

Resiliency in Force Majeure Situations such as Lava and Hurricanes

2nd NELHA Conference on Energy Storage Trends and Opportunities

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Hawaii Electric Light Company

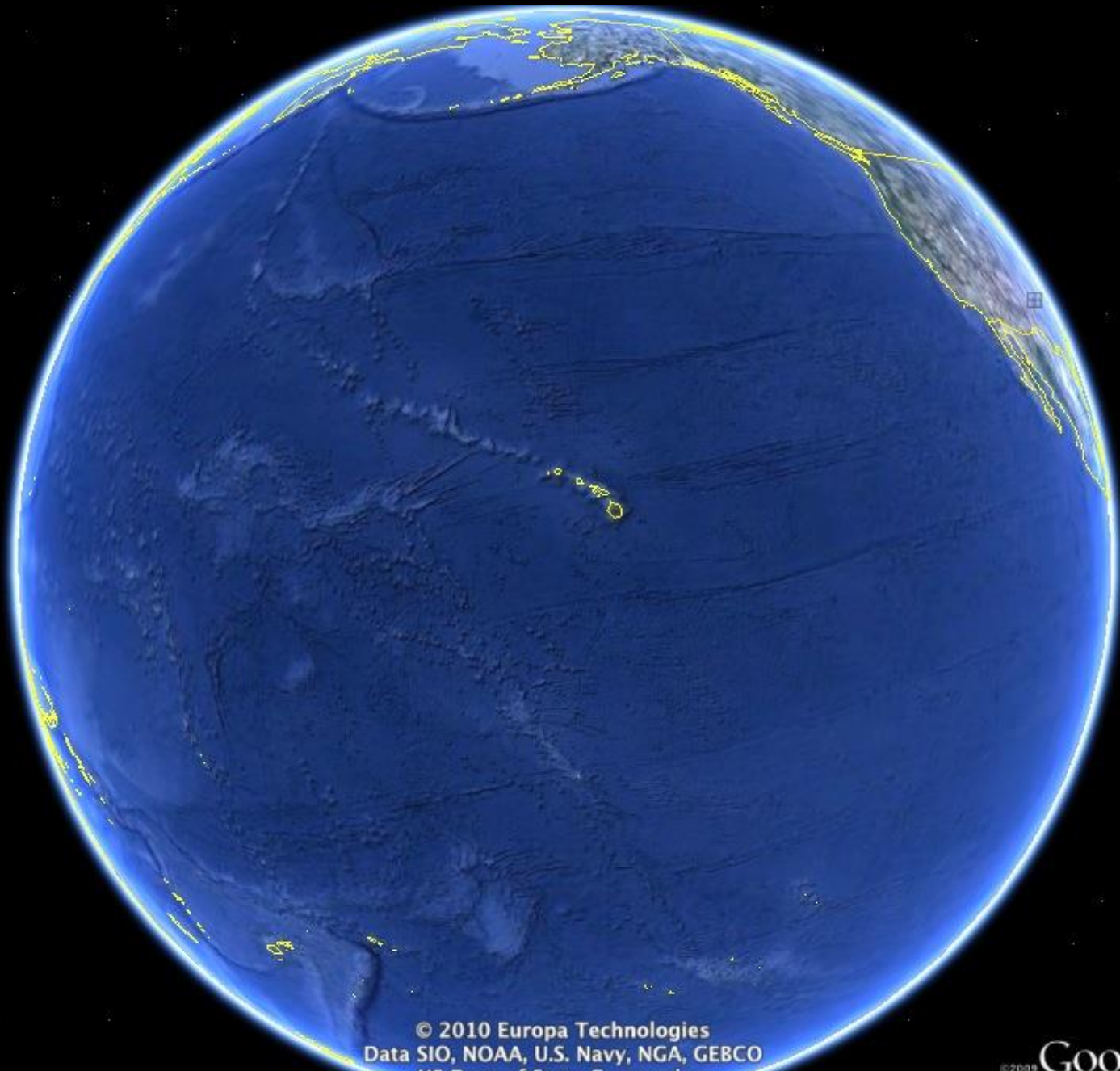


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Resilience

- Robustness – ability to absorb shocks and continue operating
- Resourcefulness – ability to skillfully manage as crisis as it unfolds
- Rapid recovery – ability to get services back as quickly as possible
- Adaptability – ability to incorporate lessons learned from past events





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2018 Leilani Eruption



September 18, 2018



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Pohoiki Switching Station



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Kapoho Sub



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Channelized Flow

- Highways were crossed
- Access cutoff
- Walls grew to about 50-60 feet high
(Approximately the height of the transmission poles)



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Daily Ash Explosions

- Large flying rocks
- Inhalation hazard
- Insulator contamination =
Flashover/outage/damage
- Clogged filters



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What was Different?

- Unpredictable – cracks, falling poles, eruptions, toxic gas, isolation



Timeline

- ◆ May 3: First fissure erupts in Leilani Estates
- ◆ May 4: Magnitude 6.9 earthquake
- ◆ May 17: Kilauea summit ash & steam explosion #1
- ◆ May 20: Lava enters ocean near MacKenzie park
- ◆ May 29: Pohoiki Switching Station overrun
- ◆ June 4: Kapoho Beach Lots covered
- ◆ Aug 6: Eruptive activity ceases



Impact

- ◆ 24 fissures; Fissure 8 was most active
- ◆ Highway 132 and 137 closed due to crossing
- ◆ 935 customers, 835 poles, 229 transformers
- ◆ Puna Geothermal Venture (38 MW) isolated
 - Pohoiki Switching Station overrun
- ◆ Approximately 2500 residents displaced

Plans, Plans, Plans!

Contingency switching scenarios

Staffing Plan

Kalapana Entry/Exit Plan

DER Force Majeure Plan

UAV Plan

Pohoiki Loss Plan

Microgrid Plan

Ash Contamination Plan

Incident Action Plan

Deactivation Plan

Reenergizing plan

Damage Assessment Plan



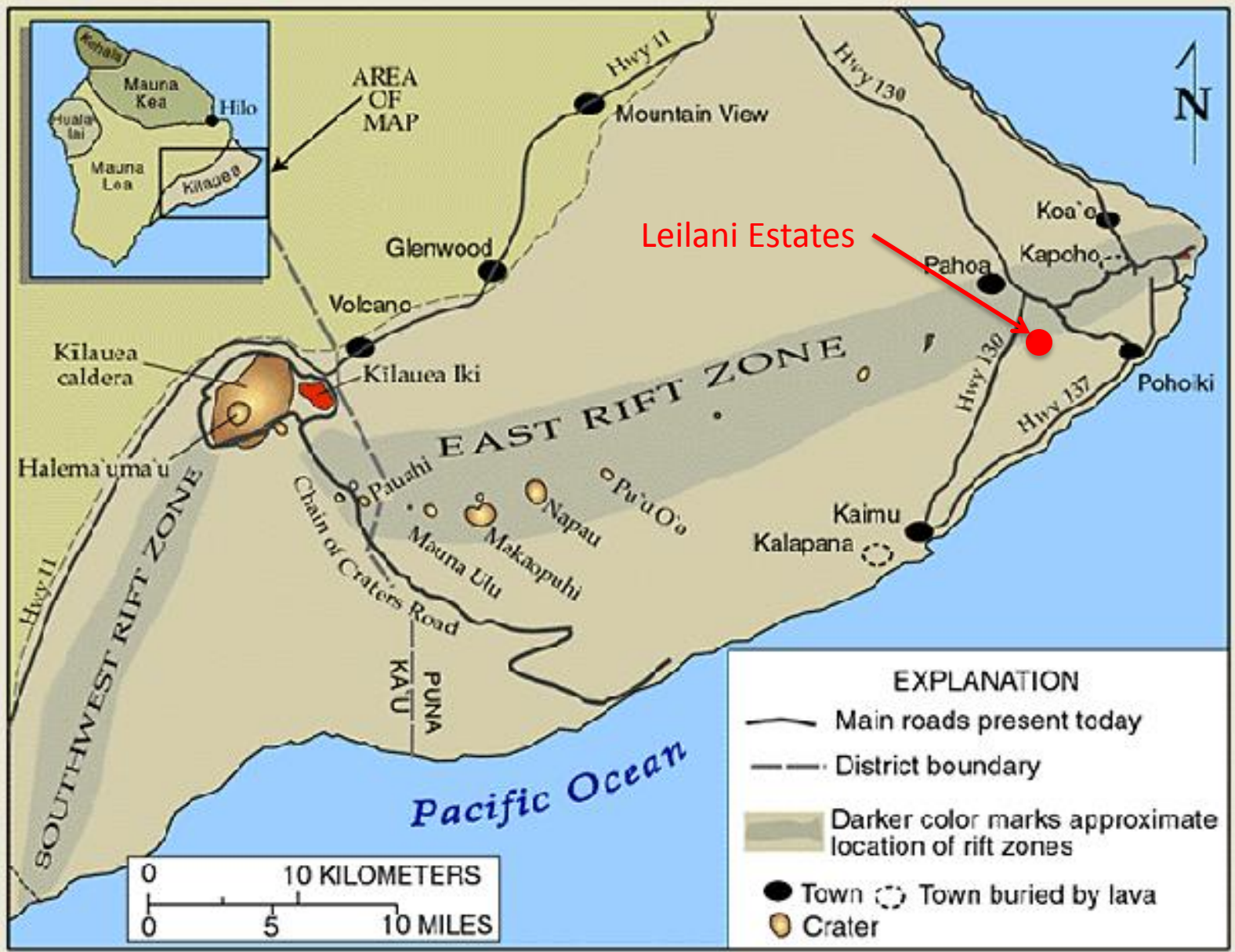
Tools and PPE



Air Monitoring Equipment and PPE

- Two-way radios
- Air monitoring equipment
- SAFEAIR badges to detect **Hydrogen Sulfide, Sulfur Dioxide**
- Dust masks
- Respirators
- Emergency overnight packs
- Avoid the **Laze** hazard





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Totals :

METERS

- Energized: 326
- De-Energized: 935

POLES

- De-Energized: 597

OH TRANSFORMERS

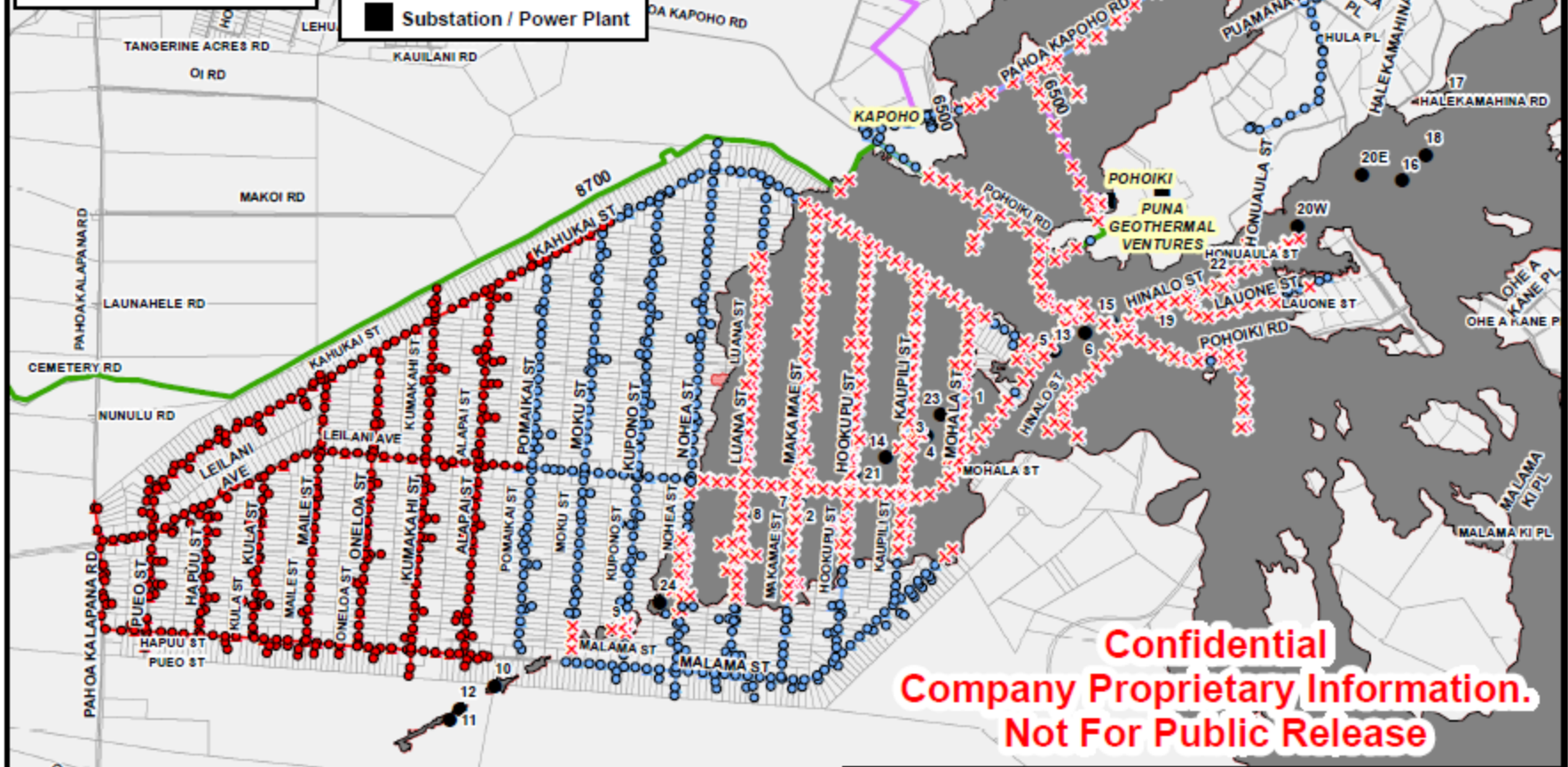
- De-Energized: 164

- Energized
- De-Energized
- Flow as of 6_14_2018
- Previous Flow Extent
- Fissures
- 6500 Ln
- 8700 Ln
- Substation / Power Plant

- Pole Down / Broken (This Map) - 428
- Downed Transformers (This Map) - 112
- Pole Down / Broken Total - 765
- Downed Transformers Total - 209

Estimated damage counts are as of June 14, 2018

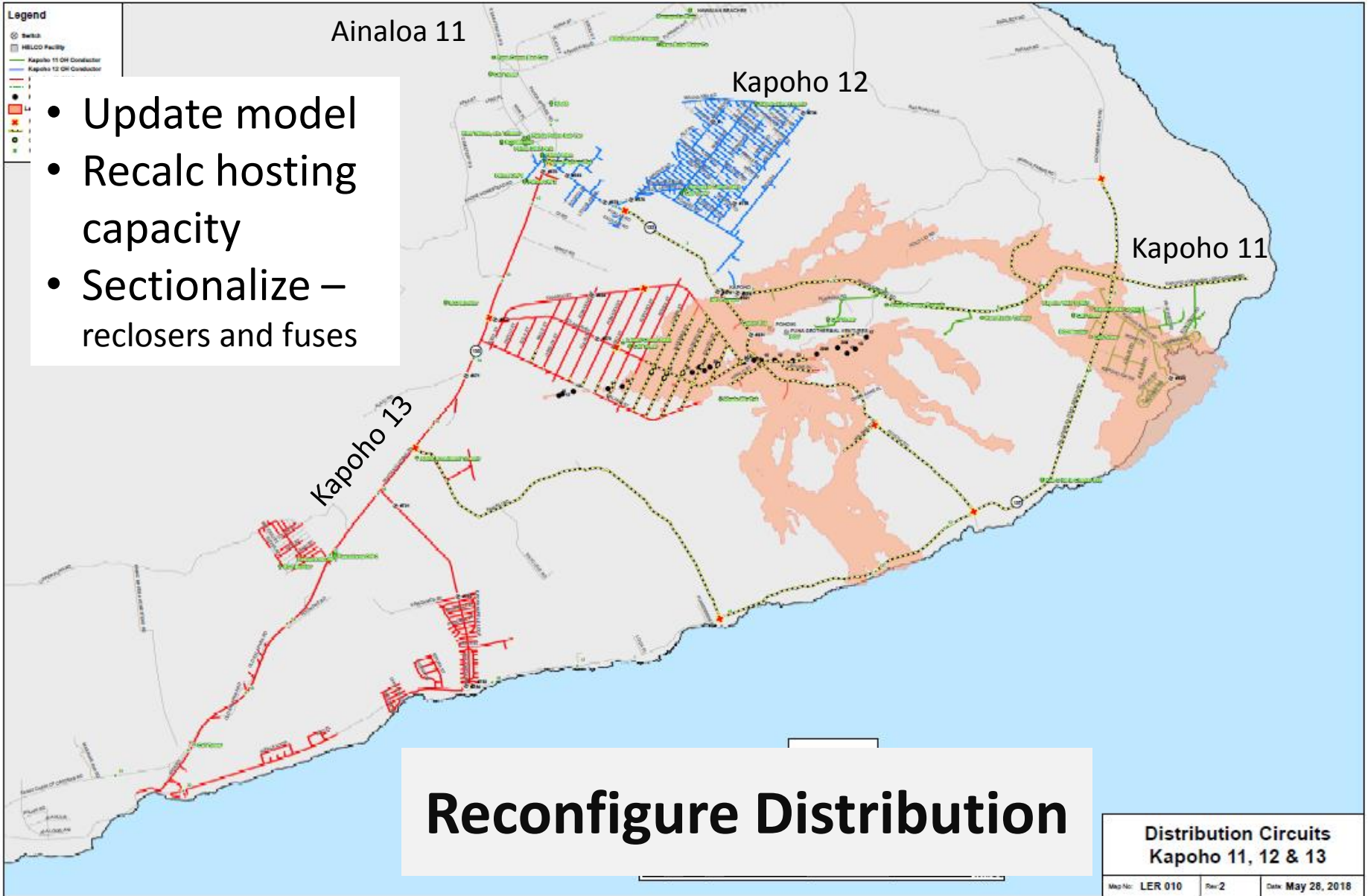
The counts herein are estimates only, created from aerial images and have not been verified.



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Company Proprietary Information.
Not For Public Release**

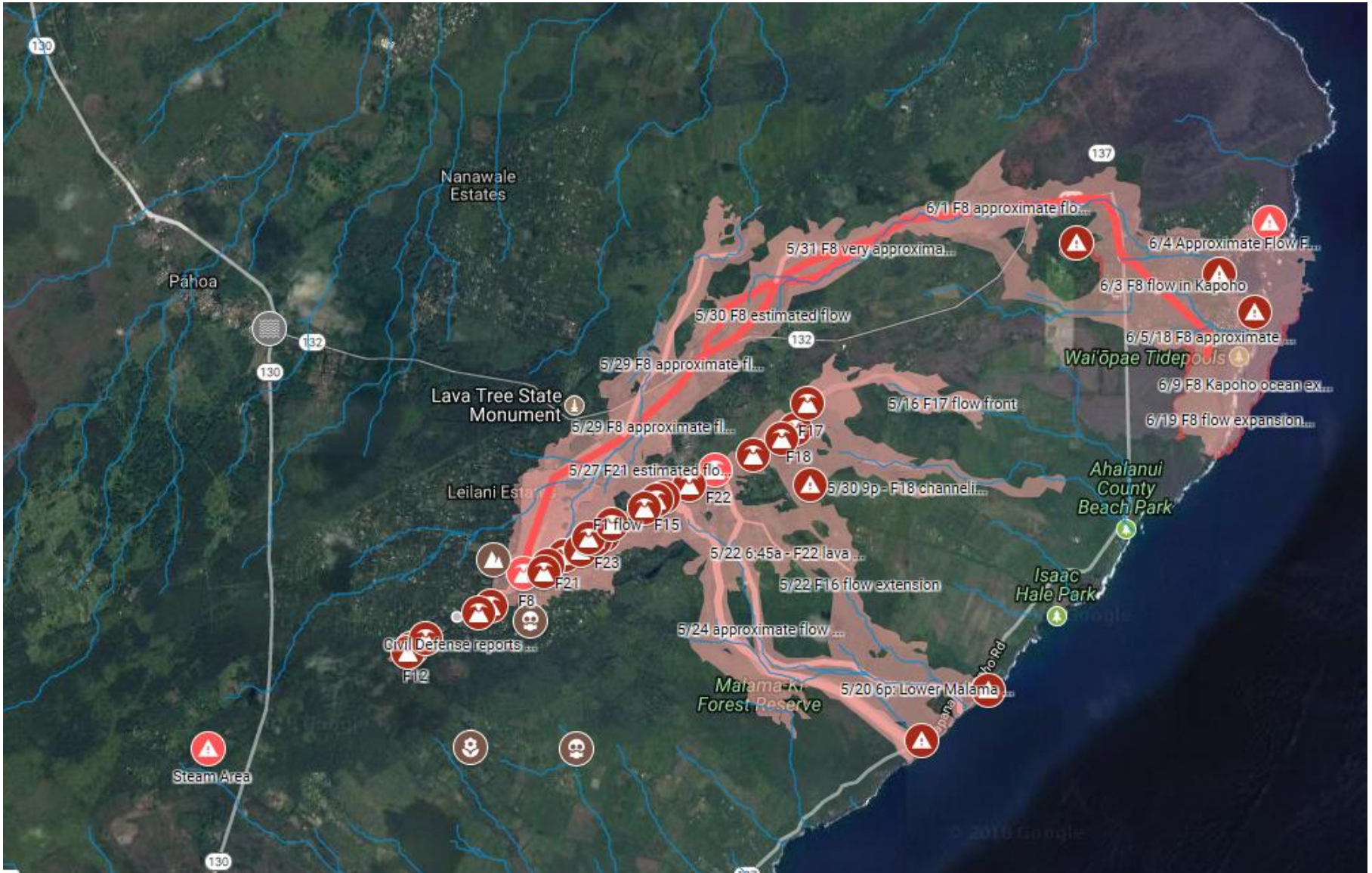
Safety Note : De-energized facilities are hazardous and NOT safe to approach.

Energized and Estimated Damage Summary		
Map No: LER 002	Rev: 37	Date: June 14, 2018



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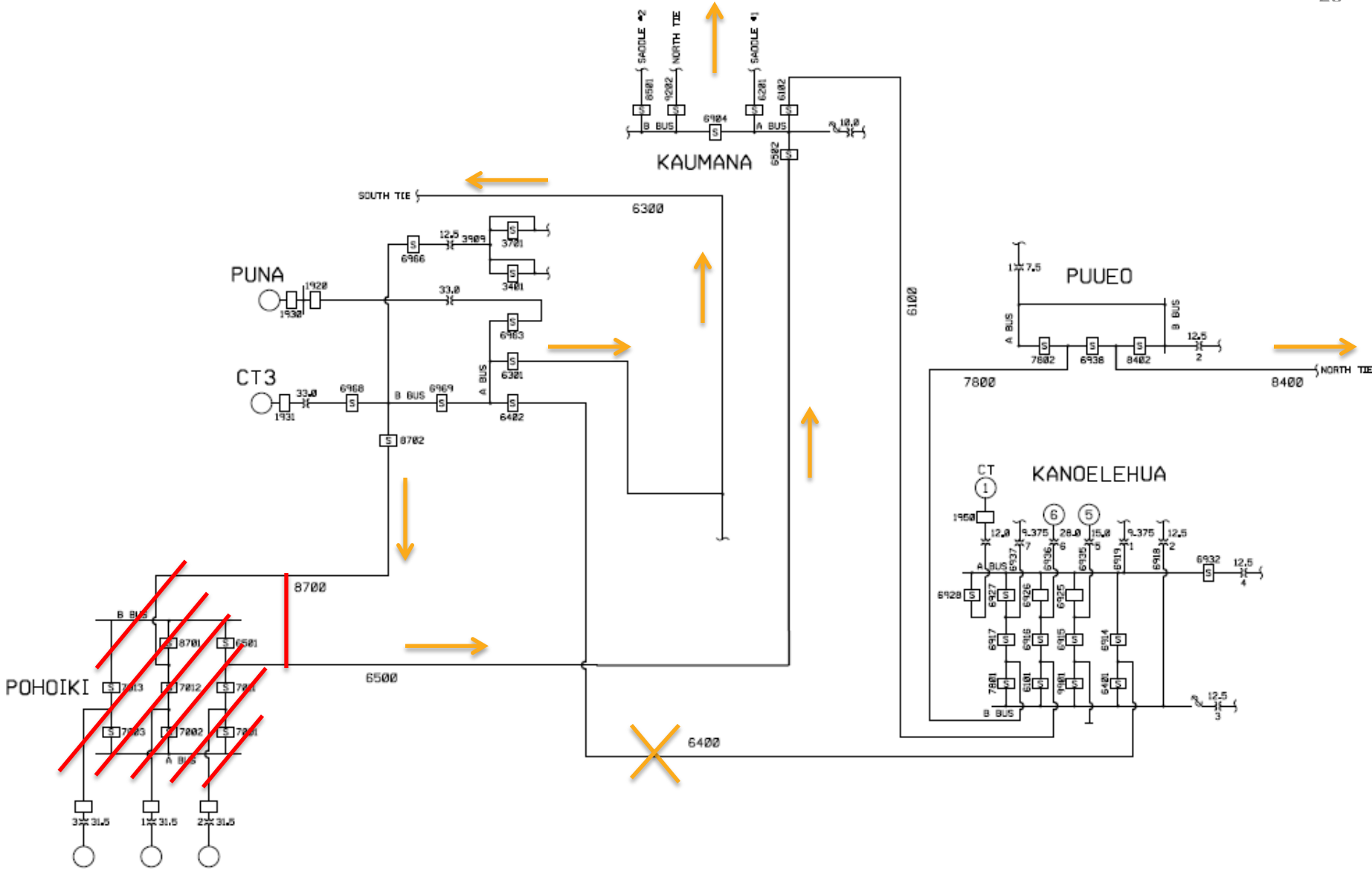


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Damage Assessment with UAV



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Transmission Stability

Microgrid Design



- 500 kW diesel
- 200 kW diesel
- PV with battery

- Ground fault detection
- Balanced equally-loaded phases



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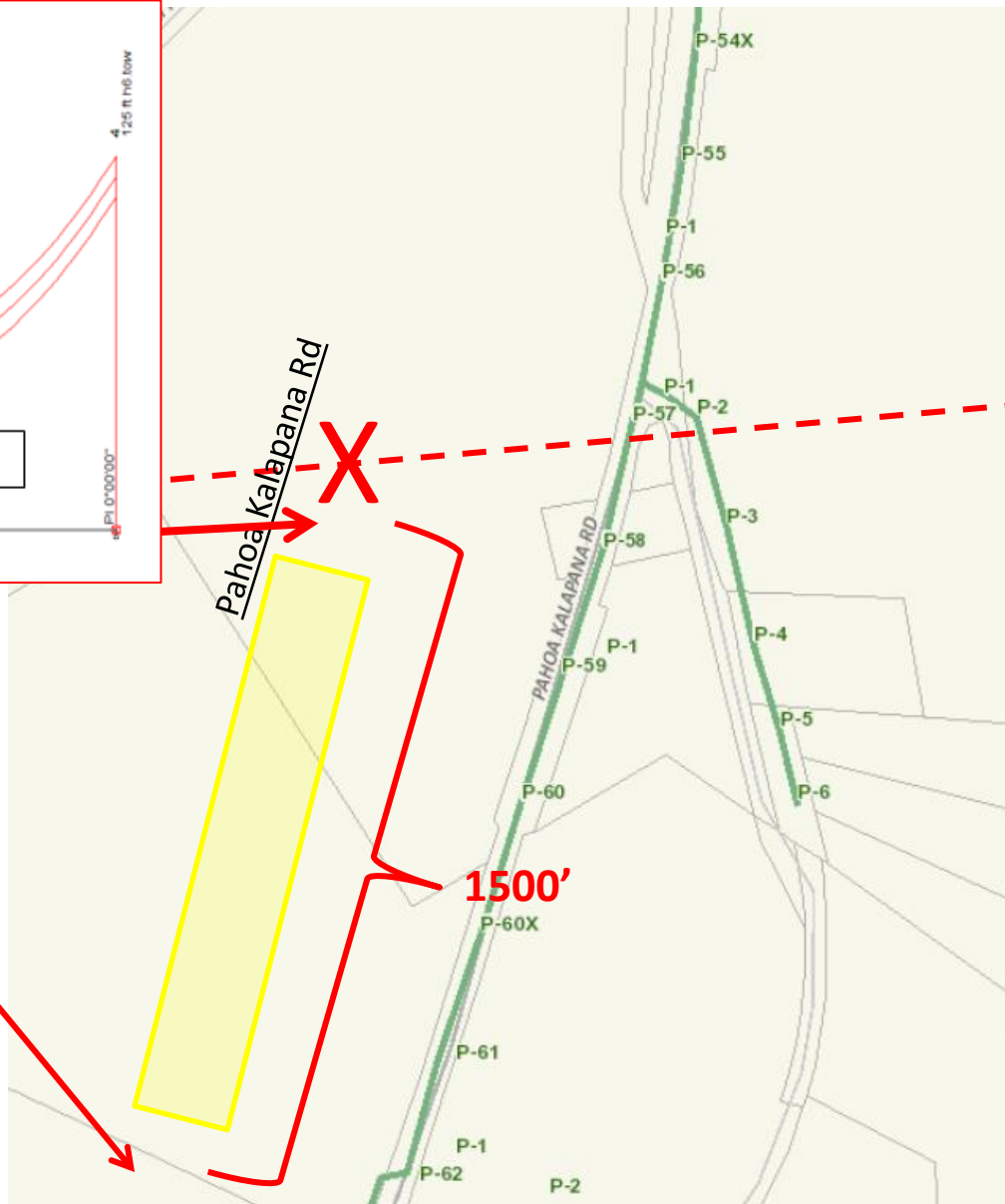
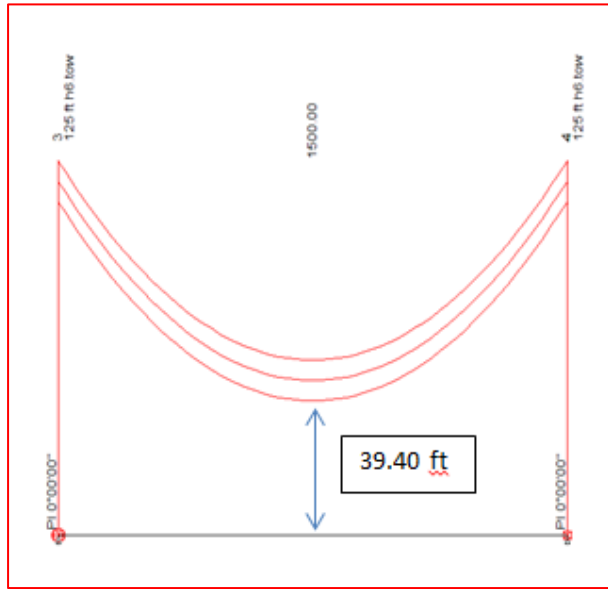
Portable PV / Battery Trailer



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Span with Stock-on-hand

1500' Span



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National Incident Management System

*Third Edition
October 2017*



FEMA

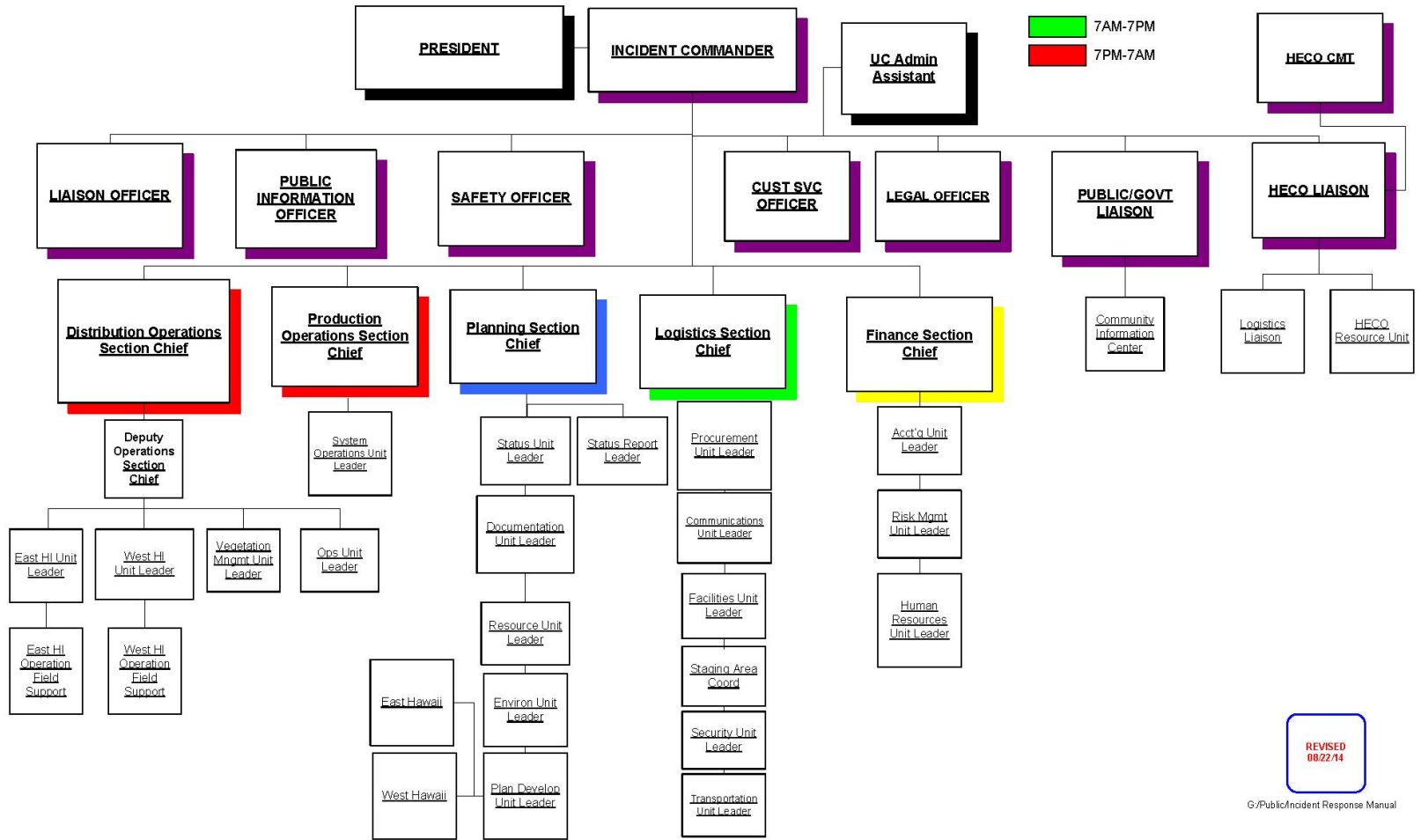


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Preparation is critical



Hawaii Electric Light Company, Inc.
INCIDENT MANAGEMENT TEAM



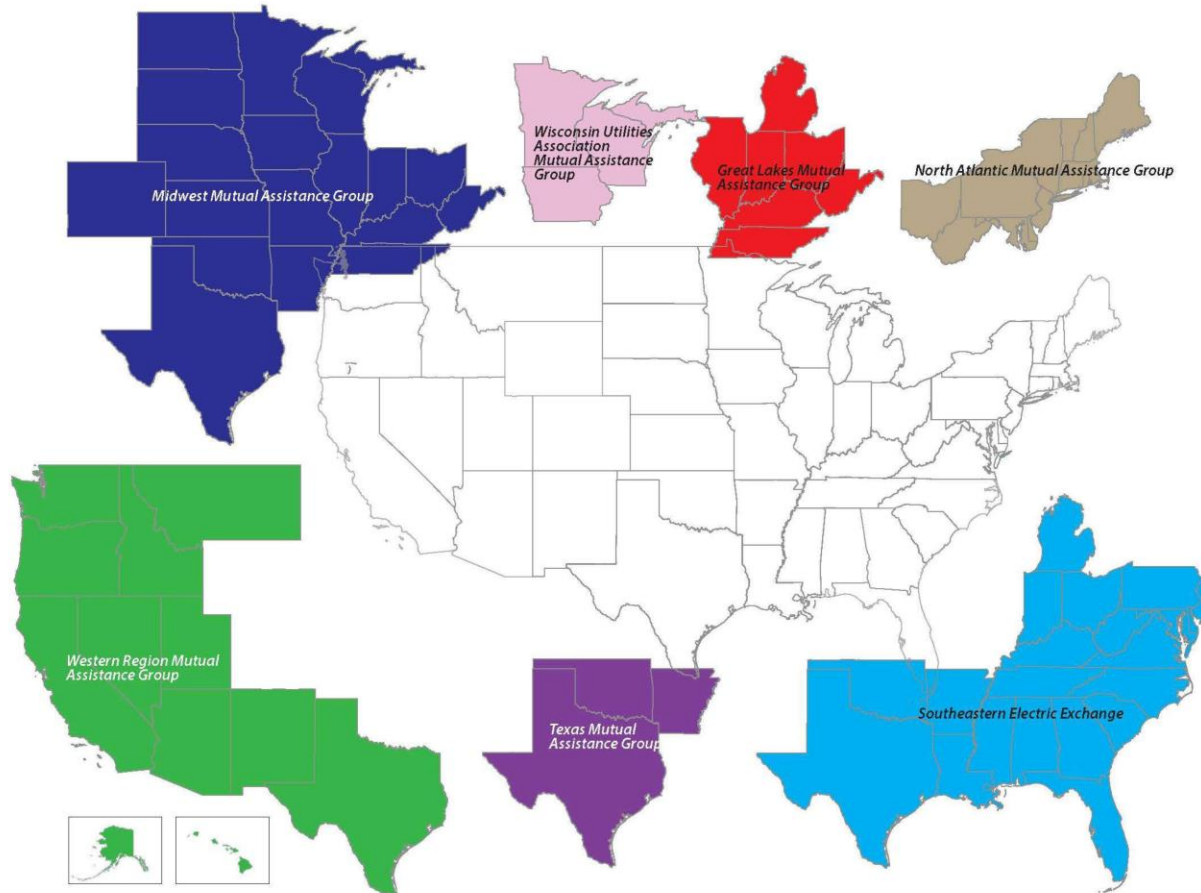
REVISED
08/22/14

G/Public/Incident Response Manual



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Regional Mutual Assistance Groups



Produced by Edison Electric Institute's Project Support Group. Data Source: Regional Mutual Assistance Groups 2014.

10/2014



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Mahalo!

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