2023 Wildfire Mitigation Plan

May 8, 2023

PACIFICORP

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ACRONYMS

ACS .... American Community Survey
AFN .... Access and functional needs
ANSI .... American National Standards Institute
CPUC .... California Public Utilities Commission
DFA .... Distribution fault anticipation
ECC .... Emergency Coordination Center
EFR .... Elevated fire risk
ERC .... Energy release component
FPI .... Fire potential index
GACC .... Geographic Area Coordination Center
GHG .... Greenhouse gas
GO 95 .... California General Order 95
GRC .... General rate case
HWW .... High Wind Warning
HFTD .... High fire threat district
IOU .... Investor-owned utility
IR .... Infrared
iUTI .... Integrated utility threat index
LRAM .... Localized Risk Assessment Model
MARS .... Multi-attribute risk score
MAVF .... Multi-attribute value function
NLCD .... National Land Cover Database
NWS .... National Weather Service
PDZ .... Power de-energization zone
PSPS .... Public Safety Power Shutoff
QA/QC .... Quality assurance/quality control
RAMP .... Risk assessment mitigation phase
RF .... Radio frequency
RSE .... Risk-spend efficiency
S-MAP .... Safety model and assessment proceeding
SCADA .... Supervisory control and data acquisition
SME .... Subject matter expert
TCC .... Time current characteristic
WFA-E .... Wildfire Analyst-Enterprise
WMP .... Wildfire mitigation plan
WRF .... Weather research and forecast
WRRM .... Wildfire Risk Reduction Model
WSAB .... Wildfire Safety Advisory Board
WUI .... Wildland-urban interface
ZOP .... Zone of protection

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1 EXECUTIVE SUMMARY

In the opening section of the WMP, the electrical corporation must provide an executive summary that is no longer than 10 pages. The executive summary must provide brief narratives on each of the following topics.

Summary of 2020 -2022 WMP Cycle

The electrical corporation must provide a brief overview of its progress in achieving the goals, objectives, and targets specified in the previous WMP submissions. The overview must discuss areas of success, areas for improvement, and any major lessons learned.

Summary of 2023 – 2025 Base WMP

The electrical corporation must summarize the primary goal, objectives, and framework for the development of the WMP for the three-year cycle. The electrical corporation may use a combination of brief narratives and bulleted lists.

Wildfire has long been an issue of notable public concern. Despite effective fire suppression agencies and increased suppression budgets, wildfires have grown in number, size and intensity and continue to impact communities at a more substantial rate than previously recorded, particularly in California. Increased human development in the wildland-urban interface, the area where people (and their structures) are intermixed with, or located near, substantial wildland vegetation has increased the probability and exacerbated the costs of wildfire damage in terms of both harm to people and property damage.

For decades the California Public Utility Commission (CPUC or Commission) has worked to address the specific risks created by the operation of an electric grid through regulations and programs, with even more substantial and targeted efforts over the past several years. PacifiCorp which does business as Pacific Power in California, has been an active participant as these efforts have evolved. The CPUC first initiated a decade-long fire safety rulemaking in 2008. The first phase of this rulemaking focused on immediate measures in the highest fire risk area, in the seven counties of southern California. Thereafter, rules (codified in General Orders [GO] 95, 165 and 166) having a longer timeline for implementation were developed to reduce the risk of fire ignition caused by overhead utility systems. These rules culminated at approximately the same time the state was experiencing widespread drought, and the company was directed to identify and implement actions, including these new rules, to address wildfire risk on its system. As a result, a Fire Prevention Plan and a Drought Mitigation Plan were prepared and implemented starting in 2014.

In early 2018, as the multi-phase rulemaking concluded, the state of California experienced catastrophic wildfires in both northern and southern California, spurring greater efforts to augment the Drought Mitigation and Fire Prevention plans. In response to Senate Bill (SB) 901, California took a comprehensive approach to mitigating wildfires while also working to create a more resilient electric grid. A key element of SB 901, Public Utilities Code § 8386 and resolutions WSD-002, WSD-005 and WSD-011, was the requirement for all electric utilities to develop and implement Wildfire Mitigation Plans (WMP or Plan).

As a result, Pacific Power, along with other utilities in California, developed and filed its first WMP which described the investments to construct, maintain and operate electrical lines and equipment in a manner that will minimize the risk of wildfire. In evaluating which engineering, construction, and operational strategies to deploy, Pacific Power's WMP was guided and is still guided today by the following core principles:

- Frequency of ignition events related to electric facilities can be reduced by engineering more resilient systems that experience fewer fault events.
- When a fault event does occur, the impact of the event can be minimized using equipment and personnel to shorten the duration to isolate the fault event.
- Systems that facilitate situational awareness and operational readiness are central to mitigating fire risk and its impacts.

These WMPs were first filed and approved in 2019 and in 2020 the plans were bolstered with process changes developed, at the time, by the Wildfire Safety Division (WSD).

1.1 SUMMARY OF 2020 – 2022 WMP CYCLE

Starting in 2020, utilities began filing WMPs on a three-year cycle with annual updates consistent with the guidance published by the WSD and authority provided in Public Utilities Code § 8386. Pacific Power's 2020-2022 WMP, filed and approved in 2020, built upon on the company's previous plan and incorporated changes based on stakeholder feedback and input solicited through the WMP review and evaluation process consistent with the new template and requirements.

Areas of Success

During the 2020-2022 cycle, Pacific Power made progress toward mitigating wildfire risk through implementation of its plans. Key accomplishments include:

- Procured new risk modeling tools, datasets, and software to advance both the company's situational awareness and risk modeling capabilities;
- Upgraded 103 reclosers, relays and circuit breakers to enable advanced protection and control schemes, incorporate greater customization and more complex logic, and provide additional event data;
- Replaced 2,116 expulsion fuses with non-expulsion fuses to reduce the potential for ignition associated with fuse operations;

- Rebuilt 83 miles of bare conductor with insulated covered conductor[1] designs to mitigate the risk associated with contact related faults;
- Implemented annual Infra-red (IR) inspections on overhead transmission lines;
- Cleared 3,014 poles in 2022 to reduce the risk of fire ignition should sparks be emitted from electrical equipment;
- For vegetation inspections, in 2022 there were 879 line miles inspected beyond routine maintenance and 546 miles inspected for routine maintenance.
- Installed 83 weather stations to collect additional data and, where appropriate, characterize local conditions to inform decision making;
- Established a meteorology department to gather, interpret, and translate this new data into forecasted risk and situational awareness reports;
- Created a new wildfire safety department including both project management, compliance, and program delivery functions;
- Implemented and maintained a Public Safety Partner portal[2]. The Public Safety Partner portal is a secure web-based application that hosts key information about customers that have been identified as critical facilities or infrastructure. to provide information to public safety partners during PSPS events and support notification and provision of support to critical facilities that may be impacted by an outage.
- Since 2020, the Company conducted 5 PSPS TTXs (Tabletop Exercises) and 3 PSPS plan reviews with Public Safety Partners and emergency responders to bolster preparedness for PSPS events;
- Established a Wildfire Safety Advisory Board (WSAB)[3] and conducted regular meetings to solicit input on plan development and PSPS preparedness;
- Executed 3 PSPS events from 2020 through 2022 that impacted a total of 7 circuits and less than 2,600 customers in each event;
- Began offering both generator rebate program and a free-to-the-customer portable battery program to qualified customers and successfully delivered 85 portable batteries to 73 customers to mitigate potential impacts to customers of PSPS;
- A webinar for California customers was delivered on May 3, 2022. The webinar along

[1] Covered conductor may also be called spacer cable, aerial cable, or tree wire.

[2] Pacific Power's Public Safety Partners Portal was developed consistent with the requirements in Part B of Appendix A of D. 21-06-034 issued 6/29/2021.

[3] Pacific Power's Wildfire Safety Advisory Board was established and implemented consistent with the requirements in Appendix A of D. 20-05-051 issued 6/5/2020.

with the video "Investing in Resilience-Wildfire Safety" were posted on the Pacific Power website and YouTube channel.

- Implemented a multi-pronged external engagement strategy to inform customers and communities which garnered 3,122,100 impressions, 6,226 clicks, and a 0.20% clickthrough rate for California.
- Conducted five customer surveys via e-mail and telephone since 2020 to assess the effectiveness of Pacific Power's outreach and education efforts.

2020-2022 Experience

Throughout the 2020-2022 WMP cycle, Pacific Power learned:

Risk Methodology and Assessment

- Collaboration with other utilities through joint IOUs (Investor-owned Utility) workstreams is helpful in the development and implementation of Pacific Power's initial risk-spend-efficiency (RSE).
- Continued investment in more granular data and enterprise supported, sophisticated risk models is required to advance Pacific Power's risk modeling capabilities.

Grid Design, Operations, and Maintenance

- Unlike traditional distribution projects with short lead times and moderate construction needs, line rebuilds with covered conductor require significantly more resources and generally 12–24 months depending on permitting and right of way requirements.
- Accelerated remedies for expulsion fuse replacement are a relevant factor in system hardening; these remedies were implemented in the HFTD.
- Accelerated material order ahead of design milestones can expedite project delivery.
- Identified quality control and verification of contractor work as key areas of improvement.
- Continued identification of conditions through IR inspections year over year highlights the effectiveness and supports continued implementation on an annual basis.
- Clear identification of fire risk conditions can facilitate prioritization and accelerated correction, consistent with or ahead of General Order timeline requirements.
- Enhanced work tracking to report on the use of alternative work practices during

elevated fire risk weather conditions is challenging but helpful to understanding program requirements, frequency, and benefits.

Vegetation Management and Inspections

- Identification of separate vegetation-related conditions expedites work completion.
- Performing environmental desktop prescreening expedites approval of vegetation management programs on federally managed land.

Situational Awareness and Forecasting

- Investment in datasets and data processing capabilities can improve risk forecasting horizons and provide more time to assess and prepare for risk events, such as PSPS.
- Data infrastructure and processing redundancy is relevant for added risk modeling tool reliability.
- Technosylva's modeling capabilities, with meteorology team help, can inform future decision-making processes during PSPS events after the full rollout of the software has been completed.
- Portable weather stations, which can be installed quickly at the first sign of concerning weather trends, provide detailed insight into remote areas without the delay required for permanent installations.

Emergency Preparedness

- Additional time to prepare, plan, and execute a PSPS event is important to PSPS success.
- Using workflow process tools improves the efficiency of notifications with public safety and other state partners.
- As compared to other outages, PSPS implementation requires significantly more coordination with both internal and external stakeholders and customers, as well as increased level of data management, documentation, and tracking to ensure compliance with all notifications and post event reporting.
- Collaboration with public safety partners to continuous evaluation CRC locations and services is important to mitigate PSPS impacts to customers and communities.

Community Outreach and Engagement

- Direct engagement with tribal leaders helps the company target generators to tribal members with the most in need.

- Determination of medical baseline and AFN populations relies heavily on customer awareness and self-identification.

- Results from customer surveys showed that Pacific Power remains the primary sources for wildfire preparedness information, and email, social media, and TV news are the most channels for wildfire communications.

Continuous Improvement

Based on this experience, Pacific Power intends to continue investing in tools, data, and software to advance the company's risk assessment and modeling capabilities, leverage this capability to inform program and project evolution, and expand the company's PSPS preparedness. These have been incorporated into the 2023-2025 Base WMP and further discussed below.

1.2 SUMMARY OF 2023 – 2025 BASE WMP

Similar to Pacific Power's 2020-2022 California WMP, this 2023-2025 WMP guides the mitigation strategies that will be deployed or are currently being implemented in California. As described above, these efforts are designed to reduce the probability of utility related wildfires, as well as to mitigate the damage to Pacific Power facilities because of wildfire. The new 2023-2025 Base WMP incorporates Pacific Power's years of experience as well as feedback and recommendations from OEIS, stakeholders, customers, and communities. As a result, the 2023-2025 WMP seeks to:

- Advance the maturity of Pacific Power's overall risk modeling capabilities, specifically in the areas of risk assessment, risk-spend efficiency, project and program selection, and prioritization;

- Leverage these new capabilities to evaluate and consider potential expansion of programs or projects beyond existing HFTD boundaries;

- Expand the weather station network as needed to fill in data gaps;

- Evaluate existing pilot projects, such as distribution IR inspections, wildfire cameras, and smoke sensors, for broader implementation;

- Accelerate delivery of grid hardening projects where possible by establishing a long-term relationship with a construction management partner to increase available resources and increase productivity.

- Mature and refine the Fire Potential Index (FPI) to support PSPS decision making processes;

- Invest in data management and analytics software to support improved PSPS event management and post event reporting, as well as data governance and quarterly data reports;

- Expand PSPS preparedness through incremental Public Safety Partner engagement, including the completion of a functional exercise that builds upon years of collaboration and previously completed tabletop exercises;

- Continue implementation of customer support programs, such as the free-to-the-customer portable battery program and generator rebate program.

The strategies embodied in this plan are evolving and are subject to change. As new analyses, technologies, practices, environmental influence or risks are identified, changes to address them may be incorporated into future iterations of the plan of managed through the Change Order[4] process.

[4] See OEIS guidelines for Change Orders at https://energysafety.ca.gov/news/2022/11/08/energy-safety-adopts-revised-2022-change-order-guidelines-for-electrical-corporations/

2 RESPONSIBLE PERSONS

The electrical corporation must list those responsible for executing the WMP, including:

- Executive-level owner with overall responsibility
- Program owners with responsibility for each of the main components of the plan
- As applicable, general ownership for questions related to or activities described in the WMP

Titles, credentials, and components of responsible person(s) must be released publicly. Electrical corporations can reference the WMP Process and Evaluation Guidelines and California Code of Regulations Title 14 section 29200 for the submission process of any confidential information.

Executive-level owner with overall responsibility

- Name and title: Allen Berreth, Vice President of Transmission and Distribution Operations
- Email: Allen.Berreth@Pacificorp.com
- Phone number: 503-813-6205

Program owners specific to each section of the plan

Section 1: Executive Summary

Program owner

- Name and title: Megan Buckner, Director of Wildfire Program Delivery
- Email: Megan.Buckner@PacifiCorp.com
- Phone number: 503-813-5209
- Component: entire section

Section 2: Responsible Persons

Program owner

- Name and title: Megan Buckner, Director of Wildfire Program Delivery
- Email: Megan.Buckner@PacifiCorp.com
- Phone number: 503-813-5209
- Component: entire section

Section 3: Statutory Requirements Checklist

Program owner

- Name and title: Megan Buckner, Director of Wildfire Program Delivery
- Email: Megan.Buckner@PacifiCorp.com
- Phone number: 503-813-5209
- Component: entire section

Section 4: Overview of WMP

Program owner

- Name and title: Megan Buckner, Director of Wildfire Program Delivery
- Email: Megan.Buckner@PacifiCorp.com
- Phone number: 503-813-5209
- Component: entire section

- Name and title: Jeff Vickers, Managing Dir, Delivery Assurance
- Email: Jeffrey.Vickers@Pacificorp.com
- Phone number: 801-220-4008
- Component: Summary of WMP Expenditures

- Name and title: Kevin Benson, Director of Asset Risk
- Email: Kevin.Benson@PacifiCorp.com
- Phone number: 541-213-1990
- Component: Risk Informed Framework

Section 5: Overview of the Service Territory

Program owner

- Name and title: Megan Buckner, Director of Wildfire Program Delivery
- Email: Megan.Buckner@PacifiCorp.com
- Phone number: 503-813-5209
- Component: entire section

Section 6: Risk Methodology and Assessment

Program owner

- Name and title: Kevin Benson, Director of Asset Risk
- Email: Kevin.Benson@PacifiCorp.com
- Phone number: 541-213-1990
- Component: entire section

Section 7: Wildfire Mitigation Strategy Development

Program owner

- Name and title: Kevin Benson, Director of Asset Risk
- Email: Kevin.Benson@PacifiCorp.com
- Phone number: 541-213-1990

- Component: Subsection 7.1 - Risk Evaluation

- Name and title: Megan Buckner, Director of Wildfire Program Delivery
- Email: Megan.Buckner@PacifiCorp.com
- Phone number: 503-813-5209
- Component: Subsection 7.2 - Wildfire Mitigation Strategy

Section 8: Wildfire Mitigations

Program owner

- Name and title: Amy McCluskey, Managing Director of Asset Management and Wildfire Safety
- Email: Amy.McCluskey@PacifiCorp.com
- Phone number: 503-813-5493
- Component: entire section

- Name and title: Kevin Schiedler, Wildfire Mitigation Delivery Director
- Email: Kevin.Schiedler@PacifiCorp.com
- Phone number: 503-813-5595
- Component: Grid Design, Operations and Maintenance

- Name and title: Brian King, Director of Environmental & Vegetation Management
- Email: Brian.King@PacifiCorp.com
- Phone number: (503) 813-6031
- Component: Vegetation Management and Inspections

- Name and title: Jon Connelly, Director of Asset Management
- Email: Jonathan.Connelly@PacifiCorp.com
- Phone number: 503-813-6152
- Component: Asset Inspection and Maintenance

- Name and title: Steve Vanderburg, Manager of Meteorology and Emergency Management
- Email: Steven.Vanderburg@PacifiCorp.com
- Phone number: 503-251-5180
- Component: Situational Awareness and Forecasting / FPI

- Name and title: Megan Buckner, Director of Wildfire Program Delivery
- Email: Megan.Buckner@PacifiCorp.com
- Phone number: 503-813-5209
- Component: Wildfire Detection Network

- Name and title: Eleonore Yotsov, Director of Emergency Management
- Email: Eleonore.Yotsov@PacifiCorp.com

- Phone number: (503) 813-5253
- Component: Emergency Preparedness

- Name and title: Erin Isselmann, VP, Corporate Communications
- Email: Erin.Isselmann@Pacificorp.com
- Phone number: (503) 813-6571
- Component: Community Outreach and Engagement

Section 9: Public Safety Power Shutoff

Program owner

- Name and title: Eleonore Yotsov, Director of Emergency Management
- Email: Eleonore.Yotsov@PacifiCorp.com
- Phone number: (503) 813-5253
- Component: Entire Section

Section 10: Lessons learned

Program owner

- Name and title: Megan Buckner, Director of Wildfire Program Delivery
- Email: Megan.Buckner@PacifiCorp.com
- Phone number: 503-813-5209
- Component: Subsection 7.2 - Wildfire Mitigation Strategy

Section 11: Corrective Action Program

Program owner

- Name and title: Amy McCluskey, Managing Director of Asset Management and Wildfire Safety
- Email: Amy.McCluskey@PacifiCorp.com
- Phone number: 503-813-5493
- Component: entire section

Section 12: Notices of Violation and Defect

Program owner

- Name and title: Megan Buckner, Director of Wildfire Program Delivery
- Email: Megan.Buckner@PacifiCorp.com
- Phone number: 503-813-5209
- Component: entire section

Appendix

Program owner

- Name and title: Megan Buckner, Director of Wildfire Program Delivery

- Email: Megan.Buckner@PacifiCorp.com
- Phone number: 503-813-5209
- Component: entire section

3 STATUTORY REQUIREMENTS CHECKLIST

This section provides a checklist of the statutory requirements for a WMP as detailed in Public Utilities Code section 8386(c). By completing the checklist, the electrical corporation affirms that its WMP addresses each requirement.

For each statutory requirement, the checklist must include a reference and hyperlink to the relevant section and page number in the WMP. Where multiple WMP sections provide the information for a specific requirement, the electrical corporation must provide references and hyperlinks to all relevant sections. Unique references must be separated by semicolons, and each must include a brief summary of the contents of the referenced section.

Table 3-1 Statutory Requirements Checklist

Public Utilities Code section 8386	Description	WMP Section/Page
(c)(1)	An accounting of the responsibilities of the responsible person(s) executing the plan	Section 2, p.20
(c)(2)	The objectives of the WMP	Sections 4.1and 4.2, p.28
(c)(3)	A description of the preventive strategies and programs to be adopted by the electrical corporation to minimize the risk of its electrical lines and equipment causing catastrophic wildfires, including consideration of dynamic climate change risks	Sections 8.1 p.123, 8.2 p.189, and 8.3 p.219.
(c)(4)	A description of the metrics the electrical corporation plans to use to evaluate the WMP's performance and the assumptions that underlie the use of those metrics	Sections 6 p.63 and 7.1.4 p.112.
(c)(5)	A discussion of how the application of previously identified metrics to previous plan performances has informed the WMP	Sections 6.1.1 p.63 and 6.5 p.90.
(c)(6)	Protocols for disabling reclosers and deenergizing portions of the electrical distribution system that consider the associated impacts on public safety, as well as protocols related to mitigating the public safety impacts of those protocols, including impacts on: critical first responders, health and communication infrastructure, customers with access and functional needs, and those with financial concerns.	Sections 8.4 p.255 and 9 p.318
(c)(7)	Appropriate and feasible procedures for notifying a customer who may be impacted by the deenergizing of electrical lines. The procedures shall direct notification to all public safety offices, critical first responders, health care facilities, and operators of telecommunications infrastructure with premises within the footprint of potential PSPS for a given event.	Section 9 p.318
(c)(8)	Plans for vegetation management	Section 8.2 p.189
(c)(9)	Plans for inspections of the electrical corporation's electrical infrastructure	Section 8.1.3 p.137

Public Utilities Code section 8386	Description	WMP Section/Page
(c)(10)	PSPS protocols associated with the electrical corporation's transmission infrastructure, for instances when the PSPS may impact customers who, or entities that, are dependent upon the infrastructure.	
(c)(11)	A list that identifies, describes, and prioritizes all wildfire risks, and drivers for those risks, throughout the electrical corporation's service territory, including all relevant wildfire risk and risk mitigation information that is part of Safety Model Assessment Proceeding (SMAP) and Risk Assessment Mitigation Phase (RAMP) filings.	Section 7.1.4 p.112
(c)(12)	A description of how the WMP accounts for the wildfire risk identified in the electrical corporation's RAMP filing.	N/A
(c)(13)	A description of the actions the electrical corporation will take to ensure its system will achieve the highest level of safety, reliability, and resiliency, and to ensure that its system is prepared for a major event, including hardening and modernizing its infrastructure with improved engineering, system design, standards, equipment, and facilities, such as undergrounding, insulating of distribution wires, and replacing poles.	Section 8.1 p.123
(c)(14)	A description of where and how the electrical corporation considered undergrounding electrical distribution lines within those areas of its service territory identified to have the highest wildfire risk in a commission fire threat map.	Section 8.1.2.1 p.131
(c)(15)	A showing that the electrical corporation has an adequately sized and trained workforce to promptly restore service after a major event, taking into account employees of other utilities pursuant to mutual aid agreements and employees of entities that have entered into contracts with the electrical corporation	
(c)(16)	Identification of any geographic area in the electrical corporation's service territory that is a higher wildfire threat than is currently identified in a Commission fire threat map, and where the Commission should consider expanding the high fire threat district based on new information or changes in the environment	Section 5.3.3 p.39
(c)(17)	A methodology for identifying and presenting enterprise-wide safety risk and wildfire-related risk that is consistent with the methodology used by other electrical corporations unless the Commission determines otherwise	Sections 6.1 p.63 and 6.2 p.70.
(c)(18)	A description of how the plan is consistent with the electrical corporation's disaster and emergency preparedness plan prepared pursuant to Section 768.6, including both of the following: (A) Plans to prepare for, and to restore service after, a wildfire, including workforce mobilization and prepositioning equipment and employees (B) Plans for community outreach and public awareness before, during, and after a wildfire, including language notification in English, Spanish, and the top three primary languages used in the state other than English or Spanish, as determined by the Commission based on the United States Census data.	Section 8.4 p.255 and 8.5 p.300

Public Utilities Code section 8386	Description	WMP Section/Page
(c)(19)	A description of how the WMP is consistent with the electrical corporation's disaster and emergency preparedness plan prepared pursuant to Public Utilities Code section 768.6, including plans to restore service and community outreach	Sections 8.4 p.255 and 8.5 p.300
(c)(20)	Protocols for compliance with requirements adopted by the Commission regarding activities to support customers during and after a wildfire, outage reporting, support for low-income customers, billing adjustments, deposit waivers, extended payment plans, suspension of disconnection and nonpayment fees, repair processing and timing, access to utility representatives, and emergency communications.	Section 8.4.6 p.298
(c)(21)	A description of the processes and procedures the electrical corporation will use to do all of the following: (A) Monitor and audit the implementation of the plan (B) Identify any deficiencies in the plan or the plan's implementation and correct those deficiencies (C) Monitor and audit the effectiveness of electrical line and equipment inspections, including inspections performed by contractors, carried out under the plan and other applicable statutes and commission rules.	Sections 7.1.2 p.105 and 8.1.6 p.170
(c)(22)	Any other information that the Wildfire Safety Division may require.	Multiple sections of the WMP

4 OVERVIEW OF WMP

4.1 PRIMARY GOAL

Each electrical corporation must state the primary goal of its WMP. At a minimum, the electrical corporation must affirm its compliance with California Public Utilities Code section 8386(a):

"Each electrical corporation shall construct, maintain, and operate its electrical lines and equipment in a manner that will minimize the risk of catastrophic wildfire posed by those electrical lines and equipment."

Pacific Power's WMP describes the current and planned investments and strategies leveraged to construct, maintain, and operate its electrical lines and equipment in a manner that will minimize the risk of catastrophic wildfire posed by those electrical lines and equipment. In doing so, the WMP is guided by the following core principles:

- Frequency of ignition events related to electric facilities can be reduced by engineering more resilient systems that experience fewer fault events.
- When a fault event does occur, the impact of the event can be minimized using equipment and personnel to shorten the duration to isolate the fault event.
- Systems that facilitate situational awareness and operational readiness are central to mitigating fire risk and its impacts.

Pacific Power's WMP also seeks to consider the impact on California customers and communities in the overall imperative to provide safe, reliable, and affordable services.

4.2 PLAN OBJECTIVES

This section summarizes plan objectives over the 2023-2025 WMP cycle. Plan objectives are determined by the portfolio of mitigation initiatives proposed in the WMP.

The following table includes a summary Pacific Power's 2023-2025 WMP objectives.

Table 4-1 Summary of Plan Objectives

Initiative Category	Objectives
Risk Methodology and Assessment	• Complete implementation of WRRM and ignition risk assessment in 2023. • Complete PSPS risk assessment in 2024. • Continue refinement of RSE calculation methodology and calculate RSE for grid hardening initiatives
Grid Design, Operations, and Maintenance	• Continue execution of grid hardening plans. • Continue planned inspection programs, including Infra-red (IR) inspections on transmission lines. • Begin implementation of the IR inspection on distribution lines. • Continue to deploy EFR (Elevated Fire Risk) settings.
Vegetation Management	• Continue progressing programs (annual patrols, routine cycle work and annual pole clearing). • Implement Enhanced Overhang Reduction pilot project.
Situational Awareness and Forecasting	• Complete implementation of FPI (Fire Potential Index). • Deployment of Wildfire Detection Network (wildfire detection cameras and smoke sensors) • Evaluate DFA (Distribution Fault Anticipators) • Expand weather station network.
Emergency Preparedness	• Continued use of tabletop exercises to prepare for emergencies and PSPS events. • Incorporate feedback and industry best practices into emergency management practices. • Implement improvements to Public Safety Partner Portal (PSP Portal)
Community Outreach and Engagement	• Enhance customer outreach based on survey feedback and industry best practices. • Implement customer feedback from post season wildfire mitigation surveys into future outreach efforts. • Increase outreach to AFN populations
PSPS	• Evaluate expansion of the free portable battery and backup electric power rebate programs.

4.3 PROPOSED EXPENDITURES

In this section, its projected expenditures in thousands of U.S. dollars per year for the next three-year WMP cycle, as well as the planned and actual expenditures from the previous three-year WMP cycle (e.g., 2020–2022), in both tabular and graph form.

Table 4-2 below summarizes planned spend as reported in Table 12 for the 2020-2022 WMP cycle. The planned spend for the 2023-2025 cycle is reported as indicated in the new data guidelines issued by OEIS for financial reporting on Table 11.

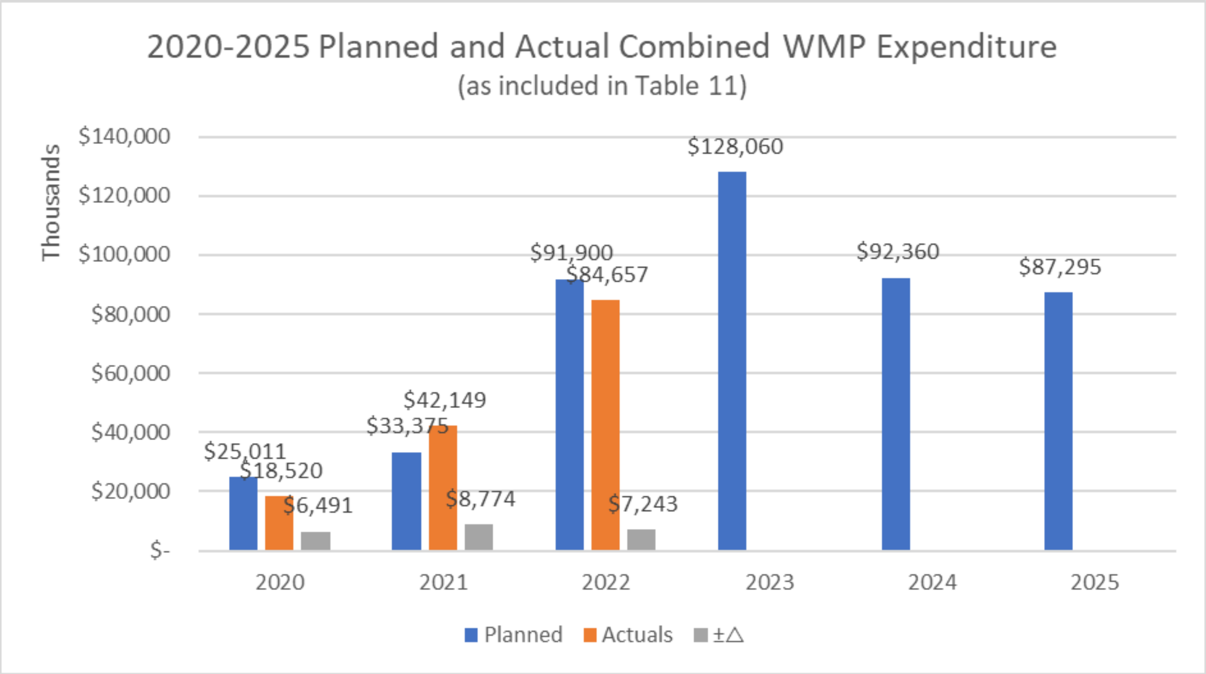


Table 4-2 Summary of WMP Expenditures

Year	Spend (thousand $USD)
2020	Planned (as reported in the 2022 WMP Update) = $25,011 Actual = $18,520 ±△ = $6,491
2021	Planned (as reported in the 2022 WMP Update) = $33,375 Actual = $42,149 ±△ = $ ($8,774)
2022	Planned (as reported in the 2022 WMP Update) = $91,900 Actual = 84,657 ±△ = 7,243
2023	Planned = 128,060
2024	Planned = 92,360
2025	Planned = 87,295

4.4 RISK-INFORMED FRAMEWORK

The electrical corporation must adopt a risk-informed approach to developing its WMP. The purposes of adopting this approach are as follows:

The risk-informed approach adopted by the electrical corporation must, at a minimum, incorporate several key components, described below. In addition, the evaluation and management of risk must include consideration of a broad range of performance objectives (e.g., life safety, property protection, reduction of social vulnerability, reliability, resiliency, affordability, health, environmental protection, public perception, etc.), integrate cross-disciplinary expertise, and engage various stakeholder groups as part of the decision-making process.

Table 4-3 provides a summary of Pacific Power's risk-informed approach to developing its WMP in accordance with the WMP guidelines issued by OEIS on December 6, 2022. Each component of the risk-informed approach is discussed in more detail in subsequent sections.

Table 4-3 Risk-Informed Approach Components

Risk-Informed Approach Component	Brief Description
1. Goals and Objectives	Goals and objectives of Pacific Power's WMP are described in Sections 4.1 and 4.2.
2. Scope of Application (i.e., electrical corporation service territory)	The physical characteristics of Pacific Power's system in terms of major elements including service territory, infrastructure, environment, and various assets-at-risk are described in Section 5.
3. Hazard Identification	Hazard identification and likelihoods are included in Section 0.
4. Risk Scenario Identification	Section 6.3 provides an overview of the scenarios Pacific Power is using in its risk analysis following the implementation of WRRM.
5. Risk Analysis (i.e., likelihood and consequences)	On Sections 6.2.1 and 6.2.2, Pacific Power identifies the components of its overall utility risk framework and describes how the Company how is developing the risk calculation.
6. Risk Presentation	Section 6.4 describes how calculated risk is presented to stakeholders.
7. Risk Evaluation	Section 7.1.1 describes Pacific Power's future baseline risk analysis framework that will consist of four main components: (1) the HFRA Map, (2) the WRRM project selection and planning tool, (3) a risk reduction evaluation and prioritization tool, and (4) advanced analytics and effectiveness evaluation.
8. Risk Mitigation and Management	As explained in Section 6.1, Pacific Power is deploying new tools to estimate risk and will evolve its process to identify and prioritize mitigations to leverage these new developments. Details about the evolution of the Mitigation Selection and Prioritization High Level Process is provided in Section 7.1.4

Figure 4-1 summarizes how the components above are used by Pacific Power to develop the WMP.

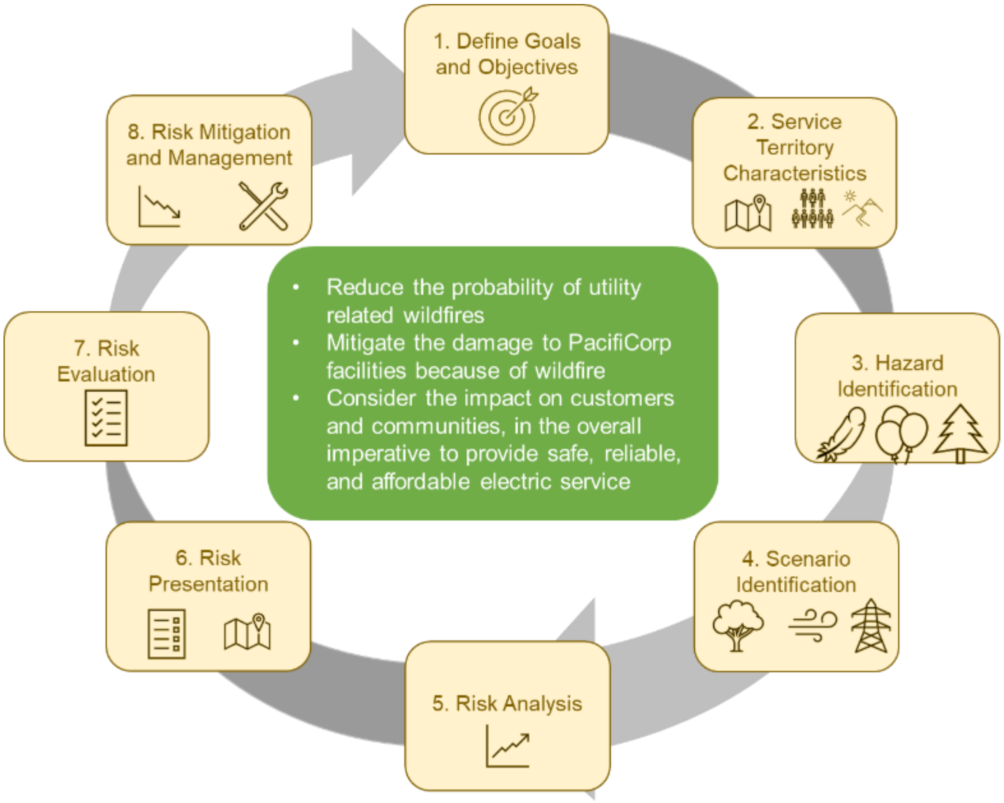


Figure 4-1 Risk Informed Approach Components

5 OVERVIEW OF THE SERVICE TERRITORY

In this section of the WMP, the electrical corporation must provide a high-level overview of its service territory and key characteristics of its electrical infrastructure. This information is intended to provide the reader with an understanding of the physical and technical scope of the electrical corporation's WMP.

5.1 SERVICE TERRITORY

The electrical corporation must provide a high-level description of its service territory, addressing the following components:

- Area served (in square miles)
- Number of customers served

The electrical corporation must provide a geospatial map that shows its service territory (polygons) and distribution of customers served (raster or polygons). This map should appear in the main body of the report.

Pacific Power provides electricity to approximately 47,000 customers via 63 substations, 3,250 overhead transmission and distribution line miles, and 631 underground line miles across nearly 11,000 square miles in northern California. See Table and Figure below.

Table 5-1 Service Territory High-Level Statistics

Characteristic	Description
Area served (sq.mi.)	11,292
Number of customers served	47,333
Number of counties and cities served	4 counties, 42 cities
Overhead circuit miles	3,250
Underground circuit miles	631

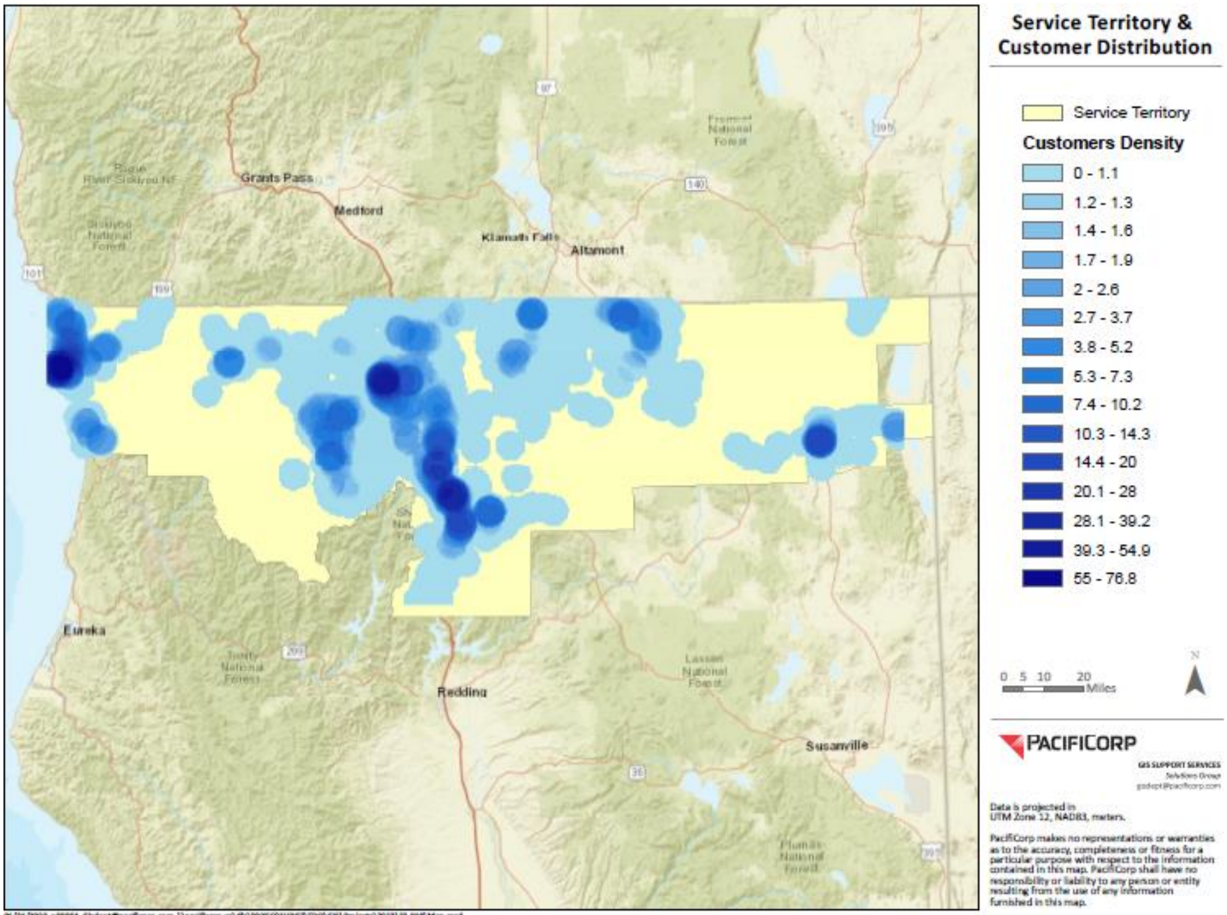


Figure 5-1 Service Territory and Customer Distribution

5.2 ELECTRICAL INFRASTRUCTURE

> The electrical corporation must provide a high-level description of its infrastructure including all power generation facilities, transmission lines and associated equipment, distribution lines and associated equipment, substations, and any other major equipment.

Approximately one third of Pacific Power's 3,250 overhead line-miles in California are located within the HFTD; of that approximately 2% percent are located within Tier 3, an area generally deemed to be "Extreme Fire Threat." Similarly, approximately half of Pacific Power's California substations are located within the HFTD, two of which are located within Tier 3. See table below.

Table 5-2 Overview of Key Electrical Equipment

Type of Equipment	HFTD	Non-HFTD	Total
Substations (#)	32	31	63
Power generation facilities (#)	3	1	4
Overhead transmission lines (circuit miles)	344	386	730
Overhead distribution lines (circuit miles)	814	1,706	2,520
Hardened overhead distribution and transmission lines (circuit miles)	32	31	63
Underground transmission and distribution lines (circuit miles)	399	232	631
Distribution transformers (#)	6,998	12,606	21,502
Reclosers (#)	35	47	82
Poles (#)	20,370	39,448	59,818
Transmission towers (#)	2,321	2,995	5,316
Microgrids (#)	N/A	N/A	N/A

5.3 ENVIRONMENTAL SETTINGS

The electrical corporation must provide a high-level overview of the wildfire environmental settings within its service territory.

5.3.1 Fire Ecology

The electrical corporation must provide a brief narrative describing the fire ecology or ecologies across its service territory. This includes a brief description of how ecological features, such as the following, influence the propensity of the electrical corporation's service territory to experience wildfires: generalized climate and weather conditions, ecological regions and associated vegetation types, and fire return intervals.

The electrical corporation must provide tabulated statistics of the vegetative coverage across its service territory. The tabulated data must include a breakdown of the vegetation types, total acres per type, and percentage of service territory per type. The electrical corporation must identify the vegetative database used to characterize the vegetation (e.g., CALVEG). Table 5-3 provide an example of the minimum level of content and detail required.

The Pacific Power service territory in California is characterized by a diverse and rugged topography, spanning across portions of four counties at the northernmost part of the state.

These counties include Del Norte, Siskiyou, and Modoc, which run along the state line with Oregon from west to east. Additionally, Pacific Power operates in Shasta County, just south of Siskiyou County, along the Sacramento River, extending as far south as the community of Delta, which lies just north of Lake Shasta. The terrain between Crescent City and Yreka is marked by complex topography, with average precipitation decreasing rapidly from west to east. On the western end of this region, there are rain forests, while arid valleys dominate the landscape from Yreka and Interstate 5 eastward. In recent years, the region has experienced more frequent and intense wildfires, which have been linked to a combination of climate change, fire suppression, and changes in land use.

Fire Weather Patterns

Critical fire weather patterns occur during the summer months, when high temperatures, low humidity, and dry lightning storms increase the risk of wildfire. The region's strong diurnal winds can also cause fires to spread quickly and unpredictably. In the late summer and early fall, vegetation tends to reach the most extreme dryness levels, and early season dry frontal systems can produce strong winds that lead to the most extreme fire weather conditions seen throughout the year.

Coastal

The Crescent City district resides within Del Norte County. The mountainous terrain associated with the Coast Range and the Klamath Mountains dominates Del Norte County's geography. A broad coastal plain can be found in the northwest portion of the county with the western edge of the Klamath Mountains as its easterly boundary. Rising abruptly from the coastal plain, the Klamath Mts extend north into Oregon.

The far northern coastal area of California contains the Northern California coastal forests as defined by the WWF (World Wildlife Fund, Inc) and the southern section of the Coast Range ecoregion as defined by the EPA (Environmental Protection Agency). This ecoregion is dominated by redwood forest, containing the tallest and some of the oldest trees in the world. The redwood forests thrive in a thin belt up to 35 miles (56 km) wide next to the coast, where the trees are kept moist by winter rains and summer fog.

Wildfire occurrence is rare along the coastal plain in far northern California. Marine layer fog frequently provides cool temperatures and high humidity during the summer months when inland areas are much warmer and drier. Brief dry offshore wind events during the late summer and early fall prior to the onset of the fall rainy season produce the highest fire risk.

Coast Range to the Cascade Range

The Klamath and Siskiyou Mountains are a notable biodiversity hotspot, containing one of the four most biodiverse temperate forests in the world. The diversity is caused by the ecoregion being adjacent to a number of other ecoregions, diverse soil, and having refugia caused by isolation in the last ice age. Some endemic species in the Klamath mountains are limited to only one mountain or valley. The Yreka district lies within Siskiyou County and northern Shasta County. The Shasta Valley in central Siskiyou County is more arid, open and wind-prone, while the remainder of the district, including the Sacramento Canyon in northern Shasta County, is more rugged and forested.

Inland northwestern California's fire ecology is influenced by its Mediterranean climate, with hot and dry summers and cool, wet winters, and its vegetation types, which include mixed conifer forests, oak woodlands, chaparral, and grasslands. These plant communities have adapted to frequent fires with some species having thick bark, resprouting capabilities, or seeds that require heat to germinate. The understory vegetation includes a variety of shrubs, herbs, and grasses, many of which also have fire-adapted traits, such as deep roots or fire-resistant seeds. Fire return intervals in this region vary, with mixed conifer forests having fire return intervals of approximately 10-30 years, while chaparral and grasslands may have return intervals of less than 10 years.

The Shasta Valley, located in the northern part of California, also have a unique fire ecology. The dominant vegetation in the Shasta Valley is a mix of grasslands, sagebrush, and juniper woodlands. These plant communities have adapted to the frequent fires that historically occurred in the region. The region's valleys are at lower elevations than those to the east of the Cascades. The climate is semi-arid with hot summers and relatively mild winters. The topography includes a mix of valleys and rolling hills, which can influence fire behavior.

East of the Cascades to the Great Basin

The Tulelake district sits within eastern Siskiyou and western Modoc Counties in large open and arid wind-swept valleys and nearby foothills of Mt Shasta. Eastern Siskiyou and western Modoc Counties are dominated by lava flows and the Medicine Lake Highlands. The Alturas district lies within Modoc County. The northern half of the county is the Modoc Plateau, a large expanse of lava flows, cinder cones, juniper flats, pine forests, and seasonal lakes, plus the alkaline Goose Lake. The eastern edge of the county is dominated by the Warner Mountains. The Surprise Valley sits to the east of the Warner Mts and includes Cedarville and the western edge of the Great Basin. Portions of the Alturas district can be found on both sides of the Warner Mts.

The dominant vegetation east of the Cascades in far northern California is a mix of sagebrush, juniper woodlands, and pine forests. These plant communities have adapted to the frequent fires that historically occurred in the region. The frequency and intensity of fires in Modoc County have been influenced by the region's arid climate, with hot summers and cold winters. The region has also been impacted by human activities, such as livestock grazing, mining, and logging, which can alter fuel loads and increase the risk of ignition. Fire return intervals are generally 10-30 years in forests and up to 10 years in grasslands and brush.

The table below describes the high-level fire ecology overview within Pacific Power's service territory that is incorporated into the company's risk assessment models.

Table 5-3 Existing Vegetation Types in the Service Territory

Vegetation Type	Acres[5]	Percentage of Service Territory*
Deciduous forest	44,037	0.9%
Evergreen forest	1,452,370	30.7%
Mixed forest	30,653	0.6%
Shrub/scrub	1,610,845	34.0%
Grassland	634,827	13.4%
Pasture	211,927	4.5%
Cultivated farmland	431,635	9.1%
Woody wetlands	7,791	0.2%
Herbaceous wetlands	66,355	1.4%
		*% do not total 100% due to exclusion of developed land and rounding

[5] Acres represented in Table 5-3 represent the vegetation types evaluated as part of Pacific Power's risk modeling efforts which may be less than the company's total service territory.

5.3.2 Catastrophic Wildfire History

The electrical corporation must provide a brief narrative summarizing its wildfire history for the past 20 years (2002-2022) as recorded by the electrical corporation, CAL FIRE, or another authoritative sources. For this section, wildfire history must be limited to electrical corporation ignited catastrophic fires (i.e., fires that caused at least one death, damaged over 500 structures, or burned over 5,000 acres). This includes catastrophic wildfire ignitions reported to the CPUC that may be attributable to facilities or equipment owned by the electrical corporation and where the cause of the ignition is still under investigation. Electrical corporations must clearly denote those ignitions as still under investigation. In addition, the electrical corporation must provide catastrophic wildfire statistics in tabular form, including the following key metrics:

- Ignition date
- Fire name
- Official cause (if known)
- Size (acres)
- Number of fatalities
- Number of structures damaged
- Estimated financial loss (U.S. dollars)

Table below provides an example of the content and level of detail required for the tabulated historical catastrophic utility-related wildfire statistics. The electrical corporation must provide an authoritative government source (e.g., CPUC, CAL FIRE, U.S. Forest Service, or local fire authority) for its reporting of wildfire history data and loss/damage estimates, to the extent this information is available.

Pacific Power tracks fire events that involve its infrastructure consistent with regulatory requirements. To meet the request for information and fulfill this WMP requirement, wildfires that meet the definition of "catastrophic" as provided by the Office of Energy Safety are included in the narrative and Table 5-4 below. The narrative and table below were populated based on the catastrophic wildfire events experienced in Pacific Power's service territory as captured and recorded by CAL Fire:

The **Slater Fire** ignited on September 7, 2020, and burned 157,220 acres, causing two fatalities and damaging or destroying 451 structures. The official cause is under investigation.

The **McKinney Fire** ignited on July 29, 2022, and burned 60,138 acres, causing four fatalities and damaging or destroying 196 structures. The official cause is under investigation.

Table 5-4 Catastrophic Wildfires Within Pacific Power's Service Territory in California

Ignition Date	Fire Name	Fire Size (acres)	# of Fatalities	# of Structures Destroyed and Damaged	Financial Loss (US$)	Official Cause (if known)
09/07/2020	Slater Fire[6,7]	157,220	2	451	Data not available	Under Investigation
07/29/2022	McKinney Fire[8,9]	60,138	4	196	Data not available	Under Investigation

The electrical corporation must also provide a map or set of maps illustrating the catastrophic wildfires. One representative map must appear in the main body of the WMP, with supplemental or detailed maps provided in Appendix C as needed. The maps must include the following:

- Fire perimeters
- Legend and text labeling each fire perimeter
- County lines

[6] "Slater/Devil Fires". InciWeb. 8 September 2020.

[7] "Microsoft Word - 2020.11.6 Slater and Devil Fires Update.docx" (PDF). InciWeb. 8 September 2020.

[8] "McKinney Fire Incident Report". www.fire.ca.gov.

[9] "McKinney Fire Information – InciWeb the Incident Information System". inciweb.nwcg.gov.

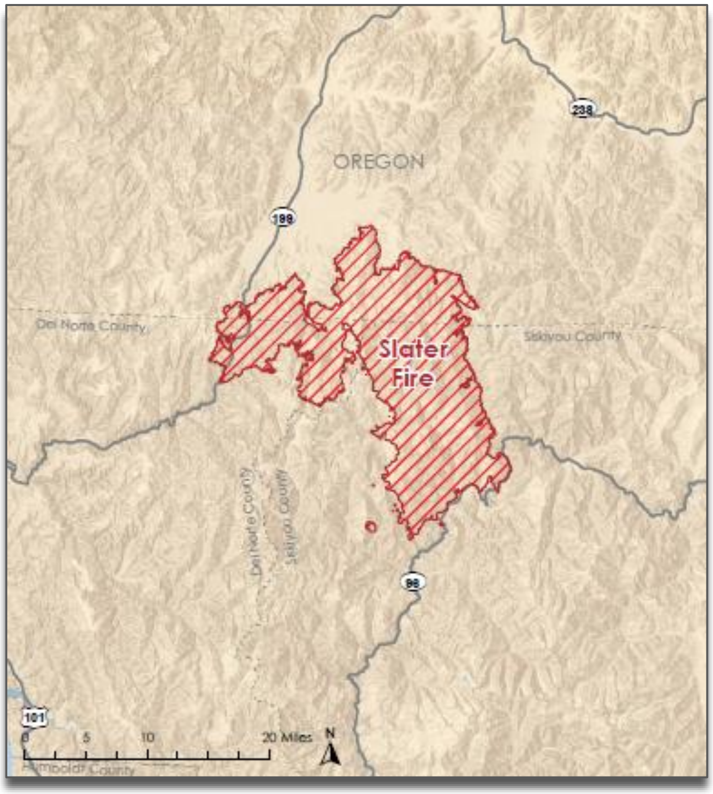


Figure 5-2 Slater Fire Map[10]

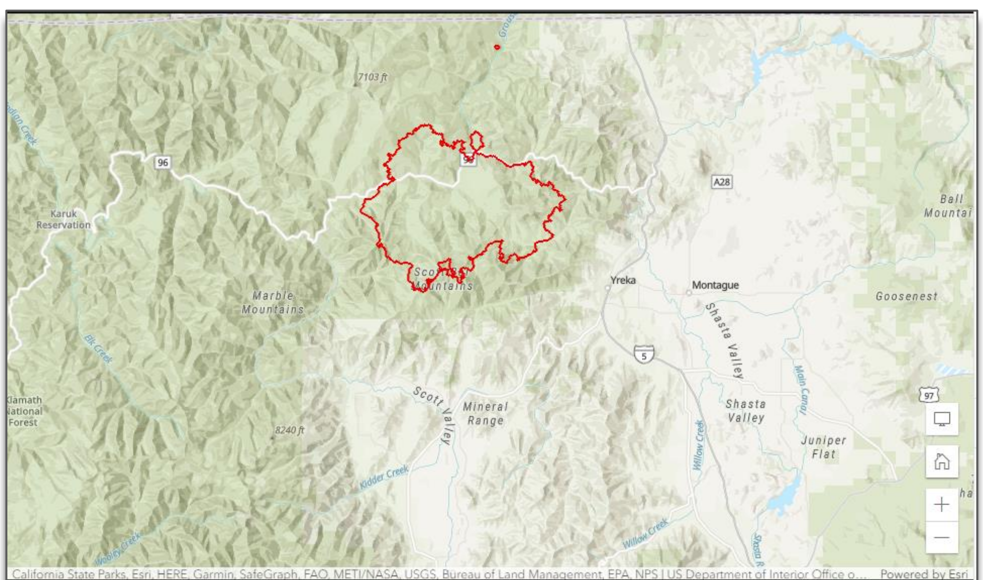


Figure 5-3 McKinney Fire Map[11]

[10]See 2020 Fire Siege - https://www.fire.ca.gov/media/hsviuuv3/cal-fire-2020-fire-siege.pdf
[11]See https://www.arcgis.com/apps/mapviewer/index.html?webmap=9031a581dc2340c6a3d2c24ccf47f45d

5.3.3 High Fire Threat Districts

The electrical corporation must provide a brief narrative identifying the CPUC-defined HFTD across its territory. The electrical corporation must also provide a map of its service territory overlaid with the HFTD. The map must be accompanied by tabulated statistics on the CPUC-defined HFTD including the following minimum information:

- Total area of the electrical corporation's service territory in the HFTD (sq. mi.)
- The electrical corporation's service territory in the HFTD as a percentage of its total service territory (%)

For the HFTD map, the HFTD layer(s) (raster or polygon) must cover the electrical corporation's service territory and the HFTD layer must match the latest boundaries as published by the CPUC. Table 55 provides an example of the content and level of detail required.

The figures and table below depict Pacific Power's service territory overlaid with the HFTD that reflect areas of elevated wildfire risk as designated by Office of Energy Infrastructure Safety and CAL FIRE.

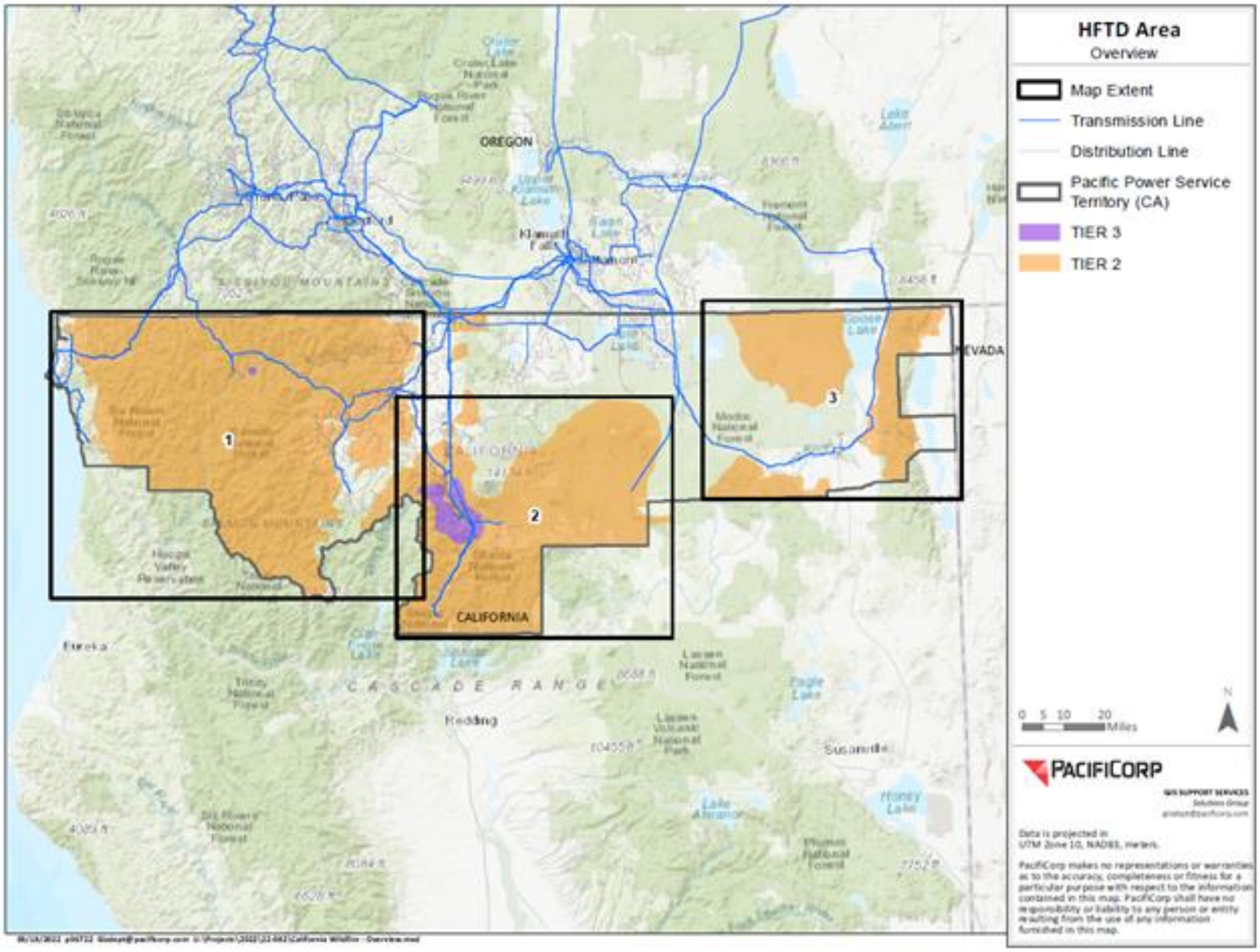


Figure 5-4 HFTD Area Overview

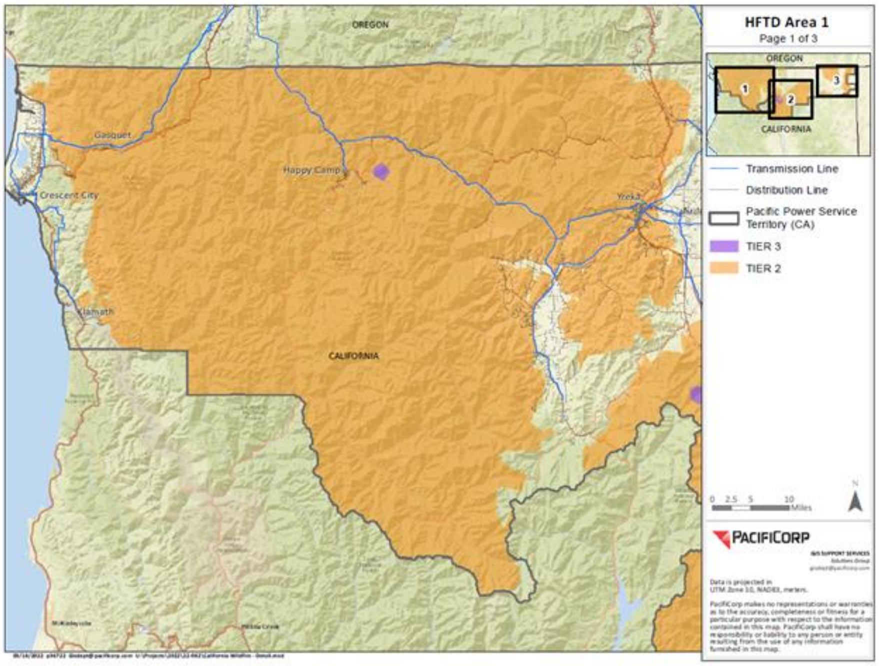


Figure 5-5 HFTD Area 1

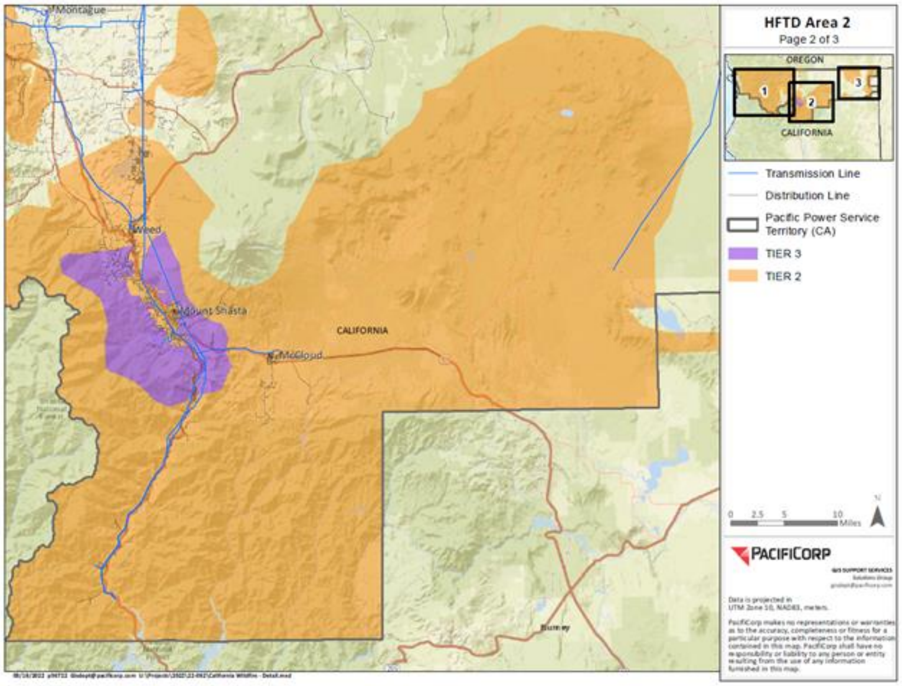


Figure 5-6 HFTD Area 2

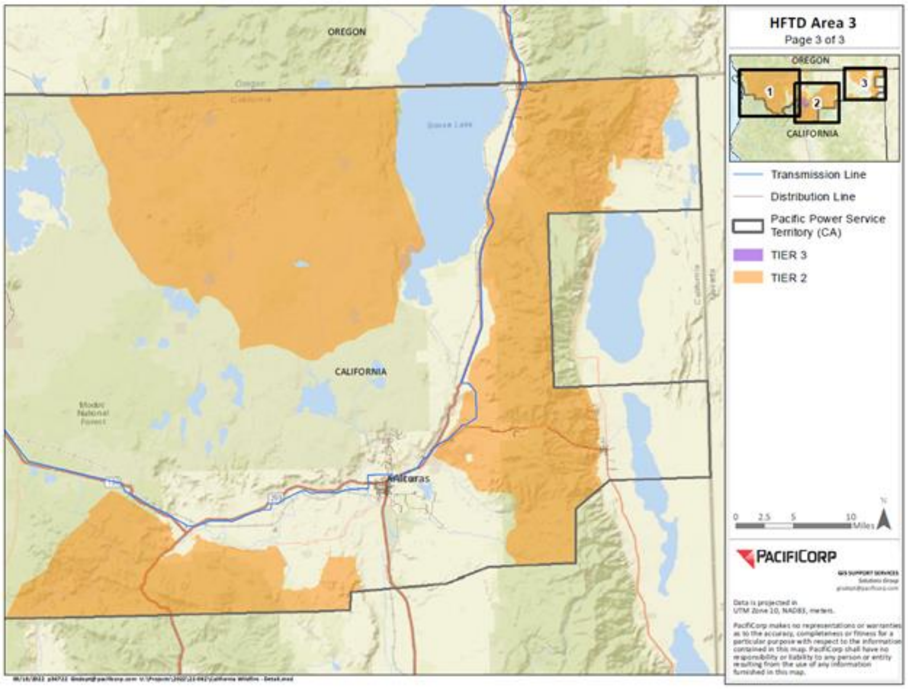


Figure 5-7 HFTD Area 3

The following table includes Pacific Power's current baseline state of service territory in the HFD areas.

Table 5-5 Pacific Power's HFTD Statistics

High Fire Threat District	Total Area of Individual District (sq. mi.)	% of Total Service Territory
Non-HFTD	2,027	64%
Tier 2	1,086	34%
Tier 3	76	2%
Total =	3,189	100%

5.3.4 Climate Change

It is critical for the electrical corporation to understand general climate conditions and how climate change impacts the frequency and the intensity of extreme weather events and the vegetation that fuels fires.

5.3.4.1 General Climate Conditions

The electrical corporation must provide an overview of the general weather conditions and climate across its service territory in the past 30- to 40-year period. The narrative must include, at a minimum, the following:

- Average temperatures throughout the year
- Extreme temperatures that may occur and when and where they may occur
- Precipitation throughout the year

The electrical corporation must also provide a graph of the average precipitation and maximum and minimum temperatures for each distinct climatic region of its service territory. At a minimum, it must provide one graph in the main body of the report. Figure below provides an example of the climate/weather graph.

Pacific Power's service territory exists in two northern California climate regions: North Coast Region and the Sierra Nevada Region. The North Coast Region is in a temperate climate zone while the Sierra Nevada Region is in a continental climate zone[12].

Annual precipitation varies between the two climate regions. The area of the North Coast Region where Pacific Power infrastructure exists receives moderate to high annual precipitation with an average of 55.3 inches per year between 1991 and 2020. The area of the Sierra Nevada Region where Pacific Power infrastructure exists receives low precipitation with an average of 17.9 incher per year between 1991 and 2020. Both climate regions receive most of their annual precipitation between December and May, with July and August receiving the least precipitation.

Temperatures in the two climate regions feature similar annual trends. For the years 1991 to 2020, the coldest and warmest months in both regions are December and July, with average low and high temperatures in the North Coast Region and Sierra Nevada Regions being 29.30/83.38 °F and 21.36/84.01 °F, respectively. Figure 5-8 shows monthly average mean climatology for the North Coast Region between 1991 and 2020 and Figure 5-9 shows average mean climatology for the Sierra Nevada Region between 1991 and 2020.

[12] "What Are the Different Climate Types?" National Oceanic and Atmospheric Administration. https://scijinks.gov/climate-zones/. Accessed 7 February 2023

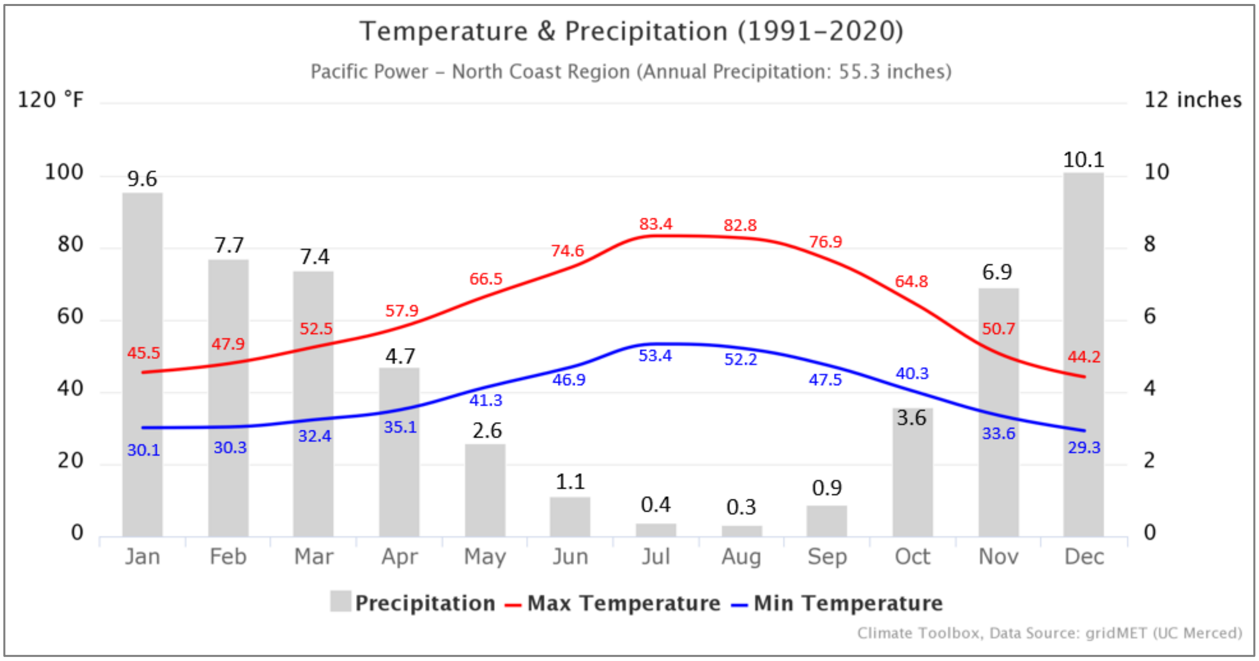


Figure 5-8 Annual Mean Climatology for the Pacific Power's service territory in the North Coast Region, 1991–2020

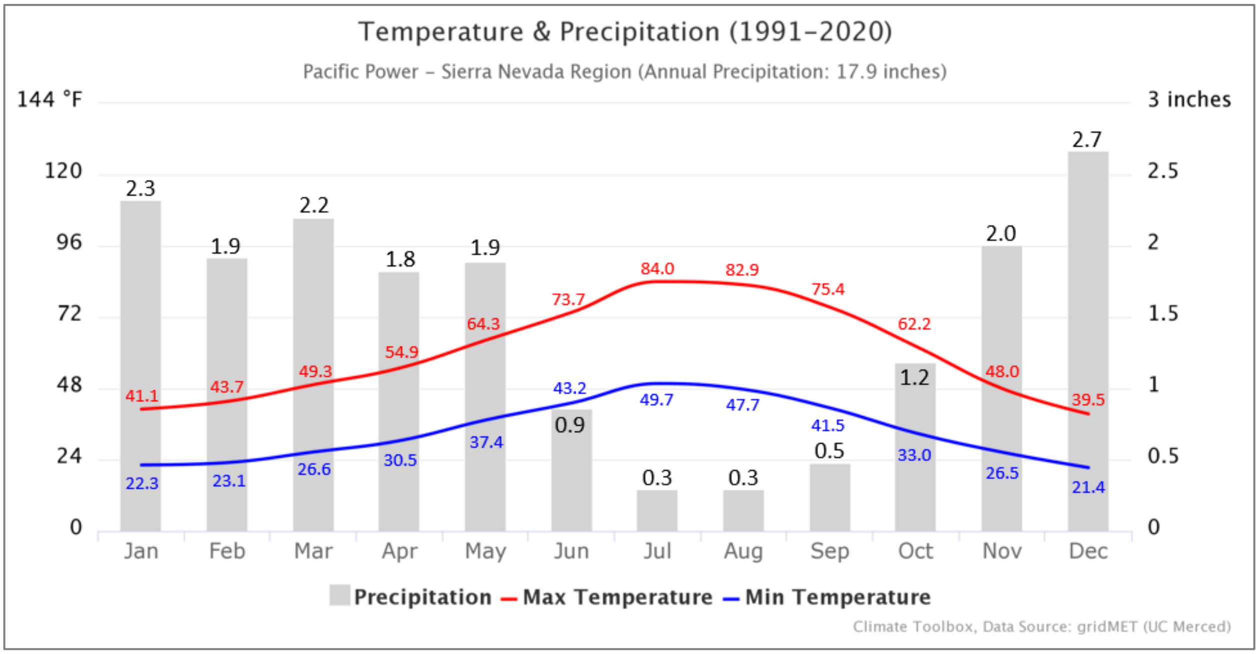


Figure 5-9 Annual Mean Climatology for the Pacific Power's service territory in the Sierra Nevada Region, 1990–2020s

The North Coast Region and the Sierra Nevada Region both feature similar extreme temperatures. The North Coast Region recorded low and high temperatures of -32 and 110 °F while the Sierra Nevada Region recorded low and high temperatures of -29 and 115 °F. Table below features extreme temperatures in both climate regions at representative weather stations from the National Weather Service's NOWData.

Table 5-6 Record temperatures from the National Weather Service's NOW Data for representative weather stations across Pacific Power's service territory in California

Sierra Nevada Region			
Data Location	**Record Low Temp**	**Record High Temp**	**Period of Record**
Alturas Municipal Airport	-27 °F (Dec. 2013)	107 °F (July 2002)	1998 - 2023
Canby 3 SW	-32 °F (Feb. 1989)	107 °F (July 2002)	1975 - 2023
Adin Ranger Station	-22 °F (Dec. 1972)	110 °F (July 1972)	1955 - 2023
Lava Beds National Monument	-18 °F (Dec. 1990)	103 °F (July 2003)	1959 - 2023

North Coast Region			
Data Location	**Record Low Temp**	**Record High Temp**	**Period of Record**
Mt. Hebron RS	-29 °F (Dec. 1990)	104 °F (Sep. 2003)	1947 - 2023
Mount Shasta	-13 °F (Dec. 1990)	102 °F (July 2007)	1988 - 2003
Dunsmuir Treatment Plant	4 °F (Dec. 1990)	109 °F (July 2022)	1978 - 2023
Yreka	-11 °F (Dec. 1972)	112 °F (July 1939)	1893 - 2023
Fort Jones RS	-2 °F (Dec. 1972)	115 °F (Aug. 1978)	1914 - 2023
Gasquet RS	27 °F (Dec. 2013)	92 °F (July 2013)	2011 - 2023
Crescent City 3 NNW	19 °F (Dec. 1990)	97 °F (Sep. 1939)	1894 - 2023

5.3.4.2 Climate Change Phenomena and Trends

The potential impacts of climate change on locations across the North Coast Region are all encompassing, with climate change influencing important atmospheric variables including temperature and precipitation. Changes within the temperature and precipitation variables can cause impacts to communities and natural resources for the North Coast Region. The following list discusses the major climate change risks for the region, per the North Coast Region Report from California's Fourth Climate Change Assessment[13]:

- Average annual maximum temperatures are likely to increase by 5-9 °F throughout the region through the end of the 21st century. Interior regions will experience the greatest degree of warming.

- Annual precipitation is not expected to change significantly but will likely be delivered in more intense storms and within a shorter wet season. As a result, the region is expected to experience prolonged dry seasons and reduced soil moisture conditions, even if annual precipitation stays the same or moderately increases. Less precipitation will fall as snow and total snowpack will be a small fraction of its historical average.

[13] North Coast region Report - North Coast Region Report (ca.gov)

- There is a higher likelihood of extreme wet years and extreme dry years (drought). An "average" rainfall year will become less common.
- A rise in extreme precipitation events will increase the frequency and extent of flooding in low-lying areas, particularly along the coast where food risk will be enhanced with rising sea levels.
- Streamflows in the dry season are expected to decline and peak flows in the winter are likely to increase.
- Sea-level rise projections differ along the coast but are greatest for the Humboldt Bay region and Eel River delta, threatening communities, prime agricultural land, critical infrastructure, and wildlife habitat.
- Wildfires will continue to be a major disturbance in the region. Future wildfire projections suggest a longer fire season, an increase in wildfire frequency, and an expansion of the area susceptible to fire.

The Figures below illustrate a historical time series of mean temperature for the North Coast Region. The time series spans a timeframe of 1900 to 2020, with the black line showing an 11-year running mean. The graphs do differ depending on what part of the North Coast Region the Pacific Power service area resides, but the common theme is that the running mean starts to increase in all three figures during the 1980s and more notable, rapidly increases around 2005.

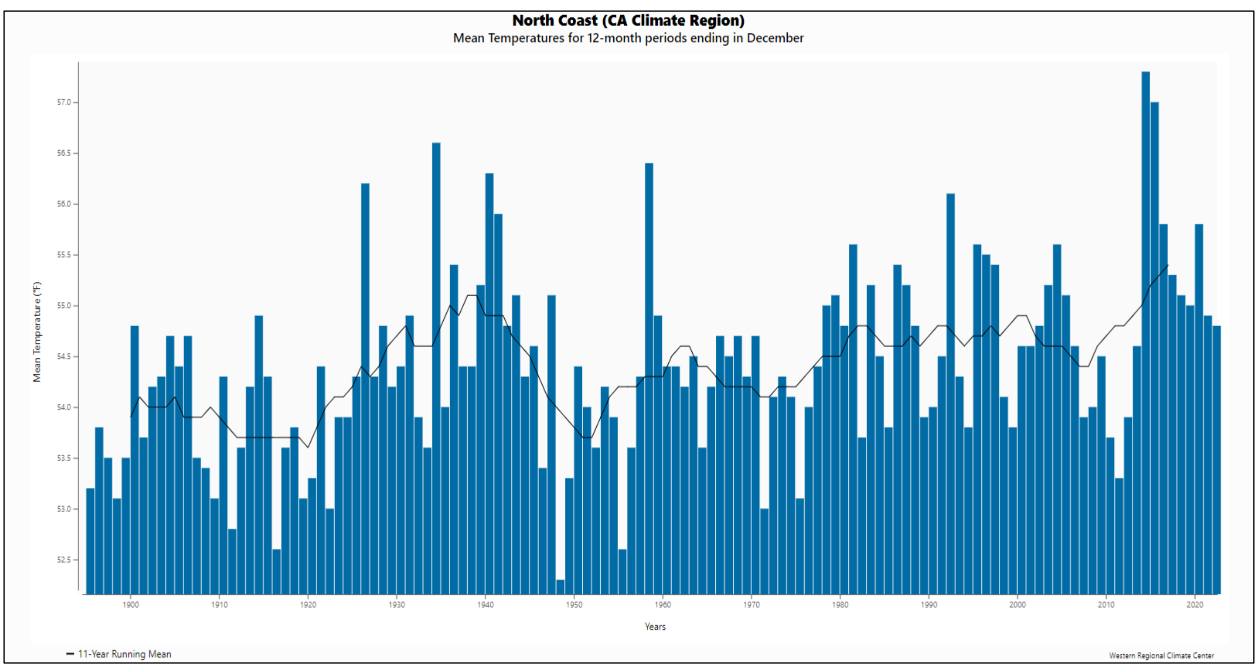


Figure 5-10 North Coast California Climate Region, Mean Temperature for 12-month period ending in December

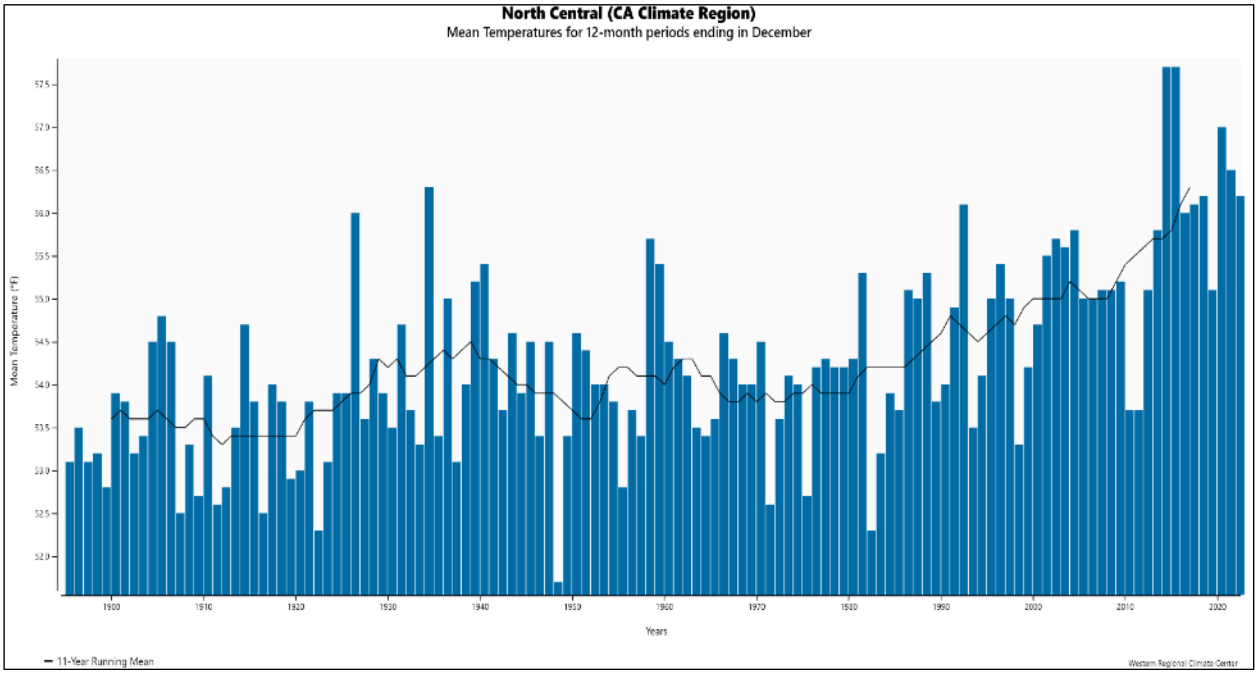


Figure 5-11 North Central California Climate Region, Mean Temperature for 12-month period ending in December

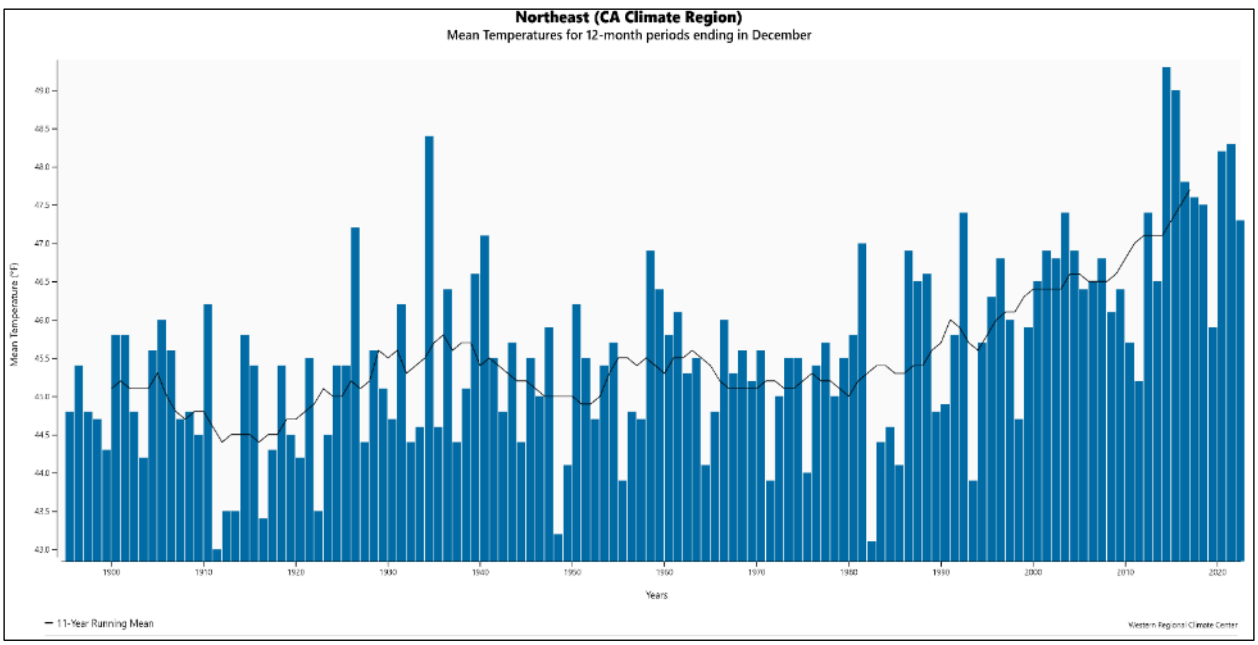


Figure 5-12 Northeast California Climate Region, Mean Temperature for 12-month period ending in December

Figure 5-13 through Figure 5-15 show a similar timeseries to the mean temperature plots above but are focused on precipitation over the same areas. Precipitation is highly variable from year to year, so the 11-year running mean is the most important data to focus on in the next series of images. For all parts of the North Coast Region, the 11-year mean after about the year 2000 shows a decrease in annual precipitation for all sections of the region.

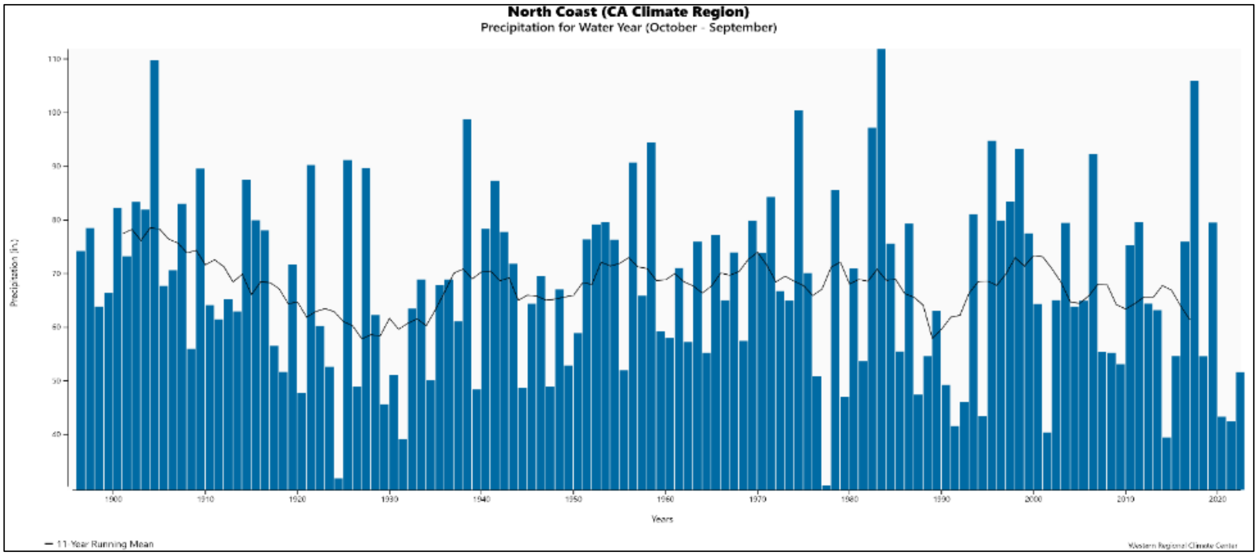


Figure 5-13 North Coast California Climate Region, Mean Temperature for 12-month period ending in December

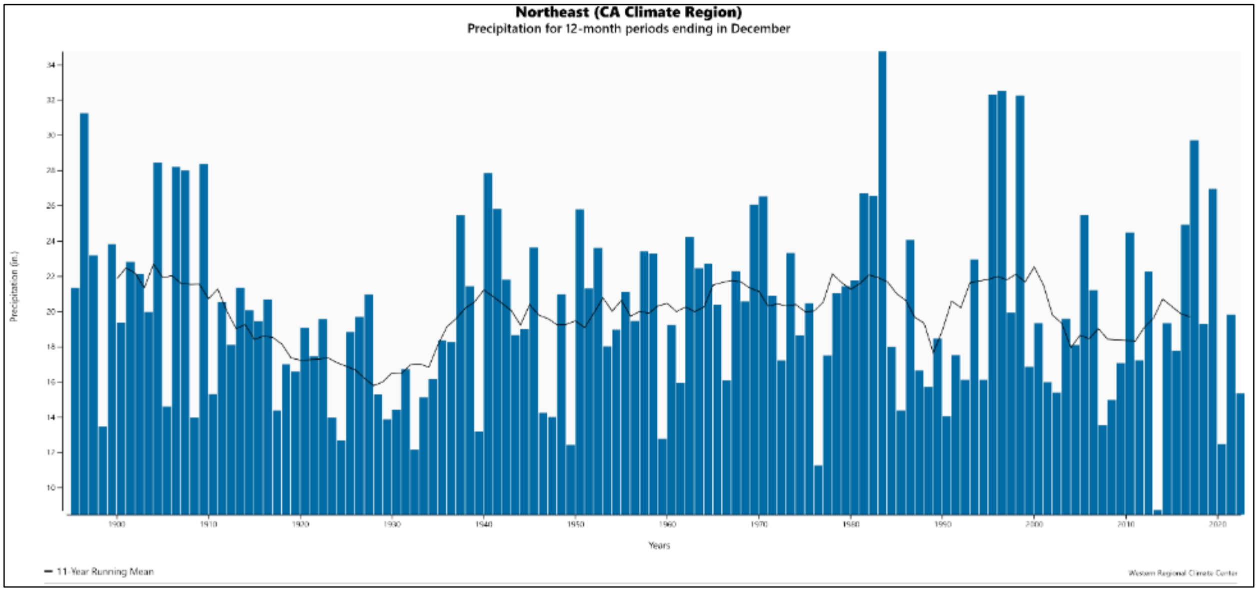


Figure 5-14 Northeast California Climate Region, Precipitation for 12-month period ending in December

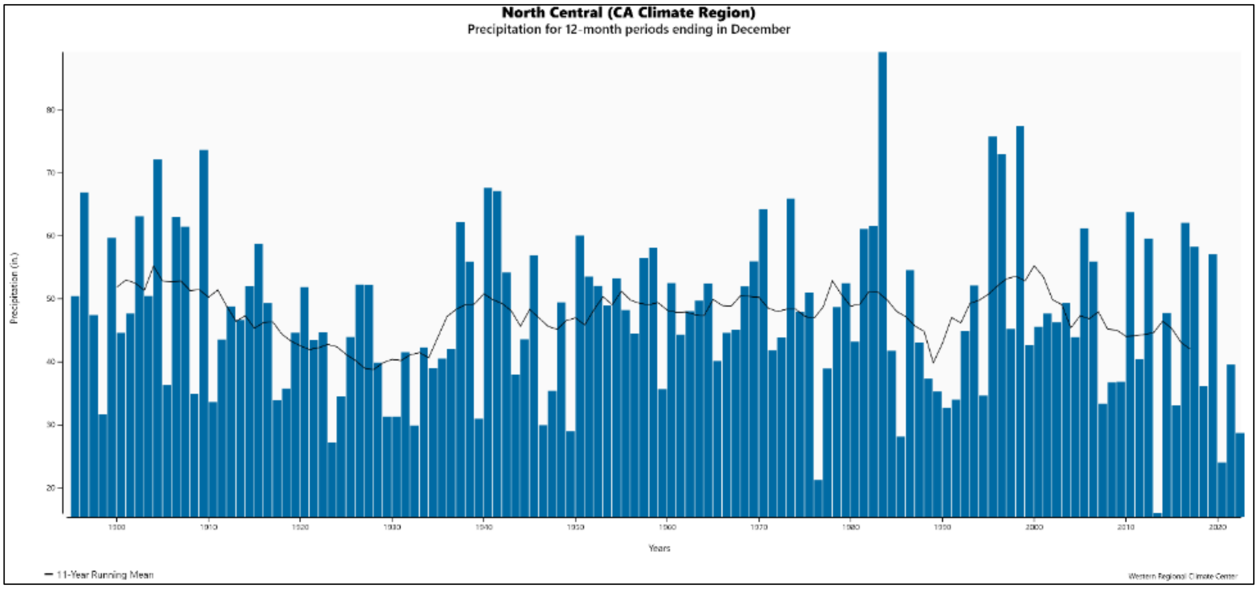
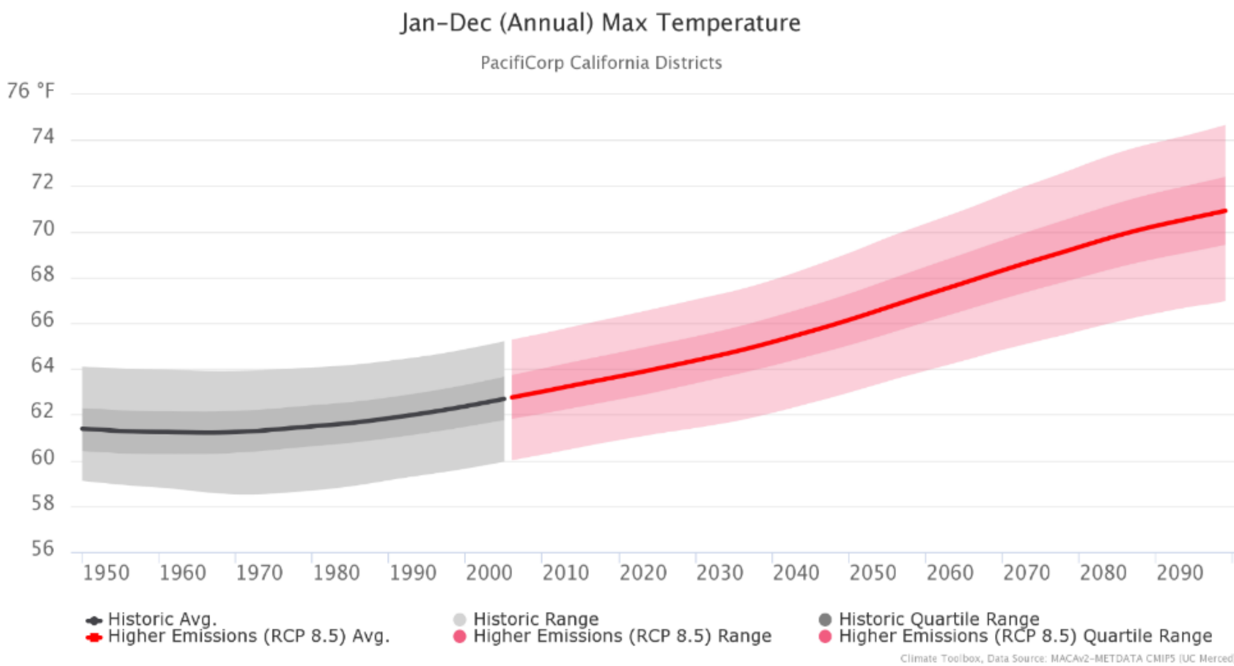


Figure 5-15 North Central California Climate Region, Precipitation for 12-month period ending in December

As was discussed previously, potential impacts in climate change can translate into a change of mean, maximum and minimum temperatures. Figure 5-16 shows annual maximum and minimum temperatures for Pacific Power California districts both historically and in the future. The curve in both maximum and minimum temperatures with the added variable of higher emissions shows the upper and lower ranges of possible temperatures through 2100.



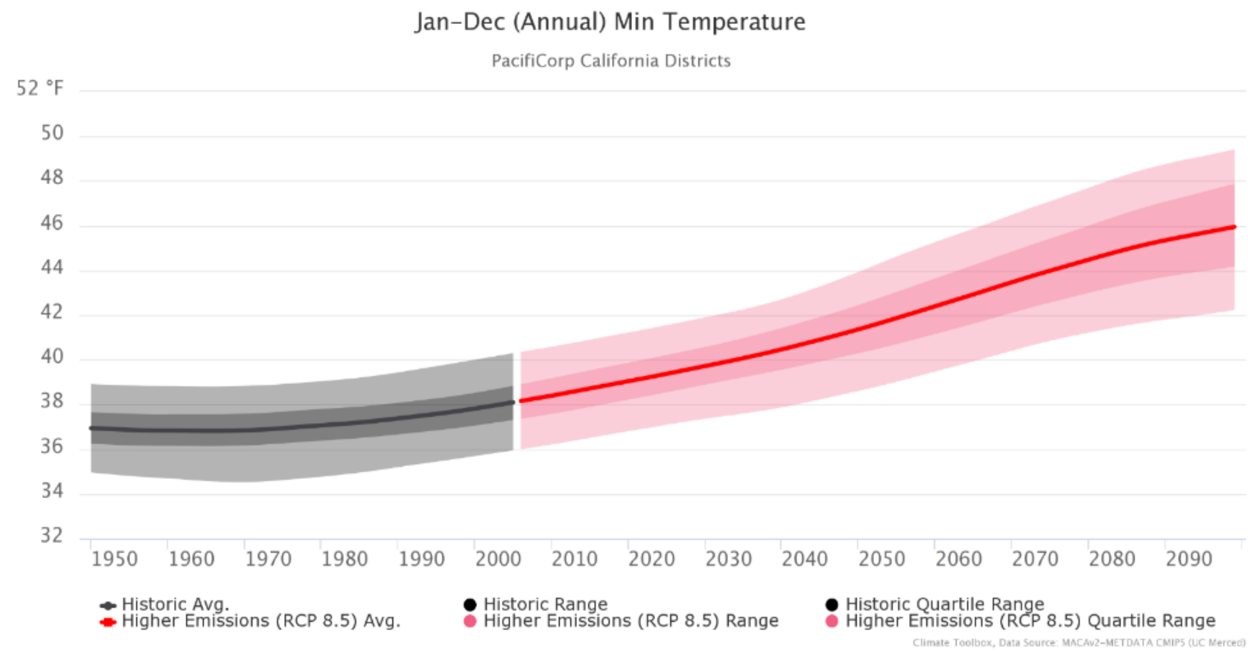


Figure 5-16 Projected Change in Maximum Temperature (Daytime Highs) and Minimum Temperature (Nighttime Lows) Through 2100 for the Service Territory

Changes in precipitation patterns, both location and amounts, in addition to increases in temperature will have direct effects on fuel moisture and extreme fire danger days in future years, both during the Winter/Spring period and more notably, the Summer/Fall periods. All of this data can be found at the Climate Toolbox, Data Source: gridMET & MACAv2-METDATA (University of Idaho).

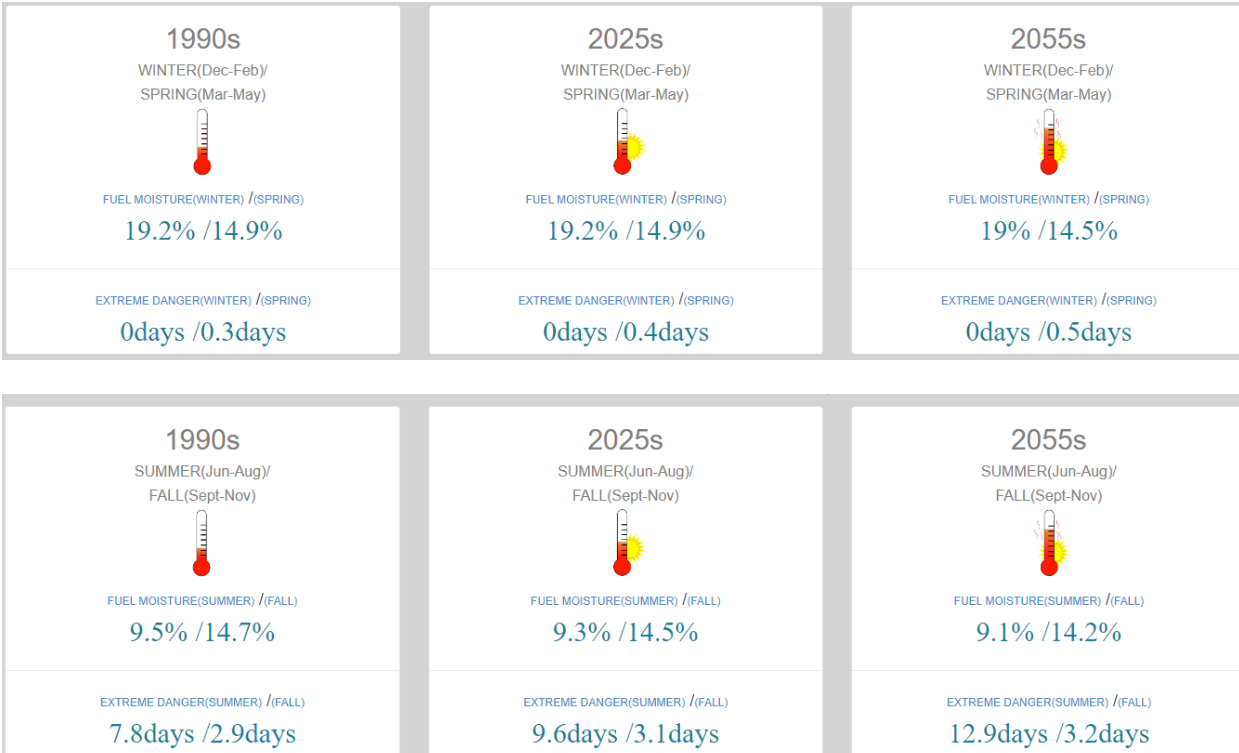


Figure 5-17 North Coast Central California Fire Danger Projections for Winter/Spring and Summer/Fall Periods

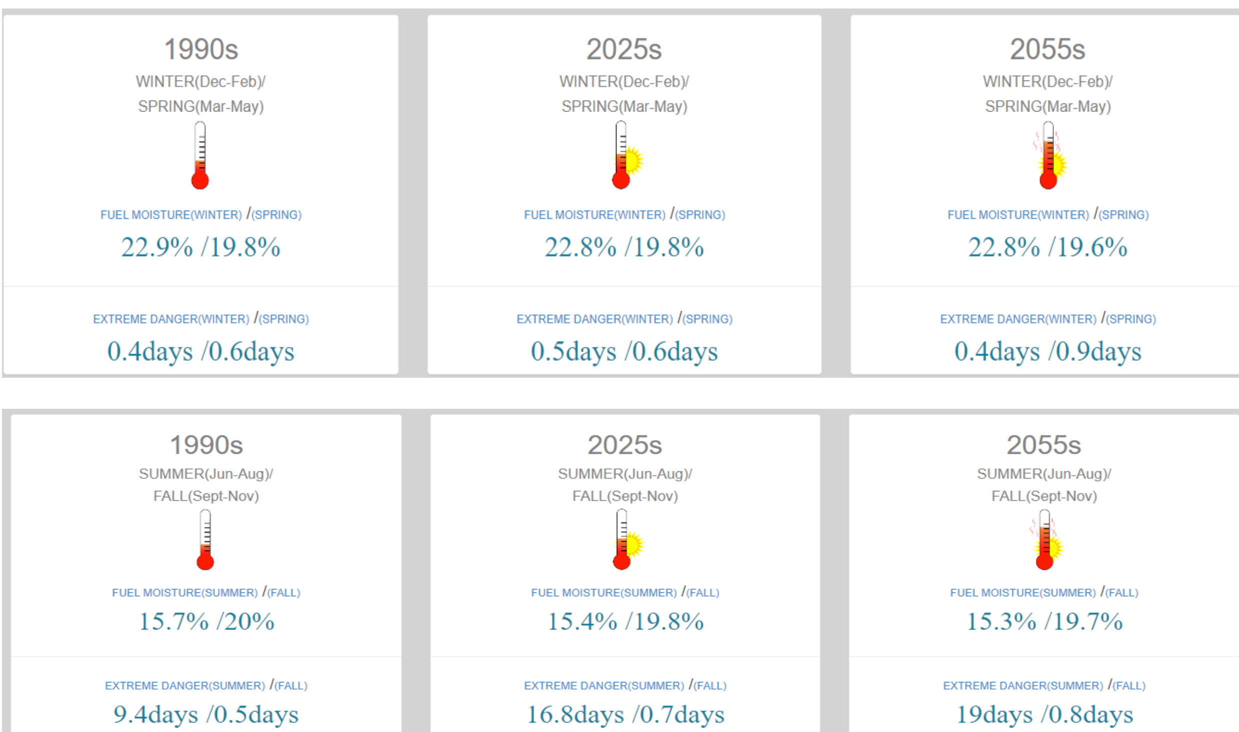


Figure 5-18 North Central California Fire Danger Projections for Winter/Spring and Summer/Fall Periods

5.3.5 Topography

The electrical corporation must provide an overview and brief description of the various topographic conditions across its service territory.

The topography of the Pacific Power service territory in California is diverse and rugged. The Pacific Power service territory within California occupies portions of four counties at the far northern end of the state. Those counties are Del Norte, Siskiyou, and Modoc along the state line with Oregon, from west to east. And just to the south of Siskiyou County Pacific Power operates along the Sacramento River in Shasta County as far south as the community of Delta, which is just to the north of Lake Shasta.

In the west the Crescent City district resides within Del Norte County. The mountainous terrain associated with the Coast Range and the Klamath Mountains dominates Del Norte County's geography. Elevation ranges from sea level to over 6,400 feet. A broad coastal plain can be found in the northwest portion of the county with the western edge of the Klamath Mountains as its easterly boundary. Rising abruptly from the coastal plain, the Klamath Mountains extend north into Oregon and are situated between the Cascade Range to the east and the Coast Range to the north.[14]

Average precipitation drops rapidly from west to east in the rugged complex terrain between Crescent City and Yreka, with rain forests on the western end and arid valleys on the eastern end. The Yreka district lies within Siskiyou County and northern Shasta County. The Shasta Valley in central Siskiyou County is more arid, open and wind-prone, while the remainder of the district, including the Sacramento Canyon in northern Shasta County, is more rugged and forested.

To the east the Tulelake district sits within eastern Siskiyou and western Modoc Counties in large open and arid wind-swept valleys and nearby foothills to the north and northeast of Mt Shasta. Eastern Siskiyou and western Modoc Counties are dominated by lava flows and the Medicine Lake Highlands, reaching over 5,000 ft in elevation.

The Alturas district lies within Modoc County. The northern half of the county is the Modoc Plateau, a 1-mile (1.6 km) high expanse of lava flows, cinder cones, juniper flats, pine forests, and seasonal lakes, plus the alkaline Goose Lake. Below the rim of the Plateau is the large Warm Springs Valley that forms the bottom of the Pit River watershed that runs through the county. The north fork and south fork of the Pit River come together just south of Alturas. The eastern edge of the county is dominated by the Warner Mountains. East of the Warner Range is Surprise Valley, which includes Cedarville, and the western edge of the Great Basin.[15] Portions of the Alturas district run along the western edge of the Warner

[14] Del Norte Fire Safe Plan (Retrieved October 28, 2011)

[15] Michael G. Barbour; William Dwight Billings (2000). North American Terrestrial Vegetation. Cambridge University Press. ISBN 978-0-521-55986-7. Retrieved September 27, 2013.

Mountains, on the eastern side in and near Cedarville, and along Hwy 299 on both sides of the range.

5.4 COMMUNITY VALUES AT RISK

In this section of the WMP, the electrical corporation must identify the community values at risk across its service territory.

5.4.1 Urban, Rural, and Highly Rural Customers

The electrical corporation must provide a brief narrative describing the distribution of urban, rural, and highly rural areas and customers across its service territory.

The company serves a sparse area generally not developed, much of which is federal, state or tribal lands. When calculated at the district level consistent with rule 21.2 in California General Order 95 to inform inspection cycles, the population density of Pacific Power's entire service territory is classified as rural.[16] However, when calculated at the more granular level to classify individual 1-mile x 1-mile grids as urban, rural, or highly rural,[17] Pacific Power's population density demonstrates some degree of variability. However, as shown in the table below, most Pacific Power's customers in each category (critical facilities, residential, commercial, AFN) are in either rural or highly rural areas. In the table below, AFN includes, as a subset, medical baseline customers.

Table. Pacific Power's Percentage Distribution of Urban, Rural, and Highly Rural Customers

Customers Category	Urban	Rural	Highly Rural
Critical facilities	14.75%	51.78%	33.47%
Residential	15.19%	61.30%	23.51%
Commercial	11.47%	58.90%	29.63%
AFN	14.47%	61.97%	23.56%

Table. Pacific Power's Distribution of Urban, Rural, and Highly Rural Customers

Customers Category	Urban	Rural	Highly Rural	Total
Critical Facilities	216	758	490	1,464
Residential	5,619	22,669	8,693	36,981
Commercial	922	4,735	2,382	8,039
AFN	113	484	184	781

[16] California General Order 95 defines rural as having a population density of less than 1,000 persons per square mile.
[17] This method of calculation was first used in Pacific Power's 2020 WMP and is consistent with WMP CFR 17.701.

5.4.2 Wildland-Urban Interfaces

The electrical corporation must provide a brief narrative describing the wildland-urban interfaces (WUIs) across its service territory.

The figure below depicts the current WUI overlaid with Pacific Power's service territory. As the name suggests, the WUI exists where structures or other human development meet or intermingle with undeveloped wildland or vegetation fuels, such as Weed, Yreka, or Crescent City. Based on experience and feedback from local stakeholders, Pacific Power is expecting limited growth in the WUI.

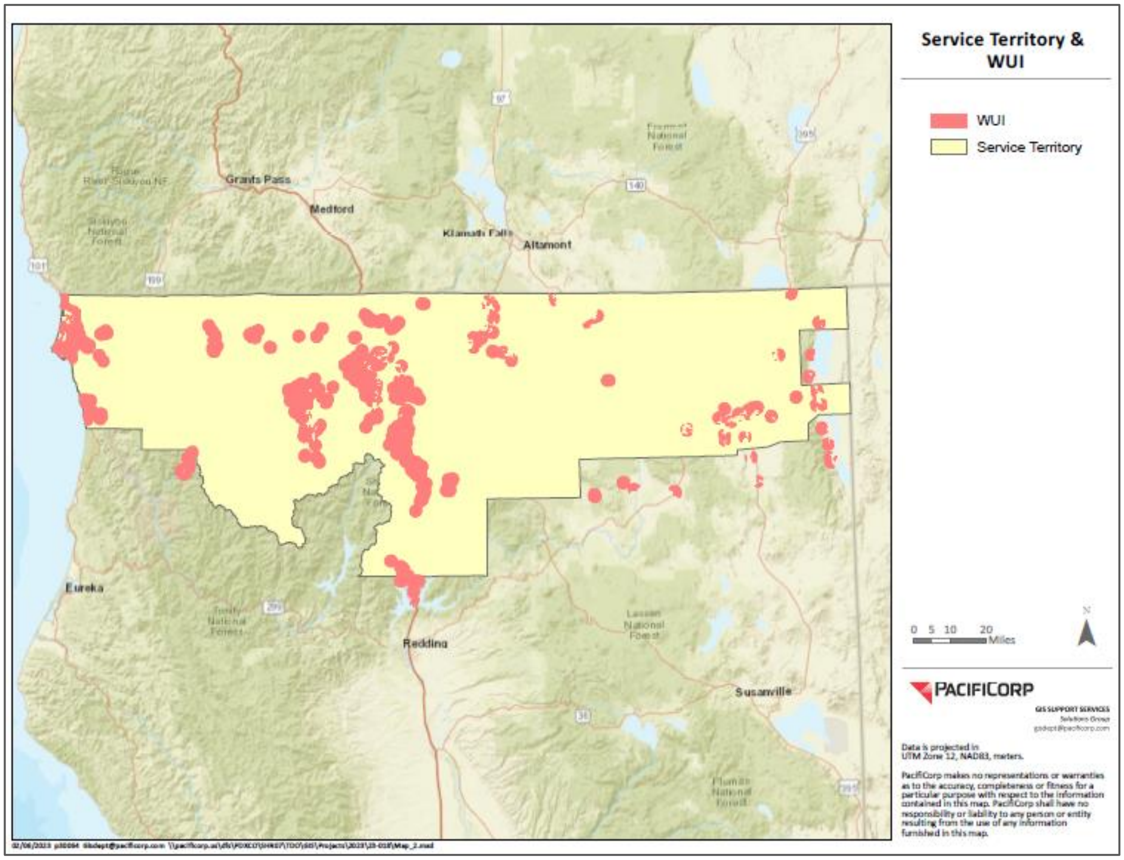


Figure 5-19 Pacific Power's Service Territory and WUI

5.4.2 Communities at Risk from Wildfires

In this section of the WMP, an electrical corporation must provide a high-level overview of communities at risk from wildfire as defined by the electrical corporation (e.g., within the HFTD and HFRA). This includes an overview of individuals at risk, AFN customers, social vulnerability, and communities vulnerable because of single access/egress conditions within its service territory.

5.4.2.1 Individuals at Risk from Wildfire

The electrical corporation must provide a brief narrative (one to two paragraphs) describing the total number of people and distribution of people at risk from wildfire across its service territory.

Pacific Power continues to seek improvements to identifying the electricity dependent customers with AFN through defining, mapping, and enabling self-identification, and has mapped their respective databases to flag customers as "AFN." From February 2022 to January 17, 2023, the number of customers who self-identified as AFN increased by 314, which represents a 67% increase in AFN customer identification over the year. The table below shows the distribution of AFN customers in the HFTD.

Table 5-7 Distribution of AFN customers in the HFTD

Category	Non-HTFD	Tier 2	Tier 3	Total
AFN Customers (%)	55.57%	43.28%	1,15%	100%
AFN Customers	434	338	9	781

5.4.2.2 Social Vulnerability and Exposure to Electrical Corporation Wildfire Risk

The electrical corporation must provide a brief narrative describing the intersection of social vulnerability and community exposure to electrical corporation wildfire risk across its service territory. This intersection is defined as census tracts that 1) exceed the 70th percentile according to the Social Vulnerability Index (SVI) or have a median household income of less than 80 percent of the state median, and 2) exceed the 85th percentile in wildfire consequence risk according to the electrical corporation's risk assessment(s).

For SVI, the electrical corporation must use the most up-to-date version of Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry's Social Vulnerability Index dataset (Year = 2018;8 Geography = California; Geography Type = Census Tracts).

In addition, the electrical corporation must provide a single geospatial map showing its service territory (polygon) overlaid with the distribution of the SVI and exposure intersection and urban and major roadways. Any additional maps needed to provide clarity and detail should be included in Appendix C.

Pacific Power is currently working on calculating its composite risk score and therefore cannot provide areas that exceed the 85th percentile at this time. The map below provides the social vulnerability index (SVI) along with Pacific Power's service territory and California's HFTD maps.

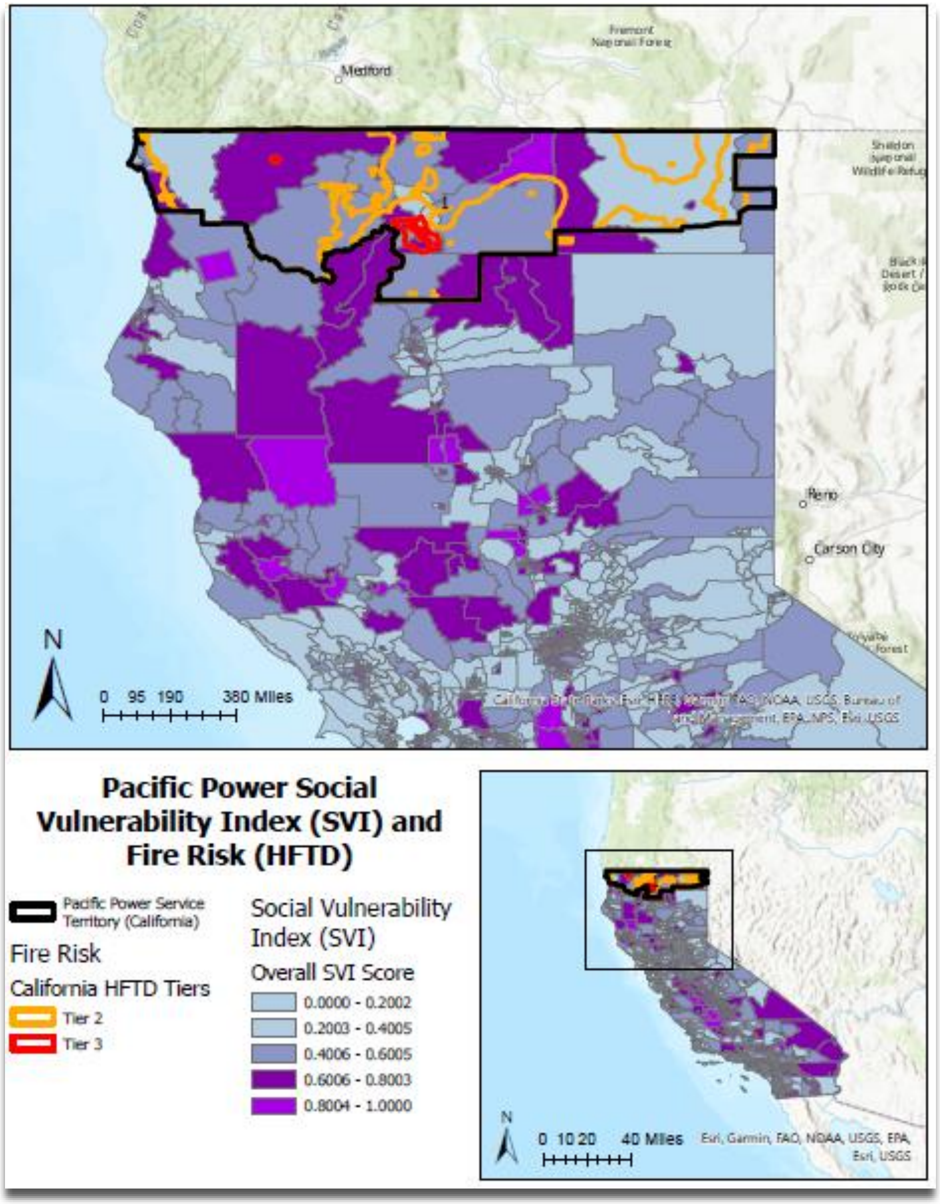


Figure 5-20 Social Vulnerability Index Map

5.4.2.3 Sub-Divisions with Limited Egress or No Secondary Egress

The electrical corporation must provide a brief narrative overview (one to two paragraphs) describing sub-divisions with limited egress or no secondary egress, per CAL FIRE data, across the electrical corporation's service territory.

In reviewing the Office of the State Fire Marshall (OFSM) subdivision review plan and surveys conducted pursuant to Assembly Bill 2911,[18] Pacific Power did not identify any completed surveys within the company's service territory. Pacific Power did identify 9 subdivisions that may be assessed at a future time. These are described in the table and image below.

Table 5-8 Subdivisions to be Evaluated as part of OFSM Subdivision Review Plan[19]

Subdivision Name	Responsibility Area	FHSZ	City	County
Pruett	SRA	Very High	Yreka	Siskiyou
North Fork	SRA	Very High	Gasquet	Del Norte
Mud Hen Village	SRA	Moderate	Crescent City	Del Norte
Vipond	SRA	Moderate	Crescent City	Del Norte
Parkview	SRA	Moderate	Crescent City	Del Norte
Sandman	SRA	Moderate	Crescent City	Del Norte
Church Tree	SRA	Moderate	Crescent City	Del Norte
Duncan	SRA	Moderate	Klamath	Del Norte
Bowman	SRA	High	Alturas	Modoc

Figure 5-21 Subdivisions to be Evaluated per OFSM Subdivision Review Plan

[18] Assembly Bill 2911 added Section 4209.5 to the Public Resources Code which tasks Board of Forestry and Fire Protection with surveying subdivisions within the State Responsibility Area (SRA) and Local Responsibility Area (SRA) Very High Fire Hazard Severity Zones without a secondary egress route that are at significant fir risk, and to provide recommendations based on those surveys.

[19] Information compiled from the Board of Forestry and Fire Protection Subdivision Review Map https://calfire-forestry.maps.arcgis.com/apps/webappviewer/index.html?id=a045e9e9c01c4dd7abdf14ad30646eaf

5.4.3 Critical Facilities and Infrastructure at Risk from Wildfire

The electrical corporation must provide a brief narrative describing the distribution of critical facilities and infrastructure located in the HFTD/HFRA across its service territory.

At this time approximately 3.6% of Pacific Power's California assets are designated in the HFTD.

Table 5-9 Distribution of Pacific Power's Assets in the HFTD

Category	Non-HTFD	Tier 2	Tier 3	Total
Critical facilities	915	498	51	1,464
Overhead distribution circuit miles	1,705	773	40	2,518
Overhead transmission circuit miles	386	321	23	730
Underground distribution circuit miles	232	344	55	631
Underground transmission circuit miles	0	0	0	0

5.4.4 Environmental Compliance and Permitting

In this section, the electrical corporation must provide a summary of how it ensures its compliance with applicable environmental laws, regulations, and permitting related to the implementation of its WMP.

In conjunction with externally contracted resources, Pacific Power's Environmental Department implements a robust process to ensure environmental compliance throughout the project from design through construction, which includes the following components.

- **Desktop Environmental Constraints Review.** The environmental compliance process starts early while the project is still in the design phase with a desktop environmental constraints review. Multiple resource databases, aerial imagery, previous survey data, and other available relevant data sources are reviewed to identify environmental constraints that may require permitting, agency review and approval, and/or specific design features to avoid impacts to resources.

- **Resource Surveys.** Pacific Power uses the findings from the desktop environmental constraints analysis to identify necessary resource field surveys. Qualified resource specialists (cultural, biological, wetland, etc.) coordinate with agencies as necessary and conduct field surveys to assess any presence of and potential impacts to sensitive resources. The findings from the field studies are then compiled into reports that will be submitted to various agency specialists for review. If sensitive resources are identified, Pacific Power coordinates with design to modify the design if possible, to avoid or mitigate impacts.

- **Coordination with Design.** Once environmental constraints are reviewed and resource surveys conducted, the Pacific Power works with the design engineers to determine if adjustments can be made to avoid potential impacts or permitting needs. This step also includes access route field verification to identify access route improvements, if any, and properly account for in the environmental constraints review. Regularly scheduled coordination meetings between design, environmental, and construction representatives are conducted to ensure frequent, consistent, and effective communication between all groups to identify and resolve issues to maintain environmental compliance.

- **Identify and Obtain Required Permits and Approvals.** In some instances, permit applications and approvals are required by various local, state, and federal agencies. Approvals are also necessary from land management agencies when working on public land. For example, wetlands that cannot be avoided may require coordination and permitting with the CA water resources board, CA Department of Fish and Wildlife, and potentially the US Army Corp of Engineers. US Fish and Wildlife Service and CA Department of Fish and Wildlife will be consulted if project activities have the potential to impact species listed as threatened and endangered. The presence of cultural and heritage resources will require coordination with the CA SHPO (State Historic Preservation Officer), Tribal THPO (Tribal Historic Preservation Officer) or Consulting Party Tribes to obtain permits and approvals. Pacific Power reaches out to agencies early in the process to understand agency requirements and expectations, and to provide the agency lead with sufficient time to plan. Construction in locations where permits are required is not scheduled to begin without permission from the appropriate regulatory agency or agencies.

- **Construction Conditions Memorandums**. Construction conditions memos are created as an environmental assurance plan for the crews (internal or contracted) to maintain awareness of any sensitive resources within the project and identify applicable permit conditions. The memos include measures (e.g., cultural and biological monitors, sediment and storm water controls, avoidance areas etc.) to avoid and/or mitigate impacts to any sensitive resources in the project area and comply with any permit conditions.

- **Environmental Field Observation.** As part of the beginning-to-end environmental compliance procedures, periodic field observations will be conducted by environmental specialists to ensure construction is taking place in accordance with the construction conditions memos and overall good housekeeping practices. Additionally, the environmental specialists will assess the effectiveness of environmental control measures. This process helps to improve resource protection measures in future wildfire hardening projects as lessons learned.

Roadblocks

Pacific Power has encountered various roadblocks related to environmental laws, regulations, and permitting. Below are examples along with actions Pacific Power has or is in the process of taking to address the roadblocks.

Unclear Regulations: Environmental regulations where application and approval criteria are unclear or vary based on the interpretations of the agency representative. For example, different regions of the same agency may have different interpretations of a regulation or require a different level of documentation, causing denials or delays of discretionary permits when applying for the same permits in different regions.

> ***Action(s) Taken:*** *Pacific Power is working to develop and strengthen relationships with agencies to improve communications and better understand their needs and expectations. Additionally, Pacific Power engages with agencies early in the design process to educate agencies on the work that is being conducted and allow for early identification of potential regulatory requirements.*

Agency Staffing Shortages. Staffing shortages often result in long lead times for review and approval of projects and associated permits. A significant portion of Pacific Power's territory crosses public land requiring approval from the land management agency prior to proceeding with the work.

> ***Action(s) Taken:*** *Pacific Power performs comprehensive environmental reviews before submitting projects to agencies for approval to lessen the workload on agency staff. If potential resource concerns are identified during desktop review, Pacific Power typically performs proactive surveys to collect as much information as possible to supplement the applications and facilitate quicker/less time-intensive reviews by agencies.*

Long Agency Processing Times. Administrative and regulatory processes often have long timeframes to obtain resource permits, right-of-entry permits, permit amendments, notices to proceed, and other discretionary agency actions. Staffing shortages at many public agencies, can further exacerbate the issue.

> ***Action(s) Taken****: Pacific Power is in the process of developing Operations & Maintenance (O&M) plans with the four National Forests in the Pacific Power territory in California. The O&M Plans include agreed upon review timeframes for the Forests, based on level of project complexity. This facilitates quicker and more predictable turnaround times from the Forest.*

Lack of Recent Resource Data. Field surveys are often required for Pacific Power projects due to the amount of service territory that crosses public land and lack of current resource data in many areas. Cultural surveys, in particular, are often required where recent survey data doesn't exist. Obtaining a survey permit, performing the survey, preparing the report, obtaining approval of the report, and incorporating the findings into the overall project can at times take a year or longer.

> ***Action(s) Taken:*** *During the summer of 2023, Pacific Power will be performing proactive cultural resource surveys to mitigate some need for project-specific cultural resource surveys where possible and decrease the timeline for approval for projects.*

Planned Improvements

The O&M Plan with the Klamath National Forest is complete, pending final signatures. Pacific Power and the Klamath National Forest have begun implementing some of the procedures in the O&M Plan, including an annual meeting to discuss upcoming work. These procedures are being implemented to improve communication and decrease the Forest's review time for wildfire mitigation project activity. In 2023, Pacific Power is also working with the remaining three California National Forests within the service territory to develop similar O&M Plans.

Over the past year, Pacific Power has improved the construction memorandums by providing specific environmental requirements by structure location and adding clear maps of avoidance areas to minimize any potential for confusion in the field. Pacific Power also implemented the environmental field observations as a way to monitor environmental compliance and identify and rectify any identified issues.

Table 5-10 Relevant State and Federal Environmental Laws, Regulations, and Permitting Requirements for Implementing the WMP

Environmental Law, Regulation, or Permit	Responsible Permittee/Agency
National Forest Special Use Permit	US National Forest
National Forest Notice to Proceed	US National Forest
National Park Service Special Use Permit	US National Park Service
Nationwide Permit 57	US Army Corps of Engineers
Section 404 Wetland Permit	US Army Corps of Engineers
Finding of No Hazard	Federal Aviation Administration
California Environmental Quality Act	Various Lead Agencies
Encroachment Permit	California Department of Transportation
Right of Entry Permit	California Department of Parks and Recreation
Section 401 Water Quality Certification	California Water Resources Board

6 RISK METHODOLOGY AND ASSESSMENT

In this section of the WMP, the electrical corporation must provide an overview of its risk methodology, key input data and assumptions, risk analysis, and risk presentation (i.e., the results of its assessment). This information is intended to provide the reader with a technical understanding of the foundation for the electrical corporation's wildfire mitigation strategy for its Base WMP. Sections 6.1–6.7 below provide detailed instructions.

For the 2023-2025 Base WMP, the electrical corporation does not need to have performed each calculation and analysis indicated in sections 6.2, 6.3, and 6.6. If the electrical corporation is not performing a certain calculation or analysis, it must describe why it does not perform the calculation or analysis, its current alternative to the calculation or analysis (if applicable), and any plans to incorporate those calculations or analyses into its risk methodology and assessment.

6.1 METHODOLOGY

In this section, the electrical corporation must present an overview of its risk calculation approach. This includes one or more graphics showing the calculation process, a concise narrative explaining key elements of the approach, and definitions of different risks and risk components.

6.1.1 Overview

The electrical corporation must provide a brief narrative describing its methodology for quantifying its overall utility risk of wildfires and PSPS.

Pacific Power's risk evaluation models, processes, and tools employ the concept that risk is generally a combination of likelihood and consequence. The likelihood, or probability, of an event is an estimate of a particular event occurring within a given timeframe. The consequence of an event is generally expressed in terms of potential impacts to customers, public safety partners, communities, and utility facilities when an event occurs.

Different than situational awareness tools and models which evaluate weather driven types of risk in the short term and inform operational protocols and decision making as described in Sections 8.3.6 and 8.1.8, Pacific Power's overall risk methodology and assessment evaluates risk more broadly over longer-term planning horizons to inform strategies and programs that may be deployed over many years.

Pacific Power's risk methodology considers topography, vegetation-based fuels data, climatology, demographics, historic fire weather days, live and dead fuel moisture estimates, and the presence of structures and evaluates the potential impact in terms of harm to people and damage to property to identify the geographic areas in Pacific Power's service territory at the greatest risk of wildfire should an ignition occur.

The purpose of Pacific Power's risk methodology is to:

- Understand the overall utility risk and associated risk components of wildfires spatially and temporally across Pacific Power's service territory;
- Use this understanding of risk to inform the development of a comprehensive wildfire mitigation strategy as discussed in Section 7 that achieves the goals and objectives stated in Section 4; and
- Use a common suite of tools and analysis to inform situational awareness as discussed in Section 8.3 and assess overall utility risk to inform long term investment as discussed in this section.

Pacific Power's risk assessment models are evolving to include a quantified and more granular approach to determine the utility's overall risk and potential consequence of both wildfire and PSPS. Prior to 2023, Pacific Power leveraged a combination of California's HFTD map and the company's internal Localized Risk Assessment Model (LRAM) to qualitatively evaluate relative risk and develop programs and inform strategies. Through collaboration and sharing of best practices with other utilities and leading companies in the industry, Pacific Power is currently on the path toward operation of a fully quantified risk model by the end of 2024. This enterprise-supported repeatable solution will allow the utility to:

- Assess the level of risk associated with the asset in a specific location, including the probability of an ignition from a utility asset and the impacts of an ignition on an asset's location.
- Understand the consequence of an ignition to a location based on the built environment and community demographics.
- Evaluate the likelihood of a PSPS in a location.
- Determine the vulnerability of a location of a PSPS and the exposure because of a PSPS to economic, social, or physical consequences; and
- Calculate a utility risk that is the result of this analysis to identify the high-risk locations.

To enable Pacific Power's evolution to a quantified risk assessment model, in 2023 the Company initiated implementation of the Wildfire Risk Reduction Module (WRRM), a commercially available module in the software suite from Technosylva Inc. more commonly known as Wildfire Analyst™ (WFA-E). WRRM's wildfire modeling and risk analysis calculates metrics, including the probability of an ignition from a utility asset given certain conditions, potential spread of a wildfire, and the consequences of a fire including potential acres burned, population impacted, number of buildings threatened, and estimated number of buildings destroyed. These are derived using an eight-hour simulation duration based on a typical first burning period. The probability of an ignition and the consequence are combined to create locational composite risk values to support prioritization for decision making for asset hardening and related mitigations as discussed in Section 7. The calculation of ignition risk using WRRM model will be completed by the end of 2023.

In response to the new WMP guidelines published on December 6, 2022, Pacific Power is also planning to develop a PSPS risk assessment solution to quantify PSPS probability and consequence as an additional input to the overall utility risk model. Until this solution is implemented in Q1 of 2024, Pacific Power will continue to use the PSPS layer in the company's LRAM to qualitatively assess community impacts. This layer, which has traditionally helped Pacific Power prioritize PSPS related mitigation efforts, includes a factor called Downstream Customer Counts (DCC). In determining PSPS impacts, this factor considers:

- The total number of customers impacted;
- The number/type of critical facilities, including an assessment of backup generation capabilities;
- The number/type of AFN customers, including an assessment of backup generation capabilities; and
- The economic impact to commercial customers.

Figure 6-1 shows the timeline for implementation of PSPS risk assessment solution

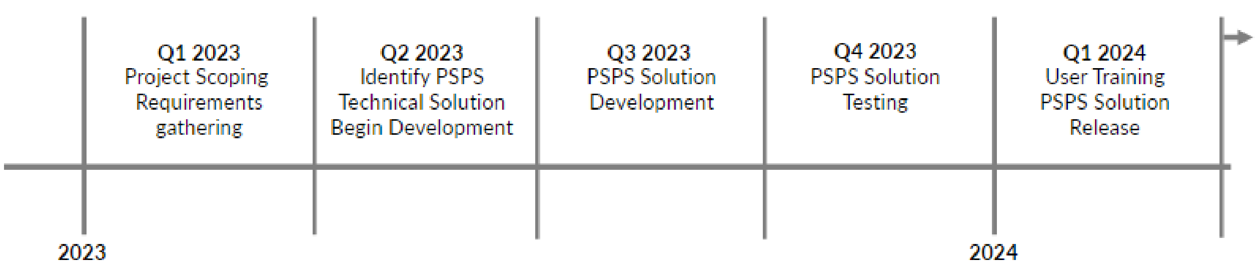


Figure 6-1 Timeline for implementation of PSPS risk assessment solution

Once implemented, the PSPS risk assessment solution will include a quantified risk assessment score and be incorporated into Pacific Power's overall utility risk score as seen in Figure 6-2 below.

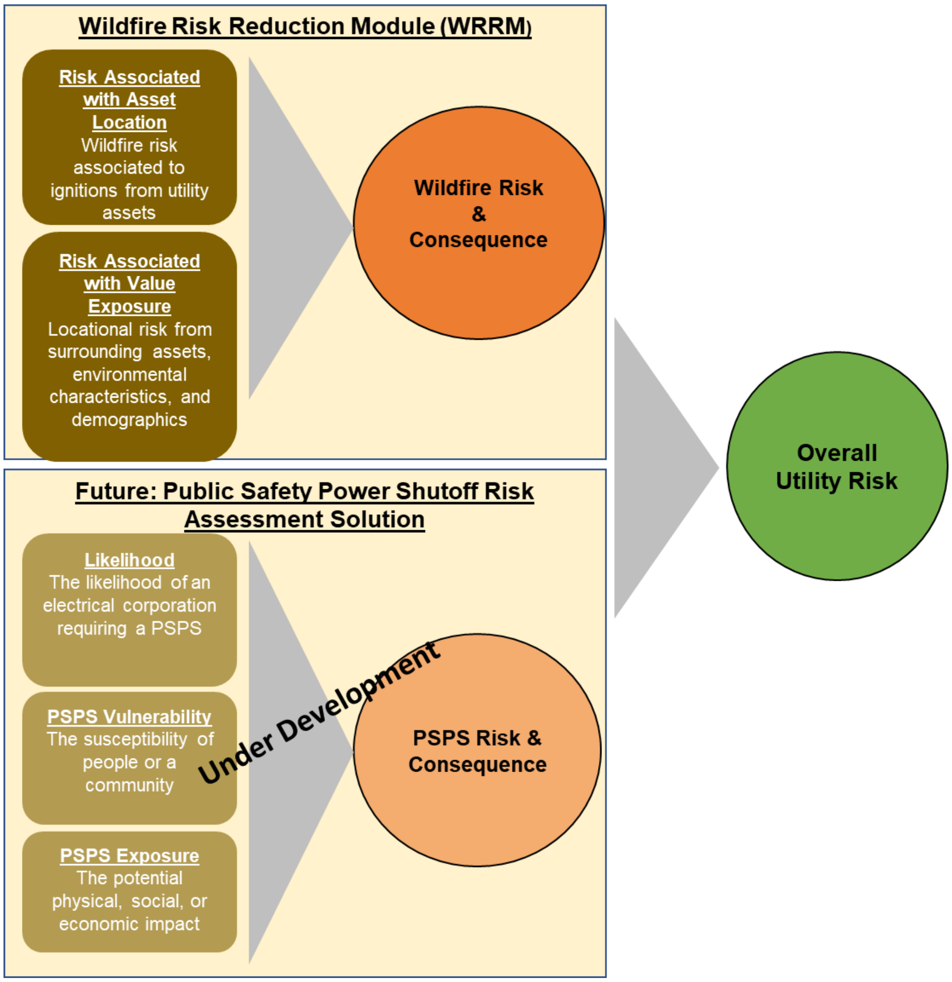


Figure 6-2 High-Level Risk Assessment Approach

6.1.2 Summary of Risk Models

In this section, the electrical corporation must summarize the calculation approach for each risk and risk component identified in Section 6.2.1.

Table 6-1 below shows the risk model components used in Pacific Power's risk analysis. As discussed previously, the risk components currently do not include PSPS probability or consequence components.

Table 6-1 Summary of Risk Model Components

ID	Risk Component	Design Scenario(s)	Key Inputs	Source of Inputs (Data and/or Models)	Key Outputs	Units
R1	Overall Utility Risk	WC1, WC2, VC1, VC2, VC3, WLC5	Ignition Risk	See Appendix B, Wildfire Risk Reduction Module	Composite Risk Score Wildfire Risk Associated with ignitions from Utility Assets Locational risk calculated from all surrounding assets, environmental characteristics, and demographics	Composite risk score is a 1 to 5 rating based on normalization of combined outputs.
R2	Ignition Risk	WC1, WC2, VC1, VC2, VC3, WLC5	Wildfire Likelihood Wildfire Consequence	See Appendix B, Wildfire Risk Reduction Module	Possible Acres burned Number of buildings threatened Estimated number of buildings destroyed Population in area Population at risk	Acres/Fire simulation Buildings/Fire simulation Buildings Destroyed /Fire simulation Population Impacted/Fire simulation Population at Risk/Fire simulation
WL1	Wildfire Likelihood	WC1, WC2, VC1, VC2, VC3, WLC5	Burn Probability Ignition Likelihood	See Appendix B, Wildfire Risk Reduction Module	Probability of a wildfire	Wildfires/Year

ID	Risk Component	Design Scenario(s)	Key Inputs	Source of Inputs (Data and/or Models)	Key Outputs	Units
WL3	Burn Probability	WC1, WC2, VC1, VC2, VC3, WLC5	Historic Weather Conditions Terrain Surface Fuels WUI and Non-Forest Fuels Land Use Canopy Fuels Hydrography Croplands Fuel Moisture	Pacific Power's 30 Year Weather Research & Forecast (WRF) provided to Wildfire Risk Reduction Module-See Appendix B Technosylva provides land characteristics and fuels moisture information, see Appendix B	Probability of a wildfire burning a specific location	Value between 0 and 1.0 representing the percent probability.
WL2	Ignition Likelihood	WC1, WC2, VC1, VC2, VC3, WLC5	Probability of Failure Historic wind conditions Likelihood of vegetation contact Likelihood of an object contact	See Appendix B, Wildfire Risk Reduction Module	Probability of ignition	Ignitions/Year
WL4	Equipment Likelihood of Ignition	WC1, WC2, WLC5	Asset location and attributes Historic weather conditions	GREATER, provided by Pacific Power Pacific Power's 30 Year Weather Research & Forecast (WRF) Inputs provided to Wildfire Risk Reduction Module-See Appendix B	Probability failure of equipment in extreme weather conditions	See PoF discussion in section 6.2.1
WL5	Contact from Vegetation Likelihood	WC1, WC2, VC1, VC2, VC3, WLC5	Fire incidents near Pacific Power assets Asset location and attributes Surface Fuels WUI and Non-Forest Fuels Land Use Canopy Fuels	Pacific Power: Fire Incident Database Pacific Power: GREATER Pacific Power inputs provided to Wildfire Risk Reduction Module-See Appendix B Technosylva provides terrain and fuels information, see Appendix B	Likelihood of a vegetation contact	Contacts/Year

ID	Risk Component	Design Scenario(s)	Key Inputs	Source of Inputs (Data and/or Models)	Key Outputs	Units
WL6	Contact from Object Ignition Likelihood	WC1, WC2, WLC5	Fire incidents near Pacific Power assets Asset location and attributes	Pacific Power: Fire Incident Database Pacific Power: GREATER Pacific Power inputs provided to Wildfire Risk Reduction Module- See Appendix B	Likelihood of an object contact	Contacts/Year
WC1	Wildfire Consequence	WC1, WC2, WLC5	Wildfire Exposure Potential Wildfire Vulnerability Fire Hazard Intensity	See Appendix B, Wildfire Risk Reduction Module	Number of buildings threatened Estimated number of buildings destroyed Population at risk Community Resilience	Plexels/ 8-hour
WC2	Wildfire Exposure Potential	N/A	Buildings Damage Inspection Dataset (DINS) Building loss factor Critical Facilities Population	Supplied/managed by Technosylva, see Appendix B	Buildings at risk Population a risk	Polygon footprints/ 8-hour 90 meter/ 8-hour
WC3	Wildfire Vulnerability	N/A	Suppression Difficulty Population Density Roads Socially Vulnerable Population Fire Stations	Supplied/managed by Technosylva, see Appendix B	Socially vulnerable populations at risk Egress difficulty Suppression difficulty	Plexels/ 8-hour
WC4	Fire Hazard Intensity	WC1, WC2, WLC5	Fire Growth Flame Length Crown Fire Acres Burn Frequency	Supplied/managed by Technosylva, see Appendix B	Fire Behavior Area Impacted	Acres/8-hour

6.2 RISK ANALYSIS FRAMEWORK

In this section of the WMP, the electrical corporation must provide a high-level overview of its risk analysis framework. This includes a summary of key modeling assumptions, input data, and modeling tools used.

6.2.1 Risk and Risk Component Identification

In this section, the electrical corporation must provide a brief narrative and one or more simple graphics describing the framework that defines its overall utility risk. At a minimum, the electrical corporation must define its overall utility risk as the comprehensive risk due to both wildfire and PSPS events across its service territory.

While risk mapping identifies geographic locations with a heightened level of wildfire risk, Pacific Power also analyzes the components of risk associated with utility facilities. An understanding of the risk drivers informs specific mitigation tactics or strategies that can be used to reduce the amount of risk associated with utility operations. For example, if the risk of utility related wildfire exists due to the potential for equipment failure, an increase in inspections or maintenance activities can help mitigate the risk. If the risk exists due to potential contact with third party objects, constructing a system more resilient to contact with objects can help to mitigate the risk. With the implementation of WRRM, Pacific Power is transitioning to a risk model that can identify the specific assets associated with the risk, the areas of risk, and the consequence of an ignition or wildfire in that area.

Pacific Power's risk assessment model is depicted in Figure 6-3 below. The ID number in each box corresponds to the Risk ID number in Table 6-1. As previously discussed, Pacific Power is at the early stages of developing a new PSPS risk assessment solution to quantify PSPS risk and consequence. Therefore, the PSPS risk drivers are included as placeholders and not described in detail in Figure 6-3 or discussed below. As discussed previously, Pacific Power is transitioning to the WRRM model to calculate ignition risk. Figure 6-3 shows the mapping of the risk components to their names in WRRM with a "W: <Name>". WRRM also groups the risk components into Risk Associated with Ignition Locations (RAIL) and Risk Associated with Value Exposure (RAVE) that are discussed further below in Figure 6-4.

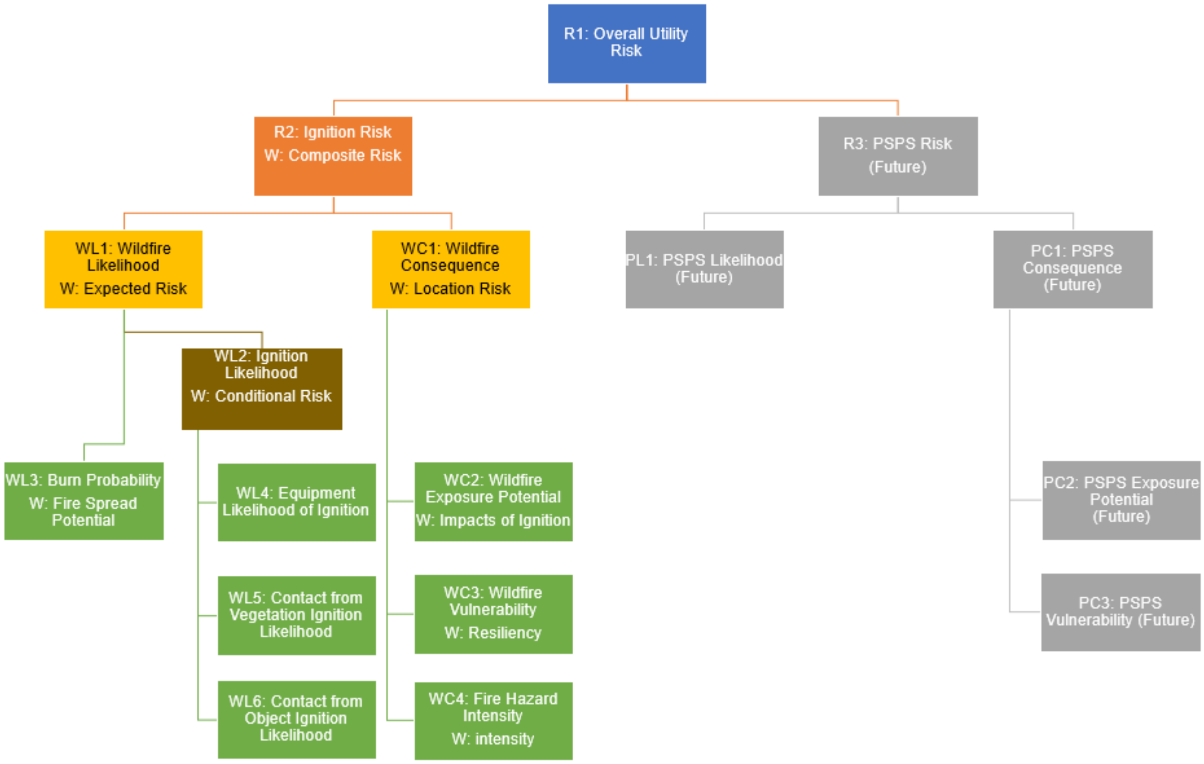


Figure 6-3 Pacific Power Risk Assessment Model

Below is the discussion of risk assessment components Pacific Power currently uses and plans to use in the future:

R1: Overall Utility Risk - As discussed in Section 6.1.1, Pacific Power is developing a PSPS Risk Assessment solution to quantify PSPS risk. At that time, the Overall Utility Risk will be a quantified risk that combines Ignition Risk and PSPS Risk. Once the Ignition Risk calculation with WRRM is complete and until the PSPS Risk Assessment solution is implemented, the Company will use the Ignition Risk as the quantified Utility Risk.

To quantify Ignition Risk and the subcomponents shows in Figure 6-2, Pacific Power is deploying WRRM. Figure 6-4 shows the components of the WRRM model and how those components determine the Ignition Risk.

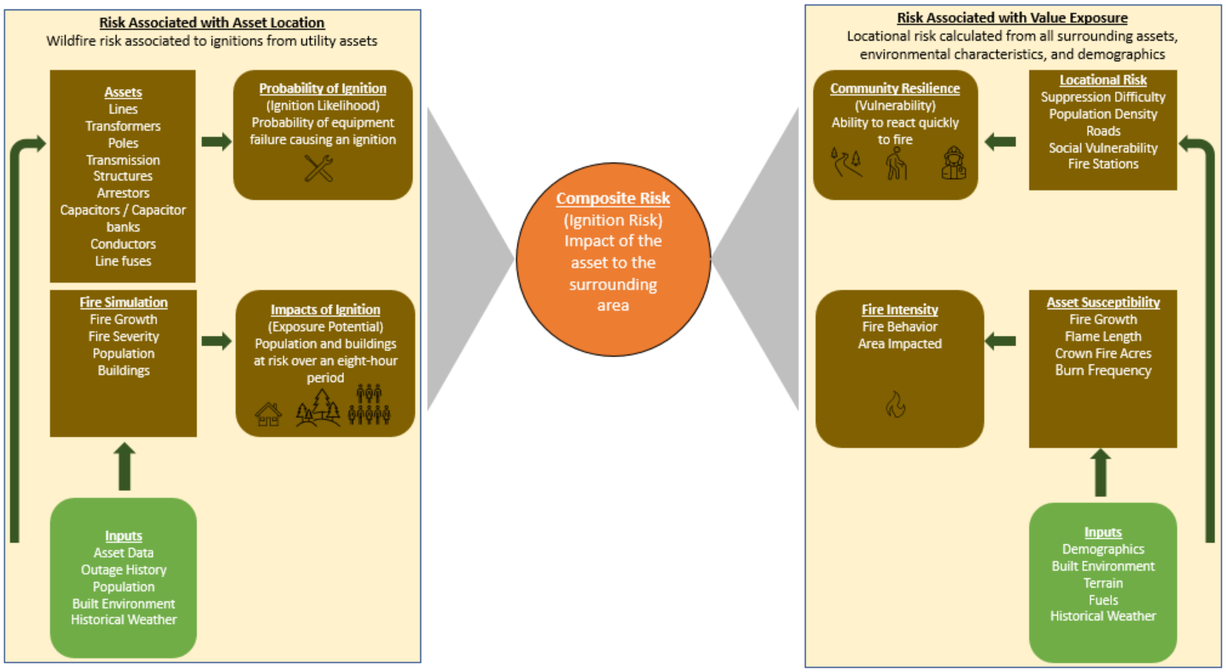


Figure 6-4 WRRM Model Components

R2: Ignition Risk - Pacific Power describes its ignition risk calculations in section 6.2.2.3.

WL1: Wildfire Likelihood (W: Probability of Failure) - Pacific Power describes its Wildfire Likelihood calculations in section 6.2.2.1.

RAIL Outputs:

WL2: Ignition likelihood (W: Probabiliy of Failure) - This is the result of potential asset equipment failure, drivers causing that failure and/or ignition, and the damage that may lead to an ignition. Ignition Likelhood has the following subcomponents:

1. **WL4: Equipment Likelihood of Ignition -** This considers the likelihood of an equipment failure under certain weather conditions causing an ignition.
2. **WL5: Contact From Vegetation Ignition Likelihood -** This considers probability of contact from vegetation causing an ignition.
3. **WL6: Contact from Object Ignition Likelihood -** This considers probability of contact from another object causing an ignition.

WL3: Burn Probability (W: Fire Spread Potential) - The spread potential of fires originating at an ignition location is a function of the fire environment such as fuel, topography, and weather in the area surrounding the ignition location. The fire spread model defines where possible ignitions will spread across the landscape. This definition of spread is critical for definiting vulnerability, i.e., potential impacts due to an utility-asset caused fire. The risk associated with each possible ignition provides the basis for evaluating the best opportunities for reducing risk by implementing mitigation projects.

WC2: Wildfire Exposure Potential (W: Impacts of Ignition) - Vulnerability refers to the exposure and susceptibility of values-at-risk (VAR), such as population, buildings, and critical facilities. Exposure is the location of VAR with respect to wildfire hazard; while susceptibility refers to to the level of impact caused by wildfires of different intensities. For WRRM, the vulnerability is captures as a baseline risk for population impacted, number of buildings impacted, estimated number of buildings destroyed, and acres burned. Flame length, Raote of Spread (ROS), and Fire Behavior Index metrics are also included.

WC1: Wildfire Consequence (W: Location Risk) - In WRRM, the Risk Associated with Value Exposure (RAVE) represents the locational risk factors calculated from all the surrounding assets, environmental characteristics, and demographics. Community demographics, topography, and the built environment influence how at risk or resilient a community is to wildfire over an eight-hour period from the initial ignition.

RAVE Subcomponents Include:

WC3: Wildfire Vulnerability (W: Community Resiliency) - How vulnerable a community is to a wildfire and the ability to respond quickly to fight the fire and/or people to evacuate

WC4: Fire Hazard Intensity (W: Fire intensity) - How a fire is expected to behave and what area may be impacted from the point of ignition

R3: PSPS Risk: As discussed in Section 6.1.1, Pacific Power is developing a PSPS risk assessment solution to quantify PSPS risk as an additional input to the overall utility risk model. While the requirements have not been defined, the Company expects the PSPS Risk will be an aggregation of the PSPS likelihood and consequence scores.

PL1: PSPS Likelhood: As discussed in Section 6.1.1, Pacific Power is developing a PSPS risk assessment solution to quantify PSPS Likelihood aligned with the OEIS definition of PSPS Likelihood as "The likelihood of a electrical corporation requiring a PSPS given a probabilistic set of environmental conditions."

PC1: PSPS Consequence - As discussed in Section 6.1.1, Pacific Power is developing a PSPS risk assessment solution to quantify PSPS Consequence aligned with the OEIS definition of PSPS Consequence as "The total anticipated adverse effects from a PSPS for a community. This considers the PSPS exposure potential and inherent PSPS vulnerabilities of communities at risk (Exposure Potential+Vulnerability)."

PC2: PSPS Exposure Potential: As discussed in Section 6.1.1, Pacific Power is developing a PSPS risk assessment solution to quantify PSPS Exposure Potential aligned with the OEIS definition of PSPS Exposure Potential as "The potential physical, social, or economic impact of a PSPS event on people, property, critical infrastructure, livelihoods, health, local economies, and other high-value assets."

PC3: PSPS Vulnerability: As discussed in Section 6.1.1, Pacific Power is developing a PSPS risk assessment solution to quantify PSPS Vulnerability aligned with the OEIS definition of PSPS Vulnerability as "The susceptibility of people or a community to adverse effects of a PSPS event, including all characteristics that influence their capacity to anticipate, cope with, resist, and recover from the adverse effects of a PSPS event (e.g., high AFN population, poor energy resiliency, low socioeconomics)."

Below is an evaluation of the impact of the factors on the quantification of risk that are reflected in the risk model. The ID numbers tie to the Risk ID number in Table 6-1.

Equipment/Assets WL4, WL5

For the WRRM model, wind speeds are modeled to develop fragility curves that are used in the Probability of Failure (PoF) calculation to identify at what point a transmission or distribution asset may fail in windy conditions and create the risk of an ignition. The results are based on three-hour aggregated probabilities based on the maximum wind gust at ground level during that three-hour period. In the example shown in Figure 6-5, the modeled circuit near the Weed Substation shows the increase in probability of failure as wind gust speed increases.

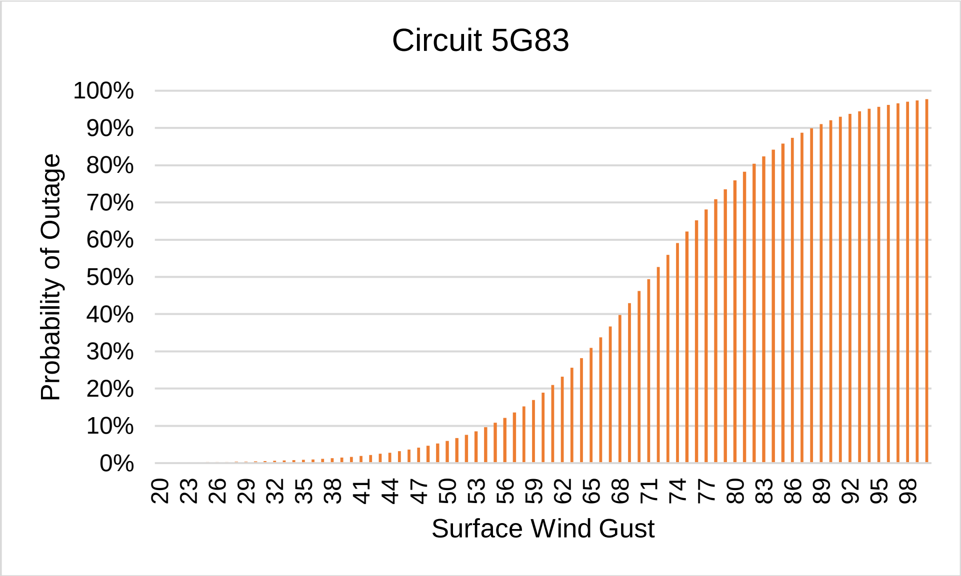


Figure 6-5 Probability of Outage from Ground Level Wind Gusts

Weather WL3, WL2, WL4

WRRM uses historical weather days to best represent days when and where the weather and fuel conditions will most likely lead to increased risk of ignition. The possible historical weather days are between May 1-October 31, representing typical and/or statutory fire days in Pacific Power's multistate operating areas. The model used to select the fire weather days is probabilistic and is not intended to provide a deterministic weather forecast. The worst weather days are selected using the following inputs:

- The Hot, Dry, Windy (HDW) Index
- Energy Release Component (ERC) for fuel conditions
- Wind Gusts Percentile (Gust)

Climate Change R1, R2, WL1, WL3, WL2, WL4, WL5, WL6, WC1

Pacific Power has provided eight years of the 30-Year Weather Research and Forecast (WRF) Model to Technosylva to calculate the historical weather days that best represents the days when weather and fuel conditions can lead to increased risk of ignition. Pacific Power will continue providing the historical years until the 30 years is complete and then move to an annual cadence to capture new days that should be incorporated into the historical weather days to account for changing weather conditions.

The WRRM model also forecasts mid-range (2025) and long-range (2030) vegetation conditions to account for changes vegetation over time.

Topography, Fuel, Vegetation, R1, R2, WL1, WL2, WL4, WL4, WL5, WL6, WC1, WC2

In WRRM, the Risk Associated with Ignition Locations (RAIL) represents the wildfire risk associated to ignitions from utility asset risk based on the characteristics of the asset, including age and materials. RAIL assesses the asset risk by associating the ignition impact over an eight-hour period to an ignition location. RAIL does not consider the characteristics of an asset location that may impact the resiliency of the location to a wildfire. Factors considered in RAIL calculations include:

- Surface and canopy fuel
- Topography
- Wind speed and direction
- Fuel Moisture
- Historical fire occurrence identifying time of data, typical weather conditions, and duration
- Fire encroachment into urban areas

Social Vulnerability, Physical Vulnerability, Coping Capabilities R1, WC1, WC2, WC3, WC4

In WRRM, the Risk Associated with Value Exposure (RAVE) represents the locational risk calculated from all the surrounding assets, environmental characteristics, and demographics. Community demographics, topography, and the built environment influence how at risk or resilient a community is to wildfire or an eight-hour period from the initial ignition. RAVE is calculated independently of the asset risk calculated in RAIL and considers the following:

- Population density
- Socially vulnerable populations: elderly, people with disabilities, or people in poverty
- Infrastructure: major and minor roads, location of fire stations, and building density
- Suppression difficulty: Terrain and fuels
- Fire history: burn history at the location
- Historic weather
- Crown fire: The amount the fire can spread through crowning in continuous spread through the tree crown

6.2.2 Risk and Risk Components Calculation

Figure 6-6 is the schematic for the WRRM calculations with the ID number from Table 6-1 and mapping of the risk components to their names in WRRM with a “W: <Name>”. As discussed in Section 6.1, Pacific Power currently does not quantify PSPS risk of consequence and uses LRAM for qualitative insights on the numbers of customers that could be affected by a PSPS. Pacific Power is developing a PSPS Risk Assessment solution to quantify the likelihood, risk, and exposure. This WMP activity is tracked with the Tracking ID# RA-01.

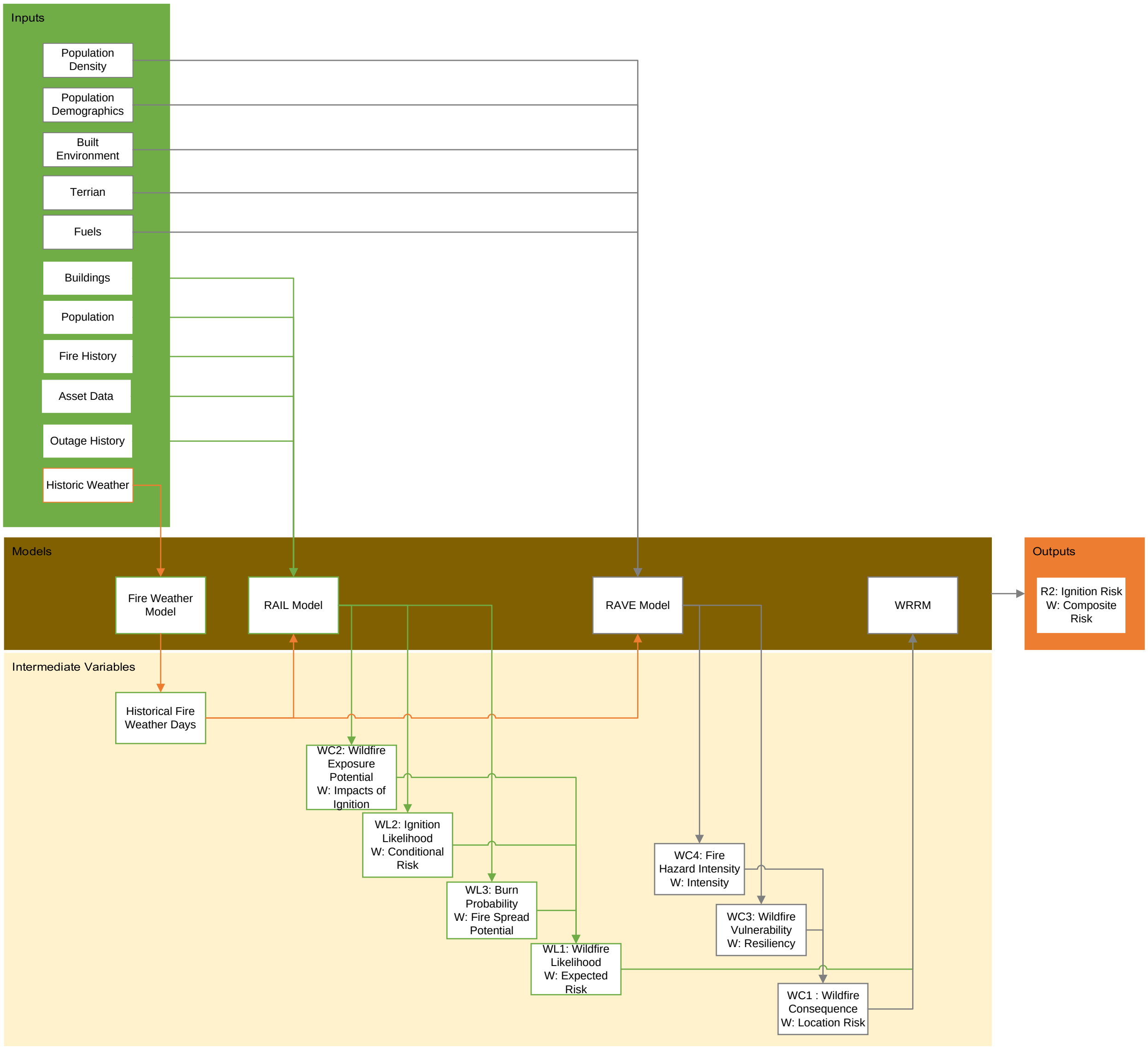


Figure 6-6 WRRM Calculation Schematic

6.2.2.1 Likelihood

Ignition Likelihood (Probability of Failure): The Wildfire Risk Reduction Model (WRRM) includes a probability of failure (POF) which predicts at the hourly level failure probabilities using wind and asset attributes across all circuits. The POF model examines all sustained outages with the potential to cause ignition including equipment failure, contact from object, vegetation contact and integrates them with historical weather data to create dynamic circuit fragility curves. The fragility curves have two components: a static probability of failure that represents the POF in the absence of wind and the dynamic exponential increase due to wind. These curves are then used to calculate failure probabilities for each circuit on a given historical weather day within WRRM. The POF ranges on a scale from 0 to 1 and is calculated at ignition points along distribution and transmission circuits.

Burn Probability (Probability of Ignition): The Wildfire Risk Reduction Model (WRRM) includes a probability of ignition (POI) uses the National Fire Danger Rating System (NFRDS) model. The NFRDS model utilizes fuel dryness and wind to estimate the probability of a fire starting from an ignition source. POI determines the probability that burning material will create a wildfire that requires suppression. The POI ranges on a scale from 0 to 1 and is calculated at ignition points along distribution and transmission circuits.

Wildfire Likelihood (Expected Risk): Both POF and POI contribute to overall wildfire likelihood. These two components together give Pacific Power a robust picture of the ignition likelihood and burn probability with POF informing the *ignition likelihood* and POI informing the *burn probability* Figure 6-7

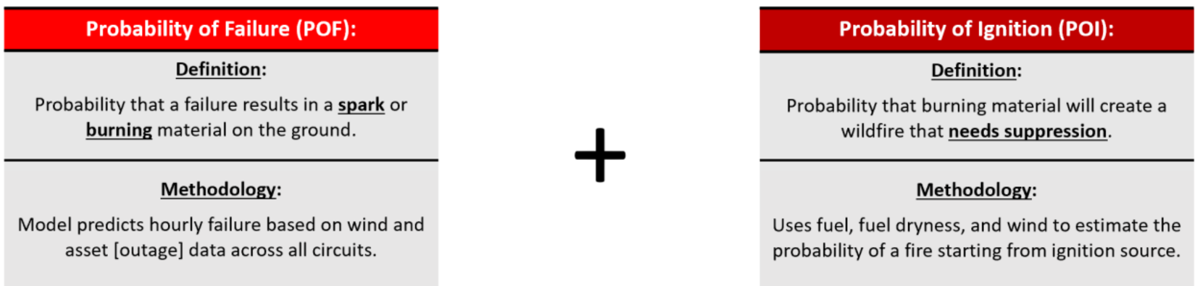


Figure 6-7 Schematic showing the two probability calculations for ignition likelihood and burn probability (fire spread potential)

WRRM calculates Expected Risk (ER) by combining the Probability of Failure (POF) outputs with the environmental Probability of Ignition (POI). By combining the POF and POI, WRRM estimates the probability of a specific line segment starting a wildfire that requires suppression on any given day in the selected weather history.

The Wildfire Likelihood calculation is:

$$WL=IL+(Att(Percentile*Weighting))$$

Where:

- WL=Wildfire Likelihood
- IL=Ignition Likelihood. This is the expected risk and utilizes POF and POI.
- Att=Selected attribute. The attributes could include Fire Spread, Fire Behavior, and Fire Size Potential. One attribute or multiple attributes may be selected for the calculation.
- Percentile. The percentile is based on expected weather conditions at each percentile with better weather days (low wind, wet) at lower percentiles and

worst weather days (hot, dry, and windy) at higher percentiles.

- Weighting. This is the weighting assigned to a specific attribute.

PSPS Likelihood: As discussed in Section 6.1.1, Pacific Power is developing a PSPS risk assessment solution to quantify PSPS likelihood and expects to implement the solution in Q1 2024.

6.2.2.2 Consequences

Wildfire Consequence (Location Risk): Wildfire Consequence refers to the impacts to values-at-risk, such as population, buildings, and critical facilities. In WRRM, consequence is captured as risk outputs for population impacted, number of buildings threatened, estimated number of buildings destroyed, and acres burned. Flame Length, Rate of Spread, and Fire Behavior Index metrics are also included.

The wildfire consequence model implemented within WRRM calculates the following impacts:

Number of Buildings Threatened – risk metric based on total number of buildings impacted assigned to every ignition point.

Number of Buildings Destroyed – an estimate of the number of buildings destroyed for each fire spread simulation derived using the Building Loss Factor (BLF) data assigned to each building and calculated at every ignition point

Total Population - risk metric based on population impacted assigned to every ignition point.

Fire Size Potential - risk metric based on number of acres burned assigned to every ignition point. Based on the spread of a fire predicted for each ignition point, fire spread predictions are run for each weather scenario day. This results in different risk values for each ignition point and asset for each weather scenario run.

To achieve this, fire ignition points are defined along assets, and impacts from fire spread predictions are associated back to the source ignition points and assets, iFor WRRM, simulations are run for each asset ignition point for each weather scenario (selected weather day). Impacts are calculated for each simulation resulting in hundreds of sets of impacts for each asset.

A set of summary outputs is calculated from the consequence model outputs. These include:

- Standard Deviation values for all simulations
- Average impact value for all simulations

- Percentiles for each impact output for all simulations (0, 20, 40, 50, 60, 80, 90, 95, 98, 100)

These summary values are calculated for each consequence model output, i.e. number of buildings threatened, estimated buildings destroyed, population impacted and acres burned.

The Wildfire Consequence calculation:

$$WC=(SUM((Att_1(Percentile*Weighting)), (Att_2(Percentile*Weighting)), (Att_3(Percentile*Weighting)), (Att_4((Percentile*Weighting)), (Att_5(Percentile*Weighting)))$$

Where:

WC=Wildfire Consequence

Att=Selected Attribute

Percentile=The selected percentile

Weighting=Weighting assigned to the attribute

To account for the unique characteristics of its service territory, Pacific Power is using the attributes in the RAVE and RAIL sub models to develop a Wildfire Consequence score each circuit based on wind-driven and terrain-driven fire events. By modeling consequence for each type of fire, Pacific Power expects to have a better understanding of the highest risk circuits and risk drivers to apply to mitigation selection and prioritization. Pacific Power is currently selecting the attributes to use that will best reflect the wildfire consequence for wind driven and terrain driven events respectively.

Wildfire Hazard Intensity (Intensity): Wildfire Intensity is how a fire is expected to behave and what area may be impacted from the point of ignition. Wildfire Hazard Intensity considers:

Suppression difficulty: Terrain and fuels

Fire History: Burn history at the location

Historic Weather

Crown fire: The amount the fire can spread through crowning in continuous spread through the tree crown

To account for the unique characteristics of its service territory, Pacific Power is using the attributes in the RAVE and RAIL sub models to develop a Wildfire Hazard Intensity score for each circuit based on wind driven fire and terrain driven fire events. The behavior of the fire in each type of event may create different intensities. By modeling Wildfire Hazard

Intensity for each type of fire, Pacific Power expects to have a better understanding of the highest risk circuits and risk drivers to apply to mitigation selection and prioritization. Pacific Power is currently selecting the attributes to use that will best reflect the Wildfire Hazard Intensity for wind driven and terrain driven events respectively.

Wildfire Exposure Potential (Impacts): Exposure is the location of values at risk (VAR) with respect to wildfire hazard.

To account for the unique characteristics of its service territory, Pacific Power uses the attributes in the RAVE and RAIL sub models to develop a Wildfire Exposure Potential score for each circuit based on wind driven fire and terrain driven fire events.

By modeling Wildfire Exposure Potential for each type of fire, Pacific Power expects to have a better understanding of the highest risk circuits and risk drivers to apply to mitigation selection and prioritization. Pacific Power is currently selecting the attributes to use that will best reflect the Wildfire Exposure Potential for wind driven and terrain driven events respectively.

Wildfire Vulnerability (Resiliency): Vulnerability refers to the susceptibility of values-at-risk (VAR), such as population, buildings, and critical facilities.

Wildfire Vulnerability is part of the RAVE sub model in WRRM and includes the following attributes:

Disability: Percent of population identified as disabled within the plexel

Poverty: Percent of population identified as under the poverty level within the plexel

Fire Stations: Stations per square mile using a 20 mile search distance.

PSPS Consequence, Exposure Potential and Vulnerability: As discussed in Section 6.1.1, Pacific Power is developing a PSPS risk assessment solution to quantify PSPS consequence, exposure, and vulnerability and expects to implement the solution in Q1 2024.

6.2.2.3 Risk

Ignition Risk (Composite Risk): Ignition Risk is the likelihood of an ignition from a utility asset given certain conditions and the consequence if a wildfire were to occur. Integrating RAVE with RAIL risk metrics allows for calculation of a composite risk metric for electric utility assets that incorporates local risk factors that can substantially increase risk for possible fires caused by an asset

To account for the unique characteristics of its service territory, Pacific Power is modeling Ignition Risk for each circuit based on wind driven fire and terrain driven fire events. By modeling likelihood and consequence for each circuit for each type of fire, Pacific Power expects to have a better understanding of the highest risk circuits and the drivers to the risk to apply the appropriate mitigation.

The Ignition Risk (IR) Calculation:

$$IR=IR_{WD}+IR_{TD}$$

Where:

IR=Ignition Risk

WD=Wind Driven Fire

TD=Terrain Driven Fire

PSPS Risk: As discussed in Section 6.1.1, Pacific Power is developing a PSPS risk assessment solution to quantify PSPS risk and expects to implement the solution in Q1 2024.

Utility Risk: Utility risk is currently not calculated and will be calculated after the implementation of PSPS risk assessment solution in 2024. Until this is calculated, Pacific Power will rely on the Ignition Risk for prioritization.

6.2.3 Key Assumptions and Limitations

Table 6-2 below shows the assumptions and limitations of the model.

Table 6-2 Risk Modeling Assumptions and Constraints/Limitations

Assumption	Justification	Constraints/Limitations	Applicable Model(s)
The physical framework development is based on an idealized situation in steady state spread which may not fit some extreme behavior of fires.	The model is semi-empirical and as a result does not capture all possible wildfire scenarios.	The model may not represent unique weather cases.	Wildfire Spread Model
Fuels are assumed to be continuous and uniform for the scale of the input (typically between 10-to-30-meter (m) resolution)	This is the highest resolution data available across the service territory, and the standard for fuels mapping for fire agencies and IOUs in the US.	Real fuels are more granular and thus not captured by the fire spread modeling.	Wildfire Spread Model
Fire characteristics at a point only depends on the conditions at that point (point-functional model). This means that there are certain non-local phenomena like: • Increase of ROS due to a concave front. • Fire interaction between different parts of the same fire or a different one	Point functional models are much faster to solve than non-local ones.	Several non-local effects like radiation concentration from different parts of the front are not taken into account.	Wildfire Spread Model
Fire spread is assumed to be elliptical although there are several variations such as double ellipse, oval, egg-shape, etc.	Fire perimeters obtained in constant wind and slope conditions are known to have a pseudo elliptical shape. The difference between existing fire shape models is small and it is not clear which one is the correct one.	This approach would does not capture the real spread mechanism of fire nor the small difference in fire shape, and only captures a macroscopic shape of the perimeter	Wildfire Spread Model
Weather is given hourly and is assumed to remain constant during that time. There is no interpolation in time to compute evolution of weather between hours.	Computing sub hourly wind speeds is expensive and not the standard among fire agencies or IOUs. Sub hourly data is not readily available.	Winds change more rapidly than at the hour level and thus are not captured by the fire spread model.	Wildfire Spread Model

Assumption	Justification	Constraints/Limitations	Applicable Model(s)
Reliability of weather inputs in the mid-range forecast (2 to 5 days)	Weather forecasts become less accurate the further out in time you model, however WRF models are proven to be very accurate in reflecting past weather scenarios and predicting future short-term weather scenarios.	Fire spread models are impacted due to imperfect weather.	Wildfire Spread Model
Fire is not coupled with the atmosphere in any way. This may seem like a major limitation in the model as wind is a main contribution to fire spread and at present many models (especially physical ones) try to couple wind and fire.	It is not technically feasible to run millions of simulations considering the coupling effect given current science and technology. Empirical and semi-empirical models have been developed using an average wind speed as an input, so it is not clear that considering more granular wind at the front is advisable or performs less.	Fire atmosphere interactions are not captured.	Wildfire Spread Model
Fire is always assumed to be fully developed. Fire acceleration, flashover, or decay is not considered.	Fire acceleration only affects the initial time of the fire expansion and its effect on an 8 hour simulation may not be too significant.	Models are not valid for short duration fires.	Wildfire Spread Model
Atmospheric instability which may have a deep impact on ROS (beer 1991) is not considered in the model.	Capturing atmospheric instability is not easy with the present forecast available	There is a significant range of fire behavior that may not be considered in the model.	Wildfire Spread Model
Gusts are not considered in the model	Gust duration is highly unpredictable and that could affect the fire very differently.	Fire behavior at a lower scale is not expected to follow a simple symmetrical behavior with respect to wind and slope	Wildfire Spread Model

Assumption	Justification	Constraints/Limitations	Applicable Model(s)
No interaction between slope and wind other than creating an effective or equivalent wind. This means that fire is assumed to have an elliptical shape no matter the alignment of wind and slope.	The slope-wind effect is known to be significantly symmetrical in fires under control conditions. There are not many non physical models that describe the wind-slope effect in a non symmetrical way.	Fire behavior at a lower scale is not expected to follow a simple symmetrical behavior with respect to wind and slope	Wildfire Spread Model
Fuel array description of the vegetation may not perfectly describe fuel characteristics.	There are no perfect fuel datasets available at the territory scale. However, additional custom fuel models have been developed and used to reflect more accurate spread in WUI, agricultural and timber areas.	Fuel characteristics are not captured perfectly by the fire spread model.	Wildfire Spread Model
Spotting is only considered in surface fires	Calculating crown spotting would require having an accurate tree inventory (height, species, width, etc.). However, the models are still thoroughly validated on non surface fires.	Wildfire spread for crown fires is impacted.	Wildfire Spread Model

6.3 RISK SCENARIOS

In this section of the WMP, the electrical corporation must provide a high-level overview of the scenarios to be used in its risk analysis in Section 6.2.

6.3.1 Design Basis Scenarios

Table 6-3 shows the design basis scenarios used in WRRM. Pacific Power risk models use May 1-October 31 as the fire season dates in the model. This is based on the expert judgement of typical fire season in Pacific Power's service territory.

As discussed in Section 6.2.1, failure winds speeds are modeled to identify at what point a specific transmission or distribution circuit may fail in windy conditions and not the specific design scenarios WLC1-WLC4.

Table 6-3 Design Basis Scenarios

Scenario ID	Design Scenario	Purpose
WLC1	Wind Load	Baseline wind load used in design, construction, and maintenance
WLC2	Wind Load	95^{th} percentile wind gusts based on maximum daily values over the 30-year history
WLC3	Wind Load	Wind gusts with a probability of exceedance of 5 percent over the three-year WMP cycle (i.e. 60-year return interval)
WLC4	Wind Load	Wind gusts with a probability of exceedance of 1 percent over the three-year WMP cycle (i.e. 300-year return interval)
WLC5	Wind Load	WRRM models wind speeds to identify at what point a specific transmission or distribution circuit may fail in windy conditions. The results are based on three-hour aggregated probabilities based on the maximum wind gust during that three-hour period
WC1	Weather Condition	Anticipated weather conditions over the next three years. This is based on historical weather days that best represents the days when weather and fuel conditions can lead to increased risk of ignition. See 6.2.1 Weather for details
WC2	Weather Condition	Long term conditions. Pacific Power has provided eight years of the 30-Year Weather Research and Forecast (WRF) Model to Technosylva to calculate the historical weather days that best represents the days when weather and fuel conditions can lead to increased risk of ignition. Pacific Power will continue providing the historical years until the 30 years is complete and then move to an annual cadence to capture new days that should be incorporated into the historical weather days to account for changing conditions in locations

Scenario ID	Design Scenario	Purpose
VC1	Vegetation Condition	Modeling of current vegetation conditions to identify where current vegetation fuels risk
VC2	Vegetation Condition	Modeling of projected 2025 vegetation conditions to identify potential mid-range vegetation fuels risk
VC3	Vegetation Condition	Modeling of projected 2030 vegetation conditions to identify potential long-range vegetation fuels risk

6.3.2 Extreme Event/High Uncertainty Scenarios

As Pacific Power's quantified risk model is newly implemented, extreme event/high uncertainty scenarios have had limited consideration at this time. As Pacific Power continues to work with the model, it may consider additional extreme-event high uncertainty scenarios to integration into the risk model. Table 6-4 presents the extreme event scenarios currently considered in the models.

Table 6-4 Extreme-Event Scenarios

Scenario ID	Extreme Event Scenario	Purpose
ES1	Climate Change 1 Weather Condition 2 Vegetation Condition 3	Impact of climate change on long-term weather and vegetation conditions that impact fire behavior.

6.4 RISK ANALYSIS RESULTS AND PRESENTATION

In this section of the WMP, the electrical corporation must present a high-level overview of the risks calculated using the approaches discussed in Section 6.2 for the scenarios

6.4.1 Top Risk Areas within the HFRA

This WMP activity is tracked with the Tracking ID# RA-02.

6.4.1.1 Geospatial Maps of Top-Risk Areas within the HFRA

Pacific Power does not currently have self-identified HFRA areas defined. Refer to section 6.4.1.2 for plans to consider establishing and subsequent creation of updates to maps.

6.4.1.2 Proposed Updates to the HFTD

Pacific Power does not currently propose any updates to the CPUC-approved HFTD. In 2023, Pacific Power plans to use new risk models and data sets to evaluate and, if needed, supplement the HFTD. Once established, Pacific Power plans to continue evaluating the HFRA and update its boundaries on a regular cycle, as needed, using the most updated methodologies, tools, and data. In determining the planned update frequency of the HFRA, Pacific Power considered both the duration of the update itself as well as the intended use of the assessment and the impacts to corresponding programs or projects. Because the HFRA will be used to inform multiyear programs, such as asset inspections and vegetation management, modifying geographic boundaries too frequently would be disruptive to making and tracking progress on these programs. As a general baseline, Pacific Power plans to evaluate and refresh the HFRA on a five-year nominal cycle, consistent with the detailed inspection cycle described in Section 8.2. See Figure below for the timeline to establish and update the HFRA moving forward.

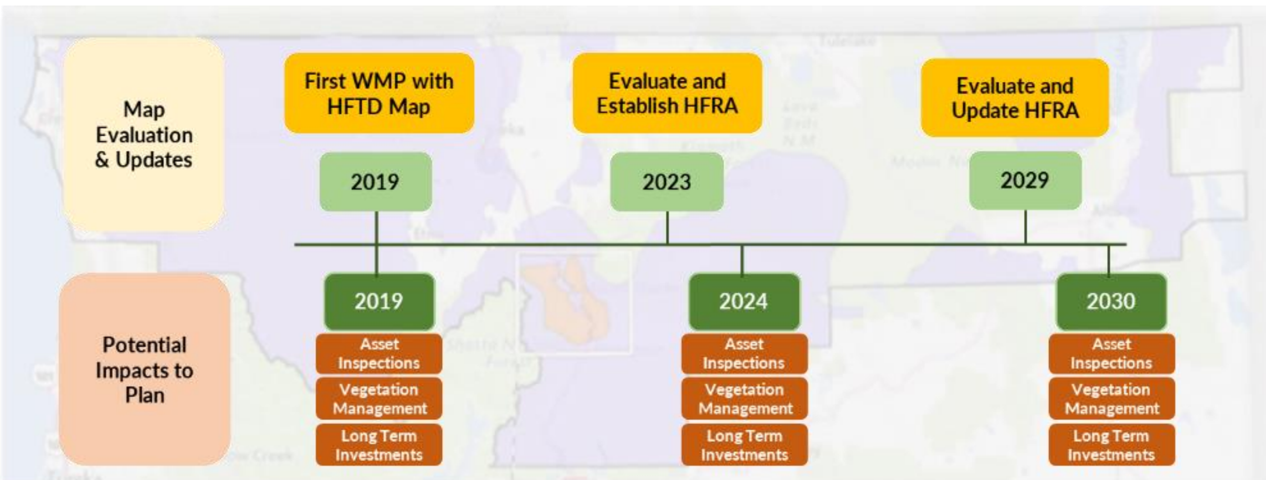


Figure 6-8 HFRA Establishment and Update Plan

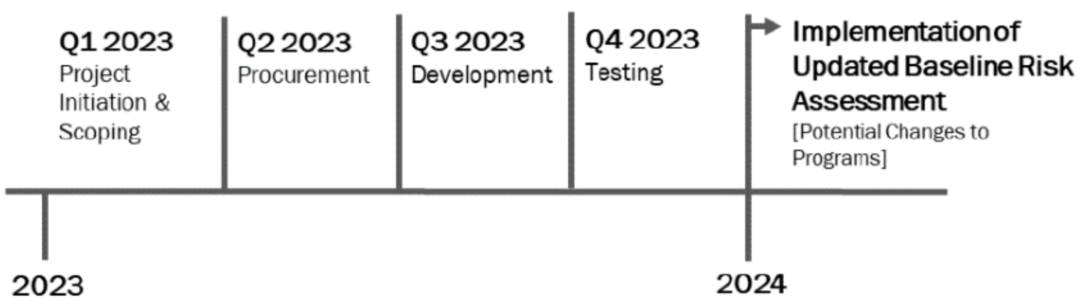


Figure 6-9 Timeline for the Establishment and Implementation of HFRA

6.4.2 Top Risk-Contributing Circuits/Segments/Spans

As discussed in Section 6.1.1, Pacific Power has recently implemented WRRM which will be used to calculate the ignition risk and associated subcomponents of the risk. When that calculation is complete, Pacific Power will be able to identify the highest risk overhead assets and their risk scores and drivers in the Q4 QDR.

Once fully implemented, WRRM will be leveraged to calculate ignition risk at the asset level in approximately 100 meter sections along a circuit. This granularity will account for changes in terrain, vegetation, and weather conditions that may vary along longer circuits, which can be common in Pacific Power's rural service territory. Once operational, Pacific Power expects to provide information on the highest risk assets circuits, segments, or spans sorted in order from highest risk to lowest. Specifically, Pacific Power will utilize output from the Wildfire Risk Reduction Model (WRRM) and its components to develop an ignition risk score as discussed in Section 6.2.2 above. This score will include information on the ignition risk coupled with the locational and environmental risk factors at the circuit segment-level.

Once Pacific Power obtains the ignition risk score, circuits will be ranked similar to how other IOUs present their highest risk circuits. Therefore, TBD values have been populated in the table below to reflect that this work is in progress and not yet completed.

Table 6-5 Summary of Top-Risk Circuits, Segment, or Spans

Risk Ranking	Circuit, Segment, of Span ID	Overall Utility Risk Score	Ignition Risk Score	PSPS Risk Score	Top Risk Contributors
TBD	TBD	TBD	TBD	TBD	TBD

6.4.3 Other Key Metrics

In addition to the risk model described in Section 6.1.2, Pacific Power also tracks the following. Risk Spend Efficiency is also a key metric that Pacific Power is developing and tracking with the Tracking ID# RA-03. For a discussion of RSE see Section 7.1.4.

Fire Potential Index

As of the date of this filing, Pacific Power does not have FPI as a metric. For a discussion of Fire Potential Index (FPI) please refer to Section 8.3.6.

Red Flag Warning

The Red Flag Warning is sourced from the National Weather Service. Table 6-6 shows the frequency of key metrics in the Service Territory.

High Wind Warning

The High Wind Warning is sourced from the National Weather Service. Table 6-6 shows the frequency of key metrics in the Service Territory.

Table 6-6 Key Metrics Statistical Frequency

Metric	Non-HFTD	HFTD Tier 2	HFTD Tier 3	Areas Without a Heightened Risk of Fire	Areas With a Heightened Risk of Fire
FPI-OCM/OCM	TBD	TBD	TBD	TBD	TBD
RFW-OCM/OCM	1,365	916	125	TBD	TBD
HWW-OCM/OCM	607	916	125	TBD	TBD

6.5 ENTERPRISE SYSTEM FOR RISK ASSESSMENT

In this section, the electrical corporation must provide an overview of inputs to, operation of, and support for a centralized wildfire and PSPS risk assessment enterprise system. This overview must include discussion of:

The electrical corporation's database(s) used for storage of risk assessment data.

The electrical corporation's internal documentation of its database(s).

Integration with systems in other lines of business.

The internal procedures for updating the enterprise system including database(s).

Any changes to the initiative since the last WMP submission and a brief explanation as to why those changes were made. Include any planned improvements or updates to the initiative and the timeline for implementation.

Currently, Pacific Power does not have a centralized enterprise risk assessment database to store wildfire and PSPS data.

Outages are managed and recorded by a central, system operations team using a real time operating system. With all events, outage response personnel identify the cause of the outage including whether the trouble call is reportable and associated with utility related infrastructure or due to customer related equipment (such as a service panel issue), and classify all utility related events by assigning company cause codes into the real time system. Response personnel also provide comments that are documented as part of the permanent outage record. Within an hour of event even closure, the real time system then populates the historic outage data repository, PROSPER, via an automated datalink PROSPER dates to the early 2000s, and stores the outage data and records used to inform wildfire risk driver analysis. The outage records, including causes and any additional comments, are mapped to the drivers outlined in Table 6-7 below.

Table 6-7 Outage Causes with Possible Correlation to Ignition Potential

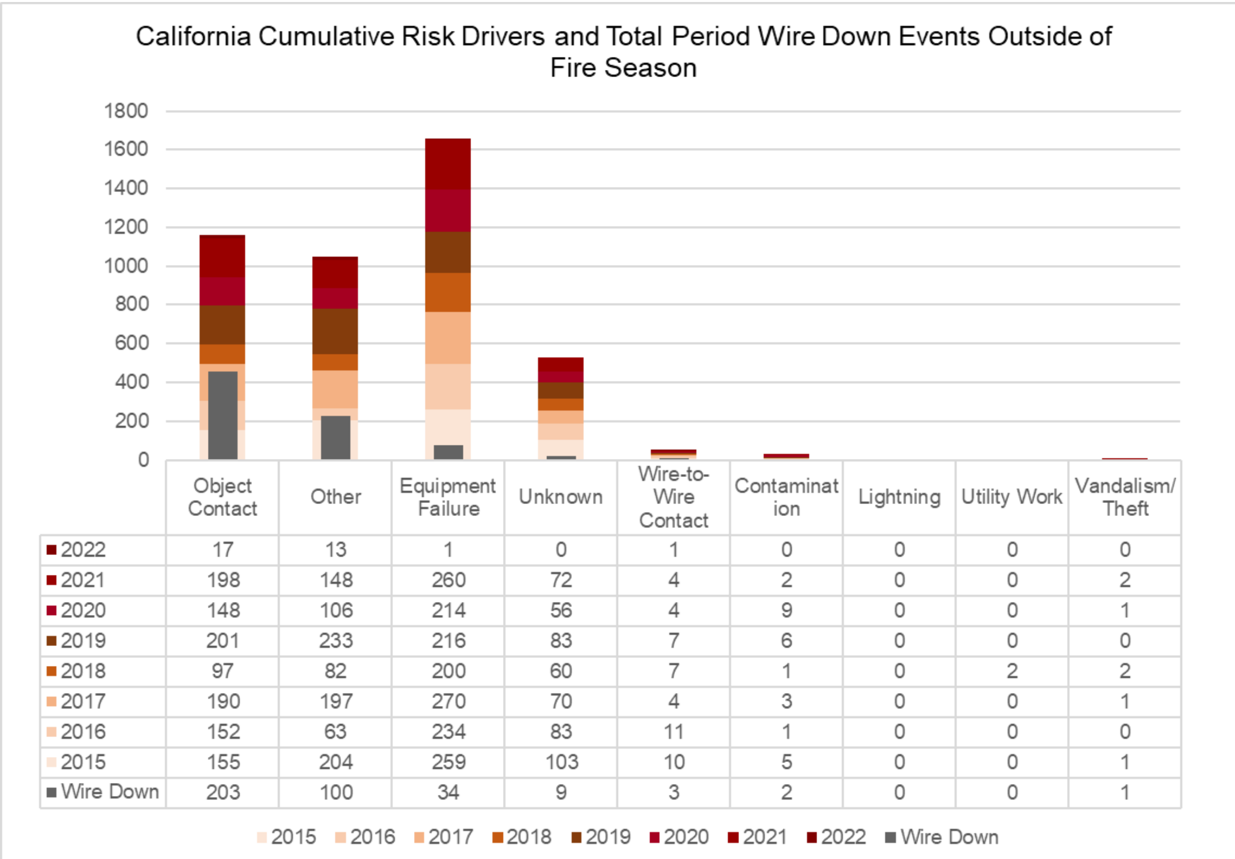
Outage Category	Description
Animals	Animals making unwanted direct contact with energized assets
Environment	Exposure to environmental factors, such as contamination
Equipment Damaged	Broken equipment from car hit-poles, vandalism, or other non-lightening weather- related factors
Equipment Failure	Failure of energized equipment due to normal deterioration and wear, such as a cross arm that has become cracked or the incorrect operation of a recloser, circuit breaker, relay, or switch
Lightning	Outage event directly caused by lightning striking either (i) energized utility assets or (ii) nearby vegetation or equipment that, as a result, contacts energized utility assets
Other External Interference	External factors not relating to damaged equipment such as mylar balloons, hay or other interference resulting in a potential ignition source
Not Classifiable	Outage event with unknown cause or multiple potential possible causes identified
Operational	Outage event resulting from improper operating practice or other human error
Tree-Preventable	Outage attributed to vegetation condition which should have been remedied during regular cycle maintenance under the company's vegetation management program
Tree-Outside Program	Outage attributed to vegetation condition not managed under the company's vegetation management program

In the first years of the WMP implementation, information from the ignition risk drivers in the table above helped shape Pacific Power's programs which typically focus on methods, tactics, and technologies that reduce outages or, more specifically, fault events. Table 6-8 below generally maps Pacific Power's key risk drivers to the primary programs included in this plan, demonstrating what elements impact a group or groups of risk drivers. It is important to note that elements may not address a risk driver 100% but are designed to mitigate the risk associated with that driver. Furthermore, for many risk drivers, risk is mitigated through a combination of programs and there is not always a 1:1 relationship between a risk driver category and a mitigation program. All elements and programs in the plan work together to collectively mitigate wildfire risk.

Table 6-8 Risk Driver Mapping to Potential Mitigation Program(s)

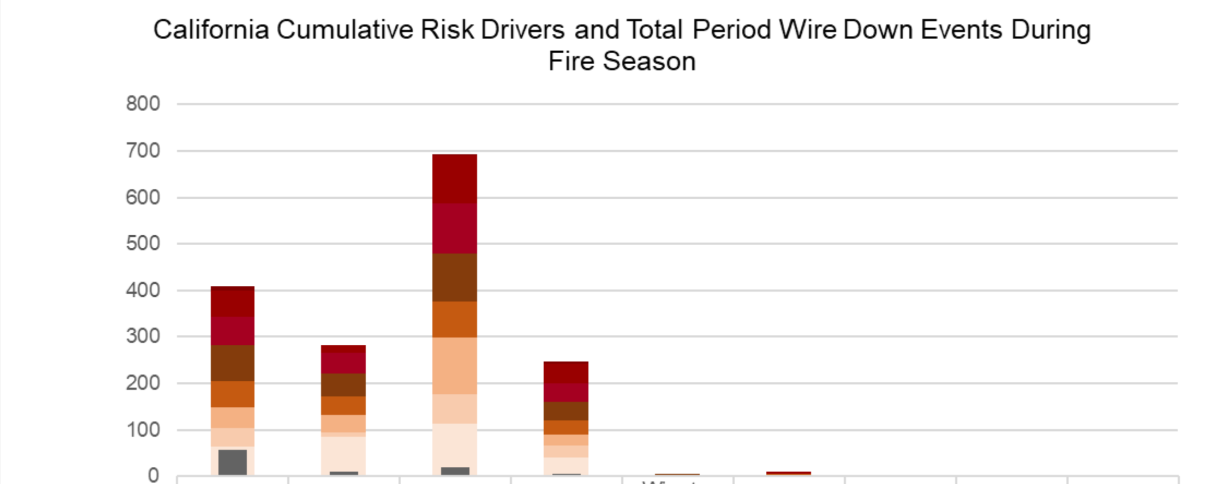
Key Risk Driver	Significant Contributor to Wire Down Events	Potential Mitigation Categories				
		Asset Inspections	Vegetation Management	System Hardening	Field Operations	System Operations
Object Contact	X	X	X	X	X	X
Other	X	X	X	X	X	X
Equipment Failure	X	X	X	X	X	X
Unknown	X	X	X	X	X	X
Wire-to-wire Contact	X	X		X	X	X
Contamination		X		X	X	X
Lightning				X		
Utility Work		X		X	X	X

Key Risk Driver	Significant Contributor to Wire Down Events	Potential Mitigation Categories				
		Asset Inspections	Vegetation Management	System Hardening	Field Operations	System Operations
Vandalism/Theft		X		X		



	Object Contact	Other	Equipment Failure	Unknown	Wire-to-Wire Contact	Contaminat ion	Lightning	Utility Work	Vandalism/ Theft
2022	17	13	1	0	1	0	0	0	0
2021	198	148	260	72	4	2	0	0	2
2020	148	106	214	56	4	9	0	0	1
2019	201	233	216	83	7	6	0	0	0
2018	97	82	200	60	7	1	0	2	2
2017	190	197	270	70	4	3	0	0	1
2016	152	63	234	83	11	1	0	0	0
2015	155	204	259	103	10	5	0	0	1
Wire Down	203	100	34	9	3	2	0	0	1

Figure 6-10 California Cumulative Ignition Risk Drivers and Wire Downs Outside of Fire Season



	Object Contact	Other	Equipment Failure	Unknown	Wire-to-Wire Contact	Contamination	Lightning	Utility Work	Vandalism/ Theft
2022	10	0	1	3	0	0	0	0	0
2021	58	18	104	42	0	3	0	0	0
2020	60	44	108	40	0	1	0	0	2
2019	78	49	103	42	3	1	0	0	0
2018	56	41	77	30	0	2	0	0	0
2017	44	37	123	24	1	1	0	0	0
2016	41	8	64	24	0	1	0	0	0
2015	63	86	112	41	1	0	0	1	0
Wire Down	56	9	18	5	0	0	0	0	0

Figure 6-11 California Cumulative Ignition Risk Drivers and Wire Downs During Fire Season

While PROSPER tracks outages and causes, it is not designed to calculate wildfire risk or PSPS risk or provide analytics to show outage trends or locations where there is higher risk. For fire incident tracking, Pacific Power plans to supplement its existing file repository with an advanced data analytics platform to enable long-term trend analysis. The data analytics tool will combine fire incident information with utility asset and outage data (if applicable) to create a comprehensive view of each tracked fire event. Actual fire incident data, including time, location, affected equipment (if any), and burn area size, is critical to WRRM to validate modeled ignition risk and fire spread, update assumptions, and refine calculations. This WMP activity is tracked with the Tracking ID# RA-04.

The analytics platform will also be used to enable viewing of WRRM risk outputs, PSPS risk and utility risk in a single location to support quantification of utility risk, to identify locations where mitigation efforts are needed to reduce the risk of a wildfire or PSPS event. Figure below shows a timeline for implementation of this platform.

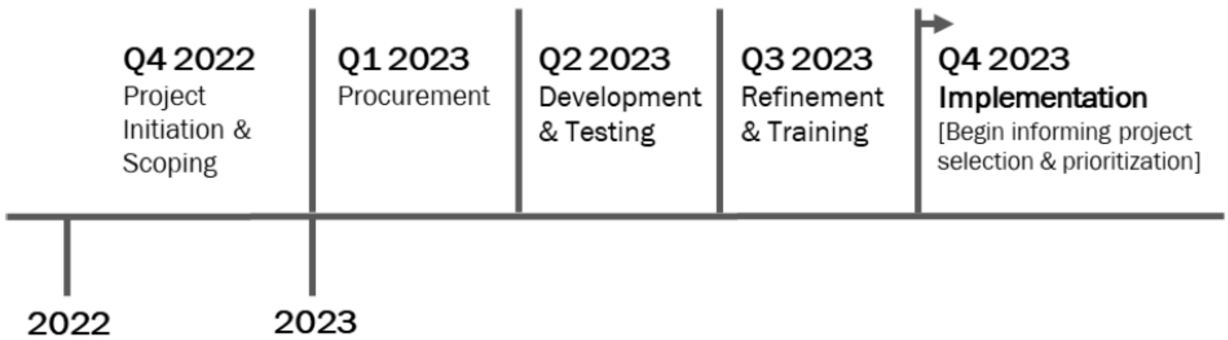


Figure 6-12 Analytics Platform Implementation Timeline

6.6 QUALITY ASSURANCE AND CONTROL

The electrical corporation must document the procedures it uses to confirm that the data collected and processed for its risk assessment are accurate and comprehensive. This includes but is not limited to model, sensor, inspection, and risk event data used as part of the electrical corporation's WMP program. In this section of the WMP, the electrical corporation must describe the following:

- Independent review: Role of independent third-party review in the data and model quality assurance
- Model controls, design, and review: Overview of the quality controls in place on electrical corporation risk models and sub-models.

6.6.1 Independent Review

Independent Review of Pacific Power's Provided Data

At the time of this filing, Pacific Power is not soliciting external, independent reviews of its data. Reviews of data collected or managed by the company collected are generally conducted by internal subject matter experts. Table 6-9 summarizes the reviews.

Table 6-9 Validation and Independent Review of Pacific Power's Data

Input	3rd Party Data Validation	Independent Review	Subject Matter Expert Review
Asset location and attributes	No	No	Yes
Historic weather conditions	No	No	Yes
Fire incidents near Pacific Power assets	No	No	Yes

Independent Review of Risk Model and Calculations

The models used by Technosylva in WFA-E, including WRRM are described in detail in Appendix B, including the following information on independent review results:

“The core models implemented in WFA-E form the basis of most operational propagation models in use today (Andrews et al 1980, Gould 1991). They have been implemented in well-known software like NEXUS (Scott and Reinhardt 2001), Fire and Fuels Extension to Forest Vegetation Simulator (FFE-FVS) (Reinhardt and Crookston 2003), FARSITE (Finney 2004), Fuel Management Analyst (FMAPlus) (Carlton2005), FlamMap (Finney 2006) and BehavePlus (Andrews et al.2008). Nevertheless, forest fires are a very difficult phenomenon to simulate which depends on many different factors and typical simulations are able to predict the source dataset with mean absolute percent errors between 20 and 40% (Cruz et al. 2013)

“One of the important facts in fire simulation is the definition of the fuel models, with analysis providing different results for different fuels and regions. For example, Sanders (2001) observed a pattern of over-prediction by FARSITE in fuel models 1,2, 5 by a large margin, moderate in fuel 10 and some underprediction for fuel model 8. Zigner et al (2020) used two case studies during strong winds reveling that FARSITE was able to successfully reconstruct the spread rate and size of wildfires when spotting was minimal. However, in situations when spotting was an important factor in rapid downslope wildfire spread, both FARSITE and FlamMap were unable to simulate realistic fire perimeters. Ross et al. (2006) used measurements from temperature sensors during prescribed burn in the Appalachian Mountains to recreate the fires and compared fire behavior simulated by FARSITE. They obtain a set of ROS adjustment factors that better represented the observed fire behavior obtaining a ROS adjustment factor of 1.5 and 2 for fuels 9 and 11 respectively, and a decreasing factor of 0.2 to the fuel type 6.

“Apart from these reviews Technosylva has been constantly improving the accuracy and performance of the published fire models to better adjust the results to observed fire behavior. This includes a better definition of the fuel types, improved forecast of live fuel moisture content, modifications to the crown fire modelling initialization scheme, and automatic fire adjustment based on data assimilation techniques using ROS adjustment factor. In addition, Technosylva has implemented more than 21 additional models into the WFA-E platform to enhance accuracy and address know limitations of published fire models. These improvements include crown fire analysis, ember and spotting, urban / non-burnable area encroachment, consequence and impact quantification, etc. It is important to note that improvement of the fire modeling platform of choice necessitates not only improvements in mathematical algorithms but substantial improvements in the accuracy and resolution of input data sources. These work in concert to enhance the modeling and outputs to match observed and expected fire behavior. A robust operationalization of fire models requires constant and on-going research, testing, validation and implementation of both models and data sources."

Fire model validations are performed both internally and during operational scenarios in the California in collaboration with CAL Fire. Technosylva assessed the performance of fire spread models for initial attack incidents (either surface and crown) currently used in operational environments in California through the analysis of the rate of spread (ROS) of 1,853 wildfires. The work is going to be published in a high-impact peer review scientific journal. The paper states that the fire spread model's performance for California is in line with previous studies developed in other regions and the models are accurate enough to be used in real-time operations to assess initial attack fires. However, Technosylva identified how some environmental variables may bias the ROS predictions, especially in timber areas where the Scott and Burgan (2005) fuel models clearly underestimated ROS. New improvements in the fuel families and crown fire spread models have allowed to improve the accuracy and performance of the fire models to better adjust the results to observed fire behavior.

6.6.2 Model Controls, Design, and Review

WFA-E and the models in it such as WRRM are developed and maintained by Technosylva, a third-party software provider. Standard software development practices are followed to test and release software changes and release versions following a standardized numbering system. Quality Assurance and Quality Control are performed on model outputs regularly and, especially, when a real fire is spreading across the service territory. The WFA-E module named FireSim allows analyzing single fire events on demand to evaluate model's performance.

Pacific Power provided asset information, and the models use the characteristics unique to its service territory such as weather, terrain, and vegetation, however there was no customization of the software to accommodate these changes. See Appendix B for the model inputs.

As part of the annual risk analysis update, Pacific Power may refine its inputs and adjust attributes and weightings. If changes are made, Pacific Power will maintain a log with changes, enhancements, and improvements.

6.7 RISK ASSESSMENT IMPROVEMENT PLAN

Pacific Power has recently implemented WFA-E to begin to quantify its utility risk and expects to continue to learn and evolve its risk assessment process and models as WFA-E is used more and additional solutions are brought online. Table 6-9 highlights the known improvements.

Table 6-10 Risk Assessment Improvement Plan

Improvement #	Key Risk Assessment Area	Proposed Improvement	Type of Improvement	Expected Value Add	Timeframe and Key Milestones
1.	Risk Assessment Methodology	Implement PSPS Risk Assessment Solution	Technical Programmatic	Quantification of PSPS risk Quantification of Utility risk	Q1 2023—Project Scoping Q2 2023—Identify Solution Q3 2023—Solution Development Q4 2023—Solution Testing Q1 2024 - PSPS Solution Release
2.	Design Basis	Evaluate and Establish HFRA (If needed)	Programmatic	Updated HFRA boundaries to support mitigation planning efforts	
3.	Risk Event Tracking	Implement Fire Incident Tracking Database	Technical Programmatic	Improved tracking of where incidents are taking place to validate risk model	
4.	Design Basis	Evaluate Adding Timber Loss as a Consideration to WRRM RAVE Calculation	Technical Programmatic	Inclusion of locational risk unique to Pacific Power's operating area	
5.	Risk Assessment Methodology	Implement annual review and update process for WFA-E model data	Technical Programmatic	Updated risk information to support annual planning processes	Q1 2023—Identify processes and attributes that need regular review Q2 2023—Implement process
6.	Design Basis	Expansion of Service Territory Modeled in WRRM	Technical Programmatic	Expand wildfire and PSPS risk modeling to assess all utility assets in California	
7.	Risk Tracking	Centralized Solution to track Wildfire and PSPS Risks	Technical Programmatic	Single location to track wildfire and PSPS risk	

Improvement Plan Summaries

1. Implement Public Safety Power Shutoff (PSPS) Risk Assessment Solution

Problem statement: Currently, Pacific Power does not have methodology or solution to quantify PSPS risk for mitigation planning and relies on qualitative information to assess long-term PSPS likelihood and community impacts.

Planned improvement: Pacific Power will develop a methodology to quantify long-term PSPS risk in its service territory. The methodology will align with OEIS guidance and the best practices from other IOUs. The solution is anticipated to be a technical implementation incorporated into advanced data analytics tool described already described.

Anticipated benefit: This improvement will allow the company to quantify PSPS risk and integrate it into the utility risk model with wildfire risk. This will allow Pacific Power to prioritize where to plan and implement mitigation efforts that reduce wildfire risk, PSPS risk or both risks in its service territory.

Region prioritization (where relevant): HFTD locations will be prioritized for the initial implementation of the PSPS risk assessment solution

Supporting documentation (as necessary): N/A

2. Identify HFRA

Problem statement: Pacific Power leverages the CPUC-approved HFTD map to inform wildfire mitigation programs and has yet to evaluate the need to supplement the HFTD with the creation of an HFRA.

Planned improvement: Pacific Power will analyze its service territory and identify if there are any areas that should be identified as a HFRA based on WRRM wildfire risk outputs. Areas identified as a HFRA, may be subject to enhanced mitigation efforts to reduce the risk of a wildfire as discussed in section 6.4.1.2 This analysis will also incorporate best practices and lessons learned by other IOUs that identify areas outside of the HFTD with elevated fire risk.

Once established, Pacific Power anticipates performing this analysis on a five-year cycle.

Anticipated benefit: Reduce the risk of wildfire for customers and communities outside of the HFTD through enhanced mitigation efforts.

Region prioritization (where relevant): Pacific Power will prioritize areas adjacent to the HFTD in its analysis.

Supporting documentation (as necessary): N/A

3. Implement Fire Incident Tracking Database

Problem statement: The existing ignition tracking repository was developed based on CPUC reporting requirements and lacks certain information and analytical capability useful for wildfire risk modeling.

Planned improvement: Improve ignition data collection processes to ensure additional information is collected to perform analysis on trends and areas of concern. The improvements could include, but aren't limited to:

- Validation of current data fields for completeness and necessity
- Review and updates of current business process for any changes needed to ensure consistent data collection
- Potential system changes as identified including migration of existing fire incident data to the advanced data analytics platform

Anticipated benefit: Additional data collection enables analysis of trends including ignition causes and locations to improve probability of ignition calculations and models in WFA-E that identify locations at risk of utility asset caused wildfires. This will improve Pacific Power's prioritization of mitigation efforts.

Region prioritization (where relevant): N/A

Supporting documentation (as necessary): N/A

4. Evaluate Adding Timber Loss as a Consideration to WRRM RAVE Calculation

Problem statement: The RAVE calculation currently in WRRM for wildfire vulnerability has inputs for population, buildings, egress, social vulnerability, and fire station locations among other variables. Pacific Power is considering if other metrics could be considered to reflect the conditions in its service territory.

Planned improvement: Pacific Power plans to evaluate if timber loss could be added to the RAVE model as an input to wildfire vulnerability, known in RAVE as community resiliency. Many of the communities in Pacific Power's service territory rely on the timber industry as a significant contributor their local economy. **Anticipated benefit:** Augmented assessment of the consequences of a wildfire that includes location-specific economic impacts to inform wildfire mitigation planning efforts.

Region prioritization (where relevant): N/A

Supporting documentation (as necessary): N/A

5. Implement annual review and update process for WFA-E model data

Problem statement: Accurate, current input data is critical to successful application of WFA-E models, especially as mitigation program progress. For example, if WRRM does not include updated utility asset information after a mitigation is implemented, it will continue to show higher than actual wildfire risk in hardened portions of the system when mitigation efforts should be directed elsewhere.

Planned improvement: Implement an annual process to ensure the WFA-E has updated information from Pacific Power to support planning and operational response. This updated information could include but is not limited to:

- Utility assets
- Weather history
- Ignition and outage history
- Map updates
- Fire Potential Index (FPI) levels
- Updates to RAVE input weightings

Anticipated benefit: An annual process ensures that the model has current information from Pacific Power so model results reflect the current state of utility assets and meteorological information. This will support both operational decision-making for during hazardous weather conditions and planning mitigation efforts to focus on the current areas of high utility risk.

Region prioritization (where relevant): N/A

Supporting documentation (as necessary): N/A

6. Expansion of Service Territory Modeled in WRRM

Problem statement: In the initial implementation of WRRM, since Pacific Power focused analysis on the known areas of highest risk, such as the HFTDs, the larger portion of Pacific Power's service territory was not included in this analysis.

Planned improvement: The Company is evaluating if the remaining lines miles of its service territory should be added to WRRM for modeling.

Benefit: Inclusion of Pacific Power's entire service territory in the WFA-E analyses for improved identification of circuits or assets of high utility risk outside of HFTDs where mitigation efforts should be implemented.

Region prioritization (where relevant): Analysis will be of areas outside of the HFTD as these are already included in WRRM.

Supporting documentation (as necessary): N/A

7. Consolidated Tracking of Utility Risk

Problem statement: With the implementation of WRRM and planned development of PSPS risk modeling, Pacific Power will have multiple risk data sets covering a large geographic area without an application that consolidates this data for use in operations and mitigation planning.

Planned improvement: Pacific Power plans to develop and implement a utility risk data analytics tool in the advanced data analytics platform to show wildfire and PSPS risk in a single location and quantify and display Utility risk.

Benefit: This improvement will result in a single application to track Wildfire, PSPS, and Utility risk for operational decision-making and to prioritize mitigation efforts ensuring that maximum benefit can be realized from the myriad of tools and analyses available.

Region prioritization (where relevant): N/A

Supporting documentation (as necessary): N/A

7 WILDFIRE MITIGATION STRATEGY DEVELOPMENT

In this section of the WMP, the electrical corporation must provide a high-level overview of its risk evaluation and process for deciding on a portfolio of mitigation initiatives to achieve maximum feasible risk reduction and that meet the goal(s) and plan objectives stated in Section 4.2, and wildfire mitigation strategy for 2023-2025.

7.1 RISK EVALUATION

7.1.1 Approach

In this section of the WMP, the electrical corporation must provide a brief narrative of its risk evaluation approach, based on the risk analysis outcomes presented in Section 6, to help inform the development of a wildfire mitigation strategy that meets the goal(s) and plan objectives stated in Sections 4.1– 4.2.

While many elements are still in development, Pacific Power's future baseline risk analysis framework will consist of four main components: (1) the HFTD/HFRA Map, (2) the WRRM project selection and planning tool, (3) a risk reduction evaluation and prioritization tool, and (4) advanced analytics platform. This framework is depicted visually in the figure below.

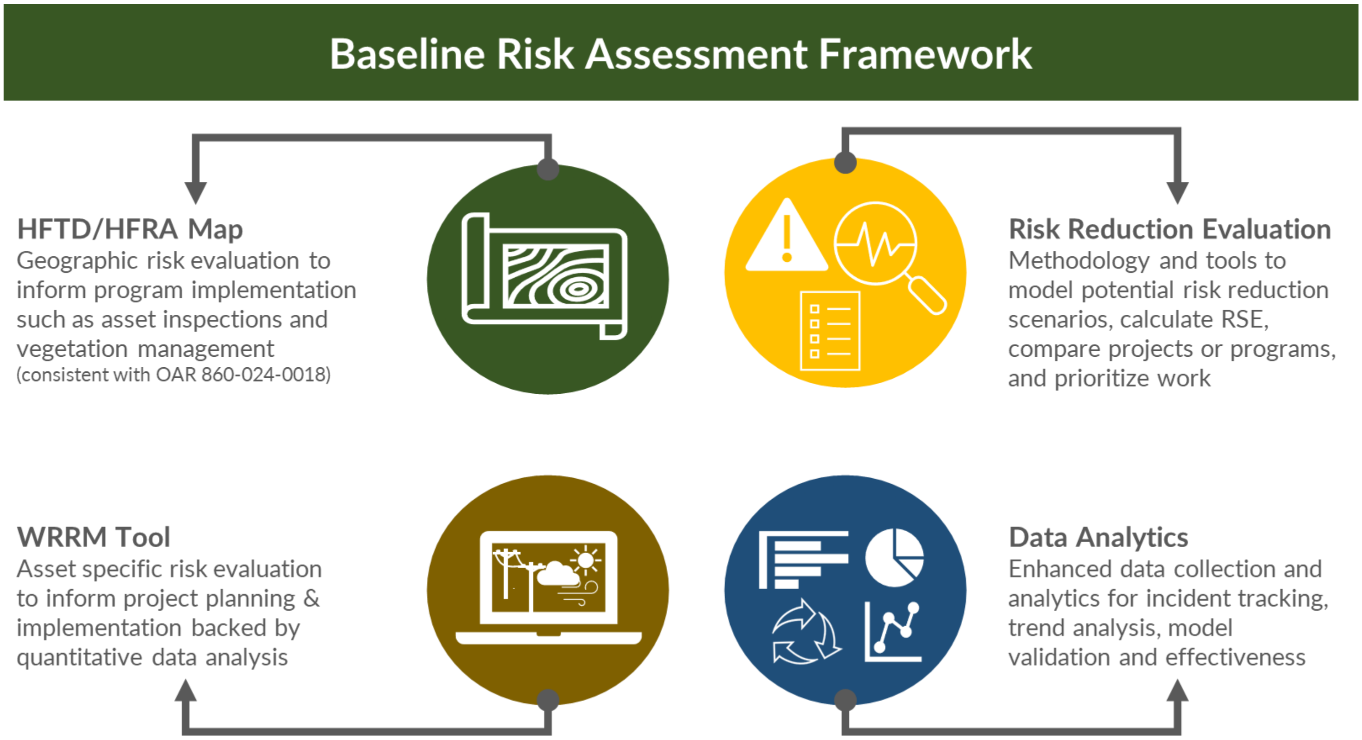


Figure 7-1 Pacific Power's Future Baseline Risk Assessment Framework

The Risk Assessment Improvement Plan discussed in Section 6.7 will have a substantial impact on this framework and the company's project and program selection, prioritization, planning, and implementation processes. For example, the planned evaluation and potential establishment of the HFRA could impact programs such as vegetation management and asset inspections beginning in 2024. The WRRM tool will build upon the initial analysis performed in 2019 to provide a repeatable, transparent way of evaluating projects in long term investment supported by data analytics and modeling beginning in 2023 for projects to be constructed in 2024. And finally, the advanced data analytics platform will provide enhanced data collection, analytics, and risk reduction scenario modeling to enhance project prioritization and evaluate program effectiveness beginning in 2024.

The image below visually depicts these projects, how these projects will impact Pacific Power's processes, and when these changes will be implemented to evolve the company's framework. Once the foundational elements are completed, Pacific Power will be able to apply a high-level decision-making process that aligns with many other utilities to further develop its portfolio of wildfire mitigation initiatives. The high-level process represented in Figure 7-1 includes four key phases (1) risk modeling and assessment, (2) project and program identification, (3) evaluation and selection, and (4) implementation and modeling. The steps included in this high-level process will be discussed in more detail in Sections 7.1.3 and 7.1.4 below.

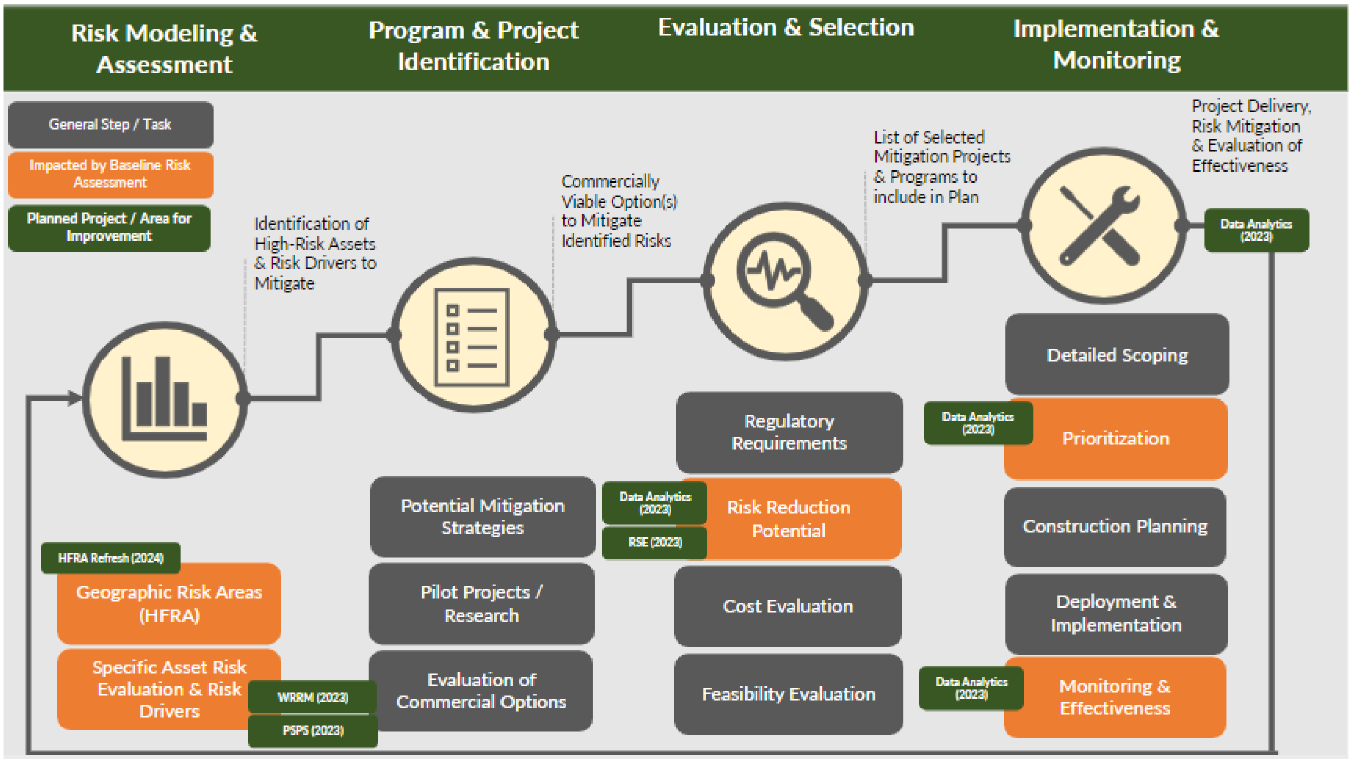


Figure 7-2 Mitigation Selection and Prioritization High Level Process

7.1.2 Key Stakeholders for Decision Making

In this section, the electrical corporation must identify all key stakeholder groups that are part of the decision-making process for developing and prioritizing mitigation initiatives. At a minimum, the electrical corporation must do the following:

- Identify each key stakeholder group (e.g., electrical corporation executive leadership, the public, state/county public safety partners)
- Identify the decision-making role of each stakeholder group (e.g., decision maker, consulted, informed)
- Identify method of engagement (e.g., meeting, workshop, written comments)
- The electrical corporation must also describe how it communicates decisions to the identified key stakeholders.

In 2022 Pacific Power developed a new department, commonly referred to as Wildfire Safety. This new department consists of 13 full-time employees, is led by a Managing Director, and includes both a project management office focused on delivery of line rebuilds and other system hardening initiatives, and a project delivery team responsible for overall plan development, monitoring, and implementation. The overall organization is depicted in Figure 7-3. This WMP activity is tracked with the Tracking ID# WP-01.

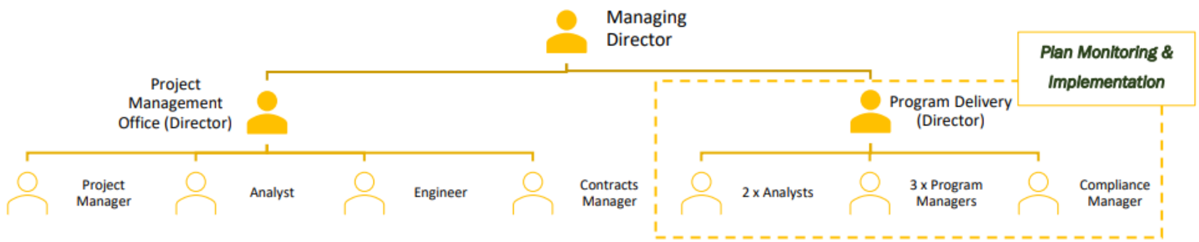


Figure 7-3 Pacific Power's Wildfire Safety Department

While the broader Wildfire Safety team is tasked with supporting all types of wildfire mitigation initiatives and strategies across the company's entire service territory, a key function of the Wildfire Safety Program Delivery team is to develop, implement, monitor, and improve the company's WMP. It is the responsibility of Wildfire Safety Program Delivery to coordinate with other internal departments such as Asset Management, Vegetation Management, Field Operations, and Emergency Management to ensure all aspects of the plan are delivered. Additionally, Wildfire Safety regularly evaluates its plan and provides updates as needed and consistent with statutory and regulatory requirements, including managing quarterly data reporting (QDR), the annual compliance report (ACR) and change order requests.

The Figure below represents how various departments participate in the development of the plan and its various components and projects. These same stakeholder groups also play an active role in delivery of plan elements where appropriate.

Figure 7-4 Stakeholder Groups Participating in Plan Development

In addition to engaging key internal stakeholders, each year prior to fire season, Pacific Power distributes updated safety information on and information on the company's WMP to press outlets across its service area as a low-cost outreach method.

Once a year, Pacific Power hosts a webinar providing an overview of the company's mitigation program and strategies. Among other items, key mitigation strategies addresses in the webinar include situational awareness capabilities, system hardening investments, and PSPS process review. The webinar also brings to focus how Pacific Power engages with local communities and Public Safety Partners on wildfire safety. The webinar also serves as a forum for customers, community stakeholders, and the public-at-large to ask questions during the livestream. A webinar for California customers was delivered on May 3, 2022. The webinar along with the video "Investing in Resilience-Wildfire Safety" were posted on the Pacific Power website and YouTube channel.

Pacific Power is a public utility, and as such, aims to develop a WMP that aligns with public interests. In 2022, the company conducted a series of virtual Wildfire Safety Advisory Board

(WASB) meetings. While these board meetings were designed specific to address PSPS planning and preparedness, Pacific Power leveraged the opportunity to communicate an overview of its 2020-2022 WMP, provide an environment for direct questions and answers, and foster engagement from key public safety partners and local agencies in the company's overall wildfire mitigation planning processes.

Three in-person meetings were hosted and summarized in Table 7-1

Table 7-1 WASB Meeting Details and Attendance

Meeting Occurrence	Date	General Topics
Q1	February 17, 2022	Organizational Improvements PSPS Zones New for 2022 PSPS Plan Planned PSPS Tabletop Exercises CRC Plans PSPS Mitigation Programs 2022 Access and Functional Needs Update
Q2	May 19, 2022	Pacific Power Asset Overview PSPS Overview Advanced Weather Forecasting & Situational Awareness Tabletop Exercise Experience Power Wildfire Safety Website PSPS Impact Mitigation Programs Wildfire Safety Preparedness PSPS Regulatory Update
Q4	November 17, 2022	Vision for emergency management Tabletop exercises and workshops for 2023 Public Safety Partner Portal Customer Program Updates

At these meetings, Pacific Power generally prepared a presentation to walk-through high-level topics and solicited input and feedback, encouraging two-way dialogue. Additionally, participants were provided a means of submitting follow up questions via email. Attendance and engagement varied throughout the year depending on other competing priorities in the local communities. In 2023, Pacific Power intends to continue hosting these board meetings but will look for ways to increase engagement and adjust the frequency as preferred by board members.

Figure 7-2Table 7-2 summarizes key stakeholder groups that are part of the decision-making process for developing and prioritizing mitigation initiatives.

Table 7-2 Stakeholder Roles and Responsibilities in the Decision-Making Process

Stakeholder	Stakeholder Point of Contact	Electrical Corporation Point of Contact	Stakeholder Role	Engagement Methods
Wildfire Safety Program Delivery	Director, Wildfire Safety Program Delivery	Director, Wildfire Safety Program Delivery	WMP Monitoring and Implementation	Executive briefings, meetings, written comments
Asset Risk Management	Director, Asset Risk	Director, Asset Risk	Risk Modeling and Assessment	Executive briefings, meetings, written comments
Wildfire Safety Project Management Office	Director, Project Management Office	Director, Project Management Office	Program Scoping and Execution	Meetings, written comments
Wildfire Safety	Managing Director, Wildfire Safety	Mng Dir, Wildfire Safety & Asset Management	Oversight and Compliance	Executive briefings, meetings, written comments
Vegetation Management	Dir, Environmental & Vegetation Mgmt	Dir, Environmental & Vegetation Mgmt	Program Scoping and Execution	Meetings, written comments
Operations	Mng Dir, Operations	Mng Dir, Operations	Program Scoping and Execution	Meetings, written comments
System Operations	VP, Systems Operations	VP, Systems Operations	Program Scoping and Execution	Meetings, written comments
Meteorology	Mgr, Meteorology	Mgr, Meteorology	Risk Modeling and Assessment	Meetings, written comments
Emergency Management	Dir, Emergency Mgmt	Dir, Emergency Mgmt	Program Scoping and Execution	Meetings, written comments
Engineering	VP, Engrg & T&D Standards	VP, Engrg & T&D Standards	Standardization	Meetings, written comments
Modoc County	Chester Robertson, County Administrator Heather Hadwick, Deputy Director Office of Emergency Services		Wildfire Advisory Board	• Annual webinar providing an overview of the company's wildfire mitigation program and strategies • In-person community forums • Wildfire Advisory Board

Stakeholder	Stakeholder Point of Contact	Electrical Corporation Point of Contact	Stakeholder Role	Engagement Methods
Siskiyou County	Bryan Schenone, Director Emergency Services Nancy Ofgren, Supervisor Ed Valenzuela, Supervisor Adam Heilman, Staff Services Gary Freeman, Community AFN Administrator Giselle Nova, Coordinator, Firesafe Council Coordinator		Wildfire Advisory Board	• Annual webinar providing an overview of the company's wildfire mitigation program and strategies • In-person community forums • Wildfire Advisory Board
Karuk Tribe	Josh Saxton, General Manager Scot Steinbring, Fire Management Officer		Wildfire Advisory Board	• Annual webinar providing an overview of the company's wildfire mitigation program and strategies • In-person community forums • Wildfire Advisory Board participation
City of Dunsmuir	Matthew Bryan, Mayor		Wildfire Advisory Board	• Annual webinar providing an overview of the company's wildfire mitigation program and strategies • In-person community forums • Wildfire Advisory Board participation
City of Yreka	Jason Ledbetter, City Manager		Wildfire Advisory Board	• Annual webinar providing an overview of the company's wildfire mitigation program and strategies • In-person community forums • Wildfire Advisory Board participation
College of the Siskiyous	Veronica Rivera, Director of Facilities		Wildfire Advisory Board	• Annual webinar providing an overview of the company's wildfire mitigation program and strategies • In-person community forums • Wildfire Advisory Board participation

Stakeholder	Stakeholder Point of Contact	Electrical Corporation Point of Contact	Stakeholder Role	Engagement Methods
Roseburg Forest Products	Paul Hamann, General Manager		Wildfire Advisory Board	• Annual webinar providing an overview of the company's wildfire mitigation program and strategies • In-person community forums • Wildfire Advisory Board participation
Customers and the General Public				• Annual webinar providing an overview of the company's wildfire mitigation program and strategies • In-person community forums • Paid media • News media interviews (digital, broadcast, print, radio)
Public Utility Commission	Office of Energy Infrastructure Safety			• WMP • Quarterly Initiative Update (QIU) • Workshops

7.1.3 Risk-Informed Prioritization

For programs and projects already in progress, Pacific Power will continue implementing its mitigation programs in 2023 based on risk assessment and prioritization developed for the 2020-2022 WMP cycle. Once the new tools are implemented and new risk analysis is complete, Pacific Power will update its approach to prioritization.

In Phase 1 — Risk Modeling and Assessment, of the process depicted in Figure 7-2, the decision-making process begins with identifying the areas of high wildfire risk. With the implementation of WRRM to support risk modeling, Pacific Power can identify assets associated with high wildfire risk which can then be aggregated into larger geographical areas to identify where there is high cumulative wildfire risk based on assets in an area. While Pacific Power has begun to utilize WRRM to identify risks and prioritize areas of highest risk and will begin populating Table 7-3 in Q4 of 2023 once the Company has conducted an in-depth analysis of the output. The Overall Utility Risk will be populated once PSPS risk has completed and validated for the Q4-2024 QDR submittal.

Table 7-3 Prioritized Areas in Pacific Power's Service Territory Based on Overall Utility Risk

Priority	Area	Description	Overall Utility Risk	Associated Risk Drivers
TBD	TBD	TBD	TBD	TBD

7.1.4 Mitigation Selection Process

7.1.4.1 Identifying and Evaluating Mitigation Initiatives

In Phase 2 —Program and Project Identification of the process depicted in Figure 7-2, Pacific Power identifies and evaluates potential mitigations. Identifying mitigation pilots and possible programs sometimes require an evaluation of current industry practices and technology utilized. Pacific Power has relationships with other utilities across multiple states and discusses industry practices with them to learn from their experiences. The Company uses these learnings as well as learnings from completed projects and programs to evaluate proven solutions as a mitigation program. Where feasible, Pacific Power evaluates multiple mitigation options to ensure that the solution ultimately selected is the most cost effective relative to the risk reduced. Where there is limited information on a possible mitigation, Pacific Power may undertake a pilot to evaluate the cost effectiveness of a possible solution before determining if it should be applied more widely. This WMP activity is tracked with the Tracking ID# WP-02.

In Phase 3 —Evaluation and Selection, Pacific Power evaluates initiatives based on a combination of several criteria, including:

- Regulatory requirements
- Stakeholder and customer input
- Wildfire risk impact
- Customer impact
- Ease of implementation/Constructability
- Project costs

Programs are reviewed and approved by senior management for program planning.

Pacific Power also implementing Risk Spend Efficiency (RSE) concepts in assessing wildfire and PSPS mitigation alternatives.

Pacific Power RSE Background:

Risk Spend Efficiency (RSE) scores are calculated to capture changes in risk per dollar spent. Their main objective is to allow Pacific Power to target certain high fire risk areas for mitigation efforts (i.e., covered conductors, undergrounding) while allowing for efficient and smart spending. Given that the cost of certain mitigation efforts can require millions of dollars per mile in relation to covered conductors and undergrounding, targeting areas with the highest risk and biggest return on investment in the form of reduced wildfire risk is the main objective of RSE scores.

To calculate RSE scores Pacific Power must analyze the key drivers of ignition risk asset wise, mitigation efforts available, their effectiveness, and the associated cost of each mitigation effort. To quantify the risk associated with each asset, the utility will employ the Wildfire Risk Reduction Model (WRRM), along with its components, Risk Associated with Ignition Location (RAIL) and Risk Associated with Value Exposure (RAVE). RAIL will allow Pacific Power to determine where risk is highest within the service territory and RAVE allows the utility to understand the environmental impacts of a potential ignition.

At a simplified level, RSE is:

$$RSE = \frac{CoRE_b - CoRE_m}{Cost}$$

where $CoRE_b$ is equal to the consequence of the risk event occurring should no mitigation be enacted (baseline risk). $CoRE_m$ is the consequence of the risk event occurring should a mitigation be enacted *(i.e. covered conductors, undergrounding, expulsion fuse replacement, etc.)*. The $Cost$ is the total cost of the mitigation effort being enacted and is typically calculated using the amount of capital expenditure the mitigation requires.

An illustration of this calculation using two hypothetical examples with covered conductor and undergrounding as the mitigation efforts. For each example, Pacific Power employed WRRM to identify a one-mile segment of high-risk circuit located in Weed, CA. This selection was based off fire spread potential, flame length, buildings destroyed, population, and other various risk factors. Then the pre- and post-mitigation risk is calculated. The cost is the total cost per circuit mile of the mitigation effort.

Below are the general steps to obtain pre-mitigation risk scores ($CoRE_b$):

1. Obtain output from WRRM to identify a high-risk circuit based on several risk drivers
2. Obtain the number of buildings destroyed should an ignition occur
3. Determine the median home price in the area and multiply that by buildings destroyed
4. Determine mitigation effort
5. Obtain re-built costs for reconstructing bare wire after ignition (no mitigation)
6. Arrive at a final pre-mitigation consequence of risk baseline score ($CoRE_b$)

Below are the general steps to obtain post-mitigation risk scores ($CoRE_m$):

1. Use the same circuit as identified for the pre-mitigation risk stated above
2. Obtain number of buildings destroyed should an ignition occur
3. Determine the median home price in the area and multiply that by buildings destroyed
4. Determine mitigation effort

5. Calculate the risk reduction for that mitigation (here, we reduce the risk by 50% as estimated via a study conducted by Southern California Edison on covered conductor effectiveness)

6. Obtain re-build costs but assume covered conductor is installed after ignition (mitigation)

7. Arrive at a final post-mitigation consequence of risk mitigation score ($CoRE_m$)

The first example is showing the RSE when the mitigation effort is covered by conductor (Figure 7-3).

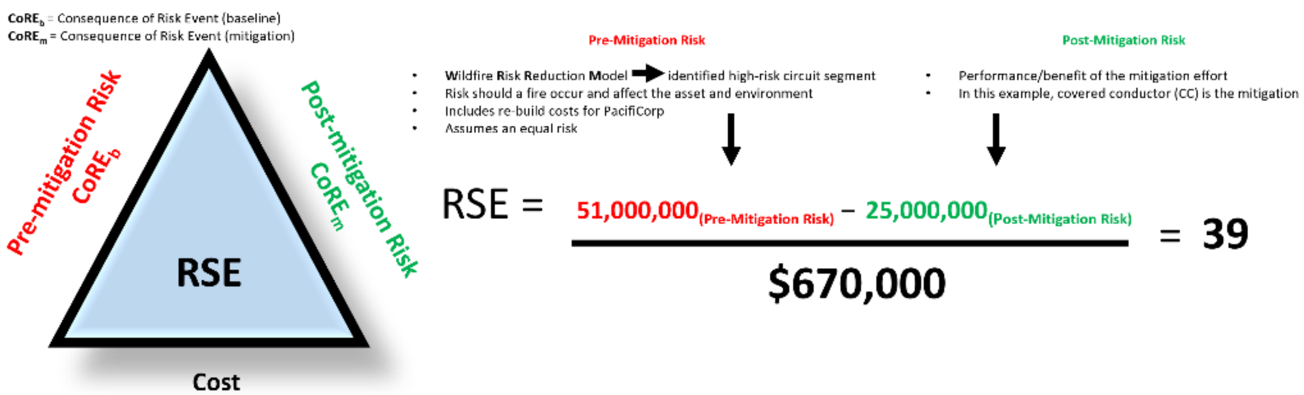


Figure 7-5 Illustrative Example of RSE Calculation with Covered Conductor as the Mitigation Effort

This example illustrates that adding covered conductor to this circuit would yield an RSE of 39. This example uses one-circuit mile as an example for cost purposes. Installing covered conductor would reduce the pre-mitigation risk by approximately 65%. To compare other mitigation efforts with an illustrative example, use undergrounding as the other potential mitigation for this same high-risk circuit. (Figure 7-4).

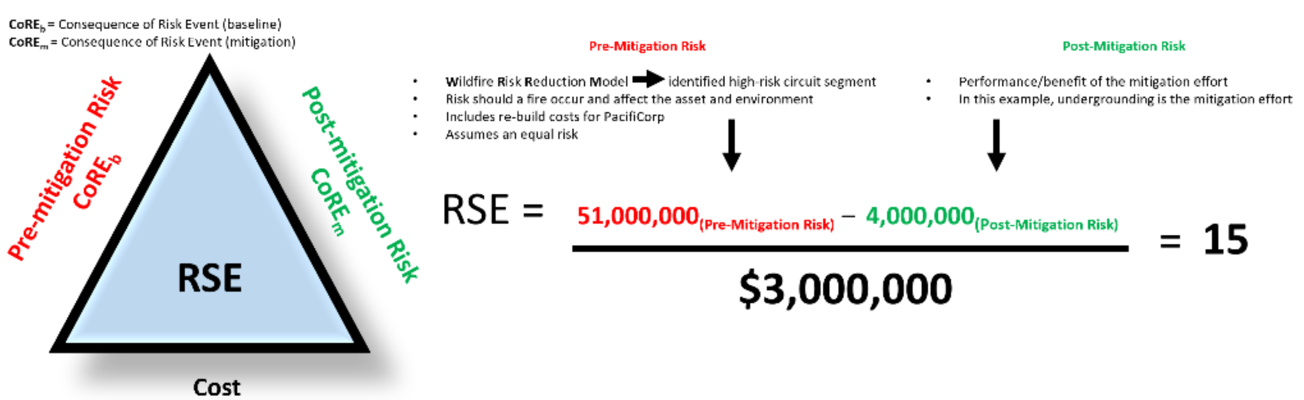


Figure 7-6 Illustrative Example of RSE Calculation with Undergrounding as the Mitigation Effort

From the example above for undergrounding, the RSE is 15. This is lower than the RSE for covered conductor (39). This is not surprising given that while undergrounding reduces the risk of ignition by almost 99% (see study by PG&E), it also costs substantially more per circuit mile than covered conductor. Therefore, in this illustration installing covered conductor on this circuit is the better solution as the risk reduction per dollar spent is overall more efficient.

RSE will help Pacific Power determine which mitigation efforts to focus on while reducing the most risk per dollar spent. The calculation of RSE is also flexible enough to handle certain unique situations and leaves room for improvement. There are some assumptions made in the above equation, and one of the main ones is that of equal risk. The equation above assumes there is an equal risk of the circuit causing an ignition, with probability of ignition (POI) absence. Future versions of RSE will incorporate risk probability in the calculations along with consequences.

Pacific Power plans to calculate RSE for grid hardening initiatives such as: covered conductor (spacer cable and tree wire), undergrounding, and other mitigations like the large IOUs in California.

Moving forward, Pacific Power plans to continue its refinement of RSE throughout 2023 and ensure its calculations align with other larger California utilities. In collaboration with them through joint workstreams and other venues, Pacific Power's will gather and share information to make the risk spend efficiency calculations as accurate as possible.

As discussed above, Pacific Power is developing their RSE process and does not have RSE calculations yet for proposed mitigations. Figure 7-7 shows the timeline for implementation of RSE calculations for grid hardening initiatives.

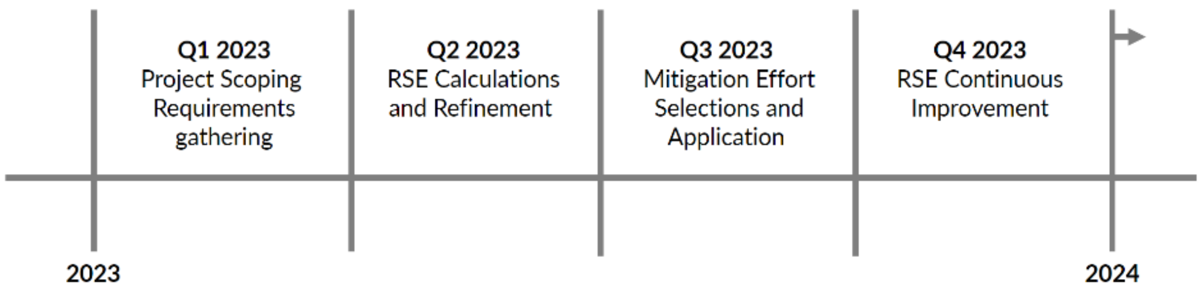


Figure 7-7 Timeline for RSE Implementation

7.1.4.2 Mitigation Initiative Prioritization

Once programs are selected, they are prioritized. Currently, work is prioritized in locations with a high fire risk first which, generally, occur within the HFTD. Additionally, programs that have the potential to reduce the impact of PSPS as discussed in Section [Reference] are also prioritized to the extent possible, recognizing that some programs have longer implementation times than others. For example, the ability to obtain permits can impact the implementation of covered conductor through the line rebuild program regardless of Pacific Power's efforts to prioiritize the program. Section 7.1.1 describes Pacific Power's high level decision making process. Figure 7-8 shows the high level considerations described above to prioritize inittiaves to mitigate wildfire risk.

Figure 7-8 Current Mitigation Selection Considerations

After the prioritization is determined, the program will move to the design stage. The design stage can take on many different forms depending on the program, ranging from schematics and process design to a complete engineering design. Once the scope, prioritization, and design have been completed the program is ready to be implemented. As the program is implemented, it is monitored for adherence to scope, schedule, budget, and installation dates.

The following image depicts the current breakdown of initiatives by geographic area, with work in the HFTD being prioritized over work outside of the HFTD.

Initiative Tracking ID	Initiative/ Program	Non-HFTD	HFTD
CO-01	Public outreach and education awareness program	x	x

Initiative Tracking ID	Initiative/ Program	Non-HFTD	HFTD
EP-01	Emergency preparedness plan	x	x
EP-02	External collaboration and coordination	x	x
EP-03	Public emergency communication strategy	x	x
EP-05	Customer support in wildfire and PSPS emergencies	x	x
GH-01	Line Rebuild - Covered conductor installation		x
GH-04	Installation of system automation equipment	x	x
GH-05	Expulsion Fuse Replacement	x	x
AI-01	Transmission Patrol inspections	x	x
AI-02	Distribution Patrol Inspections	x	x
AI-03	Transmission Detail Inspections	x	x
AI-04	Distribution Detail Inspections	x	x
AI-05	Transmission Intrusive Pole Inspections	x	x
AI-06	Distribution Intrusive Pole Inspections	x	x
AI-07	Enhanced IR Inspections in transmission lines	x	x
AI-08	Enhanced IR Inspections in distribution lines	x	x
AI-11	Substation Inspections	x	x

Initiative Tracking ID	Initiative/ Program	Non-HFTD	HFTD
AI-12	Quality assurance / quality control	x	x
MA-01	Maintenance: Weather Station	x	x
GO-01	Equipment Settings to Reduce Wildfire Risk (Grid Ops): EFR and Fault Indicators	x	x
GO-02	Grid Response Procedures and Notifications (Grid Ops): Patrols	x	x
PS-01	Protocols on PSPS	x	x
RA-01	Risk and Risk Component Calculation	x	x
RA-02	Top Risk Areas within the HFRA	x	x
RA-03	Other Key Metrics	x	x
RA-04	Enterprise System for Risk Assessment	x	x
SA-01	Environmental monitoring systems	x	x
SA-02	Grid monitoring systems	x	x
SA-03	Smoke and Air Quality Sensors	x	x
SA-04	Wildfire Detection Cameras	x	x
SA-05	Weather Forecasting	x	x
SA-06	Fire potential index	x	x
VM-01	Vegetation Inspections: Detailed Inspection – Distribution	x	x

Initiative Tracking ID	Initiative/ Program	Non-HFTD	HFTD
VM-02	Vegetation Inspections: Detailed Inspection - Transmission	x	x
VM-03	Vegetation Inspections: Patrol Inspection - Distribution		x
VM-04	Vegetation Inspections: Patrol Inspection - Transmission		x
VM-05	Pole clearing	x	x
VM-06	Clearance - Distribution	x	x
VM-07	Clearance - Transmission	x	x
VM-08	Fall-in mitigation		x
VM-11	Quality assurance / quality control	x	x
WP-01	Wildfire Mitigation Strategy Development	x	x
WP-02	Identifying and Evaluating Mitigation Initiatives	x	x

As explained in Section 6.1 and 7.1.4, Pacific Power is deploying new tools to evaluate risk and plans to evolve its process to identify and prioritize mitigations by geographic area. With implementation of WRRM, along with its components RAVE and RAIL, and RSE metrics, Pacific Power plans to identify assets associated with high wildfire/ PSPS risk and can use that information to support project selection and planning activities. These can then be aggregated into larger geographical areas and used to inform geographic prioritization of initiatives.

7.1.4.3 Mitigation Initiative Scheduling

Programs may be scheduled based a combination of factors including regulatory requirements, constructability and risk. For example:

- Infra-red inspections on transmission lines are scheduled in time intervals that match the peak loading on each line.

- Certain vegetation management activities are planned to happen before the fire season.
- Weather station maintenance starts in spring due to limited access to some locations during winter months.
- Asset inspections are performed during specific times of the year so that they meet inspection cycle timing required by regulatory requirements.
- Construction of grid hardening projects occurs year-round, however some projects are located away from year-round roads and cannot take place during wet seasons due to limited access.
- Grid hardening project scheduling has been impacted by permitting in two major ways. First permit agencies have experienced a significant increase in permit submissions from Pacific Power due to the volume of projects increasing review times. Second permits include specific conditions specifying time of year for construction activities to minimize impacts to the environment.

Interim solutions are not a consideration for initiatives that span multiple years.

As discussed below in section 7.2.1 the initiatives have slightly different methods for tracking progress.

To measure the effectiveness of the mitigation initiative it would depend on the type of initiative. For example.

- An inspection initiative would be effective in both the completing the scope of inspections and having any findings being reported on. Being able to find areas of concern to report on through each inspection cycle shows the inspections are effective.
- The line re-build program would be effective if there were no contact faults reported on those sections of lines that were re-built.
- A community outreach program would be determined effective if the communication and collaboration activity goals mentioned in the initiative were met.

7.2 WILDFIRE MITIGATION STRATEGY

7.2.1 Overview of Mitigation Initiatives and Activities

As described in Section 4, Pacific Power's WMP is guided by the following core principles:

- Frequency of ignition events related to electric facilities can be reduced by engineering more resilient systems that experience fewer fault events.
- When a fault event does occur, the impact of the event can be minimized using equipment and personnel to shorten the duration to isolate the fault event.
- Systems that facilitate situational awareness and operational readiness are central to mitigating fire risk and its impacts.

Pacific Power's WMP also seeks to consider the impact on California customers and communities in the overall imperative to provide safe, reliable, and affordable services.

Therefore, Pacific Power WMP initiatives are designed to provide timely and cost-effective wildfire mitigation benefits through a range of programs. To select these initiatives, Pacific Power is moving toward the risk-informed framework and mitigation selection process outlined in Section 7.1. Mitigations selected prior to this new framework were informed by the guiding principles above, subject matter expert reviews, collaboration with other utilities, and stakeholder and regulator input as described in Section 7.1.2 and Section 7.1.3.

For each mitigation initiative selected for implementation, the description, schedule, and progress monitoring components are described in the corresponding sub-sections within Section 8. Progress on all Pacific Power's wildfire mitigation programs will be tracked and reported quarterly to OEIS through the QDR process. Table 7-4 below summarizes planned mitigation initiatives and activities.

<u>Grid Designs, Operations, and Maintenance</u> – Completion and progress of initiatives within this category are tracked a few different ways. When applicable progress is communicated through construction or inspection management partners. In other situations, progress will be tracked through closed work orders or completed records tracked within internal asset software programs such as SAP or FPI (Facility Point Inspection).

<u>Vegetation Management and Inspections</u> – Completion and progress of initiatives within vegetation management are tracked utilizing vendor supplied progress reports. The reports provided by the vendor shows completed areas which can then be used to compare against the internal plan.

<u>Situational Awareness and Forecasting</u> – Initiatives within situational awareness and forecasting utilize vendors and contractors for completing the work. Different reports are utilized from the vendor to track completed deliverables and completion for the different initiatives. When applicable closed work orders can be used to show the completion of an activity.

Emergency Preparedness Plan and Community Outreach and Engagement – Initiatives within these two categories can be tracked through completed documents. Completed documents can include meeting minutes, training documentation, surveys, and records of different community communications.

Table 7-4 below summarizes planned mitigation initiatives and activities.

Table 7-4 Pacific Power's WMP Mitigation Initiatives for 3-year and 10-year Outlooks

WMP Category	Within Three Years	Within Ten Years	Location in WMP
Grid Design, Operations, and Maintenance	• Continue execution of grid hardening plans • Replace all expulsion fuses within the HFTD • Incorporation of IR technology for enhanced inspections • Continue planned inspection programs • Continue planned transmission and distribution wires maintenance • Continue planned substation apparatus maintenance programs • Continue to deploy EFR (Elevated Fire Risk) settings	• Improve EFR (Elevated Fire Risk) settings. capabilities • Complete Line Rebuild of all identified overhead line miles within the HFTD • Complete System Automation upgrades on all identified relays • Pilot new inspection technology as it becomes available and potentially incorporate into new or existing asset inspection programs	Section 8.1
Vegetation Management	• Continue progressing programs (annual patrols, routine cycle work and annual pole clearing). • Review and revise Standard Operating Procedures	• Continue to improve the QA/QC program	Section 8.2
Situational Awareness and Forecasting	• Complete calculation of FPI (Fire Potential Index). • Deployment of Wildfire Detection Network (wildfire detection cameras and smoke sensors) • Evaluate DFA (Distribution Fault Anticipators) • Expand weather station network.	• Continue to leverage AI and machine learning to create a more automated weather and risk forecasting system • Continue expansion and refinement of weather station network	Section 8.3
Emergency Preparedness	• Continued use of tabletop exercises to prepare for emergencies and PSPS events • Complete and implement outage procedures – Restoration Annex • Complete and implement outage procedures – Restoration Annex • Incorporate feedback and industry best practices into emergency management practices. • Implement improvements to Public Safety Partner Portal (PSP Portal)	• Continue collaboration and coordination with Public Safety Partners • Include hazards specific annexes for all service territory in the ERP	Section 8.4

WMP Category	Within Three Years	Within Ten Years	Location in WMP
Community Outreach and Engagement	• Perform Pre and Post-fire season customer survey • Continue partnering with public safety partners in communities throughout California regarding wildfire safety and preparedness and PSPS • Increase outreach to AFN populations • Implement customer feedback from post season wildfire mitigation surveys into future outreach efforts	• Improve surveys based on 2023-2025 experience • Continue to meet every two-three years with other utilities to discuss best practices and lessons learned • Increase availability of website wildfire and PSPS resources into additional languages • Continue to increase outreach to AFN populations	Section 8.5
PSPS	• Evaluate expansion of the free portable battery and backup electric power rebate programs	• Automate collection and dissemination of key PSPS data	Section 9

7.2.2 Anticipated Risk Reduction

7.2.2.1 Projected Overall Risk Reduction

As described in Section 6, Pacific Power has begun to utilize WRRM to identify areas with the highest ignition risk.

As discussed in Section 7.1.4.1, Pacific Power expects to implement a Risk Spend Efficiency Model to quantify risk reduction at the circuit level in Q3 2023.

With the implementation of WRRM to identify circuits with the highest ignition risk and the RSE model to calculate the expected risk reduction and most efficient mitigation, Pacific Power expects to include the quantified ignition risk reduction in the Q4-2023 QDR submittal.

To provide a calculation of Utility Risk reduction will require the implementation of the PSPS Risk Assessment solution. As discussed in Section 6.1, PSPS risk will be implemented in Q1 2024. Pacific Power anticipates providing the Utility Risk reduction for high-risk circuits in the Q4-2024 QDR submittal as this aligns with the completion of the annual planning cycle for mitigation projects and programs in the following year. Figure 7-9 below shows the timeline and sequencing of implementation of the models and when results will be available.

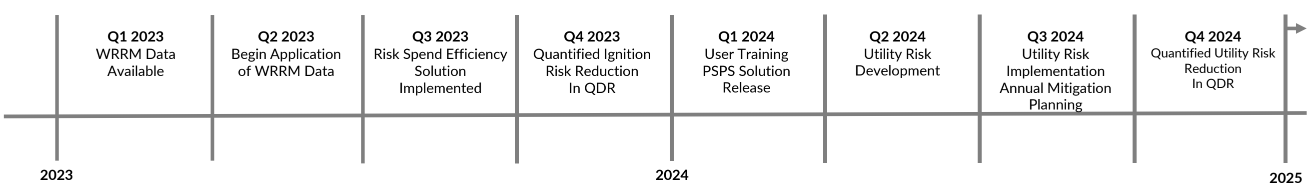


Figure 7-9 Current Mitigation Selection Considerations

7.2.2.2 Risk Impact of Mitigation Initiatives

As discussed in Section 7.1.3, Pacific Power is in the early stages of quantifying risk reduction and does not have a quantification of risk reduction on specific circuits at this time. This information will be available with the implementation of the RSE model starting in Q3 2023 for Wildfire Likelihood Risk and reported in the Q4 2024 QDR.

To quantify the percentage reduction in risk, Pacific Power expects to use the below calculation to quantify the % change in risk.

$$\left[\frac{Risk\ Before - Risk\ After}{Risk\ Before}\right]100$$

Where:

Risk Before is the current Risk

Risk After is the estimated Risk after the selected mitigation is implemented

7.2.2.3 Projected Risk Reduction on Highest-Risk Circuits Over the Three-Year WMP Cycle

Section 7.2.2.1 discusses the timeline for when wildfire risk, PSPS risk, utility risk, and RSE will be operational. As the various models and RSE are implemented, Pacific Power anticipates presenting the following:

Q4 2024 QDR: Ignition Risk and expected risk reduction of selected mitigations. This will be a numeric calculation using WRRM and RSE models to calculate for the highest risk circuits and assets the current Ignition Risk and expected Ignition Risk after implementation of mitigations and the percent change.

Q4 2025 QDR: Utility Risk and expected risk reduction because of selected mitigations. This will be a numeric calculation using WRRM, PSPS Risk and RSE models to calculate for the highest risk circuits and assets the current Utility Risk and expected Utility Risk after implementation of mitigations and the percent change.

While the above timeline reflects Pacific Power's current best estimate for delivery, the company will look for ways to expedite delivery of this information.

7.2.3 Interim Mitigation Initiatives

Pacific Power does not evaluate or implement interim mitigations but focuses resources on the mitigations summarized in Section 7.2.1 and detailed in subsequent sections. The various strategies, programs, and investments described in Section 7.2.1 are designed to reduce the risk of wildfire, in a manner consistent with emerging industry best practices. Additionally, maturation in the areas of risk mapping and situational awareness facilitate the prioritization and balancing of efforts to ensure the plan is delivered as efficiently as practical.

8 WILDFIRE MITIGATIONS

8.1 GRID DESIGNS, OPERATIONS, AND MAINTENANCE

8.1.1 Overview

In this section, the electrical corporation must identify objectives for the next 3- and 10-year periods, targets, and performance metrics related to the following grid design, operations, and maintenance programmatic areas:

1. Grid design and system hardening
2. Asset inspections
3. Equipment maintenance and repair
4. Asset management and inspection enterprise system(s)
5. Quality assurance / quality control
6. Open work orders
7. Grid operations and procedures
8. Workforce planning

8.1.1.1 Objectives

Each electrical corporation must summarize the objectives for its 3-year and 10-year plans for implementing and improving its grid design, operations, and maintenance.

Table 8-1 Grid Design, Operations, and Maintenance Objectives (3-year plan)

Objectives for Three Years (2023–2025)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Continue execution of grid hardening plans.	GH-01, GH-02, GH-03, GH-04, GH-05	N/A	QDR actuals	December 2025 for 2023-2025 targets	8.1.2
Replace all expulsion fuses within the HFTD	GH-05	N/A	QDR Actuals	December 2025	8.1.2.12

Objectives for Three Years (2023–2025)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Incorporation of IR technology for enhanced inspections	AI-06, AI-07	GO 95, GO165, Pacific Power Policies 001, 358 and Procedure 069	Revised/ new version of protocols	January 2024	8.1.3.5, 8.1.3.6
Continue planned inspection programs	AI-01, AI-02, AI-03, AI-04, AI-05, AI-08	GO 95, GO 165, Pacific Power Policies 001, 342, 297, 298, 358, 034 and Procedure 069	QDR actuals	Annually to January 2025	8.1.3
Continue planned transmission and distribution wires maintenance	MA-01	GO 95, GO165, and Pacific Power policy 001	QDR actuals	Annually to January 2025	8.1.4
Continue planned substation apparatus maintenance programs	MA-01	GO 174 and Pacific Power policy 001	QDR actuals	Annually to January 2025	8.1.4
Continue to deploy EFR (Elevated Fire Risk) settings	GO-02	Internal policy PAC-1000	QDR actuals	Ongoing activity	8.1.8

Table 8-2 Grid Design, Operations, and Maintenance Objectives (10-year plan)

Objectives for Ten Years (2026–2032)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Improve EFR (Elevated Fire Risk) settings. capabilities	GO-01	PAC-1000	2025 WMP update	December 2032	8.1.8
Complete Line Rebuild of all identified overhead line miles within the HFTD	GH-01	N/A	QDR Actuals	December 2032	8.1.2.1

Objectives for Ten Years (2026–2032)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Complete System Automation upgrades on all identified relays	GH-04	N/A	QDR Actuals	December 2026	8.1.2.8
Pilot new inspection technology as it becomes available and potentially incorporate into new or existing asset inspection programs	N/A	GO 95, GO 165, Pacific Power Policies 001, 342, 297, 298, 358, 034 and Procedure 069	A list of pilot projects, circuits the pilots were implemented on, results summary, and completion dates	Conduct a pilot that will be completed by the end of 2023 with a list of pilots implemented into inspection programs by end of 2033	8.1.38.1.3

8.1.1.2 Targets

Initiative targets are forward-looking quantifiable measurements of activities identified by each electrical corporation in its WMP. Electrical corporations will show progress toward completing targets in subsequent reports, including QDRs and WMP Updates.

Table 8-3 Grid Design, Operations, and Maintenance Targets by Year

Initiative Activity	Tracking ID	2023 Target & Unit	x% Risk Impact 2023	2024 Target & Unit	x% Risk Impact 2024	2025 Target & Unit	x% Risk Impact 2025	Method of Verification
Line Rebuild - Covered conductor installation	GH-01	130 Line miles	TBD	80 Line miles	TBD	80 Line miles	TBD	Completed work orders/ GIS Data Submission(s)
Distribution Pole Replacement	GH-02	2,600 poles	TBD	1,600 poles	TBD	1,600 poles	TBD	Completed work orders/ GIS Data Submission(s)

Initiative Activity	Tracking ID	2023 Target & Unit	x% Risk Impact 2023	2024 Target & Unit	x% Risk Impact 2024	2025 Target & Unit	x% Risk Impact 2025	Method of Verification
Transmission Pole Replacement	GH-03	260 poles	TBD	160 poles	TBD	160 poles	TBD	Completed work orders/ GIS Data Submission(s)
Installation of system automation equipment	GH-04	40 devices		20 devices		10 devices		Completed work orders/ GIS Data Submission(s) /Charging authorization forms
Expulsion fuse replacement	GH-05	5,000 Fuse Locations	TBD	500 Fuse locations	TBD	0 Fuse locations	TBD	Completed work orders/ GIS Data Submission(s)

Table 8-4 Asset Inspections Targets by Year

Initiative Activity	Tracking ID	Target End of Q2 2023 & Unit	Target End of Q3 2023 & Unit	End of Year Target 2023 & Unit	x% Risk Impact 2023	Target End of Q2 2024 & Unit	Target End of Q3 2024 & Unit	End of Year Target 2024 & Unit	x% Risk Impact 2024	Target 2025 & Unit	x% Risk Impact 2025	Method of Verification
Transmission Patrol Inspections	AI-01	5,727 inspections	9,343 inspections	11,754 inspections	TBD	5,863 inspections	9,566 inspections	12,034 inspections	TBD	12,030 inspections	TBD	Completed work orders/FPI Data
Distribution Patrol Inspections	AI-02	14,431 inspections	36,057 inspections	50,474 inspections	TBD	13,230 inspections	33,058 inspections	46,276 inspections	TBD	50,485 inspections	TBD	Completed work orders/FPI Data
Transmission Detail Inspections	AI-03	453 inspections	1,810 inspections	2,715 inspections	TBD	272 inspections	1,088 inspections	1,631 inspections	TBD	540 inspections	TBD	Completed work orders/FPI Data
Distribution Detail Inspections	AI-04	3,260 inspections	6,501 inspections	8,662 inspections	TBD	3,264 inspections	6,509 inspections	8,672 inspections	TBD	10,135 inspections	TBD	Completed work orders/FPI Data
Transmission Intrusive Pole Inspections	AI-05	0 inspections	561 inspections	935 inspections	TBD	0 inspections	470 inspections	783 inspections	TBD	960 inspections	TBD	Completed work orders/FPI Data
Distribution Intrusive Pole Inspections	AI-06	298 inspections	1,562 inspections	2,404 inspections	TBD	313 inspections	1,639 inspections	2,523 inspections	TBD	3,173 inspections	TBD	Completed work orders/FPI Data

Initiative Activity	Tracking ID	Target End of Q2 2023 & Unit	Target End of Q3 2023 & Unit	End of Year Target 2023 & Unit	x% Risk Impact 2023	Target End of Q2 2024 & Unit	Target End of Q3 2024 & Unit	End of Year Target 2024 & Unit	x% Risk Impact 2024	Target 2025 & Unit	x% Risk Impact 2025	Method of Verification
Enhanced (Infrared) Inspections in transmission lines	AI-07	120 line miles	700 line miles	700 line miles	TBD	120 line miles	700 line miles	700 line miles	TBD	700 line miles	TBD	Completed work orders/SAP Data Submission(s)
Enhanced (Infrared) Inspections in distribution lines	AI-08	0 line miles	810 line miles	810 line miles	TBD	0 line miles	810 line miles	810 line miles	TBD	TBD line miles (pending 2023-2024 pilot results.	TBD	Completed work orders/SAP Data Submission(s)
Substation Inspections (Minor, Major, Security, and Infrared)	AI-11	225 inspections	393 inspections	451 inspections	TBD	225 inspections	393 inspections	451 inspections	TBD	451 inspections	TBD	Completed work orders/SAP Data Submission(s)

8.1.1.3 Performance Metrics Identified by the Electrical Corporation

Performance metrics indicate the extent to which an electrical corporation's Wildfire Mitigation Plan is driving performance outcomes. The electrical corporation must:

- List the performance metrics the electrical corporation uses to evaluate the effectiveness of its grid design, operations, and maintenance in reducing wildfire and PSPS risk

For each of these performance metrics listed, the electrical corporation must:

- Report the electrical corporation's performance since 2020 (if previously collected)
- Project performance for 2023-2025
- List method of verification

Table 8-5 Grid Design, Operations, and Maintenance Performance Metrics Results by Year

Performance Metrics	2020	2021	2022	2023 Projected	2024 Projected	2025 Projected	Method of Verification (e.g., third-party evaluation, QDR)
Equipment-caused ignitions	--	--	--	--	--	--	--
Equipment-caused outages	--	--	--	--	--	--	--
Grid inspection findings	--	--	--	--	--	--	--
Open work orders (tags)	--	--	--	--	--	--	--

At the time of this filing, Pacific Power is unable to provide performance metrics for Grid Design, Operations, and Maintenance.

8.1.2 Grid Design and System Hardening

In this section the electrical corporation must discuss how it is designing its system to reduce ignition risk and what it is doing to strengthen its distribution, transmission, and substation infrastructure to reduce the risk of utility-related ignitions resulting in catastrophic wildfires.

The electrical corporation is required, at a minimum, to discuss grid design and system hardening for each of the following mitigation activities:

- Covered conductor installation
- Undergrounding of electric lines and/or equipment
- Distribution pole replacements and reinforcements
- Transmission pole/tower replacements and reinforcements
- Traditional overhead hardening
- Emerging grid hardening technology installations and pilots
- Microgrids
- Installation of system automation equipment
- Line removal (in the HFTD)
- Other grid topology improvements to minimize risk of ignitions
- Other grid topology improvements to mitigate or reduce PSPS events
- Other technologies and systems not listed above

Pacific Power's electrical infrastructure is engineered, designed, and operated in a manner consistent with prudent utility practice, enabling the delivery of safe, reliable power to all customers. When installing new assets, Pacific Power is committed to incorporating new technology and engineered solutions. When conditions warrant, Pacific Power may engage in strategic system hardening, which Pacific Power interprets to mean replacement of existing assets (or, in some circumstances, modifying existing assets using a new design and additional equipment) to make the assets more resilient.

Grid hardening programs are designed in reference to the equipment on the electrical network that could be involved in the ignition of a wildfire or be subject to an existing wildfire event. In general, grid hardening programs attempt to reduce the occurrence of events involving the emission of sparks (or other forms of heat) from electrical facilities or reduce the impact of an existing wildfire on utility infrastructure. System hardening programs represent the greatest long-term mitigation tool available for use by electric utilities. The phasing and prioritization of such programs is therefore focused on locations that present the greatest risk.

No single grid hardening program mitigates all wildfire risk related to all types of equipment. Individual programs address different factors, different circumstances, and different geographic areas. Each program described below, however, shares the common objective of reducing overall wildfire risk associated with the design and type of equipment used to construct electrical facilities. In prioritizing particular design or equipment elements, these programs can also consider environmental factors impacting the magnitude of a wildfire. Dry and windy conditions pose the greatest degree of risk. Consequently, grid hardening programs may specifically attempt to reduce the potential of an ignition event when it is dry and windy, by looking at equipment that is more susceptible to failure or contact with foreign objects when it is dry and windy.

It must be emphasized, however, that grid hardening cannot prevent all ignitions, no matter how much is invested in the electrical network. Equipment does not always work perfectly and, even when manufactured and maintained properly, can age, and fail; in addition, there are external forces and factors impacting equipment, including from third parties and natural conditions. Therefore, Pacific Power cannot guarantee that a spark or heat coming from equipment owned and operated by Pacific Power will never ignite a wildfire. Instead, Pacific Power seeks to reduce the potential of an ignition associated with any electrical equipment. To this end, Pacific Power plans to make investments with targeted system hardening programs.

Grid hardening referenced in this plan is geared toward specific programs aimed at making existing facilities more resistant to wildfire, even though those existing facilities are fully functional and do not require any corrective work under current utility practices. Pacific Power's grid hardening initiatives generally involve the retrofitting of existing overhead lines and substation components with more fire resilient materials including covered conductor, fire resistant poles, relays/reclosers, and replacement of expulsion fuses.

In this section, Pacific Power describes initiatives such as equipment upgrades, maintenance, and planning for more resilient infrastructure.

8.1.2.1 Line Rebuild program - Covered conductor installation

Utility Initiative Tracking ID: GH-01

Overview of the activity:

Pacific Power overhead distribution equipment and lines are designed to meet current compliance requirements. However, under certain conditions, such as high wind speeds, these lines can become more vulnerable to the "contact by object" risk drivers. Pacific Power is addressing this risk through the line rebuild program. Pacific Power's line rebuild program includes deployment of the following main techniques:

Reconductor with covered conductor: Specialized overhead covered conductors can be constructed with additional shielding and enhanced insulating properties to aid in wildfire mitigation.

Undergrounding: Under the line rebuild program, Pacific Power is also considering undergrounding. While an underground design does not eliminate every ignition potential (i.e., because of above ground junctions), it is considered the most effective strategy for reducing the risk of any utility-related ignition. Unfortunately, the cost of underground construction often makes it difficult to apply on a widespread basis. Therefore, Pacific Power evaluates the potential to convert overhead lines to underground lines for rebuild projects on a project-by-project basis. Through the design process, each individual project is assessed to determine whether sections of the rebuild should be completed with underground construction. For example, a more remote, heavily forested location with few customer connections could be an ideal candidate for undergrounding.

Line Removal: Overhead lines may become idle facilities due to changes in customer need or construction of alternate feeds. When an overhead line is determined to no longer be needed the line will be removed fully removing the ignition risks associated with the line.

Impact of the activity on wildfire risk:

Covered conductor is less susceptible to incidental contact with foreign objects, such as branches or Mylar balloons. While covered conductor does not prevent incidental contact from occurring, it reduces the potential that incidental contact will result in a fault event, thereby reducing the wildfire risk.

Impact of the activity on PSPS risk:

At this moment, Pacific Power is not able to determine the impact of the activity on PSPS risk. Please see Section 6.1.1. for details of the plan to develop a PSPS risk assessment solution to quantify PSPS risk.

Updates to the activity:

Since initiation in 2019, the company has delivered fewer miles of line rebuild in California than planned and is currently faced with the continued challenge of ramping up to achieve 2023 targets. Line rebuild projects using covered conductor were initially viewed similar to other distribution projects with short lead times and moderate construction needs. However, these projects generally require a 12-24 project pipeline, depending on permitting and right of way requirements. Additionally, construction resources can often compete within the region, resulting in construction bottle necks. Pacific Power acknowledges that these challenges are likely to continue and impact the delivery of line rebuild. To address these challenges, Pacific Power is planning to engage a construction management partner through a competitive bidding process initiated in 2022 and concluding in 2023. This new contracted partner is expected to facilitate delivery of the various aspects of line rebuild projects, such as project management, project controls, project reporting, engineering, estimating, permitting, surveying, material management, construction, and post construction inspections. Pacific Power anticipates that the new contracted partner will begin supporting the delivery of covered conductor in 2023.

8.1.2.2 Undergrounding of electric lines and/or equipment

Undergrounding is performed under the line rebuild program detailed on Section 8.1.2.1. In 2022 Pacific Power completed 62 miles of line rebuild which includes one mile of undergrounding.

Impact of the activity on wildfire risk: Similar to covered conductor described in Section 8.1.2.1, underground is less susceptible to incidental contact with foreign objects. Different than covered conductor, underground reduces the potential for contact to happen, with the exception of limited above ground equipment, and reduces the potential that incidental contact will result in a fault event, thereby reducing the wildfire risk. For information regarding RSE calculation see section 7.1.4.1.

Impact of the activity on PSPS risk: At the time of this filing, Pacific Power is not able to determine the impact of the activity on PSPS risk. Please see Section 6.1.1. for details of the plan to develop a PSPS risk assessment solution to quantify PSPS risk.

8.1.2.3 Distribution pole replacements and reinforcements

Utility Initiative Tracking ID: GH-02

Overview of the activity:

Pacific Power included pole replacement program with the line rebuild installations as an efficient use of resources. That being said, exclusively poles replaced under the line rebuild program are counted in the WMP. In some cases, poles need to be replaced to accommodate the additional weight of covered conductor; replacing wooden poles with stronger nonwooden solutions such as fiberglass or steel also increases grid resiliency and eliminates the need to return later. This approach also ensures that pole replacements are prioritized effectively.

Impact of the activity on wildfire risk:

Pacific Power plans to mitigate the risk associated with wood poles by replacing them with more fire resilient materials.

Impact of the activity on PSPS risk:

At this moment, Pacific Power is not able to determine the impact of the activity on PSPS risk. Please see Section 6.1.1. for details of the plan to develop a PSPS risk assessment solution to quantify PSPS risk.

Updates to the activity:

Pacific Power has previously reported transmission and distribution poles as a single value. During the 2023-2025 WMP Pacific Power will be tracking and reporting these values separately.

8.1.2.4 Transmission pole/tower replacements and reinforcements

Utility Initiative Tracking ID: GH-03

Overview of the activity:

Pacific Power included pole replacement program with the covered conductor installations as an efficient use of resources. That being said, exclusively poles replaced under the line rebuild program are counted in the WMP. In some cases, poles need to be replaced to accommodate the additional weight of covered conductor; replacing wooden poles with stronger nonwooden solutions such as fiberglass or steel also increases grid resiliency and eliminates the need to return later. This approach also ensures that pole replacements are prioritized effectively.

Impact of the activity on wildfire risk: Pacific Power plans to mitigate the risk associated with wood poles by replacing them with more fire resilient materials.

Impact of the activity on PSPS risk:

At this moment, Pacific Power is not able to determine the impact of the activity on PSPS risk. Please see Section 6.1.1. for details of the plan to develop a PSPS risk assessment solution to quantify PSPS risk.

Updates to the activity:

Pacific Power has previously reported transmission and distribution poles as a single value. During the 2023-2025 WMP Pacific Power will be tracking and reporting these values separately.

8.1.2.5 Traditional overhead hardening

At the time of this filing, Pacific Power does not have a traditional overhead hardening program.

8.1.2.6 Emerging grid hardening technology installations and pilots

At the time of this filing, Pacific Power does not have a traditional overhead hardening program.

8.1.2.7 Microgrids

At the time of this filing, Pacific Power does not have a program for microgrids.

8.1.2.8 Installation of system automation equipment

Utility Initiative Tracking ID: GH-04

Overview of the activity:

This program includes the deployment of distribution and transmission protection and control schemes and equipment, such as relays, circuit breakers, reclosers and communications equipment, to enhance fault detection capabilities, reduce fault isolation time, improve fault location and record availability, and speed up restoration efforts.

Impact of the activity on wildfire risk: Various risks can be mitigated by shutting off power to segments of the system. System automation equipment allows for this power shut off to happen very quickly, reducing the fire potential and happen for a short period of time, allowing for power to be restored more quickly.

Impact of the activity on PSPS risk: At this moment, Pacific Power is not able to determine the impact of the activity on PSPS risk. Please see section 6.1.1. for details of the plan to develop a PSPS risk assessment solution to quantify PSPS risk.

Updates to the activity:

In 2022, the company delivered fewer system automation projects in California than planned and is currently faced with the continued challenge of ramping up to achieve 2023 targets. System automation projects using within substations were initially viewed similar to other distribution projects with short lead times and moderate construction needs. However, these projects generally require a 12-24 project pipeline, depending on the scope of the rebuild. Additionally, construction resources within the region tend to compete, resulting in construction bottle necks. Pacific Power acknowledges that these challenges are likely to continue and impact the delivery of system automation. To address these challenges, Pacific Power is planning to engage a construction management partner through a competitive bidding process initiated in 2022 and concluding in 2023. This new contracted partner is expected to facilitate delivery of the various aspects of system automation projects, such as project management, project controls, project reporting, engineering, estimating, permitting, surveying, material management, construction, and post construction inspections. Pacific Power anticipates that the new contracted partner will begin supporting the delivery of system automation in 2023.

8.1.2.9 Line removal (in the HFTD)

Line removal (in the HFTD) may occur to accommodate the line rebuild program. See Section 8.1.2.1.

8.1.2.10 Other grid topology improvements to mitigate or reduce PSPS events

At the time of this filing, Pacific Power does not have programs related to other grid topology improvements to minimize risk of ignitions.

8.1.2.11 Other technologies and systems not listed above

At the time of this filing, Pacific Power does not have programs for other technologies and systems not listed above.

8.1.2.12 Expulsion Fuse Replacements

Utility Initiative Tracking ID: GH-05

Overview of the activity:

This is a project to install new and CAL FIRE-approved non expulsion fuses including power fuses and current limiting fuses to replace existing expulsion fuse equipment with planned end date in 2024. Following OEIS guidelines, the description of the Expulsion Fuse Replacement project is under Section 8.1.4.

Pacific Power is proactively replacing expulsion fuses throughout the HFTD. Pacific Power is completing replacement of expulsion fuses concurrent with line rebuild where practical to utilize resources most efficiently. Expedited replacement of expulsion fuses is planned on lines where covered conductor is planned but it is scheduled to occur more than 12 months in the future. Finally, replacement includes lines within the HFTD that are not planned for line rebuild. To the extent that Pacific Power establishes an HFRA as outlined in Section 6.7 or identifies additional areas to be mitigated through implementation of the WRRM tool described in Section 6.1.1, this program scope may increase or change beginning in 2025.

Impact of the activity on wildfire risk:

This activity mitigates the equipment facility failure risk driver associated with fuses.

Impact of the activity on PSPS risk:

At this moment, Pacific Power is not able to determine the impact of the activity on PSPS risk. Please see Section 6.1.1. for details of the plan to develop a PSPS risk assessment solution to quantify PSPS risk.

Updates to the activity:

There are no changes to the Expulsion Fuse Replacement program. Pacific Power is on track to complete this activity in 2024.

8.1.3 Asset Inspections

In this section, the electrical corporation must provide an overview of its procedures for inspecting its assets.

The electrical corporation must first summarize details regarding its vegetation management inspections in the table below, including the following:

- Type of inspection: i.e., distribution, transmission, or substation
- Inspection program name: Identify various inspection programs within the electrical corporation
- Frequency or trigger: Identify the frequency or triggers, such as inputs from the risk model. Indicate differences in frequency or trigger by HTFD Tier, if applicable
- Method of inspection: Identify the methods used to perform the inspection (e.g., patrol, detailed, aerial, climbing, and LiDAR)
- Governing standards and operating procedures: Identify the regulatory requirements and the electrical corporation's procedures for addressing them

In addition to the proactive replacement and upgrades described above in Section 0, Pacific Power also maintains its system and assets consistent with the California General Orders (GO) through a range of inspection and maintenance programs. These programs are tailored to identify conditions that could result in premature failure or potential fault scenarios, including situations in which the infrastructure may no longer be able to operate per code or engineered design, or may become susceptible to external factors, such as weather conditions. Generally, these programs focus on inspection and correction of overhead and underground transmission and distribution facilities but also include substation facilities as well.

Pacific Power performs inspections on a routine basis as dictated by both state-specific regulatory requirements and Pacific Power-specific policies. In California, these programs are performed in alignment with GO 95, GO 165, and GO 174 requirements and, in certain instances, exceed these requirements.

When an inspection is performed on a Pacific Power asset, inspectors use a predetermined list of condition codes (defined below) and priority levels (defined below) to describe any noteworthy observations or potential noncompliance discovered during the inspection. Once recorded, Pacific Power uses condition codes to establish the scope of and timeline for corrective action to maintain conformance with General Order (GO) requirements, state-specific code requirements and Pacific Power specific policies. This process is designed to correct conditions while reducing impact to normal operations.

These programs are summarized at a high level in the table below. For clarity, inspection programs are separated by voltage class in the table. However, in the narrative and subsections, the programs following the table, distribution and transmission inspections are grouped based on how the programs are managed and the type of inspection performed.

Table 8-6 Asset Inspection Frequency, Method, and Criteria

Type	Inspection Program	Frequency or Trigger (Note 1)	Method of Inspection (Note 2)	Governing Standards & Operating Procedures
Distribution	Patrol inspections of overhead distribution electric lines and equipment	1 year in HFTD/2 years in non-HFTD	Visual	GO 95, GO 165, Pacific Power Procedure 069, Policy 001, and Policy 342
Transmission	Patrol inspections of overhead transmission electric lines and equipment	1 year in all areas for transmission	Visual	GO 95, GO 165, Pacific Power Procedure 069, Policy 001, and Policy 342
Distribution	Detailed inspections of overhead distribution electric lines and equipment	5 years in all areas for distribution	Detail	GO 95, GO 165 Pacific Power Procedure 069, Policy 001, and Policy 297
Transmission	Detailed inspections of overhead transmission electric lines and equipment	5 years in HFTD/10 years in non-HFTD for transmission	Detail	GO 95, GO 165 Pacific Power Procedure 069, Policy 001, and Policy 297
Distribution	Pole Test and Treat (Intrusive) inspections of distribution poles	20 years in all areas for distribution	Intrusive	GO 95, GO 165, Pacific Power Procedure 069, Policy 001, and Policy 298
Transmission	Pole Test and Treat (Intrusive) inspections of transmission poles	10 years in all areas for transmission	Intrusive	GO 95, GO 165, Pacific Power Procedure 069, Policy 001, and Policy 298
Transmission	Enhanced (Infrared) inspections of overhead transmission electric lines and equipment	1 year in HFTD/2 years in non-HFTD	Infrared	Pacific Power Procedure 069, Policy 001, and Policy 358

Type	Inspection Program	Frequency or Trigger (Note 1)	Method of Inspection (Note 2)	Governing Standards & Operating Procedures
Substation	Major/minor and security transmission and distribution substation inspections	Monthly (minimum of 10 inspections annually) for WECC substations Monthly (minimum of 7 inspections annually) – All other substations	Visual – Minor/Security Detail - Major	GO 174, Pacific Power Policy 001, Policy 034, Form 3274F, Form 3274S
Substation	Infrared transmission and distribution substation inspections	1 year for transmission and WECC substations 2 years for distribution substations	Infrared	GO 174, Pacific Power Policy 001

8.1.3.1 Patrol inspections of transmission and distribution electric lines and equipment

Pacific Power's patrol inspections of transmission and distribution electric lines and equipment program is implemented consistent with California GO 95 and 165 and involves performing a brief visual inspection by viewing each facility from a vantage point allowing reasonable viewing access. These inspections are intended to identify damage or defects to the transmission and distribution system, or other potential hazards or right-of-way-encroachments that may endanger the public or adversely affect the integrity of the electric system, including items that could potentially cause a spark. These WMP activities are tracked with Tracking IDs# AI-01 and AI-02.

Process

The process of patrol inspections involves multiple teams within Pacific Power. Below is a flow diagram that outlines the patrol inspection process from initiation to completion:

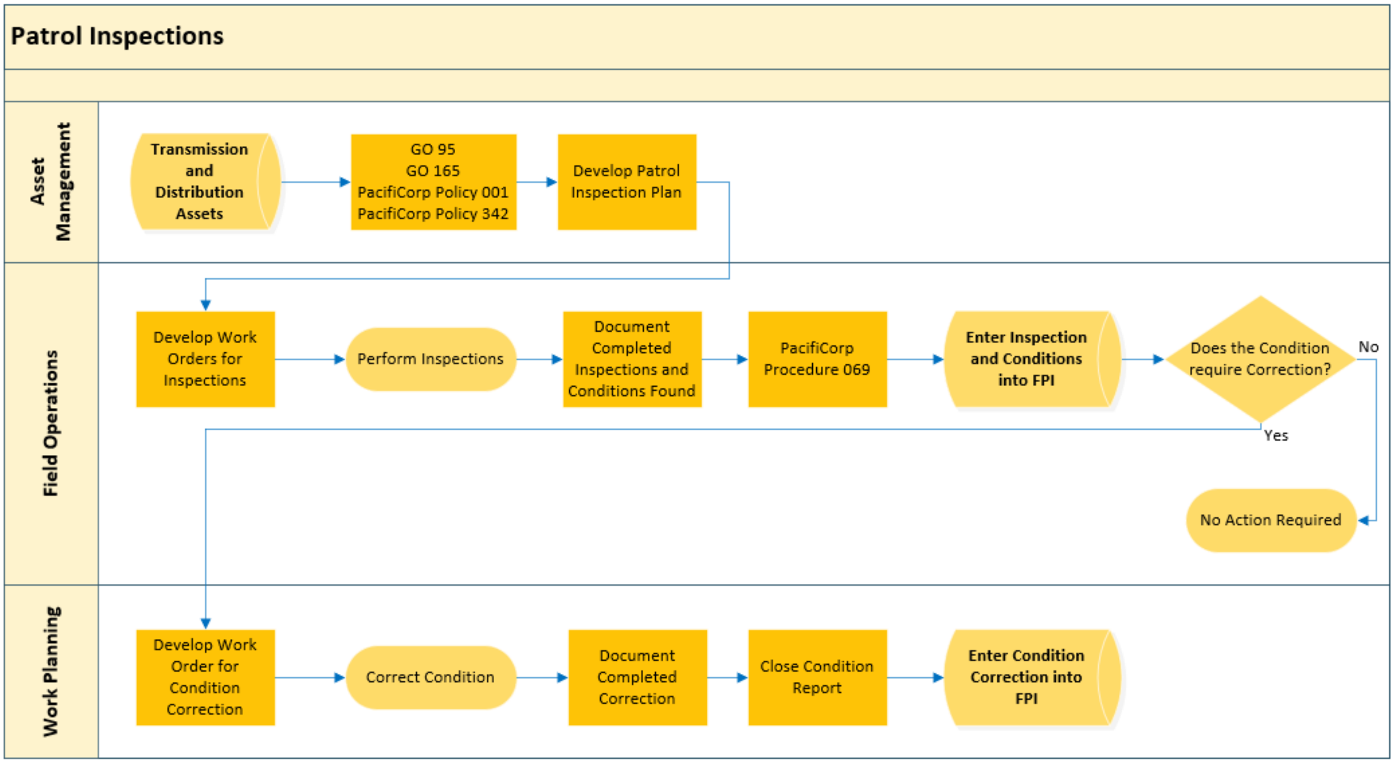


Figure 8-1 Patrol Inspections of Transmission and Distribution Electric Lines and Equipment Workflow

Frequency of Trigger

Pacific Power's patrol inspections program is conducted on a planned cycle where Pacific Power inspects overhead assets located within the HFTD more frequently than those assets located outside of the HFTD, to mitigate higher risk areas. Additionally, in a given calendar year, inspections of facilities located within the HFTD occur earlier in the year, specifically Tier 3 areas. While all required inspections are completed within the prescribed cycle, the intent of this prioritization is to inspect facilities located in the highest fire threat areas prior to fire season where the risk is the greatest.

Accomplishments, Roadblocks, and Updates

As a result of reduced cycle time for inspections in HFTD areas, the company completed 59,608 incremental patrol inspections in 2022. The company plans to continue its patrol inspections on transmission and distribution per policy.

In the next 5 years, the company plans to continue patrol inspections at current frequency levels.

8.1.3.2 Detailed inspections of transmission and distribution electric lines and equipment

Pacific Power's detailed inspections of transmission and distribution electric lines and equipment is an inspection performed to maintain regulatory compliance with California GO 95 and 165. These inspections involve a careful visual inspection accomplished by visiting each structure, as well as inspecting adjacent spans between structures, which is intended to identify potential nonconformance with GO or other applicable state requirements, infringement by other utilities or individuals, defects, potential safety hazards, and deterioration of the facilities that need to be corrected to maintain reliable and safe service. These WMP activities are tracked with Tracking IDs# AI-03 and AI-04.

During an evaluation, an inspector documents potential violations and noteworthy observations — including potential fire threats — by assigning a condition code and priority level. The priority levels align with GO 95, Rule 18; the conditions codes are specifically designed to predetermine fire threat as well as other types of conditions. In a typical year, Pacific Power performs approximately 13,000 detailed inspections of electric transmission and distribution facilities and has historically identified approximately 7,000 conditions that require corrective action.

Process

The process of detailed inspections involves multiple teams within Pacific Power. Below is a flow diagram that outlines the detailed inspection process from initiation to completion:

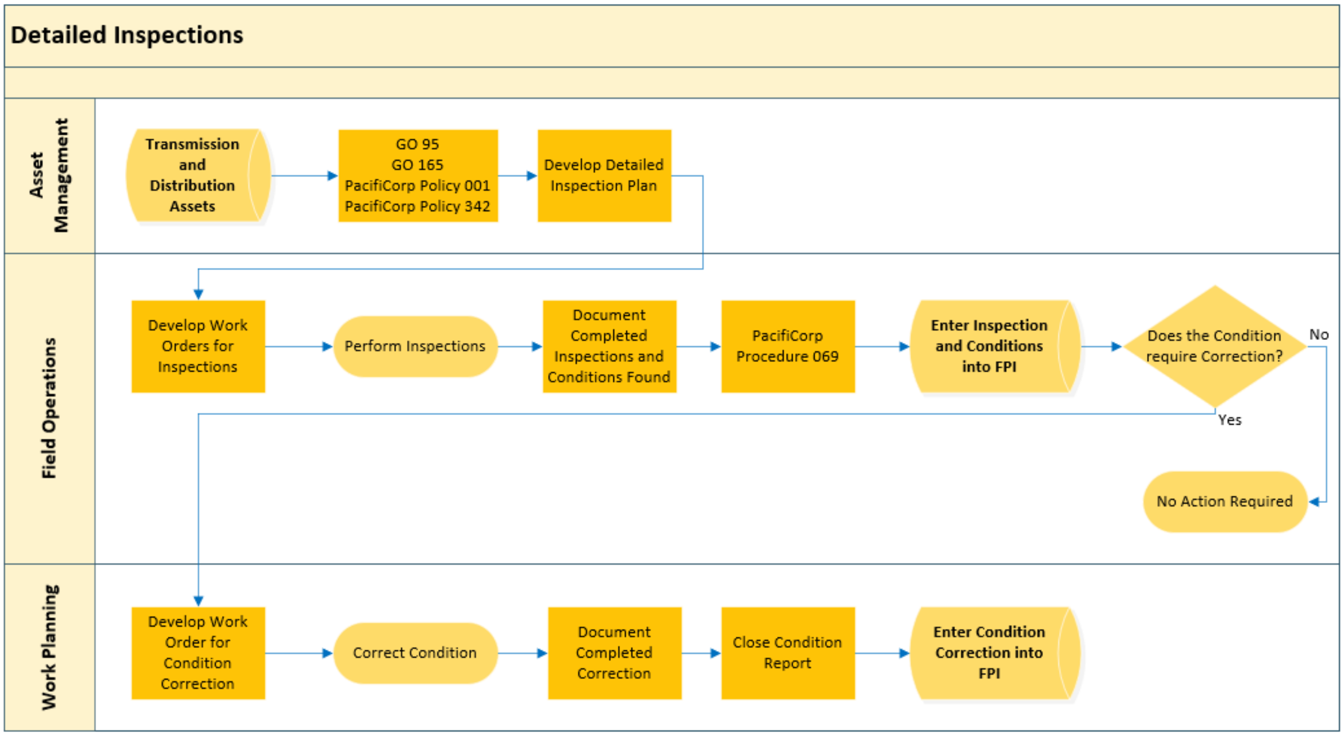


Figure 8-2 Detailed Inspections of Transmission and Distribution Electric Lines and Equipment Workflow

Frequency of Trigger

Pacific Power's detailed inspections program is conducted on a planned cycle where Pacific Power inspects overhead assets located within the HFTD more frequently than those assets located outside of the HFTD, to mitigate higher risk areas. Additionally, in a given calendar year, inspections of facilities located within the HFTD occur earlier in the year, specifically Tier 3 areas. While all required inspections are completed within the prescribed cycle, the intent of this prioritization is to inspect facilities located in the highest fire threat areas prior to fire season where the risk is the greatest.

Accomplishments, Roadblocks, and Updates

As a result of reduced cycle time for inspections in HFTD areas, the company completed 11,432 incremental detail inspections in 2022. The company plans to continue this effective distribution and transmission detail inspection per policy.

In the next 5 years, the company plans to continue detailed inspections at current frequency levels.

8.1.3.3 Intrusive pole inspections

Pacific Power's intrusive pole inspection program, which may include pole-sounding, inspection hole drilling and excavation tests, is designed to identify decay, wear or woodpecker damage, assess the condition of wood poles and identify the need for any treatment, repair or replacement. Like other inspection programs, intrusive inspections mitigate some wildfire risk by identifying and correcting conditions. In this case, the inspections identify poles for replacement or reinforcement to prevent potential structural failure of a pole that could lead to a potential wire down event and ignition risk. These WMP activities are tracked with Tracking IDs# AI-05 and AI-06.

Process

The process of intrusive inspections involves multiple teams within Pacific Power organization. Below is a flow diagram that outlines the patrol inspection process from initiation to completion:

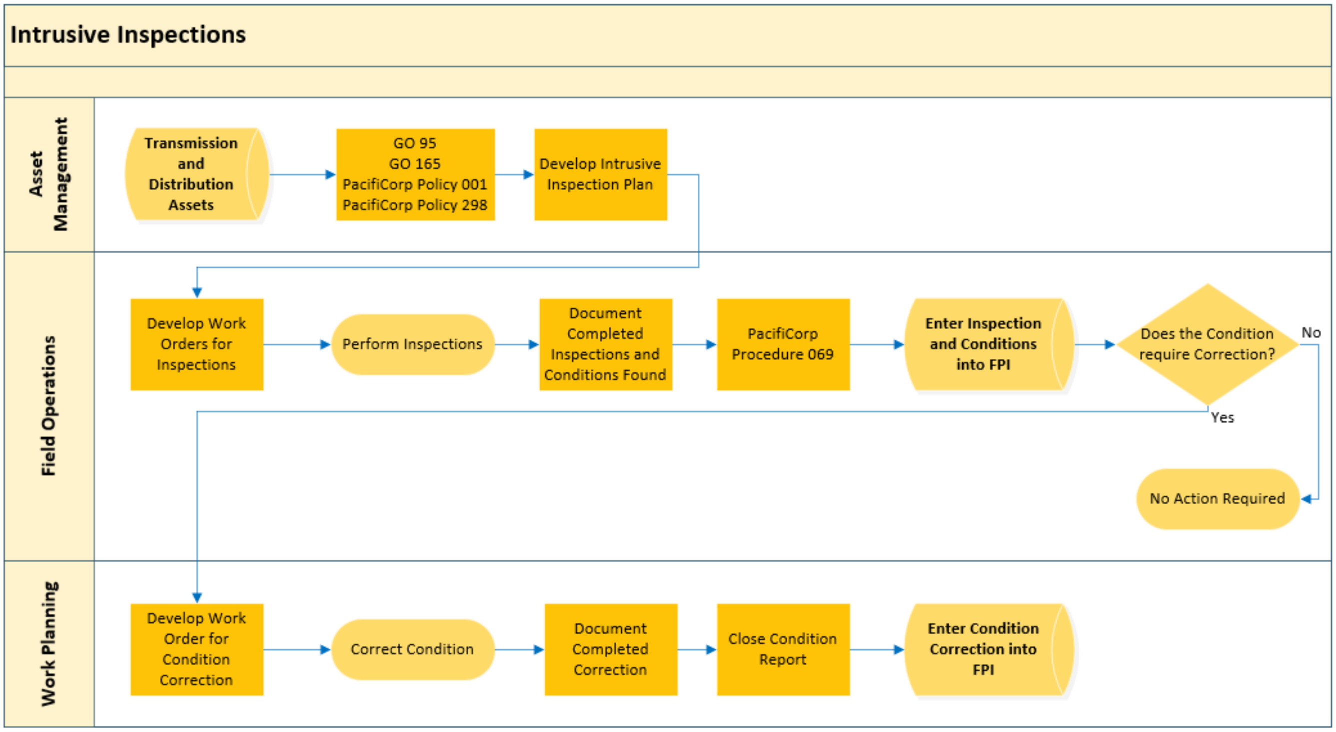


Figure 8-3 Intrusive Pole Inspections Workflow

Frequency of Trigger

Pacific Power's intrusive poles inspections are performed consistent with the cycle prescribed in California GO 165.

Accomplishments, Roadblocks, and Updates

The company completed 4,437 intrusive inspections in 2022. The company plans to continue the intrusive inspections on transmission and distribution per policy.

In the next 5 years, the company plans to continue intrusive inspections at current frequency levels.

8.1.3.4 Substation Inspections

Unlike overhead lines, substation assets are not located in the public space. However, substation equipment, such as circuit breakers and relays, are critical components of protection and control schemes and system operations and can have an impact on overhead line operation. Like other inspection programs, substation inspections, which assess both the substation security and key equipment condition, identify potential correction work or maintenance needed. This corrective work and maintenance mitigates the risk of mis-operation that could negatively impact system operation and protection and control schemes in place. This WMP activity is tracked with Tracking ID# AI-11.

Process

The process of substation inspections involves multiple teams within Pacific Power. Below is a process flow diagram that outlines the substation inspection process from initiation to completion.

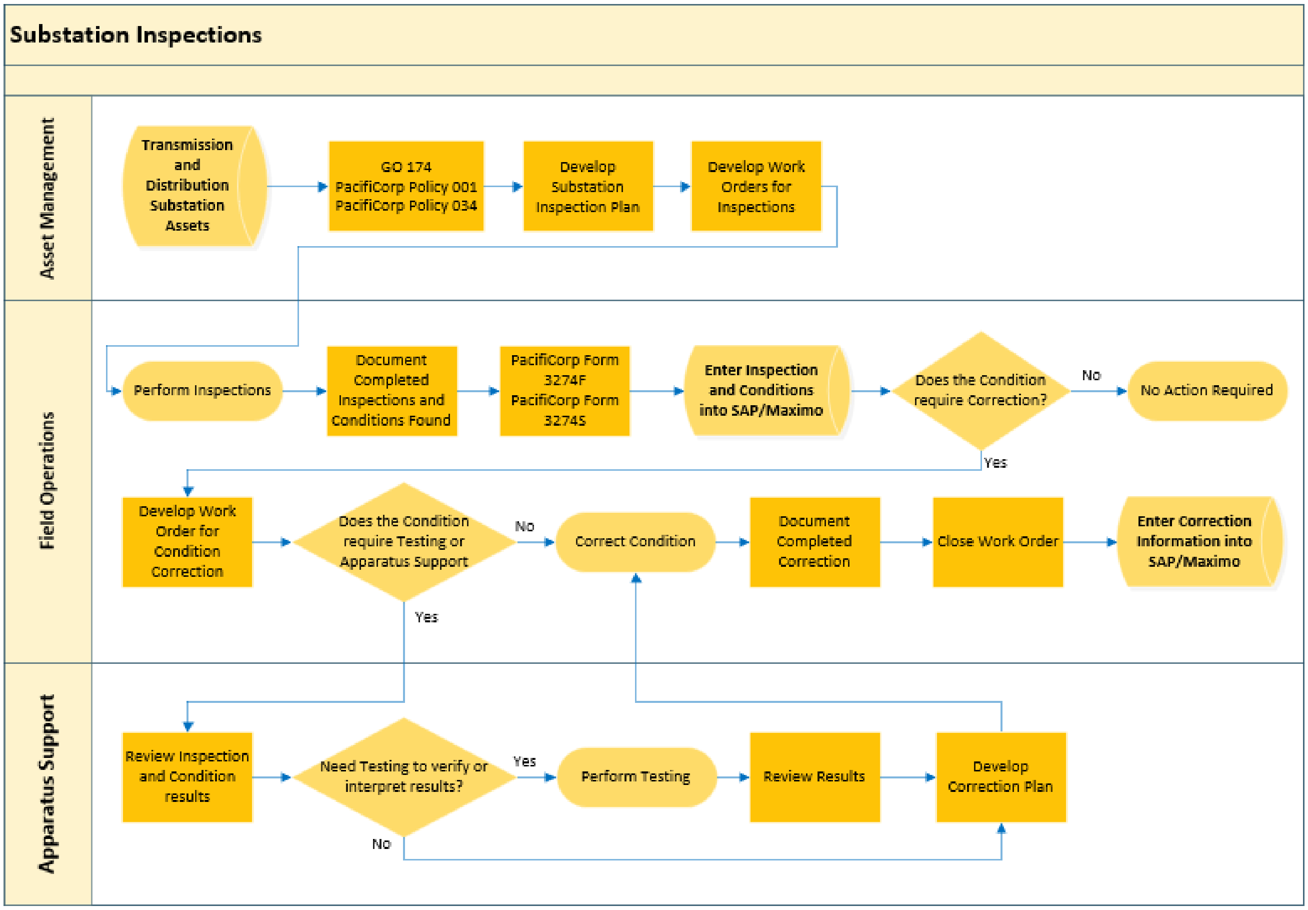


Figure 8-4 Substation Inspections Workflow

Frequency of Trigger

Substation inspections are planned and scheduled based on voltage class of the assets and compliance requirements. For example, WECC and transmission substations, which have greater potential for negative impacts should a mis operation occur, are infrared inspected every 12 months compared to distribution substations, which are inspected every 24 months due to the lower risk.

Accomplishments, Roadblocks, and Updates

In 2022, Pacific Power a total of 444 inspections. The company plans to continue its substation inspection program per policy.

In the next 5 years, the company plans to continue its substation inspections at current frequency levels.

8.1.3.5 Infrared inspections of distribution electric lines and equipment

In 2022, Pacific Power initiated a pilot to build upon the successes of the transmission infrared inspection program described in Section 8.1.3.6 and determine whether using infrared at distribution voltages could detect hot spots. In 2022, IR inspections were performed on 11 different circuits across 47 miles and identified 6 conditions. In 2023, Pacific Power plans to expand this pilot to include all distribution line miles within the HFTD to evaluate how the program might work on a larger scale. Pending results, the pilot could continue into 2024 or develop into a formal program. This WMP activity is tracked with Tracking ID# AI-08.

Process

Below is a flow diagram that outlines the infrared inspections of distribution electric lines and equipment process from initiation to completion:

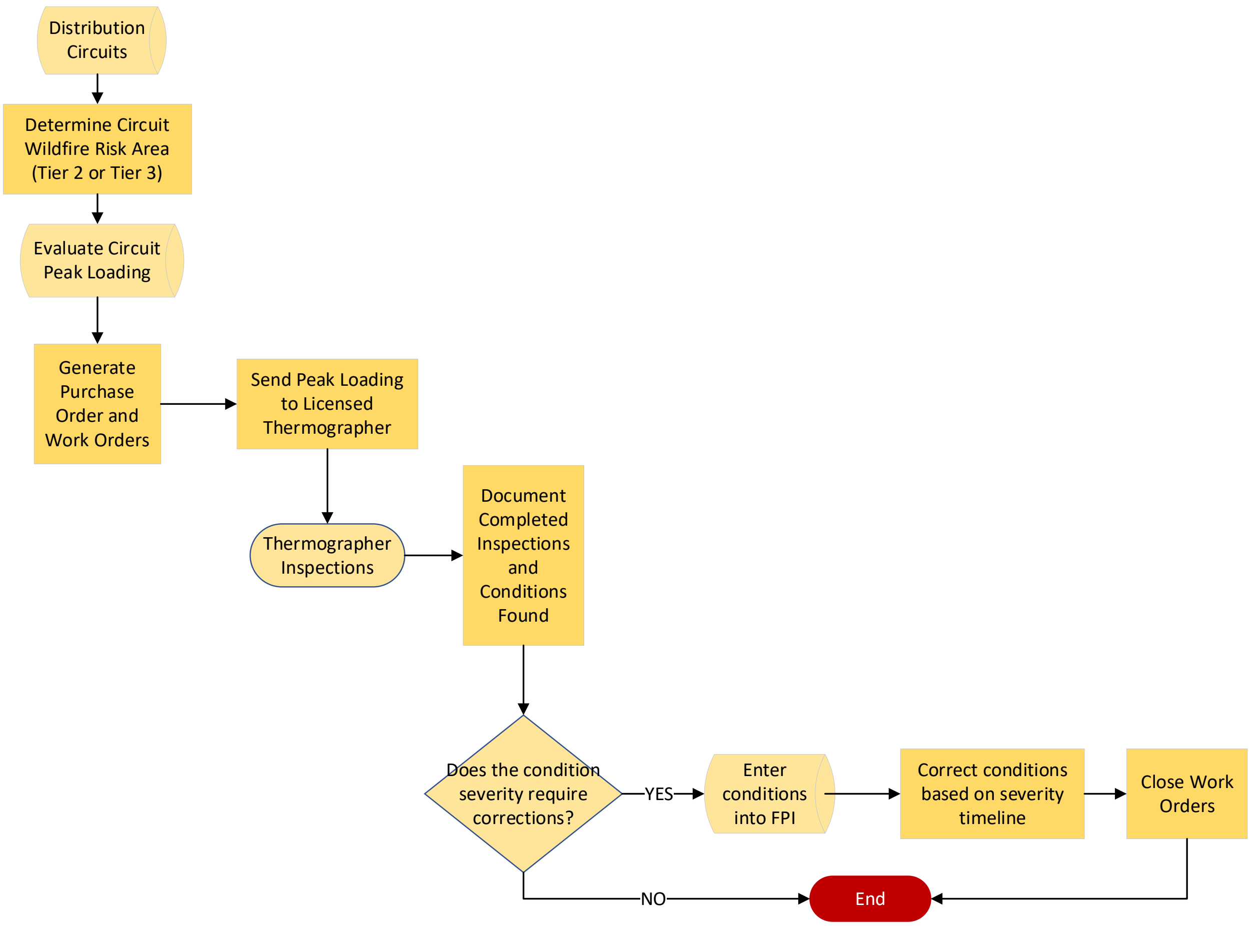


Figure 8-5 Infrared Inspections of Distribution Electric Lines and Equipment Workflow

Frequency of Trigger

Pacific Power plans to perform inspections during anticipated peak loading conditions. Peak loading intervals are determined by looking at historical data, when available, or traditionally higher loading periods on the lines. Based on an initial review, peak intervals for distribution circuits within the HFTD happen at two main periods throughout the year – winter in the morning and summer in the afternoon.

Accomplishments, Roadblocks, and Updates

As described above, Pacific Power performed a pilot inspection in 2022 on 47 miles of distribution lines. In 2023, the scope is expanding to inspect the entire distribution network within the HFTD, or 814 miles and approximately 20,000 poles. As targeting peak or near peak loading conditions is critical to successful identification of hot spots, planning, scheduling, and execution continues to be important and challenging. Pacific Power also plans to use a licensed thermographer for the inspections, as a licensed thermographer has the necessary certifications to identify issues and give inputs to the severity of the condition found.

8.1.3.6 Infrared inspections of transmission electric lines and equipment

Pacific Power has implemented the enhanced transmission line inspection program with a focus on proactive identification and prevention of equipment failures. The inspections are performed annually with the inspections scheduled during peak loading intervals. Peak loading is when the equipment is under the highest potential stress increasing the probability of finding issues via infrared inspections. The inspections are conducted aerially with a helicopter and a licensed thermographer. This WMP activity is tracked with Tracking ID# AI-07.

Process

Below is a flow diagram that outlines the infrared inspections of distribution electric lines and equipment process from initiation to completion:

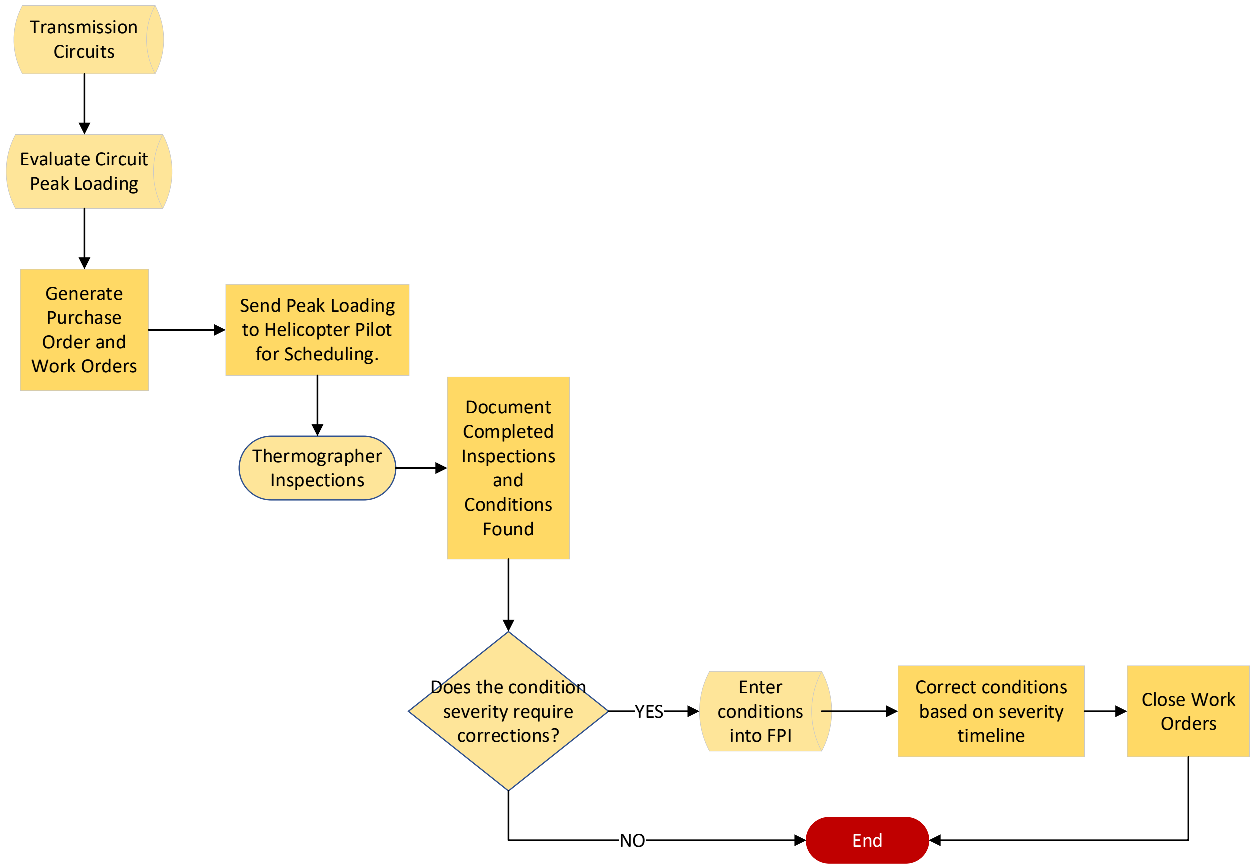


Figure 8-6 Infrared Inspections of Transmission Electric Lines and Equipment Workflow

Frequency of Trigger

The inspections are performed on an annual basis during periods when the lines are near peak loading.

Accomplishments, Roadblocks, and Updates

The enhanced infrared inspection program for transmission lines has been conducted since 2021. Since then, there have been improvement made to the loading classification of the lines which allowed for fewer timeframes and increased the efficiency in scheduling the inspections. There have been improvements made to how conditions are reported to align better with other asset inspection and correction programs.

8.1.4 Equipment Maintenance and Repair

In this section, in addition to the information described above regarding distribution, transmission, and substation inspections, the electrical corporation must provide a brief narrative of maintenance programs. As a narrative, the electrical corporation must include its strategy for maintenance, such as whether the electrical corporation replaces or upgrades facilities/equipment proactively (for example, an electrical corporation may monitor dissolved gases in its transformers to detect potential transformer failures to alert engineering and maintenance personnel or component lifecycle management) or if it runs its facilities/equipment to failure. The narrative must include, at minimum, the following types of equipment:

- Capacitors
- Circuit breakers
- Connectors, including hotline clamps
- Conductor, including covered conductor
- Fuses, including expulsion fuses
- Distribution poles
- Lightning arrestors
- Reclosers
- Splices
- Transmission poles/towers
- Transformers

Equipment maintenance and repair activities are a key component to ensuring in-service equipment on the system remains reliable and operates properly. These programs are tailored to specific assets based on voltage class, equipment type, location on the system, and expected deterioration from the environment and system conditions it is subject to during the life of its operation.

Pacific Power performs maintenance on a routine basis that is based on federal and state-specific regulatory requirements as well as Pacific Power-specific policies. When maintenance is performed on an asset, field operations personnel utilize information gathered from inspections, tests, and operation history to inform the maintenance activities and schedule for the specific asset. Once the maintenance activities are completed, the information is recorded and used to inform future maintenance activities in addition to federal and state specific requirements as well as Pacific Power specific policies. This process is designed to identify and address any potential hazards to prevent mis operation or premature failure of the equipment.

Key terms associated with Pacific Power's Maintenance and Repair programs are defined as follows:

- **Equipment Type.** The type of equipment or facility maintenance plan applies to.
- **Equipment Description.** Further information to describe equipment or facility in more detail.
- **Equipment Use.** Application equipment or facility is used for.
- **Equipment Model or Manufacturer.** The model, type, or manufacturer of the equipment.
- **Operating Rating.** The voltage rating of the equipment.
- **Equipment Code.** SAP/Maximo code that identifies equipment category.
- **Maintenance Task.** Maintenance task description.
- **Maintenance ID.** ID used in SAP/Maximo systems to identify the maintenance task.
- **Interval.** Scheduled Time period in-between consecutive maintenance tasks.
- **Counter (Operations/Faults).** Number of recorded equipment operations or faults before maintenance order is scheduled.

Maintenance Activities and Schedule for Assets

Pacific Power's maintenance activities and schedule for its assets is based on company Policy 001 which is a result of a combination of manufacturer recommendations, failure and corrective maintenance history and experience, and input from subject matter experts within the company. Maintenance activities are determined and scheduled based on the equipment type, equipment use, operating rating, and the number of operations or faults the equipment encounter's during service. Policy 001, attached as Appendix F summarizes the maintenance and activities currently being performed for assets in-service on Pacific Power's system, including non-WMP programs.

Weather Station Maintenance

In addition to the maintenance summarized above, Pacific Power also performs annual maintenance and calibration of its weather station fleet. Pacific Power has continued to increase the weather station density across the service territory with close to 100 (portable and fixed) weather stations in California. Accurate weather station data is a critical component of weather modeling and decision-making processes. The weather station maintenance program is an annual program to ensure each weather station is operational and reporting correct and accurate data. There are three types of weather stations, remote automated weather stations (RAWS), micro-stations, and portable weather stations, and each require different methodologies to complete the maintenance. This WMP activity is tracked with Tracking ID# MA-01.

Weather Station Type	Maintenance Responsibility / Location	Maintenance Frequency
RAWS	Manufacturer / in field	Annual, within a 10-15 month window
MicroStation	Contracted Resources / in field	Annually between April - July
Portable Weather Station	Manufacturer / Performed at manufacturer's facility	Annually packed and shipped to the manufacturer within a 10-15 month window; Returned with a certificate of compliance

Completing the above annual maintenance on the weather stations on the schedule described, ensures they are operational, reporting accurate data, and ready to be used prior to fire season.

Expulsion Fuse Replacement

This is a project to install new and CAL FIRE-approved non expulsion fuses including power fuses and current limiting fuses to replace existing expulsion fuse equipment with planned end date in 2024. Following OEIS guidelines, the description of the Expulsion Fuse Replacement project is under Section 8.1.4. Project targets are listed on table Table 8-3 Grid Design, Operations, and Maintenance Targets by Year.

Pacific Power is proactively replacing expulsion fuses throughout the HFTD. Pacific Power is completing replacement of expulsion fuses concurrent with line rebuild where practical to utilize resources most efficiently. Expedited replacement of expulsion fuses is planned on lines where covered conductor is planned but it is scheduled to occur more than 12 months in the future. Finally, replacement includes lines within the HFTD that are not planned for line rebuild. To the extent that Pacific Power establishes an HFRA as outlined in Section 6.7 or identifies additional areas to be mitigated through implementation of the WRRM tool described in Section 6.1.1, this project scope may increase or change beginning in 2025.

8.1.5 Asset Management and Inspection Enterprise System(s)

In this section, the electrical corporation must provide an overview of inputs to, operation of, and support for centralized asset management and inspection enterprise system(s) updated based upon inspection results and activities such as hardening, maintenance, and remedial work. This overview must include discussion of:

- The electrical corporation's asset inventory and condition database.
- Describe the electrical corporation's internal documentation of its database(s).
- Integration with systems in other lines of business.
- Integration with the auditing system(s) (see QA/QC section below).
- Describe internal procedures for updating the enterprise system including database(s) and any planned updates.
- Any changes to the initiative since the last WMP submission and a brief explanation as to why those changes were made. Include any planned improvements or updates to the initiative and the timeline for implementation.

Currently, Pacific Power does not have an Asset Management and Inspection Enterprise System. Instead, the company leverages a combination of legacy databases and internal planning tools to determine asset inventory and manage inspection, correction, and maintenance programs. For example, substation asset information is stored in Maximo, and inspection and condition records for assets outside the substation are stored in Facility Point Inspection (FPI), mainframe style database. Furthermore, legacy maintenance records are stored SAP while future maintenance records will be stored in Maximo. Pacific Power does not currently have plans to develop or migrate toward a single Enterprise System. To perform the QA/QC activities described in the next section, data is typically extracted from each system of record and evaluated.

8.1.6 Quality Assurance and Quality Control

In this section, the electrical corporation must provide an overview of its quality assurance and quality control (QA/QC) activities for asset management and inspections.

To perform QA/QC of inspections, Pacific Power uses a combination of process controls, software tools, company policy, and physical record checking to quickly identify inaccuracies for corrective action, evaluation, root cause analysis and system improvements. Engaging in these initiatives is a cost-effective means to minimize the risk that inspection results are inaccurate or unreliable. This WMP activity is tracked with Tracking ID# AI-12.

Inspection results are reviewed continuously to confirm that inspections in the HFTD are meeting acceptable standards of performance. Pacific Power's main QA/QC components, including enhancements to mitigate wildfire risk, are:

- Physical audits of at least 5% of planned inspections of facilities with a focus fire threats and Tier 2 and Tier 3 prioritization
- Software controls that prohibit freeform condition assignment, allowing for result controls, minimizing the amount of human error capable
- A quarterly review of already audited results as a secondary check, including desktop audits
- Annual training with inspectors to address audit findings and improve inspection reliability and accuracy

These components are described in more detail below, including any program enhancements, costs, and evolution consistent with feedback from the OEIS and PC-4.

All QA/QC activities are tracked across a master spreadsheet. All audit results are entered into this spreadsheet for reference for field and desktop audits for both Internal and External audits. External audits are reviewed the week they are received. Internal audits reference all available information from the external audited work and Inspections performed.

Physical Audits

Pacific Power's QA/QC physical audits are conducted on a random selection of inspected facilities, where corrections due to inspection results are prioritized by GO 95 priority levels, including expedited correction timelines for conditions classified as a fire risk and in the Tier 2 and Tier 3 districts. Pacific Power emphasizes audits in wildfire risk areas by prioritizing Tier 2 and Tier 3 regions for inspection in the first half of the year. This means these regions go through the QA/QC process first. After a physical audit is done, the audit results are compared with the original inspection results to see if they conform to the set condition reporting criteria, data entry, and work performance in accordance with company specifications.

Nonconforming results are sent to the inspection contractor for reinspection along with the required reinspection timeline.

Software Controls

In recent years, Pacific Power began using cellphones and tablets to make inspection records and findings. A renewed focus on inspection QA/QC in 2020 led to the enhancement of the inspection programs and structure along with added software controls to ensure inspections and findings are recorded consistently with internal procedures. Nonconforming results are denied. For example, if the inspection program is designed to only allow either an A or B priority assigned to a certain type of finding, an inspector can't enter a C Priority. This ensures that findings are not accidentally mischaracterized with a lower priority level.

Quarterly Desktop Reviews

Two macro-level desktop audits were conducted quarterly; one desktop audit was conducted by the field inspection support group (standard process as per Pacific Power internal policy) and another was conducted by a cross-functional team of asset management, work planning and operational performance management. The cross-functional team desktop audit prioritized review of "fire risk" conditions and conditions in Tier 2 and Tier 3 regions for QA/QC and correction.

To support these ongoing reviews, a new internal tool was developed to evaluate inspection results, automatically isolate open fire risk conditions in plots, facilitate quick data export, provide insight about trends, and drive a deeper understanding of the fire risk conditions.

Historically, desktop reviews consisted of all open conditions generally grouped together without specific focus areas. The new tool automatically identifies potential misalignment with internal procedures, including alignment with fire risk priorities and types. Initial rollout of this new tool proved useful and, as part of the 2021 plan, desktop review of inspection results continued to use this tool and grow to review inspection results within 30 days of input. This will ensure that potential mismatches or mischaracterization of conditions and risk can be immediately addressed. This new quick QA/QC response is projected to address issues while they are fresh in the minds of inspectors, drive continuous improvement and learning opportunities, increase record accuracy and inspection result reliability.

Pacific Power intends to continue quarterly desktop reviews, which typically include a deep dive into trends and risk.

Annual Training

Pacific Power field inspection support conducts annual field inspector training in January. This training includes technical content such as NESC code or California General Order requirements as well as program content, such as how to record findings, assess priorities, ensure effectiveness of an inspection, and facilitate corrective action. In January 2022, this training included additional content regarding fire risks and broader participation from asset management to ensure alignment in content and priorities. While this training covers Pacific Power's total service territory, the training did include focused on the specific Tier 2 and Tier 3 planned inspections in California and the potential challenges and risks associated with the HFTD. Pacific Power intends to continue to grow this training with a focus on wildfire mitigation and incorporate lessons learned through the other QA/QC components to foster continuous improvement.

The inspection activity, sample size, type of audit, audit results, and target pass rate for future activities for asset inspection and grid hardening activities is summarized in Table 8-8. The sample size for each QA/QC activity is based on experience and history with the company's current asset inspection programs as well as subject matter expertise. It has been found during QA/QC activities that the targets summarized in Table 8-8 have been sufficient to determine if there are any discrepancies, patterns, or issues with the inspection activity being performed and representative with the company's inspection programs.

Since the implementation of Grid Hardening projects as part of the company's Wildfire Mitigation Program, its processes have had to evolve to ensure the projects that have been completed mitigate the associated risk. This has involved the development of pre/post energization checklists that are used to ensure the project is being constructed to meet the requirements of the company's latest wildfire mitigation standards and ensures the project is constructed as designed. The company plans to audit 100% of all Grid Hardening projects through post construction inspections that leverage these newly developed checklists.

Table 8-7 Grid Design and Maintenance QA/QC Program

Activity Being Audited	Sample Size	Type of Audit	Audit Results 2022	Yearly Target Pass Rate for 2023-2025
Patrol inspections	100% in HFTD Tier 2 and 3	Field	92%	95%
Detailed inspections	5% of Contractor inspections 3% of Company inspections	Field	97%	90% Urban 80% Rural
Intrusive inspections	5% of Contractor inspections 3% of Company inspections	Field	97%	90% Urban 80% Rural
Desktop Audit	75% or greater of Company inspections	Field	84%	75% or greater

8.1.7 Open Work Orders

In this section, the electrical corporation must provide an overview of the procedures it uses to manage its open work orders resulting from inspections that prescribe asset management activities.

The work order process is initiated during asset inspections, regardless of the type of inspection being performed. The inspector conducting the inspection will notate any potential violations or noteworthy observations by assigning a Condition Code and Priority Level in Pacific Power's Facility Point Inspection (FPI) system. Priority Levels are assigned to align with GO 95 requirements.

While the same condition codes are used throughout Pacific Power's service territory, the timeframe for corrective action varies depending on location within the HFTD and the energy release risk. In all cases, the timeline for corrections considers the priority level of any identified condition. Conditions are planned and corrected consistent with the timeframes set forth in GO 95. Correction timeframes are accelerated for conditions in the HFTD, as discussed in greater detail below.

Pacific Power designates certain conditions as energy release risk conditions. As the name suggests, this category includes conditions which, under certain circumstances, can correlate to increase risk of a fault event and potential release of energy at the location of the condition. Certain condition codes are categorically designated as an energy release risk. If a condition is designated under a particular condition code associated as an energy release risk and the condition exists within the HFTD, the condition is designated as a fire threat condition, which means that the condition is treated as a condition type which corresponds to a heightened risk of fire ignition.
Conditions that are categorically designated as Energy Release Risk (historically known as Fire Risk) Conditions will have accelerated correction time periods within Tier 2 and Tier 3 locations, to align with GO 95 requirements. For example, Energy Release Risk conditions found in HFTD area's (Tier 2 or Tier 3) are considered Fire Threat conditions and the correction time period is accelerated to minimize fire risk.

Once the Condition is input into FPI it is considered an open work order. Pacific Power uses Geographic Information Systems Maintenance Organizer (GISMO) application tool for identifying Suggested Correction Dates. Corrections are then planned with the intent to complete on or prior to the GISMO Suggested Correction Date. While GISMO Suggested Correction Dates are developed to facilitate prioritization in Correction and align with compliance requirements, they are not meant to indicate compliance requirements and, in many cases, will not match compliance requirements exactly.

For example, a Pacific Power C priority, which maps to a GO95 Level 3 priority, requires correction within 60 months as per GO 95. However, to promote operational efficiency and bundle the Correction of both B priority and C priority Conditions, Pacific Power plans to complete C priority Conditions within 36 months. Therefore, the Suggested Correction Date in GISMO reflects this 36-month correction timeframe per business rules. The inability to correct a C priority Condition within 36 months is not indicative of failure to meet compliance requirements per GO 95.

In GISMO, a month is the from day to day. To expand on the previous example, a C priority condition found on August 20, 2019, will have a GISMO correction due date of August 20, 2022. The GO 95 Level 3 priority requires 60 months, which would correlate to a compliance correction due date of August 31, 2024. Setting the GISMO correction due date ahead of the compliance required date promotes completing the work ahead of requirements. Should corrections be completed after the GISMO date but before the compliance date, they are considered compliant.

Circumstances may also exist where, to promote operational efficiency, Corrections may be bundled or prioritized in a manner that the Correction is completed after the GISMO Suggested Correction Date but still before the GO 95 compliance correction date. Additional scenarios that can affect the timing of the correction include customer related issues, third party refusal, no access, permit requirements, and system emergencies. However, these circumstances should not be common. Furthermore, it is critical to note that Suggested Correction Dates may change with time to reflect changes in regulation, risk, or due to operational efficiency requirements.

Upon completion of the Condition correction, FPI is updated to show the nature of the work, the completion date, and the identity of the persons that completed the work for the specific work order. Once the Condition is changed to complete the work order is complete.

Any Condition that is not completed on or before the compliance date is considered a past due work order. These work orders are actively monitored and tracked so that they can be corrected as soon as possible. Pacific Power does not currently have the capability to project trends or future targets with regards to past due work orders but has included the current number of past due work orders in the Chart and Table 8-9 below.

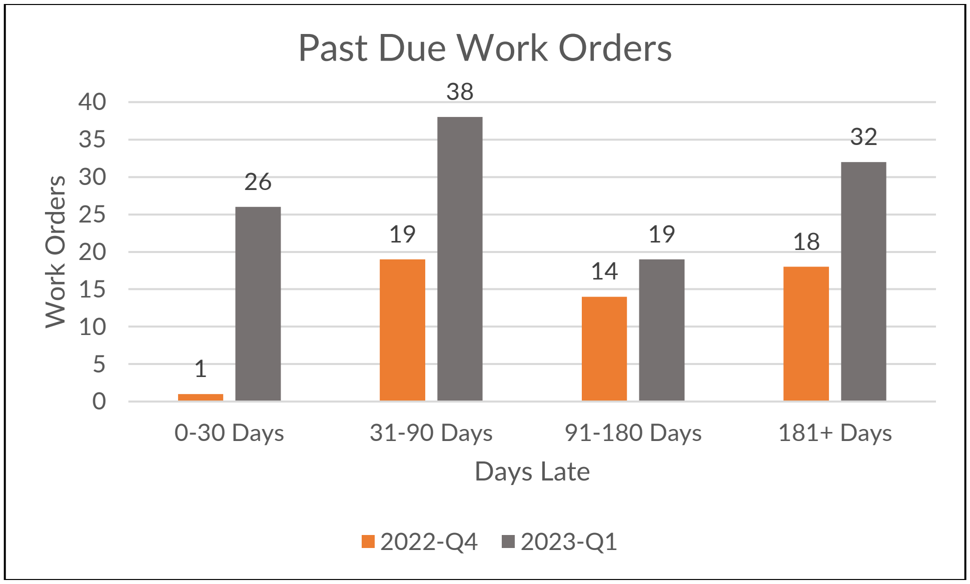


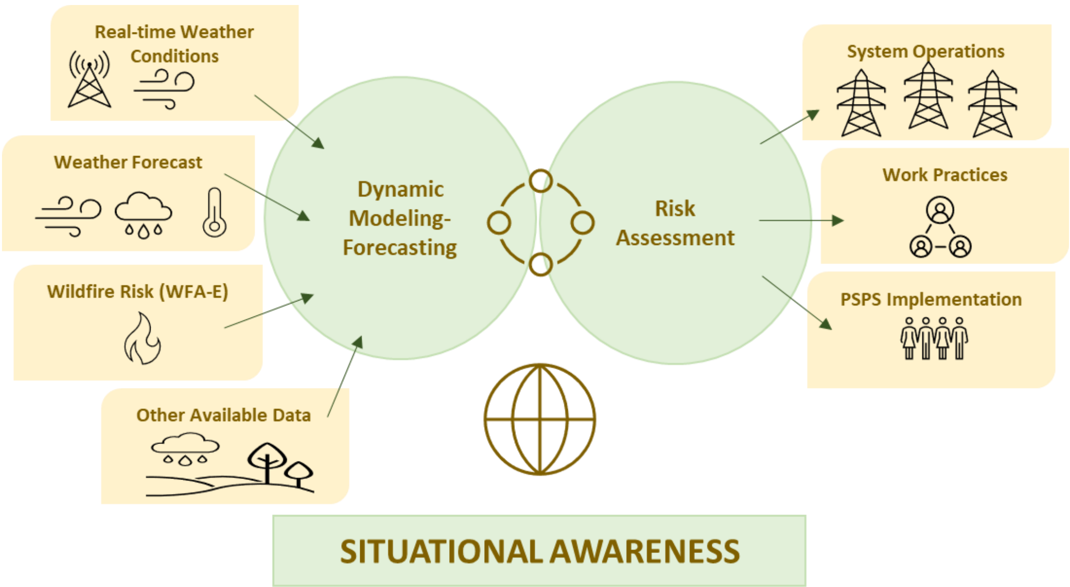
Table 8-8 Number of Past Due Asset Work Orders Categorized by Age

HTFD Area	0-30 Days		31-90 Days		91-180 Days		181+ Days	
	Q4-2022	Q1-2023	Q4-2022	Q1-2023	Q4-2022	Q1-2023	Q4-2022	Q1-2023
Non-HFTD	0	22	18	22	14	17	17	31
HFTD Tier 2	1	4	1	8	0	2	1	1
HFTD Tier 3	0	0	0	8	0	0	0	0

8.1.8 Grid Operations and Procedures

As described in Section 6, Pacific Power uses a combination of tools, analysis, and maps layered with a risk driver analysis to inform strategic asset inspections, vegetation maintenance practices, and long-term system hardening solutions. However, as climate and weather patterns change, extreme weather events are predicted to become more frequent, and the potential exists for seasonal, dynamic, and/or isolated risk events to occur that compound or deviate from this baseline risk. Therefore, having an additional sophisticated, dynamic risk model grounded in situational awareness is pertinent to ensure electric utilities know when, where, how, and why to take abnormal action to mitigate the risk of wildfire.

Pacific Power's approach to situational awareness, which is described in more detail in Section 8.3, includes the acquisition of data to forecast and assess the risk of potential or active events to inform operational strategies, response to local conditions, and decision making. These key components, which are outlined in the graphic below, are leveraged to inform risk-based system operations and work practices as discussed in the sections below.



8.1.8.1 Equipment Settings to Reduce Wildfire Risk

In this section, the electrical corporation must discuss the ways in which operates its system to reduce wildfire risk. The equipment settings discussion must include the following:

- Protective equipment and device settings
- Automatic recloser settings
- Settings of other emerging technologies (e.g., rapid earth fault current limiters)

For each of the above, the electrical corporation must provide a narrative on the following:

- Settings to reduce wildfire risk
- Analysis of reliability/safety impacts for settings the electrical corporation uses
- Criteria for when the electrical corporation enables the settings

Adjustments to power system operations can help mitigate wildfire risk. System operations adjustments generally include the modification of relay settings for protective devices on distribution lines or changes to line re-energization testing protocols described further in this section. These adjustments are not universally applied to power system operations because there are certain disadvantages in their use, especially because they may increase outage frequency and duration experienced by customers. In other words, a balance is required to provide customers with reliable power while still mitigating wildfire risk. To help balance these concerns, Pacific Power is deploying technologies such as fault indicators as discussed below. This WMP activity is tracked with Tracking ID# GO-01.

Protective Equipment and Device Settings

Line protective devices, such as line reclosers, are currently deployed on various transmission and distribution lines throughout Pacific Power's service territory. When a line trips open due to fault activity, reclosers can be programmed to momentarily open, allow the fault to dissipate, then reclose in an effort to test if the fault is temporary. The reclosing function gives the ability to restore service on a line that has tripped while maintaining the option to open again if the fault persists. If the fault is permanent, the recloser will operate and stay open (known as the "lock out" state) until the line has been deemed ready for re-energization. The image below generally depicts one potential configuration of a distribution circuit with multiple line reclosers installed.

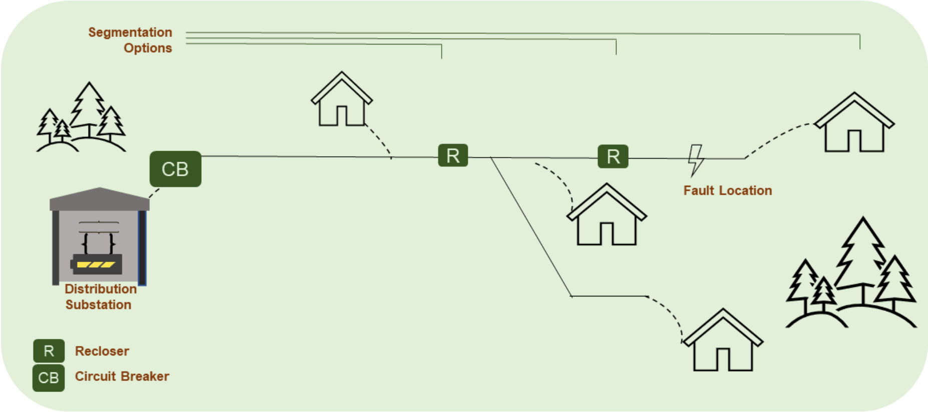


Figure 8-7: Example of Distribution Circuit with Multiple Reclosers

In general, recloser operation is beneficial because it reduces the number of sustained outages and improves customer reliability. The reclosing function, however, implicates some degree of ignition risk because additional energy can be released if a fault persists. When a fault is detected on the line, a recloser will trip and reclose based on predetermined settings to re-energize the line. If the fault is temporary in nature and is no longer present upon the reclose operation, the line will re-energize resulting in limited impact to customers. If the fault persists, however, reclosing can, depending on the circumstances, potentially result in arcing or an emission of sparks. Accordingly, a strategic balance between customer reliability goals and wildfire mitigation goals is required.

Pacific Power has used recloser disabling strategies on transmission lines for many years, and it has employed more frequent disabling of reclosers on transmission lines in recent years because of the increased wildfire risk. Pacific Power has been able to use these strategies without having too great of an impact on customer reliability. With wildfire risk continuing to increase, Pacific Power is implementing additional strategies on the distribution network, including the use of modified protection and control schemes to reduce wildfire risk, refers to as Elevated Fire Risk (EFR) settings.

Elevated Fire Risk (EFR) Modes

EFR modes of operation are intended to reduce fault clearing times and arc energy expended during a fault event, to detect and respond to all faults on the system and to maintain an acceptable level of customer service reliability. Pacific Power has many different intelligent electric devices in operation as protective devices on the distribution system. Each device has a different set of functions and limitations which may be employed to reduce risk during elevated fire risk conditions. At the same time, changes to the reclosing settings of devices can have significant impacts on customer service reliability, which itself implicates safety concerns.

The primary method to reduce arc energy is the reduction of fault interruption time. Settings are designed to maintain coordination between the different zones of protection, as necessary. Furthermore, total arc energy expended during a system event can be reduced by limiting the number of times the arc may be established. This can be accomplished by adopting a policy of limited reclosing while in the elevated fire risk mode. Reclosing, however, is an important tool for maintaining service reliability. Thus, the approach towards reclosing functionality in certain EFR modes will be influenced by the network configuration. Reliability is enhanced by deploying automatic sectionalizing devices or field reclosers to protect downstream segments of a circuit. These devices allow selective protection for certain sections of the line and provide indication and direction to guide restoration efforts. In general, when these elements are in place, EFR modes limit reclose attempts at a circuit breaker; but, in the absence of downstream devices, the protective relay at the substation in EFR mode will perform a single reclose attempt to reestablish / restore service.

The use of instantaneous overcurrent and definite time elements limit the operation of fuses on the distribution system. This is by design, because fused elements require time to operate and delay is undesirable in the context of elevated fire risk. The limitation of fuse operation on the distribution system has a two-fold impact on system protection. First, sensitivity of the overcurrent elements on the protective relays must be evaluated so that these relay elements can provide adequate protection to the end of line. Second, additional fault indication devices are warranted to aid in locating a fault, thereby supporting quicker restoration.

System Coordination in EFR Modes

System coordination in the EFR setting is maintained through short time delays. This short time delay allows downstream reclosers on the system to operate before upstream devices have time to respond to the faulted system conditions. With increased sensitivity on the relays and short time delays, however, it is still not expected that a downstream fuse will have time to operate.

Substation relays and recloser controllers on the system which have not yet been upgraded to intelligent electric devices shall use existing tag and recloser control functions to mitigate fire risk. Below is a table of the current common relays deployed on the Pacific Power system, the type of EFR mode that can be used on that specific relay, together with the expected fault operation outcomes and coordination.

While the program and methods used to deploy EFR settings are continuously evolving, the following table describes the current EFR Modes, expected fault operation, reclosing action, coordination with reclosers, and actions to restore depending on the type of equipment installed. Changes to the approach outlined below are possible and generally managed through internal company policies and procedures.

Table 8-9: Current EFR Mode Configurations

Relay	EFR Mode	Expected Fault Operation	Reclosing Action	Coordinates with Reclosers	Action to restore	Notes
SEL-751 Prior to May 2020	Tagged/Reclose Off	Lockout	No	No	Reclose Off	43RT – Tagged 43R – Reclose Off
SEL-751 Prior to December 2021	EFR 1	Trip, Reclose, Lockout	Yes	Yes	EFR Mode, Reclose Off	43RT – Tagged 43R – Reclose Off
SEL-751 with reclosers	EFR 2	Lockout	No	Yes	EFR Mode, Reclose Off	43RT – Tagged 43R – Reclose Off
SEL-751 without reclosers	EFR 1	Trip, Reclose, Lockout	Yes	N/A	EFR Mode, Reclose Off	43RT – Tagged 43R – Reclose Off
SEL-651R2 Prior to December 2019	Tagged/Reclose Off	Lockout	No	No	EFR Mode, Reclose Off	
SEL-651R2 Prior to April 2022	EFR 2	Trip, Reclose, Lockout	Yes	Yes	EFR Mode, Reclose Off	
SEL-651R2	EFR 2	Trip, Reclose, Lockout	Yes	Yes	EFR Mode, Reclose OFF	
SEL-351R4 prior to March 2020	Tagged/Reclose Off	Trip, Reclose, Lockout	No	No	Reclose Off	
SEL-351R4	EFR 2	Trip, Reclose, Lockout	Yes	Yes	EFR Mode, Reclose Off	
351R2 Prior to April 2020/ Form 6	Tagged / Reclose Off	Lockout	No	No	Reclose OFF	
351R2	EFR2	Trip, Reclose, Lockout	Yes	Yes	EFR Mode, Reclose Off	
DPU 2000R / DPU 2000 / Form 4C	Tagged / Reclose Off	Lockout	No	No	Reclose OFF	43RT – Tagged 43R – Reclose Off
DPU Electromechanical	Reclose Off	Lockout	No	No	Reclose ON	If relay configured for Zone Sequence
DPU Electromechanical	Reclose Off	Lockout	No	No	Reclose OFF	

Reliability Impacts of EFR Settings

The implementation of EFR settings on the distribution network can have an impact on customer reliability as depicted in Figure 8-8 and Pacific Power is exploring different strategic combinations to find the right balance.

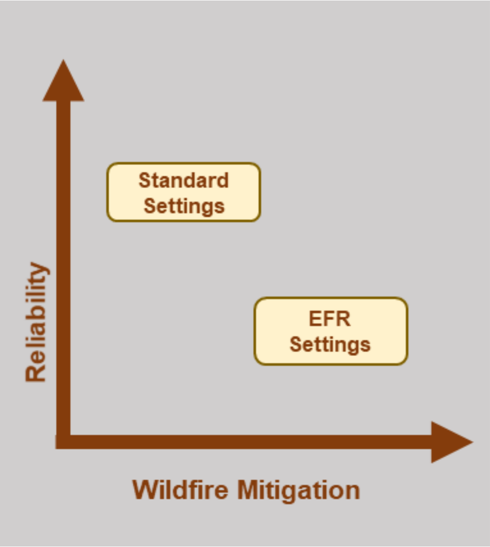


Figure 8-8: General Relationship between EFR Settings, Reliability, and Wildfire Mitigation

To mitigate impacts to customer reliability, Pacific Power generally does not disable reclosing seasonally. Instead, Pacific Power leverages a daily risk assessment process and situational awareness reports described in Section 8.3.6. For example, when meteorological conditions of increased wildfire risk occur, an alternative operating mode may sometimes be used to reduce the number of reclose attempts, increase the open interval time between trip and reclose operations, or set the recloser to lock out upon a single trip event. In 2023, Pacific Power plans to continue evaluating situational awareness, customer outages and other information to further optimize the settings and implement EFR settings as needed.

General Criteria for Using EFR Settings

The Company deploys a cross-departmental approach to monitoring meteorological conditions related to wildfire risk and adjusting daily operations of distribution system assets, including implementation of EFR settings. The various information and departments are coordinated by leveraging situational awareness assessments that inform the operational actions across the service territory. These situational awareness reports, also known as the District-Level Wildfire Risk Matrix, are described in Section 8.3.6.

Operational Procedures for Using EFR Settings

Figure below illustrates the operational coordination. As Pacific Power is continuously improving and evolving its plan and programs, the process below is subject to change and is managed by internal company policies and procedures.

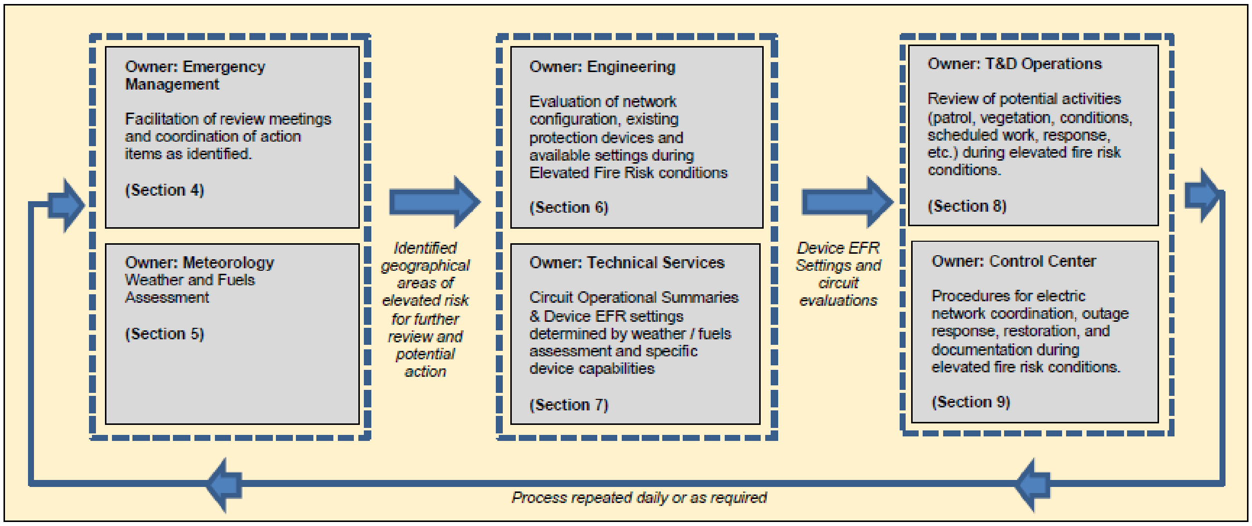


Figure 8-9: Operational Process for EFR Implementation

EFR Capabilities

By leveraging the combination of configurations outlined in Table 8-9, Pacific Power is able to implement EFR settings across all distribution circuits in California. Additionally, line protective devices, such as line reclosers or relays, are currently being upgraded on various transmission and distribution lines throughout Pacific Power's service territory as described in Section 8.1.2.8. to enable the more sophisticated EFR 1 and EFR 2 modes.

Effectiveness of EFR Settings

Currently, Pacific Power does not have any specific calculations or quantitative assessment of effectiveness for EFR settings. As discussed above, use of EFR Settings implicates the need to balance reliability concerns against wildfire mitigation goals. Pacific Power is not yet aware of a formulaic methodology to assess effectiveness, but it will continue to evaluate potential approaches. In general, Pacific Power believes that selective application, based on specific daily risk assessments accomplishes a greater degree of effectiveness, because it better balances the competing objectives

Automatic Recloser Settings

As described above, automatic reclosing is a part of standard protection and control settings. It can be beneficial because it reduces the number of sustained outages and improves customer reliability. The reclosing function, however, implicates some degree of ignition risk because additional energy can be released if a fault persists. Risk-based modifications to automatic recloser settings are considered embedded in the EFR program described above.

Settings of Other Emerging Technologies

Pacific Power does not currently have other modified protection and control setting programs.

8.1.8.2 Grid Response Procedures and Notifications

The electrical corporation must provide a narrative on operational procedures it uses to respond to faults, ignitions, or other issues detected on its grid that may result in a wildfire including, at a minimum, how the electrical corporation:

- Locates the issues
- Prioritizes the issues
- Notifies relevant personnel and suppression resources to respond to issues
- Minimizes/optimizes response times to issues

Issue Location

In all circumstanced, Pacific Power's System Operations is the central hub of communications of the distribution network. If an outage occurs on the distribution network, Region Operations generally manages the outage response and direct restoration efforts. Similar to the use of EFR settings, an operator's response may change based on the daily risk assessment. Under elevated wildfire conditions (YELLOW), the operator will coordinate with field personnel to decide if any additional actions are warranted due to particular circumstances. In significant or extreme wildfire conditions (ORANGE or RED), an operator may not restore until after additional patrols are performed as described below.

Re-energization Practices

Pacific Power also modifies re-energization practices based on risk-assessments, thereby also requiring a balance between customer reliability and wildfire mitigation. If a breaker or recloser has "locked-out" – meaning that it has opened and no longer conducts electricity – a system operator or field personnel will sometimes "test" the line. To test the line, the system operator or field personnel will close the device, thereby allowing the line to be re-energized. If the fault has cleared, then the system will run normally. If the fault has not cleared, the device will lock out again. If the device locks out again, the system operator then knows that additional investigation or work will be required before the line can be successfully re-energized. Because faults are often temporary, line-testing can be an efficient tool to maintain customer reliability similar to the use of reclosing described in the previous section. At the same time, line-testing can potentially result in arcing or an emission of sparks if a fault has not yet cleared when the line is tested. To mitigate this risk, Pacific Power requires an appropriate level of patrol prior to line testing, depending on local circumstances. In 2023, Pacific Power plans to further incorporate situational awareness reports to continue informing re-energization protocols during periods of elevated risk.

Response Tools to Minimize Impacts

Implementation of EFR settings or other operations protocols for the purpose of wildfire mitigation can result in more frequent outages to customers. While sometimes warranted to reduce the risk of wildfire, Pacific Power recognizes the disruption this can have to customers and communities.

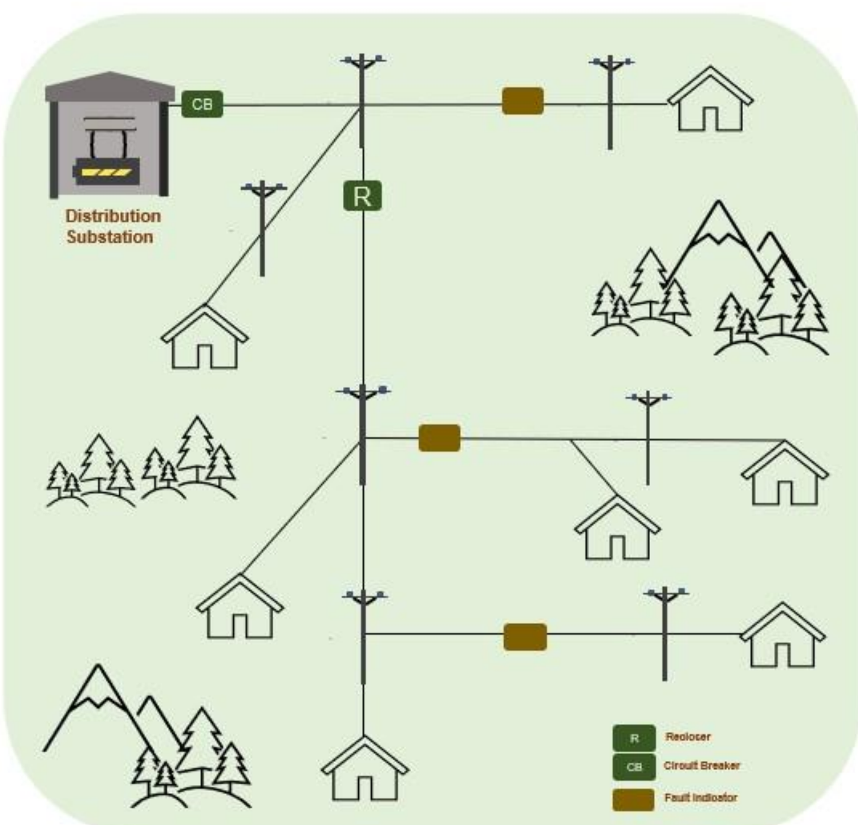


Figure 8-10: General Fault Indicator Location

The time it takes to patrol a line and overall impact to customers can be substantially reduced when the fault location (or at least approximate location) can be determined quickly. Pacific Power installed fault indicators in 2022 across the California service territory, prioritizing circuits that fed into the HFTD areas where EFR settings are most likely to be implemented. When an outage occurs, these new tools are utilized by regional operators and field personnel to narrow down potential fault locations, optimize the deployment of resources, and expedite restoration.

As Pacific Power continues to understand risk and implement mitigation programs such as EFR settings, the company may install additional fault indicators as needed to continue balancing the impact to customers and wildfire mitigation.

Fire Suppression Notifications

Pacific Power's emergency management team maintains relationships with federal and state emergency responders and mutual assistance groups. The company's emergency manager has contact information for state, county and tribal emergency managers, the state's Emergency Operations Center Emergency Support Functions (ESF) personnel, and the Geographic Area Coordination Centers for fire-related emergency response. District operations managers also maintain relationships with local first responders. If an incident like a wildland fire occurs and emergency operations are established, a district manager or an identified company representative will deploy when needed or requested to the jurisdictional agency's Incident Command Post (ICP) to provide necessary electric utility support and coordination.

8.1.8.3 Personnel Work Procedures and Training in Conditions of Elevated Fire Risk

The electrical corporation must provide a narrative on the following:

- The electrical corporation's procedures that designate what type of work the electrical corporation allows (or does not allow) personnel to perform during operating conditions of different levels of wildfire risk, including:
- What the electrical corporation allows (or does not allow) during each level of risk
- How the electrical corporation defines each level of wildfire risk
- How the electrical corporation trains its personnel on those procedures
- How it notifies personnel when conditions change, warranting implementation of those procedures
- The electrical corporation's procedures regarding deployment of firefighting staff and equipment (e.g., fire suppression engines, hoses, water tenders, etc.) to worksites for site-specific fire prevention and ignition mitigation during on-site work

During fire season, Pacific Power modifies field operations and work practices to further mitigate wildfire risk. Additionally, Pacific Power invests in tools and equipment to mitigate wildfire risk. This WMP activity is tracked with Tracking ID# GO-02.

Modified Work Practices

As a part of the situational awareness reports and briefings prepared by the meteorology department as described in Section 8.3.6, the operations department within Pacific Power considers the local weather and geographic conditions that may create an elevated risk of wildfire. These practices are targeted to reduce the potential of direct or indirect causes of ignition during planned work activities, fault response and outage restoration.

Pacific Power personnel working in the field during fire season mitigate wildfire risk through a variety of tactics. Routine work, such as condition correction and outage response, poses some degree of ignition risk, and, in certain circumstances, crews modify their work practices and equipment to decrease this risk. In the extremely unlikely event that a fire ignition occurs while field crews or other Pacific Power personnel are working in the field (collectively "field personnel"), such field personnel are equipped with basic tools to extinguish small fires.

Pacific Power is able to mitigate some wildfire risk by managing the way that field work is scheduled and performed. To effectively manage work during fire season, area managers regularly review local fire conditions and weather forecasts provided to them as part of Pacific Power's monitoring program – discussed in the situational awareness section.

During fire season generally, operations managers are encouraged to defer any nonessential work at locations with dense and dry wildland vegetation, especially during periods of heightened fire weather conditions. If essential work needs to be performed in the HFTD and other areas with appreciable wildfire risk, certain restrictions may apply, including the evaluation of hot work, selection of Personal Protective Equipment (PPE) and suppression tools, or consideration for additional site prep work.

These restrictions are evaluated based on the daily situational awareness reports described in Section 8.3.6. As Pacific Power is continuously improving and evolving its plan and programs, the process below is subject to change and is managed by internal company policies and procedures. However, in general, whenever wildfire risk potential is at little or no wildfire risk (GREEN), work may be conducted using normal operating practices. When the Meteorology Department, however, forecasts wildfire risk conditions that are elevated (YELLOW), significant (ORANGE) or extreme (RED), local T&D Operations may modify operating practices. For example, certain personal protective equipment and basic fire-fighting tools are required for any field work during periods of elevated fire risk. Local area management will also evaluate, after considering multiple factors regarding the local circumstances of a particular circuit, whether any hot work modifications should be made. If wildfire risk is significant or extreme, local area management will also consider whether any additional work might be appropriate.

1. When a circuit is identified as having elevated wildfire risk or above – meaning YELLOW, ORANGE or RED – local area management will complete an Elevated Fire Risk Work Evaluation (using a standard checklist form for that purpose).

2. When a circuit is identified as having significant wildfire risk or above – meaning ORANGE or RED – in addition to the actions in No. 1 above, local area management will complete an Additional Work Evaluation (using a standard checklist form for that purpose).

3. When a circuit is identified as having extreme wildfire risk or above – meaning RED – in addition to the actions in No. 1 and No. 2 above, local area management will cancel planned hot work (instead of considering alternatives as part of a Hot Work Evaluation).

The activities of T&D Operations, with respect to a particular category of wildfire risk potential, is summarized in the following table:

Fire Risk Potential Yellow	Fire Risk Potential Orange	Fire Risk Potential Red
PPE Equipment and Tools Daily Hot Work Evaluation	PPE Equipment and Tools Daily Hot Work Evaluation Additional Work Evaluation	PPE Equipment and Tools Cancel Hot Work Additional Work Evaluation

Additional Resources

To implement some of the wildfire mitigation programs generally described above and in Sections 8.1.8.1 and 8.1.8.2, additional labor resources and field personnel time is often required to (a) support system operations in assessing localized risk and administering EFR settings and (b) responding to outages during fire season with additional patrols and coordination.

Under normal operating procedures, system operators and field personnel work together on a daily basis to manage the electrical network. In many situations, system operators depend on field personnel to gather information and assess local conditions. As discussed in Sections 8.1.8.1 and 8.1.8.2, there are system operations procedures during wildfire season for implementing EFR settings and limiting line-testing. Consequently, system operators need field personnel to gather information and assess local conditions during fire season more frequently than would otherwise be required under normal operating procedures. The requests from system operators may be varied, ranging from a simple phone call to confirm that it is raining in a particular area, to a much more time-intensive request, such as a full line patrol on a circuit.

Field personnel may also spend some additional time when responding to an outage during fire season. As discussed in Section 8.1.8.2, a heightened risk exists with traditional restoration practices. To mitigate this risk, field operations may perform some amount of line patrol on certain de-energized sections of the circuit, notably during fire season and particularly in the HFTD dependent on current conditions at the work site and the duration of the restoration work. Depending on the circumstances, this extra patrol might be done just before or just after re-energizing the line. Typically, this type of line patrol does not involve a close inspection of any particular facility; instead, it is a quick visual assessment specifically targeted to identify obvious foreign objects that may have fallen into the line during restoration work.

8.1.9 Workforce Planning

In this section, the electrical corporation must report on qualifications and training practices regarding wildfire and PSPS mitigation for workers in the following target roles:

- Asset inspections.
- Grid hardening.
- Risk event inspection.

Table 8-10 Workforce Planning, Asset Inspections

Worker Title	Minimum Qualifications for Target Role	Special Certification Requirements	Electrical Corporation % FTE Min Quals	Electrical Corporation % Special Certifications	Contractor % FTE Min Quals	Contractor % Special Certifications	Reference to Electrical Corporation Training/Qualification Programs
Field Inspection Specialist	NESC, GO 95 trained		100%		N/A		Annual inspector training conducted by Pacific Power
Field Inspector	NESC, GO 95 trained		N/A		100%		Annual inspector training conducted by Pacific Power

Table 8-11 Workforce Planning, Grid Hardening

Worker Title	Minimum Qualifications for Target Role	Special Certification Requirements	Electrical Corporation % FTE Min Quals	Electrical Corporation % Special Certifications	Contractor % FTE Min Quals	Contractor % Special Certifications	Reference to Electrical Corporation Training/Qualification Programs
Journeyman/Lineman	Qualified Electrical Worker		88%				
Highline Patrolman	Qualified Electrical Worker		4%				
Technician	Qualified Electrical Worker		8%				

Table 8-12 Workforce Planning, Risk Event Inspection

Worker Title	Minimum Qualifications for Target Role	Special Certification Requirements	Electrical Corporation % FTE Min Quals	Electrical Corporation % Special Certifications	Contractor % FTE Min Quals	Contractor % Special Certifications	Reference to Electrical Corporation Training/Qualification Programs
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

8.2 VEGETATION MANAGEMENT AND INSPECTIONS

8.2.1 Overview

In accordance with Public Utilities Code section 8386(c)(9), each electrical corporation's WMP must include plans for vegetation management.

In this section, the electrical corporation must identify objectives for the next 3- and 10-year periods, targets, and performance metrics related to the following vegetation management programmatic areas:

- Vegetation inspections
- Vegetation and fuels management
- Vegetation management enterprise system
- Environmental compliance and permitting
- Quality assurance / quality control
- Open work orders

Pacific Power's vegetation management program is modeled on industry best practices, including systematic maintenance, scientifically based pruning to maintain safe vegetation to conductor clearances, tree removal (both incompatible species and hazard trees), tree replacement, cover-type conversion, herbicide use, tree growth regulator applications, and the use of specialized tools and equipment.

8.2.1.1 Objectives

Each electrical corporation must summarize the objectives for its 3-year and 10-year plans for implementing and improving its vegetation management and inspections.

Table 8-13 Vegetation Management Implementation Objectives (3-year plan)

Objectives for Three Years (2023–2025)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Continue progressing programs (annual patrols, routine cycle work and annual pole clearing).	VM-01. VM-02, VM-03, VM-04, VM-05	GO 95, Rule 35, Tree Trimming Guidance	QDR	December 2025	8.2.2
Review and revise Standard Operating Procedures	VM-11	GO 95, Rule 35, Tree Trimming Guidance	WMP reporting	December 2024	8.2.5

Table 8-14 Vegetation Management Implementation Objectives (10-year plan)

Objectives for Ten Years (2026–2032)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Continue to improve the QA/QC program	VM-11	N/A	N/A	2032	8.2.5

8.2.1.2 Targets

Initiative targets are forward-looking quantifiable measurements of activities identified by each electrical corporation in its WMP. Electrical corporations will show progress toward completing targets in subsequent reports, including QDRs and WMP Updates.

Table 8-15 Vegetation Management Initiative Targets by Year

Initiative Activity	Tracking ID	2023 Target & Unit	x% Risk Impact 2023	2024 Target & Unit	x% Risk Impact 2024	2025 Target & Unit	x% Risk Impact 2025	Method of Verification
Fuels management – Pole clearing beyond PRC 4292	VM-05	3126 Poles brushed in LRA HFTD areas	TBD	3126 Poles brushed in LRA HFTD areas	TBD	3126 Poles brushed in LRA HFTD areas	TBD	Annual post-work audit by internal staff

Table 8-16 Vegetation Inspections and QAQC Targets by Year

Initiative Activity	Tracking ID	Target End of Q2 2023 & Unit	Target End of Q3 2023 & Unit	End of Year Target 2023 & Unit	x% Risk Impact 2023	Target End of Q2 2024 & Unit	Target End of Q3 2024 & Unit	End of Year Targe 2024 & Unit	x% Risk Impact 2024	Target 2025 & Unit	x% Risk Impact 2025	Method of Verification
Detailed Inspection – Distribution	VM-01	450 circuit miles inspected	700 circuit miles inspected	829 circuit miles inspected	TBD	524 circuit miles inspected	786 circuit miles inspected	874 circuit miles inspected	TBD	826 circuit miles inspected	TBD	Inspection records, billing, project closeout documentation, and field verification
Detailed Inspection - Transmission	VM-02	158 line miles inspected	211 line miles inspected	264 line miles inspected	TBD	361 line miles inspected	482 line miles inspected	602 line miles inspected	TBD	270 miles of line inspected	TBD	Inspection records, billing, project closeout documentation, and field verification
Patrol Inspection - Distribution	VM-03	820 circuit miles inspected	1,027 circuit miles inspected	1,027 circuit miles inspected	TBD	578 circuit miles inspected	865 circuit miles inspected	865 circuit miles inspected	TBD	922 circuit miles inspected	TBD	Inspection records, billing, project closeout documentation, and field verification

Initiative Activity	Tracking ID	Target End of Q2 2023 & Unit	Target End of Q3 2023 & Unit	End of Year Target 2023 & Unit	x% Risk Impact 2023	Target End of Q2 2024 & Unit	Target End of Q3 2024 & Unit	End of Year Targe 2024 & Unit	x% Risk Impact 2024	Target 2025 & Unit	x% Risk Impact 2025	Method of Verification
Patrol Inspection - Transmission	VM-04	296 line miles inspected	329 line miles inspected	329 line miles inspected	TBD	99 line miles inspected	99 line miles inspected	99 line miles inspecte d	TBD	329 line miles inspecte d	TBD	Inspection records, billing, project closeout documentation, and field verification
QAQC - Post-Audits Distribution (Patrol)	VM-11	635 line miles	1,027 line miles	1,027 line miles	TBD	520 line miles	865 line miles	865 line miles	TBD	922 line miles	TBD	Mileage documentation and tracking
QAQC – Post Audits Transmission (Patrol)	VM-11	175 line miles	329 line miles	329 line miles	TBD	40 line miles	99 line miles	99 line miles	TBD	329 line miles	TBD	Mileage documentation and tracking

8.2.1.3 Performance Metrics Identified by the Electrical Corporation

Performance metrics indicate the extent to which an electrical corporation's Wildfire Mitigation Plan is driving performance outcomes. The electrical corporation must:

- List the performance metrics the electrical corporation uses to evaluate the effectiveness of its vegetation management and inspections in reducing wildfire and PSPS risk
- For each of these performance metrics listed, the electrical corporation must:
- Report the electrical corporation's performance since 2020 (if previously collected)
- Project performance for 2023-2025
- List method of verification

Table 8-17 Vegetation Management and Inspection Performance Metrics Results by Year

Performance Metrics	2020	2021	2022	2023 Projected	2024 Projected	2025 Projected	Method of Verification (e.g., third-party evaluation, QDR)
Vegetation-caused ignitions	-	-	-	-	-	-	-
Vegetation-caused outages	-	-	-	-	-	-	-

At the time of this filing, Pacific Power is unable to provide Vegetation Management and Inspection Performance Metrics.

8.2.2 Vegetation Management Inspections

In this section, the electrical corporation must provide an overview of its procedures for vegetation management inspections.

The electrical corporation must first summarize details regarding its vegetation management inspections. The table must include the following:

- Type of inspection
- Inspection program name
- Frequency or trigger
- Method of inspection
- Governing standards and operating procedures

Pacific Power's Vegetation Management inspection programs are summarized in the table below and described in the following subsections.

Table 8-18 Vegetation Management Inspection Frequency, Method, and Criteria

Type	Inspection Program	Frequency or Trigger (Note 1)	Method of Inspection (Note 2)	Governing Standards & Operating Procedures
Distribution	Detailed	Three-Year Cycle	Ground	CPUC GO 95 Rule 35, PRC 4293
Transmission	Detailed	Annual to Three-Years	Aerial and Ground	FAC 003-4, PRC 4293
Distribution	Patrol	Annual	Ground	CPUC GO Rule 35, PRC 4293
Transmission	Patrol	Annual	Aerial and Ground	FAC 003-4, PRC 4293
Distribution	Pole Clearing	Annual	Ground	PRC 4292

Ground inspection: ground-based visual inspection to identify vegetation conditions requiring correction, including Level 1 limited visual assessment consistent with ANSI A300 Part 9.

Aerial inspection: helicopter-based visual inspection to identify vegetation conditions requiring correction. Conditions identified through aerial inspection may be reviewed with follow-up ground inspection to verify conditions.

8.2.2.1 Detailed inspections and management practices for vegetation clearances around distribution electrical lines and equipment

Process

Detailed inspections for vegetation clearances around distribution electric lines in California are generally performed on a planned cycle where vegetation along a circuit scheduled for cycle maintenance is inspected and vegetation requiring work is identified for pruning or removal. These WMP activities are tracked with Tracking IDs# VM-01 and VM-02.

Detailed inspections are designed to identify vegetation conditions for correction that are inconsistent with distribution specifications in the company's Vegetation Management Standard Operating Procedures (Vegetation SOP). Correcting these conditions, which is discussed in Section 8.2.3.2 minimizes safety and reliability risks posed by trees and other incompatible vegetation that could encroach upon or grow near power lines. Detailed inspections are generally ground inspections. During detailed inspections, the inspector identifies vegetation requiring work based on criteria including (not all inclusive):

- Work thresholds, where identified by Pacific Power;
- Presence of dead wood in tree crowns at risk of falling or being blown into conductors;
- Readily climbable trees and tree houses near conductor;
- ANSI A300 (Part 9) Level 1 limited visual assessment strategies, to identify high-risk (hazard) trees while taking into consideration factors such as prevailing winds, slope, and tree orientation. The inspector may conduct a closer inspection or Level 2 assessment of suspect trees, to further assess their condition;
- Inventory reduction actions, such as discretionary removals, to reduce future work volumes.

The overall objective of detailed inspections of distribution lines is to minimize vegetation-related reliability, safety, and wildfire ignition risks. Pacific Power's vegetation management program is compliant with GO 95, Rule 35, applicable Public Resource Codes, and is described in detail in the Vegetation SOP. Pacific Power employs a work-flow process associated with implementing detailed inspections including the following:

- Pacific Power develops a workplan identifying distribution circuits to be inspected each year based on the established cycle.
- Circuit information important to inspection implementation (project information, circuit maps, sensitive customers, etc.) is uploaded into the mobile data management

software tool or made available through other means to the inspection contractor.

- The work is issued to the inspection contractor and inspection type and associated specifications identified.
- Ground inspection is initiated by the inspection contractor, who identifies vegetation conditions in accordance with Pacific Power specifications, which are consistent with applicable regulations (required clearance distances).
- If conditions that require corrective maintenance (i.e., conditions that are within Pacific Power's work thresholds) are identified, the work location is documented, and data collected to inform corrective maintenance actions. Inspection results are documented and tracked. Imminent conditions are immediately reported for corrective actions.
- During inspection, where corrective actions are identified, landowners are notified of the needed vegetation management work and landowner approvals obtained.
- Inspection on a circuit is generally initiated 1-6 weeks prior to the vegetation management corrective maintenance taking place. As the inspection is completed, the work is released to the vegetation management contractor to conduct the corrective maintenance.
- As Inspection of the circuit is completed, project or process documentation is submitted by the inspection contractor to close out the inspection.

Figure 8-11 show a workflow diagram depicting inspection process.

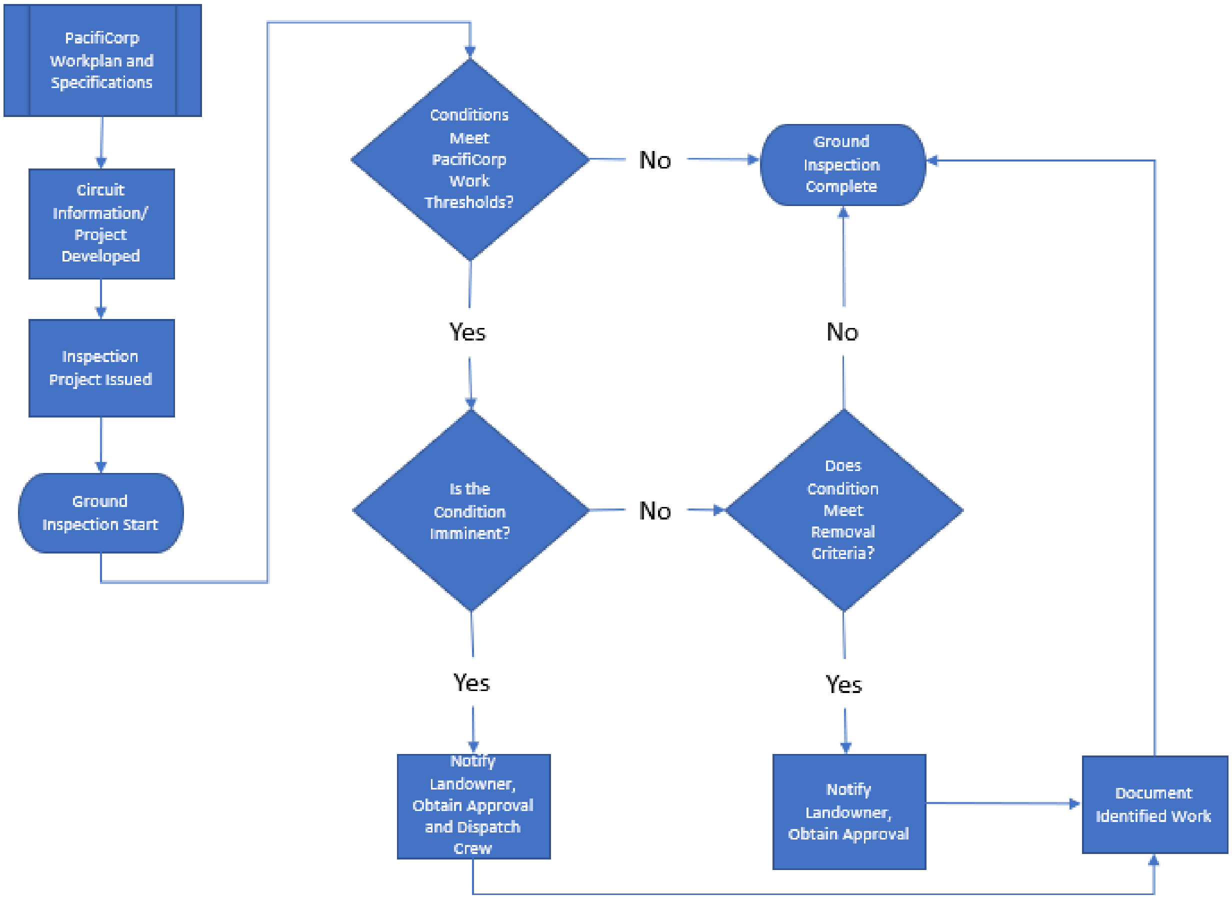


Figure 8-11 Vegetation Management Inspection Workflow

Frequency of Triggers

Detailed inspections for vegetation clearances around distribution electric lines in California are generally performed on a planned three-year cycle as part of the routine maintenance program. Pacific Power sequences the circuits to be inspected, while considering factors including circuit location (e.g., located within HFTD), when last scheduled work took place, knowledge of tree conditions, predominant species/growth rate, environmental factors (e.g., weather conditions impacting access or ability to perform work), and other influencing factors. These risk factors are considered by Pacific Power's Utility Forestry Arborists coupled with their working knowledge to prioritize circuits for inspection. Additionally, limited inspections may be conducted/triggered associated with customer requests, agencies, and Pacific Power T&D Operations requests based on observed conditions and/or reliability metrics. Weather events or conditions may also trigger additional limited inspections 8.2.2.2.

Accomplishments, Roadblocks, and Updates

In 2022, Pacific Power completed over 1,100 miles of detailed inspections of distribution circuits as part of routine maintenance, increased internal staffing to assist with quality control efforts, relocated staff within service territory to more efficiently support the vegetation management program and continued to make improvements to our mobile data management software, including updated inventory, work complete, audit exception, adder request, and refusal forms to enhance data collection and analysis capabilities. New reporting functions were also developed using data collected to provide the vegetation management department with additional information to be used by vegetation management staff to drive continuous improvement and identify quality control opportunities. Establishing a local workforce continues to be an area for improvement. There is a lack of qualified locally based vegetation management workers. This coupled with a newer/younger workforce, results in inefficiencies and inconsistencies as the workforce becomes more familiar with Pacific Power's expectations and vegetation of the area.

To address these opportunities for improvement, Pacific Power, as stated above, has increased its staffing levels, specifically regarding quality control to identify inefficiencies and inconsistencies for correction. In addition, Pacific Power in conjunction with its contractor are hiring local resources at entry level positions and brining in journeyman from out of the area to run crews until the local resources gain needed experience until they are qualified to run a crew themselves. This approach takes time, however, and will help bring stability to the local workforce.

8.2.2.2 Detailed inspections and management practices for vegetation clearances around transmission electrical lines and equipment

Process

Similar to detailed inspections of distribution lines, vegetation management detailed inspections of transmission line corridors focus on maintaining clearances and identifying high risk (hazard) trees. Transmission lines generally have wider rights-of-way, which allows Pacific Power to generally maintain clearances well over the Minimum Vegetation Clearance Distance (MVCD) required in FAC-003-04. Inspections are generally ground based. Where aerial inspections take place, they are generally followed up with ground inspections to confirm conditions identified during aerial inspection. These WMP activities are tracked with Tracking IDs# VM-06 and VM-07.

During detailed inspections, the inspector identifies vegetation requiring work based on criteria including (not all inclusive):

- Action thresholds as identified by Pacific Power;
- ANSI A300 (Part 9) Level 1 limited visual assessment strategies, to identify high-risk (hazard) trees while taking into consideration factors such as prevailing winds, slope,

and tree orientation. The inspector may conduct a closer inspection or Level 2 assessment of suspect trees, to further assess their condition; and

- Opportunities to employ integrated vegetation management (IVM) where practicable to the full extent of the right-of-way, to promote cover-type conversion, thereby preventing any future incompatible vegetation growth disrupting clearances.

The overall objective of detailed inspections of transmission lines is to minimize and/or eliminate vegetation-related reliability (cascading outages), safety, and wildfire ignition risks, while maintaining compliance with applicable Public Resource Codes, NERC requirements, and is described in detail in the Vegetation SOP. Pacific Power employs a work-flow process associated with implementing detailed inspections including the following (additional aerial inspections may also be conducted):

- Pacific Power develops a workplan identifying transmission lines to be inspected each year.
- Transmission line information important to inspection implementation (project information, line maps, sensitive customers, etc.) is uploaded into the mobile data management software tool or made available through other means to the inspection contractor.
- The work is issued to the inspection contractor and inspection type and associated specifications identified.
- Ground inspection is initiated by the inspection contractor, who identifies vegetation conditions in accordance with Pacific Power specifications, which are consistent with applicable regulations (required clearance distances).
- If conditions that require corrective maintenance (i.e., conditions that are within Pacific Power's action thresholds) are identified, the work locations are documented, and data collected to inform corrective maintenance actions, such as recommended year to conduct the corrective action. Inspection results are documented and tracked. Imminent conditions are immediately reported for corrective actions.
- During inspection, where corrective actions are identified, landowners are notified of the needed vegetation management work and landowner approvals obtained.
- Inspection on a transmission line is generally initiated 1-6 weeks prior to the vegetation management corrective maintenance taking place. As the inspection is completed, the work is released to the vegetation management contractor to conduct the corrective maintenance.
- As Inspection of the line is completed, project or process documentation is submitted by the inspection contractor to close out the inspection.

Refer to Figure 8-11 for a workflow diagram depicting inspection process.

Frequency of Triggers

Detailed inspections of transmission lines are generally scheduled as follows:

- Main Grid Transmission: Annually
  - Pacific Power lineman conduct annual inspection of main grid transmission lines in compliance with R4 of NERC Standard FAC-003. Pacific Power vegetation management detailed inspections supplement lineman inspections.
- Local Transmission: At a minimum once every three years, in conjunction with the distribution detailed inspection.

Pacific Power sequences local transmission lines to be inspected, while considering factors including line location (e.g., located within HFTD), when last scheduled work took place, knowledge of tree conditions, predominant species/growth rate, environmental factors (e.g., weather conditions impacting access or ability to perform work), and other influencing factors. These risk factors are considered by Pacific Power's Utility Forestry Arborists coupled with their working knowledge to prioritize transmission lines for inspection.

Additionally, limited inspections may be conducted/triggered associated with customer requests, agencies, and Pacific Power T&D Operations requests based on observed conditions and/or reliability metrics. Weather events or conditions may also trigger additional limited inspections (refer to section

Accomplishments, Roadblocks, and Updates

In 2022, Pacific Power completed over 270 miles of detailed inspections of local and main grid transmission lines as part of routine maintenance. For additional accomplishments and opportunities, refer to Section 8.2.2.1.

8.2.2.3 Patrol inspections of vegetation around distribution electric lines and equipment

Process

To further reduce wildfire risk in the HFTD, Pacific Power conducts annual vegetation patrol inspections, generally of distribution lines that are off cycle and of those lines where the detailed inspection is not completed prior to the height of the fire season. This WMP activity is tracked with Tracking ID# VM-03.

Patrol inspections are designed to identify vegetation conditions for correction that are inconsistent with distribution specifications in the company's Vegetation Management Standard Operating Procedures (Vegetation SOP). Correcting these conditions, which is discussed in Section 8.2.3.2 minimizes safety and reliability risks posed by trees and other incompatible vegetation that could encroach upon or grow near power lines. Patrol inspections are generally ground inspections. During patrol inspections, the inspector identifies vegetation requiring work based on criteria including (not all inclusive):

- Work thresholds, as identified by Pacific Power; and
- ANSI A300 (Part 9) Level 1 limited visual assessment strategies, to identify high-risk (hazard) trees while taking into consideration factors such as prevailing winds, slope, and tree orientation. The inspector may conduct a closer inspection or Level 2 assessment of suspect trees, to further assess their condition.

The overall objective of patrol inspections of distribution lines is to minimize vegetation-related reliability, safety, and wildfire ignition risks by addressing vegetation conditions that require corrective action prior to the next scheduled work (e.g., trees that may have become hazard trees over the course of the past year and trees that have or likely to violate minimum clearance distances before the end of the current growing season). Pacific Power's vegetation management program is compliant with GO 95, Rule 35, applicable Public Resource Codes, and is described in the Vegetation SOP. Pacific Power employs a work-flow process associated with implementing detailed inspections including the following:

- Pacific Power develops a workplan identifying distribution circuits to be inspected each year (off cycle circuits).
- Circuit information important to inspection implementation (project information, circuit maps, sensitive customers, etc.) is uploaded into the mobile data management software tool or made available through other means to the inspection contractor.
- The work is issued to the inspection contractor and inspection type and associated specifications identified.
- Ground inspection is initiated by the inspection contractor, who identifies vegetation conditions in accordance with Pacific Power specifications, which are consistent with applicable regulations (required clearance distances).
- If conditions that require corrective maintenance (i.e., conditions that are within Pacific Power's work thresholds) are identified, the work location is documented, and data collected to inform corrective maintenance actions. Inspection results are documented and tracked. Imminent conditions are immediately reported for corrective actions.
- During inspection, where corrective actions are identified, landowners are notified of the needed vegetation management work and landowner approvals obtained.
- Inspection on a circuit is generally initiated 1-6 weeks prior to the vegetation management corrective maintenance taking place. As the inspection is completed,

the work is released to the vegetation management contractor to conduct the corrective maintenance.

- As Inspection of the circuit is completed, project or process documentation is submitted by the inspection contractor to close out the inspection

Refer to Figure 8-11 for a work-flow diagram depicting inspection process.

Frequency of Triggers

Patrol inspections or "readiness patrols" are conducted annually on the entire length of circuits where they are either completely within or only a portion thereof is within HFTD where detailed inspections and associated corrective actions have not been completed or are not scheduled.

Pacific Power sequences distribution circuits to be inspected, while considering factors including HFTD tier (Tier II or Tier III), when last scheduled work took place, knowledge of tree conditions, predominant species/growth rate, environmental factors (e.g., weather conditions impacting access or ability to perform work), and other influencing factors. These risk factors are considered by Pacific Power's Utility Forestry Arborists coupled with their working knowledge to prioritize distribution circuits for inspection.

Additionally, limited inspections may be conducted/triggered associated with customer requests, agencies, and Pacific Power T&D Operations requests based on observed conditions and/or reliability metrics. Weather events or conditions may also trigger additional limited inspections (refer to Section 8.2.3.7).

Accomplishments, Roadblocks, and Updates

In 2022, Pacific Power completed over 1,000 miles of patrol inspections of distribution circuits. For additional accomplishments and opportunities, refer to Section 8.2.2.1.

8.2.2.4 Patrol inspections of vegetation around transmission electric lines and equipment

Process

To further reduce wildfire risk in the HFTD, Pacific Power conducts annual vegetation patrol inspections, generally of transmission lines that not scheduled for detail inspection. This WMP activities are tracked with IDs# VM-04.

Patrol inspections are designed to identify vegetation conditions for correction that are inconsistent with applicable transmission specifications in the company's Vegetation Management Standard Operating Procedures (Vegetation SOP). Correcting these conditions, which is discussed in Section 8.2.3.2 minimizes and/or eliminates safety and reliability risks posed by trees and other incompatible vegetation that could encroach upon or grow near power lines. Patrol inspections are generally ground inspections but may be augmented with aerial inspections. During patrol inspections, the inspector identifies vegetation requiring work based on criteria including (not all inclusive):

- Work thresholds, as identified by Pacific Power;
- ANSI A300 (Part 9) Level 1 limited visual assessment strategies, to identify high-risk (hazard) trees while taking into consideration factors such as prevailing winds, slope, and tree orientation. The inspector may conduct a closer inspection or Level 2 assessment of suspect trees, to further assess their condition;

The overall objective of patrol inspections of transmission lines is to minimize vegetation-related reliability, safety, and wildfire ignition risks by addressing vegetation conditions that require corrective action prior to the next scheduled work (e.g., trees that may have become hazard trees over the course of the past year and trees that have or are likely to violate minimum clearance distances before the end of the current growing season). Pacific Power's vegetation management program is compliant with applicable rules and regulations and is described in the Vegetation SOP. Pacific Power employs a work-flow process associated with implementing detailed inspections including the following:

- Pacific Power develops a workplan identifying transmission lines to be inspected each year.
- Transmission line information important to inspection implementation (project information, circuit maps, sensitive customers, etc.) is uploaded into the mobile data management software tool or made available through other means to the inspection contractor.
- The work is issued to the inspection contractor and inspection type and associated specifications identified.
- Ground inspection is initiated by the inspection contractor, who identifies vegetation conditions in accordance with Pacific Power specifications, which are consistent with applicable regulations (required clearance distances).
- If conditions that require corrective maintenance (i.e., conditions that are within Pacific Power's work thresholds) are identified, the work location is documented, and data collected to inform corrective maintenance actions. Inspection results are documented and tracked. Imminent conditions are immediately reported for corrective actions.
- During inspection, where corrective actions are identified, landowners are notified of the needed vegetation management work and landowner approvals obtained.
- Inspection on a transmission line or portion of transmission line is generally initiated 1-6 weeks prior to the vegetation management corrective maintenance taking place.

As the inspection is completed, the work is released to the vegetation management contractor to conduct the corrective maintenance.

- As inspection of the transmission line or portion of the transmission line is completed, project or process documentation is submitted by the inspection contractor to close out the inspection

Refer to Figure 8-11 for a work-flow diagram depicting inspection process.

Frequency of Triggers

Patrol inspections or "readiness patrols" are conducted annually on the portion of the transmission line within the HFTD on lines that are not scheduled for detailed inspections.

Pacific Power sequences transmission lines to be inspected, while considering factors including HFTD tier (Tier II or Tier III), when last scheduled work took place, knowledge of tree conditions, predominant species/growth rate, environmental factors (e.g., weather conditions impacting access or ability to perform work), and other influencing factors. These risk factors are considered by Pacific Power's Utility Forestry Arborists coupled with their working knowledge to prioritize distribution circuits for inspection.

Additionally, limited inspections may be conducted/triggered associated with customer requests, agencies, and Pacific Power T&D Operations requests based on observed conditions and/or reliability metrics. Weather events or conditions may also trigger additional limited inspections (See Section 8.2.3.7).

Accomplishments, Roadblocks, and Updates

In 2022, Pacific Power completed over 160 miles of patrol inspections of transmission lines. For additional accomplishments and opportunities, refer to Section 8.2.2.1.

8.2.3 Vegetation and Fuels Management

In this section, the electrical corporation must discuss the following mitigation initiatives associated with vegetation and fuels management:

- Fuels management
- Clearance
- Fall-in mitigation
- Substation defensible space
- High-risk species
- Fire-resilient right-of-way
- Emergency response vegetation management

8.2.3.1 Fuels Management

Pacific Power's fuels management efforts include wood and slash management and pole clearing activities. These efforts are described in the following subsections. Fuels management is implemented in accordance with the company's Vegetation SOP.

8.2.3.1.1 Wood and Slash Management

Pacific Power does not have a separate wood and slash management program or initiative beyond the management practices as identified in its Vegetation SOP. Pacific Power's wood and slash management practices, which are part of the base vegetation management program and not presented as an initiative, is summarized as follows.

The completion of both planned and emergency vegetation management work results in smaller vegetation materials such as brush, tree limbs or shrubs less than 6 inches in diameter, a byproduct also referred to as "slash." The presence of slash from vegetation management activities can contribute to the overall fuel availability along a utility right-of-way.

Pacific Power manages slash in developed areas by chipping or removing (recycles where practicable) it where accessible, unless the property owner indicates otherwise. In rural, off-road areas Pacific Power uses a lop and scatter and chipping (where accessible) practice to reduce the volume of available fuel within the right-of-way and adheres with land managing agency requirements.

An integral component of Pacific Power's vegetation program that influences fuel management and reduction of slash are the appropriate use of herbicide and tree-growth regulators as part of Integrated Vegetation Management (IVM). As identified in ANSI A300, Part 7, IVM is a system of managing plant communities in which compatible and incompatible vegetation are identified, action thresholds considered, and best management practices/control options (including herbicide use) implemented to achieve management goals and objectives. By preventing and/or inhibiting undesirable vegetation growth, the volume of slash can be further reduced. Pacific Power uses herbicides and tree-growth regulators, where approved by the property owner or land managing agency in targeted areas.

8.2.3.1.2 Pole Clearing

Consistent with California Public Resource Code (PRC) § 4292, Pacific Power conducts pole clearing activities involving removal of all vegetation within a 10-foot radius cylinder (up to 8 feet vertically) of clear space around a subject pole, removal of dead vegetation from 8 feet to the highest point of the conductor, and applying herbicides and/or soil sterilant to prevent any vegetation regrowth (unless prohibited by law or the property owner). See below. This WMP activity is tracked with Tracking ID# VM-05.

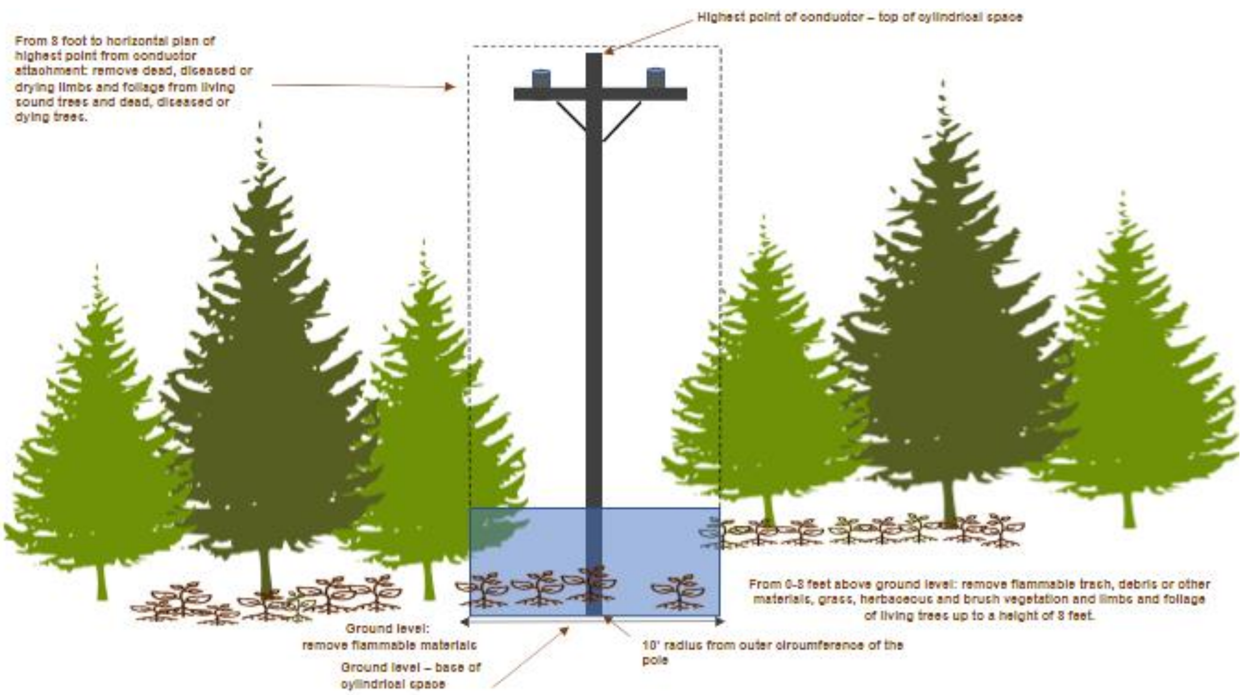


Figure 8-12 Pole Clearing

Pole clearing is designed to reduce the risk of fire ignition if sparks are emitted from electrical equipment. Pacific Power vegetation management has expanded pole clearing to include Local Responsibility Area (LRA) subject equipment poles located in the HFTD in additional to its existing program in compliance with regulations of clearing State Responsibility Area (SRA) subject poles. In addition to state required pole clearing activities, Pacific Power addresses vegetation adjacent to "subject" poles in local responsibility areas to further reduce wildfire ignition risks and increase wildfire resiliency. In 2022, Pacific Power conducted vegetation clearing of over 3,000 poles outside of SRA (CAL FIRE state-regulated areas). In 2023, Pacific Power plans to clear vegetation over 3,100 poles under the expanded pole clearing project.

8.2.3.2 Clearance

Pacific Power conducts cycle-based maintenance coupled with annual patrol and corrective maintenance (incremental to routine maintenance) to maintain required minimum clearance distances as identified in Table 1 of GO 95.

Pacific Power has adopted expanded post-work minimum clearance distances, of at least 12 feet for all distribution lines and has increased post-work clearance distances to 30 feet for transmission lines greater than or equal to 115 kV but less than 230 kV.

Pacific Power also prunes vegetation beyond minimum required clearances in multiple ways as presented in the Vegetation SOP. First, Pacific Power uses increased clearance distances on distribution lines for certain species of trees, depending on tree growth rate. Pacific Power separates vegetation into three categories: (a) slow-growing; (b) moderate growing; and (c) fast growing. In all cases, Pacific Power applies the 12-foot minimum post-work clearance for slow-growing species. In certain cases, Pacific Power applies an increased clearance for moderate growing and fast-growing species.

Second, Pacific Power integrates spatial concepts to distinguish between (i) side clearances, (ii) under clearances, and (iii) overhang clearances. Recognizing that certain trees grow faster vertically than other trees, it is appropriate to use an increased clearance when moderate- or fast-growing trees are under a conductor. Increasing overhang clearances also reduces the potential for faults due to overhang.

Third, as a practical matter, Pacific Power will often prune beyond the minimum required distances because of the physical structure of the tree. Pacific Power uses natural target pruning. Natural targets are the final pruning cut location at a strong point in a tree's disease defense system, which are branch collars and proper laterals. Pruning at natural targets protects the joining trunk or limb. This technique is drawn from ISA Best Management Practices: Tree Pruning.

Pacific Power is transitioning from a four year cycle to a three year cycle in its California service territory. In order to maintain minimum required clearance distances through the cycle maintenance period, Pacific Power may also conduct additional mid-cylce inspection and correction activities (hotspot actions) to target cyclebusters, which are those trees that may not hold for an entire cycle (refer to Section 8.2.3.5 for addition discussion). In addition. a critical component of vegetation management is appropriate application of herbicide to inhibit regrowth and maintain minimum required clearances.

8.2.3.3 Fall-In Mitigation

Pacific Power identifies and addresses fall-in risk, or hazard trees as part of routine maintenance (detailed inspections) and annual patrols (circuits within or partially within HFTD). Hazard trees identified during inspections are removed or pruned sufficiently to eliminate the hazard. In addition to inspections conducted by vegetation management contractors/personnel, Pacific Power district operations (through line inspections they conduct), customers, agencies, etc., may identify fall-in risk conditions that are vetted by vegetation management and mitigated as warranted.

Pacific Power's existing SOPs require the removal of hazard trees. Consistent with California law, removal is required when "dead, rotten or diseased trees or dead, rotten or diseased portions of otherwise healthy trees overhang or lean toward and may fall into a span of supply or communication lines."[20] Furthermore, the SOP encourages removal, when allowed, even when removal is not required under GO 95, Rule 35 or PRC § 4293. Pacific Power coordinates with its inspectors to identify discretionary removals to moderate future workloads and mitigate potential future risks.

Hazard trees are identified through detailed inspections and patrols by field crews performing work. Pacific Power uses industry best practice Level 1 limited visual assessment, as defined in ANSI A300 (Part 9). Suspect trees are targeted for removal. Coordination with the property owner to obtain consent to removal is often part of the process. Pacific Power goes to great lengths to obtain property owner permission, making repeated and reasoned requests by different representatives of the company.

In addition, failure of limbs, or branches overhanging electrical conductors pose a fall-in risk. Increased overhang clearances may decrease this mode of fall-in risk. As such and as part of this initiative, Pacific Power is implementing an Enhanced Overhang Reduction Pilot to determine efficacy of increased overhang pruning; in other words, to determine effects of this activity to trees species and reduce the amount of vegetation and/or limbs overhanging high-voltage power lines thereby decreasing ignition potential from vegetation and conductor contact.

Through implementation of this project, trees pruned will have increased conductor to vegetation post-work clearances as depicted in the Figure 8-13 Enhanced Overhang Clearance. Because of the increased amount of crown removed to achieve increased overhang clearance, the subject trees will be evaluated (visual assessment) within one year of work to assess their condition and determine tree species response where practicable. Pacific Power uses a Level 1 Assessment, as defined in ANSI A 300 (Part 9), to detect potential dieback, decay, and/ or other defects that can be associated with removing more than one third of the crown. Pacific Power may also conduct additional monitoring as needed or in subsequent years based on results and consider alternatives, for example, tree removal depending on tree response to increased crown removal. This WMP activity is

[20] GO 95, Rule 35; see also Public Resources Code § 4293 "Dead trees, old decadent or rotten trees, trees weakened by decay or disease and trees or portions thereof that are leaning toward the line which may contact the line from the side or may fall on the line shall be felled, cut, or pruned so as to remove such hazard."

tracked with Tracking ID# VM-08.

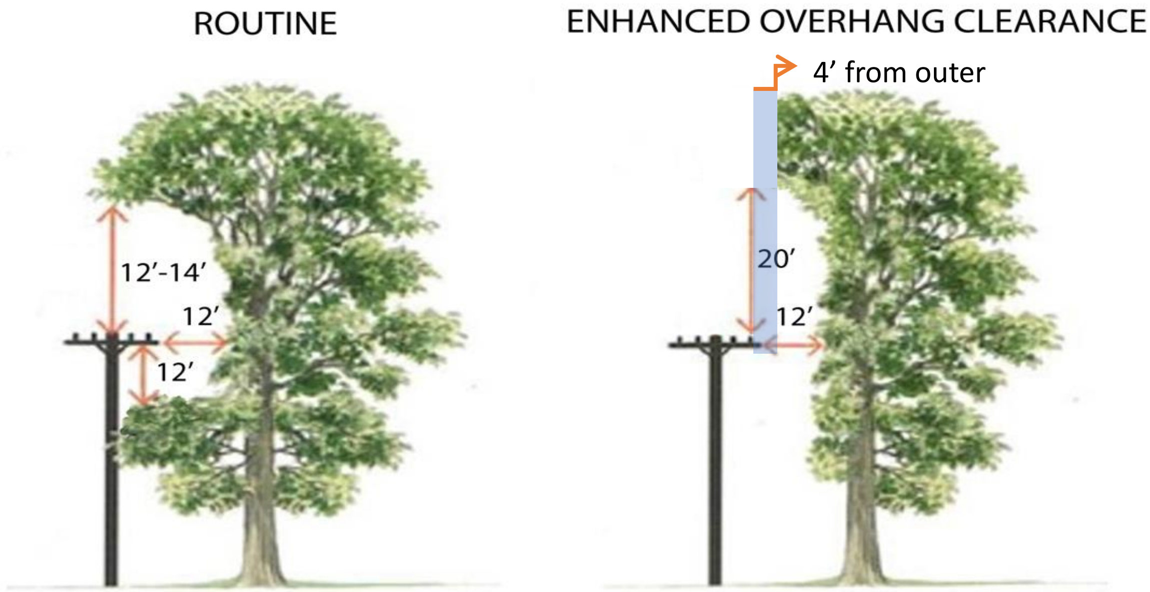


Figure 8-13 Enhanced Overhang Clearance

In 2022, Pacific Power identified targets sections of distribution circuits for project implementation. The following timeline is applicable:

- 2023: Enhanced overhang reduction work is targeted for implementation and completion. Overhang reduction work will be post-audited to ensure overhang reduction specifications were implemented and document if not achieved.
- 2024: Tree condition will be reviewed to determine the impact of enhanced overhang reduction/crown removal. Trees will be assessed for dieback or other defects.
- 2025: Preliminary results of the pilot will be reviewed, and determinations made.

8.2.3.4 Substation Defensible Space

Vegetation contact with conductors creates an ignition risk, and a risk of fire damage to substation equipment. Substation inspections determine where vegetation may pose a current or future risk to substation equipment. Pacific Power performs substation inspections for vegetation to remove overhang limbs or climbable vegetation and remove weeds. As part of the detailed and patrol inspections, hazard trees are identified and mitigated to address fall-in risk.

8.2.3.5 High-Risk Species

Species with fast growth rates can be considered high-risk/at-risk species as they pose an elevated risk of electrical contact. In addition to growth rates, other risk factors — being prone to structural failure (trunk, branch, roots) and environmental factors, such as wind — are considered when prescribing remedial actions, including discretionary removal. Remediation of at-risk trees is part of the company's vegetation management program. Pacific Power's vegetation maintenance program objective is to prevent vegetation from growing-into, and contacting, power lines. Pacific Power has established post-work clearance specifications categorized by tree growth rates to prevent vegetation-to-conductor contacts. Vegetation inspections categorize growth by species as: slow, moderate, fast (cycle-buster). Within the HFTD, pruning is performed to prevent vegetation from breaching a 4-foot minimum clearance within one year. This may require additional pruning for at-risk species with very fast growth rates. Pre-listers also identify discretionary removals of at-risk species to eliminate ignition risk and need for cyclical pruning. Pacific Power also applies tree growth regulators, where landowner approval is obtained, to fast-growing trees to slow growth and minimize potential that they will encroach upon facilities or required minimum clearances prior to the next scheduled maintenance.

8.2.3.6 Fire-Resilient Right-of-Ways

Pacific Power utilizes integrated vegetation management (IVM) best practices to manage vegetation in which undesirable vegetation is identified and selected control(s) are implemented, consistent with the American National Standards Institute guidance. Through implementation of IVM practices and the vegetation management program, Pacific Power strives to establish sustainable plant communities within its rights-of-way that are compatible with the electric facilities, wherever possible. These communities are stable, low-growing, compatible with conductors, diverse, and establish a sustainable supply of forage, escape and nesting cover, movement corridors for wildlife, reduced fire risk, and more open access to the line. Beyond manual and mechanical control methods used to address undesirable species, Pacific Power utilizes herbicides to inhibit regrowth and promote cover type conversion and tree growth regulators targeting fast growing species, where landowner approval has been obtained. Appropriate application of herbicide is an integral part of Pacific Power's vegetation management strategy.

In addition, Pacific Power promotes right tree in right place or small trees for small places concepts with customers coupled with our tree replacement voucher program. Tree replacement vouchers may be provided to customers on a case-by-case basis to offset removal of incompatible species within or adjacent to the right-of-way. Pacific Power provides information to customers regarding vegetation that is compatible with utility rights-of-way and coordinates with communities through Arbor Day functions or other educational outreach opportunities.

8.2.3.7 Emergency Response of Vegetation Management

While Pacific Power is committed to executing the company's planned vegetation management programs, circumstances may still arise where, due to variable conditions such as weather, additional risk can be mitigated through supplemental vegetation inspections and corrective work. Pacific Power has developed daily weather briefings that provide weather forecast information as a tool for management/response-based decision making. Based on these weather forecasts and at times of elevated risk, vegetation management actions may be taken, including targeted patrols to identify and address potential ignition risks due to vegetation and inform decision making (including PSPS events). These patrols may be performed throughout the weather event and/or PSPS event and are initiated and prioritized based on risk and situational awareness.

Pacific Power also adheres with local requirements and restrictions to mitigate ignition risk. During red flag warnings or other fire precaution levels, Pacific Power may move resources to work in other areas that are not impacted by the restrictions or are outside of the HFTD, where feasible. Vegetation management personnel also follow local guidance and requirements as they pertain to fire restrictions, such as work hours, using a fire watch following work and using equipment that minimize potential to cause sparks.

Regarding response to wildfires, Pacific Power foresters and/or vegetation management contractors patrol wildfire-impacted areas adjacent to electrical infrastructure to identify trees impacted by fire within strike distance of electrical infrastructure, determine risk, and determine strategy for mitigating the identified risk. Trees that pose an imminent risk are topped or felled to eliminate the risk as soon as practicable. Depending on the risk identified and considering other factors such as land ownership and environmental concerns, other mitigation efforts to address remaining fire-impacted trees may occur. In all cases, safety is paramount; vegetation post-fire work is done to reduce safety risks to the public and Pacific Power crews or contractors that may be responding to repair infrastructure damaged or destroyed by fire.

8.2.4 Vegetation Management Enterprise System

In this section, the electrical corporation must provide an overview of inputs to, operation of, and support for a centralized vegetation management enterprise system updated based upon inspection results and management activities such as trimming and removal of vegetation.

Data collection and management is a critical element to a vegetation management program and to facilitate continuous improvement. Pacific Power historically has been a paper-based data collection program. In the early 1990s, the Company developed a database known as "PVM" (Pacific Power Vegetation Management), which stores information reported by vegetation management contractors at time of invoice submittal, including invoice amount and production data (man hours, quantity of trees pruned or removed); however, data collected in the field was still primarily paper-based or through using unconnected electronic formats such as Microsoft Excel and Word. Pacific Power access the PVM database through a business objects reporting function.

In 2020, Pacific Power transitioned from a paper-based decentralized field data collection system to a mobile data management software (MDMS). The MDMS utilized by Pacific Power combines rapid GIS mapping with custom forms for field data collection such as inspections, consulting, and surveying; allowing users to capture and update data in the field, including GPS locations, photos, and other information. Data captured via electronic forms supports a variety of data types, including text, numeric, date and time, GPS coordinates, and photos. The mobile app is compatible with both Android and iOS devices.. Some of the primary uses of the MDMS include inventory and work complete data collection. Pacific Power does not maintain an inventory and work history of specific trees with unique identifiers, but rather collects an inventory of the work identified at a location to be conducted within the calendar year by powerline and retains this work history for future reference. Pacific Power's MDMS is not integrated with other systems in other lines of business within Pacific Power. The MDMS is also used by Pacific Power personnel to document audit findings.

Pacific Power seeks opportunities to refine the MDMS data collection process through creating new forms or updating existing forms to capture additional data fields as data gaps are identified to allow for informed vegetation management program decision making. Pacific Power has updated several forms including the inventory, work complete, adder request, audit exception, tree coupon (voucher) and property owner refusal to enhance data collection and tracking capabilities.

8.2.5 Quality Assurance and Quality Control

In this section, the electrical corporation must provide an outline of its quality assurance and quality control (QA/QC) activities for vegetation management.

Quality control actions such as audits are critical to ensure vegetation requiring work (pruning and/or removal) is properly identified and the work is subsequently conducted in accordance with vegetation program standards/specifications. Pacific Power conducts post-audits (quality control reviews) to compare completed work against specifications, such as post-work clearances as identified in the Vegetation SOP (Sections 4.3, 4.4, and 6.8). This WMP activity is tracked with Tracking ID# VM-11.

Post-audits are completed annually and include review of routine maintenance (work identified during detailed inspections) and additional work completed annually within the HFTD (work identified during patrol inspections).

Post-audits are primarily conducted by Pacific Power internal staff, however, contract staff may assist on an as needed basis. Post-auditor minimum qualifications include ISA arborist certification.

Pacific Power has hired additional staff throughout its service territory to increase internal post-audit capacity. Post-audits are generally conducted soon after the vegetation management work is completed at a location, to identify any issues before vegetation management crews leave the area for their next work assignment. Post-audits are intended to identify recurring quality-related issues early on, so that Pacific Power staff can review with the contractors conducting the work and implement any needed corrective measures.

The staff conducting post-audits record work exceptions (inconsistencies with Pacific Power specifications or work missed) using the MDMS. The audit exceptions are then visible to the vegetation management contractor within the MDMS and assigned to that contractor, who remains responsible for the work, including any corrective action.

Pacific Power also conducts ad hoc tree crew audits or crew visits where a Pacific Power forester engages with the vegetation management contractor, such as a crew leader, and/or supervisor to review work and/or discuss opportunities for improvement. Like Pacific Power's other programs, if an exception is identified that poses an imminent safety or reliability risk, the audit will be suspended and the exception addressed through corrective actions.

During post-audits, observations and instruction about corrections are documented in the mobile data management software system, observations are discussed, and feedback is provided to the vegetation management contractor.

Pacific Power has continued to refine its work management process, specifically filing specific, work-related milestone-type documentation including contractor accepted work release, work completed documentation, contractor signed completed work release, post-audit completion and audit findings, or exceptions addressed and corrected.

While the audits focus on the execution of the vegetation management actions (e.g., pruning and removals), the post-audits do result in findings that relate to the initial inspection, such as trees needing work that may have been missed by the pre-lister (which ought to also be caught by the work crew). Pacific Power will incorporate pre-inspection audits as a QA/QC improvement in 2023.

Table 8-19 Vegetation Management QA/QC Program

Activity Being Audited	Sample Size	Type of Audit	Audit Results 2022	Yearly Target Pass Rate for 2023-2025
Routine Cycle Maintenance (identified during detailed inspections) - Distribution	Target 100%	Field	72% (of all miles audited)	N/A

Activity Being Audited	Sample Size	Type of Audit	Audit Results 2022	Yearly Target Pass Rate for 2023-2025
Annual Corrective Work (identified during patrol inspections) - Distribution	Target 100%	Field	100% (of all miles audited)	N/A
Pole Clearing (Beyond PRC 4292 requirements)	Target 10%	Field/Desktop	100% (of targeted poles to audit)	N/A
Routine Maintenance (identified during detailed inspections) - Transmission	Target 100%	Field	83% (of all miles audited)	N/A
Annual Corrective Work (identified during patrol inspections) - Transmission	Target 100%	Field	100% (of all miles audited)	N/A

8.2.6 Open Work Orders

In this section, the electrical corporation must provide an overview of the procedures it uses to manage its open work orders resulting from vegetation management inspections that prescribe vegetation management activities.

Pacific Power conducts inspections of vegetation along its powerlines scheduled for work within the calendar year. Through these inspections, such as detailed and patrol inspections, an inventory of work is identified. Pacific Power issues a work release to the vegetation management contractor to correct vegetation conditions identified in the inventory. Specific work releases or work orders are not issues for each work location, but rather one work release is issued for the entire powerline being worked.

As corrections are made, the vegetation management contractor fills out a work complete form and changes the color of the work location icon in the MDMS to visually represent work complete at that location as well. Pacific Power foresters and contractors use this visual representation to identify area where work has not yet been completed and review these areas in regular conversations to ensure completion before end of calendar year. Pacific Power does not have a formal system for tracking "open" work locations through time, which is a limitation of our current MDMS. Generally, as work locations are complete, these locations are moved within our MDMS project to a work complete project so that only open work locations are present within the MDMS project that the vegetation management contractor is working from. Generally, open work locations are noted on the work release by the vegetation management contractor.

In 2022, Pacific Power has created a report that links forms (e.g., inventory and work complete) at a work location. In 2023, this report will be reviewed and modified to allow for tracking of open work locations (locations without a work complete form) to help drive completion of any open work locations prior to end of each calendar year.

Table 8-20 Number of Past Due Vegetation Management Work Orders Categorized by Age is left blank since Pacific Power does not have specific due dates for each condition at the time of this filing.

Table 8-20 Number of Past Due Vegetation Management Work Orders Categorized by Age

HTFD Area	0-30 Days	31-90 Days	91-180 Days	181+ Days
Non-HFTD				
HFTD Tier 2				
HFTD Tier 3				

8.2.7 Workforce Planning

In this section, the electrical corporation must provide a brief overview of its recruiting practices for vegetation management personnel.

When recruiting for internal positions, Pacific Power utilizes internal and external job boards, including the Utility Arborist Association career page, to broaden reach and interest from prospective candidates. Regarding implementation of the vegetation management program activities, such as inspection and correction work, Pacific Power relies on a contracted workforce. Pacific Power’s recruitment and training strategies focus on management of the contractual relationship with independent contractors. Pacific Power’s vegetation management program is a 100% contracted front-line resource, managed by internal management and the Company’s utility foresters. Pacific Power requires that its utility foresters are certified arborists and certified utility specialists by the International Society of Arboriculture (ISA). Pacific Power is not directly responsible for the training of the vegetation management workforce, who are employees of an independent contractor, however, does provide annual environmental awareness training and conducts audits and crew visits, which may lead to discussions and opportunities for improvement. Contracted resources complete any training and meet qualifications set forth by the independent contractor and applicable union.

Table 8-21 Vegetation Management Qualifications and Training presents Pacific Power worker titles and associated minimum qualifications identified by Pacific Power for contracted target roles who conduct work vegetation inspections and oversee project work.

Table 8-21 Vegetation Management Qualifications and Training

Worker Title	Minimum Qualifications for Target Role	Special Certification Requirements	Electrical Corporation % FTE Min Quals	Electrical Corporation % Special Certifications	Contractor % FTE Min Quals	Contractor % Special Certifications	Reference to Electrical Corporation Training/Qualification Programs
Inspector (Forest Tech)	Education in related field or industry experience	ISA Certification	N/A	N/A	100%	88%	N/A
General Foreperson	5 years industry experience	ISA Certification, Utility Specialist	N/A	N/a	100%	0%	N/A

8.3 SITUATIONAL AWARENESS AND FORECASTING

8.3.1 Overview

In this section, the electrical corporation must identify objectives for the next 3- and 10-year periods, targets, and performance metrics related to the following situational awareness and forecasting programmatic areas:

- Environmental monitoring systems
- Grid monitoring systems
- Ignition detection systems
- Weather forecasting
- Ignition likelihood calculation
- Ignition consequence calculation

8.3.1.1 Objectives

Each electrical corporation must summarize the objectives for its 3-year and 10-year plans for implementing and improving its situational awareness and forecasting.

Table 8-22 Situational Awareness Initiative Objectives (3-year plan)

Objectives for Three Years (2023–2025)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Calculate Fire Potential index	SA-06	N/A	Screen shot of FPI in WFA-E third-party software	May 2023	8.3.6
Install Wildfire Detection Cameras	SA-04	N/A	Contract with third party supplier for cameras and maintenance	November 2025	8.3.4.1

Objectives for Three Years (2023–2025)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Partner with the Department of Homeland Security for Wildland Fire Sensors Program	SA-03	N/A	Completed work orders	Ongoing – Beginning March 2023	8.3.4.1
Evaluate DFA (Distribution Fault Anticipation)	SA-02	N/A	QDR, 2025 WMP Update	Ending in 2024	8.3.3.1
Expand weather station network	SA-01	N/A	Completed work orders	December 2025	8.3.2

Table 8-23 Situational Awareness Initiative Objectives (10-year plan)

Objectives for Ten Years (2026–2032)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Continue to leverage AI and machine learning to create a more automated weather and risk forecasting system	SA-05	N/A	WMPs	End of 2032	8.3.5
Continue expansion and refinement of weather station network	SA-01	N/A	WMPs	Ongoing, End of 2032	8.3.2

8.3.1.2 Targets

Initiative targets are forward-looking quantifiable measurements of activities identified by each electrical corporation in its WMP. Electrical corporations will show progress toward completing targets in subsequent reports, including QDRs and WMP Updates.

Situational Awareness Initiative Targets by Year

Initiative Activity	Tracking ID	2023 Target & Unit	x% Risk Impact 2023	2024 Target & Unit	x% Risk Impact 2024	2025 Target & Unit	x% Risk Impact 2025	Method of Verification
Wildfire Cameras	SA-04	2	TBD	6	TBD	N/A	TBD	Completed work orders
Smoke and Air Quality Sensors	SA-03	20	TBD	N/A	TBD	N/A	TBD	Completed work orders
DFA	SA-02	2	TBD	N/A	TBD	N/A	TBD	QDR - Table 1
Weather Stations	SA-01	12	TBD	8	TBD	6	TBD	Completed work orders, GIS Data Submission(s)

8.3.1.3 Performance Metrics Identified by the Electrical Corporation

Performance metrics indicate the extent to which an electrical corporation's Wildfire Mitigation Plan is driving performance outcomes. Each electrical corporation must list the performance metrics the electrical corporation uses to evaluate the effectiveness of its situational awareness and forecasting in reducing wildfire and PSPS risk

Table 8-24 Situational Awareness and Forecasting Performance Metrics Results by Year

Performance Metrics	2020	2021	2022	2023 Projected	2024 Projected	2025 Projected	Method of Verification (e.g., third-party evaluation, QDR)
Weather Station Fleet Annual Operational Status	N/A	N/A	N/A	90%	90%	90%	Internal Data Reporting
Total Available WRF Simulations Completed	N/A	N/A	N/A	95%	95%	95%	Internal Data Reporting
Total FPI Simulations Completed	N/A	N/A	N/A	N/A	95%	95%	Internal Data Reporting
Total Positive Wildfire Camera Ignition Detections	N/A	N/A	N/A	90%	90%	90%	Internal Data Reporting

8.3.2 Environmental Monitoring Systems

The electrical corporation must describe its systems and procedures for monitoring environmental conditions within its service territory. These observations should inform the electrical corporation's near-real-time risk assessment and weather forecast validation.

8.3.2.1 Existing Systems, Technologies, and Procedure

The electrical corporation must report on the environmental monitoring systems and related technologies and procedures currently in use, highlighting any improvements made since the last WMP submission.

Pacific Power owns and operates a network of weather stations that provide 10-minute observations of temperature, humidity, wind speed, wind direction and wind gusts. Weather stations are calibrated annually before wildfire season to ensure accuracy of the data throughout fire season. There are three different types of weather stations used throughout the territory: microstations, remote automated weather station (RAWS), and portable stations. The microstations are stations installed directly on the utility infrastructure, distribution or transmission poles, and are the most common type of weather station used in the weather station network. The RAWS are able to be installed in remote locations on a tri-pod structure. The portable stations are stations readily available for deployment in the event of extreme weather conditions to provide better granularity to the weather data collected. This WMP activity is tracked with Tracking ID# SA-01.

The weather stations are installed in locations dictated by fire risk. The areas are mainly but not limited to the HFTD. Each circuit is analyzed for fire risk and the climatology differences in the region dictates how many weather stations are needed. The stations are placed in areas of the lines that can be sectionalized in the event the information is needed to inform operational decisions.

Table 8-25 Environmental Monitoring Systems

System	Measurement/ Observation	Frequency	Purpose and Integration
RAWS	Temperature, Humidity, Wind Speed & Gust, Wind Direction, Rainfall, and 10-hour Dead Fuel Moisture	Hourly	Improve weather forecasts and real time situational awareness in remote locations.

System	Measurement/ Observation	Frequency	Purpose and Integration
Microstation	Temperature, Humidity, Wind Speed & Gust, Wind Direction, Rainfall	10 minute	Improve weather modeling and forecasts, improve real time weather data, and inform operational decisions.

8.3.2.2 Evaluation and Selection of New Systems

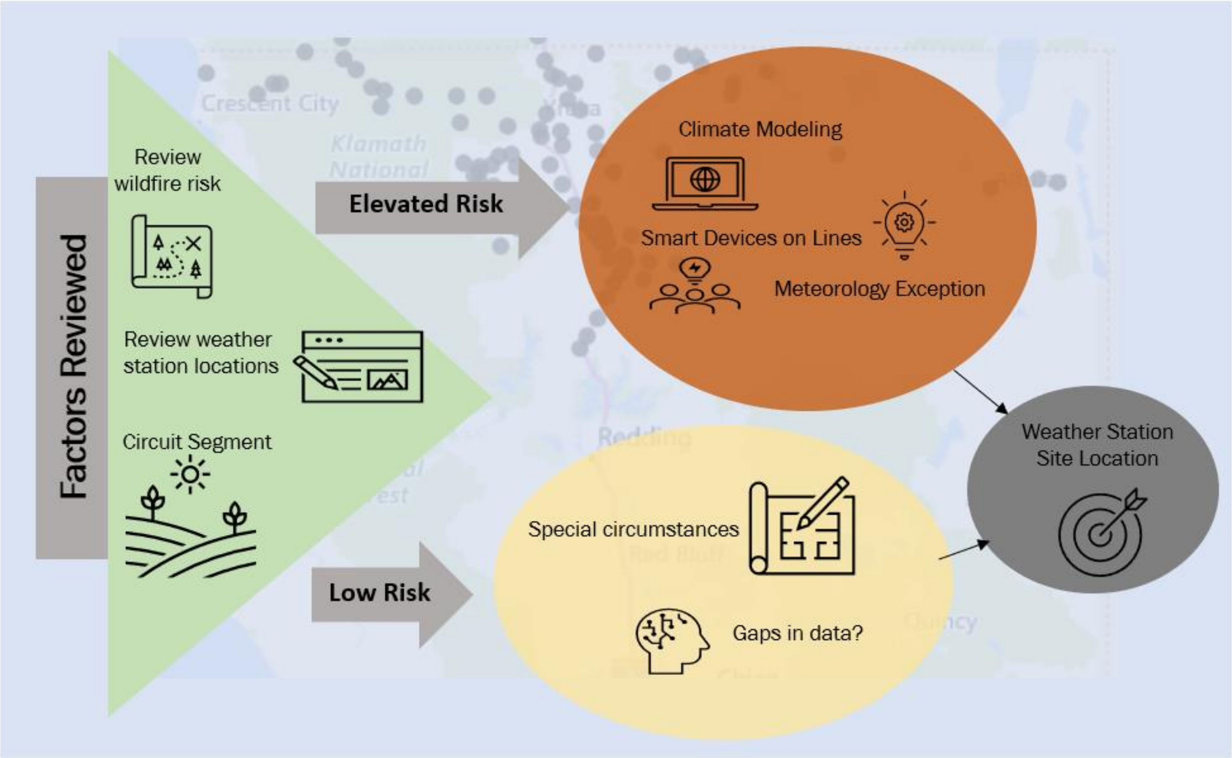
The electrical corporation must describe how it evaluates the need for additional environmental monitoring systems.

Pacific Power currently operates both microstations and RAWS weather stations as described above. While Pacific Power is open to new technologies, at this time, no other environmental monitoring systems are being considered. Generally, when deciding on new technologies, the collected data and limits of the sensors are evaluated along with installation and maintenance criteria. The data collected must also integrate with existing systems and offer something unique that isn't accomplished with the existing weather station equipment.

8.3.2.3 Planned Improvements

The electrical corporation must describe its planned improvements for its environmental monitoring systems.

The weather station network has been built following a methodology to assess risk, climatology data, and the best location for placement. The intent of weather station placement is to provide reliable and accurate data to support better forecasting and to inform real time situational awareness and decision-making during adverse fire weather conditions.



Pacific Power intends to continue building out its weather station network as described below.

Table 8-26 Planned Improvements to Environmental Monitoring Systems

System	Description	Impact	x% Risk Impact	Implementation Schedule
Microstations / Weather Stations	Expansion and continued build out of the microstation fleet	Additional data collection and general coverage	N/A	26 incremental by 2025

8.3.2.4 Evaluating Mitigation Initiatives

The electrical corporation must describe its procedures for the ongoing evaluation of the efficacy of its environmental monitoring program.

When analyzing the weather station data collected during critical fire weather events, it has been shown necessary to have a utility-owned weather station network to support real-time decision making versus relying solely on publicly available data. Pacific Power weather stations are installed directly on our facilities to fill critical gaps in existing observation networks and to ensure that the data reported is representative of the weather impacting our facilities. This is in contrast to other publicly available weather stations that may report conditions that are not representative of our facilities due to their distance from our facilities or other factors. Additionally, Pacific Power weather stations report every 10 minutes (and up to every 30 seconds during emergency operations) whereas other public weather stations may only report once per hour. Lastly, Pacific Power has complete control and knowledge of the network calibration and maintenance to ensure that the weather data used to support operational decision making is of the highest quality.

While not specifically located in California, the example in Figure 8-14 Weather Station Report below from a September 10, 2022, PSPS event in Oregon highlights how Pacific Power's weather stations fill critical gaps and capture localized stronger wind conditions that would otherwise go undetected using the existing non-utility weather station networks. This same concept would apply to the company's California service territory.

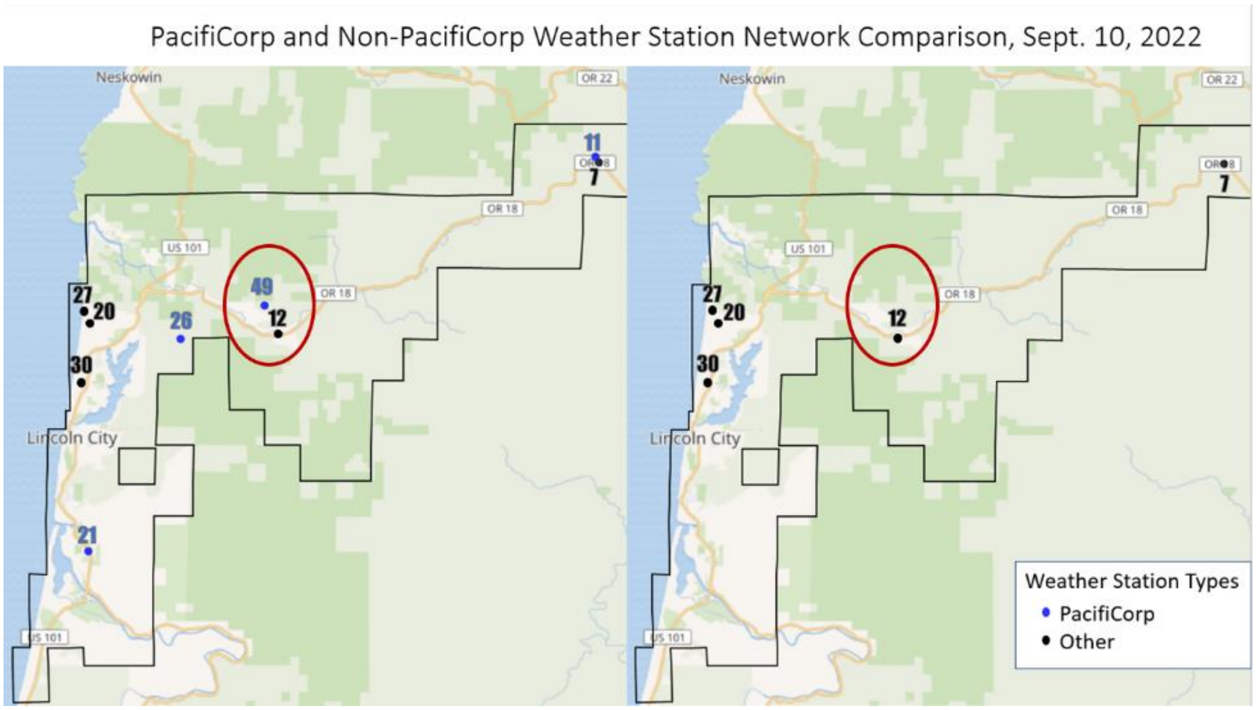


Figure 8-14 Weather Station Report

8.3.3 Grid Monitoring Systems

The electrical corporation must describe its systems and procedures used to monitor the operational conditions of its equipment. These observations should inform the electrical corporation's near-real-time risk assessment.

8.3.3.1 Existing Systems, Technologies, and Procedures

The electrical corporation must report on the grid system monitoring systems and related technologies and procedures currently in use, highlighting any improvements made since the last WMP submission.

Pacific Power is piloting the use of distribution fault anticipation (DFA) technology with Texas A&M University. This technology provides situational awareness of potential outages by measuring high and low current fault conditions on distribution circuits. Alerts from the DFA devices are communicated through cellular networks preemptively. This WMP activity is tracked with Tracking ID# SA-02.

The DFA devices are continuously monitoring to detect, classify and alert when high or low current fault conditions are measured. The alerts preemptively identify equipment along distribution circuits that could cause an outage.

There were four identified high-risk circuits for the DFA devices to be installed on. Two devices were installed at Weed Substation. The other circuits are feeding into a newly built substation, and due to ongoing construction, the 2 devices are expected to be operational in 2023.

The distribution fault anticipation devices serve as continuous monitoring tool that are expected to record incipient faults which could indicate a potential fault location. The DFA devices work with relays, breakers, and circuit fault interrupters to give a clearer picture of a fault event on a particular circuit with those devices.

Table 8-27 Grid Operation Monitoring Systems

System	Measurement/ Observation	Frequency	Purpose and Integration
Continuous Monitoring	Current (Amps) Voltage (Volts) Waveform analysis Event Categorizations	Continuous observations with events reported as observed.	Distribution fault anticipator (DFA) Insipient fault detection used as a precursor to a larger fault.

8.3.3.2 Evaluation and Selection of New Systems

The electrical corporation must describe how it evaluates the need for additional grid operation monitoring systems. This description must include:

- How the electrical corporation evaluates the impact of new systems on reducing risk (e.g., expected reduction in ignitions from failures, expected reduction in failures)
- How the electrical corporation evaluates the efficacy of new technologies

These descriptions should include flow charts as appropriate.

The DFA devices will collect data for 12 months to be able to capture all seasons and any events detected. The devices are installed with SCADA equipment that provides data to Pacific Power's EMS system. The data from DFA events can be compared against other devices providing real time information which also triggers outage notifications. The comparison can be used to identify the unique data that the DFA devices are expected to provide.

8.3.3.3 Planned Improvements

The electrical corporation must describe its planned improvements in its grid operation monitoring systems. This must include any plans for the following:

- Expansion of existing systems
- Establishment of new systems

Currently, Pacific Power intends to install a cumulative of 4 DFA devices in California as a part of its WMP. This pilot intends to establish a base set of devices for reporting data. Events generated by the DFA will be analyzed as event reports are generated. If the DFA technology proves to be successful, then Pacific Power will look to expand DFA devices in substations where there's a strong communication network connection. As DFA requires a strong communication network, expansion of DFA could be limited in Pacific Power's service territory in the short term.

Table 8-28 Planning Improvements to Grid Operation Monitoring Systems

System	Description	Impact	x% Risk Impact	Implementation Schedule
Line sensors on distribution lines	Installation of DFA sensors on certain circuit segments in distribution lines in HFTD	Early fault detection to prevent ignition from a line which had failure resulting from contact or equipment failure	TBD	Pilot program - ending in 2024 Analysis of pilot, 2024

8.3.3.4 Evaluating Mitigation Initiatives

The electrical corporation must describe its procedures for the ongoing evaluation of the efficacy of its grid operation monitoring program.

The DFA devices are designed to report incipient faults along with larger magnitude faults. The faults are then categorized and given a percentage with the suggestion to the cause of the fault. The event reports generated by the DFA can be compared against outage notifications received by relays, communicating circuit fault interrupters, reclosers, and other line equipment that might detect a similar issue. While still in the pilot phase, a successful DFA program could limit technicians time when investigating a fault or alert to problematic equipment through the incipient faults.

8.3.3.5 Enterprise System for Grid Monitoring

In this section, the electrical corporation must provide an overview of its enterprise system for grid monitoring.

Currently Pacific Power does not have an Enterprise System for Grid Monitoring.

8.3.4 Ignition Detection Systems

The electrical corporation must describe its systems, technologies, and procedures used to detect ignitions within its service territory and gauge their size and growth rates.

8.3.4.1 Existing Ignition Detection Sensors and Systems

The electrical corporation must report on the sensors and systems, technologies, and procedures for ignition detection that are currently in use, highlighting any improvements made since the last WMP submission.

Pacific Power's existing and planned ignition detection sensors and systems are summarized in the table below and further described in the following subsections.

Table 8-29 Fire Detection Systems Currently Deployed

Detection System	Capabilities	Companion Technologies	Contribution to Fire Detection and Confirmation
Smoke and Air Quality Sensors	Highly advanced, ground-based sensors that can detect and pinpoint the location of smoke	Satellite Imagery Weather Station Data Wildfire Detection Cameras	Smoke and air quality sensors can help to speed up response times and protect lives and property
High Definition Cameras (planned for 2023-2024)	AI software 24/7 to support early detection of ignitions	Satellite Imagery Weather Station Data Fire Modeling Software	Supports wildfire-reactive responses to ignition
Fire Modeling Software	1-96 hour forecast of the wildfire potential and consequence if there is a wildfire	Weather Research and Forecasting (WRF)	Provides identification of areas that may require additional monitoring due to conditions

Smoke and Air Quality Sensors

Pacific Power installed 20 intelligent smoke and particulate sensors in the highest fire risk areas of its Northern California service territory. This effort will support continued evaluation of the durability and accuracy of the sensors to support the Department of Homeland Security's Smart Cities Internet of Things (SCITI) Lab's wildland fire sensor program. This WMP activity is tracked with Tracking ID# SA-03.

High-Definition Cameras

With implementation of advanced wildfire detection technologies and fire modeling software solutions, Pacific Power recognizes that it can respond quickly to support wildfire-reactive responses to ignition.

Pacific Power has some experience with high-definition cameras in the company's Utah service territory. Additionally, Pacific Power partnered with forest agencies in Oregon to mount cameras on utility infrastructure. In 2023, Pacific Power plans to begin installing up to 8 high-definition (HD) camera systems in Pacific Power's Northern California service territory.

The camera systems will include 2 HD, pan-tilt-zoom (PTZ) cameras, one of which will operate in "sentry" mode and continuously rotate 360 degrees. Pacific Power intends to place the camera systems in areas that offer a 360 viewshed, except where it is impossible due to viewshed limitations. It is also expected that all cameras will run artificial intelligence (AI) software 24/7 to support early detection of ignitions. All camera systems and the AI software are capable of near-infrared and nighttime detection. At this point in time, the advanced detection camera platform does not integrate fire modeling software; however, camera feeds can be used to substantiate models produced by fire modeling software solutions. This WMP activity is tracked with Tracking ID# SA-04.

Because coverage of the existing camera network in California is so extensive, Pacific Power has chosen to fill in the "gaps" in the existing camera network within its service territory. To that end, Pacific Power anticipates that it will place camera stations in or around the locations shown below:

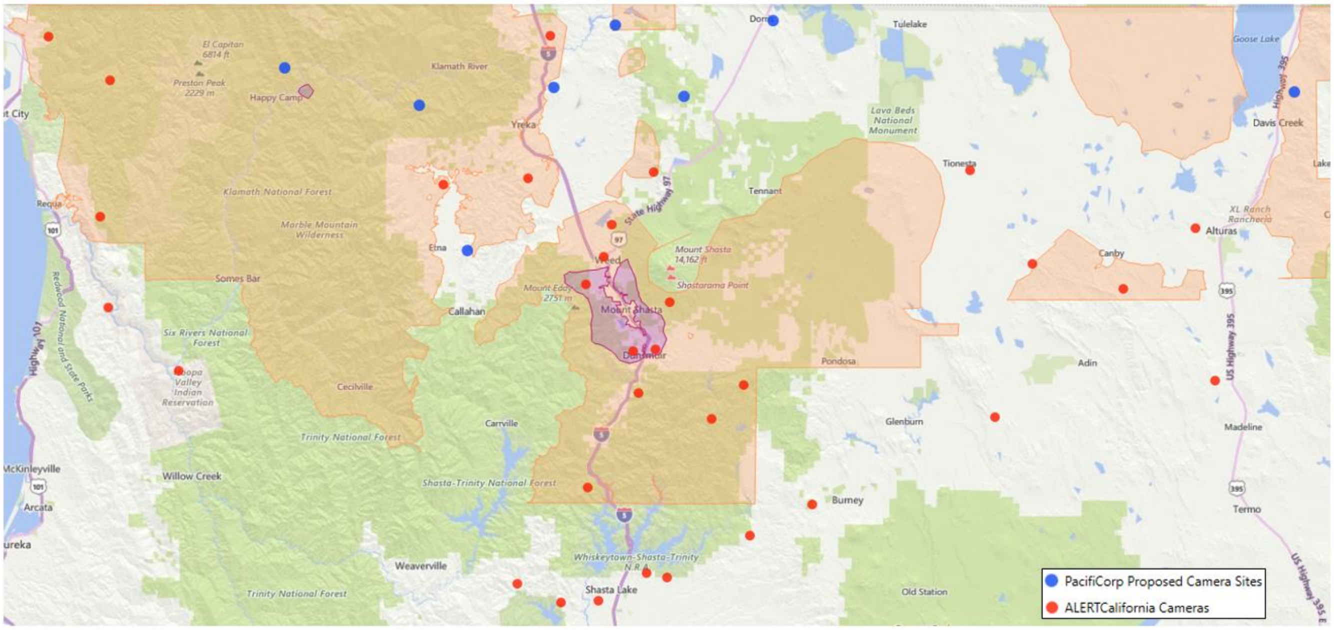


Figure 8-15 Camera Proposed Installation Locations

Camera feeds are transferred to the cloud via a secure, redundant network architecture intended to ensure maximum network availability for camera data transfer. Camera data is also constantly fed to the AI model for training purposes. For instance, when the AI model detects smoke, it is sent to a human monitor for validation. If the human monitor determines that the detection is a false positive, then the image is sent to the AI model for training. If the monitor determines that the detection is a true positive, the image is sent to a web dashboard and an alert is issued via email and SMS. A high-level diagram of the flow of data into the AI model is shown below:

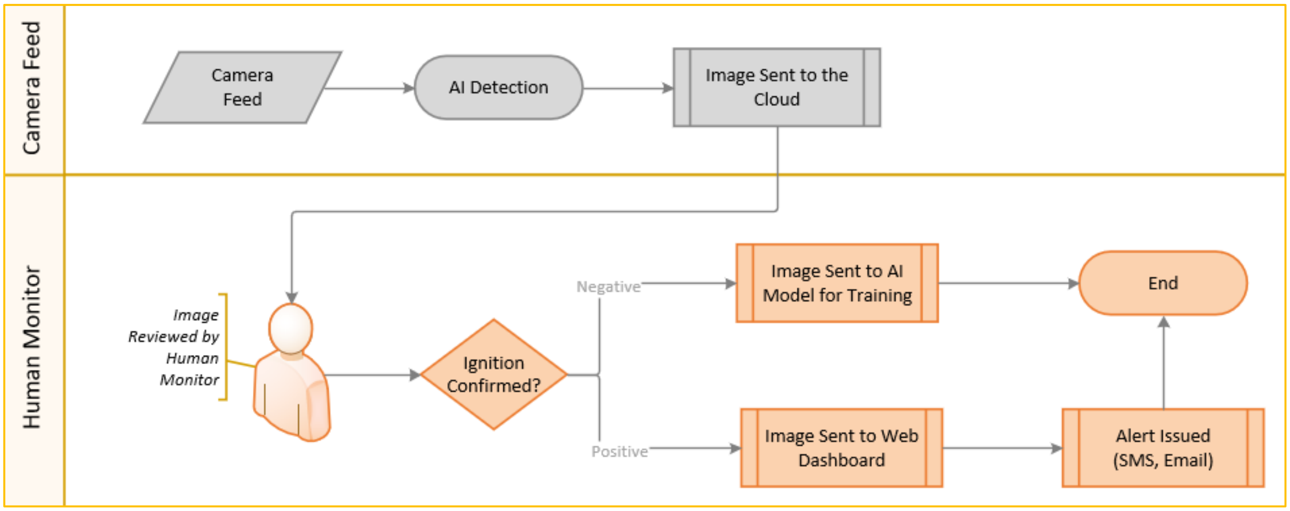


Figure 8-16 Camera Data Flow Diagram

Fire Growth Potential Software

To support seasonal wildfire modeling, in 2022, Pacific Power procured and implemented a suite of wildfire risk modeling tools from Technosylva more commonly referred to as WFA-E (Wildfire Analyst Enterprise). In addition to the WRRM tool described in 6.1.2 the WFA-E (Wildfire Analyst Enterprise) also includes FireCast and FireSim, two seasonal fire models, and is the application currently used by Pacific Power's Meteorology Department to forecast the risk of wildfire and the potential behavior of a wildfire should it occur. Technosylva, the company that developed and provided implementation and ongoing operational support for WFA-E, sources most of the data inputs for the Seasonal Wildfire Model.

FireCast performs millions of wildfire simulations daily across the company's six-state service territory to assess the fire risk in any given area. This output is also joined with a subset of distribution and transmission asset data to provide asset-specific wildfire risk and consequence forecasts. FireCast provides a 96-hour look ahead to discern if there is a risk of wildfire within that period, where the risk is and where the greatest consequence is if there is a wildfire. FireCast also allows for comparison of forecast conditions to historical conditions in the operational area.

FireSim, also part of the WFA-E solution, is a simulation that can be run to forecast the potential fire behavior and spread from as little as one hour to up to a 96-hour period to assess the potential impact on populations, buildings, utility assets and other resources in the field. FireSim's model assumes no suppression efforts to slow the fire's spread and considers the following elements.

- **Initial Attack Assessment**. Assessment of how difficult initial attack will be for first responders and the probability of stopping the fire within the first operating period.
- **Population at Risk.** Number of people in the path of the fire and the timing of when the fire is likely to arrive at populations.
- **Assets at Risk.** Physical assets such as utility equipment, residential and commercial structures, barns, outbuildings etc. and the timing of when the fire is likely to arrive at assets.
- **Places at Risk.** These are locations identified on the maps that may not be physical assets but have other significance. These could include parks, reservoirs, cultural sites, campgrounds, etc. These locations are default locations from Google Earth Studio.
- **Weather and fuels conditions.** Wind speed, direction, fuel moisture content.

Figure 8-17 is an example of an output from FireSim output of Mount Shasta, dated September 10, 2022.

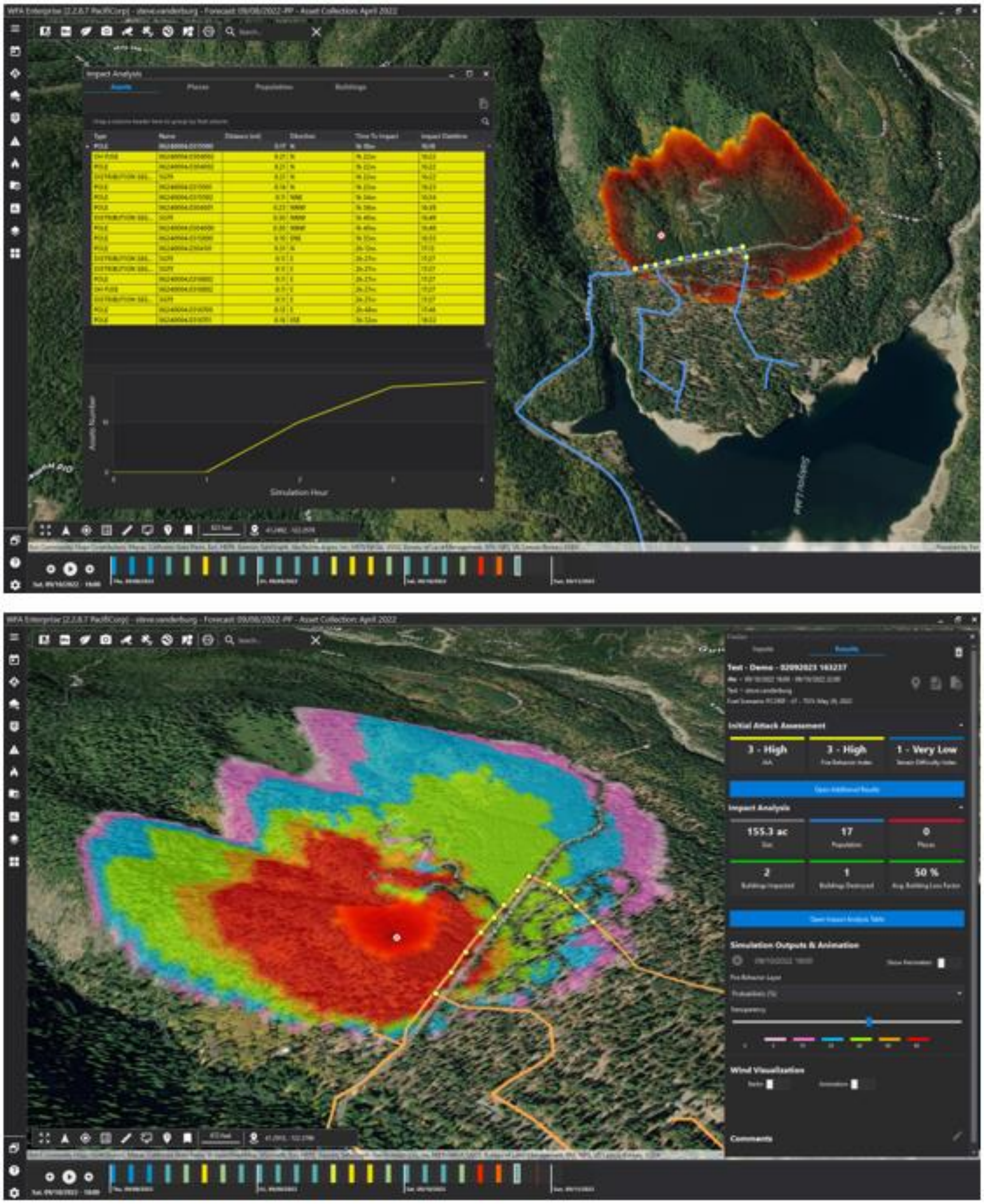


Figure 8-17 Example of a FireSim Output, Mt. Shasta

FireCast can be used to provide a 96-hour forecast at intervals of fire risk at a macro level (service territory and operating area) or a micro level (lines, circuits) to provide the following:

- The potential for a fire given fuel, weather, and other conditions
- Fire characteristics or, rather, a simulation of how a fire would behave if there was an ignition. This would include, for instance, forecasted rate of spread,

size, and flame length

- Population threatened
- Impact to assets (e.g., identification of buildings that would be threatened if a fire were to start).

These outputs are assigned a score as a raw value and then ranked in percentiles for risk. The percentiles can be compared to the scores of the historical fire weather days. is an example of FireCast output of Mount Shasta, also dated September 10, 2022.

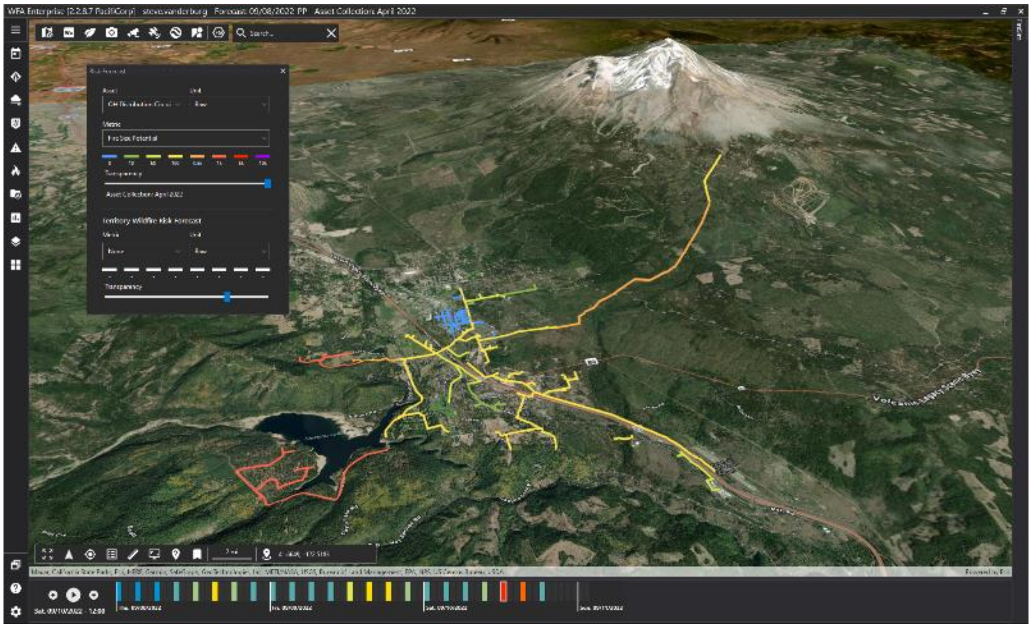
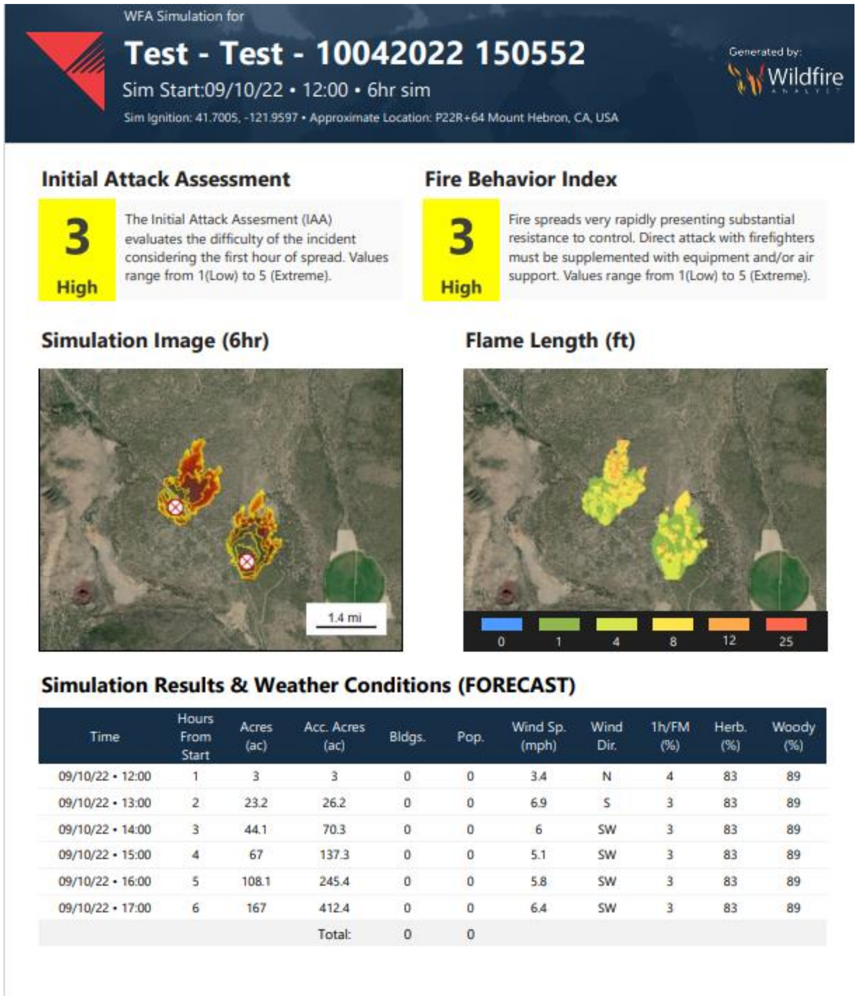


Figure 8-18 Example of FireCast Output, Mt. Shasta

FireSim models the following elements across time to provide risk scores and forecast of the fire growth and timing of arrival at buildings or populations, the results are presented in a Wildfire Spread Prediction Report. Figure 8-19 below shows a summary page example.



WFA Simulation for

Test - Test - 10042022 150552

Sim Start:09/10/22 • 12:00 • 6hr sim

Sim Ignition: 41.7005, -121.9597 • Approximate Location: P22R+64 Mount Hebron, CA, USA

Generated by: Wildfire Analyst

Initial Attack Assessment

3 High

The Initial Attack Assesment (IAA) evaluates the difficulty of the incident considering the first hour of spread. Values range from 1(Low) to 5 (Extreme).

Fire Behavior Index

3 High

Fire spreads very rapidly presenting substantial resistance to control. Direct attack with firefighters must be supplemented with equipment and/or air support. Values range from 1(Low) to 5 (Extreme).

Simulation Image (6hr)

Flame Length (ft)

Simulation Results & Weather Conditions (FORECAST)

Time	Hours From Start	Acres (ac)	Acc. Acres (ac)	Bldgs.	Pop.	Wind Sp. (mph)	Wind Dir.	1h/FM (%)	Herb. (%)	Woody (%)
09/10/22 • 12:00	1	3	3	0	0	3.4	N	4	83	89
09/10/22 • 13:00	2	23.2	26.2	0	0	6.9	S	3	83	89
09/10/22 • 14:00	3	44.1	70.3	0	0	6	SW	3	83	89
09/10/22 • 15:00	4	67	137.3	0	0	5.1	SW	3	83	89
09/10/22 • 16:00	5	108.1	245.4	0	0	5.8	SW	3	83	89
09/10/22 • 17:00	6	167	412.4	0	0	6.4	SW	3	83	89
			Total:	0	0					

Figure 8-19: Example of FireSim Summary Report

Minutes can mean everything in terms of whether a fire becomes catastrophic. The placement of wildfire cameras and smoke sensors to enhance situational awareness, as well as implementation of fire modeling software solutions, particularly those that have AI/machine learning capabilities, have the potential to:

- Speed up fire detection time, resulting in a reduction of destruction (environment, property)
- Provide Pacific Power Emergency Management and first responders with another set of tools to monitor fire progression and coordinate response efforts that may include field response, evacuations, Public Safety Power Shutoffs, and property protection.

8.3.4.2 Evaluation and Selection of New Detection Systems

The electrical corporation must describe how it evaluates the need for additional ignition detection technologies.

As described in Section 8.3.4.1, Pacific Power initiated installed of up to 8 HD cameras to fill in the "gaps" of the existing, extensive camera network within its service territory. Once a "gap" in the existing camera network has been identified, Pacific Power evaluates whether the area may benefit from placement of camera(s). Areas deemed suitable include, for example, rural areas that may be susceptible to fire. If an area is deemed suitable for placement of a camera, then specific location(s) for camera placement are identified (e.g., on fire lookout towers, existing communication structures, etc.) and a full viewshed analysis is completed to determine whether the location provides adequate coverage of the area. Next, a site survey is completed, and an installation estimate is developed by the camera supplier. The general process is shown in the Figure 8-20 below:

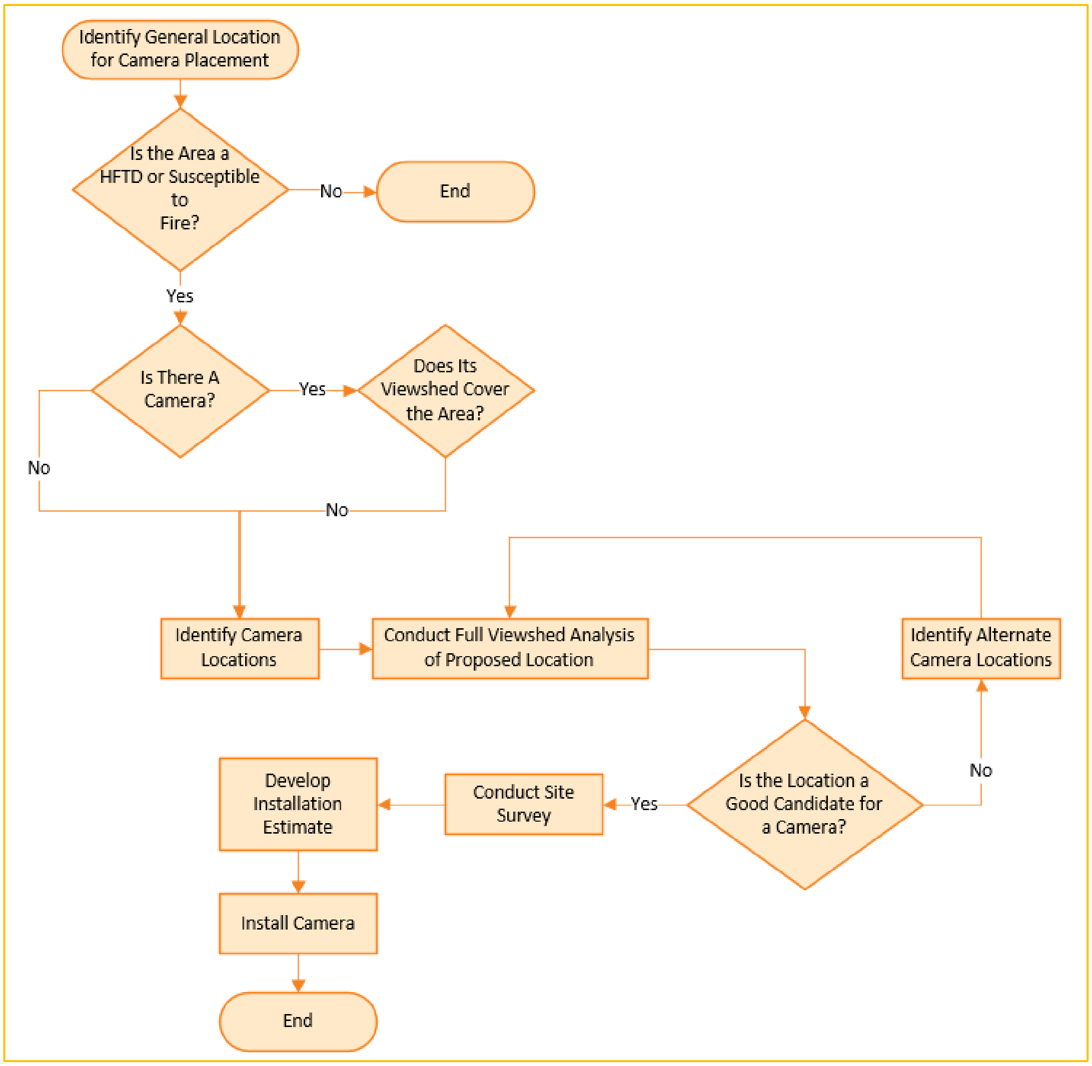


Figure 8-20 Camera Placement Methodology

Once installed, Pacific Power anticipates that data to evaluate success of camera placement may be collected and analyzed as described below.

- **Number of positive detections that occurred pre-911 call and the time difference between the two.** Data to make the comparison will be collected from two sources, the Integrated Reporting of Wildland-Fire Information (IRWIN) system and from the AI software supplier's platform. First, data will be pulled from the two systems. Next, the time of first report provided by IRWIN will be subtracted from the AI detection time in a spreadsheet.

- **Number of false positive and false negative alerts.** Real-time monitoring is performed through the dashboard and Admin system, and wildfire detection results are continuously generated. Among the detection results, there are true positives and false positives. Upon analyzing the detection data before the time when a true positive occurred, a false negative (missing detection) may be discovered. It is expected that these data will be provided to Pacific Power ahead of its bi-weekly project review meetings and as requested.

- **User feedback on the functionality of the software.** This data may be collected via feedback obtained in project meetings, interviews with administrative users (e.g., Pacific Power Emergency Management), and solicited from first responders electronically. Pacific Power anticipates that this feedback will be obtained on an ongoing basis.

Because the primary beneficiaries of the cameras are first responders, Pacific Power may use these data to assess the value of the camera systems. For instance, if the AI detection data does not show the level of accuracy reported by the AI software supplier prior to implementation of the software, Pacific Power may determine that it is not worth continued investment in the AI software.

Data to evaluate success of the California smoke and air quality sensor program will be collected and analyzed monthly in the manner specified in the Department of Homeland Security's Wildland Fire Sensor program.

8.3.4.3 Planned Integration of New Ignition Detection Technologies

The electrical corporation must provide an implementation schedule for new ignition detection and alarm system technologies.

Planning Improvements to Fire Detection and Alarm Systems

System	Description	Impact	x% Risk Impact	Implementation Schedule
Wildfire Detection Cameras with AI Software	Installation of high-definition cameras with AI capabilities in HFTDs	Reduction in time from ignition to detection	TBD	Installation of cameras beginning in 2023 and extending into 2024

8.3.4.4 Evaluating Mitigation Initiatives

The electrical corporation must describe its procedures for the ongoing evaluation of the efficacy of its fire detection systems.

As described in Section 8.3.4.2, Pacific Power anticipates that data to evaluate success of camera placement may be collected and analyzed as described below.

- **Number of positive detections that occurred pre-911 call and the time difference between the two.** Data to make the comparison will be collected from two sources, the Integrated Reporting of Wildland-Fire Information (IRWIN) system and from the AI software supplier's platform. First, data will be pulled from the two systems. Next, the time of first report provided by IRWIN will be subtracted from the AI detection time in a spreadsheet.

- **Number of false positive and false negative alerts.** Real-time monitoring is performed through the dashboard and Admin system, and wildfire detection results are continuously generated. Among the detection results, there are true positives and false positives. Upon analyzing the detection data before the time when a true positive occurred, a false negative (missing detection) may be discovered. It is expected that these data will be provided to Pacific Power ahead of its bi-weekly project review meetings and as requested.

- **User feedback on the functionality of the software**. This data may be collected via feedback obtained in project meetings, interviews with administrative users (e.g., Pacific Power Emergency Management), and solicited from first responders electronically. Pacific Power anticipates that this feedback will be obtained on an ongoing basis.

8.3.4.5 Enterprise System for Ignition Detection

In this section, the electrical corporation must provide an overview of its enterprise system for ignition detection.

Camera systems do not integrate with any of Pacific Power's enterprise IT systems (e.g., GIS) and are therefore not subject to internal (Pacific Power) QA/QC auditing or system updates. Further, it is important to emphasize that the primary beneficiaries of the cameras are emergency responders. Camera systems may be used to substantiate the simulations produced by fire modeling solutions, like FireSim, but they do not play the same critical role in operational decision-making.

8.3.5 Weather Forecasting

The electrical corporation must describe its systems and procedures used to forecast weather within its service territory. These forecasts should inform the electrical corporation's near-real-time-risk assessment and PSPS decision-making processes.

Weather forecasts play a critical role in mitigating the risk of electric utility-caused wildfires. By accurately predicting weather conditions and its impact on the grid, electric utilities can proactively take steps to reduce the risk of fire ignition and spread, ensuring public safety. The ability to gather, interpret, and translate data into an assessment of utility specific risk and inform decision making is key component of Pacific Power's situational awareness capability. To support this effort, Pacific Power has developed an experienced meteorology department within the company's broader emergency management department. This team consists of four full-time meteorologists, one data scientist, and one manager. The team's experience includes decades of fire weather forecasting for various government agencies such as the National Weather Service (NWS) and Geographic Area Coordination Center (GACC). Figure 8-21 shows the Meteorology Team. This WMP activity is tracked with Tracking ID# SA-05.

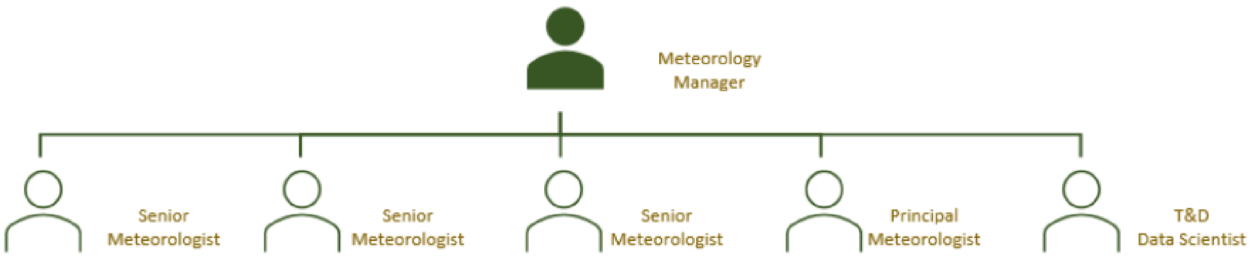


Figure 8-21 Pacific Power's Meteorology Team

The objectives of this department are to supplement the company's longer term risk analysis capabilities (also referred to in this document as baseline risk modeling and described in Section 6.1.1 with a real time risk assessment and forecasting tool, identify and close any forecasting data gaps, manage day to day threats and risks, and provide information to operations to inform recommend changes to operational protocols during periods of elevated risk as depicted in **Error! Reference source not found.** below.

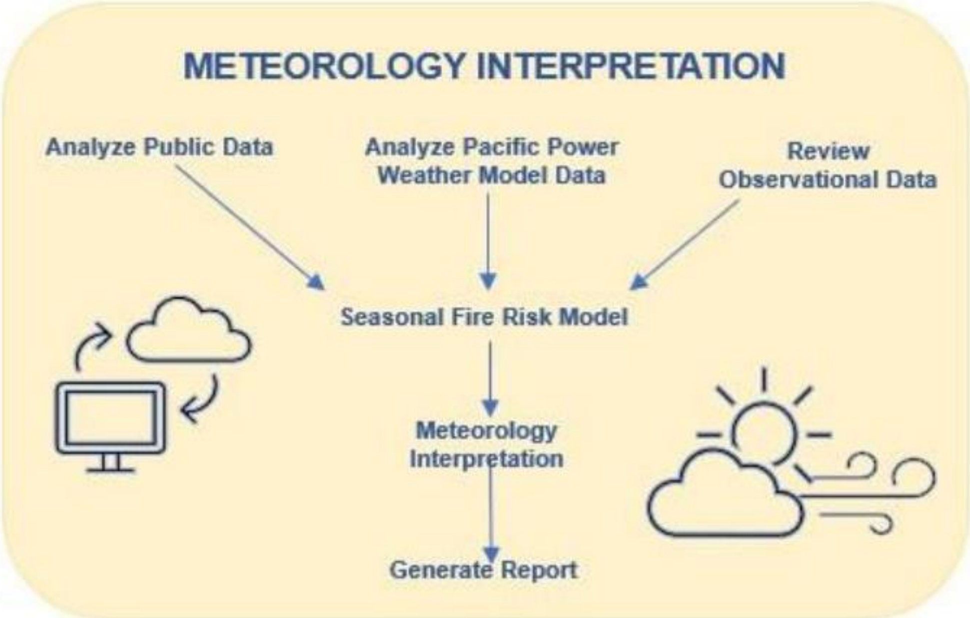


Figure 8-22 Meteorology Daily Process

8.3.5.1 Existing Modeling Approach

Pacific Power's existing weather and seasonal wildfire modeling approach is focused on the development of a data-driven, impacts-based forecasting system which consists of an operational Weather Research and Forecasting (WRF) model, a complimentary 30-year WRF reanalysis, and the use of Wildfire Risk Analyst Enterprise (WFA-E). More specifically,

- Pacific Power's WRF model provides twice-daily operational weather forecasts across its entire service territory. The company's WRF model output includes National Fire Danger Rating System (NFDRS) variables relevant to forecasting fuels conditions and wildfire danger.
- Pacific Power is building a 30-year WRF reanalysis to create a high-resolution climatology of fire weather and fuels conditions across its service territory. Work began in late 2021. Full completion expected in Q2 of 2023.
- Pacific Power will build and train machine learning models using the WRF reanalysis and other relevant training data such as past power outage records, wildfire statistics, and historical weather observations. These models will use the output from Pacific Power's operational WRF to predict weather-related outages, wildfire risk, and other relevant impacts.
- Pacific Power uses Technosylva's Wildfire Analyst Enterprise to produce a daily forecast of wildfire potential, risks, and consequences for distribution and transmission assets across California.

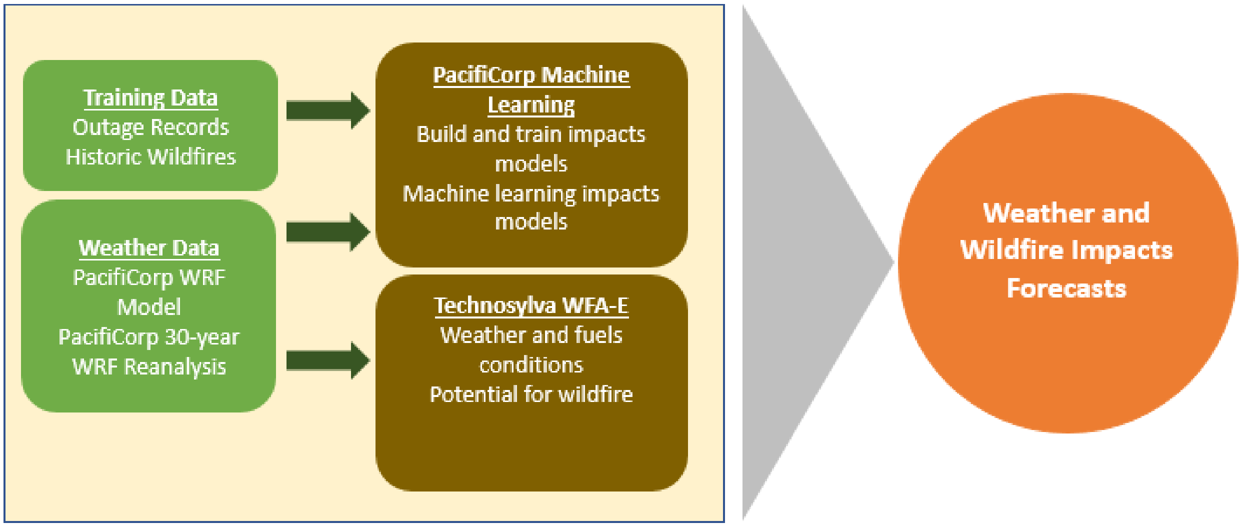
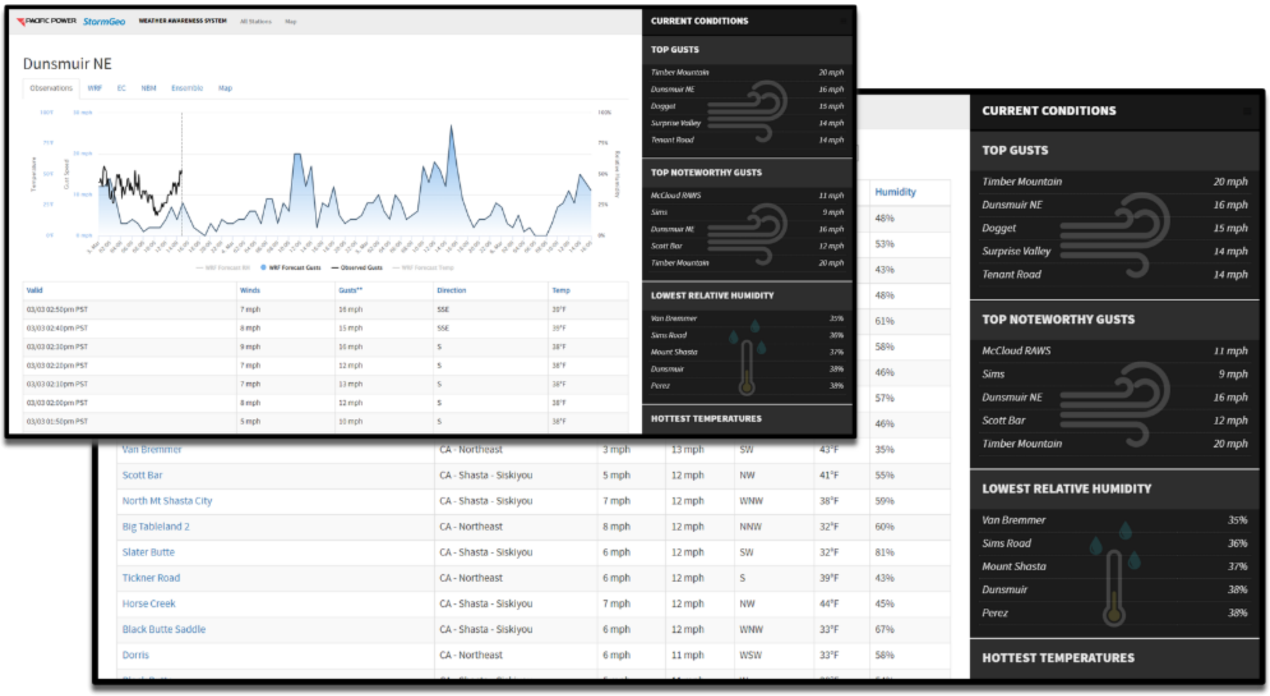


Figure 8-23 Existing Weather and Seasonal Wildfire Modeling Approach

Operational WRF Model: Pacific Power's Meteorology department currently runs a twice daily, GFS-initialized, 2km-resolution, hourly Weather Research and Forecasting (WRF) model, which produces a comprehensive 96-hour forecast of atmospheric, fire weather, and National Fire Danger Rating System (NFDRS) variables. The model's high resolution gives a much more complete picture of finer scale atmospheric features than is available with most public four-day ahead timescale models. The WRF output is made available internally through the company's GREATER application, WFA-E, and a web-based visualization portal. Additionally, WRF forecasts are publicly available through the company's situational awareness websites including:

- https://pacificorpweather.com
- https://pacificpowerweather.com/, and
- https://rockymountainpowerweather.com/.

An example of this publicly available information is depicted below.



Pacific Power WRF Configuration

- Inner Domain = 1.3 million square miles
- Spatial Horizontal Resolution = 2km
- Spatial Vertical Resolution = 52 vertical levels
- Temporal Resolution = 1 hour
- Forecast horizon = 96-hour
- Atmospheric inputs for WRF initialization = GFS
- New Thompson microphysics scheme
- MYNN surface layer scheme
- MYNN3 PBL scheme
- New Goddard shortwave radiation scheme
- New Goddard longwave radiation scheme
- NoahMP land surface scheme
- Land use data = MODIS 30s
- Terrain height = GMTED 2010 30s
- Sea surface temperature = NASA SpoRT and RTG blended temperatures at 1km horizontal resolution.

- Albedo, green vegetation fraction and Leaf Area Index = MODIS climatological inputs
- WRF soil moisture is cycled in between forecasts
- WRF snow cover is cycled in between forecasts

Pacific Power's WRF domain is depicted in the image below. In Figure 8-24, the dark gray shaded region represents the 6km outer domain. The orange box represents the outer edge of the inner 2km domain.

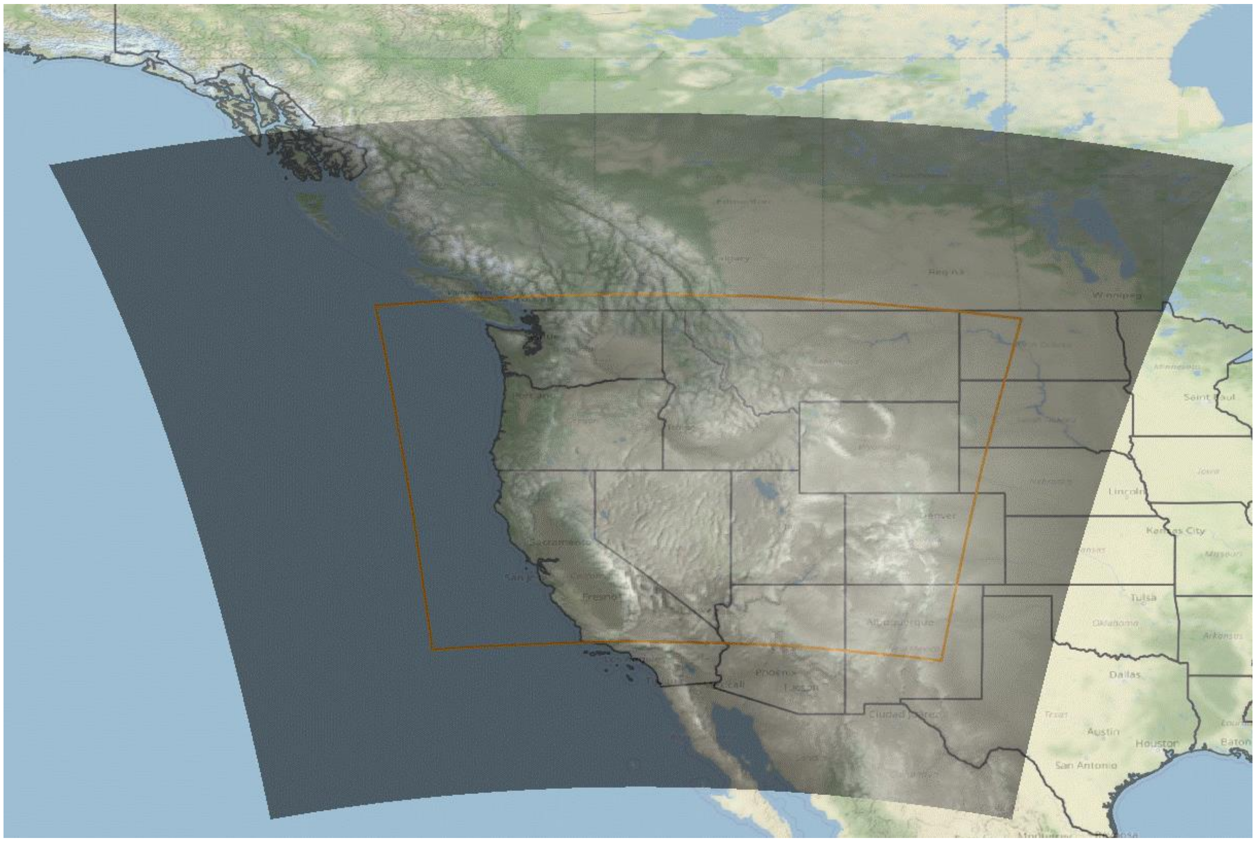


Figure 8-24 Pacific Power WRF Domain

30-Year WRF Reanalysis: Pacific Power is actively developing a 30-year, 2km-resolution, hourly WRF reanalysis (to be completed by Q2 2023). The completed WRF reanalysis will function as both a detailed climatological record of weather and fire weather across Pacific Power's service territory and also as a training dataset for statistical and machine learning models. These models will use the output from Pacific Power's operational WRF to predict weather-related outages, wildfire risk, and other relevant impacts. Although not yet complete, Pacific Power has already begun training models off a portion of the completed reanalysis dataset along with archived power outage records and historical wildfire data to improve the company's weather-related outage and wildfire risk thresholds.

The 30-year WRF reanalysis is initialized with CFSR instead of GFS, otherwise the configuration is identical to that of Pacific Power's operational WRF. The WRF reanalysis contains the same weather, fire weather, and NFDRS outputs as the operational WRF.

WFA-E: To support seasonal wildfire modeling, in 2022, Pacific Power procured and implemented a suite of wildfire risk modeling tools from Technosylva more commonly referred to as WFA-E (Wildfire Analyst Enterprise). In addition to the WRRM tool describes in Section 6.0 the WFA-E (Wildfire Analyst Enterprise) also includes FireCast and FireSim, two seasonal fire models, and is the model currently used by Pacific Power's Meteorology Department to forecast the risk of wildfire and the potential behavior of a wildfire should it occur. Technosylva, the company that developed and provided implementation and ongoing operational support for WFA-E, sources most of the data inputs for the Seasonal Wildfire Model which are generally described in Appendix A – Dynamic Modeling Data Inputs.

FireCast performs millions of wildfire simulations daily across the company's six-state service territory to assess the fire risk in any given area. This output is also joined with a subset of distribution and transmission asset data to provide asset-specific wildfire risk and consequence forecasts. FireCast provides a 96 hour look ahead to discern if there is a risk of wildfire within that period, where the risk is and where the greatest consequence is if there is a wildfire. FireCast also allows for comparison of forecast conditions to historical conditions in the operational area.

FireSim, part of the WFA-E solution, is a simulation that can be run to forecast the potential fire behavior and spread from as little as one hour to up to a 96-hour period to assess the potential impact on populations, buildings, utility assets and other resources in the field. FireSim's model assumes no suppression efforts to slow the fire's spread and considers the following elements.

- **Initial Attack Assessment:** Assessment of how difficult initial attack will be for first responders and the probability of stopping the fire within the first operating period.
- **Population at Risk**: Number of people in the path of the fire and the timing of when the fire is likely to arrive at populations.
- **Assets at Risk:** Physical assets such as utility equipment, residential and commercial structures, barns, outbuildings etc. and the timing of when the fire is likely to arrive at assets.
- **Places at Risk:** These are locations identified on the maps that may not be physical assets but have other significance. These could include parks, reservoirs, cultural sites, campgrounds, etc. These locations are default locations from Google Earth Studio.
- **Weather and fuels conditions:** Wind speed, direction, fuel moisture content.

To support the weather forecasting performed by FireCast and FireSim in WFA-E, Table

8-30 shows the inputs identified by Technosylva.

Table 8-30 FireCast and FireSim Weather Inputs

Feature Group	Description	Spatial Granularity (meters)	Temporal Granularity	Data Vintage	Source
Landscape	TERRAIN	10	YEARLY		US Geological Survey
Landscape	SURFACE FUELS	30/10	PRE FIRE SEASION, MONTHLY UPDATE IN FIRE SEASON, END OF FIRE SEASON	2020	TECHNOSYLVA
Landscape	WUI AND NON FOREST FUELS LAND USE	30/10	TWICE A YEAR	2020	TECHNOSYLVA
Landscape	CANOPY FUELS (CBD,CH,CC,CBH)	30/10	PRE FIRE SEASON, MONTHLY UPDATE IN FIRE SEASON, END OF FIRE SEASON	2020	TECHNOSYLVA
Landscape	ROADS NETWORK	30	YEARLY		US Geological Survey
Landscape	HYDROGRAPHY	30	YEARLY		US Geological Survey
Landscape	CROPLANDS	30	YEARLY	1997	US Department of Agriculture
Weather and Atmosphere	WIND SPEED	2000	HOURLY / 96 HOUR FORECAST		ADS
Weather and Atmosphere	WIND DIRECTION	2000	HOURLY / 96 HOUR FORECAST		ADS
Weather and Atmosphere	WIND GUST	2000	HOURLY / 96 HOUR FORECAST		ADS
Weather and Atmosphere	AIR TEMPERATURE	2000	HOURLY / 96 HOUR FORECAST		ADS
Weather and Atmosphere	SURFACE PRESSURE	2000	HOURLY / 96 HOUR FORECAST		ADS
Weather and Atmosphere	RELATIVE HUMIDITY	2000	HOURLY / 96 HOUR FORECAST		TECHNOSYLVA
Weather and Atmosphere	PRECIPITATION	2000	HOURLY / 96 HOUR FORECAST		ADS
Weather and Atmosphere	RADIATION	2000	HOURLY / 96 HOUR FORECAST		ADS
Weather and Atmosphere	WATER VAPOR MIXING RATIO 2m	2000	HOURLY / 96 HOUR FORECAST		ADS
Weather and Atmosphere	SNOW ACCUMULATED - OBS	1000	DAILY		NOAA

Feature Group	Description	Spatial Granularity (meters)	Temporal Granularity	Data Vintage	Source
Weather and Atmosphere	PRECIPITATION ACCUMULATED - OBS	4000	DAILY		NOAA
Weather and Atmosphere	BURN SCARS	10	5 DAYS	2000	NASA/ESA
Weather and Atmosphere	WEATHER OBSERVATIONS DATA	Points	10 MIN		SYNOPTIC
Fuels	HERBACEOUS LIVE FUEL MOISTURE	250	DAILY / 5-DAY FORECAST	2000	TECHNOSYLVA
Fuels	WOODY LIVE FUEL MOISTURE	250	DAILY / 5-DAY FORECAST	2000	TECHNOSYLVA / ADS
Fuels	1 hr DEAD Fuel Moisture	2000	HOURLY / 96 HOUR FORECAST		TECHNOSYLVA / ADS
Fuels	10 hr DEAD Fuel Moisture	2000	HOURLY / 96 HOUR FORECAST		TECHNOSYLVA / ADS
Fuels	100 hr DEAD Fuel Moisture	2000	HOURLY / 96 HOUR FORECAST		TECHNOSYLVA / ADS

8.3.5.2 Known Limitations of Existing Approach

The electrical corporation must describe any known limitations of its existing modeling approach resulting from assumptions, data availability, and computational resources. It must discuss the impact of these limitations on the modeling outputs.

There are several limitations and challenges to Pacific Power's current modeling approach including:

- **Computational Requirements:** Pacific Power's WRF's domain covers the entirety of Pacific Power's 6-state service territory. Significant computational resources are needed to efficiently run a WRF of this size. Even with two sizeable HPCCs and recent WRF optimizations, the operational WRF forecasts are not available until 5+ hours after initialization. In addition to the operational WRF, it will have taken one of Pacific Power's HPCCs running continuously for nearly 16 months to produce the companion 30-year WRF reanalysis. Looking ahead over the coming 1-3 years, computational resource requirements will increase significantly as Pacific Power looks to extend its WRF forecast from 4 days to 7 days and transition from a single deterministic WRF (current approach) to a multi-member WRF ensemble as required.

- **Data Management:** Pacific Power's WRF generates nearly 1 TB of weather forecast data every single day. Further, the 30-year WRF Reanalysis is expected to contain approximately 5 PB of data. Managing the large amount of output produced by these two models is extremely challenging for both Pacific Power and its vendors.

- **Data Availability:** GFS model output is a critical input into Pacific Power's WRF. Unexpected problems related to the servers at the National Center for Environmental Prediction (NCEP) can result in delayed or even missing WRF runs. This would be serious if such a problem occurred immediately prior to and during a significant fire weather event. Further, the NFDRS WRF outputs (specifically 1, 10, 100, & 1000-hour Dead Fuel Moisture) require a continuous record to run properly. Therefore, missed WRF runs will need to be completed before future runs can occur if they are to contain accurate NFDRS outputs.

- **Forecast Uncertainty:** Another limitation to the current modeling approach is that Pacific Power relies on a single, deterministic WRF model to support much of its forecast operations. This approach provides a single forecast solution and does not account for any forecast uncertainty that may exist. The proposed solution is to establish a multi-member WRF ensemble, though as mentioned above, there are significant computational resource constraints that must first be addressed before a WRF ensemble could be implemented at this scale.

If there is missing asset attributes (ex: age, materials), WFA-E will look at information for the similar assets in the same location or close by and correlate missing asset attributes to the attributes of those assets.

Fuels data in WFA-E does not consider specific fuels that may have been identified during inspections. Technosylva uses LANDFIRE, NIFS, and other ancillary data to prepare the WUI custom fuels analysis.

8.3.5.3 Planned Improvements

Table 8-31 Planned Improvements to Weather Forecasting Systems

System	Description	Impact	x% Risk Impact	Implementation Schedule
30-Year WRF Reanalysis	Hourly record of WRF weather and NFDRS outputs from Jan. 1991 to Dec. 2021 at a 2km horizontal resolution across the entire service territory.	Improve accuracy of forecast and trend analysis. Will be used to train models to forecast utility impacts.	TBD	Complete reanalysis Q3 2023 Integrate reanalysis into operational and planning processes Q3 2023
WRF Ensemble	Strategically sub-select GEFS members to initialize a multi-member WRF Ensemble	Mitigates some of the inherent uncertainty associated with deterministic weather forecasts.	TBD	Develop WRF Ensemble configuration by Q4 2023. Full implementation by Q4 2024.
GEFS Self Organizing Maps (SOMs) Ensemble Forecast Tool	Build historical SOM node array using ERA5 Reanalysis. Build an automated GEFS SOM node association framework and	Mitigates some of the inherent uncertainty associated with deterministic weather forecasts. Independent	TBD	Build historical SOM node array using ERA5 Reanalysis by Q3 2023. Full implementation by Q4 2023

System	Description	Impact	x% Risk Impact	Implementation Schedule
	forecast tool	of WRF. Can help identify extreme weather threats based solely on map types and historical impacts.		
Bias-corrected WRF Forecast	Develop machine learning models to bias correct the WRF forecast for Pacific Power Weather Stations, RAWS, and other relevant weather stations.	Will improve the surface wind forecast for critical weather stations used to support short-term wildfire mitigation activities such as PSPS.	TBD	Begin training machine learning models in Q2 2023. Implement first set of weather station models in Q2 2024. Add additional station models as available through Q4 2024 and 2025.

In addition to the items listed above, Pacific Power is currently investigating what it would require extending its current WRF forecast from 4 days to 7 days while still maintaining timely delivery of the WRF output.

8.3.5.4 Evaluating Mitigation Initiatives

The electrical corporation must describe its procedures for the ongoing evaluation of the efficacy of its weather forecasting program.

Evaluation of the efficacy of Pacific Power's model performance is primarily qualitative at this early stage in the program's development. Pacific Power's meteorologists use WRF to perform their normal daily forecast duties. It is in that capacity that the WRF model is continually evaluated against real-time observations and other publicly available model data. Any trends or biases that are observed are communicated to the vendor for investigation. Here are a few ways in which Pacific Power's meteorologists have qualitatively determined WRF to be an effective part of our wildfire mitigation strategy:

- There are currently no other publicly available weather models that can provide a four-day (96-hour) 2km resolution weather and NFDRS forecast across Pacific Power's entire 6-state service territory. Hi-resolution NFDRS outputs are especially critical as they provide insight into fuel moisture and fire weather conditions for all Pacific Power distribution and transmission at the zone of protection (ZOP) level. The company meteorologists have observed that WRF tends to perform better in the utility's complex terrain than other, coarser-resolution models. Further, WRF has been instrumental to providing advanced warning of significant and extreme fire weather threats since its implementation.
- The combination of the operational WRF data with the partially completed WRF reanalysis data allows for a historical comparison between the current and past

forecasts. This enables the meteorologists to "size up" the forecasted fire weather threats in the context of past threats. Further, the WRF reanalysis data is actively being trained on past system impacts.

- WRF, in combination with WFA-E, has already demonstrated success in recent events such as the September 2022 PSPS event in Oregon. In that example, Pacific Power was able to use the data from its WRF and from WFA-E to identify the circuits of risk several days in advance of the threat based on circuit-level wind-related outage probabilities, ZOP-level fuels and fire weather forecasts, and wildfire spread and consequence modeling.

Evaluation of the model's performance and efficacy is expected to become increasingly sophisticated and automated over time. However, even before that happens, there is no doubt among Pacific Power's SMEs that the current modeling approach has dramatically increased the company's ability to prepare for and mitigate against extreme fire weather threats.

8.3.5.5 Enterprise System for Weather Forecasting

At this stage in the program's development, Pacific Power does not have an enterprise system for weather forecasting. However, Pacific Power is open to the possibility that the program may eventually grow to include an enterprise forecasting system as business requirements evolve.

Pacific Power receives its Weather Research Forecast (WRF) model data from the vendor Atmospheric Data Solutions (ADS) twice daily and is stored internally for ease of use. The various parameters within the WRF model cover the entire six state service territory, but also encompasses locations beyond the service territory, from the west coast of the United States to just east of the Rocky Mountains. This data is stored in various file formats including .CSV, .GEOJSON and .ZIP. The WRF 30-year reanalysis data is housed by ADS on the Hadoop Data Manager and is easily accessed by Pacific Power employees whenever needed.

8.3.6 Fire Potential Index

The electrical corporation must describe its process for calculating its fire potential index (FPI) or a similar a landscape scale index used as a proxy for assessing real-time risk of a wildfire under current and forecasted weather conditions. The electrical corporation must document the following:

- Its existing calculation approach and how its FPI is used in its operations
- The known limitations of its existing approach
- Implementation schedule for any planned changes to the system

8.3.6.1 Existing Calculation Approach and Use

The electrical corporation must describe:

- How it calculates its own FPI or if uses an external source, such as the United States Geological Survey35
- How it uses its or an FPI in its operations

Additionally, if the electrical corporation calculates its own FPI, it must provide tabular information regarding the features of its FPI.

Pacific Power does not yet have an operational Fire Potential Index (FPI) per se. Instead, Pacific Power Meteorology assigns a district-level wildfire risk based on an assessment of the Geographic Area Coordination Center's (GACC) 7-Day Significant Fire Potential product, publicly available fuels information, and weather forecast data. Wildfire risk is expressed using a four color-code scheme with general inputs assessed and categorized as follows:

PacifiCorp Wildfire Risk	GACC 7-Day Significant Fire Potential	Fuels Considerations	Wind Gust Considerations
Little to No Wildfire Risk	Low or Little to No Risk		
Elevated Wildfire Risk	Low or Moderate	Dry	
Significant Wildfire Risk	Moderate	Very Dry	
	High Risk*	Dry or Very Dry	Max Gusts < 95th Percentile
Extreme Wildfire Risk	High Risk*	Dry or Very Dry	Max Gusts ≥ 95th Percentile

* Excludes Lightning or Recreation High Risk triggers

PacifiCorp Fuels	100-hr Dead Fuel Moisture	1000-hr Dead Fuel Moisture	Energy Release Component
Dry	Near or Below Average*		Near or Above Average*
Very Dry	≤ 10th Percentile	≤ 10th Percentile	≥ 90th Percentile

*Relative to the average fire season values for a given location

Figure 8-25 District-Level Wildfire Risk

When moving into an elevated, significant, or extreme wildfire risk, Meteorology performs an additional review of fuels and fire weather forecasts and observations, including by using some or all of the additional metrics and methods listed below.

- **Fire Weather Conditions:** This includes National Weather Service Fire Weather Watches and Red Flag Warnings, publicly available weather model data, and fire weather and NFDRS outputs from Pacific Power's Operational WRF model.
- **Fire Weather and Drought Indices:** This includes the Hot-Dry-Windy Index and the Evaporative Demand Drought Index (EDDI).
- **Wildfire Risk:** This includes an assessment from FireCast of the potential for

extreme fire behavior and consequence should an ignition occur. Live and dead fuels moisture conditions inform the risk.

- **Fuels Conditions:** This includes a more detailed assessment of live fuel moisture (herbaceous and woody), dead fuel moisture, grassland curing, and tree mortality.
- **Fuels and Fire Behavior Advisory:** These advisories are issued by the GACC when abnormal fuels conditions and/or fire behavior poses a threat to firefighter and public safety. The combination of exceptionally dry fuels and excessive tree mortality is an example of conditions that could prompt the issuance of a Fuels and Fire Behavior Advisory.
- **Current Wildfire Activity**: Current wildfire activity in or near a district can indicate that the weather and fuels conditions are contributing to fire occurrence and spread. This information provides insight into how a new fire may behave. Additionally, initial attack on a new fire may be impacted by resource availability due to ongoing wildfires in the region.

The district-level wildfire risk is made available to the company via the System Impacts Forecast Matrix, a 5-day forecast product issued daily by the Meteorology team. The final district-level wildfire risk forecast is shown in the "F" columns of the Systems Impacts Forecast Matrix (Figure 8-26). The "Wx" columns represent the weather-related power outage potential. This index, which impacts programs described in Section 8.1.8, is depicted in the figure below.

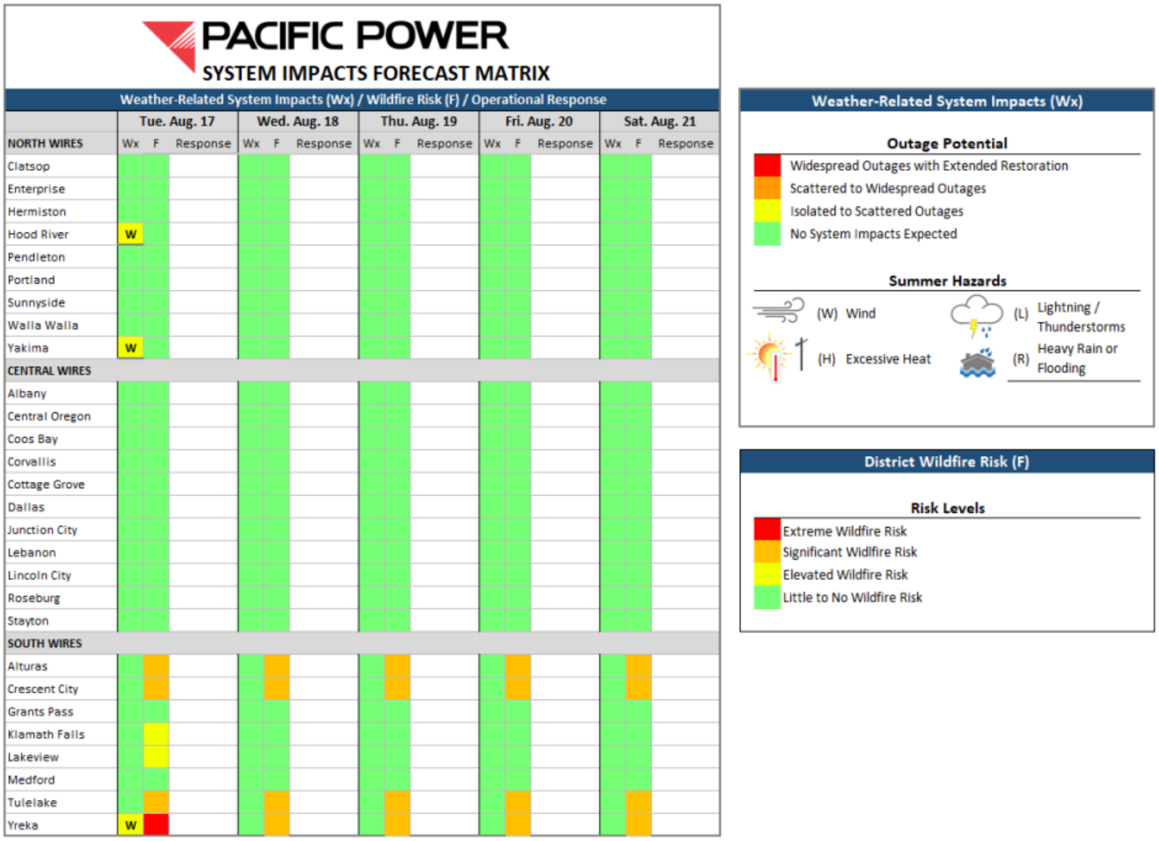


Figure 8-26 Systems Impacts Forecast Matrix

Instead of using a statistical, gridded fire potential index, Meteorology looks at a variety of factors, inputs, and tools to produce weather forecasts as described above. This helps Pacific Power to prepare for weather conditions ranging from snow and ice to fire risk and may review some or all of the following to produce the District Level Wildfire Risk Index.

This systems impact forecast metric is generally used to inform operational strategies, response to local conditions, and decision making, including the potential for PSPS implementation. For a discussion of how Pacific Power uses its District-Level Wildfire Risk Matrix to modify operational practices, see Section 8.1.8.3. To understand how this matrix is used to inform modifications to system operations, such as the implementation of EFR settings, see Section 8.1.8.1. More details regarding the impact of this matric on assessing the potential for PSPS see Section 9.1.6.

This WMP activity is tracked with Tracking ID# SA-06.

8.3.6.2 Known Limitations of Existing Approach

The electrical corporation must describe any known limitations of current FPI calculation.

The current model is reliant on the expert judgement of Meteorologists to derive a district wildfire risk based on a review of multiple sources, including external agencies whose objectives and criteria may not align with the utility's objectives and criteria. Though effective, the existing approach is relatively simplistic and does not allow for a quantifiable comparison between the current forecast and past fire weather events.

Implementation of a calculated FPI as discussed in Section 8.3.6.3 below, in combination with detailed analysis of the 30-year WRF reanalysis and wildfire history, will enable Pacific Power to quantify daily fire potential beginning in the 2023 wildfire season.

8.3.6.3 Planned Improvements

The electrical corporation must describe its planned improvements for its FPI including a description of the improvement and the planned schedule for implementation.

Prior to the onset of the 2023 fire season, Pacific Power plans to update the data inputs into its District Fire Risk categories using a calculated Fire Potential Index (FPI) in development by Technosylva. The FPI model will quantify the potential for large or consequential wildfires out several days based on weather, fuels, and terrain inputs. To accomplish this, Technosylva performed a detailed analysis of past weather from Pacific Power's WRF reanalysis, satellite-derived hotspot (wildfire) data from The Visible Infrared Imaging Radiometer Suite (VIIRS), and other environmental data. See general approach below in Figure 8-27.

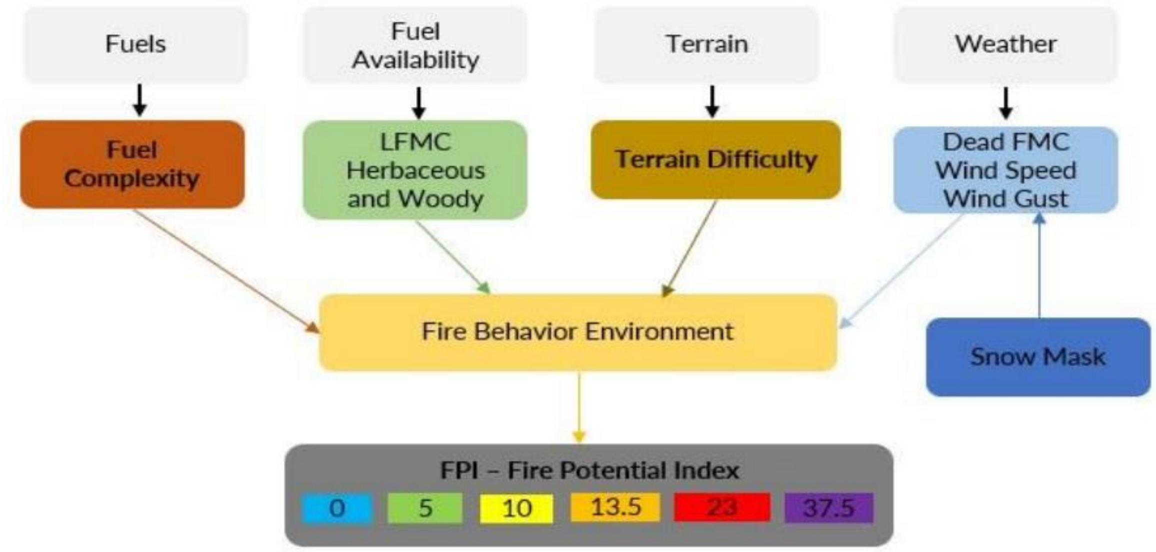


Figure 8-27 2023 Fire Potential Index (FPI) Model

The FPI is currently in development, planned for testing and refinement in the second quarter, and is still on track for full implementation ahead of the 2023 wildfire season. See Figure 8-28 for the development timeline.

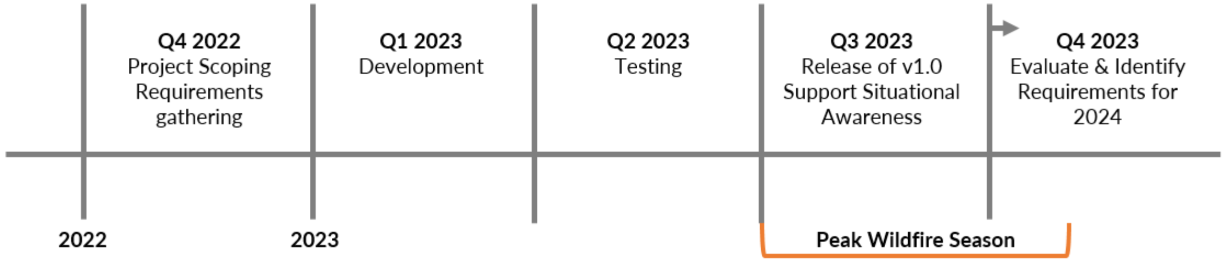


Figure 8-28 Fire Potential Index (FPI) Development Timeline

8.4 EMERGENCY PREPAREDNESS

8.4.1 Overview

Each electrical corporation must develop and adopt an emergency preparedness plan in compliance with the standards established by the CPUC pursuant to Public Utilities Code section 768.6(a). In this section, the electrical corporation must identify objectives for the next 3- and 10-year periods, targets, and performance metrics.

Wildfires and PSPS events introduce unique risk management challenges requiring the electrical corporation to evaluate, develop, and implement wildfire - and PSPS-specific emergency preparedness activities as part of a holistic emergency preparedness strategy.

In addition to direct customer notifications, other methods such as social media, website and Pacific Power app, and partnerships with local media, 24/7 real time situation updates are utilized.

Communications with local emergency management agencies (via the County Office of Emergency Services), tribal partners, telecommunications infrastructure providers, large customers and other local partners are established. Communication protocols are ongoing through the duration of an event and through customer restoration.

Pacific Power has a partnership with Redwood Coast and Far North Regional Centers who help to prepare AFN customers for a PSPS event and amplify notifications and solutions.

To promote PSPS awareness and preparedness in tribal communities, Pacific Power partners with the Karuk and Yurok tribal emergency managers to help prepare the tribal communities in advance of wildfire season.

Pacific Power meets with tribal governments throughout the year, including PSPS workshops, exercises and other opportunities.

8.4.1.1 Objectives

Each electrical corporation must summarize the objectives for its 3-year and 10-year plans for implementing and improving its emergency preparedness.

Table 8-32 Emergency Preparedness Initiative Objectives (3-year plan)

Objectives for Three Year (2023–2025)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Continue the use of tabletop exercises to prepare for emergencies and PSPS events.	EP-02	N/A	Invitation, agenda	Annually in Q1/Q2	8.4.3
Complete Internal staff ECC (Emergency Coordination Center) and Department Operations Center (DOC) 3- year training program	EP-01	D.21-06-034, Guidelines, NIMS (National Incident Management System)	Training curriculum, LMS (Learning Management System) reports	2025	8.4.2
Complete and implement outage procedures – Restoration Annex	EP-01	N/A	Proof of training completion	2023	8.4.2
Implement improvements to Public Safety Partner Portal (PSP Portal)	EP-03	CPUC D. 20-06-017 Appendix A	Screenshots, portal documentation	2024	8.4.4

Table 8-33 Emergency Preparedness Initiative Objectives (10-year plan)

Objectives for Ten Years (2026–2032)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Continue collaboration and coordination with Public Safety Partners	EP-02	N/A	Meeting invitations, agendas	Ongoing – to 2032	8.4.3
Include hazards specific annexes for all service territory in the ERP	EP-01	GO 166, THIRA and/or HVA guidance	Updated ERP annexes	April 2030	8.4.2

8.4.1.2 Targets

Initiative targets are forward-looking quantifiable measurements of activities identified by each electrical corporation in its WMP. Electrical corporations will show progress toward completing targets in subsequent reports, including QDRs and WMP Updates.

Table 8-34 Emergency Preparedness Initiative Targets by Year

Initiative Activity	Tracking ID	2023 Target & Unit	x% Risk Impact 2023	2024 Target & Unit	x% Risk Impact 2024	2025 Target & Unit	x% Risk Impact 2025	Method of Verification
External collaboration and coordination	EP-02	1 Functional Exercise (FE) 1 Table Top Exercise (TTX) 1 workshop	TBD	1 (FE) 1 (TTX) 1 workshop	TBD	1 (FE) 1 (TTX) 1 workshop	TBD	After Action Report and Improvement Plan (AAR/IP)

8.4.1.3 Performance Metrics Identified by the Electrical Corporation

Performance metrics indicate the extent to which an electrical corporation's Wildfire Mitigation Plan is driving performance outcomes.

Table 8-35 Emergency Preparedness Performance Metrics Results by Year

Performance Metrics	2020	2021	2022	2023 Projected	2024 Projected	2025 Projected	Method of Verification (e.g., third-party evaluation, QDR)
Percentage of Wildfire/PSPS events followed by an After-Action Review or feedback process	n/a	n/a	n/a	90%	95%	100%	Meeting notes or similar documentation

8.4.2 Emergency Preparedness Plan

In this section, the electrical corporation must provide an overview of how it has evaluated, developed, and integrated wildfire- and PSPS-specific emergency preparedness strategies, practices, policies, and procedures into its overall emergency plan based on the minimum standards described in GO 166. The electrical corporation must provide the title of its latest emergency preparedness report, the date of the report, and an indication of whether the plan complies with CPUC R. 15-06-009, D. 21-05-019, and GO 166. The overview must be no more than two paragraphs.

In addition, the electrical corporation must provide a list of any other relevant electrical corporation documents that govern its wildfire and PSPS emergency preparedness planning for response and recovery efforts. This must be a bullet point list with document title, version (if applicable), and date. For example:

Electrical Corporation's Emergency Response Plan (ECERP), Third Edition, dated January 1, 2021.

The Company's 2023 Emergency Response Plan (ERP), Third edition, dated September 28, 2022, complies with CPUC R. 15-06-009, D. 21-05-019 and GO 166. The plan consists of a base plan and 10 functional annexes. The Fourth edition of the plan will be revised and submitted by April 28, 2023, per GO 166. The ERP provides tactics, policies and procedures which are used in response to any emergency incidents or planned event which could after Pacific Power assets. By implementing the principles of the National Incident Management System (NIMS), the structure can provide guidance and support to emergency responses of any size or scope. This plan is intended to be the primary reference material for any emergency or contingency response affecting Pacific Power's employees, assets, or business continuity but does not replace day-to-day operational or internal business unit contingency plans. This WMP activity is tracked with Tracking ID# EP-01.

The 10 functional annexes include governance transfer, emergency response organizational structure, on-scene incident response, resourcing and mutual assistance, training and exercise and emergency communication. The plan does not contain hazard specific annexes.

8.4.2.1 Overview of Wildfire and PSPS Emergency Preparedness

In this section of the WMP, the electrical corporation must provide an overview of its wildfire- and PSPS-specific emergency preparedness plan.

Purpose and Scope of the Plan

Pacific Power's primary PSPS specific emergency preparedness plan is called he Public Safety Power Shutoff Execution Playbook (PSPS Playbook). The PSPS Playbook is currently a standalone document and not part of the Company's all hazards Emergency Response Plan (ERP). The PSPS Playbook is intended to provide the minimum guidelines for a planned de-energization of energized facilities when extreme weather or other conditions pose an imminent safety threat to persons and/or property.

Overview of Protocols, Policies and Procedures

Pacific Power processes for wildfires and PSPS events generally follow the same overall flow shown in Figure 70. The company utilizes weather forecasts and other situational awareness information to identify when a potential public safety power shutoff event may be warranted. Based on the best available weather forecast and other relevant situational awareness information, senior management can initiate a public safety power shutoff event. There is no operational flow diagram at the time of this writing, however the process map below illustrates key components of wildfire and PSPS emergency response procedures.

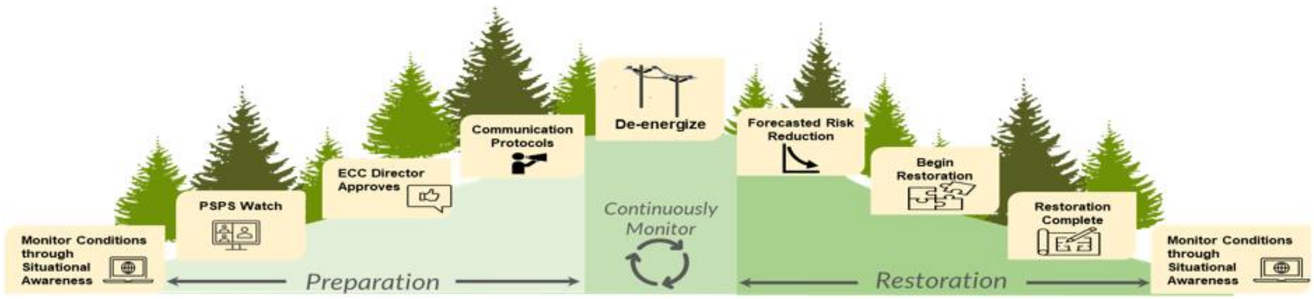


Figure 8-29 : Process Flow Diagram Overview

Upon agreement by executive management to initiate Public Safety Power Shutoff actions, the Emergency Coordination Center (ECC) will be activated (if it has not already been activated).

The ECC Staff will then prepare a Public Safety Power Shutoff Plan, which at a minimum shall include:

- Forecasted date and time that the de-energization event will start.
- Estimated duration of the event.
- Date and time that affected customers will be notified under a proposed customer notification plan.
- Critical customers and facilities on the circuit such as hospitals, emergency centers, and water/water treatment plants that will be impacted.
- With respect to each circuit or portion of a circuit planned for de-energization, a description of the circumstances that give rise to the need to de-energize with specific focus on how it creates an "imminent and significant risk to persons and/or property;"
- A description of measures considered as an alternative to de-energization and why such measures alone are insufficient.
- A description of the public safety benefits the company hopes to achieve by de-energizing the applicable electrical facilities.
- A description of proposed efforts to mitigate the adverse impacts on customers and communities impacted by de-energization; and
- The proposed date and time for notifying the appropriate commission staff.
- Additional information may be required as part of a specific state event mitigation plan.

Pacific Power actively monitors real-time weather conditions and tries to provide customers with additional notifications if de-energization is likely. When real-time observations and weather forecasts indicate that the three triggers for "de-energization watch" have been evaluated, and the Wildfire Risk Index is elevated, a de-energization watch protocol is initiated. The protocol includes activation of an Emergency Coordination Center (ECC), communication with local public safety partners, and implementation of additional monitoring activities.

The ECC is staffed by specialized staff who assemble during de-energization warning and implementation to provide critical operations support through the collection and analysis of data. The ECC, under direction of the Operational Leadership Branch (OLB) makes decisions to maintain the safety and reliability of the transmission and distribution system and helps facilitate cross-organization incident coordination. The ECC is led by an ECC Manager and has the support of a safety officer, a joint information team, emergency management, meteorology and operational stakeholders representing field operations, system operations, vegetation management, engineering, and other specialties.

When the ECC is activated, Pacific Power emergency management gathers input from public safety partners to properly characterize and consider impacts to local communities and send notifications to the operators of pre-identified critical facilities, partner utilities, and adjacent local public safety partners. The Pacific Power customer service team then coordinates through the ECC to confirm customer lists for the area to develop a communication plan for those customers potentially impacted.

Local patrol and inspection of lines during a PSPS watch can include a variety of methods depending on the accessibility of locations, the reliability of the line, area conditions and other factors. The ECC reviews these factors to determine necessary tasks such as the deployment of crews or remote monitoring by system operations.

Because of the public desire for reliable electric service, together with public safety concerns associated with de-energization, a PSPS is a measure of last resort. Nonetheless, consistent with existing regulations and the general mandate to operate the electrical system safely, the ECC has discretion to determine when a PSPS is appropriate.

The OLB and ECC Manager considers all available information, including real-time feedback and input from other ECC participants and field operations to determine whether PSPS should be executed. Additionally, the OLB and ECC Manager may decide to further refine the PSPS areas described above. As a matter of practical reality, the ECC Manager cannot know whether a PSPS will prevent a utility-related ignition. If a PSPS is not implemented and an ignition occurs, the ignition itself is not proof that a PSPS should have been implemented. Likewise, if a PSPS is implemented, the event itself does not prove that an ignition that would have otherwise occurred was prevented.

Drills, simulations, and tabletop exercises are described in Section 8.4.2.3.

Notification of and communication to customers during and after a wildfire or PSPS event are detailed in Section 8.4.4 and follow the protocols below.

Table 36 : Overview of Notification and Communication[21]

Communication Protocols	
48-72 hours prior	De-energization warning to Public Safety Partners and priority customers
24-48 hours prior	De-energization warning
1 – 4 hours prior	De-energization imminent
Beginning of Event	Beginning of Event
Re-energization begins	Re-energization begins
Re-energization completed	Re-energization completed
Cancellation of event	De-energization event canceled

Since the last WMP submission, Pacific Power emergency management has extended communications to partners to learn more about how to best reach communities and plans to update outreach as updated partner information becomes available.

Table 8-37 Key Gaps and Limitations in Integrating Wildfire- and PSPS-Specific Strategies into Emergency Plan

Gap or Limitation Subject	Remedial Brief Description	Remedial Action Plan
Limited feedback on PSPS Playbook from partners	2023 PSPS Playbook workshop did not yield in any feedback from public safety partners	Continue to outreach, socialize, train and exercise to ensure alignment of plans, roles and expectations.

[21] Pacific Power's notification and communication protocols were developed consistent with the requirements in D.19-05-042.

8.4.2.2 Key Personnel, Qualifications, and Training

In this section, the electrical corporation must provide an overview of the key personnel constituting its emergency planning, preparedness, response, and recovery team(s) for wildfire and PSPS events.

Personnel Qualifications

Table 8-38 Emergency Preparedness Staffing and Qualifications

Role	Incident Type	Responsibilities	Qualifications	No. of Dedicated Staff Required	No. of Dedicated Staff Provided	No. of Contract Workers Required	No. of Contract Workers Provided
Emergency Management Director	Wildfire, PSPS	• Lead, oversee, and coordinate emergency preparedness program • Oversee all functions related to preventing, mitigating, responding to, and recovering from emergencies due to all relevant hazards for the electrical corporation • Develop, maintain, and update the electrical corporation emergency preparedness plan with associated policies, practices, and procedures • Direct and manage emergency program managers and specialists • Evaluate emergency management staff available to respond to emergencies • Monitor program performance; recommend and implement modifications to systems and procedures • Develop and oversee the electrical corporation's emergency coordination center; evaluate regular and emergency communication systems; make recommendations as appropriate	• Incident Command Certifications: ICS 100, 200, 300, 700, 800 • Master's in Disaster Risk Management • Minimum 15 years' experience in disaster risk management and/or emergency preparedness and planning	3	3	N/A	N/A

Role	Incident Type	Responsibilities	Qualifications	No. of Dedicated Staff Required	No. of Dedicated Staff Provided	No. of Contract Workers Required	No. of Contract Workers Provided
Emergency Program Manager	Wildfire, PSPS	• Leads the Emergency Coordination Center (ECC) • Serve as point of contact for all wildfire-related emergencies/disasters in conjunction with the Emergency Management Director • Serve as liaison for emergency response functions at the field response level	• Bachelor's degree in Emergency Management or related field. • Incident Command Certifications: ICS 100, 200, 300, 700, 800 • Minimum 5 years' experience in disaster risk management and/or emergency preparedness and planning	2	2	N/A	N/A
T&D Managing Director	Wildfire, PSPS	• Leads Transmission and Distribution Department Operations Center (DOC) • Coordinates response to incidents • Manages wildfire mitigation projects • Participates in ECC coordination meetings	• Minimum 15 years' experience in system operations or System Operations Control Center Leadership. • Experience in building effective teams with bargaining, non-bargaining, and degreed personnel to meet the challenges of increasing customer demands in both blue-sky and disaster recovery scenarios. • Expertise in disaster response and recovery.	20	20	N/A	N/A

Role	Incident Type	Responsibilities	Qualifications	No. of Dedicated Staff Required	No. of Dedicated Staff Provided	No. of Contract Workers Required	No. of Contract Workers Provided
Region System Operations Director	Wildfire, PSPS	• Participate in ECC. • Coordinate switching between field and engineering organizations. Directs execution of the same via Operators. • Respond to and mitigate outage duration and risk	•Minimum 15 years' experience in system operations or System Operations Control Center Leadership. • Experience in building effective teams with bargaining, non-bargaining, and degreed personnel to meet the challenges of increasing customer demands in both blue-sky and disaster recovery scenarios. • Expertise in meeting common performance indices such as CAIDI (Customer Average Interruption Duration Index) and SAIDI (System Average Interruption Duration Index) with practical application and maturation staged approach to attaining the same. Application of the same led to a five-minute drop in CAIDI in the span of a year. • Expertise in black starts, as well as disaster recovery and load, shed models. • Expertise in the development of Incident Response Plans and Wildfire Response Plans.				

Role	Incident Type	Responsibilities	Qualifications	No. of Dedicated Staff Required	No. of Dedicated Staff Provided	No. of Contract Workers Required	No. of Contract Workers Provided
Public Information Officer (PIO)	Wildfire, PSPS	• Plan and host press conferences to announce major news or address crises • Prepare press releases, speeches, articles, social media posts, and other materials for public consumption • Develop strategies and procedures for working effectively with the media • Maintain good working relationships with media organizations • Collaborate with executive management and marketing team to ensure a cohesive public image • Work with various teams to organize and host public events and promotions Speak directly to the public or media to address questions and represent the organization	• Bachelor's degree in communications, public relations, journalism, or related field • Prior experience in a public relations role • Exceptional written and verbal communication skills • Strong understanding of the media, including social media • Organized and detail-oriented work ethic • Ability to travel on short notice • Great public speaking and interpersonal skills	0	0	N/A	N/A

Personnel Training

Table 8-39 Pacific Power's Personnel Training Program

Training Topic	Purpose and Scope	Training Method	Training Frequency	Position or Title of Personnel Required to Take Training	# Personnel Requiring Training	# Personnel Provided with Training	Form of Verification or Reference
Emergency Coordination Center (ECC) Training program	ECC staff will be trained in accordance with CA OEIS curriculum standards for a Type III Utility Representative credential through identified course material.	Online, workshops and in person	Annually	All ECC personnel	50	30	Training records, meeting materials, certificates
Emergency Notification system	To test the internal notification system functions and maintain competency in sending incident alerts.	Online	Quarterly	ECC Manager, Incident Management Specialist	10	4	Quarterly completion verifications in ENS & in log.

External Contractor Training

Pacific Power does not provide emergency preparedness training for contractors.

Table 8- Contractor Training Program

Training Topic	Purpose and Scope	Training Method	Training Frequency	Position or Title of Personnel Required to Take Training	# Personnel Requiring Training	# Personnel Provided with Training	Form of Verification or Reference
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

8.4.2.3 40Drills, Simulations, and Tabletop Exercises

The electrical corporation must report on its program(s) for conducting external discussion-based and operations-based exercises for both wildfire and PSPS emergency events.

Pacific Power's program for conducting external discussion-based and operations-based exercises for both wildfire and PSPS emergency events are summarized in the table below. As Pacific Power operates across six states, many of these exercises prepare the company for wildfire and PSPS emergency events beyond the company's service territory in California and were included for context.

Table 8-41Internal Drill, Simulation, and Tabletop Exercise Program

Category	Exercise Title and Type	Purpose	Exercise Frequency	Position or Title of Personnel Required to Participate	# Personnel Participation Required	# Personnel Participation Completed	Form of Verification or Reference
Discussion Based	ECC PSPS TTX (During CA FE)	To review plans and ensure ECC staff members understand their roles and responsibilities during a PSPS event.	Annually	All ECC Personnel	50	TBD	Training records & meeting materials
Discussion Based	DOC/ECC/EPG GridEx TTX	To prepare staff for the Grid Ex Functional Exercise	Biennial	All ECC Personnel	100	TBD	Training records & meeting materials
Functional Exercise	GridEx VII	Practice how we would respond to and recover from coordinated cyber and physical security threats and incidents	Biennial	All ECC Personnel	50	TBD	Training records & meeting materials
Discussion Based	ECC PSPS TTX	To review plans and ensure ECC staff members understand their roles and responsibilities during a PSPS event.	Annually	All ECC Personnel	50	TBD	Training records & meeting materials
Discussion Based	Black Sky TTX	To review plans and ensure ECC staff members understand their roles and responsibilities during a catastrophic event.	Annually	All ECC Personnel	50	TBD	Training records & meeting materials
Discussion Based	ECC Winter Storm TTX	To review plans and ensure ECC staff members understand their roles and responsibilities during a Winter Storm event.	Annually	All ECC Personnel	50	TBD	Training records & meeting materials
Discussion Based	Executive Policy Group Workshop	To review plans and ensure EPG staff members understand their roles and responsibilities during an ECC Event	Annually	All EPG Personnel	10	TBD	Training records & meeting materials
Discussion Based	DOC/ECC EPG GridEx TTX	To prepare staff for the Grid Ex Functional Exercise	Biennial	All ECC Personnel	100	TBD	Training records & meeting materials
Functional Exercise	GridEx VIII	Practice how we would respond to and recover from coordinated cyber and physical security threats and incidents	Biennial	All ECC Personnel	50	TBD	Training records & meeting materials

Category	Exercise Title and Type	Purpose	Exercise Frequency	Position or Title of Personnel Required to Participate	# Personnel Participation Required	# Personnel Participation Completed	Form of Verification or Reference
Discussion Based	ECC PSPS TTX	To review plans and ensure ECC staff members understand their roles and responsibilities during a PSPS event.	Annually	All ECC Personnel	50	TBD	Training records & meeting materials
Discussion Based	Black Sky TTX	To review plans and ensure ECC staff members understand their roles and responsibilities during a catastrophic event.	Annually	All ECC Personnel	50	TBD	Training records & meeting materials
Discussion Based	ECC Winter Storm TTX	To review plans and ensure ECC staff members understand their roles and responsibilities during a Winter Storm event.	Annually	All ECC Personnel	50	TBD	Training records & meeting materials
Discussion Based	Executive Policy Group Workshop	To review plans and ensure EPG staff members understand their roles and responsibilities during an ECC Event	Annually	All EPG Personnel	10	TBD	Training records & meeting materials

Table 8-42 External Drill, Simulation, and Tabletop Exercise Program

Category	Exercise Title and Type	Purpose	Exercise Frequency	Position or Title of Personnel Required to Participate	# Personnel Participation Required	# Personnel Participation Completed	Form of Verification or Reference
Discussion-Based	PSPS Playbook workshop	Review PSPS plan and opportunity to discuss any gaps in assumptions and expectations. Ensure alignment with State and local public safety partners.	Annually	Program Director of Emergency Management Region Systems Operations Program Manager and supervisors Emergency Operations Center Manager Public Safety Partners such as Fire chief(s) or liaison Police, sheriff, and California Highway Patrol chiefs or liaisons County Health liaison American Red Cross liaison Emergency Operations Supervisor(s) for relevant city/county jurisdictions	50	48	Workshop presentation materials

Category	Exercise Title and Type	Purpose	Exercise Frequency	Position or Title of Personnel Required to Participate	# Personnel Participation Required	# Personnel Participation Completed	Form of Verification or Reference
Discussion-Based	Siskiyou Co PSPS TTX	Enhance awareness of PSPS plan. Understand roles and responsibilities. Validate plans and procedures.	Annually	Program Director of Emergency Management Region Systems Operations Program Manager and supervisors Emergency Operations Center Manager Public Safety Partners such as Fire chief(s) or liaison Police, sheriff, and CHP chiefs or liaisons County Health liaison American Red Cross liaison Emergency Operations Supervisor(s) for relevant city/county jurisdictions	50	48	HSEEP Documentation and completion logs
Operations-Based	Siskiyou Co FE	Enhance awareness of PSPS plan. Understand roles and responsibilities. Validate plans and procedure Execute response actions	Annually	Program Director of Emergency Management Region Systems Operations Program Manager and supervisors Emergency Operations Center Manager Public Safety Partners such as Fire chief(s) or liaison Police, sheriff, and CHP chiefs or liaisons County Health liaison American Red Cross liaison Emergency Operations Supervisor(s) for relevant city/county jurisdictions	50	43	HSEEP Documentation and completion logs

8.4.2.4 Schedule for Updating and Revising Plan

The electrical corporation must provide a log of the updates to its emergency preparedness plan since 2019 and the date of its next planned update.

Updates should occur every two years, per R. 15-06-009 and D. 21-05-019. For each update, the electrical corporation must provide the following:

- Year of updated plan
- Revision type (e.g., addition, modification, elimination)
- Component modified (e.g., communications, training, drills/exercises, protocols/procedures, MOAs)
- A brief description of the lesson learned that informed the revision

A brief description of the specific addition, modification, or elimination

Pacific Power conducts annual updates to the company's Emergency Response Plan annually in accordance with California Public Utilities Commission General Order 166. The last update to the plan was completed in September, 2022 and the next filing of the plan will be completed in April, 2023.

Table 8-43 Wildfire-Specific Updates to the Emergency Preparedness Plan

ID #	Year of Updated Plan	Revision Type	Lesson Learned	Revision Description	Reference Section
1	2019	Plan implemented	Statutory change due to CPUC R. 15-06-009, D. 21-05-019	Updated plan to comply with the National Incident Management System (NIMS) per GO 166	Sections 15, page 41.
2	2020	Addition	N/A	Created PSPS Playbook (a standalone plan) for additional guidance during PSPS Event response	N/A
3	2021	Modification	N/A	Transitioned from Fire Prevention, Preparedness and Response annex to Wildfire Mitigation Plan Updated PSPS Playbook (a standalone plan) for additional guidance during PSPS Event response	N/A
4.	2022	Revision	Statutory change due to CPUC R. 15-06-009, D. 21-05-019	Updated plan based on operational changes remaining in compliance with the National Incident Management System (NIMS) per GO 166	All

ID #	Year of Updated Plan	Revision Type	Lesson Learned	Revision Description	Reference Section
5	2022	Plan reviewed and revised	N/A	N/A	Title page. Formatting and copyright notice Record of Revisions. Addition of reviewers and approvers of plan Section 1. Mitigation Overview, Company Overview and Operational Mitigation Section 2. Purpose Section 3. Situation Section 4. Control and Coordination Acronyms table added Section 5. Control and Coordination Section 6. Mutual Assistance Agreements Section 8. Sheltering, Evacuation and Accountability

8.4.3 External Collaboration and Coordination

8.4.3.1 Emergency Planning

In this section, the electrical corporation must provide a high-level description of its wildfire and PSPS emergency preparedness coordination with relevant public safety partners at state, county, city, and tribal levels within its service territory. The electrical corporation must indicate if its coordination efforts follow California's SEMS or, where relevant for multi-jurisdictional electrical corporations (e.g., PacifiCorp), the Federal Emergency Management Agency (FEMA) National Incident Management Systems (NIMS), as permitted by GO 166.

Pacific Power has conducted several preparedness actions with areas of wildfire concern within its service territory. Workshops and exercises have and will continue to be conducted annually. Pacific Power has also hosted workshops to coordinate response and ensure response efforts are complimentary to tribal, state, county and local response actions. Pacific Power conducts its response activities within the National Incident Management System organizational structure which allows seamless integration with public sector agencies. Through these coordination sessions, Pacific Power and other potentially affected agencies have developed partnerships which have proven very effective through both exercise and actual response to incidents. This WMP activity is tracked with Tracking ID# EP-02.

Table 8-44 State and Local Agency Collaboration(s)

Name of State or Local Agency	Point of Contact and Information	Emergency Preparedness Plan Collaboration – Last Version of Plan Agency Collaborated	Emergency Preparedness Plan Collaboration – Collaborative Role	Memorandum of Agreement (MOA)?	Brief Description of MOA
CUEA	Jenny Regino jenny.regino@caloes.ca.gov	2022 Version	Attended Virtual Meeting and provided comments during workshop	No	N/A
CalOES	Karen Valencia karen.valencia@caloes.ca.gov	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
CalOES	Eric Howard eric.howard@caloes.ca.gov	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
CalOES	Robert Goyeneche robert.goyeneche@caloes.ca.gov	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
CalOES	Jason Vela jason.vela@caloes.ca.gov	2022 Version	Attended Virtual Meeting and provided comments during workshop	No	N/A

Name of State or Local Agency	Point of Contact and Information	Emergency Preparedness Plan Collaboration – Last Version of Plan Agency Collaborated	Emergency Preparedness Plan Collaboration – Collaborative Role	Memorandum of Agreement (MOA)?	Brief Description of MOA
CalFire	Jeff Fuentes jeff.fuentes@fire.ca.gov	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
CalFire	Tristan Howard tristan.howard@fire.ca.gov	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
CalFire	Steve Walker steve.walker@fire.ca.gov	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
CalFire	Greg Roath greg.roath@fire.ca.gov	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
Del Norte County OES	Deborah Otenburg Deborah.otenburg@co.del-norte.ca.us	2022 Version	Attended Virtual Meeting and provided comments during workshop	No	N/A
Redwood Coast Resource Center	Debbie West dwest@redwoodcoastrc.org	2022 Version	Attended Virtual Meeting and provided comments during workshop	No	N/A

Name of State or Local Agency	Point of Contact and Information	Emergency Preparedness Plan Collaboration – Last Version of Plan Agency Collaborated	Emergency Preparedness Plan Collaboration – Collaborative Role	Memorandum of Agreement (MOA)?	Brief Description of MOA
Redwood Coast Resource Center	Fred Keplinger fkeplinger@redwoodcoastrc.org	2022 Version	Attended Virtual Meeting and provided comments during workshop	No	N/A
Modoc County OES	Heather Hadwick hhadwick@modocsheriff.us	2022 Version	Attended Virtual Meeting and provided comments during workshop	No	N/A
Shasta County OES	Rob Sandbloom rsandbloom@co.shasta.ca.us	2022 Version	Attended Virtual Meeting and provided comments during workshop	No	N/A
Siskiyou County OES	Bryan Schenone bschenone@co.siskiyou.ca.us	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
Siskiyou County Public Health	Coleman Fitszgerald cjfitzgerald@co.siskiyou.ca.us	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
Hoopa Tribe	Greg Moon gmoon@hoopa-nsn.gov	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A

Name of State or Local Agency	Point of Contact and Information	Emergency Preparedness Plan Collaboration – Last Version of Plan Agency Collaborated	Emergency Preparedness Plan Collaboration – Collaborative Role	Memorandum of Agreement (MOA)?	Brief Description of MOA
CPUC	Lew, Desmond Desmond.Lew@cpuc.ca.gov	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
CPUC	Dunton, Drucilla Drucilla.Dunton@cpuc.ca.gov	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
AT&T	Patel, Ankur ap2992@att.com	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
AT&T	Patterson, Sheri SP4701@att.com	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
Castella Fire	Heilman, Adam Adam.heilman@castellafire.us	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A

Name of State or Local Agency	Point of Contact and Information	Emergency Preparedness Plan Collaboration – Last Version of Plan Agency Collaborated	Emergency Preparedness Plan Collaboration – Collaborative Role	Memorandum of Agreement (MOA)?	Brief Description of MOA
AT&T	Marfia, Renee rc3194@att.com	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
Frontier Communications	Turman, Thomas Thomas.Turman@FTR.com	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
AT&T	Hauser, Shelley sh3253@att.com	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
Karuk Tribe	Frost, Darrel dfrost@karuk.us	2023 Version (1/23)	Attended Virtual Meeting on 1/19/2023 Provided comments during workshop	No	N/A
Yurok Tribe	Amos Pole apole@yuroktribe.nsn.us	2022 Version	Attended Virtual Meeting and provided comments during workshop	No	N/A

Table 8-45 Key Gaps and Limitations in Collaboration Activities with State and Local Agencies

Gap or Limitation Subject	Remedial Brief Description	Remedial Action Plan
Limited feedback on PSPS Playbook	Participation in 1/19/23 workshop did not include all invited partners.	Walk through PSPS playbook during TTX in March to ensure understanding and in preparation for the FE in May.

8.4.3.2 Communication Strategy with Public Safety Partners

The electrical corporation must describe at a high level its communication strategy to inform external public safety partners and other interconnected electrical corporation partners of wildfire, PSPS, and re-energization events as required by GO 166 and Public Utilities Code section 768.6.

Strong partnerships between the utility and local public safety, health, other utilities, and emergency management agencies are essential for effective coordination in any event that impacts the community. Pacific Power will serve as the initiating agency in the event of a Public Safety Power Shutoff and will coordinate with all local agencies as appropriate. The utility will take advantage of the expertise and recommendations offered by state and local emergency management agencies. Any non-outage related issues or incidents that arise during a Public Safety Power Shutoff will be handled by local emergency management and public safety.

Pacific Power emergency management staff will maintain regular outreach with local jurisdictions to include voice and email notifications and communication at least daily during the event. Additionally, if requested, a Pacific Power employee may be dispatched to the affected State or County Emergency Operations Centers in the role of Agency Representative and will be to provide a constant and direct conduit for information.

To help Pacific Power understand local sensitivities and concerns during a Public Safety Power Shutoff, Pacific Power will typically discuss the Critical Infrastructure affected with the Local Emergency Management Agencies. This information adds to the situational awareness of Pacific Power's incident command personnel before the event's initiation. Identified specific information for states and counties can be found in Appendix E.

Pacific Power will conduct outreach to adjacent utilities as appropriate based on the event's circumstances. Other utility contact information can be found within mutual assistance directories or the use of the "In Case of Crisis" application which is an electronic directory of all WRMAA member utility points of contact, internal directory as created for smaller neighboring utilities, CPUC and through ESF-12 (Energy) requests for coordination.

Effective communication is essential in any incident that impacts the public. Pacific Power will coordinate local communication from the Emergency Coordination Center unless a physical Joint Information Center is activated. Event update meetings will be held as needed with an option to join remotely. In addition, should a Community Resource Center (CRC), as outlined in the Community Resource Center Plan, be established, company representatives will be present to communicate with and assist community members. The communication plan can be found in Appendix D of the PSPS Execution Playbook.

When feasible, the decision to activate a Community Resource Center should be made at the 48-hour point. If 48-hour notice is not feasible, a CRC decision should be made at least within the 24-hour point, because a minimum of a 24-hour notice is typically needed to successfully mobilize a Community Resource Center (see the CRC Plan for specifics).

Frequency of prearranged communication review and updates.

The following timelines may be modified if changing conditions do not allow for advance notification. In such cases, the company will notify customers as reasonably practicable. Additional communication methods can be added or removed based on the circumstances of the event and regulatory requirements. For more information on PSPS communications, see Section 9.

Date of last discussion-based or operations-based exercise(s) on public safety partner communication.

The company conducts two annual exercises. The discussions-based exercise was conducted on April 28, 2022. The operations-based exercise was conducted on May 26, 2022.

Table 8-46 High-Level Communication Protocols, Procedures, and Systems with Public Safety Partners

Public Safety Partner Group	Name of Entity	Point of Contact and Information	Key Protocols	Frequency of Prearranged Communication Review and Update	Communication Exercise(s): Date of Last Completed	Communication Exercise(s): Date of Planned Next
Emergency Management	California State OES	Don Boland		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Emergency Management	California State OES	Jenny Regino		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Emergency Management	California State OES	Robert Goyenche		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Emergency Management	Del Norte County OES	Deborah Otenburg		Annually in the spring	Feb 8, 2022 3:00 PM	June, 2023 (upon hiring of new emergency manager)
Emergency Management	Modoc County OES	Heather Hadwick		Annually in the spring	May 3, 2022 6:30 PM	June, 2023 (upon hiring of new emergency manager)
Emergency Management	Shasta County OES	Rob Sanbloom		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Emergency Management	Siskiyou	Bryan Schenone		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Emergency Management	Hoopa Tribe	Greg Moon		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Emergency Management	Karuk Tribe	Darrell Frost		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Emergency Management	Yurok Tribe	Amos Pole		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Telecommunications	Siskiyou Telephone	Mark Apland		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Telecommunications	AT&T	Robert Guess		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Telecommunications	AT&T	Adam Bensaid		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Telecommunications	AT&T	Josh Overton		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Telecommunications	Frontier Communications	Jeff MacDonnel		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023
Telecommunications	Frontier Communications	Charles Born		Annually in the spring	May 26, 2022 9:00 AM	May 15-18, 2023

Table 8-47 Key Gaps and Limitations in Communication Coordination with Public Safety Partners

Gap or Limitation Subject	Remedial Brief Description	Remedial Action Plan
Limited feedback on Communication Protocols	Participation in 1/19/23 workshop did not include all invited partners.	Through the use of additional workshops and exercises we will be able to add to agencies which can provide input on communications protocols

8.4.3.3 Mutual Aid Agreements

Timely restoration requires significant logistical expertise, skilled line workers and assessors, and specialized equipment on a large scale. Mutual assistance is an essential part of the energy industry's contingency planning and restoration process. Utility companies impacted by a major outage event are able, under mutual assistance, to increase the size of their workforce by borrowing restoration workers from other companies. When called up, a company will send skilled restoration workers along with specialized equipment, oversight management, and support personnel to assist the restoration efforts of a fellow electric/gas service company. Crew members who deploy for mutual assistance are provided just-in-time training at the pre-deployment briefing.

The primary goal of the mutual assistance program is to restore service in a safe, effective, and efficient manner. The program also serves additional objectives that benefit the entire energy industry. These include:

- Promote the safety of employees and customers
- Strengthen relationships among utility companies
- Provide a means for utility companies to receive competent, trained employees and contractors from other experienced companies
- Provide a predefined mechanism to share industry resources expeditiously
- Mitigate the risks and costs of member companies related to major incidents
- Proactively improve resource-sharing during emergency conditions
- Share best practices and technologies that help the utility industry improve its ability to preparefor, and respond to, emergencies

- Promote and strengthen communication among Regional Mutual Assistance Groups (RMAGs)
- Enable a consistent, unified response to emergency events

Mutual assistance is both incoming and outgoing. Pacific Power is a member of multiple emergency associations to facilitate mutual assistance and maintains active mutual assistance agreements with the following organizations:

- California Utilities Emergency Association (CUEA)
- Western Regional Mutual Assistance Group
- Edison Electric Institute
- Intercompany Mutual Aid Agreement

Table 8-48 High-Level Mutual Aid Agreement for Resources During a Wildfire or De-Energization Incident

Mutual Aid Partner	Scope of Mutual Aid Agreement	Available Resources from Mutual Aid Partner
Multiple IOU, PUD and Cooperatives	Western Region Mutual Assistance Agreement (WRMAA)	Line crews, substation crews, vegetation, damage assessment, field management, emergency management, and safety
Berkshire Hathaway Energy companies	Inter-Company Agreement	Line crews, substation crews, vegetation, damage assessment, field management, emergency management, and safety
Multiple IOUs, PUD and Cooperatives	California utility Emergency Association (CUEA)	Line crews, substation crews, vegetation, damage assessment, field management, emergency management, and safety
Multiple IOUs, PUD and Cooperatives	Idaho Mutual Assistance Agreement	Line crews, substation crews, vegetation, damage assessment, field management, emergency management, and safety
Multiple IOUs, PUD and Cooperatives	One Utah Mutual Assistance Agreement	Line crews, substation crews, vegetation, damage assessment, field management, emergency management, and safety
Multiple IOUs, PUD and Cooperatives	Wyoming Mutual Assistance Agreement	Line crews, substation crews, vegetation, damage assessment, field management, emergency management, and safety

8.4.4 Public Emergency Communication Strategy

The electrical corporation must describe at a high level its comprehensive communication strategy to inform essential customers and other stakeholder groups of wildfires, outages due to wildfires, and PSPS and service restoration, as required by Public Utilities Code

8.4.4.1 Protocols for Emergency Communications

Pacific Power follows a comprehensive communications process internally for the coordination before, during and after an incident with communication redundancies in place. Processes and procedures for notification of stakeholders, including, but not limited to the general public, priority essential services and public safety partners, AFN populations, populations with limited English proficiency, tribes and people in remote areas as listed in the table below.

Pacific Power personnel will receive notification of an incident or potential event as early as feasible prior to activation of an incident or event. Information provided will include the current or forecasted weather conditions and additional key variables triggering an event, the affected area, customer count and the date and time of the event. The goal is for the Pacific Power Emergency Manager to begin notifying local authorities, emergency management services and for the company to begin notifying stakeholders as early as possible in advance of an incident or potential event which could result in a loss of power due to wildfire or PSPS. Several key roles are responsible for conducting emergency communications. This WMP activity is tracked with Tracking ID# EP-03.

Emergency Management staff will initiate emergency communications process with an Emergency Coordination Center activation. Emergency Management staff will manage the ECC, set cadence and coordinate with public safety partners at the state and local level.

The Public Information Officer (PIO) develops accurate, accessible and timely information to use in press/media briefings that pertain to the power supply and customer safety. The PIO develops and attends media briefings, providing current information, summaries and messaging templates as a part of the Emergency Coordination Center personnel.

The Regional Business Manager (RBM) is responsible for communicating and coordinating with community leaders, non-governmental organizations (NGOs), business leaders (managed accounts) and political leaders at the city and county level.

Customer Service (Mission Control) utilizes an automated integrated voice response telecommunication system to communicate with impacted customers via their preferred method of communication including: phone call, text or email, as well as maintaining social media and website content related to the event.

Regulatory staff will coordinate any regulatory communication with Commission Staff, in addition to direct communication between Emergency Management and ESF12.

Table 8-49 Protocols for Emergency Communication to Stakeholder Groups

Stakeholder Group	Event Type	Method(s) for Communicating	Means to Verify Message Receipt
General public	Wildfire	Media release, interviews, social media, website, direct customer calls	N/A
General public	Wildfire-related outage	Media release, interviews, social media, website, direct customer calls	N/A
General public	PSPS-related outage	Media release, interviews, social media, website, direct customer calls	N/A
General public	Restoration of service	Media release, interviews, social media, website, direct customer calls	N/A
Priority essential services	Wildfire	Emergency Management personnel, Public Safety Partners, ESF12, RBMs	N/A
Priority essential services	Wildfire-related outage	Emergency Management personnel, Public Safety Partners, ESF12, RBMs	N/A
Priority essential services	PSPS-related outage	Emergency Management personnel, Public Safety Partners, ESF12, RBMs	N/A
Priority essential services	Restoration of service	Emergency Management personnel, Public Safety Partners, ESF12, RBMs	N/A
AFN populations	Wildfire	Media release, interviews, social media, website, direct customer calls	N/A
AFN populations	Wildfire-related outage	Media release, interviews, social media, website, direct customer calls	N/A
AFN populations	PSPS-related outage	Personal phone call, welfare check if unable to reach via phone call	Confirm via personal phone call or welfare check
AFN populations	Restoration of service	Personal phone call, welfare check if unable to reach via phone call	Confirm via personal phone call or welfare check

Stakeholder Group	Event Type	Method(s) for Communicating	Means to Verify Message Receipt
Populations with limited English proficiency	Wildfire	Via same methods as general public with translated content in key languages: English, Spanish, Chinese traditional, Chinese simplified, German, Hmong, Mixteco, Vietnamese and Tagalog	N/A
Populations with limited English proficiency	Wildfire-related outage	Via same methods as general public with translated content in key languages: English, Spanish, Chinese traditional, Chinese simplified, German, Hmong, Mixteco, Vietnamese and Tagalog	N/A
Populations with limited English proficiency	PSPS-related outage	Via same methods as general public with translated content in key languages: English, Spanish, Chinese traditional, Chinese simplified, German, Hmong, Mixteco, Vietnamese and Tagalog	N/A
Populations with limited English proficiency	Restoration of service	Via same methods as general public with translated content in key languages: English, Spanish, Chinese traditional, Chinese simplified, German, Hmong, Mixteco, Vietnamese and Tagalog	N/A
Tribes	Wildfire	Emergency Management personnel, Public Safety Partners, ESF12, RBMs, Media release, interviews, social media, website, direct customer calls	N/A
Tribes	Wildfire-related outage	Emergency Management personnel, Public Safety Partners, ESF12, RBMs, Media release, interviews, social media, website, direct customer calls	N/A

Stakeholder Group	Event Type	Method(s) for Communicating	Means to Verify Message Receipt
Tribes	PSPS-related outage	Emergency Management personnel, Public Safety Partners, ESF12, RBMs, Media release, interviews, social media, website, direct customer calls	N/A
Tribes	Restoration of service	Emergency Management personnel, Public Safety Partners, ESF12, RBMs, Media release, interviews, social media, website, direct customer calls	N/A
People in remote areas	Wildfire	Media release, interviews, social media, website, direct customer calls	N/A
People in remote areas	Wildfire-related outage	Media release, interviews, social media, website, direct customer calls	N/A
People in remote areas	PSPS-related outage	Media release, interviews, social media, website, direct customer calls	N/A
People in remote areas	Restoration of service	Media release, interviews, social media, website, direct customer calls	N/A

8.4.4.2 Messaging

In this section, the electrical corporation must describe its procedures for developing effective messaging to reach the largest percentage of stakeholders in its service territory before, during, and after a wildfire, an outage due to wildfire, or a PSPS event.

Public Safety Partner Portal

During a PSPS event, Pacific Power recognizes the importance of providing additional geographical details of area(s) that may be affected by an outage. In 2022, Pacific Power implemented a Public Safety Partner Portal. The Public Safety Partner portal is a secure web-based application that hosts key information about customers that have been identified as critical facilities or infrastructure. This information includes, for example, the location, primary/secondary contact information, and backup generation capabilities of critical customers. The portal is accessible to public safety partners during PSPS events to support notification and provision of support to critical facilities that may be impacted by an outage. In addition to enhancing coordination with local public safety partners during emergencies, the portal also enhances Pacific Power's ability to prioritize power restoration, backup power evaluation, additional communications, and allocation of other resources before and during PSPS events to critical facility customers.

By the end of 2023, Pacific Power plans to make significant improvements to its Public Safety Partner portal for added functionality. Pacific Power expects that by the 2024 fire season, Public Safety Partner Portal users will be able to view interactive maps and can see critical facility data within a pre-determined zone that is relevant to their needs/permission level. With the interactive maps, users will be able to filter relevant data based on map zoom or map area selection and data will be readily available via export. Users can also set up notification preferences for critical events taking place in their jurisdiction and in surrounding areas where applicable.

8.4.4.3 Current Gaps and Limitations

In tabulated format, the electrical corporation must provide a list of current gaps and limitations in its public communication strategy. Where gaps or limitations exist, the electrical corporation must indicate the remedial action plan and the timeline for resolving the gaps or limitations. For all requested information, the electrical corporation should indicate a form of verification that can be provided upon request for compliance assurance.

Table 8-50 Key Gaps and Limitations in Public Emergency Communication Strategy

Subject of Gap or Limitation	Brief Description of Gap/ Limitation	Strategy for Improvement
PSPS Awareness	Customer recall of PSPS is down from levels observed in 2021	**Strategy**: Focus communications on preparedness for outage, whether due to PSPS or other factors. Promote Pacific Power website as a resource for information (e.g., via bill insert, social media) **Target Timeline**: Year round
Generator Rebate Program	Customer awareness of generator rebate program remains low (8%)	**Strategy**: Add/ emphasize information about the generator rebate program to preparedness communications **Target Timeline**: Year round in alignment with outage awareness communications

Wildfire Safety Communications Awareness	Wildfire safety awareness among customers has decreased since November 2022	**Strategy**: Reevaluate off season messaging and cadence in pre-fire season survey **Target Timeline**: April 2024

8.4.5 Preparedness and Planning for Service Restoration

8.4.5.1 Overview of Service Restoration Plan

Pacific Power has implemented policies and procedures to ensure a timely response to emergency outages and to coordinate the necessary personnel and resources to ensure timely restoration.

This plan outlines steps that will be taken to ensure restoration is coordinated based on expected outage duration and level of damage to determine when an appropriate handoff or escalation is needed. In general, priorities are set such that service is restored first to critical and essential customers, and that the largest number of customers receive service in the shortest amount of time. The dispatcher and/or local operations managers will coordinate field response. Crews are assembled in the area(s) being impacted by the outage. Based on expected outage duration and material damage, the logistics are handled by the Emergency Coordination Centers (ECC).

Though there may be exceptions, the following represents system restoration priorities, from highest priority to lower priority:

1. Transmission substations and associated lines.
1. Sub-transmission substations and associated lines.
2. Three-phase feeders.
3. Single-phase primary lines.
4. Service wires on the low-voltage side of the transformer.

Exceptions to this priority listing could include situations endangering life and property, critical customers, and restoration performed at the request of civil authorities. These exceptions shall be handled by the Incident Management Team on a case-by-case basis.

Overview:

Critical customers are those who rely on Pacific Power to provide electrical power for the vital sustainment of life, essential service to a community or large revenue customers who are important financially to both the company and the community. There are three categories of critical customers that Pacific Power serves:

- **Access and Functional Needs, such as Medical Baseline Customers:** Life support customers are those residential customers who depend on electrical power to maintain machinery or equipment vital to sustainment of life. These may include dialysis machines, breathing apparatus or other critical medical equipment needed. Pacific Power will make every attempt to restore these customers as soon as possible.

- **Critical Infrastructure Customers:** Key customers are those who use electrical power to provide an essential service to a community. These customers could include police, fire, hospitals, airports, television, and radio stations. The locations and specific requirements of these customers shall be determined and tracked locally, and these customers shall be given priority, as practical, during restoration efforts. These customers usually have some type of backup generation that automatically engages when there is a loss of AC power.

- **Strategic Customers:** Strategic customers are typically large-revenue customers who are important financially to both the company and the community. Typically, these customers are manufacturing plants, but they also may be government installations, municipalities, or other entities. These customers may have backup or self-generation that allows them to continue all or part of their activities upon loss of utility power. These power systems, if they feed into the utility's local system, are already coordinated with the utility prior to the disaster. Strategic customers are assigned account representatives who should be involved with all contacts with these customers before, during, and after an emergency.

At this time Pacific Power does not have an operational flow diagram to address this procedure.

Drills, simulations, and tabletop exercises are covered in section 8.4.2.3 Drills, Simulations, and Tabletop Exercises. Table 8-41 lists internal and table 8-42 list external drills, simulations and tabletop exercises.

Coordination and collaboration with public safety partners (e.g., interoperable communications) are covered in previous section 8.4.3. External Collaboration and Coordination, specifically 8.4.3.2 Communication strategy with Public Safety Partners and on table 8-46. External agencies and public safety partners are listed in table 8-44.

Notification of and communication to customers during and after a wildfire- or PSPS-related outage are covered in the previous section 8.4.4 Public Emergency Communications Strategy and table 8-49.

8.4.5.2 Planning and Allocation of Resources

Prior to the start of a potential PSPS event, a company meteorologist provides the coincidence of assets and weather that may result in a PSPS. All identified circuits, or portions of circuits, are geographically shared with operations incident command. Field resources are assigned to pre-inspect assets and vegetation and staged in advance of the potential event to observe strategic locations within each of the impact areas. The role of the observer is to look for unsafe conditions that may trigger the need to de-energize lines for safety. Some of these conditions may include wind conditions causing debris or vegetation to potentially fly into lines, and/or extreme conductor movement that may lead to wires contacting each other.

Each circuit, or portion of circuit, that may be impacted by a PSPS event has a pre-defined resource allocation for pre-inspection, observation and restoration activities for overhead line sections. These resource requirements are documented in the field incident response plan, and within the switching restoration plans. The plan also identifies if the line could be patrolled on the ground, identifies known areas that may not be safe for patrol in the dark, and considers areas where helicopter patrol is feasible. Based on the total resources needed to patrol all line segments impacted by a PSPS event estimated restoration times based on switching evolution is calculated. If there is a large enough event that there is a shortage of patrol resources, then restorations are prioritized by critical infrastructure affected and the number of customers impacted to prioritize restoration circuits.

Restoration Priorities and Resource plans are approved by the Emergency Coordination Center Director. Additionally, each individual authorization to patrol and authorization to re-energize is issued by ECC Director after consulting with a company meteorologist and field observers to confirm conditions have subsided.

8.4.5.3 Drills, Simulations, and Tabletop Exercises

Internal Exercises

Table 8-51 Internal Drill, Simulation, and Tabletop Exercise Program for Service Restoration

Category	Exercise Title and Type	Purpose	Exercise Frequency	Position of Title of Personnel Required to Participate	Personnel Required	Personnel Completed	Form of Verification or Reference
Tabletop Exercise	Joint Information System Tabletop	To ensure that we are operationally ready to carry out the roles and responsibilities within the Joint Information System (JIS) environment during a PSPS event	Annually	Communications Representative Regional Business Mangers Customer Service Representatives Emergency Management	16	21	Teams Meeting Record & Exercise Invite

External Exercises

Table 8-52 External Drill, Simulation, and Tabletop Exercise Program for Service Restoration

Category	Exercise Title and Type	Purpose	Exercise Frequency	Position or Title of Personnel Required to Participate	Personnel Required	Personnel Completed	Form of Verification or Reference
Discussion-Based	Siskiyou Co PSPS TTX	Enhance awareness of PSPS plan. Understand roles and responsibilities. Validate restoration plans and procedures.	Annually	Program Director of Emergency Management Region Systems Operations Program Manager and supervisors Emergency Operations Center Manager Public Safety Partners such as Fire chief(s) or liaison Police, sheriff, and CHP chiefs or liaisons County Health liaison American Red Cross liaison Emergency Operations Supervisor(s) for relevant city/county jurisdictions	50	48	HSEEP Documentation and completion logs as provided to CPUC

Category	Exercise Title and Type	Purpose	Exercise Frequency	Position or Title of Personnel Required to Participate	Personnel Required	Personnel Completed	Form of Verification or Reference
Operations Based	Siskiyou Co PSPS FSE	Provide utility and public safety partners an opportunity to practice coordination and communications functions to respond to and recover from a PSPS event	Annually	Program Director of Emergency Management Region Systems Operations Program Manager and supervisors Emergency Operations Center Manager Public Safety Partners such as Fire chief(s) or liaison Police, sheriff, and CHP chiefs or liaisons County Health liaison American Red Cross liaison Emergency Operations Supervisor(s) for relevant city/county jurisdictions	20	52	HSEEP documentation as provided to CPUC

8.4.6 Customer Support in Wildfire and PSPS Emergencies

In this section of the WMP, the electrical corporation must provide an overview of its programs, systems, and protocols to support residential and non-residential customers in wildfire emergencies and PSPS events.

Outage reporting - In reporting outages, Pacific Power will continue its customer outage management protocols and real-time outage maps to inform customers about the presence and location of outages as well as the estimated restoration plans. Details regarding Pacific Power's PSPS-specific notifications, tools, messaging, and support services have been included in the PSPS Execution Playbook. Additionally, Pacific Power has the following wildfire emergency-related customer support programs.

Support for low-income customers — Pacific Power's support for low-income customers program includes the ability to:

- Freeze all standard and high-usage reviews for the CARE program eligibility until the 12-month period has lapsed, or potentially longer.
- Contact all community outreach contractors and community-based organizations who assist in enrolling hard-to-reach low-income customers, to better inform customers of these eligibility changes.
- Partner with program administrators of the customer-funded emergency assistance program for low-income customers and increase the assistance limit amount for affected customers during the following 12-month period.

Billing adjustments — Pacific Power can adjust billing, including prorating monthly bill to the date of the emergency or subsequent damage to customer premises and recalibrating energy usage estimates when premises are unoccupied because of a disaster.

Deposit waivers — Pacific Power can waive deposit and late fee requirements for one year from the declared emergency.

Extended payment plans — Affected customers with existing service or those seeking to establish service at a new residence, who have an old bill, are offered a payment plan with 20% due, with equal installments for the remainder for at least 12 billing cycles with no interest.

Suspension of disconnection and nonpayment fees — Pacific Power may suspend disconnection for nonpayment and associated fees and eliminate reporting to credit reporting agencies or any collection services for unpaid bills.

Repair processing and timing — Immediately after the emergency, the company assesses the premises of affected customers whose utility service had been disrupted or degraded and, if applicable, the meter is removed. Every attempt is made to have service available to the customer immediately after the PSPS event or emergency is over. Additionally, time from when the service is requested is tracked.

Community support centers — Pacific Power has logistical support for deployment of community support centers, if necessary, during a PSPS event. Customers can access Pacific Power representatives in person at the Community Resource Centers, on the phone via the Customer Service phone number and online via social media platforms.

Medical Baseline Support Services – Pacific Power provide medical baseline support services through the portable battery program described in Section 9.4 as well as the AFN notification protocols described in the PSPS Execution Playbook Section 6. This WMP activity is tracked with Tracking ID# EP-05.

Access to utility representatives — Pacific Power will directly contact customers with damaged facilities after the meter is removed from the damaged property and will expedite any work required to reinstate electrical service. Additionally, Pacific Power will closely coordinate with local agencies to facilitate any permitting requirements and ensure work is completed as quickly as practical. Furthermore, when activated, CRC's described in Section 8.4.3.2 are staffed with Pacific Power employees to support customers locally during events.

8.5 COMMUNITY OUTREACH AND ENGAGEMENT

8.5.1 Overview

In this section, the electrical corporation must identify objectives for the next 3- and 10-year periods, targets, and performance metrics related to the following community outreach and engagement mitigation initiatives.

Public outreach and education

Pacific Power provides wildfire safety, preparedness and PSPS public outreach and education of wildfire mitigation efforts through a variety of communication channels. This information is provided in greater detail in Section 8.5.2.

Public engagement in the WMP decision-making process

Pacific Power's wildfire mitigation efforts have continued to develop and evolve across all categories since the submission of the 2021 and 2022 WMP Update. Program modifications are made based on customer feedback acquired through surveys that are conducted with residential, business and Community Based Organization (CBO) customers. Pacific Power compiles customer feedback, internal analysis, subject matter expertise, external industry collaboration and benchmarking, and feedback from stakeholders and regulators such as the Office of Energy Infrastructure Safety (OEIS). The company's particular areas of focus in 2023 include enhancing data analytics and modeling capabilities, evaluating technologies and efficacy studies to assess wildfire mitigation strategies and PSPS risk, and enhancing PSPS preparedness.

Engagement with AFN populations, local governments, and tribal communities

Pacific Power continues to refine and enhance both identification of AFN customers and ongoing communication targeted to reach more AFN customers. While all medical baseline customers are identified as AFN customers, in 2023, Pacific Power intends to increase outreach to all customers to identify more customers relying on medical equipment and to broaden the scope of customers who self-identify as AFN. California Alternate Rates for Energy (CARE) applications are sent to all residential customers. In 2021, Pacific Power added a check box on the CARE application asking customers to identify as AFN. The check box added an additional 193 AFN customers throughout the service territory. Additional information is provided in Section 8.5.2

Collaboration on local wildfire mitigation and planning

In 2022, Pacific Power enhanced its emergency preparedness plan in collaboration with key internal business units and external public safety partners. Pacific Power meets at least annually with county and local emergency management agencies, public health authorities, local law enforcement and fire jurisdictions and other interested parties. Through these meeting, Pacific Power gathers inputs from the community and adjusts plans as needed.

Pacific Power also participates in regulatory proceedings, town hall meetings, and open-house events to engage other industry leaders, and community leaders and members. These events focus on a range of aspects of Pacific Power's wildfire emergency planning and preparedness programs, including communication protocols, notification protocols, and resource coordination efforts.

Best practice sharing with other electrical corporations from within and outside of California

Industry collaboration is another component of Pacific Power's Wildfire Mitigation Plan. Through active participation in workshops, international and national forums, consortiums, and advisory boards, Pacific Power maintains an understanding of existing best practices and collaborates with industry experts regarding new technologies and research. Through our lessons learned we have been able to develop processes and procedures that are being adopted in other states and countries in coordination with other agencies and jurisdictions.

Pacific Power is an active member of the International Wildfire Risk Mitigation Consortium, an industry-sponsored collaborative that shares wildfire risk mitigation insights and discoveries of innovative, unique utility wildfire practices from across the globe. This consortium, with working groups focused in the areas of asset management, operations and protocols, risk management, and vegetation management, supports working and networking channels between members of the global utility community to support the ongoing sharing of data, information, technology, and practices.

Additionally, Pacific Power plays leadership and support roles through other organizations such as the Edison Electric Institute, the Electric Sector Coordinating Council, and the Institute of Electrical and Electronics Engineers (IEEE). Within the western United States, Pacific Power also engages with the Western Energy Institute and the Rocky Mountain Electric League as well as the Western Protective Relaying Conference.

8.5.1.1 Objectives

Each electrical corporation must summarize the objectives for its 3-year and 10-year plans for implementing and improving its community outreach and engagement.

The following tables describes Pacific Power's 3-year and 10-year plans for implementing and improving community outreach and awareness.

Table 8-53 Community Outreach and Engagement Initiative Objectives (3-year plan)

Objectives for Three Years (2023–2025)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Perform Pre and Post-fire season customer survey	CO-01	CPUC D. 20-06-017 Appendix A Part E	Survey results	Pre-Season Survey Once a year in Q2 Post-Season Survey Once a year in Q4	8.5.2
Continue partnering with public safety partners in communities throughout California regarding wildfire safety and preparedness and PSPS	CO-03	Requirement to provide updated PSPS processes to public safety partners	Records of public safety partner meetings, workshops and exercises	Oct. 2025	8.5.4
Increase outreach to AFN populations	CO-02	Requirement to engage AFN/vulnerable populations in PSPS areas.	Records of produced outreach materials both print and digital and records of materials broadcasted or sent throughout the service territory in various languages and communication channels	Oct. 2025	8.5.3

Objectives for Three Years (2023–2025)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Implement customer feedback from post season wildfire mitigation surveys into future outreach efforts	CO-01	CPUC D. 20-06-017 Appendix A Part E	Records of wildfire strategic plan implementation of media, both paid and earned and proactive media that correlates with customer feedback.	Oct. 2025	8.5.2

Table 8-54 Community Outreach and Engagement Initiative Objectives (10-year plan)

Objectives for Ten Years (2026–2032)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Improve surveys based on 2023-2025 experience	CO-01	CPUC D. 20-06-017 Appendix A Part E		2028	8.5.2
Continue to meet every two-three years with other utilities to discuss best practices and lessons learned	CO-04	Guidance document for sharing data and information externally	Records of meeting and travel logs to a wildfire mitigation meeting, workshop or conference of peer utilities	Oct. 2032	8.5.5
Increase availability of website wildfire and PSPS resources into additional languages	CO-01	Requirement to engage AFN/vulnerable populations in PSPS areas	Records of websites updates and logs showing an increased resource library in additional languages	Oct. 2032	8.5.2

Objectives for Ten Years (2026–2032)	Applicable Initiative(s), Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Continue to increase outreach to AFN populations	CO-02	CPUC D. 20-06-017 Appendix A Part G	Records of increased efforts to reach AFN customers via communication channels	Oct. 2032	8.5.3

8.5.1.2 Targets

Initiative targets are forward-looking quantifiable measurements of activities identified by each electrical corporation in its WMP. Electrical corporations will show progress toward completing targets in subsequent reports, including QDRs and WMP Updates.

Table 8-55 Community Outreach and Engagement Initiative Targets by Year

Initiative Activity	Tracking ID	2023 Target & Unit	x% Risk Impact 2023	2024 Target & Unit	x% Risk Impact 2024	2025 Target & Unit	x% Risk Impact 2025	Method of Verification
Pre-fire season survey	CO-01	50% or more of the sample survey are aware of wildfire safety communications	TBD	55% or more of the sample survey are aware of wildfire safety communications	TBD	60% or more of the sample survey are aware of wildfire safety communications	TBD	MDC Research conducts the survey and provides the results through survey reports.

Initiative Activity	Tracking ID	2023 Target & Unit	x% Risk Impact 2023	2024 Target & Unit	x% Risk Impact 2024	2025 Target & Unit	x% Risk Impact 2025	Method of Verification
Pre-fire season survey	CO-01	Pacific Power remains the most mentioned source of communication about wildfire preparedness	TBD	Pacific Power remains the most mentioed source of communication about wildfire preparedness	TBD	Pacific Power remains the most mentioed source of communication about wildfire preparedness	TBD	MDC Research conducts the survey and provides the results through survey reports.

Table 8-56 PSPS Outreach and Engagement Initiative Targets by Year

Initiative Activity	Tracking ID	Target End of Q2 2023 & Unit	Target End of Q3 2023 & Unit	End of Year Target 2023 & Unit	x% Risk Impact 2023	Target End of Q2 2024 & Unit	Target End of Q3 2024 & Unit	End of Year Target 2024 & Unit	x% Risk Impact 2024	Target 2025 & Unit	x% Risk Impact 2025	Method of Verification
AFN resources on the website	CO-01	0	1 additional language for the medical certificate	1 additional language for the medical certificate	TBD	0	1 additional language for the medical certificate	1 additional language for the medical certificate	TBD	1 additional language for the medical certificate	TBD	Review of the website and backend logs

8.5.1.3 Performance Metrics Identified by the Electrical Corporation

Performance metrics indicate the extent to which an electrical corporation's Wildfire Mitigation Plan is driving performance outcomes. Each electrical corporation must:

List the performance metrics the electrical corporation uses to evaluate the effectiveness of its community outreach and engagement in reducing wildfire and PSPS risk

For each of those performance metrics listed, the electrical corporation must:

- Report the electrical corporation's performance since 2020 (if previously collected)
- Project performance for 2023-2025
- List method of verification

Based on an average of three PSPS events that occurred in Pacific Power's California service territory between 2020-2021, Pacific Power's overall success rate in customer contact prior to a PSPS event has been 94% and the company's success rate in contacting medical baseline customers prior to a PSPS event impacting them has been 100%. In 2022 there was no PSPS event in the Pacific Power service territory for California.

With the increased focus of pre-event communication through phone calls, text, email, TV, radio, and social media, Pacific Power has set a goal of 100% overall notification for years 2023-2025 and will continue 100% notification for medical baseline customers.

Table 8-57 Community Outreach and Engagement Performance Metrics Results by Year

Performance Metrics	2020	2021	2022	2023 Projected	2024 Projected	2025 Projected	Method of Verification (e.g., third-party evaluation, QDR)
% of customers notified prior to a PSPS event impacting them	100%	88%	N/A[22]	100%	100%	100%	Customer service logs, public safety partners
% of medical baseline customers notified prior to a PSPS event	100%	100%	N/A	100%	100%	100%	Customer service logs, public safety partners

[22] Pacific Power did not conduct a PSPS event in 2022.

8.5.2 Public Outreach and Education Awareness Program

The electrical corporation must provide a high-level overview of its public outreach and education awareness program(s) for wildfires; outages due to wildfires, PSPS events, and protective equipment and device settings; service restoration before, during, and after the incidents (as required by Public Utilities Code section 8386[c][19][B]); and vegetation management. This includes outreach efforts in English, Spanish, Chinese (including Cantonese, Mandarin, and other Chinese languages), Tagalog, and Vietnamese, as well as Korean and Russian where those languages are prevalent within the service territory.

Overview – Public Outreach and Education Awareness Program

Pacific Power maintains a flexible, dynamic education and awareness strategy that is informed by customer survey data, community stakeholder input, and community needs. Some communication efforts target the company's entire customer base, while other communications target communities in the HFTD with some overlap into non-HFTD locations depending on the media market and distribution channel. Overall, Pacific Power's outreach includes information that can be heard, watched, discussed and read in a variety of ways with the goal of accessibility and understandability. This WMP activity is tracked with Tracking ID# CO-01.

Pacific Power notifies customers and delivers clear and understandable information; communications are available in different languages (English, Spanish, Chinese traditional, Chinese simplified, German, Hmong, Mixteco, Vietnamese and Tagalog) and use multiple modes/channels to reach different AFN populations.

Pacific Power regional business managers maintain company relationships with local government jurisdictions, tribal communities and community based organizations. Regional business managers are the primary contact for local leadership and critical customers in their area of responsibility. Pacific Power also routinely provides collateral, such as brochures and safety checklists for distribution through these organizations to customers.

Pacific Power's emergency management teams work with local government public safety agencies and tribal communities to discuss the impacts of PSPS events, how to prepare for them, to account for vulnerable populations and to predetermine the appropriate deployment locations for Community Resource Centers (CRCs) to ensure accessibility for customers.

Additional information is available in the Pacific Power 2023 AFN Plan – Attachment A, Sections 2.1.5, 2.2 and 2.3.

Table 8-58 List of Target Communities

Target Community	Interests or Concerns Before, During, and After Wildfire and PSPS events
AFN populations including Medical Baseline customers	Limited access to information and resources to understand the risks of wildfire, how to prepare individually and what steps Pacific Power has taken to harden our infrastructure, the steps we take to initiate a PSPS event and how the restoration process is conducted and how we communicate with customers during each phase.
Community Based Organizations	These organizations are established in the communities as entities that provide essential and consistent services to the residents and are a place that residents rely on for information. In working with these organizations, Pacific Power can provide wildfire and PSSP information before, during and after an event which provides an additional reach to customers that may not seek out information on Pacific Power's website, App and customer service.
Rural Residential Customers	Limited access to information and resources based upon geographical location and available essential services. Information on defensible space, understanding the steps we take to initiate a PSPS event and how the restoration process is conducted and how we communicate with customers during each phase
Commercial Customers that have a high impact of essential services to a small community with limited resources	Working with essential service businesses and those that provide considerable employment or resources to a community. To provide timely information when Pacific Power is preparing for a PSPS event to mitigate adverse effects to available services and resources within the community by the businesses having time to implement continuity plans.

Table 8-59 List of Community Partners

Community Partners	County	City
Modoc County Emergency Management	Modoc	Alturas
Happy Camp Fire Protection District	Siskiyou	Happy Camp
Siskiyou County Emergency Management	Siskiyou	Yreka
Karuk Tribe	Siskiyou	Happy Camp
Dunsmuir Fire Department	Siskiyou	Dunsmuir
Salvation Army	Siskiyou	Yreka

Community Partners	County	City
Family and Community Resource Center of Weed	Siskiyou	Weed
Family and Community Resource Center of Happy Camp	Siskiyou	Happy Camp
Family and Community Resource Center of Mt. Shasta	Siskiyou	Mt. Shasta
Family and Community Resource Center of Dunsmuir	Siskiyou	Dunsmuir
South Yreka Fire Department	Siskiyou	Yreka
Fire Safe Councils - Siskiyou	Siskiyou	Yreka
Fires Safe Councils - Dunsmuir	Siskiyou	Dunsmuir
Siskiyou Childcare Council	Siskiyou	Weed
Siskiyou Economic Development	Siskiyou	Yreka

Table 8-60 Community Outreach and Education Programs

Core Activity	Event Type	Period of Application (Before, During, After Incident)	Name of Outreach or Education Program	Description of Program	Target Audience	Reference/ Link
Website information	Wildfire	Before	Wildfire and Grid Hardening	The website provides information on Pacific Power's efforts to harden the grid and infrastructure to be more resilient against wildfires	General public, AFN customers, Rural customers and Commercial customers	https://www.pacificpower.net/outages-safety/wildfire-safety.html

Core Activity	Event Type	Period of Application (Before, During, After Incident)	Name of Outreach or Education Program	Description of Program	Target Audience	Reference/ Link
Website information	Wildfire /PSPS	Before, during and after	PSPS	The website provides information and actions that should be taken before during and after a PSPS event	General public, AFN customers, Rural customers and Commercial customers	https://www.pacificpower.net/outages-safety/wildfire-safety/public-safety-power-shutoff.html
Website information	Vegetation management for customers	Before	General hazards prevention and mitigation	The website provides information and actions that should be taken for managing vegetation on private property and what customers should do if they see a hazard with the power lines	General public, AFN customers, Rural customers and Commercial customers	https://www.pacificpower.net/outages-safety/vegetation-management.html
PSPS Webinar	Wildfire /PSPS	Before	PSPS Pre-Wildfire Season Webinar	Explanation of the mitigation measures, how Pacific Power will conduct a PSPS event if needed and how it will be communicated to customers	General public, AFN customers, Rural customers and Commercial customers	N/A

Core Activity	Event Type	Period of Application (Before, During, After Incident)	Name of Outreach or Education Program	Description of Program	Target Audience	Reference/ Link
PSPS Townhalls	Wildfire /PSPS	After	PSPS Post-Wildfire Season Townhalls	If there is a PSPS event, Pacific Power will conduct post wildfire season townhalls with the affected communities to gather feedback as part of the effort to continue to improve communications and expectations with the communities and customers.	General public, AFN customers, Rural customers and Commercial customers	If there is a PSPS, in person community meetings

8.5.3 Engagement with Access and Functional Needs Populations

In this section, the electrical corporation must provide an overview of its process for understanding, evaluating, designing, and implementing wildfire and PSPS risk mitigation strategies, policies, and procedures specific to AFN customers across its territory. The electrical corporation must also report, at a minimum, on the following:

- Summary of key AFN demographics, distribution, and percentage of total customer base.
- Evaluation of the specific challenges and needs during a wildfire or PSPS event of the electrical corporation's AFN customer base.
- Plans to address specific needs of the AFN customer base throughout the service territory specific to the unique threats that wildfires and PSPS events may pose for those populations before, during, and after the incidents. This should include high-level strategies, policies, programs, and procedures for outreach, engagement in the development and implementation of the AFN-specific risk mitigation strategies, and ongoing feedback practices.

From February 2022 to January 17, 2023, the company had a net increase of 314 customers who identified as AFN, which represents approximately a 67% increase in AFN customer identification over the year. The total AFN population on January 17, 2023 was 781 customers or approximately 1.7% of the company's customer base. For details on the distribution of AFN customers, see section 5.4.1.

Pacific Power continues to refine and enhance both identification of AFN customers and ongoing communication targeted to reach more AFN customers. While all medical baseline customers are identified as AFN customers, in 2023, Pacific Power intends to increase outreach to all customers to identify more customers relying on medical equipment and to broaden the scope of customers who self-identify as AFN. Customers will receive communications about the medical baseline rate and a Spanish version of the medical baseline application will be available on the website this year.

California Alternate Rates for Energy (CARE) applications are sent to all residential customers. In 2021, Pacific Power added a check box on the CARE application asking customers to identify as AFN. As a result of the update to the CARE applications, an additional 1,470 AFN customers (total) throughout the service territory. The updates made to the Company's CARE application has shown positive results, with approximately 60% of the Company's AFN customers attributed to this AFN identification channel. Given the positive results, Pacific Power intends to retain this feature.

Pacific Power AFN customers can access information on wildfire preparedness and programs through communication campaigns, outreach, personal contact and following when an event is forecasted on the company's website.

Pacific Power provides additional PSPS notifications to individuals classified as medical baseline customers in Pacific Power's customer service system and to individuals who self-identify as having access and functional needs (AFN). Having key messages across several communications channels and materials asking AFN customers to self-identify with the company is a central component to the company's community engagement and customer outreach strategy. Pacific Power has engaged a vendor to survey AFN population to help inform the company's communication outreach related to those customers. This includes assessing the need and type of communications for people with AFN who may not be able to use standard forms of communication. Survey data has informed the overall strategy and the company has adjusted and expanded where key messages are disseminated to increase AFN self-identification.

Pre-fire season, Pacific Power enhances online customer communications through the website, customer notification emails, social media, wildfire webinars and partners with Community Based Organizations, Tribal Authorities, companies providing medical equipment, local governments, and community centers to amplify the reach to customers and clients. Pacific Power's website provides digital brochures and handouts that contain information on resiliency for medical equipment, wildfire preparedness, how to identify as AFN, and the medical baseline program. Outreach is available in multiple languages including Chinese traditional, Chinese simplified, Tagalog, Vietnamese, Mixteco, Zapoteco, Hmong, German, and Spanish.

The company's customer care agents have access to and training with wildfire safety and preparedness and PSPS-related communications and can facilitate a conversation between the customer and translation service to ensure the customer receives the wildfire safety and preparedness and PSPS-related information they need.

Additionally, Pacific Power, through a third party vendor, MDC Research, conducts annual online and phone surveys with customers, including independent living, assisted living and skilled nursing centers and AFN representatives and CBOs (Family and Community Resource Center of Weed, Mount Shasta CRC, Dunsmuir CRC, Happy Camp Family/CRC, Yreka CRC, HUB Communities, Tulelake/Newell FRC, Scott Valley CRC, Helping Right Now, among others) located in potential PSPS areas regarding the company's PSPS and wildfire safety communications.

PSPS Activation, when a PSPS event is forecasted, a list of impacted customers is extracted from the GIS system. AFN customers are identified, and the list is provided to employees for personal phone calls to each customer. Pacific Power has sectionalized high fire consequence areas into small zones for possible de-energization. By reducing the number of customers affected by an event, the number of AFN customers is subsequently reduced.

The smaller numbers allow Pacific Power to personally reach out to each AFN customer. The results of the contact are reported to the ECC Manager. Contact occurs prior to an event, at the beginning of re-energization, and after energization is completed. If the AFN customer needs additional assistance, the ECC Manager can quickly relay the information to the county's emergency manager.

Post PSPS and Restoration, AFN customers are contacted by an employee of the company after the power is restored. It is a continuation of the ongoing contact prior and throughout a PSPS event. The check-in ensures no additional support is needed for the customer after the power is restored. Pacific Power works to deliver consistent services and resource offerings to AFN customers:

Identification of individuals who are electricity dependent

- Collaborate with State and Community Based Organizations (CBOs) to leverage the common definition and identify targeted outreach opportunities
- Continue to deploy and expand strategies to enhance identification of individuals with AFN:
- Partner with state agencies, hospital associations, healthcare providers, and CBOs to identify targeted audiences
- Marketing to promote beneficial programs like Medical Baseline and CARE to reach individuals with AFN
- Marketing and outreach to encourage customers to self-identify as individuals with AFN
- Continue to promote the ability for customers to "self-certify/identify" as individuals with AFN/Vulnerable Customer status across new channels including websites

Establish communication plan that reaches all AFN segments

- Provide communications in prevalent languages and preferred formats, including ASL communications (e.g., notifications, programs and resources information)
- Partnering with state agencies, hospital associations, healthcare providers, durable medical equipment companies, multifamily dwellings, paratransit companies, and community-based organizations to further promote assistance programs

Support AFN customers during a PSPS Event

- Community Resource Centers staffed with emergency medical personnel and other services.

- Call each AFN customer prior to an event, during an event, and after event to ensure the safety of the individual.
- Incorporate a direct feedback loop with Incident Command and local Emergency Management.

8.5.4 Collaboration on Local Wildfire Mitigation Planning

In this section, the electrical corporation must provide a high-level overview of its plans, programs, and/or policies for collaborating with communities on local wildfire mitigation planning (e.g., wildfire safety elements in general plans, community wildfire protection plans, local multi-hazard mitigation plans) within its service territory.

Throughout the year, Pacific Power participates in regulatory proceedings, town hall meetings, and open-house events to engage other industry leaders, community leaders and members, and local emergency response management organizations. These events focus on a range of aspects of Pacific Power's wildfire emergency planning and preparedness programs, including communication protocols, notification protocols, and resource coordination efforts.

Table 8-61 Collaboration in Local Wildfire Mitigation Planning

Name of County, City, or Tribal Agency or Civil Society Organization (e.g., nongovernmental organization, fire safe council)	Program, Plan, or Document	Last Version of Collaboration	Level of Collaboration
Siskiyou County	PSPS Playbook	May 2022	Functional Exercise
Del Norte County	PSPS Playbook	Feb 2022	Tabletop Exercise
Modoc County	PSPS Playbook	May 2022	Functional Exercise
Shasta County	PSPS Playbook	May 2022	Functional Exercise
Hoopa Tribe	PSPS Playbook	May 2022	Functional Exercise
Karuk Tribe	PSPS Playbook	May 2022	Functional Exercise
Yurok Tribe	PSPS Playbook	May 2022	Functional Exercise
California OEIS	PSPS Playbook	May 2022	Functional Exercise

See Table 8-46 High-Level Communication Protocols, Procedures, and Systems with Public Safety Partners for this information.

Table 8-62 Key Gaps and Limitations in Collaborating on Local Wildfire Mitigation Planning

Subject of Gap or Limitation	Brief Description of Gap or Limitation	Strategy for Improvement
Low engagement / No feedback received	During the 2022 exercise series limited engagement occurred and little to no feedback was provided by attendees	Strategy: Continue to expand on aspects through exercises, encourage feedback via post exercise surveys, and consider additional engagement through the Wildfire Safety Advisory Board (WSAB) meetings. Target timeline: Kicked off regular WSAB meetings in April 2023, conducted the PSPS Playbook workshop in February of 2023, completed a PSPS tabletop in March of 2023, and plan to perform a functional in May 2023.

8.5.5 Best Practice Sharing with Other Electrical Corporations

In this section, the electrical corporation must provide a high-level overview of its policy for sharing best practices and collaborating with other electrical corporations on technical and programmatic aspects of its WMP program. The narrative must be no more than one page.

In addition, the electrical corporation must provide a list in tabular form of relevant electrical corporations and other entities it has shared or collaborated or intends to continue to share or collaborate or begin sharing or collaborating, with on best practices for technical or programmatic aspects of its WMP program.

For each entity, the best practice subject, date(s) of collaboration, whether the collaboration is technical or programmatic, list of electrical corporation partners, a description of the best practice sharing/collaborative activity with a reference, and any outcomes from that sharing or activity.

Reference the Utility Initiative Tracking ID where appropriate.

The overview and table must be no longer than two pages in the main body of the WMP. The full table can be included as an appendix as needed.

Pacific Power participates in the joint IOUs workstreams where utilities in California share their experience with covered conductor projects. to understand best practices. At the time of this filing, Pacific Power does not have specific policies applied to sharing best practices and collaborating with other electrical corporations on technical and programmatic aspects of its WMP program.

Pacific Power is also an active member of the International Wildfire Risk Mitigation Consortium (IWRMC), an industry-sponsored collaborative designed to facilitate the sharing of wildfire risk mitigation insights and discovery of innovative and unique utility wildfire practices from across the globe. This consortium, with working groups focused in the areas of asset management, operations and protocols, risk management, and vegetation management, facilitates a system of working and networking channels between members of the global utility community to support the ongoing sharing of data, information, technology, and practices.

Additionally, Pacific Power plays leadership and support roles through other organizations such as the Edison Electric Institute (EEI), the Electric Sector Coordinating Council (ESCC), and the Institute of Electrical and Electronics Engineers (IEEE). Within the western United States, Pacific Power also engages with the Western Energy Institute (WEI) and the Rocky Mountain Electric League (RMEL) as well as the Western Protective Relaying Conference. Collaboration also occurs regarding research and applications of technologies through Pacific Power's parent company (Berkshire Hathaway Energy, BHE) and its affiliated companies.

Table **8-63** Best Practice Sharing with Other Electrical Corporations

Best Practice Subject	**Dates of Collaboration (YYYY–YYYY)**	**Technical or Programmatic**	**Electrical Corporation Partner(s)**	**Description of Best Practice Sharing or Collaborating**	**Outcome**
Covered conductor workstream	2020–Current	Technical	PGE, SCE, SDGE, Liberty, Pacific Power, BVES	Share utility experience and promote consistency on reporting of effectiveness and cost of covered conductor	Workstream report completed in February 2023.

9 PUBLIC SAFETY POWER SHUTOFF

9.1 OVERVIEW

In Sections 9.1–9.4 of the WMP,[1] the electrical corporation must:

- Provide a high-level overview of key PSPS statistics
- Identify circuits that have been frequently de-energized and provide measures for how the electrical corporation will reduce the need for, and impact of, future PSPS implementation on those circuits
- Describe expectations for how the electrical corporation's PSPS program will evolve over the next 3 and 10 years
- Describe any lessons learned for PSPS events occurring since the electrical corporation's last WMP submission
- Describe the electrical corporation's protocols for PSPS implementation

9.1.1 Key PSPS Statistics

In this section, the electrical corporation must include a summary table of PSPS event data. These data must be calculated from the same source used in the GIS data submission (i.e., they should be internally consistent). If it is not possible to provide these data from the same source, the electrical corporation must explain why.

Table 9-1 PSPS Event Statistics

	No. of Events	Total Circuits De-energized	Total Customers Impacted	Total Customer Minutes of Interruption
2020	2	1	2,559[23]	
2021	1	6	1,953	
2022	0	0	0	0

[23] As requested in the QDR template from OEIS: customers impacted by PSPS: if multiple PSPS events impact the same customer, count each event as a separate customer.

9.1.2 Identification of Frequently De-energized Circuits

Public Utilities Code section 8386(c)(8) requires the "[i]dentification of circuits that have frequently been de-energized pursuant to a PSPS event to mitigate the risk from wildfire and the measures taken, or planned to be taken, by the electrical corporation to reduce the need for, and impact of, future PSPS of those circuits, including, but not limited to, the estimated annual decline in circuit PSPS and PSPS impact on customers, and replacing, hardening, or undergrounding any portion of the circuit or of upstream transmission or distribution lines.

At the time of this filing, Pacific Power does not calculate the frequently de-energized circuits metric currently since the number of PSPS are historically low as shown in Table 9-1 PSPS Event Statistics above.

Table 9-2 Frequently De-energized Circuits

Entry #	Circuit ID	Name of Circuit	Dates of Outages	Number of Customers Served by Circuit	Number of Customers Affected	Measures Taken, or Planned to Be Taken, to Reduce the Need for and Impact of Future PSPS of Circuit
N/A	N/A	N/A	N/A	N/A	N/A	N/A

9.1.3 Objectives

Each electrical corporation must summarize the objectives for its 3-year and 10-year plans to reduce the scale, scope, and frequency of PSPS events.

Table 9-3 PSPS Objectives (3-year plan)

Objectives for Three Years (2023–2025)	Applicable Initiative(s) & Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Deliver dashboard for situational awareness during PSPS response	EP-03	N/A	Screenshots, system documentation	April 2024	8.4.6
Evaluate expansion of the free portable battery and backup electric power rebate programs	EP-05	N/A	Work orders, WMP updates	December 2025	8.4.4

Table 9-4 PSPS Objectives (10-year plan)

Objectives for Ten Years (2026–2032)	Applicable Initiative(s) & Tracking ID(s)	Applicable Regulations, Codes, Standards, and Best Practices (See Note)	Method of Verification (i.e., program)	Completion Date	Reference (section & page #)
Automate collection and dissemination of key PSPS data	EP-03	N/A	Systems documentation	March 2026	8.4.48.4.6

9.1.4 Targets

Initiative targets are forward-looking quantifiable measurements of activities identified by each electrical corporation in its WMP. Electrical corporations will show progress toward completing targets in subsequent reports, including QDRs and WMP Updates.

Reducing the impact of PSPS is a significant goal of Pacific Power’s WMP and Pacific Power perceives the best way to reduce PSPS impacts is to reduce the number, geographic scope, and duration of PSPS events. While recognizing the general application of all mitigation initiatives to help reduce the impact of PSPS, Pacific Power also acknowledges that certain initiatives are more directly tied to the PSPS Program.

Above all, improved situational awareness reflects a category of initiatives closely related to the PSPS decision-making process. Like other utilities, Pacific Power's situational awareness plans include the installation of additional weather stations to access localized weather risk data and inform decision making. Additionally, to better leverage this weather data and other key information, Pacific Power is investing in range of new data processing and modeling capabilities.

This includes key investment and the development of an operational weather forecast model that leverages fully redundant HPCC capabilities to process and deliver a twice daily 96-hour forecast as described in Section 8.3.5. Furthermore, Pacific Power is continuing to implement Technosylva's WFE-A modeling suite as described in Sections 4.4 and Section 8.3.5, including FireCast, to model fire spread risk daily across Pacific Power's service territory, FireSim to model on demand fires spread potential, and WRRM to quantify asset risk and inform planning.

This additional data and more sophisticated situational awareness model will continue to better inform decision making, which reduces PSPS impacts by (i) reducing the likelihood that a PSPS will be implemented unnecessarily and (ii) facilitating a more surgical application of PSPS, thereby reducing its scope.

Other initiatives have less direct involvement in the PSPS decision-making process. But those initiatives can still have a dramatic influence on reducing PSPS impacts by reducing the likelihood of PSPS. Many of Pacific Power's initiatives are specifically geared to reduce wildfire ignition risk with the most notable being the line rebuild program described in Section 8.1.2.1. Implementation of covered conductor through Pacific Power's line rebuild program, will materially reduce PSPS impacts by (a) making PSPS substantially less likely and (b) helping Pacific Power surgically reduce the size and areas of impact. Above all, the mechanical properties of a covered conductor design physically prevent the initiation of a flash-over due to vegetation on the line. Notably, while data continues to be gathered to better understand specific relationships, the general correlation between wind, vegetation contacts, and wildfire spread is well-understood. Installing covered conductor will increase the grid's resiliency against wind-driven vegetation contacts, which can lead to devasting wildfire ignitions. High winds are, of course, a critical factor in the assessment of risk and considered in any PSPS decision-making process. The mitigation benefits of covered conductor, especially when combined with other grid hardening efforts implemented as part of a rebuild effort, will significantly decrease PSPS impacts by significantly decreasing the likelihood of a PSPS. If the powerlines can withstand higher wind speeds, it will decrease the occurrence of PSPS events. Projects completed through the line rebuild program also give Pacific Power flexibility to take a more surgical approach to PSPS.

Other initiatives specifically address reducing the impact of a PSPS that has actually been implemented. Examples include the portable battery program and generator rebate program discussed in Section 9.4. Additionally, Pacific Power continues improving its readiness to open Community Resource Centers in any community impacted by a PSPS as described in Section 8.4.3.2.

While all of Pacific Power's initiatives mitigate PSPS impacts to some extent, Pacific power's key initiative targets that mitigate the impact of PSPS are included in the table below. These initiatives are not considered additive and are further described in each program's corresponding section in the WMP.

Table 9-5 PSPS Targets

Initiative Activity	Tracking ID	2023 Target & Unit	x% Risk Impact 2023	2024 Target & Unit	x% Risk Impact 2024	2025 Target & Unit	x% Risk Impact 2025	Method of Verification
Line Rebuild	GH-01	130 Line Miles	TBD	80 Line Miles	TBD	80 Line Miles	TBD	Completed work orders/GIS Data Submissions
Installation of System Automatio n Devices	GH-04	40 Devices		20 Devices		10 Devices		Completed work orders/ GIS Data Submission(s)/Charging authorization forms
Installation of Weather Stations	SA-01	12 Stations		8 Stations		6 Stations		Completed work orders, GIS Data Submission(s)
External Collaborati on and Coordinati on	EP-02	1 Tabletop Exercise		1 Tabletop Exercise		1 Tabletop Exercise		After Action Report and Improvement Plan

9.1.5 Performance Metrics Identified by the Electrical Corporation

Performance metrics indicate the extent to which an electrical corporation's Wildfire Mitigation Plan is driving performance outcomes.

At the time of this filing, Pacific Power has only conducted a limited amount of PSPS events to develop performance metrics. Our goal over time is to conduct mitigation efforts in order to reduce the amount of PSPS events, circuits and impacted customers over time. The scale and frequency of PSPS events is largely weather driven. For each PSPS event, the goal is to notify all impacted customers at least 24 hours prior to any PSPS event.

Table 9-6 PSPS Performance Metrics Results by Year

Performance Metrics	2020	2021	2022	2023 Projected	2024 Projected	2025 Projected	Method of Verification (e.g., third-party evaluation, QDR)
Percentage of impacted customers notified at least 24 hours before a PSPS event	100%	88%	N/A[24]	100%	100%	100%	QDR
Numbers of circuits de-energized	1	6	0	3	2	0	QDR
Numbers of customers impacted	2,559	1,953	0	2,000	1,000	0	QDR

9.1.6 Protocols on PSPS

The electrical corporation must describe its protocols on PSPS implementation

PSPS Monitoring and Review

Multiple factors are considered when deciding to de-energize. The primary factors considered are as follows:

72-Hour weather circuit forecast: Prior to an Emergency Coordination Center activation, Meteorology issues a weather circuit forecast, which is a matrix of circuit-associated weather stations and numerous forecasted winds and expected outage parameters. The 72-hour weather circuit forecast, also referred to the District-Level Wildfire Risk Matrix, is a high-level forecast which includes districts or areas within a district that could be impacted. See Section 8.3.6.1The 48-hour and 24-hour weather circuit forecasts include a 48-hour peak gust value and time of achieving that gust, a 24-hour peak gust value and time of achieving that gust, earliest date/time to reach the 95th percentile, and the forecasted max gusts for all weather stations. The weather circuit forecast becomes a reference point to assess which areas demand greater focus as the event unfolds. See section 6.3 for greater detail on meteorological processes. See Section 8.3.6 for more information regarding Pacific Power's daily forecast process and Fire Potential Index.

Pre-event inspections and strategic field observations: Field observers look for tree branches and unsecured customer items (tarps, umbrellas) or whether conductors are still, swaying, or galloping in the wind. Depending on the situation, a field observer may report

[24] Pacific Power did not conduct any PSPS events in 2022.

on an hourly basis or may be asked to report on a more frequent basis. They also have the ability to radio in and declare if a situation is unsafe based on their observations. These field observer reports may inform decisions about the use of PSPS. These reports are not measurements but provide situational awareness that is combined with other quantitative information sources that meteorology uses to inform the ECC director to determine PSPS actions.

Information from emergency services: During days with extreme risk and in preparation for potential PSPS events, many first responder agencies, including police and fire, are in active communication with the ECC staff. These agencies provide information and understanding that if a fire were to occur, what suppression resources would be available or may be hampered by conditions or other activities. This information helps to inform decisions regarding PSPS. If a fire should occur, agencies such as CAL FIRE may request to de-energize a line for safety while suppressing a fire. These requests for de-energization are not considered PSPS events but public and firefighter safety protocols.

Meteorology and outage impact data, including 95th and 99th Percentile Winds: Weather data plays a major role in PSPS decision making. The 95th and 99th percentile wind gusts are calculated values based on a statistical analysis of the weather stations history and the coincidental outage incident on the circuit associated with the weather station. Even if a given weather station has a low 99th percentile wind speed that is within the design criteria of most electric lines, several factors will still be considered to determine whether a PSPS is necessary, including if the area rarely sees that wind speed, the chances of foreign object or vegetation contact, and the likelihood of other environmental factors contacting lines. Wind forecasts are also evaluated along with fuels, terrain and other key factors that could indicate the potential for large and damaging fires.

Location of existing fires: Locations of existing fires are communicated and tracked. Active fires can influence PSPS decisions in multiple ways. For instance, an existing fire may indicate potential resource constraints if additional ignitions occur, causing a more conservative approach to de-energization. A PSPS may impact water resources or Emergency Response Incident Command. All factors in determining whether to enact a PSPS or whether to modify the location of a PSPS in favor of additional risk mitigation measures.

Other, non-weather-related factors: Some pertain to information in the field based on unresolved damage found during inspections and active temporary construction/configuration of the electrical system. In the days leading up to a potential PSPS event, these factors are compiled and populated for each sectionalizing device to assist with developing increased awareness of risk levels attributed to assets on the electrical system. Because of these protocols, there is not a standard risk threshold across all devices or risk events. Customers and community partners are then notified of the PSPS potential, and additional inspections of the circuit segments forecasted to be impacted are initiated to assess their condition before the event. Ultimately, forecasts facilitate preparation for a possible PSPS event, however, decisions to de-energize are based off real time conditions in coordination with meteorological and coincidental historical outage data.

This WMP activity is tracked with Tracking ID# PS-01.

9.2 COMMUNICATION STRATEGY FOR PSPS

In Section 8.4.4 of the WMP, the electrical corporation must discuss all public communication strategies for wildfires, outages due to wildfires and PSPS, and service restoration. Thus, in this section, the electrical corporation is only required to provide a cross-reference to Section 8.4.4 and any other section of the WMP providing details of the emergency public communication strategy for PSPS implementation.

Refer to Section 8.4.4.

9.3 KEY PERSONNEL, QUALIFICATIONS, AND TRAINING FOR PSPS

In Section 8.4.2.2 of the WMP, the electrical corporation must discuss all key personnel planning, qualifications, and training for wildfires, outages due to wildfires, and PSPS, and service restoration. Thus, in this section, the electrical corporation is only required to provide a cross-reference to Section 8.4.2.2 and any other section of the WMP providing details of key personnel, qualifications, and training for PSPS implementation.

Refer to Section 8.4.2.2.

9.4 PLANNING AND ALLOCATION OF RESOURCES FOR SERVICE RESTORATION DUE TO PSPS

In Section 8.4.5.2 of the WMP, the electrical corporation must address planning of appropriate resources (e.g., equipment, specialized workers) and allocation of those resources to assure the safety of the public during service restoration. Thus, in this section, the electrical corporation is only required to provide a cross-reference to Section 8.4.5.2 and any other section of the WMP providing details of resource planning for PSPS implementation.

Refer to section 8.4.5.2 for resource planning for PSPS implementation.

Medical Baseline Portable Battery Program

Pacific Power offers free portable batteries to eligible medical baseline customers. The Company offers delivered free-to-the-customer portable batteries to medical baseline customers in its California service territory. The program includes contracted services to manage customer outreach and provide portable batteries, a technical evaluation of the customer's unique needs to specify the correct device education and technical support to the customer once installed. Each customer receives individual education upon installation and remote technical support as needed. Pacific Power will continue to deliver the program in 2023 and it is currently evaluating the sustainability of the program in the long term, for example by offering extended warranties to delivered batteries.

Backup Electric Power Rebate Program

Pacific Power offers a backup electric power rebate for residential customers who reside in Tier 2 or Tier 3 high fire threat districts. All customers are eligible for a $200 rebate for the purchase of one generator or portable battery. CARE and medical baseline customers are eligible for a $400 rebate. Items approved for rebate include portable battery and gasoline generator options. Both tenants and property owners may receive the rebate.

Pacific Power began offering the rebate program in 2021. The Company is working to increase awareness of the programs in place to lessen the impact of PSPS events.

10 LESSONS LEARNED

An electrical corporation must use lessons learned to drive continuous improvement in its WMP. Electrical corporations must include lessons learned due to ongoing monitoring and evaluation initiatives, collaboration with other electrical corporations and industry experts, and feedback from Energy Safety and other regulators.

The electrical corporation must provide a summary of new lessons learned since its most recently approved WMP or WMP Update, and any ongoing improvements to address existing lessons learned. This must include a brief narrative describing the new key lessons learned and a status update on any ongoing improvements due to existing lessons learned. The narrative should be limited to two pages.

Lessons learned can be divided into the three main categories: (1) internal monitoring and evaluation, (2) external collaboration with other electrical corporations, and (3) feedback from Energy Safety or other authoritative bodies. The following are examples of more specific sources of lessons learned:

1. Internal monitoring and evaluation initiatives:
    - Tracking of risk events
    - Findings from fire root cause analysis
    - Drills and exercises
    - Operational and procedural reviews
    - After-action reviews
    - Feedback from community engagement
2. Collaboration with other electrical corporations:
    - Sharing of best practices
    - Cross-utility research
    - Industry working groups
3. Feedback from Energy Safety or other authoritative bodies:
    - Areas of continuous improvement identified in Decisions in the previous WMP evaluation period
    - Findings from post-wildfire investigations by Energy Safety, CAL FIRE, and any other authoritative bodies
    - Findings from Compliance Division assessments

For each lesson learned, the electrical corporation must identify the following in Table 10-1:

- Year the lesson learned was identified
- Subject of the lesson learned
- Specific type or source of lesson learned (as identified in the bullet lists above)
- Brief description of the lesson learned that informed improvement to the WMP
- Brief description of the proposed improvement to the WMP and which initiative(s) or activity(s) the electrical corporation intends to add or modify
- Estimated timeline for implementing the proposed improvement
- Reference to the documentation that describes and substantiates the need for improvement including:
    - Where relevant, a hyperlinked section and page number in the appendix of the WMP
    - Where relevant, the title of the report, date of report, and link to the electrical corporation webpage where the report can be downloaded

Table 10-1 Lessons Learned

ID #	Year of Lesson Learned	Subject	Type or Source of Lesson Learned	Description of Lesson Learned	Proposed WMP Improvement	Timeline for Implementation	Reference
1	2022	Collaboration with other utilities through joint IOU.	Risk Methodology and Assessment	The collaborative workstreams is helpful in the development and implementation of Pacific Power's initial risk-spend-efficiency (RSE)	Continue ongoing collaboration with other utilities to learn best practices,	Ongoing Joint IOUs weekly meetings	Section 7.1.4.1
2	2022	Granular data for sophisticated risk models.	Risk Methodology and Assessment	Investment in more granular data and enterprise support risk models is required to advance Pacific Power's risk modeling capabilities.	Continue investment to provide more granular data that is needed to enhance the risk modeling capabilities.	Q4/2024	Section 8.3.5 and Section 4.4
3	2021/2022	Covered conductor timeline.	Grid Design, Operations, and Maintenance	The timeline to complete a covered conductor project takes a significantly more about of time to complete compared to standard distribution line conductor projects.	Continue planning for the necessary resources needed for the project and estimate existing and new line-rebuild projects from the newly expected delays.	Starting the second half of 2023	Section 8.1.2.1
4	2021/2022	Enhanced IR Inspections	Grid Design, Operations, and Maintenance	Continued findings of conditions through IR inspections highlights the effectiveness of the inspections.	Continue performing an enhanced infrared inspection on transmission lines.	Ongoing	Section 8.1.3.6

ID #	Year of Lesson Learned	Subject	Type or Source of Lesson Learned	Description of Lesson Learned	Proposed WMP Improvement	Timeline for Implementation	Reference
5	2021	Identification of separate vegetation conditions.	Vegetation Management and Inspections	Identification of separate vegetation related conditions expedites work completion.	Continue to identify opportunities to improve Pacific Power's vegetation management mobile data management software with respect to data collection to inform implementation of vegetation management program.	Ongoing, started in 2022.	Section 8.2.2
6	2018	Prescreening sites when on federally managed land.	Vegetation Management and Inspections	Perform environmental desktop prescreening expedited approval of vegetation management programs when completing those were on federally managed land.	Continue performing environmental prescreening activities for programs that will involve federally managed land.	Ongoing, started in 2019.	Section 5.4.4
7	2022	Dataset and data processing investments for risk forecasting.	Situational Awareness and Forecasting	Investment in datasets and data processing capabilities are needed to improve risk forecasting and provide more time to prepare for and assess potential risk events.	Continue investments into datasets and tools that allow for an improved risk forecasting ability to improve the assessment and preparation for risk events.	2023-2024	Section 8.3.5
9	2022	PSPS implementation and coordination	Emergency Preparedness	A PSPS implementation requires significantly more coordination with internal and external stakeholders and customers. It also requires an increased level of data management, documentation, and tracking to endure	Invest in tools to improve documentation and level of data management, documentation, and tracking to endure compliance with all notifications.	2024	Section 6.5

ID #	Year of Lesson Learned	Subject	Type or Source of Lesson Learned	Description of Lesson Learned	Proposed WMP Improvement	Timeline for Implementation	Reference
				compliance with all notifications.			
10	2022	CRC locations for communities	Emergency Preparedness	Collaboration with public safety partners is required for continuous evaluation of CRC locations and services to lessen the impact to customers and communities in a PSPS event.	Continue partnering with public safety partners and community based organizations.	Ongoing	Section 8.4.3.2
11	2021/2022	Communication form Pacific Power to customers.	Community Outreach and Engagement	Direct engagement with tribal leaders assists the company to assist tribal members in need with generators. Customer surveys showed that Pacific Power remained the primary source for wildfire preparedness information.	Continue direct and regular communications with communities within Pacific Powers service territory.	Implemented in 2022 and ongoing from 2023 through 2025.	Section 8.5.4 and Section 8.4.3.2

11 CORRECTIVE ACTION PROGRAM

In this section, the electrical corporation must describe its corrective action program. The electrical corporation must present a summary description of the relevant portions of its existing processes and procedures.

The electrical corporation must report on how it maintains a corrective action program to track formal actions and activities undertaken to:

Prevent recurrence of risk events

Address findings from wildfire investigations (both internal and external)

Address finding from Energy Safety's Compliance Assurance Division (i.e., audits and notices of defect and violation)

Address Areas for Continued Improvement (ACI) identified by Energy Safety as part of the WMP evaluation

The electrical corporation must report on how it reviews each improvement area in accordance with its corrective action program. At a minimum, the electrical corporation must:

- **Identify insufficient occurrence and response** – Identify targeted corrective actions for areas where the event occurrence, response, or feature was insufficient.
- **Identify actions to reduce recurrence** – Identify improvement actions (as applicable) to reduce the likelihood of recurrence, improve response/mitigation actions, or improve operational processes, practices, and/or procedures.
- **Track implementation** – Track the improvement action plan and schedule in the electrical corporation's action tracking system.
- **Improve external communication** – For areas where weaknesses were identified in the response of external agencies, develop communication plan to share the information and conclusion with the responsible agency. The completion of this action and the agency's response must be documented.
- **Integrate lessons learned across industry** – Identify applicable generic lessons learned to improve overall effectiveness of the electrical corporation WMP.
- **Share lessons learned with others** – Identify and communicate any significant generic lessons learned that should be disseminated broadly (i.e., to other electrical corporations and responsible regulatory authorities, such as Energy Safety or CAL FIRE).

The WMP should not include detailed corrective action plans for each risk event, finding, and/or improvement area. However, this documentation must be made available to Energy Safety upon request.

Program activities to prevent the recurrence of risk events are largely wildfire mitigation programs, which are described within this document. These programs are developed to prevent faults, thus reducing risk. Key related programs include the wildfire mitigation programs described in this WMP, the asset inspection and correction programs, as well as the compliance review of audits and notices of defects and violations.

Pacific Power performs incident investigations and reporting consistent with existing regulatory requirements. Pacific Power leverages the data collected through this process to inform wildfire mitigation program activities. As described in section 6.5. Actions and activities to prevent the recurrence of risk events are largely wildfire mitigation programs, which are described within this document, which are anticipated to prevent faults, thus reducing risk, are described within this document. Key related programs include the wildfire mitigation programs described in this WMP document, the asset inspection and correction programs, as well as the compliance review of audits and notices of defects and violations.

Pacific Power continues to develop and mature models to better understand ignition probability, wildfire risk, and estimations of wildfire consequences along electric lines and equipment. The enhanced understanding and more predictive modeling methods better inform long-term and operational decision-making at Pacific Power.

The company currently tracks ignitions through the incident tracking system described in Section 6.5. While PROSPER tracks outages and causes, it is not designed to calculate wildfire risk or PSPS risk or provide analytics to show outage trends or locations where there is higher risk. For fire incident tracking, Pacific Power plans to enable long-term trend analysis of the incident data to enable viewing of WRRM risk outputs, PSPS risk and utility risk in a single location to support quantification of utility risk, to identify locations where mitigation efforts are needed to reduce the risk of a wildfire or PSPS event.

Pacific Power tracks, reviews, and addresses all observations, defects and violations identified from Energy Safety. Specifically, when the company is notified of defects or violations found by Energy Safety, it performs a field verification initially to verify existence and the need for corrective action. Once the conditions have been field verified, a plan of correction is developed for each condition based on the type and severity of the condition, which establishes a correction timeline for conformance with the General Orders (GO). As progress is made, the company engages in bi-weekly calls with Energy Safety to discuss progress on existing notices and any additional notices that are received. After the conditions have been corrected, they are closed out and documented with photo verification to confirm the correction has been completed and the condition no longer exists.

As part of the WMP evaluation by Energy Safety, Pacific Power identified several areas for continued improvement. Specifically, Pacific Power reports that the formal action of establishing a Wildfire Mitigation program delivery team, has been completed. This team is planned to track, monitor and report on implementation of all programs. Additionally, this team supports the improvement of communication and attends other utility working group meetings to integrate lessons learned from across the industry into Pacific Power wildfire mitigation programs. Other examples include the implementation of a separate, expulsion fuse replacement program as described in Section 8.1.2.12 or piloting wildfire detection equipment as described in Section 8.3.4.1.

12 NOTICES OF VIOLATION AND DEFECT

As of January 1, 2023, Pacific Power had not received any open Notices of Violation (NOV) or Notices of Defect (NOD) to report in this section.

ID	Type	Severity	Date of Notice	Date of Response	Summary Description of Violation/Defect	Estimated Completion Date	Summary Description of Correction
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

APPENDIX A: DEFINITIONS

Term	Definition
10-hour dead fuel moisture content	Moisture content of small dead vegetation (e.g.., grass, leaves, which burn quickly but not intensely), which can respond to changes in atmospheric moisture content within 10 hours.
Access and functional needs (AFN) populations	Per Public Utilities Code (Pub. Util. Code) § 8593.3 and D.19-05-042, individuals who have developmental or intellectual disabilities, physical disabilities, chronic conditions, injuries, limited English proficiency or who are non-English speaking, older adults, children, people living in institutionalized settings, or those who are low income, homeless, or transportation disadvantaged, including, but not limited to, those who are dependent on public transit or those who are pregnant.
Authority Having Jurisdiction	AHJ, party with assigned responsibility, depending on location and circumstance.
Asset (utility)	Electric lines, equipment, or supporting hardware.
At-risk species	Species of vegetation that have an elevated risk of (1) coming into contact with powerlines, (2) causing an outage or ignition, and/or (3) easily ignitable and within close enough proximity to potential arcing, sparks and/or other utility equipment thermal failures. "At-risk species" must be a function of species-specific characteristics including growth rate, failure rate of limbs, trunk, and/or roots (as compared to other species), height at maturity, flammability, vulnerability to disease or insects, etc.
Baseline (ignition probability, maturity)	A measure, typically of the current state, which establishes a starting point for comparison with measures from other states.
Carbon dioxide equivalent	Tons of greenhouse gases (GHG) emitted, multiplied by the global warming potential relative to carbon dioxide.
Circuit mile	The total length in miles of separate circuits regardless of the number of conductors used per circuit
Contractor	Any individual in the temporary and/or indirect employ of the utility whose limited hours and/or time-bound term of employment are not considered as "full-time" for tax and/or any other purposes.

Critical facilities and infrastructure	For brevity in the WMP, "critical facilitates and infrastructure" may be shortened to "critical infrastructure" and/or "critical facilities" throughout the WMP. Critical facilities and infrastructure are defined in accordance with the definition adopted in D.19-05-042 and modified in D.20-05- 051: those facilities and infrastructure that are essential to the public safety and that require additional assistance and advance planning to ensure resiliency during de-energization events. Namely:
	• Emergency Services Sector
	  ○ Police Stations
	  ○ Fire Station
	  ○ Emergency Operations Centers
	  ○ Public safety answering points
	• Government Facilities Sector
	  ○ Schools
	  ○ Jails and prisons
	• Healthcare and Public Health Sector
	  ○ Public Health Departments
	  ○ Medical facilities, including hospitals, skilled nursing facilities, nursing homes, blood banks, health care facilities, dialysis centers and hospice facilities (excluding doctor offices and other non- essential medical facilities)

Term	*Definition*

	• *Energy Sector*
	   ○ *Public and private utility facilities vital to maintaining or restoring normal service, including, but not limited to, interconnected publicly owned utilities and electric cooperatives*
	• *Water and Wastewater Systems Sector*
	   ○ *Facilities associated with the provision of drinking water or processing of wastewater including facilities used to pump, divert, transport, store, treat and deliver water or wastewater*
	• *Communications Sector*
	   ○ *Communication carrier infrastructure including selective routers, central offices, head ends,*
	   ○ *cellular switches, remote terminals and cellular sites*
	• *Chemical Sector*
	   ○ *Facilities associated with the provision of manufacturing, maintaining, or distributing hazardous materials and chemicals (including Category N-Customers as defined in D.01-06-085)*
	• *Transportation Sector*
	   ○ *Facilities associated with automobile, rail, aviation, major public transportation, and maritime transportation for civilian and military purposes*

Customer hours	*Total number of customers, multiplied by the average number of hours (e.g.., of power outage).*
Data cleaning	*Calibrating raw data to remove errors (including typographical and numerical mistakes).*
Dead fuel moisture content	*Moisture content of dead vegetation, which responds solely to current environmental conditions and is critical in determining fire potential.*
Detailed inspection	*In accordance with GO 165, an inspection where individual pieces of equipment and structures are carefully examined, visually and through use of routine diagnostic test, as appropriate, and (if practical and if useful information can be so gathered) opened, and the condition of each rated and recorded.*
Enhanced inspection	*Inspection whose frequency and thoroughness exceeds the requirements of the detailed inspection, particularly if driven by risk calculations.*
Enterprise system	*A centralized information system that ensures data may be shared throughout all functional levels and management hierarchies of an organization, as needed.*
Evacuation impact	*Number of people evacuated, with the duration for which they are evacuated, from homes and businesses, due to wildfires.*
Evacuation zone	*Areas designated by CAL FIRE and local fire agency evacuation orders, to include both "voluntary" and "mandatory" in addition to other orders such as "precautionary" and "immediate threat".*
Fire Season	*The time of year that wildfires are most likely to take place for a given geographic region due to historical weather conditions, vegetative characteristics and impacts of climate change. Goals and targets which have milestones related to the onset, duration, or end of "fire season" or "height of fire season" must be accompanied with calendar dates.*
Frequently de-energized circuit	*A circuit which has been de-energized pursuant to a de- energization event to mitigate the risk of wildfire three or more times in a calendar year.*
Fuel density	*Mass of fuel (vegetation) per area which could combust in a wildfire.*
Fuel management	*Removing thinning, or otherwise altering vegetation to reduce the potential rate of propagation or intensity of wildfires.*

Term	*Definition*
Fuel moisture content	*Amount of moisture in each mass of fuel (vegetation), measured as a percentage of its dry weight.*
Full-time employee	*Any individual in the ongoing and/or direct employ of the utility whose hours and/or term of employment are considered as "full-time" for tax and/or any other purposes.*
GO 95 nonconformance	*Condition of a utility asset that does not meet standards established by General Order 95.*
Greenhouse gas (GHG) emissions	*Health and Safety Code 38505 identifies seven greenhouse gases that ARB is responsible to monitor and regulate to reduce emissions: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), sulfur hexafluoride (SF6), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and nitrogen trifluoride (NF3).*
Grid hardening	*Actions (such as equipment upgrades, maintenance, and planning for more resilient infrastructure) taken in response to the risk of undesirable events (such as outages) or undesirable conditions of the electrical system to reduce or mitigate those events and conditions, informed by an assessment of the relevant risk drivers or factors.*
Grid topology	*General design of an electric grid, whether looped or radial, with consequences for reliability and ability to support de- energization (e.g., being able to deliver electricity from an additional source).*
Hazard tree	*A tree that has a structural defect that makes it likely to fail in whole or in part.*
High Fire Threat District (HFTD)	*Per D.17-01-009, areas of the State designated by the Office of Energy Infrastructure Safety and CAL FIRE to have elevated wildfire risk, indicating where each utility must take additional action (per GO 95, GO 165, and GO 166) to mitigate wildfire risk.*
Highly rural region	*In accordance with 38 CFR 17.701, "highly rural" must be defined as those areas with a population of less than 7 persons per square mile. For the purposes of the WMP, "area" must be defined as census tracts.*
High Wind Warning (HWW)	*Level of wind risk from weather conditions, as declared by the National Weather Service (NWS). For historical NWS data, refer to the Iowa State University Iowa archive of NWS watch / warnings.25*
HWW overhead (OH) Circuit Mile Day	*Sum of overhead circuit miles of utility grid subject to High Wind Warnings (HWW, as defined by the NWS) each day within a given time, calculated as the number of overhead circuit miles that are under an HWW multiplied by the number of days those miles are under said HWW. For example, if 100 overhead circuit miles are under an HWW for 1 day, and 10 of those miles are under HWW for an additional day, then the total HWW OH circuit mile days would be 110.*
Ignition probability	*The relative possibility that an ignition will occur, probability is quantified as a number between 0% and 100% (where 0% indicates impossibility and 100% indicates certainty). The higher the probability of an event, the more certainty there is that the event will occur. (Often informally referred to as likelihood or chance).*
Ignition-related deficiency	*Any condition which may result in ignition or has previously resulted in ignition, even if not during the past five years.*

[25] https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml

Term	Definition
Impact/consequence of ignitions	*The effect or outcome of a wildfire ignition upon objectives, which may be expressed by terms including, although not limited to, maintaining health, and safety, ensuring reliability, and minimizing economic and/or environmental damage.*
Initiative	*Measure or activity proposed or in process designed to reduce the consequences and/or probability of wildfire or PSPS.*
Inspection protocol	*Documented procedures to be followed to validate that a piece of equipment is in good condition and expected to operate safely and effectively.*
Invasive species	*A species that is: 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.*
Level 1 finding	*In accordance with GO 95, an immediate safety and/or reliability risk with high probability for significant impact.*
Level 2 finding	*In accordance with GO 95, a variable (non-immediate high to low) safety and/or reliability risk.*
Level 3 finding	*In accordance with GO 95, an acceptable safety and/or reliability risk.*
Life expectancy	*Anticipated years that a piece of equipment can be expected to meet safety and performance requirements.*
Limited English proficiency (LEP)	*Populations with limited English working proficiency based on the International Language Roundtable scale.*
Line miles	*The number of miles of transmission and/or distribution line. Differs from circuit miles because individual circuits, such as the two circuits of a double-circuit line, are not counted separately in circuit miles but are counted as separate total miles of line.*
Live fuel moisture content	*Moisture content within living vegetation, which can retain water longer than dead fuel.*
Lost energy	*Energy that would have been delivered if not for an outage.*
Major roads	*Interstate highways, U.S. highways, state and county routes.*
Match drop simulation	*Wildfire simulation method that takes an arbitrary ignition and forecasts propagation and consequence/impact.*
Medical baseline customers	*Residential customers with qualifying medical conditions and/or depend on power for qualifying medical devices for certain medical needs. For example, customers that have specific heating and cooling or mobility needs.*
Member of the public	*Any individual not employed by the utility.*
Multi-attribute value function	*Risk calculation methodology introduced during CPUC's S- MAP and RAMP proceedings.*
Near miss	*Previously used to define an event with probability of ignition. Redefined under "Risk event."*
Need for PSPS	*When the utility's criteria for utilizing PSPS are met.*
Noncompliant clearance	*Rights-of-way whose vegetation is not trimmed in accordance with the requirements of GO 95.*
Outages of the type that could ignite a wildfire	*Outages that, in the judgement of the utility, could have ignited a wildfire.*

Term	*Definition*
Outcome metrics	*Measurements of the performance of the utility and its service territory in terms of both leading and lagging indicators of wildfire, PSPS, and other consequences of wildfire risk, including the potential unintended consequences of wildfire mitigation work, such as acreage burned by utility-related ignitions.*
Overcapacity	*When the energy transmitted by utility equipment exceeds that of its nameplate capacity.*
Patrol inspection	*In accordance with GO 165, a simple visual inspection of applicable utility equipment and structures that is designed to identify obvious structural problems and hazards. Patrol inspections may be carried out during other company business.*
Percentile conditions	*Top X% of a particular set (e.g.., wind speed), based on a historical data set with sufficient detail. For example, "Top 95 percentile wind speeds in the last 5 years" would refer to the 5% of avg daily wind speeds recorded by each weather station. If 1,000 weather stations recorded average daily wind speeds over 10 days, then the 95th percentile wind speed would be the top 5% of weather station-days. In this example, there will be 10 days each with 1,000 weather station reports and a total of 10,000 weather station-days, so 50 observations will be in the top 5%. The lowest wind speed in this top 5% would be the "95th percentile wind speed".*
Planned outage	*Electric outage announced ahead of time by the utility.*
Preventive maintenance (PM)	*The practice of maintaining equipment on a regular schedule, based on risk, elapsed time, run-time meter readings, or number of operations. The intent of PM is to "prevent" maintenance problems or failures before they take place by following routine and comprehensive maintenance procedures. The goal is to achieve fewer, shorter, and more predictable outages.*
Priority essential services	*Critical first responders, public safety partners, critical facilities and infrastructure, operators of telecommunications infrastructure, and water utilities/agencies.*
Program targets	*Quantifiable measurements of activity identified in WMPs and subsequent updates used to show progress towards reaching the objectives.*
Progress metrics	*Measurements that track how much utility wildfire mitigation activity has changed the conditions of utility wildfire risk exposure or utility ability to manage wildfire risk exposure, in terms of leading indicators of ignition probability and wildfire consequences.*
Property	*Private and public property, buildings and structures, infrastructure, and other items of value that are destroyed by wildfire, including both third-party property and utility assets.*
PSPS event	*Defined as the time from the first public safety partner notified of a planned public safety de-energization to the final customer re-energized.*
PSPS risk	*The potential for the occurrence of a PSPS event expressed in terms of a combination of various outcomes of the event and their associated probabilities.*
PSPS weather	*Weather that exceeds a utility's risk threshold for initiating a PSPS.*
Red Flag Warning (RFW)	*Level of wildfire risk from weather conditions, as declared by the NWS. For historical NWS data, refer to the Iowa State University Iowa archive of NWS watch / warnings.26*

[26] https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml

Term	*Definition*
RFW OH Circuit Mile Day	*Sum of overhead circuit miles of utility grid subject to Red Flag Warning each day within a given time, calculated as the number of overhead circuit miles that are under an RFW multiplied by the number of days those miles are under said RFW. For example, if 100 overhead circuit miles are under an RFW for 1 day, and 10 of those miles are under RFW for an additional day, then the total RFW OH circuit mile days would be 110.*
Risk event	*An event with probability of ignition, including wires down, contacts with objects, line slap, events with evidence of heat generation, and other events that cause sparking or have the potential to cause ignition. The following risk events all qualify as risk events:* *Ignitions* *Outages not caused by vegetation* *Vegetation-caused outages* *Wire-down events* *Faults* *Other risk events with potential to cause ignitions*
Risk event simulation	*Simulation of what the consequence would have been of an ignition had it occurred.*
Risk-spend efficiency (RSE)	*An estimate of the cost-effectiveness of initiatives, calculated by dividing the mitigation risk reduction benefit by the mitigation cost estimate based on the full set of risk reduction benefits estimated from the incurred costs. For ongoing initiatives, the RSE can be calculated by determining the "marginal benefit" of additional spending in the ongoing initiative. For example, the RSE of an ongoing initiative could be calculated by dividing the mitigation risk reduction benefit from a 5% increase in spend by the cost associated with a 5% increase in spend*
Rule	*Section of public utility code requiring a particular activity or establishing a particular threshold.*
Run-to-failure	*A maintenance approach that replaces equipment only when it fails.*
Rural region	*In accordance with GO 165, "rural" must be defined as those areas with a population of less than 1,000 persons per square mile as determined by the United States Bureau of the Census. For the purposes of the WMP, "area" must be defined as census tracts.*
Safety hazard	*A condition that poses a significant threat to human life or property.*
Simulated wildfire	*Propagation and impact/consequence of a wildfire ignited at a particular point ('match drop'), as simulated by fire spread software.*
Slash	*Branches or limbs less than four inches in diameter, and bark and split products debris left on the ground because of utility vegetation management. This definition is consistent with Public Resources Code Section 4525.7.*
Span	*The space between adjacent supporting poles or structures on a circuit consisting of electric lines and equipment. "Span level" refers to asset-scale granularity.*
System Average Interruption Duration Index (SAIDI)	*System-wide total number of minutes per year of sustained outage per customer served.*
Third-party contact	*Contact between a piece of electrical equipment and another object, whether natural (tree branch) or human (vehicle).*

Term	Definition
Time to expected failure	*Time remaining on the life expectancy of a piece of equipment.*
Top 30% of proprietary fire potential index (FPI)	*Top 30% of FPI or equivalent scale (e.g., "Extreme" on SCE's FPI; "extreme", 15 or greater, on SDG&E's FPI; and 4 or above on PG&E's FPI).*
Tree with strike potential / danger tree	*A tree within or adjacent to the utility right- of-way that has a structural defect or lean that makes it likely to fail in whole or in part and contact electrical equipment or facilities.*[27]
Unplanned outage	*Electric outage that occurs with no advance notice from the utility (e.g.., blackout).*
Urban region	*In accordance with GO 165, "urban" must be defined as those areas with a population of more than 1,000 persons per square mile as determined by the United States Bureau of the Census.*
Utility-related ignition	*Ignitions involving utility infrastructure or employees, including all ignitions determined by AHJ investigation to originate from utility infrastructure.*
Vegetation management	*Trimming, removal, and other remediations of vegetation used to maintain utility ROW and reduce the risk of outages, ignitions, and other disruption and danger.*
Vegetation risk index	*Risk index indicating the probability of vegetation- caused outages and/or ignitions along a particular circuit, based on the vegetation species, density, height, growth rate, etc.*
Weather normalization	*Adjusting metrics based on relative weather risk factors or indices*
Wildfire impact/ consequence	*The effect or outcome of a wildfire affecting objectives, which may be expressed, by terms including, although not limited to health, safety, reliability, economic and/or environmental damage.*
Wildfire risk	*The potential for the occurrence of a wildfire event expressed in terms of ignition probability, wildfire impact/consequence.*
Wildfire-only WMP programs	*Activities, practices, and strategies that are only necessitated by wildfire risk, unrelated to or beyond that required by minimum reliability and/or safety requirements. Such programs are not indicated or in common use in areas where wildfire risk is minimal (e.g., territory with no vegetation or fuel) or under conditions where wildfires are unlikely to ignite or spread (e.g., when rain is falling).*
Wildland-urban interface (WUI)	*A geographical area identified by the state as a "Fire Hazard Severity Zone", or other areas designated by the enforcing agency to be a significant risk from wildfires, established pursuant to Title 24, Part 2, Chapter 7A.*
Wire down	*Instance where an electric transmission or distribution conductor is broken and falls from its intended position to rest on the ground or a foreign object.*

[27] "Danger tree" is more specifically defined in California Code of Regulation Title 14 § 895.1.

APPENDIX B: SUPPORTING DOCUMENTATION

Supporting Documentation for Risk Methodology and Assessment

Summary Documentation

Below are described the three bowtie models within the Wildfire Risk Reduction Model (WRRM). ID in the outputs refers to the ID in Table 6-1 and W: <Name> refers to the name used in WRRM. It is important to note that some of the information in this Appendix was provided and reviewed by Technosylva.

Figure B-1: Risk Associated with Asset Location (RAIL): Wildfire risk associated to ignitions from utility assets, including ignition potential, fire spread potential, and locational vulnerability to a wildfire.

Figure B-2: Risk Associated with Value Exposure (RAVE): Locational risk calculated from all surrounding assets, environmental characteristics, and demographics. This includes the fire intensity and the vulnerability of the community to a wildfire including social vulnerability, egress, terrain, and possible building damage.

Figures B-3: Composite Risk: The combination of RAIL and RAVE to provide an ignition risk.

Figure B-1 Risk Associated with Ignition Locations (RAIL) Bowtie Model

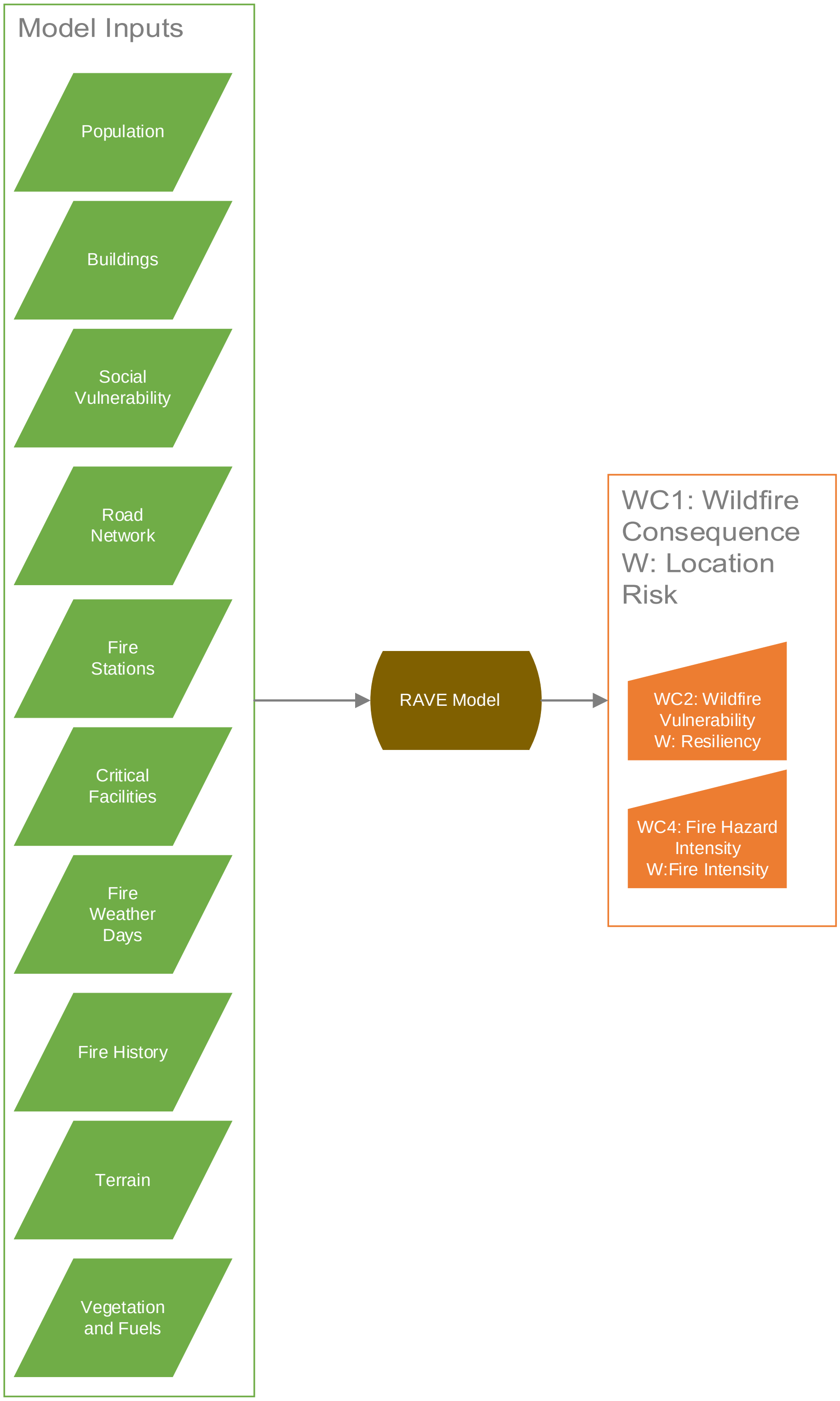


Figure B-2 Risk Associated with Value Exposure (RAVE) Bowtie Model

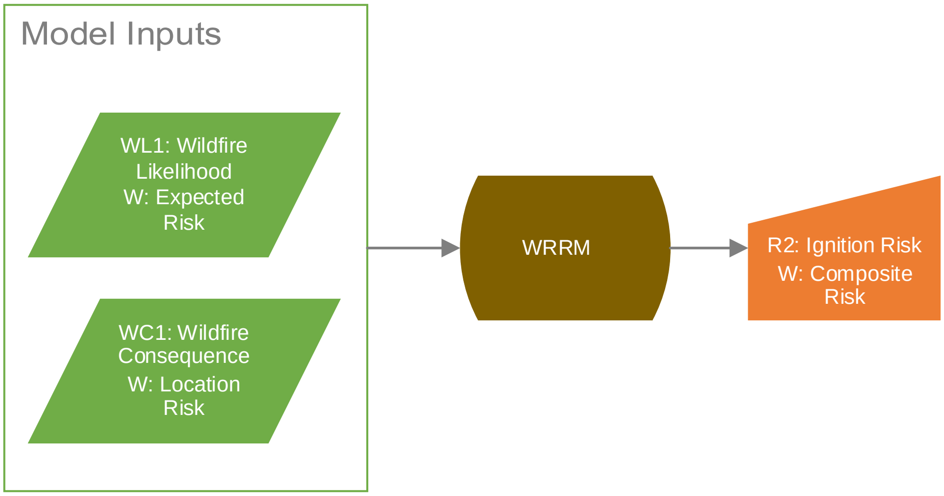


Figure B-3 Composite Risk Bowtie Model

Below in Figure B-4 is the calculation schematic for WRRM. The ID in the outputs refers to the ID in Table 6-1 and W: <Name> refers to the name used in the WRRM model.

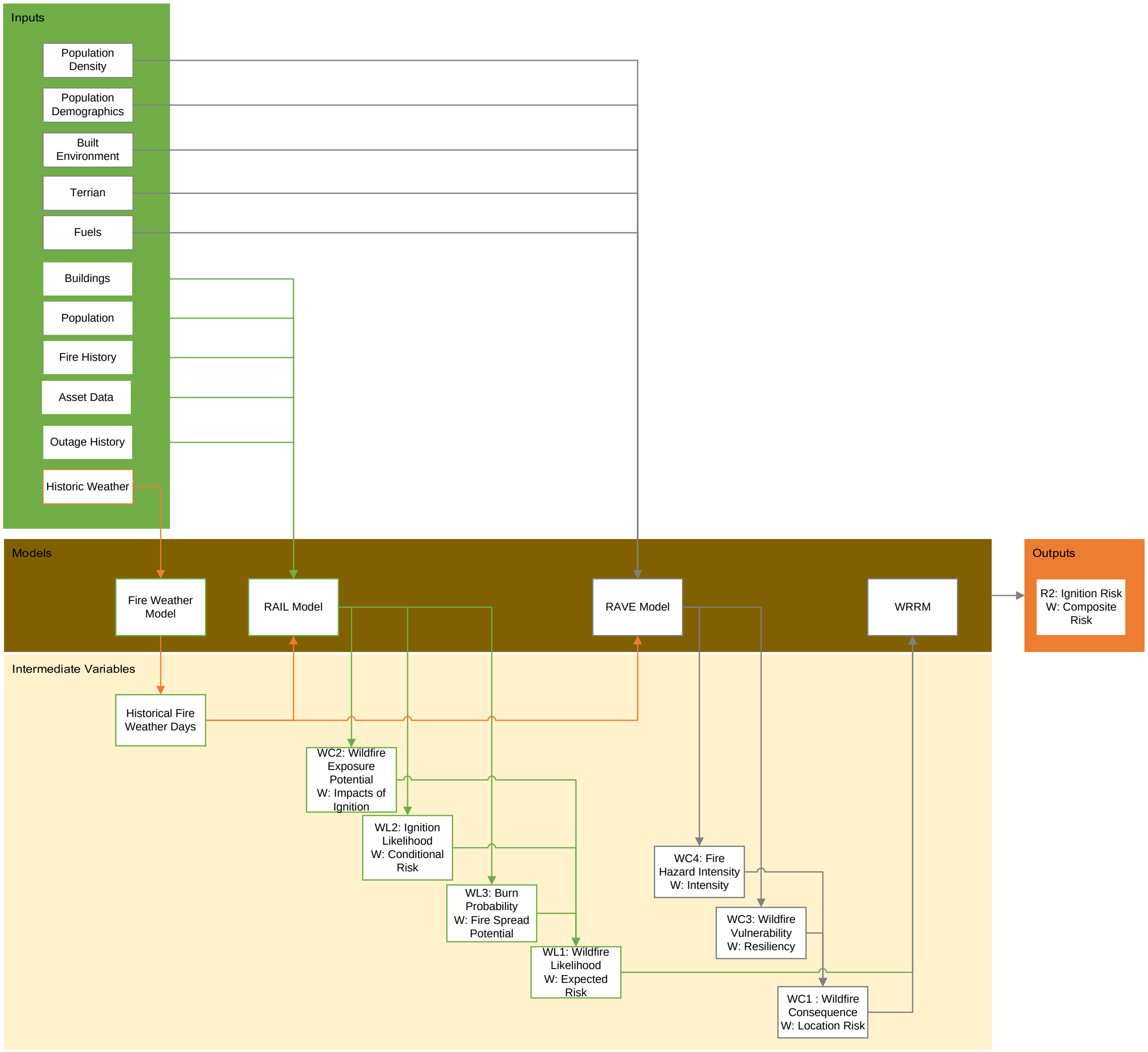


Figure B-4 Composite Risk Calculation Schematic

Purpose of WRRM

WRRM is part of the Wildfire Risk Analysis Enterprise (WFA-E) software from Technosylva. It is a modeling tool to measure the current level of risk of overhead utility equipment ignition under specific weather conditions and the consequence if there was an ignition. WRRM modeling is the start of the planning process as it identifies the areas of highest risk and consequence that should be looked at to consider mitigation strategies.

There are three components in WRRM as shown in the bowties above that support planning processes:

Risk Associated with Ignition Locations (RAIL)

In WRRM, RAIL represents the wildfire risk associated to ignitions from utility asset risk based on the characteristics of the asset, including age and materials. RAIL assesses the asset risk by associating the ignition impact over an eight-hour period to an ignition location. RAIL does not consider the characteristics of an asset location that may impact the resiliency of the location to a wildfire. Factors considered in RAIL calculations include:

- Surface and canopy fuel
- Topography
- Wind speed and direction
- Fuel Moisture
- Historical fire occurrence identifying time of data, typical weather conditions, and duration
- Fire encroachment into urban areas

RAIL Outputs:

- Ignition likelihood: This is the result of potential asset equipment failure, drivers causing that failure and/or ignition, and the damage that may lead to an ignition
- Fire spread potential: The spread potential of fires originating at an ignition location is a function of the fire environment such as fuel, topography, and weather in the area surrounding the ignition location. The fire spread model defines where possible ignitions will spread across the landscape. This definition of spread is critical for defining vulnerability, i.e., potential impacts due to a utility-asset caused fire. The risk associated with each possible ignition provides the basis for evaluating the best opportunities for reducing risk by implementing mitigation projects.
- Vulnerability: Vulnerability refers to the exposure and susceptibility of values-at-risk (VAR), such as population, buildings, and critical facilities. Exposure is the location of VAR with respect to wildfire hazard; while susceptibility refers to the level of impact caused by wildfires of different intensities. For WRRM, the vulnerability is captures as a baseline risk for population impacted, number of buildings impacted, estimated number of buildings destroyed, and acres burned. Flame length, Rate of Spread (ROS), and Fire Behavior Index metrics are also included.

Risk Associated with Value Exposure (RAVE)

In WRRM, RAVE represents the locational risk calculated from all the surrounding assets, environmental characteristics, and demographics. Community demographics, topography, and the built environment influence how at risk or resilient a community is to wildfire or an eight-hour period from the initial ignition. RAVE is calculated independently of the asset risk calculated in RAIL and considers the following:

Population density

Socially vulnerable populations: Elderly, people with disabilities, or people in poverty

Infrastructure: Major and minor roads, location of fire stations, and building density

Suppression difficulty: Terrain and fuels

Fire History: Burn history at the location

Historic Weather

Crown fire: The amount the fire can spread through crowning in continuous spread through the tree crown

RAVE Outputs:

Community resiliency: How vulnerable a community is to a wildfire and their ability to respond quickly to fight the fire and/or evacuate

Fire intensity: How a fire is expected to behave and what area may be impacted from the point of ignition

Composite Risk

This is the combination of RAIL and RAVE to provide an ignition risk, the likelihood of an ignition from a utility asset given certain conditions and the consequence if a wildfire were to occur.

Assumptions and Limitations

- The physical framework development is based on an idealized situation in steady state spread which may not fit some extreme behavior of fires.
- Fuels are assumed to be continuous and uniform for the scale of the input (typically between 10-to-30-meter (m) resolution)
- Fire characteristics at a point only depends on the conditions at that point (point-functional model). This means that there are certain non-local phenomena like:
- Increase of ROS due to a concave front.

- Fire interaction between different parts of the same fire or a different one
- Fire spread is assumed to be elliptical although there are several variations such as double ellipse, oval, egg-shape, etc.
- Weather is given hourly and is assumed to remain constant during that time. There is no interpolation in time to compute evolution of weather between hours.
- Reliability of weather inputs in the mid-range forecast (2 to 5 days)
- Fire is not coupled with the atmosphere in any way. This may seem like a major limitation in the model as wind is a main contribution to fire spread and at present many models (especially physical ones) try to couple wind and fire. The main reasons for us not to consider the coupling is:
  - It would make it unfeasible to run millions of simulations considering the coupling effect.
  - Empirical and semi-empirical models have been developed using an average wind speed as an input, so it is not clear that considering more granular wind at the front is advisable.
- Fire is always assumed to be fully developed. Fire acceleration, flashover, or decay is not considered.
- Atmospheric instability which may have a deep impact on ROS (beer 1991) is not considered in the model.
- Gusts are not considered in the model
- No interaction between slope and wind other than creating an effective or equivalent wind. This means that fire is assumed to have an elliptical shape no matter the alignment of wind and slope.
- Models have been developed with scares empirical data. The abundance of today's fire data sources, however, is allowing us to better adjust models to observed fire patterns.
- Fuel array description of the vegetation may not perfectly describe fuel characteristics.
- Spotting is only considered in surface fires

Description of the calculation procedure shown in the bow tie model

Risk Associated with Asset Location (RAIL)

Risk must be characterized with specific ignition locations, such as the electrical utility network assets. Instead of characterizing wildfire risk where the expected risks occur, a RAIL analysis assigns those potential impacts to the ignition location. This identifies the risk associated with individual assets, and identifies which assets have the greatest risk (potential impacts) if causing a wildfire. The three main components of a RAIL analysis are:

1) probability of ignition for the asset

2) fire spread potential of wildfires starting at the asset ignition location, and

3) consequence of the values-at-risk (population, buildings, etc.) impacted by the fire spread.

By combining these three components we can identify risk scores for specific assets.

These components must be assessed for each potential ignition location being considered, i.e., OH lines:

1. Probability of ignition

   In the WRRM, electrical distribution equipment is the key ignition source under consideration. Probability of ignition is a result of potential asset equipment failure, drivers causing that failure and/or ignition, and the damage that may lead to an ignition.

   A description of how probability of ignition data for assets is integrated into the risk scores

2. Fire Spread Potential The spread potential of fires originating at an ignition location is a function of the fire environment—fuel, topography, and weather—in the area surrounding the ignition location. The fire spread model defines where possible ignitions will spread across the landscape. This definition of spread is critical for defining consequence, i.e. potential impacts due to an asset caused wildfire. The risk associated with each possible ignition provides the basis for evaluating the best opportunities for reducing risk by implementing mitigation projects. This section describes the elements of the fire spread model component of WRRM based on Technosylva's Wildfire Analyst Enterprise product.

   Factors to be considered in this component of the WRRM include:

   surface and canopy fuel (spatial)

   topography (spatial)

   wind speed and direction (spatial and temporal)

   fuel moisture (spatial and temporal)

historical fire occurrence identifying time of data, typical weather conditions and duration (spatial and temporal)

fire encroachment into urban areas (spatial)

The fire spread potential component of the WRRM relies on a fire spread modeling system, which consumes spatial and temporal information about the fire environment to simulate fire spread from a given ignition location for a specified period of time. Fuels and landscape characteristics data are used in combination with weather and fuel moisture data as key inputs to derive the fire spread simulation. An 8-hour fire duration is used representing a typical first burning period, although this may be adjusted if desired. Accordingly, the simulation represents a fire spread potential for a specific set of input conditions (i.e., wind speed, wind direction, fuel moisture, temperature, humidity, etc.) that change spatially by the hour. Weather data has a 2 km spatial resolution. Other landscape input metrics have a 30-meter spatial resolution.

3. Consequence

   Consequence refers to the impacts to values-at-risk, such as population, buildings, and critical facilities. For the WRRM, consequence is captured as baseline risk outputs for population impacted, number of buildings threatened, estimated number of buildings destroyed, and acres burned. Flame Length, Rate of Spread, and Fire Behavior Index metrics are also included.

WRRM Risk Metrics

The calculation of risk metrics applies to both the primary asset risk outputs and the supplemental territory wide risk outputs. Asset risk metrics include more detailed calculations as they integrate individual asset probability of ignition data to extend conditional risk to expected risk. Conditional risk is calculated from the spread predictions (simulations) assuming a probability of ignition of 1.0 for each asset, i.e., all assets are assumed to have the same probability of ignition. These impacts reflect if a fire were to occur. Expected risk integrates the probability of ignition for the specific asset. Expected risk can only be calculated for asset risk as it is dependent on having a probability of ignition for the individual asset. Accordingly, asset risk includes both conditional and expected metrics while territory risk only includes conditional metrics. Type of Risk Metrics Based on the impacts calculated from the fire spread prediction for each ignition source, a consistent set of risk metrics are calculated and assigned back to the asset ignition locations. In this manner risk is quantified for each asset segment (distribution). Risk metrics are categorized as follows:

1. Baseline Risk – primary outputs are calculated based on the number of buildings threatened, number of buildings destroyed, population impacted, and acres burned from a fire spread prediction.

Baseline risk is calculated for both Asset Risk and Territory Risk.

Baseline Risk Model

The baseline risk model implemented within WRRM calculates the following impacts: 1. Number of Buildings Threatened – risk metric based on total number of buildings impacted assigned to every ignition point.

2. Number of Buildings Destroyed – an estimate of the number of buildings destroyed for each fire spread simulation is derived using the Building Loss Factor (BLF) data assigned to each building.

3. Total Population - risk metric based on population impacted assigned to every ignition point.

4. Fire Size Potential - risk metric based on number of acres burned assigned to every ignition point. Baseline risk metrics are calculated based on the spread of a fire predicted for each ignition point. Fire spread predictions are run for each weather scenario day extracted from the utility climatology. This results in hundreds of different risk values for each ignition point and asset, i.e., one for each weather scenario run

To achieve this for Asset Risk, fire ignition points are defined along assets, and impacts from fire spread predictions are associated back to the source ignition points and assets, i.e. segments for linear features. For WRRM, multiple simulations are run for each asset ignition point – one for each of the weather scenarios (days). Impacts are calculated for each simulation resulting in hundreds of sets of impacts for each asset.

Since the weather scenarios are not weighted, i.e. they are all considered equal, a set of summary outputs are calculated from the sets of baseline risk outputs. These include:

Standard Deviation values for all simulations

Average impact value for all simulations

Percentiles impact value for all simulations (0, 20, 40, 50, 60, 80, 90, 95, 98, 100)

These summary values are calculated for each baseline risk output, i.e. number of buildings threatened, estimated buildings destroyed, population impacted and acres burned. Providing these summary outputs allows a utility to utilize the aggregate score that is preferred. For Territory Risk, baseline risk metrics are calculated for each point consistent with Asset Risk.

Incorporating Probability of Ignition for Assets

The impact values calculated by the WRRM analysis fire spread simulations represent the conditional risk, that is, the impacts should a fire occur. It is assumed all probability of ignition is the same for all assets. This is referred to as "Conditional Risk" – conditional on a fire occurring. It provides the basis for integrating asset probability of ignition to calculate an "Expected Risk" – impacts that are expected to occur based on probability of different assets causing an ignition.

Expected Risk (ER) is the product of equipment-related Probability of Ignition (POI) for the asset, equipment-related Probability of Failure (POF), and the Conditional Risk (CR) of a wildfire should one ignite at that location.

$$ER = POI * POF * CR$$

CR is a function of both fire spread potential and consequence in the area surrounding the asset. CR is modeled by combining a custom implementation of deterministic fire spread models (Component 2 of the RAIL analysis) with geospatial data pertaining to the consequence and potential damage of structures across the territory (Component 3).

Risk Associated with Value Exposure (RAVE)

The need to develop a comprehensive asset risk analysis necessitates the combination of asset risk values with risk factors describing the characteristics of the landscapes potentially impacted from asset ignited fires. Technosylva has conducted analysis of these landscape factors and created a set of data analysis outputs that quantify and describe the potentially affected landscapes. The landscape related risk factors data is referred to as Risk Associated with Value Exposure (RAVE).

The RAVE risk metrics are intended to be combined with the Risk Associated with Ignition Locations (RAIL) metrics already calculated in daily risk forecasts (FireCast) and WRRM to facilitate a composite asset risk metric. This metric provides a comprehensive measure of risk that can be incorporated into Multi-Attribute Risk Score (MARS) and Multi-Attribute Value Function (MAVF) frameworks to support short term operational decision making, and long term mitigation planning.

The three main components of a RAVE analysis are:

1) local characteristics of impacted areas

2) fire spread exposure of wildfires potentially ignited by utility assets, and

3) vulnerability of the local area (population, buildings, etc.)

By combining these three components we can identify risk scores across the landscape, and tie these specifically to electric utility assets as possible fire ignition sources.

Integrating RAVE with existing RAIL risk metrics allows for calculation of a composite risk metric for electric utility assets that incorporates local risk factors that can substantially increase risk for possible fires caused by an asset, i.e., increase the asset risk.

For example, if an area potentially impacted from an asset ignited fire has certain risk factors, such as:

significant terrain difficulty for suppression or egress issues (local characteristics),

high crown fire potential and majority of volatile fuels (fire spread exposure), and/or

high senior age and poverty ratio (vulnerability),

then the possibility of damage or loss is amplified by these risk factors. Accordingly, the risk score for an asset that impacts an area with these characteristics should be increased as it is worse than risk for another asset source that may impact areas without these factors present.

Local Characteristics and Vulnerability tend to be more static factors as they relate to landscape characteristics, population, buildings, and manmade infrastructure. Fire Spread Exposure factors tend to be more dynamic as they relate to fire behavior conditions caused by varying weather conditions, and hence can vary significantly based on specific weather scenarios.

Plexels as RAVE Analysis Units

To properly characterize risk factors across the landscape an analysis unit is required. In the GIS world, geo-administrative polygons are typically used to define socio-economic and demographic characteristics, and raster grids are used for terrain related characteristics. However, the use of geo-administrative boundaries does not provide the granularity necessary to characterize risk factors for fire spread simulations; a smaller unit is necessary. Hexagons are used as the analysis unit for RAVE analysis.

The hexagon was selected as it has many benefits over using the conventional raster grid approach. In particular, hexagons are preferred when the analysis includes aspects of connectivity or movement paths, as is required for wildfire spread prediction across the terrain. Hexagons reflect distortion over large areas, as is the requirement for this analysis.

For RAVE, hexagons are referred to as plexels – comprised of the main components of hexagons, pixels and population – the primary attribute of the landscape we are concerned with.

Prior to the 2022 analysis, hexagons were created across the service territory at a 1000 meter centroid spacing. Each plexel was approximately 214 acres.

In 2022, Technosylva switched to Uber's Hexagonal Hierarchical Spatial Index (H3) system. Level 8 or Level 9 hexagons are used, depending on the size of the project area. Level 8 hexagons are approximately 1100 meters from centroid to centroid and 200 acres in size. Level 9 hexagons are approximately 425 meters from centroid to centroid and 26 acres in size.

Level 8 hexagons were used in this analysis.

It is important to note that analysis was only conducted for plexels where population or buildings are located. Areas without population or buildings are not included in the analysis as these do not represent current areas of concern.

Locational Risk Factors and Asset Fire Susceptibility

RAVE data was calculated using both static data (Locational Risk Factors), and dynamic data (Asset Fire Susceptibility) using outputs from fire simulations derived using customer weather scenarios. By default, the series of historical weather scenarios identified from the customer's climatology has been used.

Locational Risk Factors Locational Risk Factors reflect more static data as they do not change frequently. These include data primarily related to population, buildings, and manmade infrastructure. Current metrics calculated and summarized on a per plexel basis are:

Population Density Population Count Building Density

Number of Buildings

Building Loss Factor • Road Density – major and minor

Fire Station Density

Social vulnerability characteristics such as senior population ratio, disability population ratio, and poverty population ratio

Majority Fuel Model

Terrain Difficulty Index

Road Availability (with and without social vulnerability factors)

Years Since Last Fire

Figure B-5 presents an example of Senior Population data for the service territory. This metric is classified as percent of population as shown in the adjacent legend.

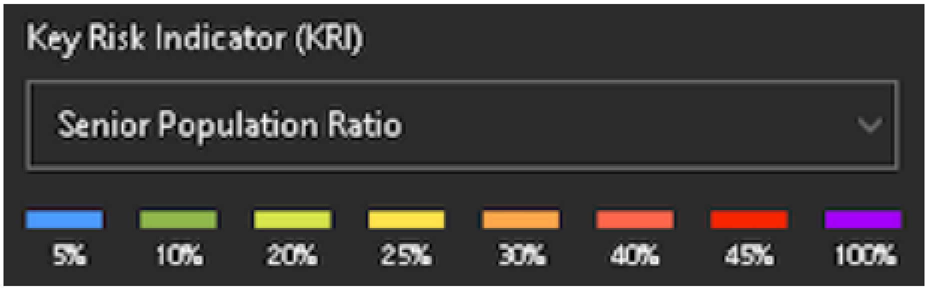


Figure B-5. Example of Senior Population Data for the Service Territory

Asset Fire Susceptibility Factors

Asset Fire Susceptibility Factors are calculated based on fire simulations from asset ignition points and aggregated on a per plexel basis. The metrics represent vulnerability based only on asset ignited fires. By default, historical weather scenarios identified for the climatology have been used, although daily weather forecasts could be used and RAVE metrics calculated on a daily forecast basis if desired.

These metrics include:

Acres Burned (8 hour simulations)

Population Impacted

Buildings Threatened

Estimated Buildings Destroyed

Building Loss Factor

Fire Behavior Index • Flame Length

Rate of Spread

Burn Frequency – the number of times the plexel was burned from fire simulations from asset ignitions

Building Loss Factor

The Asset Fire Susceptibility data provided with the RAVE delivery are derived using the same weather scenarios used for WRRM data analysis. This is the default RAVE analysis provided.

It is important to note that these dynamic factors will change as weather scenarios change (i.e. more are added), fuels are updated and asset data is updated.

Asset Susceptibility

Asset Susceptibility results are dynamic, based on the number of weather days used in the analysis. Analysis outputs are assigned to the landscape as plexels (hexagons), not back to the asset ignition source. The following Table B-1 lists the layers provided:

Table B-1. Asset Fire Susceptibility Layers

Layer	Description	Units
Burn Frequency	Burn Frequency is the number of times a plexels is touched from all asset ignited simulations run for the selected weather days. It is similar to traditional burn probability although this only represents a frequency, not a probability.	Number of times impacted by a fire simulation
Fire Behavior Index	The Fire Behavior Index layer group includes FBI results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs.	Fire Behavior Index within the plexel
Acres	The Acres layer group includes acres results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8- hour simulation runs.	Acres burned within the plexel
Buildings Threatened	The Buildings Threatened layer group includes buildings impacted results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs.	Number of buildings impacted within the plexel
Buildings Destroyed	The Buildings Destroyed layer group includes buildings destroyed results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs.	Estimated number of buildings destroyed within the plexel
Building Loss Factor	The Building Loss Factor layer group includes building loss factor results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs.	Estimated building loss factor within the plexel
Population	The Population layer group includes population impacted results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs.	Number of population (people) impacted within the plexel
Flame Length	The Flame Length layer group includes flame length results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs.	Flame Length in feet within the plexel

Layer	Description	Units
Rate of Spread	The Rate of Spread layer group includes rate of spread results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs	Rate of Spread in chains / hour within the plexel

Locational Risk Factors

Locational Risk Factors are static results, calculated from the ESRI Living Atlas and Technosylva source data.

Table B-2. Locational Risk Factors Layers

Layer	Description	Units
Total Miles—Major Roads	Total miles of major roads by plexel	Miles
Total Miles—Minor Roads	Total miles of minor roads by plexel	Miles
Fuel Model Majority	Majority fuel model within each plexel	Fuel model number of fuels that have the most acres within the plexel
Building Density	Building Density by plexel	Buildings per acre
Number of Buildings	Number of Buildings by plexel	Number of buildings
Building Loss Factor (Median)	Median building loss factor by plexel	Percent
Building Loss Factor (Mean)	Average building loss factor by plexel	Percent
Population Count	Population Count by plexel	Number of People
Population Density	Population Density by plexel	Population Per Acre
Fire Stations Density	Density of Fire Stations by plexel. Represents a mean value of a density surface created from station points using a Kernel interpolation method.	Stations per sq. mile using a 20 mile search distance.
Terrain Difficulty Index	Technosylva's Terrain Difficulty Index (2022) by plexel	Values from Very Low to Extreme
Disability Population Ratio	Disability population ratio by plexel	Percent of population identified as disabled within the plexel
Poverty Population Ratio	Poverty population ratio by plexel	Percent of population identified as under the poverty level within the plexel
Senior Population Ration	Senior population ratio by plexel	Percent of population identified as senior (GE 65 years of age) within the plexel
Road Availability (without social vulnerability)	Road Availability without factoring social vulnerability (disability, poverty, and senior) population ratios by plexel	Poor to Good Egress

Layer	Description	Units
Road Availability (with social vulnerability)	Road Availability using social vulnerability (disability, poverty, and senior) population ratios by plexel	Poor to Good Egress
Years Since Last Fire	Years since last fire by plexel (calculated for 2022)	Years

For all fields containing raw values they are classified either using a Natural Breaks (Jenks) classification or a qualitative classification from Very Low to Very High.

Composite Risk

Integrating RAVE with existing RAIL risk metrics allows for calculation of a composite risk metric for electric utility assets that incorporates local risk factors that can substantially increase risk for possible fires caused by an asset, i.e., increase the asset risk.

For example, if an area potentially impacted from an asset ignited fire has certain risk factors, such as:

significant terrain difficulty for suppression or egress issues (local characteristics),

high crown fire potential and majority of volatile fuels (fire spread exposure), and/or

high senior age and poverty ratio (vulnerability),

then the possibility of damage or loss is amplified by these risk factors. Accordingly, the risk score for an asset that impacts an area with these characteristics should be increased as it is worse than risk for another asset source that may impact areas without these factors present.

How the outputs will be characterized and presented

Figure B-6 is an illustration of how outputs can be characterized and presented. On the right is the estimate of acres burned at the 50th percentile of worst-weather conditions, on the left is the estimate of acres burned at the 99th percentile of worst-weather conditions.

Acres Burned 50th Percentile

Acres Burned 99th Percentile

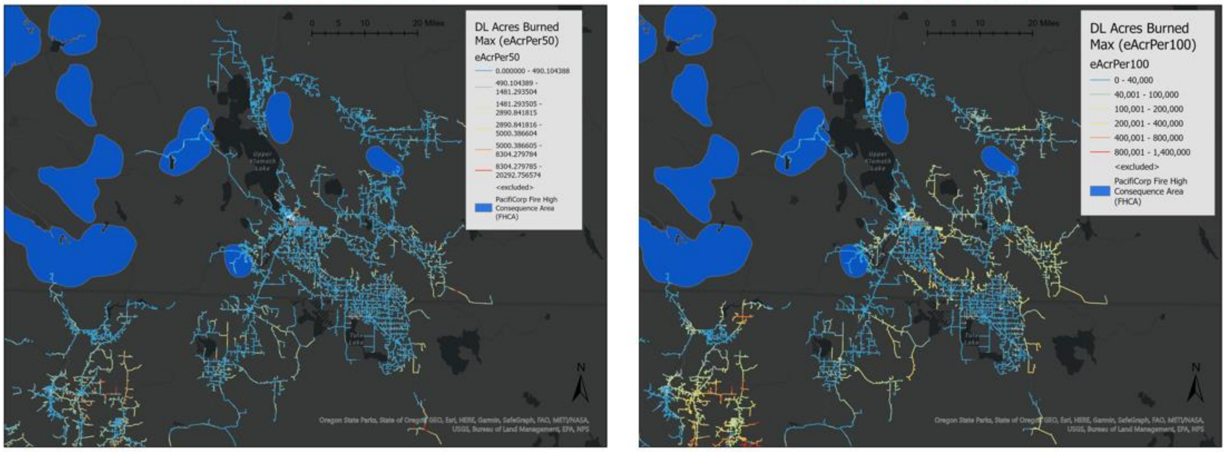


Figure B-6. Example of WRRM Output

Detailed Model Documentation

Model Purpose

Pacific Power uses WFA-E, a software solution developed by Technosylva for wildfire risk modeling for planning purposes.

The application of wildfire behavior modeling and risk analysis is used to quantify the potential impacts from possible electric utility infrastructure asset caused ignitions. The basis of this modeling is that not all ignitions (fires) are created equal, and each asset caused ignition can have substantially different consequence based on ignition location and related landscape characteristics.

The wildfire modeling and risk analysis derives a set of consequence metrics that quantify impacts. This includes potential acres burned, population impacted, number of buildings threatened, and estimated number of buildings destroyed. These are currently derived using an 8-hour simulation duration, based on a typical first burning period. Testing is underway to evaluate different fire durations based on suggestions in the most recent WMP Guidelines.

Technosylva's Wildfire Analyst™ Enterprise (WFA-E) product is used to conduct the modeling, deliver modeling outputs, and monitor and visualize results with software applications.

The wildfire behavior modeling and risk analysis is applied to address two different, yet similar, scenarios. First, the modeling is used with historical re-analysis WRF weather data to support the mitigation planning process. The WFA-E Wildfire Risk Reduction Model (WRRM) is used to quantify risk metrics from millions of wildfire simulations using the numerous WRF weather scenarios defined. This wildfire consequence data is then combined with probability of failure and ignition analysis developed internally to define composite risk values to support prioritization decision making for asset hardening and related mitigation.

Pacific Power uses data from WRRM to support their annual planning process across the service territory.

Model Version

WRRM Release 2.12.1

At this time, the utility specific changes are:

Theoretical Foundation

The basis of the wildfire risk modeling for electric utility assets lies in the published, proven and accepted fire science for wildfire behavior modeling. The Technosylva WFA-E product used to create risk metrics for both operational and planning initiatives utilizes the best-in-class fire science available. Technosylva has been able operationalize proven wildfire behavior models and validate these models through on-going collaboration with CAL FIRE and the US Forest Service Missoula Fire Laboratory as the only unique vendor selected. This collaboration provides the operational platform to test and validate a suite of wildfire behavior and risk models that are utilized for statewide intelligence and operations by CAL FIRE, and by each IOU in California for operations and mitigation.

To support the model R&D and implementation, Technosylva regularly publishes peer reviewed and accepted articles regarding these models. Technosylva has been involved in 30+ publications over the past 24 months, with 11 as the principal investigator. Some of these publications are referenced on the Technosylva web site at https://technosylva.com/scientific-research/.

The published fire science provides the theoretical foundation for the operational models, tempered by validation analysis conducted on an on-going basis, to continually refine the models to match what occurs with observed wildfire behavior. The rest of this section provides a detailed description of the theoretical and mathematical foundation for the WFA-E models.

Phenomenon and Physical Laws (Model Basis)

Describe the theoretical basis of the phenomenon and the physical laws on which the model is based.

Fire is a self-sustained and usually uncontrolled sequence of processes basically carried out by the combination of fuel, oxygen and heat. In forest fires (also referred to as wildland fire or wildfire), the fuel is given by the vegetation layer composed of trees, bushes and all kinds of dead and living foliage (organic matter). The oxygen is abundantly present in the atmosphere and the heat is caused by the combustion of the flame and transported mainly by radiation and convection within the vegetation.

A quick review of the process involved could be described as follows. Consider a homogeneous flammable solid material like wood to which and external heat flux has been imposed. As the solid material absorbs the heat it raises its temperature at a rate dependent on the net heat capacity of the material (mix of all the components of the solid, including water). As the temperature increases, the moisture content in the solid diminishes and eventually dries up the solid. A further increase of the temperature causes the pyrolysis process of the wood (around 550 K), the organic material decomposes into a stream of volatile gases (smoke, carbon and oxygen) and into solid remains like char (nearly pure carbon), and ashes (incombustible minerals like calcium, potassium, etc). The pyrolyzed fuel vapor convects and diffuses mixing with the oxygen of the atmosphere and forming a combustible mixture. The high gas temperature favors the initiation of a gas phase combustion reaction in the combustible-oxidizer mixture. The compound molecules break apart, the atoms recombine with the oxygen to form water, carbon dioxide and some other products. The whole process is ruled by many factors, the types of char and volatile, the amount of oxygen and the exact chemical reactions taking place. The temperature difference between the gases released in the pyrolysis process and the ambient air together with the gained temperature due to the oxidation reaction (around 1000 K), generates a buoyancy flow that raises up the hot combusting gas forming the characteristic flames of the fire.

In the wildland, fire behavior deeply depends on the vegetation (type, size and vertical arrangement), terrain, wind and moisture conditions of the vegetation (dead and living material). From a descriptive perspective, wildfires main observables are the fires Rate of Spread (ROS), flame length, flame intensity, heat per unit area, flame depth, and residence time. Depending on the behavior of the fire it may be classified as surface and crown fire. Surface fires burn loose needles, moss, lichen, herbaceous vegetation, shrubs, small trees and sampling that are at or near the surface of the ground. Crown fires burn forest canopy fuels, which include live and dead foliage/ branches, lichens in trees, and tall shrubs that lie well above the surface fuels. They are usually ignited by a surface fire. Crown fires can be passive or active. Passive crown fires involve the burning of individual trees or small groups of trees (often called torching). Active crown fires, or also referred to as running crown fires, present a solid wall of flame from the surface through the canopy fuel layers.

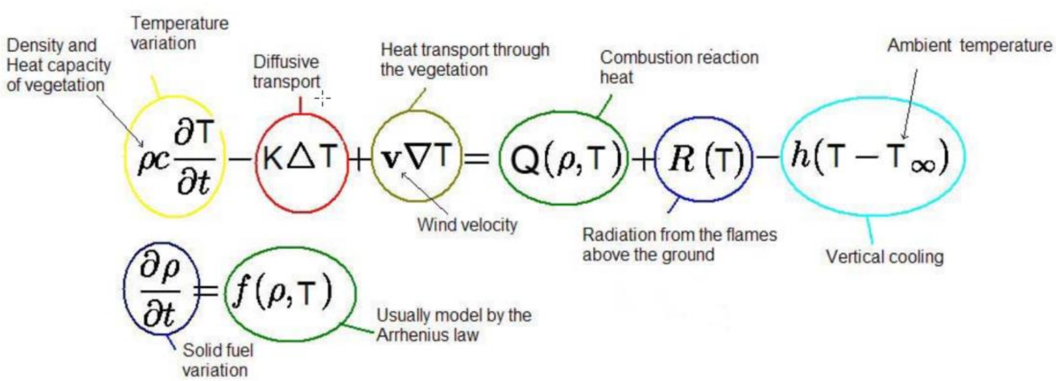
Fire growth from an ignition point can be split into four distinct phases (Fire science 2021), in the first phase the fire starts to burn slowly as the influx of air caused by the buoyancy flow of hot gasses causes the flames to tilt inwards. Once the fire has spread enough from the ignition point, wind is able to enter the already burn vegetation and pushes the flames away from the center and tilts them towards the unburned fuels, increasing the heat transfer, and therefore accelerating the fire. As the fire moves further away from the center, the acceleration of the fire depends more on the local characteristics of the curvilinear front. Finally, the fire may reach a steady-state when the fire line is uniform enough so that it can be considered of infinite length.

Governing Equations

Present the governing equations and the mathematical model employed.

“Fire modelling is a highly challenging problem from both the physical and the numerical point of view, and consequently historical advances in this field have always been forced to a compromised position due to the desire of practical usefulness, computer capabilities, required input data, and existing numerical methods. It is only by the consideration of these requirements that the primary natural approaches to the problem can be understood. The primary broad approaches are physical models, quasi-empirical models, and empirical ones.

Physical models are the most complex and have the advantage to be more generally valid across different fuels and weather conditions (Cruz 2017). They are usually posed as a set of coupled differential equations derived from conservation laws and defined on a usually bidimensional domain representing the vegetation layer considered as a porous medium where the main variables develop. The degree of approximation of the initial semi-physical description of the problem, as well as the rest of physical effects considered in the modelling may vary greatly from one model to another. Despite these different approaches, a conventional 2D multiphase model, sketching vegetation temperature through a convection reaction diffusion equation, and a solid combustible material evolution in time may serve as a simple example for illustration purposes.



Example of a 2D multiphase model sketching vegetation temperature and solid combustible

Even though physical models are very promising, they are not easy to make operational because in many cases the detailed input data they need is not readily available, and because they require a lot of computer processing capability, as they usually use adaptive meshes to keep track of the burning front. Some numerical methods used for solving these models are the Finite Element Method (FEM), Finite Difference methods (FDM), etc.

Empirical and semi-empirical models are mainly based on experimental data: laboratory runs, controlled outdoor fires, or well documented wildland fires. The difference between the empirical and semi-empirical approach is that the former ones contain no physical basis at all and are generally statistical in nature, while the later use some form of physical framework on which the statistical model is based (Andrews 2018, Sullivan 2009). These models are largely developed to support decision making and are the main operational models used today. They are typically able to predict the source dataset with mean absolute percent errors between 20 and 40% (Cruz et al. 2013)

Further review of exiting fire modelling approaches can be found in Catchpole and De Mestre (1986), Weber (1991), Pastor et al. (2003), Sullivan (2009a,b,c)

Assumptions

Identify the major assumptions on which the fire model is based and any simplifying assumptions.

The following are some of major assumptions contained in the models

- The physical framework development is based on an idealized situation in steady state spread which may not fit some extreme behavior of fires.
- Fuels are assumed to be continuous and uniform for the scale of the input (typically between 10 to 30 meter (m) resolution)
- Fire characteristics at a point only depends on the conditions at that point (point-functional model). This means that there are certain non-local phenomena like:
    - Increase of ROS due to a concave front.
    - Fire interaction between different parts of the same fire or a different one
- Fire spread is assumed to be elliptical although there are several variations such as double ellipse, oval, egg-shape, etc.
- Weather is given hourly and is assumed to remain constant during that time. There is no interpolation in time to compute evolution of weather between hours.
- Reliability of weather inputs in the mid-range forecast (2 to 5 days)
- Fire is not coupled with the atmosphere in any way. This may seem like a major limitation in the model as wind is a main contribution to fire spread and at present many models (specially physical ones) try to couple wind and fire. The main reasons for us not to consider the coupling is:
- It would make it unfeasible to run millions of simulations considering the coupling effect.
- Empirical and semi-empirical models have been developed using an average wind

speed as an input, so it is not clear that considering more granular wind at the front is advisable.

- Fire is always assumed to be fully developed. Fire acceleration, flashover, or decay is not considered.
- Atmospheric instability which may have a deep impact on ROS (beer 1991) is not considered in the model.
- Gusts are not considered in the model
- No interaction between slope and wind other than creating an effective or equivalent wind. This means that fire is assumed to have an elliptical shape no matter the alignment of wind and slope.
- Models have been developed with scares empirical data. The abundance of today's fire data sources, however, is allowing us to better adjust models to observed fire patterns.
- Fuel array description of the vegetation may not perfectly describe fuel characteristics.
- Spotting is only considered in surface fires

Independent Review Results (see Guide ASTM E 1355)

Provide the results of any independent review of the theoretical basis of the model. Guide E1355 recommends a review by one or more recognized experts fully conversant with the chemistry and physics of the fire phenomena but not involved with the production of the model.

The core models implemented in WFA-E form the basis of most operational propagation models in use today (Andrews et al 1980, Gould 1991). They have been implemented in well-known software like NEXUS (Scott and Reinhardt 2001), Fire and Fuels Extension to Forest Vegetation Simulator (FFE-FVS) (Reinhardt and Crookston 2003), FARSITE (Finney 2004), Fuel Management Analyst (FMAPlus) (Carlton2005), FlamMap (Finney 2006) and BehavePlus (Andrews et al.2008). Nevertheless, forest fires are a very difficult phenomenon to simulate which depends on many different factors and typical simulations are able to predict the source dataset with mean absolute percent errors between 20 and 40% (Cruz et al. 2013)

One of the important facts in fire simulation is the definition of the fuel models, with analysis providing different results for different fuels and regions. For example, Sanders (2001) observed a pattern of over-prediction by FARSITE in fuel models 1,2, 5 by a large margin, moderate in fuel 10 and some underprediction for fuel model 8. Zigner et al (2020) used two case studies during strong winds reveling that FARSITE was able to successfully reconstruct the spread rate and size of wildfires when spotting was minimal. However, in situations when spotting was an important factor in rapid downslope wildfire spread, both FARSITE and FlamMap were unable to simulate realistic fire perimeters. Ross et al. (2006) used measurements from temperature sensors during prescribed burn in the Appalachian Mountains to recreate the fires and compared fire behavior simulated by FARSITE. They obtain a set of ROS adjustment factors that better represented the observed fire behavior obtaining a ROS adjustment factor of 1.5 and 2 for fuels 9 and 11 respectively, and a decreasing factor of 0.2 to the fuel type 6.

Apart from these reviews Technosylva has been constantly improving the accuracy and performance of the published fire models to better adjust the results to observed fire behavior. This includes a better definition of the fuel types, improved forecast of live fuel moisture content, modifications to the crown fire modelling initialization scheme, and automatic fire adjustment based on data assimilation techniques using ROS adjustment factor. In addition, Technosylva has implemented more than 21 additional models into the WFA-E platform to enhance accuracy and address know limitations of published fire models. These improvements include crown fire analysis, ember and spotting, urban / non-burnable area encroachment, consequence and impact quantification, etc. It is important to note that improvement of the fire modeling platform of choice necessitates not only improvements in mathematical algorithms but substantial improvements in the accuracy and resolution of input data sources. These work in concert to enhance the modeling and outputs to match observed and expected fire behavior. A robust operationalization of fire models requires constant and on-going research, testing, validation and implementation of both models and data sources."

Mathematical Foundation

Techniques, Procedures, Algorithms

Describe the mathematical techniques, procedures, and computational algorithms employed to obtain numerical solutions.

The fire propagation model in WFA-E is a point-punctual model where the fire characteristics at a given point (cell) only depends on the conditions at that cell (weather, terrain, vegetation). This fits well in fire simulation as most of wildfire characteristics mainly depend on local characteristics (Di Gregorio et al 2003), but excludes the effects of non-local phenomena.

The overall resolution is done using a Cellular Automata (CA) where space is discretized into cells (from 10 m to 30 m resolution), and physical quantities take on a finite set of values at each cell. The potential ROS at each cell at any time is given by the propagation models (surface and crown fire). CA models directly incorporate spatial heterogeneity in topography, fuel characteristics, and meteorological conditions, and they can easily accommodate any empirical or theoretical fire propagation mechanism, even complex ones (Collin et al. 2011)

Spotting is introduced as a random event where firebrands can be lifted and generate secondary ignition points ahead of the fire (in the direction of the wind).

The time evolution is done using a Minimum Travel Time (Fast-Marching) algorithm. This algorithm is similar to the well-known Dijkstra´s (1959) algorithm but more adapted to grids instead of the original model that uses graphs. This approach has been used with success in many forest fires propagation models like FlamMap (Finney 2002) and many others (CITES). The algorithm provides a solution of the Eikonal equation of a spreading curve subject to a given speed function ROS(**x**). This is done by searching for the fastest fire travel time along straight line transects of neighboring cells in the lattice. The number of neighboring cells considered determines the angle discretization of the spreading fire. The neighborhood or degrees of freedom, u, in WFA-Eranges from 8 cells (Moore neighborhood) to 32 cells.

References to Techniques and Algorithms

Provide references to the algorithms and numerical techniques.

The Technosylva WFA-E platform utilizes numerous models to address specific operational requirements. These models are integrated into an extendible platform that facilitates continued improvement as R&D advancements are made. The following table lists the primary models employed on WFA-E:

Table B-3. Primary Models Employed on WFA-E

Model	Model Reference	Notes
Surface fire	Rothermel 1972, Albini 1976 Kitral IntecChile	WFA-E uses the core Rothermel model for fire propagation, however it can be configured for custom versions to support any empirical or semi empirical fire model. This has been done for different models employed in other countries, i.e. Chile, Canada, etc. In this regard, WFA-E platform is easily extended for use in unique geographies.
Crown Fire	Van Wagner (1977,1989,1993); Finney (1998); Scott and Reinhardt (2001)	Critical surface intensity and critical ROS for crown fire initialization. Expected ROS and flame intensity.
Time Evolution	Technosylva (Monedero, Ramirez 2011)	Fast-Marching method adapted to fire simulations. Minimum Travel Time algorithm with 32 degrees of freedom.
High-Definition Wind	Forthoffer et al (2009)	High resolution wind model obtained through the integration of the USFS WindNinja software. Note Technosylva is also the contractor for the USFS Missoula Fire Sciences Lab. for the on-going enhancement and customization of the WindNinja software. This provides Technosylva a unique understanding of the model science foundation and implementation approaches.
Wind Adjustment Factor	Andrews 2012	Wind speed conversion with height. Based on Albini and Baughman (1979); Baughman and Albini (1980); Rothermel (1983); Andrews (2012)

Model	Model Reference	Notes
Fire Shape	Andrews 2018,	Unique ellipse based solely on the effective wind speed.
Live Moisture Content	Cardil et al.	Machine learning Algorithm based on historical NDVI weather reading
Dead Moisture Content	Nelson (2002)	
Spark Modelling	Technosylva	Ignition point displacement based on wind speed
Urban Encroachment	Technosylva 2016	Includes several variations of urban encroachment algorithms developed internally to facilitate spread of fires into non-burnable urban fuels. This incorporates a distance-based friction model. Based on research publications by NIST.
Spotting	Technosylva 2019	Surface spotting model for wind driven fires. Albini (1983a, 1983b); Chase (1984); Morris (1987)
Building Loss Factor	Technosylva (Cardil xxx)	Machine Learning algorithm taking into account building conditions. Based on historical damage inspection data on buildings affected by fires over the past 13 years

Many of these models were originally published from research by the USFS Missoula Fire Sciences Laboratory. Technosylva has implemented, and enhanced these models, in addition to developing new models. Most Technosylva custom developed models are supported by journal publications as part of our corporate R&D program. Some of these models are referenced on the Technosylva web site at https://technosylva.com/scientific-research/. Key references are provided below for many of the models employed in the WFA-E platform.

Beer, T. The interaction of wind and fire. Boundary-Layer Meteorol 54, 287–308 (1991). https://doi.org/10.1007/BF00183958

Cruz Miguel G., Alexander Martin E. (2010) Assessing crown fire potential in coniferous forests of western North America: a critique of current approaches and recent simulation studies. International Journal of Wildland Fire 19, 377-398.

Cruz, Miguel G.; Alexander, Martin E. (2013). Uncertainty associated with model predictions of surface and crown fire rates of spread. Environmental Modelling & Software. 47: 16-28.

Scott, J.H. 2006. Comparison of crown fire modeling systems used in three fire management applications. USDA For. Serv. Res. Pap. RMRS-RP-58.

Scott, J.H., and Reinhardt, E.D. 2001. Assessing crown fire potential by linking models of surface and crown fire behavior. USDA For. Serv. Res. Pap. RMRS-RP-29.

Bennett, M., S.A. Fitzgerald, B. Parker, M. Main, A. Perleberg, C.C. Schnepf, and R.

Mahoney. 2010. Reducing Fire Risk on Your Forest Property. PNW 618: 40 p.

Fire Science Core Curriculum. 2017. OSU Extension Service, EM 9172: 197p

Gould, James. (1991). Validation of the Rothermel fire spread model and related fuel parameters in grassland fuels. Proceedings of the Conference on Bushfire Modelling and Fire Danger Rating Systems. 51-64.

Di Gregorio, Salvatore & Bendicenti, E.. (2003). Simulations of Forest Fires by the Cellular Automata Model.

J. Glasa and L. Halada. On elliptical model for forest fire spread modeling and simulation. Mathematics and Computers in Simulation, 78(1):76–88, 2008.

T. Ghisu, B. Arca, G. Pellizzaro, and P. Duce. A level-set algorithm for simulating wildfire spread. CMES Computer Modeling in Engineering & Sciences, 102(1):83–102, 2014

Dijkstra, E. W. (1959). A note on two problems in connexion with graphs. Numerische Mathematik, 1(1), 269–271.

Finney, M A, (2002). Fire growth using minimum travel time methods. Canadian Journal of Forest Research, 1420-1421, 32(8)

Sanders, Kristen A., "Validation and calibration of the FARSITE fire area simulator for Yellowstone National Park" (2001). *Graduate Student Theses, Dissertations, & Professional Papers*. 3990. https://scholarworks.umt.edu/etd/3990

A. Collin, D. Bernardin & O. Séro-Guillaume (2011) A Physical-Based Cellular Automaton Model for Forest-Fire Propagation, Combustion Science and Technology, 183:4, 347-369,

Zigner, K.; Carvalho, L.M.V.; Peterson, S.; Fujioka, F.; Duine, G.-J.; Jones, C.; Roberts, D.; Moritz, M. Evaluating the Ability of FARSITE to Simulate Wildfires Influenced by Extreme, Downslope Winds in Santa Barbara, California. *Fire* 2020, *3*, 29. https://doi.org/10.3390/fire3030029

Phillips, Ross J.; Waldrop, Thomas A.; Simon, Dean M. 2006. Assessment of the FARSITE model for predicting fire behavior in the Southern Appalachian Mountains. Proceedings of the 13th biennial Southern Silvicultural Research Conference. Gen. Tech. Rep. SRS-92. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station: 521-525

Equations and Implementation

Present the mathematical equations in conventional terminology and show how they are *implemented in the code.*

Summary

The mathematical model used to simulate surface fire spread is the model developed by Rothermel (1972) with some modifications from Albini (1976) and some minor adjustments from Technosylva. It accepts the initial 13 fuel models (Anderson 1982) as well as Scott and Burgan's (2005) dynamical fuels where there is a transfer load between the herbaceous and dead classes. Among other outputs this model provides the surface fire rate of spread, flame length and flame intensity in the direction of maximum spread (head front). Crown fire is implemented using the model developed by Van Wagner (1977,1993) which computes the transition viability to crown fire, as well as the expected ROS and intensity in active crown fires. Spotting is modeled as a pseudo random event. The maximum expected spotting distance from the fire is obtained using the wind-driven model developed by (Albini 1983a; Albini 1983b; Chase 1984) and then embers are generated randomly on the front of the fire and the actual traveled distance is computed also randomly based on the maximum distance available. In this modeling there is no tracking of individual embers in the air. Wind speed profiles at different heights (2m, 10m, 20ft) are obtained through a logarithm wind profile found in Andrews (2012). Fire is assumed to spread following an elliptical shape only dependent on the effective wind speed (Andews 2012). The time evolution is done using a Fast-Marching method on a regularly spaced landscape grid of a Cellular Automata.

Surface Fire

The default propagation engine implemented in WFA is Rothermel's (1972) surface model with the modifications proposed by Albini (1976) and the requirements to accept Scott and Burgan (2005) fuel models. The basic equation in the model predicts the heads fire rate of spread without wind or slope:

$R_0 = I_R \xi / \rho_b \varepsilon Q_{ig}$

Here I_R is the reaction intensity (energy released rate per unit area of the fire front), ξ the propagating flux ratio, ρ_b the bulk density, ε the effective heating number, and Q_{ig} the heat of ignition. The equation is derived by applying the energy conservation to a unit volume of fuel ahead of a steadily advancing fire in a homogeneous fuel bed. In this model, the ROS may be viewed as the ratio between the heat flux received by the unburned fuel ahead of the fire (numerator) and the heat required to ignite it (denominator).

The input parameters to compute the ROS in the case of no wind or slope are the moisture content and the characteristics of the vegetation. Moisture content is given by the 1h, 10h and 100h dead moisture content, and the woody and herbaceous live moisture content. Fuels are assumed to be a mixture of different vegetation types depending on their class (dead or live) and size (less than 0.25 inch, 0.25-1 inch, 1-3 inch), with each class having different surface to volume ratio and loads. The inputs required to define a fuel type is given in the following table:

Table B-4. Input Variables for Each Fuel Type.

			LOAD				SAV					
Fuel	1h	10h	100h	herb	woody	1h	herb	woody	Dyn	Depth	MoistExt	heat

Here Dyn (dynamic) is a boolean variable to define if there should be a transfer between the herbaceous load and the dead one based on the herbaceous content. In general, SAV values (the fineness of the fuel) strongly affects the ROS and flame length of the fire, while the fuel load does not affect the rate of spread but can have a strong effect on the flame length.

The effect of wind and slope can be incorporated in the model through a couple of dimensionless parameters depending on the midflame wind speed U and the terrain angle θ:

$$ROS = R_0 (1+\Phi_w + \Phi_s)$$

with

$$\Phi_s = 5.275\ \beta-0.3\ (\tan \theta)$$

$$\Phi_w = C * U^{B} (\beta / \beta_{op})^{-E}$$

Where β_{op} and β are the optimum and standard packing ratios respectively, and C, B, and E are parameters depending on the surface to volume ratio σ:

$$C = 7.47 * \exp(-0.133\ \sigma^{0.55});$$

$$B = 0.02526\ \sigma^{0.54}$$

$$E = 0.715 * \exp(-0.000359 * \sigma)$$

The slope and wind factors are summed together to obtain the final ROS. If they are not aligned the resultant vector defines the direction of maximum spread (which will be between the direction of wind and the direction of slope). This final slope-wind factor can also be used to compute an equivalent or effective wind speed causing the same effect as the combined effect of wind and slope. To do that we simply inverse the equation of the wind factor to obtain:

$$U_e = [\ \Phi_e (\beta / \beta_{op})^{E} / C\ ]^{-B}$$

The Rothermel model predicts fire characteristics (ROS, flame length, etc) only in the direction of maximum spread (head front) obtained from the combined effect of wind and slope. To compute the ROS in a direction different from the direction of maximum spread, and to be able to use the model in a 2D landscape it is assumed that a free burning fire perimeter from a single ignition point has an elliptical shape. There are several different approaches to compute the ellipse (or ellipses) eccentricity based on wind and slope (Albini [2], Anderson 1983 [6], Alexander, etc). The present implementation follows the equations in Andrews (2008) depending on the effective wind speed U_e in mi/h in the direction of maximum spread. The length to with ratio is given by:

$$L/W = 0.1 + 0.25\ U_e$$

Or equivalently the eccentricity e is given by

$$e = (Z^2 - 1)^{0.5} / Z$$

so that the ROS in any direction φ is given by

$$ROS(\varphi) = ROS\ (1-e) / (1+e)$$

One of the most important variables of fire is the amount of heat it generates as this is the main contributor to fire spread and fire severity. The amount of heat can be measured using different variables like the reaction intensity (IR), the Heat per Unit Area (HPA) or the fireline intensity. The Reaction intensity is the rate of energy release per unit area within the flaming front (with units of energy/area/time), heat per unit area is the amount of heat energy released per unit are within the flaming front (units of energy/area), fire line intensity is the rate of heat energy released per unit time per unit length of the fire front (units of energy/distance/time). Fireline intensity is independent of the depth zone and It is calculated as the product of the available fuel energy and the ROS of the fire (Byram 1959):

$$I_B = HA \cdot ROS$$

Where The heat per unit area depends on the reaction intensity of the fire (IR) and the time that the area is in the flaming front (residence time tr)

$$H_A = I_R \cdot tr = 384 \cdot I_R / \sigma$$

In this model the flame length and Byram's intensity are closely related by:

$$FL = 0.45\ I^{0.46}$$

Where the flame length is in feet and the intensity in Btu/ft/sc.

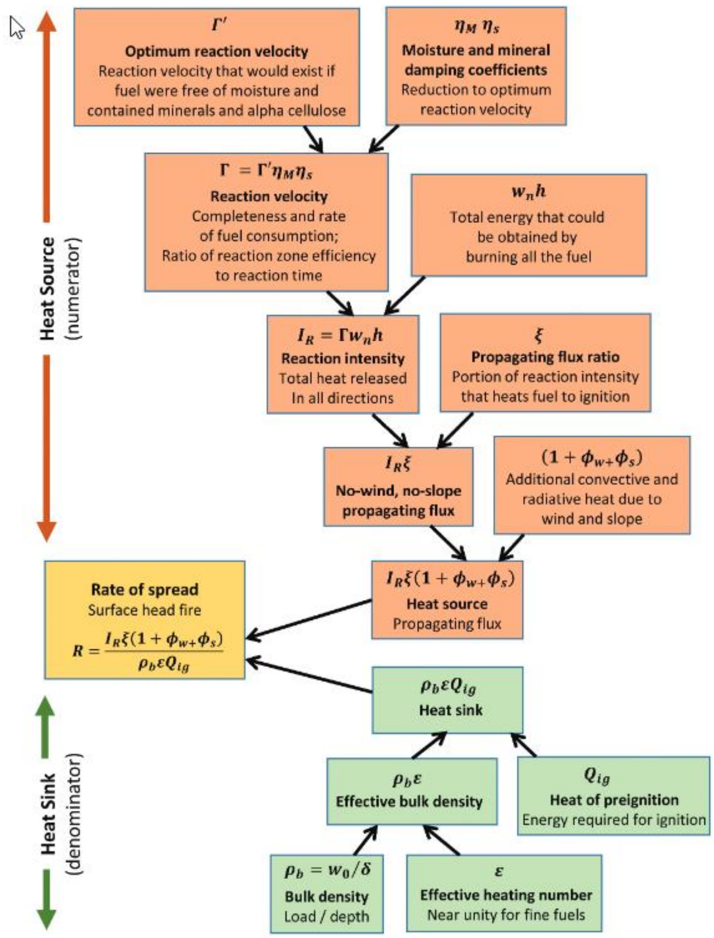


Figure B-6. Flow of Calculation provided in Andrews (2018)

For a much more in-depth discussion of the Rothermel surface model please read Andrews (2018) and Rothermel (1972).

Crown fire

Crown fires burn forest canopy fuels. They are usually generated by surface fires and represent a major change in fire behavior due to an increased rate of spread and heat released. Crown fires can be passive, active or conditional based on the capacity of the surface fire to move into areal fuels, and to the capacity of the burning canopy to move between individual trees.

Crown fire initiation occurs when the surface fire provides enough heat to raise the temperature of the canopy fuel to ignition temperature. In Van Wagner (1977) model, this minimum intensity is given by:

$$I_{ini} = (0.01 * CBH\ (460 + 25.9\ FMC))^{1.5}$$

Where CBH is the canopy base height (m) and FMC is the foliage moisture content of the canopy cover. Foliar moisture content (FMC) is usually not known, but it is assumed that for most species old foliage should be around 100 percent and this value has been used as a default value when no other information is available (Scott 2001). This approach however does not consider any known humidity conditions of the site and in WFA the FMC is computed based on the 100h moisture content as follows:

$$FMC = 75 + 2 \cdot m100h$$

Once the fire has transitioned to the canopy it is necessary to have a critical mass-flow rate for the fire to be self-sustained. Vang Wagner found this critical mass to be 0.05 kg m-2 sec-1 (Scott 2001) which can be used to determine a minimum crown fire rate of spread only dependent on the Canopy Bulk Density (CBD) and given by

$$R_{active} = 3 / CBD$$

Other existing models not used in WFA-E are Alexander (1998) which is very similar to Van Wagner (1977) but includes additional inputs like flaming residence time, plume angle and fuel bed characteristics, Cruz et at. (1999) fire transition model, and Cruz et al. (2002) crown fire spread model given by:

$$ROS = c1\ U^{c2}\ CBD \cdot C3 \cdot e^{c4xEFM}$$

Where U is the wind at 10m, CBD the canopy bulk density, EFM is the fine dead moisture content, and C1, C2, C3, C4 are a set of regression coefficients.

The model for the ROS of crown fires was computed by Rothermel (1991) through a linear regression between observed crown ROS and the surface fire model. It states that the crown fire of an active ROS is 3.34 times the rate of spread of the surface model 10 assuming a 0.4 wind reduction factor.

$$R = 3.34(R_{10})_{40\%}$$

Based on these conditions, crown fire may be classified as:

Surface fire if neither the intensity nor the minimum crown ROS is met

Passive Crown fire (torching): Fire spreads through the surface fuels, occasionally torching overstory trees. Overall ROS is that of the surface fire.

Conditional Crown: Fire cannot transition to crown, but active crown fire is possible if there was a fire transition to crown by other means

Active Crown: Fire spreads through the overstory tree canopy if both conditions are meet

Fire Type		Active crown fire?	
		No	Yes
Transition to crown fire?	No	Surface	Conditional Crown
	Yes	Torching	Crowning

Figure B-7. Crown Fire Classification as Shown in BehavePlus

Van Wagner's crown fire transition and propagation models are well known and used operationally but have shown to have a significant underprediction bias when used in assessing potential crown fire behavior in conifer forests of western North America (Cruz et al. 2010). To try to correct this bias Technosylva has introduced two new parameters in the model that has been adjusted based on the analysis carried out by the scientific team using data from the last two fire seasons in California. The model introduces two new parameters 1) a crown factor multiplier for the Canopy Bulk Density (CBD) which decreases the minimum crown ROS required to have an active crown fire, and a factor that forces a smooth transition between the surface and the crown fire behavior. The final ROS of the overall fire when crown fire type is conditional or crowning is a weighted average of surface and crown ROS

$$ROS = surfROS * (1-\alpha) + \alpha * crownRos$$

Where the value α ranges from 0 to 1 and depends on the **active ratio** in the following way:

$$\alpha = activeRatio^{1/smoothFactor}$$

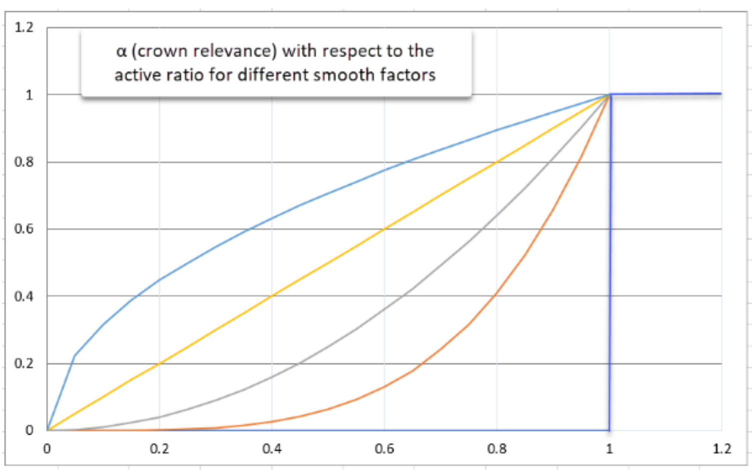


Figure B-8. Example Effect of the Smooth Factor (0 blue, 0.25 red, 0.5 gray, 1 yellow) in the Crown Contribution for Active Ratios Lower than 1

At present, with WFA-E the crown CBD factor is set to 1.2 and the smooth factor to 0.4. This approach to provide a gradual transition in the fire's rate of spread (and flame length) from the initial onset of crowning similar to the crown fraction burned (CFB) (Alexander 1998) used in other modelling systems like FlamMap, FARSITE or Nexus, with the main difference being the smoothing function itself. Cruz et al. observes that there is no evidence of such a smooth transition between surface and crown fire regimes in the experimental data but rather an abrupt transition is observed far more commonly. In our context, however, where the main aim is to produce a forecast risk and not to simulate an individual fire we consider that it is important to reflect the fact that the fire conditions are close to generate an active crown fire.

For a more in-depth discussion of the crown fire models please read Cruz et al (2010) Scott et al. (2006)

Wind adjustment factor

Fire simulations require wind speed at midflame to compute surface fire spread and at 20ft to compute crown fire characteristics. To convert the wind between the two heights, WFA-E uses the wind adjustment factor (WAF) found in Andrews (2012) and implemented in the software BehavePlus and Farsite. The model is based on the work of Albini and Baughman (1979) and Baughman and Albini (1980), using some assumptions made by Finney (1998). This implementation considers two different models for sheltered and unsheltered conditions from the overstory. As described in Andrews (2012), the unsheltered WAF is based on an average wind speed from the top of the fuel bed to a height of twice the fuel bed depth. The sheltered WAF is based on the assumption that the wind speed is approximately constant with height below the top of a uniform forest canopy. Sheltered WAF is based on the fraction of crown space occupied by tree crowns. The unsheltered WAF model is used if crown fill portion is less than 5 percent. Midflame wind speed is the 20-ft wind multiplied by the WAF.

Unsheltered WAF depends on the surface fuel bed depth (in feet):

$$WAF = \frac{1.83}{\ln\left(\frac{20 + 0.36H}{013H}\right)}$$

Sheltered WAF:

$$WAF = \frac{0.555}{\sqrt{fH} * \ln\left(\frac{20 + 0.36H}{0.13H}\right)}$$

With H, the canopy height, and f ,the crown fill portion, depending on the canopy cover (CC) and the crown ratio (CR):

f = CC*CR / 3

CR = (CH-CBH) / CH

CR is the ratio of the crown length to the total height of a tree.

Time evolution

The fire models can predict the potential ROS of the front at any point and direction but is not able to compute the evolution of the fire perimeter in time. The main models to do that are:

Using Huygens principle of wave propagation like in Farsite (xxx) and discretizing in time

Using a Minimum Travel Time Algorithm or Fast Marching method, and discretizing in space

Using the more general but usually slower Level Set Method.

"In the context of wildfires, Huygens principle states that each point on a fire front is in itself the source of an elliptical wavelet (fire) which spreads out in an independent way in the forward direction. This approach is numerically solved by splitting the perimeter into a set of nodes, computing the evolution of those nodes in the direction normal to the perimeter based on the ROS given by the propagation model and a given time steps, and then reconstructing the front based on the position of the transported nodes. The main weakness of vector-based approaches is the need for a computationally costly algorithm for generating the convex hull fire-spread perimeter at each time step, especially in the presence of fire crossovers and unburned islands (Ghisu et al. 2014). Raster based implementations are computationally more efficient (Glasa et al. 2008), but can suffer from significant distortion of the produced fire shape if the number of neighboring cells considered (number of possible spread directions) is low.

Encroachment

Encroachment is a critical component in the WFA-E fire modeling simulations as it affects the number of buildings, assets, facilities and population impacted. It does not have a relevant effect on other impact metrics. To take advantage of enhanced algorithms for spread encroachment using adjacent fuels and fire behavior data, the non-burnable (and especially urban) fuel classification needed to be updated to provide better granularity and characterization of the type of urban/WUI. Accordingly, to test these methods an enrichment of the current fuels data was developed by Technosylva to delineate urban fuels into different types of urban and also a level of density of buildings. This enhancement of the basic Scott and Burgan fuel models is used in combination with enhanced encroachment algorithms to more accurately calculate potential impacts to buildings and population.

Urban areas have been classified into classes depending on their structure (roads, urban core, isolated, sparse) and their surrounding fuels, characterized as high versus low fire behavior fuels). Specific encroachment factors can then be applied to each grouping.

Spark Modeling

Electrical failures can cause sparks and produce an ignition meters away from the asset location. To take this into account, the WFA-E allows the ignition point location to be displaced if the underlying vegetation type is either non-combustible or WUI. This displacement is in the direction of the wind and is proportional to the wind speed. The displacement distance and wind speed algorithm has been developed using expert opinion from electric utility engineers familiar with asset failure and ignition probability.

Weather

WFA-E requires historical daily weather data to run the fire simulations. The minimum required variables are the wind speed at 10m, the dead moisture content, and the live moisture content. More explicitly:

Northward 10m wind speed

Eastward 10m wind speed

Dead moisture content 1hr

Dead moisture content 10hr

Dead moisture content 100hr

Herbaceous moisture content

Woody moisture content

The dead moisture may be given by the client or may be computed based on Nelson model. Similarly, the herbaceous moisture content may be provided by the client or may be computed using Technosylva's Machine Learning algorithm based on historical NDVI weather reading. The Technosylva DFM model has been developed to meet customer needs using the latest modelling approaches. The input wind speed required by the propagation model is 20ft; to convert the initial 10m wind speeds to 20ft, we use a logarithmic profile from Andrews (2012) leading to a 13% wind speed reduction.

Weather data is obtained from the Weather Research and Forecasting (WRF) Model weather forecast data. The forecast weather has a 2 km resolution which can lead to sharp changes in weather conditions between neighboring cells. In order to increase accuracy and meet the underlying 30m cell size resolution of the fuels data, weather data is interpolated spatially using a bilinear interpolation scheme. The smoothing of the source weather data ensures that integration with the wildfire behavior models results in outputs that do not have hard edges in the data.

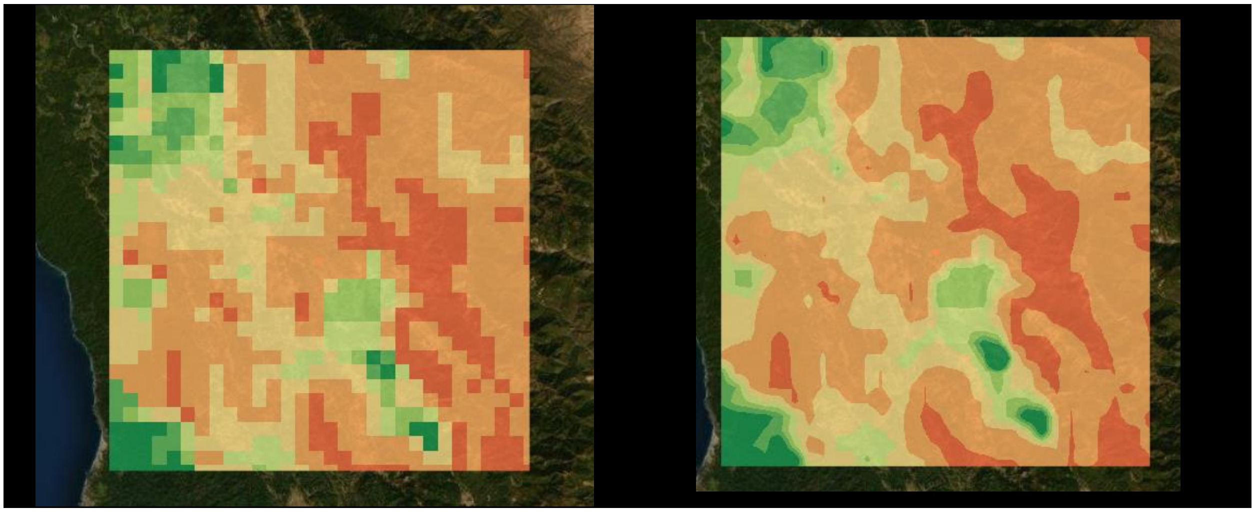


Figure B-9. Left: Initial weather definition. Right interpolated weather definition

Impact and consequence value calculation

Wildfire spread modeling is undertaken with asset ignition locations to derive potential impacts. The output impact values (risk metrics) are assigned back to the asset ignition point location. Using this approach allows us to differentiate between the risk output associated with different assets (and their ignition locations) using the same weather data although weather values may vary based on spatial location and time of day (hourly). For both operational and mitigation applications, the wildfire spread modeling is conducted using High Performance Computers (HPC) and typically involves hundreds of millions of spread simulations. The amount of simulation will vary depending operational use with daily forecasts versus mitigation planning use with hundreds of weather scenarios.

The main goal for the WFA-E simulations is to create a forecast risk associated to each ignition point and surrounding area. This is done by running individual simulations and associating the following main risk metrics back to each ignition point. The following baseline risk metrics are calculated from the spread simulations

Acres Burned (referred to as Fire Size Potential)

Number of Buildings Threatened

Estimated Number of Buildings destroyed

Population impacted

Numerous conventional fire behavior outputs are also calculated, the most important being:

Rate Of Spread (ROS)

Flame Length (FL)

Fire Behavior Index (FBI) – combination of ROS and FL

Limitations (see Guide ASTM E 1895)

Identified the limitations of the model based on the algorithms and numerical techniques.

The Technosylva WFA-E platform Is an integration of numerous specialty models designed to address specific scientific requirements and methods.

The following assumptions applied to the models used in WFA-E:

The physical framework development is based on an idealized situation in steady state spread

Rate Of Spread at a point only depends on the conditions at that point (point-functional models). This means that there is no increase in speed due to non-local contributions of the fire front.

Fire model is not directly coupled with the atmosphere. Fire will not modify local atmosphere. However, this is being addressed with seamless integration with the WRF-SFIRE model in development at San Jose State University, Wildfire Interdisciplinary Research Center. WRF-SFIRE is an option available to WFA-E customers to address specific convection based fire scenarios.

Fire is always assumed to be fully developed with fire acceleration, flashover, or decay not being considered.

Atmospheric instability, which may have a deep impact on ROS (Beer 1991), is not considered in the model in any way.

Gusts are not considered in the model

No interaction between slope and wind other than creating an effective or equivalent wind. This means that fire is assumed to have an elliptical shape no matter the alignment of wind and slope.

Experimental data is scarce and the empirical adjustment of models have been based on wind tunnel experiments and a few well documented fires

Fuel array description of the vegetation may not perfectly describe fuel characteristics.

Spotting is only considered in surface fires

Model Substantiation

The WRRM wildfire simulation models inside the Technosylva's platform are the same as the models used in the WFA-E tools, FireCast and FireSim, which are currently used by the State of California for operational wildfire modeling after being selected from among 131 proposals in the RFI2 process during the 2019 fire season. These models have undergone a full cycle of validation, verification and calibration as a result from their utilization on operational wildfire scenarios.

Validation Data

- National Guard FireGuard Polygons dataset: fire activity data from 2019 for individual incidents every 15 min
- VIIRS and MODIS hotspots twice daily from NASA FIRMS
- Fire Perimeters from NIFC Incidents data

Model Verification

- The models implemented in the platform have been verified in the internal documentation of Technosylva to support they are properly implemented.
- The intrinsic models inside WFA-E and WRRM are part of the Wildfire Analyst Pocket application from Technosylva, which is a tool for training the S-390 Intermediate Fire Behavior course in California.

Model Validation

- During the last three fire seasons, our provider has validated the performance of the fire behavior modeling with more than 1850 fires in California, under a different set of conditions. The results are in a paper submitted to the International Journal of Wildland Fire "Performance of operational fire spread models in California", currently under review. Validation process is part of the paper, coauthored by the Technosylva scientific team along with CAL Fire and USFS personnel.

Model Calibration

- As a result of this validations, the existing wildfire behavior fuel models (Scot and Burgan 40 fuel models) have been calibrated and resulted in two new fuel models based on Machine Learning: Timber Understory (TUML1) and Timber Litter (TLML1) fuels. Technosylva refers to the next publication of the paper for extended information.

Additional Models Supporting Risk Calculation

Weather Analysis

To support the WFA-E, which includes FireCast and FireSim discussed in Section WRRM model, Pacific Power has provided Technosylva data from Pacific Power's 30-Year Weather Research & Forecast (WRF).

Model Inputs

The 30-Year WFF provides historic weather conditions of temperature, humidity, wind speeds and energy release component at a 2-kM resolution. The company has provided eight years of the 30-Year WRF model to Technosylva for WFA-E and will continue providing historical years in batches until 30 years is complete and then move to an annual cadence to provide the prior year's data to stay current.

In addition to the information Pacific Power provides from the 30-Year WRF model, Technosylva also sources the landscape, weather, and fuels inputs shown in Table B-5 to support WFA-E modeling.

Table B-5. Landscape, Weather, and Fuels Inputs in WFA-E Model

Dataset	Spatial Resolution (meters)	Temporal Resolution	Data Vintage	Source
Landscape Characteristics				
TERRAIN	10	YEARLY		USGS
SURFACE FUELS	30/10	PRE FIRE SEASON, MONTHLY UPDATE IN FIRE SEASON, END OF FIRE SEASON	2020	TECHNOSYLVA
WUI AND NON FOREST FUELS LAND USE	30/10	TWICE A YEAR	2020	TECHNOSYLVA
CANOPY FUELS (CBD,CH,CC,CBH)	30/10	PRE FIRE SEASION, MONTHLY UPDATE IN FIRE SEASON, END OF FIRE SEASON	2020	TECHNOSYLVA
ROADS NETWORK	30	YEARLY		USGS
HYDROGRAPHY	30	YEARLY		USGS
CROPLANDS	30	YEARLY	1997	USDA
Weather and Atmospheric Data				
WIND SPEED	2000	HOURLY / 124 HOUR FORECAST	1990	ADS/DTN
WIND DIRECTION	2000	HOURLY / 124 HOUR FORECAST	1990	ADS/DTN
WIND GUST	2000	HOURLY / 124 HOUR FORECAST	1990	ADS/DTN
AIR TEMPERATURE	2000	HOURLY / 124 HOUR FORECAST	1990	ADS/DTN
SURFACE PRESSURE	2000	HOURLY / 124 HOUR FORECAST	1990	ADS/DTN
RELATIVE HUMIDITY	2000	HOURLY / 124 HOUR FORECAST	1990	TECHNOSYLVA
PRECIPITATION	2000	HOURLY / 124 HOUR FORECAST	1990	ADS/DTN
RADIATION	2000	HOURLY / 124 HOUR FORECAST	1990	ADS/DTN

Dataset	Spatial Resolution (meters)	Temporal Resolution	Data Vintage	Source
WATER VAPOR MIXING RATIO 2m	2000	HOURLY / 124 HOUR FORECAST	1990	ADS/DTN
SNOW ACCUMULATED - OBS	1000	DAILY	2008	NOAA
PRECIPITATION ACCUMULATED - OBS	4000	DAILY	2008	NOAA
BURN SCARS	10	5 DAYS	2000	NASA/ESA
WEATHER OBSERVATIONS DATA	Points	10 MIN	1990	SYNOPTIC
Fuel Moisture				
HERBACEOUS LIVE FUEL MOISTURE	250	DAILY / 5-DAY FORECAST	2000	TECHNOSYLVA
WOODY LIVE FUEL MOISTURE	250	DAILY / 5-DAY FORECAST	2000	TECHNOSYLVA / ADS
1 hr DEAD FM	2000	HOURLY / 124 HOUR FORECAST	1990	TECHNOSYLVA / ADS
10 hr DEAD FM	2000	HOURLY / 124 HOUR FORECAST	1990	TECHNOSYLVA / ADS
100 hr DEAD FM	2000	HOURLY / 124 HOUR FORECAST	1990	TECHNOSYLVA / ADS

Model Outputs

FireCast and Fire Sim: Comparison of the 96-hour weather forecast to historical fire weather days in the same location. This includes temperature, humidity, winds, barometric pressure, and fuel moisture

WRRM: Identification of areas where assets are at high risk of failure and high risk of ignition under certain weather conditions to support planning of projects and programs to reduce wildfire risk long term. This includes wind gusts, energy release component, and humidity. See Section 6.2.1 for further discussion

Calculation of the uncertainty of the input parameters and model assumptions, limitations, and parameterizations on the model results

Fuel Conditions

For these layers, data developed by Technosylva is used. Technosylva provides an annual fuel updating subscription where initial fuels is developed using advanced remote sensing object segmentation methods using high resolution imagery, available LiDAR & GEDI, and other standard imagery sources, as NAIP, Sentinel 2 and Landsat. This is supplemented with in-the-field surveys to verify the fuels for possible areas of concern and to validate the fuels classification. Surface and canopy fuels data is critical for accurate fire behavior modeling, so it is paramount that this data is up-to-date, and when used, results in the observed and expected fire behavior.

Surface and canopy fuels are updated throughout the year, to accommodate changes to the fuels, typically monthly during fire season. This ensures that all major disturbances, such as fires, urban growth, landslides, etc. are updated in the fuels data. A variety of methods, including burn severity analysis, are used to update the fuels. Up to date fuels data is critical to ensuring the fire behavior outputs from our modeling are accurate, as it is a key input into risk analysis.

Technosylva continually tests new fuels datasets that become available from other sources, such as LANDFIRE, federal risk assessment regional projects, and independent sources, such as the California Forest Observatory data. Unfortunately, the publicly available data does not perform at the level required when confronted with operational testing. In general, these publicly available data do not result in fire behavior outputs that facilitated accurate predictions. Ultimately with any fuels dataset, the quality and accuracy of the fuels is measured on whether it produces 'observed and expected fire behavior'. Fortunately, Technosylva is able to test this data, and other fuels data including their custom data, operationally on a daily basis with CAL FIRE and the IOUs against active wildfires to see how it performs.

Updates to the fuels, and algorithms that use the fuels data for fire behavior modeling is on-going with us, as we continue to enhance the data and algorithms to match observed fire behavior across the state. These methods and algorithms are proprietary.

WUI and Non-Forest Fuels Land Use classes are based on a Technosylva proprietary method that characterizes WUI and other land uses classes that have been a typical limitation of the Scott and Burgan classification, as they are defined in general non burnable classes. In combination with the Surface Fuels, this provides a solid foundation for fire behavior and impact analysis.

Calculation of Risk and Risk Components

Likelihood

Ignition Likelihood

$$ER = POI * POF * CR$$

Expected Risk (ER) is the product of equipment-related Probability of Ignition (POI) for the asset, equipment-related Probability of Failure (POF), and the Conditional Risk (CR) of a wildfire should one ignite at that location

CR is a function of both fire spread potential and consequence in the area surrounding the asset. CR is modeled by combining a custom implementation of deterministic fire spread models with geospatial data pertaining to the consequence and potential damage of structures across the territory

Equipment Likelihood of Ignition

By incorporating circuit information, weather data, and outage records into a statistical model, we can accurately determine the likelihood of ignitions associated with equipment. The model outputs an hourly probability of failure (POF) for each circuit segment, only considering outages that have the potential to produce sparks or ignitable material. A key advantage of the statistical model approach is that it provides well-calibrated predictions, meaning that the model's predicted probabilities closely match the actual occurrence of events under similar conditions. For instance, if the model predicts a 10% probability of failure for a particular circuit under specific weather conditions, and you examine the dataset for all the days with similar weather conditions, you would find that approximately 10% of those days did, in fact, experience a failure.

It is important to note that not all outages that produce sparks will necessarily result in ignition. To address this, we integrate the NFDRS ignition component (IC) into our analysis. The IC provides a detailed assessment of the probability that any burnable material could generate a wildfire that requires suppression efforts. By incorporating this additional layer of analysis, we can more accurately assess the risk of equipment ignition and wildfire. By combining the POF model with the IC, we effectively obtain a likelihood of wildfire occurrence for each asset on each day, enabling us to make informed decisions and take appropriate measures to prevent and mitigate future hazards.

Contact from Vegetation Likelihood of Ignition

The contact from vegetation likelihood of ignition is calculated the same way as described in the equipment likelihood of ignition section.

Contact from Object Likelihood of Ignition

The contact from object likelihood of ignition is calculated the same way as described in the equipment likelihood of ignition section.

Burn Probability

Burn Frequency	Burn Frequency is the number of times a plexels is touched from all asset ignited simulations run for the selected weather days. It is similar to traditional burn probability although this only represents a frequency, not a probability.	Number of times impacted by a fire simulation

PSPS Likelihood

PacificCorp currently does not calculate PSPS likelihood. See Section 6.7 for plan to implement PSPS Risk Assessment Solution.

Consequence

Wildfire Consequence

Fire Behavior Index	Combination of Rate of Spread and Flame Length during the first 2 hrs of the fire simulation, following the NWCG standards on fire behavior classes	The Fire Behavior Index layer group includes FBI results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs.	Fire Behavior Index within the plexel
Acres	Fire Simulation size with no suppression for 8 hours simulations	The Acres layer group includes acres results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs.	Acres burned within the plexel
Buildings Threatened	Buildings from an improved dataset available from different sources (Microsoft, OSM, Esri, FEMA) inside the fireplain of the 8 hrs. simulations.	The Buildings Threatened layer group includes buildings impacted results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs.	Number of buildings impacted within the plexel
Buildings Destroyed	Applying a proprietary Building Loss Factor (a % of probability of being destroyed)	The Buildings Destroyed layer group includes buildings destroyed results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs.	Estimated number of buildings destroyed within the plexel
Building Loss Factor	Model created with a ML model based on CAL FIRE data on the Buildings Threatened results. It considers vegetation type and density around the buildings, surrounding buildings, position in the terrain	The Building Loss Factor layer group includes building loss factor results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs.	Estimated building loss factor within the plexel
Population	Population from an raster dataset created by the Oak Ridge National Lab (2021) inside the fireplain of the 8 hrs. simulations.	The Population layer group includes population impacted results for percentiles 100, 98, 95, 90, 80, 60, 40, 20, and 0 for 8-hour simulation runs.	Number of population (people) impacted within the plexel

Wildfire Hazard Intensity

Fire_Intensity = FBI * Net_Area /Total_Area

Where FBI is the Fire Behavior Index (FBI) in WRRM and the Net_Area = Crown_Area + δ * Surface_Area

Wildfire Exposure Potential

Wildfire Vulnerability

Resilience= W_1* Road_Availability/SDI

- Where SDI is the difficulty of suppression on a scale of 1-5

PSPS Consequence

PacificCorp currently does not calculate PSPS consequence. See Section 6.7 for plan to implement PSPS Risk Assessment Solution.

PSPS Exposure Potential

PacificCorp currently does not calculate PSPS exposure potential. See Section 6.7 for plan to implement PSPS Risk Assessment Solution.

Vulnerability of a Community to PSPS

PacificCorp currently does not calculate PSPS vulnerability. See Section 6.7 for plan to implement PSPS Risk Assessment Solution.

Risk

Ignition Risk

Composite Asset Risk=(Impact* Intensity)/ Resilience

PSPS Risk

PacificCorp currently does not calculate PSPS risk. See Section 6.7 for plan to implement PSPS Risk Assessment Solution.

Overall Utility Risk

Currently, Pacific Power uses the Ignition Risk (Composite Risk in WRRM) as the utility risk, this will change when PSPS risk is quantified.

APPENDIX C: ADDITIONAL MAPS

No additional maps are provided.

APPENDIX D: AREAS FOR CONTINUED IMPROVEMENT

As Pacific Power identifies areas for continues improvement, an update will be provided.

APPENDIX E: REFERENCED REGULATIONS, CODES, AND STANDARDS

Name of Regulation, Code, or Standard	Brief Description
GO 95	Overhead electric line construction.
GO 165	Inspection cycles for electric distribution facilities.
GO 166	Rulemaking for electric distribution facility standard setting.
GO 174	Rules for Electric Utility Substations.
SB 901	
Public Utility Code 8386	The requirement for utilities to submit a wildfire mitigation plan.
Assembly Bill 2911	
NESC	National Electric Safety Code
ANSI A300	Industry accepted standards for tree care practices.
NERC FAC-003	Transmission vegetation management.
PRC 4292	Maintain brush, grass, and forest covered land around a distribution pole on mountainous lands.
PRC 4293	Maintain clearances around transmission and distribution lines.

APPENDIX F: PACIFICORP'S POLICY 001

Distribution and Transmission Line Assets:

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Calendar Year	Counters	Governing Standards & Operating Procedures
LINE RECLOSER/PROTECTION DEVICES	Distribution transfer switch – U/G	No relay protection	Operate MO	5		GO 95, GO 165, PacifiCorp Procedure 069, Policy 001, Policy 192, Policy 297, and Policy 342
	Distribution recloser controller	Distribution Circuits	Recloser Controller Mtc and Battery Replacement	3		
	Distribution recloser controller	Distribution Circuits	Recloser Controller Mtc and Battery Replacement	2		
	Distribution fuse saver	Distribution Circuits	Battery Replacement	5		
LINE FAULT INDICATORS	Fault indicators	Transmission Circuits and transmission lines	Fault Indicator Battery Replacement	9		
			Fault Indicator Battery Replacement	8		
LINE HIGH-VOLTAGE SWITCHES	Transmission high-voltage switches	Transmission lines	High-Voltage Switch Battery Replacement	3		
WEATHER STATIONS	Weather Stations – All RAWS and Microstations		Maintenance/ Inspection	1 (May)		PacifiCorp Procedure 069, Policy 001, and Policy 356

Substation Assets:

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years (months)	Counters (Ops/Fault)	Governing Standards & Operationg Procedures
BATTERIES	Vented or NiCad (VLA)	WECC - Bulk Electrical System	Battery Inspection	4 months		GO 174 and PacifiCorp Policy 001
	Valve Regulated (VRLA)	WECC - Bulk Electrical System	Battery Maintenance	4 months		
	Vented or NiCad (VLA)	WECC - Bulk Electrical System	Battery Maintenance	18 months		
	All	Transmission and distribution (Non-WECC)	Battery Maintenance	2		
CIRCUIT BREAKERS	Breaker battery		Circuit Breaker Battery Replacement	3		
	Recloser battery		Recloser Battery Replacement	3		
	Recloser battery		Recloser Battery Replacement	2		
	All types		Warranty Inspection	4		
	All types	All applications except transformer low side	Exercise Breaker	1		

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years (months)	Counters (Ops/Fault)	Governing Standards & Operationg Procedures
		circuit breakers with no bypass, or 35kV and below cap bank switches and others as approved by Asset Management.				
	Air	Breakers selected by Pacific Power Asset Management (LGCU)	Minor Maintenance	3		GO 174 and PacifiCorp Policy 001
	Air	Breakers selected by Pacific Power Asset Management (LGCU)	Overhaul	9		
	Air	All applications except bus, cap and low side transformer	Overhaul		50-Fault	
	Air	Tertiary-fed reactor, cap bank, station service, synchronous condenser	Overhaul	6		
	SF6 gas	Breakers selected by Pacific Power Asset Management (LGCU)	Minor Maintenance	3		
	SF6 gas	Capacitor/reactor without zero crossing	Minor Maintenance	8	Capacitors 2,000-Ops Reactors 1,000-Ops	
	SF6 gas	Reactor with zero crossing controls	Minor Maintenance	6		

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years (months)	Counters (Ops/Fault)	Governing Standards & Operationg Procedures
	SF6 gas	Reactor with zero crossing controls	Control System Download	2		
CIRCUIT BREAKERS (cont'd)	SF6 gas puffer	Line, transformer, bus	Minor Maintenance	10		
	SF6 gas, dual pressure	Line, transformer, bus	Minor Maintenance	4		GO 174 and PacifiCorp Policy 001
	SF6 gas, dual pressure		Overhaul	6		
	SF6 gas, dual pressure		Overhaul	6		
	SF6 gas, dual pressure		Overhaul	8		
	SF6 gas bottles	Breakers selected by Pacific Power Asset Management (LGCU)	Minor Maintenance	3		
	SF6 gas	Breakers selected by Pacific Power Asset Management (LGCU)	Overhaul	9		
	SF6 gas bottles (sealed module)	All applications except bus, cap and low side transformer	Overhaul		50-Fault	

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years (months)	Counters (Ops/Fault)	Governing Standards & Operationg Procedures
	Oil	Breakers selected by Pacific Power Asset Management (LGCU)	Minor Maintenance	3		
	Oil	Capacitor or reactor	Minor Maintenance	6	1,000-Ops	
	Oil	Breakers selected by Pacific Power Asset Management (LGCU)	Overhaul	6		
	Oil	All applications except bus, cap and low side transformer	Overhaul		30-Fault	GO 174 and PacifiCorp Policy 001
	Oil	Line transformer, bus	Minor Maintenance	6	Set-up as Multi-ctr. No counter pts.	
	Vacuum	Breakers selected by Pacific Power Asset Management (LGCU)	Minor Maintenance	3		
	Vacuum	Breakers selected by Pacific Power Asset Management (LGCU)	Overhaul	9		
	Vacuum	All applications except bus, cap and low side transformer	Overhaul		50-Fault	
	Vacuum	Tertiary-fed reactor, cap bank	Overhaul	8		

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years (months)	Counters (Ops/Fault)	Governing Standards & Operationg Procedures
CIRCUIT BREAKERS (cont'd)	Vacuum	Tertiary-fed SVC, wind site breakers	Overhaul	10		
	Vacuum	Synchronous condenser	Overhaul	6		
CIRCIT SWITCHERS	Gas	Reactive switching or transformer with 100kV or above low side	Inspect and Operate	5		
	Gas	All applications	Overhaul	Contact AM		
	Gas	All applications	Overhaul		3,000-Ops	GO 174 and PacifiCorp Policy 001
	Gas	All applications	Overhaul		1,500-Ops	
	Gas	All applications	Overhaul		1,000-Ops	
FUSE	All spare power transformer fuses		Air Flow Test	5		
GENERATOR	Emergency		Annual Inspection	1		
GRID RESILIENCE STORAGE FACILITY	Grid resilience facility		GR Equipment/Bldg Inspection	4 months		

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years (months)	Counters (Ops/Fault)	Governing Standards & Operationg Procedures
HVAC	Air conditioners, heating		Inspect and Operate	1		
REACTORS	All types		Warranty Inspection	4		
	Substation	Oil-filled	DGA and Oil Quality Tests	1		
	Substation		DGA and Oil Quality Tests	4 months		
REGULATOR	1-phase					
	3-phase – non-vacuum		Overhaul	4		GO 174 and PacifiCorp Policy 001
	3-phase vacuum LTC		Overhaul	8		
REGULATOR (cont'd)	3-phase – LTC in Tank		DGA and Oil Quality Tests	4 months		
	3-phase – LTC in separate tank		DGA and Oil Quality Tests	1		
REGULATOR LTC	3-phase vacuum LTC		DGA Tests	1		

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years (months)	Counters (Ops/Fault)	Governing Standards & Operationg Procedures
	3-phase non-vacuum with separate LTC tank		DGA Tests	4 months		
SERIES CAPACITOR	Under 10 years old		Inspection	4		
	Over 10 years old		Inspection	2		
	With air gap trigger		Air Gap Injection		25 Operations	
SYNCHRONOUS VAR CONTROLLER (SVC)	Thyristor switched		Inspection/Check out	2		
SUBSTATION	Substations – WECC		Sub Safety/Operational Inspection	monthly		GO 174 and PacifiCorp Policy 001
	Substations – Oregon	Oregon only	Sub Safety/Operational Inspection	monthly		
	Substations – all others Including Mobiles		Sub Safety/Operational Inspection	monthly		
	Pole mount/other facility with no electrical exposure,		Facility Safety/ Operational Inspection	varies		

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years (months)	Counters (Ops/Fault)	Governing Standards & Operationg Procedures
	fence requirement. Excludes FII sites.					
	Distribution substation		Infrared Testing	2		
	Transmission substation WECC substations		Infrared Testing	1		
	Substation security system (WECC only)		Inspection	3		
SUBSTATION (cont'd)	Wood poles		Detail Pole Test and Treat	10		
TANK	Oil/fuel storage tank		Inspection	1		
	Oil/fuel storage tank, above ground		Certified Tank Inspection	20		GO 174 and PacifiCorp Policy 001
	SF6 cylinder trailers/carts		Inspection	5		
TECH OPS BUILDING	Strategic spare equipment		Spare Equipment Inspection	4 months		
TRANSFORMER	All types		Warranty Inspection	4		

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years (months)	Counters (Ops/Fault)	Governing Standards & Operationg Procedures
	1-phase	1 phase	DGA and Oil Quality Tests	3		
	3-phase	3 phase	DGA and Oil Quality Tests	3		
	1 or 3-phase		DGA and Oil Quality Tests	1		
	Over 40 years old		DGA and Oil Quality Tests	1		
	Mobile		DGA and Oil Quality Tests	1		
	Designated/strategic spare		Oil Quality Tests	2		
TRANSFORMER LTC	All types except vacuum		DGA Tests	4 months		
	Vacuum		DGA Tests	1		GO 174 and PacifiCorp Policy 001
	Reactive with or without filter		Overhaul LTC	3		
	Reactive without filter		Overhaul LTC	3		

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years (months)	Counters (Ops/Fault)	Governing Standards & Operationg Procedures
	Reactive with filter, distribution only		Overhaul LTC	6		
TRANSFORMER LTC (cont'd)	Reactive with filter, transmission only		Overhaul LTC	3		
	Resistive without filter		Overhaul LTC	6		
	Resistive with filter, distribution only		Overhaul LTC	9		
	Resistive with filter, transmission only		Overhaul LTC	6		
	Vacuum		Overhaul LTC	12		
	Vacuum		Overhaul LTC		300,000 -Ops	
	Vacuum		Overhaul LTC	8		
	Mobile		Overhaul LTC			GO 174 and PacifiCorp Policy 001

Relay Assets:

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years	Governing Standards & Operating Procedures
WECC – BULK ELECTRIC SYSTEM					
WECC/BES RELAY PACKAGE	Microprocessor relay protection system Monitored and alarming to SCADA	BES (WECC) line, bus or apparatus protection	Major and Control: test and calibrate overall relay package, control circuitry, CTs and PTs and control circuitry	12	PacifiCorp Policy 001
			Minor: settings, test auxiliaries, verify inputs	12	
	Microprocessor relay protection system Not monitored	BES (WECC) line, bus or apparatus protection	Major and control: test and calibrate overall relay package, control circuitry, CTs and PTs and control circuitry	12	
			Major: test and calibrate relays, auxiliaries, verify inputs	12	
	Primary microprocessor with electromechanical or electronic backup relay	BES (WECC) line, bus or apparatus protection	Major and control: test and calibrate overall relay package, control circuitry, CTs and PTs and control circuitry	12	
			Major: test and calibrate relays, auxiliaries, verify inputs	12	

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years	Governing Standards & Operating Procedures
	Electronic or electromechanical relay protection system	BES (WECC) line, bus or apparatus protection	Major and control: test and calibrate overall relay package, control circuitry, CTs and PTs and control circuitry	12	PacifiCorp Policy 001
			Major: test and calibrate relays, auxiliaries, verify inputs	12	
	Programmable Logic Controller (PLC)-based protection systems for series capacitor banks or other devices	BES (WECC) line, bus or apparatus protection	Major and control: test and calibrate overall relay package, control circuitry, CTs and PTs and control circuitry	6	
WECC/BES RELAY PACKAGE (cont'd)	Transmission protection with reclosing relay per PRC-005-4 Monitored and alarming to SCADA	BES (WECC) line, bus or apparatus protection	Major and control: test and calibrate overall relay package, control circuitry, CTs and PTs and control circuitry	12	
			Minor: settings, test auxiliaries, verify inputs	12	
	Transmission protection with reclosing relay per PRC-005-4 Not monitored	BES (WECC) line, bus or apparatus protection	Major and control: test and calibrate overall relay package, control circuitry, CTs and PTs and control circuitry	12	

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years	Governing Standards & Operating Procedures
			Major: test and calibrate relays, auxiliaries, verify inputs	12	
WECC – UNDER-FREQUENCY AND UNDER-VOLTAGE					
WECC UF/UV RELAY PACKAGE	Microprocessor relay protection system Monitored and Alarming to SCADA	WECC - Distributed, All UFLS or UVLS	Major and control: test and calibrate overall relay package, control circuitry, CTs and PTs and control circuitry	12	PacifiCorp Policy 001
			Minor: A/D, settings, auxiliaries	12	
	Microprocessor relay protection system Not Monitored	WECC - Distributed, All UFLS or UVLS	Major and control: test and calibrate overall relay package, control circuitry, CTs and PTs and control circuitry	6	
	Electronic or electromechanical relay protection system – load shed	WECC - Distributed, All UFLS or UVLS	Major and control: test and calibrate overall relay package, control circuitry, CTs and PTs and control circuitry	6	
TRANSMISSION					
TRANSMISSION RELAY PACKAGE	Microprocessor relay protection system	Non-BES (WECC) transmission line, bus or apparatus protection	Major and control: test and calibrate overall relay package, control circuitry, CTs and PTs and control circuitry	12	PacifiCorp Policy 001
			Minor: A/D, settings, auxiliaries	12	

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years	Governing Standards & Operating Procedures
	Primary microprocessor with electrical mechanical or electronic backup relay	Non-BES (WECC) transmission line, bus or apparatus protection	Major and Control: Test and Calibrate Overall Relay Package, Control Circuitry, CT's and PT's and Control Circuitry	6	
	Electromechanical or electronic relay protection system	Non-BES (WECC) transmission line, bus or apparatus protection	Major and Control: Test and Calibrate Overall Relay Package, Control Circuitry, CT's and PT's and Control Circuitry	6	
	Transmission auto-throwover	Any transmission line throwover relay package (Excludes Automated Subs)	Perform relay functional test and decouple and operate motor operators.	6	PacifiCorp Policy 001
DISTRIBUTION					
DISTRIBUTION RELAY PACKAGE	Microprocessor relay protection system	Distribution - Non UFLS / UVLS - all applications	Test and Calibrate Relay Package and components	12	PacifiCorp Policy 001
	Electromechanical or electronic relay protection system	Distribution - Non UFLS / UVLS - all applications	Test and Calibrate Relay Package and components	12	
AUXILIARY RELAYS	Fuse-protected	Transformer	Test and Calibrate Relays/Devices	12	
DISTRIBUTION RELAY PACKAGE	Electromechanical or electronic relay with capacitive components protection system	Transformer	Test and Calibrate Relay Package and components	6	
HMI AND WECC – REMEDIAL ACTION SCHEMES					

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Years	Governing Standards & Operating Procedures
RELAY – HMI	Automated substation	Substation	Replace CPU Battery	5	PacifiCorp Policy 001
RELAY – REMEDIAL ACTION SCHEME	Remedial Action Scheme and components	Remedial Action Scheme components	Remedial Action Scheme functional testing	6	
			Major and Control: test and calibrate overall relay package, control circuitry, CTs, PTs and control circuitry	12	PacifiCorp Policy 001
			Minor: settings, test auxiliaries, verify inputs	12	
DOBLE TEST EQUIPMENT					
Relay - Doble Test Equip	Doble F6150 test equipment	Relay Test Equip	Test and calibrate relay test set	12	PacifiCorp Policy 001

Meter Assets:

Equipment	Equipment Types	Equipment Use	Interval Years	Governing Standards & Operating Procedures
Meter Package	Intertie Meters (Interchange Meter as Defined by NERC Bal-005)	PAC-owned WECC	2	PacifiCorp Policy 001
	Intertie Meters (Interchange Meter as defined by NERC Bal-005)	Foreign-owned	Varies	

Equipment	Equipment Types	Equipment Use	Interval Years	Governing Standards & Operating Procedures
	Borderline or PAC gen meters	PAC-owned Non-WECC	2	
	Borderline or cust gen meters	Foreign-owned Non-WECC	Varies	
	Borderline, gen retail, PAC gen or load meters	PAC-owned Non-WECC	2	
	Check or Stateline Meters	PAC-owned Non-WECC	5	
	Retail	PAC-owned Non-WECC	Varies	
	CAISO/EIM Meters	PAC-owned	2	
	CAISO/EIM Meters	Foreign-owned	2	

Communication Assets:

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Calendar Year	Governing Standards & Operating Procedures
Antenna structure registration	FCC number attached to a tower and cleared with the FAA	Non-BES	Check tower for FCC antenna registration number	4	PacifiCorp Policy 001
Base radio	Mobile radio system base station	Non-BES	Testing	1	
Base radio control link	Point to point mobile radio system	Non-BES	Testing	2	

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Calendar Year	Governing Standards & Operating Procedures
Power supply	Battery and charger	Non-BES	Inspect and maintain	1	
Substation site/vented lead acid	Battery and charger	BES (WECC)	Battery inspection	4 month	
Substation site/valve regulated	Battery and charger	BES (WECC)	Battery maintenance	4 month	
Substation site/vented lead acid	Battery and charger	BES (WECC)	Battery maintenance	18 month	
Digital cross connect system	Digital cross connect system	Non-BES	Testing	1	
Generator (comm.)	LP gas engine generator	Non-BES	Inspect and maintain	1	
Generator (comm.)	Diesel generator only	Non-BES	Inspect	1 month	
Communication site	Property and equipment	Non-BES	Inspection	6 month	
Fiber optics terminal	FO multiplex equipment	Non-BES	Test and maintain	4	
DMX Ffber optics terminal	FO multiplex equipment	Non-BES	Inspect	1	PacifiCorp Policy 001
Equipment Type	**Equipment Description**	**Equipment Use**	**Maintenance Task**	**Interval Calendar Year**	
Radio (MAS) Master all/Transmission only for remotes	SCADA radio	Non-BES	Testing	1	PacifiCorp Policy 001
MAS radio control link	Point to point SCADA radio system	Non-BES	Testing	1	

Equipment Type	Equipment Description	Equipment Use	Maintenance Task	Interval Calendar Year	Governing Standards & Operating Procedures
Radio (digital)	Digital microwave	Non-BES	Testing	1	
Optical transport network		Non-BES	Testing	1	
Power line carrier	On/off PLC terminal	BES (WECC)	Inspect	4 month	
Power line carrier	PLC terminal	BES (WECC)	Maintenance	2	
Remote terminal unit/transmission only	SCADA remote	Non-BES, except Jim Bridger SEL RTU's	Inspection	1	
GE N60	Logic controller	CIP	Test	5	
Monarch comm. channels	SCADA	Non-BES	Inspection	4 month	
Tone relay	Tone relay terminal	BES (WECC)	Test and maintain	1	
Tone relay	Tone relay terminal	BES (WECC)	Test and maintain	4	
Tower (guyed)	Tower	Non-BES	Inspect and maintain	3	
Tower(steel)	Tower	Non-BES	Inspect and maintain	5	PacifiCorp Policy 001