DFO NEED FOR DEVELOPMENT

Need for Development Amendment

Lethbridge Area

September 10, 2020

(Original dated July 10, 2018)

Prepared	Reviewed	Approved	Authentication	Responsible Member Validation
Jude Marasigan, EIT Engineer in Training Distribution Planning Sept. 10, 2020	Kevin Noble, P.Eng. Manager Distribution Planning SEPT 11, 2020	Richard Bahry, P.Eng. Director Engineering Sept 11, 2020	PROFESSIONAL ENGINEER ALBERTA KEVIN NOBLE SEPT 11, 2020	FortisAlberta Inc. APEGA Permit # P07387 Kevin Noble, P.Eng. Responsible Member SEPT 11, 2020
			Authenticated original filed with the Engineering Department	

Executive Summary

Note: The original Need for Development (NFD) for P2123 Lethbridge Area reliability project was signed on July 10, 2018. During stage 3 of the AESO Connection Process, the AESO has requested FortisAlberta to validate the need and solutions with the most up-to-date data available and to consolidate the other alternatives considered that were not included in the original NFD. This document contains the updates and additions to the July 10, 2018 NFD to address AESO's request.

FortisAlberta Inc. (FortisAlberta) requested system access service to address distribution system reliability concerns in the Lethbridge area.

Load studies indicate that under N-1 contingency, unsupplied loads, i.e. customer loads which cannot be restored by switching only, could occur for the North Lethbridge 370S and Riverbend 618S substations. This violates FortisAlberta planning criteria for electrical load restoration.

Potential solutions were assessed to address the reliability concerns for the Lethbridge area. Based on information available to FortisAlberta, technical merit and distribution capital cost, the FortisAlberta preferred alternative includes the following transmission upgrades:

- Make a second source transformer available at the North Lethbridge 370S substation;
- Relocate an existing 25 kV distribution feeder to the second transformer;
- Other associated upgrades as required.

The full scope of the required transmission upgrades and the estimated transmission capital cost associated with the preferred alternative will be provided by the Transmission Facility Owner (TFO), AltaLink Management Limited (AltaLink).

The estimated distribution capital cost associated with the FortisAlberta preferred alternative is $4.12 million (±30%,2021$).

Based on existing reliability concerns and in consideration of the target timelines for the Alberta Electric System Operator (AESO) Connection Process, the requested In-Service Date (ISD) for the Lethbridge area facility upgrades is November 1, 2021.

No Demand Transmission Service (DTS) change is requested with the project.

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1. Background

FortisAlberta has identified existing reliability concerns in the Lethbridge area; specifically, at the North Lethbridge 370S and Riverbend 618S Points of Delivery (PODs).

North Lethbridge 370S substation supplies a mix of residential, farm and commercial services immediately north of the City of Lethbridge. It is situated at the northwest edge of the City of Lethbridge at LSD 3 SEC 18 TWP 9 RGE 21 W4M with three-phase 25 kV ties to Coaldale 254S, Monarch 492S and Riverbend 618S feeders. At the substation, there exists a 130/24.9 kV 25/33/41 MVA LTC (load tap changing) transformer (T1) supplying four 25 kV distribution feeders that is restricted to 30.3 MVA by an associated equipment. There is also a 138/26.5 kV 15/20/25 MVA LTC transformer (T4) at the substation that is normally out of service (standby) de-energized.

Riverbend 618S substation supplies loads immediately south and east of the City of Lethbridge. It is situated approximately 3.5 km south of the City of Lethbridge with three-phase 25 kV ties to Coaldale 254S, North Lethbridge 370S, Spring Coulee 385S and Stirling 67S feeders. At the substation, there exists a 138/24.9 kV 15/20/25 MVA transformer (T1) in series with a 24.94 kV 15/20/25 MVA voltage regulator (VR1) supplying two 25 kV distribution feeders.

2. Criteria

The analysis of the existing system and potential solutions in the Lethbridge area has been conducted based upon the following FortisAlberta's distribution planning criteria:

- Normal loading of FortisAlberta 25 kV distribution feeders is not to exceed 13.0 MVA
- FortisAlberta planning criteria for electrical load restoration requires that adequate backup supply for contingency situations be available subject only to switching time. Backup capability refers to the ability to restore service after an interruption without necessary first repairing the cause of the interruption.
- Transmission equipment must not be operated at load levels greater than the equipment nameplate rating.
- Distributed Energy Resources (DER) are not dispatchable by FortisAlberta and are not considered for the purposes of solving the identified distribution deficiencies.
- Delivered voltage on the distribution system shall comply with the requirements of CSA Standard *C235 – Preferred Voltage Levels for AC Systems, 0 to 50,000 V.*

3. Forecasting Methodology

FortisAlberta's load forecasting approach is performed on all the company's 25 kV distribution feeders that are connected to POD substations. A consistent bottom-up load forecast approach, as described below, is utilized that incorporates localized influences specific to the area supplied by the distribution feeders and the associated POD substation.

On an annual basis, this peak demand load of each distribution feeder is obtained from meters located at the substation that serves the feeder. This recorded meter date is reviewed over a date range of March 1 of the current year through February 28 of the following year to capture the yearly distribution feeder peak loads.

The load forecast involves statistical trending of historical feeder recorded peaks and includes aggregated committed load with the application of distribution system planning and engineering judgement. The resultant feeder load forecast identifies the anticipated upper bounds of electric system peak capacity that would be required annually to address customer needs.

Committed loads include individual customer-contracted peak demands and load allocated to committed subdivision developments where FortisAlberta holds signed contracts with developers. Differences between the forecast and actual committed loads occur when customers do not make full use of their committed contracted demand.

For individual feeder load forecasting, the forecast increases from year 0 to year 1 is the result of the following four factors:

- Forecasted aggregated customer load growth;
- New contracted committed load additions;
- Existing contracted committed loads; and
- Planned load transfers.

The individual 25 kV anticipated feeder peak loads are then summed up, with the application of a coincidence factor to the individual distribution feeder peaks, to determine the anticipated peak loads on the substation transformer that the 25 kV feeders are connected to. The resultant anticipated peak loads on the substation transformers are then totaled, with the application of a coincidence factor to the individual calculated substation transformer loads, to determine the total substation predicted peak loads.

The DTS contract level of each project is determined from the load forecast table in the NFD document that is associated with the preferred solution. This is done by identifying the predicted peak load at the POD substation during the year of the project's ISD. A conversion of

power units is needed to contract for DTS. This is accomplished by multiplying the POD forecast by the substation power factor (pf). The resultant is subsequently multiplied by a POD load coincidence factor of 0.9 to determine the DTS level that FortisAlberta requests from the AESO.

4. Existing System Assessment

The existing FortisAlberta POD substations and distribution systems in the Lethbridge area are shown in Figure A-1 in Appendix A.

4.1 Load Forecast

Table 4-1 provides FortisAlberta's historical and forecast peak load levels for the FortisAlberta POD substations and distribution feeders in the Lethbridge area. This load forecast was used to assess the existing system in this Need for Development document.

Table 4-1: FortisAlberta Historic and Forecast Load – Existing System

				RECORDED - MVA LOADING						PREDICTED - REQUIRED CAPACITY									
SUB		CAPACITY	W or S	2015 Peak MVA	2016 Peak MVA	2017 Peak MVA	2018 Peak MVA	2019 Peak MVA	2019 Peak PF	2020 Year 1 MVA	2021 Year 2 MVA	2022 Year 3 MVA	2023 Year 4 MVA	2024 Year 5 MVA	2025 Year 6 MVA	2026 Year 7 MVA	2027 Year 8 MVA	2028 Year 9 MVA	2029 Year 10 MVA
		T/R MVA																	
370S	N. Lethbridge (Spare)	T4 15/20/ 25																	
370S	Lethbridge (North)	T1 25/33/ 41	S	21.4	22.5	24.6	23.9	22.1	93%	22.3	22.6	22.8	23.1	23.4	23.7	24.0	24.3	24.6	24.9
370S	17LN (SPARE)	17LN is fed by 370S-455LW		0.0	0.0	0.0	0.0	0.0	90%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
370S	204LN	T1 C.L.B.O.E. 30.3MVA	S	7.3	7.4	8.6	7.6	7.5	91%	7.9	7.9	8.0	8.1	8.1	8.2	8.3	8.3	8.4	8.5
370S	455LW		S	7.9	8.2	8.3	8.2	8.3	89%	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.4	9.5	9.6
370S	465LE		S	7.1	7.8	8.3	8.7	7.8	97%	6.7	6.8	6.9	7.0	7.2	7.3	7.4	7.6	7.7	7.8
618S	Riverbend	T1 15/20/ 25																	
618S		VR1 15/20/ 25	S	14.0	14.4	17.2	16.9	15.4	89%	12.9	13.1	13.4	13.6	13.9	14.1	14.4	14.6	14.9	15.2
618S	18LN		S	4.2	4.2	4.4	4.6	4.5	97%	4.5	4.6	4.6	4.7	4.8	4.9	4.9	5.0	5.1	5.2
618S	266LE		S	10.5	11.3	13.3	12.9	12.2	86%	9.0	9.2	9.4	9.6	9.7	9.9	10.1	10.4	10.6	10.8
		Area Total		35.4	36.9	41.8	40.8	37.6		35.2	35.7	36.2	36.7	37.3	37.8	38.4	39.0	39.5	40.1

Notes

C.L.B.O.E.: Capacity Limited By Other Equipment

Transfer 3.2 MW from 618S-266LE to 370S-465LE

Transfer 5.2 MW from 370S-465LE to 254S-411L

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
N-1 Assessment for 370S											
Total Station Load	22.1	22.3	22.6	22.8	23.1	23.4	23.7	24.0	24.3	24.6	24.9
N-1 Capacity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Back-up from 254S	7.6	2.7	2.5	2.3	2.0	1.8	1.6	1.5	1.3	1.2	1.0
Back-up from 492S	5.9	4.9	4.7	4.3	3.9	3.6	3.3	3.0	2.8	2.6	2.4
Back-up from 618S	1.6	4.1	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8
N-1 Unsupplied Load	7.1	10.6	11.2	12.2	13.1	14.0	14.8	15.6	16.4	17.1	17.8
N-1 Assessment for 618S											
Total Station Load	15.4	12.9	13.1	13.4	13.6	13.9	14.1	14.4	14.6	14.9	15.2
N-1 Capacity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Back-up from 67S	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Back-up from 370S	1.8	2.3	2.3	2.2	2.1	2.1	2.0	1.9	1.9	1.8	1.8
Back-up from 385S	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.1
N-1 Unsupplied Load	11.4	10.2	10.5	10.8	11.2	11.5	11.8	12.2	12.5	12.9	13.3

FortisAlberta POD substations and distribution feeder loadings were assessed for the Lethbridge area. The following distribution reliability concerns noted from Table 4-1 will be addressed in this application:

- The level of unsupplied load at the North Lethbridge 370S substation under N-1 contingency could have been as high as ~7.1 MVA in 2019 and if left unaddressed, predicted to be as high as ~17.8 MVA by 2029;
- The level of unsupplied load at the Riverbend 618S substation under N-1 contingency could have been as high as ~11.4 MVA in 2019 and if left unaddressed, predicted to be as high as ~13.3 MVA by 2029.

These exceed FortisAlberta's planning criteria for electrical load restoration.

5. Alternatives Analysis

Several alternatives were considered, and based on information available to FortisAlberta, technical merit and distribution capital cost, four alternatives are presented in this document. Alternative 2 has the lowest estimated capital cost.

5.1 Alternative 1: Distribution Upgrades and Load Shifting

5.1.1 Description

To resolve the reliability issues in the Lethbridge area, it would be necessary to construct extensive distribution upgrades to improve load transfer capability to adjacent substations. In addition, it would be necessary to ensure that the substations in the area have enough transformation capacity to support all loads during N-1 contingency in the area.

Based on the above and information provided in Section 5.1.2, it was determined that distribution upgrades and load shifting would be insufficient to address all the identified concerns in the area.

Details regarding distribution ties to The City of Lethbridge Electric Utility distribution system is provided in Appendix C.

5.1.2 Technical Analysis

To address the North Lethbridge 370S reliability issues, all adjacent feeders were considered in the study. All existing and potential three-phase 25 kV tie lines cannot fully back-up North

Lethbridge 370S without violating the voltage criteria or exceeding distribution equipment nameplate capacity.

Similarly, to address the Riverbend 618S reliability issues, all adjacent feeders were considered in the study. The closest back-up POD for Riverbend 618S is North Lethbridge 370S; therefore, a tie line between the two PODs will be required. Other existing tie lines have limited back-up capability due to feeder lengths and associated voltage violations. With the new tie line, North Lethbridge 370S will exceed its transformation capacity under N-1 conditions at Riverbend 618S.

Therefore, distribution upgrades alone cannot solve the reliability issues at North Lethbridge 370S and Riverbend 618S without violating voltage requirements or without exceeding distribution equipment nameplate capacity. Increase of available transformation capacity in the area is required.

As a result, Alternative 1 is not a technically acceptable solution, and load forecasts and costs have not been included for this alternative.

5.2 Alternative 2: Upgrades at the North Lethbridge 370S Substation

5.2.1 Description

Transmission upgrades at the North Lethbridge 370S substation:

- Make a second source transformer available;
- Relocate an existing 25 kV feeder breaker to the proposed new second transformer; and
- Other associated upgrades as required.

Distribution upgrades associated with this alternative includes building/re-building approximately 22 km of distribution lines and installation of voltage regulators to increase back-up capability within the area and from surrounding feeders. Refer to Appendix B, Figure B-1 for a simplified sketch showing the Alternative 2 system development.

All 25 kV overhead conductors, new and existing, exiting the substation and distribution feeder ties shall be 477 ACSR. All underground feeder cables, new and existing, shall be 750 MCM. All transmission components on the secondary side of the 25 kV source transformers, new and existing, shall be sized to enable the feeders to simultaneously supply 26 MVA per feeder. All 25 kV feeder breakers shall be equipped with associated equipment to enable under-frequency load shedding.

Transmission facilities must be equipped with the appropriate equipment for interconnection with FortisAlberta's Automated Metering system. Provisions should be made for

interconnecting the substation transformer neutrals with the distribution line neutrals as per the AltaLink standard.

All 138 kV and 25 kV busses shall have adequate switch points and protection to minimize frequency and duration of outages associated with the maintenance or failure of substation components upstream of the 25 kV bus. Failure of such upstream components must not result in a total substation outage.

5.2.2 Technical Analysis

The addition of a source transformer at North Lethbridge 370S combined with associated distribution upgrades, including the addition of a tie line between North Lethbridge 370S and Riverbend 618S, will increase reliability within the area. It will fully address the existing reliability issues discussed.

5.2.3 Load Forecast

The load forecast resulting from Alternative 2 is provided in Table 5-2.

Table 5-2: Alternative 2 – Upgrades at the North Lethbridge 370S Substation

				RECORDED - MVA LOADING						PREDICTED - REQUIRED CAPACITY									
SUB		CAPACITY	W or S	2015 Peak MVA	2016 Peak MVA	2017 Peak MVA	2018 Peak MVA	2019 Peak MVA	2019 Peak PF	2020 Year 1 MVA	2021 Year 2 MVA	2022 Year 3 MVA	2023 Year 4 MVA	2024 Year 5 MVA	2025 Year 6 MVA	2026 Year 7 MVA	2027 Year 8 MVA	2028 Year 9 MVA	2029 Year 10 MVA
		T/R MVA																	
370S	N. Lethbridge ~~(Spare)~~	T4 15/20/ 25									6.8	6.9	7.0	7.2	7.3	7.4	7.6	7.7	7.8
370S	465LE		S								6.8	6.9	7.0	7.2	7.3	7.4	7.6	7.7	7.8
370S	Lethbridge (North)	T1 25/33/ 41	S	21.4	22.5	24.6	23.9	22.1	93%	22.3	16.0	16.2	16.4	16.5	16.7	16.9	17.0	17.2	17.4
370S	17LN (SPARE)	17LN is fed by 370S-455LW		0.0	0.0	0.0	0.0	0.0	90%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
370S	204LN	~~T1 C.L.B.O.E. 30.3MVA~~	S	7.3	7.4	8.6	7.6	7.5	91%	7.9	7.9	8.0	8.1	8.1	8.2	8.3	8.3	8.4	8.5
370S	455LW		S	7.9	8.2	8.3	8.2	8.3	89%	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.4	9.5	9.6
370S	465LE		S	7.1	7.8	8.3	8.7	7.8	97%	6.7	moved to T4								
370S	**Station Total**			**21.4**	**22.5**	**24.6**	**23.9**	**22.1**	93%	**22.3**	**22.6**	**22.8**	**23.1**	**23.4**	**23.7**	**24.0**	**24.3**	**24.6**	**24.9**
618S	Riverbend	T1 15/20/ 25																	
618S		VR1 15/20/ 25	S	**14.0**	**14.4**	**17.2**	**16.9**	**15.4**	**89%**	**12.9**	**13.1**	**13.4**	**13.6**	**13.9**	**14.1**	**14.4**	**14.6**	**14.9**	**15.2**
618S	18LN		S	4.2	4.2	4.4	4.6	4.5	97%	4.5	4.6	4.6	4.7	4.8	4.9	4.9	5.0	5.1	5.2
618S	266LE		S	10.5	11.3	13.3	12.9	12.2	86%	9.0	9.2	9.4	9.6	9.7	9.9	10.1	10.4	10.6	10.8
		Area Total		**35.4**	**36.9**	**41.8**	**40.8**	**37.6**		**35.2**	**35.7**	**36.2**	**36.7**	**37.3**	**37.8**	**38.4**	**39.0**	**39.5**	**40.1**

Notes

C.L.B.O.E.: Capacity Limited By Other Equipment

Transfer 3.2 MW from 618S-266LE to 370S-465LE

Transfer 5.2 MW from 370S-465LE to 254S-411L

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
N-1 Assessment for 370S											
Total Station Load	**22.1**	**22.3**	**22.6**	**22.8**	**23.1**	**23.4**	**23.7**	**24.0**	**24.3**	**24.6**	**24.9**
N-1 Capacity	0.0	0.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Back-up from 254S	7.6	2.7	2.5	2.3	2.0	1.8	1.6	1.5	1.3	1.2	1.0
Back-up from 492S	5.9	4.9	4.7	4.3	3.9	3.6	3.3	3.0	2.8	2.6	2.4
Back-up from 618S	1.6	4.1	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8
N-1 Unsupplied Load	7.1	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N-1 Assessment for 618S											
Total Station Load	**15.4**	**12.9**	**13.1**	**13.4**	**13.6**	**13.9**	**14.1**	**14.4**	**14.6**	**14.9**	**15.2**
N-1 Capacity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Back-up from 67S	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Back-up from 254S	2.2	0.0	3.3	3.4	3.5	3.6	3.6	3.7	3.9	4.1	4.1
Back-up from 370S	1.8	2.3	5.7	5.8	5.9	5.9	6.0	6.0	6.1	6.2	6.3
Back-up from 385S	0.0	0.3	4.3	4.4	4.4	4.5	4.5	4.5	4.6	4.6	4.8
N-1 Unsupplied Load	11.4	10.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

5.2.4 Cost Estimate

If Alternative 2 is pursued, AltaLink will prepare a facility application for the requested transmission upgrades. This facility application will include an estimate of the transmission capital cost.

The distribution capital cost associated with Alternative 2 is estimated to be $4.12 million (±30%, 2021$).

5.3 Alternative 3: Upgrades at the Riverbend 618S Substation

5.3.1 Description

Transmission upgrades at the Riverbend 618S Substation:

- Install a second source transformer at Riverbend 618S;
- Connect a new 25 kV distribution feeder breaker to the second substation transformer; and
- Other associated upgrades as required.

Distribution upgrades associated with this alternative include constructing extensive distribution upgrades to improve load transfer capability of North Lethbridge 370S to adjacent substations.

5.3.2 Technical Analysis

These upgrades cannot solve the reliability issues at North Lethbridge 370S without violating voltage requirements or without exceeding distribution equipment nameplate capacity.

5.3.3 Cost Estimate

As this alternative is not technically acceptable, cost estimate is not provided.

5.4 Alternative 4: Upgrades at the Macdonald 146S Substation

5.4.1 Description

Transmission upgrades at the Macdonald 146S Substation:

- Establish a FortisAlberta POD at the Macdonald 146S Substation;
- Connect two new 25 kV distribution feeder breakers to the new substation transformer; and
- Other associated upgrades as required.

Distribution upgrades associated with this alternative include installation of new lines in an urban area from the Macdonald 146S substation. This alternative includes building/re-building approximately 28 km of distribution lines and installation of voltage regulators.

All 25 kV overhead conductors, new and existing, exiting the substation and distribution feeder ties shall be 477 ACSR. All underground feeder cables, new and existing, shall be 750 MCM. All transmission components on the secondary side of the 25 kV source transformers, new and existing, shall be sized to enable the feeders to simultaneously supply 26 MVA per feeder. All 25 kV feeder breakers shall be equipped with associated equipment to enable under-frequency load shedding.

Transmission facilities must be equipped with the appropriate equipment for interconnection with FortisAlberta's Automated Metering system. Provisions should be made for interconnecting the substation transformer neutrals with the distribution line neutrals as per the AltaLink standard.

All 138 kV and 25 kV busses shall have adequate switch points and protection to minimize frequency and duration of outages associated with the maintenance or failure of substation components upstream of the 25 kV bus. Failure of such upstream components must not result in a total substation outage.

5.4.2 Technical Analysis

These upgrades will allow for load transfers to reduce loading at a North Lethbridge 370S feeder and a Riverbend 618S feeder and reinforce the ties from the adjacent feeders. Alternative 4 is a technically acceptable solution.

5.4.3 Cost Estimate

Alternative 4 is a technically acceptable solution and if this alternative is pursued, the transmission facility owner will prepare a facility application for the requested transmission upgrades. This facility application will include an estimate of the transmission capital cost.

The distribution capital cost associated with Alternative 4 is estimated to be $8.22 million (±30%, 2021$).

6. Alternatives Assessment

6.1 Alternative 1: Distribution Upgrades

Alternative 1 is not a technically acceptable solution.

6.2 Alternative 2: Upgrades at the North Lethbridge 370S Substation

Alternative 2 is technically acceptable and has the lowest combined transmission and distribution estimated costs. Alternative 2 is the preferred alternative.

6.3 Alternative 3: Upgrades at the Riverbend 618S Substation

Alternative 3 is not a technically acceptable solution.

6.4 Alternative 4: Upgrades at the Macdonald 146S Substation

Although Alternative 4 is technically acceptable, it has a higher combined transmission and distribution estimated costs than Alternative 2. Alternative 4 is not the preferred alternative.

7. Conclusion

Alternative 2 is FortisAlberta's preferred alternative to address the existing reliability concerns in the area due to its lowest estimated capital costs and acceptable technical feasibility.

Transmission related upgrades of Alternative 2 includes:

- Making a second source transformer available at the North Lethbridge 370S substation;
- Relocate an existing 25 kV distribution feeder to the second transformer;
- Other associated upgrades as required.

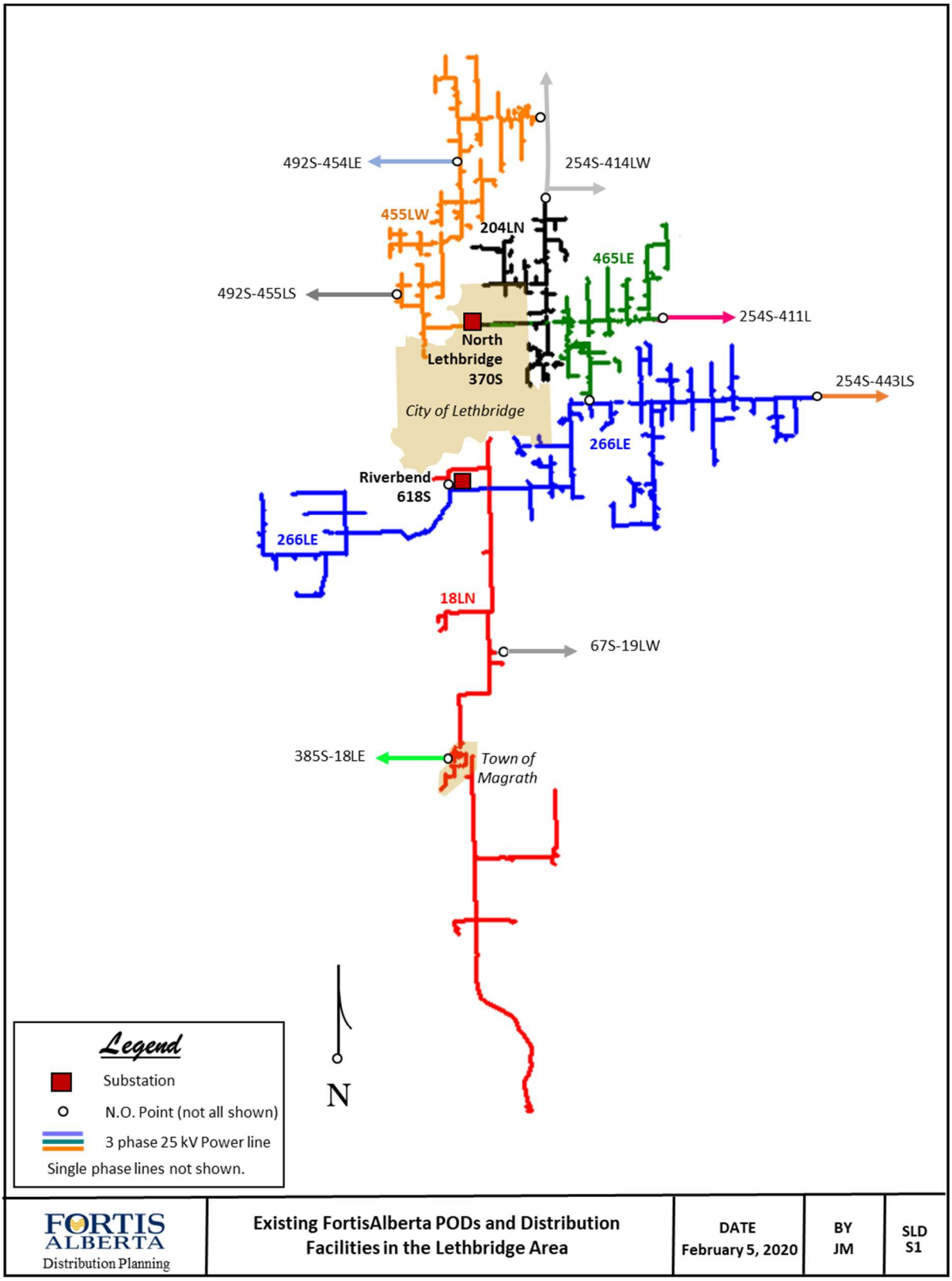
An estimate for the transmission system capital cost will be provided by the TFO.

The estimated distribution capital cost associated with the preferred alternative is $4.12 million (±30%, 2020$).

Based on existing reliability concerns and in consideration of the target timelines for the Alberta Electric System Operator (AESO) Connection Process, the requested In-Service Date (ISD) for the Lethbridge area facility upgrades is November 1, 2021.

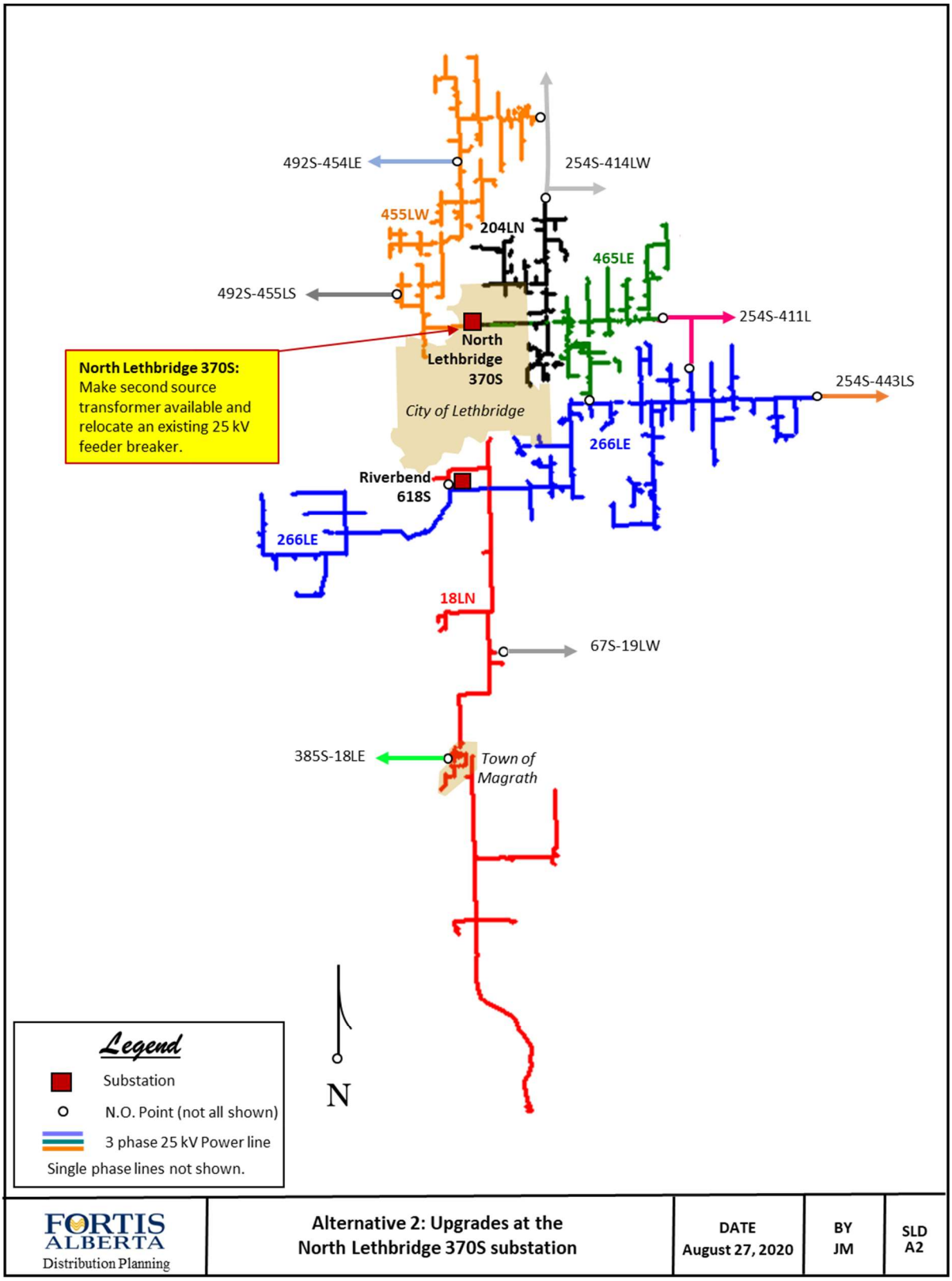
Appendix A – Existing System

Figure A-1 – Existing System



Appendix B – Alternative 2: Upgrades at the North Lethbridge 370S Substation

Figure B-1 – Alternative 2: Upgrades at the North Lethbridge 370S Substation



Appendix C – Copy of the Supplemental to the Need for Development Document

Supplemental to the Need for Development

Lethbridge Area

February 6, 2020

Prepared	Reviewed	Approved	Authentication	Responsible Member Validation
FEB 6, 2020 Jude Marasigan, EIT Engineer in Training Distribution Planning	FEB 6, 2020 Kevin Noble, P.Eng. Manager Distribution Planning	2020 - Feb 6 Richard Bahry, P.Eng. Director Engineering	PROFESSIONAL ENGINEER ALBERTA ZUREX FONTANILLA 06 FEB 2020	FortisAlberta Inc. APEGA Permit # P07387 Kevin Noble, P.Eng. Responsible Member FEB 6, 2020
			Authenticated original filed with the Engineering Department	

Re: *P2123 – Supplemental Information to FortisAlberta's July 10, 2018 Need for Development in the Lethbridge Area*

The Alberta Electric System Operator (AESO) has requested FortisAlberta Inc. (FortisAlberta) to provide the details of alternatives that considers ties to The City of Lethbridge Electric Utility (LEU) distribution system to address the area reliability concern.

In addition, the AESO also requested FortisAlberta to provide a sketch showing the proposed distribution upgrades associated with Alternative 2: Upgrades at the North Lethbridge 370S substation. See Appendix C for the requested sketch.

Interconnection with the Lethbridge Electric Utility (LEU) Distribution System

FortisAlberta reviewed the feasibility of installing new interconnection points with LEU's distribution system to address the reliability concerns in the Lethbridge area and identified the following:

1. The FortisAlberta and LEU distribution systems are not electrically synchronized and currently do not have the appropriate infrastructure to interconnect. See Table A below for details.

Table A: Distribution System Operating Parameters

Distribution Facility Owner (DFO)	3 Phase Voltage	Phase Angle
FortisAlberta	25 kV	0° (Reference)
LEU	13.8 kV	30°

2. Three new interconnection points would be required to address the reliability concerns, as long as these interconnection points are synchronized with the FortisAlberta distribution system and have sufficient capacity available. See Appendix B for the location and associated capacity requirements for the interconnection points.

3. FortisAlberta distribution upgrades associated with (2), includes building/re-building approximately 18 km of distribution lines, installation of new voltage regulators and upgrading of existing voltage regulators. The estimated distribution capital cost is $5.43 million (±30%, 2020$). This cost does not include the costs of non-FortisAlberta standard phase-shifting step-up transformers, the cost or feasibility of land acquisition

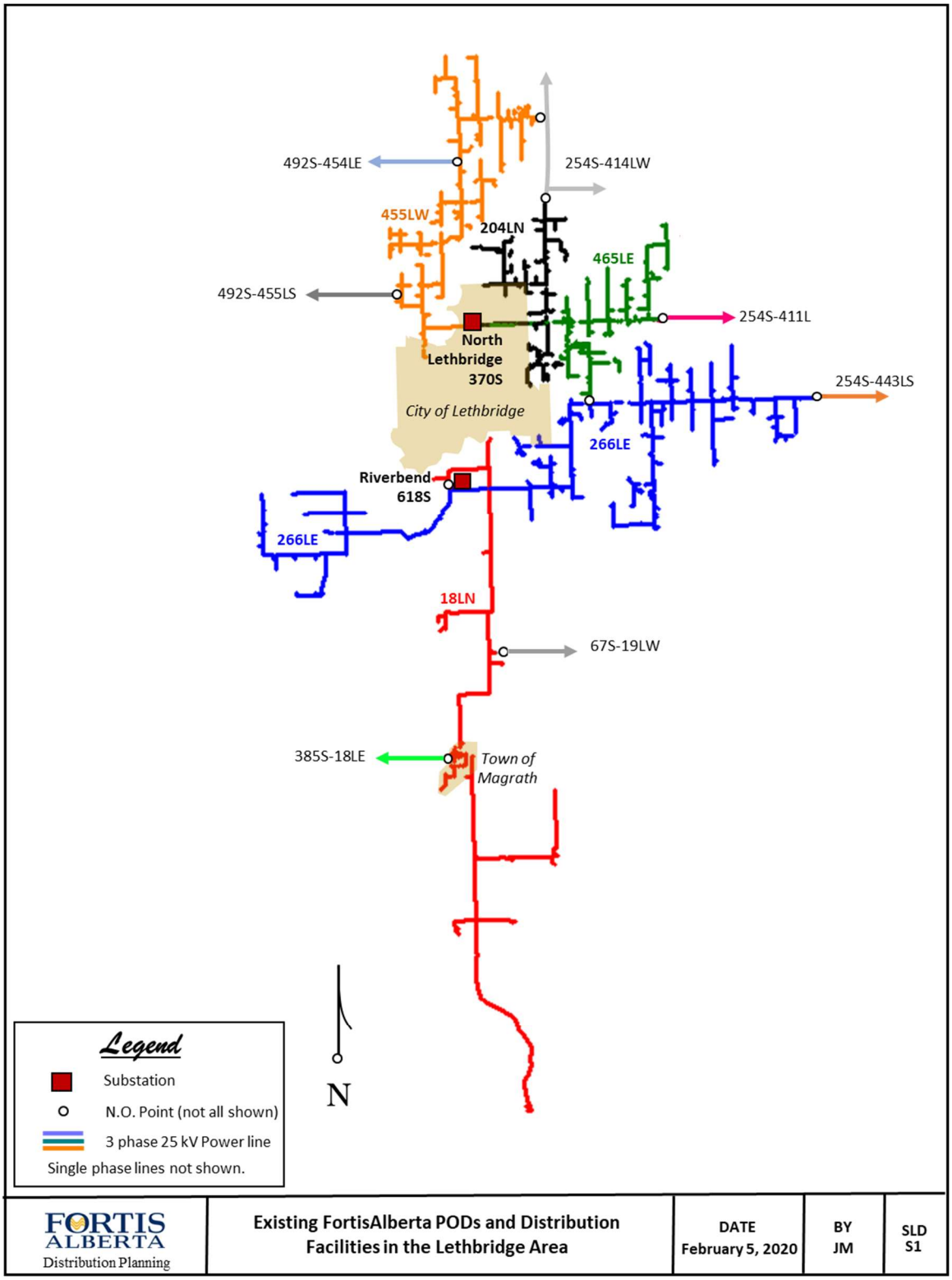
to accommodate the installation of non-standard phase-shifting step-up transformers, or any LEU costs associated with providing the required electrical capacity at the proposed interconnection points.

4. If LEU can supply the required capacity at the three interconnection points at 25 kV, in-phase with the FortisAlberta system, FortisAlberta would not require any upgrades beyond those presented in (2).

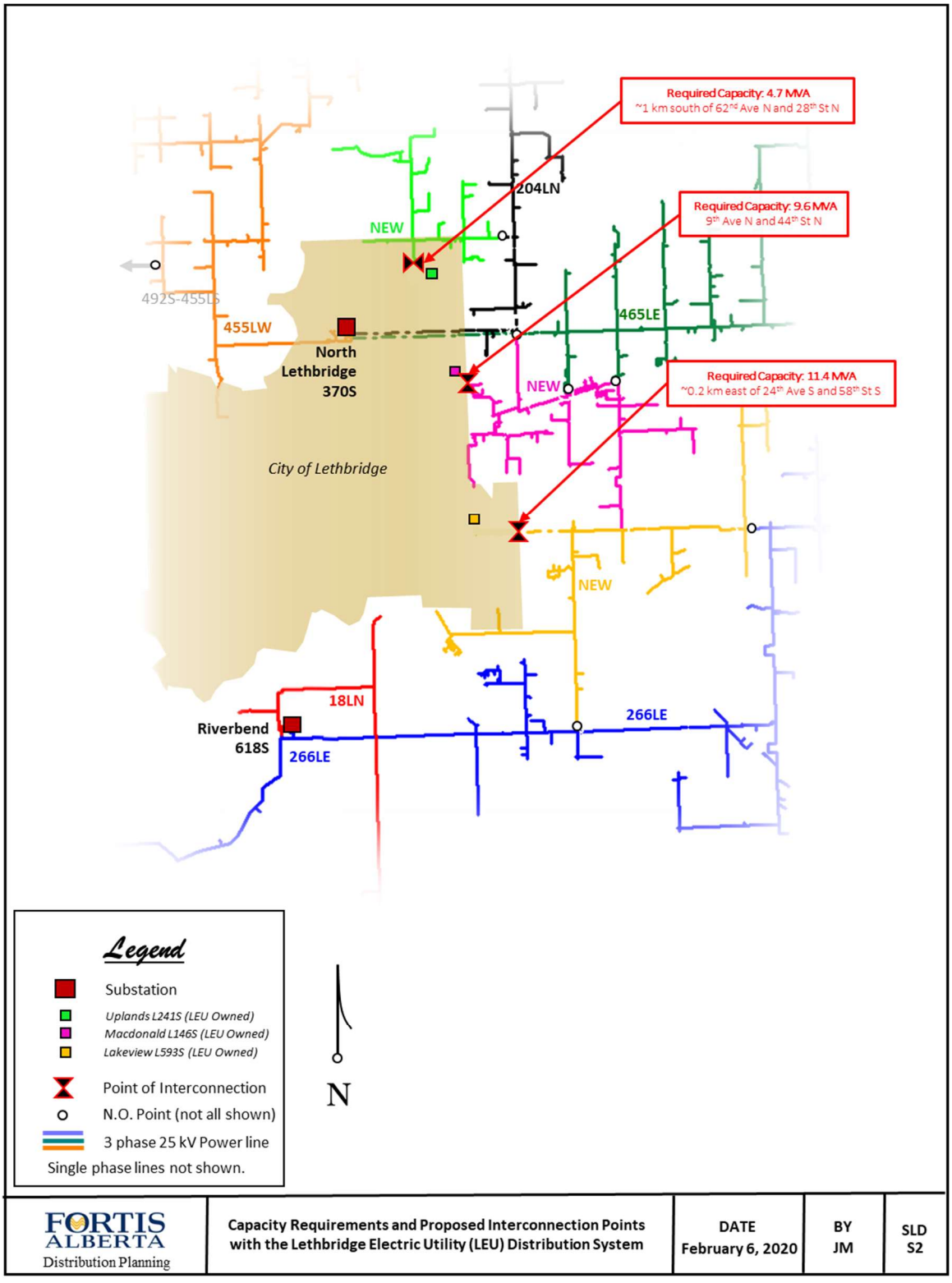
5. If LEU can supply the required capacity at the three interconnection points at 13.8 kV, 30 degrees out of phase with the FortisAlberta system, FortisAlberta would need to investigate the use of non-FortisAlberta standard 13.8/25 kV phase-shifting step-up transformers. FortisAlberta predicts that the installed cost of three 13.8/25 kV phase-shifting transformers to be similar to or greater than the installed cost of similarly sized FortisAlberta standard 25kV/4160V non phase-shifting step-down transformers. The installed cost for three similarly sized FortisAlberta standard 25kV/4160V non phase-shifting transformers is $1.07 million (±30%, 2020$), excluding any associated land acquisition costs.

6. Alternative 2 of FortisAlberta's July 10, 2018 Lethbridge Area Need for Development document remains FortisAlberta's preferred alternative as it continues to be the lowest cost alternative.

Appendix A – Existing System



Appendix B – Capacity Requirements and Proposed Interconnection Points with the Lethbridge Electric Utility (LEU) Distribution System



Appendix C – Distribution Upgrades Associated with Alternative 2: Upgrades at the North Lethbridge 370S Substation