Westshore Terminals Ltd.
Commodity Expansion
Efficiency Study
Electrical, Instrumentation and Controls

Revision 4
8/6/2021

Presented To:
Westshore Terminals Ltd.

Presented By:
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1. Revision History

Date:	Description of Change	Edited by:	Revision:
03/08/2021	Re-issued for review	JP	1
03/18/2021	Re-issued for review	VC	2
05/25/2021	Issued for use based on BHP comments	VC	3
06/08/2021	Issued for use based on BHP comments	LG	4

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2. Executive Summary

This report refers to a 4.5 million-tonnes-per-year potash export facility being considered at Westshore Terminals, a coal export terminal located in Delta, British Columbia. This new facility would expand Westshore's current facilities to handle the unloading, storage, and export of potash. An energy efficiency study has been conducted by enCompass to analyze the efficiency of the incoming system and that the system is prepared according to the VFPA Project Energy Study Guidelines (VFPA 2016).

The aim of the study is to identify the energy savings from implementing the energy conservation measures (ECMs) into the project design and operation. Energy calculations are performed for baseline conditions and compared to the optimized design to determine the energy efficiency of the overall system.

The ECM's are implemented into the system under two categories:

1. Type of equipment used to run the motors
2. Operational methodology

Using energy efficient equipment to operate motors and using the optimal operational mode to transfer the product into the vessel will provide the most cost and energy savings. Lighting and building materials are not considered in this document because high efficiency lighting is already the standard being developed for the potash system, and the building materials are set by the general engineering contractor.

The calculations show that the most significant energy savings can be found by using Variable Frequency Drives (VFDs) to run all conveying equipment. This reduction in demand and the associated energy savings can be seen in Table 1 below.

ECM #	ECM Description	Total Load (MVA)	Demand Reduction (MVA)	Energy Savings (MWh/year)
1	Equipment used to run the motors	4.892	0.8	1354.18
2	Operational methodology	13.1	1.4	2181.64

Table 1: Calculated Energy savings with ECMs integrated system

Based on these calculations, the savings are estimated to be 16.36% for category 1 and 10.87% for category 2 annually.

3. Background Information

Westshore Terminals is Port Metro Vancouver's only dedicated coal terminal located on Robert’s bank in the Strait of Georgia on the south side of the estuary of the Fraser River. The new potash expansion project will consist of major mechanical equipment additions including covered conveyors, a railcar dumper, a storage shed, a potash reclaimer, and dust collectors. All the new equipment will be driven by electric motors.

The energy efficiency report follows the VFPA project energy study guidelines, which describe the studied system and identify the ECMs included in the project. Calculations are performed on the system with baseline conditions and compared with the calculation performed with ECMs to determine the energy efficiency of the optimized system.

The preliminary design of the project has been developed to be energy efficient by introducing energy conservation measures (ECMs) and utilizing a BATNEEC design philosophy.

BATNEEC stands for the best available technology not entailing excessive costs. The optimal technology provides a balance between environmental and economic impact. This report will go over the different measures taken in different components of the preliminary design of the potash handling system to make the design energy efficient.

4. System Description

The site plan can be found in Appendix A: Site Plan, which illustrates the newly proposed site overview and boundaries. Potash will be delivered to Westshore Terminals via rail and loaded into vessels using the potash handling system. This system will include a new railcar dumper, vibrating feeders, conveyors, tripper, a storage building, a potash reclaimer and use the existing shiploaders.

The potash handling system electrical power will be fed from existing Substation 1, 3, 4, and two new substations that will be built to accommodate the equipment. The single line diagrams can be found in Appendix C: Single Line Diagram.

The dust collection system will start and stop automatically based on the operation mode. The primary areas of dust collection are the dumper area and the conveyor transfer towers. VFDs are also being considered for dust collector motors, however, the potential savings are unknown due to operating at a reduced capacity and therefore have not been incorporated into the efficiency study at this time.

4.1. Operating Modes

The potash handling system has four operating modes:

1. Rail to Storage
2. Rail to Ship
3. Storage Reclaim
4. Dual Sourcing

In Rail to Storage operating mode, potash will be unloaded from the railcars by the railcar dumper into hoppers below. Vibrating feeders underneath the hoppers will uniformly deposit product onto conveyors to be transported to the storage building. Potash will be piled uniformly in the storage building using conveyors and a movable tripper.

In Rail to Ship operating mode, the process will bypass the storage building and the conveyors will transfer potash directly from the railcar dumper to the existing shiploaders for loading into a vessel.

In Storage Reclaim operating mode, product will be transferred from the storage building to a vessel. The reclaimer will reclaim product from the pile and transfer it to the vessel via conveyors and existing shiploaders.

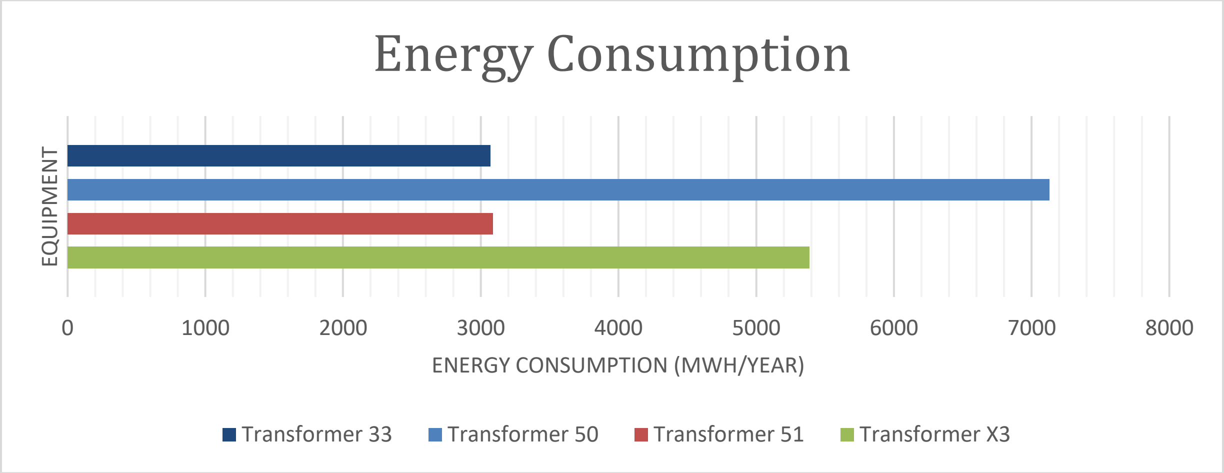
Lastly, Dual Sourcing operation mode is a combination of the Rail to Ship and Storage Reclaim operation modes. Product will be simultaneously loaded into the vessel from the railcar dumper and the storage building. Detailed process flow diagrams for each operation mode can be found in Appendix B: Process Flow Diagram.

5. Baseline

The efficiency calculations for the potash handling system were made with the baseline as a system without ECMs. The electrical power simulation software called EasyPower was used to perform the calculations. The results showing annual energy consumption of the potash handling system (MWh/year) and demand (MVA), are presented in Figure 1 and Figure 2, respectively. The energy consumption values were calculated assuming all the energy is being consumed by the electrical loads.

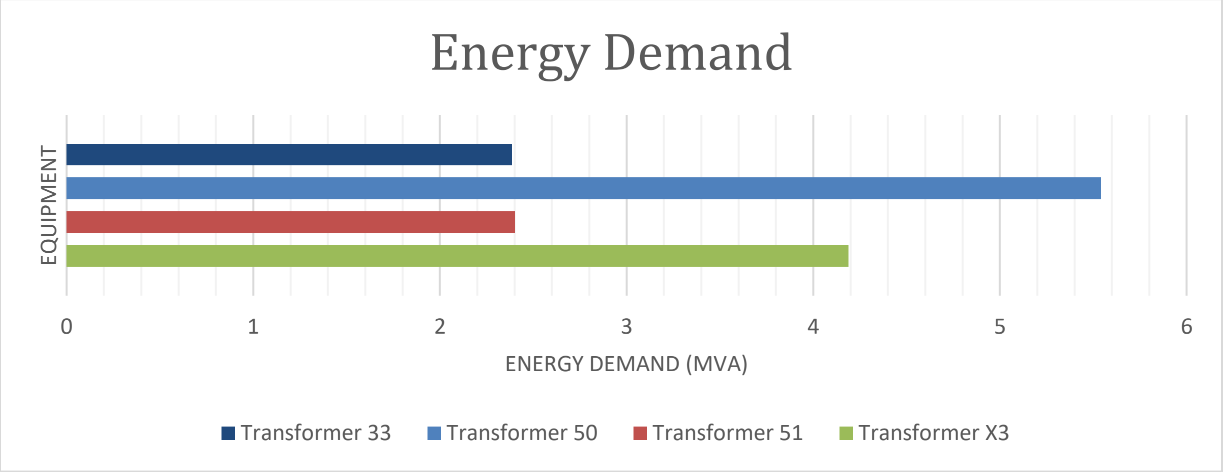
Additionally, Figure 3 and Figure 4 shows the values for the potash handling conveyor system's annual power consumption and demand, respectively.

Calculations have been made assuming that the potash handling system will run inbound operations for 1286 hours/year and outbound operations for 2200 hours/year handling approximately 3500 tonnes/hour and 2000 tonnes/hour of potash respectively. These calculations excluded all the coal systems. Calculations are shown in Appendix D: Easy Power Data.



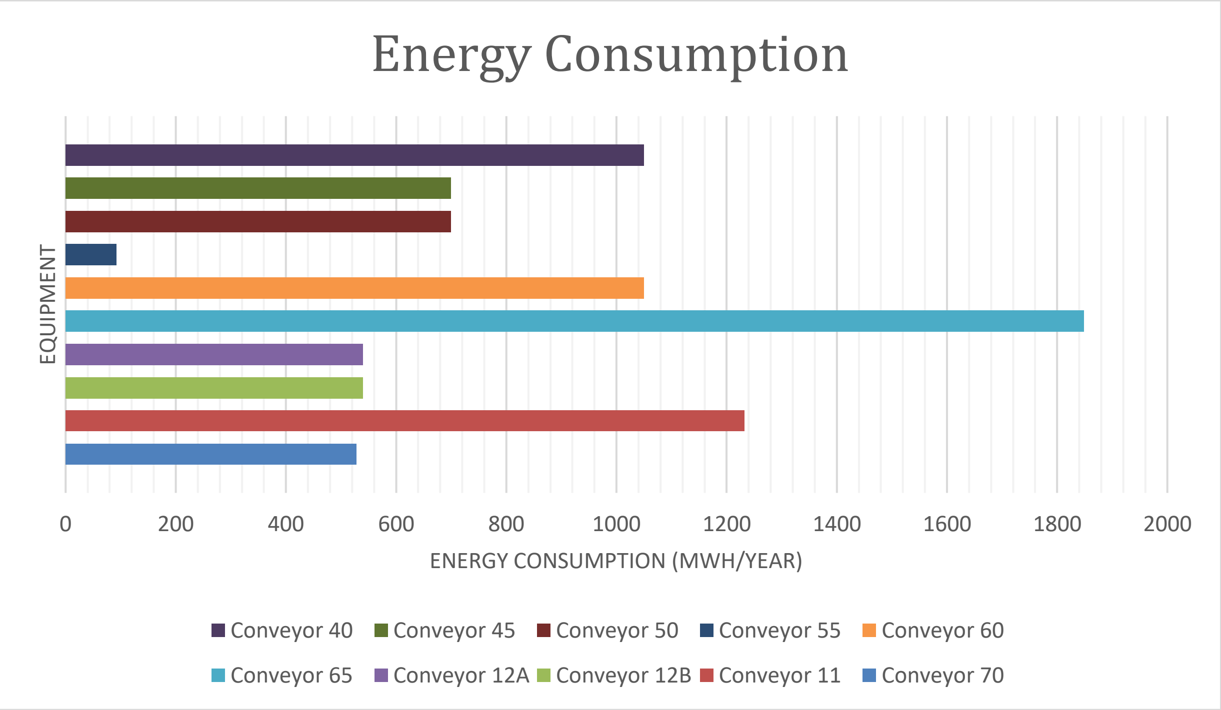
	Transformer 33	Transformer 50	Transformer 51	Transformer X3
Energy Consumption (MWh/year)	5289	9615	5322	6682

Figure 1:Potash handling system baseline energy consumption



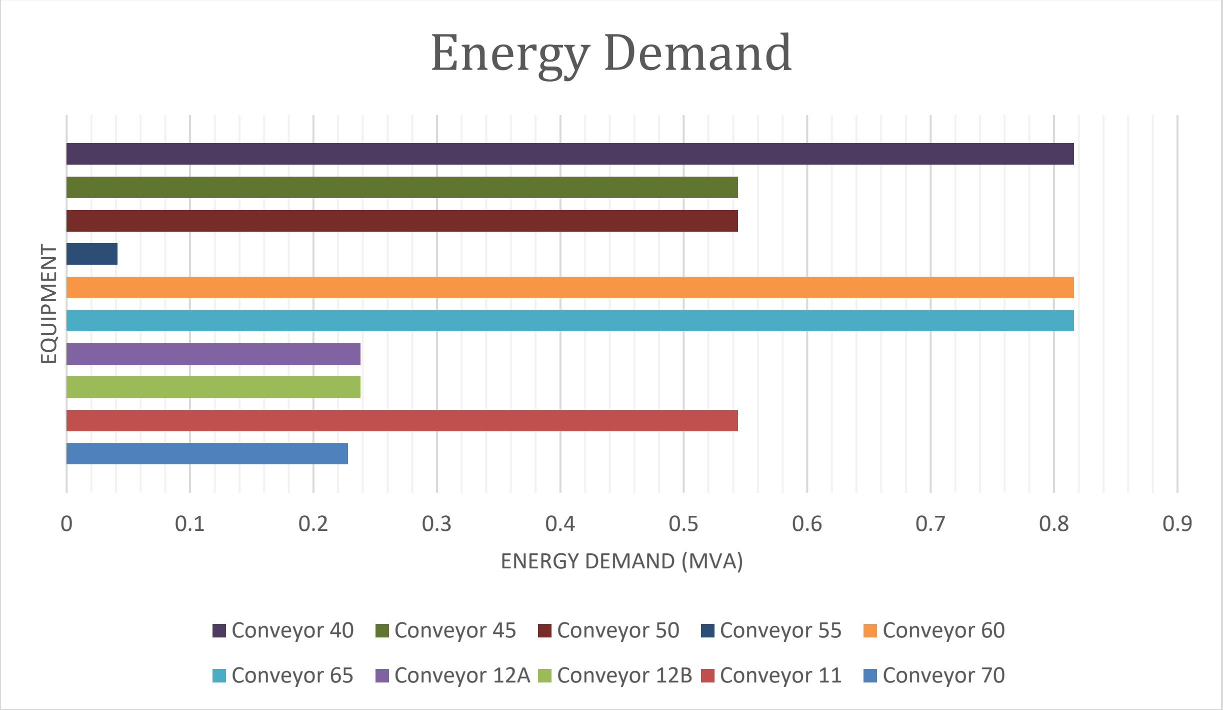
	Transformer 33	Transformer 50	Transformer 51	Transformer X3
Energy Demand (MVA)	4.816	8.264	4.846	5.607

Figure 2: Potash handling system baseline energy demand



	Conveyor 40	Conveyor 45	Conveyor 50	Conveyor 55	Conveyor 60	Conveyor 65	Conveyor 70	Conveyor 11	Conveyor 12 A	Conveyor 12 B
Energy Consumption (MWh/year)	1049.38	699.58	699.58	92.4	1049.38	1848	528	1232	539	539

Figure 3: Conveyor system baseline energy consumption



	Conveyor 40	Conveyor 45	Conveyor 50	Conveyor 55	Conveyor 60	Conveyor 65	Conveyor 70	Conveyor 11	Conveyor 12 A	Conveyor 12 B
Energy Demand (MVA)	0.816	0.544	0.544	0.042	0.816	0.84	0.24	0.56	0.245	0.245

Figure 4:Conveyor system baseline energy demand

6. Calculations

6.1. Methodology

The ECMs used for analysis are broken down into two groups and listed as benchmarks to compare with the optimized system:

1. Equipment Selection
2. Operational Methodology

6.1.1. Equipment Selection

Equipment selection contains the following 2 categories:

1. VFDs are used to run conveyor motors over fluid couplings
2. LED fixtures are used for indoor lighting over incandescent or fluorescent light bulbs

6.1.1.1. Conveying System VFDs

The conveyor system is a central part of the potash handling system which is used to transport product automatically and efficiently from one point to another. To improve the conveyor system's energy efficiency, variable frequency drives (VFDs) were chosen to start and control conveyors speed to significantly reduce the amount of energy used.

When a motor is started, inrush current is minimized by a VFD, controlling the level of power entering the motor and maximizing energy savings of the system. VFDs reduce the current peaks when starting large motors by delivering power to the motor at a low frequency and gradually increasing the frequency and motor speed to reach the desired speed.

VFDs control different parameters such as frequency, voltage and current supplied to an electric motor. This enables the motor to control the speed of the conveyors more efficiently. The incoming power supply is modified based on the load requirements of the system and the speed of the conveyor system is precisely adjusted to match the demand.

VFDs distribute incoming power more efficiently to the load due to their high power factor. This ensures that energy is being more effectively used by the system with reduced losses.

The potash handling system consists of mechanical equipment such as conveyors, dust collectors, a tripper, a positioner, and a reclaimer, which are all driven by electric motors. VFDs vary the fixed incoming voltage and frequency to control a motor's speed and torque. This makes them more energy efficient than other motor equipment. VFDs also control in-rush current spikes during motor startup which reduce energy losses. Alternatively, mechanical slippage occurs in any fluid coupling under load and some energy is lost as heat thereby reducing its efficiency.

For these beneficial reasons, VFDs will be used to control the conveyor motors.

6.1.1.2. Lighting Equipment

LED fixtures have been chosen for installation in the potash handling site due to their highly energy efficient characteristics including high lumens per wattage and dimmable capability. LEDs use less energy to provide the same illumination as fluorescent or HID luminaires, providing considerable cost and energy savings. Lighting levels at the potash handling site will be determined following IESNA guidelines. A total of 1658 lights will be installed at the site— 1215 on the conveyor galleries and 443 in operating areas. The lighting levels in conveyor galleries will be set to 50 lux and lighting levels in operating areas with high traffic and maintenance will be set to 150 lux. Lights will be installed at a standard distance of 14ft.

Photocell sensors will be used to control illumination levels. The lighting fixtures will vary in intensity of light depending on the activity in the area. Motion sensors will automatically dim the lights after a set time when no motion is detected and turn off lights completely in some areas.

The following areas will remain fully illuminated during repairs and/or inspections:

- Super structures
- Ground level around transfer towers
- Storage building entrance and exits
- Rail unloading building
- Electrical buildings

Lighting in access and egress areas will always remain on for safety reasons.

6.1.2. Operational Methodology

The baseline operational method assumed is a first in, first out philosophy. In a first in first out system, the rail will load to the storage facility rather than load a vessel. Below are several operational methods suggested as ECMs to improve system efficiency over the baseline.

1. Rail to ship loading, where the vessel will be directly loaded from railcars
2. Dual sourcing in which potash will be loaded into the vessel simultaneously from railcars and the storage building
3. Conveyor loaded stop during shiploader hatch change operations

6.1.2.3. Rail to Ship

Potash is typically unloaded from the railcars and transferred to the storage facility. There, the product is uniformly layered in the storage shed by the potash tripper, for optimal reclaiming. Product is reclaimed from the pile and sent to the shiploaders for vessel loading.

To optimize the operational methodology, whenever a vessel and potash train are present, the vessel may be loaded directly from the railcars. Product can be unloaded into the dumper and sent directly to the shiploaders for vessel loading. This will eliminate the need to transfer material to the storage building and the need to reclaim product stored in the pile. A direct vessel loading methodology will reduce potential energy usage waste as well as potential material loss, by reducing the number of steps and the amount of equipment required for loading operations.

Depending on the age of the product in the storage building, during loading operations, it is preferred to always reclaim from the storage building first as opposed to rail to ship or dual sourcing operations to ensure the product in the storage building meets quality requirements.

6.1.2.4. Dual Sourcing

The above process can be further optimized by using a dual source operational mode. In this mode, the product will be loaded into a vessel from the storage building reclaim while simultaneously being loaded directly from the railcars. Using both sources simultaneously will decrease overall loading times. Overall downtime is decreased as one source can remain active if the other is stopped for issues. Storage-specific equipment such as the potash tripper and the storage-specific belts will not be needed and less equipment in use will reduce system energy usage.

6.1.2.5. Loaded Stop

Both shiploaders can be used simultaneously for loading, increasing the efficiency of loading, and decreasing overall loading time. A hatch change is required once the hatch has been filled to the pre-determined target. During a hatch change, product can be diverted to the other shiploader to ensure a continuous loading process.

If both respective hatches are full and both shiploaders require a hatch change at the same time, a loaded stop will be activated. When a loaded stop is active, all conveyors will stop fully loaded, except for the shiploader conveyors which will continue to run until they are clear of all remaining product. When loading from the storage shed, the reclaimer in the storage building will boom up for approximately 5 seconds, stopping material flow to the system. Approximately 15 seconds after the reclaimer boom has been raised, the first conveyor will stop. Each conveyor between the storage shed and the shiploader will consecutively stop, fully loaded, approximately 15 seconds after the preceding conveyor. Only the shiploader conveyors will clear all remaining product off the belts. The total stop time when loading from the storage shed is approximately 105 seconds. Similarly, if a vessel is being loaded directly from railcars when a loaded stop is activated, the total time required for the conveyor system to come to a stop is approximately 100 seconds.

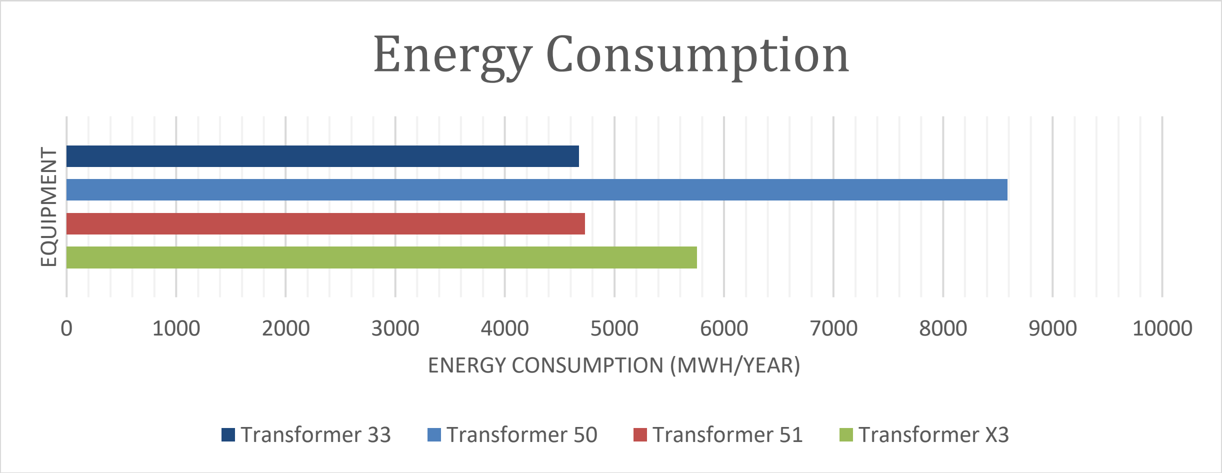
If a loaded stop is not integrated into the system, each of the conveyors would be required to run until they are clear of product individually. This would take 8 minutes when a vessel is being loaded from the storage building and 15 minutes when a vessel is being loaded directly from the rail for the conveyor system to stop.

6.2. ECM Calculation Results

The assumptions used in calculating the energy consumption and demand are as follows:

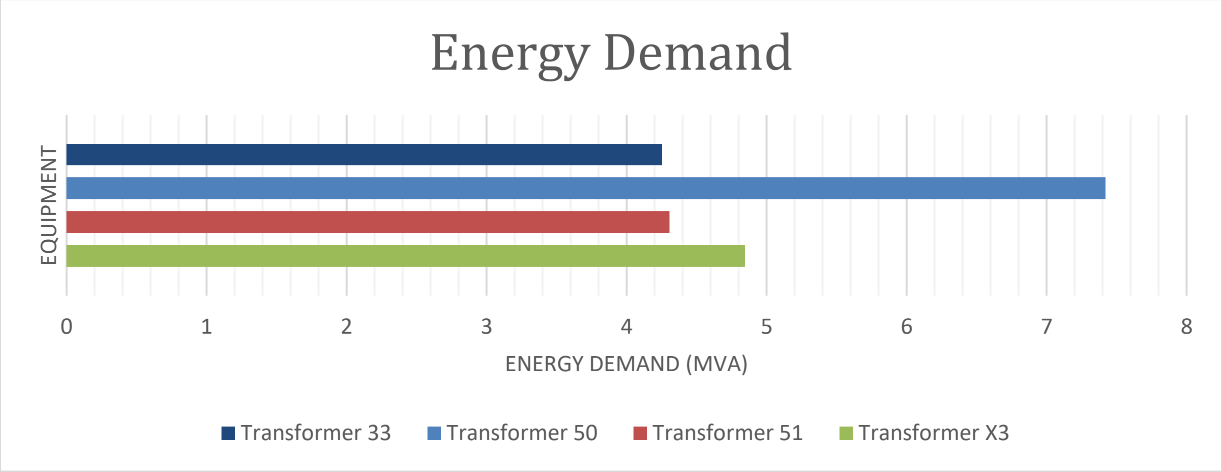
1. A baseline power factor of 0.82 and an efficiency of 91% were assumed for all motors.
2. Inbound operations will run for 1286 hours a year handling approximately 3500 tonnes of potash per hour.
3. Outbound operations will run for 2200 hours a year handling approximately 2000 tonnes of potash per hour.
4. Dual sourcing or rail to ship operational modes will be used whenever railcars and a vessel are present at the same time.
5. All the energy is consumed by the loads (PF = 1).

Figure 5 and Figure 6 show the annual power consumption and demand of the potash handling system after implementing ECMs. Figure 7 and Figure 8 show the power consumption and demand of the potash handling conveyor system after implementing the ECM. The calculations are shown in Appendix D: Easy Power Data.



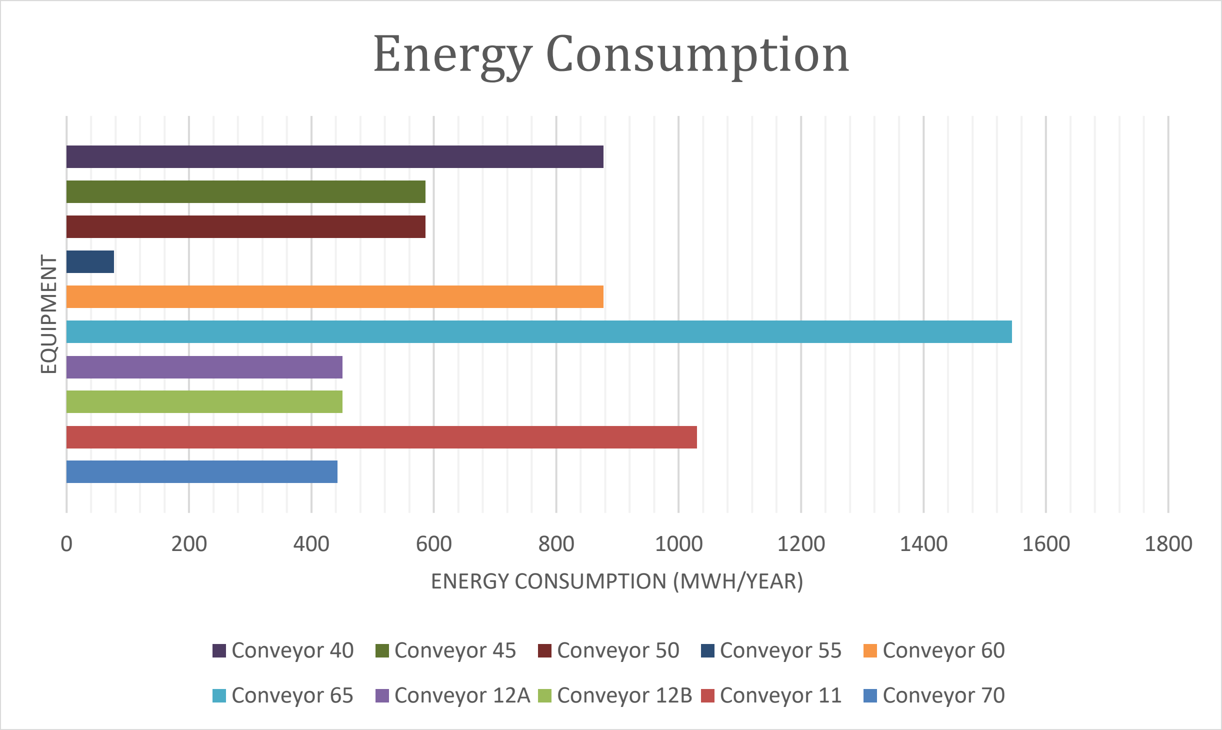
	Transformer 33	Transformer 50	Transformer 51	Transformer X3
Energy Demand (MWh/year)	4677	8586	4728	5753

Figure 5:Potash handling system ECMs energy consumption



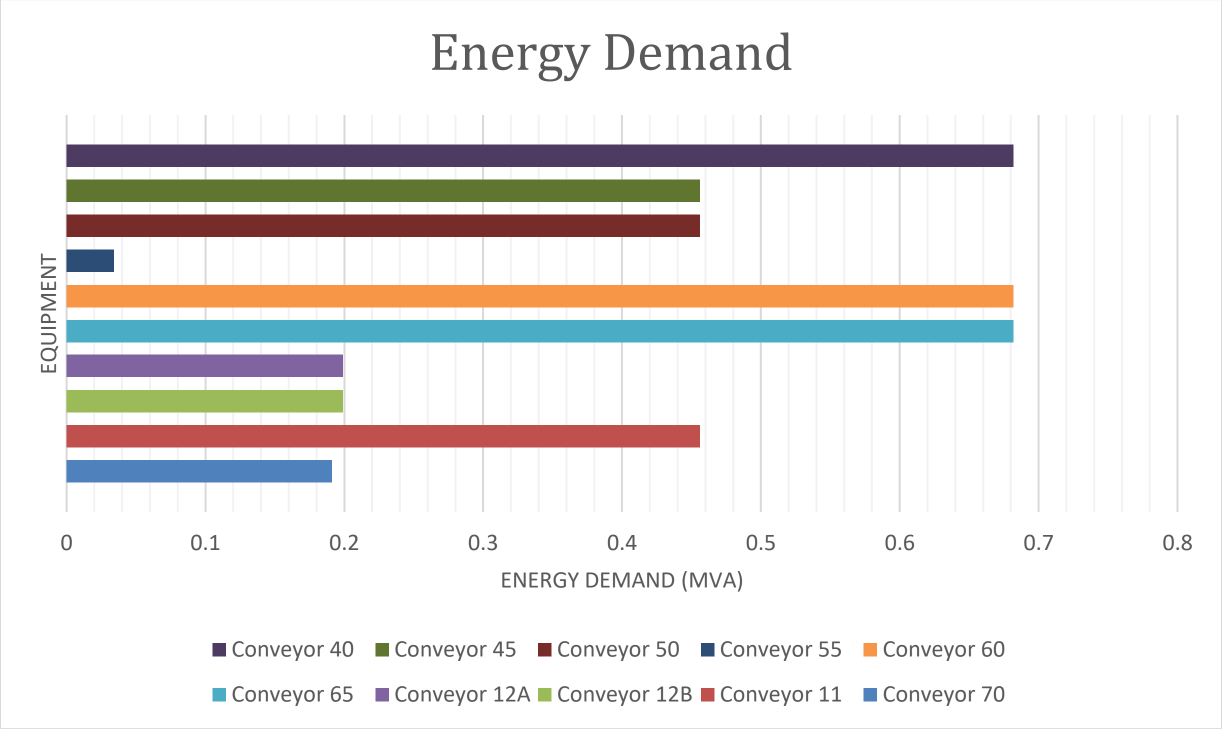
	Transformer 33	Transformer 50	Transformer 51	Transformer X3
Energy Consumption (MVA)	4.252	7.418	4.304	4.845

Figure 6:Potash handling system ECMs energy demand



	Conveyor 40	Conveyor 45	Conveyor 50	Conveyor 55	Conveyor 60	Conveyor 65	Conveyor 70	Conveyor 11	Conveyor 12 A	Conveyor 12 B
Energy Consumption (MWh/year)	877.05	586.42	586.42	77	877.05	1544.4	442.2	1029.6	451	451

Figure 7:Conveyor system ECMs energy consumption



	Conveyor 40	Conveyor 45	Conveyor 50	Conveyor 55	Conveyor 60	Conveyor 65	Conveyor 70	Conveyor 11	Conveyor 12 A	Conveyor 12 B
Energy Consumption (MVA)	0.682	0.456	0.456	0.035	0.682	0.702	0.201	0.468	0.205	0.205

Figure 8:Conveyor system ECMs energy demand

6.3. Savings

6.3.1. Equipment Selection Savings

Figure 9 illustrates the energy savings when controlling conveyor motors using VFDs vs the baseline to be approximately 1354.18 MWh/year in energy consumption which is 16.36% savings annually. Also, the demand decreases from 4.892 MVA to 4.092 MVA annually as shown in Figure 10.

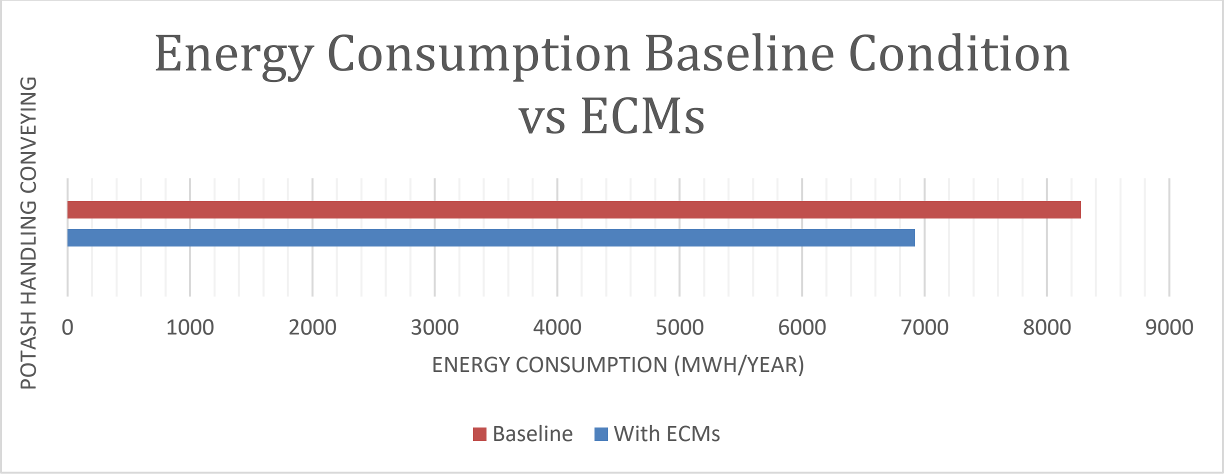


Figure 9: Conveyor system baseline vs ECMs energy consumption

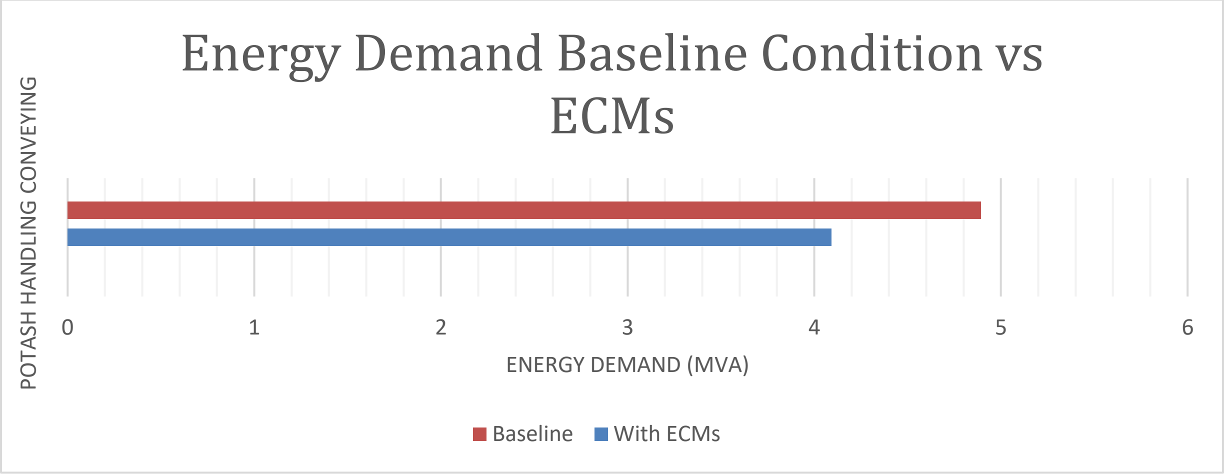


Figure 10: Conveyor system baseline vs ECMs energy demand

6.3.2. Operational Selection Savings

Figure 11 below shows a comparison of the baseline vs optimized system with ECMs. The energy consumption and demand values for the system were only taken from the supply transformers, transformer 50 and 51. Using the optimized system with ECM generates system savings of approximately 2181.64 MWh/year in energy consumption, which is 10.87% savings annually. The optimized system energy demand decreases from 13.1 MVA to 11.72 MVA annually as shown in Figure 12.

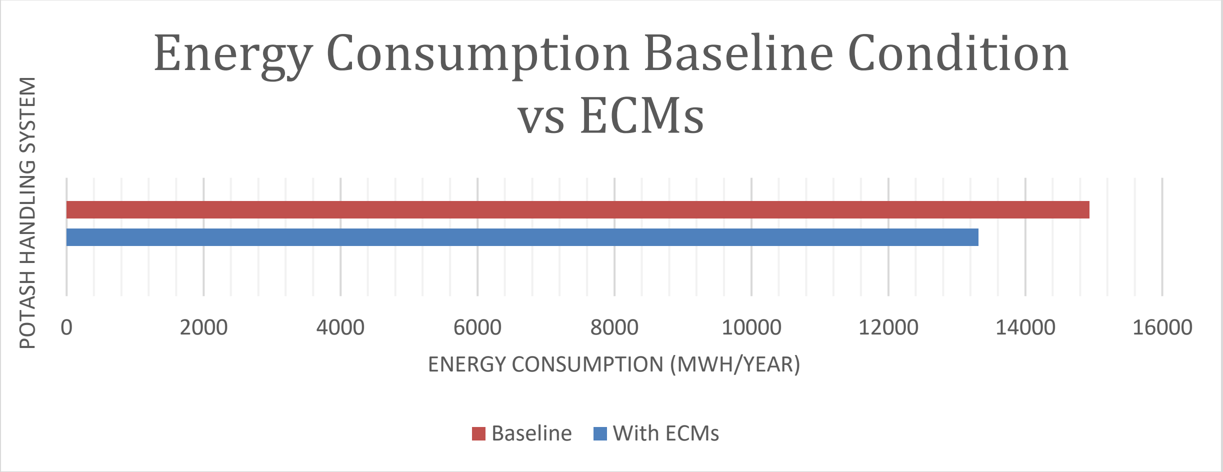


Figure 111: Potash handling system baseline vs ECMs energy consumption

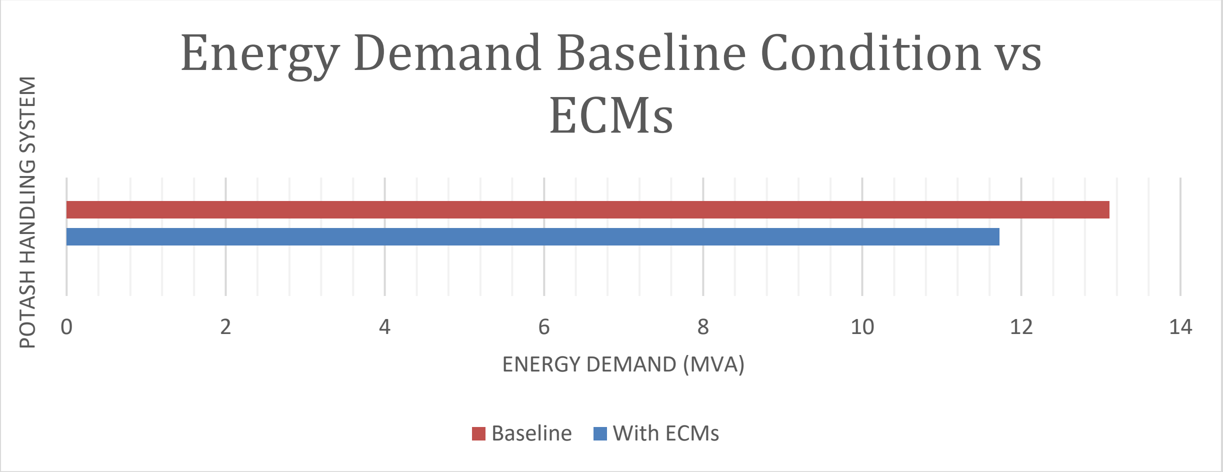
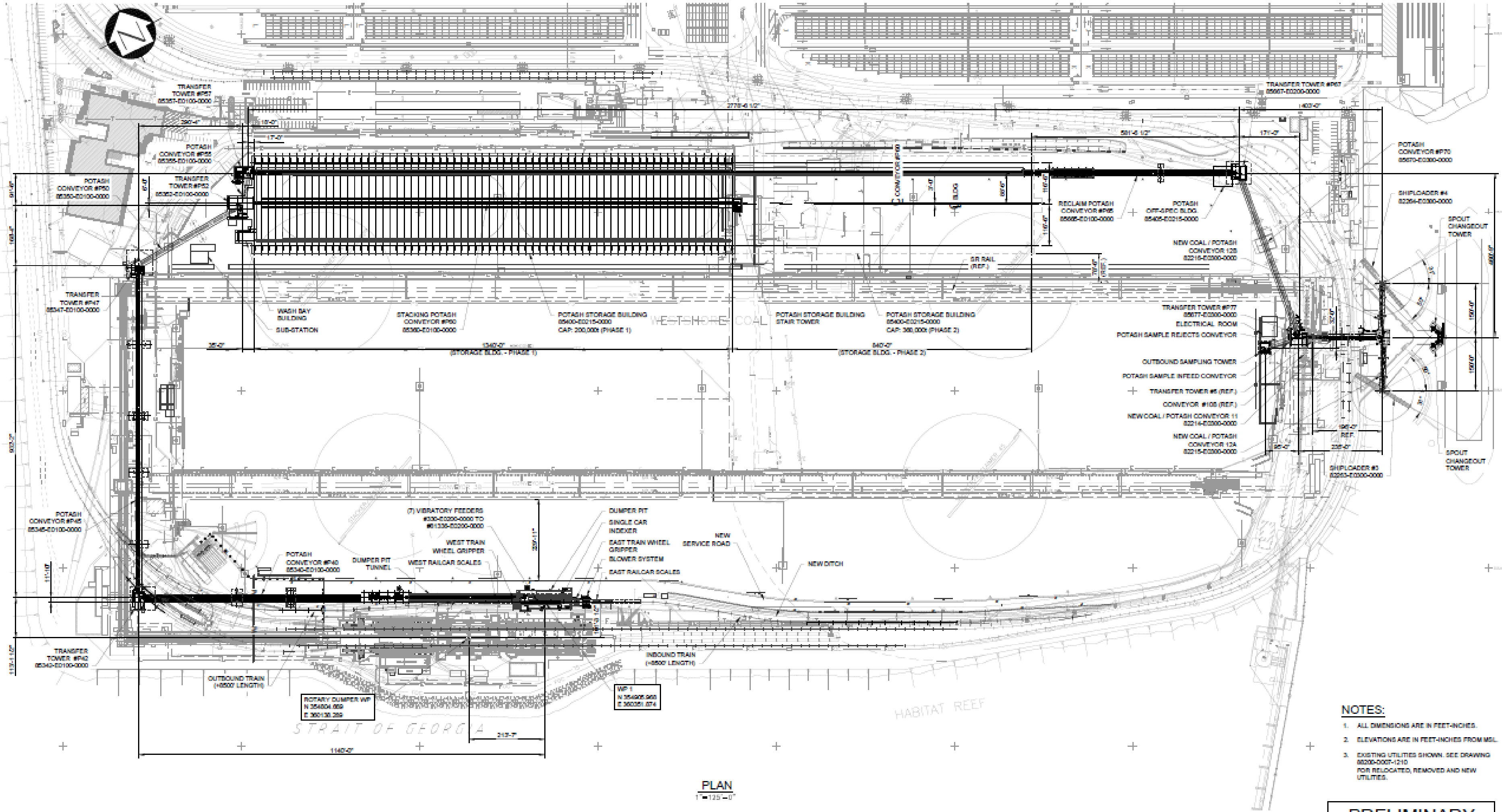


Figure 122: Potash handling system baseline vs ECMs energy demand

7. References

Authority, V. F. (2016, May). Project & Environmental Review Guidelines – Project Energy Study .Retrieved from Port of Vancouver: https://www.portvancouver.com/wp-content/uploads/2015/05/PER-Project-Energy-Study-Guidelines-FINAL-2016-05-20.pdf

8. Appendix A: Site Plan



NOTES:

1. ALL DIMENSIONS ARE IN FEET-INCHES.
2. ELEVATIONS ARE IN FEET-INCHES FROM MSL.
3. EXISTING UTILITIES SHOWN. SEE DRAWING 88200-D007-1210 FOR RELOCATED, REMOVED AND NEW UTILITIES.

PRELIMINARY
NOT FOR CONSTRUCTION

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			P8	2020-11-27	ISSUED FOR REVIEW	DOC		DOC		PMD	AJK
			P7	2020-11-13	ISSUED FOR REVIEW	DOC		DOC		PMD	AJK
			P6	2020-08-31	ISSUED FOR INFORMATION	DOC		DOC		PMD	AJK
			P5	2020-07-03	ISSUED FOR STAGE 1 REVIEW	DOC		DOC		PMD	AJK
			P4	2020-06-02	ISSUED FOR REVIEW-STORAGE BLDG & SURGE BIN MOVED 25FT SOUTH	DOC		DOC		PMD	AJK
			P3	2020-05-22	ISSUED FOR REVIEW	DOC		DOC		PMD	AJK
			P2	2020-05-07	ISSUED FOR REVIEW	DOC		DOC		PMD	AJK
			P1	2020-04-16	ISSUED FOR REVIEW	DOC		DOC		PMD	AJK
REFERENCE DRAWINGS / DESIGN STANDARDS			ISSUES / REVISIONS			* HAND INITIALS ON FILE					

DRAWN BY:
SCALE:

WestshoreTerminals

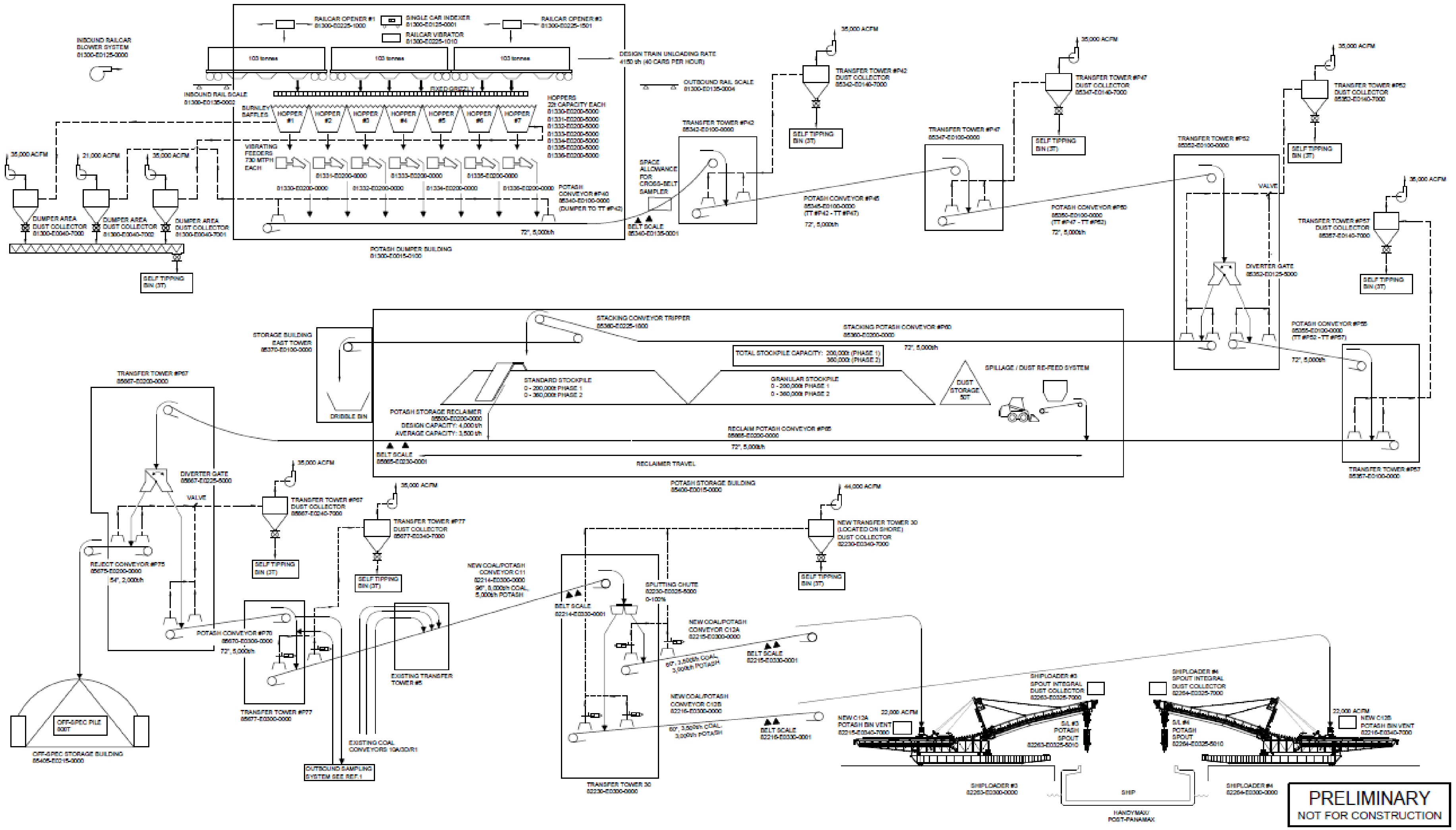
CWA PROJECT NUMBER: 19899

NEW CARGO STUDY
SITE PLAN

40101-D0000-0000 P9

ACAD FILENAME: 40101-D0000-0000
REV.

9. Appendix B: Process Flow Diagram



PRELIMINARY
NOT FOR CONSTRUCTION

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			P5	2020-11-06	ISSUED FOR REVIEW	TTH		PMD		PMD	AJK
			P4	2020-08-31	ISSUED FOR INFORMATION	TTH		PMD		PMD	AJK
			P3	2020-07-03	ISSUED FOR STAGE 1 REVIEW	TTH					
			P2	2020-05-21	ISSUED FOR REVIEW	TTH					
1	85679-D0020-0000	OUTBOUND SAMPLING FLOWSHEET	P1	2020-04-09	ISSUED FOR REVIEW	TTH					
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REFERENCE DRAWINGS / DESIGN STANDARDS			ISSUES / REVISIONS			♦ HAND INITIALS ON FILE					

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SCALE: N.T.S.

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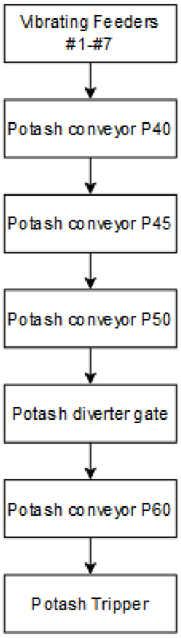
NEW CARGO STUDY
PROCESS FLOW DIAGRAM

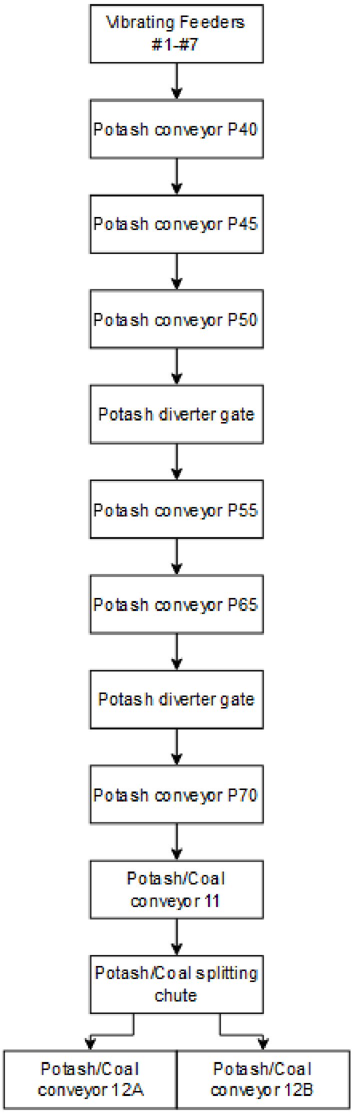
40101-D0025-0000
P6
REV.

ACAD FILENAME: 40101-D0025-0000

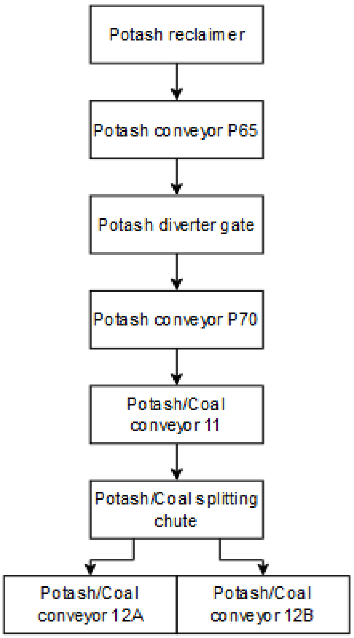
Process flow diagram for different Operational modes



Rail to Storage building process



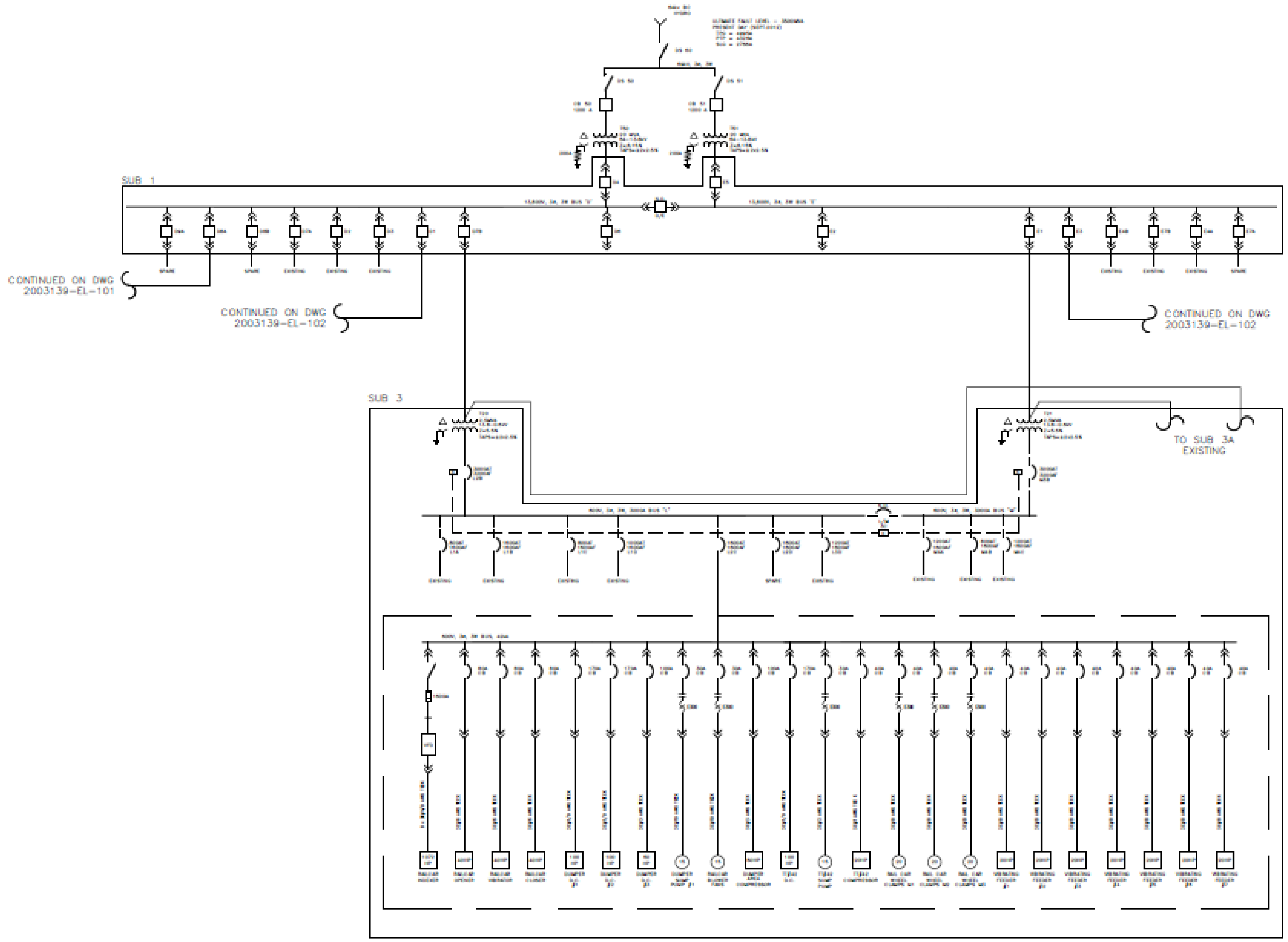
Rail to Ship process



Storage Building to Rail process

10. Appendix C: Single Line Diagram

REVISIONS			
REV	DESCRIPTION	DATE	REV BY
E	NO CHANGE	9/15/2020	VC
F	UPDATED TO EQUIPMENT LIST REV P4	10/29/2020	VC
G	UPDATED TO WTL COMMENTS	11/13/2020	VC
H	UPDATED TO BHP COMMENTS	12/15/2020	VC



POTASH EXPANSION

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WWW.ENCOMPASSGROUP.CA

Westshore Terminals Ltd.

WESTSHORE
EXPANSION PROJECT
PHASE II – STAGE 1
DUMPER SINGLE LINE DIAGRAM

DRAWN BY V.CVJETAN	PROJECT NO. 2003139	DWG NO. 2003139–EL–100	REV H
CHKD BY	SCALE No Scale	DATE 2020/04/29	SHEET 1 OF 1

REVISIONS			
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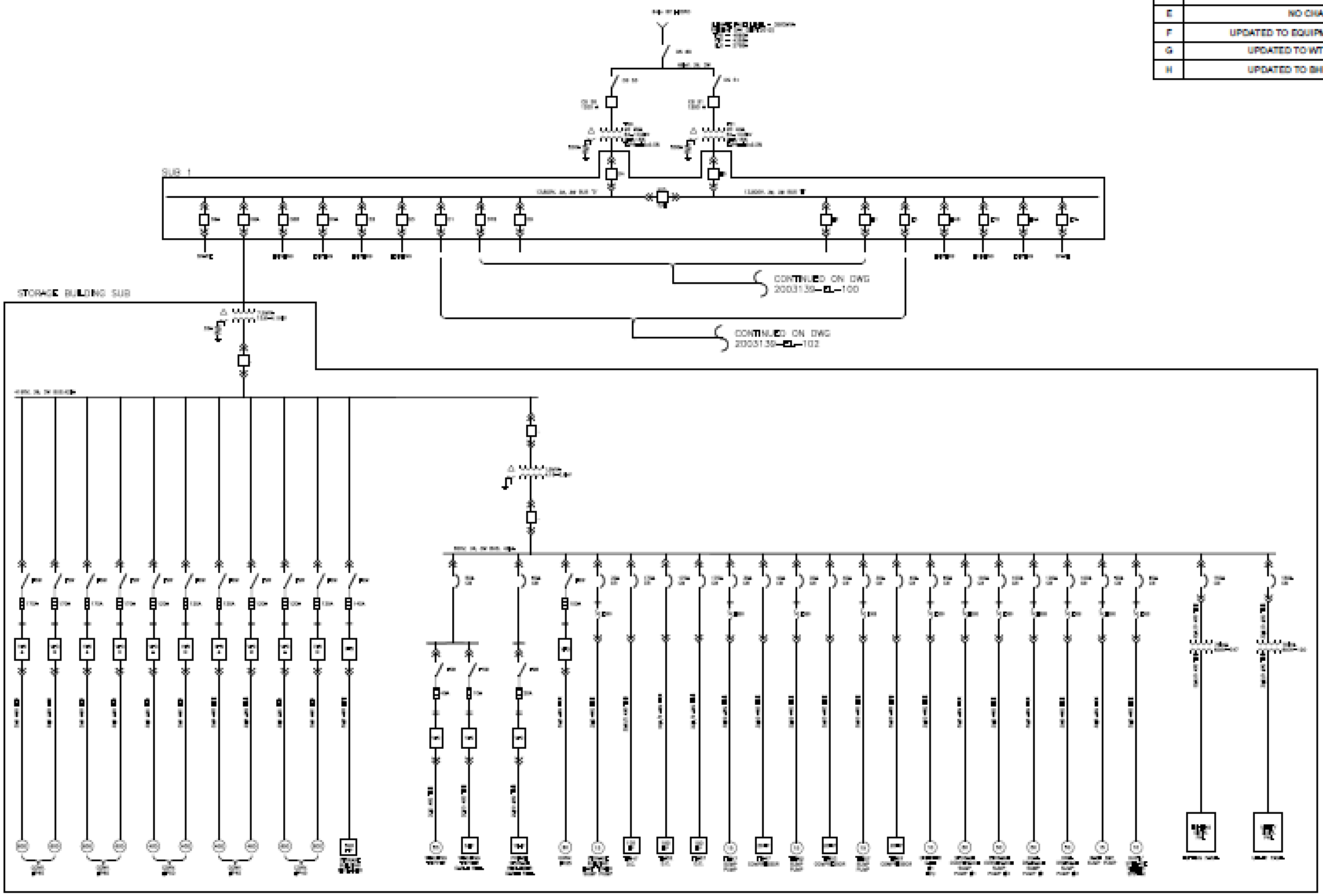

POTASH EXPANSION

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V3B 0M3
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WWW.ENCOMPASSGROUP.CA

Westshore Terminals Ltd.

WESTSHORE
EXPANSION PROJECT
PHASE II – STAGE 1
STORAGE SINGLE LINE DIAGRAM

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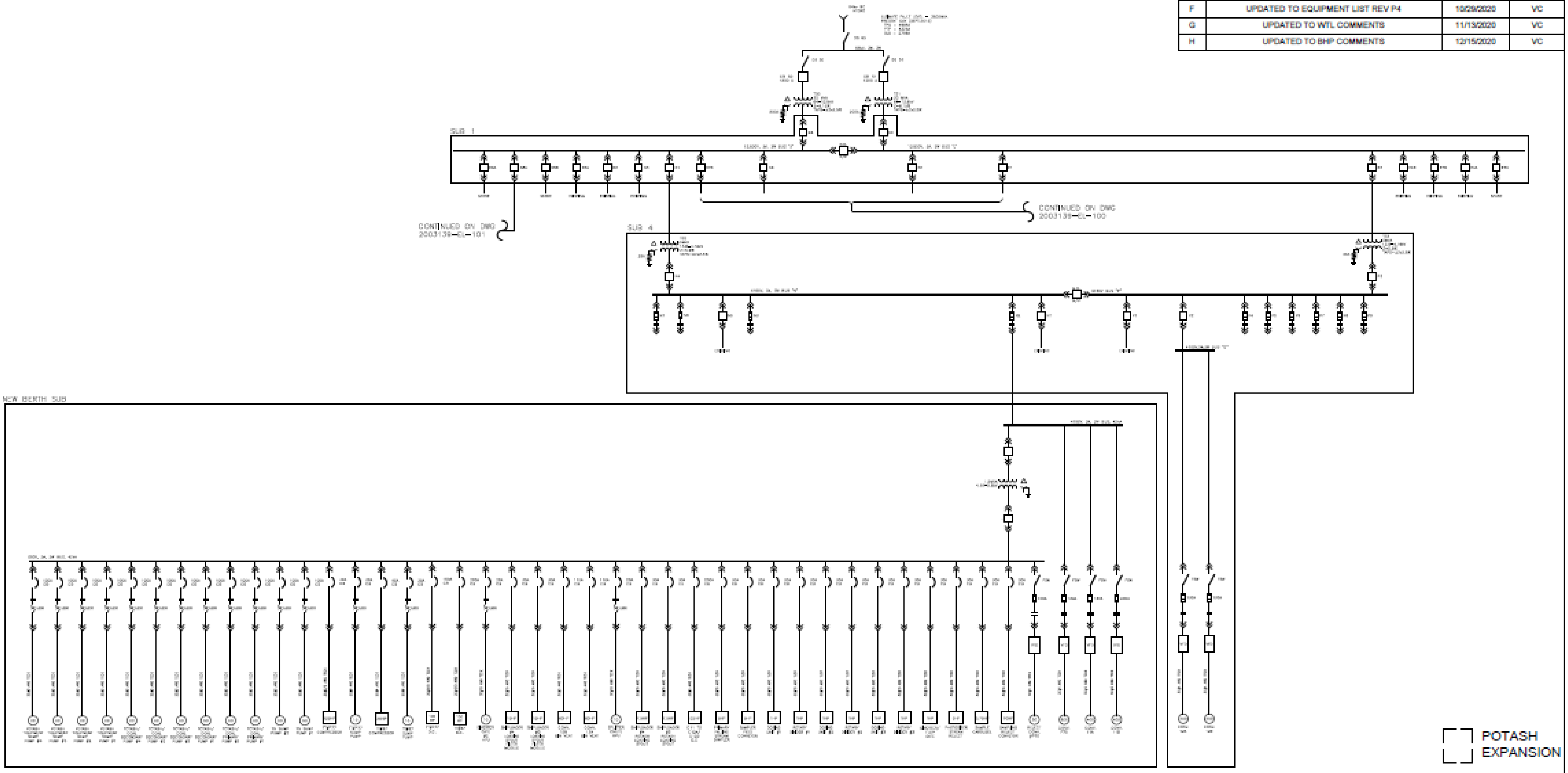
G	UPDATED TO WTL COMMENTS	11/13/2020	VC
H	UPDATED TO BHP COMMENTS	12/15/2020	VC



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Westshore Terminals Ltd.

WESTSHORE
EXPANSION PROJECT
PHASE II – STAGE 1
BERTH SINGLE LINE DIAGRAM

DRAWN BY V.CVJETAN	PROJECT NO. 2003139	DWG NO. 2003139–EL–102	REV H
CHKD BY	SCALE No Scale	DATE 2020/04/29	SHEET 1 OF 1

11. Appendix D: Easy Power Data

Equipment Calculations	Base					ECM				
Equipment	MVA	PF	MW	Hrs/Yr	MWh/Yr	MVA	PF	MW	Hrs/Yr	MWh/Yr
Conv 40 (Inbound)	0.816	0.82	0.816	1286	1049.376	0.682	0.98	0.682	1286	877.052
Conv 45 (Inbound)	0.544	0.82	0.544	1286	699.584	0.456	0.98	0.456	1286	586.416
Conv 50 (Inbound)	0.544	0.82	0.544	1286	699.584	0.456	0.98	0.456	1286	586.416
Conv 55 (Outbound)	0.042	0.82	0.042	2200	92.4	0.035	0.98	0.035	2200	77
Conv 60 (Inbound)	0.816	0.82	0.816	1286	1049.376	0.682	0.98	0.682	1286	877.052
Conv 65 (Outbound)	0.84	0.82	0.84	2200	1848	0.702	0.98	0.702	2200	1544.4
Conv 70 (Outbound)	0.24	0.82	0.24	2200	528	0.201	0.98	0.201	2200	442.2
Conv 11 (Outbound)	0.56	0.82	0.56	2200	1232	0.468	0.98	0.468	2200	1029.6
Conv 12A (Outbound)	0.245	0.82	0.245	2200	539	0.205	0.98	0.205	2200	451
Conv 12B (Outbound)	0.245	0.82	0.245	2200	539	0.205	0.98	0.205	2200	451

Dumper/Inbound Operations	Base					ECM				
Equipment	MVA	PF	MW	Hrs/Yr	MWh/Yr	MVA	PF	MW	Hrs/Yr	MWh/Yr
Transformer 50	5.542	0.83	5.542	1286	7127.012	4.855	0.946	4.855	1286	6243.53
Transformer 51	2.401	0.812	2.401	1286	3087.686	2.134	0.912	2.134	1286	2744.324
Transformer 33	2.386	0.816	2.386	1286	3068.396	2.126	0.915	2.126	1286	2734.036
Transformer X3	4.187	0.826	4.187	1286	5384.482	3.562	0.97	3.562	1286	4580.732

Remaining Reclaim/Outbound Operations	Base					ECM				
Equipment	MVA	PF	MW	Hrs/Yr	MWh/Yr	MVA	PF	MW	Hrs/Yr	MWh/Yr
Transformer 50	2.722	0.873	2.722	914	2487.908	2.563	0.926	2.563	1286	3296.018
Transformer 51	2.445	0.811	2.445	914	2234.73	2.17	0.913	2.17	1286	2790.62
Transformer 33	2.43	0.816	2.43	914	2221.02	2.126	0.915	2.126	1286	2734.036
Transformer X3	1.42	0.873	1.42	914	1297.88	1.283	0.966	1.283	1286	1649.938

Total Operations	Base		ECM	
Equipment	MVA	MWh/Yr	MVA	MWh/Yr
Transformer 50	8.264	9615	7.418	8586
Transformer 51	4.846	5322	4.304	4728
Transformer 33	4.816	5289	4.252	4677
Transformer X3	5.607	6682	4.845	5753

Dumper/Inbound Totals	
Total MWh with ECM (T50 and T51)	8987.85
Total MWh without ECM (T50 and T51)	10214.7
Total MVA with ECM (T50 and T51)	6.989
Total MVA without ECM (T50 and T51)	7.9
Operational Efficiency	12.0106
Operational ECM Energy Savings	1226.84
Total Conveyor MWh with ECM	2926.94
Total Conveyor MWh without ECM	3497.92
Total Conveyor MVA with ECM	2.276
Total Conveyor MVA without ECM	2.72
Conveyor Efficiency	16.3235
Conveyor ECM Energy Savings	570.984
Reclaim/Outbound Totals	
Total MWh with ECM (T50 and T51)	4325.96
Total MWh without ECM (T50 and T51)	4722.64
Total MVA with ECM (T50 and T51)	4.733
Total MVA without ECM (T50 and T51)	5.2
Operational Efficiency	8.39946
Operational ECM Energy Savings	954.8
Total Conveyor MWh with ECM	3995.2
Total Conveyor MWh without ECM	4778.4
Total Conveyor MVA with ECM	1.816
Total Conveyor MVA without ECM	2.172
Conveyor Efficiency	16.3904
Conveyor ECM Energy Savings	783.2

Inbound and Outbound totals	
Total MWh with ECM (T50 and T51)	13313.8
Total MWh without ECM (T50 and T51)	14937.3
Total MVA with ECM (T50 and T51)	11.722
Total MVA without ECM (T50 and T51)	13.1
Operational Efficiency	10.8689
Operational ECM Energy Savings	2181.64
Total Conveyor MWh with ECM	6922.14
Total Conveyor MWh without ECM	8276.3
Total Conveyor MVA with ECM	4.092
Total Conveyor MVA without ECM	4.892
Conveyor Efficiency	16.3622
Conveyor ECM Energy Savings	1354.18

$$Energy\ Consumption\ \left(\frac{MWh}{Year}\right) = Energy\ Demand\ (MVA) * PF * \frac{Hours}{Year}$$

$$Demand\ Reduction\ (MVA) = Total\ Load\ (MVA) - Total\ Load\ with\ ECM\ (MVA)$$

$$Energy\ Savings\ \left(\frac{MWh}{Year}\right) = Demand\ Reduction\ (MVA) * PF * \frac{Hours}{Year}$$

$$Energy\ Efficiency\ (\%) = \frac{Demand\ Reduction\ (MVA)}{Total\ Load\ (MVA)} * 100\%$$