



# **Arc Hazard Analysis Report**

## **For**

# **Lake Worth T&D System**

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# City of Lake Worth

## Arc Hazard Analysis Report

### I. ARC FLASH ASSESSMENT - SCOPE

UC Synergetic, Inc. (UCS) performed an arc flash analysis of the City of Lake Worth (Lake Worth) transmission and distribution system. This report summarizes the assumptions, procedure, and results of the analysis.

Based on the documentation provided by Lake Worth, including the delivery point impedance from Florida Power & Light (FPL), a fault current and arc flash analysis was performed on the Lake Worth T&D system. Milsoft© and ARCPRO™ software tools were used to model and document results for the system. Since upstream protective devices at the FPL delivery point are unknown, arc flash calculations begin at Lake Worth's transmission bus. From there, each of Lake Worth's substations and respective feeders were modeled to complete the power system.

### II. ANALYSIS PARAMETERS

Per IEEE 1584a, for voltages over 15 kV the "Lee Method" is recommended to compute the arc flash incident energy and working distances. Industry experience has shown that this methodology is excessively conservative. UCS performed the Lee Method analysis on the Lake Worth transmission and higher voltage distribution system and found multiple locations where incident energy values were such that energized work could not be performed, or the level of PPE required was impractical for the work tasks performed and the local climate. This is consistent with the findings of other utilities. For that reason, utilities operating systems above 15 kV have utilized Table 410-2 "Clothing and clothing systems – voltage, fault current, and maximum clearing time for voltages 46.1 to 800 kV" from the 2007 edition of the National Electric Safety Code (NESC), subsequently updated via Tentative Interim Amendment Table 410-2 "...for voltages 46.1 to 800 kV" issued in September 2008 by the

NESC. These tables show the clothing system required given ranges of bolted fault current and the maximum clearing time for various voltage levels.

UCS calculated specific incident energy values using ARCPRO™. ARCPRO™ is a specially designed arc flash calculator developed by Ontario Hydro Technologies (now Kinetrics), whose calculations were used to produce the NESC tables stated above. A limitation of ARCPRO™ methodology is that the results calculated are limited to open air single phase-to-ground arcs. They are not intended for phase-to-phase arcs or enclosed arcs (“arc in a box”). However, ARCPRO™ results can be adjusted for these conditions using the following adjustment factors for three-phase arcs and “arc in a box” conditions using the following factors recommended by ARCPRO™ documentation.

| Scenario             | Adjustment Factor – Multiply by |
|----------------------|---------------------------------|
| 1-phase arc in a box | 1.5                             |
| 3-phase open air arc | 1.2 to 2.2                      |
| 3-phase arc in a box | 3.7 to 6.5                      |

**Table 1 - ARCPRO Recommended Multipliers for Various Conditions**

For the analysis, the highest adjustment factors were used to account for the worst case scenario. The values shown in the NESC tables are reported in increments of 5000 amps (Table 410-1, voltages to 46kV) and 10000 amps (Table 410-2, voltages 46.1 to 800 kV). Actual fault levels provided by Lake Worth or calculated from the impedance model were used. Since Lake Worth is fed at 138kV transmission voltage and utilizes both 26.4 kV and 4.16 kV distribution voltages, ARCPRO™ provides reasonable incident energy calculations consistent with industry practice. For consistency, ARCPRO methodology was used on the 4.16 kV distribution system also.

Milsoft© was used to model the distribution system. The models were built based on drawings provided by Lake Worth. Since a detailed system model was not available, UCS modeled the system with sufficient accuracy to capture the ranges of fault current experienced on each feeder and to confirm values provided by Lake Worth. Each substation was modeled with a source, the relay, and then the backbone of the feeder. The longest fused tap on each feeder was also modeled (if applicable) to show incident energy values beyond a fuse as the protective device and to capture the lower ranges of fault current on each feeder. Based on information provided by Lake Worth, there are no reclosers on any of the distribution feeders.

The source for each of the feeders represents the corresponding 4.16kV or 26.4kV bus. To model the source impedance at each bus, the fault current values, provided by Lake Worth were entered into Milsoft© and then calculated. Relay settings were then used to determine the fault clearing times for the representative fault current levels.

#### **A. Assumptions**

Given the lack of specific data in some instances, the following assumptions were used in the analysis.

1. The City of Lake Worth's transmission system is fed by Hypoluxo and Canal Substations which are owned and operated by FPL. Lake Worth also operates generation at the Main Plant substation. The source impedances at these substations were provided.
2. At Lake Worth substations, any parallel transformers are assumed to be operated with the bus tie switch open; none are operating in parallel. If the bus tie switched is closed and the transformers are paralleled, the fault currents could be as much as two times the levels reported.
3. Since detailed power flow and relay data for the transmission system was not provided, all transmission relays are assumed to have instantaneous settings enabled and can reach to the end of their protective range(s). Results for the 138 kV system are shown for fault clearing times of 3, 6, and 12 cycle clearing times at IEEE 516 Minimum Approach Distance. UCS considers 6 cycles to be a conservative estimate for clearing time for higher voltage facility protective devices. Prior to performing any energized work on the transmission system, proper clearances shall be obtained to ensure instantaneous trip is enabled at both ends and automatic reclosing is disabled. A regular testing and maintenance program should be utilized to ensure proper operation of relays and breakers.
4. Typical X/R ratios for each transformer were assumed based on the MVA rating of the transformer.
5. Ratings and some locations for individual lateral fuses were not known. Where a fuse was identified on a drawing, a 65 amp type T fuse was assumed with the following exceptions.
  - 7th Ave. 4kV Station – 704 feeder, Davis Road 4kV Station - DR01 feeder, Main 26kV Station - 26B1E03 feeder, & East Switching Station 26kV - 26B5002 feeder, for which no fuse zones could be identified on the map,

- Canal 26kV Station - Feeders 26B6003 and 26B6004, & Main 26kV Station - 26BW13 feeder, where 80 T fuses were modeled due to the feeder lengths.

Where smaller fuses are used, the arc will be extinguished faster and thus lower incident energy level will result. If larger fuses are known to exist, the energy levels will be higher and should be verified. If a lateral is not fused, or the fuse is too large to coordinate with the upstream device, the relay settings will determine the clearing time and may result in longer arc duration and a higher incident energy level.

6. It is assumed that for all energized work, the overcurrent relay's instantaneous trip is enabled and automatic reclosing is disabled.

### **III. TRANSMISSION AND DISTRIBUTION SYSTEM ANALYSIS**

#### **A. Transmission System Analysis**

Incident energy levels for the 138 kV system were calculated using the fault current levels provided at each location. In addition, the incident energy was calculated at two working distances: 3.1 feet (representing line to ground work) and 4.51 feet (representing line-to-line work) based on IEEE 516 Minimum Approach Distances; and at three assumed fault clearing times: 3, 6, and 12 cycles. Results are shown for both single phase open air arcs, computed directly by ARCPRO™, single phase arc in a box using the 1.5 multiplier from Table 1, and phase-to-phase open air arc using the 2.2 multiplier from Table 1. Given the phase separation at 138 kV, three phase enclosed arcs are unlikely, but the values could be calculated using the 6.5 multiplier from Table 1.

The 138 kV results table can be found in Appendix A: Transmission System Results.

#### **B. Distribution System Analysis**

Using the Milsoft© models of each substation and feeder, selected points on each feeder were chosen to perform the arc flash analysis. Basic points chosen along each feeder are: just beyond the breaker (JBB), end of breaker zone (EOBZ), just beyond the fuse, and end of fuse zone (EOFZ). Long fused taps were modeled and incident energy was calculated to determine arc flash analysis at low levels of fault current. The results show that fused taps have lower incident energy for two reasons: (1) lower fault currents mean lower energy intensity and (2) fuses have fast clearing time.

For all arc flash analysis, it is assumed that during work on energized devices, the relay instantaneous is enabled, and automatic reclosing is “off.” During the course of the study, Lake Worth personnel checked the instantaneous settings on relays and confirmed that in all cases they are set to reach the end of their respective zones. Initial data provided indicated that in some cases instantaneous settings were either disabled or set too high to reach through the breaker’s protective zone. If instantaneous trip is not utilized under normal conditions, alternate settings can be used on electronic relays to ensure instantaneous trip is enabled during energized line work.

Two tables show the arc flash analysis calculations: one for the 26.4 kV system and one for the 4.16 kV system. Incident energy was calculated at three distances – 18, 48, and 72 inches. The eighteen-inch results reflect typical industry accepted working distance for gloving applications. The four-foot (48”) results represent working distances associated with the use of a five-foot hot stick; while the six-foot (72”) results represent working distances associated with an eight-foot hot stick. For each working distance, the incident energy is shown for four scenarios: (1) a single phase open air arc calculated directly by ARCPRO, plus additional scenarios calculated using the highest values in Table 1 above: (2) a single phase arc “in a box” scenario using a 1.5 multiplier, (3) a three phase open air arc using a 2.2 multiplier, and (4) a three phase arc in a box scenario using a 6.5 multiplier. The arc flash boundary (the point at which the incident energy level decreases to a “just curable burn” value of 1.2 cal/cm<sup>2</sup>) is provided for each scenario as well.

Both tables can be found in Appendix B: Distribution System Results.

#### **IV. FINAL CONSIDERATIONS**

When calculating incident energy levels, it is assumed that the devices are operating as designed and that the instantaneous or fast trip is enabled. It is imperative when performing energized line work to ensure that the instantaneous trips are enabled and automatic reclosing is disabled. Furthermore, a regular maintenance program is essential to ensure devices are operating as designed. Incident energy levels during arc flash events are dependent on the fault clearing time and could be significantly higher if a fast trip curve is disabled, non-operational, or altered for any reason.

The results are based on data provided by the City of Lake Worth at the time of the assessment. Since some settings were unavailable, certain engineering assumptions and reasonable conditions were

used to produce a complete model. The energy levels and arc flash boundaries were calculated by the fault current levels and device clearing times computed from the following software programs ARCPRO™ and Milsoft©.

This study should be considered a guide in determining appropriate engineering controls, work practices, and personal protective equipment (PPE) to be utilized by qualified personnel performing energized line work. It is offered as a starting point, not a substitute for, a comprehensive and ongoing safety and training program in the practices and procedures associated with working on energized electrical facilities. Furthermore, it is absolutely essential that following any alterations to the system such as changes by FPL to their facilities, an adjustment to the relay settings or protection scheme, or reconductoring or re-switching of the generation, transmission, or distribution system; that a re-evaluation of the assessment be undertaken.

## V. REFERENCES

The following references, standards, and guides were used for this analysis. The standards referenced are current at the time of this analysis. As standards evolve, energy levels and working distances should be re-evaluated.

IEEE Std 1584-2002: *“IEEE Guide for Performing Arc Flash Hazard Calculations”*; IEEE Industry Applications Society; amended as IEEE Std 1584a-2004 – Amendment 1, 23 September 2004.

National Electric Safety Code (NESC), ANSI C2-2007; Part 4: *“Rules for the Operation of Electric Lines”*; IEEE

Tentative Interim Amendment 2007-5 to the NESC, 5 September 2008; Revision to Table 410-2: *“Live-line tool work clothing and clothing systems – voltage, fault current, and maximum clearing time for voltages 46.1 to 800 kV”*.

IEEE Std 516-2009 *“IEEE Guide for Maintenance Methods on Energized Power Lines”*, 24 June 2009; IEEE Power and Energy Society.

NFPA 70E-2009 *“Standard for Electrical Safety in the Workplace”*; National Fire Protection Association



**Appendix A**

**Transmission System Results**

| Lake Worth 138 kV Arc Flash Results |                      |                         |   |       |       |  |       |       |  |       |       |
|-------------------------------------|----------------------|-------------------------|---|-------|-------|--|-------|-------|--|-------|-------|
|                                     |                      |                         | Incident Energy (cal/cm <sup>2</sup> ) at Fault Duration (cycles) -- Single Phase Open Air Arcs |       |       | Incident Energy (cal/cm <sup>2</sup> ) at Fault Duration (cycles) -- Single Phase Arc in a Box |       |       | Incident Energy (cal/cm <sup>2</sup> ) at Fault Duration (cycles) -- Phase to Phase Open Air Arc |       |       |
| Location                            | Fault Current (Ph-G) | Distance <sup>(1)</sup> | 3   | 6     | 12    | 3  | 6     | 12    | 3  | 6     | 12    |
| FPL Cedar                           | 23099                | 3.10 ft.                | 0.767   | 1.530 | 3.070 | 1.151  | 2.295 | 4.605 | 1.687  | 3.366 | 6.754 |
|                                     |                      | 4.51 ft.                | 0.363   | 0.727 | 1.450 | 0.545  | 1.091 | 2.175 | 0.799  | 1.599 | 3.190 |
|                                     | AF Boundary (in.):   |                         | 30  | 42    | 60    | 38   | 53    | 75    | 55   | 77    | 110   |
| Hypoluxo                            | 12928                | 3.10 ft.                | 0.363   | 0.726 | 1.45  | 0.545  | 1.089 | 2.175 | 0.799  | 1.597 | 3.190 |
|                                     |                      | 4.51 ft.                | 0.172   | 0.344 | 0.688 | 0.258  | 0.516 | 1.032 | 0.378  | 0.757 | 1.514 |
|                                     | AF Boundary (in.):   |                         | 21  | 29    | 41    | 26   | 36    | 51    | 39   | 53    | 75    |
| Main                                | 9588                 | 3.10 ft.                | 0.251   | 0.502 | 1.000 | 0.377  | 0.753 | 1.500 | 0.552  | 1.104 | 2.200 |
|                                     |                      | 4.51 ft.                | 0.119   | 0.238 | 0.475 | 0.179  | 0.357 | 0.713 | 0.262  | 0.524 | 1.045 |
|                                     | AF Boundary (in.):   |                         | 18  | 24    | 34    | 23   | 30    | 43    | 33   | 44    | 62    |

Notes:

- <sup>(1)</sup> IEEE 516 Table D.3 Feet, For Work Between 72.6 and 121 kV: Minimum Approach Distances  
 Line to Ground Work: MAD = 3.10 ft  
 Line to Line Work: MAD = 4.51 ft  
 Assume T = 3.0 per NESC Rule 441.A4a
- <sup>(2)</sup> Assumed Arc Gap = 7.968 inches per NESC Table 410-2 Note 1
- <sup>(3)</sup> Multiplier for Single Phase Arc in a Box = 1.5 per ArcPRO Recommendation
- <sup>(4)</sup> Recommended scenario 6 cycle clearing time but should be verified in field

**Appendix B**

**Distribution System Results**

| 26.4 kV Distribution System |         | Fault Data Zones            |                    |                         |   |                             |                    |                         |   |                                   |                    |                         |   |                               |                    | ARCPRO Results Using Worst Case for Each Feeder |   |                             |                                 |                         |                         |                                    |                         |                         |                                    |                         |                         |                                  |                         |                         |               |               |
|-----------------------------|---------|-----------------------------|--------------------|-------------------------|---|-----------------------------|--------------------|-------------------------|---|-----------------------------------|--------------------|-------------------------|---|-------------------------------|--------------------|---|---|-----------------------------|---------------------------------|-------------------------|-------------------------|------------------------------------|-------------------------|-------------------------|------------------------------------|-------------------------|-------------------------|----------------------------------|-------------------------|-------------------------|---------------|---------------|
| Locations                   |         | Just Beyond Station Breaker |                    |                         |   | End of Station Breaker Zone |                    |                         |   | Just Beyond the Fuse (See Note 2) |                    |                         |   | End of Fuse Zone (See Note 2) |                    |   |   | Worst Case of All Zones (4) | 18" Rubber Gloving Applications |                         |                         | 4' (for 5' Hot Stick Applications) |                         |                         | 6' (for 8' Hot Stick Applications) |                         |                         | Arc Flash Boundary (1.2 Cal/Cm2) |                         |                         |               |               |
| Station Name                | FDR     | Three Phase Fault           | Single Phase Fault | Fault Duration (Cycles) | Incident Energy @ 18 in. (cal/cm <sup>2</sup> ) | Three Phase Fault           | Single Phase Fault | Fault Duration (Cycles) | Incident Energy @ 18 in. (cal/cm <sup>2</sup> ) | Three Phase Fault                 | Single Phase Fault | Fault Duration (Cycles) | Incident Energy @ 18 in. (cal/cm <sup>2</sup> ) | Three Phase Fault             | Single Phase Fault | Fault Duration (Cycles)                         | Incident Energy @ 18 in. (cal/cm <sup>2</sup> ) |                             | 1-Ph Fault Open Air Arc         | 1-Ph Fault Arc in a Box | 3-Ph Fault Open Air Arc | 3-Ph Fault Arc in a Box            | 1-Ph Fault Open Air Arc | 1-Ph Fault Arc in a Box | 3-Ph Fault Open Air Arc            | 3-Ph Fault Arc in a Box | 1-Ph Fault Open Air Arc | 1-Ph Fault Arc in a Box          | 3-Ph Fault Open Air Arc | 3-Ph Fault Arc in a Box | Ph-G (inches) | 3-Ph (inches) |
| Main 26 kV Station          | 26BE09  | 7357                        | 8760               | 5                       | 1.34  | 5119                        | 4787               | 55.3                    | 7.09  | 5119                              | 4787               | 1.8                     | 0.23  | 5003                          | 4624               | 1.9   | 0.233   | EOBZ                        | 7.09                            | 10.64                   | 15.60                   | 46.09                              | 1.01                    | 1.52                    | 2.22                               | 6.57                    | 0.45                    | 0.67                             | 0.99                    | 2.92                    | 44.5          | 81.58         |
| Main 26 kV Station          | 26B1E03 | 7357                        | 8760               | 9                       | 2.42  | 6353                        | 6718               | 9                       | 1.74  | *                                 | *                  | *                       | *   | *                             | *                  | *   | *   | JBB                         | 2.42                            | 3.63                    | 5.32                    | 15.73                              | 0.34                    | 0.52                    | 0.76                               | 2.24                    | 0.15                    | 0.23                             | 0.34                    | 0.99                    | 26            | 47.67         |
| Main 26 kV Station          | 26B1E12 | 7357                        | 8760               | 28                      | 7.52  | 4464                        | 3899               | 63                      | 6.27  | 4464                              | 3899               | 2.8                     | 0.279   | 4888                          | 4442               | 3.2   | 0.372   | JBB                         | 7.52                            | 11.28                   | 16.54                   | 48.88                              | 1.07                    | 1.61                    | 2.35                               | 6.96                    | 0.48                    | 0.71                             | 1.05                    | 3.09                    | 45            | 82.50         |
| Main 26 kV Station          | 26BW05  | 6884                        | 8194               | 32                      | 7.92  | 3400                        | 2771               | 109                     | 7.23  | 4058                              | 3524               | 2.8                     | 0.248   | 3859                          | 3286               | 3.2   | 0.258   | JBB                         | 7.92                            | 11.88                   | 17.42                   | 51.48                              | 1.13                    | 1.70                    | 2.49                               | 7.35                    | 0.50                    | 0.75                             | 1.10                    | 3.26                    | 46            | 84.33         |
| Main 26 kV Station          | 26BW13  | 6884                        | 8194               | 32                      | 7.92  | 3890                        | 3333               | 81                      | 6.75  | 4155                              | 3656               | 3.9                     | 0.36  | 3891                          | 3333               | 4.8   | 0.396   | JBB                         | 7.92                            | 11.88                   | 17.42                   | 51.48                              | 1.13                    | 1.70                    | 2.49                               | 7.35                    | 0.50                    | 0.75                             | 1.10                    | 3.26                    | 46            | 82.50         |
| 7th Ave. North Station      | 26B0701 | 5129                        | 4761               | 18                      | 2.29  | 4366                        | 3773               | 23                      | 2.20  | 4366                              | 3773               | 2.5                     | 0.239   | 4188                          | 3562               | 2.8   | 0.251   | JBB                         | 2.29                            | 3.44                    | 5.04                    | 14.89                              | 0.33                    | 0.49                    | 0.72                               | 2.12                    | 0.15                    | 0.22                             | 0.32                    | 0.94                    | 25            | 45.83         |
| Canal 26 kV Station         | 26B6003 | 3733                        | 3042               | 32                      | 2.38  | 2613                        | 1944               | 68                      | 2.83  | 2676                              | 2001               | 10.3                    | 0.447   | 2592                          | 1926               | 11.2  | 0.455   | EOBZ                        | 2.83                            | 4.25                    | 6.23                    | 18.40                              | 0.40                    | 0.60                    | 0.88                               | 2.61                    | 0.18                    | 0.27                             | 0.39                    | 1.16                    | 28            | 51.33         |
| Canal 26 kV Station         | 26B6004 | 3733                        | 3042               | 32                      | 2.38  | 2830                        | 2142               | 57                      | 2.70  | 2830                              | 2142               | 9.1                     | 0.415   | 2720                          | 2042               | 10  | 0.426   | EOBZ                        | 2.70                            | 4.05                    | 5.94                    | 17.55                              | 0.38                    | 0.58                    | 0.84                               | 2.50                    | 0.17                    | 0.26                             | 0.38                    | 1.11                    | 27            | 49.50         |
| East Switching Station      | 26B5002 | 6366                        | 6735               | 5                       | 0.97  | 5411                        | 5174               | 32                      | 4.51  | *                                 | *                  | *                       | *   | *                             | *                  | *   | *   | EOBZ                        | 4.51                            | 6.77                    | 9.92                    | 29.32                              | 0.64                    | 0.96                    | 1.41                               | 4.17                    | 0.29                    | 0.43                             | 0.63                    | 1.85                    | 35            | 64.17         |
| East Switching Station      | 26B5003 | 6366                        | 6735               | 5                       | 0.97  | 4854                        | 4432               | 36                      | 4.21  | 4854                              | 4432               | 2                       | 0.23  | 4757                          | 4302               | 2.1   | 0.234   | EOBZ                        | 4.21                            | 6.32                    | 9.26                    | 27.37                              | 0.60                    | 0.90                    | 1.32                               | 3.90                    | 0.27                    | 0.40                             | 0.59                    | 1.74                    | 34.5          | 63.25         |
| 18th Ave.                   | 26B1801 | 4310                        | 3804               | 23                      | 2.25  | 3592                        | 2961               | 31                      | 2.23  | 3592                              | 2961               | 3.8                     | 0.272   | 3483                          | 2843               | 4   | 0.271   | JBB                         | 2.25                            | 3.38                    | 4.95                    | 14.63                              | 0.32                    | 0.48                    | 0.70                               | 2.08                    | 0.14                    | 0.21                             | 0.31                    | 0.92                    | 25            | 45.83         |

1. Circuits where no fuse zone could be identified on the map are marked with an \*.
2. All circuits were modeled using 65 T Fuse for the Fuse Zone with the exception of 26B6003, 26B6004, and 26BW13 where 80 T fuses were modeled due to the feeder length
3. Circuit 26B5003 was assumed to have the same relay settings as 26B5002 as well as 26B1E12 having the same relay settings as 26B1E03.
4. JBB = Just Beyond Station Breaker; EOBZ = End of Station Breaker Zone; EOFZ = End of Fuse Zone
5. Arc Gap = 6 inches per NESC

| 26.4 kV Distribution System |         | Fault Data Zones                                    |                    |                         |   |   |                    |                         |   |                                   |                    |                         |   |                               |                    | ARCPRO Results Using Worst Case for Each Feeder |   |                             |                                 |                         |                         |                                    |                         |                         |                                    |                         |                         |                                  |                         |                         |               |               |
|-----------------------------|---------|---|--------------------|-------------------------|---|---|--------------------|-------------------------|---|-----------------------------------|--------------------|-------------------------|---|-------------------------------|--------------------|---|---|-----------------------------|---------------------------------|-------------------------|-------------------------|------------------------------------|-------------------------|-------------------------|------------------------------------|-------------------------|-------------------------|----------------------------------|-------------------------|-------------------------|---------------|---------------|
| Locations                   |         | Just Beyond Station Breaker (Instantaneous Enabled) |                    |                         |   | End of Station Breaker Zone (Instantaneous Enabled) |                    |                         |   | Just Beyond the Fuse (See Note 2) |                    |                         |   | End of Fuse Zone (See Note 2) |                    |   |   | Worst Case of All Zones (4) | 18" Rubber Gloving Applications |                         |                         | 4' (for 5' Hot Stick Applications) |                         |                         | 6' (for 8' Hot Stick Applications) |                         |                         | Arc Flash Boundary (1.2 Cal/Cm2) |                         |                         |               |               |
| Station Name                | FDR     | Three Phase Fault                                   | Single Phase Fault | Fault Duration (Cycles) | Incident Energy @ 18 in. (cal/cm <sup>2</sup> ) | Three Phase Fault                                   | Single Phase Fault | Fault Duration (Cycles) | Incident Energy @ 18 in. (cal/cm <sup>2</sup> ) | Three Phase Fault                 | Single Phase Fault | Fault Duration (Cycles) | Incident Energy @ 18 in. (cal/cm <sup>2</sup> ) | Three Phase Fault             | Single Phase Fault | Fault Duration (Cycles)                         | Incident Energy @ 18 in. (cal/cm <sup>2</sup> ) |                             | 1-Ph Fault Open Air Arc         | 1-Ph Fault Arc in a Box | 3-Ph Fault Open Air Arc | 3-Ph Fault Arc in a Box            | 1-Ph Fault Open Air Arc | 1-Ph Fault Arc in a Box | 3-Ph Fault Open Air Arc            | 3-Ph Fault Arc in a Box | 1-Ph Fault Open Air Arc | 1-Ph Fault Arc in a Box          | 3-Ph Fault Open Air Arc | 3-Ph Fault Arc in a Box | Ph-G (inches) | 3-Ph (inches) |
| Main 26 kV Station          | 26BE09  | 7357  | 8760               | 5                       | 1.34  | 5119  | 4787               | 5                       | 0.64  | 5119                              | 4787               | 1.8                     | 0.23  | 5003                          | 4624               | 1.9   | 0.233   | JBB                         | 1.34                            | 2.01                    | 2.95                    | 8.71                               | 0.19                    | 0.29                    | 0.42                               | 1.24                    | 0.09                    | 0.13                             | 0.19                    | 0.55                    | 19            | 34.83         |
| Main 26 kV Station          | 26B1E03 | 7357  | 8760               | 5                       | 1.34  | 6353  | 6718               | 5                       | 0.97  | *                                 | *                  | *                       | *   | *                             | *                  | *   | *   | JBB                         | 1.34                            | 2.01                    | 2.95                    | 8.71                               | 0.19                    | 0.29                    | 0.42                               | 1.24                    | 0.09                    | 0.13                             | 0.19                    | 0.55                    | 19            | 34.83         |
| Main 26 kV Station          | 26B1E12 | 7357  | 8760               | 5                       | 1.34  | 4464  | 3899               | 5                       | 0.50  | 4464                              | 3899               | 2.8                     | 0.279   | 4888                          | 4442               | 3.2   | 0.372   | JBB                         | 1.34                            | 2.01                    | 2.95                    | 8.71                               | 0.19                    | 0.29                    | 0.42                               | 1.24                    | 0.09                    | 0.13                             | 0.19                    | 0.55                    | 19            | 34.83         |
| Main 26 kV Station          | 26BW05  | 6884  | 8194               | 5                       | 1.24  | 3400  | 2771               | 5                       | 0.33  | 4058                              | 3524               | 2.8                     | 0.248   | 3859                          | 3286               | 3.2   | 0.258   | JBB                         | 1.24                            | 1.86                    | 2.73                    | 8.06                               | 0.18                    | 0.26                    | 0.39                               | 1.14                    | 0.08                    | 0.12                             | 0.17                    | 0.51                    | 19            | 34.83         |
| Main 26 kV Station          | 26BW13  | 6884  | 8194               | 5                       | 1.24  | 3890  | 3333               | 5                       | 0.42  | 4155                              | 3656               | 3.9                     | 0.36  | 3891                          | 3333               | 4.8   | 0.396   | JBB                         | 1.24                            | 1.86                    | 2.73                    | 8.06                               | 0.18                    | 0.26                    | 0.39                               | 1.14                    | 0.08                    | 0.12                             | 0.17                    | 0.51                    | 19            | 34.83         |
| 7th Ave. North Station      | 26B0701 | 5129  | 4761               | 5                       | 0.64  | 4366  | 3773               | 5                       | 0.48  | 4366                              | 3773               | 2.5                     | 0.239   | 4188                          | 3562               | 2.8   | 0.251   | JBB                         | 0.64                            | 0.96                    | 1.40                    | 4.14                               | 0.09                    | 0.14                    | 0.20                               | 0.59                    | 0.04                    | 0.06                             | 0.09                    | 0.26                    | 13            | 23.83         |
| Canal 26 kV Station         | 26B6003 | 3733  | 3042               | 5                       | 0.37  | 2613  | 1944               | 5                       | 0.21  | 2676                              | 2001               | 10.3                    | 0.447   | 2592                          | 1926               | 11.2  | 0.455   | EOFZ                        | 0.46                            | 0.68                    | 1.00                    | 2.96                               | 0.07                    | 0.10                    | 0.14                               | 0.43                    | 0.03                    | 0.04                             | 0.06                    | 0.19                    | 11            | 20.17         |
| Canal 26 kV Station         | 26B6004 | 3733  | 3042               | 5                       | 0.37  | 2830  | 2142               | 5                       | 0.24  | 2830                              | 2142               | 9.1                     | 0.415   | 2720                          | 2042               | 10  | 0.426   | EOFZ                        | 0.43                            | 0.64                    | 0.94                    | 2.77                               | 0.06                    | 0.09                    | 0.14                               | 0.41                    | 0.03                    | 0.04                             | 0.06                    | 0.18                    | 12            | 22.00         |
| East Switching Station      | 26B5002 | 6366  | 6735               | 5                       | 0.97  | 5411  | 5174               | 5                       | 0.70  | *                                 | *                  | *                       | *   | *                             | *                  | *   | *   | JBB                         | 0.97                            | 1.45                    | 2.12                    | 6.27                               | 0.14                    | 0.21                    | 0.31                               | 0.90                    | 0.06                    | 0.09                             | 0.14                    | 0.40                    | 17            | 31.17         |
| East Switching Station      | 26B5003 | 6366  | 6735               | 5                       | 0.97  | 4854  | 4432               | 5                       | 0.59  | 4854                              | 4432               | 2                       | 0.23  | 4757                          | 4302               | 2.1   | 0.234   | JBB                         | 0.97                            | 1.45                    | 2.12                    | 6.27                               | 0.14                    | 0.21                    | 0.31                               | 0.90                    | 0.06                    | 0.09                             | 0.14                    | 0.40                    | 17            | 31.17         |
| 18th Ave.                   | 26B1801 | 4310  | 3804               | 5                       | 0.49  | 3592  | 2961               | 5                       | 0.36  | 3592                              | 2961               | 3.8                     | 0.272   | 3483                          | 2843               | 4   | 0.271   | JBB                         | 0.49                            | 0.73                    | 1.07                    | 3.17                               | 0.07                    | 0.10                    | 0.15                               | 0.45                    | 0.03                    | 0.05                             | 0.07                    | 0.20                    | 12            | 22.00         |

6. Phase Instantaneous of 2400 Amps and Ground Instantaneous of 1200 Amps will cover all conditions with sufficient margin
7. Individual instantaneous settings can be used at each feeder, provided:
  - Phase pickup is set below the three phase fault current at end of station breaker zone.
  - Ground pickup is set below the single phase fault current at end of station breaker zone.
  - (Recommend additional safety margin to ensure instantaneous operation, e.g. set to 80% of fault current to be cleared)

| 4.16 kV Distribution System |      | Fault Data Zones            |                    |                         |                                    |                             |                    |                         |                                    |                                   |                    |                         |                                    |                               |                    |                         |                                    | ARCPRO Results Using Worst Case for Each Feeder |                                 |                        |                        |                        |                                    |                        |                        |                        |                                    |               |               |      |                                  |       |
|-----------------------------|------|-----------------------------|--------------------|-------------------------|------------------------------------|-----------------------------|--------------------|-------------------------|------------------------------------|-----------------------------------|--------------------|-------------------------|------------------------------------|-------------------------------|--------------------|-------------------------|------------------------------------|---|---------------------------------|------------------------|------------------------|------------------------|------------------------------------|------------------------|------------------------|------------------------|------------------------------------|---------------|---------------|------|----------------------------------|-------|
| Locations                   |      | Just Beyond Station Breaker |                    |                         |                                    | End of Station Breaker Zone |                    |                         |                                    | Just Beyond the Fuse (Assume 65T) |                    |                         |                                    | End of Fuse Zone (Assume 65T) |                    |                         |                                    | Worse Case of All Zones                         | 18" Rubber Gloving Applications |                        |                        |                        | 4' (for 5' Hot Stick Applications) |                        |                        |                        | 6' (for 8' Hot Stick Applications) |               |               |      | Arc Flash Boundary (1.2 Cal/Cm2) |       |
|                             |      | Three Phase Fault           | Single Phase Fault | Fault Duration (Cycles) | Incident Energy @ 18 in. (cal/cm²) | Three Phase Fault           | Single Phase Fault | Fault Duration (Cycles) | Incident Energy @ 18 in. (cal/cm²) | Three Phase Fault                 | Single Phase Fault | Fault Duration (Cycles) | Incident Energy @ 18 in. (cal/cm²) | Three Phase Fault             | Single Phase Fault | Fault Duration (Cycles) | Incident Energy @ 18 in. (cal/cm²) |   | 1-Ph Fault Value x 1.5          | 1-Ph Fault Value x 2.2 | 1-Ph Fault Value x 6.5 | 1-Ph Fault Value x 1.5 | 1-Ph Fault Value x 2.2             | 1-Ph Fault Value x 6.5 | 1-Ph Fault Value x 1.5 | 1-Ph Fault Value x 2.2 | 1-Ph Fault Value x 6.5             | Ph-G (inches) | 3-Ph (inches) |      |                                  |       |
| Station Name                | FDR  |                             |                    |                         |                                    |                             |                    |                         |                                    |                                   |                    |                         |                                    |                               |                    |                         |                                    |   |                                 |                        |                        |                        |                                    |                        |                        |                        |                                    |               |               |      |                                  |       |
| 4th Ave.                    | 401  | 8153                        | 8820               | 5                       | 0.65                               | 1936                        | 1442               | 5                       | 0.05                               | 1936                              | 1442               | 10.5                    | 0.118                              | 1873                          | 1390               | 11                      | 0.117                              | JBB   | 0.65                            | 0.97                   | 1.42                   | 4.19                   | 0.09                               | 0.13                   | 0.19                   | 0.56                   | 0.04                               | 0.06          | 0.08          | 0.25 | 18                               | 33.00 |
| 4th Ave.                    | 402  | 8153                        | 8820               | 5                       | 0.65                               | 2190                        | 1654               | 5                       | 0.07                               | 2190                              | 1654               | 8                       | 0.107                              | 2148                          | 1617               | 8.4                     | 0.111                              | JBB   | 0.65                            | 0.97                   | 1.42                   | 4.19                   | 0.09                               | 0.13                   | 0.19                   | 0.56                   | 0.04                               | 0.06          | 0.08          | 0.25 | 18.5                             | 33.92 |
| 4th Ave.                    | 404  | 8153                        | 8820               | 5                       | 0.65                               | 4242                        | 3670               | 5                       | 0.20                               | 4242                              | 3670               | 2.4                     | 0.10                               | 2994                          | 2354               | 4.5                     | 0.10                               | JBB   | 0.65                            | 0.97                   | 1.42                   | 4.19                   | 0.09                               | 0.13                   | 0.19                   | 0.56                   | 0.04                               | 0.06          | 0.08          | 0.25 | 13                               | 23.83 |
| 6th Ave.                    | 601  | 8012                        | 8684               | 5                       | 0.63                               | 3073                        | 2434               | 5                       | 0.12                               | 3073                              | 2434               | 4                       | 0.09                               | 2876                          | 2254               | 5                       | 0.10                               | JBB   | 0.63                            | 0.95                   | 1.39                   | 4.11                   | 0.08                               | 0.13                   | 0.19                   | 0.55                   | 0.04                               | 0.06          | 0.08          | 0.24 | 16                               | 29.33 |
| 6th Ave.                    | 602  | 8012                        | 8684               | 5                       | 0.63                               | 2156                        | 1627               | 5                       | 0.07                               | 2156                              | 1627               | 8                       | 0.11                               | 1546                          | 1132               | 16                      | 0.13                               | JBB   | 0.63                            | 0.95                   | 1.39                   | 4.11                   | 0.08                               | 0.13                   | 0.19                   | 0.55                   | 0.04                               | 0.06          | 0.08          | 0.24 | 18                               | 33.00 |
| 6th Ave.                    | 604  | 8012                        | 8684               | 5                       | 0.63                               | 4060                        | 3397               | 5                       | 0.18                               | 4060                              | 3397               | 2.6                     | 0.09                               | 3084                          | 2444               | 4.2                     | 0.09                               | JBB   | 0.63                            | 0.95                   | 1.39                   | 4.11                   | 0.08                               | 0.13                   | 0.19                   | 0.55                   | 0.04                               | 0.06          | 0.08          | 0.24 | 13                               | 23.83 |
| 7th Ave.                    | 701  | 7872                        | 8556               | 5                       | 0.62                               | 2293                        | 1748               | 5                       | 0.07                               | 2293                              | 1748               | 7.4                     | 0.10                               | 1882                          | 1403               | 10.5                    | 0.11                               | JBB   | 0.62                            | 0.93                   | 1.36                   | 4.03                   | 0.08                               | 0.12                   | 0.18                   | 0.54                   | 0.04                               | 0.05          | 0.08          | 0.24 | 17.5                             | 32.08 |
| 7th Ave.                    | 702  | 7872                        | 8556               | 5                       | 0.62                               | 1774                        | 1316               | 5                       | 0.05                               | 1774                              | 1316               | 19                      | 0.19                               | 1701                          | 1257               | 20                      | 0.19                               | JBB   | 0.62                            | 0.93                   | 1.36                   | 4.03                   | 0.08                               | 0.12                   | 0.18                   | 0.54                   | 0.04                               | 0.05          | 0.08          | 0.24 | 13                               | 23.83 |
| 7th Ave.                    | 704  | 7872                        | 8556               | 5                       | 0.62                               | 1416                        | 1031               | 5                       | 0.03                               | 1416                              | 1031               | 19                      | 0.19                               | 1701                          | 1257               | 20                      | 0.19                               | JBB   | 0.62                            | 0.93                   | 1.36                   | 4.03                   | 0.08                               | 0.12                   | 0.18                   | 0.54                   | 0.04                               | 0.05          | 0.08          | 0.24 | 22                               | 40.33 |
| 11th Ave.                   | 1101 | 13388                       | 15724              | 5                       | 1.48                               | 2871                        | 2143               | 5                       | 0.10                               | 2871                              | 2143               | 5                       | 1.01                               | 2565                          | 1895               | 7                       | 0.11                               | JBB   | 1.48                            | 2.22                   | 3.26                   | 9.62                   | 0.19                               | 0.29                   | 0.43                   | 1.26                   | 0.09                               | 0.13          | 0.19          | 0.56 | 20                               | 36.67 |
| 11th Ave.                   | 1102 | 13388                       | 15724              | 5                       | 1.48                               | 3980                        | 3089               | 5                       | 0.16                               | 3980                              | 3089               | 3                       | 0.09                               | 3224                          | 2436               | 4                       | 0.09                               | JBB   | 1.48                            | 2.22                   | 3.26                   | 9.62                   | 0.19                               | 0.29                   | 0.43                   | 1.26                   | 0.09                               | 0.13          | 0.19          | 0.56 | 20                               | 36.67 |
| 11th Ave.                   | 1103 | 13388                       | 15724              | 5                       | 1.48                               | 2065                        | 1500               | 5                       | 0.06                               | 2065                              | 1500               | 10                      | 0.12                               | 1797                          | 1293               | 13                      | 0.13                               | JBB   | 1.48                            | 2.22                   | 3.26                   | 9.62                   | 0.19                               | 0.29                   | 0.43                   | 1.26                   | 0.09                               | 0.13          | 0.19          | 0.56 | 20                               | 36.67 |
| 11th Ave.                   | 1104 | 13388                       | 15724              | 5                       | 1.48                               | 2473                        | 1821               | 5                       | 0.08                               | 2473                              | 1821               | 7                       | 0.11                               | 2312                          | 1693               | 8                       | 0.11                               | JBB   | 1.48                            | 2.22                   | 3.26                   | 9.62                   | 0.19                               | 0.29                   | 0.43                   | 1.26                   | 0.09                               | 0.13          | 0.19          | 0.56 | 20                               | 36.67 |
| 12th Ave.                   | 1201 | 8487                        | 9206               | 5                       | 0.69                               | 2989                        | 2337               | 5                       | 0.11                               | 2989                              | 2337               | 5                       | 0.11                               | 2279                          | 1720               | 8                       | 0.11                               | JBB   | 0.69                            | 1.03                   | 1.51                   | 4.46                   | 0.09                               | 0.14                   | 0.20                   | 0.59                   | 0.04                               | 0.06          | 0.09          | 0.26 | 16.5                             | 30.25 |
| 12th Ave.                   | 1202 | 8487                        | 9206               | 5                       | 0.69                               | 4957                        | 4304               | 5                       | 0.25                               | 4957                              | 4304               | 2                       | 0.10                               | 3499                          | 2807               | 3.4                     | 0.10                               | JBB   | 0.69                            | 1.03                   | 1.51                   | 4.46                   | 0.09                               | 0.14                   | 0.20                   | 0.59                   | 0.04                               | 0.06          | 0.09          | 0.26 | 13.5                             | 24.75 |
| 12th Ave.                   | 1203 | 8487                        | 9206               | 5                       | 0.69                               | 1385                        | 1002               | 5                       | 0.03                               | 1385                              | 1002               | 20                      | 0.13                               | 1359                          | 982                | 21                      | 0.13                               | JBB   | 0.69                            | 1.03                   | 1.51                   | 4.46                   | 0.09                               | 0.14                   | 0.20                   | 0.59                   | 0.04                               | 0.06          | 0.09          | 0.26 | 22                               | 40.33 |
| 12th Ave.                   | 1204 | 8487                        | 9206               | 5                       | 0.69                               | 3335                        | 2654               | 5                       | 0.13                               | 3335                              | 2654               | 3.6                     | 0.09                               | 1842                          | 1361               | 12                      | 0.12                               | JBB   | 0.69                            | 1.03                   | 1.51                   | 4.46                   | 0.09                               | 0.14                   | 0.20                   | 0.59                   | 0.04                               | 0.06          | 0.09          | 0.26 | 16                               | 29.33 |
| 15th Ave.                   | 1501 | 7623                        | 8373               | 5                       | 0.60                               | 3366                        | 2747               | 5                       | 0.14                               | 3366                              | 2747               | 3.5                     | 0.09                               | 2865                          | 2270               | 5                       | 0.10                               | JBB   | 0.60                            | 0.90                   | 1.32                   | 3.91                   | 0.08                               | 0.12                   | 0.18                   | 0.52                   | 0.04                               | 0.05          | 0.08          | 0.23 | 16.5                             | 30.25 |
| 15th Ave.                   | 1502 | 7623                        | 8373               | 5                       | 0.60                               | 4305                        | 3724               | 5                       | 0.20                               | 4305                              | 3724               | 2.2                     | 0.09                               | 3284                          | 2667               | 4                       | 0.11                               | JBB   | 0.60                            | 0.90                   | 1.32                   | 3.91                   | 0.08                               | 0.12                   | 0.18                   | 0.52                   | 0.04                               | 0.05          | 0.08          | 0.23 | 13                               | 23.83 |
| 15th Ave.                   | 1503 | 7623                        | 8373               | 5                       | 0.60                               | 4446                        | 3881               | 5                       | 0.22                               | 4446                              | 3881               | 2                       | 0.08                               | 3195                          | 2581               | 4                       | 0.10                               | JBB   | 0.60                            | 0.90                   | 1.32                   | 3.91                   | 0.08                               | 0.12                   | 0.18                   | 0.52                   | 0.04                               | 0.05          | 0.08          | 0.23 | 13                               | 23.83 |
| 15th Ave.                   | 1504 | 7623                        | 8373               | 5                       | 0.60                               | 2910                        | 2312               | 5                       | 0.11                               | 2910                              | 2312               | 5                       | 0.11                               | 2675                          | 2097               | 5.3                     | 0.10                               | JBB   | 0.60                            | 0.90                   | 1.32                   | 3.91                   | 0.08                               | 0.12                   | 0.18                   | 0.52                   | 0.04                               | 0.05          | 0.08          | 0.23 | 17.5                             | 32.08 |
| 18th Ave.                   | 1802 | 7829                        | 8666               | 5                       | 0.63                               | 2800                        | 2205               | 5                       | 0.10                               | 2800                              | 2205               | 5                       | 0.10                               | 2360                          | 1813               | 7                       | 0.11                               | JBB   | 0.63                            | 0.94                   | 1.38                   | 4.06                   | 0.08                               | 0.13                   | 0.18                   | 0.54                   | 0.04                               | 0.06          | 0.08          | 0.24 | 17                               | 31.17 |
| 18th Ave.                   | 1803 | 7829                        | 8666               | 5                       | 0.63                               | 1778                        | 1323               | 5                       | 0.05                               | 1778                              | 1323               | 12                      | 0.12                               | 1621                          | 1196               | 15                      | 0.13                               | JBB   | 0.63                            | 0.94                   | 1.38                   | 4.06                   | 0.08                               | 0.13                   | 0.18                   | 0.54                   | 0.04                               | 0.06          | 0.08          | 0.24 | 20                               | 36.67 |
| 18th Ave.                   | 1804 | 7829                        | 8666               | 5                       | 0.63                               | 2579                        | 2006               | 5                       | 0.09                               | 2579                              | 2006               | 6                       | 0.10                               | 2521                          | 1954               | 6.2                     | 0.10                               | JBB   | 0.63                            | 0.94                   | 1.38                   | 4.06                   | 0.08                               | 0.13                   | 0.18                   | 0.54                   | 0.04                               | 0.06          | 0.08          | 0.24 | 17                               | 31.17 |
| Davis Road                  | DR01 | 8377                        | 9005               | 5                       | 0.67                               | 1704                        | 1251               | 5                       | 0.05                               | 1704                              | 1251               | 19                      | 0.19                               | 1621                          | 1196               | 15                      | 0.13                               | JBB   | 0.67                            | 1.00                   | 1.46                   | 4.32                   | 0.09                               | 0.13                   | 0.19                   | 0.57                   | 0.04                               | 0.06          | 0.09          | 0.25 | 21                               | 38.50 |
| Main 4kV South              | 3S03 | 11627                       | 12758              | 5                       | 1.10                               | 3367                        | 2569               | 5                       | 0.12                               | 3367                              | 2569               | 4                       | 0.10                               | 2789                          | 2083               | 5.5                     | 0.10                               | JBB   | 1.10                            | 1.65                   | 2.42                   | 7.15                   | 0.14                               | 0.22                   | 0.32                   | 0.94                   | 0.06                               | 0.10          | 0.14          | 0.42 | 17.5                             | 32.08 |
| Main 4kV South              | 3S04 | 11627                       | 12758              | 5                       | 1.10                               | 2284                        | 1676               | 5                       | 0.07                               | 2284                              | 1676               | 8                       | 0.11                               | 2284                          | 1676               | 10                      | 0.14                               | JBB   | 1.10                            | 1.65                   | 2.42                   | 7.15                   | 0.14                               | 0.22                   | 0.32                   | 0.94                   | 0.06                               | 0.10          | 0.14          | 0.42 | 17.5                             | 32.08 |
| Main 4kV South              | 3S05 | 11627                       | 12758              | 5                       | 1.10                               | 2389                        | 1767               | 5                       | 0.07                               | 2389                              | 1767               | 7.2                     | 0.11                               | 2270                          | 1665               | 8                       | 0.11                               | JBB   | 1.10                            | 1.65                   | 2.42                   | 7.15                   | 0.14                               | 0.22                   | 0.32                   | 0.94                   | 0.06                               | 0.10          | 0.14          | 0.42 | 17.5                             | 32.08 |
| Main 4kV North              | 3N11 | 11562                       | 14039              | 5                       | 1.25                               | 3116                        | 2357               | 5                       | 0.11                               | 3116                              | 2357               | 4                       | 0.09                               | 2617                          | 1944               | 6                       | 0.10                               | JBB   | 1.25                            | 1.88                   | 2.75                   | 8.13                   | 0.17                               | 0.25                   | 0.36                   | 1.07                   | 0.07                               | 0.11          | 0.16          | 0.48 | 18.5                             | 33.92 |
| Main 4kV North              | 3N12 | 11562                       | 14039              | 5                       | 1.25                               | 2129                        | 1554               | 5                       | 0.06                               | 2129                              | 1554               | 9                       | 0.11                               | 2051                          | 1493               | 10                      | 0.12                               | JBB   | 1.25                            | 1.88                   | 2.75                   | 8.13                   | 0.17                               | 0.25                   | 0.36                   | 1.07                   | 0.07                               | 0.11          | 0.16          | 0.48 | 18.5                             | 33.92 |
| Main 4kV North              | 3N13 | 11562                       | 14039              | 5                       | 1.25                               | 2343                        | 1724               | 5                       | 0.07                               | 2343                              | 1724               | 8                       | 0.11                               | 2175                          | 1591               | 9                       | 0.12                               | JBB   | 1.25                            | 1.88                   | 2.75                   | 8.13                   | 0.17                               | 0.25                   | 0.36                   | 1.07                   | 0.07                               | 0.11          | 0.16          | 0.48 | 18.5                             | 33.92 |

- Notes:
1. Circuits where no fuse could be identified on the map are marked with an \*.
  2. All circuits were modeled using 65 T Fuse for the Zone Fuse.
  3. JBB - Just Beyond Breaker, EBZ - End of Station Breaker Zone, JBF - Just beyond the Fuse; EFZ - End of the Fuse Zone