OWEC

Wildfire Mitigation Strategies
And
Lessons Learned

CENTRAL ELECTRIC COOPERATIVE, INC.

December 4, 2025

Technology

Distribution Fault Anticipation (DFA)

December 4, 2025

CENTRAL ELECTRIC COOPERATIVE, INC.

DFA

DFA and "Smart Grid"

- AMI and self-healing technologies
  - Important components in modernizing grid
  - Remain reactive to faults and outages
- DFA complements AMI and self-healing by providing visibility before, during, and after faults and outages.
  - Detects incipient faults
  - Diagnoses misoperating equipment
  - Reports operations of unmonitored devices, such as capacitors and reclosers
  - Identifies root cause of faults
 - Confirms effective repair

DFA

Circuit Situational Awareness

- What do I know about my circuits?
  - The breaker is closed.
  - No one has reported an outage.
  - Therefore, circuits are presumed healthy.

- What do I <u>not</u> know about my circuits?
  - Circuit 12 has a burning clamp (that may drop a line next week).
  - Conductor slap in the same span has locked circuit 27 out three times in the past five years.
  - Intermittent vegetation contact on circuit 34 has caused three momentary interruptions in the past two weeks (but no one has reported the blinks).

DFA

What Would You Do?

2017/03/24 14:33:11

RMS Amps vs Time (seconds)
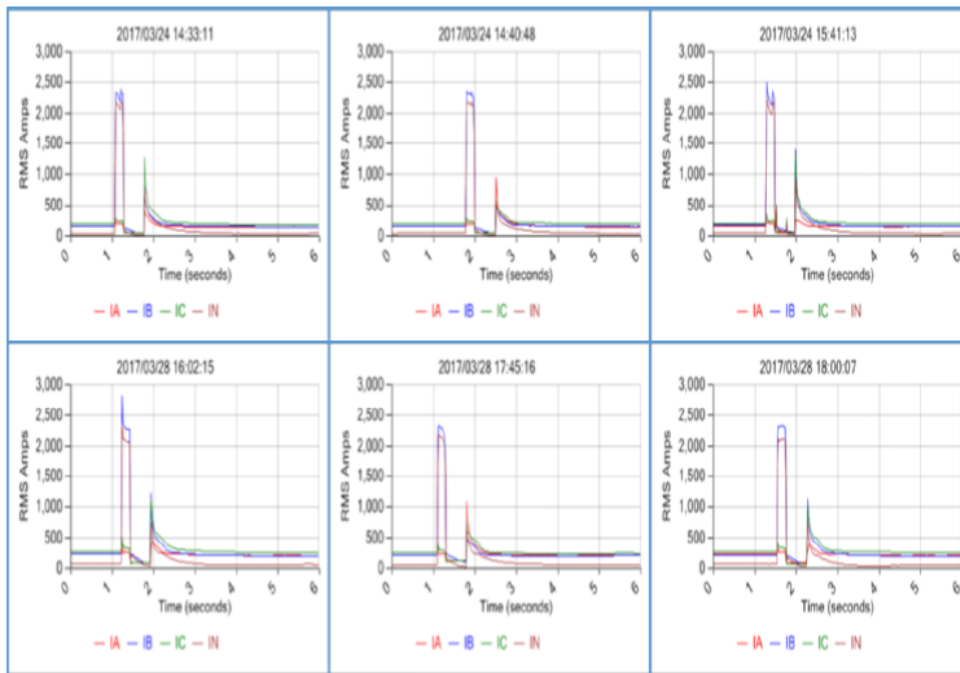
— IA — IB — IC — IN
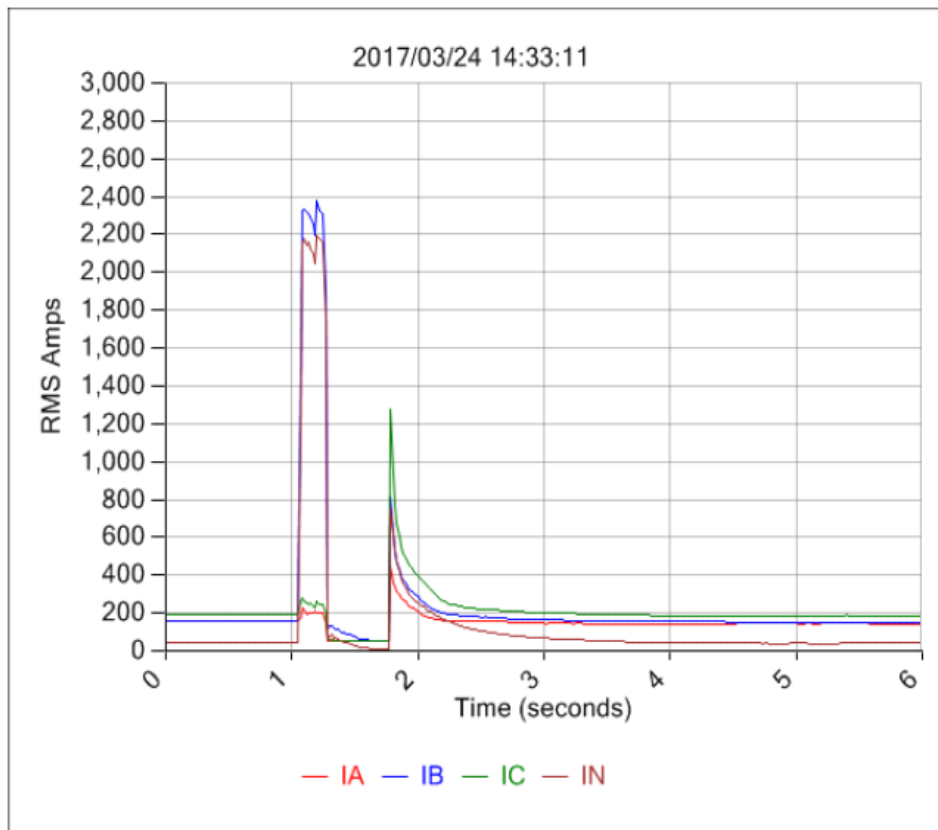
- Assume you know this fault occurred.
  - Downstream recloser trip/closed
  - No substation breaker operation
  - No outage

- What is the significance of this event?

- What would you do in response?

DFA

What Would You Do?

- Now assume six <u>identical</u> faults have occurred in four days.
  - Downstream recloser trip/closed
  - Still no outage

Possible recurrent fault	B	Three-Phase reclose, 2332 Amps	6 (4 days)

- Now what is the significance of the events?
- Now what would you do in response?

03/28/17 18:00:07

03/28/17 17:45:16

03/28/17 16:02:15

03/24/17 15:41:13

03/24/17 14:40:48

03/24/17 14:33:11

DFA

Waveform Classification – Behind the Scenes

DFA On-Line Waveform Classification Engine

(Signal Processing Performed by DFA Device in Substation)

DFA Device software technologies
- Multi-rate polyphase filter banks for phase drift compensation
- Fuzzy expert system for classification
- Fuzzy dynamic time warping for shape recognition
- Hierarchical agglomerative clustering for recurrent faults
- Finite state machine for fault SOE identification
- Shape-based and event-specific feature extraction
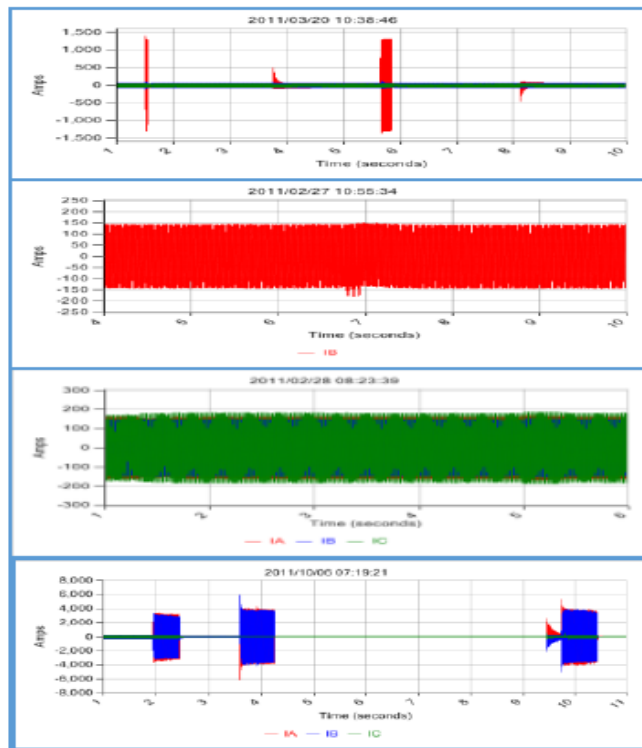- Hierarchical classification architecture for feature space dimensionality reduction

The DFA on-line waveform classification engine uses sophisticated software to identify circuit events. Software is improved regularly, with field units updated seamlessly via Internet.

# DFA

Waveform Classification – Behind the Scenes

DFA

Detection and Location of Intermittent Faults

Possible recurrent fault		C	Single-Phase reclose, 510 Amps	2 (18 days)	09/28/11 13:45:22

Change page: ◄ 1 ►   Change page: 1 Go   Page size: 2 Change   Displaying page 1 of 1, items 1 to 2 of 2.

Event Type	Phases	Comments	Occurred	
Single-Phase reclose	C	F-(3.0c,510A,CG)-T-(0,0,19)%-2.1s-C	09/28/11 13:45:22	
Single-Phase reclose	C	F-(3.0c,510A,CG)-T-(0,0,21)%-2.0s-C	09/10/11 14:19:25	

Sub

Subject Circuit (125 miles of O/H line)

Unmonitored Line Reclosers (about 20 on this circuit)

- Distribution circuit; conventional overhead construction; 125 miles; numerous reclosers.
- Routine operating conditions; no active customer complaints; fair weather.
- 9/28/2011: DFA generated the report shown above, providing an alert that the same fault had occurred twice in the past 18 days.
- Drilling down into the report provided details of the two fault events.
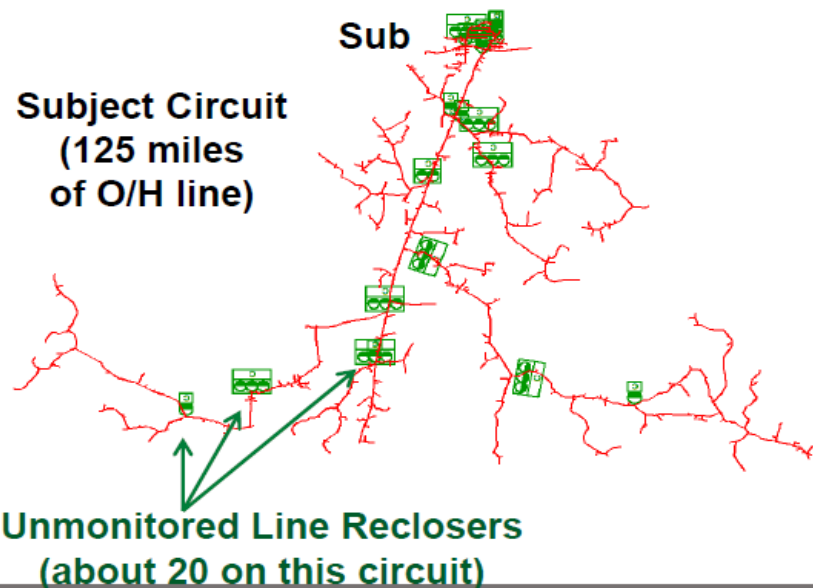
DFA often provides the only notice of intermittent faults. This is key. DFA also provides location information, even though these faults have not caused outages yet.

DFA Best Use Cases

- Monitors:
    - Long line segments, multiple reclosers without communications
    - Repeating fault activity
    - Line or equipment arching
- Identifies possible cause (failure type)
- Records fault data for software input to determine location of fault
- Provides greater visibility into circuits within our high-risk wildfire areas
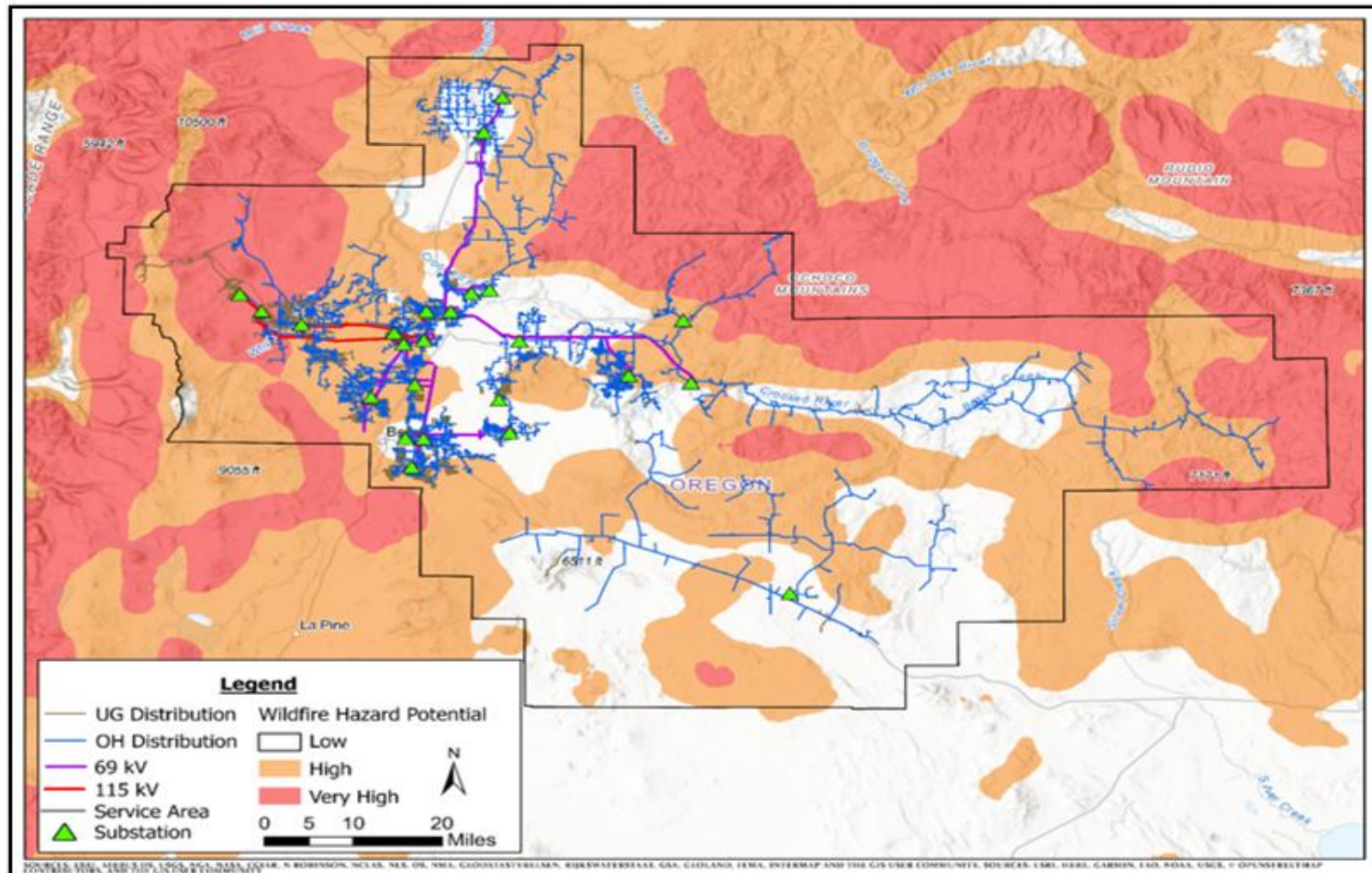
Other Mitigation Efforts

- Additional Weather Station Deployment
- Development of weather event alerts (24 Hr monitoring)
- Outage data modeling
- Improved communications with personnel and line devices (Starlink)
- Enhanced vegetation management
- Increased safety patrols

Wildfire Risk
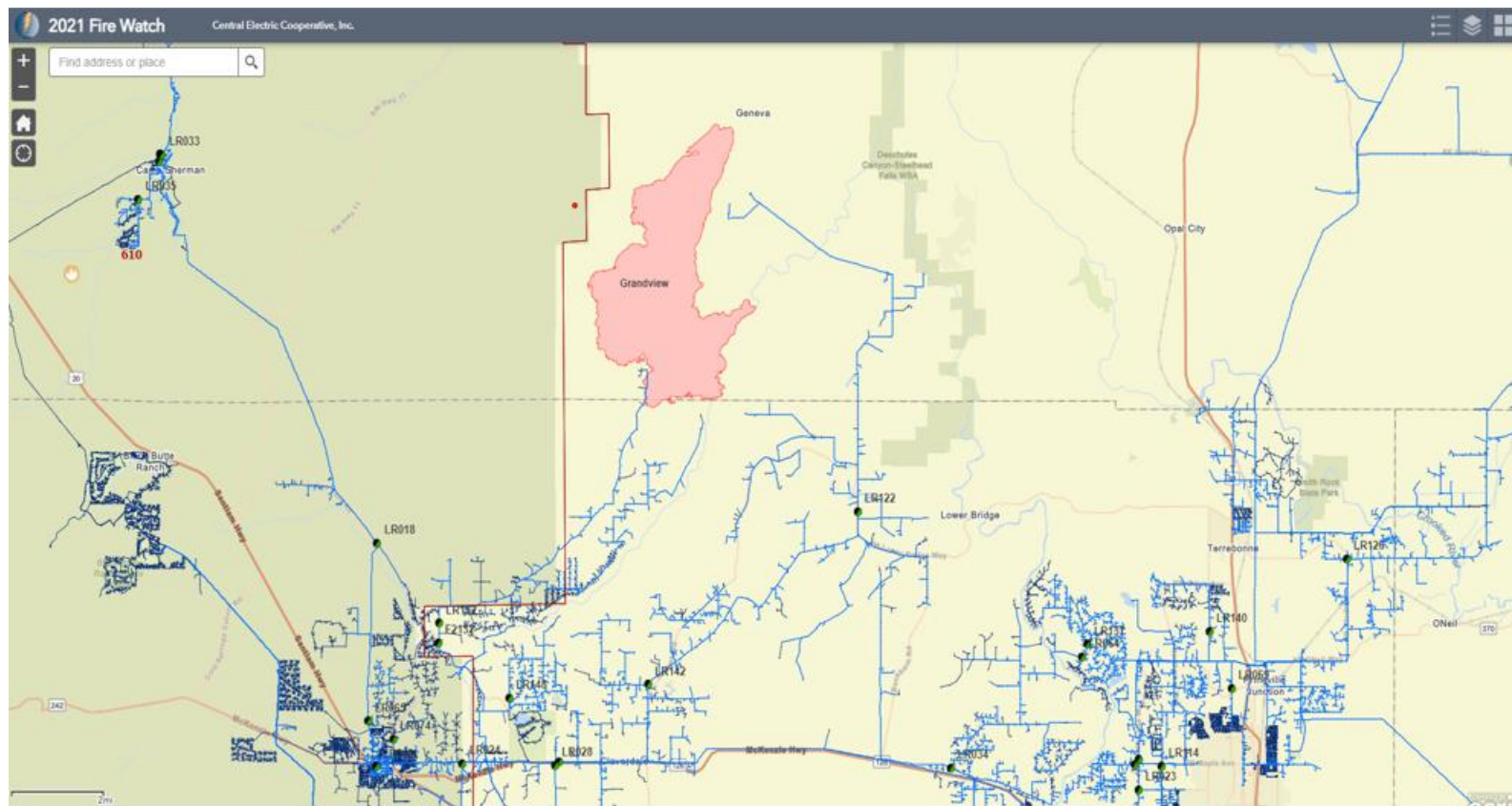
CEC Wildfire Risk Map

Grandview Fire

Grandview fire started on July 11, 2021
Totaled 6,032 acres
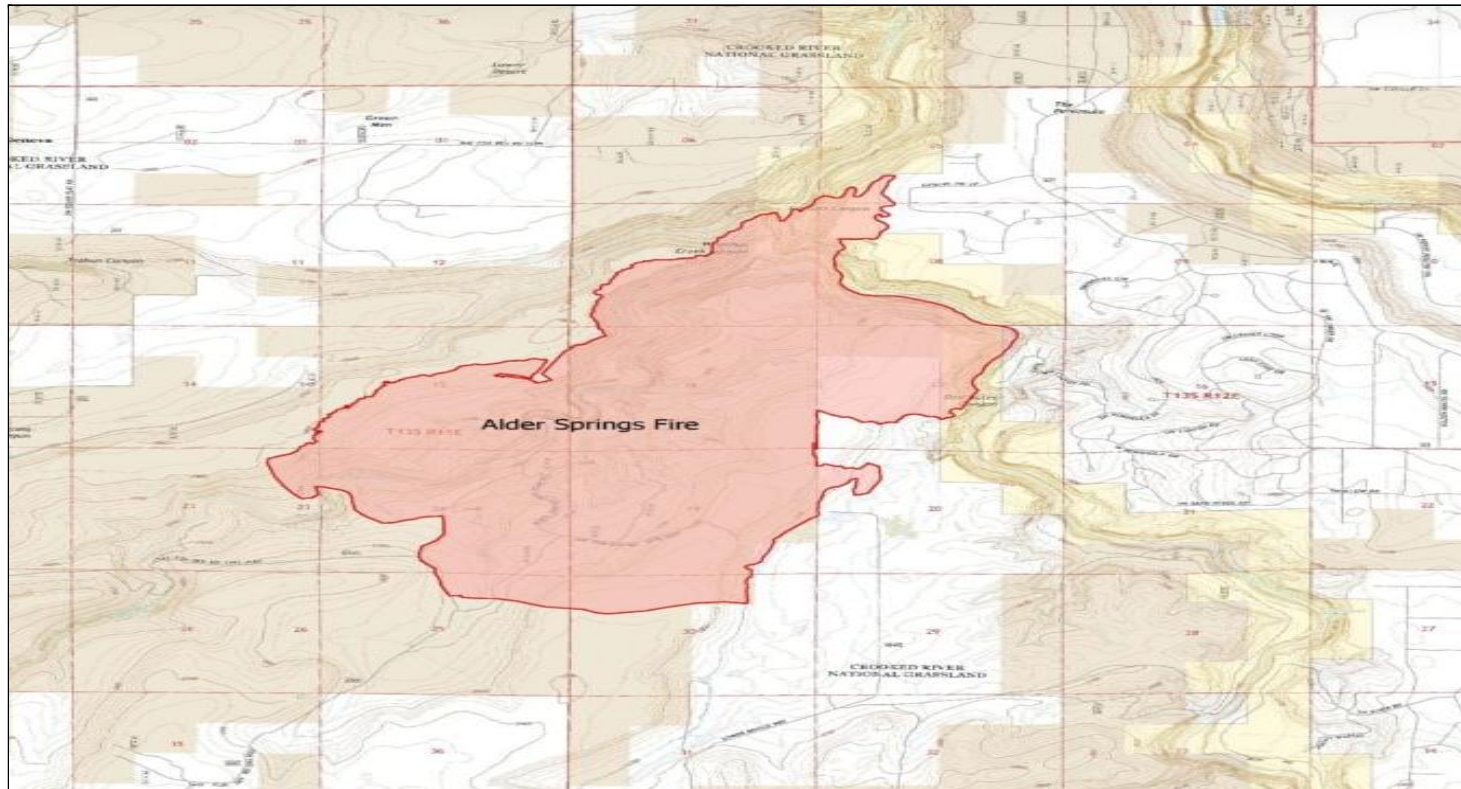Started on private land, cause still under investigation

Alder Springs Fire 2025

Alder Springs fire started on June 16, 2025
Totaled 3500 acres
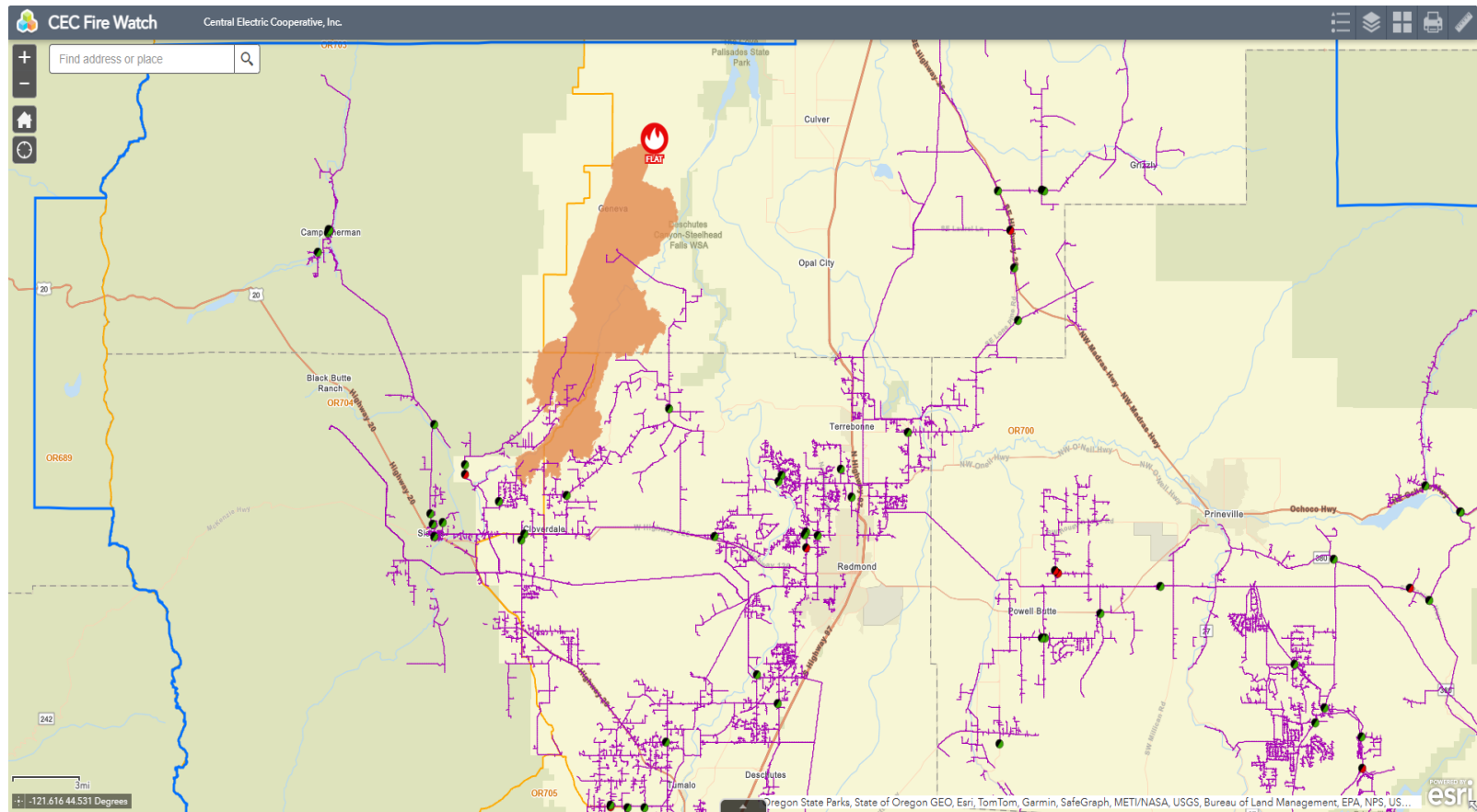Started on public land, was determined to be human caused
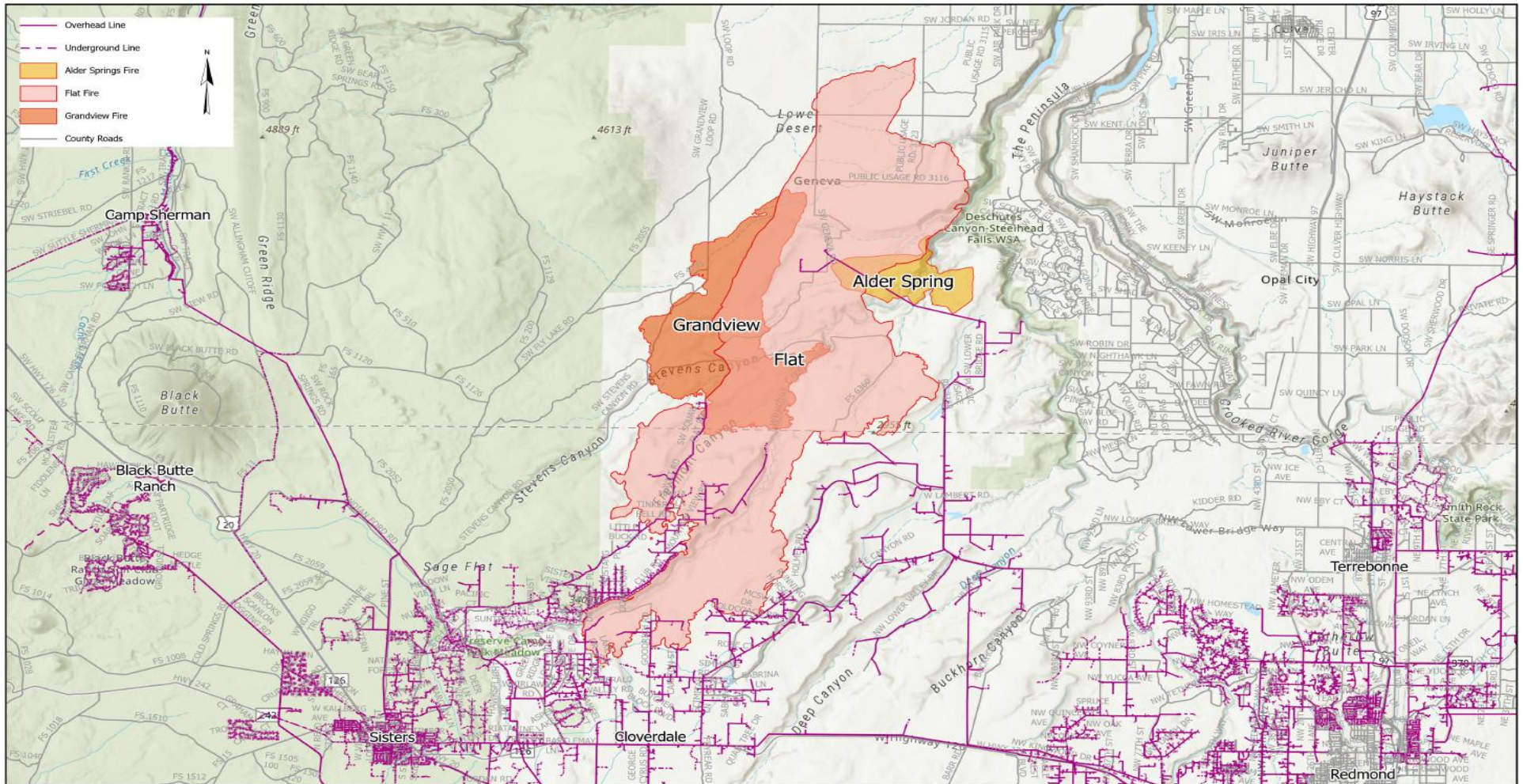
Flat Fire 2025

Flat fire started on August 21, 2025

Totaled 23,346 acres

Started on private lands and determined to be human caused
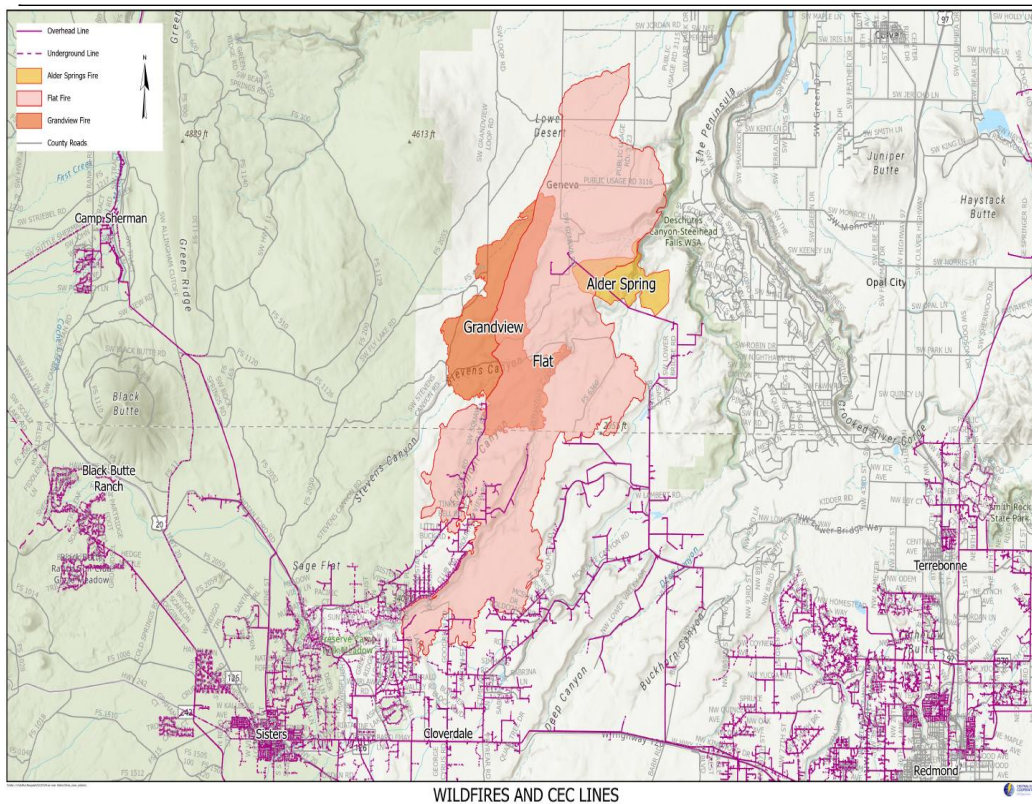
Historical Fires

WILDFIRES AND CEC LINES

Grandview Fire

Challenges Faced


WILDFIRES AND CEC LINES

- Weather patterns
- Little impact to CEC facilities
- Initiating First Contact
- Continued line of communications
- Dedicated staff
- Internal/External Personnel Changes
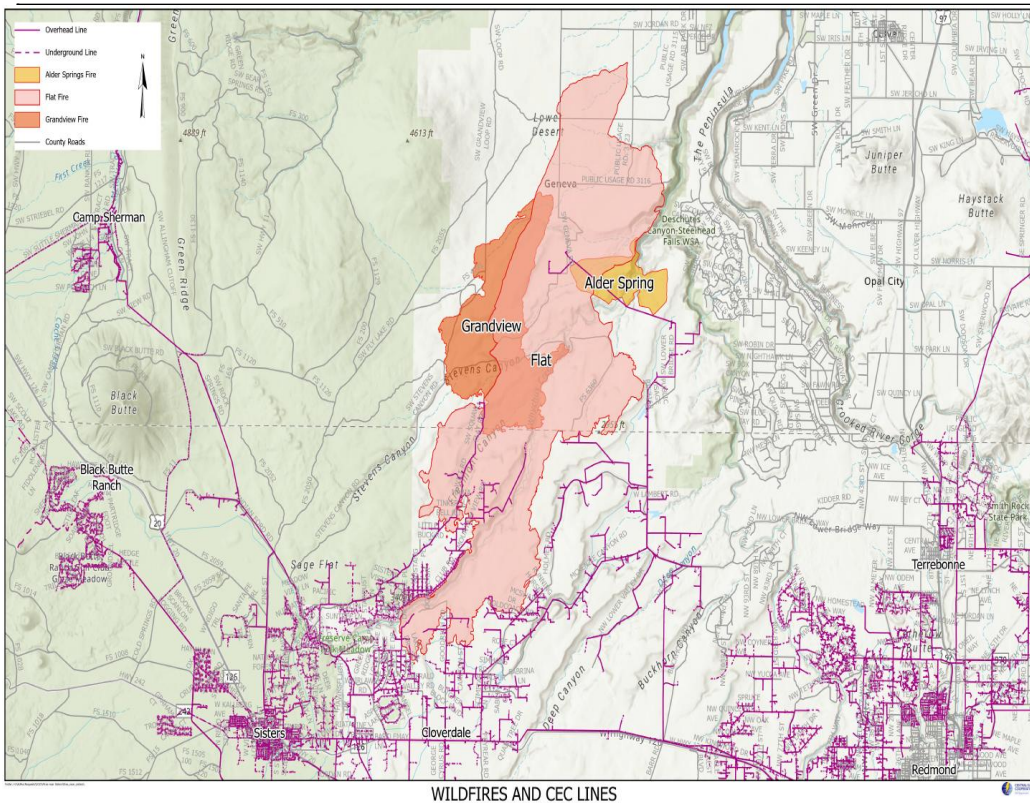- Restoration

Alder Springs Fire

Lessons Learned

- Monitor weather/wind
- Anticipate affected infrastructure
- Send personnel immediately
- Force first contact
- Embed personnel with incident command
- Lines affected had received ROW clearing and mowing two years prior
- No damage to poles or lines

WILDFIRES AND CEC LINES
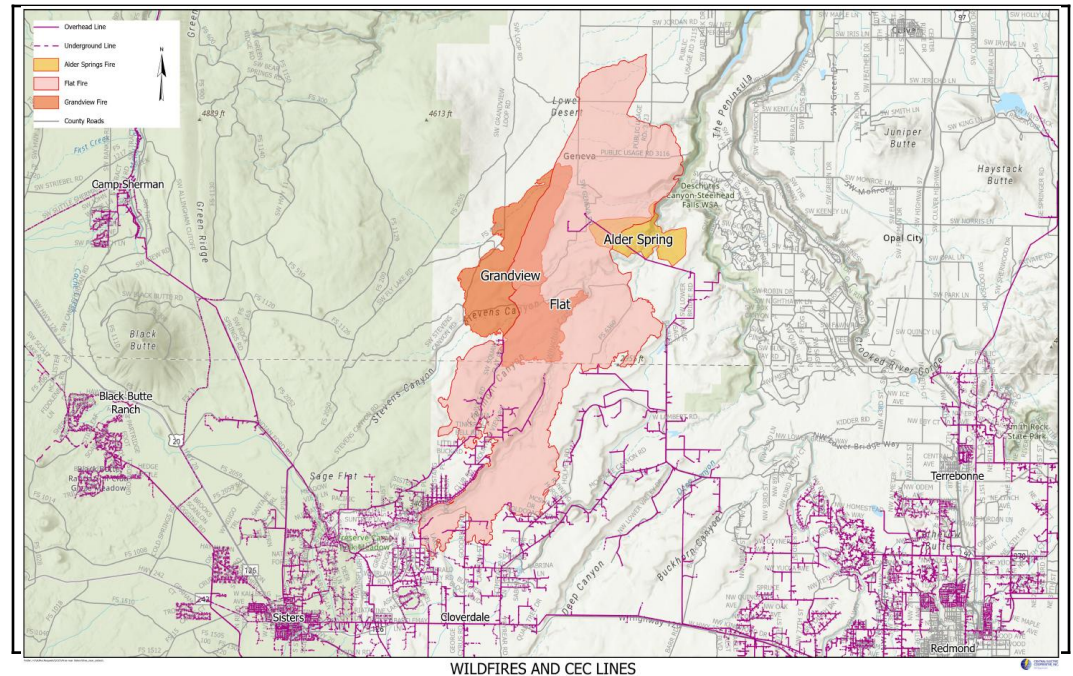
Flat Fire

Lessons Learned

WILDFIRES AND CEC LINES

- Monitor weather/wind
- Anticipate affected infrastructure
- Send personnel immediately
- Force first contact
- Embed personnel with incident command
- De-energize and re-energize lines in concert with incident command
- Restoration efforts improved due to communication

Last Thoughts

- Communications:

  - Build relationships with local emergency managers

  - Leverage these relationships, understand public critical infrastructure and where emergency shelters will be organized

  - Maintain constant communications with incident command

  - Utility communications personnel available and engaging member/customer base

Last Thoughts

- Operations:

  - Send personnel before fire impacts your system

  - Force first contact

  - Embed personnel if possible

  - Maintain communications with incident command

  - Plan for areas to be impacted

  - Know your sectionalizing points and impacts

Questions?

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