

Emergency Response

May 6, 2021



Response Basics

Utility	# events addressed by a First Responder	# events addressed by a Crew
Electric	35,679	9,371
Water/WW	9,908	391
Gas	7,950	376
Total	53,860	10,234

- 80% are small enough that a single responder can address
- Majority of events are driven by weather and other external forces

Response Process



Preparedness – Before the Event

- Continuous monitoring of system conditions
- Ensuring materials are in stock
- Ensuring contracts and mutual aid are in place
- Maintaining relationships with city and county agencies



ICS Process is Key to Preparedness

- Maintaining Incident Command System (ICS) readiness
 - Emergency levels
 - Up-to-date documents and checklists
 - On call/rotational response and management staff
 - Manage by objectives
- Continuing operational readiness with training and exercises

Level 5 – Normal Operations

Level 4 – Heightened Awareness

Level 3 – Emergency Mode

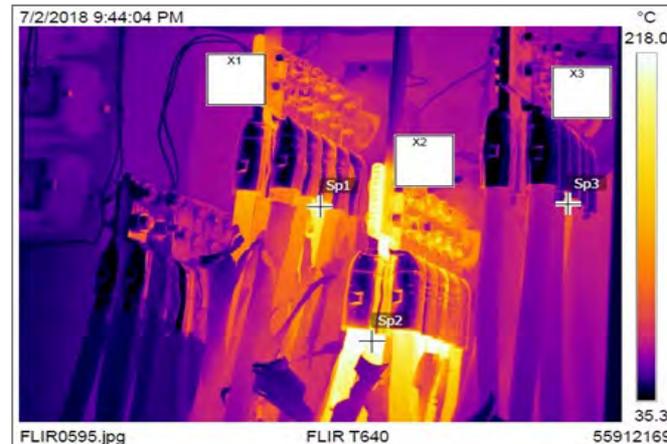
Level 2 – Severe Impact

Level 1 – Catastrophic Emergency

Summer Storm (Wind/Lightning)	5	4	3	2	1
Customers Out of Power	<10,000	10,000 - 30,000	30,000 - 50,000	50,000 - 75,000	>75,000
Breakers Locked Out	<10	<15	<30	<40	>40
Number of Events	<100	100 - 200	200 - 400	400 - 600	600+
Estimated Duration	< 1 day	1 - 2 days	2 - 3 days	3 - 5 days	> 5 days
Storm Category *	TS1 - Weak	TS2 - Moderate	TS3 - Heavy	TS4 - Intense	TS5 - Extreme
Outage Distribution	Localized	Moderate Spread	Widespread	Widespread	Widespread
ICS Mode	Operations	ICS w/remote	Full ICS	Full ICS	Senior ICS
Damage Assessment	No	Consider (10)	Yes (10- 20)	Yes (20 - 50)	Yes (50)
Extra Contract Crews	No	Consider	Yes	Yes	Yes
Off System Crews	No	No	Consider	Yes	Yes
Vegetation Crews	No	Yes	Yes	Yes	Yes

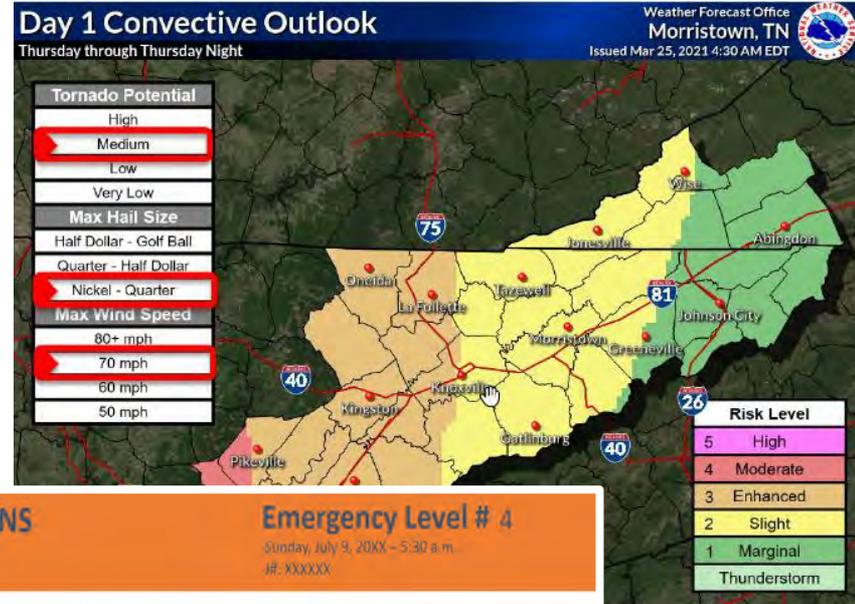
Preparedness Ensures an Efficient Response

- Ensuring programs are implemented and maintained
 - Vegetation management
 - Predictive and preventative maintenance
 - Century II renewals



Planning – As the Event Begins

- Weather monitoring
- Deployment of ICS – Level 4 Heightened Awareness
- Storm planning meetings
- Internal communication for storm readiness



STATUS: **Heightened Awareness**

KUB has implemented an expanded Incident Command Structure in response to outages in the KUB service territory.

If you typically have storm or emergency response duties, please be advised you may be needed. Please check in with your team leader or supervisor to see if you can assist with the restoration efforts.

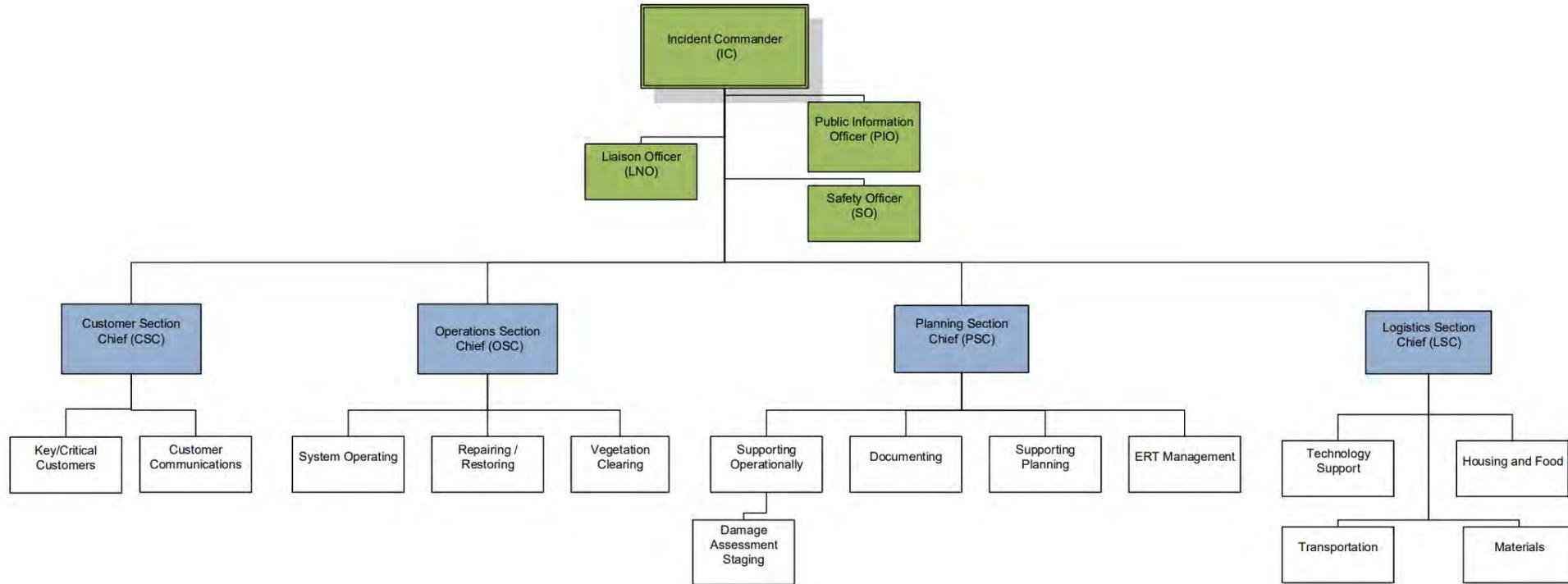
Restoration updates will be delivered via message monitor and email as appropriate, approximately every 4-6 hours, throughout the restoration efforts.

Crews React in the Planning Stage

- Material and equipment checks
- Return system(s) to normal and postpone planned work
- Crews are held and/or noticed for response



Proper Planning = Everyone Knows Their Role



Response – During the Event

- Move to ICS Level 3
 - Use of checklists for all roles
 - Many normal functions and services are paused
- Resource coordination critical
 - Internal restoration crews (KUB and contractor)
 - External restoration crews (contractor and other utilities)
- Triggers “all-hands-on-deck” philosophy
 - Work groups roll into non-traditional “storm mode” duties
 - Shifts are moved from 8 to 16 hours

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Customers Out of Power	<10,000	10,000 - 30,000	30,000 - 50,000	50,000 - 75,000	>75,000
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Storm Category *	TS1 - Weak	TS2 - Moderate	TS3 - Heavy	TS4 - Intense	TS5 - Extreme
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Damage Assessment	No	Consider (10)	Yes (10- 20)	Yes (20 - 50)	Yes (50)
Extra Contract Crews	No	Consider	Yes	Yes	Yes
Off System Crews	No	No	Consider	Yes	Yes
Vegetation Crews	No	Yes	Yes	Yes	Yes

Winter Storm (Snow/Ice)	5	4	3	2	1
Customers Out of Power	<5,000	5,000 - 15,000	15,000 - 25,000	25,000 - 50,000	> 50,000
Breakers Locked Out	<5	<10	<15	<25	>25
Number of Events	<50	50 - 100	100 - 300	300 - 500	500+
Estimated Duration	< 1 day	1 - 3 days	3 - 5 days	5 - 7 days	>7 days
Storm Category *	Nuisance	WS1 - Notable	WS2 - Significant	WS3 - Major	WS4 - Crippling
Outage Distribution	Localized	Moderate Spread	Widespread	Widespread	Widespread
ICS Mode	Operations	Full ICS	Full ICS	Full ICS	Senior ICS
Damage Assessment	No	Yes	Yes	Yes	Yes
Extra Contract Crews	No	Yes	Yes	Yes	Yes
Off System Crews	No	Consider	Yes	Yes	Yes
Vegetation Crews	No	Yes	Yes	Yes	Yes

Restoration Philosophy

■ Critical system loads

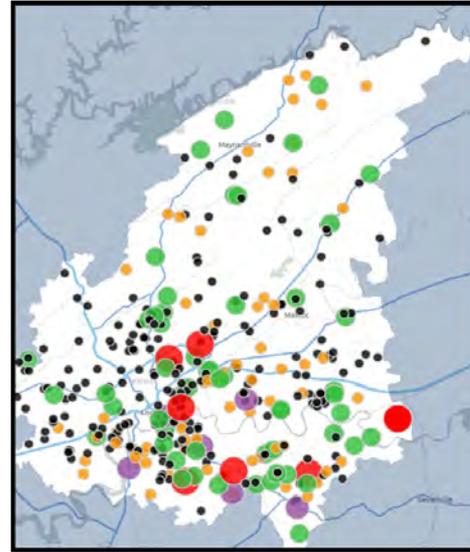
- Hospitals, communications systems, water/wastewater pump stations, and other services vital to public welfare

■ Transmission lines

- Backbone of our electric system serving the largest number of customers

■ Substation equipment

- Serve large numbers of customers and communities as a whole



Restoration Philosophy

- **Distribution lines**
 - Serve subdivisions, large residential areas, and commercial areas
- **Service lines and transformers**
 - Serve small numbers of customers
- **Balancing aging versus customer volume**



Data Driven Response

- Restoration philosophy supported via technology
 - Advanced meters
 - System protection
 - Smart switches
 - Advanced Distribution Management System (ADMS)
 - Mobile app - FieldWork
- Other data analytics
 - Outage map
 - Restoration reports

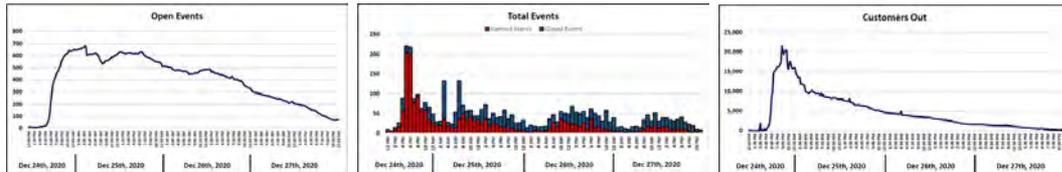
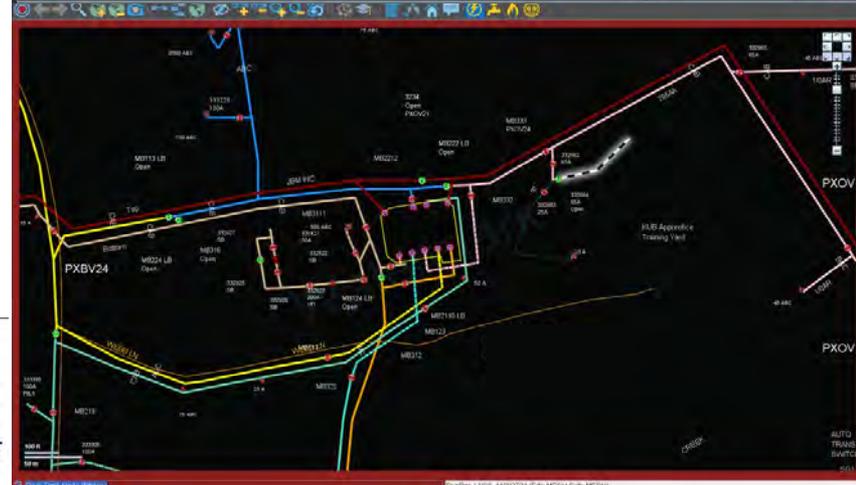
Work Agenda: All Work & Crews - CHC Alarms and Devices Lists

File Tools Sort Filter Actions Help

Total Events in View: 821 EST Customer Out: 32860 Calls: 1312 Priority Calls: Life Support Customers Out: KUB Facilities: 12 EMR Customers Out: 6

Condensed View Sort: Status (+) Crew (-) Skill Out (-) Device Type (+)

Status	Crew	Utility	Event	Class	Device	Reader	Area	Event #	# Out	Run CMI	Orig Asset	Work Queues	EST
ASB	F102	EL	POD	PO	PTR 42120, Recloser, 70 Amps, 1-Phase	CY22	South	210005887	59	162441	None		04/28/21 09:00
ASB	1187	EL	POD	PO	PTR 32126, Recloser, 70 Amps, 1-Phase	HJ32	South	210007972	53	58797	None		04/28/21 13:00
ASB	1154	EL	POD	PO	Fuse 541118, OH Fuse, 100A, TV21	TV21	East	210007851	1	57254	None		04/28/21 13:00
ASB	M187	EL	POD	PO	PTR 32245, Recloser, 800 Amps, 3-Phase	DX22	West	210006950	561	430003	None		04/28/21 13:00
ASB	M186	EL	POD	PO	PTR 43258, SCADA Breaker, 800 Amps	RA11	East	210007947	657	72658	None		04/28/21 13:00
ASB	H142	EL	POD	DA OUT	BKR FC23, SCADA Breaker, 1200 Amps	FC23	North	210007061	1600	181483	Assessed	DLXPMR	04/28/21 13:00
ASB	H140	EL	POD	DA OUT	Fuse 53869, OH Fuse, 65A, FC12	FC12	North	210007045	125	141515	Assessed	TOCYY,DL POLE	04/28/21 13:00
ASB	E106	EL	POD	PO	Fuse 32054, OH Fuse, 30A, MO12	MO12	East	210007500	738	831160	None		04/28/21 09:00
ASB	E105	EL	POD	PO	PTR 34157, Recloser, 100 Amps, 1-Phase	FC22	North	210007070	134	151670	None		04/28/21 13:00
ASB	E109	EL	POD	DA OUT	Fuse 30718, OH Fuse, 65A, PD11	PD11	North	210007079	45	50095	Assessed		04/28/21 13:00
ASB	E106	EL	POD	PO	XFMR 92334, PMT, 1000, ABC	RA11	West	210007666	31	34888	None		04/28/21 13:00
ASB	E104	EL	POD	PO	PTR 58165, Recloser, 80 Amps, 1-Phase	HMC1	East	210007200	88	62108	None		04/27/21 16:00
ASB	E103, H141	EL	POD	PO	PTR 4804, Recloser, 70 Amps, 1-Phase	MO12	North	210007505	55	61419	None		04/28/21 13:00
ASB	E105	EL	POD	PO	BKR FC126, SCADA Breaker, 1200 Amps	FC12	East	210007084	4106	850978	None		04/28/21 13:00
ASB	E101	EL	POD	DA OUT	BKR DA12, SCADA Breaker, 1000 A	DA12	North	210006917	8165	828492	Assessed		04/28/21 13:00
ASB	E101	EL	POD	PO	PTR 5842, Recloser, 800 Amps, 3-Phase	HM11	East	210007277	559	631297	None		04/28/21 13:00
NEW		EL	POD	PO	Fuse 531073, OH Fuse, 100A, KR21	KR21	East	210007420	20	22651	None		04/28/21 13:00
NEW		EL	POD	PO	Fuse 82357, OH Fuse, 65A, TV11	TV11	East	210007844	18	20208	None		04/28/21 13:00
NEW		EL	POD	PO	Fuse 32254, OH Fuse, 100A, MV12	MV12	West	210007803	16	18070	None		04/28/21 13:00
NEW		EL	POD	PO	Fuse 32254, OH Fuse, 100A, MV21	MV21	East	210007556	15	16290	None		04/28/21 13:00
NEW		EL	POD	PO	Fuse 32241, OH Fuse, 75A, MB12	MB12	West	210007530	12	13517	None		04/28/21 13:00
NEW		EL	POD	PO	XFMR 82335, PMT, 1000, B	MB12	West	210007837	11	12390	None		04/28/21 13:00
NEW		EL	POD	PO	XFMR 81600, PMT, 300, ABC	DC12	North	210008007	10	11330	None		04/28/21 13:00
UAS		EL	POD	PO	Fuse 341024, OH Fuse, 100A, BU21	BU21	North	210008014	26	24656	None		04/28/21 15:51
UAS		EL	POD	PO	Fuse 42593, OH Fuse, 65A, SO11	SO11	South	210007716	21	23034	None		04/28/21 15:51
UAS		EL	POD	PO	XFMR 33830, OH, 75, C	SK12	South	210007796	19	21371	None		04/28/21 15:51
UAS		EL	POD	PO	XFMR 36347, PMT, 750, ABC	WR42	West	210007904	18	20211	None		04/28/21 15:51
UAS		EL	POD	B WDN	XFMR 168708, PMT, 50, B	RH22	West	210008066	7	71467	None		04/28/21 15:51
UAS		EL	POD	PO	XFMR 27936, OH, 15, A	KAL2	West	210008036	1	11007	None		04/28/21 15:51



Response Resources - Field

- Troubleshooters
- Damage Assessors
- Site Safety Attendant
- Vegetation Management
- Traffic Control
- Restoration Line Crews
 - KUB
 - On-system contract
 - Off-system contract
 - Partnering utilities



Response Resources - Support

- Electric System Operators
- Planner/Schedulers
- Storeroom
- Transportation
- Material Delivery
- Communications
- Customer Service Representatives
- Information Technology
 - Hardware
 - Software
 - Smart device support
- Technical Specialists
 - Safety
 - Environmental
 - Engineering
- Logistical Support

Response Resources - Wastewater

- Plant operators
- Pump station and storage tank operators
- Field responders
- Wastewater system operators



Response Key Factors

- Sizing up the storm
 - Damage types
 - Location
- Safety



Few Customer Impacts but Hours of Work



- Tree on single phase wire with a service
- Impacts 2-4 customers
- Requires
 - Damage Assessor (1)
 - Tree Crew (1)
 - Line Crew (1)
- Job length is 2-3 hours

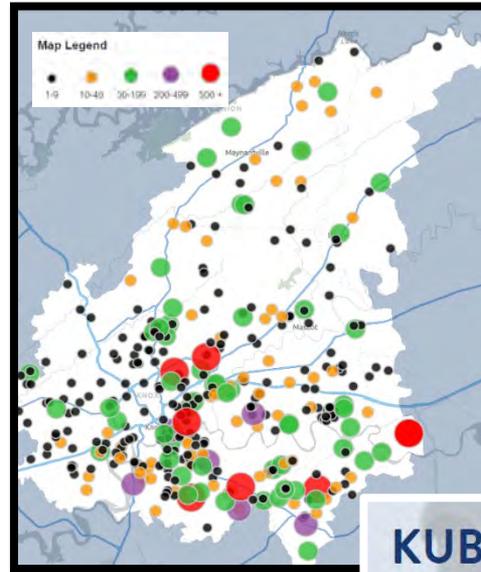
Many Customers Out – Large Effort



- Trees on transmission lines
- Impacts to thousands of customers
- Requires
 - Damage Assessor (1)
 - Isolation Crew (1)
 - Labor Crew (1)
 - Tree Crews (2)
 - Transmission Line Crews (2)
- Job length is 16+ hours

Customer Focus

- Multiple channels of communication
- Outage Map
 - Estimated Restoration Time (ERTs)



OUTAGE REPORTED ✕
05-03-2021 at 9:08 am

Customers Affected:
Less than 10

Status: We are aware of an outage in your area affecting 1 customers and are working to restore power as soon as possible. Based on experience with similar events, KUB estimates restoration on 05/03/2021 12:08 PM

Estimated Restoration Time:
12:08 pm
Mon May 3

[OUTAGE RESTORATION PROCESS](#)

KUB's Outage Restoration Process

KUB damage assessors (DAs) and line crews begin work to restore power to customers as soon as conditions are safe to do so.

How to Identify Damage Assessment & Line Work

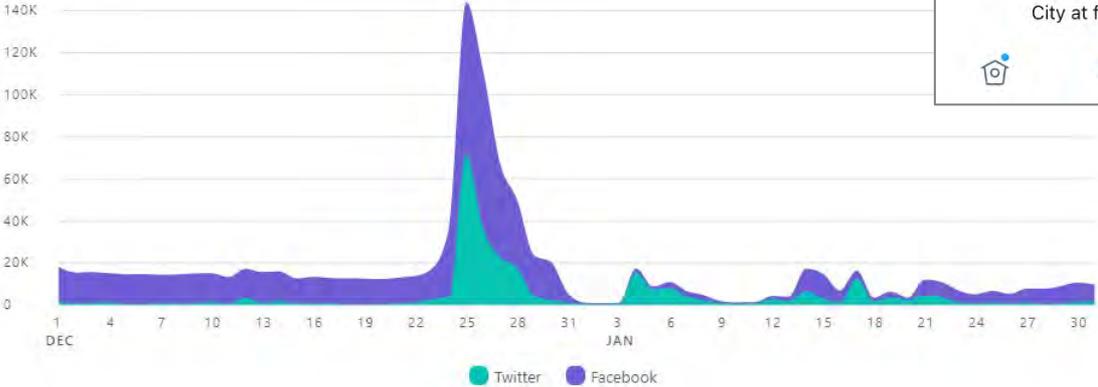
Damage Assessors (DA) are sometimes on-site in pickup trucks before line crews to determine what materials and resources crews need to make each repair. Please drive with caution around DA vehicles, as they make frequent stops to inspect damage and collect information. Once DAs relay necessary information to KUB System Operations, they move to the next outage location to assess there. Line crews in bucket trucks are then able to begin work restoring power as quickly as possible using the information DAs provide.

KUB Order of Restoration

During a typical outage, KUB uses the sequence below to determine the order of restoration. Each sequence is represented by different color outage markers on [KUB's outage map](#).

Interacting with Customers

- Social media
- Local media
- Community partners



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News reporter with @6News WATE 6 On your Side. University of Florida Alumna. Got a news tip? Email me at kcrawford@wate.com

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Knoxville Utilities Board
4,633 Tweets

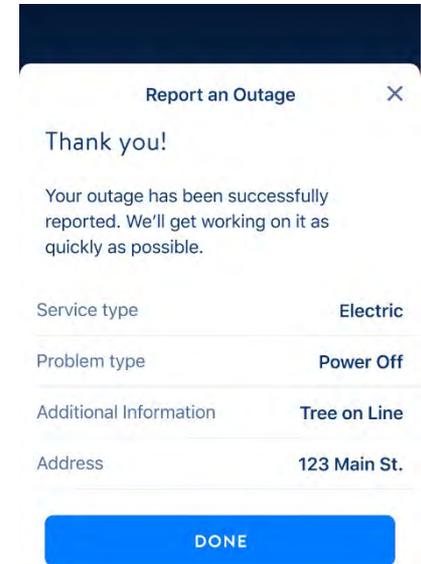
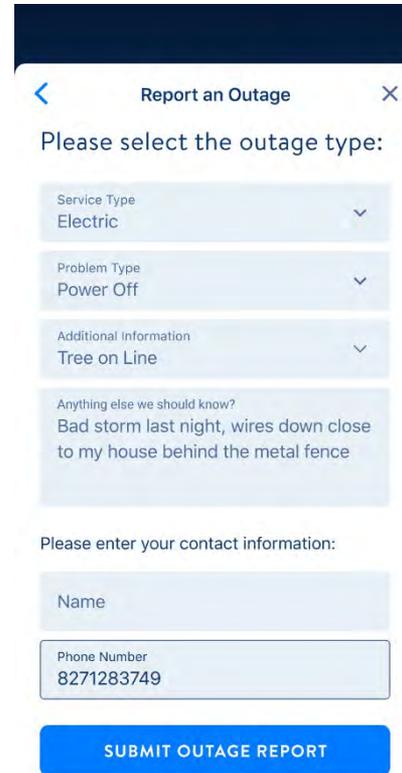
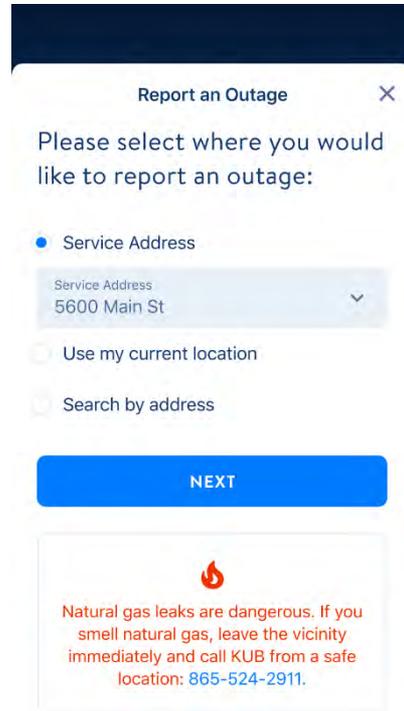
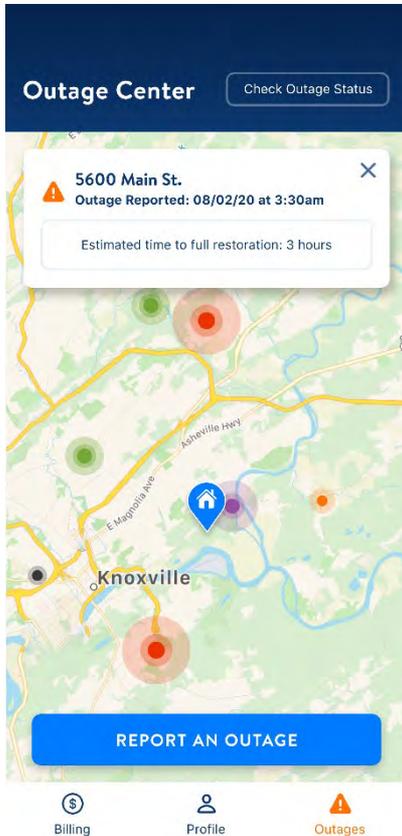
Tweets Tweets & replies Media Likes

Knoxville Utilities Board · 12/27/20
More progress has been made today as outages in our area have been reduced to 770. Crews are still working to repair electric poles and lines that were damaged in Thursday's snowstorm. For more information about our restoration efforts, please visit [kub.org](https://www.kub.org).

Knoxville Utilities Board · 12/27/20
Temperatures are expected to climb throughout the day, but there is still

Impression Metrics	Totals	% Change
Total Impressions	1,003,456	↗ 62.5%
Twitter Impressions	266,115	↗ 126%
Facebook Impressions	737,341	↗ 47.6%

KUB Customer Mobile App – Report Outage



Demobilization – Closing the Event

- Move to ICS Level 5 – Normal Operations
- Gradual reduction of resources as they finish their work
 - Release partnering utilities and off-system crews first
 - Roll back support services
- Transition to other post-storm mode functions
 - Follow up work to permanently repair any temporary repairs
 - Non-outage repair work
 - Patrol for tree and system damage risks

KUB	Storm Planning and Response Resource Guide			
	QRG	Issued	Effective: 1/30/2017	Reviewed: 11/30/2018

Note: In general, the demobilization plan should not be implemented until all damage assessing from the storm event is complete, all critical customers have power, all jobs are assigned, and no more than 10,000 customers are without power. Additional events will be reported sporadically due to other incidents occurring on the system, which will require continued assessing.

Note: The demobilization plan should consist of the timing and of the objectives that need to be met to reduce the Emergency Level.

4. Determine the actual or potential human resources needed using the chart below.

Table 2. Assignment of Personnel Resources by Emergency Level

	Emergency Level 4		Emergency Level 3		Emergency Level 2 or 1	
	Operational Periods		Operational Periods		Operational Periods	
	OP 1	OP 2	OP 1	OP 2	OP 1	OP 2
Damage Assessment						
Damage Assessment Teams	---	---	50	50	50	50
Site Safety Attendants	---	---	4+	4+	6	6
Traffic Control						
Area Wide Protection	---	4	4	6	6	6
Assessment and Repair						
OHC Troublemakers	6-7	6-7	6-7	6-7	6-7	6-7
SMSW Substation Technician Crews	5	4	5	4	5	4
OHC Supervision						
Supervisor	1	1	2	2	2	2
Line Crews						
OHC Line Crews	9	9	7	11	7	11
On-System Contract Crews	6	6	6	6	6	6
Off System Crew Leads	---	1-2	---	2-4	---	4-8+
Grounding Crews						
OHC Service/Grounding Crews	3	4	3	4	3	4
Chasers						
OHC Chasers (formerly Street Light Crews)		2	1	1	1	1
OHC Contract Chasers (formerly Street Light Crews)	2	2	2	2	2	2
Labor/Material Delivery Crews						
OHC Labor Crews	2	2	2	2	2	2
UGC Resources	---	---	3-6	3-6	6+	6+

Evaluation – Improving for the Next Event

- Debrief sessions held with key resources
- Collect ideas, improvements, and suggestions from field staff
- Create action items and assign initiatives through our Corrective and Preventative Action Program (CAPA)
 - Damage assessment
 - Incident command
 - Maximizing limited resources

1	Category	Area	Issue for Improvement	Corrective Actions	Completion D.	Managing Group	Priority
1	IT Systems	Information Services - Equipment	Satellite phones or alternate means of communication given the situation in Nashville.	No further action warranted at this point.		-	-
2	Operations	Equipment	SMS had a 25kVA that had 4 houses on it. He replaced the fuse and it would hold for a few minutes and then blow. Apparently the cold load pickup was causing the fuse to blow. We turned in a request for ESE to review.	ESE reviewing as needed. No follow up action item needed.	1/22/2021	-	-
3	Planning & Logistics	Operations - Transportation	Difficulty getting 4WD trucks while employees take trucks home.	Trucks are no longer being taken home. Add to storm readiness checklist to ensure (when we know ahead of time) that trucks are ready, available, fueled, accessible.	1/22/2021	-	-
4	IT Systems	ADMS - Interfacing	Connectivity and GPS Performance shows invalid points - not exact. Current units have too many applications using GPS data.	ISD is purchasing new devices with better GPS cards. Delivery of units week of Jan 22nd.		Dept - ISO	3
5	IT Systems / Public Information	Information Services - Configuration	Communications no longer able to see Damage Assessor Photos in KUB Apps.	ISD development is working on long term solution for this issue, to provide access to images for Communications, System Operations, and OHC crews/personnel. In the short term, we are also investigating how to regain access for both Communications and Public Information.		Dept - ISO	3
6	Planning & Logistics	Information Services - Equipment	Requested new laptops and was advised we had none - If the iPad has all needed functionality for field crews/bird dogs could there be additional units purchased/repurposed and used as laptops.	Will be covered in new laptops deployed. We'll keep old CF54's as spares until we have an adequate supply of the newer style.		Dept - ISO	3
7	Planning & Logistics	Operations - Transportation	Need a tow truck readily available.	Review Transportation contract to see if KUB can be prioritized. Contract will be re-bid this year and added to new contract. Amend contract now if new contract won't be in place before spring/summer storms.		Dept - TRN	3
8	Operations	Damage Assessment - Training	There was a storm where we deployed the DA dispatchers since the go-live of ADMS. Unlike CMSIMDS, the DA dispatchers do not work in ADMS on a daily basis. We need to increase the frequency of training for this group in order to keep the skillset up to date. Also, we need to continue to build the level of depth.	We need to increase the frequency of training for this group in order to keep the skillset up to date. Also, we need to continue to build the level of depth in this area. Annual or every 6 month training cycle?		EL UST	1 - Damage Assessment
9	Operations	Operations - Process	Continue to perform windshield surveys after the trouble is shot, not only to catch up on storm related maintenance while we have contract line crews - but also target overhang (pre-determined trouble areas) while add tree crews are here.	Send assessors back out on hardest hit circuits to see if anything was missed and identify hazard trees/overhang areas that could be trimmed/removed. Develop checklist that encompasses danger trees and overhang along with electric equipment/infrastructure issues. Add to Section Chief responsibilities.		EL UST	1 - Damage Assessment
10	Operations	Operations - Process	Better method to ensure live wire site is not left unattended after being first assessed.	Bring in AWP for training on site safety. Look at ADMS to see why initial KUB crew was routed away from the job.		EL UST	1 - Damage Assessment
11	Planning & Logistics	Administration - Housekeeping	Clean up files in Electric Operations for old storms.	Use Teams for document storage to replace intranet. Create file structure to ensure documents relate to the correct storm/event (label JM with storm type).		EL UST	1 - ICS Project
12	Planning & Logistics	ICS	Develop standardized checklist/guide as the event concludes and all activities are completed.	Covered in action item above. Doug has template to share. Review ICS resource		EL UST	1 - ICS Project
13							

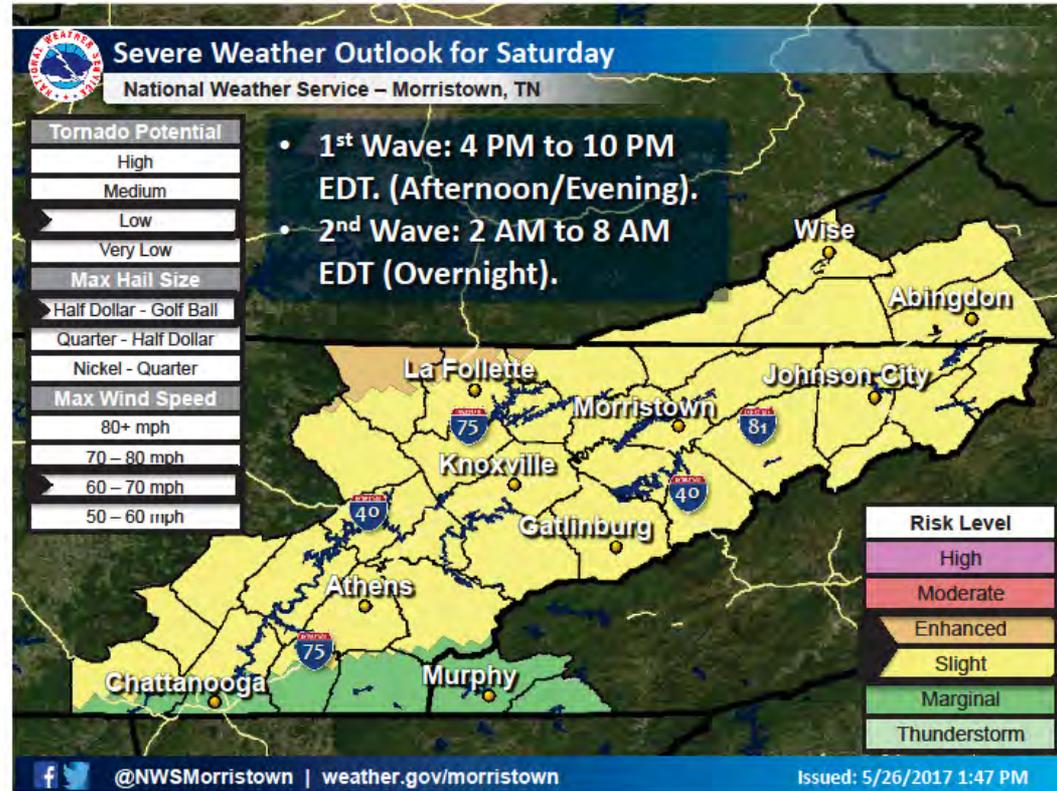
Historical Storm Comparison

	March 1993 Blizzard of '93	April 2011 Hail Storm	June 2011 Storm *	July 2015 Storm	May 2017 Storm	November 2017 Storm	Christmas 2020 Snow
Customers out	40,000+	75,000+	127,000+	56,000+	54,000+	32,000+	32,000+
Poles replaced	100	142	151	81	40	35	25
Transformers replaced	45	91	132	40	19	10	17
Customer Events	N/A	7,754	23,283	2,700	3,363	1,018	4,500
Customer calls	50,000+	45,000+	220,000+	71,000+	28,000+	21,000+	21,600+
Restoration length	8 days	7 days	7 days	3 days	2.5 days	1.5 days	4 days
Estimated cost	\$2 million	\$2 million	\$4 million	\$2.5 million	\$1.2 million	\$900,000	\$1.5 million

* June 2011 event includes two separate storms on June 21 and June 23

Example - Storm Readiness

- NWS predicted weather event one day in advance
- NWS predicted slight risk level of storms from 4–10 p.m.
- Holiday weekend
- KUB ensured key resource availability



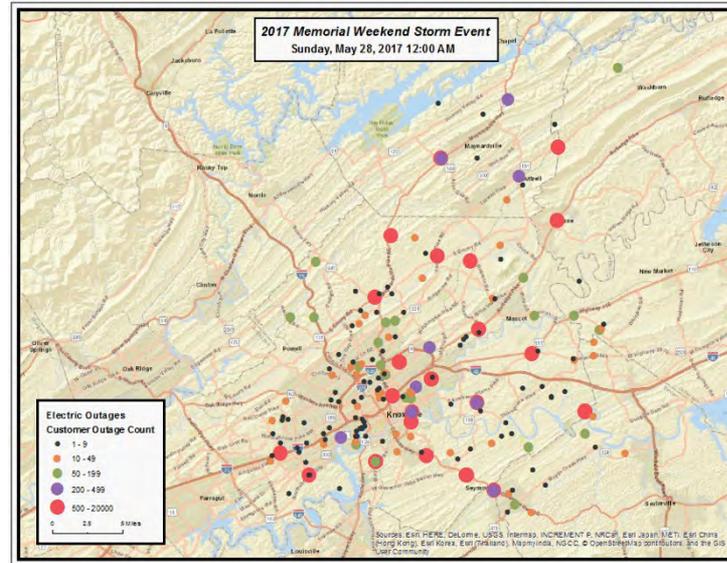
Example - Storm Impact

- Storm began 10:30 p.m. Saturday
- Winds over 50 miles per hour
- Widespread trees, limbs down
- Over 54,000 customer outages
- Fifth largest storm in 10 years
- Large number of trouble events



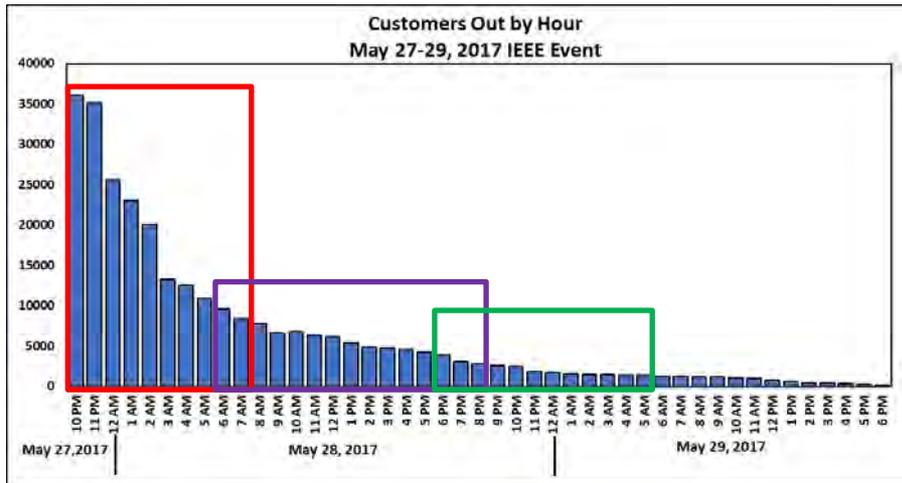
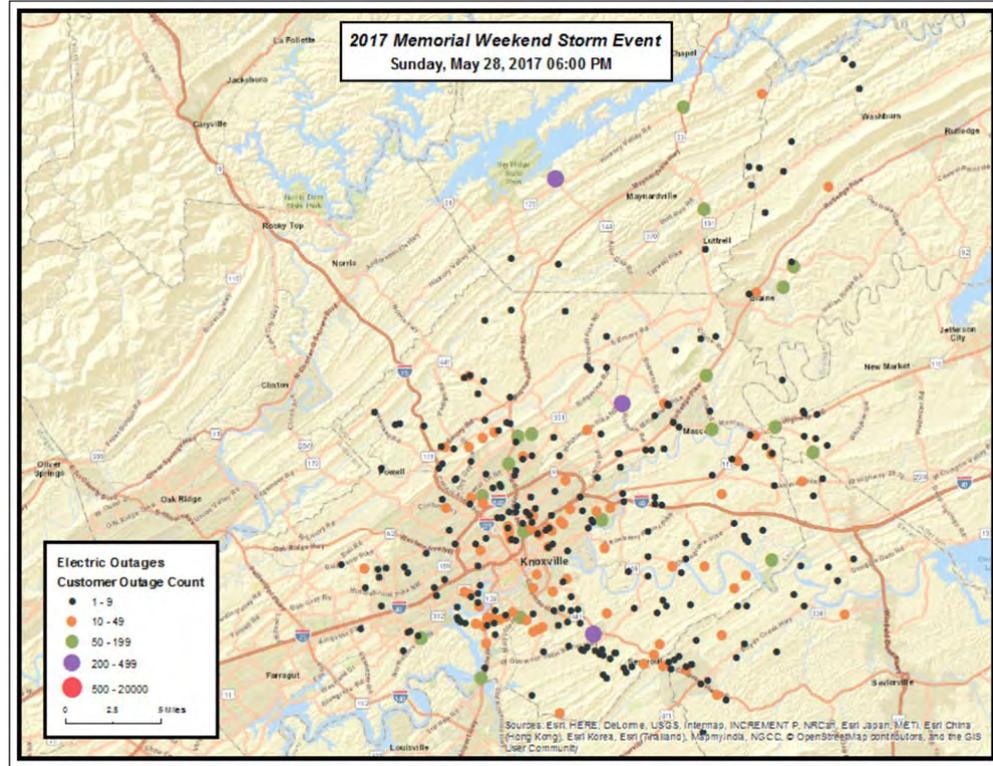
Example - Storm Response

- Implemented ICS
- Holiday weekend response
 - 116 KUB and contractor crews
 - 18 off-system crews
 - 16,000+ employee hours worked
 - 60+ administrative staff
- Service restored 2.5 days
- FEMA reimbursement

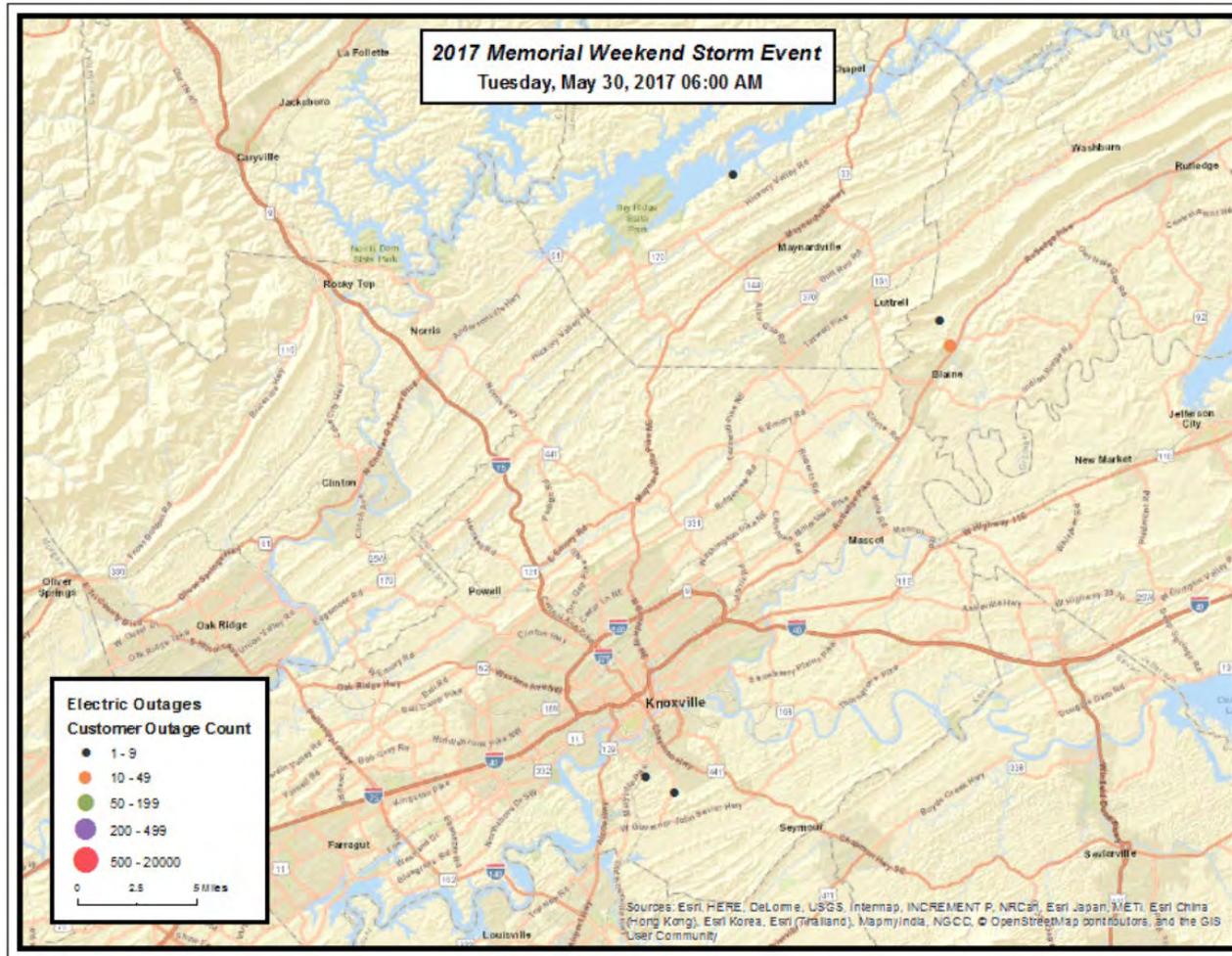


Example – Sunday 6:00 PM

- Outages reduced to less than 3,900
- Focus
 - Remaining purple dots
 - Begin to address green dots



Example – Tuesday 6:00 AM



Example – Time Lapse



To ALL the linemen working to restore power to Knoxville area today..... THANK YOU !! you are SO appreciated for your hard work !!!!!

Amanda Geames Keep up the good work KUB

Like · Reply · Message · 11h

Jason Lovett @jlovett3 · 44m

Replying to @jlovett3 @KnoxKUB

Back on! Thank you so much for your hard work. You are always so great and getting residents back on-line as quickly as possible while keeping the community updated.



Darlene James Thanks to all of you, we don't miss it until it's out!

Like · Reply · Message · 13h

Carol Jean Brooks Hopkins Kudos to the freaking awesome Linemen and all the other employees involved in this business!! Love the picture!!

Like · Reply · Message · 9h Edited

CANNOT thank you enough for your unbelievable assistance today. You saved us!!

– Cliff Rodgers,
Knox County Elections
Administrator

Kat @knox_kat · 13h

Major props to @KnoxKUB today. Great customer service! Three trucks at my house right now to restore downed power lines in my backyard. Super friendly folks and happy to get the job done!



Aileen Stivers Umbarger We love our linemen husbands/ boyfriends/ family members and are proud of them and all their hard work. But looking at the guys in the top of that bucket makes me a nervous wreck!

Like · Reply · Message · 10h

Emily Harp You guys rock! Thanks so much for staying on top of things

Like · Reply · Message · 19h