



## MEMO

**TO:** Gary Olszewski, Vancouver Fraser Port Authority  
**cc:** Val Bond, Principal Environment, BHP  
**FROM:** Tyler Abel, WSP Canada Inc.  
**SUBJECT:** Air Quality Assessment, BHP Potash Export Facility at Fraser Surrey Docks – Supplemental Supply Chain Emissions Summary  
**DATE:** April 27, 2018

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## INTRODUCTION

This memo is a companion to the WSP Canada Inc. report: Air Quality Assessment BHP Potash Export Facility at Fraser Surrey Docks, which will be referred to as “the report” in this memo. The purpose of this memo is to provide revisions to the supply chain emissions as discussed in the March 28<sup>th</sup>, 2018 meeting with the Vancouver Fraser Port Authority (VFPA). Specifically, this memo addresses the following:

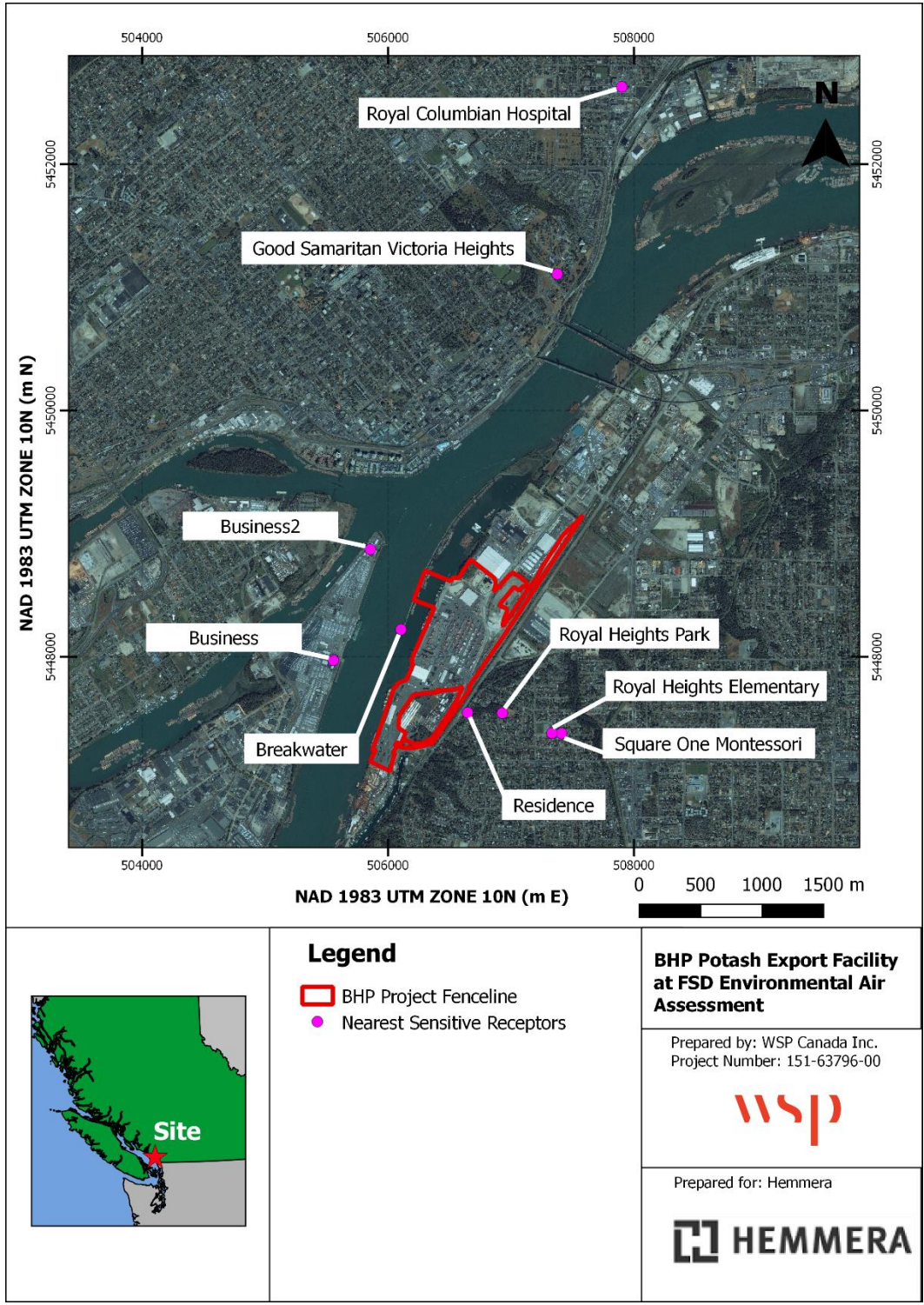
- An update to the supply chain emissions inventory to include baseline case supply chain emissions (previously only Project supply chain emissions were presented);
- An update to the Project case supply chain emissions inventory to include the baseline case supply chain emissions assumed to be displaced by the Project (from Berth 9 to Berth 8);

The information provided below describes the methods used in the updated supply chain emission inventory with appropriate references to the air assessment already provided to VFPA. The general methodology of emissions estimation follows the same methodology as the original air assessment. A tabular summary of the updated supply chain emissions for the baseline case and the Project case is also provided to allow for VFPA to review the potential change in supply chain emissions as a result of the Project.

## GEOGRAPHIC SCOPE

### FACILITY

The Project will be located adjacent to the existing Fraser Surrey Docks (FSD) terminal along the Fraser River on VFPA land. The Project site boundary (fenceline) considered for the assessment was defined within the report submitted to VFPA, and is shown in Figure 1.



**Figure 1 Facility Location and Nearest Sensitive Receptors**



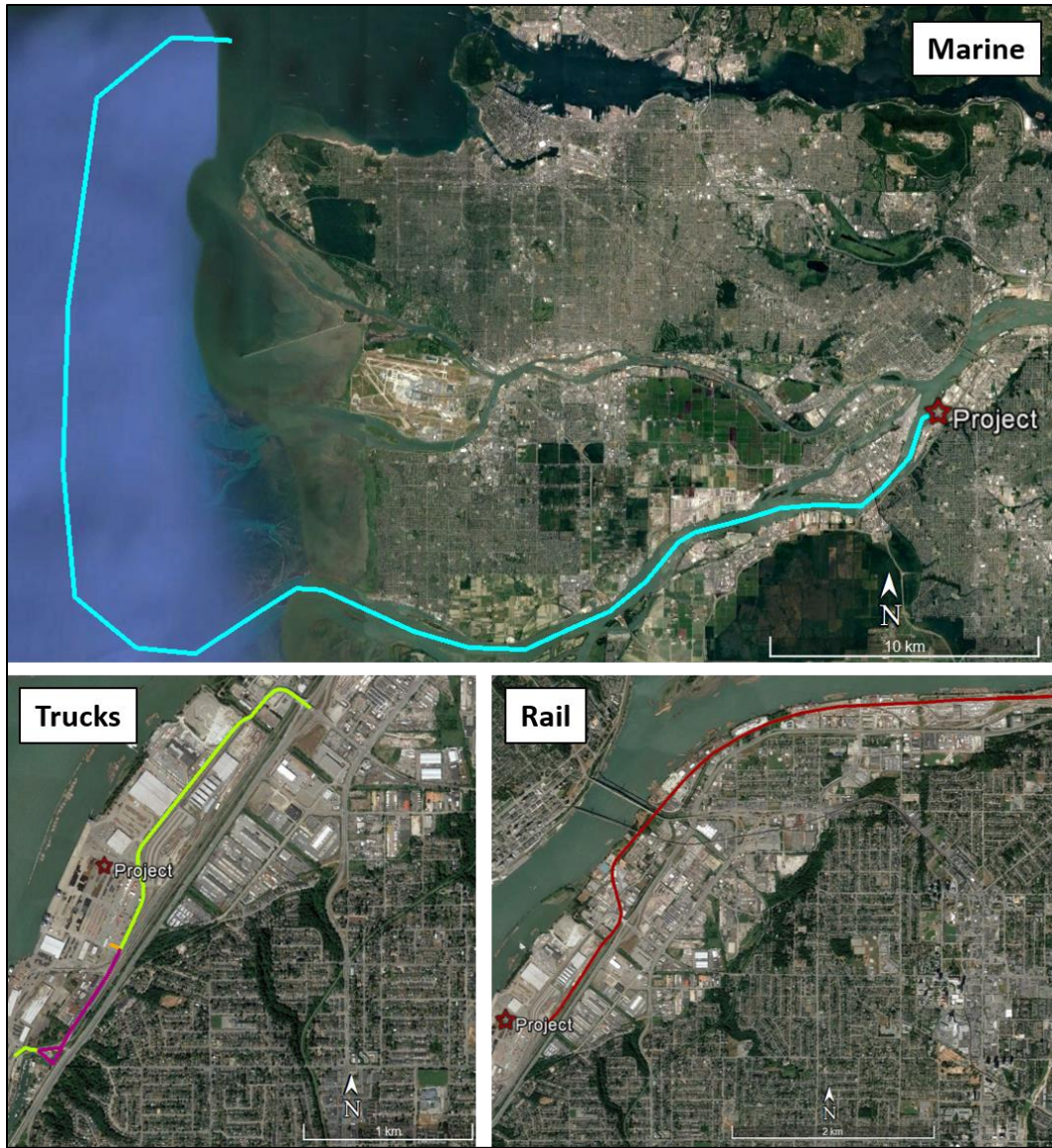
## **BASELINE – SUPPLY CHAIN**

The supply chain for the Baseline Case takes into account the emissions from marine vessels, unit trains and container and steel trucks that currently serve the existing operations at Berth 9 at the FSD facility and will be displaced by the Project to neighbouring Berth 8. The facility location and supply chain boundaries are shown in Figure 2. Detailed emission estimation methodologies including emission factors for the supply chain are presented in Appendix A Emission Estimation Methodology of the report. The combustion emission sources related to supply chain components of the Baseline Case are listed in Table 1 below.

## **PROJECT – SUPPLY CHAIN**

The supply chain for the Project takes into account the emissions from marine vessels and unit trains from the proposed Project operations, in addition to the emissions from marine vessels, unit trains and container and steel trucks from existing FSD operations which are assumed to be displaced to neighbouring Berth 8. Because the container and steel operations will not cease, but be displaced by the Project, the Baseline supply chain emissions are included in the Project Case supply chain emissions. The facility location and supply chain boundaries are shown in Figure 2. Detailed emission estimation methodologies including emission factors for the supply chain are presented in Appendix A Emission Estimation Methodology of the report. The combustion emission sources related to supply chain components of the Project Case are also listed in Table 1.





**Figure 2** Facility Location, Marine Supply Chain (blue), Rail Supply Chain (red), and Truck Supply Chain (steel trucks: green, container trucks: purple and orange).



**Table 1 Summary of Supply Chain Emission Sources**

Year	Emission Category	Source	Source Description
Baseline Case	Combustion emissions	Rail	Unit trains
		Marine	Vessel main engines
			Vessel auxiliary engines
			Vessel boilers
		On-road vehicles	Steel trucks
			Container trucks
Project Case	Combustion emissions	Rail	Unit trains
		Marine	Vessel main engines
			Vessel auxiliary engines
			Vessel boilers
		On-road vehicles	Steel trucks
			Container trucks

## ACTIVITY INFORMATION

Activity and throughput data, and activity metrics supporting the supply chain combustion emission calculations for the Baseline Case and Project Case are summarized in Table 2 through Table 5.

**Table 2 Overall Activity and Throughput Data for the Baseline and Project Supply Chain**

Year	Container Trucks		Steel Trucks	Ocean Going Vessels	Rail
	Throughput	Truck Volume (In + Out)	Truck Volume (In + Out)	Total Calls	Number of Trains
	(TEUs)	(total trips)	(total trips)	(#)	(#)
Baseline (2015)	46,878	46,878	22,100	41	142
Project (2022)	46,878	46,878	22,100	226	597

**Note:** TEU – twenty-foot equivalent unit



**Table 3 Activity Metrics for the Baseline Case and Project Case Supply Chain - Unit Rail**

Geographic Boundary	Assessment Scenario	Emission Source	Metric	Value	Units
Supply Chain	Baseline	Unit locomotive	# Engines per unit train in operation mode	2	units
			# Engines per unit train in idle operation	2	units
			Distance from the Project to the CN Thornton Rail Yard	14.8	km
			Average Travel Speed	23.8	km/h
			Operation hours per train	0.62	h/d
			Engine fuel consumption	251.7	L/h
			Annual trains per year	142	train/y
			Annual fuel consumption – idle mode, per engine	10,044	L/y
			Annual fuel consumption – operation mode, per engine	1,006	L/y
	Project	Unit locomotive	# Engines per unit train in operation mode	2	units
			# Engines per unit train in idle operation	2	units
			Distance from the Project to the CN Thornton Rail Yard	14.8	km
			Average Travel Speed	23.8	km/h
			Operation hours per train	0.62	h/d
			Engine fuel consumption	251.7	L/h
			Annual trains per year	597	train/y
			Annual fuel consumption – idle mode, per engine	42,226	L/y
			Annual fuel consumption – operation mode, per engine	4,226	L/y



**Table 4 Activity Metrics for the Baseline Case and Project Case Supply Chain - Container and Steel Trucks**

<b>Geographic Boundary</b>	<b>Assessment Scenario</b>	<b>Emission Source</b>	<b>Metric</b>	<b>Value</b>	<b>Units</b>
Supply Chain	Baseline	Container Trucks	Annual number of trucks	46,878	trucks/y
			Distance travelled per container truck	5.39	km
			Annual distance travelled	252,813	km
		Steel Trucks	Annual number of trucks	22,100	km
			Distance travelled per steel truck	6.17	km
			Annual distance travelled	136,357	km
	Project	Container Trucks	Annual number of trucks	46,878	trucks/y
			Distance travelled per container truck	5.39	km
			Annual distance travelled	252,813	km
		Steel Trucks	Annual number of trucks	22,100	km
			Distance travelled per steel truck	6.17	km
			Annual distance travelled	136,357	km



**Table 5 Activity Metrics for the Baseline Case and Project Case Supply Chain - Ocean Going Vessels**

Geographic Boundary	Assessment Scenario	Description	Emission Source	Metric	Value	Units
Supply chain	Baseline	OGV – underway anchoring	ME (2-stroke)	# of Port Calls	41	-
				Engine capacity	8,300	kW
				Annual underway hours	498	h
			AE (4-stroke) Boiler	Engine capacity (AE)	3,762	kW
				Annual anchoring hours	2,435	h
				Annual underway hours	498	h
	Project	OGV – underway anchoring	ME (2-stroke)	# of Port Calls	226	-
				Engine capacity	6,874 - 10,513	kW
				Annual underway hours	2,782	h
			AE (4-stroke) Boiler	Engine capacity (AE)	1,602 – 3,762	kW
				Annual anchoring hours	13,442	h
				Annual underway hours	2,782	h

## EMISSION FACTORS

The emission factors that were used in the calculation of the Supply Chain emissions for the Baseline case and Project case can be found in Appendix A of the report.

## EMISSION ESTIMATES

The estimated Supply Chain emissions for the Baseline case and Project case are summarized in the Tables 6 and 7, respectively. The emissions for the Project case reflect operations that comprise the ongoing operations represented by the Baseline case plus additional operations associated with the Project. As such the Project Case estimates can be understood as the sum of existing container handling operations at Berth 9 and the proposed potash handling operations.



**Table 6 Annual Supply Chain Emissions for Baseline Case Conditions**

PRIMARY SOURCE	DETAIL	TOTAL ANNUAL EMISSIONS (tonnes/year)														
		CO	NOx	SO <sub>2</sub>	VOCs	TPM	PM <sub>10</sub>	PM <sub>2.5</sub>	NH <sub>3</sub>	DPM	Black Carbon	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2e20</sub>	CO <sub>2e100</sub>
<b>Baseline Case Emissions</b>																
Rail	Unit trains	0.16	0.91	0.00	0.04	0.02	0.02	0.02	0.01	0.02	0.01	59.44	0.00	0.02	66.71	66.77
Marine (OGV)	Vessel auxiliary engines	3.44	35.34	1.31	1.25	0.93	0.89	0.82	0.00	0.82	0.63	2095.00	0.19	0.05	2123.87	2115.53
	Vessel boilers	2.43	6.49	1.06	0.20	0.28	0.27	0.25	0.00	0.25	0.02	1683.07	0.15	0.04	1706.46	1699.64
	Vessel main engines	0.91	8.18	0.17	0.70	0.17	0.16	0.15	0.01	0.15	0.00	242.85	0.02	0.01	246.66	245.56
On-road	Container and Steel trucks	0.61	1.44	0.00	0.20	0.17	0.17	0.06	0.01	0.02	0.02	436.81	0.03	0.00	509.03	457.63
<b>Total</b>		<b>7.54</b>	<b>52.37</b>	<b>2.55</b>	<b>2.39</b>	<b>1.57</b>	<b>1.51</b>	<b>1.30</b>	<b>0.03</b>	<b>1.25</b>	<b>0.70</b>	<b>4,517.17</b>	<b>0.40</b>	<b>0.13</b>	<b>4,652.72</b>	<b>4,585.13</b>

**Table 7 Annual Supply Chain Emissions for Project Case Conditions**

PRIMARY SOURCE	DETAIL	TOTAL ANNUAL EMISSIONS (tonnes/year)														
		CO	NOx	SO <sub>2</sub>	VOCs	TPM	PM <sub>10</sub>	PM <sub>2.5</sub>	NH <sub>3</sub>	DPM	Black Carbon	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2e20</sub>	CO <sub>2e100</sub>
<b>Project Case Emissions</b>																
Rail	Unit trains	0.65	3.85	0.00	0.17	0.08	0.08	0.08	0.03	0.08	0.06	249.91	0.01	0.10	280.45	280.71
Marine (OGV)	Vessel auxiliary engines	10.82	111.14	4.13	3.93	2.92	2.80	2.57	0.01	2.57	1.98	6587.54	0.59	0.17	6678.32	6652.10
	Vessel boilers	7.32	19.57	3.18	0.60	0.84	0.81	0.74	0.01	0.74	0.07	5072.94	0.46	0.13	5143.41	5122.88
	Vessel main engines	5.41	48.71	1.03	4.18	1.01	0.97	0.89	0.05	0.89	0.03	1446.79	0.15	0.04	1469.51	1462.95
On-road	Container and Steel trucks	0.33	0.78	0.00	0.09	0.14	0.14	0.03	0.01	0.01	0.01	418.15	0.03	0.00	509.03	457.63
<b>Total</b>		<b>24.54</b>	<b>184.05</b>	<b>8.35</b>	<b>8.97</b>	<b>4.99</b>	<b>4.80</b>	<b>4.32</b>	<b>0.10</b>	<b>4.29</b>	<b>2.15</b>	<b>13,775.32</b>	<b>1.25</b>	<b>0.44</b>	<b>14,080.72</b>	<b>13,976.27</b>