Appendix A11

Air Assessment

REPORT

TDK LOGISTICS EXPANSION PROJECT: ENVIRONMENTAL AIR ASSESSMENT

Prepared for:

TDK Logistics Inc.
480 Audley Blvd #10,
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EXECUTIVE SUMMARY

TDK Logistics Inc. (TDK) is planning to upgrade their existing container storage and transport logistics facility in Delta, B.C. to accommodate increasing market demands for goods transport and container storage. Referred to as the TDK Logistics Expansion Project, TDK is working with the relevant parties to expand their existing container yard operation located at 480 Audley Blvd. This report is in support of TDK's application to the Vancouver Fraser Port Authority for the Expansion Project and to assess potential environmental impacts.

The estimated emission inventories presented in this report include emissions from the following source groups on-site:

- Rail;
- On road vehicles;
- Non-road equipment; and
- Material handling.

Emissions associated with the immediate supply chain vicinity (supply chain emissions) are also estimated.

The emission estimates include the following air contaminants:

- Criteria Air Contaminants (CACs);
    - Nitrogen oxides (NO_x), sulphur oxides (SO_x), carbon monoxide (CO), volatile organic compounds (VOCs), and particulate matter (PM, as total PM, PM_{10}, and $PM_{2.5}$)
- Greenhouse Gases (GHGs);
    - Carbon dioxide equivalent (CO_2e), carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O)
- Diesel Particulate Matter (DPM).

This inventory also presents baseline (pre- Project) emissions and future (with Project) emissions based on the facility's annual TEU throughput (Twenty-foot Equivalent Unit: a shipping container) and expected activity (outlined/projected below):

- Baseline Case (2021): 120,000 TEU
- Project Case (2025): 150,000 TEU

Table ES-1 presents the projected on-site emissions, **Table ES-2** presents the supply chain emissions, while **Table ES-3** presents emissions associated with rails and vehicle traffic in the immediate supply chain vicinity.

While an increase in overall emissions is expected, emission intensities (tonnes of Contaminant released/ 1000 TEU) are largely projected to decrease as a result of improvements in equipment emissions and operational efficiencies associated with the Expansion Project (e.g., improved truck queuing system) as shown in **Table ES-4** of this report. Increases in some contaminant categories can be primarily attributed to the addition of new source categories such as material handling and rail. Based on the relative size and scale of TDK operations, emissions associated with the Expansion Project are not expected to significantly impact air quality in the surrounding area.

Table ES 1: Estimated On-Site Air Emissions for Baseline/Project Case

Case	Source Group	Contaminant (Tonnes)											
		CO	NO_x	VOC	TPM	PM_{10}	$PM_{2.5}$	DPM	SO_x	CO_2	CH_4	N_2O	CO_2e
Baseline (120,000 TEU)	On-road Vehicles	0.59	1.68	0.16	0.12[a]	0.12[a]	0.08[a]	0.08	6.95E-04	203	0.01	0.002	203
	Non-road Equipment	7.22	10.41	0.70	0.52	0.52	0.50	0.50	3.90E-03	1,016	0.03	0.04	1,029
	Rail	-	-	-	-	-	-	-	-	-	-	-	-
	Material Handling	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**7.82**	**12.09**	**0.86**	**0.64**	**0.64**	**0.58**	**0.59**	**4.59E-03**	**1,218**	**0.04**	**0.04**	**1,232**
Project (150,000 TEU)	On-road Vehicles	0.53	1.41	0.11	0.09[a]	0.09[a]	0.05[a]	0.05	6.74E-04	199	0.01	0.002	199
	Non-road Equipment	7.67	10.58	0.72	0.53	0.53	0.52	0.52	4.97E-03	1,380	0.03	0.04[a]	1,394
	Rail	0.11	0.80	0.05	0.02	0.02	0.02	0.02	2.88E-04	39	0.00	0.01	43
	Material Handling	-	-	-	4.51	1.49	0.25	-	-	-	-	-	-
	Total	**8.30**	**12.78**	**0.87**	**5.15**	**2.13**	**0.83**	**0.58**	**5.94E-03**	**1,617**	**0.04**	**0.06**	**1,637**
Difference (+/-)		0.49	0.69	0.01	4.52	1.49	0.25	-3.87E-03	1.34E-03	399	4.75E-03	0.02	405

[a] Particulate emissions include brake wear and tire wear emissions from on-road vehicle activity.

Table ES 2: Estimated Supply Chain Air Emissions for Baseline/Project Case

Case	Source Group	Contaminant (Tonnes)											
		CO	NO_x	VOC	TPM	PM_{10}	$PM_{2.5}$	DPM	SO_x	CO_2	CH_4	N_2O	CO_2e
Baseline (120,000 TEU)	On-road Vehicles	8.63	23.47	1.22	1.90[a]	1.90[a]	1.19[a]	1.19	0.01	4,052	0.07	0.01	4,056
	Non-road Equipment	-	-	-	-	-	-	-	-	-	-	-	-
	Rail	-	-	-	-	-	-	-	-	-	-	-	-
	Material Handling	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**8.63**	**23.47**	**1.22**	**1.90**	**1.90**	**1.19**	**1.19**	**0.01**	**4,052**	**0.07**	**0.01**	**4,056**
Project (150,000 TEU)	On-road Vehicles	9.05	21.34	1.02	1.73[a]	1.73[a]	0.90[a]	0.86	0.02	4,733	0.08	0.01	4,738
	Non-road Equipment	-	-	-	-	-	-	-	-	-	-	-	-
	Rail	0.13	0.96	0.06	0.02	0.02	0.02	0.02	0.00	46	0.00	0.02	52
	Material Handling	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**9.18**	**22.30**	**1.08**	**1.75**	**1.75**	**0.92**	**0.88**	**0.02**	**4,780**	**0.09**	**0.03**	**4,790**
Difference (+/-)		0.55	-1.18	-0.15	-0.15	-0.15	-0.27	-0.31	2.50E-03	728	0.02	0.02	734

[a] Particulate emissions include brake wear and tire wear emissions from on-road vehicle activity.

Table ES 3: Estimated Onsite + Supply Chain Air Emissions for Baseline/Project Case

Case	Source Group	Contaminant (Tonnes)											
		CO	NO_x	VOC	TPM	PM_{10}	$PM_{2.5}$	DPM	SO_x	CO_2	CH_4	N_2O	CO_2e
Baseline (120,000 TEU)	On-road Vehicles	9.23	25.16	1.38	2.02[a]	2.02[a]	1.27[a]	1.27	1.46E-02	4,254	0.07	0.01	4,259
	Non-road Equipment	7.22	10.41	0.70	0.52	0.52	0.50	0.50	3.90E-03	1,016	0.03	0.04	1,029
	Rail	-	-	-	-	-	-	-	-	-	-	-	-
	Material Handling	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**16.45**	**35.56**	**2.08**	**2.54**	**2.54**	**1.77**	**1.78**	**0.02**	**5,270**	**0.11**	**0.05**	**5,288**
Project (150,000 TEU)	On-road Vehicles	9.58	22.75	1.12	1.83[a]	1.83[a]	0.95[a]	0.91	1.67E-02	4,932	0.09	0.01	4,937
	Non-road Equipment	7.67	10.58	0.72	0.53	0.53	0.52	0.52	4.97E-03	1,380	0.03	0.04	1,394
	Rail	0.23	1.75	0.11	0.04	0.04	0.03	0.04	6.33E-04	85	0.00	0.03	95
	Material Handling	-	-	-	4.51	1.49	0.25	-	-	-	-	-	-
	Total	**17.48**	**35.08**	**1.95**	**6.91**	**3.88**	**1.75**	**1.46**	**0.02**	**6,397**	**0.13**	**0.09**	**6,426**
Difference (+/-)		1.03	-0.49	-0.14	4.37	1.34	-0.02	-0.32	3.84E-03	1,127	0.02	0.04	1,139

[a] Particulate emissions include brake wear and tire wear emissions from on-road vehicle activity.

Table ES 4: Onsite + Supply Chain Air Emission Intensities

Case	Emission Intensity (Tonnes of Contaminant/ 1000 TEU)											
	CO	NO_x	VOC	TPM	PM_{10}	$PM_{2.5}$	DPM	SO_x	CO_2	CH_4	N_2O	CO_2e
Baseline	0.14	0.30	0.02	0.02	0.02	0.01	1.48E-02	1.54E-04	43.91	8.91E-04	4.22E-04	44.06
Project	0.12	0.23	0.01	0.05	0.03	0.01	9.74E-03	1.49E-04	42.65	8.66E-04	5.86E-04	42.84
% Diff.	-15%	-21%	-25%	118%	22%	-21%	-34%	-3%	-3%	-3%	39%	-3%

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GLOSSARY OF ACYRONYMS AND ABBREVIATIONS

List of Acronyms	
AAQO	Ambient Air Quality Objectives
B.C.	British Columbia
B.C. MOE	B.C. Ministry of the Environment and Climate Change Strategy
CAAQS	Canadian Ambient Air Quality Standards
CAC	Common Air Contaminant
CFS	Container Freight Station
DB	Dynamic Breaking
EF	Emission Factor
IPCC	Intergovernmental Panel on Climate Change
MOVES	Motor Vehicle Emission Simulator
MV	Metro Vancouver
PER	Project and Environmental Review
RAC	Railway Association of Canada
SRY	Southern Railway Company
TDK	TDK Logistics Inc.
TEU	Twenty-Foot Equivalent Units
U.S. EPA	United States Environmental Protection Agency
VFPA	Vancouver Fraser Port Authority
VKT	Vehicle Kilometers Travelled
Contaminants	
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
DPM	Diesel Particulate Matter
GHG	Greenhouse Gas
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
N_2O	Nitrous Oxide
TPM	Total Particulate Matter
PM_{10}	Inhalable particulate matter (particulate matter up to 10 micrometers in size)
$PM_{2.5}$	Fine particulate matter (particulate matter up to 2.5 micrometers in size)
SO_2	Sulphur Dioxide
SOx	Sulphur Oxides
VOC	Volatile Organic Compound

1.0 INTRODUCTION

TDK is a Canada Customs sufferance full-service Container Freight Station (CFS), container storage and transport logistics company located on Annacis Island, BC. TDK is planning to upgrade their existing container storage and transport logistics facility in Delta, B.C. to accommodate increasing market demands for goods transport and container storage. Referred to as the TDK Logistics Expansion Project (Project), TDK is working with the relevant parties to expand their existing container yard operations at their Metro Terminals location.

As part of TDK's container storage and transport logistics facility resides within VFPA jurisdiction and as per VFPA application requirements, an Environmental Air Assessment is completed to determine potential environmental impacts as a result of the Project and provided to VFPA for review and approval.

The assessment of Project related air emissions presented in this report supports the VFPA application to accommodate the proposed Expansion Project following the VFPA PER process. The Environmental Air Assessment will be written as a standalone document following the VFPA PER Guidelines – Environmental Air Assessment and other directions provided through the PER process.

This study characterized the emissions associated with TDK's operations including current and projected emissions (with the Expansion Project included) for review.

1.1 Facility Overview

TDK Metro Terminals is located on ~6.5-acres of land at 480 Audley Blvd on Annacis Island in Delta, BC. The facility is an Import & Export Distribution Hub operating from 7am – 11pm, Monday to Friday and Saturday/Sunday by appointment. As an Import & Export Distribution Hub, the facility functions as a centralized location for the loading/unloading of containers, container/material storage, and for directing containers to their intended end destination.

At the facility's container yard, shipping containers are stored either full or empty, after being unloaded by inbound trucks and before being loaded onto outbound trucks. TDK also provides container yard services (e.g., customs sufferance bonded container yard storage, refrigerated container storage and reefer plugs, etc.) minimizing the number of times a container needs to leave the yard, thereby reducing the amount of truck traffic/movements. Additionally, TDK's facility includes a Container Freight Station (CFS) Warehouse, allowing for additional services such as bulk commodity loading/unloading activities and CFS stuffing and de-stuffing services.

TDK currently has an approximate annual throughput of 120,000 twenty-foot equivalent units (TEUs) and activity level of 65,000 gate transactions per annum.

2.0 PROJECT DESCRIPTION

The Project consists of improvements to increase TDK's container capacity from an annual throughput of 120,000 to ~150,000 twenty-foot equivalent units (TEUs). This expansion will be achieved by increasing the Terminal footprint from ~6.5 to ~15.75 acres and investing in infrastructure to allow for greater operational efficiency and additional services including rail to accommodate container and grain transport. A mobile conveyor system will be used for rail related grain transfers, allowing grain to be unloaded from incoming hopper railcars without needing permanent infrastructure (e.g., permanent conveyors, grain pits, etc.).

The inclusion of rail will allow TDK to further align the facility with existing container yard services and is consistent with the Port's land use plan, with a focus on maximizing efficiency on site and to accommodate increasing demand for trade intensification and diversification. An overview of the Project and its aspects is provided below.

The existing warehouse (~26,000 sq. ft.) will also be replaced with a new warehouse (~50,000 - 60,000 sq. ft.) with increased storage capacity. This new facility is not located within VFPA jurisdiction. The Expansion Project will also allow the facility to accommodate a greater number of trucks per day. Truck activity levels are anticipated to increase from ~65,000 to ~80,000 gate transactions per annum.

2.1 Project Overview

The Expansion Project is designed to improve current container yard/trucking operations and accommodate new transload operations in a cohesive manner within the assumed leasehold. The Project and proposed site layout consists of various components which will be further detailed in the sections below:

- Trackwork on site to accommodate rail operations (for container and grain transport);
  - Capacity: 2 x Maxi-Stack (2 x 5 Well Cars) on each track and ~4 agri cars/day
- New warehouse (on land parcel out-of-scope for this assessment); and
- Reconfiguration of the existing container yard.

The proposed rail configuration takes advantage of the existing rail spur (operated by Southern Railway of British Columbia (SRY)) entering from the southwestern extent of TDK's current leasehold to develop new trackwork for future rail operations. The new lead track aims to maximize use of the available space for the remaining transload facilities, container stacking area and the future warehouse. With the support of SRY, this facility will be unit train capable which will help prevent rail congestion and backlog. As noted above, the rail service component of the facility has great potential for improving the overall efficiency and thus increasing throughput volume. A flow diagram showing the facility's main activities following with the inclusion of rail is shown below in **Figure 1** for reference.

A reconfigured truck gate is also planned near the same area as the current truck entrance at the northwestern edge of TDK's current leasehold. Four new truck entry queuing lanes will accommodate up to twenty trucks within the site, minimizing the queuing that is currently observed on the local road network. The anticipated truck volume will increase from 65,000 gate transactions to ~80,000 gate transactions annually upon Project completion. The orientation of the gates and the proposed container yard configuration also enables the addition of:

- A turnaround exit lane for unauthorized trucks that have entered the site but do not have permission to drop off their container; and,
- Two entry trouble parking spots for trucks to pull off and remedy any issues to avoid holding the truck queue.

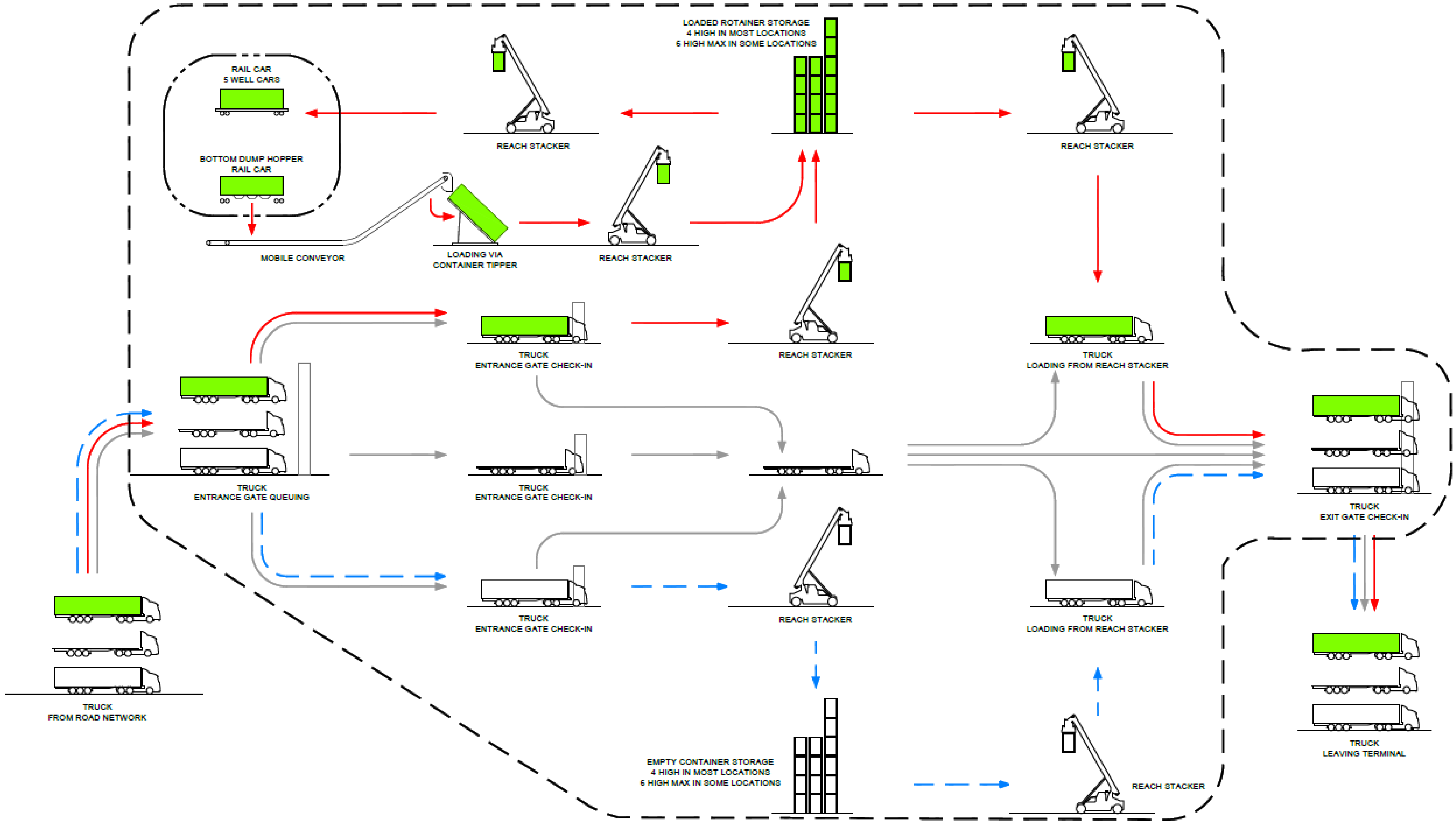


Figure 1: Operations Flow Diagram

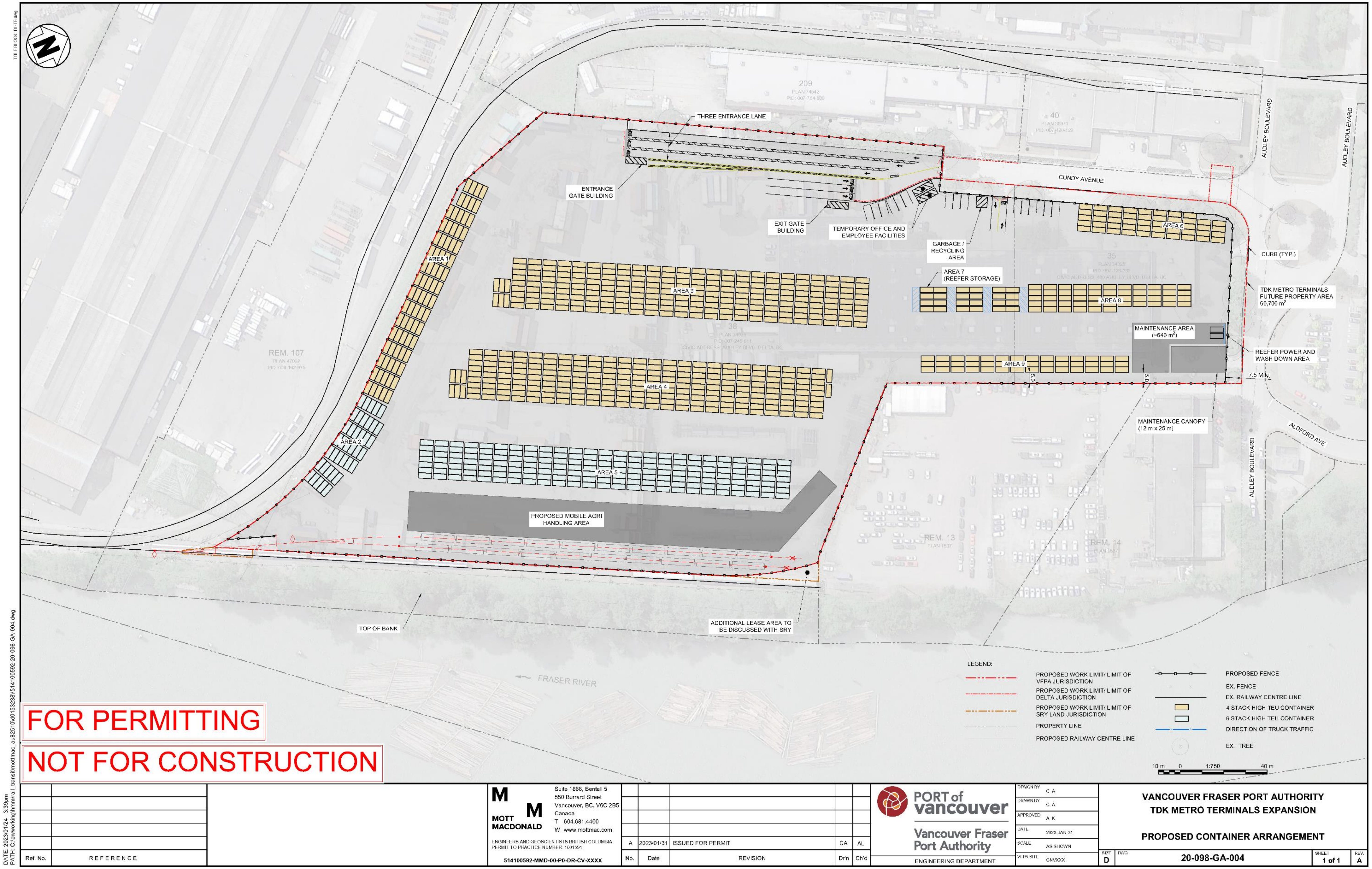


Figure 2: Project Site Layout

In addition to the upgrades noted above, the container yard will be reconfigured for access from both sides of each stack, allowing for more efficient and effective handling within the yard. Container stacks will be organized to allow single-direction truck circulation with consideration for the maneuvering of container handlers, truck transfer lane access, and truck bay access. An aerial image of the site showing planned changes and layout of the site following the expansion project is shown in **Figure 2**.

It is anticipated that the hours of operations following Project completion will remain the same (Monday to Friday, 7:00 AM to 11:00 PM and Saturday and Sunday by appointment).

2.2 Project Cases

The scope for this Level 1 Air Assessment includes the development of an emissions inventory of current/baseline operations, and development of an inventory for future/post Expansion Project operations. It is expected that a business-as-usual scenario (no Project case) will be similar to the current/baseline case.

This study characterizes the emissions associated with TDK's operations including current and projected emissions (with the Expansion Project included) for review. Based on correspondence with TDK, 2021 is considered representative of pre-Project operations and was used as the baseline year for the 'current/baseline case' of the Air Assessment, with the anticipated partial Project completion year of 2025 as the basis for the 'future/Project case'. While the Project is anticipated to begin operations in 2025, the Project is expected to be fully completed in 2026.

Facility throughput, rail activity, and truck activity numbers considered for this assessment are based on provided information for current pre-expansion scenario, and projected throughput/activity for the post expansion scenario. To support increases in annual throughput, warehouse capacity and container yard storage capacity as result of the Expansion Project, TDK plans to acquire additional pieces of equipment. Non-road equipment numbers are based on current equipment counts and are conservatively adjusted in the future scenario to account for expected increases in throughput/activity.

A summary of the key activity aspects considered for the current and anticipated future (with Project) scenarios is shown in **Table 1** below.

Table 1: Scenario Summary

Item	Current/Baseline Case	Future/Project Case
Scenario Year	2021	2025*
Facility Throughput	120,000 TEU per annum	150,000 TEU per annum
Truck Activity	65,000 Gate Transactions per annum	80,000 Gate Transactions per annum
Non-road Equipment	- 8 Container Handlers - 10 Forklifts - 2 Yard Trucks	- 12 Container Handlers - 15 Forklifts - 3 yard trucks
Rail Activity	N/A	- Import Transload: 5,200 53 ft intermodal units per annum - Export: 1460 hopper cars per annum
Material Handling	N/A	96,000 tonnes grain throughput per annum

*While the Project is anticipated to begin operations in 2025, the Project is expected to be fully completed in 2026

3.0 GEOGRAPHIC SCOPE

As noted above, this air assessment includes the development of an inventory for current/baseline operations, and development of an inventory for future/post Expansion Project operations.

For each scenario, emissions are assessed based on both on-site activities only (Facility Emissions) and offsite activities in the direct supply chain vicinity (Supply Chain Emissions). The scope of onsite activities includes areas within the VFPA jurisdiction. Areas within adjacent municipal jurisdictions (e.g., the City of Delta) will be covered separately and by their respective processes. The geographic scopes considered in the assessment for the facility and direct supply chain are outlined in **Sections 3.1** and **3.2** below.

3.1 Facility

As per the PER Air Guidelines, Facility Emissions are those released within the facility boundary and includes activities within TDK's direct control. This includes emissions from: onsite rail activities, onsite truck activities, non-road equipment usage, and material handing activities. Emissions associated with electricity consumption are largely due to warehouse heating/lighting. Since the new warehouse is to be located outside VFPA jurisdiction, emissions associated with electricity consumption were not considered as part of this assessment. An image illustrating the Terminal's facility boundary is shown in **Figure 3** for reference.

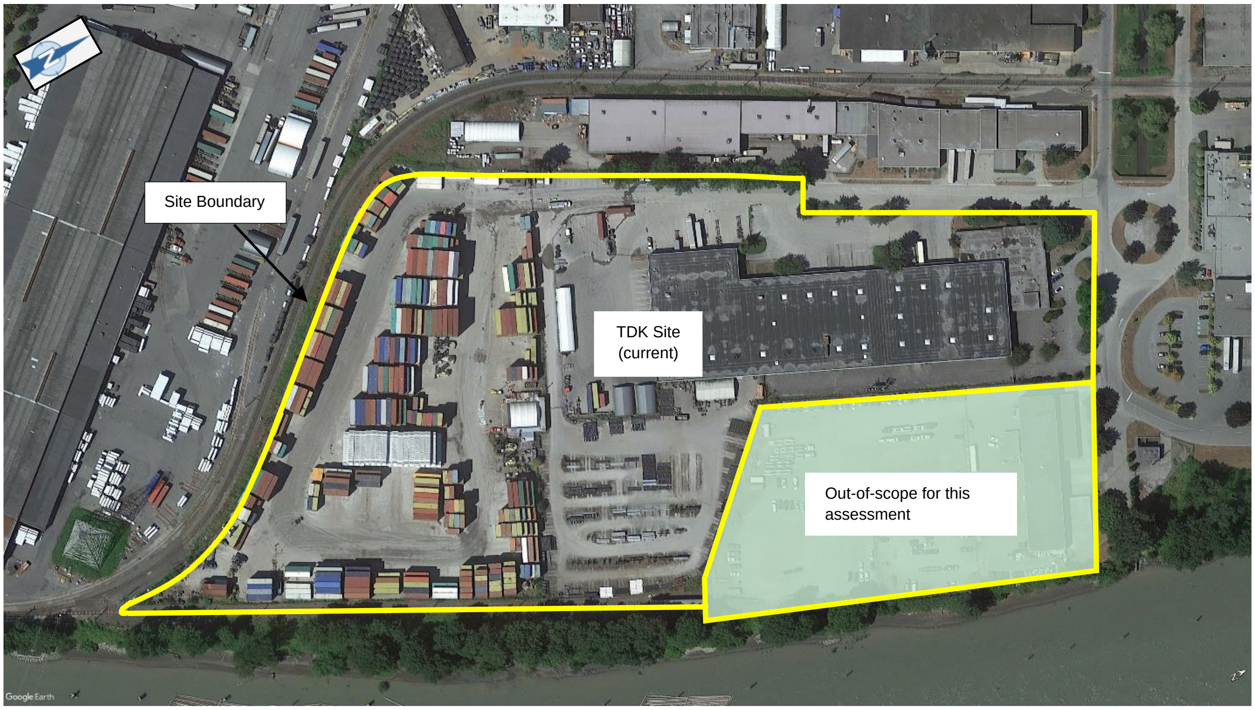


Figure 3: Facility Boundary

3.2 Supply Chain

Supply chain emissions associated with TDK operations are also considered and include transportation movements by truck and rail to and from their logistics facility. Since supply chains associated with storage/transport/logistics hubs are expansive and vary, this assessment will focus and compare supply chain emissions in the area surrounding TDK.

As noted above, the Expansion Project will utilize existing rail tracks to allow rail access to the TDK's terminal facility (operated by SRY). SRY operated rail lines connect to the mainline providing access to the main rail network. Trains are moved using SRY operated rail lines to and from the site and the SRY Trap Yard, which connects to the main rail network. Truck access to and from the site is provided through the main access route to Annacis Island (Highway 91) and extends to the main shipping terminals (Centerm/Vanterm/Deltaport).

For this study, Project related supply chain emissions for the Assessment will consider rail traffic on SRY operated rail lines to the SRY Trap Yard as well as truck emissions to and from Centerm/Vanterm/Deltaport. An image illustrating the supply chain boundary considered for truck and rail travel for the assessment is shown in **Figure 4** and **Figure 5** for reference.

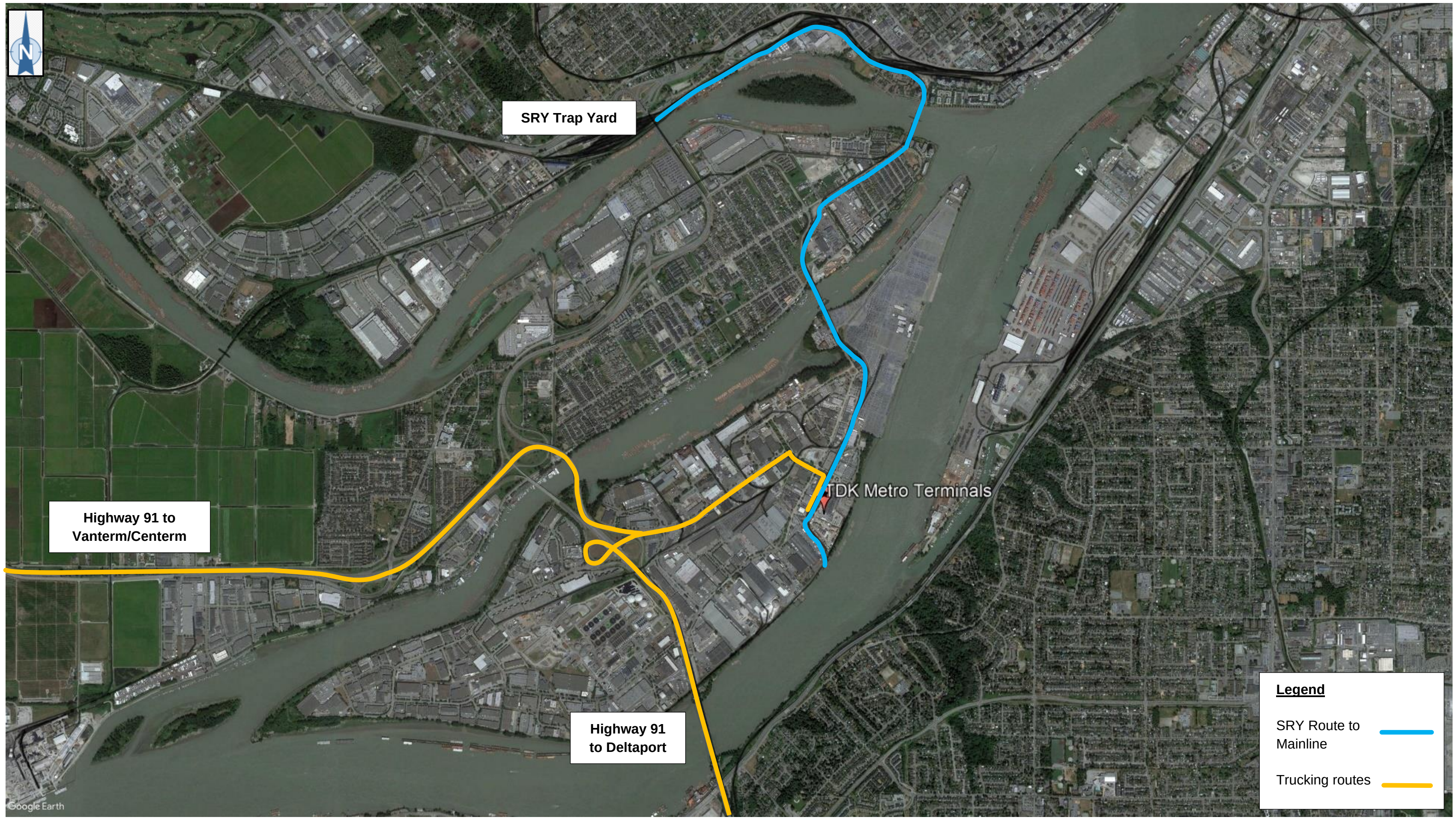


Figure 4: Supply Chain Boundary (Near view)

Figure 5: Supply Chain Boundary (Full view)

3.3 Receiver Identification and Proximity

The TDK facility is located on Annacis Island; a narrow island under the jurisdiction of City of Delta in the Lower Mainland, British Columbia, located just downstream of the south arm of the Fraser River between Lulu Island to the north and the Delta peninsula to the south. The island is mostly an industrial zone, with some residential/commercial areas across the water on either side. A map showing the land use in the surrounding area is provided in **Appendix B** for reference.

Since the immediate areas near the facility are primarily industrial sites, receivers of interest such as schools, childcare facilities, hospitals, senior living, residences, parks and outdoor recreation space, and businesses are either located further away (relative to typical facility-receiver distances) or are located across the Fraser River. The closest receivers of interest for each of the receiver types noted above to the facility are listed below in **Table 2**.

Table 2: Receivers of Interest

Receiver Type	Name of Closest Receiver	Distance from site to Receiver
Hospital	Surrey Memorial Hospital	~ 6.0 km
School	Brooke Elementary School	~ 1.0 km
Childcare Facility	Ewen Childcare Centre	~ 1.7 km
Seniors Facility	Delta Lodge	~ 1.15 km
Residence	9071 Collings Way	~ 0.76 km
Business	Livingston Vehicle Transportation	Shared fenceline
Park or Public Space	Way Ravine Environmental Reserve	~ 0.76 km

4.0 EMISSION SOURCES

Emission sources for both current/baseline operations and future/post Expansion Project operations are considered in this assessment. Descriptions of the facility's primary sources, emission variability, and pollutants of concern are included in the sections below.

4.1 Primary Sources

As a container storage and transport logistics facility, primary emission sources at TDK's facility and in the immediate supply chain include trucks, and non-road equipment (e.g., container handlers, forklifts, etc.). With the inclusion of the Expansion Project and integration of rail to the site, additional sources for the future scenario also includes rail activities (e.g., travel, idling etc.). Fugitive dust related to grain handling (hopper to conveyor, conveyor to container) is also included in this assessment. Emissions are calculated using a combination of emission factors and activity estimates. As appropriate, emissions factors sources include factors from the Rail Association of Canada (RAC), US EPA Motor Vehicle Emission Simulator (MOVES) and NONROAD model. Additional details related to emissions calculations and the methodologies used are presented in **Appendix A** for reference.

Overviews of the activity metrics used to estimate emissions for primary sources are shown in the **Sections 4.1.1** to **4.1.4** below

4.1.1 On Road Vehicles

On-road vehicle emissions associated with TDK operations are generated from truck travel to/from the facility as well as truck related activities onsite. Depending on the task and logistical requirements, container trucks may enter/leave the facility either empty or loaded with a container. Vehicle emissions include travel emissions or during periods when engines are idling (e.g., when queuing at the gate and idling in the container yard). As noted above, a reconfigured truck gate is also planned near the same area as the current truck entrance at the northwestern edge of TDK's current leasehold. Four new truck entry queuing lanes will accommodate up to twenty trucks within the site, minimizing the queuing that is currently observed on the local road network. To account for improvements in queue time at the gate, a reduced value for engine idling is considered for the future scenario. Based on current projections, the upgraded gate operation can reduce truck entry/exit times by approximately four minutes, reducing on-site idling time from approximately 16 minutes to 12 minutes per truck.

Since the Expansion Project also considers increases in site acreage and container storage capacity, distance travelled onsite was also adjusted based on anticipated travel paths. As noted above, container stacks will be organized to allow single-direction truck circulation with consideration for the maneuvering of container handlers, truck transfer lane access, and truck bay access.

Typical distances travelled in the immediate supply chain is expected to stay consistent between current and future scenarios. An average roundtrip distance of ~50km was assumed for supply chain travel between TDK and a main shipping terminal (Centerm/Vanterm/Deltaport). A summary of metrics relevant to current and future cases for on-road vehicle operations is shown in **Table 3** below. Additional details related to emissions calculations and the methodologies used are presented in **Appendix A**.

Table 3: On Road Metrics Summary

Geographic Boundary	Item	Current/Baseline Case	Future/Project Case
-	Truck Activity	65,000 Gate Transactions	80,000 Gate Transactions
Facility Boundary	Distance Travelled onsite per truck	0.51 km	0.61 km [a]
	Idling Time onsite per truck	16 mins [b]	12 mins
Supply Chain	Distance Travelled Supply Chain per truck (roundtrip)	50 km	50 km
	Idling Time in supply chain per truck (roundtrip) [c]	12 mins	12 mins

[a] Averaged distance of the Project's three primary truck paths for container storage.
[b] Based on maximum truck entry, exit and yard idling times of 3, 5, and 8 minutes respectively.
[c] As a result of traffic signals/congestion on streets, 16% of supply chain travel time is assigned to idling (AECOM, 2018).

4.1.2 Non-Road Equipment

Non-road emission sources include vehicles or pieces of equipment that operate exclusively within the facility. TDK's current inventory of operational equipment includes eight container handlers, ten forklifts and two yard trucks. These pieces of equipment are used to move container, cargo, and other items as needed based on operational, storage and distribution requirements. TDK plans to acquire additional pieces of equipment to accommodate increases in annual throughput, warehouse capacity, and container yard storage capacity as result of the Expansion Project. Non-road equipment numbers are based on current equipment counts and are conservatively adjusted in the Project scenario to account for expected increases in throughput/activity. An approximate 50% increase in equipment inventory is expected based on TDK projections. The number of equipment considered for both current and Project cases are summarized in **Table 4** for reference. Additional details related to emissions calculations and the methodologies used are presented in **Appendix A**.

Table 4: Non-Road Equipment Summary

Non-road Equipment	Current/Baseline Case	Future/Project Case
Container Handlers	8	12
Forklifts	10	15
Yard Trucks	2	3

4.1.3 Rail

The proposed rail-served Expansion Project aligns with the existing container yard on the site and is consistent with the Port's land use plan. Rail related emissions are generated from locomotive travel to/from the facility and travel/idling onsite. Containers will be delivered to the site using double stack well railcars while grain will be delivered in hopper railcars.

The proposed number of rail cars per year is considered significant by SRY and SRY indicates they have capacity to support this. With the support of SRY, this facility will be unit train capable which will help prevent rail congestion and backlog. The rail service component of the facility has great potential for improving the overall efficiency and thus increasing throughput volume.

As noted above, the proposed rail configuration takes advantage of the existing rail spur (operated by SRY) entering from the southwestern extent of TDK's current leasehold to develop new trackwork for future rail operations. The new lead track aims to maximize use of the available space for the remaining transload facilities, container stacking area and the future warehouse. The new trackwork consists of two sets of tracks with capacity for 2 x Maxi-Stack (2 x 5 Well Cars) on each track and ~4-6 agri cars/day. A summary of activity metrics for future rail operations is shown in **Table 5** below. Additional details related to emissions calculations and the methodologies used are presented in **Appendix A**.

Table 5: Rail Activity Metrics Summary

Item		Container Trains	Grain Trains
Throughput		5,200 – 53 ft intermodal units per annum	1,460 hopper cars (96,000 tonnes of grain) per annum
Train Length		20 – 53 ft intermodal units (2x5 double stacked well cars)	5-6 hopper cars
Activity		1 train per day on weekdays (~260 trains per annum)	1 train per day on weekdays (~260 trains per annum)
Travel Time per trip (roundtrip) [a]	**Siding Travel**	3.5 mins	3.5 mins
	Supply Chain	27.8 mins	27.8 mins
Idling Time per trip		35 mins [b]	135 mins [c]

[a] Travel distances in the supply chain and siding are conservatively approximated as 7 km and 0.35 km. Typical travel speeds of 25 mph in the supply chain and 10 mph on the siding are assumed.
[b] Based on typical unloading rates of 1:45 mins per container (Jacobs, 2016).
[c] Based on a Project unloading rate of 6,500 bushels/hr and annual throughputs of 96,000 tonnes grain per annum.

4.1.4 Material Handling

With the inclusion of rail transport to/from the site, the facility will be able to handle approximately ~96,000 tonnes of grain transfers per annum.

To facilitate grain transfers from rail, a mobile conveyor system will be used. The mobile conveyor system (Brantt Field Grain Belt 1545TDLP or similar) will allow grain to be unloaded from incoming hopper railcars as needed, without requiring permanent infrastructure (e.g., permanent conveyors, grain pits, etc.). Additionally, a temporary sprung structure will be erected during transfer processes to minimize fugitive dust emissions from railcar unloading. Grain will be transferred from hopper railcars to conveyor to be loaded to a container (elevated using a container tipper). Loaded grain containers will then be moved to storage using a container hander/reach stacker as needed before being delivered to a shipping terminal by truck for export by ship.

An image illustrating the grain unloading process and transfers onsite is shown in **Figure 6** below.

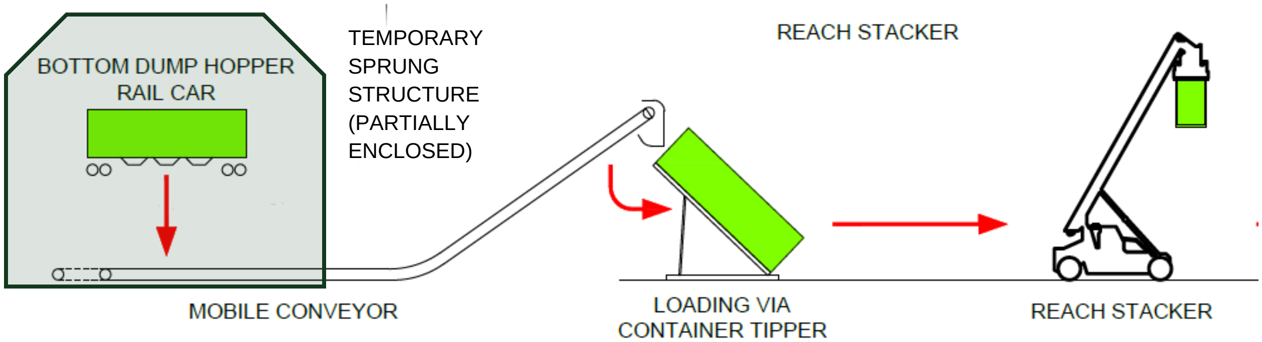


Figure 6: Grain Handling Material Flow

As with other bulk products, potential emissions from grain handling include fugitive dust generated from material transfers/drops (e.g., from hopper rail car to conveyor, and from conveyor to container). Fugitive dust emissions are expressed as PM (TPM, PM_{10}, and $PM_{2.5}$ size fractions) and will be limited as per best procedures and dust management practices. Additional details related to emissions calculations and the methodologies used are presented in **Appendix A**.

4.2 Emission Variability

TDK operates Monday to Friday, 7:00 AM to 11:00 PM and Saturday and Sunday by appointment. Emissions vary with the level of activity at the Terminal, which varies throughout the day and week. Due to the nature of logistic hub operations, activities and related emissions also vary based on fluctuating shipment/transportation demands within the region. Onsite-rail emissions only occur while trains are at TDK. Non-road and mobile equipment emissions vary based on their required utilization and activities. Emissions are anticipated to be the highest during the highest level of activity at TDK (e.g., when there is a train onsite, high equipment levels, and a high level of truck traffic to/from the site). It is worth noting that grain handling is expected to be busiest in the fall.

4.3 Pollutants of Concern

Emissions from the Facility and Supply Chain can be primarily attributed to fuel combustion and material handling operations (from grain). Based on the sources noted above, the following contaminants are considered for the Air Assessment:

- Criteria Air Contaminants (CACs);
  - Nitrogen oxides (NO_x), sulphur oxides (SO_x), carbon monoxide (CO), volatile organic compounds (VOCs), and particulate matter (PM, as total PM, PM_{10} and $PM_{2.5}$)
- Greenhouse Gases (GHGs);
  - Carbon dioxide equivalent (CO_2e), carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O)
- Diesel Particulate Matter (DPM).

GHG emissions are reported as 100-Year CO_2e, based on 100-Year Global Warming Potentials for CO_2, CH_4, and N_2O (1, 25, and 298 respectively), in accordance with *BC Best Practices Methodology for Quantifying Greenhouse Gas Emissions* (B.C. MOE, 2021). Due to the nature of the facility and its sources, minimal/negligible amounts of other contaminants (e.g., NH_3, SF_6, PFCs and HFCs) are expected and are not considered at this stage.

5.0 CURRENT CONDITION

5.1 Air Quality

Understanding the current and baseline air quality in the area is important to determining the sensitivities and features of the local airshed. Air quality can be impacted by both human and natural sources as well as from both nearby and distant sources. It is not always clear what is the cause of a change in air quality, but with the information from nearby stations, a baseline understanding can be formed.

5.1.1 Regional Air Quality Objectives

Standards, objectives, and guidelines are expressed by various levels of Canadian government to ensure the protection of human health and the environment. Applicable ambient air quality objectives (from Metro Vancouver, B.C. MOE, CAAQS) are shown in **Table 6**, noting the applicable averaging periods for each objective. The most stringent objectives/standards are considered applicable for a particular air contaminant and averaging period.

Table 6: Applicable[(a)] Ambient Air Quality Objectives for Air Contaminants

Air Contaminant	Averaging Time	Ambient Air Quality Objective [a]	
		(µg/m³)	(ppb)
Carbon Monoxide (CO)	1-hour	14,900	13,000
	8-hour	5,700	5,000
Nitrogen Dioxide (NO_2)	1-hour	113	60
	Annual	32	17
Sulphur Dioxide (SO_2)	1-hour	183	70
	Annual	13	5
Total Particulate Matter (TPM)[(a)]	24-hour	120	--
	Annual	60	--
Inhalable Particulate Matter (PM_{10})	24-hour	50	--
	Annual	20	--
Fine Particulate Matter ($PM_{2.5}$)	24-hour	25	--
	Annual	8 (6) [b]	--

[a] Objectives obtained from Metro Vancouver, B.C. MOE, CAAQS
[b] Metro Vancouver has a long-term goal of 6 µg/m³.

5.1.2 Baseline Air Quality Concentrations

Baseline air quality concentrations in the area are based on data collected by the network of air quality monitoring stations operated by Metro Vancouver in the Lower Fraser Valley. Three stations in the vicinity of TDK's facility were used in this air assessment to provide a baseline of the air quality in the area. These monitoring stations were chosen based on the proximity to the facility, data availability and the air quality parameters monitored. Stations include:

- T13 North Delta: 3km SE of TDK
- T17 Richmond South: 13km SW of TDK
- T18 Burnaby South: 6km NW of TDK

Table 7 indicates the statistical form of background concentrations used for comparison purposes.

Table 7: Statistical Form of Background Concentrations

Contaminant	Averaging Period	Ambient Concentration (µg/m^3)
CO	1-hour	98th percentile ranked 1-hour values of each year, averaged over 3 years
	8-hour	98th percentile ranked 8-hour rolling average value of each year, averaged over 3 years
NO_2	1-hour	98th percentile ranked daily maximum 1-hour values of each year, averaged over 3 years
	Annual	Annual average of each year, averaged over 3 years
SO_2	1-hour	99th percentile ranked daily maximum 1-hour values of each year, averaged over 3 years
	Annual	Annual average of each year, averaged over 3 years
PM_{10}	24-hour	98th percentile ranked rolling 24-hour average values of each year, averaged over 3 years
	Annual	Annual average of each year, averaged over 3 years
$PM_{2.5}$	24-hour	98th percentile ranked rolling 24-hour average values of each year, averaged over 3 years
	Annual	Annual average of each year, averaged over 3 years

Table 8 provides a summary of the ambient air quality data collected at the three MV stations using 2019 - 2021 data. Percentile values are also shown for the 1-hour concentrations, to identify typical patterns between relatively high concentrations and average values.

Table 8: Ambient Air Quality

Contaminant	AAQO/Standard Averaging Period	Ambient Concentration (µg/m^3)	T13 Data Availability	T17 Data Availability	T18 Data Availability
CO	1-hour	489	0%	99%	97%
	8-hour	440			
NO_2	1-hour	57.9	98%	99%	99%
	Annual	21.0			
SO_2	1-hour	3.2	0%	98%	97%
	Annual	0.47			
PM_{10}	24-hour	15.5	0%	0%	91%
	Annual	8.0			
$PM_{2.5}$	24-hour	12.3	88%	99%	98%
	Annual	5.0			

The monitoring stations that were selected for background concentrations of CACs was based on their vicinity to the facility, similar surrounding terrain, and residential and commercial land uses. These stations are considered to be representative of the ambient air quality around TDK. The annual hourly data files were provided by the Air Quality and Climate Change department of Metro Vancouver and are available from the department by request.

5.1.2.1 Air Quality Advisories

For reference, dates where air quality advisories were issued are noted below.

In 2019 there were no air quality advisories issued.

In 2020 there were three air quality advisories issued. On July 30th and 31st there was an Ozone air quality advisory due to elevated levels of ground level ozone. On August 16th and 17th there was a PM and Ozone air quality advisory also due to increased levels of ozone and particulate matter. From September 8th to 19th there was an advisory due to wildfires and increased particulate matter.

In 2021 there were four air quality advisories issued. On June 26th and 30th there was an Ozone advisory due to elevated levels of ground level ozone. On July 30th and 31st there was an Ozone and PM air quality advisory due to elevated levels of ground level ozone and particulate matter. In August there were two air quality advisories related to wildfires and subsequent elevated particulate matter. The first was from August 1st to 3rd and the second was from August 12th to 14th.

5.2 Meteorological Influences

A variety of meteorological influences can impact the concentrations of air contaminants in the atmosphere. Factors contributing to the stability of the atmosphere (e.g., temperature/humidity and wind speed/direction, surrounding terrain) can be directly related to the direction and rate in which contaminants disperse. While studies aimed to predict contaminant dispersion is considered outside the scope of a Level 1 Environmental Air Assessment, meteorological influences and data collected from meteorological stations near the TDK site are described/presented below for reference and additional context.

The local meteorological conditions of the site are governed by the convergence of land-based and marine air masses. The facility is located on Annacis Island along the Fraser River, a water body that extends southwest and northeast of the site.

Figure 7 depicts 3-year (2019-2021) wind roses from relevant nearby stations (T13, T17, T18)[1]. As can be observed in the figure, the Fraser River has a significant impact on the wind regime and wind patterns in the area. The prevailing winds in the vicinity of the facility are generally easterly (blowing from the east).

Available meteorological data for temperature and relative humidity from the nearby stations are presented in **Table 9** below.

Table 9: Humidity and Temperature Data – MV Stations T13, T17, T18, 2019-2021

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Station T13: North Delta												
Daily Mean Temperature	4.73	2.47	5.94	9.76	13.63	16.38	18.10	18.09	15.24	9.38	5.78	3.36
Station T17: Richmond South												
Daily Mean Temperature	4.14	1.94	5.91	9.68	13.56	16.28	18.21	18.17	15.31	9.06	6.10	3.04
Station T18: Burnaby South												
Mean Relative Humidity	87.52	79.69	70.89	66.75	70.25	71.62	71.55	75.38	81.78	83.88	86.01	91.04
Daily Mean Temperature	5.18	2.44	6.48	10.14	14.04	16.57	18.67	18.51	15.58	9.76	6.81	3.80

[1] Data extracted from British Columbia Ministry of Environment Envista database (https://envistaweb.env.gov.bc.ca/)

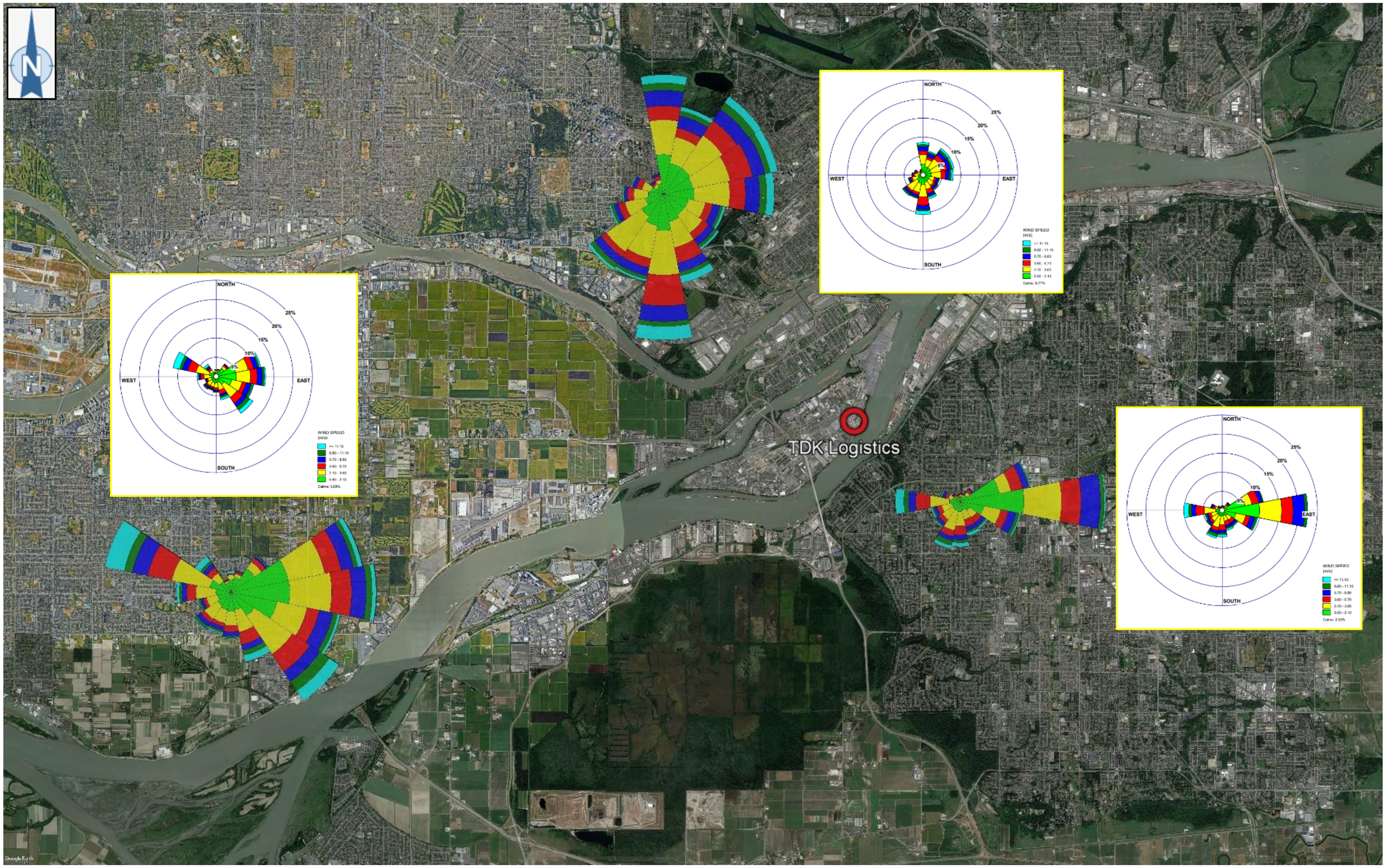


Figure 7: MV Monitoring Stations T13, T17 and T18 Wind roses, 2019 – 2021

5.3 Historical Activity

As noted above, TDK has a current annual throughput capacity of 120,000 TEU. For the purposes of this report, 2021, was selected as the baseline year. 2021 is considered representative of pre-Project operations as confirmed by TDK. As an indicator of throughput, gate transactions are listed in **Table 10** below for reference.

Table 10: Historical Throughput

Year	Gate Transactions
2018	53,018
2019	54,643
2020	61,597
2021	65,153
2022 [a]	49,331

[a] Year to date as of mid-December 2022 and prorated to end of the year.

6.0 FUTURE CONDITION

6.1 Horizon Year

It is anticipated that the Expansion Project will begin operations in 2025. Hence, 2025 has been chosen as the horizon year for this assessment, considering a project targeted annual throughput capacity of 150,000 TEU. The project will be fully completed in 2026.

To note, while new engines in TDK's equipment inventory were considered where relevant, projected emissions for other aspects of the operation (e.g., truck/rail) are conservative in nature as fuel consumption rates/best available technologies/fuel regulations were assumed to be constant in the two scenarios. As time progresses and technologies improve, more efficient engines, controls, and stringent fuel regulations are anticipated which would result in further emission reductions.

The Project consists of improvements to increase TDK's container capacity from annual throughput of 120,000 to ~150,000 twenty-foot equivalent units (TEUs).

7.0 EMISSION ESTIMATES

The resulting emission estimates for baseline and Project cases are based on current and projected activity levels for truck movements, material handling, and rail and considers adjustments in operations (i.e., material flow, commodity handling capacities) associated with the Expansion Project.

As mentioned above, this air emissions inventory includes the following scenarios:

- Current/Baseline Case – 2021 (pre–Expansion Project); and
- Future/Project Case – 2025 (post Expansion Project). The project is expected to be completed and begin operations in 2025 and fully operational in 2026.

7.1 Baseline Case

Facility emissions in the baseline case include the following sources:

- On-road emissions (container truck travel/idling onsite); and
- Non-road emissions (including container handers, forklifts, and yard trucks).

Supply Chain emissions in the baseline case include on-road emissions from truck travel/idling between the TDK facility and main shipping terminals.

Estimated annual onsite and supply chain emissions for the baseline case are presented in **Table 11** below.

Table 11: Estimated On-Site & Supply Chain Air Emissions for Baseline Case

Case	Source Group	Contaminant (Tonnes)											
		CO	NO_x	VOC	TPM	PM_{10}	$PM_{2.5}$	DPM	SO_x	CO_2	CH_4	N_2O	CO_2e
Onsite	On-road Vehicles	0.59	1.68	0.16	0.12[a]	0.12[a]	0.08[a]	0.08	6.95E-04	203	0.01	1.68E-03	203
	Non-road Equipment	7.22	10.41	0.70	0.52	0.52	0.50	0.50	3.90E-03	1,016	0.03	0.04	1,029
Supply Chain	On-road Vehicles	8.63	23.47	1.22	1.90[a]	1.90[a]	1.19[a]	1.19	0.01	4,052	0.07	0.01	4,056
Total		**16.45**	**35.56**	**2.08**	**2.54**	**2.54**	**1.77**	**1.78**	**0.02**	**5,270**	**5,270**	**0.05**	**52,88**

[a] Particulate emissions include brake wear and tire wear emissions from on-road vehicle activity.

7.2 Project Case

Facility emissions in the project case include the following sources:

- On-road emissions (container truck travel/idling onsite);
- Non-road emissions (including container handers, forklifts, and yard trucks);
- Rail emissions on the TDK siding (travel/idling); and
- Material handling emissions from grain transfers.

Supply Chain emissions in the project case include the following sources:

- On-road emissions (container truck travel/idling in the supply chain);
- Rail emissions from travel in the supply chain.

Estimated annual onsite and supply chain emissions for the project case are presented in **Table 12** below.

Table 12: Estimated Onsite + Supply Chain Air Emissions for Project Case

Case	Source Group	Contaminant (Tonnes)											
		CO	NO_x	VOC	TPM	PM_{10}	$PM_{2.5}$	DPM	SO_x	CO_2	CH_4	N_2O	CO_2e
Onsite	On-road Vehicles	0.53	1.41	0.11	0.09[a]	0.09[a]	0.05[a]	0.05	6.74E-04	199	0.01	1.62E-03	199
	Non-road Equipment	7.67	10.58	0.72	0.53	0.53	0.52	0.52	4.97E-03	1,380	0.03	0.04	1,394
	Rail	0.11	0.80	0.05	0.02	0.02	0.02	0.02	2.88E-04	39	2.14E-03	0.01	43
	Material Handling	-	-	-	4.51	1.49	0.25	-	-	-	-	-	-
Supply Chain	On-road Vehicles	9.05	21.34	1.02	1.73[a]	1.73[a]	0.90[a]	0.86	0.02	4,733	0.08	0.01	4,738
	Rail	0.13	0.96	0.06	0.02	0.02	0.02	0.02	3.46E-04	46.33	2.58E-03	0.02	52
Total		**17.48**	**35.08**	**1.95**	**6.91**	**3.88**	**1.75**	**1.46**	**0.02**	**6,397**	**0.13**	**0.09**	**6,426**

[a] Particulate emissions include brake wear and tire wear emissions from on-road vehicle activity.

8.0 MITIGATION POTENTIAL

The emissions mitigation potential with the container storage and transport logistics facility includes items and equipment operated by and under the control of the facility operator. Potential mitigation options and best available technologies (BAT) for container processing and logistic operations includes items such as:

- Extensive electrification of terminal operations;
- Changing to hybridized power systems; and
- Running equipment on the cleanest diesel engines.

Many of these technologies entail excessive cost to implement and accelerating the capital replacement of equipment will introduce significant additional capital costs before the return on the original investment has been fully realized. As such, investment related to the replacement of TDK's equipment fleet and introduction of new technologies are not considered a financially realistic option at this time and have therefore been excluded from the scope of this air assessment.

8.1 Application of Best Available Procedures

The majority of effort will be spent on good engineering and operational best practices/procedures that are consistent with equipment design requirements.

More specifically, the following operational procedures are applied to minimize Project emissions:

- Where practical, procurement of Project on-road and non-road engines and vehicles are completed to meet the latest applicable Canadian emissions standards and guidelines;
- Equipment and engines are maintained to maximize efficiency (associated maintenance programs for equipment and engines are to be documented/kept on file);
- Where applicable, equipment and vehicles are turned off when not in use to avoid unnecessary idling;
- Regular maintenance is conducted to ensure effective dust management and completion of transfer operations (e.g. conveyor transfers, loading rates, etc.) to limit escape of fines and dust;
- Regular observations of the product handling stream and site-wide housekeeping is conducted and any areas requiring maintenance identified;
- Truck routes at the proposed Terminal are optimized to minimize bottlenecks and truck idling onsite; and
- Container storage areas are optimized to allow for more efficient use of container storage space and increased container density in the yard.

9.0 IMPACT POTENTIAL

9.1 Baseline Case to Project Case Comparison

In order to compare project air emissions to the baseline scenario, summary tables showing estimated emissions onsite (**Table 13**), supply chain (**Table 14**) and estimated emissions onsite including supply chain (**Table 15**) are presented below.

Table 13: Estimated On-Site Air Emissions for Baseline/Project Case

Case	Source Group	Contaminant (Tonnes)											
		CO	NO_x	VOC	TPM	PM_{10}	$PM_{2.5}$	DPM	SO_x	CO_2	CH_4	N_2O	CO_2e
Baseline (120,000 TEU)	On-road Vehicles	0.59	1.68	0.16	0.12[a]	0.12[a]	0.08[a]	0.08	6.95E-04	203	0.01	0.002	203
	Non-road Equipment	7.22	10.41	0.70	0.52	0.52	0.50	0.50	3.90E-03	1,016	0.03	0.04	1,029
	Rail	-	-	-	-	-	-	-	-	-	-	-	-
	Material Handling	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**7.82**	**12.09**	**0.86**	**0.64**	**0.64**	**0.58**	**0.59**	**4.59E-03**	**1,218**	**0.04**	**0.04**	**1,232**
Project (150,000 TEU)	On-road Vehicles	0.53	1.41	0.11	0.09[a]	0.09[a]	0.05[a]	0.05	6.74E-04	199	0.01	0.002	199
	Non-road Equipment	7.67	10.58	0.72	0.53	0.53	0.52	0.52	4.97E-03	1,380	0.03	0.04[a]	1,394
	Rail	0.11	0.80	0.05	0.02	0.02	0.02	0.02	2.88E-04	39	0.00	0.01	43
	Material Handling	-	-	-	4.51	1.49	0.25	-	-	-	-	-	-
	Total	**8.30**	**12.78**	**0.87**	**5.15**	**2.13**	**0.83**	**0.58**	**5.94E-03**	**1,617**	**0.04**	**0.06**	**1,637**
Difference (+/-)		0.49	0.69	0.01	4.52	1.49	0.25	0.00	1.34E-03	399	0.00	0.02	405

[a] Particulate emissions include brake wear and tire wear emissions from on-road vehicle activity.

Table 14: Estimated Supply Chain Air Emissions for Baseline/Project Case

Case	Source Group	Contaminant (Tonnes)											
		CO	NO_x	VOC	TPM	PM_{10}	$PM_{2.5}$	DPM	SO_x	CO_2	CH_4	N_2O	CO_2e
Baseline (120,000 TEU)	On-road Vehicles	8.63	23.47	1.22	1.90[a]	1.90[a]	1.19[a]	1.19	0.01	4,052	0.07	0.01	4,056
	Non-road Equipment	-	-	-	-	-	-	-	-	-	-	-	-
	Rail	-	-	-	-	-	-	-	-	-	-	-	-
	Material Handling	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**8.63**	**23.47**	**1.22**	**1.90**	**1.90**	**1.19**	**1.19**	**0.01**	**4,052**	**0.07**	**0.01**	**4,056**
Project (150,000 TEU)	On-road Vehicles	9.05	21.34	1.02	1.73[a]	1.73[a]	0.90[a]	0.86	0.02	4,733	0.08	0.01	4,738
	Non-road Equipment	-	-	-	-	-	-	-	-	-	-	-	-
	Rail	0.13	0.96	0.06	0.02	0.02	0.02	0.02	0.00	46	0.00	0.02	52
	Material Handling	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**9.18**	**22.30**	**1.08**	**1.75**	**1.75**	**0.92**	**0.88**	**0.02**	**4,780**	**0.09**	**0.03**	**4,790**
Difference (+/-)		0.55	-1.18	-0.15	-0.15	-0.15	-0.27	-0.31	0.00	728	0.02	0.02	734

[a] Particulate emissions include brake wear and tire wear emissions from on-road vehicle activity.

Table 15: Estimated Onsite + Supply Chain Air Emissions for Baseline/Project Case

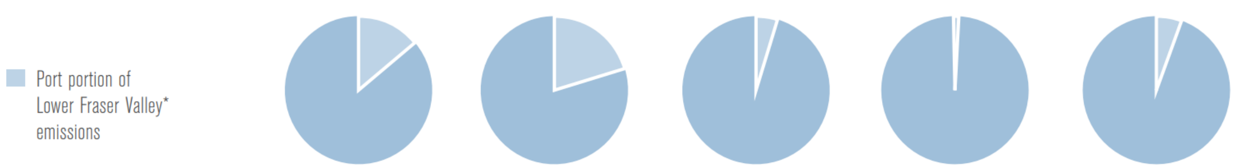
Case	Source Group	Contaminant (Tonnes)											
		CO	NO_x	VOC	TPM	PM_{10}	$PM_{2.5}$	DPM	SO_x	CO_2	CH_4	N_2O	CO_2e
Baseline (120,000 TEU)	On-road Vehicles	9.23	25.16	1.38	2.02[a]	2.02[a]	1.27[a]	1.27	1.46E-02	4,254	0.07	0.01	4,259
	Non-road Equipment	7.22	10.41	0.70	0.52	0.52	0.50	0.50	3.90E-03	1,016	0.03	0.04	1,029
	Rail	-	-	-	-	-	-	-	-	-	-	-	-
	Material Handling	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**16.45**	**35.56**	**2.08**	**2.54**	**2.54**	**1.77**	**1.78**	**0.02**	**5,270**	**0.11**	**0.05**	**5,288**
Project (150,000 TEU)	On-road Vehicles	9.58	22.75	1.12	1.83[a]	1.83[a]	0.95[a]	0.91	1.67E-02	4,932	0.09	0.01	4,937
	Non-road Equipment	7.67	10.58	0.72	0.53	0.53	0.52	0.52	4.97E-03	1,380	0.03	0.04	1,394
	Rail	0.23	1.75	0.11	0.04	0.04	0.03	0.04	6.33E-04	85	0.00	0.03	95
	Material Handling	-	-	-	4.51	1.49	0.25	-	-	-	-	-	-
	Total	**17.48**	**35.08**	**1.95**	**6.91**	**3.88**	**1.75**	**1.46**	**0.02**	**6,397**	**0.13**	**0.09**	**6,426**
Difference (+/-)		1.03	-0.49	-0.14	4.37	1.34	-0.02	-0.32	0.00	1,127	0.02	0.04	1,139

[a] Particulate emissions include brake wear and tire wear emissions from on-road vehicle activity.

9.2 Emissions in the Surrounding Area

To provide additional context to emissions associated with the Project Case, a figure showing emission totals from the Port of Vancouver most recently published Port Emission Inventory Report (VFPA, 2015) is presented in **Figure 8** below. VFPA conducts emission inventories on a five-year basis; however, the results of the 2020 emission inventory are not yet available. As such, these figures are only used to provide general comparisons.

Emission contributions to regional, provincial and national totals by type (tonnes), 2015



	SO_x	NO_x	$PM_{2.5}$	VOC	CO_2e
Port of Vancouver	268	12,971	288	567	1,079,686
Lower Fraser Valley	1,626	50,357	5,243	65,828	17,529,390
British Columbia	60,485	276,444	80,882	164,868	60,900,000
Canada	1,054,399	1,893,775	1,620,872	1,858,662	722,000,000

* The Lower Fraser Valley includes the entire Metro Vancouver region and the southwestern portion of the Fraser Valley Regional District.

Figure 8: Port of Vancouver 2015 Emissions Inventory[2]

TDK is one of over 100 industrial tenants at the Port of Vancouver (VFPA, 2015). Based on the data presented in **Figure 8** the scale of TDK emissions is relatively insignificant relative to other emissions even on Port land only. While port tenants include various types of operations of varying scale, emissions associated with TDK operations and the Expansion Project are not expected to significantly impact air quality in the surrounding area.

9.3 Conclusions

TDK commissioned this Level 1 Air Assessment to support the TDK Logistics Expansion Project which aims to accommodate increasing market demands for goods transport and container storage. The Emission Inventory presented in this report supports the application to VFPA to accommodate this expansion.

Based on projected estimates, overall emissions are projected to increase in both Facility Emissions and Supply Chain boundaries due to increased volume of container movement, addition of rail

[2] 2015 Port Emissions Inventory Report

operations/material handling operations, and purchasing of additional equipment (container handlers, forklifts, yard trucks) to support the expansion.

While an increase in overall emissions is expected, emission intensities (tonnes of Contaminant released/ 1000 TEU) are largely projected to decrease as a result of improvements in equipment emissions and operational efficiencies associated with the Expansion Project (e.g., improved truck queuing system) as shown in **Table 16** below. Increases in some contaminant categories can be primarily attributed to the addition of new source categories such as material handling and rail. Based on the relative size and scale of TDK operations, emissions associated with the Expansion Project are not expected to significantly impact air quality in the surrounding area.

Table 16: Onsite + Supply Chain Air Emission Intensities

Case	Emission Intensity (Tonnes of Contaminant/ 1000 TEU)											
	CO	NO_x	VOC	TPM	PM_{10}	$PM_{2.5}$	DPM	SO_x	CO_2	CH_4	N_2O	CO_2e
Baseline	0.14	0.30	0.02	0.02	0.02	0.01	1.48E-02	1.54E-04	43.91	8.91E-04	4.22E-04	44.06
Project	0.12	0.23	0.01	0.05	0.03	0.01	9.74E-03	1.49E-04	42.65	8.66E-04	5.86E-04	42.84
% Diff.	-15%	-21%	-25%	118%	22%	-21%	-34%	-3%	-3%	-3%	39%	-3%

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LIMITATIONS

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This report involves matters that could be precisely determined at the time of research. Calculations and assumptions generally depend on professional judgement in light of limitations and consider industry standards for the preparation of similar reports.

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Opinions expressed in this report are those of the authors and do not necessarily reflect the opinion of TDK Logistics Inc.

APPENDIX A: ESTIMATION METHODOLOGIES

A.1 - On Road Vehicles

On road vehicle emissions associated with TDK operations are the result of truck activities. Emissions were estimated using a combination of transportation model emission rates, project specific distance details, and key activity estimates.

The general equation for calculating truck emissions from travel is shown below:

Equation 1a:

$$E = EF \ x \ VKT \ x \ C$$

Where:

E = emissions in tonnes per year
EF = emission factor for a given pollutant (g/VKT)
VKT = Total vehicle kilometres travel (VKT)
C = unit conversion factor to tonnes (10^{-6} tonnes/g)

For activities such as queuing/engine idling, emissions were calculated using time-based emission rates as shown in the general equation below:

Equation 1b:

$$E = EF \ x \ H \ x \ C$$

Where:

E = emissions in tonnes/yr
EF = emission factor for a given pollutant (g/hr)
H = Hours per activity (hr)
C = unit conversion factor to tonnes (10^{-6} tonnes/g)

Emissions rates associated with truck exhaust emissions were estimated and extracted from the US EPA Motor Vehicle Emission Simulator, also known as MOVES[3]. Emissions estimation in MOVES is dependent on several factors including travel speeds, area of assessment, vehicle age, and climatic conditions. Emission factors from diesel combination short haul trucks were used as a basis for the emission calculations. Travel speeds were conservatively estimated to be below road/on-site speed limits to avoid underestimating emissions and account for the slower speeds typically associated with fully loaded heavy vehicles, road traffic, and controlled intersections. Travel speeds of 10 km/hr and 40 km/hr were considered within site boundaries and offsite roads respectively based on site speed limits of 10 mph and a typical road speed limit of 50 km/hr.

MOVES was run using area specific relative humidity and temperature. Data was obtained from MV station Burnaby South (T18) as it is the nearest meteorological station with both parameters. Average relative humidity and temperatures for January and July from the last three years 2018-2021 were used, shown in **Table 17** for reference.

[3] U.S. Environmental Protection Agency – *MOVES3 Model*

Table 17: Average Relative Humidity and Temperature

Parameter [a]	January	July
Relative Humidity (%)	87.52	71.55
Temperature (ºC)	5.18	18.67

[a] Obtained from Metro Vancouver Station Burnaby South (T18)

In cases where specific information/data were not available (e.g., vehicle age distribution) default model settings/data for Washington, USA – King County were used. Emission factors obtained from the EPA's MOVES model were then multiplied by activity estimates (e.g., total kilometers travelled, idling times, etc.) to yield total yearly emissions.

To note and since MOVES does not display select contaminants included in the scope of this assessment, additional rates/scaling factors for diesel fuel combustion were applied based on U.S. EPA guidance (U.S. EPA, 2020). For diesel fuel combustion, the PM_{10} EF was assumed to be the same for total particulate matter (TPM), and diesel particulate matter.

On-road activity data and EFs applied for the baseline and Project case are shown in **Table 18** and **Table 20**, respectively. The MOVES age distribution used for the baseline and Project case are shown in **Table 19** and **Table 21**, respectively.

Table 18: Activity Data and MOVES model Emission Factors of On-road Vehicles (Baseline Case)

Parameter	Idling	Onsite Travel	Offsite-Travel
Annual Truck Activity	65,000		
Speed	0 km/hr	10 km/hr	40 km/hr
Distance Travelled per Truck	-	0.51 km	50 km (roundtrip)
Idling time per Truck	16 min onsite 12 minutes offsite	-	-
Emission Factors			
Emission Factor Units	(g/hr)	(g/VKMT)	(g/VKMT)
CO	0.372	6.266	2.568
NOx	1.140	14.964	6.949
VOCs	0.109	1.162	0.349
TPM	0.059	0.590	0.352
PM_{10}	0.059	0.590	0.352
$PM_{2.5}$	0.054	0.543	0.324
DPM	0.059	0.590	0.352
SOx	4.35E-04	0.007	0.004
CO_2	126.987	2129.973	1216.17
CH_4	0.005	0.061	0.019
N_2O	1.35E-03	0.008	0.002
PM_{10} (Brakewear/Tirewear)	-	1.098	0.219
$PM_{2.5}$ (Brakewear/Tirewear)	-	0.138	0.028

Table 19: MOVES Age Distribution (Baseline Case)

Vehicle Year	% Breakdown
2021	5.0%
2020	5.3%
2019	5.8%
2018	5.4%
2017	4.9%
2016	4.8%
2015	5.6%
2014	5.0%
2013	4.4%
2012	4.0%
2011	2.0%
2010	1.5%
2009	2.3%
2008	1.7%
2007	6.0%
2006	4.0%
2005	3.8%
2004	2.1%
2003	2.2%
2002	1.6%
2001	2.7%
2000	3.5%
1999	2.7%
1998	2.0%
1997	1.8%
1996	1.9%
1995	2.5%
1994	1.7%
1993	1.3%
1992	0.8%
1991	1.5%

Table 20: Activity Data and MOVES model Emission Factors of On-road Vehicles (Project Case)

Parameter	Idling	Onsite Travel	Offsite-Travel
Annual Truck Activity	80,000 Trucks		
Speed	0 km/hr	10 km/hr	40 km/hr
Distance Travelled per Truck	-	0.61 km	50 km (roundtrip)
Idling time per Truck	12 min onsite 12 minutes offsite	-	-
Emission Factors			
Emission Factor Units	(g/hr)	(g/VKMT)	(g/VKMT)
CO	0.322	5.315	2.186
NOx	0.957	11.933	5.105
VOCs	0.077	0.784	0.236
TPM	0.037	0.349	0.206
PM_{10}	0.037	0.349	0.206
$PM_{2.5}$	0.034	0.321	0.189
DPM	0.037	0.349	0.206
SOx	4.13E-04	0.007	0.004
CO_2	121.827	2002.846	1154.07
CH_4	0.005	0.061	0.019
N_2O	1.35E-03	0.008	0.002
PM_{10} (Brakewear/Tirewear)	-	1.087	0.218
$PM_{2.5}$ (Brakewear/Tirewear)	-	0.137	0.028

Table 21: MOVES Age Distribution (Project Case)

Equipment Type	Equipment Count
2025	5.0%
2024	5.1%
2023	5.4%
2022	5.5%
2021	5.2%
2020	5.4%
2019	5.8%
2018	5.3%
2017	4.6%
2016	4.4%
2015	5.1%
2014	4.4%
2013	3.8%
2012	3.4%
2011	1.7%
2010	1.3%
2009	1.8%
2008	1.4%
2007	4.6%
2006	3.0%
2005	2.8%
2004	1.5%
2003	1.5%
2002	1.1%
2001	1.8%
2000	2.3%
1999	1.7%
1998	1.3%
1997	1.1%
1996	1.2%
1995	1.5%

A.2 - Non-road Equipment

Non-road emission sources include vehicles or pieces of equipment that operate exclusively within the facility. The facility's primary non road equipment considered includes: forklifts, container handlers, and yard trucks.

The equipment type, age, horsepower (hp) ratings, and equipment operating hours were estimated based on facility information provided by TDK. Emissions for these pieces of equipment were estimated using either hp-based or fuel-based emission factors from the EPA NONROAD Model.

The general equations for hp-based and fuel-based emission factors used to calculate emissions from non-road equipment are shown below for reference.

Equation 2a:

$$E = EF \ x \ HP \ x \ LF \ x \ H \ x \ C$$

Where:

E = emissions in tonnes/yr
EF = engine capacity-based emission factor for a given pollutant (g/hp-h)
HP = equipment horsepower rating (hp)
LF = engine load factor
H = total equipment operating hours (h)
C = unit conversion factor to tonnes (10^{-6} tonnes/g)

Equation 2b:

$$E = EF \ x \ HP \ x \ LF \ x \ H \ x \ C$$

Where:

E = emissions in tonnes/yr
EF = fuel based emission factor for a given pollutant (g/h)
LF = engine load factor
H = total equipment operating hours (h)
C = unit conversion factor to tonnes (10^{-6} tonnes/g)

Table 22 and **Table 24** show the activity data and NONROAD model EFs applied for each equipment type for the baseline and Project case, respectively. Annual operating hours for container handlers and forklifts were based on information provided through site visits and fuel consumption data. Annual operating hours for yard trucks were conservatively estimated based on approximate usage and facility schedule. Emission factors were generated directly using NONROAD for each equipment type modeled using the baseline and Project case years, 2021 and 2025, respectively.

Table 23 and **Table 25** indicate the manufacture year and tier level used for emissions estimates generated by using NONROAD default parameters. Load factors were taken from US EPA report EPA420-P-02-P14 (US EPA, 2002).

As noted above, TDK plans to acquire additional pieces of equipment to accommodate increases in annual throughput, warehouse capacity and container yard storage capacity as result of the Expansion Project. Non-road equipment numbers are based on current equipment counts and are conservatively adjusted in the Project scenario to account for expected increases in throughput/activity. An approximate

50% increase in equipment inventory is expected based on TDK projections. This includes an additional four container handlers, five forklifts, and a yard truck. Additional non-road equipment were assumed to be purchased used, but meet Tier 4 emissions standards. For the purposes of this study, equipment manufactured in 2021 were used to represent the additional non-road items considered in the Project scenario. In cases where years for specific equipment in TDK's inventory were not available in the NONROAD model database, the closest available year was used.

As with trucks, additional rates/scaling factors for diesel fuel combustion were applied based on U.S. EPA guidance (U.S. EPA, 2020). For diesel fuel combustion, the PM_{10} EF was assumed to be the same for total particulate matter (TPM) and diesel particulate matter.

Table 22: Non-Road Equipment Characteristics and Associated NONROAD Model Emission Factors (Baseline Case)

Equipment Type	Tier	Age	Emission Factors (g/hp-hr)										
			CO	NOx	VOC	TPM	PM_{10}	$PM_{2.5}$	DPM	SOx	CO_2	CH_4	N_2O[a]
Container Handler	T0	1995	3.200	8.581	0.767	0.503	0.503	0.488	0.488	0.002	529	0.004	-
Container Handler	T1	2006	0.826	5.714	0.356	0.282	0.282	0.274	0.274	0.002	530	0.007	-
Container Handler	T1	2007	0.826	5.714	0.356	0.282	0.282	0.274	0.274	0.002	530	0.007	-
Forklift	Phase 1	2005	48.294	3.622	0.940	0.063	0.063	0.063	0.063	0.003	548.125	0.215	-
Forklift	Phase 1	2006	48.294	0.063	0.940	0.063	0.063	0.063	0.063	0.003	548.125	0.215	-
Forklift	Phase 2	2008	5.331	0.978	0.130	0.063	0.063	0.063	0.063	0.003	551.193	0.030	-
Forklift	Phase 2	2012	5.331	0.977	0.130	0.063	0.063	0.063	0.063	0.003	551.195	0.030	-
Forklift	Phase 2	2012	5.331	0.977	0.130	0.063	0.063	0.063	0.063	0.003	551.195	0.030	-
Forklift	Phase 2	2013	5.331	0.978	0.130	0.063	0.063	0.063	0.063	0.003	551.195	0.030	-
Forklift	Phase 2	2013	5.331	0.977	0.130	0.063	0.063	0.063	0.063	0.003	551.196	0.030	-
Yard Truck	T1	2006	2.202	5.837	0.241	0.281	0.281	0.273	0.273	0.002	536.136	0.005	-

[a] NONROAD does not calculate an emission factor for N_2O, this GHG was estimated using relative N_2O U.S. Default Factors ratios from the Climate Registry (The Climate Registry, 2022)

Table 23: TDK Fleet Inventory (Baseline Case)

CURRENT EQUIPMENT LIST AND DETAILS						
MOVES Category	**Equipment Type**	**Tier**	**Equipment Year**	**Engine Size (hp)**	**Average Operating Hours**	**SCC Default Load Factor**
Dsl - Other General Industrial Eqp	Container Handler	T0	1995	250	1564	0.43
	Container Handler	T1	2006	220	1564	0.43
	Container Handler	T1	2006	220	1564	0.43
	Container Handler	T1	2007	197	1564	0.43
	Container Handler	T1	2006	220	1564	0.43
	Container Handler	T1	2006	220	1564	0.43
	Container Handler	T1	2006	220	1564	0.43
	Container Handler	T1	2006	220	1564	0.43
LPG - Forklifts	Forklift	Phase 1 LPG	1978[a]	100	1033	0.30
	Forklift	Phase 1 LPG	1994[a]	97	1033	0.30
	Forklift	Phase 2 LPG	2006	67	1033	0.30
	Forklift	Phase 2 LPG	2008	59	1033	0.30
	Forklift	Phase 2 LPG	2008	59	1033	0.30
	Forklift	Phase 2 LPG	2008	59	1033	0.30
	Forklift	Phase 2 LPG	2012	118	1033	0.30
	Forklift	Phase 2 LPG	2012	51	1033	0.30
	Forklift	Phase 2 LPG	2013	118	1033	0.30
	Forklift	Phase 2 LPG	2013	51	1033	0.30
Diesel Terminal Tractor	Yard Truck	T1	2006	200	2000[b]	0.59
	Yard Truck	T1	2006	200	2000[b]	0.59

[a]Modelled as Phase 1 LPG, 2005 due to NONROAD database constraints
[b]Conservative estimate based on approximate usage and facility schedule

Table 24: Non-Road Equipment Characteristics and Associated NONROAD Model Emission Factors (Project Case)

Equipment Type	Tier	Age	Emission Factors (g/hp-hr)										
			CO	NOx	VOC	TPM	PM_{10}	$PM_{2.5}$	DPM	SOx	CO_2	CH_4	N_2O[a]
Container Handler	T0	1995	3.199	8.581	0.767	0.503	0.503	0.488	0.488	0.002	529	0.004	-
Container Handler	T1	2006	0.826	5.714	0.356	0.282	0.282	0.274	0.274	0.002	530	0.007	-
Container Handler	T1	2007	0.826	5.714	0.356	0.282	0.282	0.274	0.274	0.002	530	0.007	-
Container Handler	T4 no DPF w SCR	2021	0.021	0.148	0.009	0.010	0.010	0.010	0.010	0.001	531	0.001	-
Forklift	Phase 1	2005	48.294	3.622	0.940	0.063	0.063	0.063	0.063	0.003	548.125	0.215	-
Forklift	Phase 1	2006	48.294	0.063	0.940	0.063	0.063	0.063	0.063	0.003	548.125	0.215	-
Forklift	Phase 2	2008	5.331	0.978	0.130	0.063	0.063	0.063	0.063	0.003	551.193	0.030	-
Forklift	Phase 2	2012	5.331	0.977	0.130	0.063	0.063	0.063	0.063	0.003	551.194	0.030	-
Forklift	Phase 2	2012	5.331	0.977	0.130	0.063	0.063	0.063	0.063	0.003	551.194	0.030	-
Forklift	Phase 2	2013	5.331	0.977	0.130	0.063	0.063	0.063	0.063	0.003	551.194	0.030	-
Forklift	Phase 2	2013	5.331	0.977	0.130	0.063	0.063	0.063	0.063	0.003	551.194	0.030	-
Forklift	Phase 2	2021	4.767	0.927	0.109	0.058	0.058	0.058	0.058	0.003	551.273	0.019	-
Yard Truck	T1	2006	2.202	5.837	0.241	0.281	0.281	0.273	0.273	0.002	536.136	0.005	-
Yard Truck	T4 no DPF w SCR	2021	0.022	0.149	0.009	0.012	0.012	0.012	0.012	0.001	536.806	0.001	-

[a] NONROAD does not calculate an emission factor for N_2O, this GHG was estimated using relative N_2O U.S. Default Factors ratios from the Climate Registry (The Climate Registry, 2022)

Table 25: TDK Fleet Inventory (Project Case)

CURRENT EQUIPMENT LIST AND DETAILS						
MOVES Category	Equipment Type	Tier	Equipment Year	Engine Size (hp)	Average Operating Hours	SCC Default Load Factor
Dsl - Other General Industrial Eqp	Container Handler	T0	1995	250	1564	0.43
	Container Handler	T1	2006	220	1564	0.43
	Container Handler	T1	2006	220	1564	0.43
	Container Handler	T1	2007	197	1564	0.43
	Container Handler	T1	2006	220	1564	0.43
	Container Handler	T1	2006	220	1564	0.43
	Container Handler	T1	2006	220	1564	0.43
	Container Handler	T1	2006	220	1564	0.43
	Container Handler	T4 no DPF w SCR	2021	220	1564	0.43
	Container Handler	T4 no DPF w SCR	2021	220	1564	0.43
	Container Handler	T4 no DPF w SCR	2021	220	1564	0.43
	Container Handler	T4 no DPF w SCR	2021	220	1564	0.43
LPG - Forklifts	Forklift	Phase 1 LPG	1978[a]	100	1033	0.30
	Forklift	Phase 1 LPG	1994[a]	97	1033	0.30
	Forklift	Phase 2 LPG	2006	67	1033	0.30
	Forklift	Phase 2 LPG	2008	59	1033	0.30
	Forklift	Phase 2 LPG	2008	59	1033	0.30
	Forklift	Phase 2 LPG	2008	59	1033	0.30
	Forklift	Phase 2 LPG	2012	118	1033	0.30
	Forklift	Phase 2 LPG	2012	51	1033	0.30
	Forklift	Phase 2 LPG	2013	118	1033	0.30
	Forklift	Phase 2 LPG	2013	51	1033	0.30
	Forklift	Phase 2 LPG	2021	59	1033	0.30
	Forklift	Phase 2 LPG	2021	59	1033	0.30
	Forklift	Phase 2 LPG	2021	59	1033	0.30
	Forklift	Phase 2 LPG	2021	59	1033	0.30
	Forklift	Phase 2 LPG	2021	59	1033	0.30
Diesel Terminal Tractor	Yard Truck	T1	2006	200	2000[b]	0.59
	Yard Truck	T1	2006	200	2000[b]	0.59
	Yard Truck	T4 no DPF w SCR	2021	200	2000[b]	0.59

[a]Modelled as Phase 1 LPG, 2005 due to NONROAD database constraints
[b]Conservative estimate based on approximate usage and facility schedule

A.3 - Rail

Project-related rail emissions are due to the combustion of diesel fuel from locomotives operating within facility bounds and in the immediate supply chain. The general equation below is used to calculate emissions from rail.

Equation 3:

$$E = EF \ x \ FC \ x \ C$$

Where:

E = emissions in tonnes/yr
EF = emission factor (g/litre)
FC = fuel consumption rate (litres/yr)
C = unit conversion factor to tonnes (10^{-6} tonnes/g)

Based on Project design, containers and grain products will be brought onto the site from the SRY Trap Yard. It is understood that unit trains hauling long strings of rail cars are brought first into the SRY Trap Yard. Subsequently, they are broken down into smaller strings of railcars, and brought into the Project with the use of a diesel-powered switcher locomotive. No switching activities are conducted at the TDK facility.

Train emissions are based on transit in the supply chain (to and from the SRY Trap Yard), transit on the siding onsite, and idling emissions onsite. For this study, travel distances in the supply chain and onsite are conservatively approximated as 7 km and 0.35 km respectively. Based on Project information, it is assumed that trains service the site 5 days per week, with an average of one cargo train and one grain train per day in the Project Case. A summary of rail activity metrics is shown in **Table 26** for reference.

Table 26: Rail Activity Metrics

Item		Container Trains	Grain Trains
Throughput		5,200 – 53 ft intermodal units per annum	1,460 hopper cars (96,000 tonnes of grain) per annum
Train Length		20 – 53 ft intermodal units (2x5 double stacked well cars)	5-6 hopper cars
Activity		1 train per day on weekdays (~260 trains per annum)	1 train per day on weekdays (~260 trains per annum)
Travel Time[a] per trip (roundtrip)	**Siding Travel**	3.5 mins	3.5 mins
	Supply Chain	27.8 mins	27.8 mins
Idling Time per trip		35 mins[b]	135 mins[c]

[a]Travel distances in the supply chain and siding are conservatively approximated as 7 km and 0.35 km. Typical travel speeds of 25 mph in the supply chain and 10 mph on the siding were assumed
[b]Based on typical processing rates of 1:45 mins per container (Jacobs, 2016)
[c]Based on a Project unloading rate of 6,500 bushels/hr and annual throughputs of 96,000 tonnes grain per annum

Based on SRY's locomotive fleet and conventional locomotive models used in the Port of Vancouver operational area, the EMD GP9 switcher locomotive was chosen and used to represent typical locomotive operations.

As RAC has not included a summary of duty cycles in their Locomotive Emissions Monitoring Program report since the 2010 program, the fuel consumption rate for the transit operation was determined by combining the duty cycle for line haul operations provided by RAC's 2010 report (RAC, 2010) with GP9 fuel consumption rates at various power notch levels (Railserve, 2013) to obtain a weighted fuel consumption rate of 71.6 L per hour of travel. A fuel consumption rate of 16.6 L per hour of idling was used. A summary of the fuel consumption rates and duty cycle percentages considered is shown in **Table 27** below.

Table 27: Rail – Fuel Consumption and Duty Cycle

	Throttle Notch Position										Avg Fuel Consumption (L/hr)
	Idle	1	2	3	4	5	6	7	8	DB	
EMD GP9 Fuel Consumption (L/hr)	16.6	28.5	71	117.2	171.6	229.1	293.9	368.1	442.7	53.4	71.6
Percent of Time in Notch Position for Line Haul (%)	67.4%	8.3%	4.9%	4.1%	3.5%	2.0%	2.0%	1.6%	6.2%	0.0%	

Since the GP9 is a switcher type locomotive, published fuel-based emission factors for switcher locomotives from the Railway Association of Canada's (RAC) Locomotive Emissions Monitoring (LEM) Program 2020 (RAC, 2020) were used with the fuel consumption above to estimate emissions.

Based on US EPA practices, emissions factors for inhalable particulate matter (PM_{10}) and total particulate matter (TPM) are assumed to be equivalent, with the fine inhalable particulate matter ($PM_{2.5}$) factor approximated to be 97 percent (%) of the PM_{10} factor.

Emission factors used to estimate emissions from rail operations are shown in **Table 28** below.

Table 28: Rail – GHG/CAC Emission Factors (g/litre), Switch

Locomotive Type	NO_2	CO	VOC	SO_2	PM	PM_{10}	$PM_{2.5}$	DPM	CO_2	CH_4	N_2O	CO_2e_{100}
Switcher	55.34	7.35	3.40	0.02	1.13	1.13	1.10	1.10	2681	0.149	1.029	2991

*Note: Additional scalings applied based on U.S. EPA 2020: PM_{10} = PM, $PM_{2.5}$ = 0.97 * PM_{10}; VOC = 1.053 * HC, CO_2e_{100} – carbon dioxide equivalent based on a 100-year time horizon*

A.4 - Material Handling

As noted above, the inclusion of rail transport to/from the site will allow the facility to handle approximately ~96,000 tonnes of grain transfers per annum. A mobile conveyor system will be used to transport grain from incoming hopper railcars to a tilted container to be stored as needed and delivered to a shipping terminal by truck.

Fugitive dust emissions from this process occurs at two main points:

a) When grain is unloaded from the bottom of the hopper railcars onto the mobile conveyor system; and
b) When grain is transferred from the mobile conveyor system into a container which will be moved offsite by truck

Emissions factors used to estimate fugitive dust emissions expressed as PM (TPM, PM_{10}, $PM_{2.5}$) are based on AP-42 Section 9.9.1 Grain Elevators and Processes (U.S. EPA, 2003), reproduced in **Table 29** below.

Table 29: Particulate Emission Factors for Grain Elevators (kg/tonne grain handled)

Emission Source	PM	PM_{10}	$PM_{2.5}$
Grain Receiving – Rail	0.016	0.0039	0.00065
Grain Shipping – Truck	0.043	0.0145	0.00245

Emission factors are multiplied by anticipated grain throughput values (96,000 tonnes per annum) to yield annual emissions estimates. Due to limited availability of grain specific information, to account for the temporary, partially enclosed sprung structure erected over rail dumping operations, a 75% control efficiency is applied to transfer point a) based on common control efficiency values used in other material handling industries (Golder Associates, 2010).The general equation below is used to calculate fugitive emissions from grain handling.

<u>Equation 3:</u>

$$E = EF\ x\ T\ x\ C\ x\ (1 - CE)$$

Where:

E = emissions in tonnes/yr
EF = emission factor (kg/tonne of grain handled)
T = grain throughput (tonnes of grain handled/yr)
C = unit conversion factor to tonnes (10^{-3} tonnes/kg)
CE = control efficiency (%)

APPENDIX B: SURROUNDING AREA LAND USE

Land Use

The figure below illustrates the land use around/near the TDK facility. The area around TDK is primarily surrounded by industrial zoning, with commercial, recreational, agricultural, and residential areas located further away.

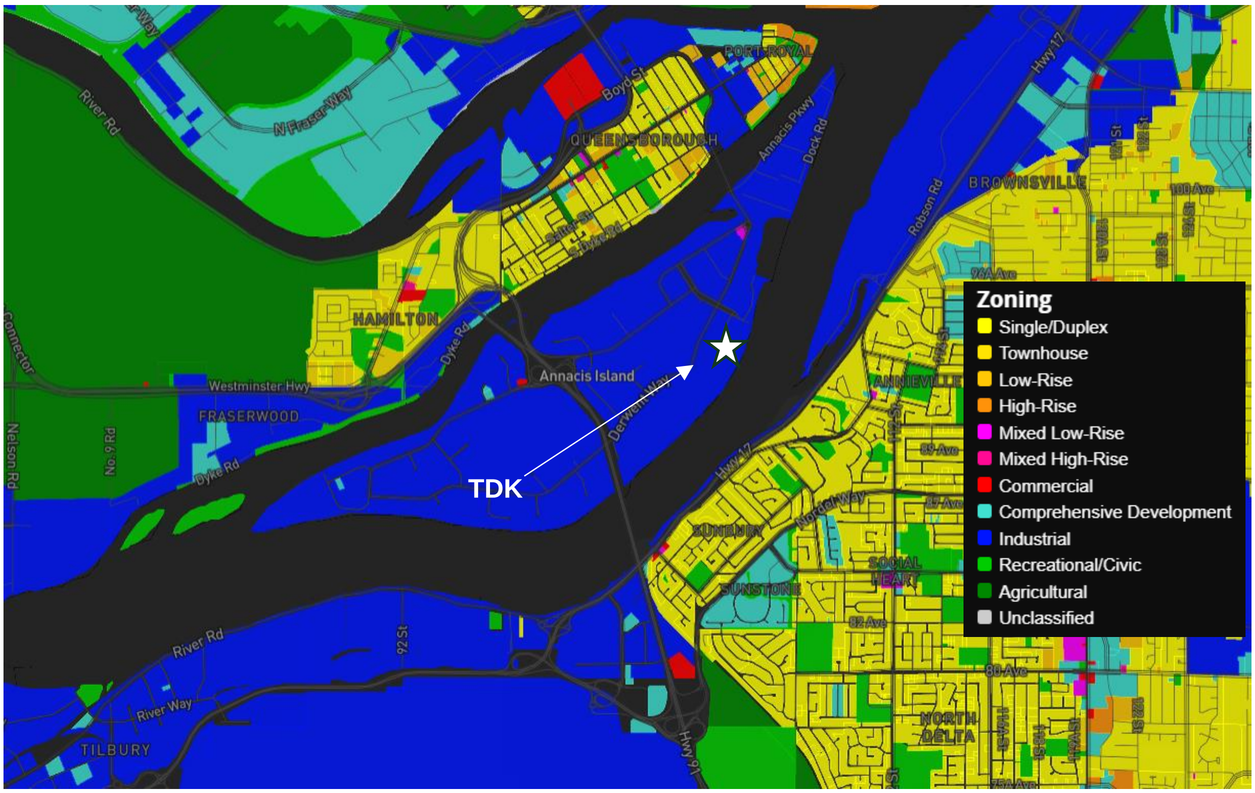

Figure B- 1: Land Use Surrounding TDK