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Electric Reliability Presentation

Jason C. Bailey
Assistant Director – System Operations

CAIDI - Customer Average Interruption Duration Index

The average time to restore service to interrupted customers within a specified area of service over a given period of time.

SAIDI – System Average Interruption Duration Index

The average minutes of service interruption duration per customer served within a specified area of service over a given period of time.

SAIFI – System Average Interruption Frequency Index

The average number of Service Interruptions per customer within a specified area of service over a given period of time.

MAIFI – Momentary Average Interruption Event Frequency Index

The average number of Momentary Interruption Events recorded on primary circuits for a specified area of service over a given period of time.

L-Bar – Average Duration of Outage Events

The sum of each outage event duration for all outage events occurring during a given time period, divided by number of outage events over the same time period within a specific area of service.

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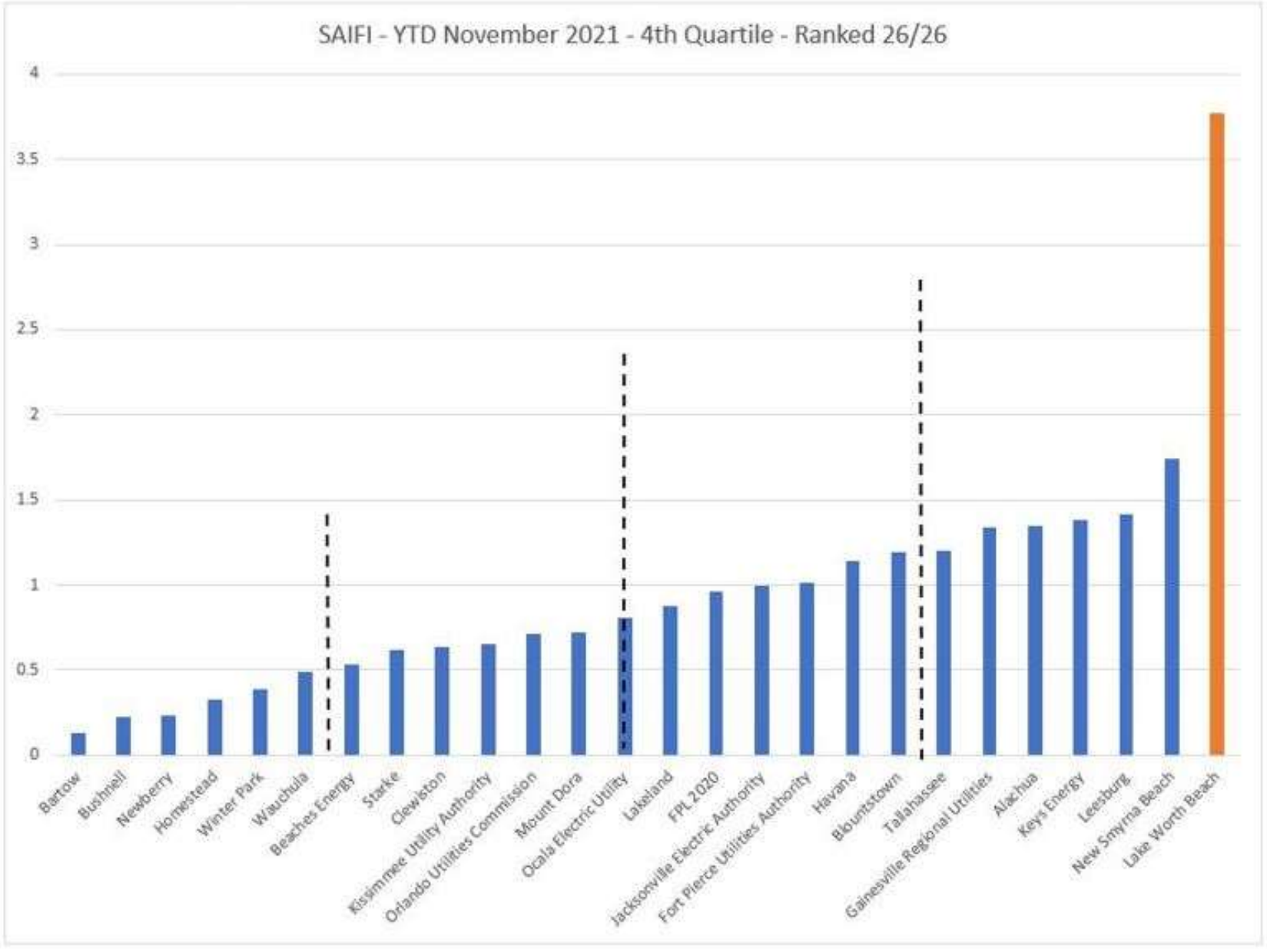
SAIFI - measures the average frequency of interruptions for the average customer

	YTD Nov Value	YTD Nov Goal	YTD Nov Rank	YTD Nov Quartile
LWBU - 2021	3.9	0.5	26/26	4th



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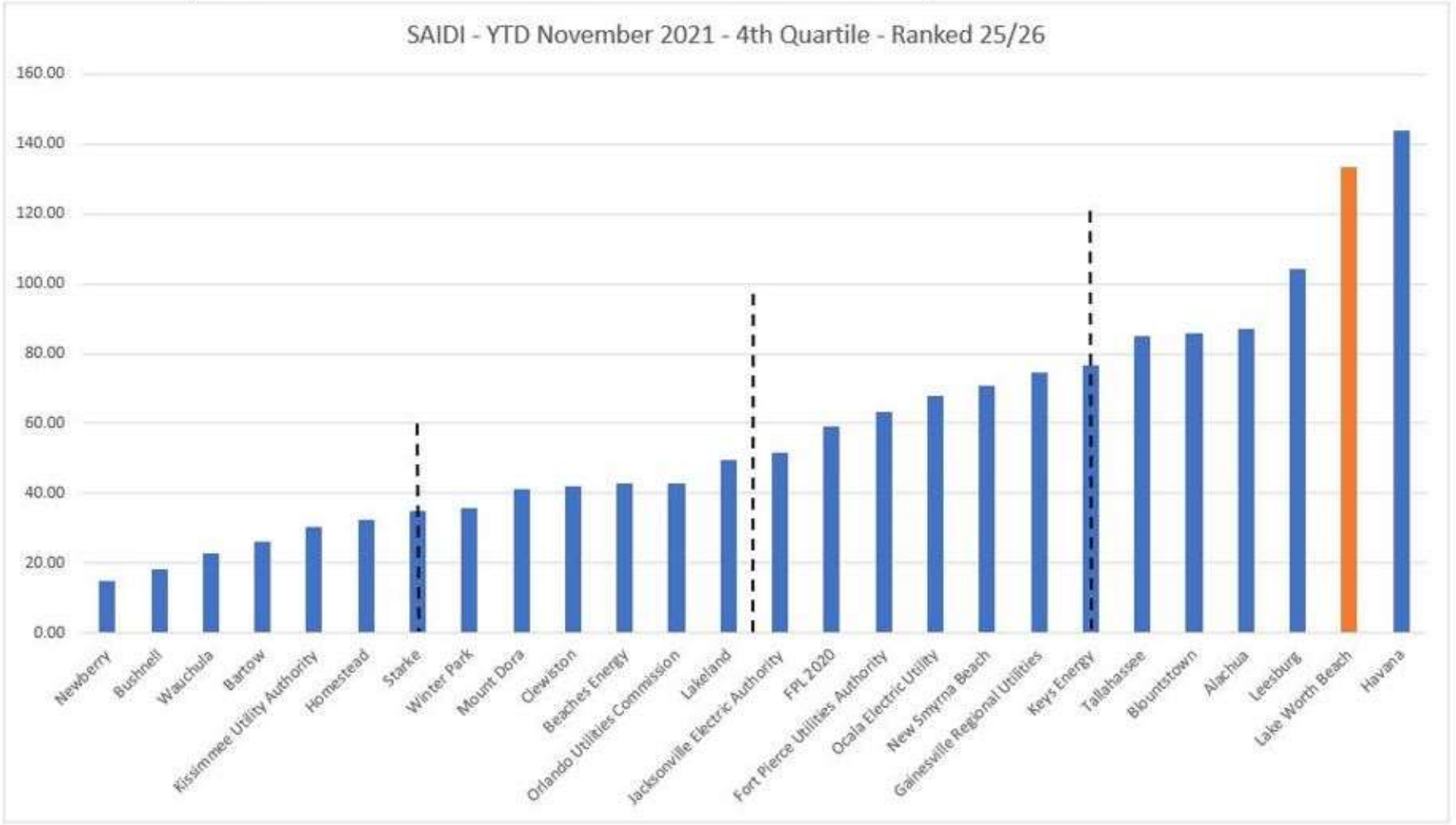
SAIDI - Measures the average duration of interruptions for the average customer

	YTD Nov Minutes	YTD Nov Goal	YTD Nov Rank	YTD Nov Quartile
LWBU - 2021	133.4	34.9	25/26	4th



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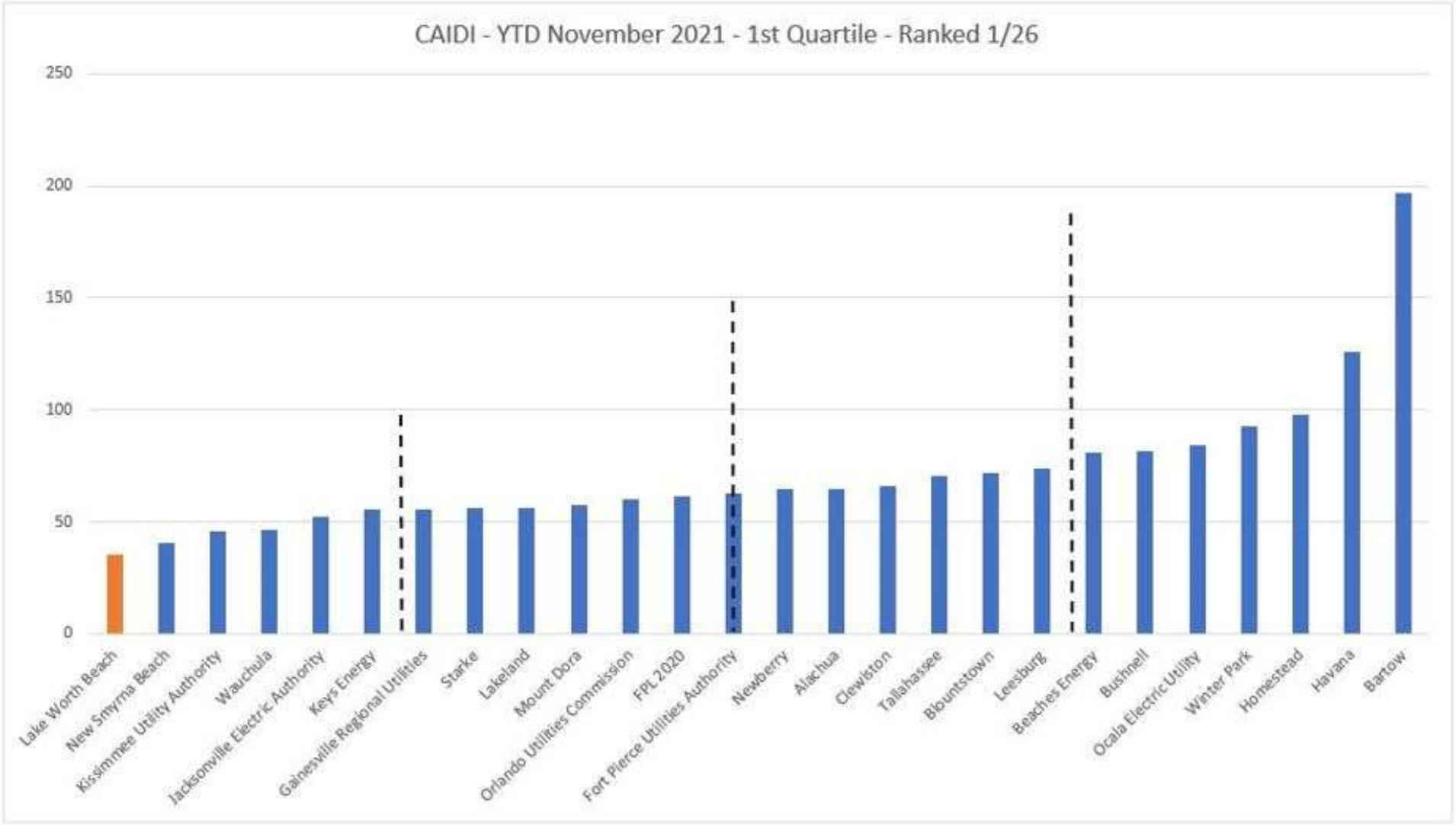
CAIDI - Measures the average repair time experienced by the average interrupted customer

	YTD Nov Minutes	YTD Nov Goal	YTD Nov Rank	YTD Nov Quartile
LWBU - 2021	34.1	55.5	1/26	1st



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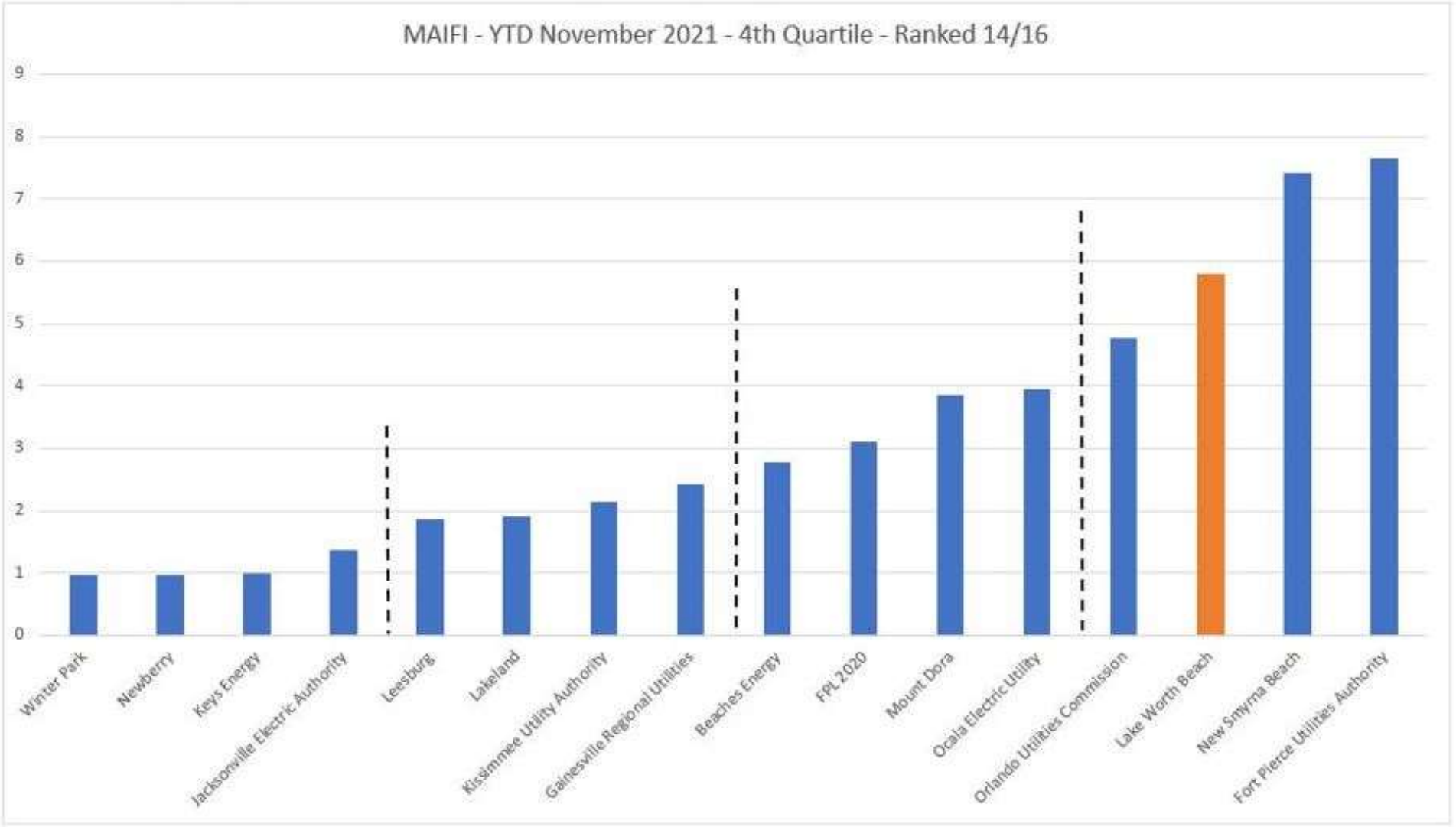
MAIFI - measures the average frequency of momentary interruption events for the average customer

	YTD Nov Value	YTD Nov Goal	YTD Nov Rank	YTD Nov Quartile
LWBU - 2021	5.8	1.4	14/16	4th



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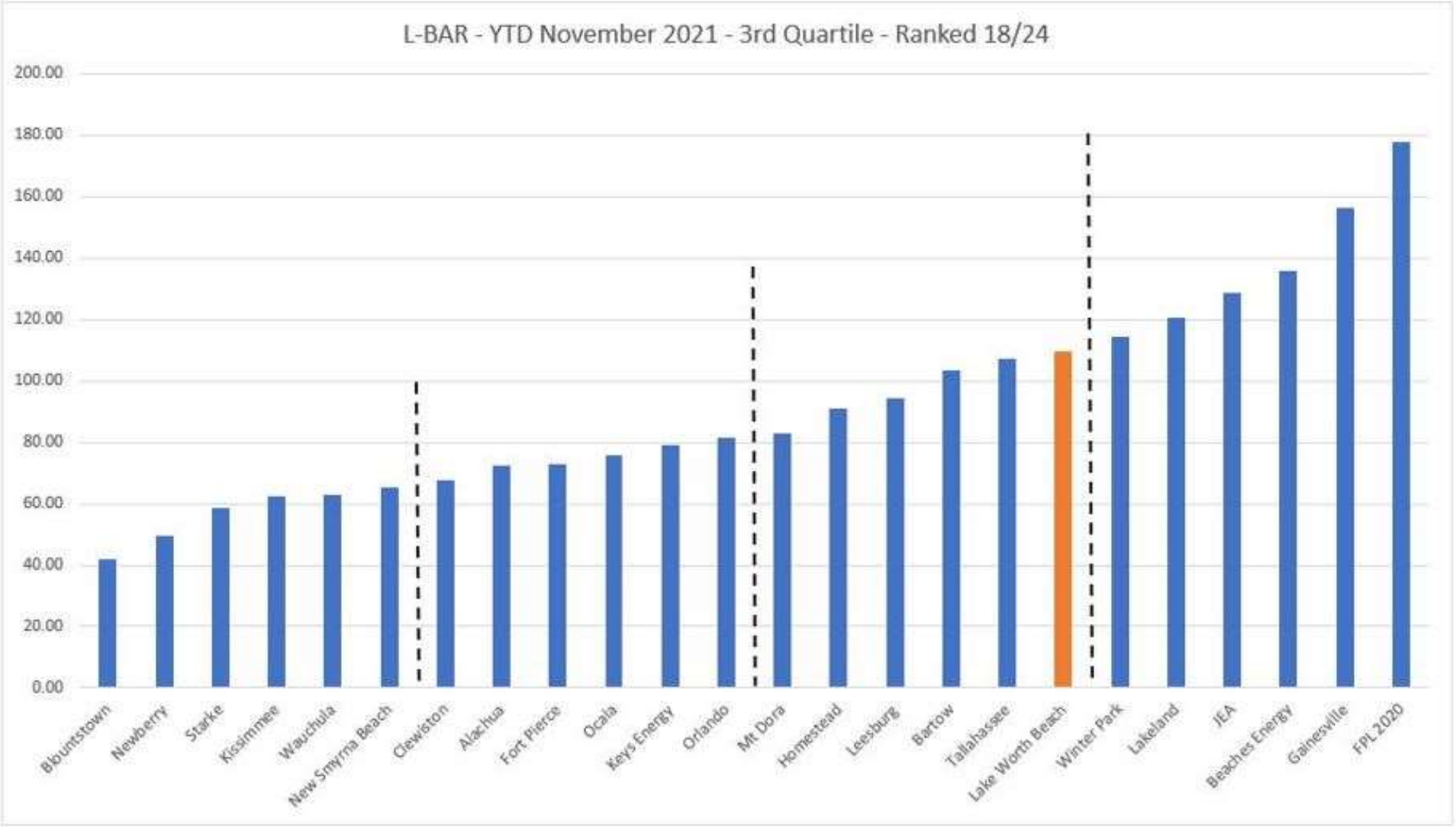
L_BAR - Measures the average length of a single outage

	YTD Nov Minutes	YTD Nov Goal	YTD Nov Rank	YTD Nov Quartile
LWBU - 2021	107.4	65.1	18/24	3rd



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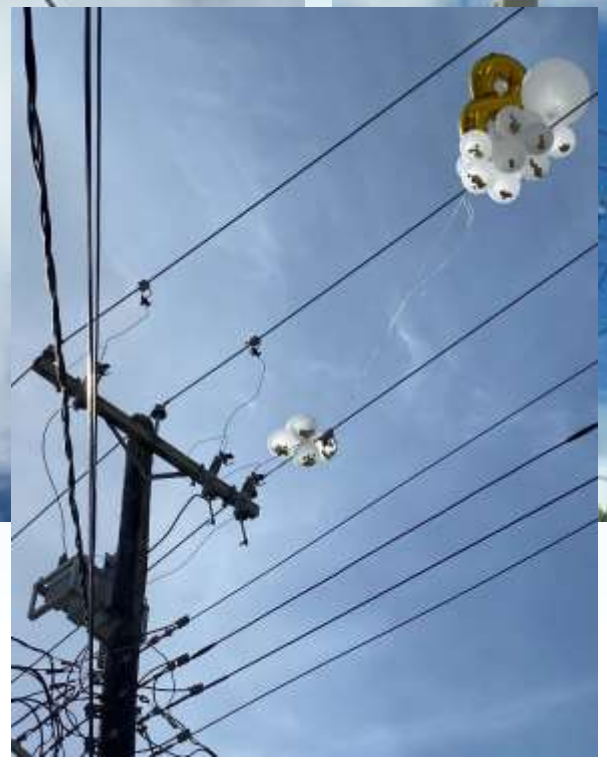

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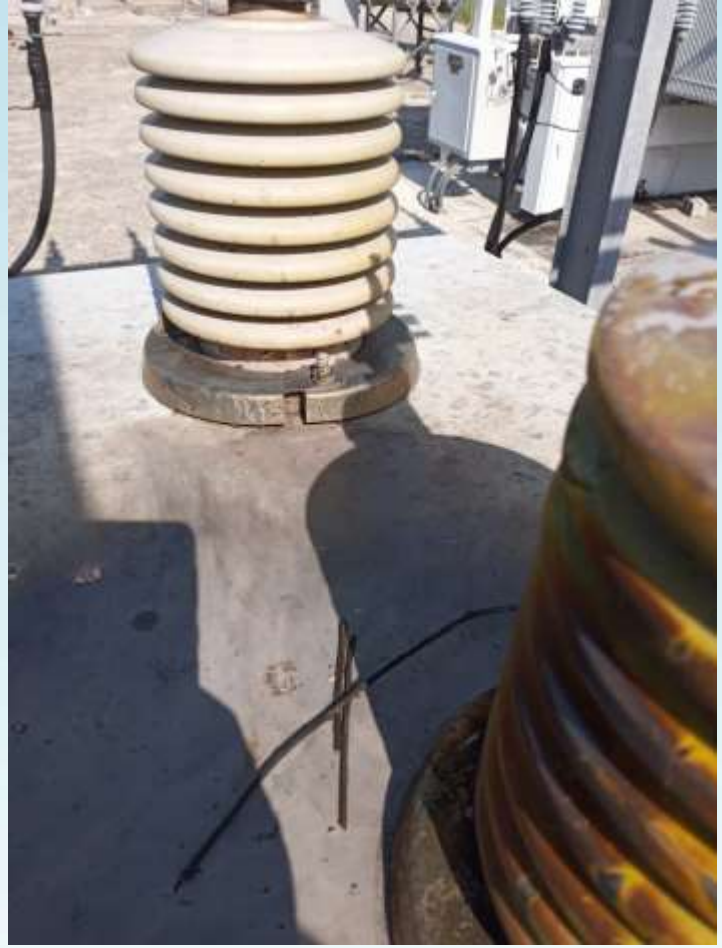

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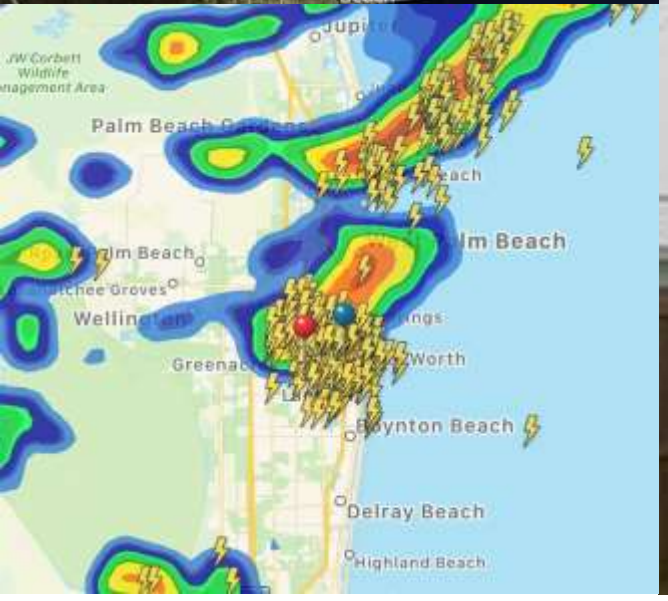

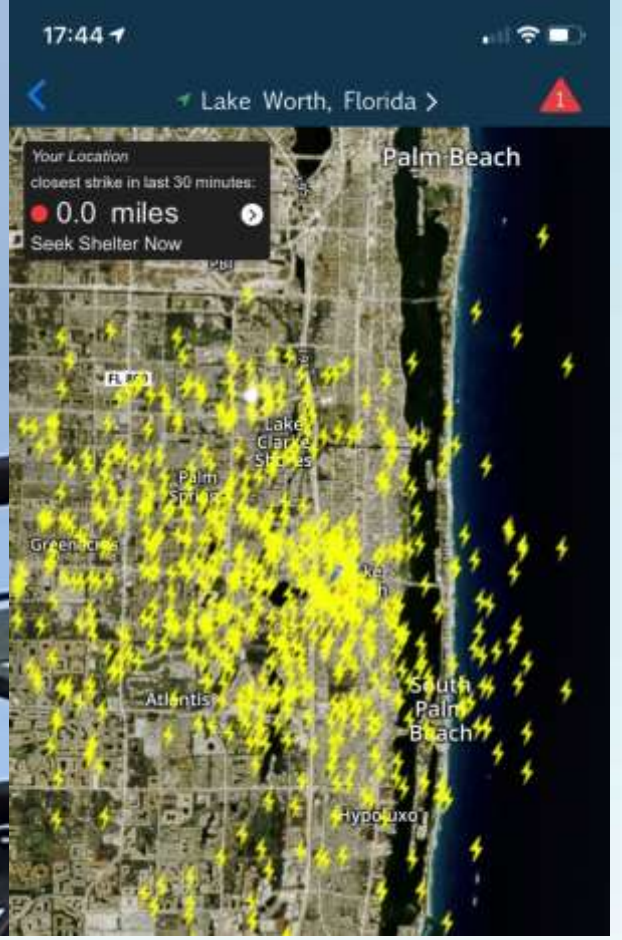

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System Hardening and Reliability Improvement Program

Walt Gill
Assistant Director of Electric Transmission & Distribution

Why Perform SHRIP?

1. Support load growth & to create “A Grid of the Future”
   - ❖ Net Metering/Rooftop Solar
   - ❖ At-home & Public EV charging stations & Vehicle to Grid Technology
   - ❖ Battery Energy Storage
   - ❖ Micro-Grids
2. Build in redundancy; improved operating flexibility for reduced outage times

   and quicker recovery from storm events
1. Resiliency against weather and wildlife
2. Automation
   - Less manual switching done by crews, safer and faster
3. Keep our costs down
   - Make every kW produced count; reduced line losses
   - Improve Power Factor
4. Prolong equipment life
5. Reduce warehouse and stock items
6. Streamline processes
7. Increase personnel productivity
8. Standardized distribution voltage of 26kV; ensures system capability to deliver and receive energy from distributed resources
9. Replace and upgrade the aging equipment and substation structures
   - Meet NESC, NFPA 70E, OSHA standards

Typical SHRIP Activities Underway and Funded Using Series 2020 Revenue Bonds

- ✓ Repair and/or replacement of the least reliable 26kV system components; Rebuilding substations, new transformers; replacing rotting poles, insulators and steel brackets
    1. Decrease the number of outages
    2. Personnel and Public safety
- ✓ Upgrading to higher distribution voltage; Conversions of 4kV circuits to 26kV
    1. Solves the problem of overloaded lines
    2. Allows for more system switching flexibility
    3. Saves money by decreasing the line losses
- ✓ Splitting large circuits into smaller sections; Sectionalizing Circuits
    1. Less customers affected by each outage = less outages experienced by each individual customer
- ✓ System Automation; new SCADA & New System Operations Center
    1. Improved visibility and understanding of how the system is operating
    2. Improved control and rapid switching
    3. Decrease outage restoration time

Tie Line Protection & Control

Replacement of aged electro-mechanical relays were replaced with state of art micro-processor controls

- ✓ **GPS Clock – time stamping of events to the Nanosecond; rapid identification of sequence of events during faults**
- ✓ **Ability to identify fault locations within feet**
- ✓ **Power Quality Monitoring**
- ✓ **Primary Line Protection**
- ✓ **Secondary Line Protection**
- ✓ **I/O Module-ATS Alarms**
- ✓ **Annunciator-Battery Charger Alarms**

Specialized contractors performed inspections and repairs on the single 138kV transmission tie line serving the while energized and supplying power to the City; reduced risks of multiple Island Operations.

Replaced inoperable 138kV Switches; renewed ability to isolate portions of the Transmission Tie Line for maintenance. These new switches are motor controlled and operated remotely via SCADA.

Installed new pole and switch on the Transmission Tie Line which allows us to perform Main Yard maintenance without the need for an Island Operation.

Out with old and in with the new!

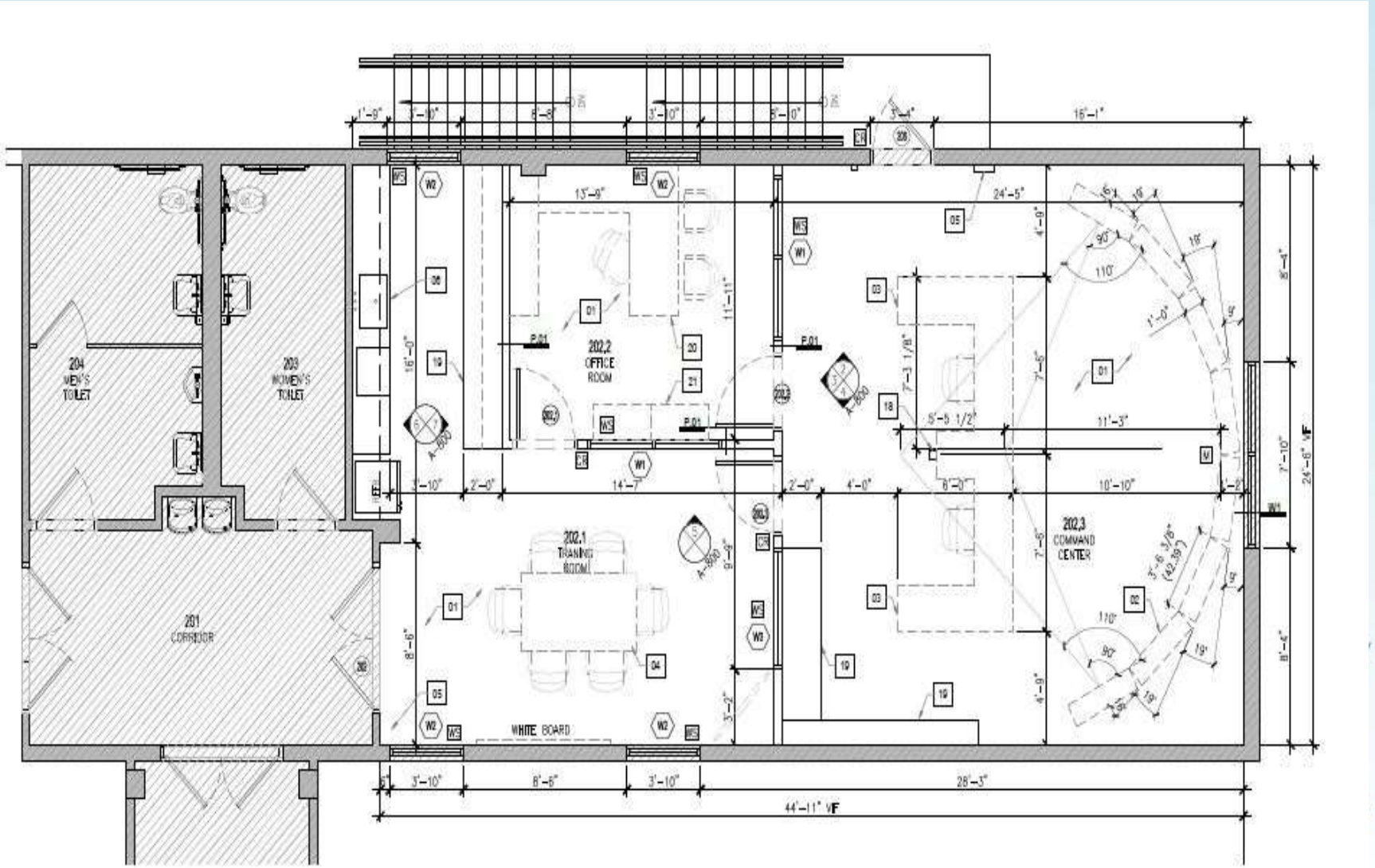
We replaced the original failing disconnect switches in the Main Yard that were manufactured in the late 1970's. These new switches will allow us to safely and reliability isolate equipment for maintenance and testing purposes.

Inspected & Repaired Static Line on the 138kV Tie Line

Drone inspections revealed points of failures and high priority repairs

- ✓ Repaired spalling pole-top concrete
- ✓ Repaired failed and separated pole bonds
- ✓ Replaced worn brackets

New Electric System Operations Center



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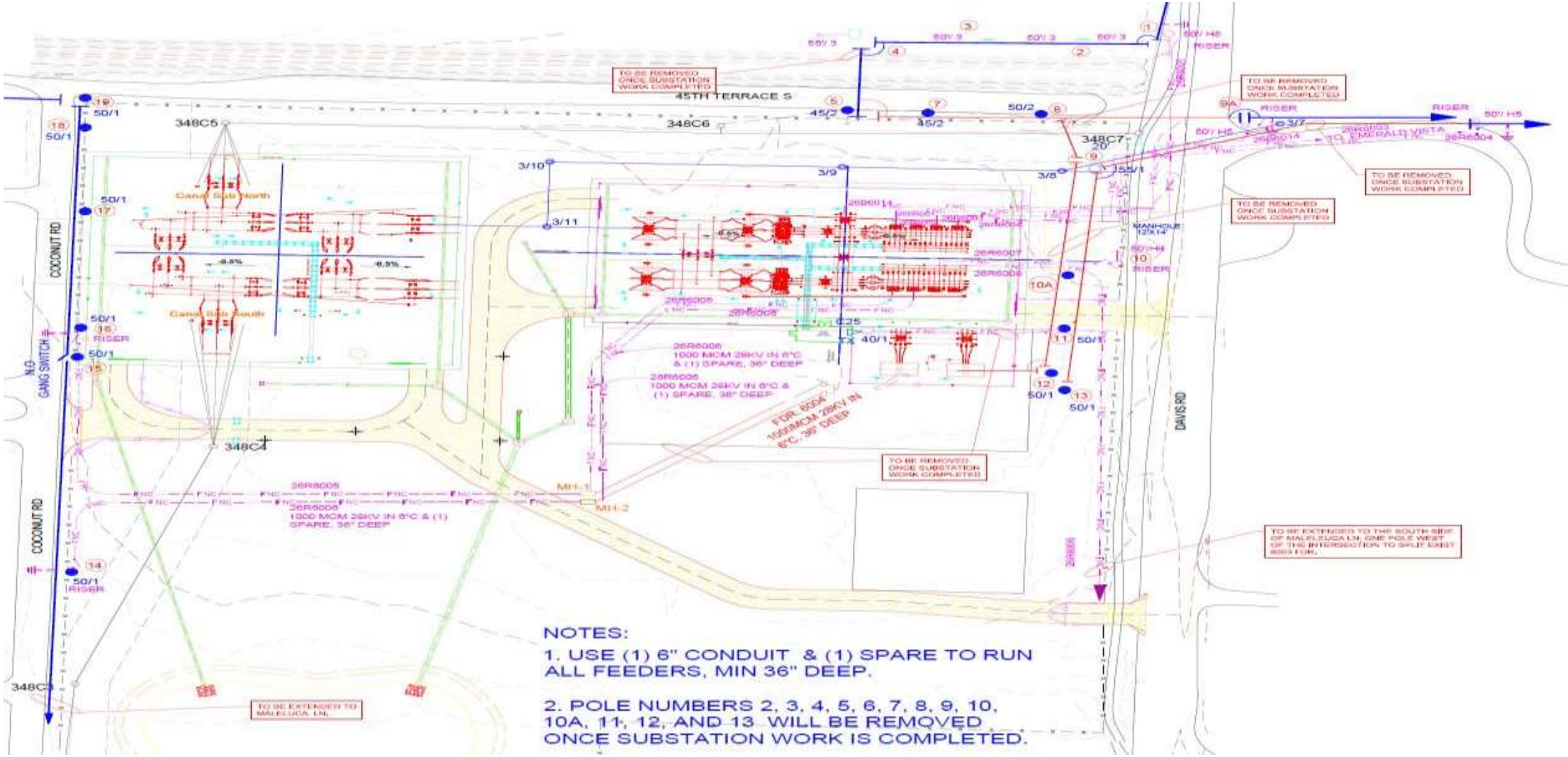
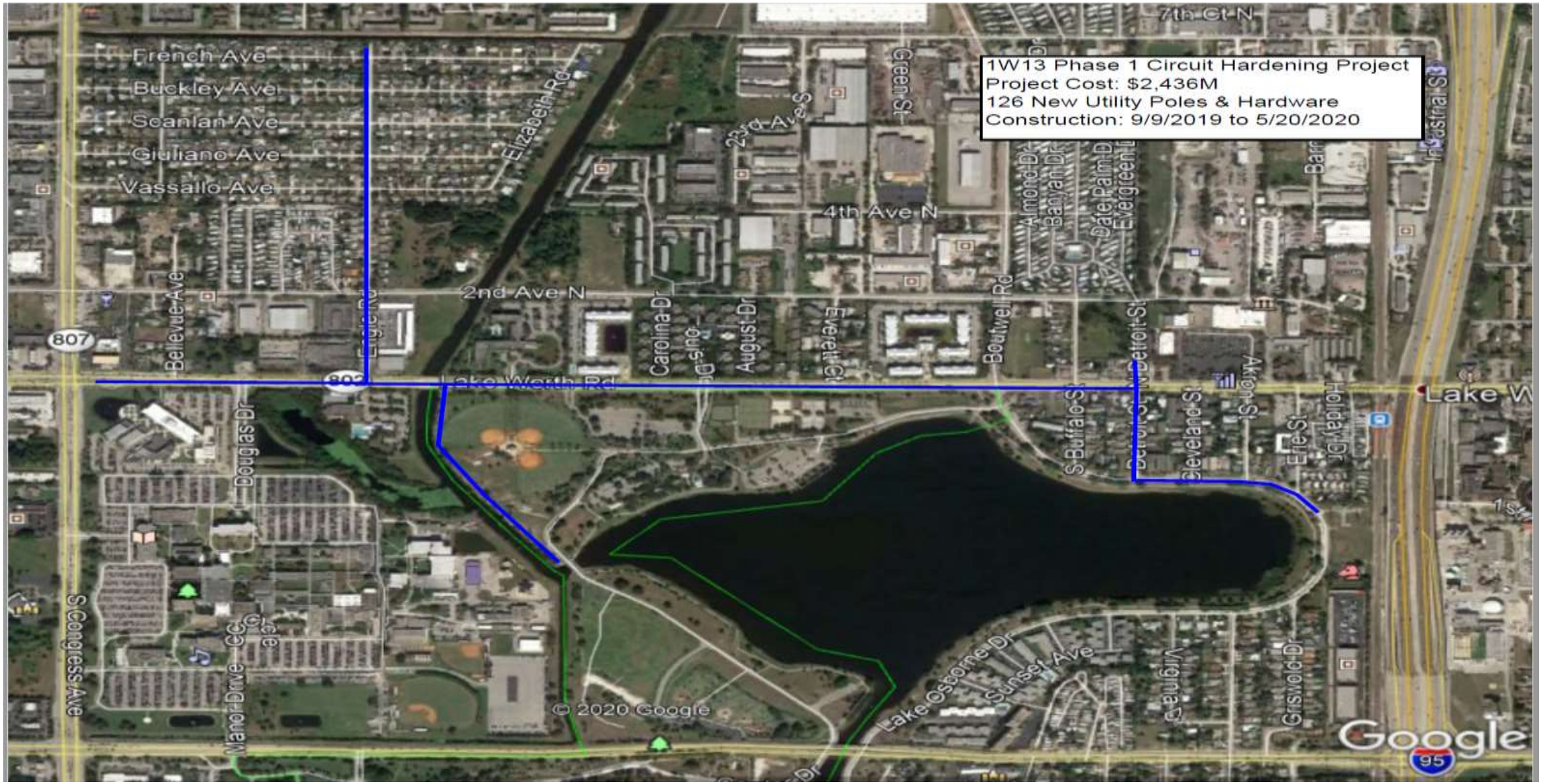
2020 Bond SHRIP Projects – New 138kV Canal Switch Yard & 8-Bay Distribution Substation



Distribution Scope

- ✓ Remove/Replace steel cross-arms; replace with fiberglass cross-arms
- ✓ Remove/Replace deteriorated wood cross-arms as needed
- ✓ Remove/Replace deteriorated wood poles
- ✓ Remove/Replace open-wire secondary; replace with insulated 4/0 triplex
- ✓ Upgrade insulators to current design standard
- ✓ Remove any “Automatic” Conductor Sleeves and Replace with Compression Type
- ✓ Install animal guards
  - ➢ Middle Φ on cross-arms/vertical/Modified-vertical construction
  - ➢ Install insulated bird-wire on transformers, fuse switches and Lightning Arresters (“LA’s”)
  - ➢ Install “eel-guard” on feeder jumpers/junctions
- ✓ Replace blown or damaged LA’s
- ✓ Remove/Replace leaking or deteriorated transformers
- ✓ Test all ground rod locations; maximum 25 Ohm’s, record per location
- ✓ Repair/replace missing/damaged pole bonds
- ✓ Replace broken or missing down-guys
- ✓ Inform CLWB EU team of areas requiring vegetation management
- ✓ Coordinate all planned outages
  - ➢ Hang door notices 72 hours in advanced, phone calls if number on record
  - ➢ Provide PIO with with outage schedule and affected locations

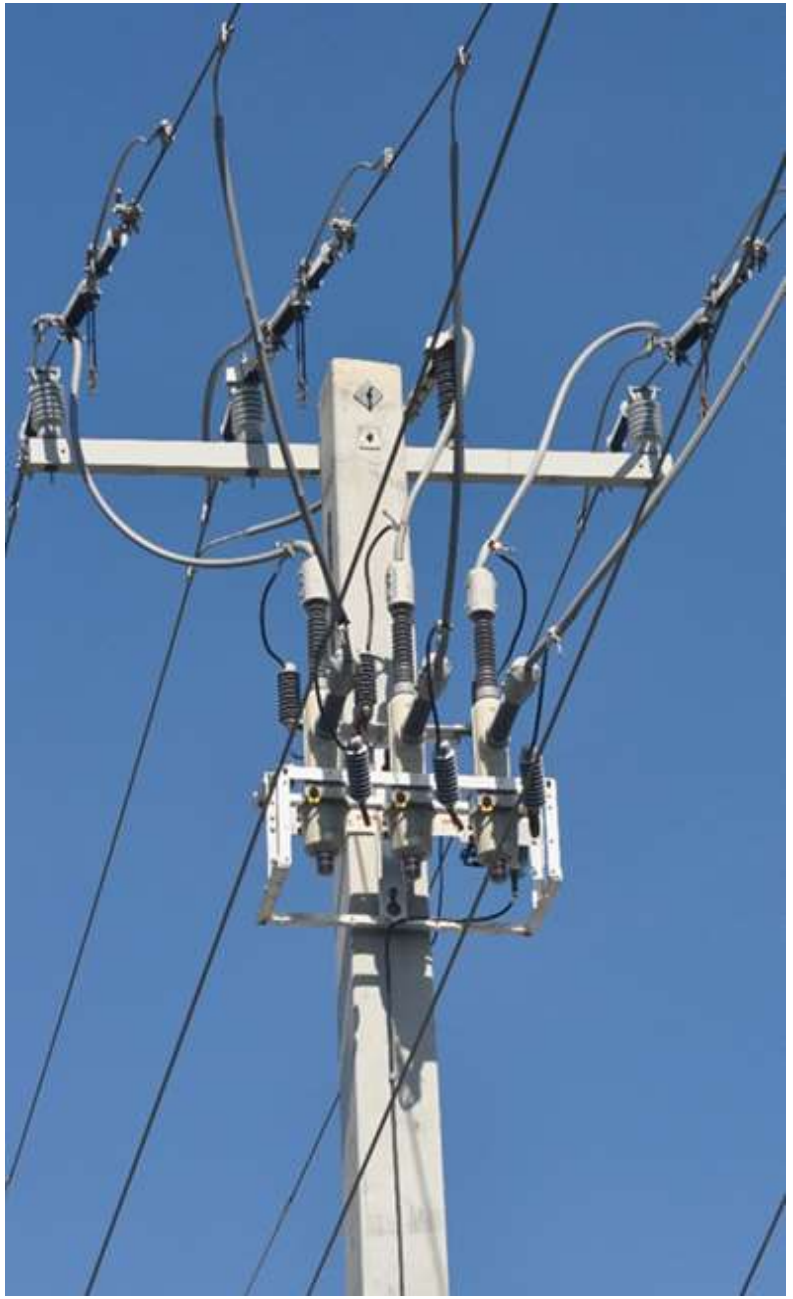
Project Example: “West13” Circuit Phase 1 Area Covered



SYSTEM HARDENING
S·H·R·I·P
RELIABILITY IMPROVEMENT

In early 2019 the West 13 Circuit was ranked the system's poorest performing circuit

- ✓ August 2019; Phase 1 Construction Started
- ✓ October 2019; Mid-point Reclosers placed in Service
- ✓ July 2020; Work Complete, System returned to Normal Configuration



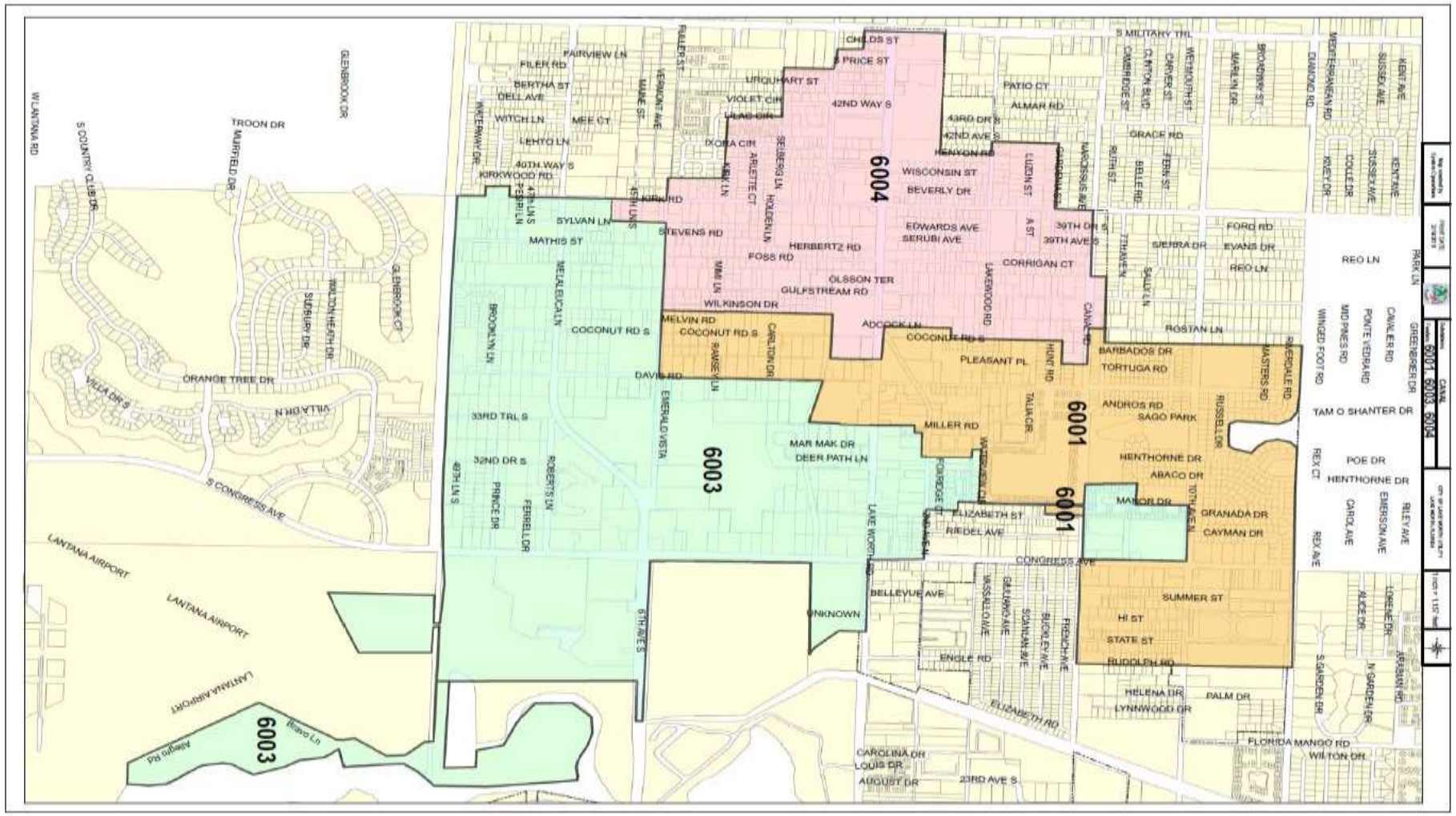
West 13 Phases 2 & 3

- ✓Phase 2 design completed and currently acquiring permits and materials
- ✓Construction of Phase 2 is currently scheduled to begin summer of 2022.
- ✓Phase 3 currently designed; funding & scheduling pending FY2023

Western Circuits Project Area

Staff has identified 2348 poles, that will need to be looked at and corrected

- ✓ Metal Brackets
- ✓ Old Insulators
- ✓ Open Wire Secondary
- ✓ Pole Bonding
- ✓ Animal Guard
- ✓ Automatic Conductor Sleeves
- ✓ Bad Poles



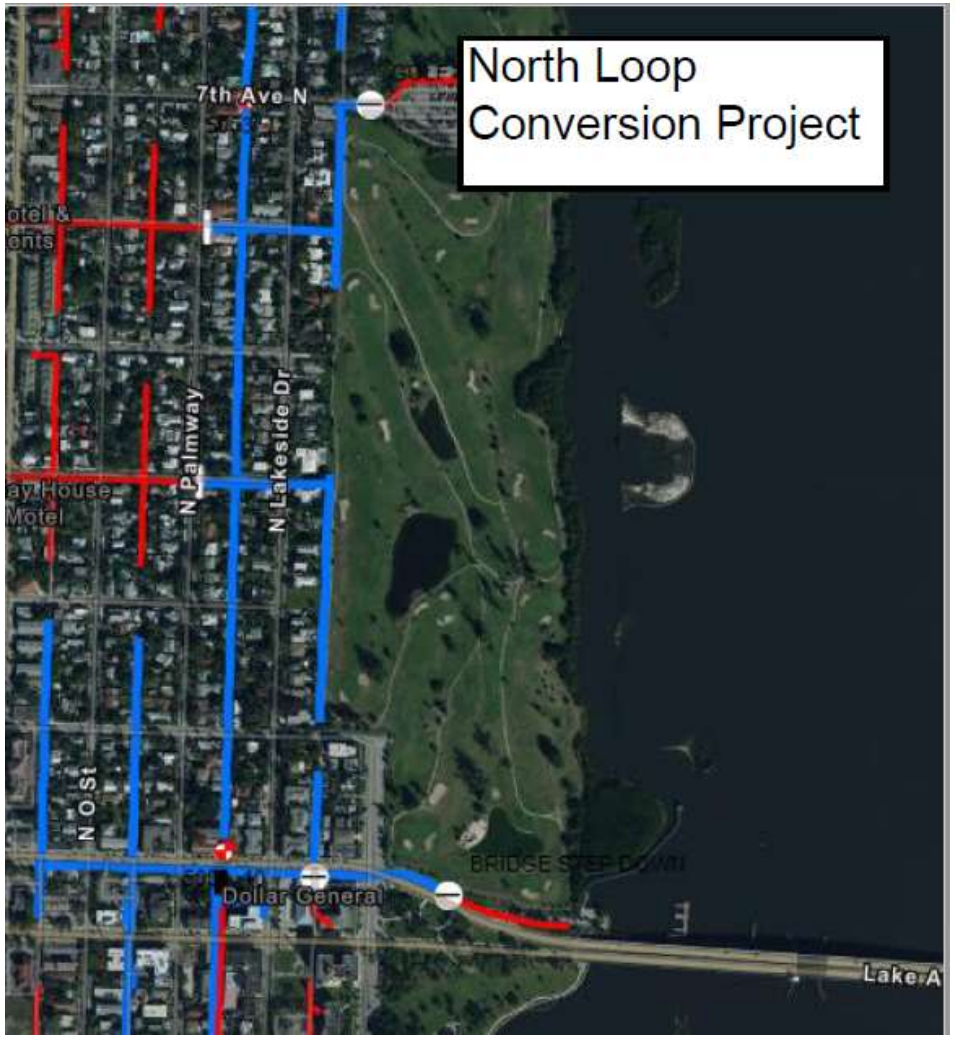
Looping Projects – Internal Crews

- Productive use of in-house labor
- Learning opportunity for larger scale work to come
- Alleviated immediate needs ahead of availability of bond funds
- All design and construction was completed by our own in-house engineers and line crews

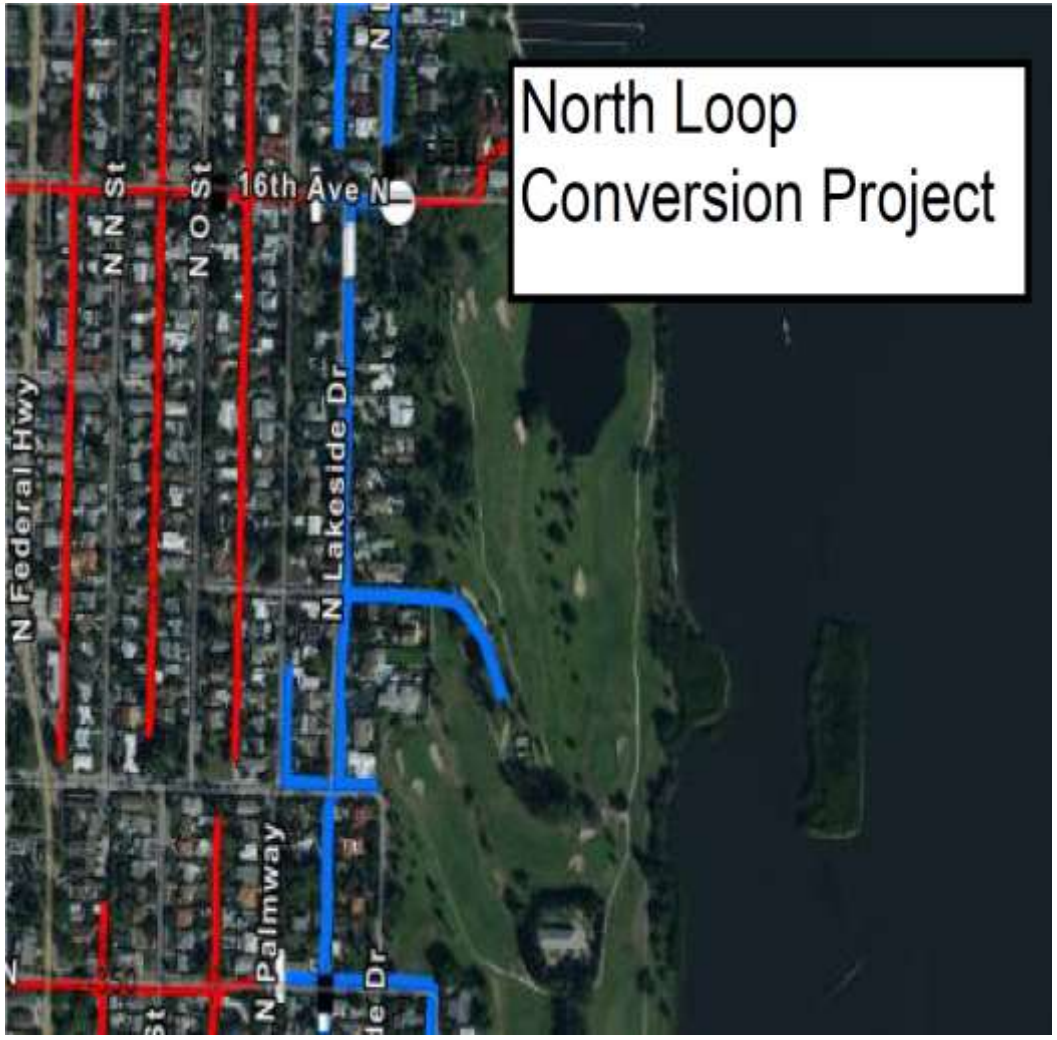
SYSTEM HARDENING

S·H·R·I·P

RELIABILITY IMPROVEMENT



- District 3 Area
- The old 4kv circuits were operating beyond ideal limits



SYSTEM HARDENING

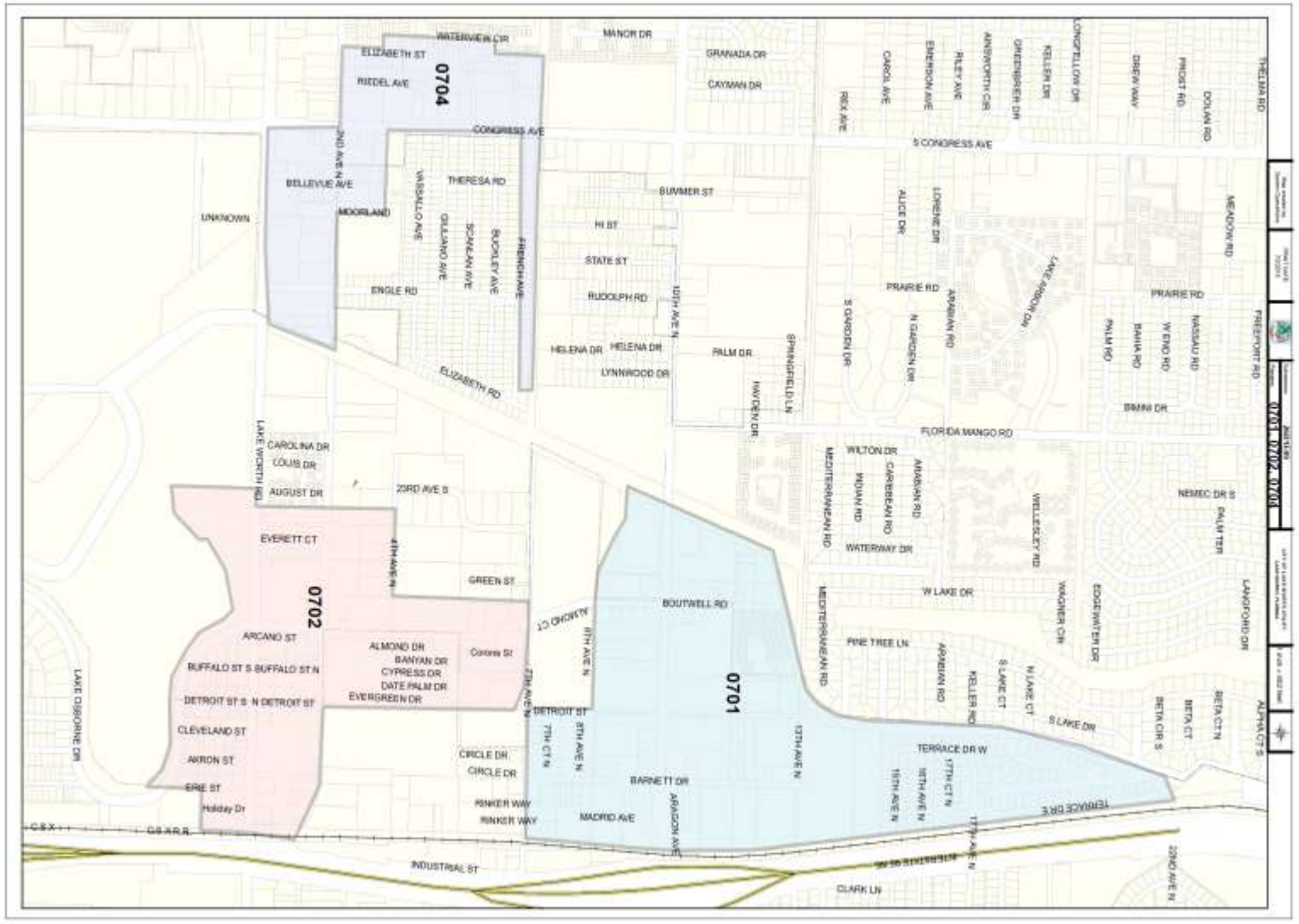
S·H·R·I·P

RELIABILITY IMPROVEMENT

- Districts 1 & 4 Area
- The old 4kv circuits were operating beyond ideal limits

7th Ave N Substation Rebuild and Circuit Hardening
District 2

- 7th Ave N feeds the area West of I-95.
- This Substation services 1,150 Customers
- On Going Project
- Forecast to complete April 2022



SYSTEM HARDENING

S·H·R·I·P

RELIABILITY IMPROVEMENT

Old 7TH Ave Substation Equipment

SYSTEM HARDENING

S·H·R·I·P

RELIABILITY IMPROVEMENT

7th Ave Substation Rebuild Underway

SYSTEM HARDENING

S·H·R·I·P

RELIABILITY IMPROVEMENT

7th Ave Substation Rebuild Underway

SYSTEM HARDENING

S·H·R·I·P

RELIABILITY IMPROVEMENT

With Internal Crews and Contractors Working Together – Since Starting SHRIP…

- 931 Poles have been replaced and upgraded
- 394 Transformers have been replaced and upgraded
- 3800 feet of feeder conductor replaced and upgraded with 336 ACC Conductor
- Removed 26506 feet of Open Wire and replaced with Triplex

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CIP & SHRIP Series 2023 Revenue Bond Requirements for Project Funding

Paul Nicholas
Engineering Manager – Special Projects

2021 Poorest Performing Circuits

CIRCUIT #	CIRCUIT COUNT	CUSTOMERS AFFECTED	TRIP/ CLOSE	# AFFECTED T/C	OUTAGE MINUTES	TOTAL OUTAGE MINUTES	OUTAGE COUNT	CUSTOMERS AFFECTED	TRIP/ CLOSE	# AFFECTED T/C	OUTAGE MINUTES	TOTAL OUTAGE MINUTES	OUTAGE COUNT	WORST
CC26B6001	1806	4807	11	14632	5780	196713	59	44	52	48	52	52	52	300
CC26B6003	2597	7661	4	3953	3521	210187	42	49	42	41	51	51	51	285
CC26B1W13	2213	3628	7	9223	2566	145527	24	42	50	45	48	48	47	280
26B6001	799	2777	7	12621	2428	110237	23	41	49	47	46	46	46	275
26R0603	1142	5324	4	4002	2417	136321	21	46	41	42	45	45	45	264
26R6001-1	1007	2030	4	2011	3352	86476	36	36	40	37	50	50	50	263
26B6003	2016	5627	1	2597	2479	184612	28	47	32	39	47	47	49	261
26R1W13-1	960	1231	5	4797	1453	108245	11	34	45	44	43	43	41	250
26B5003	3505	8583	6	19666	525	340466	11	50	48	49	30	30	42	249
26B1W13	2213	2394	2	4426	1089	37210	12	39	37	43	41	41	43	244
26B6004	1377	458	1	1373	2988	58784	27	28	31	35	49	49	48	240
26R1801	477	566	5	2384	1257	30746	11	30	44	38	42	42	40	236
26R6003-1	581	2034	3	1356	1042	25575	14	37	39	34	40	40	44	234
26B1E12	3855	39	7	33073	577	3627	7	15	51	52	31	31	38	218
26B1W05	4872	4664	5	24118	426	307777	3	43	47	51	25	25	24	215
4A3N13	816	119	2	1629	655	19520	6	24	35	36	32	32	35	194
4R1204	428	45	2	854	859	4493	7	17	33	30	38	38	36	192
4R1201	559	68	1	559	820	11845	6	21	27	27	37	37	33	182
4R1502	679	64	1	679	1005	11580	3	19	29	29	39	39	23	178
26B1E09	1639	4992	2	3284	135	125639	4	45	36	40	11	11	28	171

Circuits were ranked 1 to 52 in 5 separate categories with 52 being the poorest performance rating.
These 5 categories included customers affected, breaker operations, outage minutes per customer, total outage minutes, and number of outages on the circuit.

Performance ranking & methodology will be included for review by independent engineering firms in addition to bond rating agency and investors.

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2022 Series Bond Request

Electric Utility FY 22 Year Budget Request

		Account Details			FY 2022		
Item	Project Title	Project Number	GL Account #	Description	FY22 Request	Pay Go	Series 2022 Bonds
10	Line Truck Replacement	No # required	421-6034-531-64-30	Machinery & Equipment / Vehicles	580,500		580,500
12	EV Charging Station	No # required	421-6020-531-64.40	Machinery & Equipment / Misc. Equipment	310,000	30,000	280,000
19	1900 Building Improvements Phase 2 - Breakroom, Men's Lavatory & Line Worker Ready Room	EL 22XX	421-6010-531-62-00	Service / Buildings	259,875		259,875
20	Cultural Plaza/Customer Service Renovation	EL 22XX	421-6010-531-62-00	Service / Buildings	750,000		750,000
21	Meter Test Board	EL 22XX			50,600	50,600	
22	Warehouse Forklift	EL 22XX			67,000	67,000	
23	NERC CIP Security	EL 2201	421-6020-531-63.15	Improve Other than Build / Infrastructure	108,500	108,500	
26	System Hardening & Reliability Improvement (SHRIP)	Multiple #'s	421-6034-531-63-15	Improve Other than Build / Infrastructure	35,240,000		37,840,000
	Total Electric Fund				**37,366,475**	**256,100**	**39,710,375**

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2022 Bond SHRIP Projects

		Account Details			Series 2022 Bond
Item	Project Title	Project Number	GL Account #	Description	FY22
	Substation				
10	6th Ave S sub (6-bank station Additional Construction costs and Land Purchase)	SH2111	421-6034-531-63-15	6th AVE South (H Street) Substation Design & Construction	$ 1,200,000
13	Substation Capacitor Banks (Main Yard)	SH22XX	421-6034-531-63-15	Main Yard Capacitor Banks, Study, Eng, Materials & Install	$ 500,000
14	Digital Gas Analysis Equipment from ABB for (4) large power transformers	SH22XX	421-6034-531-63-15	Digital Gas Analizer for XFMRS & SCADA	$ 225,000
15	SEL FR12 Digital Fault Indicators (12 sets)	SH22XX	421-6034-531-63-15	Fault Indicators	$ 15,000
16	12th AVE SUB (Design & Construction)	SH22XX	421-6034-531-63-15	R/R Existing 4kV with 26kV	$ 4,000,000
	Distribution				
24	6th AVE S. - Circuit Construction (0601,0602,0604)	SH2123	421-6034-531-63-15	6th AVE/H Street Substation Circuit Design, Constr. & Voltage Conversion	$ 10,500,000
25	6th AVE S. - Circuit Construction (0603)	SH2124	421-6034-531-63-15	6th AVE/H Street Substation Circuit Design, Constr.	$ 3,000,000
26	1W05 Phase 1 -Constr. A St. & 10th Ave N to 18th Ave N, East on 18th Ave N to Substation	SH2125	421-6034-531-63-15	1W05 Phase 1 Constr.	$ 3,000,000
27	1W05 Phase 2 -Constr. RR Tracks 18th Ave N to 24th Ave N	SH2126	421-6034-531-63-15	1W05 Phase 2 Constr.	$ 1,500,000
28	1W05 Phase 3- Design - UG Work (W05-E09-E06-3N11-3N12)	SH2127	421-6034-531-63-15	1W05 Phase 3 Design & Construction	$ 250,000
30	Beach Tie - New ICW Crossing Construction	SH2129	421-6034-531-63-15	Design for New ICW crossing to Casino Complex	$ 3,000,000
36	138kV Tie-Line Underbuild Distribution Circuits Constr. (6004 & 6003)	SH 2135	421-6034-531-63-15	Distribution Underbuild on FP&L 138kV T-Line	$ 2,500,000
45	1E09 & 1N11/0703 UG at 7th AVE N & I-95	SH 22XX	421-6034-531-63-15	E09 & 1N11/0703 UG at 7th AVE N & I-95	$ 400,000
39	System Reclosers	SH22XX	421-6034-531-63-15	Distribution System Reclosers	$ 250,000
40	XPLE UG Cable Replacement @ Various Locations & Substations	SH22XX	421-6034-531-63-15	XPLE UG Cable Replacement	$ 500,000
41	12 AVE S Sub Circuits	SH22XX	421-6034-531-63-15	12th AVE Circuits (1201, 1202, 1203 & 1204)	$ 4,500,000
42	New Main Yard Feeder 1W18	SH22XX	421-6034-531-63-15	New Main Yard Feeder tie to 1W05/1E03	$ 2,500,000
				Totals	**$ 37,840,000**

FY 20-21 Challenges Encountered

- ✓ COVID related issues led to decrease in productivity
- ✓ Material shortages & long lead times
- ✓ Increase in material costs, shipping & logistic challenges

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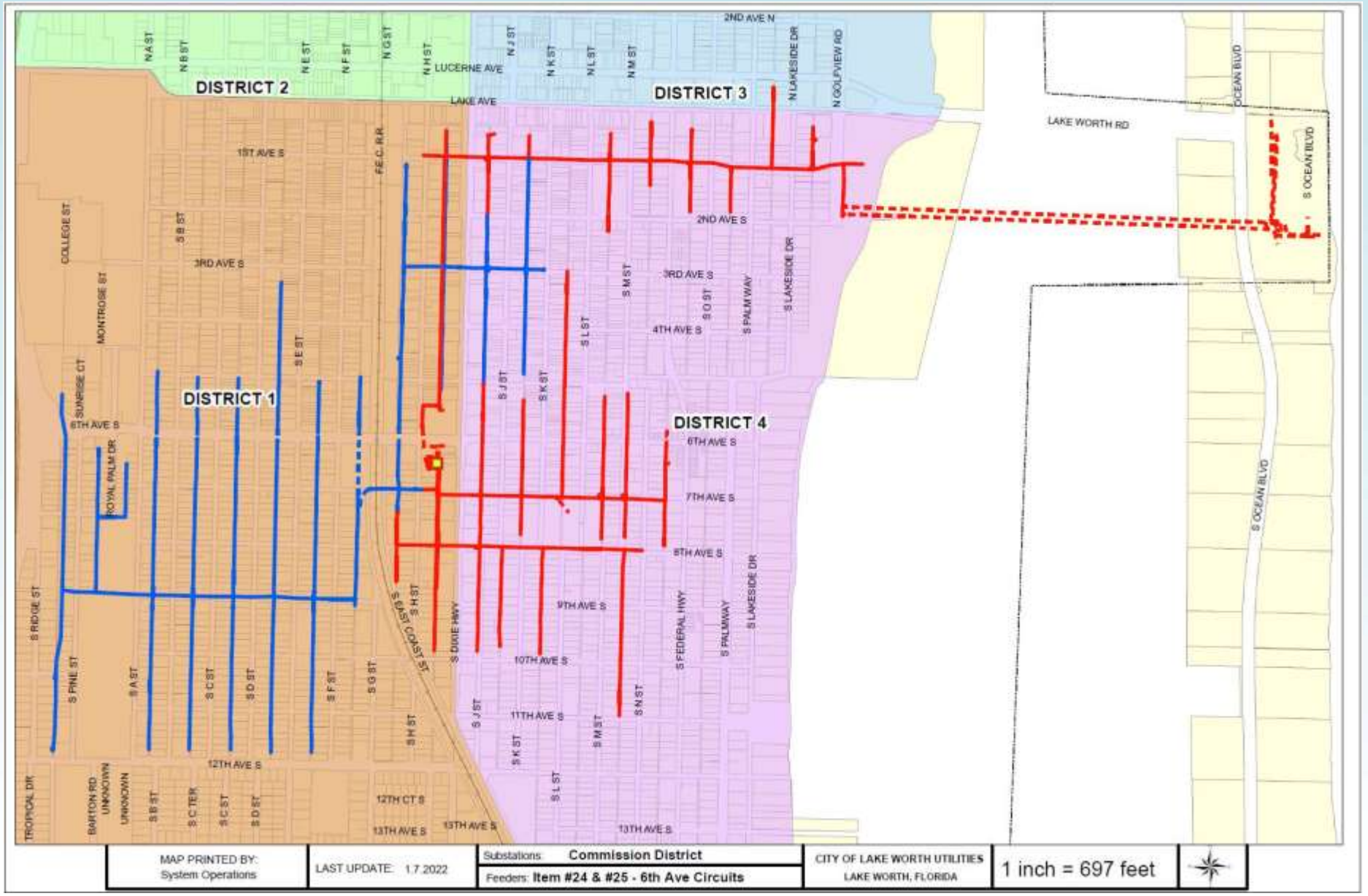
2022 Bond SHRIP Projects Geographically; 6th AVE Circuits & Beach Tie



Existing 4kV Substation (4 Bay)
New 26kV Substation (6 Bay)
Customers Served (2,569)

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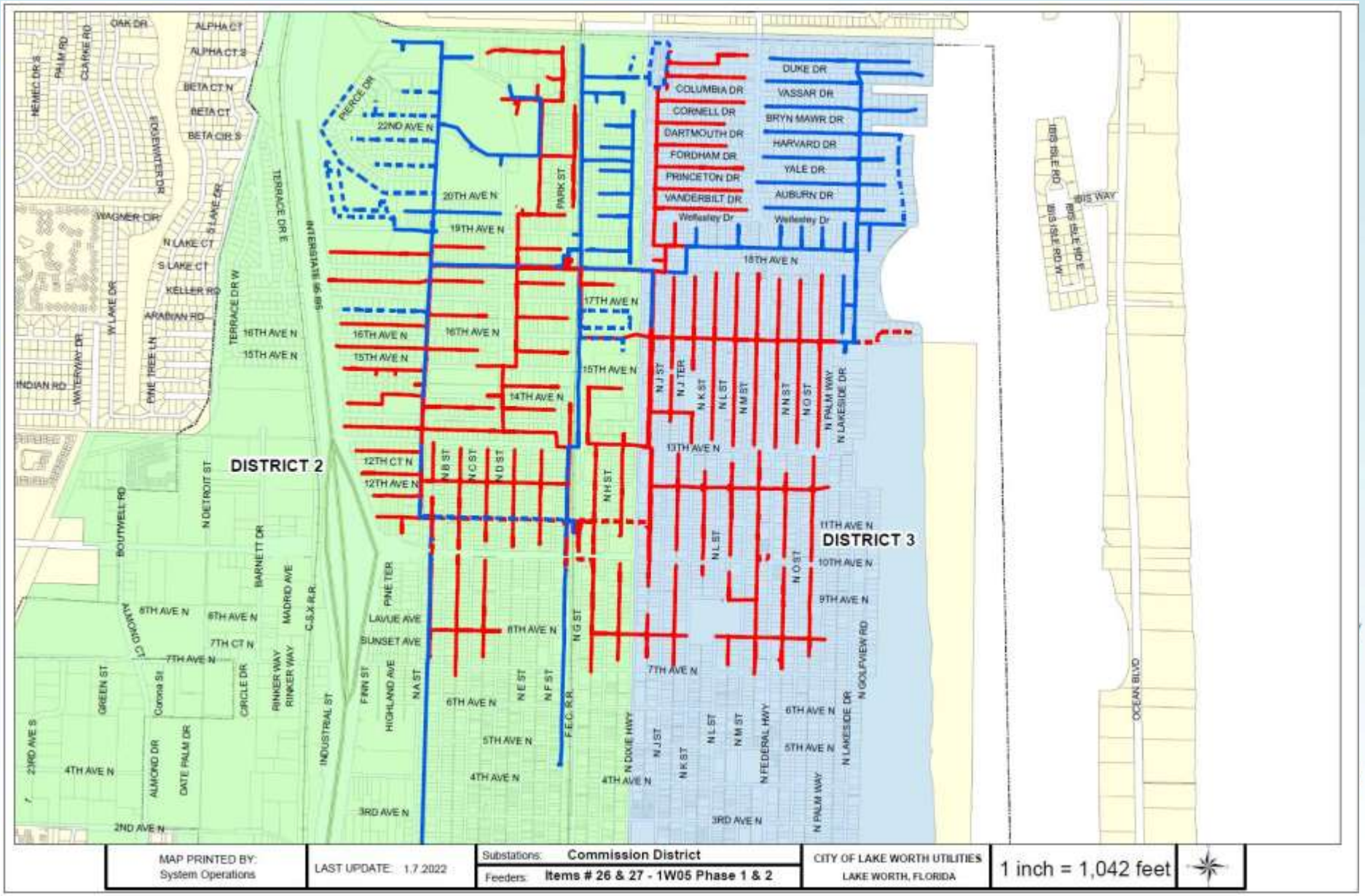
2022 Bond SHRIP Projects Geographically – West 05 PH1 & PH 2 & New 1W18



Customers Served – 4,872

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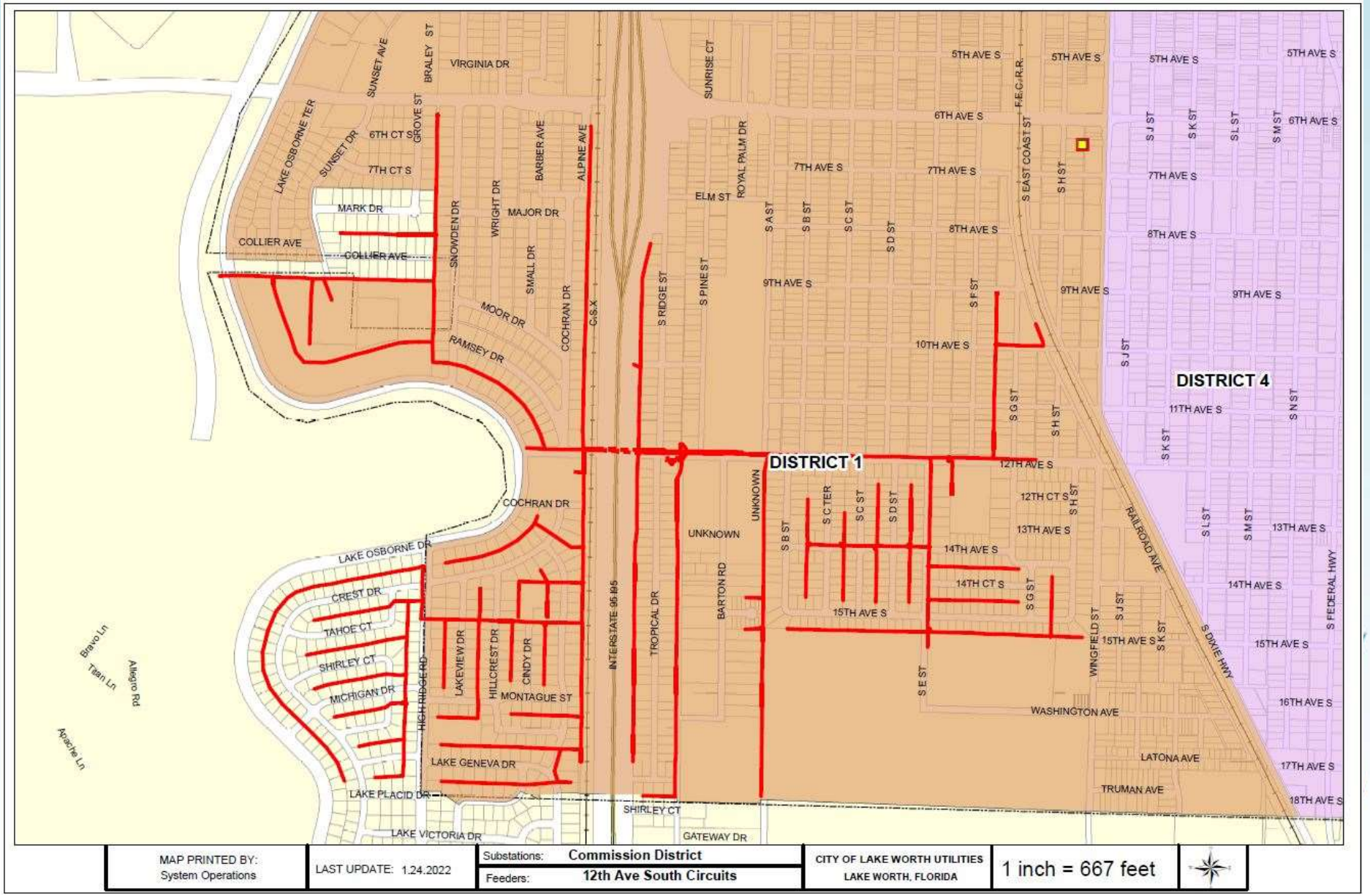
2022 Bond SHRIP Projects Geographically – 12th AVE Sub & Circuits



Existing 4kV Substation – 4 Bay
New 26kV Substation – 4 Bay
Customers Served – 2,194

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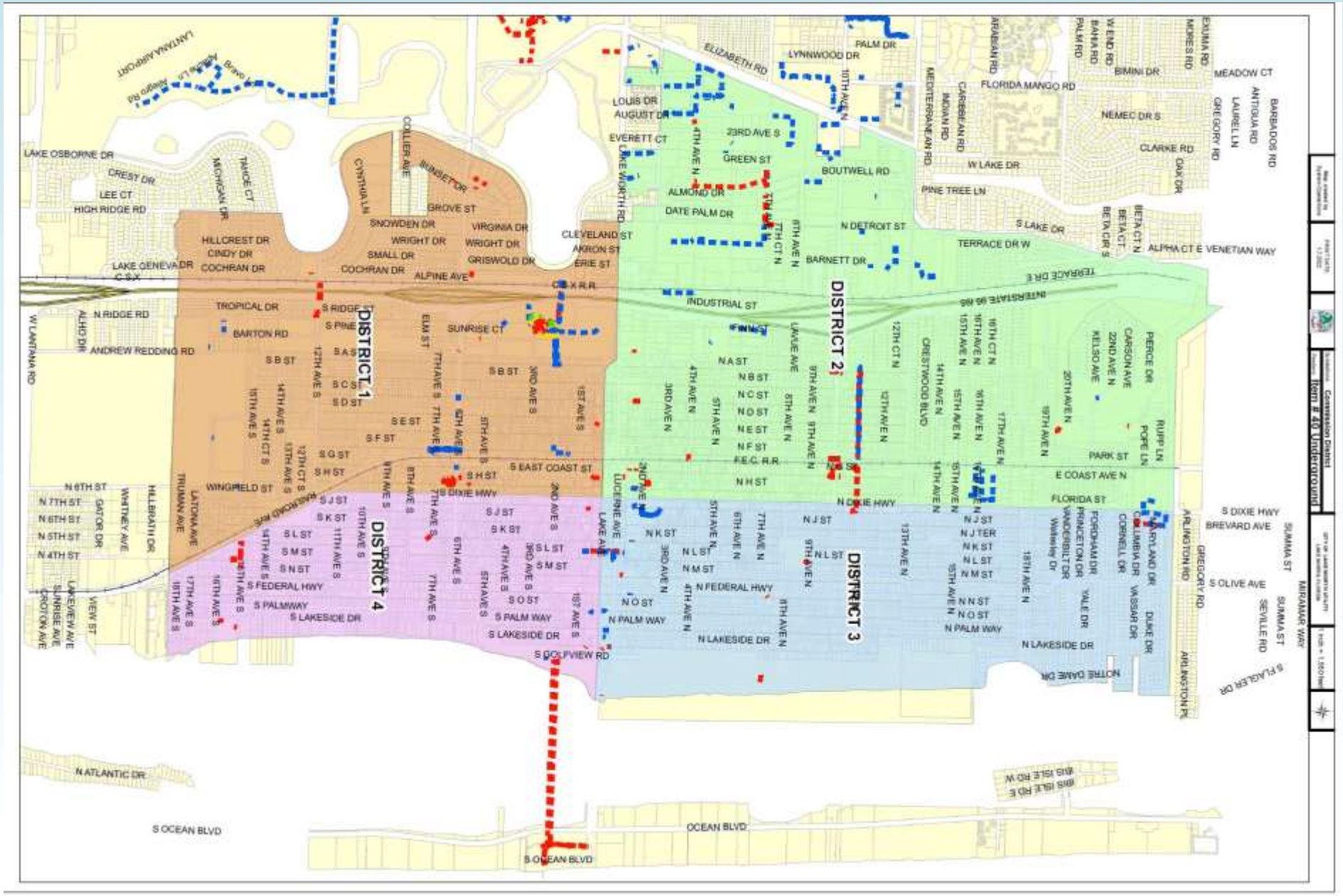
2022 Bond SHRIP Projects Geographically – Underground Feeder Replacement



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Thank you… Questions?