

Enbridge Mainline System Overview

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Meet our speakers



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Agenda

Enbridge Mainline System Overview

Marlon Samuel

- Overview
- History
- Mainline Service
- How we Operate
- Operational Principles

Optimizing the Mainline

Trent Tetzlaff &
Laszlo Varsanyi

- How we Optimize
- Optimization Examples
- Mainline Contracting and Optimization (Laszlo Varsanyi)

Mainline Nominations and Allocation Processes

Trent Tetzlaff &
Laszlo Varsanyi

- Nomination and Verification Procedures
 - Apportionment
 - Schedule Change Requests
 - Overview of Mainline Contracting and Mainline Operations (Laszlo Varsanyi)
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Mainline System Overview [★]

Marlon Samuel

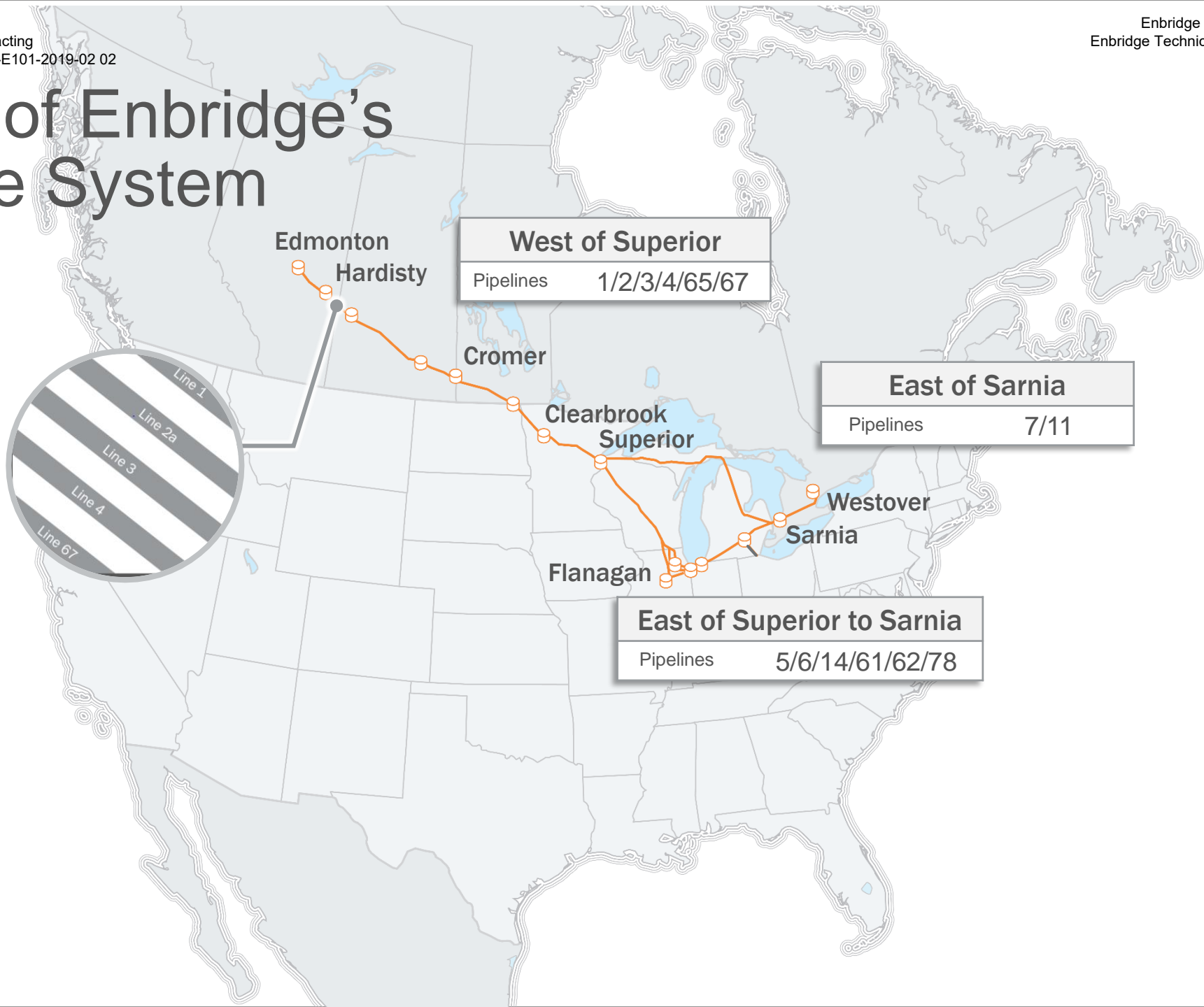


Enbridge Mainline: One of the world's most complex oil pipeline systems

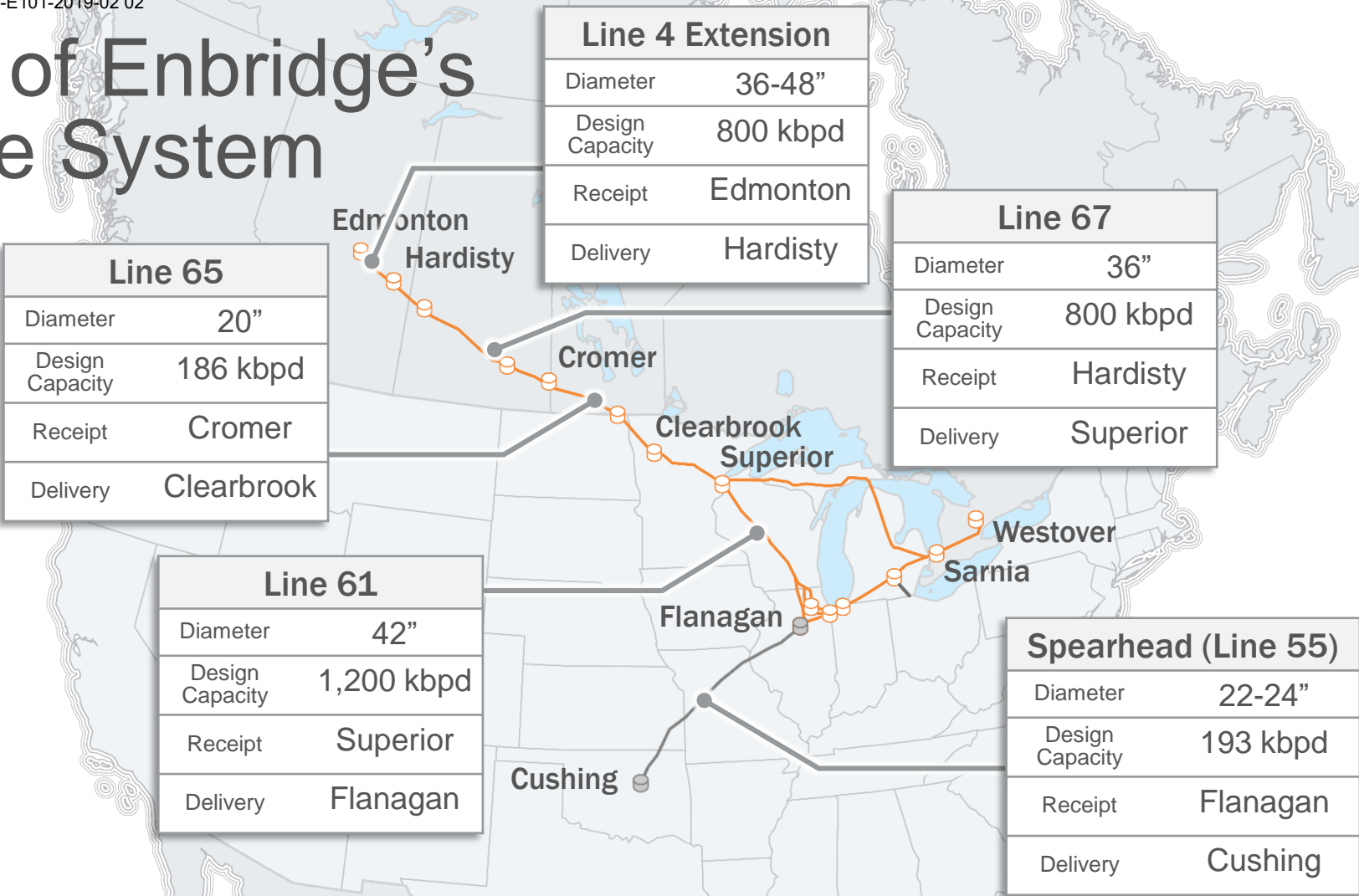
- Integrated system
- Comprised of the Canadian Mainline and the Lakehead System in the United States
- 8 pipelines in Canada and 12 pipelines in the United States
- Approximately 26,000 km of oil pipelines across North America
- Moves over 2,700 kbpd of petroleum products out of Western Canada
- Transports 47 different commodities to numerous markets across North America
- Serves a variety of shippers, including Producers, Refiners, and Marketers



History of Enbridge's Mainline System



History of Enbridge's Mainline System



2006 - 2010

History of Enbridge's Mainline System

Line 67 build back	
Diameter	36"
Design Capacity	800 kbpd
Receipt	Edmonton
Delivery	Hardisty

Southern Access Extension (Line 63)	
Diameter	24"
Design Capacity	300 kbpd
Receipt	Flanagan
Delivery	Patoka

Line 62	
Diameter	22"
Design Capacity	235 kbpd
Receipt	Flanagan
Delivery	Griffith

Line 9 Re-reversal	
Diameter	30"
Design Capacity	300 kbpd
Receipt	Sarnia
Delivery	Montreal

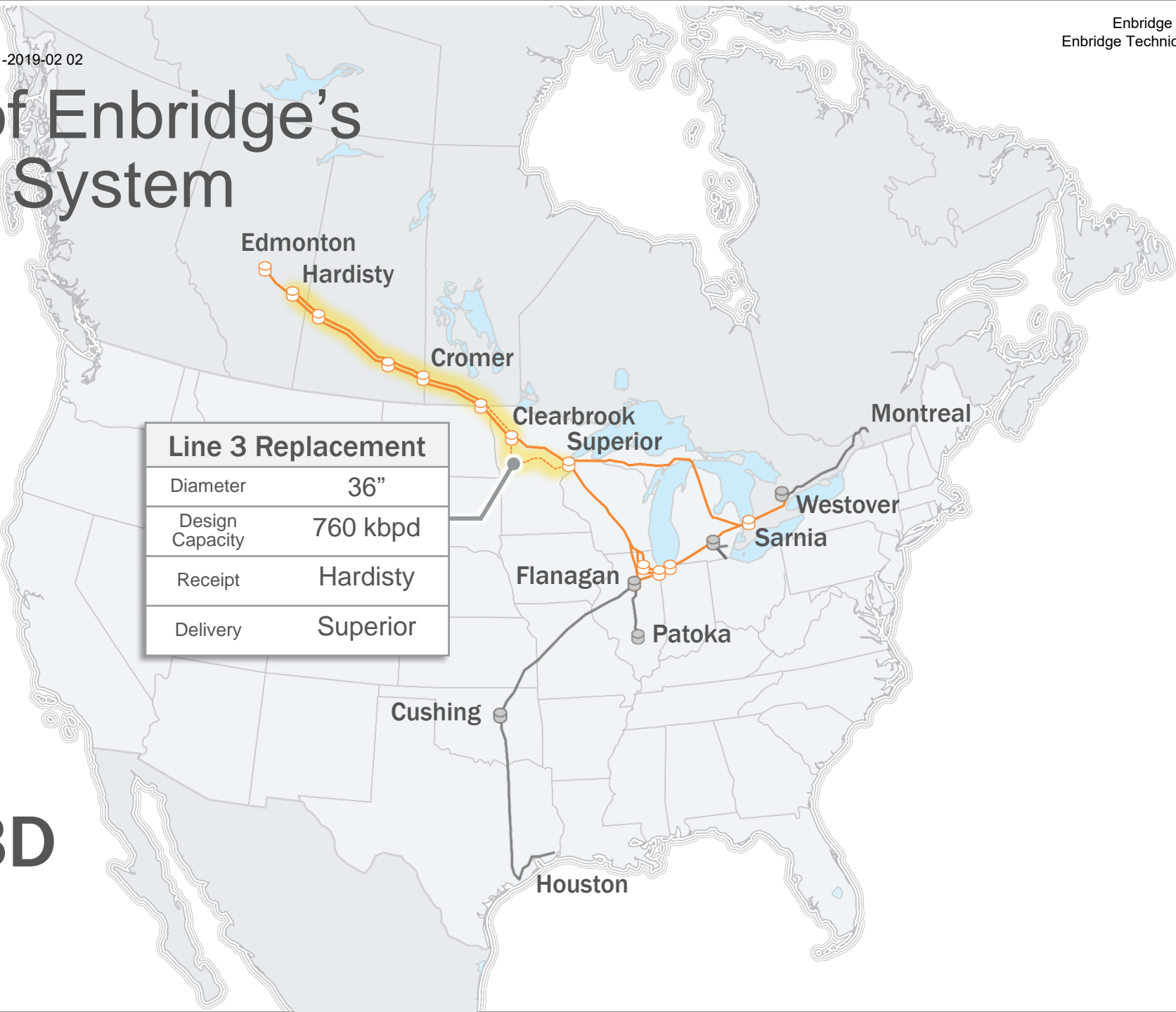
Line 79	
Diameter	16"
Design Capacity	80 kbpd
Receipt	Stockbridge
Delivery	Detroit

Line 78	
Diameter	30/36"
Design Capacity	570 kbpd
Receipt	Flanagan
Delivery	Sarnia

Flanagan South Pipeline (Line 59) & Seaway Pipeline (Line 60)	
Diameter	22-24-30"
Design Capacity	650 (L59)/950(L60) kbpd
Receipt	Flanagan
Delivery	USGC

2013 - 2015

History of Enbridge's Mainline System



Date: TBD



Enbridge Mainline Service

Enbridge provides transportation services to Shippers

- Does not own the products that are transported
- Tankage is used for operational purposes only

Main facilities used to provide service:

- Pipelines
- Pump Stations
- Terminals - including operational tankage



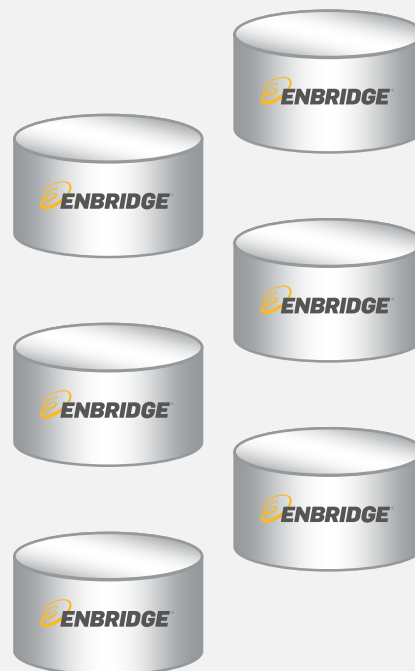


System Operational Tankage

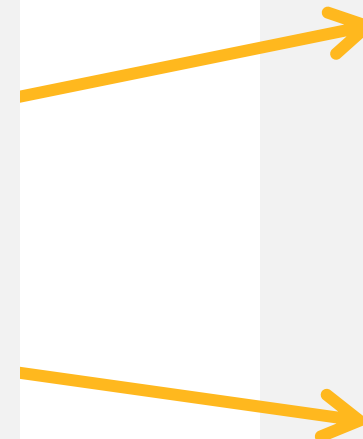
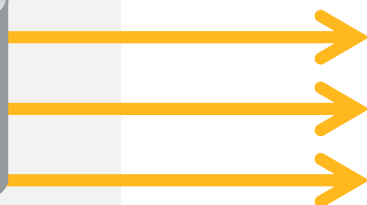
Receipt Tankage



Breakout Tankage



Delivery Tankage







Enbridge Mainline Service

Enbridge transports 5 main product types/grades:

- Natural Gas Liquids
 - Refined Products
 - Light Crude Oil
 - Medium Crude Oil
 - Heavy Crude Oil
-
- Within each product class there are different commodities, each with different characteristics
 - It is important to Enbridge shippers that their products retain their distinct quality characteristics
 - To meet this shipper requirement, Enbridge must segregate different product types and commodities in the pipelines and tankage

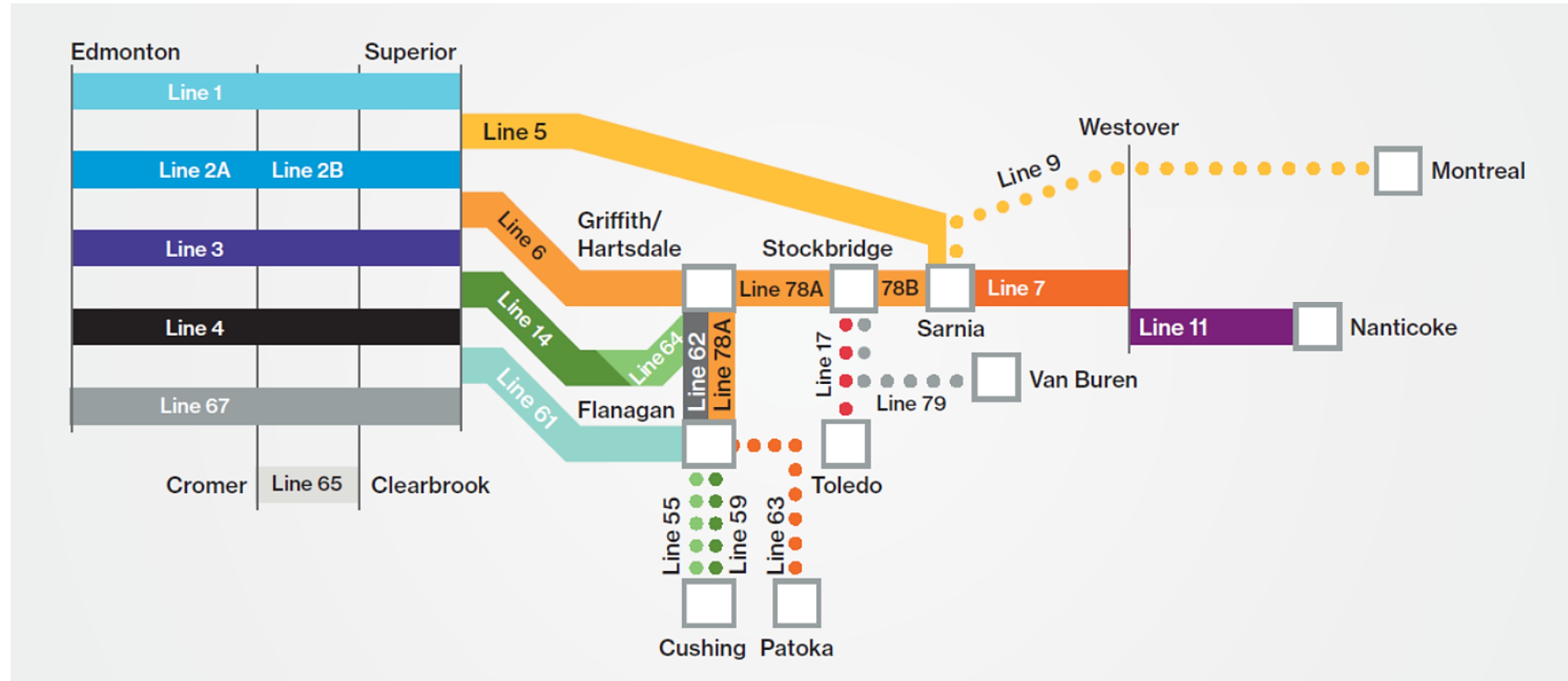




Pipeline transportation service

Crude Segregation by Lines

For operational and quality reasons, certain pipelines can only transport specific products, while other pipelines have a greater range of flexibility



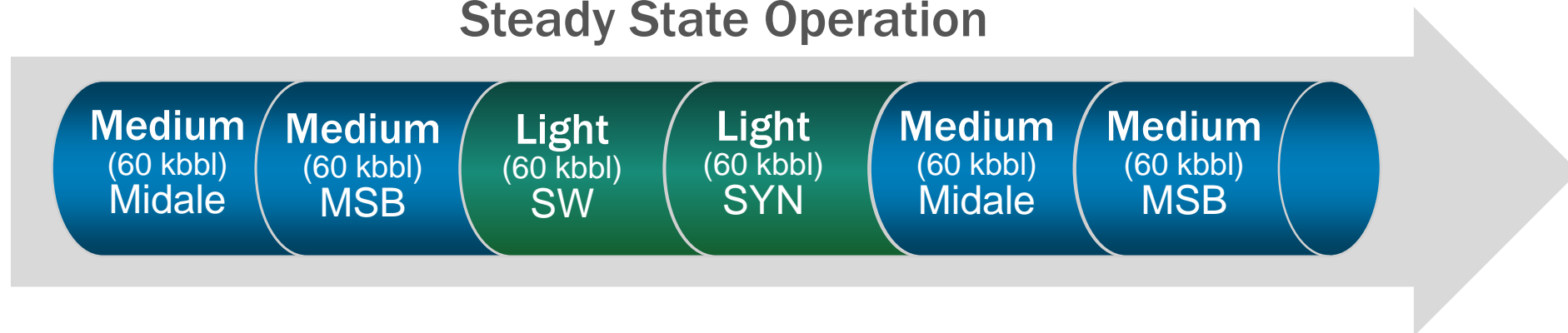


Importance of a Batched System

The Enbridge Mainline is a batched system

- A batched system allows multiple grades and commodity types to be moved in the same pipeline while maintaining their distinct characteristics and qualities.
 - This differs from a common stream system, where all of the crude transported is of similar grade and commodity and is therefore commingled
- Mainline transports 47 different commodities – each is transported as a separate batch
- Batches are required to be transported in a certain order to ensure steady state operation and maintain quality

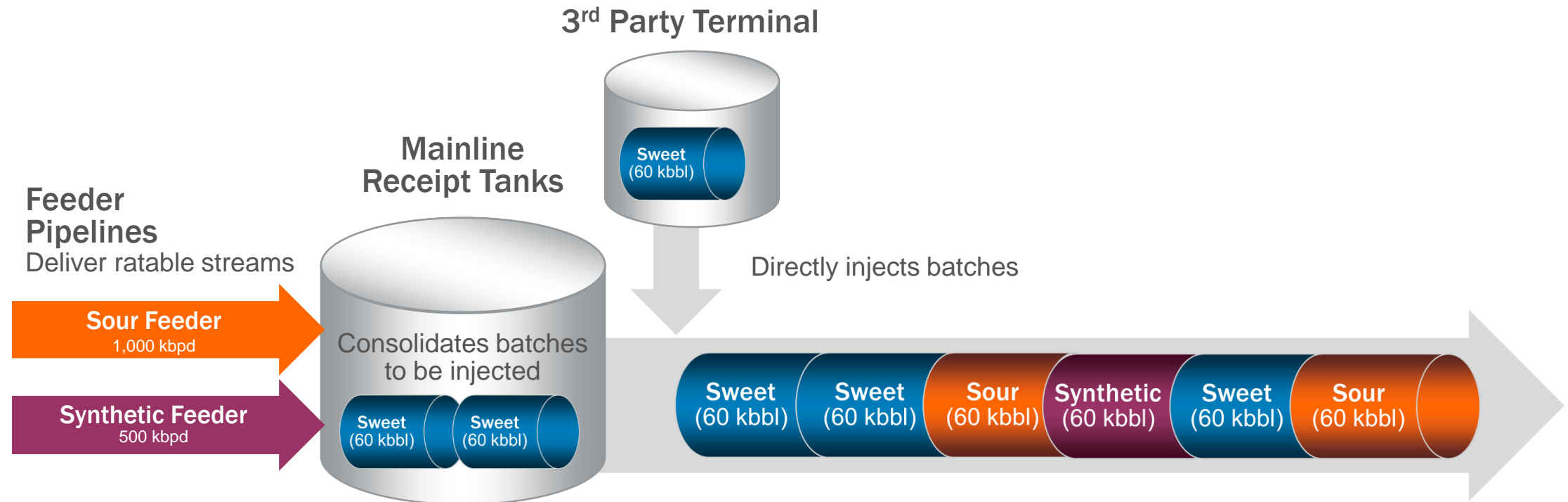
Steady State Operation





Receiving Crude

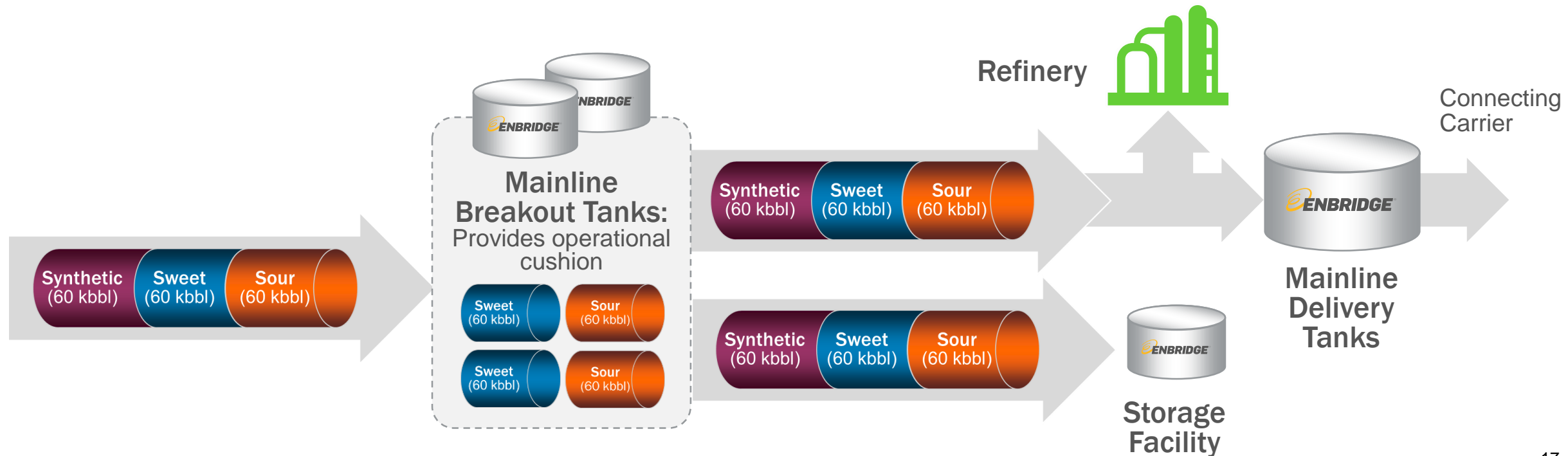
- Products are received at multiple terminal locations into receipt tankage, batched and injected onto the Mainline system
- 3rd parties that meet Mainline capacity requirements can also directly inject onto the Mainline system





Transportation and Delivery on our Pipelines

- Products continue to move segregated through the system in batches in order to optimize quality
- Depending on location, batches can run through multiple operational breakout tanks
- Product is then delivered to customer, either directly off the line or at times through Delivery tankage to the final destination





Operational Principles

Mainline operations are designed to meet these key principles:

- Safety
- Crude Quality
- Ratability
- Reliability
- Throughput
- Optimization



Heavy	Light
AHS	OSC
AVB	OSD
AWB	PSY
BHB	SSX
CHV	SW
CL	SYN
KDB	CRW
PDH	
PXB	Medium
SH	MSB
SHB	
SMA	Other
SSS	NGL
SYB	RP
WDB	

Line 1, 2A, 3, 4, 67

Hardisty	
Heavy	Light
AWB	HSC
BHB	SW
CDB	SYN
CHV	
CL	Medium
FRB	MSB
HDB	BSS
KDB	
OCC	
OSH	
PBS	
PCH	
PDH	
SHB	
SMA	
SYB	
WCS	
CHS	
CHT	
CHY	

Kerrobert	
Heavy	Light
AWB	SW
CHV	
CL	Other
	NGL

Cromer	
Medium	Light
M	SW
LSB	UHC
Other	
NGL	

Eastern Region	
Markets Served	Eastern Canada and PADD I
Main Feedstock	8 Refineries
Extension Pipelines	Line 9

Regina	
Heavy	Light
PCH	LSB
	NSA
Other	SW
RP	UHC

Clearbrook	
Light	
UHC	

Market Access Region	
Markets Served	USGC Patoka Cushing
Egress Available	1,150 kbpd
Extension Pipelines	SAX FSP Spearhead

Central Region	
Markets Served	PADD II
Main Feedstock	10 Refineries
Extension Pipelines	Mustang MOJO Toledo

↑ Injection location
↓ Delivery location

Mainline Overview

In-Month Management Activities Key Levers for Optimization

Trent Tetzlaff & Laszlo Varsanyi



Continuous Management

Keys to Success

Key operating principles of **safety, quality, ratability, reliability, throughput and optimization** are met through continuous management and balancing of operational considerations to achieve **steady state operation**

Key Considerations

Prior to Month	In Month
<ul style="list-style-type: none">• Supply and delivery verification	<ul style="list-style-type: none">• Quality
<ul style="list-style-type: none">• Pipeline allocation of shipper nominations	<ul style="list-style-type: none">• Minimizing downtime
<ul style="list-style-type: none">• Line capacities	<ul style="list-style-type: none">• Optimizing power
<ul style="list-style-type: none">• Terminal movements	<ul style="list-style-type: none">• Window optimization
<ul style="list-style-type: none">• Optimization of planned maintenance	<ul style="list-style-type: none">• Optimizing throughput
<ul style="list-style-type: none">• Power planning	<ul style="list-style-type: none">• Managing customer needs – Ratability and Reliability



Continuous Management

Quality Overview – Grades Transported

Enbridge transports 47 different commodities

- Commodities are received from the 9 receipt locations
- Commodities are then grouped and transported to their destinations as 47 different transport commodities
- Target batch size is 60kbbbl
- Required to minimize interfaces and meet meter and sampling specifications

Light Synthetic	Sour	Heavy	Dilbit	Synbit	Cracked
PSY	MSB	PCH	KDB	SYB	OCC
SYN	LSB	CHV	FRB	SMA	PBS
HSC	M	CL	AWB	CHY	Other
SSX	UOM	WCS	BHB	Heavy Low Resid	
NSA	Condensate	AHS	CDB		SSS
OSC		WHB	CNX	OSH	
OSD	CRW	ARB	PDH	AVB	
Sweet	OSN	UVM	SH		
		CHS	SHD		
			WDB		
			AMH		
			CHT		
MSW			PMH		
UHC					
UHL					
UHM					

Precise Batch Cuts to Preserve Quality

Enbridge closely monitors each receipt and delivery location and utilizes strategies to minimize degradation and contamination

In-line management:

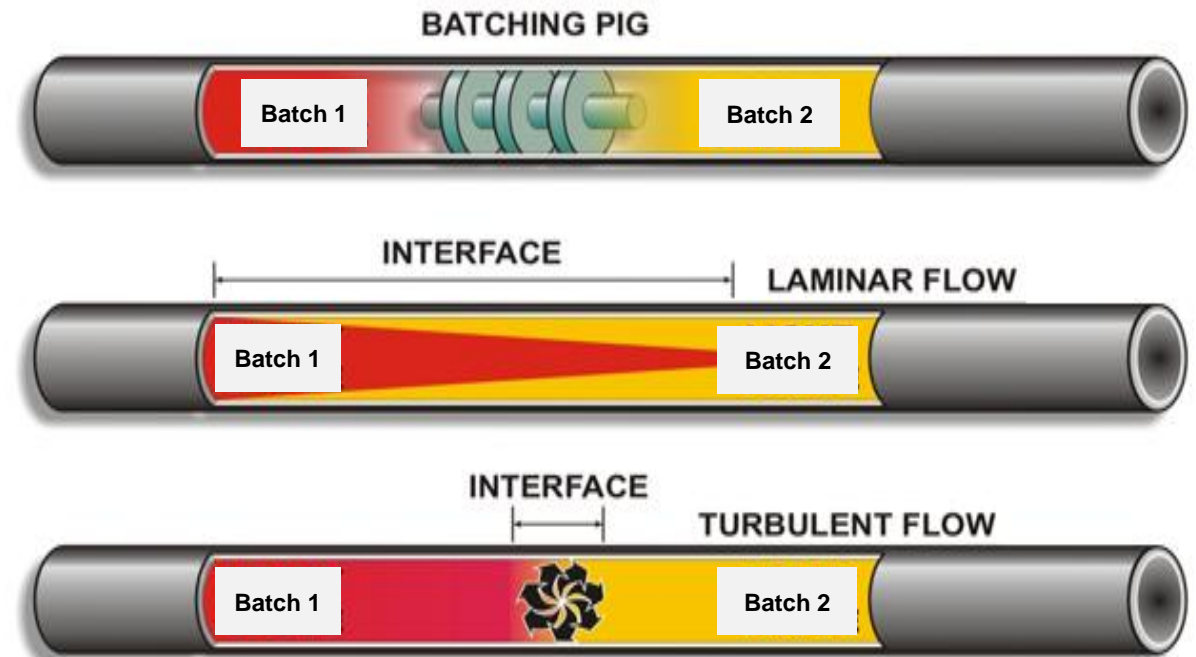
- Three types of operations that impact batch interfaces:
 - Pigging
 - Laminar flow
 - Turbulent flow (main focus)

Batch Swings

- Realtime tracking of density and viscosity inputted into batch cut tool to minimize degradation and contamination

Terminal Management

- 11 breakout terminals use table 5¹ guidelines - best efforts to minimize batch commingling



¹Table 5 is Enbridge's guidelines for commingling



System Maintenance

- Maintenance is executed considering Canadian and Lakehead systems together, including considerations for production and demand for Canadian and US refineries to minimize impacts
- Aligned with industry, outages at refiners and feeders occur in conjunction

Example of Line 4:

- 80 critical maintenance activities completed in a 24 hour window across 3 provinces and 2 states
- Minimized throughput loss by more than 1,000,000 barrels as compared to historical execution



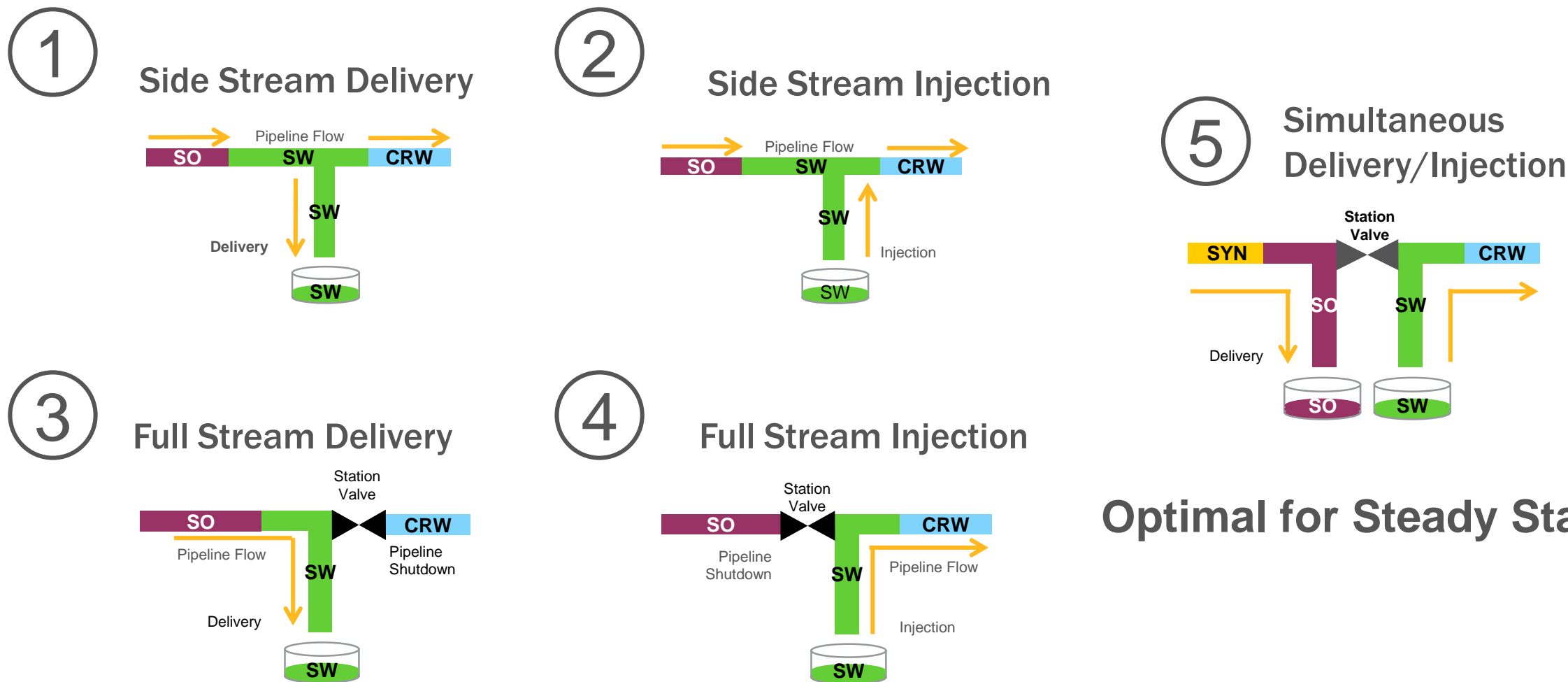


Ensuring Optimized Steady State Operation

- Understanding maintenance is key
 - Target minimizing planned/unplanned outages therefore less pipeline starts/stop
- Crude oil is different than gas
 - Not fungible or compressible
 - Every barrel must have a designated home prior to being injected
- All products are scheduled to a destination prior to injection
 - Batch from Edmonton destined for Chicago with 20 day transit, supply and destination position evaluated prior to injection from Edmonton
 - Transit time on our system can vary from 2 days to approximately 30 days

Midstream Operations

5 main types of operations can occur at midstream receipt/delivery sites



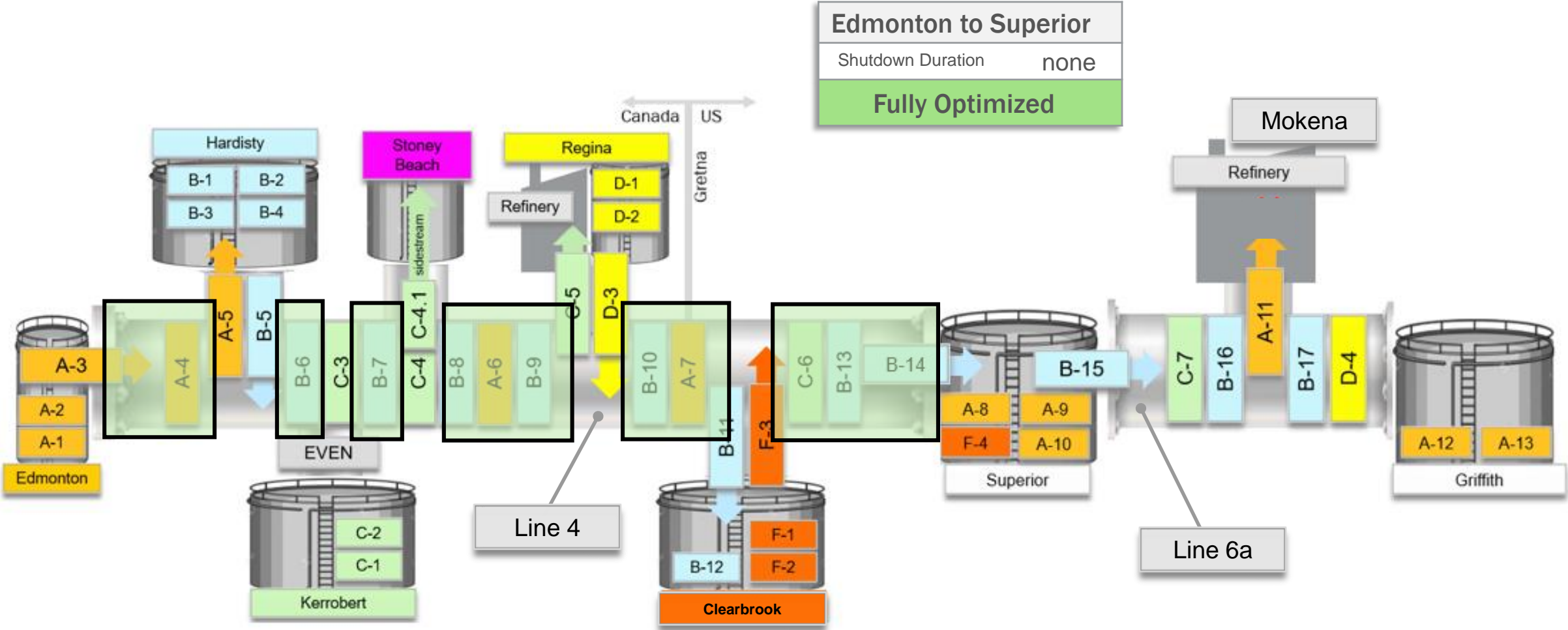
Optimal for Steady State



Line 4 Example: Scheduling Optimization

Fully Optimized

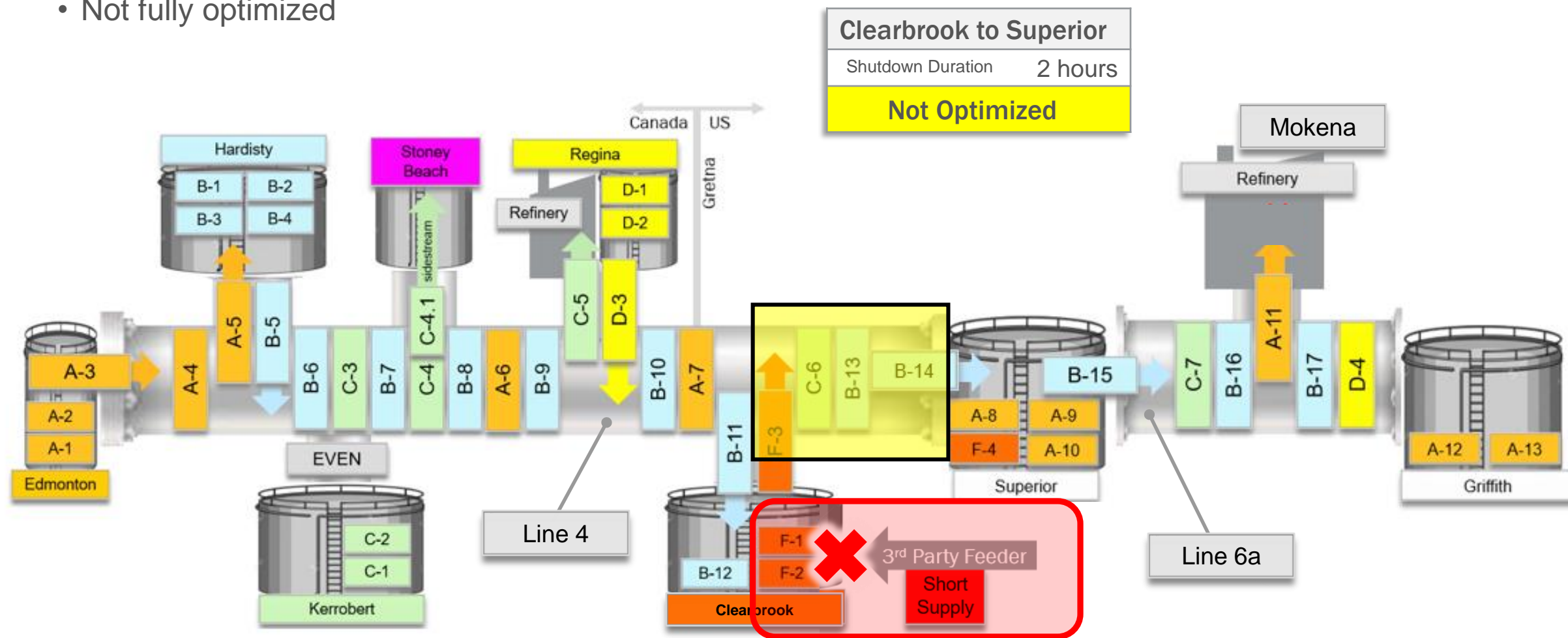
- Segments operating at 100% utilization



Line 4 Example: Feeder Constraint

Importance of feeder verification

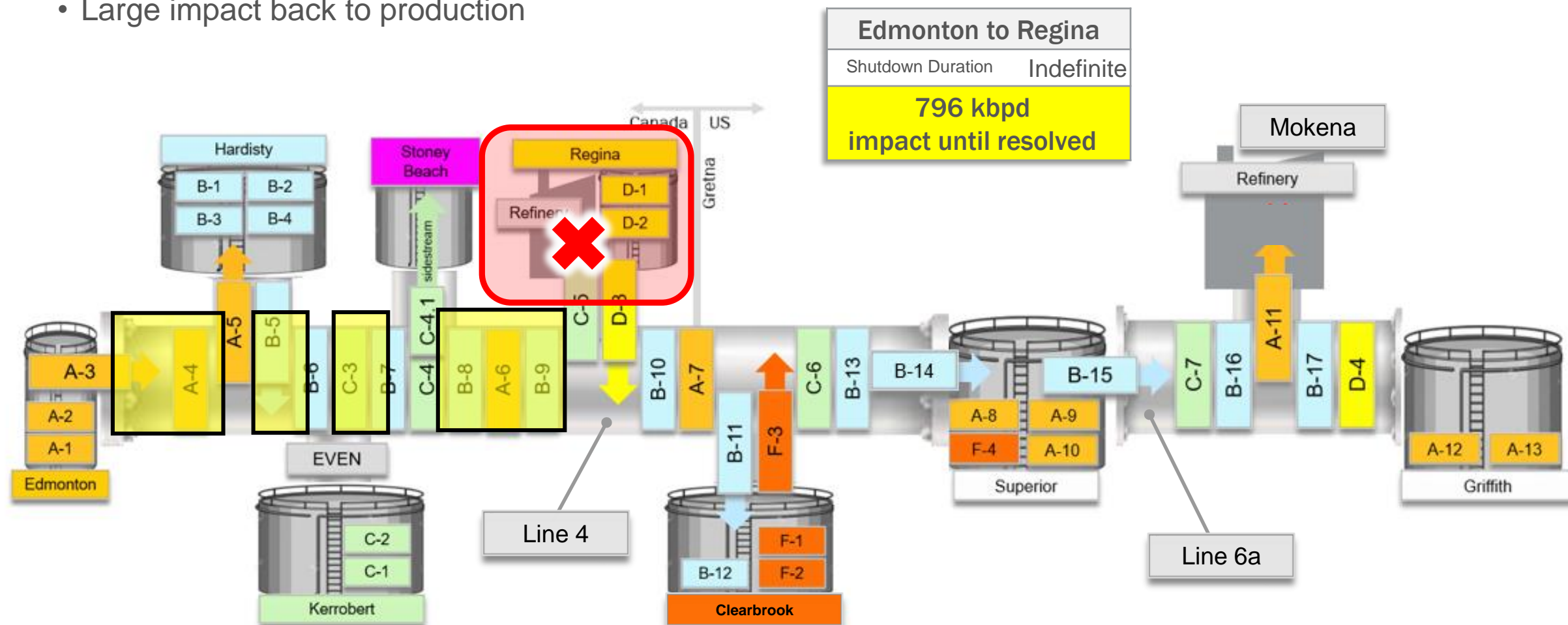
- Example of shortage of supply
 - Short notice injection change or shortage of feeder volume
- Not fully optimized



Line 4 Example: Destination Constraint

Importance of destination verification

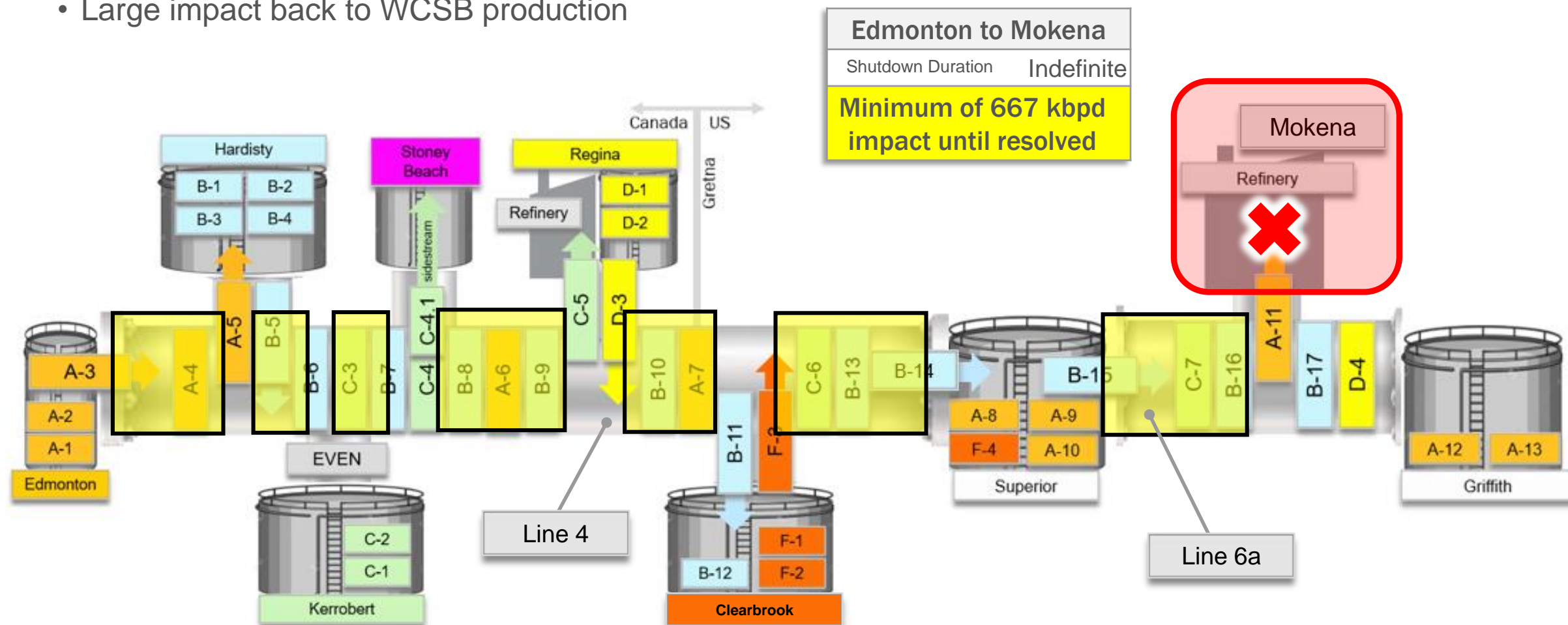
- Example of delivery facility not accepting volume
 - Short notice of failure to accept delivery
- Large impact back to production



Line 4 and 6a Example: Destination Constraint

Importance of destination verification

- Example of delivery facility not accepting volume
 - Short notice of failure to accept delivery
- Large impact back to WCSB production



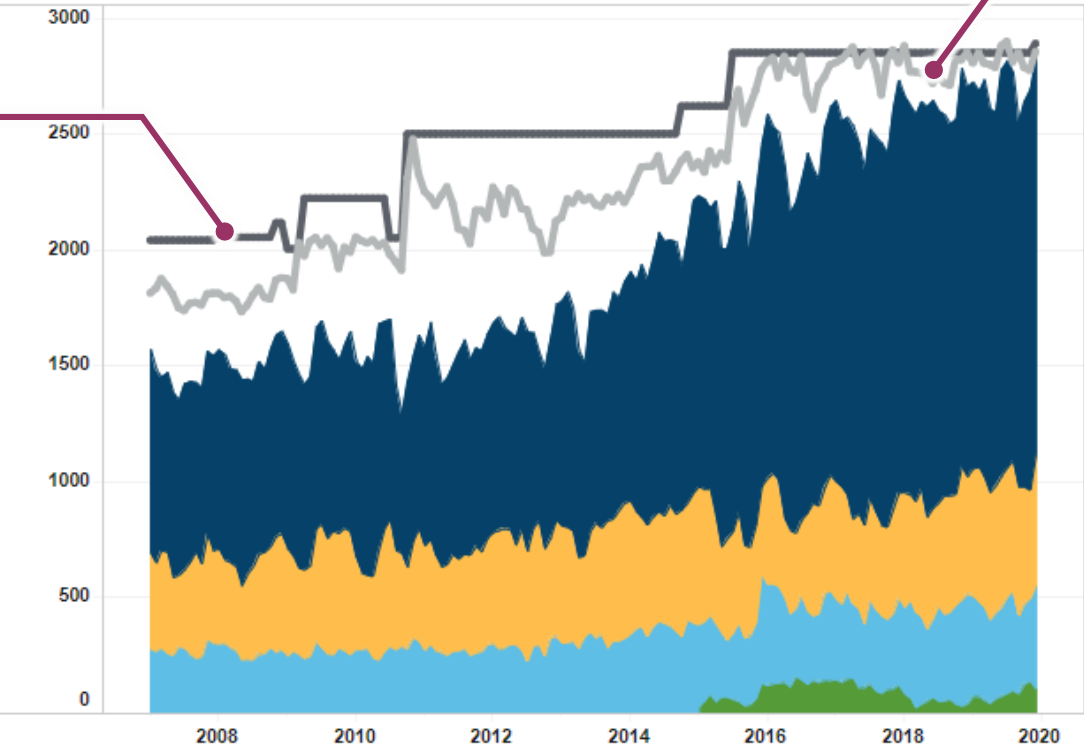


Throughput Optimization

Nameplate
Annual
Capacity

Available
Capacity

Key Point: ex-Gretna - Monthly flow



Annual flow

	domestic heavy	domestic light / n..	foreign light
2019	1,680	938	85
2018	1,685	893	51
2017	1,639	769	121
2016	1,490	780	135
2015	1,341	782	61
2014	1,118	876	
2013	937	801	0
2012	871	776	
2011	861	694	
2010	839	698	
2009	830	732	
2008	849	673	
2007	791	668	

Select date:

January 2007 December 2019

- domestic heavy intracanda / export
- domestic light / ngl intracanda
- domestic light / ngl export
- foreign light import

All units in thousands of barrels per day



Mainline Contracting - Hauls

4 Service Haul Segments:

1. Edmonton to Hardisty ("E2H")
 2. Short Haul – Western Canada receipt and delivery points
 3. Medium Haul – Western Canada receipt points with deliveries to Clearbrook and Superior
 4. Long Haul – Western Canada receipt points to delivery points ex Western Canada (Gretna) including Eastern Canada
- Shippers can contract from Edmonton or Hardisty
 - Edmonton – Contract volumes for receipt at Edmonton
 - Hardisty – Contract volumes for receipt at any applicable Western Canadian receipt point downstream of, and including, Hardisty
 - Maintains current point to point tolling
 - Crude Petroleum Shippers can ship either condensate, light, medium, or heavy barrels to fulfill their contracts



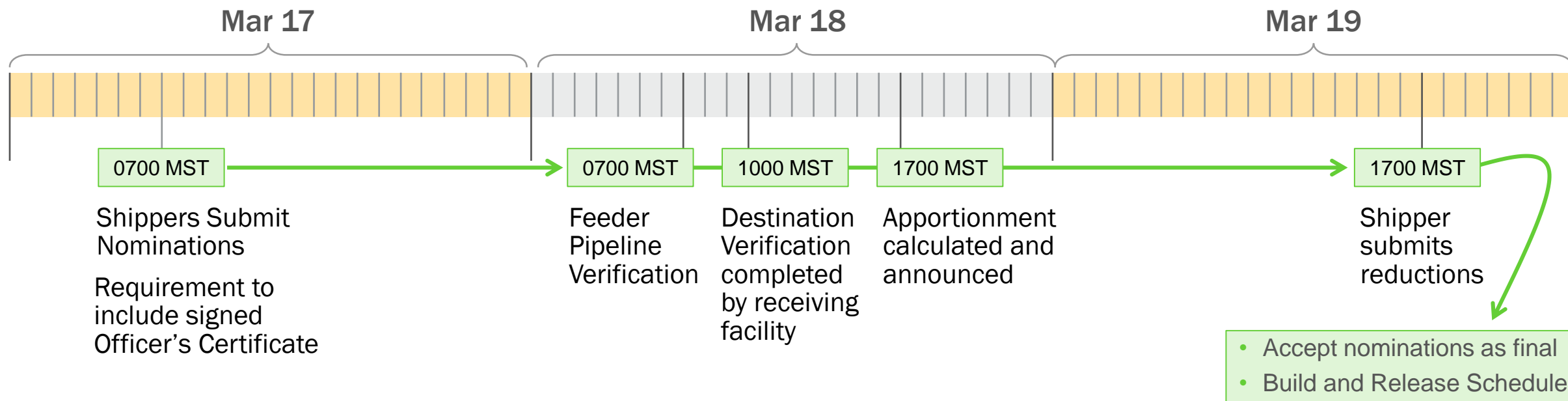
Enbridge designed the Service Hauls/Segments to take into account how the Enbridge Mainline System is used today

Details on Mainline Nomination & Allocation

Trent Tetzlaff and Laszlo Varsanyi



Nominations Timeline



- Enbridge sets the nomination deadline one year in advance
- Monthly schedule is released minimum of 2-4 days prior to month-start
- Line Space Queue opens when monthly schedule is released
 - Calls for Crude and Line Space Queue act as a supplement to nominations to fill the underutilized pipeline space on pipelines that are not apportioned



Nominations Submission

Current Process:

- Each shipper submits nominations including the following details via our Swiftlink online shipper portal:
 - Commodity Grade
 - Receipt location and feeder
 - Destination location and facility
 - Volume
 - Valid credit for Enbridge Mainline approved by Enbridge credit group



Additional Information needed with Mainline Contracting:

- Which contract shipper is nominating to
- If shipper is nominating any committed or uncommitted volume



Shipper Certificate

Enbridge requires each shipper to submit a
Canadian Mainline Upstream Verification Officer's Certificate

This certificate is signed by an officer of the company and confirms that the shipper:

- Has the capability and intent to tender each crude type and has not inflated its nomination to factor in any apportionment
 - If allocated the space, intends to deliver the barrel to Enbridge
 - Has taken into account all other commercial arrangements
- Has **not** included any volume that:
 - Has been nominated to alternative pipeline, rail or terminal
 - Has been sold to another party
- For calculating their available supply, considers:
 - for production – intends to produce volume
 - for purchases – has entered into binding agreements to purchase
 - for storage – is projected to have the crude available for the month it is being nominated

Example

kbpd	New	Balance
Production	+200	
To rail	-100	100
Sold	-50	50
Purchased	+25	75
From storage	+50	125
Available		125



Feeder Verification

- All volume nominated is verified by the operator of the feeder pipeline via the **Swiftlink** portal prior to accepting nominations.
- If volume is not verified from Feeder, volume is removed from shipper nomination accordingly.

Verify Volumes and Splits

Managed Facility: * External Facility: * NOS Period: *

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 Site: EDMONTON TERMINAL Commodity:

Nominated Volumes

Shipper	Shipper Nominated Volume (m ³)	Verified Volume (m ³)	Balance (m ³)
<div></div>	29,000.000	<div>50,000.000</div>	-21,000.000
Total	29,000.000	50,000.000	-21,000.000



Destination Verification Procedure

Destination facilities are grouped into 3 categories:

1. Refinery
2. Storage Facility
3. Connecting Carrier

Setting Capability:

Destination facilities establish stated capabilities based on the type of destination facility. Destination facilities set overall capability and update as applicable.

Monthly Affidavit:

Monthly process to verify volume – affidavit signed by officer (or designate) swearing to the destination facility's ability and intent to accept stated volumes by shipper and commodity



Apportionment

Currently apportionment is conducted by calculating the highest point of constraint in the network and allocating capacity through that point pro-rata based on nominations

Once apportionment is calculated

- Letters are sent to all shippers indicating their allocated space and requesting they reduce their nominations accordingly
- Shippers are required to amend their nominations in Swiftlink within 24 hours
- Volume cannot be redirected or supply changes made, only reductions allowed

Changes with Mainline Contracting

- Canadian Mainline allocations completed first
 - Minimum 10% of available capacity allocated to uncommitted
 - 90% of available capacity allocated to committed
- Lakehead allocated pro rata after Canadian Mainline complete



Change Requests

Enbridge processes ~3,000+ change requests per month

- Change requests
 - Buy/Sell
 - Trade
 - Time Trade
 - Volume
 - Redirection (supply and destination)
- Large market liquidity in the Enbridge system
- Same mechanisms for inline commercial activity will exist with Mainline Contracting, required for high system optimization



Summary of In-month Activities

	Today	Contracting – <i>Same as today</i>	
	All Shippers	Committed Shipper	Uncommitted Shipper
Line space queue/calls for crude	First come first serve	✓	✓
Mid month apportionment	All barrels reduced pro-rata	✓	✓
Transfers at source	Allowed	✓	✓
Change requests (ex buy/sell)	Allowed @ ENB discretion	✓	✓
Redirections (receipt or delivery)	Allowed @ ENB discretion	✓	✓

Thank you
