Appendix F

Worst Performing Feeders Report

Alectra Utilities

Distribution System Plan (2020-2024)

Worst Performing Feeder Report

July 2018

Revision 1

Executive Summary

This report provides a summary of feeder performance and a break down based on cause codes, and sub-cause codes by Alectra Utilities four service territories. Feeder performance is evaluated utilizing three criteria, the number of momentary interruptions, the number of sustained outages, and the total duration of all sustained outages (excluding scheduled outages). It is recommended that future reports, upon availability of data to utilize customer specific metrics to evaluate system area performance rather than feeder performance. This transition will better identify the specific areas of the feeder showing signs of poor performance.

Across all the service territories, the most common causes of outages are Defective Equipment and Foreign Interference. Adverse Weather plays a role as well, however, for rate zones are not impacted by a Major Event Day (MED), Adverse Weather does not appear and instead is replaced by Tree Contacts. Examining the sub-causes, it is evident across Alectra Utilities that cable, and cable related devices, splices/terminations are the primary sub-causes of Defective Equipment. Distribution Transformers indicate each year as one of the top three causes, but no single element stands out under duration for second leading cause.

In regards to feeder performance, maps are provided in Appendix A for the various service territories. The tables below provide the feeder ID's and reason it is a top poor performing feeder by service territory.

Table 1: Summary of Feeder and Issues (Alectra Central North - Brampton)

Feeder ID	Trigger
42M46	Momentary and Frequency
42M13	Momentary and Frequency
Pleasant TS – All feeders	Duration

Table 2: Summary of Feeder and Issues (Alectra East)

Feeder ID	Trigger
138M8	Duration
138M6	Duration
12M3	Frequency

Table 3: Summary of Feeder and Issues (Alectra Central South - Mississauga)

Station Name	Feeder ID	Trigger
Chinook MS	21F7	Momentary, Frequency and Duration
Stillmeadow	24F4	Momentary and Frequency
Erindale TS	All feeders	Momentary and Duration

Table 4: Summary of Feeder and Issues (Alectra West)

Station Name	Feeder ID	Trigger
Dundas T.S.	2D2X	Momentary, Frequency and Duration
Nebo T.S.	331X	Momentary and Duration
Nebo T.S.	341X	Momentary and Frequency

The Maintenance & Reliability department uses this information to perform the following:

- Generate Capital Projects or Programs for asset renewal, if required
- Focus maintenance programs (tree trimming) on these feeders, if required
- Share the information with the Asset Condition Assessment department for long term capital planning
- Share any material related issues with the Standards department for tracking, or discussion with manufacturers
- Track, review and asses investments made to ensure feeder performance is improving.

Contents

Alectra Central North (Brampton) Reliability

Momentary Outages by Year

The table below provides a summary for 2016, 2017 and YTD June 2018 for momentary outages per feeder. Feeders highlighted in green appear every year, where feeders in blue only appear two out of the three years, and feeders in white only appear in one of the three years.

Table 5: Top 10 Momentary Outages by Year (Alectra Central North)

2016 Top 10 Momentary Outages	
Feeder ID	# of Events
136M48	20
42M14	9
136M8	8
136M47	7
42M46	7
42M67	6
42M13	6
74M47	6
25M1	5
42M10	5
2017 Top 10 Momentary Outages	
Feeder ID	# of Events
42M10	13
136M47	9
42M47	8
42M14	8
25M10	7
74M4	7
42M46	6
136M48	6
25M1	6
42M70	5
2018 Top 10 Momentary Outages	
Feeder ID	# of Events
74M6	7
8F1	7
136M48	6
42M13	5
42M26	5
136M44	4
42M45	4
42M46	4
42M61	3
42M24	2

Summarizing the results provide the following:

Table 6: Momentary Outages Occur in Three Years (Alectra Central North)

Momentary Outages Occur Each Year for Three Years	
Feeder ID	# of Events
136M48	32
42M46	17

Table 7: Momentary Outages Occur in Two Years (Alectra Central North)

Momentary Outages Occur Each Year for Two Years	
Feeder ID	# of Events
42M10	18
42M14	17
136M47	16
42M13	11
25M1	11

Combining the lists provide the top feeders with year over year momentary reliability concerns.

Table 8: Feeders Performance by Momentary Outages (Alectra Central North)

Top Worst Performing Feeders by Momentary Outages	
Feeder ID	# of Events
136M48	32
42M10	18
42M46	17
42M14	17
136M47	16
42M13	11
25M1	11

Sustained Outages by Year

The table below provide a summary for 2016, 2017 and YTD June 2018 for sustained outages per feeder (not including scheduled outages). Feeders highlighted in green appear every year, where feeders in blue only appear two out of the three years, and feeders in white only appear in one of the three years.

Table 9: Top 10 Sustained Outages by Year (Alectra Central North)

2016 Count of Sustained Outages	
Feeder ID	# of Events
42M9	17
136M47	16
25M8	12
42M70	12
74M4	12
42M13	11
74M3	11
74M5	10
42M61	9
42M12	9
2017 Count of Sustained Outages	
Feeder ID	# of Events
42M47	18
42M46	16
42M70	12
136M47	12
74M4	10
42M13	8
74M5	8
25M10	8
25M11	8
42M9	7
2018 Count of Sustained Outages	
Feeder ID	# of Events
42M9	11
42M61	7
42M13	7
136M47	7
8F1	7
42M66	6
42M46	6
25M10	6
21F2	5
42M14	5

Summarizing the results provide the following:

Table 10: Number of Sustained Outage Occur in Three Years (Alectra Central North)

Feeders With The Highest Count of Sustained Outage Every Year For Three Years	
Feeder ID	# of Events
42M9	35
136M47	35
42M13	26

Table 11: Number of Sustained Outage Occur in Two Years (Alectra Central North)

Feeders With The Highest Count of Sustained Outage Every Year For Two Years	
Feeder ID	# of Events
42M70	24
74M4	22
42M46	22
74M5	18
42M61	16
25M10	14

Combining the lists provide the top feeders with year over year the highest number of sustained outages.

Table 12: Feeders Performance by Number of Sustained Outages (Alectra Central North)

Top Worst Performing Feeders by Count of Sustained Outages	
Feeder ID	# of Events
42M9	35
136M47	35
42M13	26
42M70	24
74M4	22
42M46	22
74M5	18
42M61	16
25M10	14

Customer Minutes of Interruption (CMI) from Sustained Outages by Year

The table below provides a summary for 2016, 2017 and YTD June 2018 based on the total CMI of sustained outages per feeder. Feeders highlighted in green appear every year, where feeders in blue only appear two out of the three years, and feeders in white only appear in one of the three years.

Table 13: Top 10 Sustained Outages for CMI by Year (Alectra Central North)

2016 Total CMI	
Feeder ID	CMI
42M67	532,450
74M4	435,738
D6M16	367,337
25M11	355,133
136M47	278,534
42M43	265,578
20F3	223,585
25M1	129,384
14F3	112,585
14F5	96,036
2017 Total CMI	
Feeder ID	CMI
42M68	553,842
42M46	517,528
42M47	343,101
42M13	313,014
14F5	256,947
42M10	175,396
25M12	160,905
42M70	157,436
25M6	141,993
25M3	132,802
2018 Total CMI	
Feeder ID	CMI
42M61	802,287
42M66	761,191
136M52	424,445
22F8	291,762
42M9	199,589
25M13	178,362
21F2	151,165
42M68	139,031
42M14	114,910
25M8	109,510

Summarizing the results provide the following:

Table 14: Sustained Outage for CMI Occur in Two Years (Alectra Central North)

Top 10 Outage Duration Occurs in Two Years Excl SO	
Feeder ID	CMI
42M68	692,873
14F5	352,983

Since there is only one listing, the final list of the top feeders with year over year the greatest CMI from sustained outages is the same as above.

Table 15: Feeder Performance by CMI (Alectra Central North)

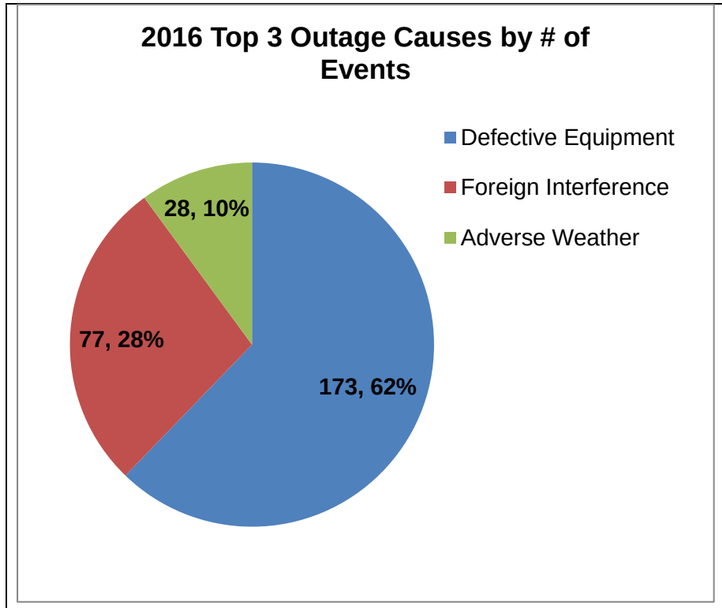
Top Worst Performing Feeders by CMI From Sustained Outages	
Feeder ID	CMI
42M68	692,873
14F5	352,983

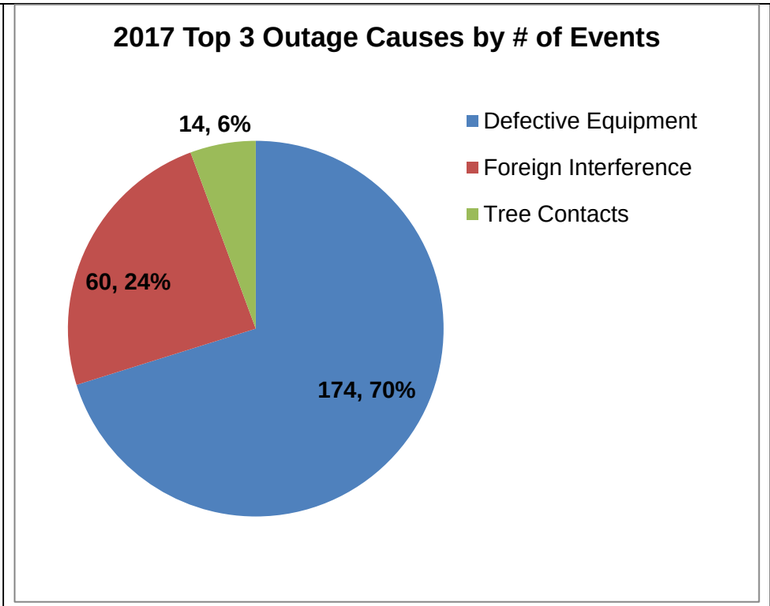
Summarizing all the results Momentary, Frequency, and Duration, highlights that no feeder shows up in all three lists. The Pleasant TS 42M46 and 42M13 show up under the lists for Momentary and Frequency and would be considered the worst feeders in Alectra Brampton. A number of feeders out of Pleasant TS show up several times under the yearly Duration lists, therefore the region serviced by Pleasant TS is considered a problematic area. Below is a table summarizing the top three worst performing feeder's year over year.

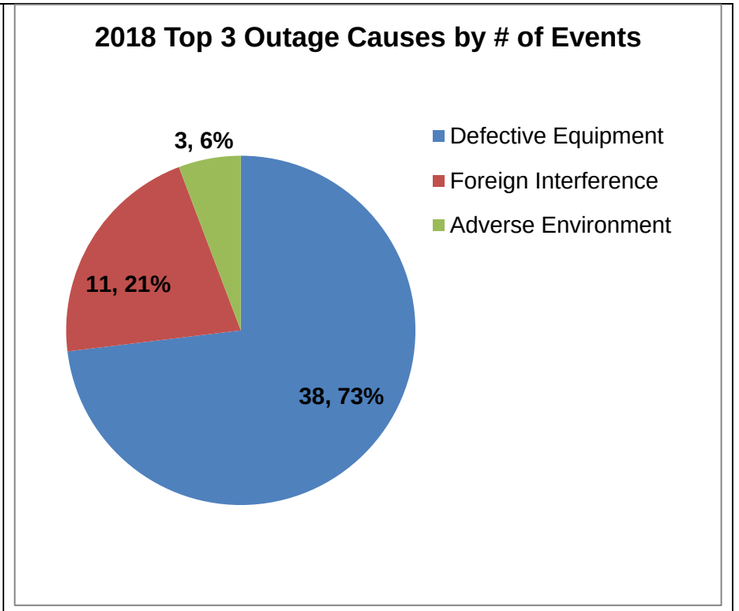
Table 16: Overall Worst Performing Feeders (Alectra Central North)

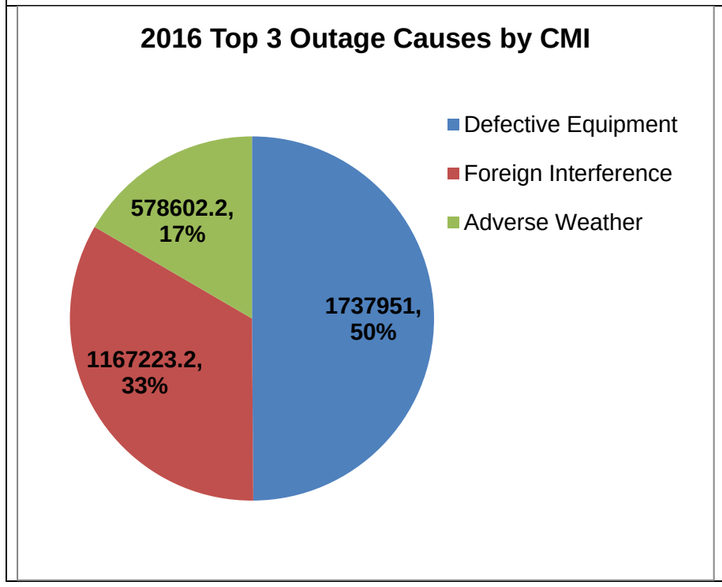
Top Worst Performing Feeders	
Feeder ID	Trigger
42M46	Momentary and Frequency
42M13	Momentary and Frequency
Pleasant TS – All feeders	Duration

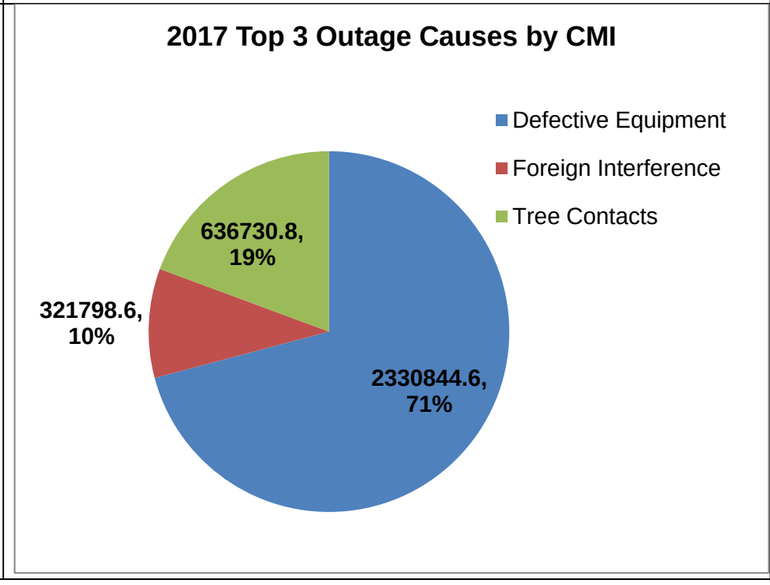
Cause Code Breakdown (Excluding Loss of Supply)

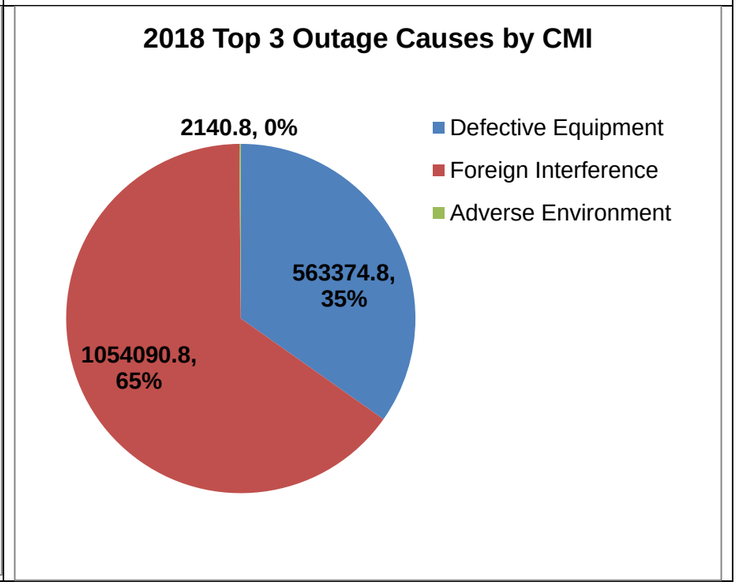












Based on the breakdown of Cause Codes per year the following is evident:

1) Top Causes (by number of events or duration):
    a. Material and Equipment Breakdown
    b. Foreign Interference
    c. Adverse Weather
    d. Tree Contact (to a less extent)
2) Adverse Weather is driven by MEDs
    a. 2016 – 0 MEDs
    b. 2017 – 1 MED (Slightly over threshold)
    c. 2018 – 2 MEDs (Both slightly over threshold)

Examining the sub-cause codes for the top causes, the following trend is evident:

1) Material and Equipment Breakdown:
    a. Secondary Cable failures is the top cause each year
    b. Distribution Cable failures top cause for duration and second cause each year
    c. Transformer failures major cause in the last 3 years
2) Foreign Interference Breakdown:
    a. Animal Contacts and Pole Hits appear in every year that Foreign Interference makes the top three
3) Adverse Weather Breakdown:
    a. Winds

Alectra East Reliability

Momentary Outages by Year

The table below provides a summary for 2016, 2017 and YTD June 2018 for momentary outages per feeder. Feeders highlighted in green appear every year, where feeders in blue only appear two out of the three years, and feeders in white only appear in one of the three years.

Table 17: Top 10 Momentary Outages by Year (Alectra East)

2016 Top 10 Momentary Interruption	
Feeder ID	# of Events
MS305-F1	9
MS308-F3	9
MS331-F1	9
98M7	8
D6M2	8
20M3	7
26M8	7
45M4	7
A-1F4	7
153M4	6
2017 Top 10 Momentary Interruption	
Feeder ID	# of Events
MS331-F6	12
26M13	9
20M22	8
27M3	8
MS303-F4	8
MS331-F1	8
A-1F2	7
A-3F1	7
MS308-F1	7
MS321-F4	7
2018 Top 10 Momentary Interruption	
Feeder ID	# of Events
138M6	7
20M4	6
27M8	6
51M2	6
80M25	6
A-1F4	6
MS331-F1	6
45M3	5
5122M12	5
A-1F2	5

Summarizing the results provide the following:

Table 18: Momentary Outages Occur in Three Years (Alectra East)

Momentary Outages Occur Each Year for Three Years	
Feeder ID	# of Events
MS331-F1	23

Table 19: Momentary Outages Occur in Two Years (Alectra East)

Momentary Outages Occur Each Year for Two Years	
Feeder ID	# of Events
A-1F4	14

Combining the lists provide the top feeders with year over year momentary reliability concerns.

Table 20: Feeders Performance by Momentary Outages (Alectra East)

Top Worst Performing Feeders by Momentary Outages	
Feeder ID	# of Events
MS331-F1	23
A-1F4	14

Sustained Outages by Year

The table below provides a summary for 2016, 2017 and Jun YTD 2018 for sustained outages per feeder (not including scheduled outages). Feeders highlighted in green appear every year, where feeders in blue only appear two out of the three years, and feeders in white only appear in one of the three years.

Table 21: Top 10 Sustained Outages by Year (Alectra East)

2016 Count of Sustained Outages	
Feeder ID	# of Events
12M3	26
20M21	22
26M11	20
45M4	20
27M8	18
5122M5	18
MS331-F6	17
36M7	16
27M5	15
24M5	14
2017 Count of Sustained Outages	
Feeder ID	# of Events
45M4	25
12M3	22
51M2	21
12M1	18
26M8	18
27M3	17
12M6	16
20M22	16
24M7	15
26M11	13
2018 Count of Sustained Outages	
Feeder ID	# of Events
26M8	20
20M21	15
51M2	15
51M31	15
12M6	13
80M25	13
MS307-F3	12
12M1	11
12M4	11
12M3	10

Summarizing the results provide the following:

Table 22: Number of Sustained Outage Occur in Three Years (Alectra East)

Feeders With The Highest Count of Sustained Outage Every Year For Three Years	
Feeder ID	# of Events
12M3	58

Table 23: Number of Sustained Outage Occur in Two Years (Alectra East)

Feeders With The Highest Count of Sustained Outage Every Year For Two Years	
Feeder ID	# of Events
45M4	45
26M8	38
20M21	37
51M2	36
26M11	33
12M1	29
12M6	29

Combining the lists provide the top feeders with year over year the highest number of sustained outages.

Table 24: Feeders Performance by Number of Sustained Outages (Alectra East)

Top Worst Performing Feeders by Count of Sustained Outages	
Feeder ID	# of Events
12M3	58
45M4	45
26M8	38
20M21	37
51M2	36
26M11	33
12M1	29
12M6	29

Customer Minutes of Interruption (CMI) from Sustained Outages by Year

The table below provides a summary for 2016, 2017 and June YTD 2018 based on the total CMI of sustained outages per feeder. Feeders highlighted in green appear every year, where feeders in blue only appear two out of the three years, and feeders in white only appear in one of the three years.

Table 25: Top 10 Sustained Outages for CMI by Year (Alectra East)

2016 Total CMI	
Feeder ID	CMI
138M8	5,632,858
138M6	4,031,767
23M7	3,086,484
13M4	2,930,963
23M6	2,634,968
153M4	2,107,466
138M7	2,107,403
5122M9	1,818,720
MS331-F6	1,765,790
13M1	1,592,079
2017 Total CMI	
Feeder ID	CMI
138M8	1,888,582
5122M9	1,490,201
20M12	1,166,247
MS322-F1	867,774
MS331-F1	863,412
5122M10	821,223
MS302-F2	693,870
12M1	576,690
24M6	565,575
A-3F4	556,928
2018 Total CMI	
Feeder ID	CMI
27M8	2,975,661
138M8	2,737,843
138M6	2,398,952
MS307-F2	1,577,118
A-5F1	1,144,418
A-5F2	1,057,528
51M2	931,379
25M2	814,379
45M4	723,759
A-3F1	693,124

Summarizing the results provide the following:

Table 26: Sustained Outage for CMI Occur in Three Years (Alectra East)

Top 10 Outage Duration Occurs in Three Years Excl SO	
Feeder ID	CMI
138M8	10,259,283

Table 27: Sustained Outage for CMI Occur in Two Years (Alectra East)

Top 10 Outage Duration Occurs in Two Years Excl SO	
Feeder ID	CMI
138M6	6,430,719
5122M9	3,308,921

Combining the lists provide the top feeders with year over year the greatest CMI from sustained outages.

Table 28: Feeder Performance by CMI (Alectra East)

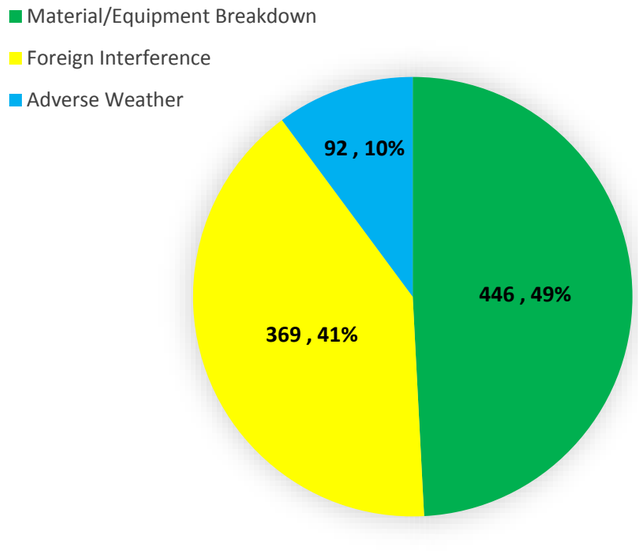
Top Worst Performing Feeders by CMI From Sustained Outages	
Feeder ID	CMI
138M8	10,259,283
138M6	6,430,719
5122M9	3,308,921

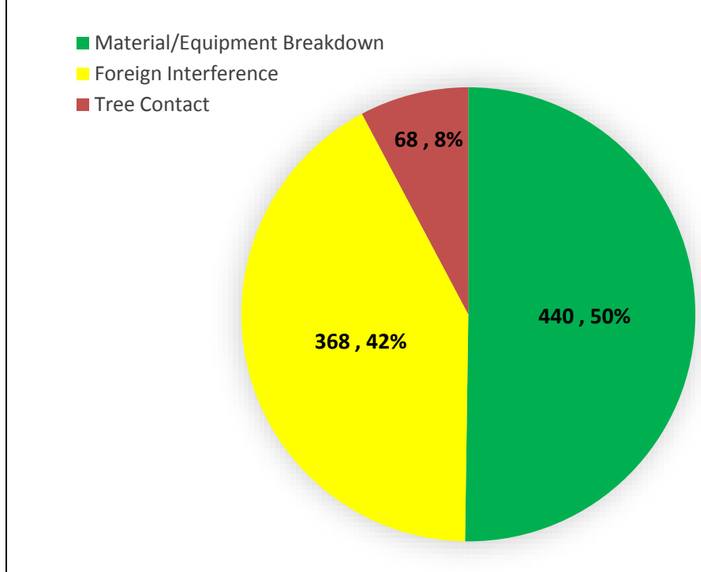
Summarizing all the results Momentary, Frequency, and Duration, highlights that no feeder shows up in all three lists. The 12M3 shows up in list for duration and frequency and would be considered the worst feeder in Alectra East. The 138M6 would be considered the next worse, based on duration only. The 45M4 while having minimal duration, appears in both frequency and momentary related outages. Below is a table summarizing the top three worst performing feeder's year over year.

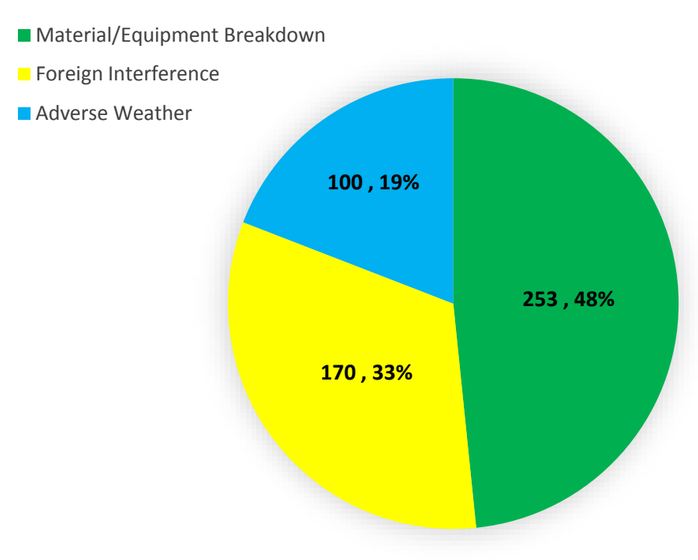
Table 29: Overall Worst Performing Feeders (Alectra East)

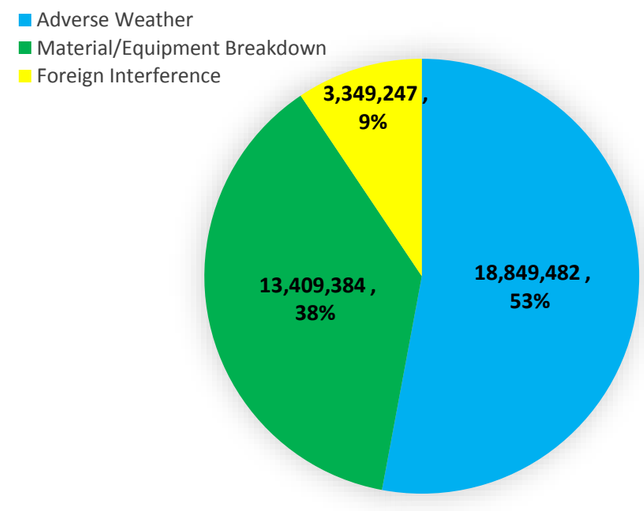
Top Worst Performing Feeders	
Feeder ID	Trigger
138M8	Duration
138M6	Duration
12M3	Frequency

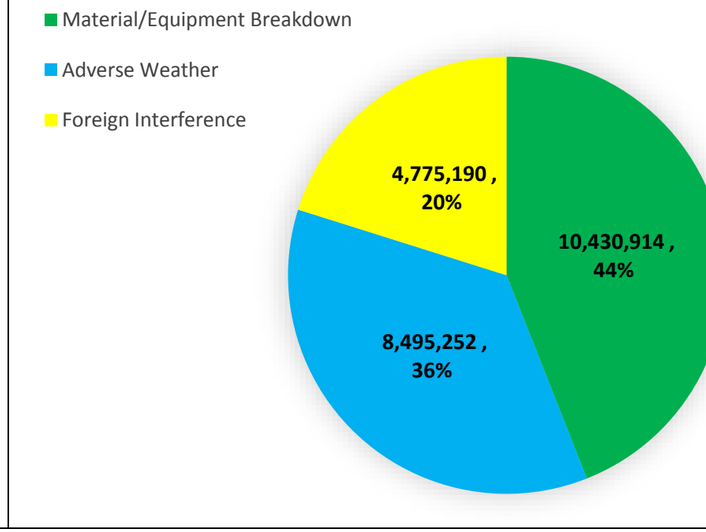
Cause Code Breakdown (Excluding Loss of Supply)

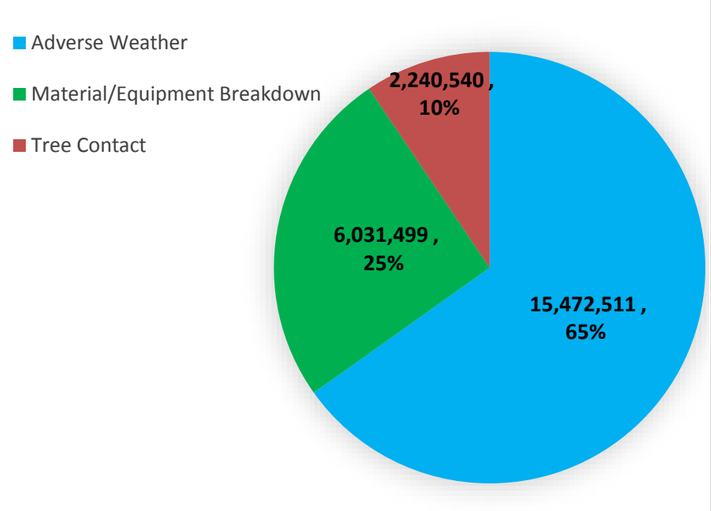












Based on the breakdown of Cause Codes per year the following is evident:

1) Top Causes (by number of events or duration):
    a. Material and Equipment Breakdown
    b. Adverse Weather
    c. Foreign Interference
    d. Tree Contact (to a less extent)
2) Adverse Weather is driven by MEDs
    a. 2016 – 2 MED (Significantly over threshold)
    b. 2017 – 2 MED (One Significantly over threshold, one slightly over threshold)
    c. 2018 – 1 MEDs (Significantly over threshold)

Examining the sub-cause codes for the top causes, the following trend is evident:

1) Material and Equipment Breakdown:
    a. Splice failures appear each year in the top three for both the frequency of events and duration
    b. Padmounted distribution transformers and transformer for frequency of events and oddly in duration as well.
2) Adverse Weather Breakdown:
    a. Winds
    b. Ice Storm
3) Foreign Interference Breakdown:
    a. Animal Contacts and Pole Hits appear in every year that Foreign Interference makes the top three
4) Tree Contacts:
    a. Tree Failed (This is directly related to weather events)
    b. Broken Branch

Alectra Central South (Mississauga) Reliability

Momentary Outages by Year

The table below provides a summary for 2016, 2017 and YTD June 2018 for momentary outages per feeder. Feeders highlighted in green appear every year, where feeders in blue only appear two out of the three years, and feeders in white only appear in one of the three years.

Table 30: Top 10 Momentary Outages by Year (Alectra Central South)

2016 Momentary Count		
Station Name	Feeder	# of Events
Still Meadow MS	24F3	16
Lorne Park TS	67M4	13
Chinook MS	21F7	12
Still Meadow MS	24F4	12
Chalkdene MS	69F1	11
Bramalea TS	74M25	10
Aquitane	59F1	9
Woods MS	68F1	9
Meadowwale Town Ctr	57F4	9
Rogers	30F7	9
2017 Momentary Count		
Station Name	Feeder	# of Events
Chinook	21F7	18
Stillmeadow	24F4	18
Rockwood	19F4	13
Rexdale	48F4	11
Cardiff	135M2	11
Rockwood	19F5	10
Bloor	38F3	10
Thomas	52F1	10
Erindale	C5M33	10
Richview	88M7	10
2018 Momentary Count		
Station Name	Feeder	# of Events
Stillmeadow	24F4	10
Thomas	52F6	8
Meadowvale	R3107M8	8
Woodlands	13F5	6
Rexdale	48F4	5
Lorne Park	67M1	5
Thomas	52F1	5
Rockwood	19F2	5
Oakville	22M45	5
Kamato	17F1	4

Summarizing the results provide the following:

Table 31: Momentary Outages Occur in Three Years (Alectra Central South)

Momentary Outages Occur Each Year For Three Years		
Station Name	Feeder	# of Events
Still Meadow MS	24F4	40

Table 32: Momentary Outages Occur in Two Years (Alectra Central South)

Momentary Outages Occur Each Year For Two Years		
Station Name	Feeder	# of Events
Chinook MS	21F7	30
Rexdale	48F4	16

Combining the lists provide the top feeders with year over year momentary reliability concerns.

Table 33: Feeders Performance by Momentary Outages (Alectra Central South)

Top Worst Performing Feeders by Momentary Outages		
Station Name	Feeder	# of Events
Still Meadow MS	24F4	40
Chinook MS	21F7	30
Rexdale	48F4	16

Sustained Outages by Year

The table below provides a summary for 2016, 2017 and YTD June 2018 for sustained outages per feeder (not including scheduled outages). Feeders highlighted in green appear every year, where feeders in blue only appear two out of the three years, and feeders in white only appear in one of the three years.

Table 34: Top 10 Sustained Outages by Year (Alectra Central South)

2016 Count of Sustained Outages		
Station Name	Feeder	# of Events
Bloor	38F3	22
Stillmeadow	24F3	18
Woodlands	13F5	13
John	39F1	13
Chinook	21F7	12
Chalkdene	69F1	12
Bloor	38F4	11
Woods	68F1	11
Malton	37F3	10
Stillmeadow	24F4	10
2017 Count of Sustained Outages		
Station Name	Feeder	# of Events
Chinook	21F7	25
Bloor	38F3	25
Woodlands	13F4	16
Hamilton	71F3	16
Rockwood	19F4	13
Stillmeadow	24F4	13
Credit Valley	50F1	11
Bloor	38F4	11
Stillmeadow	24F5	11
Lisgar	82F5	11
2018 Count of Sustained Outages		
Station Name	Feeder	# of Events
Thomas	52F6	10
Woodlands	13F5	10
Bloor	38F3	6
Woodlands	13F3	6
Mineola	1F4	6
Malton	37F3	5
New Dixie	45F6	5
Lisgar	82F5	5
Erindale	C5M41	5
Chinook	21F3	5

Summarizing the results provide the following:

Table 35: Number of Sustained Outage Occur in Three Years (Alectra Central South)

Feeders With The Highest Count of Sustained Outage Occuring in All Three Years		
Station Name	Feeder	# of Events
Bloor	38F3	53

Table 36: Number of Sustained Outage Occur in Two Years (Alectra Central South)

Feeders With The Highest Count of Sustained Outage For Two Out Of Three Years		
Station Name	Feeder	# of Events
Chinook	21F7	37
Woodlands	13F5	23
Stillmeadow	24F4	23
Bloor	38F4	22
Lisgar	82F5	16

Combining the lists provide the top feeders with year over year the highest number of sustained outages.

Table 37: Feeders Performance by Number of Sustained Outages (Alectra Central South)

Top Worst Performing Feeders by Count of Sustained Outages		
Station Name	Feeder	# of Events
Bloor	38F3	53
Chinook	21F7	37
Woodlands	13F5	23
Stillmeadow	24F4	23
Bloor	38F4	22
Lisgar	82F5	16

Customer Minutes of Interruption (CMI) from Sustained Outages by Year

The table below provides a summary for 2016, 2017 and YTD June 2018 based on the total CMI of sustained outages per feeder. Feeders highlighted in green appear every year, where feeders in blue only appear two out of the three years, and feeders in white only appear in one of the three years.

Table 38: Top 10 Sustained Outages for CMI by Year (Alectra Central South)

2016 Total CMI		
Station Name	Feeder	CMI
Meadowwale Town Ctr MS	57F2	388,318
Bloor	38F3	377,718
Battleford MS	54F3	349,819
Tomken TS	83M26	236,072
Lisgar MS	82F5	226,850
Woodlands MS	13F2	202,570
Erindale TS	C5M36	189,412
Chalkdene MS	69F1	181,745
Woods MS	68F1	170,689
Aquitane	59F1	149,052
2017 Total CMI		
Station Name	Feeder	CMI
Erindale	C5M32	730,491
Lisgar	82F5	397,219
Woodbridge	D6M12	333,437
Erindale	C5M42	218,918
Woodlands	13F2	181,883
Chinook	21F7	169,103
Woods	68F2	163,037
Battleford	54F2	130,593
Desboro	49F3	129,241
Erindale	C5M41	127,584
2018 Total CMI		
Station Name	Feeder	CMI
Chinook	21F7	405,874
Erindale	C5M38	291,289
Tomken	83M29	272,252
Woodbridge	D6M13	242,719
Bramalea	74M45	191,952
Meadowvale	R3107M4	189,467
Clarkson	8F5	180,798
Argentia	58F1	167,122
Woodlands	13F2	136,679
Stillmeadow	24F5	127,271

Summarizing the results provide the following:

Table 39: Sustained Outage for CMI Occur in Three Years (Alectra Central South)

Feeders With Highest Total CMI Every Year For Three Years		
Station Name	Feeder	CMI
Woodlands	13F2	521,132

Table 40: Sustained Outage for CMI Occur in Two Years (Alectra Central South)

Feeders With Highest Total CMI Every Year For Two Years		
Station Name	Feeder	CMI
Chinook	21F7	624,069
Lisgar	82F5	574,977

One Important observation should be made, the Erindale TS has 5 feeders that show in the list over the three years. However, all the feeders are different. Two Erindale feeders also show up in the top 10 for momentary and sustained outages in previous years. By far the area serviced by this station should be considered the worst area in all Mississauga.

Combining the lists provide the top feeders with year over year the greatest CMI from sustained outages.

Table 41: Feeder Performance by CMI (Alectra Central South)

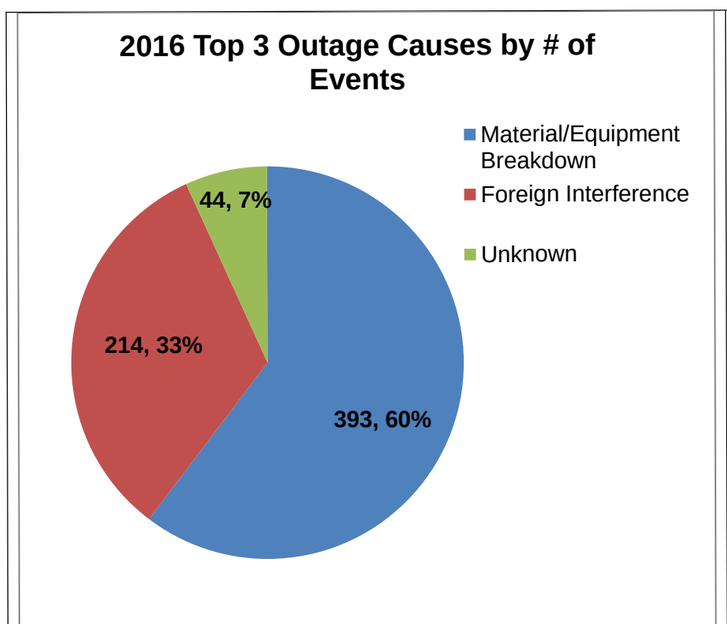
Top Worst Performing Feeders by CMI From Sustained Outages		
Station Name	Feeder	CMI
Chinook	21F7	624,069
Lisgar	82F5	574,977
Woodlands	13F2	521,132

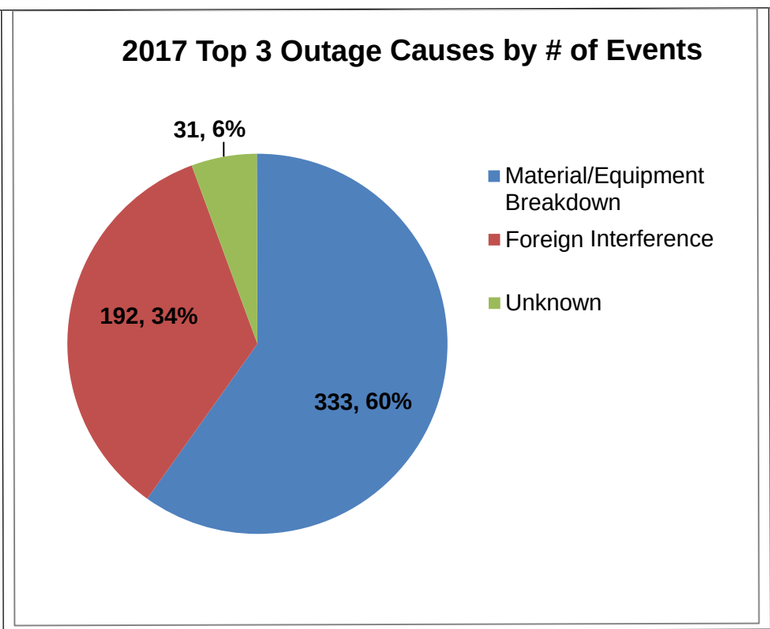
Summarizing all the results Momentary, Frequency, and Duration, highlights that only one feeder shows up on all three lists. That is the 21F7 or the Chinook MS F7. The Stillmeadow MS 24F4 shows up in both Momentary and Frequency lists. No other feeder directly stands out, however, due to the continued appearance of Erindale TS feeders the station is being mentioned below for based on Duration. Below is a table summarizing the top three worst performing feeder's year over year.

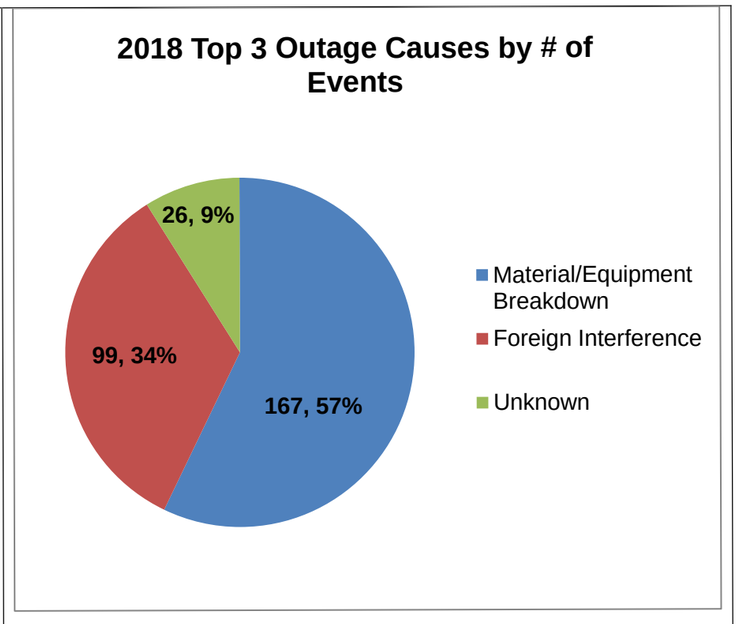
Table 42: Overall Worst Performing Feeders (Alectra Central South)

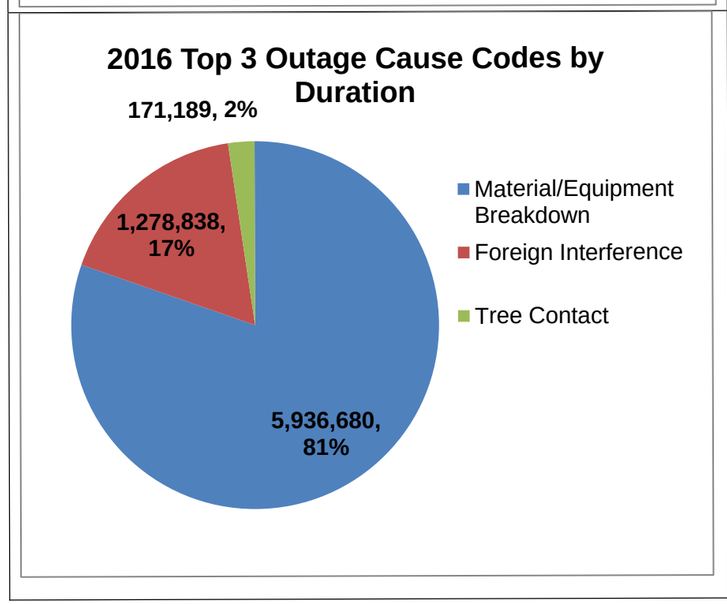
Top Worst Performing Feeders		
Station Name	Feeder ID	Trigger
Chinook MS	21F7	Momentary, Frequency and Duration
Stillmeadow	24F4	Momentary and Frequency
Erindale TS	All feeders	Momentary and Duration

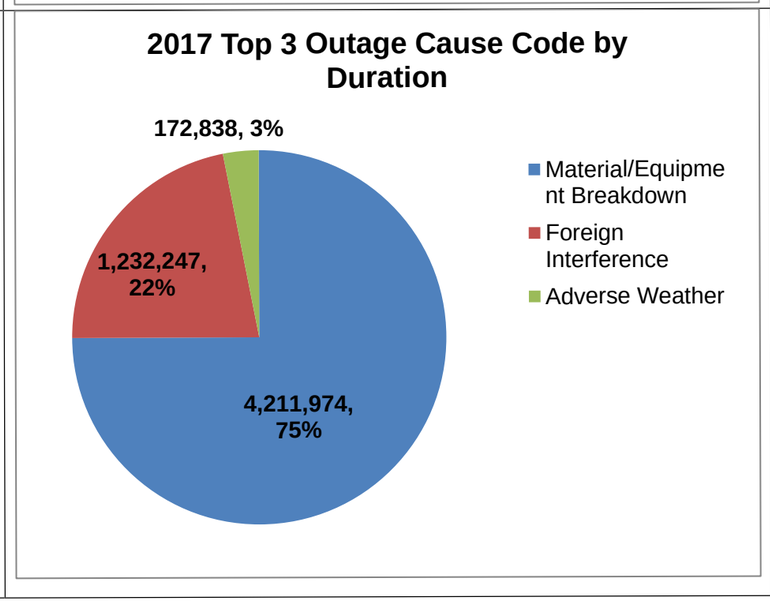
Cause Code Breakdown (Excluding Loss of Supply)

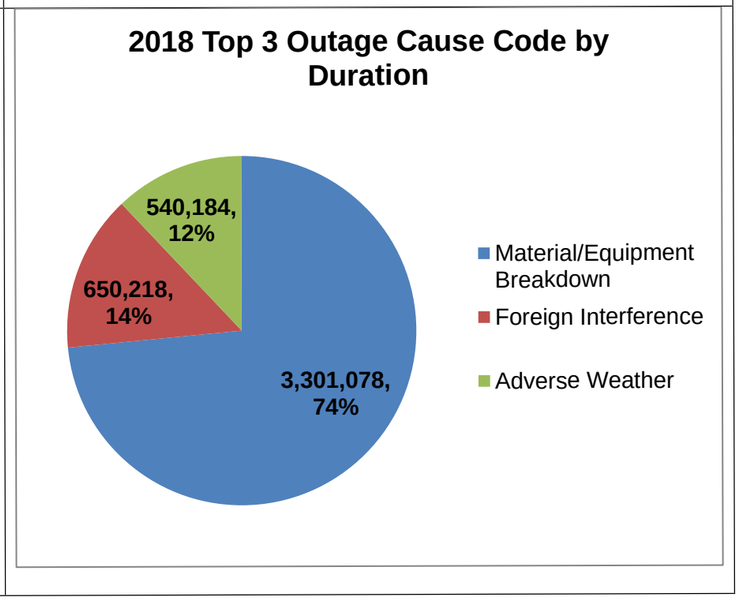












Based on the breakdown of Cause Codes per year the following is evident:

1) Top Causes (by number of events or duration):
    a. Material and Equipment Breakdown
    b. Foreign Interference
    c. Adverse Weather
2) Adverse Weather is driven by MEDs
    a. 2016 – 0 MED
    b. 2017 – 1 MED (Slightly over threshold)
    c. 2018 – 2 MEDs (One significantly over threshold, one slightly over threshold)
3) Unknown
    a. This is a leading cause of outages and needs to be addressed with Lines.

Examining the sub-cause codes for the top causes, the following trend is evident:

1) Material and Equipment Breakdown:
    a. XLPE cable faults appear each year as the top item for both the frequency of events and duration
    b. Transformers appear year over year under the cause of an outage, but have little impact on duration
    c. Terminations appear in the top 3 for duration in two of the three years
2) Adverse Weather Breakdown:
    a. Driven exclusively by Extreme Winds
3) Foreign Interference Breakdown:
    a. Animal Contacts, Pole Hits, and Dig-ins appear each year as the top three for both cause and duration in 2016 and 2017. For 2018, these sub-causes are high but no longer the top 3.

Alectra West Reliability

Momentary Outages by Year

The table below provides a summary for 2016, 2017 and YTD June 2018 for momentary outages per feeder. Feeders highlighted in green appear every year, where feeders in blue only appear two out of the three years, and feeders in white only appear in one of the three years.

Table 43: Top 10 Momentary Outages by Year (Alectra West)

2016 Momentary Count		
Station Name	Feeder ID	# of Events
Vansickle T.S.	M41	12
Vansickle T.S.	M82	11
Nebo T.S.	331X	10
Nebo T.S.	341X	10
Carlton T.S.	M17	9
Vansickle T.S.	M72	9
Bunting T.S.	M75	9
Vansickle T.S.	M71	8
Dundas T.S.	2D6X	7
Glendale T.S.	M16	7
2017 Momentary Count		
Station Name	Feeder ID	# of Events
Carlton T.S.	M17	18
Bunting T.S.	M82	14
Dundas T.S.	2D2X	13
Nebo T.S.	331X	10
Carlton T.S.	M10	8
Vansickle T.S.	M41	8
Winona T.S.	W14X	8
Nebo T.S.	341X	7
Carlton T.S.	M20	7
Carlton T.S.	M25	7
2018 Momentary Count		
Station Name	Feeder ID	# of Events
Vansickle T.S.	M82	11
Carlton T.S.	M17	9
Dundas T.S.	2D2X	8
Bunting T.S.	M62	7
Carlton T.S.	M18	6
Nebo T.S.	341X	5
Bunting T.S.	M55	5
Carlton T.S.	M10	4
Bunting T.S.	M75	4
Dundas T.S.	2D13X	3

Summarizing the results provide the following:

Table 44: Momentary Outages Occur in Three Years (Alectra West)

Momentary Outages Occur Each Year For Three Years		
Station Name	Feeder ID	# of Events
Carlton T.S.	M17	36
Nebo T.S.	341X	22

Table 45: Momentary Outages Occur in Two Years (Alectra West)

Momentary Outages Occur Each Year For Two Years		
Station Name	Feeder ID	# of Events
Vansickle T.S.	M82	22
Dundas T.S.	2D2X	21
Vansickle T.S.	M41	20
Nebo T.S.	331X	20
Bunting T.S.	M75	13
Carlton T.S.	M10	12

Combining the lists provide the top feeders with year over year momentary reliability concerns.

Table 46: Feeders Performance by Momentary Outages (Alectra West)

Top Worst Performing Feeders by Momentary Outages		
Station Name	Feeder ID	# of Events
Carlton T.S.	M17	36
Nebo T.S.	341X	22
Vansickle T.S.	M82	22
Dundas T.S.	2D2X	21
Vansickle T.S.	M41	20
Nebo T.S.	331X	20
Bunting T.S.	M75	13
Carlton T.S.	M10	12

Sustained Outages by Year

The table below provides a summary for 2016, 2017 and YTD June 2018 for sustained outages per feeder (not including scheduled outages). Feeders highlighted in green appear every year, where feeders in blue only appear two out of the three years, and feeders in white only appear in one of the three years.

Table 47: Top 10 Sustained Outages by Year (Alectra West)

2016 Count of Sustained Outages		
Station Name	Feeder ID	# of Events
Dundas T.S.	2D2X	15
Bunting T.S.	M77	15
Nebo T.S.	331X	14
Vansickle T.S.	M41	13
Dundas T.S.	2D13X	12
Glendale T.S.	M23	12
Bunting T.S.	M61	12
Nebo T.S.	341X	11
Carlton T.S.	M10	11
Carlton T.S.	M25	11
2017 Count of Sustained Outages		
Station Name	Feeder ID	# of Events
Dundas T.S.	2D2X	20
Beach T.S.	7411X	15
Carlton T.S.	M11	15
Carlton T.S.	M21	15
Carlton T.S.	M10	14
Carlton T.S.	M20	14
Vansickle T.S.	M41	14
Bunting T.S.	M77	14
Carlton T.S.	M17	13
Vansickle T.S.	M82	13
2018 Count of Sustained Outages		
Station Name	Feeder ID	# of Events
Vansickle T.S.	M82	13
Dundas T.S.	2D7X	11
Carlton T.S.	M18	10
Mohawk T.S.	0812X	9
Dundas T.S.	2D2X	9
Nebo T.S.	341X	8
Carlton T.S.	M21	8
Glendale T.S.	M23	8
Vansickle T.S.	M52	8
Newton T.S.	241X	7

Summarizing the results provide the following:

Table 48: Number of Sustained Outage Occur in Three Years (Alectra West)

Feeders With The Highest Count of Sustained Outage Every Year For Three Years		
Station Name	Feeder ID	# of Events
Dundas T.S.	2D2X	44

Table 49: Number of Sustained Outage Occur in Two Years (Alectra West)

Feeders With The Highest Count of Sustained Outage For Two Out Of Three Years		
Station Name	Feeder ID	# of Events
Bunting T.S.	M77	29
Vansickle T.S.	M41	27
Vansickle T.S.	M82	26
Carlton T.S.	M10	25
Carlton T.S.	M21	23
Glendale T.S.	M23	20
Nebo T.S.	341X	15

Combining the lists provide the top feeders with year over year the highest number of sustained outages.

Table 50: Feeders Performance by Number of Sustained Outages (Alectra West)

Top Worst Performing Feeders by Count of Sustained Outages		
Station Name	Feeder ID	# of Events
Dundas T.S.	2D2X	54
Bunting T.S.	M77	29
Vansickle T.S.	M41	27
Vansickle T.S.	M82	26
Carlton T.S.	M10	25
Carlton T.S.	M21	23
Glendale T.S.	M23	20
Nebo T.S.	341X	15

Customer Minutes of Interruption (CMI) from Sustained Outages by Year

The table below provides a summary for 2016, 2017 and YTD June 2018 based on the total CMI of sustained outages per feeder. Feeders highlighted in green appear every year, where feeders in blue only appear two out of the three years, and feeders in white only appear in one of the three years.

Table 51: Top 10 Sustained Outages for CMI by Year (Alectra West)

2016 Total CMI		
Station Name	Feeder ID	CMI
Bunting T.S.	M61	2,049,249
Lake T.S.	1721X	1,656,312
Dundas T.S.	2D13X	1,496,356
Newton T.S.	NT26-Total Station	1,110,152
Nebo T.S.	341X	969,991
Dundas T.S.	2D2X	843,012
Nebo T.S.	331X	486,543
Horning T.S.	421X	458,802
Carlton T.S.	M18	413,891
Aberdeen S/S	AB-2	391,646
2017 Total CMI		
Station Name	Feeder ID	CMI
Winona T.S.	W14X	1,780,572
Dundas T.S.	2D2X	1,652,306
Carlton T.S.	M17	1,568,113
Nebo T.S.	331X	708,325
Beach T.S.	7411X	593,809
Dundas T.S.	Total Station	576,893
Stirton T.S.	8511X	540,363
Carlton T.S.	M18	487,990
Nebo T.S.	3631X	464,153
Stirton T.S.	8631X	428,899
2018 Total CMI		
Station Name	Feeder ID	CMI
Dundas T.S.	2D7X	4,063,598
Newton T.S.	281X	2,303,102
Bunting T.S.	BU-Total Station	2,290,813
Lake T.S.	121X	1,894,598
Nebo T.S.	331X	1,831,401
Dundas T.S.	2D13X	1,781,869
Mohawk T.S.	0812X	1,368,405
Glendale T.S.	M23	1,124,439
Mohawk T.S.	0721X	1,093,248
Dundas T.S.	2D12X	974,236

Summarizing the results provide the following:

Table 52: Sustained Outage for CMI Occur in Three Years (Alectra West)

Feeders With Highest Total CMI Every Year For Three Years		
Station Name	Feeder ID	CMI
Nebo T.S.	331X	3,026,269

Table 53: Sustained Outage for CMI Occur in Two Years (Alectra West)

Feeders With Highest Total CMI Every Year For Two Years		
Station Name	Feeder ID	CMI
Dundas T.S.	2D13X	3,278,225
Dundas T.S.	2D2X	2,495,318
Carlton T.S.	M18	901,881

Combining the lists provide the top feeders with year over year the greatest CMI from sustained outages.

Table 54: Feeder Performance by CMI (Alectra West)

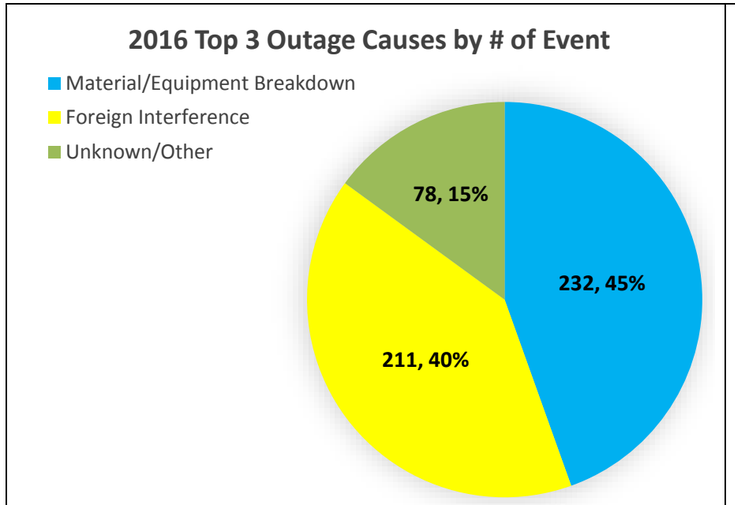
Top Worst Performing Feeders by CMI From Sustained Outages		
Station Name	Feeder ID	Combined CMI
Dundas T.S.	2D13X	3,278,225
Nebo T.S.	331X	3,026,269
Dundas T.S.	2D2X	2,495,318
Carlton T.S.	M18	901,881

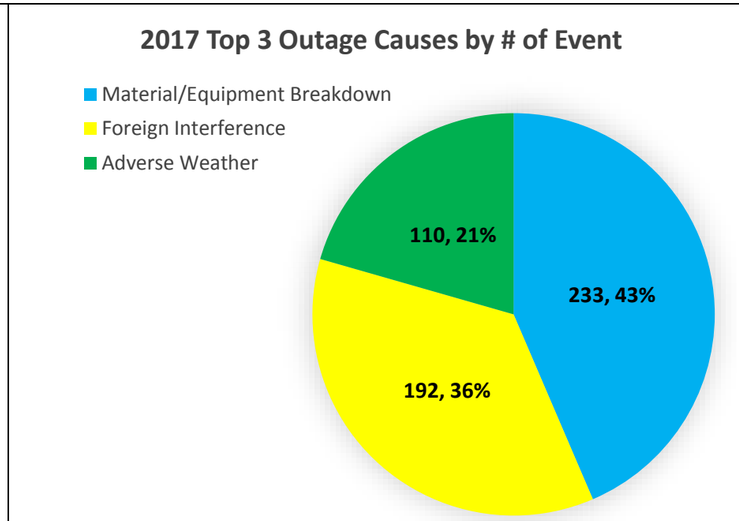
Summarizing all the results Momentary, Frequency, and Duration, highlights that only one feeder shows up on all three lists. That is the 2D2X or the Dundas TS M2 breaker. The Nebo 331X shows up on the duration and momentary lists, and the Nebo 341X shows up on the frequency and momentary listing. Below is a table summarizing the top three worst performing feeder's year over year.

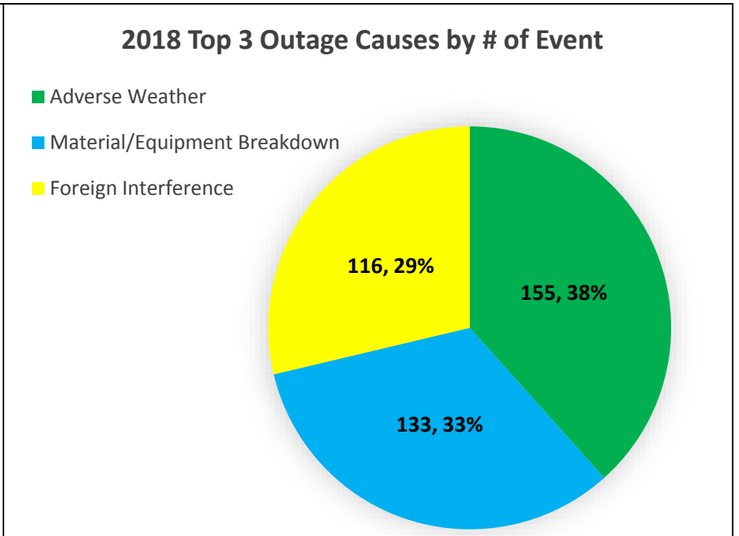
Table 55: Overall Worst Performing Feeders (Alectra West)

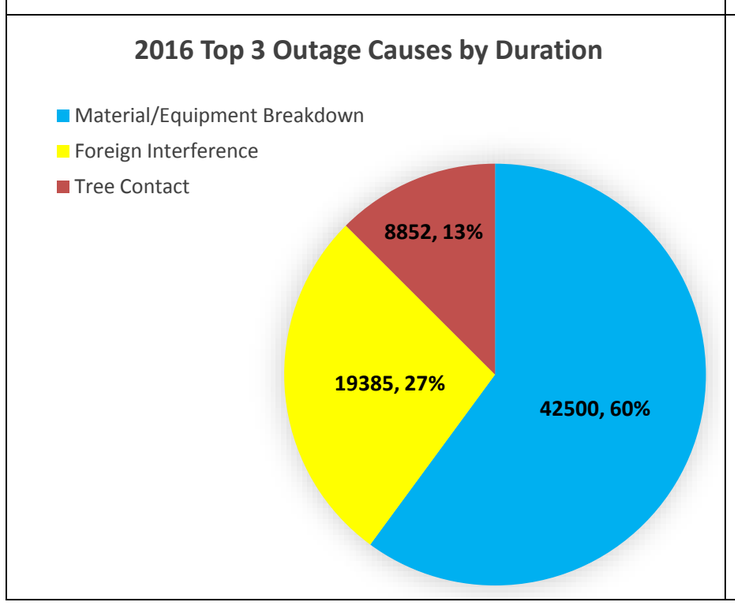
Top Worst Performing Feeders		
Station Name	Feeder ID	Trigger
Dundas T.S.	2D2X	Momentary, Frequency and Duration
Nebo T.S.	331X	Momentary and Duration
Nebo T.S.	341X	Momentary and Frequency

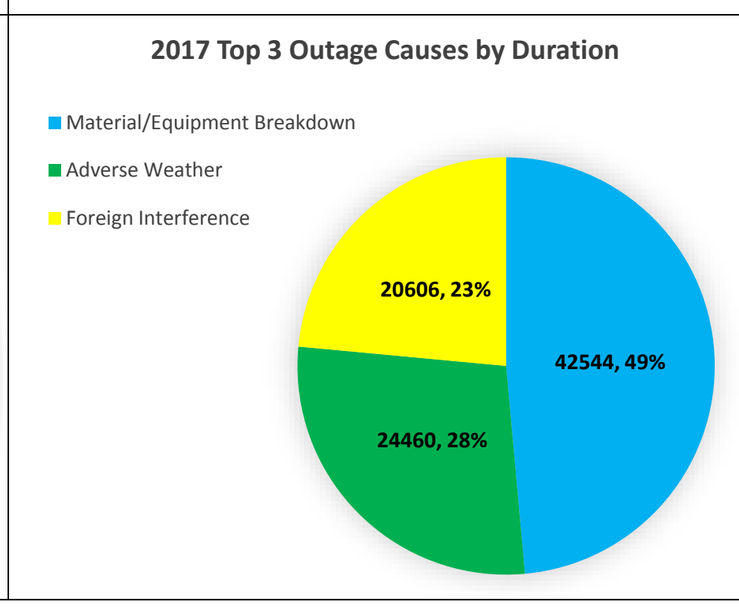
Cause Code Breakdown (Excluding Loss of Supply)

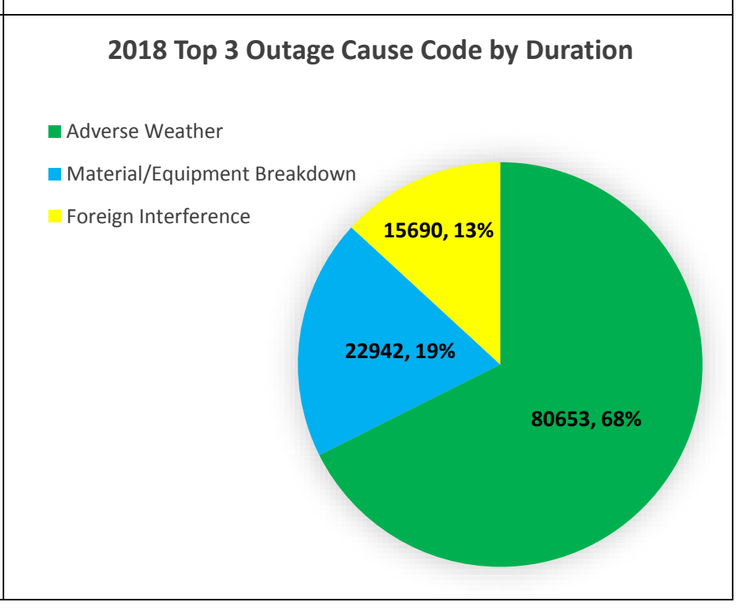












Based on the breakdown of Cause Codes per year the following is evident:

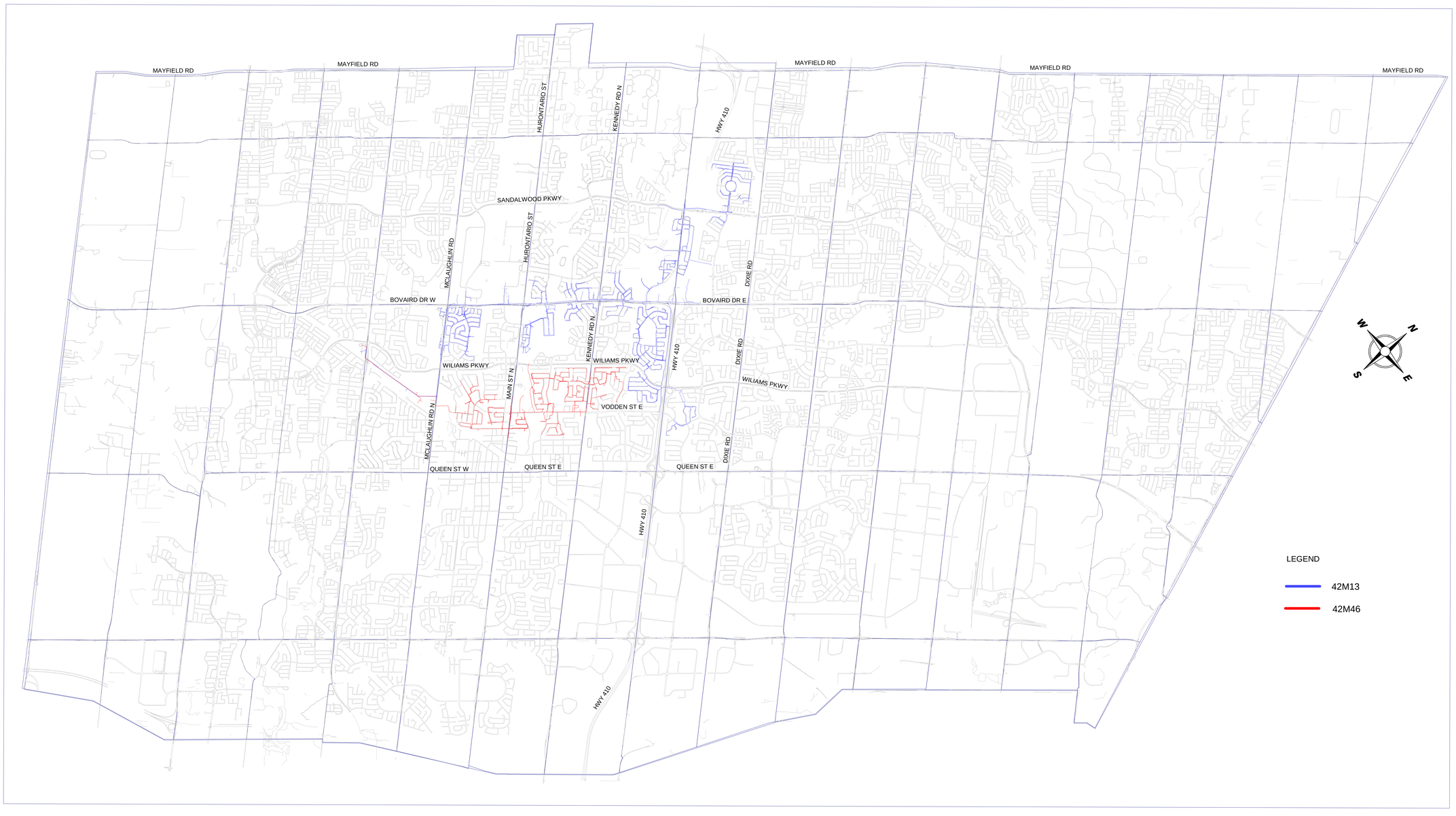
4) Top Causes (by number of events or duration):
    a. Material and Equipment Breakdown
    b. Adverse Weather
    c. Foreign Interference
1) Adverse Weather is driven by MEDs
    a. 2016 – 1 MED (marginally over threshold)
    b. 2017 – 1 MED (Significantly over threshold)
    c. 2018 – 2 MEDs (Both significantly over threshold)

Examining the sub-cause codes for the top causes, the following trend is evident:

1) Material and Equipment Breakdown:
    a. XLPE cable faults appear each year in the top three for both the frequency of events and duration
    b. PILC cable faults appear in the last two years in the top three by duration only.
    c. Distribution transformers and transformer cutouts also appear often for frequency of events, but obviously not duration.
2) Adverse Weather Breakdown:
    a. Driven exclusively by High Winds
3) Foreign Interference Breakdown:
    a. Animal Contacts and Pole Hits appear each year as two of the top three sub-causes.

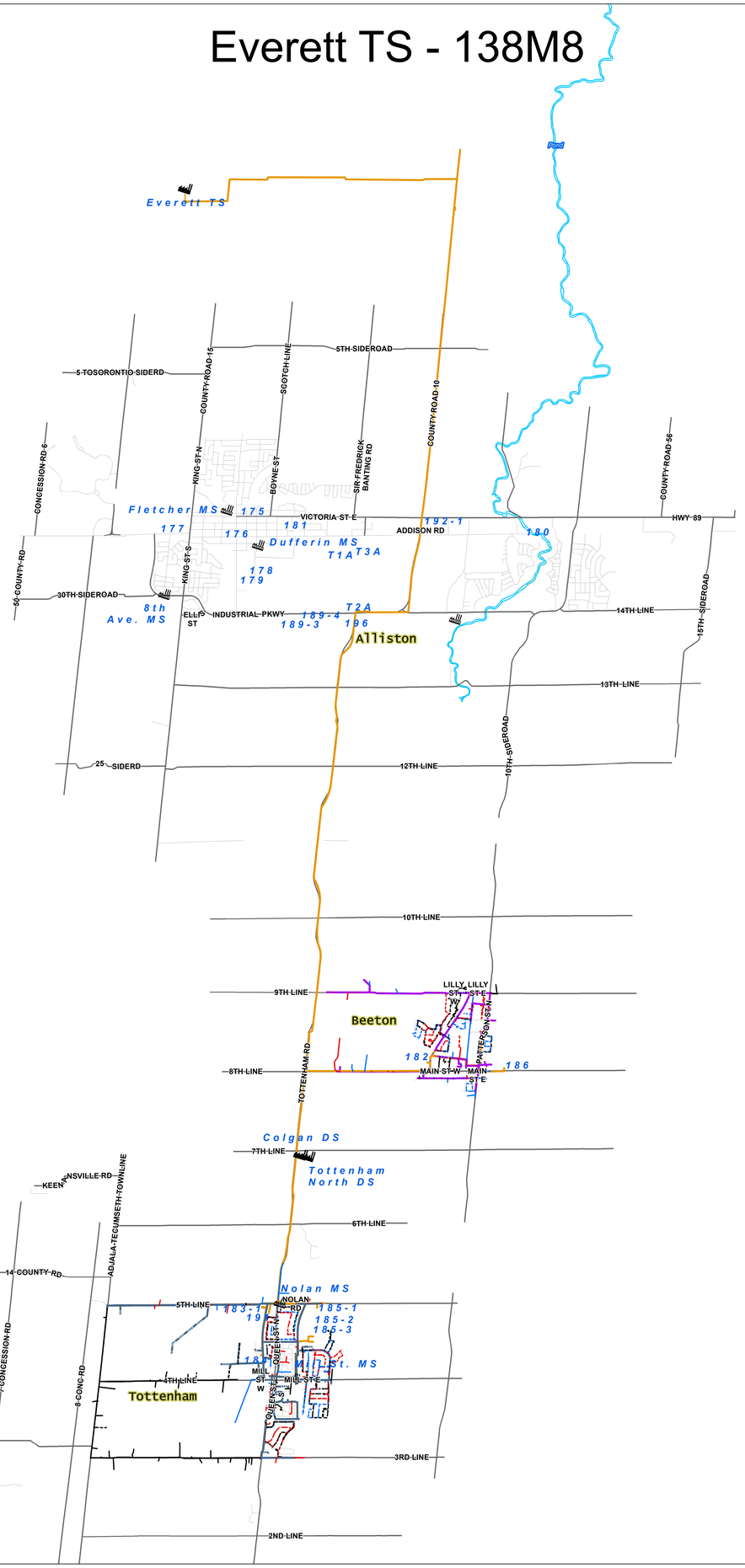
Appendix A: Feeder Maps

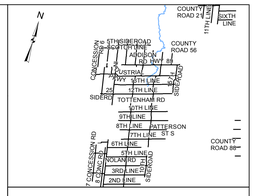
ALECTRA UTILITIES - CENTRAL BRAMPTON



Created by Dragomir Slijepcevic, GIS Technician
GIS Records at ALECTRA UTILITIES
July 26, 2018

Everett TS - 138M8





KEY PLAN

Legend

OH 1, 2 Phase
- WB
- RB
- RW
- B
- W
- R

OH 3 Phase
- Other Voltages
- 44.0 KV
- 27.6 KV
- 13.8 KV
- 8.32 KV
- 4.16 KV

UG 1, 2 Phase
- WB
- RB
- RW
- B
- W
- R

UG 3 Phase
- Other Voltages
- 44.0 KV
- 27.6 KV
- 13.8 KV
- 8.32 KV
- 4.16 KV

Electric Station
- Substation
- Transformer Station
- Transmission Lines
- Water

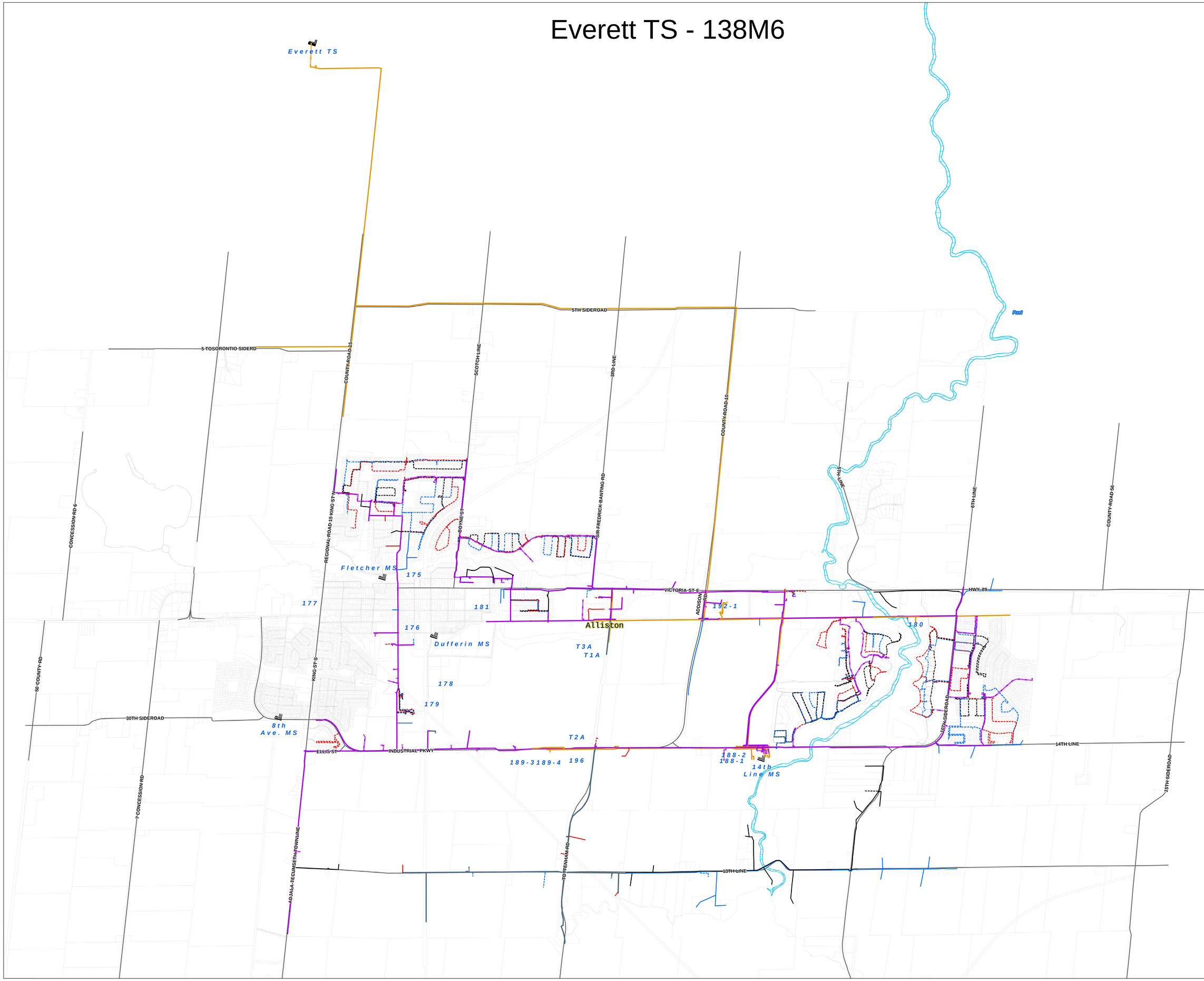
N W E S

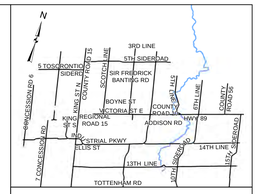
alectra utilities

Feeder:	138M8 - EVERETT TS
CITY:	ALLISTON
SCALE: 1:31,865	DATE CREATED: 1 Aug 2018
PAPER SIZE:	CREATED AND OPTIMIZED FOR 48" x 36"

0 500 1,000 2,000
Meters

Everett TS - 138M6





KEY PLAN

Legend

UG 1, 2 Phase
- WB
- RB
- RW
- B
- W
- R

UG 3 Phase
- Other Voltages
- 44.0 kV
- 27.6 kV
- 13.8 kV
- 8.32 kV
- 4.16 kV

OH 1, 2 Phase
- WB
- RB
- RW
- B
- W
- R

OH 3 Phase
- Other Voltages
- 44.0 kV
- 27.6 kV
- 13.8 kV
- 8.32 kV
- 4.16 kV

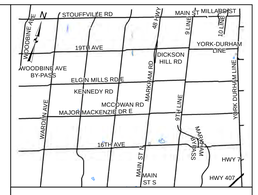
Electric Station
- Substation
- Transformer Station
- Transmission Lines
- Rail Road
- Streams
- Water

alectra utilities

Feeder:	138M6 - EVERETT TS
CITY:	ALLISTON
SCALE:	1:12,000
DATE CREATED:	25 Jul 2018
PAPER SIZE:	CREATED AND OPTIMIZED FOR 48" x 36"

0 250 500 1,000
Meters

Buttonville TS - 12M3



KEY PLAN

Legend

UG 1, 2 Phase
- WB
- RB
- RW
- B
- W
- R

UG 3 Phase
- Other Voltages
- 44.0 kV
- 27.6 kV
- 13.8 kV
- 8.32 kV
- 4.16 kV

OH 1, 2 Phase
- WB
- RB
- RW
- B
- W
- R

OH 3 Phase
- Other Voltages
- 44.0 kV
- 27.6 kV
- 13.8 kV
- 8.32 kV
- 4.16 kV

Electric Station
- Substation
- Transformer Station
- Transmission Lines
- Rail Road
- Streams
- Water

STOUFFVILLE RD
MAIN ST
48 HWY
MILLARD ST
STOUFFER ST
9 LINE
10 LINE
YORK-DURHAM LINE
WOODBINE AVE
19TH AVE
TRANSMISSION LINE
DICKSON HILL RD
REGIONAL ROAD 30
9 CONCESSION
8 CONCESSION
ELGIN MILLS RD E
KENNEDY RD
MCCOWAN RD
MARKHAM RD
8TH LINE
MAJOR MACKENZIE DR E
WARDEN AVE
Markham
16TH AVE
Buttonville TS
MAIN ST N
MAIN ST S
CNR
MARKHAM BYPASS
DONALD COUSENS PKWY
HWY 7
HWY 407

N
W
E
S

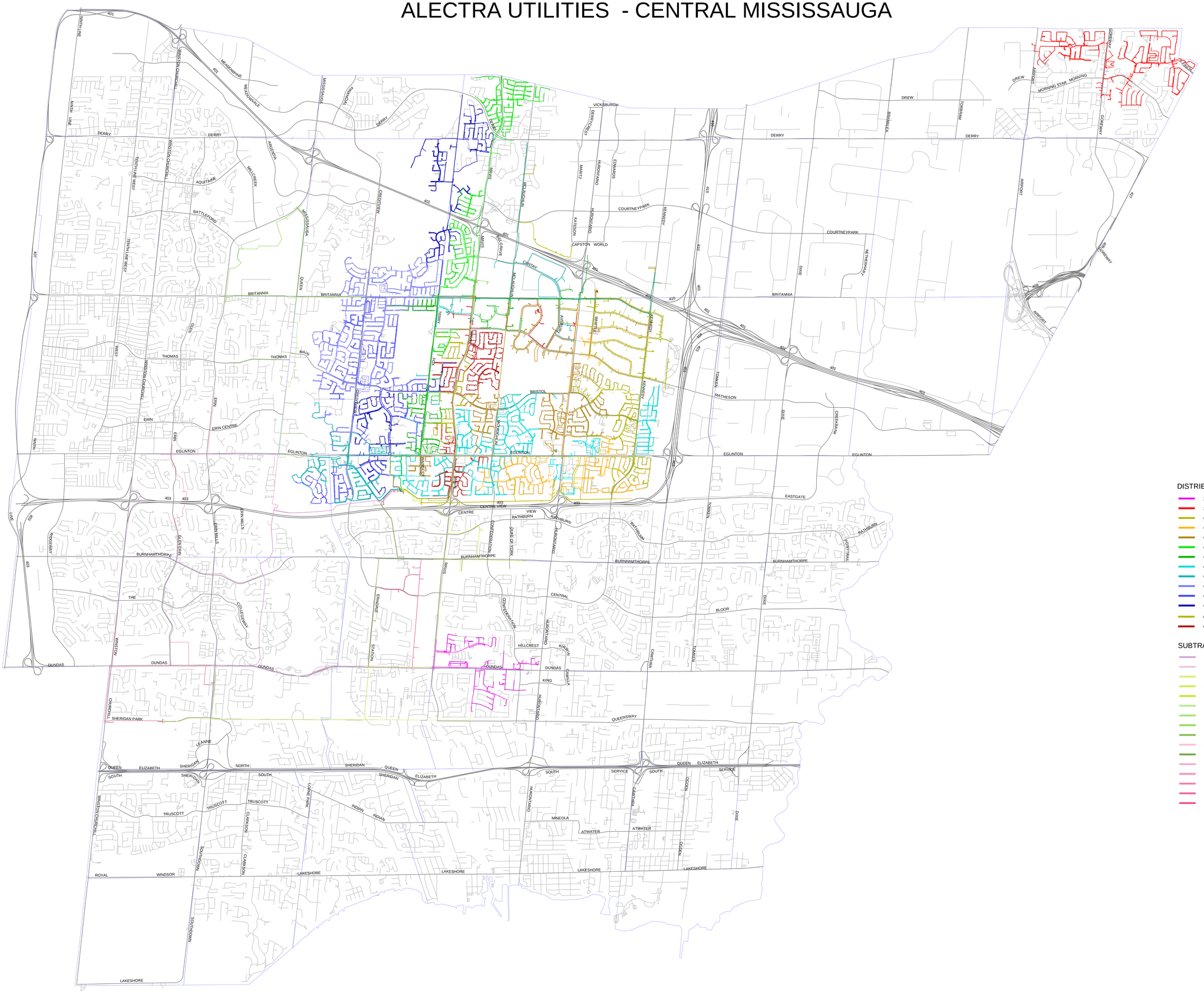
alectra utilities

Feeder:	12M3 - BUTTONVILLE TS
CITY:	MARKHAM
SCALE:	1:13,000
DATE CREATED:	25 Jul 2018
PAPER SIZE:	CREATED AND OPTIMIZED FOR 48" x 36"

0 250 500 1,000
Meters

ALECTRA UTILITIES - CENTRAL MISSISSAUGA

alectra utilities



N
W
E
S

LEGEND

DISTRIBUTION FEEDERS

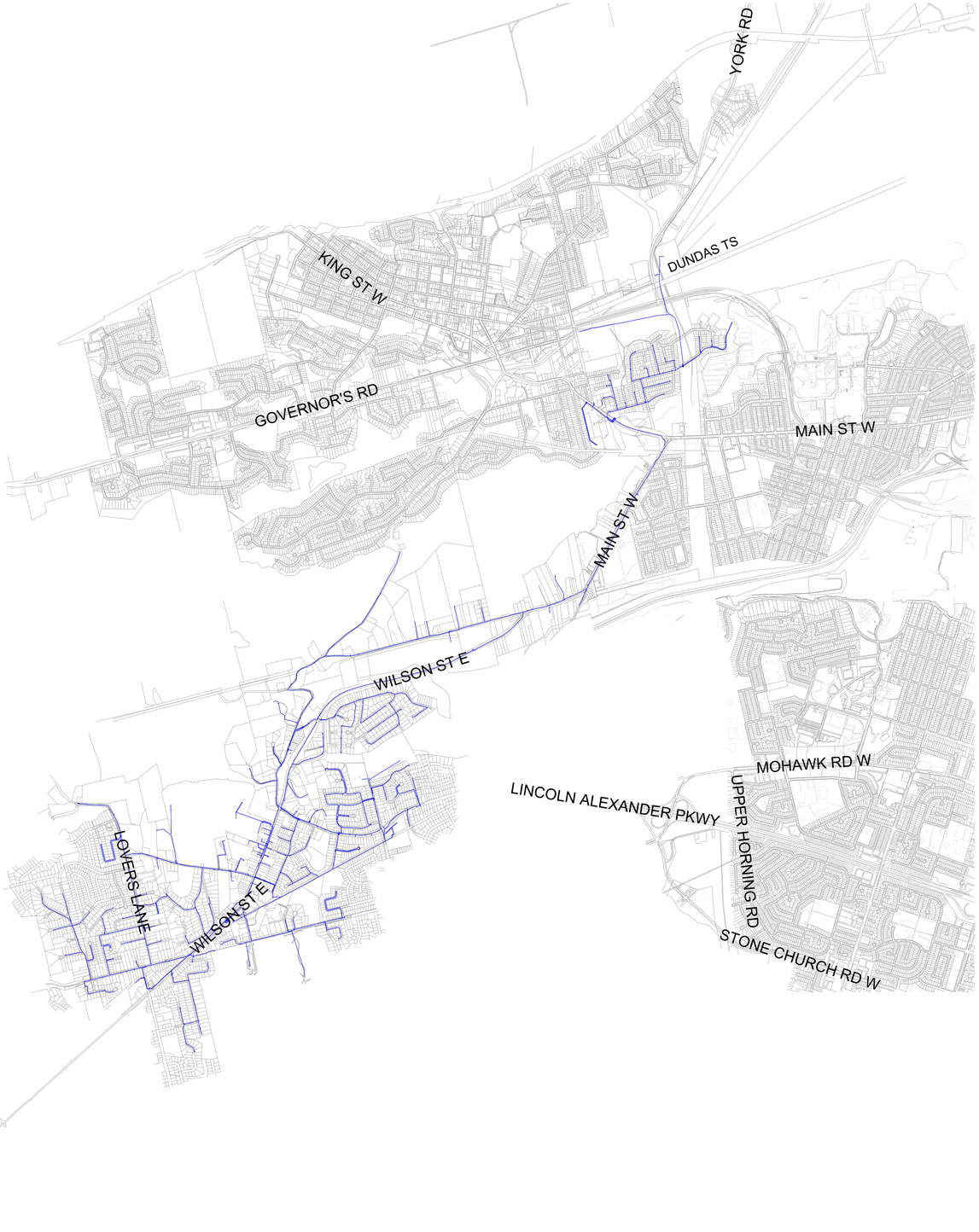
- 24F4
- 21F7
- C5M31
- C5M32
- C5M33
- C5M34
- C5M35
- C5M36
- C5M37
- C5M38
- C5M39
- C5M40
- C5M41
- C5M42

SUBTRANSMISSION FEEDERS

- C5M1
- C5M2
- C5M23
- C5M24
- C5M25
- C5M26
- C5M27
- C5M28
- C5M29
- C5M3
- C5M30
- C5M4
- C5M5
- C5M6
- C5M7
- C5M8

Created by Dragomir Slijepcevic, GIS Technician
GIS Records at Alectra Utilities
July 25, 2018

ALECTRA UTILITIES 2D2X CIRCUIT MAP

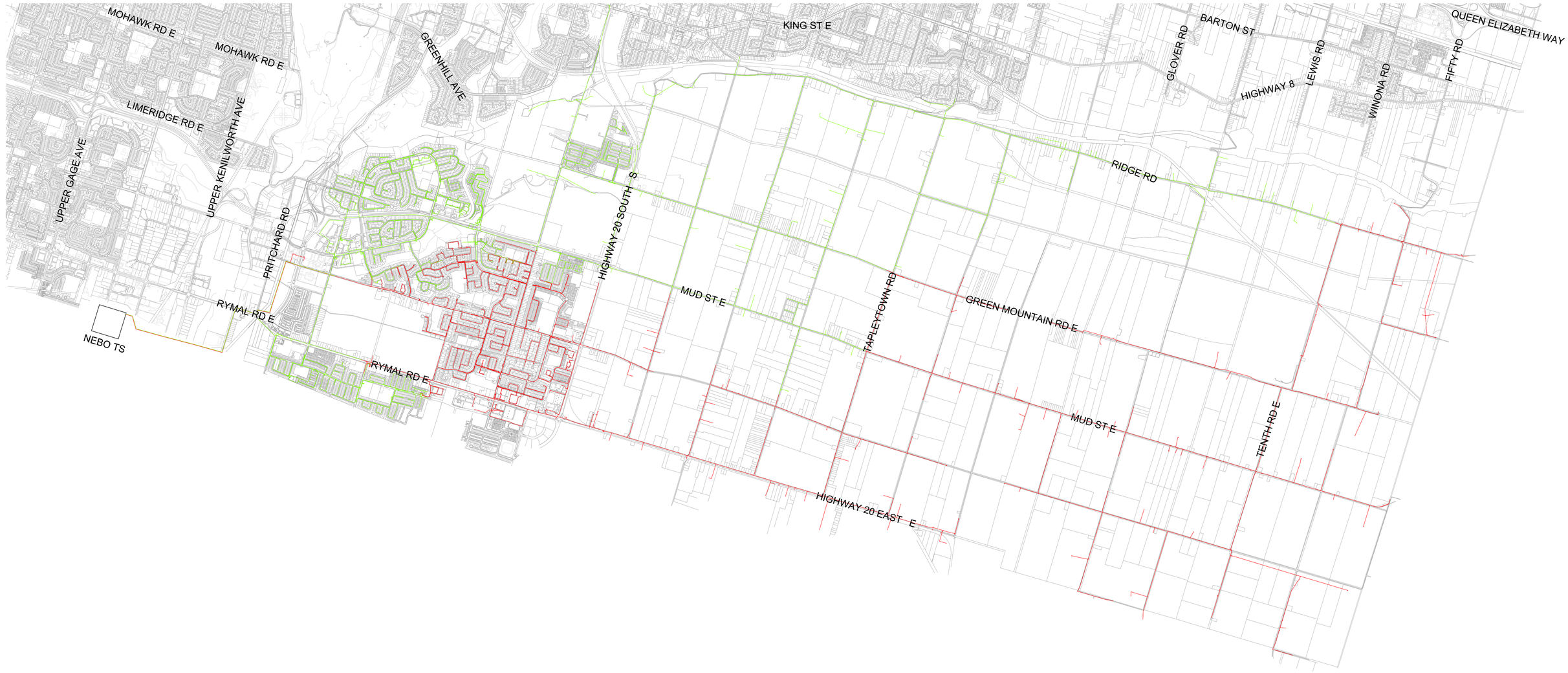


LEGEND:

2D2X = BLUE

N
E
S
W

ALECTRA UTILITIES 331X & 341X CIRCUIT MAP



LEGEND:

331X = GREEN
341X = RED