility, loading of coal onto barges, and coal on barges at the berth.*
Total Suspended Particulate (TSP)	Combustion Sources: *Tug boats and locomotives* Fugitive Dust Sources: *Rail and Barge transit, rail cars within the rail yard, unloading of rail cars, movement of coal through the facility, loading of coal onto barges, and coal on barges at the berth.*

Table 5-2: FSD Agricultural Operation Emission Sources

Air Contaminant	Contributing Emissions Sources
CO	Combustion Sources: *Front-end loaders*
NO_2	Combustion Sources: *Front-end loaders*
SO_2	Combustion Sources: *Front-end loaders*
PM_{10}	Combustion Sources: *Front-end loaders* Fugitive Dust Sources: *Rail unloading, headhouse, storage shed, material transfer, and ship loading.*
$PM_{2.5}$	Combustion Sources: *Front-end loaders* Fugitive Dust Sources: *Rail unloading, headhouse, storage shed, material transfer, and ship loading.*
Total Suspended Particulate (TSP)	Combustion Sources: *Front-end loaders* Fugitive Dust Sources: *Rail unloading, headhouse, storage shed, material transfer, and ship loading.*

5.2.5.1 Mitigation

Mitigation measures for the construction and operation of the Project are in line with relevant legislation, regulation, guidelines, objectives, and standards (refer to Section 1.3: Jurisdiction and Regulatory Framework).

Details of mitigative measures are identified in detail in *Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* (Cheminfo, 2005), found in Appendix VI.

Construction Mitigation
Fugitive dust mitigation measures during construction include:

- Comprehensive water-based dust suppression system;
- Grade the construction site in phases, timed to coincide with the actual construction in that area;
- Start linear construction at the location that is upwind from the prevailing wind direction;
- Minimize the amount of clearing required to conduct the works;
- Minimize generation of road dust (e.g. minimize the time that unpaved surfaces are exposed and use watering and/or sweeping);
- Use wind fencing in construction areas that are frequently subjected to high winds;
- During dry conditions and when necessary, control dust sources (e.g. minimize the time that unpaved surfaces are exposed, water or cover potential dust sources, sweep paved surfaces);

- As necessary, use environmentally acceptable dust suppressants or water to control dust on access roads, lay-down areas, work areas, and disposal areas;
- Prefer the use of water for dust control, with consideration for water conservation, drainage and sediment control where appropriate;
- Do not use oils for dust control;
- Stabilize surfaces of completed earthworks and/or base areas with vegetation, stones, geotextile, mulch or other erosion resistant cover;
- Compact distributed soils;
- Reduce activities that create fugitive dust during windy conditions;
- Control mud and dirt track-out from construction sites;
- Minimize drop height at material transfer locations (e.g. when loading soil onto haul trucks);
- Prohibit burning as a means of disposal of any organic or construction materials;
- Maintenance of the facility, including daily cleaning is proposed to reduce the build up of dust that could become a source of sediment during rain events (Triton, 2013a);
- Diesel particulate filters should be used on all construction equipment capable of supporting their use;
- Covered vehicles are required when transporting bulk fine materials to the Project area;
- Paved areas to be cleaned on a routine basis to prevent accumulation and mobilization of dust;
- Site-specific worker education programs to address:
    a. Idling reduction (automatic anti-idling shut-off where feasible)
    b. Operation of equipment at optimum rated loads
    c. Routine equipment inspection and maintenance
    d. Daily inspections to identify dust and equipment exhaust issues
- Use of 2003 model or later equipment and vehicles;
- Compliance with Canada-wide Standards (CWS) for air quality, particularly 'Annex A' during construction and operation;

- Ongoing assessments of the potential for dust generation and combustion emissions; and
- Limiting vehicle speeds to 15 km/h on unpaved road surfaces, and completion of visual inspections dust and exhaust emissions during construction alongside real-time air quality monitoring.

Operational Mitigation

The operational mitigation identified here has been drawn from the draft AQMP (Levelton, 2013b) in Appendix VIII). Industry best practice was considered, where practical, throughout the Project design and operational plans. Also refer to Table 6-1 of the draft AQMP for Terminal Operation Process Mitigation Strategy. In addition to these mitigations, FSD has elected to seek out a Metro Vancouver Air Emissions Permit and is currently in the process of providing additional information in support of the application.

General

Mitigation measures for terminal Operations processes include:

- Limiting rail traffic speed to 5 km/h;
- Use of alternating current (AC) locomotives equipped with Variable Frequency Drives (VFD) for coal transit;
- Rail carriers to follow anti-idling policy and locomotive shut-down procedures (Appendix III);
- Contractor commitments to use recommended dust control measures for loading coal and coal transit;
- Use an electric positioner (indexer) to position rail cars over bottom dump receiving pits;
- Water (with chemical dust suppression)/mist system used to spray coal during the unloading and coal handling processes on site;
- Covered receiving pits (except entry/exit points);
- Spraying of empty cars to remove remaining coal after leaving the dumper pit enclosure;
- Minimal drop heights and curved chutes will be implemented at transfer points;
- Enclosed conveyor system equipped with water and chemical agent spraying nozzles';
- Mechanical profiling of coal in conveyors to limit exposure to air flow; and
- Mechanical winching system will be used to warp barges along the berths during loading.

<u>*Dust Suppression*</u>

To minimize fugitive coal dust at FSD, water (with chemical dust suppression) will be delivered to the coal handling area through a combination of misting sprays, large nozzle sprays, large volume sprays, and/or agricultural sprinkler piping. FSD will use either recycled coal drainage wastewater or freshwater for dust suppression on site to wet down, as required:

- Barges;
- Coal conveyor transfer points;
- Receiving building pits; and
- Railcar, equipment, and pavement cleaning.

Upon feedback from stakeholders, further review of options for fugitive dust was carried out and improvements were made by including chemical topping and binding agents to reduce coal dust emissions from rail and barge movements (FSD, 2013b and FSD, 2013c).

Dust control on rail will be applied by BNSF and the mine site operators. The topping agents used are listed in Table 2-2. Dust control on the rail will consist of:

- Applying ‘body agent’ **at the mine site** to help bind coal particles to reduce dust losses;
- Addition of a secondary ‘body agent’ as required to reduce coal oxidation;
- Profiling the coal when loaded into ‘bread loaf shape’ to prevent wind erosion (ESL, 1985);
- Addition of ‘topping agent’ when coal is loaded into the railcar at the mine site to act as a sealant to prevent dust losses;
- Reapplication of ‘topping agent’ approximately **at midpoint of the rail movement from the mine site to FSD** to address concerns regarding potential degradation of the topping agent during transit; and
- spraying empty railcars (with water) **at the FSD terminal** after unloading to ensure coal remnants are removed to prevent dusting during return trips to the mine site.

Proposed locations of water sprays and types of water sprays to be used for dust suppression during operations include the railcar dumper, railcar wash, spray bars on the coal conveyor, at transfer points, and at the coal barges once loading is completed (Omni, 2013).

To prevent fugitive dusting during barge transit and barge loading, dust control will consist of:

- Avoiding operation of barges in wind conditions greater than 40 km/h;
- Coating of coal with 'binding agent' and 'surfactant' during the barge loading process (through plumbed sprayers in the conveyor system); and
- Profiling coal when loading onto the barge to reduce wind erosion and turbulence.

Chemical agents will remain effective for the entire barge movement. As noted in Appendix II, GE (2013) has confirmed that the treatment process will reduce fugitive dust by approximately 90%.

Air Quality Management Plan (Draft)

The draft AQMP addresses air quality management requirements relating to construction and operation of the Project (Appendix VIII). Best management practices, within constraints of the Project, are identified for construction and operation of the Facility. Air quality monitoring and reporting commitments, effectiveness of proposed mitigation measures at the Facility and during coal transportation, and results of the air quality assessment and air quality impacts identified by Levelton (2013a) are discussed. The program includes:

- Visual Site Inspections;
- Air Quality Monitoring;
- Tracking / Complaint Management Systems;
- Quarterly Reporting; and,
- Public Website for Data Access.

5.2.6 Residual Effects, Determination of Significance and Proposed Monitoring

Based on the dispersion modelling assessment, the following conclusions can be made regarding potential emissions from the FSD proposed facility:

- Particulate matter emissions from fugitive dust sources are localized around the facility and predicted air quality impacts are generally low. Exceedences of the 24-hour PM_{10} objective were predicted at eight fenceline receptors near rail unloading operations. No particulate matter exceedences were predicted beyond the fenceline. With the mitigation planned for the facility the fugitive dust sources are predicted to have low impact on air quality in the area.

- There are predicted exceedences noted for 24-hour averaged PM_{10} and annual NO_2 when combining the impacts of the proposed Project, current agricultural goods operations, and ambient background concentrations. The predicted 24-hour averaged PM_{10} exceedences are located on the facility fenceline inland, while the predicted annual NO_2 exceedences are receptors located over the Fraser River. While the modelling results are likely to be conservative by nature, monitoring after facility commission is recommended to validate that air quality exceedences will not occur.
- For all air contaminants, the maximum concentrations were predicted to occur along the facility fenceline. The predicted air contaminant concentrations quickly diminish as emissions disperse further away from FSD's facility.
- Predicted air quality impacts at sensitive receptors and within residential neighbourhoods in the vicinity of FSD with the ambient background added are low and remain below all AAQOs.

Overall, Levelton (2013a) concluded that particulate emission impacts from fugitive dust sources will be localized around the facility and are predicted to have a low impact on air quality. The construction and operational activities are likely to result in localised air quality impacts. Construction related impacts are expected to be short-term and temporary, and can include fugitive dust and combustion emission from vehicles (Levelton, 2013b), which are typical of construction. Air quality impacts from traveling barges along the Fraser River were considered to be low to negligible (Levelton, 2013a).

Based on the above, the Project is unlikely to result in significant adverse residual effects on air quality.

Table 5-3: Air Quality Assessment Results All Sources (Project [4 MMTA] and Agricultural Handling Emissions)

Air Contaminant	Averaging Time	AAQO ($\mu g/m^3$)	Background ($\mu g/m^3$)	Location of Maximum	Maximum Concentration ($\mu g/m^3$)		Maximum Concentration + Background ($\mu g/m^3$)	
					Maximum Receptor	Nearest Residential Receptor	Maximum Receptor	Nearest Residential Receptor
CO	1-hour	30,000	687	Fenceline	121	38	808	725
	8-hour	10,000	615	Over Water	76	22	691	637
NO_2	1-hour*	200	67	Fenceline	109*	96*	109*	96*
	Annual	40	27	Over Water	13.1	2.1	40.1	29.1
SO_2	1-hour	450	8.3	Fenceline	0.7	0.2	9.0	8.5
	24-hour	125	5.9	Fenceline	0.1	0.0	6.0	5.9
	Annual	30	1.6	Over Water	0.0	0.0	1.6	1.6
PM_{10}	24-hour	50	26.8	Fenceline	28.0	5.5	54.8	32.3
	Annual	20	12.0	Over Water	4.2	0.4	16.2	12.4
$PM_{2.5}$	24-hour	25	11.3	Fenceline	6.8	1.6	18.1	12.9
	Annual	8 (6)	4.1	Over Water	1.1	0.1	5.2	4.2
TSP	24-hour	120	N/A**	Fenceline	77	16.8	N/A	N/A
	Annual	60	N/A**	Over Water	12.5	13	N/A	N/A

* The Ambient Ratio Method (ARM) has been applied to the 1-hour NO_x results which includes background in the calculation as per the BC Air Quality Modelling Guidelines.
** Background data is not available for TSP.
- On site chemical suppression considers (*rail unloading, material transfer points and loading into the barges*).

5.3 Soil

5.3.1 Existing Conditions

The Project area is human-dominated and currently developed for industrial and urban use. Terminal infrastructure was constructed at location in 1930 and FSD has been in operation since 1962. Little to no natural cover exists; however, where there are areas in the Project footprint that are semi-permeable or permeable the soil landscape can be described as Humo-Ferric Podzolic where the mode of deposition of the parent material is marine (HectaresBC, 2013). The soil surface material is mineral and is described as moderately well drained.

Podzolic soils are typically found on sandy deposits in areas where the mean annual precipitation is greater than 700mm (VSM, 2013). They are forest soils capable of sustaining coniferous plant communities. Podzols have a B horizon consisting of humified organic matter, aluminum and iron.

5.3.2 Potential Effects and Proposed Mitigation

Industrial land use dominates the Project area. Local businesses include, among others, steel suppliers, an intermodal rail yard, a manufacturing facility for fire suppressants, and rail service providers. The Project is located in an Urban and Industrial land use zone (Figures 6-1 and 6-2, Socio-economic Effects Section). The Project is confined to the existing footprint of FSD and the adjacent PARY. Given the existing soil conditions of the property, the effects on soil are considered to be negligible to low; however, there is the potential to encounter contaminated soil during the construction of the Project.

Addition potential effects on soil during the construction and operation of the proposed Project may include:

- Contamination of soil due to an accidental spill of hazardous material such as fuel, oil, lubricant during construction or operation.
- Erosion of soil stockpiles during as a result of improper installation of sediment and erosion controls.
- Contamination of soil from an accidental spill of untreated wastewater during operation.

5.3.2.1 Mitigation

The EMP contains a Soil Management Plan (SMP) to mitigate for any potential effect of the Project during construction and operation. The plan proposes to characterize the soils during construction, both in the ASHROSS[2] receiving pit excavation and in the proposed dewatering pits to ensure the absence of surficial contamination these locations (Triton, 2013a). This will minimize the risk of moving potential contamination further into the soil profile by ongoing discharge.

Non-native fill will be removed from the discharge pits to expose the underlying sands. These sands will be sampled for metals and hydrocarbons at a minimum, to confirm the absence of contamination prior to discharge. The SMP will also focus on appropriate storage of suspect and non-suspect soils and on characterizing excavation spoil destined for off site disposal.

In the event contaminated soils are encountered during excavation or in the event of a hazardous material spill to soil, the following mitigation measures and management strategies will be implemented:

- Segregate suspect or known contaminated soils. Segregated soils should be placed onto an impermeable surface and protected from the elements to prevent rain splash erosion or wind losses and subsequent contaminant migration.
- Contact the Environmental Monitor to arrange for soil sampling to identify required disposal options. The monitor will collect samples consistent with the methods outlined in the MoE Technical Guidance on Contaminated Sites 1: Site Characterization and Confirmation Testing (MoE, 2009). On the basis of these results, soils will be classified and relocated or disposed of consistent with the requirements of their classification.
- Ensure confirmed contaminated soils are taken off site by a licensed hauler and deposited at a licensed facility.

5.3.3 Residual Effects, Determination of Significance and Proposed Monitoring

Given current land uses and the limited amount of natural cover, in addition to the mitigation measures identified above, effects on soil and sediment quality due to Project construction and operation are not anticipated.

5.4 Surface Water and Groundwater

This section discusses the local tributaries of the Fraser River and groundwater within the vicinity of the Project. The potential ecological effects of coal dust on the Fraser River are discussed in Section 7.3. The potential effects of fish and fish habitat are discussed in Section 5.5.

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[2] ASHROSS is a patented specific unloading station and method for unloading bulk material from a moving railcar with bottom discharge.

5.4.1 Existing Conditions

5.4.1.1 Surface Water

The Project is located within the Lower Fraser Watershed extending from Hope, BC to the mouth of the river which is approximately 34 km from FSD. The FVRD and Metro Vancouver are located in this watershed which has the highest population density in the entire Fraser River System (FBC, 2013).

Watercourses in the vicinity of the Project are minor tributary streams draining into the Fraser River (including Gunderson Slough). The streams at their lower reach have been highly modified from their natural condition in terms of drainage patterns and water quality due to the degree of urbanization in the immediate area. The surface flows for these watercourses into the Fraser River are mainly through drainage channels and culverts. Road run-off is a contributor to surface flow at the lower reaches.

The City of Surrey (1995) classifies their watercourses on the basis of salmonids habitat value. Fish presence, duration and source of water and surrounding vegetation potential are criteria used to rate the value of the watercourse. **Red-dashed watercourses** are inhabited in the overwintering period. **Yellow-coded** indicates the watercourse is significant food/nutrient value and no fish presence. **Red-coded watercourses** indicate that salmonids are present or potentially inhabited year round. **Green-coded watercourses** are non-fish bearing and provide insignificant nutrients and flow downstream.

Local watercourses in the vicinity of the Project are minor tributaries of the Fraser River. They include Shadow Brook, Unnamed green-coded watercourse at the Bekaert property, Colliers Canal, Manson Canal in Surrey (Figure 5-5). Shadow Brook and an unnamed green-coded watercourse at the Bekaert property are directly affected by the Project during construction.

Triton (2013b) also identified watercourses adjacent to the railway ROW of the PARY including: an Unnamed yellow-coded/class B ditch, and an Unnamed red-coded ditch Tributary to Armstrong Creek. The City of Surrey has a watercourse classification system to rate streams based on their value as salmonids habitat. These are discussed further in Section 5.5, Fish and Fish Habitat.

Shadow Brook is located in between Elevator Road and Robson Road in a proposed area of new track running alongside Elevator Road (Figure 5-5). This drainage has been classified as red-coded. A review of the survey drawings indicate the new track alignment will not require the relocation of the Shadow Brook channel, although there will be some encroachment (<100 m^2) into the riparian zone.

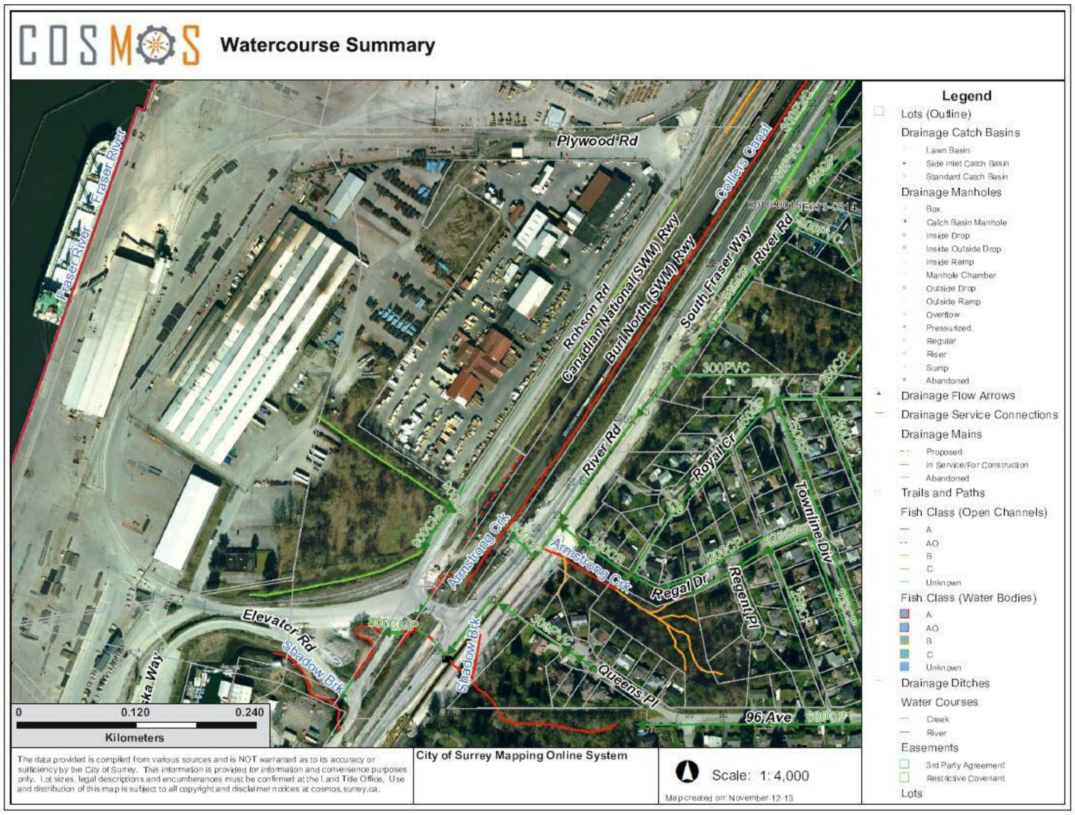

Figure 5-5: Watercourse overview (COSMOS, 2013)

In September 2012, Triton (2012a) conducted a watercourse assessment at Shadow Brook west of Robson Road, and the unnamed green-coded watercourse at the Bekaert's property. Manson Canal, Colliers Canal, the unnamed yellow-coded ditch, an unnamed green-coded ditch and an unnamed red-coded Tributary to Armstrong Creek were assessed by Triton in April 2013. The watercourse assessments consisted of the completion of Fish habitat site cards (RISC) and general description of associated riparian zones and watercourse characteristics.

The Triton (2012a) watercourse assessment is found in the FSD EMP (2012). The Triton (2013b) watercourse assessment is found in the PARY EMP (2013). Both the PARY and FSD EMPs can be reviewed in Appendix VI.

Shadow Brook had an average channel width of 1.81 m (n=12) and an average wetted width of 1.65 m (n=12). The substrate was largely fines with occasional gravels. Functional large woody debris (LWD), boulder, and cut bank cover were absent from surveyed areas. Riparian cover included Himalayan blackberry (*Rubus armeniacus*), red alder (*Alnus rubra*), reed canary grass (*Phalaris arundinacea*), and horsetail (*Equisetum* sp.).

The **unnamed green-coded ditch at the Bekaert's property** had an average channel width of 2.37 m (n=6) and an average wetted width of 1.7 m (n=6). Like Shadow Brook, the substrate was dominated by fines, and lacked LWD, boulder, and cut bank cover. Instream vegetation included duckweed (*Lemna minor*), cattail (*Typha latifolia*), and plantain (*Alisma* sp.). Riparian species included Himalayan blackberry, evergreen blackberry (*Rubus laciantus*), reed canary grass, hardhack (*Spiraea douglasii*), fireweed (*Epilobium angustifolium*), nightshade (*Atropa belladonna*), and black cottonwood (*Populus trichocarpa*).

Table 5-4 summarizes the stream characteristics of Shadow Brook and the unnamed green-coded watercourse at the Bekaert's Property.

Table 5-4: Summary of stream characteristics from Triton (2012a)

Parameter	Unnamed green-coded watercourse	Shadow Brook
Avg channel width (m)	2.37	1.8
Avg wetted width (m)	1.7	1.65
Avg Bankfull depth (m)	0.59	0.43
Avg res pool depth (m)	0.10	0.22
Avg slope %	1	1
pH	8.11	7.9
Temperature	13.1	12.65
Bed material	Fines (g)	Fines (g)
Dominant cover	Overstream vegetation	Overstream vegetation

Manson Canal had an average channel width of 8.9 m (n=6), an average wetted width of 6.4 m (n=6), and an average residual pool depth of 0.69 m. The substrate in the stream was dominated by gravel with cobble and sands subdominant. Available rearing cover for fish included: boulders, undercut banks, deep pools and overhanging vegetation (Table 5-5).

Colliers Canal had an average channel width of 4.4 m (n=6), an average wetted width of 4.2 m (n=6), and an average residual pool depth of 0.79 m (n=6). Bed material was dominated by gravel with cobble and sands subdominant. Cover was generally limited to overhanging and in-stream vegetation.

The **Unnamed Class B drainage** had an average channel width of 3.7 m (n=6) and an average wetted width of 1.8 m (n=6). Substrate was dominated by fines with some gravel. Available cover was generally limited to overhanging and in-stream vegetation.

The **green-coded ditch on Elevator Road** had an average channel width of 2.3 m (n=6) and an average wetted width of 1.3 m (n=6). The substrate consisted of fines with limited gravels. Instream vegetation was dominant.

The **red-coded Tributary to Armstrong Creek** was dry at the time of survey (fall and winter) with an average channel width of 1.0 m (n=6). The channel was poorly defined in most areas and the substrate consisted of fines– with limited to no evidence of scour observed throughout most of the surveyed length. This drainage is typically dry, as evidenced by terrestrial plants in much of the channel. However, backwatering occurs during heavy rain events. Based on field observations, the water depth in this drainage is generally ≤0.15 m, with periodic areas ≤0.35 m.

Table 5-5: Summary of Stream Characteristics from April 2013 watercourse assessment (Triton, 2013b)

Stream	Avg channel width (m)	Avg wetted width (m)	Avg res pool depth (m)	Avg slope (%)	pH	Temperature	Bed Material	Dominant Cover
Manson	8.92	6.35	0.69	1	6.50	12.9	G/C	DP
Colliers	4.43	4.18	0.79	1	6.57	13.1	G/C	IV
Unnamed Class B	3.65	1.76	-	1	6.50	12.5	F	IV
Unnamed Green Coded Ditch	2.26	1.32	-	1	6.53	12.0	F	IV
Red coded tributary	1.00	-	-	1	-	-	F	IV

IV – instream vegetation, DP – deep pools, G/C – gravel / cobble, F/G – fines / gravel

5.4.1.2 Groundwater

FSD is aligned over the Fraser River Junction Aquifer (DataBC, 2013), which is estimated at 9 square kilometres (km^2). The aquifer is shallow and unconsolidated, comprising of sand and gravel deposits (Figure 5-6). The aquifer is classified as IIIB by the MoE (2013a), referring to the level of development and vulnerability to contamination. Aquifer Class IIIB denotes the aquifer demand is low relative to productivity and is moderately vulnerable to contamination from surface sources. The Fraser River Junction Aquifer is not a local source of drinking water.

The Newton Upland Aquifer is an upland sand and gravel aquifer underlying Surrey (Figure 5-6). The aquifer is directly adjacent to the Project on the east side of River Road/South Fraser Way. The aquifer estimated areal extent of the Class IIIC aquifer is 137.4 km^2. MoE (2013a) describes the Newton Upland Aquifer as an aquifer that is lightly developed (low demand relative to productivity), with low vulnerability to contamination.

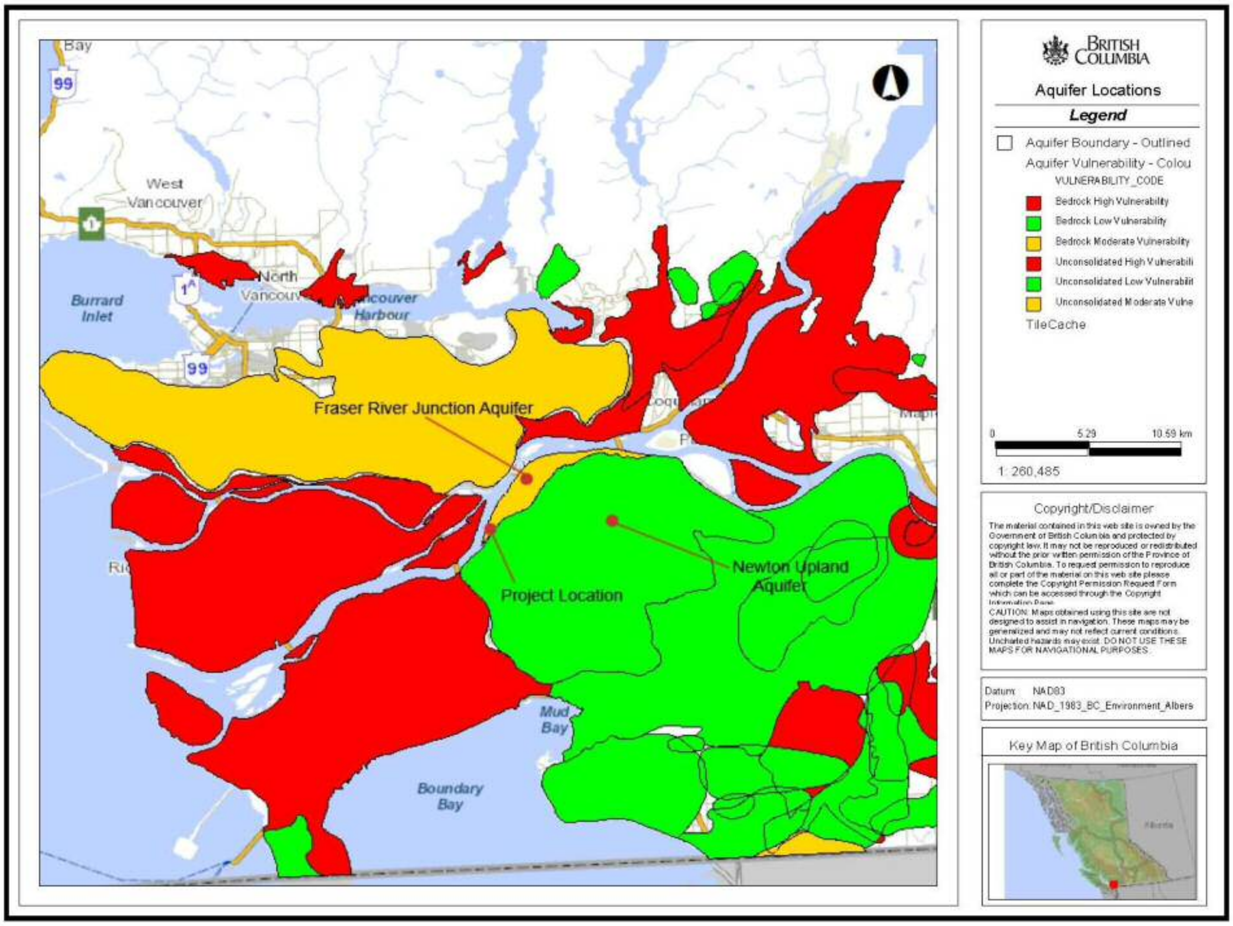

Figure 5-6: Aquifer Locations (DataBC, 2013)

5.4.2 Potential Effects and Proposed Mitigation

The potential effects on surface and groundwater during the construction and operation of the proposed Project may include:

- The introduction of hazardous material such as gasoline and diesel fuel, hydraulic fluids or lubricant into local watercourses during construction or operation. Other examples of hazardous materials that are most likely to be associated with the project include: dry concrete products and concrete wastewater, solvents and waste oils.
- Sedimentation of existing watercourses during site preparation and clearing, grading or other construction works.

- Accidental spill of unburned coal product, untreated wastewater or chemical additives (i.e., binding agents) into local watercourses during rail operation.
- Contamination of groundwater in the event of an accidental release of untreated wastewater through accidental spill on permeable soil within the Project boundaries.

The ecological effects of coal and coal dust on the aquatic environment refer to Section 7.3.

The installation of new rail, infilling of watercourses and changes to infrastructure will permanently affect Shadow Brook, the unnamed green-coded watercourse at Bekaert and the red-coded Tributary to Armstrong Creek and resulting in an approximate loss of 0.10 hectares (1027 m^2) of aquatic and riparian habitat.

No wetted losses are anticipated at Shadow Brook based on current design plans; however, up to 87 m^2 of riparian loss may occur to accommodate track relocation (Triton, 2012b).

The installation of a new switch will require infill of up to 63 m^2 of the Tributary to Armstrong Creek and approximately 502 m^2 of fragmented riparian cover.

The proposed crossing of a green-coded drainage ditch at the Bekaert site is expected to result in riparian loss of up to 270.25 m^2 of mostly introduced plant species, mainly Himalayan blackberry (Triton, 2012b). In addition, up to 113 m^2 of native substrates, of mostly fines and organics, would be lost as a result of the crossing. The crossing would accommodate a new driveway access into the Bekaert's site, the bulk of which will be constructed in the existing track alignment. Culvert installation at this drainage will have limited wetted habitat impacts given the marginal habitat values at present.

5.4.2.1 Mitigation

FSD has prepared construction and operation management plans for the Project to address for potential surface water quality and groundwater quality impacts. The management plans will address the following:

- Construction:
  - Surface Water Quality;
  - Sediment Control;
  - Hazardous Materials Management; and
  - Spill Response.
- Operation:
  - Run-off Management;

- Water Treatment;
- Water Quality Monitoring; and
- Emergency Spill Prevention and Response.

Construction mitigations measures to address surface and groundwater impacts described in the management plans (Triton, 2013a) are as follows:

Surface Water Quality and Sediment Control

- Catch basin protection will be installed prior to construction in the Shed 1 working areas and adjacent to truck routes supporting construction at the Shed 1 site.
- Excavation discharge will be directed to in-ground pits specifically created to manage turbid excavation waters, and/or concrete contact waters. These pits will be excavated prior to other works beginning on site.
- Daily site cleaning will be conducted to prevent a build-up of dust that could become a source of sediment during rain events. Similarly, site cleaning will be conducted as needed during the wet season to prevent mud tracking.
- Potentially restricting selected excavation works during inclement weather.
- Inactive soil stockpiles will be located away from catch basins and will be securely covered to prevent wind losses on dry days and rain- splash erosion of wet days.
- BC *Water Ac*t, Section 9 approval or notification will be obtained from BC Ministry of Forests, Lands and Natural Resource Operations prior to any in-stream works commencing during the construction phase.
- On site riparian restoration works to compensate for encroachment into the riparian zone at Shadow Brook.
- Erosion and sediment controls and hazardous materials management will be implemented during works at Shadow Brook to avoid damage to non-target vegetation in the riparian zone.
- Equipment storage and maintenance, fuelling and other activities will not be permitted within 15 m of Shadow Brook.
- Machine access will also be restricted in the riparian zone to the extent feasible.

Environmental Monitoring

- An environmental monitor will visit the site at least once weekly during construction to evaluate the effectiveness of mitigation measures. A water quality sampling program will be conducted in support of the excavation discharge program. FSD is proposing to collect groundwater from excavation areas and discharge it into separate in-ground infiltration pits.
- To ensure groundwater from the nearby Bekaert's site is not being mobilized into FSD's work area, excavation discharge water quality will be monitored for the following parameters:
  - pH (in situ);
  - Dissolved metals (analytical);
  - Conductivity (in situ); and
  - Total dissolved solids (TDS) (in situ).
- The parameters (the in situ parameters in particular) have been selected because they will indicate changing ground water quality. If changes are observed, excavation collection and discharge strategies may be modified. Note that if discharge is observed leaving the site then turbidity and/or total suspended solids (TSS) will be measured along with the parameters listed above at the point of discharge.

Hazardous Materials and Spill Response

- Preparing inventories of chemicals that will be used, or have the potential to be used on site. Inventories should include anticipated volumes and types of materials and MSDS.
- Providing storage and general guidelines for use of hazardous materials.
- Conducting an overview assessment of risks associated with spills of known hazardous materials used in working areas. This requires the contractor to evaluate the potential hazards of working with specific chemicals, in association with a particular task, in a particular area.
- Developing and posting spill prevention plans. Such plans would include guidelines for daily use and overnight fuel storage, as well as designated waste storage areas for oils, solvents, concrete and other potentially hazardous products. These plans also include guidelines for managing suspect or known contaminated materials.
- Developing and posting spill preparedness and response plans for chemicals in use on site. These plans should include, at a minimum, information on appropriate spill response equipment, communications and response plans.

- Outdoor storage will be secured when unmanned, and storage of hazardous or potentially hazardous materials will ideally be arranged so that stored products are away from vegetated areas and there is ≥6 m between stored products, uncontrolled grasses or weeds, and fuel dispensers.
- Storage areas and containers will be regularly inspected for leaks, poor condition, inadequate seals and other problems that may result in the spill or release of a hazardous substance.
- Personnel will read and follow the directions for all products, and have easy access to MSDS for all hazardous material on site.
- Products will be stored in their original containers and their labels maintained in good condition; labels should be protected with transparent tape as necessary.
- As needed and where safe to do so, a correctly sized funnel will be used to transfer hazardous materials from one container to another.
- Personnel will avoid mixing chemicals unless specified by the manufacturer, and will use chemicals as specified on labels, in well- ventilated areas.
- Re-useable or recycled degreasers will be used where possible or appropriate to machinery and equipment.
- Daily inspections of machinery for leaks, cracked hoses and other conditions that may result in spills. Contractors will ensure external equipment surfaces are free of oil, diesel and other potential contaminants prior to use.
- Routine inspections of storage areas and containers for leaks, poor condition, improper seals and other problems that may result in the release of a hazardous substance.
- Storage of daily use fuels, lubricants and other chemicals over impermeable areas and/or in lined, leak proof containers. Temporary covers will be used as needed to prevent rainfall from pooling in daily use storage containers.
- Daily use chemicals will be stored on site in a locked container or will be taken off site at the end of each day.
- Fuelling and equipment maintenance will be undertaken ≥30 m away from all permanent drainages.

- Written procedures for the proper use and storage of chemicals will be provided consistent with the potential risks associated with each chemical, anticipated frequency of use and any special handling requirements.
- Spill kits will be available on site and restocked after use. Details on spill preparedness and response will be provided in the Project EMP.

Operation mitigations measures to address surface and groundwater impacts described in the management plans (Triton, 2013a) are as follows:

Run-off and Stormwater

- Installation of the storm water management / dust control / sprinkler systems.
- During dry periods, water used on site would be treated and re-directed back into the system.
- During wet periods, excess water would require treatment and periodic off site discharge (under permit).
- A monitoring program will be in place and emphasize in situ measurements of pH, temperature, turbidity / TSS, specific conductivity, TDS, dissolved oxygen (DO) and oxidation reduction potential (ORP). These data will be compiled and maintained by operations personnel to evaluate site and system performance.
- Contain and treat all wastewater within the process area before discharge.
- Ensure that all discharged wastewater consistently meets Metro Vancouver criteria for suspended solids and oil/grease before discharge and/or criteria established by the provincial MoE.
- Minimize the amount of wastewater that needs to be treated and discharged by recycling it as much as possible for use in dumper flushing, railcar wash system, and application to the coal on the belts and at transfer points.

Water Quality Monitoring

- At a minimum, the monitoring program will emphasize in situ measurements of pH, temperature, turbidity / TSS, specific conductivity, TDS, DO and ORP. These data will be compiled and maintained by operations personnel to evaluate site and system performance.

Emergency Spill Prevention and Response

- Spill prevention will be addressed throughout the operation, through routine inspections and maintenance of the track, receiving pits and conveyors.
- The entire offloading operation will be manned from the time trains arrive on site to the time the loaded barges leave the site. Prior to the trains arriving on site, personnel will ensure all parts of the system, (including emergency response systems) are functioning as intended.

5.4.3 Residual Effects, Determination of Significance and Proposed Monitoring

The majority of the proposed Project area (existing FSD terminal) is currently used for industrial purposes and has management plans in place to address water quality; however, the proposed Project will be handling a product that is not currently handled at the facility.

Wastewater containing coal will be generated on site in the process areas (i.e., areas that may accumulate coal due to normal operations). FSD has designed a system that will collect coal wastewater separately from the overall site drainage system, in one of the two proposed gravity-driven settlement ponds, and where possible it will be recycled (i.e., re-used for flushing the dumper, rinsing rail cars, spraying conveyor belts, and general wash down).

During construction, the effects on water resources, Shadow Brook and the unnamed green-coded watercourse are not expected to extend beyond the Project footprint and will not last beyond construction. These watercourses in their current state (disturbed, channelized watercourses that receive run-off from the surrounding infrastructure) will not be impacted significantly by construction activity.

The construction impacts from sedimentation and introduction of hazardous materials into local watercourses, including the Fraser River, are expected to be mitigated if the environmental measures discussed above are implemented and monitored on a regular basis. No residual effects on water quality are anticipated during construction.

Wastewater from coal handling will be recycled through the water management system as much as possible during operation. In addition, stormwater quality will be monitored prior to discharge. With the implementation of management plans for water treatment, water quality monitoring, run-off and emergency spill prevention as well as the mitigation measures identified above, no significant residual effects on water quality, including the Fraser River are expected.

The effects on surface and groundwater are not expected to extend beyond the Project footprint, and will not last beyond construction. If the mitigation measures described in Section 5.4.2 are implemented, including water quality monitoring during construction and operation, it is expected that the potential effects on surface and ground water can be fully mitigated. No adverse residual effects are expected following the implementation of the proposed mitigation measures.

5.5 Fish and Fish Habitat

The following section provides a background on fish and fish habitat and discusses the potential effects of the Project during construction and operation. The measures to mitigate for the potential effects are also discussed.

5.5.1 Existing Conditions

5.5.1.1 Fish Presence in Local Watercourses and the Fraser River

The Lower Fraser River has a diverse and abundant fish population. iMapBC 2.0 (DataBC, 2013) and HectaresBC (2013) were accessed to compile a list of fish species documented on the Fraser River, and along the barge route to Texada Island in the Strait of Georgia. The list is not comprehensive (Table 5-6); however, 43 species of fish were documented, including six of seven salmonids species native to the Fraser River: Chum, Coho, Chinook, Sockeye, Pink, Cutthroat trout and Rainbow trout. Salmon are valued economically, socially and culturally in the Lower Mainland.

Table 5-6: Fish Observations on the Fraser River

Approximate Observation Location	English name	Latin Name
Fraser Surrey Docks	Chum salmon	*Oncorhynchus keta*
	Coho salmon	*Oncorhynchus kisutch*
	Cutthroat trout	*Oncorhynchus clarki*
	Rainbow trout	*Oncorhynchus mykiss*
	Sculpin	*Cottus* sp.
	Threespine stickleback	*Gasterosteus aculeatus*
	Stickleback	*Gasterosteus* sp.
Alex Fraser Bridge	Sockeye salmon	*Oncorhynchus nerka*
	White sturgeon	*Acipenser transmontanus*
	Prickly sculpin	*Cottus asper*
	Brassy minnow	*Hybognathus hankinsoni*
	Peamouth chub	*Mylocheilus caurinus*

Approximate Observation Location	English name	Latin Name
	Goldfish	*Carassius auratus*
Deas Slough/Massey Tunnel	Perch	*Perca* sp.
	Largescale sucker	*Catostomus macrocheilus*
	Northern pikeminnow	*Ptychocheilus oregonensis*
	Starry flounder	*Platichthys stellatus*
Mouth of Fraser River	Staghorn sculpin	*Leptocottus armatus*
	Redside shiner	*Richardsonius balteatus*
	Pink salmon	*Oncorhynchus gorbuscha*
	American shad	*Alosa sapidissima*
	River lamprey	*Lampetra ayresi*
	Dolly varden	*Salvelinus malma*
	Logfin smelt	*Spirinchus thaleichthys*
	Brown catfish	*Ameiurus nebulosus*
	Longnose dace	*Rhinichthys cataractae*
	Carp	*Cyprinus carpio*
	Eulachon (observed 1979)	Thaleichthys pacificus
	Mountain whitefish	Prosopium williamsoni
	Surf smelt	Hypomesus pretiosus
	Steelhead	Oncorhynchus mykiss
	Pygmy whitefish	Prosopium coulteri
	Chub	Squalius sp.
	Coastrange sculpin	Cottus aleuticus
	Pumpkinseed sunfish	Lepomis gibbosus
	Bridgelip sucker	Catastomus columbianus
	Northern mountain sucker	Catostomus platyrhynchus
	Slimy sculpin	Cottus cognatus
	Green sturgeon	Acipenser medirostris
	Kokanee	Oncorhynchus nerka

Approximate Observation Location	English name	Latin Name
	Spottail shiner	Notropis hudsonius
	Lake chub	Couesius plumbeus
	Emerald shiner	Notropis atherinoides
	Bull trout	Salvelinus confluentus

5.5.1.2 Fish Species with Special Status

The BC Conservation Data Centre (CDC) (MoE, 2013b) was accessed to obtain information on fish species at risk that are known to occur on the Fraser River and in the Strait of Georgia. There are 11 species protected under Schedule 1 of the federal *Species at Risk Act* (SARA). Twelve fish are red-listed and three are blue-listed in British Columbia. Fifteen species have been reviewed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and have been recommended for protection under SARA. See Table 5-7 for fish with special status.

Table 5-7: Fish Species with Special Status

Latin Name	English Name	BC List	SARA	COSEWIC
Acipenser transmontanus	White Sturgeon	No Status	1-Endangered (Aug 2006)	Endangered (Nov 2003)
Acipenser transmontanus pop. 4	White Sturgeon (Lower Fraser River population)	Red	-	Threatened (Nov 2012)
Catostomus sp. 4	Salish Sucker	Red	1-Endangered (Jan 2005)	Threatened (Nov 2012)
Gasterosteus sp. 2	Enos Lake Limnetic Stickleback	Red	1-Endangered (Jan 2005)	Endangered (May 2012)
Gasterosteus sp. 3	Enos Lake Benthic Stickleback	Red	1-Endangered (Jan 2005)	Endangered (May 2012)
Gasterosteus sp. 16	Vananda Creek Limnetic Stickleback	Red	1-Endangered (Jun 2003)	Endangered (Apr 2010)
Gasterosteus sp. 17	Vananda Creek Benthic Stickleback	Red	1-Endangered (Jun 2003)	Endangered (Apr 2010)
Gasterosteus sp. 4	Paxton Lake Limnetic Stickleback	Red	1-Endangered (Jun 2003)	Endangered (Apr 2010)
Gasterosteus sp. 5	Paxton Lake Benthic	Red	1-Endangered	Endangered (Apr

Latin Name	English Name	BC List	SARA	COSEWIC
	Stickleback		(Jun 2003)	2010)
Lampetra richardsoni pop. 1	Western Brook Lamprey (Morrison Creek population)	Red	1-Endangered (Jun 2003)	Endangered (Apr 2010)
Rhinichthys cataractae - Chehalis lineage	Nooksack Dace	Red	1-Endangered (Jun 2003)	Endangered (Apr 2007)
Acipenser medirostris	Green Sturgeon	Red	1-Special Concern (Aug 2006)	Special Concern (May 1987)
Spirinchus sp. 1	Pygmy Longfin Smelt	Red	-	Data Deficient (Nov 2004)
Oncorhynchus clarkii clarkii	Cutthroat Trout, *clarkii* subspecies	Blue	-	-
Salvelinus confluentus	Bull Trout	Blue	-	Special Concern (Nov 2012)
Thaleichthys pacificus	Eulachon (Pacific Coast Population)	Blue	-	Endangered (May 2011)

5.5.1.3 Fish Habitat

Watercourses in the vicinity of the Project are minor tributary streams draining into the Fraser River (including Gunderson Slough). The streams at their lower reach have been highly modified from their natural condition in terms of drainage patterns and water quality due to the degree of urbanization in the immediate area. The surface flows for these watercourses into the Fraser River are mainly through drainage channels and culverts. Fish habitat is available in these watercourses; however habitat values are variable.

The stream characteristics of the following watercourses have already been discussed in Section 5.4.1 in Surface Water. To minimize repetition, the following discusses only the fish habitat values that were determined through Triton assessments conducted in September 2012 and April 2013.

Shadow Brook (red-coded): No spawning habitat present. Rearing cover was limited with pools meeting at least one of the minimum size criteria using the provincial Fish Habitat Assessment Procedure (MoE, 1996) (residual depth of ≥0.20 m). Functioning LWD (e.g., to create scour pools or hiding cover) was absent, as was boulder/cobble cover. Riparian habitats were fragmented in both drainages and dominated by invasive plant species. This area does not provide critical fish habitat.

Collieries Creek (red-coded): Spawning habitat was moderate to low quality, with gravels present but containing some fines. Potential for rearing and migration habitat.

Manson Canal (red-coded): Available rearing cover for fish included boulder, undercut banks, deep pools and overhanging vegetation. Spawning habitat was ranked as moderate to low, as gravels were present but occurred with sands to varying degree.

Class B CN Right-of-Way ditch (yellow-coded): Substrate dominated by fines with some gravel. Potential nutrient source.

Green-coded ditch on Elevator Road: Substrate consisted of fines with limited gravel. Instream vegetation was dominant. No salmonids value.

Tributary to Armstrong Creek (red-coded): Spawning habitat was not available. Rearing habitat was poor overall, with no woody debris, pool or undercut. Dry, with terrestrial plants in much of the channel. Fish access possible, but would be at risk of stranding as water recedes.

Unnamed green-coded watercourse at the Bekaert property: No spawning habitat present. Rearing cover was limited. Functioning LWD (e.g., to create scour pools or hiding cover) was absent, as was boulder/cobble cover. Riparian habitats were fragmented in both drainages and dominated by invasive plant species. This area does not provide critical fish habitat.

5.5.2 Potential Effects and Proposed Mitigation

The potential effects on fish and fish habitat during the construction and operation of the proposed Project may include:

- Mortality of *fish, including at-risk species,* resulting from an accidental spill of hazardous material such as fuel, oil, lubricant into the aquatic environment during construction or operation.
- Mortality of *fish, including at-risk species,* resulting from an accidental spill of unburned coal product or untreated wastewater into the aquatic environment during operation.
- Mortality or disturbance of *fish, including species at risk,* from the effects of pile driving activity;
- Permanent loss of 0.10 hectares of aquatic and riparian habitat to accommodate new rail and infrastructure.
- Alteration, destruction or disturbance of *fish habitat* resulting from an accidental spill of hazardous material into the aquatic environment during construction or operation.
- Alteration, destruction or disturbance of *fish habitat* resulting from an accidental spill of unburned coal product or untreated wastewater into the aquatic environment during operation.

For a detailed discussion on the effects of coal in the aquatic environment refer to Section 7.3.

5.5.2.1 Mitigation

The mitigation measures described for surface water (found in Section 5.4.2) and Fugitive Dust Effects on Ecological Health (found in Section 7.3), also apply to minimizing and/or avoiding effects to fish and/or fish habitat during construction and operation.

Additional mitigation measures to address potential on fish and fish habitat are as follows:

Local Watercourses

- On site riparian restoration works at Shadow Brook to offset losses to riparian and aquatic habitat amounting to approximately 0.10 hectares as a result of track installation, in-filling of watercourses and infrastructure installation (Figure 5-7).

Construction in the Fraser River

- Steel Pile installation will be consistent with the *Best Management Practices for Pile Driving and Related Operations – BC Marine and Pile Driving Contractors Association* (BC Marine, 2003).
- Conferring with DFO (and other agencies with jurisdiction) to determine the preferred timing and methods of the pile driving program.
- For driving steel pipe piles that are >16“ in diameter, use a diesel hammer, air hammer, or similar powered hammer equipment.
- Pile driving should occur outside of the March 1 to June 15 sensitive period to protect juvenile salmon and eulachon (this timing restriction may not be imposed if it is unlikely that large rock may be encountered and if the appropriate mitigation measures to prevent 30 kilopascal (kPa) will be implemented).
- Maintaining emergency spill equipment available whenever working near or on the water.
- Positioning water borne equipment in a manner that will minimize damage to fish habitat. Where possible, alternative methods will be used (e.g. anchors instead of spuds).
- Vibratory pile driving is anticipated at Berth 2 and as a result, ongoing hydrophone monitoring is unlikely to be required by the regulatory agencies. FSD will commit to hydrophone monitoring at project start up, and on a selected basis thereafter (depending on site-specific

conditions and observations) to confirm pressure levels are ≤30 kPa at a distance of >1 meter from any pile being driven..

- Pile Driving Contractors will be required to prepare a detailed Pile Driving Plan (PDP) for submission to the Port and other agencies for review and comment. This plan will outline pile driving methodologies (vibratory installation anticipated), timing and mitigation measures in the context of site specific conditions and constraints.
- Depending on pile driving methodology and/or conditions encountered on site, mitigation measures may include bubble curtains and fish exclusion zones. The design of these measures will be discussed with the agencies prior to implementation.
- FSD and Lafarge will monitor designated fishing windows and, where possible, work to schedule barge traffic around those windows.

Uncontrolled releases to the aquatic environment during barge loading

- Spill prevention will be addressed throughout the operation, through routine inspections and maintenance of the track, receiving pits and conveyors.
- The entire offloading operation will be manned from the time trains arrive on site to the time the loaded barges leave the site.
- Prior to the trains arriving on site, personnel will ensure all parts of the system, (including emergency response systems) are functioning as intended.
- Prior to barge loading, personnel will confirm the barges are empty of debris and in good condition.
- FSD will require contractors submit maintenance and training records.
- Barge Loading Master Plans will be developed by the operators and submitted to FSD for review and comment.
- Barges will be double-hulled.

In the event of a spill to the Fraser River during barge loading, the following mitigation measures will be implemented:

- Operations will stop and the Director of Engineering and Maintenance (DEM), Site Superintendent, Unloading shed operator, Train conductor and the Port will be informed of the spill.

- Personnel will make an estimate of the volume released and, in consultation with DEM and Site Superintendent determine if the material can be effectively recovered. This will depend on a variety of factors including but not limited to tide level and volume released.
- In the event of a larger spill at the Berth, occurring for example if a barge door fails during filling, on site personnel in consultation with the DEM, Site Superintendent and the Port will determine if a suction dredge or similar needs to be mobilized to the spill site for recovery. Mitigation measures consistent with the Fraser River Estuary Management Plan (FREMP) guidelines for dredging would be applied to coal recovery in this context.
- Post spill (and clean up) water and sediment sampling would be conducted on site and in adjacent areas to determine the potential effects of the spill and ensure clean-up is completed consistent with the applicable provincial and federal guidelines and regulatory framework.

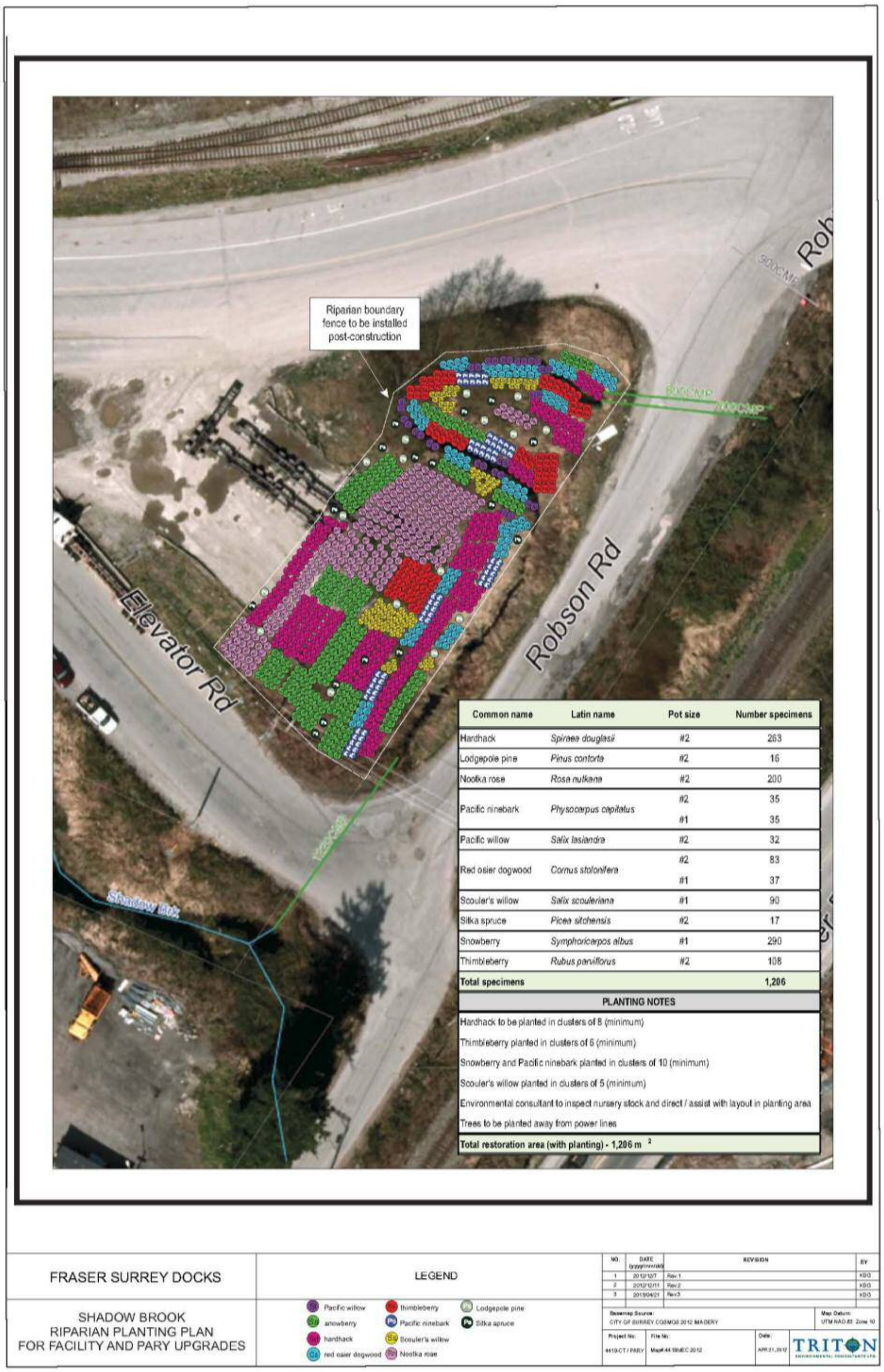

Figure 5-7: Draft Riparian Planting Plan (Triton, 2013c)

5.5.3 Residual Effects, Determination of Significance and Proposed Monitoring

The local watercourses that feed into the Fraser River are channelized at their bottom reach, often discharging to the Fraser River through culverts. Spawning and rearing opportunities for salmonids is limited and described as either not present or in low to moderate value. The watercourses in the local area are subject to run-off from the surrounding environment, which is mainly urban industrial. In addition, the channels are dominated by invasive plants such as Himalayan blackberry.

Any effects that may occur during construction, such as sedimentation or hazardous spill would be infrequent and localized as the Project will occur on the existing footprint of FSD and PARY.

With the implementation of sediment and erosion control measures, as well as good machinery operation and maintenance, the effects from construction on fish and fish habitat are negligible to low.

There is permanent loss of 0.10 hectares of aquatic and riparian habitat loss for which FSD has plans to re-plant native riparian vegetation on site. This planting plan is considered an improvement over existing conditions.

With respect to spills of coal into the aquatic environment during operation, trace elements and PAH in unburned coals proposed for handling at FSD would not be considered harmful to aquatic life because these constituents are generally not bioavailable under typical environmental conditions. For example, acidic pH (2.0 to 3.0) and basic pH (11.0) can result in leaching of selected metals from the coal matrix, however these conditions are not expected in the receiving environment. Additionally, the lower sulphur content (<1%) coal proposed for handling on site produces a more pH neutral run-off (Davis & Boegly 1981b, Tiwary 2001,Cook & Fritz 2002 in Ahrens and Morrisey, 2005), which would minimize leaching potential. Section 7.3 provides an in-depth discussion on the potential toxicity of unburned coal.

FSD is committed to the implementation of their Emergency Spill Prevention and Response Plan to address the unlikely event of a coal or hazardous spill into the local watercourses, Fraser River or Strait of Georgia. Given that standard operating procedures focus very highly on incident prevention and a spill into the aquatic environment is in the unlikely event of an accident scenario, residual effects on fish or fish habitat are not expected from the operation of the proposed Project.

5.6 Vegetation and Wildlife

The following section provides a background on vegetation and wildlife and discusses the potential effects of the Project during construction and operation. The section also identifies measures to mitigate for the potential effects.

5.6.1 Existing Conditions

5.6.1.1 Ecosystems and Vegetation

The Project is in the Coastal Western Hemlock Eastern Very Dry Maritime (CWHxm1) biogeoclimatic variant subzone (HectaresBC, 2013). The CWHxm boundary extends east toward Chilliwack on the south side of the Fraser Valley and west to the Sunshine Coast (MoTI, 2006). The low elevation of the Project location is characteristic of the CWH biogeoclimatic zone. CWHxm generally occurs below 700 m in elevation. Summers are generally cool, and the winters mild (CFCG, 2013). Twenty-six natural ecosystems have the potential to occur at or near the Project (HectaresBC, 2013); however, given the degree of development and existing land uses, the ecosystems listed in Table 5-9 are largely historical.

Anthropogenic habitat includes channelized watercourses and associated riparian habitat. Riparian habitat associated with these watercourses is predominantly invasive, including such species as Himalayan blackberry, regenerating red alder, hardhack, cattail and reed canarygrass.

Remnant ecosystems on the east side of River Road/South Fraser Way do exist on the Delta Ravine slopes (MoTI, 2006). These ecosystems are not directly affected by the Project footprint:

- western redcedar / sword fern Very Dry Maritime.
- western redcedar / three-leaved foamflower.
- lodgepole pine / peat-mosses.
- black cottonwood / red-osier dogwood

Table 5-8: Natural Ecosystems Present or Historically Occurring In or Near the Project (HectaresBC, 2013)

English name	Latin name
Black cottonwood - red alder / salmonberry	*Populus balsamifera ssp. Trichocarpa - alnus rubra / rubus spectabilis*
Black cottonwood / red-osier dogwood	*Populus balsamifera ssp. Trichocarpa – cornus sericea*
Black cottonwood / sitka willow	*Populus balsamifera ssp. Trichocarpa / salix sitchensis*
Common cattail marsh	*Typha latifolia marsh*
Common spike-rush	*Eleocharis palustris herbaceous vegetation*
Douglas-fir - lodgepole pine / grey rock-moss	*Pseudotsuga menziesii - pinus contorta / racomitrium canescens*
Douglas-fir / sword fern	*Pseudotsuga menziesii / polystichum munitum*
Douglas-fir - western hemlock / salal dry maritime	*Pseudotsuga menziesii - tsuga heterophylla / gaultheria shallon dry maritime*

English name	Latin name
Hardhack / sitka sedge	*Spiraea douglasii / carex sitchensis*
Henderson's checker-mallow tidal marsh	*Sidalcea hendersonii tidal marsh*
Hudson bay clubrush / rusty hook-moss	*Trichophorum alpinum / scorpidium revolvens*
Labrador tea / western bog-laurel / peat-mosses	*Ledum groenlandicum / kalmia microphylla / sphagnum spp.*
Lodgepole pine / peat-mosses very dry maritime	*Pinus contorta / sphagnum spp. Very dry maritime*
Lyngbye's sedge - douglas' water-hemlock	*Carex lyngbyei - cicuta douglasii*
Sitka sedge - pacific water-parsley	*Carex sitchensis - oenanthe sarmentosa*
Sitka spruce / salmonberry very dry maritime	*Picea sitchensis / rubus spectabilis very dry maritime*
Sitka willow - pacific willow / skunk cabbage	*Salix sitchensis - salix lucida ssp. Lasiandra / lysichiton americanus*
Slender sedge - white beak-rush	*Carex lasiocarpa - rhynchospora alba*
Sweet gale / sitka sedge	*Myrica gale / carex sitchensis*
Western hemlock - douglas-fir / oregon beaked-moss	*Tsuga heterophylla - pseudotsuga menziesii / eurhynchium oreganum*
Western hemlock - western redcedar / deer fern	*Tsuga heterophylla - thuja plicata / blechnum spicant*
Western redcedar / black twinberry	*Thuja plicata / lonicera involucrata*
Western redcedar / salmonberry	*Thuja plicata / rubus spectabilis*
Western redcedar - sitka spruce / skunk cabbage	*Thuja plicata - picea sitchensis / lysichiton americanus*
Western redcedar / slough sedge	*Thuja plicata / carex obnupta*
Western redcedar / sword fern very dry maritime	*Thuja plicata / polystichum munitum very dry maritime*
Western redcedar / three-leaved foamflower very dry maritime	*Thuja plicata / tiarella trifoliata very dry maritime*

5.6.1.2 Wildlife

HectaresBC (2013) lists 116 wildlife species that have been documented in Metro Vancouver (Appendix X); however, only a limited number of wildlife have been recently documented in or near the Project which is due to the high development and industrial activity. Little natural habitat remains to support the diversity of wildlife known found in the CWHxm biogeoclimatic zone. Species typically documented in this area include common wildlife such as (MoTI, 2006):

- Amphibians (such as northwestern salamander, green frog and bullfrog);
- Forest-dwelling migratory and resident songbirds birds in adjacent forest;
- Raptors (diurnal and nocturnal); and
- Mammals such as coyote and small mammals.

Non-native frogs such as green frog and bullfrog occur in local watercourses. These species are tolerant of conditions in anthropogenic channels that often have little habitat complexity, weed-dominated riparian zones and marginal water chemistry such as those at or near the Project.

Robertson Environmental Services Ltd. (RESL) completed a series of bird surveys to document avian diversity for the South Fraser Perimeter Road (SFPR) (MoTI, 2006). In areas near FSD, 29 migratory and resident songbirds were documented during the breeding season. Thirty-four species of songbirds, raptors and woodpeckers were documented in the winter.

Small mammal sampling and bat assessments were also conducted by MoTI (2006) near FSD. Small mammal results were not available; however there was no indication that species at risk, such as Pacific water shrew or southern red-backed vole, were captured. In addition, no bats were detected during the study. Construction for the SFPR, in addition to ongoing industrial activity, offer limited habitat opportunity for most wildlife, with the exception of highly mobile species (such as birds) or wildlife with high tolerance for human presence.

5.6.1.3 Species with Special Status

The following section summarizes plant and animal species with special status that are known to occur in the CWHxm in the municipalities of Surrey and Delta, BC.

Vegetation

Sixty-nine plants have special status in BC and/or in Canada (Appendix XI). Of these, three are protected under Schedule 1 of SARA (Table 5-10). The natural habitat is limited in FSD and PARY, and the likelihood of the majority of these at-risk species to be present is low; however, streambank lupine (*Lupinus rivularis*), a SARA-listed species has been historically documented in the wooded area near the proposed access road to Bekaert's site. CDC (2013) records show populations occurring across from Alaska Way from 2009-2011.

Table 5-9: SARA-listed plants

Latin Name	English Name	BC List	SARA	COSEWIC
Lupinus rivularis	streambank lupine	Red	1-E (Jan 2005)	E (Nov 2002)
Fissidens pauperculus	poor pocket moss	Red	1-E (Jun 2003)	E (May 2011)
Bidens amplissima	Vancouver Island beggarticks	Blue	1-SC (Jun 2003)	SC (Nov 2001)

Streambank lupine is categorized as Endangered and is red-listed in BC (CDC, 2013). This species is often found in wet habitats in lowland areas, associated with wet meadows and gravelly streambanks.

Streambank lupine is tolerant of disturbed conditions, and is commonly found on or near the ballast of rail lines in the Lower Mainland (CDC, 2013).

In May 2013, Triton (2013e) completed a field survey to search for streambank lupine of the road footprint and habitats, including the right-of-way and within a 200 m buffer centred on the Elevator Road entrance (Figure 5-8).

Triton (2013e) did not document streambank lupine specimens in the surveyed areas, nor do historical records overlap with proposed footprint options for the road footprint. No other listed plant species were observed.

Figure 5-8: Area of interest (Triton, 2013e)

Wildlife with Special Status

Twenty-five wildlife species with special status are known to occur in the CWHxm in the municipalities of Surrey and Delta (Appendix XII). Two amphibians, 13 invertebrates, eight mammals and one turtle species (in addition to a turtle sub-population) are considered at-risk in BC. Of these, nine are federally protected under SARA (Table 5-11).

The developed nature of FSD and surrounding area limit the potential for species at risk to inhabit the area. MoTI (2006) assessed the general area for several wildlife species including Pacific water shrew, red-legged frog, bats and other small wildlife but all results were negative. Watercourse assessments completed in 2012 and 2013 describe limited habitat availability for Pacific water shrew and red-legged frog citing poor conditions for habitation, i.e., an abundance of invasive vegetation and poor aquatic conditions (Triton, 2012a and Triton, 2013b). In addition, hydraulic and habitat connectivity to forest patches on the opposite side of River Road/South Fraser Way is not conducive for species movement, i.e., long, graded and perched culverts. Riparian and aquatic habitat between River Road and FSD can be considered sink habitat for small mammals.

There are no CDC records of at-risk wildlife near FSD.

Table 5-10: SARA-listed Wildlife

Scientific Name	English Name	BC List	SARA	COSEWIC	Class (English)
Chrysemys picta pop. 1	Painted Turtle - Pacific Coast Population	Red	1-E (Dec 2007)	E (Apr 2006)	turtles
Sorex bendirii	Pacific Water Shrew	Red	1-E (Jun 2003)	E (Apr 2006)	mammals
Rana aurora	Northern Red-legged Frog	Blue	1-SC (Jan 2005)	SC (Nov 2004)	amphibians
Anaxyrus boreas	Western Toad	Blue	1-SC (Jan 2005)	SC (Nov 2012)	amphibians
Eumetopias jubatus	Steller Sea Lion	Blue	1-SC (Jul 2005)	SC (Nov 2003)	mammals
Nearctula sp. 1	Threaded Vertigo	Red	1-SC (Jul 2012)	SC (Apr 2010)	gastropods
Danaus plexippus	Monarch	Blue	1-SC (Jun 2003)	SC (Apr 2010)	insects
Actinemys marmorata	Western Pond Turtle	Red	1-X (Jan 2005)	XT (May 2012)	turtles
Myotis keenii	Keen's Myotis	Blue	3 (Mar 2005)	DD (Nov 2003)	mammals

5.6.2 Potential Effects and Proposed Mitigation

The potential effects on vegetation and wildlife, and at-risk species during the construction and operation of the proposed Project include:

- Habitat loss and fragmentation where changes to watercourses are anticipated;
- Habitat degradation in the event of an accidental spill during construction;
- Changes to wildlife movement where changes to watercourses are anticipated;

- Sensory disturbance from noise, odours, vibration and lighting during construction and operation;
- Sensory disturbance from potential coal dust during operation; and
- Wildlife mortality as a result of collision from rail cars during operation.

The effects on wildlife and vegetation during construction and operation are considered to be negligible to low. Current land use largely precludes the presence of wildlife in the Project footprint. Additionally, the riparian habitat in the Project area is of marginal wildlife value. The riparian area is largely confined to channelized watercourses, dominated by invasive plants, fragmented, and isolated from larger and higher-valued habitat for at-risk species such as Pacific water shrew and red-legged frog. Listed plant species were not observed in riparian areas, nor were they observed along the railway tracks in the vicinity. Any losses to the riparian habitats in these drainages associated with the new track would be offset with habitat enhancements in the Shadow Brook drainage on FSD property.

5.6.2.1 Mitigation

Given the developed nature of the site, impacts on vegetation and wildlife are not anticipated. However, construction near Shadow Brook and the green-coded watercourse will require consideration of the following:

- Schedule vegetation clearing activities outside of the breeding bird season (March 1 to August 1) to avoid contravention of the BC *Wildlife Act* and *Migratory Birds Convention Act*.
- If pre-clearing activities (including building demolition if anticipated) must be scheduled within the breeding bird season, nest surveys are required to ensure no active nests will be impacted within 30 m of the working areas. Note that surrounding areas will need to be checked for raptor nesting activity, as some raptors such as Cooper's hawk (*Accipiter cooperii*) can require nest buffers of >100 m depending on site specific conditions. Given the current level of activity at the site, potential conflicts with nesting birds are not expected.
- Pre-clearing and construction listed plant surveys, with an emphasis on streambank lupine which may be present in the existing track alignment. If specimens are found in clearing / construction areas, FSD and the Contractor will work with the environmental monitor to develop a suitable transplanting plan.
- Installing temporary fencing (e.g. snow fence) around the riparian zone of Shadow Brook to prevent personnel and machine access into the area.

- Contractors working in areas with noxious weeds will ensure that equipment (bulldozers, skidders, backhoes, crushers and other vehicles) is cleaned, removing dirt and seeds from the tires, tracks and undercarriage to prevent the spread of noxious weeds.
- To the extent practical, invasives will be disposed of consistent with the recommendations in Targeted Invasive Plants Solutions (T.I.P.S.), prepared by the Invasive Plant Council of BC and providing species specific strategies for invasives.

5.6.3 Residual Effects, Determination of Significance and Proposed Monitoring

With the implementation of the above-noted mitigation measures, residual effects on vegetation and wildlife, and at-risk species are not anticipated.

6.0 SOCIO-COMMUNITY EFFECTS ASSESSMENT

FSD has consulted with multiple regulators, First Nations, stakeholders, local residents and community groups to seek feedback on social and environmental issues related to the community. The following sections provide description and summary issues raised that relate to socio-economy and socio-community concerns. The discussion will include:

- Noise and Vibration effects;
- Light effects;
- Vessel Traffic;
- Road and Rail Traffic, and Emergency Response; and
- Recreational and Commercial Fishing.

6.1 Project Area

The Project will be developed entirely on federal lands on the border between two municipalities: Surrey and the Delta. The City of New Westminster is located on the east bank of the Fraser River directly across from the Project.

The Project is located within the Surrey town centre of Whalley in the South Westminster neighbourhood (Surrey, 2013) and is directly adjacent to the North Delta neighbourhoods of Sunbury, Annieville and Nordel. Population estimates of these neighbourhoods report approximately 52,000 residents (2,000 in South Westminster; 50,000 in North Delta).

The potential effects of the Project are discussed as it relates to the above noted communities in Whalley, North Delta and the New Westminster.

6.2 Local Communities

6.2.1 Existing Conditions

FSD is a multi-purpose marine terminal located on the Fraser River at the border of Surrey (Whalley) and the Delta (North Delta) and has been in operation since 1962. FSD is the largest and most active industry in the South Westminster neighbourhood of Surrey (Surrey, 2003). The terminal serves a variety of customers involved in containers, breakbulk, project cargo, forest products and bulk. The terminal currently has facilities to handle and transfer goods by rail, truck, barge and vessel, and has warehouses for cargoes requiring covered storage. In 2007 FSD handled over 185,000 Twenty-foot Equivalent Units (TEU) of containers (FSD, 2013a).

The current FSD terminal operates 24 hours a day, seven days a week. Noise at the current terminal is generated by the movement of inbound and outgoing cargo (including containers, dimensional lumber, logs, steel, and dry bulk agricultural products), trucks and existing rail infrastructure. A number of vessels and equipment are in regular use at the FSD terminal.

The area surrounding FSD is designated as Industrial in Surrey (2012), “Draft Official Community Plan: Land Uses and Densities” and the Delta (2007) Official Community Plan for North Delta although Commercial and Residential land uses are present (Figures 6-1 and 6-2). Upland industrial uses include industries such as Interfor (wood processing), Bekaert Canada (a manufacturer of a wide variety of steel wire products), and Sylvan Distribution (rolled paper distribution centre) (UMA, 2006). UMA (2006) notes that the remaining land within the South Westminster area is undergoing transition, where low intensity industrial uses that have historically characterized this area are experiencing gradual redevelopment into more contemporary forms of industry.

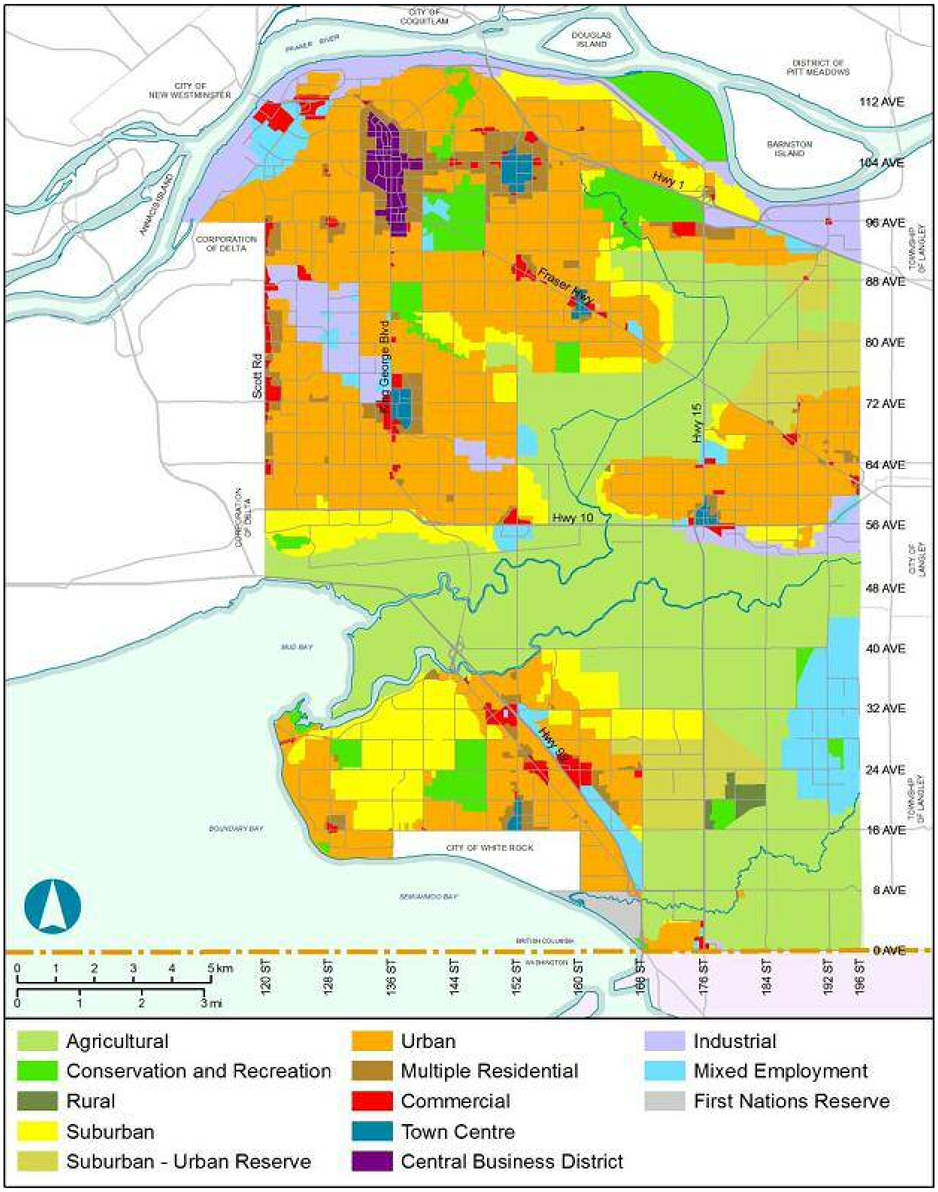

Figure 6-1: General Land Use Designations (Surrey, 2012)

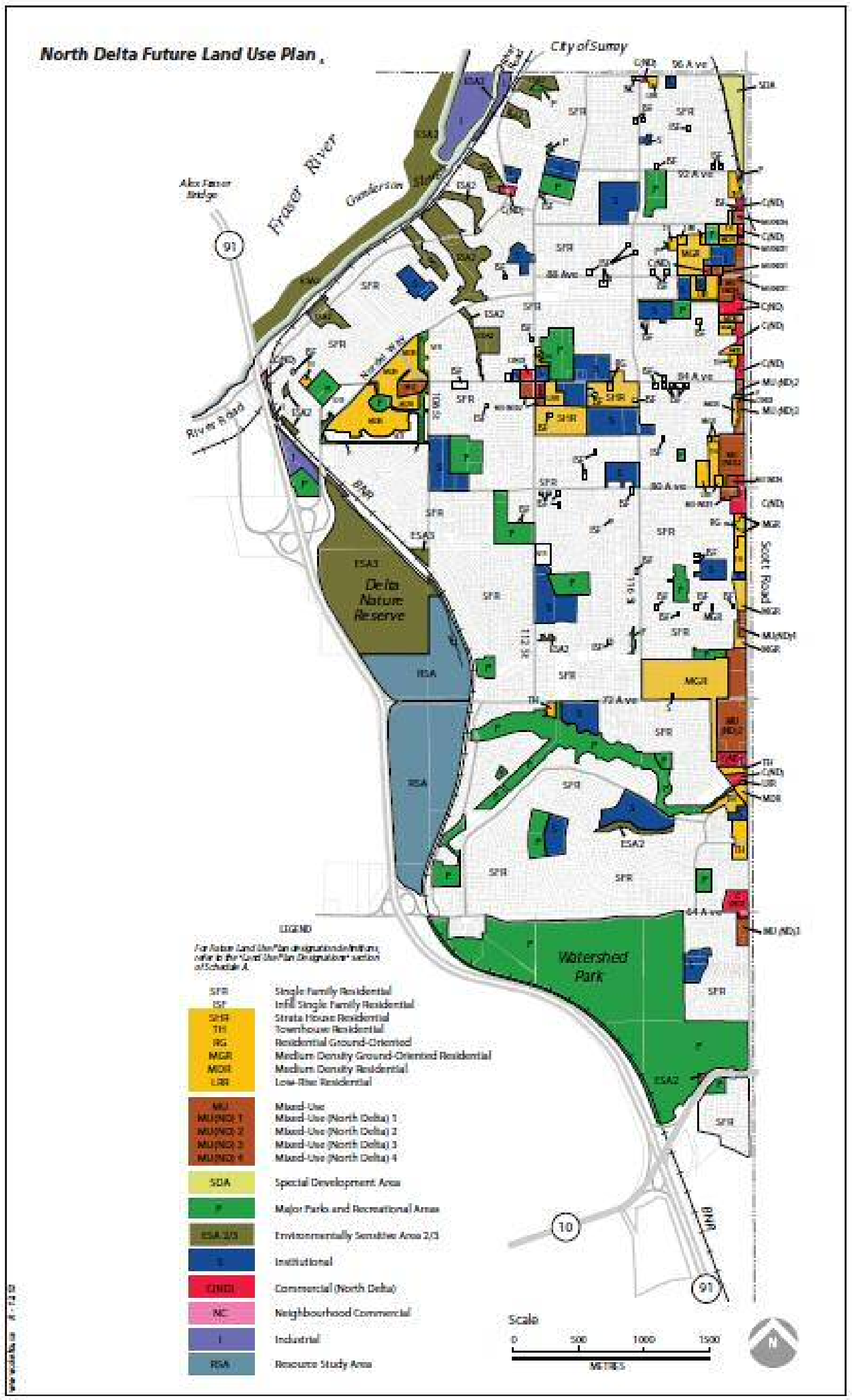

Figure 6-2: North Delta Future Land Use Plan (Delta, 2007)

6.2.1.1 Residential Neighbourhoods

While the Project is situated in a largely industrial location, there are residential neighbourhoods in proximity. The closest residential properties are located adjacent to the existing River Road corridor and SFPR (under construction), approximately 520 m to the southeast (Levelton, 2013).

City of Surrey

The City of Surrey is one of Canada's fastest growing municipalities. With a current (2011) population of 468 251, the municipality has had a substantial population increase of over 18% since 2006 (Table 6-1). The Project is located in Surrey town centre of Whalley and more specifically next to the residential neighbourhood of South Westminster. South Westminster has an estimated residential population of 2,000 people in mostly single family dwellings.

Table 6-1: City of Surrey demographic profile

	2006	2011	Change	
			#	%
Population	394,976	468,251	73,275	18.6

Source: Statistics Canada (2012a)

Corporation of Delta

There are nearly 100,000 residents living in the Delta. Delta has seen a moderate population increase, over 3% between 2006 and 2011 (Table 6-2). The Delta is comprised of three distinct communities: North Delta, Tsawwassen, and Ladner. North Delta and more specifically the residential neighbourhoods of Sunbury, Annieville and Nordel are directly adjacent to the Project. The estimated population of North Delta is 50,000 people.

Table 6-2: Corporation of Delta demographic profile

	2006	2011	Change	
			#	%
Population	96,635	99,863	3,228	3.3

Source: Statistics Canada (2012b)

6.2.1.2 Community Services

Schools

Five schools are within 3 km of the Project. These schools were included in the air dispersion modelling assessment completed by Levelton in 2012 (Figure 6-3):

- In Surrey:
  - Royal Heights Elementary School;
  - Kirkbride Elementary School; and
  - L.A. Matheson Secondary School.
- In Delta:
  - Annieville Elementary School; and
  - Delview Secondary.

Parks and Recreation

Four recreational features and parks in Surrey and Delta are located within a 3 km of the Project include (Figure 6-3):

- Ravine Park;
- Royal Heights Park;
- Tom Hopkins Ravine Park; and
- Tannery Park.

Police and Fire

Surrey works with the Royal Canadian Mounted Police (RCMP) to provide municipal level police services, and is the largest RCMP Detachment in Canada. The Surrey RCMP has 5 districts, with District 1: City Centre/Whalley serving the area where the Project is located.

Surrey has two fire halls that serve the Project area. Fire Hall #3 serves FSD and other industries in the area. Fire Hall #3 is located at 96th Avenue east of 116th Street. Fire Hall #2 serves the Whalley/City Centre area of Surrey and is located at 104th Avenue west of 132nd Street.

Police service in Delta is provided by the Delta Police Department. North Delta has a community police station at Scottsdale Centre at 7081 120th Street. In Delta, Fire Hall #3 serves the North Delta area, including FSD. Fire Hall #3 is located at 11375 84th Avenue.

Other Administrative Units

The Project is in the GVRD (operating as Metro Vancouver) but is under the jurisdiction of PMV.

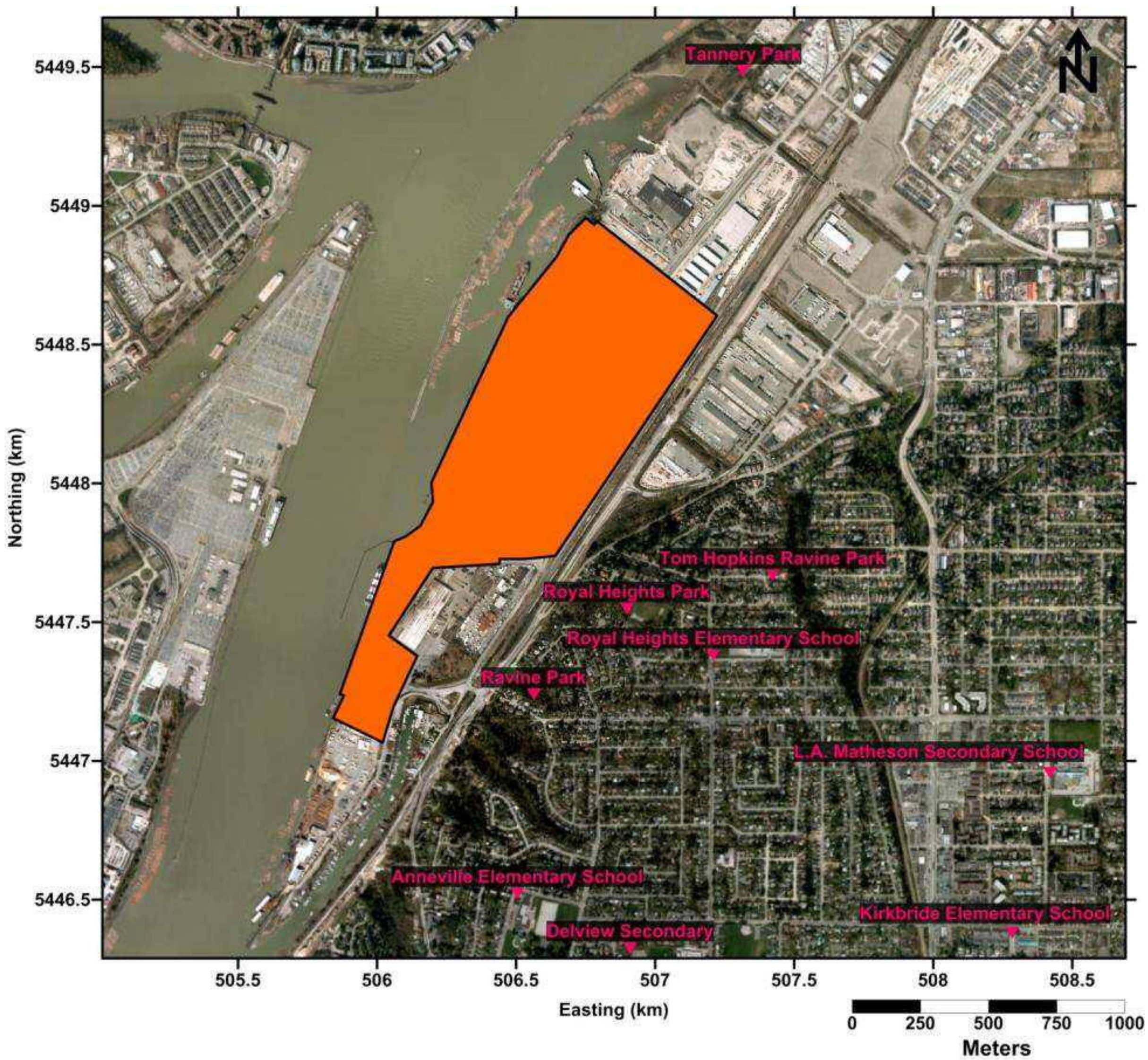

Figure 6-3: Location of schools in Proximity to the Project (Levelton, 2013)

6.2.2 Potential Effects and Mitigation: Noise and Vibration

Noise was identified as a key concern for community stakeholders during community engagement activities carried out by FSD in May 2013 (FSD, 2013b). Common concerns regarding noise included the increase in train noise, including whistles, noise created by Project operations (specifically unloading of coal), and noise during evening hours.

Pile driving is expected to be the loudest construction activity. The duration of the installation of the 12 steel piles is scheduled for a period of two weeks (FSD, 2013c and FSD, 2013d).

The preliminary EMP developed by Triton for FSD to address stakeholder concern regarding noise (Triton, 2013). The preliminary EMP, which will be finalized prior to the commencement of construction, includes a Noise Management Plan (NMP) and PDP and identifies measures to mitigate noise effects from construction and operation.

6.2.2.1 Mitigation

The NMP describes existing noise conditions at the FSD facility and proposes mitigation measures to offset the additional noise during the construction and operation of the new facility. The noise mitigations presented below relate specifically to train and vessel traffic, proposed unloading facilities. Mitigation measures during construction include:

- Contractors and supervisors to take a noise awareness training program, specifically tailored to FSD site and surrounding area;
- Construction to take place within 7:00 am and 10:00 pm Monday to Saturday in accordance with Surrey Noise Bylaw 7044 (no construction prior to 0700 or after 2200 hours);
- Selecting less noisy machinery, vehicles and equipment for use on site wherever possible;
- Routine inspection of equipment, including maintaining equipment, emphasising lubrication, replacing worn parts, and maintaining exhaust systems;
- Where needed, fit equipment with residential-rated mufflers and/or silencers for night-time work;
- Muffling back-up beepers when safe and feasible to do so;
- Shutting off equipment when not in use and operating equipment at the minimum speeds permitting operation, with hoods and shields closed;
- Enforcing speed limits to reduce vehicle noise; and

- Installing temporary noise barriers made of solid material as needed, placed as close as practical to the source of noise.

Specific mitigation measures were proposed for noise and vibration reduction while pile driving:

- Pile driving will be completed using Best Management Practices for Pile Driving and Related Operations – BC Marine and Pile Driving Contractors Association (BC Marine, 2003);
- Vibratory pile driving is anticipated at Berth 2 and as a result, ongoing hydrophone monitoring is unlikely to be required by the regulatory agencies. FSD will commit to hydrophone monitoring at project start up, and on a selected basis thereafter (depending on site-specific conditions and observations) to confirm pressure levels are ≤30 kPa at a distance of >1 meter from any pile being driven;
- Conferring with DFO (and other agencies with jurisdiction) to determine the preferred timing and methods of the pile driving program;
- Pile driving will continue for no longer than two weeks; and
- Pile driving activities will adhere to City of Surrey Noise bylaw.

Mitigation measures identified to reduce noise during operations are identified in two main areas, namely train and vessel traffic and unloading facility operations. Proposed mitigation measures include:

- All rail movement within FSD and adjacent PARY will be restricted to 5 km/h or less;
- Coal being unloaded from rail cars will have minimal drop heights and be completed in an enclosed shed surrounding the receiving pits;
- Rail car unloading and coal conveyor system will be electric, with anticipated conveyor noise levels is approximately 60 – 65 decibels (dB), within normal conversation range at 3 feet (1 m);
- The conveyor system will be covered on two of four sides, limiting the travel of noise with bottom dumping in to the receiving pits;
- An electric rail positioner will be used to move cars through the facility instead of a locomotive,
- New rail is being installed with curvatures of 12 degrees or less to minimize noise caused by steel railcar wheels pulling on tight turns, with the possible addition of lubricators; and
- Once Tannery Road and Elevator Road crossings are decommissioned (via development of SFPR and proposed access changes by FSD), train whistles associated with the coal and Agri-bulk facility will only need to be sounded once at one crossing.

FSD is working with BNSF to identify changes to roadway and railway layout to reduce the frequency of train whistles when crossing public roadways. Rail traffic at the Tannery Road and Elevator Road crossing is expected to be eliminated after the construction of an overpass at Tannery Road, and eliminating the Elevator Road crossing as part of SFPR. These changes eliminate the need to sound train whistles at previously controlled crossings.

6.2.3 Residual Effects, Determination of Significance and Proposed Monitoring: Noise and Vibration

FSD is an existing industrial facility that has 24 hour operation, 7 days a week. FSD currently handles inbound and outgoing cargo and has existing rail infrastructure that is utilized for cargo movements at the facility.

FSD will continuously evaluate noise levels and on site activities to identify opportunities to reduce noise by using quieter equipment and/or making changes to daily operations that may reduce overall noise levels. Wind direction has been identified as a potential tool to determine noise impacts on surrounding communities.

FSD will promptly respond to community concerns relating to noise by documenting public input, and evaluating specific comments in the context of coal facility and operations procedures. Resolutions will be communicated on an individual basis and will include documentation of date, time and method the concern was raised; details of the concern; and steps taken by FSD to address the concern.

Construction noise and vibration effects are expected to be temporary and reversible. Pile driving will occur for approximately two weeks. Increases in operational noise are expected to be minimal. Following the application of the mitigation measures described above, it is expected that the Project will result in no significant residual noise or vibration effects on marine life and surrounding communities during construction and operation.

6.2.4 Potential Effects and Mitigation: Light

No new mast lighting is anticipated (Triton, 2013). Existing overhead terminal lighting for the Facility is considered adequate for construction and operation. Direct lighting along conveyors, barge loader and inside the unloading shed will be required for safe operations, and any additional lighting required within the offloading facility will be developed within Occupational Health and Safety Regulation (Part 4, Illumination). As no new mast lighting is expected for the Project, the effects of light from construction and operation are considered low to negligible.

6.2.4.1 Proposed Mitigation

Measures to mitigate for light effects include the following:

- Minimizing night-time activity (where practical);
- Using light on an "as and when needed" basis;
- Direct lighting toward the ground on working areas, reducing the height of lighting to the extent possible, and minimizing the number of lights required through strategic placement;
- Eliminating upward directed light;
- Using fittings on lamps to direct light and confine the spread of light;
- Ensuring lights are in good condition at all times;
- Using lights with appropriate wavelengths to avoid distraction and disorientation by birds, where practical given safety and security requirement; and
- Shutting off lights when they are not needed.

6.2.5 Residual Effects, Determination of Significance and Proposed Mitigation: Light

No significant light effects from Project construction and operations are anticipated. A light monitoring program is not proposed for construction or operation.

6.3 Vessel Traffic

FSD handled 413 fewer vessels in 2011 than in 2005. A total of 234 vessels and 60 barges were handled at FSD in 2011. This represents a 58% reduction in the total volume of vessel traffic at FSD over six years (Table 6-3).

Table 6-3: FSD Vessel Traffic Comparison: 2005 and 2011

Ship Movement Handled by FSD	2005	2011	Difference	% change
Barge	128	60	-68	-53%
Vessels	579	234	-345	-60%
Total	707	294	-413	-58%

DNV (2012) estimated the traffic patterns of ships travelling up and down the Fraser River at nine segments between the mouth of the Fraser to Patullo Bridge (approximate) (Figure 6-4). Automatic Information System (AIS) data were analyzed and adjusted to reduce double counting and improve data accuracy. Multiple vessel types were included in the traffic estimates:

- Deep water vessel traffic;
- Cargo ferry traffic;
- Dredger traffic;
- Fishing traffic;
- Military ops traffic;
- Passenger traffic;
- Pilot vessel traffic;
- Pleasure traffic;
- Sailing traffic;
- Search and Rescue traffic;
- Tug traffic; and
- Unspecified Traffic.

Figure 6-4: Traffic pattern locations for nine segments on the Fraser River (DNV, 2012)

Table 6-4 shows there were an estimated 86,138 vessel movements (up and down river) on the Fraser River in 2011 based on the AIS data (DNV, 2012). Tug and cargo ferries were the most documented types, respectively accounting for 63% and 21% of total traffic volume. Total FSD traffic accounted for 588 up and down river vessel movements in 2011, which is less than 1% of the total river traffic volume on the Fraser River.

FSD is planning to handle 4 MT of coal volumes each year, which would require an estimated 1,280 single formation fully loaded coal barge tows (640 FSD to mouth of the Fraser/640 mouth of the Fraser to FSD). This would increase the total volume FSD river traffic from 588 to 1868 movements per annum (454 vessels more than 2005 estimates, without the Project). The projected vessel traffic from FSD after the implementation of the facility would account for 2.2% of total vessel traffic (based on 2011 numbers), which is an increase of 1.5%. This assumes no increase in volume of other FSD vessel types.

Table 6-4: Estimated Traffic Volume on the Fraser River by vessel type for 2011 (summarized from DNV, 2012)

Vessel Type	Route Segment Number (upriver/downriver)									Total Traffic (up/down)
	2.2/12.2	1.1/11.1	1.2/11.2	1.3/11.3	1.4/11.4	1.5/11.5	1.6/11.6	1.7/11.7	1.8/11.8	
Deep Water Vessel	1076	1076	1076	1076	862	862	862	862	0	7752
Cargo Ferry	4576	4576	4576	4576	0	0	0	0	0	18304
Dredger	716	698	668	1100	440	114	54	62	2	3854
Fishing	134	134	50	28	28	20	18	50	2	464
Military Ops	6	0	0	0	0	0	0	0	0	6
Passenger	76	48	48	20	22	20	20	20	8	282
Pilot Vessel	4	4	2	2	2	0	0	0	0	14
Pleasure	52	34	102	30	56	18	52	122	40	506
Sailing Vessel	4	2	4	0	2	0	0	0	0	12
Search and Rescue	134	148	130	76	72	46	54	50	24	734
Tug	5208	5276	6046	7424	6886	6080	5976	6410	4740	54046
Unspecified	8	4	4	4	4	4	4	130	2	164
Traffic Total	11994	12000	12706	14336	8374	7164	7040	7706	4818	86138

Coal barge operations proposed for the Project are as follows (DNV, 2012):

- Barges are 8,000 DWT in capacity, with the dimensions of 284' long x 72' wide x 16' draft and a 20' load height on average. Deck to top of side walls will be 7.9';
- They are coastal barges, with approximately 9 compartments, transversely framed;
- Barges will be loaded at maximum 85% capacity for transit to the mouth of the river;
- Tugs with engine power from 1,200 to 1,600 hp;
- Transit inbound or outbound expected to be approximately 3 hours (study area);
- Transit speeds about 6.3 knots over ground;
- Coal barges are at the berth for between 5 and 24 hours (average 15 hours);
- Cargo: Sub-bituminous coal (at least during start of operations); and
- Cargo loading operations to be conducted at FSD berth No. 2 & 3.

6.3.1 Potential Effects and Mitigation

The potential effects associated with the Project's marine operations are effects that are currently being considered and managed with respect to current Fraser River vessel traffic. These effects have the potential to be increased due to the increased vessel traffic associated with the Project:

- Increased risk of accidents:
  - Collision;
  - Structural failure/foundering;
  - Fire/explosion;
  - Powered grounding;
  - Drift grounding;
  - Impact at FSD; and
  - Striking at FSD.
- Interruption to commercial and recreational fisheries (discussed in Recreation and Commercial Fishing).

DNV (2012) assessed the above effects and identified that the majority of the risks assessed are tolerable; however, mitigation measures should still be considered for implementation. The risks associated with powered grounding, drift grounding, impact at FSD and collision were assessed "as low as reasonably possible" if all justified risk reduction measures are implemented. The DNV (2012) study concluded the Project is acceptable from a technical risk point of view, provided that all justified risk reduction options are implemented. These are discussed in the following section.

FSD presented the findings of the DNV (2012) study to Fraser River Stakeholders including:

- Fraser River Pilots;
- Council of Marine Carriers;
- FSD's barge operator partner (Lafarge);
- FSD;
- Transport Canada (represented by Compliance, Navigable Waters);
- BC Chamber of Shipping;
- PMV; and
- DNV (Facilitation Team).

Key comments from the Fraser River Stakeholders were:

1. Similar barge and tug operations are already occurring on the Fraser River, including many by Lafarge. These existing operations are conducted safely and without incident, so the Fraser River Stakeholders did not see that the proposed FSD barge operations carried materially increased risk
2. The Fraser River Stakeholders viewed the increase in Fraser River traffic as the largest risk exposure, but they thought that this could be managed. There was a thought that consideration should be given to widening and deepening the channel, marking secondary lanes for smaller vessel traffic (including tug and barges), in order to better accommodate increased potential traffic. It was emphasized that is important to communicate scheduled barge transits to pilots.
3. The use of an adequately sized and powered tug boat, length and condition of the tow line and bridles is critical to a safe barge operation. The Fraser River Stakeholders commented that the significant experience of Lafarge is important in this context and should help in reducing the risk of accidents by taking into consideration the key variables above.

4. During freshets, a tug assist may be considered for increased safety of the barge operations.
5. Regular maintenance and safety checks of tugs, their equipment and barges is very important. It is expected that the standard operating procedures of the Lafarge shall provide guidelines to address these issues.

6.3.1.1 Mitigation

The following mitigation measures and management strategies are recommended for implementation:

- All tugs will be inspected at regular intervals to ensure they meet the required Transport Canada regulations. Barges will be inspected at regular intervals by Lafarge in the absence of regulations or requirements for periodic inspections mandated by Transport Canada for "dumb" barges.
- Tugs will be selected in accordance with the then-current weather conditions and barge load characteristics, in order to ensure a proper match between tugs and barges. Equipment selection criteria will be based on Lafarge's significant experience in operating in the Fraser River.
- The proposed 8,000 DWT barges are compartmentalized, typically with nine compartments, such that if one compartment is punctured and begins taking on water, the damage will be contained in that compartment and the barge may be transported to a safe location for unloading and repair.
- All tugs will have monthly fire drills / training and have fire suppression equipment including fire house and pumping equipment.
- FSD will use two methods to notify vessel pilots of barge operations: (i) FSD will include barges in its vessel schedule and post this vessel schedule online, such that it is available to the public and (ii) whenever a shipping line places an order for berth space at FSD, FSD will notify the pilots and agents of the presence of any coal barges.
- Fraser River pilots will be aware of the coal barge presence and may order additional tug assist for vessel entry and exit at the FSD berth face.

In the event of an accident, FSD and the Barge operator will:

- Contact emergency services, including the coast guard and other relevant agencies, immediately following any accident.

- Communicate with the Lafarge dispatch.
- Verify the safety of all vessel occupants and assess the need for first aid or water rescue.
- Check coal cargo to ensure it is secure. It is noted that the coal will not be contained in the barge hull, but rather on the barge deck. Therefore a puncture of the hull would not directly lead to a coal spill.
- As needed, contain any spills in accordance with the FSD / Lafarge Spill Containment Plan and the FSD EMP.
- If applicable and to extent possible, ensure that tug and barge are out of the shipping lane.
- If needed, solicit assistance from other tug traffic on the Fraser River. Assistance may be available from one of the many Lafarge tugs on the Fraser River or from a third party operator.
- If tug still has power, decision will be made to re-commence journey and control barge movements through two-line management in order to prevent a barge-related accident.

6.3.1.2 Residual Effects, Determination of Significance and Proposed Mitigation

The proposed coal barge operations do not present any new operations or issues of concern that are not already being conducted or considered in the river. From the technical risk point of view, based on a semi-quantitative risk assessment conducted, risks identified are acceptable provided that all justified risk reduction options are implemented (DNV, 2012).

6.4 Road and Rail Traffic

An assessment was completed to evaluate the current and future rail and road capabilities in the Brownsville Industrial Area with respect to the proposed Project. The potential negative impacts of the Project on other rail-served businesses and road/rail conflicts (relating to emergency access) were also assessed. The assessment was completed by MMM Group and MainLine Management (MLM) in 2012 at the request of PMV in response to the FSD permit application for the Project. Much of this following section is derived from the MMM & MLM (2012) assessment.

6.4.1 Rail

The proposed operations involve upgrades to FSD in way of additional rail, two dumper pits, and a conveyance system, that will allow the FSD to handle 4 Million MT of coal on an annual basis within the next two years. The facility has been designed to unload and release a full 125-car unit train in less than eight hours, allowing for the unloading of a unit train onto two 8,000 MT barges in one regular shift. The assessment includes arrival of a train, separating and switching blocks of cars into appropriate yard tracks, movement of blocks of cars into destination tracks, assembly of the outbound train in the departure yard and departure of the train. Each of the functions described requires trackage and a conceptual operating plan to get the train to and from various tracks.

The modification of the existing rail infrastructure would be done within the existing PARY footprint. While the Project is to cover 4 Million Megatonnes per Annum (MMTA), there is no actual road or rail works required outside of FSD's lease area to enable them to initially move up to 2 MMTA. Beyond 2 MMTA, the PARY requires minor reconfiguration and expansion. No additional tracks will be added to the existing at-grade rail crossing of Elevator Road. The proposed track changes are to accommodate coal deliveries beyond 2 MMTA up to 4 MMTA.

The change in operations will include additional BNSF trains arriving and departing from the site. These trains will arrive from the southwest crossing Elevator Road to arrive and depart the existing rail yard. In 2011, FSD handled 3,436 switch movements (compared to 5,578 switch movements in 2005). This number does not include the 232 FSD switch movements related to Chemetron railcars (see below). The rail volumes for 2011 are as follows:

- CN Rail - 878 in & 878 out = 1756 movements;
- Canadian Pacific Railway (CPR) - 751 in & 751 out = 1502 movements;
- BNSF - 45 in & 45 out = 90 movements;
- Surrey Rail Yard (SRY) - 44 in & 44 out = 88 movements; and
- FSD - 116 in & 116 out = 232 movements[3]

The current capacity at the PARY is one unit coal train at a time, based on its capability to receive, stage, and depart trains. Under the proposed expansion, a maximum of two coal trains at a time could be accommodated by the PARY under assumption that planned infrastructure improvements were constructed. MMM & MLM (2012) noted businesses in the area that required rail service, CN operations and BNSF main line operations, would be minimally affected during the operation of the Project.

There is currently little rail traffic demanding capacity in the PARY since the IDC Distribution Services Ltd. (IDC) facility is currently inactive (MMM & MLM, 2012). The IDC was an intermodal rail facility adjacent to FSD that provided intermodal rail service to container customers of FSD, as well as switching and train building services, on behalf of the four major railways with access to this property (Transport Canada, 2013). The IDC tracks have been and could be considered as staging/storage tracks for FSD traffic that is

[3] Chemetron switching which is done with Chemetron railcars

non-coal. In reviewing the operating plans it appears that Chemetron operations would be minimally affected by coal operations. No significant conflicts with SRY service at Catalyst are expected as there is sufficient distance between the Catalyst switch and FSD leads connecting its dock facilities and the PARY to allow normal SRY operations without conflicting with FSD coal operations.

In considering the CN Lead at the East End of the PARY, the lead is not expected to be fouled during the unit train arrival process, or during train arrival and movement to the dumper. This circumstance is not expected to occur as there is sufficient distance between the East End of the PARY Lead and the CN connection to avoid fouling or occupying CN's track. In addition, CN would continue to have sufficient track in the PARY for interchange activities with FSD without normally affecting or being affected by coal train operations.

BNSF does not foresee any significant negative impacts on the addition of BNSF coal train operations to and from Brownsville (MMM & MLM, 2012).

The profile of each coal train (loaded and empty) used in the assessed is described below:

- 125 coal cars per train;
- Each car bottom dump-rapid discharge;
- Each loaded coal car with 106 MT of coal (13,300 MT of coal per train);
- Total weight of each loaded car at 130 MT (286,000 lbs);
- Total loaded train weight of 16,250 MT not including locomotives;
- Train length of approximately 7,000 feet with locomotives; and
- Four locomotives per train, 2 leading and 2 Distributed Power Rear End locomotives.

6.4.2 Road

The unloading operations will require the railcars to be taken from the rail yard into the loop track within the FSD facility, with the rail cars crossing Robson Road in two places. There are three locations where train movements will affect crossings (Figure 6-5).

Figure 6-5: Location of road/rail crossings (MMM & MLM, 2012)

When the trains arrive and depart they will block the Elevator Road crossing for up to 15 minutes at a time, which could result in an increase in the queues along the westbound lane of South Fraser Way. During the AM peak period this would likely extend for 145 m, and during the PM peak this could be as long as 565 m depending on the train arrival and departure times.

As the railcars are between the PARY and the dumpers will block the Robson Road crossings for 2 to 4 minutes at a time for up to 24 times for each train being unloaded. Loaded cars will cross the Robson Crossing (Figure 6-5) west while locomotives and empty cars will cross the Robson Crossing east as they return to PARY. These short blockages are likely to have a minimal impact on the traffic and significant queue lengths are not expected.

Potential changes to the road network may result from the implementation of the SFPR may impact the at-grade crossings shown in Figure 6-5. In particular, ingress and egress from Elevator Road may change.

Delcan (2013) identified the Elevator Road/River Road signalised intersection as the current primary access to the FSD terminal, and to the Gunderson Slough area. The SFPR will see closure of Elevator Road access, and access will be moved north via the new Tannery Road interchange. Closure of the Elevator Road access along the SFPR will see traffic diverted to either the new Tannery Road interchange or along Robson Road.

The volume of traffic that currently crosses rail tracks along Robson Road will also be changed once the SFPR is completed. Forecast volumes of vehicles crossing the Robson Road crossing is 210 vehicles per hour in peak morning, and 250 vehicles per hour in peak evening traffic, and a total of 2,500 vehicles per day.

FSD access modifications to provide an 8.0m wide two-way access approximately 30 m north of the northern rail spur would form a T-intersection with Robson Road, affecting traffic flow a queue at the Bekaert Canada property (Delcan, 2013).

6.4.3 Potential Effects and Mitigation

During the public consultation process, concerns were raised regarding the potential for increased rail traffic to impact access to emergency care.

Concerns regarding this issue were also raised by Dr. Paul Van Buynder, the Chief Medical Health Officer, Fraser Health Authority, and were addressed by the Honourable Lisa Raitt, PC, MP, Minister of Transport, in her letter dated September 10, 2013. In her letter, the Minister indicates that Transport Canada is responsible for regulating the safe movement of trains along federally regulated corridors in accordance with The *Railway Safety Act* (Transport Canada, 1985). Furthermore, the letter indicates that when emergency vehicles require passage, a railway company is expected to clear the train from at-grade crossings as quickly as possible.

BNSF has a policy for providing immediate access at railway crossings during emergency situations. This policy is consistent with the agreement currently in place and which FSD and BNSF have been operating under without incident for more than 50 years. BNSF's operating and emergency access plans are approved and monitored by Transport Canada.

The effects of additional rail traffic on road traffic, local rail-serviced business and emergency access are expected to be minimally affected.

Under the proposed expansion, a maximum of two coal trains at a time could be accommodated by the PARY under assumption that planned infrastructure improvements were constructed. This allows for relatively minimal effect on existing businesses and industrial areas such as CN, CPR, SRY, Catalyst, Chemetron, BNSF and Brownsville.

There are three locations where train movements will affect crossings (Figure 6-5) within the geographic scope of this EIA. There may be increased queues along the westbound land of South Fraser Way when trains block the Elevator Road. Blockage can occur for up to 15 minutes at a time. During the AM peak period this would likely extend for 145 m, and during the PM peak this could be as long as 565 m depending on the train arrival and departure times.

Short blockages at Robson Road are likely to have a minimal impact on the traffic and significant queue lengths are not expected. Loaded cars will cross the Robson Crossing (west) while locomotives and empty cars will cross the Robson Crossing (east) as they return to PARY.

Potential changes to the road network may result from the implementation of the SFPR may impact the at-grade crossings. In particular, ingress and egress from Elevator Road may change. The SFPR will see closure of Elevator Road access, and access will be moved north via the new Tannery Road interchange. Closure of the Elevator Road access along the SFPR will see traffic diverted to either the new Tannery Road interchange or along Robson Road.

The volume of traffic that currently crosses rail tracks along Robson Road will also be changed once the SFPR is completed. Forecast volumes of vehicles crossing the Robson Road crossing is 210 vehicles per hour in peak morning, and 250 vehicles per hour in peak evening traffic, and a total of 2,500 vehicles per day.

6.4.3.1 Mitigation

FSD has proposed the following mitigation measures to reduce concerns relating to longer vehicle wait times:

- The potential for vehicle wait times will be reduced by scheduling rail movements outside of peak vehicle traffic times;
- Construction traffic access and egress from the Facility will be at pre-arranged times to avoid concerns with regard to traffic congestion;
- Construction impacting regular public traffic will be performed at off-peak times when practical; and
- Notifications will be posted one week in advance and sent to surrounding properties outlining the work being carried out, times, and expected traffic impacts.

FSD is working with BNSF to identify changes to roadway and railway layout to reduce the frequency of train whistles when crossing public roadways. Rail traffic at the Tannery Road and Elevator Road crossing is expected to be eliminated after construction of an overpass at Tannery Road, and eliminating the Elevator Road crossing. These changes also eliminate the need to sound train whistles at previously controlled crossings.

FSD has mitigation measures in place for emergency access. Such measures include:

- BNSF has established procedures for providing immediate access for emergency services to railway crossings during emergency events; and
- Emergency preparedness plans.

6.4.4 Residual Effects, Determination of Significance and Proposed Monitoring

Potential effects relating to traffic interruptions and increased wait times are anticipated during construction. Increased railcar traffic at roadway crossings is also anticipated throughout the life of the Project; however, mitigation measures have been proposed to make the increase in rail traffic minimal.

FSD does not foresee issues with emergency services access, as the proposed policy is consistent with current policies with BNSF as well as best management practices that have been in place for decades.

Current access plans for emergency services are approved and monitored by Transport Canada. Proposed plans will also be submitted and monitored by Transport Canada.

With the application of mitigation measures described above, including ongoing communications with local communities about changes in traffic patterns and access during construction and operation, the increased rail traffic is not expected to result in significant adverse effects on road traffic in adjacent communities and emergency access. No residual effects are anticipated.

6.5 Recreational and Commercial Fishing

Much of the lower Fraser River foreshore is developed and currently used for industrial and commercial land uses. Barges represent a good portion of traffic on the Fraser River, in addition to recreational fishers and boaters (Table 6-4).

The volume of industrial and commercial marine boating activity in this area has resulted in a relatively low level of recreational boating activity. The number of pleasure vessels recorded by AIS in 2012 is 506 for both up and down river travel. The number of fishing vessels (recreation and commercial was not distinguished) documented was 464. Both types of vessels account for 1.1% of total vessel volume on the Fraser River in 2011.

The area is also part of the broader Aboriginal fishery which includes salt water salmon openings in various locations along the lower Fraser River. Numerous First Nations which are involved in the Lower Fraser salmon fishery and can be grouped into the three following areas (DFO, 2013):

- Below the Port Mann Bridge (http://www.pac.dfo-mpo.gc.ca/fm-gp/fraser/abor-autoc-eng.html#Below_Port_Mann_Bridge)
- Port Mann Bridge to Mission (http://www.pac.dfo-mpo.gc.ca/fm-gp/fraser/abor-autoc-eng.html#Port_Mann_Bridge_to_Mission)
- Mission to Sawmill Creek (http://www.pac.dfo-mpo.gc.ca/fm-gp/fraser/abor-autoc-eng.html#Mission_to_Sawmill_Creek)

There are five First Nations that fish in the lower Fraser (below the Port Mann Bridge):

- Musqueam First Nation;
- Tsawwassen First Nation;
- Tsleil-Waututh First Nation;
- Kwikwetlem First Nation; and
- New Westminster First Nations.

Musqueam, Tsawwassen, Tsleil-Waututh and New Westminster First Nations fish with drift nets downstream of the Port Mann Bridge and into the Strait of Georgia. The Kwikwetlem First Nation fishes from Douglas Island to the Patullo Bridge.

The Aboriginal fishery has both a commercial and a ceremonial component allowing First Nations to fish with drift nets downstream of the Port Mann Bridge and into the Strait of Georgia. Catch monitoring is performed by aboriginal fishery officers and fishery observers who monitor and conduct boat and vehicle patrols during salmon fishery openings. Catch data is collected multiple times throughout each fishery season and is recorded by species and reported to DFO.

6.5.1 Potential Effects and Mitigation

During operation, the Project would increase vessel traffic (barge and other vessels) by 1280, accounting for a 1.5% increase in total vessel traffic on the Fraser River. An increase in Fraser River traffic has the potential to affect recreational and commercial fishing activities; however the increase in river traffic could be managed with the mitigation measures outlined in the next section. In addition, similar barge and tug operations are already occurring on the Fraser River. These existing operations are conducted safely and without incident. Fishing and pleasure vessels currently account for 1.1% of the total volume on the Fraser River, based on 2011 AIS data (DNV, 2012).

6.5.1.1 Mitigation

Proposed mitigation measures to reduce effects on recreational and commercial fishing activities include:

- Provide the coal barge schedule to Fraser River users and public;
- FSD and Lafarge will monitor designated fishing windows and where possible, work to schedule traffic around those windows;
- Pre-emptively notify fishing groups if conflict is expected;

- Review of potential barge movement impacts on a regular basis and work with stakeholders to help minimize impacts;
- Additional efforts will focus on the review of potential barge movement impacts on a regular basis and working with stakeholders to help minimize impacts;
- FSD will use two methods to notify vessel pilots of barge operations: (i) FSD will include barges in its vessel schedule and post this vessel schedule online, such that it is available to the public and (ii) whenever a shipping line places an order for berth space at FSD, FSD will notify the pilots and agents of the presence of any coal barges; and
- Fraser River pilots will be aware of the coal barge presence and may order additional tug assist for vessel entry and exit at the FSD berth face.

6.5.1.2 Residual Effects, Determination of Significance and Proposed Monitoring

No significant effects relating to recreational and commercial fishing interests are anticipated during Project construction and operations.

7.0 HEALTH EFFECTS ASSESSMENT

7.1 Introduction

The Project proposes to construct a facility to handle coal arriving by rail for direct transfer to barge and transport to Texada Island. Concern has been raised by stakeholders and the public on the potential health effects associated with the operation of such a facility which is in proximity to residential neighbourhoods in Surrey and North Delta.

Issues cited as health concerns include: a reduction in air quality resulting from coal dust; increased emissions from diesel-reliant equipment, locomotives and vessels; and accidental spills of coal into the receiving environment. To address the concerns raised by the public and stakeholders, this section will discuss the following:

- Coal (chemical and physical properties)
- Diesel emission sources
- Human Health
  - Effects of coal dust
  - Effects of diesel emissions
  - Mitigation
- Ecological Health
  - Effects of coal and coal dust
  - Effects of diesel emissions
  - Mitigation
- Residual Effects and Determination of Significance
- Conclusions

FSD has committed to implementing a Project that minimizes environmental impacts to human health, the Fraser River and surrounding environment. As part of this commitment, FSD has developed detailed mitigation and has committed to implementing best management practices during the construction and operation phases.

7.1.1 Coal Formation

Coal is formed from peat, which is a mix of decayed and partly decayed plant material that builds up over time in very wet, oxygen poor environments. The change from peat into coal is a natural process called "coalification" and takes millions of years to complete.

Peat changes into coal through breakdown by bacteria, compaction (which exerts pressure on the peat), heat and time. The pressure on the peat squeezes out the water and pushes out methane and other gasses making the deposit rich in carbon over time. The longer the peat is exposed to heat and pressure the more carbon rich the deposit becomes.

The first type of coal to form from peat is lignite, followed by sub-bituminous coal, bituminous coal and anthracite coal. Each of these types of coal has different chemical and physical properties that set them apart from each other. Lignite and sub-bituminous coals are generally used for electrical power generation. Bituminous coal and anthracite are used for generating electricity and in metal processing.

7.1.2 Coal Classification

Coal falls into four main groups based on age and a variety of chemical and physical features. The chemical and physical features include, but are not limited to, volatile matter, quantity of fixed carbon and percentage of moisture and oxygen. The four main groups of coal are:

- Lignite
- Sub-bituminous
- Bituminous
- Anthracite

The Project will transfer sub-bituminous coal. Sub-bituminous coal accounts for about 38% of Canada's coal production. It is softer than bituminous coal and contains higher moisture content. It is abundant in Alberta and is mainly used for the generation of electricity. Sub-bituminous coal may be dull, dark brown to black, soft and crumbly at the lower end of the range, to bright jet-black, hard, and relatively strong at the upper end. Sub-bituminous coal is non-coking and has less sulphur but more moisture (approximately 10 to 45 percent) and volatile matter (i.e., components of coal, except for moisture, which are liberated at high temperature in the absence of air) (up to 45 percent) than bituminous coals. Carbon content is 35-45 percent and ash ranges up to 10 percent. Sulphur content is generally under 2 percent by weight.

Besides the major elements, sub-bituminous coal always contains a large number of other minor elements in trace amounts including mercury (Hg), arsenic (As), cadmium (Cd), lead (Pb), selenium (Se), and uranium (U). Further, sub-bituminous coal may also contain Polycyclic Aromatic Hydrocarbons (PAHs).

7.1.3 Diesel

Diesel is a petroleum-based fuel often used in construction equipment, power generators, trucks, passenger vehicles, locomotives, and boats. Diesel is a heavy fuel that is generally used to power vehicles with heavy loads (such as locomotives that pull coal-loaded rail cars). Combustion of diesel fuel releases $PM_{2.5}$ into the air. In many cities, diesel particulate matter (DPM) is a significant contributor to $PM_{2.5}$ levels (BIALAQS, 2012).

Source emissions for DPM were identified in BIALAQS (2012) as marine vessels, non-road engines, locomotives, heavy-duty vehicles. During Project construction and operations, diesel-powered vehicles/equipment that may be utilized include:

- Trucks;
- Construction equipment;
- Locomotives; and
- Tug boats.

Potential effects of and mitigation for DPM are discussed in Section 7.2.4.3.

7.2 Human Health Effects Assessment

7.2.1 Introduction

An assessment of the potential for the proposed facility to adversely impact human health has been conducted.

As discussed in Section 3.0, the primary concerns regarding human health raised by the public and stakeholders during the consultation program included the impact of the facility on air quality (e.g. dust generation, emissions from train locomotives and the tug boat that pull the barges). Additional concerns were raised regarding noise, as well as increased rail and marine traffic and the associated impact on the surrounding communities, including emergency response times. These concerns were also raised by Dr. Paul Van Buynder, Chief Medical Health Officer, Fraser Health Authority, in a letter dated May 2013

(Fraser Health Authority, 2013). The potential impact of the Project on air quality is discussed below, with the additional concerns addressed in Section 6.0, Socio-Community Effects Assessment.

FSD has committed to prevent air quality impacts by implementing air emission mitigation strategies and monitoring their performance against pre-established baselines and regulatory target levels, as summarized in the Environmental Policy Statement prepared by Fraser Surrey Docks (FSD, 2013a). To ensure that this commitment is met, FSD retained Levelton to conduct an Air Dispersion Modelling Assessment (Levelton, 2013a) to assess emissions, including fugitive dust, from the Project, and to develop an Air Quality Management Plan (Levelton, 2013b) to monitor air quality to determine the baseline, and to continue the monitoring program following the initiation of the Project to ensure mitigation measures are effective and air quality objectives are met.

The scope of the Levelton (2013a) air modelling included determining baseline air quality from existing Metro Vancouver monitoring stations near FSD and assessing the potential emissions associated with the various components of the Project including rail locomotives, tug boats, barges and on site operations (i.e., rail unloading, material transfer points, barge loading) and emissions from agricultural handling operations.

Levelton modelled various air contaminants associated with emission sources related to the Project and agricultural handling for various averaging periods (1 hour to annual). Air concentrations were estimated for particulate matter (PM) (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), sulphur dioxide (SO_2) and nitrogen dioxide (NO_2). There is the potential for contribution to these emissions from various combustion sources associated with the Project; additionally, PM_{10} and $PM_{2.5}$ provide a measure of the potential for fugitive dust from the coal handled/transported as part of the Project to impact air quality.

The results of the Levelton (2013a) Air Dispersion Modelling are presented in Tables 7-1 and 7-3, with a comparison of the results to the applicable air quality objectives, and an evaluation of the potential for the predicted concentrations to adversely affect human health. For a full description of the air dispersion modelling, reference should be made to Section 5.2 and Appendix VIII of this report.

The air dispersion modelling techniques and practices followed are considered to be conservative as they consider the combined effects of conservative emissions and meteorological conditions which results in the maximum predicted concentrations all within the context of atmospheric physics in the model that errs toward conservative estimates of the modelled design concentration.

7.2.2 Coal Dust

7.2.2.1 Human Exposure to Coal Dust

Coal dust has been studied for decades and the serious health effects, including coal workers' pneumoconiosis and progressive massive fibrosis, in miners with high daily exposures to coal dust over many decades are well established. While this data confirms that prolonged and high exposure levels to coal dust over many, many years can lead to serious adverse health outcomes, exposure circumstances to coal dust associated with the Project bear no similarity to the exposure conditions and risks known to be linked to serious adverse health outcomes in miners (Ritter, 2013; Appendix XIII).

The following provides a summary of the discussion provided in Dr. Len Ritter's expert opinion letter (Ritter, 2013; Appendix XIII). Dr. Ritter holds the rank of Professor Emeritus of Toxicology in the School of Environmental Sciences at the University of Guelph. Among other current appointments, Dr. Ritter is an adjunct professor in toxicology at the Chulabhorn Graduate and Research Institutes, Bangkok, Thailand; is an expert advisor to the World Health Organization (WHO) Joint Expert Committee on Food Additives, and is a member of the USEPA (United States Environmental Protection Agency) Human Studies Review Panel Board. He has advised governments both nationally and internationally on a broad range of topics related to human exposure to toxic chemicals and adverse health outcomes, and has served as an expert witness in several Courts and on review boards in matters relating to the assessment of toxic chemicals and potential risks to humans resulting from exposure to such chemicals. Dr. Ritter has 36 years of experience in toxicological health hazard and risk assessment of a broad range of toxic chemicals.

Several avenues of scientific evidence are available to examine the non-occupational, residential and by-stander exposures, which could arise from the Project. Levelton Consultants modelled exposures that might result from the Project (Levelton, 2013a). Levelton have reported a maximum predicted 24-hr average PM_{10} concentration (at the nearest residential receptor) of 32.3 µg/m^3, for both fugitive dust and combustion related emissions associated with the Project and agricultural handling operations, including background. The maximum predicted PM_{10} concentration for sources associated with the Project is 1.4 µg/m^3 (from coal dust and from combustion emissions).

Although no ambient guidelines/objectives are available for coal dust specifically, Worksafe BC's occupational exposure limits (Time Weighted Average) are either 400 or 900 µg/m^3 (depending on the type of coal) (available at http://www2.worksafebc.com/PDFs/regulation/exposure_limits.pdf). The estimated coal dust levels that might result from the FSD proposal (i.e., conservatively assumed to be 1.4 µg/m^3, which also includes contribution from combustion emissions) would be approximately 286 to

643 times lower than the acceptable occupational limits recently established by the Government of British Columbia for coal dust. In this regard, occupational exposure limits are set on the basis of exposure for 8 hrs /day, 5 days/week and over an entire working lifetime which are not expected to result in adverse health effects. Although occupational exposure limits are not explicitly derived to be protective of sensitive subpopulations (i.e., subpopulations such as children or the elderly that may be more sensitive to effects), the limits for coal dust are based on the available epidemiological data (i.e., results of occupational exposure studies). In the derivation of toxicity reference values (TRVs), or threshold levels (i.e., levels below which adverse effects would not be expected), health agencies typically apply a ten-fold uncertainty factor to account for intraspecies variability; this factor is applied to account for potential sensitive subpopulations, such as children and/or the elderly. Estimated coal dust levels associated with the Project are far less than ten-times lower than the occupational exposure limits, and thus would remain well below the limits even if a ten-fold uncertainty factor for intraspecies variability, to accommodate sensitive subsets of the population such as children or the elderly, was applied.

It may also be of interest to consider coal dust levels in mines where workers may be exposed throughout their working life. Jennings and Flahive (2005) reviewed various aspects of coal mining related adverse health outcomes and exposure to ambient inhalable and respirable coal dust levels. The authors reported Threshold Limit Values (TLV) imposed by Polish authorities for coal dust with varying silica content ranged from 300 μg/m^3 to 2000 μg/m^3, for respirable particles, depending on silica content, to 2000 μg/m^3 to 10,000 μg/m^3 for inhalable particles, also dependent on silica content. Jennings and Flahive also report that Australian authorities have imposed a time weighted average TLV of 3000 μg/m^3 while in the USA, the American Conference of Industrial Hygienists (ACGIH) has established a TLV of of 400 μg/m^3 (respirable) for anthracite and 900 μg/m^3 (respirable) for bituminous coal, the same limits adopted for occupational exposures in British Columbia. As noted earlier, these legal limits adopted in BC are approximately 286 to 643 times higher than the (modelled) levels of PM_{10} predicted from Project sources (Levelton, 2013a).

In addition to the modelled analysis of fugitive coal dust emissions carried out by Levelton, as described in Section 5.2.3, a recent assessment (SENES, 2012) of potential human exposure (and hence, risk) to fugitive coal dust, carried out by SENES under contract to Port Metro Vancouver, was considered in the health assessment of the proposed FSD coal operation. SENES summarized previously conducted monitoring studies on coal trains travelling to Roberts Bank. The monitoring studies reviewed and reported by SENES were conducted by ESL Environmental Sciences Limited (ESL, 1986) at track-side in Agassiz for a period of one month; the studies were conducted on behalf of Environment Canada and the BC Ministry of Environment and are considered a credible source. The ESL (1986) report has been reviewed, and is summarized here. The monitoring results of the ESL (1986) study indicated that the contribution of coal dust from trains to ambient total suspended particulate (TSP), sometimes also known as particulate matter or PM, adjacent the railway tracks on a day with up to six moderate-to-heavy dusting coal trains, was approximately 20-30 $\mu g/m^3$ over a 7-hour monitoring period at a distance of 4.5 m from the tracks (ESL, 1986). Additionally, ESL noted that moderate to heavy dusting was typically associated with high winds and dry conditions, and that contributions of coal dust from light dusting coal trains was not measurable. ESL (1986) also noted that total PM concentrations over a 24-hour averaging period would be much lower still because the contribution of these trains would be averaged over 24 hours instead of 7 hours, with estimated concentrations in the range of 6-9 $\mu g/m^3$ (representing only 5-7.5% of the most stringent AAQO). Furthermore, SENES (2012) further estimated the percentage of $PM_{2.5}$ in coal dust to be 2-20%. Under the assumption that 20% of this coal dust was in the $PM_{2.5}$ fraction, an upper estimate of an increase in $PM_{2.5}$ levels less than 2 $\mu g/m^3$ would be observed over a twenty-four hour period, which would further diminish with distance from the rail tracks; the predicted concentration of 2 $\mu g/m^3$ is 200 to almost 500 times less than occupational safe levels established by Worksafe BC for coal dust, and is well below the Metro Vancouver AAQO for $PM^{2.5}$ referenced below in Section 7.2.3.. At a distance of 10 m from the tracks, SENES concluded that the $PM_{2.5}$ concentrations would be further reduced to a level that would fall within 'noise levels' of $PM_{2.5}$ sampling instruments and thus would be indistinguishable from background concentrations.

The recent SENES report concluded that the 1984/85 study at Agassiz remains as the best estimate of the impact of fugitive coal dust from trains delivering coal to Roberts Bank. Although the monitoring studies reported by SENES were specific to Roberts Bank, these findings are very relevant to the proposed FSD coal operations. It is also important to note that although the Roberts Bank studies were carried out more than 25 years ago and current day monitoring/sampling methods may be superior, the modern day coal dust mitigation measures being proposed by FSD would result in a comparatively significant reduction in fugitive coal dust emissions.

In addition, on October 24, 2013, the Corporation of Delta provided FSD with a copy of a Council Report addressed to the Mayor and Council and from the Corporation of Delta Office of Climate Change and Environment (Corporation of Delta, 2013). The report provided several recommendations for continued monitoring of coal dust levels in the municipality, and also detailed the results of two coal dust monitoring programs conducted in the summer of 2013 to address concerns regarding coal dust generation from the nearby Westshore Terminals.

In the first dust monitoring program staff from the Corporation of Delta, Office of Climate Change and Environment, conducted independent monitoring to investigate the presence of coal dust in the community. The study was conducted in July 2013, during a dry period with very limited precipitation, when dustfall potential is greatest. Five dustfall canisters were set out for one month at four locations in Tsawwassen, and one location in the North 40 area, near the Boundary Bay airport, 15 m from the railway used by trains transporting coal to, and transporting empty coal cars from, Westshore Terminals. Following the one-month period, the samples were analysed by the Accuren Group Inc. to determine the presence/absence of coal dust. Coal dust was detected at very low levels in the four samples collected from Tsawwassen; low dustfall was observed at these locations with *total* measured weights of dust over the 32 day collection period ranging from approximately 6 to 14 mg; to put this into context, 10 mg is the approximate weight of 1 grain of course-grained sand. Furthermore, coal dust represented approximately 5 % of the total dust measured in the samples (Corporation of Delta, 2013). Additionally, overall dust concentrations in the samples (average of 0.17 $mg/dm^2/day$) were well below the BC AQO for average monthly dustfall in a residential area of 1.7 $mg/dm^2/day$. Higher coal dust levels were measured in the sample collected adjacent to the railway. Specifically, coal dust represented approximately 65% of the total dust measured at this location, and the overall dust concentration in the sample (average of 5.17 $mg/dm^2/day$, of which 3.36 $mg/dm^2/day$ was attributed to coal) exceeded the BC AQO for average monthly dustfall in a non-residential area of 2.9 $mg/dm^2/day$. Additional sampling has been recommended to further evaluate dust generation associated with rail transport of coal by Westshore in the area.

The second dust monitoring study was conducted by Metro Vancouver and was concurrent with the first study. The study measured the coal content of measured $PM_{2.5}$ and PM_{10} air concentrations over four consecutive seven day periods. This study differed from the Corporation of Delta study in that it measured air concentrations versus dustfall levels. The results indicated that $PM_{2.5}$ and PM_{10} concentrations were less than the Metro Vancouver AAQO, and that coal dust represented approximately 5% of the overall concentrations of $PM_{2.5}$ and PM_{10}.

The results of the Corporation of Delta and Metro Vancouver studies demonstrate that coal dust levels in communities nearby Westshore Terminals, a facility that shipped 26.1 million tons of coal in 2012, more than 6 times the volume of coal proposed to be transported as part of the FSD Project, are very low, and well below the acceptable levels described above for coal dust, and discussed below in Section 7.2.3 for particulate matter.

7.2.2.2 Coal Dust and Risk of Cancer

Concerns have been raised regarding the potential carcinogenicity of coal dust. This issue has been reviewed by the International Agency for Research on Cancer (IARC); IARC is an agency of the World Health Organization. The objective of IARC reviews, in general, is to prepare, with the help of working groups comprised of internationally recognized experts, and to publish in the form of monographs, critical reviews and evaluations of evidence on the carcinogenicity of a wide range of human exposures. It is widely accepted that monographs are recognized as an authoritative source of information on the carcinogenicity of a wide range of human exposures. A survey of users conducted by IARC in 1988 indicated that various governments and agencies in 57 countries consult the monographs.

The potential carcinogenicity of coal dust has been reviewed by IARC in 1997 (IARC, 1997); this review has not been subsequently updated by IARC. While noting a large body of published literature concerning cancer risks potentially associated with employment as a coal miner, including a small number of exposure-response associations with coal mine dust, IARC reported that epidemiological investigations (i.e., studies of the patterns, causes, and effects of health and disease conditions in defined populations, in this case, coal miners) on cancer risks in relation to coal dust *per se* have not been reported. Studies of cancers of the lung and stomach among coal miners have received the greatest attention. Interpretation of these studies has, however, been difficult due to the absence of information on levels of the specific components of coal mine dust such as coal, quartz, and metals. Results from studies that investigated coal mine dust and lung cancer in highly exposed occupational populations (miners) have not been consistent; some studies revealed excess risks, while other studies indicated lower lung cancer risks in coal miner populations. While an increased risk of stomach cancer among coal miners has been more consistently observed, the absence of consistent findings regarding increasing risk as a function of increasing exposure (in terms of intensity, frequency and duration), raises serious questions about the reliability of these findings. Moreover, coal dust was evaluated for its carcinogenicity, both separately and in combination with diesel particle aerosols, by inhalation in rats with no reported increase in cancer. Similarly, in another study involving intrapleural injection (i.e., injection between the two layers of pleura, a membrane that envelops the lung and folds back to make a lining for the chest cavity) of coal dust, no increase in the incidence of thoracic tumors was observed. In this context, IARC have also noted that exposure of laboratory rats to coal dust by inhalation or orally did not produce any evidence of mutagenicity (evidence of mutagenicity is taken to be an important line of evidence supporting carcinogenicity).

IARC has not concluded that coal dust is a human carcinogen. Rather, IARC has concluded that there is inadequate evidence of carcinogenicity of coal dust in humans or in experimental animals.

7.2.2.3 Conclusions

Dr. Ritter concluded in his expert opinion, that the proposed FSD coal handling operations do not pose a risk of adverse health effects in neighboring communities; his conclusion is based on several lines of evidence, including (Ritter, 2013; Appendix XIII):

- The results of Levelton's (2013a) comprehensive air dispersion model which predicted the particulate matter levels which could result from the proposed FSD Project operations, including from coal dust. The Levelton model has predicted a 24-hour average PM_{10} value for the nearest residential receptor of 28.2 µg/m^3, including background and fugitive dust for the agricultural operations, of which only 1.4 µg/m^3 is associated with Project related sources (from combustion emissions and fugitive coal dust). The Levelton model predicted particulate matter value of 1.4 µg/m^3 is 286 – 643 times lower than the occupational exposure limits established by the ACGIH in the US or by the Government of British Columbia, as established under its WorkSafe program (400 µg/m^3 to 900 µg/m^3, depending on type of coal), even if a ten-times uncertainty factor is applied to account for intraspecies variability / sensitive subpopulations. The Levelton model predicted particulate matter value of 28.2 µg/m^3 (with background) is also up to 106 times lower than the Australian TLV of 3000 µg/m^3.
- A recent assessment carried out by SENES on behalf of Port Metro Vancouver, concluded that the total contribution of fugitive coal dust to 24-hour average $PM_{2.5}$ concentrations at track-side would be less than 2 µg/m^3, even on a day with six moderate to heavy dusting coal trains. SENES (2012) concluded that at a distance of 10 m from the tracks, the concentrations would be further reduced to a level of impact which falls within the 'noise' level of $PM_{2.5}$ sampling instruments and would be indistinguishable from background concentrations. Coal dust air levels of 2 µg/m^3 would correspond to concentrations 200 to almost 500 times less than occupational safe levels established by British Columbia's WorkSafe program, and is well below the Metro Vancouver AAQO's referenced in Section 7.2.3.
- Recent studies conducted by the Corporation of Delta and Metro Vancouver indicate that coal dust levels over a worst-case period (i.e., during the summer, when dustfall potential is greatest) in communities nearby Westshore Terminals, a facility that transports approximately six times the volume of coal proposed as part of the Project, are less than Metro Vancouver AAQO, as well as the safe levels discussed above for coal dust.
- IARC (1997) concluded that there is inadequate evidence of carcinogenicity of coal dust in humans or in experimental animals.

SNC-Lavalin has thoroughly reviewed Dr Ritter's work and supports the same conclusion.

Further discussion of fugitive dust emissions associated with the project, including both coal dust and particulate matter from combustion sources, is presented in Section 7.2.3.

7.2.3 Health Effects of Fugitive Dust/Particulate Matter

7.2.3.1 Study Area

The study area includes the Project footprint, and nearby land outside the terminal lease boundaries including residential and commercial property in the City of Surrey, the Corporation of Delta and City of New Westminster. The air dispersion modelling study area considers a 20 km by 20 km domain, with the FSD facility located at the center of the domain, as depicted in Figure 7-1.

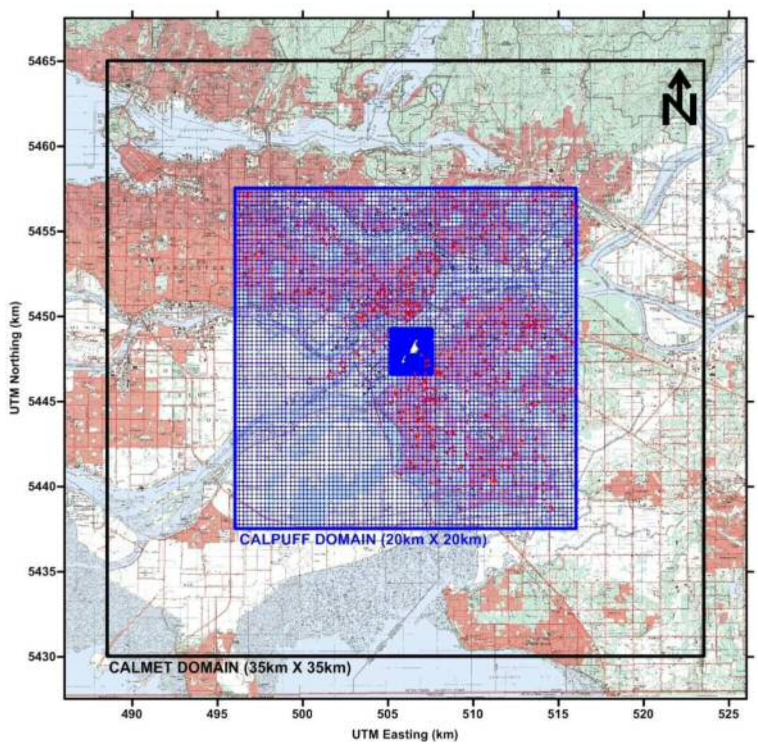

Figure 7-1: The air dispersion modelling domain is presented in blue (20 km x 20 km area)

7.2.3.2 Existing Conditions

Baseline ambient air quality in the area surrounding the FSD facility was determined using data from two Metro Vancouver ambient air quality monitoring stations (T13 North Delta and T18 Burnaby South). The monitoring stations were chosen based on their proximity to the FSD site and the air quality parameters monitored.

As indicated, predicted particulate matter concentrations were characterized using $PM_{2.5}$ and PM_{10}; the 24-hour and annual background concentrations in the area of the Project were 11.3 μg/m^3 and 4.1 μg/m^3, respectively, for $PM_{2.5}$, and 26.8 μg/m^3 and 12.0 μg/m^3, respectively for $PM_{10.}$

7.2.3.3 Potential Effects and Mitigation

Particulate matter (PM) ($PM_{2.5}$ and PM_{10}) are measures of particles with a diameter of 2.5 μm or less and 10 μm or less, respectively, that can enter the respiratory tract and are considered to be associated with health effects. PM_{10} is referred to as inhalable particulate, while particles smaller than 2.5 μm ($PM_{2.5}$) are referred to as fine, respirable particulate (WHO, 2006). PM_{10} is primarily produced by mechanical processes such as construction activities and wind (road dust, sand), whereas $PM_{2.5}$ is primarily produced by combustion sources (WHO, 2006).

Total $PM_{2.5}$ and PM_{10} concentrations associated with the Project, including from fugitive dust and combustion sources, were predicted from the facility fenceline and across a 20 km x 20 km receptor grid defining the air dispersion modelling domain. Receptors were also placed at various sensitive receptors (e.g. nearby hospitals and schools). In total, the model contained more than ten thousand receptor locations. The predicted concentrations from Project sources were summed with background ambient air concentrations reported by Metro Vancouver, with the resulting concentrations compared to the Metro Vancouver Ambient Air Quality Objectives (Metro Vancouver AAQO) (24-hour average and annual average). The Metro Vancouver AAQO are applicable based on the location of the FSD facility, and Metro Vancouver is the permitting authority for an Air Emissions Permit.

Dust mitigation is an integral component of the overall Project design. Mitigation measures have been developed to address potential fugitive dust from several sources including:

1) Coal rail cars in transit;
2) The unloading of rail cars at FSD;
3) Material transfer through conveying systems at FSD;
4) The loading of barges at FSD; and
5) Coal barges in transit between FSD and Texada Island.

FSD no longer plans to include an allowance for a coal stockpile at the facility. Proposed mitigation measures include, but are not limited to, using topper coating/surface stabilizers on all coal shipped on BNSF railcars, including re-application of the topper coating at the approximate mid-point of the rail movement; unloading the coal via trap doors in the bottom of each rail car to enclosed, shallow receiving pits in a building equipped with full water misting; an enclosed conveyance system; using barges with sidewalls; applying a binding agent to the coal as it is loaded on the barges; and, profiling the coal in railcars and on barges to such that it is more aerodynamic and less susceptible to loss from wind. Further details on the dust mitigation strategies are provided in Section 2.4 of this report. The proposed dust control measures have been considered by Levelton (2013a) in their modelling.

The principal and likely supplier of dust suppressants is GE. Extensive communications have been held with GE personnel in its Pennsylvania and Vancouver area offices in order to obtain specific information pertaining to their efficacy. As alluded to above, the review considered the benefits of the dust suppressants to minimize and/or avoid potential adverse effects to both the environment and human health.

A thorough review of topping agent MSDS considered proposed for use by BNSF and FSD was conducted to evaluate the efficacy of their application and potential significance to environmental and human health. The MSDS for the potential dust control products considered for use are provided in Appendix II. It is noted that the topping agents proposed for use by FSD will be applied at the FSD facility, and therefore are discussed in the context of occupational exposures. Exposure of the general public to the topping agents is unlikely.

In considering the selection of an effective suppressant(s) the physical-chemical properties of coal must be understood. For example, coal is hydrophobic meaning it does not have a chemical affinity for water so in order to provide an effective suppressant this property of coal must somehow be overcome given suppressants are added as a product/water spray mixture. With this in mind, GE has a range of products specifically designed to overcome this physico-chemical limitation in order to apply an effective suppressant (General Electric letter to FSD, November 2013).

The suppressant(s) considered for use on coal destined for barge transport at FSD will be sprayed on conveyors as the coal is being barge-loaded. To accommodate this, a surfactant is required to reduce surface tension on the surface of the coal which optimizes coverage and binding of the dust suppressant to coal particles. The above process requires two product formulations, a surfactant for reducing surface tension and a binding agent which typically is some form of a cationic polymer with a high affinity for organic and colloidal surfaces such as that provided by coal particles.

According to GE, the cationic polymers selected for use will bind irreversibly to coal particles assuming the product is added efficiently as the coal is being loaded. For the purposes of this assessment it is assumed the spray technology is adequately well-known that such an assumption can be made. Once the treated coal is loaded onto the barge the two conclusions that can be made are: (1) fugitive dust will be controlled and, (2) the product will not be washed off by precipitation given it is irreversibly bound to the coal. Under these conditions fugitive dust will be controlled on route to Texada Island and will also be controlled when it is off-loaded. In the event of an unlikely spill of coal into water the product is not expected to dissociate from the coal particles and no environmental toxicity is anticipated. It is true the basic formulation has measurable toxicity as described in the MSDS; however, once applied the basic nature of the suppressant is changed given it would be irreversibly bound to the coal.

There is direct corollary for describing and illustrating the efficacy of a cationic polymer and how it is being used to reduce suspended solids in water. Adding cationic polymers and other flocculants and coagulants to water containing suspended solids is a common and often required practice to optimize solids removal and to minimize and/or avoid adverse impacts to the environment. This is the same principal being applied here, where the selected product binds to coal particles thus preventing fugitive dust and leaching off the coal particle under precipitation or in the event of a spill. Application of the GE suppressant is, therefore, considered an effective control technology. Given these observations it could be considered the Best Available Control Technology (BACT) or at least the Reasonably Available Control Technology (RACT). According to GE, the nature of the potential surfactants selected for use in this application belongs to a category of surfactants commonly found in household detergents. Surfactants are anionic wetting agents and assist the binding of the cationic polymer (dust suppressant) to the coal particles.

Given the above observations the following conclusions have been noted the general qualities and benefits of the potential dust control agents selected for use:

- The chemical components and breakdown of the products of the topping agents are chemically stable, have low toxicity, do not persist in the environment and contain no known human carcinogens;
- The binding and suppressing agents are not regulated under the Transportation of Dangerous Goods Act (i.e. not considered a dangerous good) and all components of these two formulations comply with substance notification requirements under CEPA;
- Water containing the binding and suppressing agents can be discharged to sanitary given the nature of the formulations and their components (low toxicity, not persistent etc.). This assumes local regulatory provisions or agreements would accommodate the discharge to sanitary;
- The formulations are miscible and soluble in water and neither the principal formulation, its components or breakdown products persist in the environment;
- The cationic polymer applied for fugitive dust control will bind irreversibly to coal particles and will not leach off the coal once applied and is not expected to leach off the coal under

precipitation or in the event of a spill into water. The products are similar to the efficacy and application of coagulants and flocculants applied to water for removing and settling solids in water;

- The suppressant considered for use belongs to a family of products similar to household detergents and while soluble in water they will not persist in the environment as they are readily biodegradable as are the broad range of detergents allowed for domestic use;
- All of the products are chemically stable;
- Under conditions of adequate ventilation, no special precautions are required for inhalation unless levels exceed those listed in the MSDS. Handling precautions include gloves and safety glasses typical for an occupational setting. Workers at the FSD facility will be equipped with appropriate personal protective equipment and therefore, no adverse effects to workers are anticipated given the nature of the formulations, application rates and other proposed mitigation;
- All of the topping agents have been thoroughly reviewed by regulators in their respective jurisdictions and all have been successfully shown to mitigate the potential oxidation (spontaneous combustion) and fugitive dust from coal;
- In the unlikely event of a coal spill into the environment, the products would rapidly dissipate in water and if the spill occurred on land there would be no concern for air quality other than that associated with fugitive dust; and,
- Application and use of the selected dust control agents have been carefully reviewed and are considered to be the Best Available Control Technologies (BACTs) or at least the Reasonable Available Control Technology (RACT) for controlling potential fugitive dust associated with coal shipments by rail and barge. They are also safe to use in an occupational setting assuming the understandable and simple precautions outlined in the MSDS are followed.

A summary of the air modelling results for PM compared to the Metro Vancouver AAQO is presented in Table 7-1. In addition, in order to provide a more comprehensive assessment of potential adverse health effects, we also compared modelling results, where available, to the BC Ambient Air Quality Objectives (AQO) (BC MoE, 2013), the Canadian Council for Ministers of the Environment (CCME) Canada Wide Standards (CWS) for Particulate Matter (CCME, 2000) and the World Health Organization (WHO) Air Quality Guidelines (AQG) (WHO, 2006). The resulting assessment therefore provides a local, provincial, national and international context to the modelled PM values.

Table 7-1: Air Quality Assessment Results for $PM_{2.5}$ and PM_{10} (from Levelton, 2013a)

Pollutant	Averaging Time	Background ($\mu g/m^3$)	Maximum Concentration ($\mu g/m^3$)		Maximum Concentration + Background ($\mu g/m^3$)		Air Quality Objectives ($\mu g/m^3$)				
			Maximum Receptor	Nearest Residential Receptor	Maximum Receptor	Nearest Residential Receptor	Metro Vancouver [a] (planning goal)	CCME [b]	British Columbia [c] (planning goal)	WHO [d]	Most Stringent Objective
$PM_{2.5}$	24-hour	11.3	6.8	1.6	18.1	12.9	25	30	25	25	25
	Annual	4.1	1.1	0.1	5.2	4.2	8(6)	-	8(6)	10	8
PM_{10}	24-hour	26.8	28.0	5.5	**54.8**	32.3	50	-	50	50	50
	Annual	12	4.2	0.4	16.2	12.4	20	-	-	20	20

Notes:

a. Metro Vancouver Ambient Air Quality Objectives (2011)

b. CCME Canada Wide Standards (2000)

c. B.C. Ambient Air Quality Objectives (2013)

d. WHO Air Quality Guidelines (2006)

Bold – maximum concentration exceeds one or more of the AAQO

Particulate matter emissions from fugitive dust sources are localized around the facility and predicted air quality impacts are generally low. Exceedences of the 24-hour PM_{10} objective were predicted at eight fenceline receptors near rail unloading operations. No particulate matter Exceedences were predicted beyond the fenceline. With the mitigation planned for the facility the fugitive dust sources are predicted to have low impact on air quality in the area.

As presented in Table 7-1, the predicted 24-hour and annual concentrations of $PM_{2.5}$ and PM_{10} (from fugitive dust and combustion sources), including at the nearest residential receptor, were generally less than the Metro Vancouver AAQO, as well the BC AQO, the CCME CWS and the WHO AQGs. As noted in Section 5.2, exceedences of the 24-hour PM_{10} objective were predicted at eight fenceline receptors near rail unloading operations. No particulate matter exceedences were predicted beyond the fenceline. It is noted that given the conservatism in the model, the maximum predicted concentration of $PM_{2.5}$ at the nearest residential receptor is considered to be equivalent to background (predicted concentration of 4.2 $\mu g/m^3$ compared to the background concentration of 4.1 $\mu g/m^3$).

The Metro Vancouver AAQO (annual average) for $PM_{2.5}$ is based on the BC AQO for this parameter. The BC AQO for $PM_{2.5}$ was revised to 8 $\mu g/m^3$ (annual average) in 2009 following a thorough review of the scientific literature by SENES Consultants Limited (SENES), on behalf of the BC Lung Association (SENES, 2005). Additionally, the Metro Vancouver AAQO references a planning goal (i.e., future desirable level) of 6 $\mu g/m^3$. A review of guidelines from other jurisdictions for $PM_{2.5}$ (annual averages) was conducted by SENES (2005); the Metro Vancouver AAQO for $PM_{2.5}$ is among the lowest of the available guidelines across Canada and world-wide.

The Metro Vancouver AAQO, as well as the guidelines/objectives from the other jurisdictions/agencies, have been derived to be protective of potential adverse health effects associated with exposures to PM. A summary of the critical effects for which the guidelines are derived and intended to be protective of is presented below, with a more detailed discussion of potential short and long term health effects associated with exposures to PM, at ambient air levels which exceed quality guidelines, included in Appendix IX.

Effects for Particulate Matter

The available data on particulate matter and associated health impacts was compiled and reviewed by SENES (2005), on behalf of the BC Lung Association (report is the basis of the BC AQO), and was largely based on the review of health aspects of air pollution in Europe completed by the WHO in 2004 and formed the basis of the WHO (2006) update of their Air Quality Guidelines for $PM_{2.5}$ and PM_{10}. WHO (2006) summarized that long-term exposure to elevated particulate matter concentrations had the potential to lead to a marked reduction in life expectancy, primarily due to increased cardiopulmonary and lung cancer mortality. While mortality was the basis on which WHO considered that ambient air quality objectives should be set, increases in lower respiratory symptoms and reduced lung function in children, and chronic obstructive pulmonary disease and reduced lung function in adults, were likely long-term health outcomes associated with exposures to elevated $PM_{2.5}$ concentrations at or near background levels (SENES, 2005; WHO, 2006). WHO noted that epidemiological studies on large populations have not identified a threshold concentration for non mortality endpoints below which ambient PM has no effect on health (SENES, 2005; WHO, 2006; CCME, 2004). It is important to be aware that a range of thresholds may exist within the population, depending on the type of health effect and the susceptibility of subgroups; noting, however, that no threshold for effects at the population level, other than mortality (as noted above), and for the most sensitive subgroups, has been identified (SENES, 2005). WHO (2006) and SENES (2005) have indicated that as threshold levels for effects other than mortality have not been identified, the air quality guidelines have been derived on the basis of mortality and reflect concentrations below which increased mortality outcomes due to exposure to PM air pollution are not expected based on the current body of scientific evidence.

In 1998, the Associate Medical Officer of Health for the South Fraser Health Region was asked to respond to concerns related to perceived health impacts and pollution from coal dust in the Delta region (Appendix XIII). Dr. Strang's assessment noted that there was no difference in respiratory diseases or asthma in the South Fraser Valley or Delta compared to the rest of the province. Dr. Strang went on to note that death rates adjusted for age, attributable to respiratory disease and specifically due to asthma in South Fraser Valley were comparable to the rest of the province. Interestingly, Dr. Strang reported that the standardized mortality ratio for asthma in South Fraser Valley was actually lower than in the rest of the province. Finally, Dr. Strang concluded that despite public concerns about the influence of coal dust on respiratory disease and asthma, respiratory diseases and asthma were not different in Delta when compared to the rest of the province (Appendix XIII).

7.2.3.4 Residual Effects, Determination of Significance and Proposed Monitoring

Levelton (2013a) concluded that particulate emissions associated with coal dust (and combustion sources) and agricultural handling operations will be localized around the facility and are predicted to have low impact on air quality in the area. The highest concentrations of PM occur along the facility fenceline, with concentrations quickly diminishing as emissions disperse further away from the FSD facility (Levelton, 2013a). Predicted $PM_{2.5}$ and PM_{10} concentrations, including at the nearest residential receptor, were generally less than the Metro Vancouver AAQOs, as well as the BC AQO, CCME CWS and the WHO AQG. In addition, the $PM_{2.5}$ concentrations were estimated to be below the Metro Vancouver planning objective of 6 µg/m^3. As noted, the 24-hour PM_{10} concentration exceeded the AAQO of 50 µg/m^3 at 8 receptors at the facility fenceline, near the rail unloading operations. Concentrations of PM_{10} quickly diminish as emissions disperse further away from FSD's facility, with concentrations at the nearest residential receptor approximately equivalent to background. Receptors in the area of the fenceline would be limited to industrial workers, who are likely to be present for only a portion of the day (i.e., for 8 hours while at work). These short-term exposures to PM_{10} concentrations above the 24-hour AAQO are unlikely to result in unacceptable health risks.

As documented above, the guidelines have been derived based on the best available scientific evidence and, if achieved, are considered protective of health effects in the general public, including for sensitive sub-populations. In addition, a draft Air Quality Management Plan (Levelton, 2013b) has been developed to monitor air quality to determine the baseline and to continue the monitoring program following the initiation of the Project to ensure mitigation measures are effective and air quality objectives are met.

Based on the above, it is concluded that exposures to PM generated by coal handled/transported as part of the Project will not result in unacceptable health risks. Fugitive dust associated with the Project, as well as with the agricultural operations, is not anticipated to have significant adverse effects on ambient area quality in the area.

7.2.4 Health Effects of Diesel Emissions

In addition to fugitive dust, there are diesel emissions associated with the Project (i.e., from tugboats for barging and locomotives). The Levelton (2013a) air dispersion modelling included these combustion sources, and predicted associated PM, carbon monoxide (CO), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) concentrations. The results of the modelling, including a comparison to the Metro Vancouver AAQO and air quality objectives from other agencies, as well as a discussion of the potential health effects of the associated air contaminants, are discussed below.

7.2.4.1 Study Area

The study area includes the Project footprint, and nearby land outside the terminal lease boundaries including residential and commercial property in Surrey, Delta and the City of New Westminster. The air dispersion modelling study area considers a 20 km by 20 km domain, with the FSD facility located at the center of the domain, as depicted in Figure 7-1.

7.2.4.2 Existing Conditions

Baseline ambient air quality in the area surrounding the FSD facility was determined using data from two Metro Vancouver ambient air quality monitoring stations (T13 North Delta and T18 Burnaby South). The monitoring stations were chosen based on their proximity to the FSD site and the air quality parameters monitored.

Background concentrations of PM, CO, NO_2 and SO_2 are summarized in Table 7-2.

Table 7-2: Background Ambient Air Concentrations for PM, CO, NO_2 and SO_2

Pollutant	Averaging Time	Background ($\mu g/m^3$)
$PM_{2.5}$	24-hour	11.3
	Annual	4.1
PM_{10}	24-hour	26.8
	Annual	12
CO	1-hour	687
	8-hour	615
NO_2	1-hour	67
	Annual	27
SO_2	1-hour	8.3
	24-hour	5.9
	Annual	1.6

Current and historic rail traffic and barge movements at the FSD facility have been considered in the evaluation of potential impacts on air quality. The Project will result in an approximate 10% increase in the current rail traffic in Surrey. FSD previously handled eight train movements per day, including four arrivals and four departures, and are currently handling an average of two train movements per day, including one arrival and one departure. The Project would increase the FSD train movements to four movements per day from current frequencies and would be less than historical frequencies.

Current total switch movements in the area are estimated to be approximately 3430 movements annually, of which, approximately 230 are estimated to be associated with FSD (approximately 116 arrivals and departures). This is a decrease compared to historic levels of 5578 switch movements in the area in 2005.

In addition, the current number of barge movements associated with the FSD is 60 barges/year, while the current number of annual marine vessel movements at FSD is 234 vessels/year; in comparison, the overall ship movement on the Fraser River, Route 1.7, is estimated to be approximately 3850 movements, based on the PMV Tanker Traffic Study, Automatic Information System data from July 2010 to Jun 2011 (DNV, 2012). Additionally, past operations at FSD included a greater number of ship movements; in 2005, FSD barge and vessel traffic included 128 barges and 579 marine vessel movements.

As presented, the proposed increase of rail and marine movements associated with the Project is minimal (an approximate 10% increase) compared to the total number of rail and marine movements in the area.

7.2.4.3 Potential Effects and Mitigation

Emissions from diesel engines include PM, CO, NO_2 and SO_2. Carbon monoxide is primarily produced by incomplete combustion of hydrocarbons and is emitted in engine exhaust, while nitrogen dioxide and sulphur dioxide are released as emissions from the combustion of fossil fuels.

The PM, CO, NO_2 and SO_2 concentrations associated with the Project, including from tugboats and locomotives were predicted from the facility fenceline and across a 20 kilometer by 20 kilometer receptor grid defining the air dispersion modelling domain. Receptors were also placed at various sensitive receptors (eg. nearby hospitals and schools). In total, the model contained more than ten thousand receptor locations. The predicted concentrations from Project sources were summed with the background ambient air concentrations, with the resulting concentrations compared to the Metro Vancouver AAQO.

The predicted concentrations (including agricultural handling operations and summed with background) of PM_{10} and $PM_{2.5}$ are presented in Table 7-1 and included contribution from combustion sources (diesel emissions). As discussed, predicted concentrations, including at nearest residential receptor, were generally less than the Metro Vancouver AAQOs, as well as the BC AQO, the CCME CWS and the WHO AQG. Given the conservatism in the modelled estimates, and as predicted concentrations are less than the guidelines/objectives developed to be protective of adverse health effects, it was concluded that PM generated by the Project (i.e., from fugitive dust and diesel emissions) will not result in unacceptable health risks.

A summary of the results for CO, NO_2 and SO_2, compared to the Metro Vancouver AAQO, is presented in Table 7-3. The BC AQO (BC MoE, 2013), the CCME National Ambient Air Quality Objectives (NAAQO) (CCME, 1999) and the WHO AQG (WHO, 2006) are also provided for comparison purposes. The CCME has developed up to three objective values using the categories "maximum desirable", "maximum acceptable", and "maximum tolerable". The "maximum desirable" objective is the most stringent standard. British Columbia has established a similar set of objective values, designated as levels A, B and C, with level A being the most stringent. Level A is typically applied to new and proposed discharges to the environment, and is usually the same as the federal "maximum desirable" objective. Metro Vancouver's regional ambient air quality objectives are health-based objectives.

It is noted that the WHO (2006) AQG for SO_2 (24-hour average) is approximately an order of magnitude, or more, lower than the guidelines recommended by the other jurisdictions/agencies, including Metro Vancouver. The WHO (2006) have established a 10-minute average guideline of 500 $\mu g/m^3$ to be protective of short-term exposures, as well as the 24-hour average guideline of 20 $\mu g/m^3$ to be protective of longer term exposures; no annual average guideline is available. As indicated in Table 7-3, maximum predicted SO_2 concentrations associated with the Project are well below all guidelines/objectives, including the most stringent WHO 24-hour average AQG of 20 $\mu g/m^3$.

Table 7-3: Air Quality Assessment Results for CO, NO_2 and SO_2 (from Levelton, 2012)

Pollutant	Averaging Time	Background ($\mu g/m^3$)	Maximum Concentration ($\mu g/m^3$)		Maximum Concentration + Background ($\mu g/m^3$)		Air Quality Objectives ($\mu g/m^3$)								
			Maximum Receptor	Nearest Residential Receptor	Maximum Receptor	Nearest Residential Receptor	Metro Vancouver [a]	CCME [b]			British Columbia [c]			WHO	Most Stringent Objective
								Maximum Desirable	Maximum Acceptable	Maximum Tolerable	Level A	Level B	Level C		
CO	1-hour	687	121	38	808	725	30,000	15,000	35,000	-	14,300	28,000	35,000	30,000 [d]	14,300
	8-hour	615	76	22	691	637	10,000	6,000	15,000	20,000	5,500	11,000	14,300	10,000 [d]	5,500
NO_2	1-hour	67	108*	93*	108*	93*	200	-	400	1,000	-	-	-	200 [e]	200
	Annual	27	13.1	2.1	**40.1**	29.1	40	60	100	-	-	-	-	40 [e]	40
SO_2	1-hour	8.3	0.7	0.2	9.0	8.5	450	450	900	-	450	900	900	-	450
	24-hour	5.9	0.1	0.0	6.0	5.9	125	150	300	800	160	260	360	20 [e]	20
	Annual	1.6	0.0	0.0	1.6	1.6	30	30	60	-	25	50	80	-	25

Notes:

a. Metro Vancouver Ambient Air Quality Objectives (2011)

b. CCME National Ambient Air Quality Objectives (1999)

c. B.C. Ambient Air Quality Objectives (2013)

d. WHO Air Quality Guidelines for Europe (2000)

e. WHO Air Quality Guidelines (2006)

* - The Ambient Ratio Method (ARM) has been applied to the 1-hour NO_x results, which includes background in the calculation per the BC AQMG.
Bold – maximum concentration exceeds the AAQO

As presented in Table 7-3, the predicted concentrations of CO, NO_2 and SO_2, including at the maximum receptor (i.e. highest concentration predicted) and nearest residential receptor, were less than or approximately equal to (for NO_2; with the predicted concentration at the maximum receptor 40.1 $\mu g/m^3$, compared to the AAQO of 40 $\mu g/m^3$) the Metro Vancouver AAQO, as well as guidelines/objectives from other provincial, national and international jurisdictions and health agencies. Maximum concentrations are below the federal and provincial guidelines/objectives, including the CCME "Maximum Desirable" and the BC Level A levels.

The model predicted higher annual NO_2 concentrations in the region concentrated over the Fraser River, in the immediate area of the berth, and within the "fenceline" depicted on Figure 7-2. As discussed, the model predictions are conservative, and have likely resulted in an over-prediction of emissions and associated NO_2 concentrations. The proposed Air Quality Management Plan (Levelton, 2013b) does contain a commitment to monitor NO_2, which would confirm the modelled predictions and, where necessary, changes could be implemented. It is important to note that the elevated NO_2 concentrations have been predicted in areas over top of the Fraser River, where long term human exposure would not be likely. On this basis and considering the conservative nature of the estimates, adverse impacts to human health are not anticipated.

The Metro Vancouver AAQO, as well as the BC, CCME and WHO objectives/guidelines, have been derived to be protective of potential adverse health effects associated with exposures to CO, NO_2 and SO_2, including for sensitive sub-populations (e.g. children, elderly, pregnant women). A summary of the critical effects for which the guidelines are derived and intended to be protective of is presented below, with a more detailed discussion of potential short and long term health effects associated with exposures to these parameters at ambient air levels which exceed quality guidelines included in Appendix VIII.

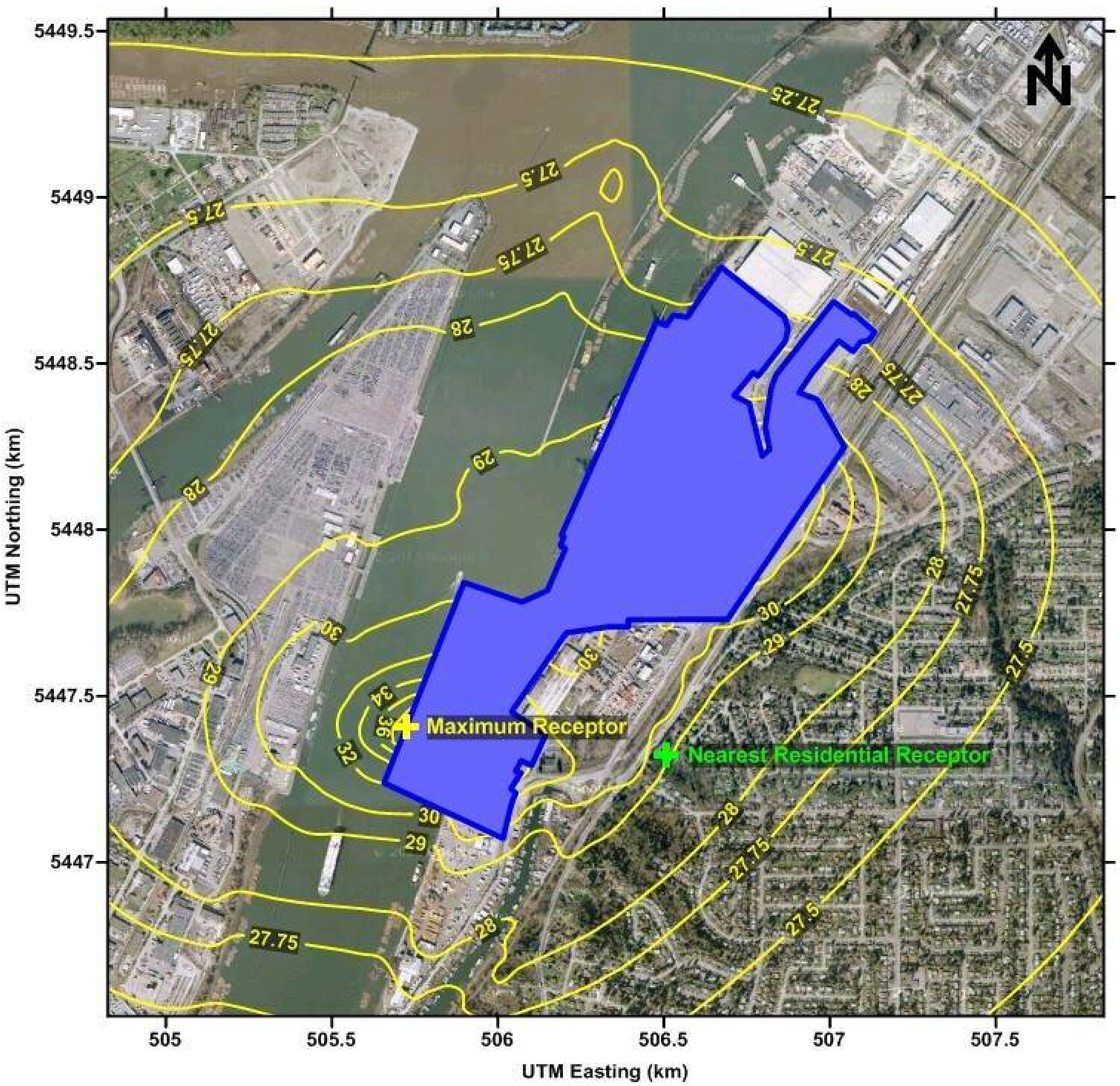

Figure 7-2: Contour plot of maximum predicted NO_2 annual concentrations (with background)

The concentrations are plotted in micrograms per cubic meter (ug/m^3), with the isopleths depicting NO_2 concentrations with distance from the FSD fenceline. The receptor where the maximum annual NO_2 concentration was predicted is indicated in yellow, and "Nearest Residential Receptor", a fixed location deemed closest to the Project related emissions, is depicted in green.

<u>*Effects for CO*</u>

Following exposure, carbon monoxide can readily diffuse across membranes (e.g., alveolar, capillary, and placental) (WHO, 2000). Absorbed CO binds with haemoglobin in the blood to form carboxyhaemoglobin (COHb) (WHO, 2000). Carbon monoxide has a significantly higher affinity for haemoglobin (200 to 250 times higher) compared to oxygen, which means that exposure to even relatively small amounts of CO results in reduced oxygen-carrying capacity of the blood (WHO, 2000).

Environmental exposure and endogenous production of CO results in COHb concentrations of approximately 0.5% to 1.5%, while pregnant women can experience COHb levels of up to 2.5%, due to increased endogenous CO production (WHO, 2000). Guidelines for a one hour average exposure of 30 mg/m^3 and an eight hour average exposure of 10 mg/m^3 were selected by WHO (2000) to ensure a COHb level of 2.5% is not exceeded in sensitive populations (i.e., non-smoking groups with coronary artery disease or foetuses of non-smoking women). The guidelines are therefore health-based and protective of sensitive sub-populations.

Effects for NO_2

The available studies indicate that there is no clearly defined dose-response relationship for health effects caused by NO_2 exposure (WHO, 2000). To derive a AQG for NO_2, WHO applied a 0.5 uncertainty factor to the lowest observed effect level (375 $\mu g/m^3$ to 565 $\mu g/m^3$) for small changes in lung function and changes in airway responsiveness following NO2 exposure, to derive a one hour average objective of 200 $\mu g/m^3$ (WHO, 2000).

Chronic exposure can result in long-term health effects and therefore, an annual average guideline of 40 $\mu g/m^3$ has been proposed (WHO, 2000). This value is based on the potential for direct toxic effects of chronic NO2 exposure at low concentrations (WHO, 2000). In addition, during epidemiological studies NO_2 is often used as a marker for other combustion-generated pollutants and it is difficult to attribute health effects solely to NO2 exposure when there are other correlated co-pollutants present; therefore, WHO (2006) indicated that retaining a conservative annual NO_2 guideline is considered prudent and health-protective.

Effects for SO_2

The available studies indicate that there is no clearly defined dose-response relationship for health effects caused by SO_2 exposure and a clearly defined exposure threshold is not evident (WHO, 2000). Although individuals with asthma are more sensitive, there is a large range of sensitivity to SO_2 exposure throughout the general population (WHO, 2000). To be protective of the most sensitive sub-populations, guidelines for SO_2 were developed considering the minimum concentrations associated with adverse effects in asthmatics (WHO, 2000). WHO (2006) reports that there is uncertainty in the causality between SO_2 and adverse effects, which may be attributed to other factors such as ultrafine particles or another correlated pollutant. WHO (2006) recommends a more stringent 24-hour guideline

(20 µg/m^3) compared to previous WHO values in order to provide greater protection as precautionary approach. As noted above, the maximum predicted SO_2 concentrations associated with the Project are well below the WHO (2006) 24-hour AQG of 20 µg/m^3.

Diesel Particulate Matter (DPM)

DPM concentrations have been considered as part of total emission output levels but have not been specifically predicted. As such, in order to evaluate the impact of DPM and compare levels against those considered acceptable, it can be conservatively assumed that the predicted $PM_{2.5}$ concentration is made up entirely of DPM. As presented in Table 7-1, the maximum predicted annual $PM_{2.5}$ concentration at the nearest residential receptor is 4.2 µg/m^3 (including background), and is considered to be approximately equivalent to background level (4.1 µg/m^3).

Unfortunately, no Metro Vancouver AAQO for DPM are available from Canadian agencies (including Metro Vancouver, the BC MoE and the CCME). However, several agencies are in the process of developing such objectives. In the absence of published objectives, reference has been made to the US Environmental Protection Agency's (USEPA) Reference Concentration (RfC) for Diesel Exhaust Emissions (DPM). A RfC is a 'safe' level of a contaminant in air below which no adverse effects are expected to occur. The USEPA's RfC for DPM is 5 µg/m^3 (available at http://www.epa.gov/iris/subst/0642.htm) and is based on a critical effect of pulmonary inflammation and histopathology observed in a chronic rat inhalation study. A human equivalent concentration (HEC) was calculated based on the no observed adverse effect level (NOAEL) from the rat study (HEC = 144 µg/m^3), and an uncertainty factor of 30 was applied (3 for interspecies variability between rats and humans and 10 for intraspecies variability, or inter-individual human variation in sensitivity). The resulting RfC is considered protective of chronic exposures in the general population, including for sensitive subpopulations.

To assess the potential for DPM associated with the Project to adversely impact human health, the maximum predicted annual $PM_{2.5}$ concentration of 4.1 µg/m^3, which has conservatively been assumed to be entirely related to DPM, has been directly compared to the RfC of 5 µg/m^3. The predicted annual concentration is considered to be the most appropriate comparison as it is representative of a long-term (rather than a short-term) exposure, and the RfC has been derived to be protective of long-term (i.e. daily exposure over a lifetime) exposures. Given that the maximum assumed DPM concentration is lower than the RfC, no significant adverse effects are predicted to be associated with DPM from the Project even if the maximum predicted $PM_{2.5}$ was fully attributable to DPM.

7.2.4.4 Residual Effects, Determination of Significance and Proposed Monitoring

Levelton (2013a) concluded that CO, NO_2, and SO_2 emissions from diesel engines will be localized around the facility and predicted to have low impact on air quality in the area.

As summarized in Table 7-2 and in Figure 7-2, the maximum predicted CO, NO_2 (Figure7-2), and SO_2 concentrations associated with the Project are less than, or in the case of NO_2, equal to, the Metro Vancouver AAQOs, as well as the BC AQO, the CCME NAAQO and the WHO AQG. As documented above, the guidelines have been derived based on the best available scientific evidence, and are considered protective of health effects in the general public, including for sensitive sub-populations. Additionally, even if it is conservatively assumed that the entire predicted $PM_{2.5}$ concentration is associated with diesel emissions/DPM, the concentration is below the USEPA 'safe' level.

As presented in Section 11 and Appendix III, FSD has developed an anti-idling policy to ensure emissions from diesel and gasoline engines are minimized; the policy requires employees turn off their engines when stopped for more than 10 seconds, that warm-up idling be minimized and that high speeds and rapid acceleration be minimized. Further details are provided in Appendix III of this EIA.

Based on the above, it is concluded that exposures to diesel emissions generated by tugboats and locomotives, as part of the Project, will not result in unacceptable health risks. Diesel emissions associated with the Project are not anticipated to have significant effects on ambient air quality in the area.

A draft Air Quality Management Plan (Levelton, 2013b) has been developed to monitor air quality to determine the baseline and to continue the monitoring program following the initiation of the Project to ensure mitigation measures are effective and air quality objectives are met.

7.2.5 Conclusions

As summarized above, predicted concentrations of air contaminants associated with fugitive dust, including coal dust, and diesel emissions associated with the Project are considered to be conservative. Despite the conservatism, the predicted concentrations are below the most stringent of the health-based AAQOs from Metro Vancouver, the BC Ministry of Environment, the CCME and the WHO, and the DPM concentration is below the USEPA 'safe' level (i.e., the USEPA RfC for diesel exhaust emissions). On this basis, fugitive dust and diesel emissions associated with the Project are not predicted to have significant adverse effects on ambient air quality in the area of the Project. Additionally, based on predicted air concentrations being below the Metro Vancouver AAQOs that have been derived to be protective of human health, including for sensitive sub-populations, fugitive dust and diesel emissions associated with the Project are not predicted to be associated with unacceptable health risks for the general public. The proposed air monitoring program will be conducted to ensure that predicted concentrations reflect reality following the commencement of the Project. As part of the monitoring program, Levelton will conduct continuous air quality and meteorological monitoring, as well as air quality site visits on a monthly basis. Quarterly reports will be prepared and will include any corrective action. The reports will be submitted to PMV, and FSD will also post the reports on their website.

Additional concerns regarding noise, as well as increased rail and marine traffic and the associated impact on the surrounding communities, including on emergency response times, has been discussed in Section 6.0.

In summary, following the application of the mitigation measures described in Section 6.2.2, it is expected that the Project will result in no significant residual noise or vibration effects on marine life and surrounding communities. FSD has committed to continuously evaluate noise levels and on site activities to identify opportunities to reduce noise by using quieter equipment and/or making changes to daily operations that may reduce overall noise levels.

The potential effects relating to traffic interruptions and increased wait times are anticipated during construction, and increased railcar traffic at roadway crossings is also anticipated throughout the life of the Project; however, mitigation measures have been proposed to minimize the impact of rail traffic on local vehicle traffic.

The requirements for emergency access at rail crossings will be addressed through the existing BNSF operating and emergency access plans, which are approved and monitored by Transport Canada. BNSF's policy provides immediate access at railway crossings during emergency situations. This policy is consistent with the agreement currently in place, and which FSD and BNSF have been operating under without incident for more than 50 years. Furthermore, concerns regarding this issue were addressed by the Honourable Lisa Raitt, PC, MP, Minister of Transport, in her letter dated September 10, 2013. In her letter, the Minister indicates that Transport Canada is responsible for regulating the safe movement of trains along federally regulated corridors in accordance with The *Railway Safety Act* (Minister of Transport, 2013). The letter indicates that when emergency vehicles require passage, a railway company is expected to clear the train from at-grade crossings as quickly as possible. With the application of mitigation measures, including ongoing communications with local communities about changes in traffic patterns and access during construction and operation, the increased rail traffic is not expected to result in significant adverse effects on road traffic in adjacent communities and emergency access.

No residual significant adverse effects are anticipated.

7.3 Ecological Health

7.3.1 Health Effects of Fugitive Dust

This section discusses the coal that will be handled at the FSD facility and ecological health effects of the coal on potential ecological receptors, such as the Fraser River. Specifically, the potential creation of fugitive dust from the handling and transfer of coal from the rail to barge at the FSD facility is addressed.

It is important to note that coal burning will not be undertaken on site. Only unburned coal treated with water and/or non-toxic dust suppressants will be barged off site.

Coal has some potential to enter the Fraser at the FSD site as dust fall, from equipment or system failures and through vessel accidents resulting in spills (Triton, 2013e). FSD is committed to implementing a Project that minimizes environmental impacts to the Fraser River and surrounding environment. As part of this commitment, FSD has developed detailed mitigation and will implement best management practices during the operation phase to limit fugitive dust and the potential for coal spills into the Fraser River.

7.3.1.1 Chemicals of potential concern in coal

From an ecological standpoint the chemicals of possible concern in coal are metals, metalloids and organic compounds – in particular PAH (Triton, 2013e). A metalloid is an element with metallic and non-metallic properties (e.g., antimony, arsenic, boron, silicon, tellurium). Metals occur naturally in the plant material that makes up peat, and these metals remain in the peat as it changes into coal. PAHs occur naturally in coal and form through the combustion or burning of organic matter at low heat (100 degree Celsius (°C) -150 °C) over long periods of time (Ministry of Environment, Lands and Parks, 1993).

7.3.1.2 Metals and metalloids

Metals and metalloids can be of concern if they dissolve or leach out of the coal matrix. This can happen, for example, in coals with higher sulphur content (3%) (Ahrens and Morrisey, 2005) that are exposed to rainfall. The combination of higher sulphur and rainfall can result in the creation of acidic run-off (e.g. pH ~2.0) which can cause different metals and elements to dissolve out of the coal. Coals with lower levels of sulphur (1-25) typically generate more neutral pH (Davis & Beogly, 1981b, Tiwary, 2001, Cook & Fritz 2002 in Ahrens and Morrisey, 2005). Similarly, acidic and/or low oxygen conditions in sediments can result in the release of dissolved metals (Biggs *et al.,* 1984). Some metals, like selenium have a different chemistry and can become available in dissolved form under more alkaline pH conditions (e.g. ≥9.0) (Al-Abed *et al.*, 2006).

7.3.1.3 Dissolved metals in the water column

Metals in dissolved form are of potential concern because they can be available to aquatic life for uptake depending on a wide variety of environmental conditions (e.g. the pH and dissolved organic matter of water) and sediment chemistry (pH, cations, oxides, sulphides, percent carbon). A chemical is bioavailable if it is in a form that can be taken up by aquatic life from the environment. In fish for example, dissolved metals in water are bioavailable if they successfully attach to, and pass through the gill surface, which allows the metals to move into their blood stream (Triton, 2013e).

Dissolved metals may, under certain circumstances, have negative effects on aquatic life. However, it is important to note that negative effects do not occur just because dissolved metals are present. Many complex factors determine whether or not dissolved metals can be taken up by aquatic life and have a demonstrated toxic effect.

The potential toxicity of metals like copper, cadmium, silver and zinc, for example, can be affected by the presence of minerals like calcium and magnesium and organic matter in the water. Calcium and magnesium are the main components of water hardness, which is important to determining the potential toxicity of some metals. Increased water hardness is associated with decreased toxicity for some metals.

In water, dissolved calcium and magnesium are present as positively charged particles (cations) that float freely in the water column. Other metals like copper, cadmium, silver and zinc are also present as charged particles. Using the example of the fish gill again, calcium and magnesium in water will compete with copper, cadmium, silver and zinc in water for attachment sites at the gill surface. When calcium and magnesium are in the water at higher concentrations, they can actually prevent other metals from attaching to the gill – making these metals *un*available for uptake. Generally speaking, the higher the calcium and magnesium concentrations the less available other metals are for uptake. This means that even though metals like copper, cadmium, silver and zinc may be present in a dissolved form that could have a toxic effect; they may not be able to reach the location on the fish gill to exert a toxic effect.

A similar situation can result when organic matter (carbon) is present in the water. Certain metals, again copper, cadmium, silver and zinc will join with organic matter in the water and when they come together, they form metal complexes that cannot cross the gill surface. Like calcium and magnesium, the more organic matter is present in the water, the more potential for metal complexes to form and the less potential for some metals to attach to the gill and have a toxic effect.

7.3.1.4 Potential for dissolved metals effects

Due to the low sulphur content of the sub-bituminous coal, and because of the mitigation measures described in previous sections for: dust control, daily site cleaning, routine maintenance and storm water run-off treatment; exposure to potentially toxic levels of dissolved metals levels from site run-off or dust fall into the Fraser is not anticipated.

In the event of a spill from a barge accident or barge overfilling, the combination of large, flowing water volumes and slightly alkaline pH of the lower Fraser River would generally limit the potential for metals and elements to be released from the coal in concentrations that would be of concern. For example, the MoE (2004) reported pH levels in the lower Fraser ranging from 7.2 to 7.8 at the Patullo Bridge and 7.4 to 7.7 at Annacis Island. An average pH of 7.64 (n=76) was observed at Fraser River Water Quality Buoy, 12 km upstream of the mouth of the river. These levels indicate the Fraser River is near neutral and slightly alkaline and given these observations any metal or element leaching that might occur is not expected to result in levels of concern in the Fraser River.

Calcium and magnesium levels in the lower Fraser River change with the tides, with salt water on the incoming tides increasing calcium and magnesium levels in the river. Swain *et al* (1998) reported an average calcium concentration of 30.0 milligrams per Litre (mg/L) and an average magnesium concentration of 39.96 mg/L in the lower Fraser River downstream of the Patullo Bridge. This corresponded to a calculated hardness of 238.76 mg/L. BWP Consulting (2001) reported calcium, magnesium and/or hardness levels at selected locations in the lower Fraser River as follows:

- Calcium (15.6 mg/L) and magnesium (4.9 mg/L) at Annacis Island
- 698 mg/L (54.6 mg/L calcium and 137 mg/L magnesium) at Ewen Slough in the South Arm of the Fraser River, downstream of Ladner

Magnesium and calcium provide some protection against the toxicity of dissolved metals to aquatic organisms. It has been stated above the potential for leaching to occur to levels of concern for metals and other elements is unlikely and the levels of calcium and magnesium the Fraser River will help protect aquatic organisms. In the marine environment the levels of calcium and magnesium are much higher than in freshwater systems like the Fraser River and the potential for problems arising from metals or elements from spilled coal is not likely.

7.3.1.5 Metals in sediments

In order to evaluate the potential for negative effects of coal on sediment quality, Triton (2013e) reviewed chemical data from the source coal and compared them with the BC provincial and federal sediment quality guidelines for the protection of aquatic life. The review showed no concentrations of metals in the source coal above the Interim Sediment Quality Guidelines (ISQG), lowest effect levels (LEL) or the effects range low (ERL) levels (Table 7-4). Levels below the ISQG are considered protective of aquatic life. This means that spilled coal settling out in bottom sediments would not be expected to result in metals concentrations above the ISQG.

Table 7-4: Comparison of trace element analyses to available provincial and federal sediment quality guidelines (Triton, 2013e)

	Arsenic	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Zinc
	1.9	0.09	3	9	0.7	16	0.034	2	0.6	0.03	5
	1	0.05	3	9	1.2	15	0.049	2	0.6	0.02	6
	1.5	0.06	2	9	1.2	21	0.053	2	0.6	0.04	6
	1.6	0.05	2	9	1.2	21	0.068	2	0.5	0.03	5
	2.1	0.05	2	9	1.1	27	0.095	2	0.6	0.05	3
	1.1	0.07	2	9	1.3	15	0.058	2	0.5	0.03	5
	1.3	0.04	2	7	0.7	16	0.059	1	0.4	0.02	3
	1.3	0.04	3	10	1.1	16	0.038	2	0.5	0.02	4
	1.6	0.07	3	9	1.3	68	0.0413	2	0.4	0.02	5
Average of source coal samples	**1.5**	**0.06**	**2**	**9**	**1.1**	**24**	**0.055**	**2**	**0.5**	**0.029**	**5**
BC Working sediment quality guidelines - freshwater	**5.9 (ISQG)**	**0.6 (ISQG)**	**37.3 (ISQG)**	**35.7 (ISQG)**	**35 ISQG**	**460 (LEL)**	**0.170 ISQG**	**16 (LEL)**	**2**	**0.5**	**123 ISQG**
BC Working sediment quality guidelines - marine	**7.24 (ISQG)**	**0.7 (ISQG)**	**52.3 (ISQG)**	**18.7 ISQG**	**30 ISQG**	**-**	**0.130 ISQG**	**30 (ERL)**	**-**	**1.0 (ERL)**	**124 ISQG**
CCME Sediment quality guidelines - freshwater	**5.9 (ISQG)**	**0.6 (ISQG)**	**37.3 (ISQG)**	**35.7 (ISQG)**	**35**	**-**	**0.170 ISQG**	**-**	**-**	**-**	**123 ISQG**
CCME Sediment quality guidelines - marine	**7.24 (ISQG)**	**0.7 (ISQG)**	**52.3 (ISQG)**	**18.7 ISQG**	**30.2**	**-**	**0.130 ISQG**	**-**	**-**	**-**	**124 ISQG**

ISQG - Interim sediment quality guideline

LEL – lowest effect level ; concentration that 95% of the benthic biota can tolerate (Ontario Ministry of Environment and Energy - freshwater biota) ERL - effects range low ; concentration below which effects are rarely observed or predicted among sensitive life stages and (or) species

7.3.1.6 Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are organic compounds from a variety of sources but can occur as a result of incomplete combustion from forest fires, combustion engines, wood stoves, coke production, etc. (CCME, 1999). Coke is a solid residue of impure carbon from bituminous coal and other carbonaceous materials after volatiles removal by destructive distillation. Coke is used as a fuel and in making steel.

PAHs occur naturally in bituminous fuels like coal and crude oil. Examples of PAHs that occur naturally in coal include: benz [a] anthracene, benzo [a] pyrene, benzo [e] pyrene, dibenzo [c,d,m] pyrene, perylene and phenanthrene (Woo *et al*., 1978 in MELP, 1993).

PAHs do not easily dissolve in water and they tend to adsorb or strongly attach themselves to particulate matter - especially organic matter such as coal (Bucheli and Gustafsson, 2000 in Ahrens and Morrisey, 2005). As a result, PAHs released into the aquatic environment often have limited potential to occur in dissolved form, or if they are present in water, it is only for a short time. PAHs released into the environment are more likely to remain bound to particulates eventually settling out into bottom sediments. In their review of potential effects of PAH (and other chemicals) from unburned coal in marine environments, Ahrens and Morrisey (2005) reported PAH concentrations in filtered leachates of <0.05 mg/L ppm with levels of 1.5 mg/L occurring more frequently.

Studies conducted by BC Research (BC Research, 1996) indicated that when coal dust entered water, it did not dissolve but formed a suspension in which the PAHs remained attached to the particles. Johnson and Bustin (2005) reported coal particles in sediments at the Westshore facility at Robert's Bank, with mean coal concentrations of 1.80% in 1977 of 3.60% in 1999.

Like dissolved metals, the presence of PAHs in sediments does not necessarily mean adverse effects on aquatic life will occur. In studies of the possible effects of PAH exposure on crustaceans (*Rhepoxynius abronius)*, *Neanthes arenaceodentata* (worms) and *Mytilus edulis* (blue mussel); Chapman (1996) concluded PAHs associated with coal particles were not bioavailable as toxic responses to PAH were not observed. Paine *et al.* (1996) and Allard *et al.* (1997) studied the fate of PAHs in sediments offshore from the Alcan Smelter in Kitimat Arm. The authors found elevated levels of PAHs in some samples (up to 10,000 ppm total PAHs) but observed limited effects on aquatic life (benthic infauna, crab and bottom fish). Toxicity testing in the study showed no effects related to PAHs (Chapman (1996) in Triton, 2003). The authors concluded PAHs were not bioavailable because of the source of PAH in the sediments was from pitch globules and coal particles to which the PAHs were tightly bound.

This tendency to strongly bind or attach to organic matter was also demonstrated by Ghosh *et al.* (2000) who reported PAH concentrations associated with coal and wood particles in sediment were many times higher than PAH concentrations associated with silica (inorganic) particles. The coal and wood particles made up only 5% of the sediment by weight, but contained 62% of the total PAH. The remaining 38% occurred in the clay and silt fractions of the sediment. These authors also studied the PAH desorption (or release) rate from the coal, wood, clays and silts and found low bioavailability of PAHs from coal and wood components the bioavailability of PAHs clays and silts was higher because these fractions had less organic matter (as cited in Triton, 2003). In addition, Jeffrey *et al*. (2002) studied the binding and bioavailability of PAHs in coal and in silt/clay from Milwaukee Harbour sediments and found PAHs were generally associated with coal particles limiting their bioavailability and confirming PAHs will preferentially remain bound to coal particles under normal water quality. These PAH were strongly bound to the coal particles, with only 8% of the PAH releasing from the coal after 100 days, as compared with 80% of the PAH releasing from the clay / silt fraction in roughly 60 days (as cited in Triton, 2003). The same study included toxicity testing (acute toxicity and bioaccumulation trials) on earthworms and the results indicated only the PAH associated with the silt/clay fraction were readily bioavailable. Ultimately, coal particles can bind PAH by incorporating them into the coal matrix or through adsorption (attachment), making them unavailable and/or resulting in limited availability for uptake by aquatic life.

7.3.1.7 Mitigation

Dust control on rail (by BNSF) will consist of:

- Application of a ‘body agent’ at the mine site to help bind coal particles to reduce dust losses. Apply a secondary ‘body agent’ as required to reduce coal oxidation (refer to Appendix II for MSDS).
- Profile the coal when loaded into ‘bread loaf shape’ to prevent wind erosion.
- Application of a ‘topping agent’ after the coal is loaded into the railcar at the mine site to act as a sealant to prevent dust losses.
- Reapplication of a ‘topping agent’ approximately at midpoint of the rail movement from the mine site to FSD to address concerns regarding potential degradation of the topping agent during transit.
- Spray empty railcars at the terminal with water after unloading to ensure coal remnants are removed to prevent dusting during return trips to the mine site.

Dust control on barges will consist of:

- Solutions of dust suppressants and water will be applied to coal at the mine, at the re-spray station and at FSD prior to barge loading. The use of dust suppressants, in combination with proposed dust mitigation measures including but not limited to: covered dumping shed and conveyors, ongoing site cleaning and system maintenance, misting and sprinkling at coal transfer and handling areas, is expected to control dust throughout the transportation chain.
- Physically configure or profile the coal load on the barge as best as possible to reduce wind erosion and turbulence.
- Coat coal with binding and suppressing agents during the barge loading process (through plumbed sprayers in the conveyor system) to prevent fugitive dusting during barge transit (refer to Appendix II for MSDS).
- Avoid the operation of barges in wind conditions greater than 40 km/h.

In addition, mitigation planning and the implementation of best management practices will include:

- Daily site cleaning.
- Daily inspections and monitoring along with routine maintenance of all supporting systems (e.g. conveyors, sprinklers, run-off collection and water treatment infrastructure) will be undertaken to identify potential issues and avoid system failures.
- Barges will be compartmentalized, such that a puncture and leak in one compartment does not make the barge inoperable;
- As part of the barging contract, FSD will also require contractors to submit maintenance and training records.
- Implement the WMP and Run-off and Collection Treatment Plan mitigation to reduce the impacts of run-off into nearby waterways by collection and water treatment prior to it being recycled or discharged.
- Separately collect coal drainage wastewater (including leachate, collected water, and exposed water) in gravity driven settlement ponds and dispose or recycle, where possible.
- A water quality monitoring program will be conducted on the excavation wastewater that is to be discharged to in-ground pits, as well as on the Loading Area Settling Pond where wastewater will be discharged to the sanitary sewer.
- During operations, monitor treated discharge water to determine what level of treatment might be required (if any).

- Implement the FSD SRP for Coal and the Lafarge SCRP.
- A twice yearly sediment survey in the river adjacent to the barge loading area will be completed throughout the life of the Project.
- Limit rail traffic speed to 5 km/h.
- Use AC locomotives equipped with VFD for coal transit.
- Rail carriers are to follow anti-idling policy and locomotive shut-down procedures.
- Use an electric positioner (indexer) to position rail cars over bottom dump receiving pits.
- Cover all receiving pits except for entry/exit points.
- Spray empty cars to remove remaining coal after leaving the dumper pit enclosure.
- Minimize drop heights at transfer points.
- Use mechanical winching system to warp barges along the berths during loading.
- Use enclosed conveyor system equipped with water and chemical agent spraying nozzles.

FSD is proposing comprehensive water-based dust suppression systems for during construction and daily operations. During operations, water will be delivered to the coal handling area through a combination of misting sprays, large nozzle sprays, large volume sprays, and/or agricultural sprinkler piping.

FSD will use recycled coal drainage wastewater augmented by clean freshwater (supplied by Surrey) for dust suppression on site to wet down the barge as required, coal conveyor transfer points, and the receiving building pits, and for railcar, equipment, and pavement cleaning. A wastewater management system will be implemented to manage all wastewater.

7.3.1.8 Residual Effects, Determination of Significance and Proposed Monitoring

Based the Triton (2013a) review and analysis of information provided by the coal supplier the following was noted:

- Coal is formed naturally from peat through the application of heat and pressure over millions of years;
- The main chemicals of concern in coal are metals, metalloids and PAHs;
- Peat and coal contain metals and metalloids, because these are naturally present in the decaying / decayed plant material from which the peat developed;

- Coal contains PAHs as a result of the naturally occurring combustion of organic matter;
- Trace elements and PAH in unburned coals proposed for handling at FSD would not be considered harmful to aquatic life because these constituents are generally not bioavailable under typical environmental conditions. Additionally, the lower sulphur content (<1%) coal proposed for handling on site produces a more pH neutral run-off (Davis & Boegly 1981b, Tiwary 2001,Cook & Fritz 2002 in Ahrens and Morrisey, 2005), which would minimize leaching potential; and
- Given the tendency of PAHs to adsorb or attach strongly to coal, we do not anticipate PAHs will be bioavailable or result in potentially toxic levels of PAHs being released.

7.3.1.9 Conclusions

Given the mitigation measures proposed at the FSD facility, there will be tight controls on surface run-off and on transiting barges and this will limit the potential for unburned coal to enter the environment. No residual effects from coal dust, coal spill or accidental release of unprocessed coal wastewater into the aquatic environment are expected.

7.3.2 Health Effects of Diesel Emissions

Within the Lower Fraser Valley, long-term regional trends from 1992 to 2011 indicated an overall reduction of the annual average concentrations and short-term peak concentrations of NO_2, SO_2, CO and $PM_{2.5}$ (Metro Vancouver, 2011). Conversely, over the same time period, O_3 has been slightly increasing. Air quality and weather information is collected from a total of 26 air quality monitoring stations located in Metro Vancouver and the FVRD, with 25 of the stations continuously collecting data (Metro Vancouver, 2011).

Levelton (2013a) conducted air dispersion modelling and completed assessment studies to estimate the potential impacts of the Project on air quality. The scope included determining baseline air quality, assessing the various components of the Project including: receiving coal loaded trains at FSD, unloading of coal from trains, movement of coal through the facility, loading of coal onto barges, coal on barges at the berth, and transportation of coal by barge.

Levelton (2013a) modelled the Project related emissions (combustion from locomotives and tug boats) and fugitive dust sources (noted above) and added these results to the background ambient air quality. The study area for the Project encompassed a 20 km by 20 km domain centered on the Project. In total the model contained more than ten thousand receptor locations, including sensitive receptors to assess the potential impact from the project.

Levelton (2013b) states that construction and operational activities are likely to result in localised air quality impacts. Construction related impacts are expected to be short-term, and can include combustion emission from vehicles.

Combustion emissions from operation activities include rail and tug emissions. Table 7-5 below summarizes the emission sources related to the Project considered in the assessment.

Table 7-5: FSD Project Emission Sources

Air Contaminant	Contributing Emissions Sources
CO	Combustion Sources: *Tug boats and locomotives*
NO_2	Combustion Sources: *Tug boats and locomotives*
SO_2	Combustion Sources: *Tug boats and locomotives*
PM_{10}	Combustion Sources: *Tug boats and locomotives*
$PM_{2.5}$	Combustion Sources: *Tug boats and locomotives*
TSP	Combustion Sources: *Tug boats and locomotives*

Contributing emissions sources identified in the proposed Project plan largely include areas where coal is in transit (VanHook, 2012). For the scope of this Project, this includes when coal is loaded onto rail cars, during transit in rail cars, loading of coal into barges for transport to Texada Island, and while coal is on the barges.

Other sources of air emissions include operation of marine vessels, non-road engines, building heating, diesel fuel combustion, heavy- and light-duty vehicles, industrial facilities, and front end loaders (Metro Vancouver, 2012; Triton, 2013a).

7.3.2.1 Potential Effects

Overall, Levelton (2013a) concluded that particulate emission impacts from fugitive dust sources will be localized around the facility and are predicted to have a low impact on air quality in the area. Air quality impacts from traveling tug boats and barges along the Fraser River were considered to be low to negligible.

Air quality concerns include human health impacts (see Section 7.1 for further detail), and pathways to enter potential contaminants into soils, plants, river and marine systems (Levelton, 2013). The effects of diesel emissions on air quality are abundant, as this has direct impacts to human health. Information on specific impacts of diesel emissions on ecological aspects of the environment such as soil, plants and water is not readily available. There is much acknowledgement that diesel emissions affect ecosystem health; however, relatively little study has been conducted to measure such effects. There has been some study on changes to plant phenology.

Honour *et.al.* (2009) demonstrated the potential for vehicle exhaust to have a direct adverse effect on urban vegetation. In the study, 12 herbaceous species were measured for growth, flower development, leaf senescence and surface wax characteristics. In a closed environment, the plants were exposed to NO(x) originating from a diesel generator. Effects were species-specific but the general changes of note included accelerated senescence, delayed flowering and structural changes to surface wax.

7.3.2.2 Mitigation

FSD proposes to utilize barges that are hauling product from Texada Island to Richmond that are currently returning empty. The effects of tugboat emissions may be offset by the incorporation of already-running tugboats, and the increase in barge numbers would not be as high as predicted in models. FSD has also developed an anti-idling policy and locomotive shut-down procedures to mitigate air emissions relating to idling unit locomotive trains (Appendix III).

A draft AQMP has been developed, outlining specific mitigation plans for the operations phase of the Project (Levelton, 2013b). Industry best practice was applied, where practical, throughout the Project design and operational plans.

Mitigation measures for the construction and operation of the Project are in line with relevant legislation, regulation, guidelines, objectives, and standards (refer to Section 1.3: Jurisdiction and Regulatory Framework). Details of mitigative measures are identified in detail in Appendix VI - *Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* (Cheminfo, 2005).

Mitigation measures to address the ecological effects of diesel emissions from Project construction and operation include (Triton, 2013a and Levelton, 2013b):

- Limit vehicle speeds to 15 km/h on unpaved road surfaces, and completion of visual inspections alongside real-time air quality monitoring during construction;
- Diesel particulate filters should be used on all construction equipment capable of supporting their use;
- Covered vehicles are required when transporting bulk fine materials to the Project area;
- Paved areas to be cleaned on a routine basis to prevent accumulation and mobilization of dust;
- Site-specific worker education programs to address:

- Idling reduction (automatic anti-idling shut-off where feasible);
- Operation of equipment at optimum rated loads;
- Routine equipment inspection and maintenance; and
- Daily inspections to identify dust and equipment exhaust issues.

- Use of 2003 model or later equipment and vehicles;
- Compliance with CWS for air quality, particularly 'Annex A' during construction and operation;
- Ongoing assessments of the potential for dust generation and combustion emissions, and
- Visual assessments of dust and exhaust emissions to be completed on an ongoing basis while machinery is operating;
- Implement an on-going air quality monitoring program to provide real-time air quality information for the site and pre-determined nearby areas;
- Limiting rail traffic speed to 5 km/h;
- Use of AC locomotives equipped with VFD for coal transit;
- Rail carriers to follow anti-idling policy and locomotive shut-down procedures (Appendix III).

7.3.2.3 Residual Effects, Determination of Significance and Proposed Monitoring

The results of the assessment indicated that for all air contaminant (CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$) and averaging periods under consideration that the maximum predicted concentrations including background were below ambient air quality objectives, with the exception being the maximum annual NO_2 results which were in line with the AAQO. The air dispersion model predicted elevated annual NO_2 concentrations in the immediate area of the berth and within the fenceline over the Fraser River. The draft AQMP (Levelton, 2013b) contains a commitment to monitor NO_2, which would verify actual concentrations and, if necessary, additional mitigation measures could be implemented.

7.3.2.4 Conclusions

Overall, Levelton (2013a) concluded that particulate emission impacts will be localized around the facility and are predicted to have a low impact on air quality in the area. Air quality impacts from traveling tug boats and barges along the Fraser River were considered to be low to negligible. With the implementation of mitigation measures, no residual significant adverse effects from Project-related diesel emissions are anticipated.

8.0 HERITAGE EFFECTS ASSESSMENT

Numerous known archaeological sites were identified in the general region with six sites located within a 2 km radius of the Project (Figure 8-1). DhRr-256 is situated opposite the Project on the east side of South Fraser Way. DhRr-73 is on the west bank opposite the Project. Three sites are located on the east bank- DhRr-196, DhRr-197 and DhRr-198 DgRr-51 is the southernmost archaeological site, located upslope of the Fraser River.

FSD does not anticipate encountering buried archaeological resources during construction given the developed nature of the Project site. Contractors will however receive pre-construction training to identify and protect potential archaeological resources in the field. Indicators of an archaeological site may include:

- **Artefacts**, such as flaked stone knives, jade adze blades, sinker stones, hand mauls, hammer stones, bone or antler hooks and loose flaked stone;
- **Middens**, which are the remains of ancient living areas and may be identified by the presence of animal bones, fire-altered rock, ash and charcoal, artefacts and cultural features like hearths or pits;
- **Transitory hunting camps**, which generally include fire altered rocks and charcoal and ash from fires. Such sites may contain post-molds from meat drying racks and stone tools or scatters of flaked stone material from tool sharpening; and
- **Burial places**, which may be indicated by the presence of light to dark brown bones either whole or in fragments and may include artefacts.

General indicators of a possible archaeological site include dark soils, which seem to be greasy in texture and contain bone, charcoal and pieces of broken rock. Other signs include patches of red or yellow brown, fire stained sediments, scattered fragments of fire-altered rocks and unusual looking soil profiles or sections of a soil profile.

Archaeological resources identified during construction may be managed in a variety of ways, including avoidance, salvage or emergency excavation, and the use of temporary or long-term site protection measures.

If an archaeological discovery is made, work should stop within 30 m of the find and the following measures implemented:

- Mark the 30 m exclusion zone around the discovery with snow fence or flagging;
- Implement slope stabilization, drainage, erosion and sediment control measures as needed to protect the discovery; and
- Contact the Environmental Inspector.

The preferred long-term approach to managing archaeological discoveries areas is avoidance. Where this is not practical, salvage or emergency excavations may be necessary. These activities would require permits issued by the Archaeology Branch and/or from First Nations. Salvage and/or emergency excavations would be undertaken by a professional archaeologist and the affected First Nations.

If salvage or emergency excavation operations are not feasible then capping the discovery with geotextile and clean, coarse textured fill may be possible. Personnel should not collect archaeological remains. However, if an isolated artefact is found and may be destroyed by not immediately removing it from the working area, then the following steps should be taken:

- Collect the artefact and mark its location with flagging, a wooden stake or some other visible marker;
- Establish a 30 m exclusion zone around the find; and
- Contact the Environmental Inspector.

In the unlikely event that human remains or suspected human remains are discovered in working areas the following steps should be taken:

- Immediately stop construction within 30 m of the remains;
- Cover exposed bone with plastic sheeting, blanket or other clean cover; and
- Contact the Environmental Inspector.

The Environmental Inspector will notify the appropriate First Nation(s), the Archaeology Branch, RCMP, and possibly the Coroner’s Office for further advice.

With the implementation of mitigation measures identified above, and in consideration of the developed nature of the Project site, there is no anticipated effect on archaeological resources from construction or operational activities. No residual effects on archaeological resources are expected.

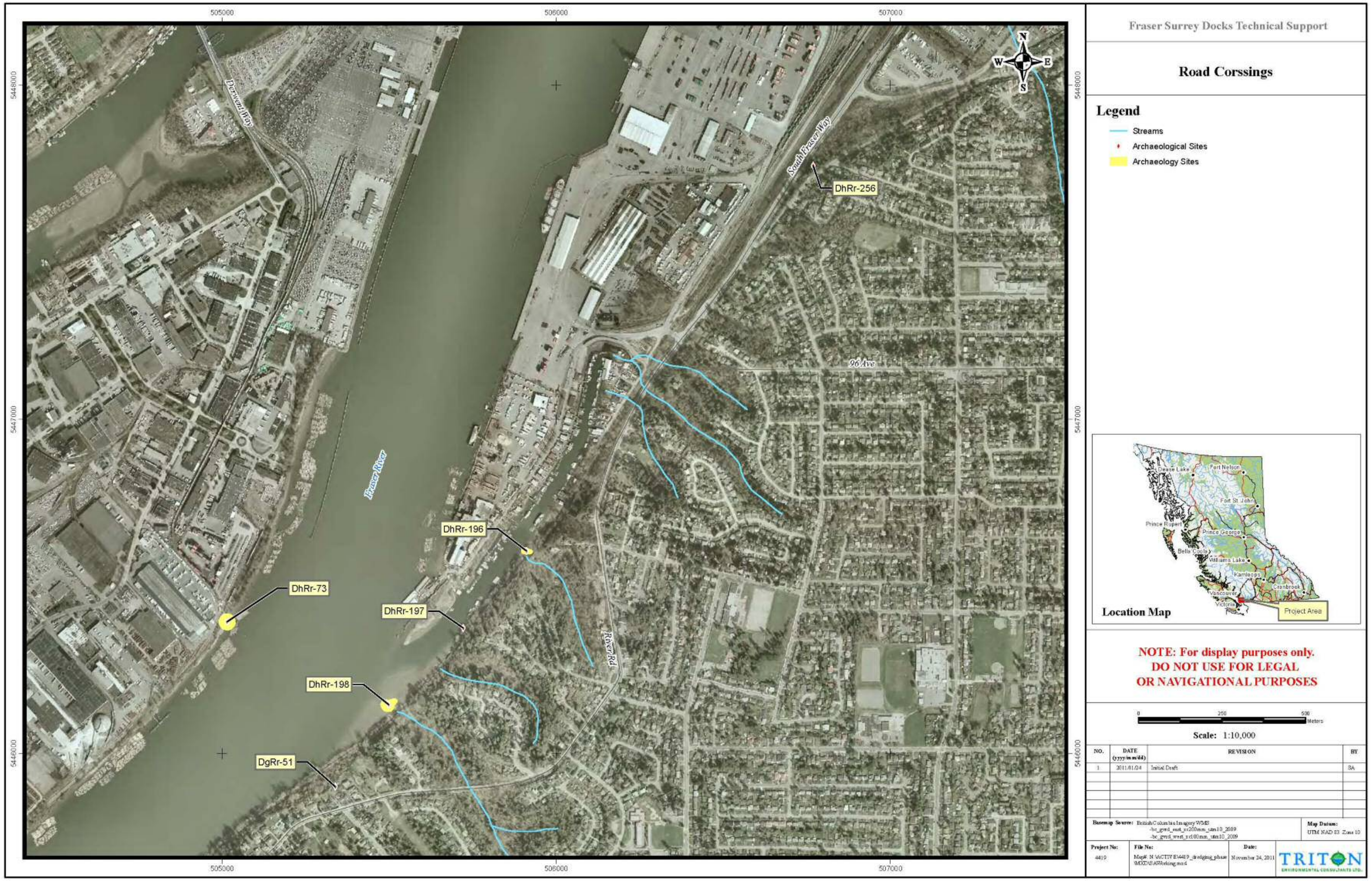

Figure 8-1: Archaeology Sites within a 2 km radius of the Project

9.0 ACCIDENTS AND MALFUNCTIONS

Accidents and malfunctions can occur during the course of Project construction and operation. FSD has prepared an Environment Management Plan to address mitigations for environmental and social components that may be affected by the Project, including mitigations to address accidents and malfunctions.

A summary of the potential effects that could result from Project accidents or malfunctions and proposed mitigation measures are discussed in Table 9-1.

Table 9-1: Summary of Potential Accidents and Malfunctions of the Project

Accident of Malfunction	Potential Environmental Effect	Proposed Mitigation/Response Plan
Construction		
Spills and leaks	Release of contaminant into soil, groundwater, surface water, and/or sediments	Specific SRPs are outlined in the Terminal EMP (Triton, 2013a) and PARY EMP (Triton, 2013b), included in Appendix VI.
Fuelling	Release of fuel into soil, groundwater, surface water, and/or sediments	No fuelling shall take place within 30 m of any watercourse or drain.
Vehicle accidents	Injury/fatality Spill/release of hazardous and/or toxic materials	Operators of all vehicles/machinery will abide by the mitigation outlined in the construction Environmental Plan. A traffic management plan will be developed for any off site works and/or works that will impact off site traffic.
Emergency Response	Effects on workers and/or neighbouring communities.	A traffic management plan will be developed for any off site works and/or works that will impact off site traffic.
Operations		
Derailment	Injury/fatality Spills/release of hazardous and/or toxic materials	Emergency Response Plan (ERP).
Vehicle accidents (impact with rail traffic)	Injury/fatality Spill/release of hazardous and/or toxic materials	Operators of all vehicles/machinery will abide by the mitigation outlined in the construction Environmental Plan. A traffic management plan will be developed for any off site works and/or works that will impact off site traffic.
Spills and leaks	Release of contaminant into soil, groundwater, surface water, and/or sediments	FSD SRP (Appendix IV).

Accident of Malfunction	Potential Environmental Effect	Proposed Mitigation/Response Plan
Fugitive airborne particulates	Effects on workers Overall air quality	Educating all workers on the risks associated with coal dust exposure and mitigation measures to reduce these risks. Regular equipment review. Ongoing air quality and dust monitoring.
Emergency Response	Effects on workers and/or neighbouring communities.	Fire Safety Plan (FSP) (RKMS, 2012) in EMP (Appendix VI).
Vessel grounding/sinking (poor navigation, power failure)	Injury/fatality Release of contaminant into soil, groundwater, surface water, and/or sediments	Lafarge Standard Operating Procedures (SOP) (Appendix V).
Impact/collision with other vessel/berth (poor navigation, power failure)	Injury/fatality Effects on FSD or other properties/vessels Release of contaminant into soil, groundwater, surface water, and/or sediments	Lafarge SOPs (Appendix V).
Spills and leaks into river waters (sub-bituminous coal, hydrocarbons)	Release of contaminant into soil, groundwater, surface water, and/or sediments	FSD SRP and Lafarge's best practice for spill containment and response (PRA-01-01-001) (Appendices IV and V, respectively).
Spill and leaks into marine waters (sub-bituminous coal, hydrocarbons)	Release of contaminant into soil, groundwater, surface water, and/or sediments	FSD SRP and Lafarge Marine Procedures (PRA-01-01-001) (Appendices IV and V, respectively).

10.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The following section discusses the environmental factors or events that are most likely to affect the Project relevant to geographic location, facility infrastructure and primary function of the facility. Project mitigation measures, design standards and criteria that have been or will be implemented to address environmental effects on construction and operation activities are also discussed.

Given the Project location in the south coast region of BC and the main function of direct coal transfer from rail to barge, the following environmental factors or events have been considered:

- Earthquake and Tsunami;
- Severe weather:
  - Heavy precipitation;
  - Flooding;
  - High wind; and
  - Fog and reduced visibility.
- Tidal conditions.

10.1 Earthquake and Tsunami Effects

An earthquake occurs when there is a release of energy resulting from tectonic plate movement. During an earthquake, sudden ground movement occurs or tremors can be felt. The effects of earthquakes include ground failure, ground shaking and tsunami (MEM, 2013a). The damage to buildings, other infrastructure and human society in general will vary depending on the magnitude of the quake and distance from the source of the seismic event.

Earthquakes are recorded every day in British Columbia, however only a small number are detectable (MEM, 2013b). In the last 100 years, several major earthquakes have occurred in BC, which is considered to be a region of high seismic activity.

A tsunami is a series of waves that occur as a result of an earthquake event occurring beneath or near an ocean floor (EMBC, 2013). Similar to earthquakes, the destruction associated with a tsunami is greatest when it occurs in the vicinity of human centres. The direct effect of a tsunami is a rapid rise in sea water inundating upland areas. The size of tsunami is dependent upon the magnitude and location of an earthquake's epicentre.

The occurrence of a tsunami with origins in deep ocean water on the coast of the Lower Mainland is low in probability because of Vancouver Island would bear the majority of the effects. The Project, situated over 30 km inland from the mouth of the Fraser River, is at low risk for a tsunami event.

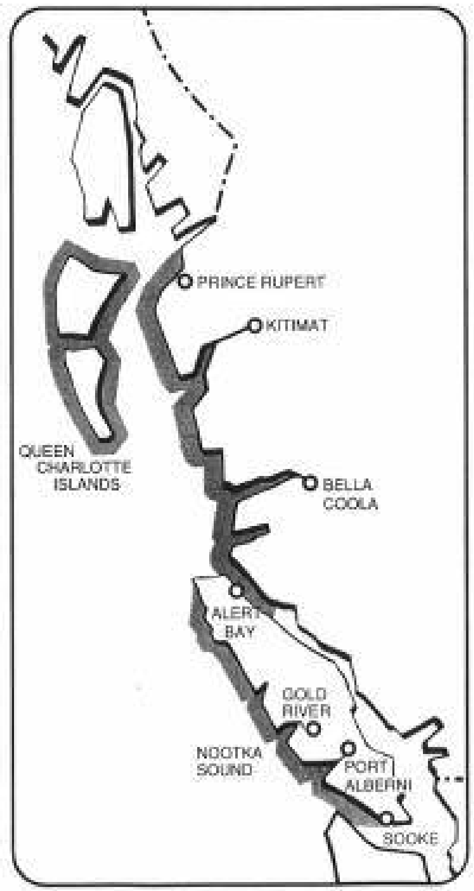

Figure 10-1: Areas at risk from tsunamis. The shaded area in this figure shows coastal BC locations at greatest risk of a damaging tsunami

Source: http://embc.gov.bc.ca/em/hazard_preparedness/Tsunami_Brochure/Prepare_for_Tsunami.html

10.1.1 Mitigation

FSD has considered the probability of earthquake events in Project design. Tsunami effects are not expected to be significant given that the facility is located over 30 km from the mouth of the Fraser River. The potential for waves to overtop the terminal and result in some loss of production were predicted if any tsunami event were to occur. The existing infrastructure at FSD already conforms to current established standards and criteria for seismic preparedness. Future construction of the coal facility will adhere to the same seismic standards and criteria such as BC Building Code and National Building Code.

10.2 Severe Weather Effects

Severe storm events and/or extreme weather conditions have the potential to affect the construction and operation of the Project. In the Lower Mainland, severe weather is experienced in the form of heavy precipitation – mostly rainfall, but periods of heavy snow fall do occur; high winds; and fog.

10.2.1 Heavy Precipitation

The Lower Mainland experiences over 1150 mm of rainfall in a single year based on Environment Canada data from 1971-2000 (Table 10-1). The heaviest periods of rainfall occur between November and January. The highest rainfall event recorded was 89.4 mm in December 1972. The most snowfall recorded on a single day was 41 centimetres (cm) in December 1996. The average yearly snowfall for the Lower Mainland is 48.2 cm. Over 95% of precipitation experienced in the Lower Mainland is due to rain. Climate data has been summarized from the Vancouver International Airport weather station (Climate ID: 1108447) (Environment Canada, 2013) located at 49°11'42.000" N and 123°10'55.000" W.

Table 10-1: Precipitation Normals from Vancouver International Airport weather station (1971-2000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	139.1	113.8	111.8	83.5	67.9	54.8	39.6	39.1	53.5	112.5	178.5	160.6	1154.7
Snowfall (cm)	16.6	9.6	2.6	0.4	0	0	0	0	0	0.1	2.5	16.3	48.2
Precipitation (mm)	153.6	123.1	114.3	84	67.9	54.8	39.6	39.1	53.5	112.6	181	175.7	1199

10.2.1.1 Mitigation

The new facility, which is located on the existing FSD footprint, will account for the potential effects of surplus water from rain or snow events through a comprehensive water management system. FSD has proposed three options to handle surplus wastewater including stormwater, recycled water and coal drainage wastewater. The preferred option is to discharge directly into the Metro Vancouver sanitary sewer system which enables FSD to meet discharge quality standards without the addition of chemicals (i.e flocculants). The preliminary application for this permit was submitted to Metro Vancouver on August 7, 2013. The second option is to discharge directly to the Fraser River, which may require the use of chemicals to adjust pH and remove solids to meet discharge quality standards as per MoE discharge permit. The third option is to discharge via an infiltration field, which would divert the water through a set of perforated pipes located in the ground and into the ground water. In the case of the second and third options, wastewater will go through a treatment process and a stringent monitoring and testing process to the water meets discharge quality standards.

10.2.2 Flooding

The Project is located within the Fraser River floodplain which experiences flooding mainly freshet (snowmelt) and heavy rainfall. Snow events, ice jams, debris flow and tsunami are less common causes of flooding of the Fraser River. In BC, flooding causes approximately $10 million in damages (MFLNRO, 2013).

Surrey is protected from high water on the Fraser River by a network of Dykes built alongside the banks of the river. These Dykes were built 18 inches higher than the freeboard from the 1948 river levels. 1948 was the last year in which there was major flooding along the Fraser River in the Lower Mainland.

The terminal at FSD was built after 1948 and was constructed with the majority of the property being at or above the level of Surrey Dyke network. The Project is not encompassed within the City of Surrey Dyke network but the majority of the site was constructed at or above the level of the current Surrey Dyke network. Approximately 30% of the terminal surface area sits below the 3.8 m 200 year flood level (FSD, 2013), and a small portion along Elevator Road sits below the 3.2 m mark of the 150 year flood level.

10.2.2.1 Mitigation

To mitigate the risks of flood at the terminal, FSD has a well established ERP for the Fraser River that is currently operated in conjunction with Surrey.

To avoid effects from potential flooding of the new infrastructure, FSD will construct the facility above 3.8 m or 200 year flood mark.

10.2.3 High Wind

Average wind temperatures recorded at the Vancouver International Airport weather station record a yearly average wind speed of 11.8 km/h based on data collected from 1971-2000 (Table 10-2). Wind direction is predominantly from the east. There are total of seven days out of the year with wind speed above 52 km/h and 1.8 days with speeds above 63 km/h. The wind speed range is between 10.6 and

12.9 km/h with highest average winds recorded in March and lowest average winds recorded in September.

DNV (2012) reported that the maximum wind speed observed on the main arm of the Fraser River (at Gravesend Reach Buoy) is less than 20 knots, which is rated as Calm on the Beaufort Scale. Given this, the Fraser River and area around FSD is calm and risk to the Project and barge operations is considered to be low.

Table 10-2: Wind Speed Normals from Vancouver International Airport weather station (1971-2000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Speed (km/h)	11.5	12.1	12.9	12.6	12	11.7	11.5	11	10.6	11	12.3	12	11.8
Most Frequent Direction	E	E	E	E	E	E	E	E	E	E	E	E	E
Maximum Hourly Speed (km/h)	69	89	77	72	61	52	48	50	64	76	89	82	
Maximum Gust Speed (km/h)	97	119	108	100	90	70	71	85	91	126	129	100	
Direction of Maximum Gust	SW	W	W	W	W	W	W	W	W	SE	W	SE	W
Days with Winds >= 52 km/h	1.2	0.7	0.9	0.5	0.3	0.1	0	0	0.2	0.6	1.2	1.3	7
Days with Winds >= 63 km/h	0.1	0.2	0.3	0.2	0.1	0	0	0	0.1	0.1	0.2	0.4	1.8

10.2.3.1 Mitigation

Barge operations will not be conducted in high wind conditions, in order to lessen the chances of an accident. The criteria will be defined in broad terms leaving room for taking into account operator experience; however, in the event that winds exceed 40 km/h barge operations will be suspended until wind decreases. In the event that barge operations are suspended during a wind event, coal will not be transferred from rail to barge.

Dust control mitigations have been identified in previous sections to address fugitive dust such as the application of topping and binding agents, as well as coal profiling (bread loaf shape) to minimize erosion.

10.2.4 Visibility and Fog

On average, visibility is reduced to 0.6 nautical miles (or 1.11 km) for approximately 20 days/year (5.5%) in coastal areas, and up to 60 days/year (16.4%) in the Fraser River delta (DNV, 2012). The Lower Mainland experiences a total of 4.8 days per year of visibility less than 1 km (Table 10-3) where 66% of these days occur between October and January, when daylight hours are decreasing and wetter weather occurs. Reduced visibility results from fog conditions, rain or snow fall. Reduced visibility affects the safe operations of barges at the facility and en route to Texada Island. The likelihood of collision and powered grounding increases when visibility is poor (less than 3.6 km).

Table 10-3: Visibility Summary for the Climate Station at Vancouver International Airport (measured in hours)

	Visibility by Month (hours)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
< 1 km	30.8	11.5	2.8	0.3	0.1	0.2	0.2	0.4	4.7	27	14.1	25	117.1
1 to 9 km	134.4	81	46.4	26.7	18	19.1	13.2	23.4	50.7	111.4	94.5	122.7	741.6
> 9 km	578.8	584.6	694.8	693	725.9	700.7	730.6	720.2	664.6	605.7	611.5	596.3	7906.5

10.2.4.1 Mitigation

A risk assessment for coal barge operations completed by DNV (2012) note that proposed barge operations do not raise issues of concern with stakeholders and that the proposed new operations are not different from existing operations already being conducted or considered in the Fraser River. FSD will implement risk management strategies, in addition to established good practice to minimize potential exposure to risks such as collision, structural failure, fire/explosion, powered grounding, drift grounding, impact and/or striking at FSD. Such strategies include:

- Night time operations will follow mandatory lighting and manning requirements;
- Fraser River pilots will be aware of the coal barge presence and may order additional tug assist for vessel entry and exit at the FSD berth face;
- Tugs will be selected in accordance with the then-current weather conditions and barge load characteristics, in order to ensure a proper match between tugs and barges. Equipment selection criteria will be based on Lafarge's significant experience in operating in the Fraser River;

- The FSD berth face to be used for the proposed barge operations is not directly open to the main shipping channel, reducing the potential for a vessel impact;
- Appropriate equipment to be selected in accordance with specific weather conditions and barge load characteristics;
- Regular tug inspections to ensure they meet Transport Canada requirements;
- Barges are to be compartmentalized to reduce the potential severity of the impacts; and
- During freshets, a tug assist should be considered for increased safety of the barge operations.

10.3 Wave Height and Tidal Conditions

No significant wave height (sea state) is expected within the Fraser River section of the barge route as the proposed barge pathway is sheltered. Significant waves could potentially affect structural integrity of barges.

Tidal currents in the Fraser River are generally about 1.5 knots. Strong currents can impact navigation and lead to a greater potential for collision, and powered and drift grounding. Additionally, strong currents can worsen the potential consequences by adding to further damage following a collision and/or faster and wider spread of pollutants, in the event of a spill.

10.3.1.1 Mitigation

FSD will implement risk management strategies, in addition to established good practice to minimize potential exposure to risks such as collision, structural failure, fire/explosion, powered grounding, drift grounding, impact and/or striking at FSD. These strategies are identified in the previous section.

10.4 Residual Effects and Determination of Significance

No residual effects on the Project resulting from natural environmental factors or events are anticipated if the mitigation measures, design standards and best management practices described above are implemented. Significant adverse effects of the Environment on the Project are not expected during construction or operation.

11.0 SUSTAINABILITY

FSD is committed to operating in an environmentally responsible manner and for promoting environmental stewardship amongst all of its key stakeholders, including employees, customers, shareholders, suppliers, contractors and the public. FSD will implement practices and policies that promote Environmental Stewardship and adhere to all environmental compliances. FSD will strive for continuous improvements of performance through consistent and measureable goals and objectives.

FSD's commitments are:

- To comply with all relevant environmental regulatory requirements and support through corresponding internal policies;

  To prevent air quality impacts by implementing appropriate air emission mitigation strategies and monitoring performance against pre-established baselines and regulatory target levels;

- To prevent pollution and emissions by continually working on process improvements to minimize the generation of hazardous waste and to reduce or prevent the release of regulated substances into the environment;
- To foster, establish and maintain an internal environmental awareness culture for their employees and contractors that supports excellence in Environmental Stewardship;
- To engage with customers, suppliers, contractors and shareholders to promote environmental stewardship, to address and reduce the environmental impacts of products and services along the value chain;
- To reach out to the communities and promote Environmental Stewardship and awareness;
- To establish a process of continual improvements governed by the commitments of this policy and assessed against key performance indicators and corporate targets (SMART); and
- To establish and maintain an environmentally conscious Purchasing Policy.

11.1 Emissions Reductions

11.1.1 Reducing Greenhouse Gases

FSD is aware that climate change is a concern of the general public and the burning of coal is a greenhouse gas contributor. As FSD is only handling the transfer of unburned coal from rail to barge, this

EIA does not include the assessment of ultimate coal use. For this reason, climate change has been excluded from the scope of this assessment.

Construction and operational activities are likely to result in localized air quality impacts (Levelton, 2013). Construction related impacts are expected to be short-term, and can include fugitive dust and combustion emission from vehicles. Possible construction activities that may result in fugitive dust include; excavation, pile driving, sand blasting, clearing, grubbing, aggregate handling, stockpiling, crushing, grading, compacting, paving, demolition, and the use of construction vehicles (Levelton, 2013b).

Fugitive dust emissions from operational activities are expected to include rail transit, loaded and empty rail cars, coal receiving pits and conveyors, loading coal on barges, and coal barge transit (Levelton, 2013b).

Other initiatives include:

- Diesel particulates filters should be used on all construction equipment capable of supporting their use;
- Use of 2003 model or later equipment and vehicles;
- Ongoing assessments of the potential for dust generation and combustion emissions; and
- Visual assessments of dust and exhaust emissions to be completed on an ongoing basis while machinery is operating.

In addition, BNSF has replaced older, less fuel efficient locomotives with approximately 2,900 new locomotives (Wallace, 2013) . Idle-control mechanisms have been installed on approximately 90 percent of BNSF's current locomotives, which will reduce air emissions and fuel consumption by automatically shutting down locomotives that are not in use. All new locomotives purchased will be equipped with this technology and retrofitting of older locomotives will continue. In 2012, BNSF upgraded their rolling stock and new Tier 3 locomotives and resulted in a reduction in diesel emissions of 69 percent relative to older locomotives. Over the past 10 years, BNSF fuel consumption has only increased 14 percent, while the volumes and distance of freight has increased 29 percent. Railroads are a fuel-efficient mode of surface transportation, and can more than three times as fuel efficient as long-haul trucks. Trains move the same ton of freight more than three times as far as trucks per gallon of fuel, according to the Association of American Railroads (AAR). This efficiency produces nearly one-quarter fewer carbon dioxide emissions per ton mile than trucks. In addition, on a per ton-mile basis compared with trucks, railroads emit less than one-seventh the particulate matter, and just one-third the nitrogen oxides and carbon monoxide.

11.1.2 Anti-idling and Shut-down Procedures

Specific worker education programs to address idling reduction such as automatic anti-idling shut-off, where feasible, operation of equipment at optimum rated loads, routine equipment inspections and maintenance, daily inspections to identify dust and equipment exhaust issues will be implemented.

11.2 Materials Handling

11.2.1 Water Recycling

The facility is proposing comprehensive water-based dust suppression systems for during daily operations. Wastewater run-off is expected to be generated, collected, treated and recycled, as much as possible.

Wastewater generation, collection, treatment, and re-use or disposal was explored by Triton (2013a, 2013b, and 2013c) and Omni (2013). Potential mitigation measures to reduce or remove the effects of planned construction and operations on surface water and groundwater are described in Section 5.4 and draw from Omni (2013) and Triton (2013a).

11.2.2 Waste Management

Recovering waste or other miscellaneous unused materials will be disposed of in an appropriately certified facility, or placed in storage.

11.2.3 Stormwater Run-off Collection and Treatment Plan

Stormwater management and fire suppression infrastructure (e.g. sumps, containment tanks, oil/water interceptor, sprinkling towers) will include the re-use of treated water for dust suppression during dry periods. In wet periods water will be treated at minimum for pH adjustment, solids removal and off site discharge under permit. FSD is investigating a permitted discharge to sanitary sewer as part of evaluating off site discharge strategies (Triton, 2013c and Triton, 2013d). The treatment plan will include in-situ measurements of pH, temperature, turbidity/TSS, specific conductivity, TDS, DO, and ORP to evaluate site and system performance (OMNI, 2013).

12.0 CUMULATIVE EFFECTS ASSESSMENT

Cumulative effects are changes to the environment that are caused by an activity in concert with other past, present and future human activities. As discussed previously, of particular relevance to scoping the cumulative effects assessment are the criteria for evaluating relevance of evidence pertaining to the assessment of cumulative effects. The following criteria must be met for cumulative environmental effects to be considered:

- There must be an environmental effect of the project being proposed;
- That environmental effect must be demonstrated to operate cumulatively with the environmental effects from other projects or activities;
- It must be known that the other projects or activities have been or will be carried out and are not hypothetical; and
- The cumulative environmental effect must be likely to occur.

It is therefore necessary to evaluate predicted residual effects of the reviewable project to determine whether any cumulative interaction with the residual effects of other projects and activities is considered likely to occur. If no cumulative interaction is considered likely, those residual effects need not be carried forward into a cumulative effects assessment.

Other predicted residual effects of the reviewable project may be negligible and thus not warrant detailed consideration in a cumulative effects assessment. This may be the case for residual effects whose relative contribution to cumulative effects may be so small as to be insignificant.

Based on the results of the effects assessments conducted in sections 5 to 7, and a review of the residual effects described, the focus of the cumulative effects assessment will be the potential for residual air quality effects to interact cumulatively with other sources of air emissions in the project area, and likely future development.

The effects of current projects and activities are reflected in the Project area conditions described in Section 5.1.

Based on Metro Vancouver air quality data, fine particulate matter concentrations ($PM_{2.5}$) in Tsawwassen, Ladner, and Delta, communities surrounding Westshore Terminals Limited Partnership coal facility in Delta, are found to be the same or less than other areas within the Lower Fraser Valley. In North Vancouver, the site of Neptune Bulk Terminals (Canada) Limited, which handles coal and other products, fine particulate matter concentrations ($PM_{2.5}$) are consistent with other monitoring stations within the CBIA.

Monitoring carried out in 1984 and 1985 on coal trains travelling to Roberts Bank measured TSP matter beside the railway tracks in Agassiz. Based on the study up to 20% of the TSP may be coal dust as $PM_{2.5}$. At a distance of 10 m from the tracks it was concluded that the concentrations of $PM_{2.5}$ from passing trains would be indistinguishable from background concentrations.

A report composed by SENES Consultants Limited in 2012 for the proposed DTRRIP located at Roberts Bank in Delta, BC calculated the current fugitive coal dust emissions from the facility on air quality in Tsawwassen based on a current throughput of 24.7 million tonnes per annum (mtpa), as well as the proposed 42% increase to 35 mtpa (SENES, 2012). Notably, all current and proposed emissions levels are well below the relevant AAQO.

Furthermore, SENES (2012) predicted that total $PM_{2.5}$ concentrations at site T39, the Metro Vancouver ambient air quality monitoring station in Tsawwassen, including all emission sources, would range from 8.7 – 9.1 µg/m^3 under average operating conditions, and 9.6 – 11.2 µg/m^3 under peak operating conditions. This is still less than 50% of the BC AQO, and due to changes in controls and operating procedures under the expansion, would represent a ***decrease*** from current levels of approximately 0.5 and 2 µg/m3 during average and peak output, respectively.

Levelton (2013a) modelled Project and agricultural handling emissions, which included CO, NO_x, SO_2, PM_{10}, $PM_{2.5}$ and TSP, and added these results to the background air quality. Project emissions from the facility included combustion sources (rail and tugs) and fugitive dust sources (rail cars within the rail yard, unloading of coal from trains, movement of coal through the facility, loading of coal onto barges, coal on barges at the berth and transport of coal by barge). Project emissions from nearby the facility from rail and barge transport (both combustion and fugitive dust) were also included in the assessment. The geographic extent to which the transportation emissions were included was based on guidance from Metro Vancouver and included barge related emission extending approximately 2 km from the berth and rail related emissions extending approximately 1.5 km from the rail yard.

Air quality modelling and assessment was conducted by Levelton (2013a) which predicted ambient air concentrations from Project related emission which were then included to the background ambient air concentrations. Results from the air quality assessment are shown in Table 5-3. It should be noted that air dispersion modelling techniques and practices followed are considered to be conservative as they consider the combined effects of conservative emissions and meteorological conditions which predict the maximum concentrations all within the context of atmospheric physics in the model that errs toward conservative estimates of the modelled design concentration.

Based on the air quality modelling assessment for the proposed Project at FSD, the following conclusions have been drawn regarding potential impact from the proposed Project:

- Particulate matter emissions from fugitive dust sources are localized around the facility and predicted air quality impacts are low. With the mitigation planned for the facility the fugitive dust sources are predicted to have low impact on air quality in the area.
- There are predicted exceedences noted for 24-hour averaged PM_{10} and annual NO_2 when combining the impacts of the proposed Project, current agricultural goods operations, and ambient background concentrations. The predicted 24-hour averaged PM_{10} exceedences are located on the facility fenceline inland, while the predicted annual NO_2 exceedences are receptors located over the Fraser River. While the modelling results are likely to be conservative by nature, monitoring after facility commission is recommended to validate that air quality exceedences will not occur.
- For all air contaminants, the maximum concentrations were predicted to occur along the facility fenceline. The predicted air contaminant concentrations quickly diminish as emissions disperse further away from FSD's facility.
- Predicted air quality impacts at sensitive receptors and within residential neighbourhoods in the vicinity of FSD with the ambient background added are low and remain below all AAQOs.

The results of the air quality assessment indicate that, when considered with existing and likely future Project activities, and the application of mitigation measures described in Sections 5.2 and 7, there will be no significant cumulative effects associated with the Project. SNC-Lavalin has reviewed the analysis and supports that view.

13.0 ENVIRONMENTAL MANAGEMENT PLANS AND FOLLOW-UP PROGRAMS

FSD has developed environmental management plans and follow-up monitoring programs for the construction and operations phases of the Project. The EMPs and monitoring plans will be updated and finalized prior to the start of construction by FSD and their contractors. Such EMPs and monitoring programs include:

- Temporary Coal Offloading Facility Preliminary Environmental Management Plan for Construction and Operations (Triton, 2013c) (Appendix VI)
- PARY Upgrade and Maintenance Project Environmental Management Plan (Triton, 2013a) (Appendix VI)
- Water Management Plan for Track Extension/Re-Construction at Shed 1, Fraser Surrey Docks, 11060 Elevator Road, Surrey, BC. (Triton, 2012) (Appendix VI)
- Water Management Plan (Omni, 2013) (Appendix VI)
- Proposed Water and sediment quality monitoring plan (Triton, 2013b and Triton, 2013d) (Appendix VI)
- Best Practices for the Reduction of Air Emissions From Construction and Demolition Activities (Cheminfo, 2005) (Appendix VI)
- Coal Transfer Facility Fire Safety Plan (RKMS, 2012) (Appendix VI)
- Construction Communications Plan (FSD, 2013) (Appendix VI)
- FSD Spill Response Plan (Appendix IV)
- Lafarge Standard Operating Procedures for barge transport, including Spill Containment and Response (Appendix V)
- Draft Air Quality Management Plan (Levelton, 2013b) (Appendix VIII)

Specific construction environmental management plans in the Preliminary EMP (Triton, 2013c, Appendix VI) include:

- Surface Water Quality and Sediment Control Plan;
- Environmental Monitoring Plan;

- Hazardous Materials Management and Spill Response Plan;
- Soils Management Plan;
- Air Quality Management Plan;
- Noise Management Plan; and
- Pile Driving Management Plan; and
- Vegetation and Wildlife Protection Plan.

Operational environmental management plans in the Project EMP (Triton, 2013c) include:

- Air Quality Management Plan;
- Run-off Collection and Treatment Plan;
- Emergency Response Plan;
- Lighting Plan; and
- Noise Management Plan.

14.0 SUMMARY OF PROJECT EFFECTS, MITIGATION MEASURES AND RESIDUAL EFFECTS

The following table summarizes the project effects, mitigation measures proposed by FSD, and any residual effects that may remain for the construction and operations phases of the Project.

Table 14-1: Potential Project Effects, Mitigation Measures and Residual Effects

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
Vegetation and Wildlife				
Loss of vegetation and habitat loss/displacement of wildlife	C, O	Track maintenance and upgrade on the PARY property; construction works in the area of Shadow Brook and green-coded watercourse.	• Conduct nesting bird surveys when pre-clearing and construction works fall between March 1 and August 1. Special consideration is to be taken for potential raptor nesting activity, as some raptors require a buffer of >100 m. • Install temporary fencing surrounding designated riparian zones (Shadow Brook). • Contractors working in areas with noxious weeds must ensure all equipment is cleaned of all dirt and seeds. • Riparian planting alongside the west bank of the proposed relocated ditch to offset riparian changes associated with the Elevator Road rail relocation and Bekaert Access Road relocation. • A re-planting plan for the areas adjacent to the ditch will be developed and provided to PMV.	No residual effects. Not significant
Fish and Fish Habitat				
Disturbance to fish populations in the Fraser River	C, O	Discharge of coal drainage wastewater and run-off; discharge of contaminants through spills; discharge of coal to	• Management plans have been developed to identify and mitigate effects of water on the Project, which include PDP; Surface Water Quality and Sediment Control Plan (SWQSCP); WMP; and RCTP. • Installation of temporary fencing surrounding designated riparian zones (Shadow Brook). • Complete pile driving outside of the March 1 to June 15 sensitive period. • Maintain equipment to prevent leaks or spills of potentially hazardous materials (i.e. hydraulic fluid, diesel, gasoline,	No residual effects. Not significant

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
		water bodies (i.e. through fugitive dust).	and other petroleum products) into waterways. • Recover waste or other miscellaneous unused materials for disposal in an appropriately certified facility or placed in storage. • Emergency spill equipment to be available whenever working near or on the river. • Position water borne equipment in a manner that will minimize damage to fish habitat • Where possible, use alternative methods (e.g. anchors instead of spuds). • • FSD and Lafarge to monitor designated fishing windows and where possible, work to schedule traffic around those windows.	
Species and Habitat with Special Status				
Riparian habitat loss	C, O	Construction activities, operations	• Installation of temporary fencing surrounding designated riparian zones (Shadow Brook). • Contractors working in areas with noxious weeds must ensure all equipment is cleaned of all dirt and seeds. • Riparian planting alongside the west bank of the proposed relocated ditch to offset riparian changes associated with the Elevator Road rail relocation and Bekaert Access Road relocation. • A re-planting plan for the areas adjacent to the ditch will be developed and provided to PMV.	No residual effects. Not significant
Effects on fish with special status	C	Construction activities	• Complete pile driving outside of the March 1 to June 15 sensitive period to protect juvenile salmon and eulachon (*Thaleichthys pacificus*).	No residual effects. Not significant

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
Water Resources – Surface Water and Groundwater				
Reduced surface water quality; increased sedimentation; contamination of surface water flow	C, O	Construction activities; land-based stages of coal conveyance.	• Implementation of management plans to mitigate effects of water, which include SWQSCP; WMP; and RCTP. • Catch basin protection installed prior to construction adjacent to truck routes supporting construction. • Excavation discharge to be directed to in-ground pit specifically created to manage turbid excavation waters and/or concrete contact waters. • Daily site cleaning to prevent build-up of dust at could become a source of sediment during rain events, and as needed during the wet season to prevent mud build-up. • Potentially restricting excavation works during inclement weather. • Inactive soil piles will be located away from catch basins and will be securely covered to prevent wind losses and erosion. • Equipment storage, maintenance or fuelling will not take place within 15 m of waterways. • Implement the WMP and RCTP mitigation to reduce the impacts of run-off into nearby waterways by collection and water treatment prior to it being recycled or discharged. The water treatment program would emphasize pH adjustment and solids removal, may include injection of buffering agents to address pH issues; adding of a chitosan flocculant to remove suspended sediment, phosphorus, metals, PAH and other organics; sand filter to treat large volumes of water with a backwash phase to flush particulates from sands; and treated water shall be directed back onto system for reuse or discharge off site during high flow. • Separately collect coal drainage wastewater (including leachate, collected water, and exposed water) in a gravity	No residual effects. Not significant

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
			driven settlement pond and dispose or recycle, where possible. • Collect grey water in pits mounted on sealed cement sumps and pump water to settlement ponds prior to recycling or disposal. • Spray coal barges with water when needed on a 5 minutes per 30 minute period using specific sprays. • Implement the FSD SRP for Coal and the Lafarge SCRP. • An Environmental Monitor will visit the site once a week during construction. • A water quality monitoring program will be conducted on the excavation wastewater that is to be discharged to in-ground pits, as well as on the Loading Area Settling Pond where wastewater will be discharged to the sanitary sewer. • During operations, monitor treated discharge water.	
Impact to watercourses at Shadow Brook and a green-coded ditch located at the Bekaert property	C	Changes to site access.	• Re-contour the drainage ditch and place appropriate drainage features when building the access. • Approval or notification pursuant to Section 9 of the BC *Water Act* will be obtained prior to any in-stream works commencing during the construction phase.	None. Loss of 0.10 hectares of riparian habitat. Compensation planting is planned.

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
Soil				
Loss of soil	C, O	Excavation works during construction; coal spills during rail operations.	• Implement the SMP during the excavation of ASHROSS receiving pit and the proposed dewatering pits. • Use the appropriate storage while on site. • Develop off site disposal management plans prior to the start of construction. • In the case of contaminated soils, soils will be segregated and placed on an impermeable surface protected from erosion and wind loss. Suspected contaminated soil samples will be collected, classified, and disposed of at an appropriate licensed facility. • Collect soil samples during work associated with ASHROSS receiving pit and proposed dewatering pits. • Implement the FSD SRP for Coal.	No residual effect. Not significant
Accumulation of fugitive coal dust, and coal spills on Fraser River sediments	O	Operations activities associated with coal.	• Profile coal when loading onto the barge to reduce wind erosion and turbulence. • Add water to wet the coal to prevent dusting. • Coat coal with “binding agent” and “surfactant” during the barge loading process (through plumbed sprayers in the conveyor system) to prevent fugitive dusting during barge transit. • Avoid operation of barges in wind conditions greater than 40 km/h. • Maintenance of the facility, including daily cleaning, is proposed to reduce the build-up of dust that could become a source of sediment during rain events. • Implement the FSD SRP for Coal and the Lafarge SCRP.	Localized residual effects. Not significant

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
			• A twice yearly sediment survey will be completed throughout the life of the Project. • Barges will be double-hulled. • Barges will be compartmentalized. • Coal will not be loaded into the hull of the barge. • All barges will be inspected prior to loading of coal.	

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
Air Quality				
Reduced air quality during construction activities	C	Construction activities	• Grade the construction site in phases, timed to coincide with the actual construction in that area. • Start linear construction at the location that is upwind from the prevailing wind direction. • Minimize the amount of clearing required to conduct the works. • Minimize generation of road dust (e.g. minimize the time that unpaved surfaces are exposed and use watering and/or sweeping). • Use wind fencing in construction areas that are frequently subjected to high winds. • During dry conditions and when necessary, control dust sources (e.g. minimize the time that unpaved surfaces are exposed, water or cover potential dust sources, sweep paved surfaces). • As necessary, use environmentally acceptable dust suppressants or water to control dust on access roads, lay-down areas, work areas, and disposal areas. • Do not use oils for dust control. • Stabilize surfaces of completed earthworks and/or base areas with vegetation, stones, geotextile, mulch or other erosion resistant cover. • Compact distributed soils. • Reduce activities that create fugitive dust during windy conditions. • Control mud and dirt track-out from construction sites. • Minimize drop height at material transfer locations (e.g. when loading soil onto haul trucks).	Localized residual effects. Not significant

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
			• Prohibit burning as a means of disposal of any organic or construction materials. • Implement on site vehicle restrictions (e.g. limit the speed of vehicles to 15 km/h travelling on unpaved access / haul roads). • Maintenance of the facility, including daily cleaning is proposed to reduce the build-up of dust that could become a source of sediment during rain events. • Implement an on-going air quality monitoring program to provide real-time air quality information for the site and pre-determined nearby areas. • Diesel particulate filters are to be used on all construction equipment, where possible.	

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
Coal dust and fugitive dust emissions	O	Terminal Operation processes.	• Refer to Table 6-1 of draft AQMP (Appendix VIII) • Limit rail traffic speed to 5 km/h. • Use AC locomotives equipped with VFD for coal transit. • Rail carriers are to follow anti-idling policy and locomotive shut-down procedures. • Use recommended dust control measures for loading coal and coal transit. • Use an electric positioner (indexer) to position rail cars over bottom dump receiving pits. • Water/mist system used to spray coal during the unloading process. • Cover all receiving pits except for entry/exit points. • Spray empty cars to remove remaining coal after leaving the dumper pit enclosure. • Minimize drop heights and curved chutes at transfer points. • Use enclosed conveyor system equipped with water and chemical agent spraying nozzles. • Use of dust limiting design for transfer points (i.e. curved shuts, baffles, belt skirting, shrouds and/or a directional snorkel).Use of mechanical profiling of coal in conveyors to limit exposure to air flow. • Use mechanical winching system to warp barges along the berths during loading. • Implement an on-going air quality monitoring program to provide real-time air quality information for the site and pre-determined nearby areas.	Localized residual effects. Not significant
Coal dust and fugitive	O	Rail Operations	• Apply “body agent” at the mine site to help bind coal particles to reduce dust losses. Apply a secondary “body agent”	Localized residual effects. Not

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
dust emissions			as required to reduce coal oxidation. • Profile the coal when loaded into "bread loaf shape" to prevent wind erosion. • Apply of "topping agent" when coal is loaded into the railcar at the mine site to act as a sealant to prevent dust losses. • Reapply of "topping agent" approximately at midpoint of the rail movement from the mine site to FSD to address concerns regarding potential degradation of the topping agent during transit. • Remove excess coal from outside of rail cars once loaded/unloaded. • Spray empty railcars at the terminal after unloading to ensure coal remnants are removed to prevent dusting during return trips to the mine site. • Implement an on-going air quality monitoring program to provide real-time air quality information for the site and pre-determined nearby areas.	significant
Coal dust and fugitive dust emissions	O	Barge Operations.	• Profile coal when loading onto the barge to reduce wind erosion and turbulence. • As a secondary dust mitigation measure, water will be sprayed on the barges in a controlled manner (i.e. approximately five minutes every 30 minutes), as deemed necessary by the operations superintendent or the Environmental Coordinator. • Coat coal with "binding agent" and "surfactant" during the barge loading process (through plumbed sprayers in the conveyor system) to prevent fugitive dusting during barge transit. • Avoid the operation of barges in wind conditions greater than 40 km/h. • Implement an on-going air quality monitoring program to provide real-time air quality information for the site and pre-	Localized residual effects at transfer point. Not significant

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
			determined nearby areas.	
Noise and Vibration				
Noise Emissions	C, O	Construction activities.	• Contractors and supervisors to take a noise awareness training program, specifically tailored to FSD site and surrounding area. • Construction to take place within Surrey noise bylaws (activity to occur between 7:00 am and 10:00 pm Monday to Saturday). • Prepare and submit a list of equipment prior to construction to evaluate potential noise impacts. • Select less noisy machinery, vehicles and equipment for use on site wherever possible, • Maintain equipment, emphasizing lubrication, replacing worn parts, and maintaining exhaust systems, • Routine inspection of equipment, • Where needed, fit equipment with residential-rated mufflers and/or silencers for night-time work, • Muffle back-up beepers when safe and feasible to do so, • Shut off equipment when not in use and operating equipment at the minimum speeds permitting operation, with hoods and shields closed, • Enforce speed limits to reduce vehicle noise. • Install temporary noise barriers made of solid material as needed, placed as close as practical to the source of noise.	No residual effects. Not significant
Overpressure	C	Pile driving.	• Pile driving will be completed using Best Management Practices for Pile Driving and Related Operations – BC Marine	No residual effects. Not

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
(shockwaves)			and Pile Driving Contractors Association (BC Marine, 2003); • Vibratory pile driving is anticipated at Berth 2 and as a result, ongoing hydrophone monitoring is unlikely to be required by the regulatory agencies. FSD will commit to hydrophone monitoring at project start up, and on a selected basis thereafter (depending on site-specific conditions and observations) to confirm pressure levels are ≤30 kPa at a distance of >1 meter from any pile being driven; • Conferring with DFO (and other agencies with jurisdiction) to determine the preferred timing and methods of the pile driving program; • Pile driving will continue for no longer than two weeks; and • Pile driving activities will adhere to City of Surrey Noise bylaw.	significant
Noise Emissions	O	Operations activities (train and vessel traffic, unloading facility operations).	• All rail movement within FSD and adjacent PARY will be restricted to 5 km/h or less. • Coal being unloaded from rail cars will have minimal drop heights and be completed in an enclosed shed surrounding the receiving pits. • Rail car unloading and coal conveyor system will be electric; with anticipated conveyor noise levels is approximately 60 – 65 dB, within normal conversation range at 3 feet (1 m). • The conveyor system will be covered on two of four sides, limiting the travel of noise with bottom dumping in to the receiving pits. • An electric rail positioner will be used to move cars through the facility instead of a locomotive. • New rail is being installed with curvatures of 12 degrees or less to minimize noise caused by steel railcar wheels pulling	No residual effects. Not significant

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
			on tight turns, with the possible addition of lubricators. • Once Tannery Road and Elevator Road crossings are eliminated (via development of SFPR and proposed access changes by FSD), train whistles associated with the coal and Agro-bulk facility will only need to be sounded once at one crossing. • Trains will arrive between 4:00am and 8:00am and depart between 5:00pm and 9:00pm. Although coal receiving is anticipated to be during dayshift hours (8:00am to 4:30pm) it could take place on the afternoon (4:30pm to 1:00am) and graveyard (1:00am to 8:00am) shifts. FSD will post afternoon and graveyard working periods on their website 48 hours in advance prior to operations. • Trains will be shut down on completion of shift. If it is known than the train will not be required for a period of 3 hours or more, it will be shut down (except in the case where the temperature is expected to drop below -3).	
Light				
Increased lighting	C, O	Construction activities; direct lighting along conveyors, barge loader and inside the unloading shed.	• Minimize night-time activity (where practical). • Use light on an “as and when needed” basis. • Direct lighting toward the ground on working areas, reducing the height of lighting to the extent possible and minimizing the number of lights required through strategic placement. • Eliminate upward directed light. • Use fittings on lamps to direct light and confine the spread of light. • Ensure lights are in good condition at all times.	No residual effects. Not significant

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
			• Use lights with appropriate wavelengths to avoid distraction and disorientation by birds, where practical given safety and security requirement. • Shut off lights when they are not needed.	
Adjacent Communities				
Traffic interruptions and increased vehicle wait times at road crossings	C, O	Increased railcar traffic; empty rail cars blocking either Robson Rd or Timberland Rd up to 24 times for 2-4 minutes each time during the unloading process; arrival and departure of coal trains will increase queue lengths at Elevator Rd crossing.	• The potential for vehicle wait times will be reduced by scheduling rail movements outside of peak vehicle traffic times. • Construction traffic access and egress from the Facility will be at pre-arranged times to avoid concerns with regard to traffic congestion. • Construction impacting regular public traffic will be performed at off-peak times when practical. • Notifications will be posted one week in advance and sent to surrounding properties outlining the work being carried out, times, and expected traffic impacts. • Rail traffic at the Tannery Road and Elevator Road crossing is expected to be eliminated after construction of an overpass at Tannery Road, and eliminating the Elevator Road crossing.	No residual effects. Not significant
Emergency vehicle access	C, O	Increased railcar traffic; empty rail cars	• BNSF will work with emergency services to have immediate access to railway crossings during emergency events. • Implement emergency preparedness plans (amend as advised by local Emergency Response agencies).	No residual effects. Not

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
		blocking either Robson Rd or Timberland Rd up to 24 times for 2-4 minutes each time during the unloading process; arrival and departure of coal trains will increase queue lengths at Elevator Rd crossing.		significant
Fire	O	Risk to adjacent communities from on site fire	• Implement a FSP and train all employees in regards to this plan. • Conveyor belts are designed with fire taps with valves at regular intervals. • A hose tap at the belt drive area directly upwind of the belt drive. • Fire retardant hydraulic fluids and fire resistant belting will be used for the conveyor system. • Regular scheduled checks and maintenance of process area equipment (i.e. conveyor system). • No open flame/ignition source/hot work is permitted in the process areas without following proper procedural controls. • CO detection (as an indicator for the potential for fire).	No residual effects. Not significant.

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
			• Regular housekeeping to eliminate coal build-up from spillage/dust.	
Recreational Interests				
Recreational fishing and boating	O	Increased congestion on Fraser River due to increase in barge traffic; navigational interactions between barges and other vessels.	• Provide the coal barge schedule to Fraser River users and public. • FSD and Lafarge will monitor designated fishing windows and where possible, work to schedule traffic around those windows. • Pre-emptively notify fishing groups if conflict is expected. • Review of potential barge movement impacts on a regular basis and work with stakeholders to help minimize impacts.	No residual effects. Not significant
Human Health				
Fugitive dust	C, O	Train activity; terminal loading; barge movement.	• Mitigation as outlined in the draft AQMP in Levelton (2013b).	Localized residual effects. Not significant
Diesel emissions	C, O	Train activity; terminal equipment; marine vessels.	• Mitigation as outlined in the draft AQMP in Levelton (2013b) • Implement the anti-idling policy and AQMP, which includes an on-going air quality monitoring program to provide real-time air quality information for the site and pre-determined nearby areas.	Localized residual effects. Not significant
Ecological Health				
Fugitive coal dust and	C, O	Train activity; terminal loading; barge	• Mitigation as outlined in the draft AQMP in Levelton (2013b).	No residual effects. Not

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
diesel emissions		movement.	• Implement an anti-idling policy and draft AQMP, which includes an on-going air quality monitoring program to provide real-time air quality information for the site and pre-determined nearby areas. Profile coal when loading onto train/barge to reduce wind erosion and turbulence. • Add water to wet the coal to prevent dusting. • Use "topping agents" for train/barge transport and coal conveyance. • Daily site cleaning to minimize dust that could become airborne.	significant
Contamination of groundwater sources; discharge of coal drainage wastewater and run-off; discharge of contaminants through spills; discharge of coal to water bodies	C, O	Construction activities; land-based stages of coal conveyance.	• Implementation of management plans to mitigate effects of water, which include SWQSCP; WMP; and RCTP. • Catch basin protection installed prior to construction adjacent to truck routes supporting construction. • Excavation discharge to be directed to in-ground pit specifically created to manage turbid excavation waters and/or concrete contact waters. • Daily site cleaning to prevent build-up of dust that could become a source of sediment during rain events, and as needed during the wet season to prevent mud build-up. • Potentially restricting excavation works during inclement weather. • Inactive soil piles will be located away from catch basins and will be securely covered to prevent wind losses and erosion. • Equipment storage, maintenance or fuelling will not take place within 15 m of waterways. • Separately collect coal drainage wastewater (including leachate, collected water, and exposed water) in a gravity driven settlement pond and dispose or recycle, where possible.	No residual effects. Not significant

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
			• Collect grey water in pits mounted on sealed cement sumps and pump water to settlement ponds prior to recycling or disposal. • Implement the FSD SRP for Coal and the Lafarge SCRP. • An Environmental Monitor will visit the site once a week during construction. • A water quality monitoring program will be conducted on the excavation wastewater that is to be discharged to in-ground pits, as well as on the Loading Area Settling Pond where wastewater will be discharged to the sanitary sewer. • During operations, monitor treated discharge water.	
Coal spills on Fraser River sediments	O	Operations activities associated with coal.	• Avoid operation of barges in wind conditions greater than 40 km/h. • Implement the FSD SRP for Coal and the Lafarge SCRP. • A twice yearly sediment survey will be completed throughout the life of the Project. • Barges will be double-hulled. • Barges will be compartmentalized. • Barge operations will not occur in win exceeding 40 km/h. • Coal will not be loaded into the hull of the barge. • All barges will be inspected prior to loading of coal.	No residual effects. Not significant
Effects of the Environmental on the Project				
Damage to	C, O	Earthquake	• Existing infrastructure at FSD conforms to standards and criteria for seismic preparedness.	No residual effects. Not

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
infrastructure			• FSD has considered the probability of earthquake events in Project design and construction with adhere to appropriate standards and criteria.	significant
Damage resulting from wave(s)/tidal changes	C, O	Tsunami	• Based on the project location (30 km from the mouth of the Fraser River), tsunami effects are not anticipated.	No residual effects. Not significant
Surplus wastewater	C, O	Heavy Precipitation	• FSD has considered the probability of surplus water from rain or snow in design of a water management system. • Three options have been proposed for handling surplus wastewater (pending permit application approval): ○ Direct discharge to Metro Vancouver sanitary sewer system; ○ Direct discharge to the Fraser River (which may require use of chemical to meet discharge quality standards); and ○ Discharge via an infiltration field. • In the case that discharge is to the Fraser River or an infiltration field, wastewater will go through a treatment process and stringent monitoring and testing process to meet discharge standards.	No residual effects. Not significant
Located in floodplain	C, O	Flooding	• FSD has a well established ERP. • New construction will be above 3.8 m or the 200 year flood mark.	No residual effects. Not significant
Barge accident	O	High wind during barge transport	• Barge operations will not occur in wind exceeding 40 km/h.	No residual effects. Not significant

Potential Effect	Project Phase	Contributing Project Activity or Physical Works	Proposed Mitigation	Residual Effects and Significance*
Collision, grounding, impact, and/or strikes	O	Visibility and fog	• Night operations will follow lighting and personnel requirements. • Fraser River pilots will be made aware of barge presence. • The FSD berth face to be used for the proposed barge operations is not directly open to the main shipping channel. • Appropriate equipment to be selected in accordance with specific weather conditions and barge load characteristics; • Regular tug inspections to ensure they meet Transport Canada requirements. • Barges are to be compartmentalized to reduce the potential severity of the impacts. • During freshets, a tug assist should be considered for increased safety.	No residual effects. Not significant
Structural integrity of barge	O	Wave height	• The barge route in the Fraser River is considered sheltered and no significant wave height is anticipated.	No residual effects. Not significant
Collision and grounding	O	Tidal conditions	• The FSD berth face to be used for the proposed barge operations is not directly open to the main shipping channel. • Appropriate equipment to be selected in accordance with specific weather conditions and barge load characteristics; • Regular tug inspections to ensure they meet Transport Canada requirements. • Barges are to be compartmentalized to reduce the potential severity of the impacts. • During freshets, a tug assist should be considered for increased safety.	No residual effects. Not significant

15.0 CONCLUSION

Based on the results of this EIA and consistent with the conclusions of Levelton and Triton, Dr. Leonard Ritter and Soleil Environmental Consultants Ltd., SNC-Lavalin has concluded that the Project is not likely to cause significant adverse environmental, socio-economic, or health effects, taking into account the implementation of appropriate effect management measures, as identified in the above sections.

The environmental review, as governed by PMV, is intended to foster sustainable development by ensuring that projects are constructed and operated in a manner that minimizes adverse environmental, socio-economic, and health effects. The effects of the Project, as provided in this EIA, have been assessed using methods that reflect standard approaches of environmental and socio-economic practitioners. After consideration of the potential residual effects, and taking into account engineering design, identified mitigation measures, best practices and current standards, the Project can be constructed and operated without significant adverse effects.

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APPENDIX I

Project Application to Port Metro Vancouver (PMV)

APPENDIX II

Binding and Suppression Agents

APPENDIX III

Dust Control and Anti-Idling

APPENDIX IV

Procedures for Small and Large-Scale Coal Spills

APPENDIX V

Standard Operating Procedures for Barge Transport

APPENDIX VI

Environmental Management Plans

APPENDIX VII

Community Engagement

APPENDIX VIII

Draft Air Quality Assessment and Draft Air Quality Management Plan

APPENDIX IX

Health Effects Associated with Exposure to PM

APPENDIX X

Metro Vancouver Wildlife List (HectaresBC 2013)

APPENDIX XI

Plants with Special Status

APPENDIX XII

Wildlife with Special Status

APPENDIX XIII

Expert Letters

APPENDIX XIV

VanHook (2012)

ATTACHMENTS

Delcan Engineering Drawings