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**PACIFIC GAS AND ELECTRIC COMPANY  
SUPPLEMENTAL FILING ADDRESSING  
REMEDIAL COMPLIANCE PLAN AND  
FIRST QUARTERLY REPORT ACTION ITEMS**

**FEBRUARY 26, 2021**

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PACIFIC GAS AND ELECTRIC COMPANY  
2021 WILDFIRE MITIGATION PLAN REPORT – SUPPLEMENTAL FILING  
FEBRUARY 26, 2021

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## LIST OF ATTACHMENTS

Throughout the Supplemental Filing to the 2021 Wildfire Mitigation Plan (WMP) there are references to attachments that are applicable to specific actions and provide additional materials. For ease of reference, we are including below a list of the attachments. In the text of this Supplemental Filing, we refer to the attachment name and number. Pacific Gas and Electric Company (PG&E or the Company) will provide on our website each attachment below:

- 2021WMP\_ClassB\_Action-PGE-2\_Atch01
- 2021WMP\_ClassB\_Action-PGE-7\_Atch01
- 2021WMP\_ClassB\_Action-PGE-11\_Atch01
- 2021WMP\_ClassB\_Action-PGE-13\_Atch01
- 2021WMP\_ClassB\_Action-PGE-13\_Atch02
- 2021WMP\_ClassB\_Action-PGE-18\_Atch01
- 2021WMP\_ClassB\_Action-PGE-24\_Atch01
- 2021WMP\_ClassB\_Action-PGE-29\_Atch01
- 2021WMP\_ClassB\_Action-PGE-30\_Atch01
- 2021WMP\_ClassB\_Action-PGE-34\_Atch01
- 2021WMP\_ClassB\_Action-PGE-34\_Atch02
- 2021WMP\_ClassB\_Action-PGE-84\_Atch01
- Supplemental Table 12 (Class B)

As one of these attachments, PG&E is including a supplemental version of Table 12 that was included in the 2021 WMP submission on February 5, 2021. The supplemental version of Table 12 includes all of the data that was included from the February 5<sup>th</sup> submission, and additional information responsive to the Action Items in this Supplemental Filing. This table will be referred to as “Supplemental Table 12 (Class B)” and is being included with this Supplemental Filing.

## **ACTION PGE-35 (Class A)**

*In its 2021 WMP update, PG&E along with Southern California Edison Company (SCE) and San Diego Gas & Electric Company (SDG&E) shall submit a joint, unified plan that reflects collaborative efforts and contains uniform definitions, methodology, timeline, data standards, and assumptions.*

### **Response:**

Initial meetings were conducted between SCE, PG&E, and SDG&E on June 19, 2020 and June 26, 2020 to discuss a strategy and potential timetable for determining a methodology for how to measure post-trim vegetation clearance distance impacts on the probability of vegetation caused ignitions and outages. After receiving additional guidance from the Wildfire Safety Division (WSD) to submit a joint, unified plan collaboratively between PG&E, SCE and SDG&E, all three Investor-Owned Utilities (IOU) came together for weekly meetings beginning on January 6, 2021. The group has been focused on creating a unified plan that contains uniform definitions, methodologies, timelines, data standards, and assumptions. The IOUs presented their plan to WSD and other stakeholders on February 18, 2021, and answered questions associated with the plan.

The plan is detailed below:

### **Uniform Definitions**

Although IOU terminology may be slightly different, all three IOUs are aligned on the definition of the respective terms Enhanced Vegetation Management (EVM) and Enhanced Clearance. The IOUs consider EVM and Enhanced Clearance as clearance to at least the California Public Utilities Commission (CPUC) recommended clearance in General Order 95, Rule 35, Appendix E, (12-foot minimum) at time of maintenance. Other uniform definitions have been agreed upon, including the understanding that clearances are measured by radial clearance from conductors.

### **Methodology**

All three IOUs will quantify vegetation-caused outage data for calendar years from outage investigation reports before the implementation of enhanced clearances. Next, all IOUs will collect or utilize vegetation-caused outage data for calendar years from outage investigation reports after implementation of enhanced clearances. Finally, the IOUs will analyze trends in outages to determine the nature of the trend and if it was related to enhanced clearances. Each IOU will measure the effectiveness of their enhanced vegetation work in areas with elevated wildfire risk by correlating the trends in vegetation-caused outages with the amount of enhanced clearances achieved at the time of trim. The IOUs expect an inverse relationship between vegetation-caused outages and the amount of enhanced vegetation clearance achieved.

### **Timeline**

Pre-enhanced work is defined as all work performed prior to the implementation of enhanced clearances in 2019 (enhanced clearance implementation times differ slightly between IOUs). Post-enhanced clearance is defined as work performed after the

implementation of enhanced clearances in 2019. The IOUs will review outage data going back at least three years or more, and enhanced clearance tracking data beginning sometime in 2019 and mostly available through 2020. The IOUs will conduct semi-annual reviews as effectiveness measures cannot be determined in short time periods. A multi-year analysis is required to determine the overall effectiveness of enhanced clearances.

### **Data Standards**

In order to provide WSD with consistent data and reporting practices, the IOUs will use data as captured at the time of work completion from the electronic tools used by field crews.

### **Assumptions**

The IOUs will only consider High Fire Threat Districts (HFTD) or High Fire Risk Areas (HFRA) for pre- and post-enhanced clearance comparison so that the analysis is limited to areas of elevated fire risk. SCE and PG&E will be utilizing data from Distribution conductors only while SDG&E will utilize data from both Distribution and Transmission.

## **ACTION PGE-1 (Class B)**

- 1) *Further describe why either ignition risk and wildfire consequence risk is calculated instead of calculating both; and*
- 2) *Provide an explanation for each initiative as to why it either reduces ignition risk or wildfire consequence risk, but not both.*

### **Response:**

PG&E does evaluate risk reduction by leveraging both ‘ignition risk’ and ‘wildfire consequence risk’. For each initiative, PG&E identified if the activity reduces ignition risk and/or wildfire consequence risk. PG&E considers ignition risk as the likelihood of a risk event (LoRE) and wildfire consequence risk as the consequence of a risk event (CoRE). The overall wildfire risk is calculated by multiplying LoRE x CoRE, as described in Section 4.5.1(b) of the 2021 WMP:

$$\text{Wildfire Risk} = \text{Ignition Probability (LoRE)} \times \text{Wildfire Consequence (CoRE)}$$

For each initiative, PG&E takes the difference between the baseline (pre-initiative) wildfire risk and the post-application, mitigated wildfire risk to quantify the risk reduction.

PG&E interprets ‘ignition risk’ in this Action as the likelihood of an ignition and ‘wildfire consequence’ as the consequence of an ignition. The multiplication of ignition risk and wildfire consequence is equivalent to the overall wildfire risk. When evaluating if an initiative mitigates ‘ignition risk’ and/or ‘wildfire consequence’, PG&E evaluates initiative’s contribution in mitigating either, or both, component(s) of the overall wildfire risk. While it is rare that an initiative mitigates both ‘ignition risk’ and ‘wildfire consequence’ directly, even when an initiative mitigates only one of either ‘ignition risk’ or ‘wildfire consequence’, it is also expected to reduce the overall wildfire risk.

In response to subpart 2) of this Action PG&E is providing an explanation for the risk reduction methodology for each initiative in the workpapers in Supplemental Table 12 (Class B). Each initiative has one of the below descriptions:

- 1) Because this initiative reduces the likelihood of ignition, it effectively reduces the overall wildfire risk. However, this initiative does not directly reduce wildfire consequence explicitly.
- 2) Because this initiative reduces the wildfire consequence, it effectively reduces the overall wildfire risk. However, this initiative does not directly reduce the likelihood of an ignition.
- 3) This initiative reduces both the likelihood of ignition and the wildfire consequence and therefore effectively reduces the overall wildfire risk.
- 4) This initiative is foundational, and while it has benefits, it primarily supports other initiatives, but does not directly reduce likelihood of ignition or wildfire consequence.
- 5) This initiative serves to mitigate the consequence of PSPS, a program utilized to minimize the wildfire risk

## **ACTION PGE-2 (Class B)**

- 1) *Provide an RSE calculation for fuel and slash management; and*
- 2) *Provide a description of how this value was calculated.*

### **Response:**

The Risk Spend Efficiency (RSE) calculation for fuel and slash management is 6.68, based on subject matter expert (SME) judgment at this time. PG&E is actively exploring fuel management in more detail to better understand risk reduction benefits and effectiveness. Much like other vegetation-related programs, the intent of fuel management is to prevent an ignition; however, unlike other vegetation related programs, fuel management addresses multiple modes of failure, whether it is vegetation or equipment failure. Since this is a new program, PG&E continues to explore ways to improve our estimation of RSE. Our current estimation is preliminary and based on a small sample size and program aspects may change in the future. As PG&E will be one of the first utility companies developing an official fuel reduction program, we believe incoming data will continue to help to identify preliminary effectiveness and cost estimations.

- The method of calculation will utilize the same RSE Lite Tool used for other WMP initiatives, with methodology provided in the 2021 WMP Attachments 'RSE Lite Methodology WMP 2021.pdf'. Additionally, 2021WMP\_ClassB\_Action-PGE-2\_Atch01 is a workpaper with further details. Given that this is a new project scope, the effectiveness and cost estimations will be preliminary estimations until this activity is performed in practice.



**ACTION PGE-6 (Class B)**

- 1) *Provide an explanation of what “limited alternatives considered” consists of for all initiatives in which PG&E provided such explanation in Table 1;*
- 2) *Use the terminology of “no alternatives considered” if “limited” does not include anything substantive; and*
- 3) *Reevaluate all initiatives with “limited” or no alternatives considered to include actual alternatives analysis.*

**Response:**

In Table 1 below, in response to Action PGE-6 (Class B), PG&E is providing a modified version of the “Table 1” that was included in the First Quarterly Report. Consistent with the direction in Action PGE-6 (Class B), the table below only includes initiatives that were identified on Table 1 of the First Quarterly Report as having “limited alternatives considered.” Thus, the table below does not include all of the initiatives originally included in Table 1 of the First Quarterly Report.

**TABLE 1: ADDITIONAL INFORMATION ABOUT SYSTEM HARDENING AND VEGETATION MANAGEMENT INITIATIVES WITH “LIMITED ALTERNATIVES CONSIDERED”**

2020 System Hardening and Veg Mgmt Initiative	2020 Table 1 WMP Alternative Considered	Action PGE-6 (Class B) Response	2021 WMP Initiative ID
5.3.3.2-1 Circuit breaker maintenance and installation to de-energize lines upon detecting a fault	Limited alternatives considered for the 2020 WMP, technology evaluations underway related to that may impact circuit breaker maintenance, operations and replacement.	This initiative includes two areas; circuit breaker maintenance and circuit breaker replacements. The alternative considered for circuit breaker maintenance was to increase maintenance activities at locations within the HFTD areas. This alternative was not pursued because it was believed that this would not improve performance of the existing circuit breakers above the levels attained by the current maintenance program. The alternatives for the circuit breaker replacement program that were considered are leaving the replacement ranking criteria as is or to include the additional factors of Accumulated Critical Current (ACC) and HFTD location. The decision was made to include the additional factors because it was believed that this would more closely align circuit breaker replacements with risks and provide additional circuit breaker replacements in substations with higher wildfire risks.	7.3.3.2-Baseline-D

2020 System Hardening and Veg Mgmt Initiative	2020 Table 1 WMP Alternative Considered	Action PGE-6 (Class B) Response	2021 WMP Initiative ID
5.3.3.2-2 Circuit breaker maintenance and installation to de-energize lines upon detecting a fault	Limited alternatives considered for the 2020 WMP, technology evaluations underway related to that may impact circuit breaker maintenance, operations and replacement.	This initiative includes two areas; circuit breaker maintenance and circuit breaker replacements. The alternative considered for circuit breaker maintenance was to increase maintenance activities at locations within the HFTD areas. This alternative was not pursued because it was believed that this would not improve performance of the existing circuit breakers above the levels attained by the current maintenance program. The alternatives for the circuit breaker replacement program that were considered are leaving the replacement ranking criteria as is or to include the additional factors of ACC and HFTD location. The decision was made to include the additional factors because it was believed that this would more closely align circuit breaker replacements with risks and provide additional circuit breaker replacements in substations with higher wildfire risks.	7.3.3.2-Baseline-T
5.3.3.2-3 Circuit breaker maintenance and installation to de-energize lines upon detecting a fault	Limited alternatives considered for the 2020 WMP, technology evaluations underway related to that may impact circuit breaker maintenance, operations and replacement.	This initiative includes two areas; circuit breaker maintenance and circuit breaker replacements. The alternative considered for circuit breaker maintenance was to increase maintenance activities at locations within the HFTD areas. This alternative was not pursued because it was believed that this would not improve performance of the existing circuit breakers above the levels attained by the current maintenance program. The alternatives for the circuit breaker replacement program that were considered are leaving the replacement ranking criteria as is or to include the additional factors of ACC and HFTD location. The decision was made to include the additional factors because it was believed that this would more closely align circuit breaker replacements with risks and provide additional circuit breaker replacements in substations with higher wildfire risks.	7.3.3.2-Enhanced-D
5.3.3.2-4 Circuit breaker maintenance and installation to de-energize lines upon detecting a fault	Limited alternatives considered for the 2020 WMP, technology evaluations underway related to that may impact circuit breaker maintenance, operations and replacement.	This initiative includes two areas; circuit breaker maintenance and circuit breaker replacements. The alternative considered for circuit breaker maintenance was to increase maintenance activities at locations within the HFTD areas. This alternative was not pursued because it was believed that this would not improve performance of the existing circuit breakers above the levels attained by the current maintenance program. The alternatives for the circuit breaker replacement program that were considered are leaving the replacement ranking criteria as is or to include the additional factors of ACC and HFTD location. The decision was made to include the additional factors because it was believed that this would more closely align circuit breaker replacements with risks and provide additional circuit breaker replacements in substations with higher wildfire risks.	7.3.3.2-Enhanced-T
5.3.3.4 Covered conductor maintenance	Limited alternatives considered to existing maintenance practices as part of the 2020 WMP.	Currently there are no alternatives being considered to our standard maintenance cycles and practices. Any long-term changes or alternatives would be guided by changes to General Order 165. See 2021 WMP at pp. 479-480.	7.3.3.4

2020 System Hardening and Veg Mgmt Initiative	2020 Table 1 WMP Alternative Considered	Action PGE-6 (Class B) Response	2021 WMP Initiative ID
5.3.3.5 Crossarm maintenance, repair, and replacement	Limited alternatives considered to existing maintenance practices as part of the 2020 WMP.	PG&E did investigate aerial spacer cable technology (Hendrix Conductor system) for overhead construction as an alternative to cross-arms. A 13-pole demonstration line was constructed in PG&E's Livermore Training facility. After careful evaluation of whole life cost and effects on crews, this Hendrix cable was not deemed as a viable alternative to cross-arms at PG&E at this time.	7.3.3.5
5.3.3.10 Maintenance, repair, and replacement of connectors, including hotline clamps	Limited alternatives considered to existing maintenance practices as part of the 2020 WMP.	PG&E reviews industry research to look for fire resilient and more effective connectors. For example, new tree-wire piercing connectors were recently added to PG&E's design standards as an example of new alternatives added to PG&E's approved connectors.	7.3.3.10
5.3.3.12-1 Other corrective action	Limited alternatives considered to generally existing programs as part of the 2020 WMP.	This initiative is intended to reduce the risk of an arc flash event within a substation propagating into adjacent wildlands. There are three actions associated with this initiative; establishment of defensible space for substations, implementation of improved animal abatement requirements and equipment repairs and replacement from deficiencies identified through the enhanced inspection program. In the defensible space area, the alternatives evaluated was to remain with the existing vegetation requirements for substations or to implement the improved requirements to establish defensible space around the equipment. The establishment of defensible space was selected due to the reduction of risk that it achieves. Regarding animal abatement, the alternatives considered were to retain the existing animal abatement criteria or to develop more stringent requirements for substations located in HFTD areas. The more stringent requirements for substations located within the HFTD areas were selected due to the reduction of the risk of animal contact-initiated arc flash events. For the repairs and replacements of equipment for deficiencies identified through the enhanced inspection program no other alternatives were considered.	7.3.3.12.1
5.3.3.14 Transformers maintenance and replacement	Limited alternatives considered to existing maintenance practices as part of the 2020 WMP.	In 2013, PG&E implemented the use of FR3 transformer oil. This oil is much more fire resilient and environmentally friendly than the standard mineral oil that has been the industry standard for transformers. PG&E continues to work with manufactures to improve designs and alternatives. PG&E is currently working with industry partners on an EPIC project to evaluate remote temperature sensing devices that will proactively identify transformers that may be imminently going to fail due to heat or loading.	7.3.3.14

2020 System Hardening and Veg Mgmt Initiative	2020 Table 1 WMP Alternative Considered	Action PGE-6 (Class B) Response	2021 WMP Initiative ID
5.3.5.1 Additional efforts to manage community and environmental impacts	No material alternatives considered, PG&E pursues continuous improvement and adjustments in community and environmental processes.	An alternative considered was not coordinating with communities to help ensure delays are avoided based on community appeals or requests to slow or alter critical maintenance plans. After consideration, PG&E believes coordination with communities is important to promote best management practices for both wildfire mitigation and environmental negative impacts.	7.3.5.1
5.3.5.2 Detailed inspections of vegetation around distribution electric lines and equipment	Except for continuous improvements, limited alternatives considered as part of the 2020 WMP.	An alternative considered is not to perform a detailed inspection of vegetation around distribution lines and equipment, but instead to allow tree crew vendors to make determinations as to the vegetation that requires work based on regulatory requirements. PG&E instead believes that a combination of inspection personnel and tree crew personnel is needed to ensure best results when considering regulatory compliance and safety.	7.3.5.2
5.3.5.3 Detailed inspections of vegetation around transmission electric lines and equipment	Except for continuous improvements, limited alternatives considered as part of the 2020 WMP.	An alternative considered is not to perform a detailed inspection of vegetation around transmission lines and equipment, but instead to allow tree crew vendors to make determinations as to the vegetation that requires work based on regulatory requirements. PG&E instead believes that a combination of inspection personnel, LIDAR information and tree crew personnel is needed to ensure best results when considering regulatory compliance and safety.	7.3.5.3
5.3.5.4 Emergency response vegetation management due to red flag warning or other urgent conditions	Except for continuous improvements, limited alternatives considered as part of the 2020 WMP.	An alternative considered was not performing additional patrols or work activities within high fire warning areas to limit the exposure of employees in the field, which could put employees at risk of potential ignitions. PG&E determined that these additional patrols and work activities far outweigh the employee exposure risk and will continue to respond before and after urgent conditions.	7.3.5.4
5.3.5.6 Improvement of inspections	N/A – Improvements relate to other initiatives, no alternatives identified.	See response to Initiatives 5.3.5.2 and 5.3.5.3 above.	7.3.5.6
5.3.5.17-1 Substation inspection	Limited alternatives identified related to the maintenance program scope for 2020.	No alternatives considered.  This initiative focuses on assessing the area around Electric Distribution Substations in Tier 2 and Tier 3 HFTD areas to identify flammable fuels and vegetation for removal. PG&E is continuing the process of inspections and removal. No alternatives were identified to this initiative intended to mitigate wildfire risk around substations.	7.3.5.17.1

2020 System Hardening and Veg Mgmt Initiative	2020 Table 1 WMP Alternative Considered	Action PGE-6 (Class B) Response	2021 WMP Initiative ID
5.3.5.17-2 Substation inspection	Limited alternatives identified related to the maintenance program scope for 2020.	No alternatives considered.  This initiative focuses on assessing the area around Electric Transmission Substations in Tier 2 and Tier 3 HFTD areas to identify flammable fuels and vegetation for removal. PG&E is continuing the process of inspections and removal. No alternatives were identified to this initiative intended to mitigate wildfire risk around substations.	7.3.5.17.2
5.3.5.19 Vegetation inventory system	For the 2020 WMP limited alternatives considered, PG&E is pursuing continual improvements, adjustments and enhancements to this software system and related computer systems. Long-term alternatives considered include different software packages and implementation approaches.	Alternatives considered include utilizing different software systems than what is currently being utilized today. Considerations have been an off-the-shelf inventory system that is fully customizable, a locked-down system that only allows changes made that affect all devices and systems or a combination of the two. PG&E will continue to evaluate different data solutions, both in back office and mobile in-the-field, to determine if any system can effectively supplant what is currently being utilized. PG&E acknowledges that no system is perfect and will only make a change to our inventory system when appropriate.	7.3.5.19
5.3.5.20 Vegetation management to achieve clearances around electric lines and equipment	Except for continuous improvements, limited alternatives considered as part of the 2020 WMP for maintaining compliance clearances.	Alternatives considered are aggressive tree pruning, tree removal or working with electric operations to adjust the infrastructure to better support regulatory compliance. Aggressive pruning would need to still follow ANSI A300 Pruning Standards and tree removals can be complicated by ownership and legal rights to remove trees. Adjustments to electric infrastructure do happen, but System Hardening is the focus and priority, which helps eliminate the need for more aggressive vegetation alternatives.	7.3.5.20

## **ACTION PGE-7 (Class B)**

- 1) *Provide a table similar to Table 1 evaluating how initiatives interact with one another as alternatives when deciding implementation.*

### **Response:**

PG&E understands that this Action Item concerns initiatives for the System Hardening Program and the EVM Program based on the context in the WSD's evaluation of the First Quarterly Report and the reference to Table 1 of PG&E's First Quarterly Report. Based on that understanding, PG&E is providing 2021WMP\_ClassB\_Action-PGE-7\_Atch01 that considers the interaction of these initiatives with one another. As was presented in PG&E's 2021 WMP, we are maturing and improving our risk quantification and analysis tools in a number of areas. Alternatives analysis—including the evaluation of existing initiatives as substitutes for one another in mitigating wildfire risk—is one of the areas where PG&E still has work to do in maturing our analysis. The attachment reflects our current level of maturity on alternatives evaluation which is primarily qualitative and SME-informed. As PG&E improves our risk quantification tools, more quantitative and location-specific analysis of these initiatives as substitutes for one another will be possible.

## **ACTION PGE-11 (Class B)**

*PG&E shall provide quantitative values for all initiatives for all subparts included in Condition Guidance-4.*

### **Response:**

PG&E provides a summary of individual WMP initiative impacts on Public Safety Power Shutoff (PSPS) in Table 2 below and the impact of multiple initiatives in Table 3. The impact of all 2021 WMP initiatives on PSPS is provided in Supplemental Table 12 (Class B).

### **Methodology**

To address this question, PG&E utilized the 2020 actual PSPS event data as well as the 2019 PSPS event data from the 10-year historical weather lookback data set that is described in more detail in Section 8.1 of our 2021 WMP. PG&E projected our 2021 portfolio of mitigation work against the 2020 actual and 2019 lookback PSPS events to quantify their impacts on PSPS thresholds, scope, frequency, and duration. These customer impacts do not include power generators and other transmission customers. The vast majority of PG&E's initiatives could be evaluated using this 2-year backcast methodology. The methodology for the few initiatives that could not be evaluated using this methodology are described separately in the Results Section below.

For the initiative benefits against the 2-year PSPS backcast, shown in Attachment 2021WMP\_ClassB\_Action-PGE-11\_Atch01, PG&E first computed the direct impact of each mitigation activity on PSPS scope, the number of customers reduced per event. Using this impact on PSPS scope, PG&E then calculated the direct PSPS event duration reduction impacts in customer-minutes interrupted using the average number of minutes per event. In addition, to capture the indirect impacts to duration due to a

smaller PSPS scope, PG&E also estimated the reduced customer minutes from a smaller event. This activity is described in the response to Action PGE-13 (Class B) below. If a 2021 mitigation affects the threshold values for initiating PSPS events, PG&E evaluated how many PSPS events were impacted by the incorporation of new thresholds. For example, if a criteria change would have prevented any number of customers from de-energization in five out of ten events, then this mitigation would be credited with a 50% reduction. Finally, to quantify the reduction in frequency of PSPS events, PG&E looked to see whether any mitigation resulted in a 2020 actual or 2019 lookback event being completely eliminated. Note that this analysis methodology demonstrates how event scope, duration, frequency, and thresholds are interrelated.

Importantly, this backcast analysis accounts for the incremental benefits of our 2021 mitigations, not the overall impact reduction that each PSPS mitigation program has had in the past or has the potential for impact reduction beyond 2021. PG&E is still in the process of finalizing our 2021 mitigation workplan, so the locations and quantities of the mitigations assumed in this analysis are based on PG&E's best knowledge today. This analysis is also subject to all of the limitations associated with using a historical weather lookback that are described in further detail in Section 8.1 of PG&E's 2021 WMP<sup>1</sup>, including the fact that it does not include updates to the PSPS scoping and meteorological models which are anticipated to be incorporated before the 2021 fire season based on work that will be performed over the coming months.

Finally, as described in our 2021 WMP, PG&E continues to evaluate conditions not currently included in the scoping of PSPS events that may drive an expansion in the scope of 2021 PSPS. As the underlying purpose of PSPS is to prevent catastrophic wildfire ignitions during severe weather conditions, PG&E is reviewing what conditions warrant calling a PSPS to prevent catastrophic wildfires, in alignment with external feedback on this issue. Specifically, we are assessing how to incorporate the presence of known, high-risk vegetation conditions adjacent to powerlines into PSPS decision making. This assessment may result in PG&E executing PSPS in 2021 for powerlines where high priority vegetation tags have been identified, including on lines that may not have met the 2020 PSPS event criteria. PG&E is still working to determine what changes to the PSPS decision making criteria may be needed to account for this risk. Following that activity over the next few months, PG&E will analyze the likely impact of that updated criteria and how it could affect PSPS event size and diminish the impacts of the actions being taken to decrease PSPS event size.

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<sup>1</sup> 2021 WMP at p. 849-850.

**TABLE 2: SUMMARY OF WMP INITIATIVE IMPACTS ON PSPS**

WMP 2021 Category	Initiative 2021 Name	i. Affects threshold values for initiating PSPS events (% of projected events impacted)	ii. Reduces frequency (# of events) of PSPS events (# of projected events completely descoped)	iii. Reduces scope (# customers impacted) of PSPS events (# of projected customer reduced per event)	iv. Reduces duration of PSPS events (# of projected Customer Minutes Interrupted (CMI) reduced per event from scope reduction)	iv. Reduces duration of PSPS events (indirect # of projected CMI reduced per event)
7.3.2 Situational awareness and forecasting	7.3.2.1.1 Advanced weather monitoring and weather stations, Numerical Weather Prediction	0	0	0	N/A	0
7.3.2 Situational awareness and forecasting	7.3.2.1.2 Advanced weather monitoring and weather stations, Fuel Moisture Sampling and Modeling	0	0	0	N/A	0
7.3.2 Situational awareness and forecasting	7.3.2.1.3 Advanced weather monitoring and weather stations, Weather Stations	0	0	0	N/A	0
7.3.2 Situational awareness and forecasting	7.3.2.4 Forecast of a fire risk index, fire potential index, or similar	0	0	0	N/A	0
7.3.2 Situational awareness and forecasting	7.3.2.5 Personnel monitoring areas of electric lines and equipment in elevated fire risk conditions	0	N/A	0	0	0



WMP 2021 Category	Initiative 2021 Name	i. Affects threshold values for initiating PSPS events (% of projected events impacted)	ii. Reduces frequency (# of events) of PSPS events (# of projected events completely descope)	iii. Reduces scope (# customers impacted) of PSPS events (# of projected customer reduced per event)	iv. Reduces duration of PSPS events (# of projected Customer Minutes Interrupted (CMI) reduced per event from scope reduction)	iv. Reduces duration of PSPS events (indirect # of projected CMI reduced per event)
7.3.2 Situational awareness and forecasting	7.3.2.6 Weather forecasting and estimating impacts on electric lines and equipment	0	0	0	N/A	0
7.3.3 Grid design and system hardening	7.3.3.11.1 Mitigation of impact on customers and other residents affected during PSPS event, Generation for PSPS Mitigation	N/A	N/A	726 (D) 325 (S)	18,291 (D) 7,850 (S)	2,884 (D) 1,293 (S)
7.3.3 Grid design and system hardening	7.3.3.16 Undergrounding of electric lines and/or equipment	20%	N/A	1,297	43,230	5,153
7.3.3 Grid design and system hardening	7.3.3.17.1 Updates to grid topology to minimize risk of ignition in HFTDs, System Hardening, Distribution	30%	N/A	413	9,188	1,640
7.3.3 Grid design and system hardening	7.3.3.17.2 Updates to grid topology to minimize risk of ignition in HFTDs, System Hardening, Transmission	0	N/A	Impacts from these activities described under 7.3.3.8.2, 7.3.3.11.1, and 7.3.3.11.2	Impacts from these activities described under 7.3.3.8.2, 7.3.3.11.1, and 7.3.3.11.2	Impacts from these activities described under 7.3.3.8.2, 7.3.3.11.1, and 7.3.3.11.2

WMP 2021 Category	Initiative 2021 Name	i. Affects threshold values for initiating PSPS events (% of projected events impacted)	ii. Reduces frequency (# of events) of PSPS events (# of projected events completely descope)	iii. Reduces scope (# customers impacted) of PSPS events (# of projected customer reduced per event)	iv. Reduces duration of PSPS events (# of projected Customer Minutes Interrupted (CMI) reduced per event from scope reduction)	iv. Reduces duration of PSPS events (indirect # of projected CMI reduced per event)
7.3.3 Grid design and system hardening	7.3.3.17.5 Updates to grid topology to minimize risk of ignition in HFTDs, Remote Grid	N/A	N/A	0	0	0
7.3.3 Grid design and system hardening	7.3.3.17.6 Updates to grid topology to minimize risk of ignition in HFTDs, Butte County Rebuild	0	N/A	0	0	0
7.3.3 Grid design and system hardening	7.3.3.3 Covered conductor installation	30% (associated with 7.3.3.17.1)	N/A	413 (associated with 7.3.3.17.1)	9,188 (associated with 7.3.3.17.1)	1,640 (associated with 7.3.3.17.1)
7.3.3 Grid design and system hardening	7.3.3.8.1 Grid topology improvements to mitigate or reduce PSPS events, Distribution Line Sectionalizing	N/A	N/A	1,961	58,187	7,790
7.3.3 Grid design and system hardening	7.3.3.8.2 Grid topology improvements to mitigate or reduce PSPS events, Transmission Line Sectionalizing	N/A	N/A	580	21,263	2,305

WMP 2021 Category	Initiative 2021 Name	i. Affects threshold values for initiating PSPS events (% of projected events impacted)	ii. Reduces frequency (# of events) of PSPS events (# of projected events completely descope)	iii. Reduces scope (# customers impacted) of PSPS events (# of projected customer reduced per event)	iv. Reduces duration of PSPS events (# of projected Customer Minutes Interrupted (CMI) reduced per event from scope reduction)	iv. Reduces duration of PSPS events (indirect # of projected CMI reduced per event)
7.3.3 Grid design and system hardening	7.3.3.8.3 Grid topology improvements to mitigate or reduce PSPS events, Distribution Line Motorized Switch Operator Pilot	N/A	N/A	1,961 (associated with 7.3.3.8.1)	58,187 (associated with 7.3.3.8.1)	7,790 (associated with 7.3.3.8.1)
7.3.5 Vegetation management and inspections	7.3.5.3 Detailed inspections of vegetation around transmission electric lines and equipment	0	N/A	8,789	209,196	34,926
7.3.5 Vegetation management and inspections	7.3.5.4 Emergency response vegetation management due to red flag warning or other urgent conditions	0	N/A	0	0	0
7.3.6 Grid operations and protocols	7.3.6.4-D Protocols for PSPS re-energization, Distribution	N/A	N/A	N/A	N/A	3,248,425

**TABLE 3: SUMMARY OF WMP INITIATIVE IMPACTS ON PSPS (MULTIPLE INITIATIVE CATEGORIES)**

WMP 2021 Category	Initiative 2021 Name	i. Affects threshold values for initiating PSPS events (% of projected events impacted)	ii. Reduces frequency (# of events) of PSPS events (# of projected events completely descoped)	iii. Reduces scope (# customers impacted) of PSPS events (# of projected cust. reduced per event)	iv. Reduces duration of PSPS events (# of projected CMI reduced per event from scope reduction)	iv. Reduces duration of PSPS events (indirect # of projected CMI reduced per event)
Multiple Initiatives	<p>7.3.3.1 Capacitor maintenance and replacement program</p> <p>7.3.3.2-Baseline-D Circuit breaker maintenance and installation to de-energize lines upon detecting a fault, Baseline – Maintenance Substation Distribution</p> <p>7.3.3.2-Baseline-T Circuit breaker maintenance and installation to de-energize lines upon detecting a fault, Baseline – Maintenance Substation Transmission</p> <p>7.3.3.2-Enhanced-D Circuit breaker maintenance and installation to de-energize lines upon detecting a fault, Enhanced – Maintenance Substation Distribution</p> <p>7.3.3.2-Enhanced-T Circuit breaker maintenance and installation to de-energize lines upon detecting a fault, Enhanced – Maintenance Substation Transmission</p> <p>7.3.3.4 Covered conductor maintenance</p> <p>7.3.3.5 Crossarm maintenance, repair, and replacement</p> <p>7.3.3.6 Distribution pole replacement and reinforcement, including with composite poles</p> <p>7.3.3.7 Expulsion fuse replacement</p> <p>7.3.3.9.1 Installation of system automation equipment, Installation of System Automation Equipment</p>	N/A	N/A	N/A	N/A	<p>Initiative is expected to reduce the likelihood of PSPS damages and hazards. A customer on a distribution circuit with damages or hazards experiences a restoration time of 14.4 hours instead of 9.5 hours, the average restoration time for a customer on a circuit without damages and hazards.</p>

WMP 2021 Category	Initiative 2021 Name	i. Affects threshold values for initiating PSPS events (% of projected events impacted)	ii. Reduces frequency (# of events) of PSPS events (# of projected events completely descope)	iii. Reduces scope (# customers impacted) of PSPS events (# of projected cust. reduced per event)	iv. Reduces duration of PSPS events (# of projected CMI reduced per event from scope reduction)	iv. Reduces duration of PSPS events (indirect # of projected CMI reduced per event)
	7.3.3.9.2 Installation of system automation equipment, Single phase reclosers					

WMP 2021 Category	Initiative 2021 Name	i. Affects threshold values for initiating PSPS events (% of projected events impacted)	ii. Reduces frequency (# of events) of PSPS events (# of projected events completely descope)	iii. Reduces scope (# customers impacted) of PSPS events (# of projected cust. reduced per event)	iv. Reduces duration of PSPS events (# of projected CMI reduced per event from scope reduction)	iv. Reduces duration of PSPS events (indirect # of projected CMI reduced per event)
Multiple Initiatives	<p>7.3.3.10 Maintenance, repair, and replacement of connectors, including hotline clamps</p> <p>7.3.3.12.1 Other corrective action, Distribution Substation</p> <p>7.3.3.12.2 Other corrective action, Transmission Substation</p> <p>7.3.3.12.3 Other corrective action, Maintenance, Transmission</p> <p>7.3.3.12.4 Other corrective action, Maintenance, Distribution</p> <p>7.3.3.13 Pole loading infrastructure hardening and replacement program based on pole loading assessment program</p> <p>7.3.3.14 Transformers maintenance and replacement</p> <p>7.3.3.15 Transmission tower maintenance and replacement</p> <p>7.3.3.17.3 Updates to grid topology to minimize risk of ignition in HFTDs, Surge Arrestor</p> <p>7.3.3.17.4 Updates to grid topology to minimize risk of ignition in HFTDs, Rapid Earth Current Fault Limiter</p>	N/A	N/A	N/A	N/A	<p>Initiative is expected to reduce the likelihood of PSPS damages and hazards. A customer on a distribution circuit with damages or hazards experiences a restoration time of 14.4 hours instead of 9.5 hours, the average restoration time for a customer on a circuit without damages and hazards.</p>

WMP 2021 Category	Initiative 2021 Name	i. Affects threshold values for initiating PSPS events (% of projected events impacted)	ii. Reduces frequency (# of events) of PSPS events (# of projected events completely descope)	iii. Reduces scope (# customers impacted) of PSPS events (# of projected cust. reduced per event)	iv. Reduces duration of PSPS events (# of projected CMI reduced per event from scope reduction)	iv. Reduces duration of PSPS events (indirect # of projected CMI reduced per event)
Multiple Initiatives	<p>7.3.4.1 Detailed inspections of distribution electric lines and equipment</p> <p>7.3.4.10 Other discretionary inspection of transmission electric lines and equipment, beyond inspections mandated by rules and regulations</p> <p>7.3.4.11 Patrol inspections of distribution electric lines and equipment</p> <p>7.3.4.12 Patrol inspections of transmission electric lines and equipment</p> <p>7.3.4.13 Pole loading assessment program to determine safety factor</p> <p>7.3.4.14 Quality assurance / quality control of inspections</p> <p>7.3.4.15-D Substation inspections, Enhanced Distribution, Substation</p> <p>7.3.4.15-T Substation inspections, Enhanced Transmission, Substation</p> <p>7.3.4.2 Detailed inspections of transmission electric lines and equipment</p> <p>7.3.4.3 Improvement of inspections</p> <p>7.3.4.4 Infrared inspections of distribution electric lines and equipment</p> <p>7.3.4.5 Infrared inspections of transmission electric lines and equipment</p> <p>7.3.4.6 Intrusive pole inspections</p> <p>7.3.4.7 LiDAR Inspections of Distribution Electric Lines and Equipment</p>	N/A	N/A	N/A	N/A	<p>Initiative is expected to reduce the likelihood of PSPS damages and hazards. A customer on a distribution circuit with damages or hazards experiences a restoration time of 14.4 hours instead of 9.5 hours, the average restoration time for a customer on a circuit without damages and hazards.</p>

WMP 2021 Category	Initiative 2021 Name	i. Affects threshold values for initiating PSPS events (% of projected events impacted)	ii. Reduces frequency (# of events) of PSPS events (# of projected events completely descope)	iii. Reduces scope (# customers impacted) of PSPS events (# of projected cust. reduced per event)	iv. Reduces duration of PSPS events (# of projected CMI reduced per event from scope reduction)	iv. Reduces duration of PSPS events (indirect # of projected CMI reduced per event)
	<p>7.3.4.8 LiDAR Inspections of Transmission Electric Lines and Equipment</p> <p>7.3.4.9 Other discretionary inspection of distribution electric lines and equipment, beyond inspections mandated by rules and regulations</p>					



WMP 2021 Category	Initiative 2021 Name	i. Affects threshold values for initiating PSPS events (% of projected events impacted)	ii. Reduces frequency (# of events) of PSPS events (# of projected events completely descope)	iii. Reduces scope (# customers impacted) of PSPS events (# of projected cust. reduced per event)	iv. Reduces duration of PSPS events (# of projected CMI reduced per event from scope reduction)	iv. Reduces duration of PSPS events (indirect # of projected CMI reduced per event)
Multiple Initiatives	<p>7.3.5.10 Other discretionary inspections of vegetation around transmission electric lines and equipment</p> <p>7.3.5.11 Patrol inspections of vegetation around distribution electric lines and equipment</p> <p>7.3.5.12 Patrol inspections of vegetation around transmission electric lines and equipment</p> <p>7.3.5.13 Quality assurance / quality control of vegetation inspections</p> <p>7.3.5.14 Recruiting and training of vegetation management personnel</p> <p>7.3.5.15 Remediation of at-risk species</p> <p>7.3.5.16 Removal and remediation of trees with strike potential to electric lines and equipment</p> <p>7.3.5.17.1 Substation inspection , Distribution substation</p> <p>7.3.5.17.2 Substation inspection , Transmission substation</p> <p>7.3.5.18.1 Substation vegetation management, Maintenance substation distribution</p> <p>7.3.5.18.2 Substation vegetation management, Maintenance substation transmission</p> <p>7.3.5.2 Detailed inspections of vegetation around distribution electric lines and equipment</p> <p>7.3.5.20 Vegetation management to achieve clearances around electric lines and equipment</p> <p>7.3.5.5 Fuel management and reduction of “slash” from vegetation management activities</p> <p>7.3.5.6 Improvement of inspections</p>	N/A	N/A	N/A	N/A	<p>Initiative is expected to reduce the likelihood of PSPS damages and hazards. A customer on a distribution circuit with damages or hazards experiences a restoration time of 14.4 hours instead of 9.5 hours, the average restoration time for a customer on a circuit without damages and hazards.</p>

WMP 2021 Category	Initiative 2021 Name	i. Affects threshold values for initiating PSPS events (% of projected events impacted)	ii. Reduces frequency (# of events) of PSPS events (# of projected events completely descope)	iii. Reduces scope (# customers impacted) of PSPS events (# of projected cust. reduced per event)	iv. Reduces duration of PSPS events (# of projected CMI reduced per event from scope reduction)	iv. Reduces duration of PSPS events (indirect # of projected CMI reduced per event)
	<p>7.3.5.7 LiDAR inspections of vegetation around distribution electric lines and equipment</p> <p>7.3.5.8 LiDAR inspections of vegetation around transmission electric lines and equipment</p> <p>7.3.5.9 Other discretionary inspections of vegetation around distribution electric lines and equipment</p> <p>7.3.6.1 Automatic recloser operations</p>					

## **Analysis Discussion**

### *PSPS Scope and Duration*

The 2-year backcast analysis shows a potential 8.0% (14,091 customers) reduction in PSPS event size in 2021 relative to 2020 and 2019 with the mitigations discussed. Note this does not include updates to our PG&E's meteorology and event scoping criteria which are still underway and may increase event size. Transmission right-of-way (ROW) vegetation mitigation (part of Initiative 7.3.5), undergrounding, and sectionalizing of distribution emerge as the largest drivers of scope reduction. Note in this analysis Rapid Earth Fault Current Limiter (REFCL) has no attributed customer reduction benefits projected because it is still in pilot stages and not anticipated to allow lines to remain energized during 2021 PSPS events. Remote Grid also projects no customer reduction benefits in this analysis because of uncertainties associated with timing of project execution and because site designs have not yet been evaluated for PSPS impacts. However, given that typically only a handful of customers are served by each remote grid location, the contribution of this initiative to PSPS scope reduction is expected to be relatively minor.

This forecast of a potential 8.0% scope reduction yields a reduction of approximately 367,205 customer minutes interrupted per PSPS event. Table 2 and 3 above shows the contribution of PG&E's various mitigation activities towards these reductions.

PG&E cannot use our backcast analysis to calculate impacts for our transmission emergency vegetation removal program because we cannot target specific locations for this activity due the emergency nature of the program. Instead, PG&E quantified how many lines were descoped (prevented for requiring de-energization) through this activity. As shown in Table 2 and 3 above, no customers directly benefitted (avoided a PSPS event) from this program in 2020, however this activity did result in one line being descoped during the September 7, 2020 event.

Some of the PSPS mitigation activities on transmission lines do not directly translate into a direct reduction in customers in the event scope for several reasons. First, due to the complexity and redundancy of the transmission system, an outage on one transmission line does not always result in an outage to customers. Second, even if a customer has a mitigated transmission path, that transmission path may serve distribution assets that remain in the scope of the PSPS event.<sup>2</sup> For these reasons, a customer count cannot be the sole metric to determine the efficacy of a transmission mitigation. Importantly, keeping transmission lines energized during PSPS weather conditions contributes to the operability and stability of the grid. Furthermore, descoping transmission lines will also directly reduce the time needed to restore customers after the weather event by reducing the circuit-miles that need to be inspected before re-energization.

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<sup>2</sup> As described in Section 8.1 of our 2021 WMP, PG&E plans to improve our mitigation planning process to further increase coordination of PSPS transmission and distributions mitigations.

To quantify this direct impact on restoration times of descoping transmission lines through our transmission vegetation, sectionalizing, and repair activity, PG&E assessed the number of circuits and miles of transmission lines in scope vs the number of circuits and miles of transmission line descoped. Based on the 2-year backcast review, Transmission Repair was able to descope approximately 6% of circuits and approximately 4% of circuit miles. Transmission vegetation management was able to descope approximately 38% of circuits and approximately 24% of circuit miles. Because approximately 28% of additional miles were descoped from transmission activities, that would also represent the reduction in resource deployments necessary to patrol prior to re-energization.

### *PSPS Thresholds and Frequency*

The risk models, criteria and thresholds PG&E uses for determining when an PSPS event should be called continue to evolve as described in PG&E's 2021 WMP.<sup>3</sup> Potential changes for 2021 include re-calibrating the Fire Potential Index Model and incorporating Technosylva wildfire consequence data if and where it provides value for PSPS and potential changes that may be needed to account for high-risk vegetation. PG&E has not currently quantified the impact of these expected changes as our meteorologists and data scientists are currently working to better understand the impacts associated with these changes. These changes have the potential to impact PSPS thresholds and frequency in addition to event scope and duration.

PG&E's distribution system hardening program is the only activity planned for 2021 that is expected to potentially affect threshold values or criteria for initiating PSPS events that can currently be quantified. PG&E expects an impact from this program because we are planning to exclude newly undergrounded circuits from PSPS and potentially include modified criteria for overhead (OH) hardened circuits into our PSPS scoping model in 2021. Of the ten PSPS events in the 2019 lookback and 2020 actuals, undergrounding and OH hardening activities would have potentially prevented some number of customers from being de-energized as many as five events. PG&E is continuing to review our hardening portfolio to identify additional hardened circuits that can be excluded from PSPS 2021 under modified criteria.

As PG&E has previously discussed, the actual frequency of PSPS events in any given year is largely determined by the weather. However, PG&E's mitigation activities can eliminate PSPS events if their impacts are at the same scale as weather events themselves. For example, PG&E's significant improvements to our PSPS criteria and meteorology tools in advance of the 2020 PSPS season contributed to reducing PSPS event frequency. These improvements included moving from a 3 kilometer (km) by 3 km to 2 km by 2 km granularity on our meteorology model. The magnitude of these improvements translated into a reduction in number of PSPS events. PG&E executed nine PSPS events in 2019, but the historical lookback shows that potentially only four of these events would have been executed using 2020 threshold values and tools.

In 2021, PG&E's meteorology and PSPS teams will continue tool and criteria refinement, but these improvements are not expected to yield the large, step-function

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<sup>3</sup> 2021 WMP at pp. 879-885.

improvement in PSPS footprints that was achieved in 2020. The backcast analysis indicates no change in PSPS event frequency due to PG&E's mitigation activities in 2021. This result is not surprising given that to remove an event from scope entirely, the summed scope footprint of all of PG&E's mitigation activities would need to cover all the assets in the entire weather footprint of a 2020 event or 2019 lookback event. Neither any individual mitigation activity nor the sum of all of PG&E's 2021 mitigation activities achieves this challenging goal. For example, the undergrounded circuits could translate into an average potential reduction in event scope of 1,297 customers per event; this impact did not entirely remove any 2020 PSPS event or 2019 lookback event. While there is no expected frequency reduction due to incremental activities in 2021, the benefit of these activities is expected to accrue over time such that their scale and magnitude should match that of weather events themselves and therefore eliminate actual PSPS events.

## **ACTION PGE-12 (Class B)**

- 1) *Analyze how initiatives will impact subparts (i), (ii), and (iii) based on “protection zone”; and*
- 2) *Define what PSPS area was used for such analysis.*

### **Response:**

All infrastructure based PSPS mitigations must be at the right location on the circuit relative to the weather polygon to prevent a customer from de-energization during any PSPS event. For example, if the location of a sectionalizing device is within the area of the weather event, it will not be useful during that event. For this reason, the number of customers in an event scope will be influenced by the protection zone-specific location of any mitigation. Since event frequency, thresholds, and duration are related to PSPS scope as described above, these PSPS characteristics are also influenced based on protection zone.

The 2-year lookback analysis described in Action PGE-11 (Class B) utilizes the PSPS analysis tools to quantify PSPS impacts at specific circuit protection zone (CPZ) levels to ensure accurate counting of customer impacts. For example, if a hardening project that includes a sectionalizing device enables a specific circuit segment to remain energized, the incremental number of customers reduced includes only the customers served by that hardening project, and not the downstream customers that may still need to be de-energized.

## **ACTION PGE-13 (Class B)**

- 1) *Reevaluate all initiatives for reduction in PSPS duration, including any indirect impacts.*

### ***Response:***

As noted above, PG&E continues to evaluate conditions not currently included in the scoping of PSPS events that may drive an expansion in the scope of 2021 PSPS. As the underlying purpose of PSPS is to prevent catastrophic wildfire ignitions during severe weather conditions, PG&E is reviewing what conditions warrant calling a PSPS to prevent catastrophic wildfires, in alignment with external feedback on this issue. Specifically, we are assessing how to incorporate the presence of known, high-risk vegetation conditions adjacent to powerlines into PSPS decision making. This assessment may result in PG&E executing PSPS in 2021 for powerlines where high priority vegetation tags have been identified, including on lines that may not have met the 2020 PSPS event criteria. PG&E is still working to determine what changes to the PSPS decision making criteria may be needed to account for this risk. Following that activity over the next few months, PG&E will analyze the likely impact of that updated criteria and how it could affect PSPS event size and diminish the impacts of the actions being taken to decrease PSPS event size. Since event duration is related to event size, the impact of these high-risk vegetation conditions could diminish the impacts of the actions taken to decrease event duration as well.

### **Direct Impacts on PSPS Duration**

In Action PGE-11 (Class B) above, PG&E quantified the direct impacts to event duration based on smaller event sizes using a 2-year backcast approach. In addition, PG&E separately quantified the impact of process improvements on restoration times as well as the indirect impacts of PG&E's activities on restoration times. The impact of all 2021 WMP initiatives on PSPS is provided in Supplemental Table 12 (Class B). PG&E describes these analyses below.

### **Restoration Process Improvements**

PG&E plans to improve and streamline the way we develop the re-energization playbook during PSPS events. The re-energization playbook indicates which facilities need to be patrolled prior to re-energization based on the location of the PSPS meteorology polygons for the event and the PSPS risk area map. The faster the re-energization playbook can be developed, the quicker resources can be pre-staged so that work can begin as soon as the "All Clear" is called and the conditions are safe to commence patrols. In particular, faster playbook development combined with accurate meteorology forecasting can allow for improved restoration staging which would increase the number of customers that can be restored shortly after the weather "All Clear" and conditions are safe to commence patrols.

While there is uncertainty in the 2021 PSPS scoping criteria that may impact restoration capabilities, as discussed above, PG&E is anticipating approximately a 30-minute reduction in the average customer restoration time for 2021 due to tool and process improvements. We believe this benefit will apply to all impacted customers. Based on

the average customer restoration time of 9.7 hours for 2020, as detailed in attachment 2021WMP\_ClassB\_Action-PGE-13\_Atch01, this reduction equates to an approximately 19.5 million customer-minutes, or a 5% improvement over 2020.

### Indirect Impacts on PSPS Duration

In addition to the fact that smaller PSPS event sizes directly result in fewer customer minutes interrupted, PG&E's scope reducing activities also have indirect impacts on duration due to a smaller PSPS scope. Based on a limited set of data points of 2020 events, PG&E found a relationship between the size of the event and the average duration per customer, with larger events having longer durations per customer. This relationship is likely explained by many factors, one of which is that larger events require more patrols across a wide geographic breadth which may present challenges from a resource staging and constraint perspective.

Due to this relationship, PG&E estimated the indirect impacts of smaller PSPS events leading to a shorter average restoration time per customer. PG&E estimated the reduced customer minutes from a smaller event using a regression, detailed in attachment 2021WMP\_ClassB\_Action-PGE-13\_Atch02, of 2020 average customer daylight restoration times on the number of customers per event with the exception of the September 7, 2020 PSPS event in which significant amounts of smoke and ongoing fires negatively impacted our restoration capability. Based on that assessment, for every 100,000 customers reduced in scope, the average daylight restoration duration shortens by approximately 30 minutes. Based on the 2021 mitigation portfolio, the indirect impact of PSPS duration per customer could shorten by up to four minutes, shortening PSPS duration at an estimated 48,000 customer minutes per event.

PG&E also identified the indirect impact of our equipment maintenance and repair activities and our vegetation management activities on restoration times. Prior to re-energization of PSPS impacted lines, PG&E patrols our de-energized lines to inspect for damages and hazards. Any damages and hazards identified would increase the restoration duration, as additional remediation is necessary to safely restore electricity to our customers. Based on 2020 events, a customer on a distribution circuit with damage and hazards experiences an average restoration time of 14.4 hours instead of 9.5 hours, the average restoration time a customer experiences on a circuit without damage and hazard.



## **ACTION PGE-14 (Class B)**

- 1) *Reevaluate all initiatives and state if they directly support the “Evolution of the PSPS Program” (as outlined on p. 4-24 of the 2020 WMP).*
- 2) *If so, expand on how the initiative directly supports the “Evolution of the PSPS Program.”*

### **Response:**

In PG&E’s 2020 WMP, the section “Evolution of the PSPS program” discusses PSPS mitigation activities. For this reason, PG&E interprets any initiative quantified in Actions PGE-11 (Class B) through PG&E-13 (Class B) as having an impact on PSPS scope, duration, frequency, or thresholds as directly supporting the evolution of the PSPS program over any time frame, even if the incremental impact in 2021 is projected to be zero. Supplemental Table 12 (Class B) describes how these initiatives support the evolution and directional vision of the PSPS program. In this attachment, PG&E describes how some initiatives indirectly support the Evolution of the PSPS program by enabling another initiative that directly supports the program. Additionally, PG&E describes how some initiatives foundationally support PSPS mitigation activities, providing the platforms, training, and data to support these activities even if they themselves do not directly impact one of the PSPS event characteristics. Foundational activities include efforts to make PSPS less impactful by reducing the impact to customers and communities that are de-energized, executing PSPS with excellence, and capturing and improving based on lessons learned from prior events.

## **ACTION PGE-16 (Class B)**

- 1) *List all initiatives in which it is developing a quantitative threshold.*
- 2) *Provide a timeline and status update for when it intends to develop such quantitative evaluations for each initiative.*
- 3) *Explain what sort of SME expertise is being used for the development of each quantitative value.*

### **Response:**

- 1) In Supplemental Table 12 (Class B), PG&E identifies the initiatives for which a quantitative measure is being developed.
- 2) In Supplemental Table 12 (Class B), PG&E identifies the timeline for developing an initial quantitative threshold for applicable initiatives. Generally, these timelines reflect establishing threshold by the end of 2021 to enable updating in the 2022 WMP. Note that the measures to be used and/or the thresholds to establish effectiveness will continue to evolve as our understanding of initiatives and their contributions to wildfire risk reduction is further understood.
- 3) The subject matter expertise being used for the development of each quantitative value is identified in Supplemental Table 12 (Class B).

**ACTION PGE-18 (Class B)**

*Provide a refiling of Attachment 1 from its QR filing that includes a column with quantitative values for both performance and risk reduction.*

***Response:***

Please refer to the Attachment 2021WMP\_ClassB\_Action-PGE-18\_Atch01 for the refiled "Attachment 1" from PG&E's First Quarterly Report.

## **ACTION PGE-24 (Class B)**

- 1) *Define what “continue” or “increase” means for each instance it is used from Tables 4 to 13.*
- 2) *Either a) implement quantitative benchmarks that are reasonable and achievable for each such instance, or b) explain how it intends to track progress of each instance if a quantitative benchmark is not provided.*

### **Response:**

In the January 8, 2021 WSD evaluation of PG&E's First Quarterly Report, a Class B deficiency was identified concerning a “lack of detail on long term planning.” While WSD acknowledges that PG&E provides adequate qualitative benchmarks, PG&E is asked to provide more quantitative benchmarks as well. The qualitative terms used in PG&E’s First Quarterly Report were “continue” or “increase.” In Action PG&E-24 (Class B), the WSD has asked PG&E to define those two terms as used from Tables 4 to 13. We have identified all instances where those terms have been used and explain their meanings in Attachment 2021WMP\_ClassB\_Action-PGE-24\_Atch01. We also identify whether a qualitative or quantitative benchmark is available for each described activity.

## **ACTION PGE-26 (Class B)**

- 1) *Explain why equipment failure is used as the current default for ignition cause,*
- 2) *Provide the percentage of ignitions from 2016 to 2020 that are inaccurately characterized as equipment failure causes,*
- 3) *Describe how PG&E checks for accuracy of ignition cause determinations currently, including any supporting documentation and procedures,*
- 4) *Explain how PG&E plans to change the inaccurately documented ignition cause of “equipment failure” moving forward, including changes in procedures, training of first responders, and Quality Assurance (QA)/QC checks for accuracy,*
- 5) *Explain how PG&E plans on remedying inaccurately documented past ignition causes (include all relevant plans, if they differ from the plan for more accurate documentation in the future), and*
- 6) *Provide a timeline for when PG&E intends to complete these improvements.*

### **Response:**

- 1) We have reviewed our response to Condition PGE-2 and determined that the response requires correction. On Page 98 of the First Quarterly Report submitted on September 9, 2020, we indicated that ignitions that a first responder is unable to identify are categorized as an equipment failure. This response needs correction and clarification. PG&E has a detailed process for investigating the cause of every potentially PG&E-attributable ignition event and correcting systems of record when discrepancies are identified. This investigation process and associated systems of record do not have a default for a suspected initiating cause. Although PG&E tries to identify the suspected initiating cause given the evidence available at the time, sometimes the evidence is sparse and PG&E investigators may attribute the cause of an ignition to equipment failure if that scenario is most likely given the physical evidence available at the time and the absence of any evidence to suggest otherwise (e.g., vegetation, bird carcass, etc.). PG&E also utilizes an ‘Unknown’ option for cause determinations but typically reserves that option for situations when other causes are unlikely. As indicated in the First Quarterly Report, our wildfire data analysis showed that 13.6 percent of the ignitions were attributed to unknown/other causes at the time the First Quarterly Report was prepared. PG&E’s process is not to automatically default to equipment failure for an ignition for which the cause cannot be determined.

Condition PGE-2 had asked us to explain why our “equipment failure rate is so high compared to other large electrical corporations.” To answer that question, PG&E would need to conduct extensive benchmarking with the other utilities to better understand the drivers of equipment failure ignitions in the state then normalize those drivers by the environmental conditions unique to their respective service territory. In 2020, PG&E’s Ignition Investigation and Asset Failure Analysis team have started to benchmark with counterparts within the other utilities and will continue to do so in 2021.

- 2) PG&E does not believe that the ignitions from 2016 to 2020 are inaccurately characterized as a result of a “current default for ignition cause.” See response to Question 1. However, we are continuing to work on our ignition investigation processes to continue to improve our ability to accurately identify the cause of each ignition, as described in more detail in the responses to Questions 3 and 4 below.
- 3) The Ignitions Investigation team within Electric Incident Investigations (EII) identifies ignition events in our system of record and performs an investigation on each event. Our ignition investigators contact internal and external first responders in the field to understand site conditions and the most likely cause determination for the event. Fire reports are collected from suppressing fire departments (where available) when cause is undetermined or other key details are unavailable to PG&E.

Starting in 2020, the Ignitions Investigation team corrects electronic field records and other systems of information if a discrepancy in event details (including cause determination) is discovered during the investigation. Approximately 500 field records associated with ignition events in the 2020 calendar year were edited by the EII team. Equipment failure ignitions undergo further bi-weekly review with PG&E’s Asset Failure Analysis team to determine key trends and insights. If the Asset Failure Analysis team identifies a discrepancy or a better cause determination, the ignition record is corrected to reflect the best interpretation of the facts.

- 4) PG&E has made significant improvements in our ignition investigation process and we believe that any inaccuracies in cause determination are largely due to limited evidence available at the time of determination instead of process issues or training gaps. That said, PG&E is working on additional improvements in 2021 to ensure the accuracy and completeness of our ignition records, including:
  - Continue field engagement with front-line employees to clarify expectations on providing quality photos and accurate data at the time of initial ignition response
  - Mature our Asset Failure Analysis program to increase our insight into equipment failure ignitions and develop corrective actions
  - Integrate the systems of record relevant to ignitions data into the Palantir Foundry platform to speed analysis and data availability
  - Benchmark with other utilities to understand how they perform ignition investigations and determine equipment failure ignitions
- 5) Currently there are no plans to revisit the cause determination for ignition events that have completed investigation.
- 6) Not applicable, see above.

## **ACTION PGE-27 (Class B)**

- 1) *Provide the percentage and OH circuit mileage of small copper conductor replacement projects that fall within HFTD areas.*
- 2) *Explain how PG&E is prioritizing small copper replacement projects.*
- 3) *Explain any parallel upgrades (pole replacements, crossarm repairs, etc.) PG&E is performing that are compatible with small copper conductor replacements, including how such are prioritized.*

### **Response:**

- 1) PG&E's conductor replacement programs are included in two separate Maintenance Activity Types (MAT). MAT 08J, which includes work in non-HFTD areas, contains essentially no small copper (CU) conductor replacement within HFTD areas. MAT 08W is PG&E's System Hardening Program which is focused on HFTD areas. The quantity of "6 CU" copper conductor removed in relation to MAT 08W projects (*i.e.*, System Hardening Program projects) is not a data point that PG&E specifically maintains and thus the information is not readily available. An ad-hoc study would be required to review documentation related to all past MAT 08W projects to compile a new dataset of 6 CU copper conductor removed on System Hardening Projects, and if this were to be a regular dataset, would need a process developed to consistently track and report the data. Thus, PG&E does not currently have the data to respond to this question for our System Hardening Program in HFTD areas.
- 2) The focus of the MAT 08J (non-HFTD area) program is small conductor replacement (*i.e.*, 6 CU, 4 CU, and 4 Aluminum Conductor Steel-Reinforced (ACSR)) with elevated wire down rates. The majority of MAT 08J projects are recommended through the Engineer Investigation Wires Down Database following an equipment failure wire down outage. The majority of outages occur on small conductor and if the criteria is met (conductor size/type, past wires down, splice count, and/or overstressed conductor relating to available fault current) then a project is created to address the segment(s) of conductor with similar attributes indicating a deteriorated state. Since the failure rates of 6 CU and 4 CU, as well as 4 ACSR in corrosion zones, are much higher than the system average failure rates – these conductors make up the majority of the projects within the MAT 08J program. Where the small copper conductor failure risks align a circuit segment that is high in the 2021 Wildfire Distribution Risk Model, and is therefore located in an HFTD, this project would be considered in the prioritization of the MAT 08W (HFTD area system hardening) program.
- 3) MAT 08J (non-HFTD) Reconductor projects also include replacing Self Protected Transformers and deteriorated or open wire secondary within scope boundaries. Since the majority of the reconductor projects involve installing a larger conductor, per PG&E standard, all pole loading needs to be reviewed resulting in approximately 1 in 5 poles being replaced within the project scope. If any equipment (crossarms, insulators, fuses, etc.) is outdated, non-standard or in a deteriorated state, then it too will be replaced. Typically, compliance tag work

(E and F tags) have a more rapid due date than the cycle time of a standard MAT 08J project – so these tags are generally not bundled with MAT 08J projects. But depending on type of tag (e.g., cross arm repair), if the tag is outstanding when a project is being constructed then it could be addressed with the MAT 08J project.

The open E and F Electric Corrective (EC) tags that overlap with the boundary of a system hardening project are re-classified as priority H tags and completed as part of the system hardening project. Some system hardening projects have been created primarily to address a high density of structure-related tags where a system hardening project would gain efficiencies and eliminate re-work as compared to independently repairing each of the tags. Currently, only 17 such “tag-driven” system hardening jobs are planned in the 2021-2023 timeframe. These tags will continue to be re-assessed to ensure further deterioration of the asset has not occurred which would require a more immediate response. If a critical risk is found upon re-assessment, that asset would be re-classified as an A or B tag and completed accordingly ahead of the system hardening project execution.



## **ACTION PGE-29 (Class B)**

- 1) *Indicate which subset of outages in Table 17 it considers to be near-miss ignition events.*
- 2) *Explain what each subcategory of “Unknown” or “Other” consists of in Tables 16 and 17 of PG&E’s QR.*
- 3) *Explain in more detail all “Unknown” and “Other” values, including what is included within those values.*

### **Response:**

- 1) In general, PG&E currently assumes that all outage events involving a fault condition represent a “near miss” ignition or a risk event.
- 2) PG&E has interpreted this request as asking for the information outlined below. It should also be noted that PG&E’s electric outage database is structured such that a basic cause, a supplemental cause, and the involved equipment can be reported for each outage. Although these fields are reported for most outages, there are a small number of exceptions that are mentioned below and includes some momentary outages that are automatically reported via SmartMeters and have limited cause details. PG&E also improved and modified our outage cause structure in 2015 and there are additional combinations of basic and supplemental causes possible when consolidating historical data from 2015 and earlier. In addition, the involved equipment is a data field that consists of most critical pieces of equipment but does not necessarily include all equipment.

In Tables 4 and 5 below, PG&E provides the referenced table, the involved Line Item, the listed Driver and Sub-Driver.

**TABLE 4: EXPLANATION OF OTHER/UNKNOWN DRIVERS FOR TABLE 16 – SYSTEM HARDENING DRIVER EFFECTIVENESS – IGNITION**

Line No.	Driver	Sub-Driver	Explanation
1	Third Party	Third Party – Other	This designation refers to all other third party related outages not covered by the more specific third party related outages listed in this table, i.e., Third Party – Unknown, Balloons, and Vehicle.
2	Third Party	Third Party – Unknown	This designation refers to all third party related outages but not reported with a supplemental cause as described above.
3	Equip Failure	Equip Failure – Other	This designation refers to all other equipment failure related outages not involving the failed equipment listed in this table (i.e., not a Capacitor bank, Conductor, Crossarm, Equip Failure – Other, Fuse, Guy/Span Wire, Insulator, Pole, Recloser, Sectionalizer, Splice/Clamp/Connector, Switch, Transformer or Voltage Regulator).
4	Equip Failure	Equip Failure - Other	This designation refers to all equipment failure related outages but not reported with a supplemental cause as described above.
5	Unk or Other	Unk or Other – Other	This designation refers to all reported outages with an undetermined cause. In these cases, the supplemental case indicates either a detailed patrol was not conducted, or a detailed patrol was conducted but no cause was determined.
6	Unk or Other	Unk or Other – Unknown	This designation refers to outages reported with an unknown cause and with no supplemental cause provided as described above.
7	Vegetation	Other/Unknown	This designation refers to other vegetation related outages due to other ground related vegetation outages or reported without additional supplemental cause information as described above.
8	Thirty Party,	Third Party – Other:	This designation refers to all other third party related outages not covered by the more specific third party related outages listed in this table, i.e., Third Party – Unknown, Balloons, and Vehicle.
9	Thirty Party,	Third Party – Unknown:	This designation refers to all third party related outages but not reported with a supplemental cause as described above.
10	Equip Failure,	Equip Failure – Other:	This designation refers to all equipment failure related outages but not reported with a supplemental cause as described above.
11	Other	Patrol – found nothing	This designation refers to all reported outages with an undetermined cause. In these cases, the supplemental cause indicates a detailed patrol was conducted but no cause was determined.

**TABLE 5: EXPLANATION OF OTHER/UNKNOWN DRIVERS FOR TABLE 17 – SYSTEM HARDENING DRIVER EFFECTIVENESS**

Line No.	Driver	Sub-Driver	Explanation
1	Other	Patrol – not conducted	This designation refers to all reported outages with an undetermined cause. In these cases, the supplemental cause indicates a detailed patrol was not conducted.
2	RIM	RIM - Other	This designation refers to other records and information management related outages due to incorrect tags, diagrams, switch logs and mis-coordination.
3	Third Party	Other	This designation refers to all other third party related outages not covered by the more specific third party related outages listed in this table, i.e., Third Party – Unknown, Balloons, and Vehicle.
4	Vegetation	Other/Unknown	This designation refers to other vegetation related outages due to other ground related vegetation outages or reported without additional supplemental cause information as described above.

- 3) When considering outages or other risk events that could be mitigated by system hardening, PG&E reviewed information beyond Other and Unknown outage causes and looked at additional factors including supplemental causes, failed/involved equipment, and equipment condition. For example, an item that is listed as unknown but has “conductor-OH” as the involved equipment is potentially preventable through System Hardening. Details of the combination of basic cause, supplemental cause, failed/involved equipment, and equipment condition is included in the Attachment 2021WMP\_ClassB\_Action-PGE-29\_Atch01.

## **ACTION PGE-30 (Class B)**

- 1) *Provide a list of all changes to equipment as described in PG&E's QR response that would cause GIS data to no longer accurately reflect the original location of the 600 miles missing from the GIS data.*
- 2) *Describe why the "start and end point" of circuit segments would no longer exist within the GIS data, broken down by percentage of cause (e.g., conductor replacement, full equipment replacements, facility removals), and*
- 3) *explain whether PG&E has completely replaced or hardened these 600 miles of its distribution system and thus no longer considers them part of the highest priority circuit segments, or if not, explain the cause of the missing information.*

### **Response:**

- 1) PG&E's GIS system, including its data and data maintenance processes, is designed to maintain the real time, as-designed representation of the circuit segments or circuit protection zones (CPZs). The GIS system is not designed to maintain or reflect the historical representation of the circuit segment or to track all the changes that have been made to circuit segments. However, in order to provide a response to Action PGE-30 (Class B), PG&E performed a deep dive through historical data sets to re-map the 5,500 miles of circuit segments from late 2018. The data for this re-mapping can be found in the Attachment 2021WMP\_ClassB\_Action-PGE30\_Atch01. Note that this data is not reflective of the current configuration of PG&E's electric grid.
- 2) As described above in the response to subpart (1), since the GIS data is maintaining the real time as-designed representation of the "start and end point" of the circuit segment, the GIS system does not maintain or reflect the historical representation or tracking of changes made to the circuit segments. This does not allow for the ability to provide details that can break down the percentage of cause of the change.
- 3) As described above in the response to subpart (1), the real time as-designed GIS data does not track the historical representation of the circuit segments. This is not an indication that the GIS data no longer reflects the 600 miles of circuit segments or that all of these miles have been replaced, eliminated or hardened. The 600 miles of circuit segment data are still maintained in the GIS system; however, the missing start and end point data is caused by asset changes since the original dataset was pulled from PG&E's GIS system and the design of the GIS system that does not maintain a historical representation of the circuit segments.

## **ACTION PGE-33 (Class B)**

- 1) *Provide the number of circuit miles and percentage of the 5,500 identified miles each of the targeted approaches consist of.*
- 2) *Provide the GIS file for the locations of each targeted approach.*

### **Response:**

- 1) In its First Quarterly Report, in response to Condition PGE-5(iii), PG&E described five targeted approaches that it used for the 2020 WMP for identifying areas for system hardening: (1) identified deteriorated OH conductor; (2) fire risk ignition modeling; (3) Electric Correction Tag Optimization Program (ECOP); (4) PSPS mitigation; and (5) other field identified optimized opportunities.<sup>4</sup> PG&E also addressed these five targeted approaches in response to Condition Guidance-10 and explained that projects are then aligned with the risk model and reviewed by an execution team.<sup>5</sup> These responses were based on information provided in and used to inform the 2020 WMP.

Separately, PG&E explained in the First Quarterly Report that our 2020 WMP risk modeling had identified that approximately 95% of the wildfire risk was in 22% of the distribution line miles.<sup>6</sup> This equates to approximately 5,500 miles (*i.e.*, 22% of 25,200 distribution miles) compromising 95% of the wildfire risk based on the model in use at that time.<sup>7</sup>

There are several clarifications that are necessary to respond to this Action Item at this point in time. First, the 95% wildfire risk being captured in 22% of the distribution miles (*i.e.*, approximately 5,500 miles) was based on PG&E's previous risk modeling that was used for the 2020 WMP. As we explain in detail in Section 4.5.1 of the 2021 WMP, PG&E's risk modeling has changed substantially such that the previous results, including that 95% risk reduction estimate, are no longer applicable. Based on our updated risk modeling, the references to 5,500 miles are no longer being used for system hardening planning purposes. This is discussed in PG&E's response to Action PGE-3 (Class B) in the 2021 WMP.<sup>8</sup>

Second, PG&E's approach for identifying System Hardening project locations has also evolved from the targeted approaches described in the First Quarterly Report. Our current approach to identifying locations for System Hardening Program work is based primarily on the 2021 Wildfire Distribution Risk Model, as well as other considerations such as wildfire rebuilding and projects that reduce PSPS impacts.

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<sup>4</sup> First Quarterly Report at p. 110.

<sup>5</sup> First Quarterly Report at p. 47.

<sup>6</sup> First Quarterly Report at pp. 109-110; see *also* 2020 WMP at p. 5-274 (explaining risk modeling that resulted in estimation of 95% risk reduction).

<sup>7</sup> 2020 WMP at p. 5-274.

<sup>8</sup> 2021 WMP at pp. 559-561.

PG&E's current approach to identifying System Hardening Program areas is described in Section 7.3.3.17.1 of the 2021 WMP.<sup>9</sup>

As PG&E continues to study and enhance our risk models, as described in Section 4.5.1 of the 2021 WMP, the specific targeted miles for the System Hardening Program will change. PG&E will continue to harden at-risk infrastructure consistent with the risk prioritization and strategies. For 2021-2022, our current target is to harden 180 miles in 2021 and 470 miles in 2022.<sup>10</sup>

Because of the changes in risk modeling and approach, the references to 5,500 miles and the targeted approaches described in the 2020 WMP are no longer current or applicable to PG&E's System Hardening Program and we do not have targeted hardening approaches identified for those 5,500 miles.

- 2) See the response to subpart (1).

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<sup>9</sup> 2021 WMP at pp. 550-556.

<sup>10</sup> 2021 WMP at p. 559, n. 6.

## **ACTION PGE-34 (Class B)**

- 1) *Provide the number and percentage of circuit miles out of the 5,500 miles in which EVM work is being completed,*
- 2) *Provide the location of such miles via GIS,*
- 3) *Provide the number and miles in which the high-risk circuits identified with the Distribution EVM model overlap with the 5,500 miles, and*
- 4) *Provide the location of the circuit miles in GIS and in accordance with data attributes and metadata specified in the WSD's GIS data reporting requirements.*

### **Response:**

- 1) As explained in our response to Action PGE-3 (Class B) (see 2021 WMP at pp. 559-561), with regards to system hardening, PG&E is “no longer targeting a specific set of miles such as the . . . 5,500 circuit protection zone (CPZ) miles referenced in the previous WMP.” However, for purposes of the response to Action PGE-34 (Class B), PG&E has reviewed the 5,500 miles of miles identified for system hardening in the previous WMP and has determined that 5,228 miles, or 95%, are currently in scope for EVM. Please note, however, that CPZs are not an attribute that is captured in the EVM system and CPZs do not always spatially align with EVM circuits, therefore the 5,228 miles is our best estimation of where EVM aligns with the 5,500 miles identified for system hardening in previous WMPs, understanding that PG&E is no longer targeting these specific miles for system hardening.
- 2) See attachment 2021WMP\_ClassB\_Action-PGE-34\_Atch01 which contains the requested segment data.
- 3) For the purposes of this request, PG&E understands that the WSD is asking for circuit protection zones and mileage for the top 50% of the highest risk ranked circuit in its 2021 Wildfire Distribution Risk Model. With that understanding, there are 286 circuit protection zones and 3,746 miles in the top 50% of risk rank within the 5,228 miles of overlap addressed in this response.

## **ACTION PGE-36 (Class B)**

- 1) *Explain how and why the 1,060 miles were prioritized, and*
- 2) *Provide the location of the 1,060 circuit miles via GIS.*

### **Response:**

- 1) In PG&E's First Quarterly Report, we described the RSE scores developed in the 2020 RMP Report and explained that PG&E "is completing our system hardening commitment in 2020 and aims to harden approximately 1,060 circuit miles in 2020-22."<sup>11</sup> This target was based on the risk modeling that PG&E was using when it developed the 2020 WMP.

In 2020, we had a 220-mile target to harden overhead (OH) facilities based on the 2019-2020 Wildfire Risk Model (which was used for the 2020 WMP). PG&E completed approximately 342 total miles, which includes 194 hardened miles in HFTD areas during fire rebuild efforts, plus another 21 miles of undergrounding through the Butte rebuild.<sup>12</sup> Our targets for 2021 and beyond have been informed by our updated risk modeling, the 2021 Wildfire Distribution Risk Model. As PG&E continues to study and enhance our risk models, as described in Section 4.5.1 of the 2021 WMP, the specific location of project targeted for the System Hardening Program will change. PG&E will continue to harden at-risk infrastructure consistent with the risk prioritization and strategies. For 2021-2022, our current target is to harden 180 miles in 2021 and 470 miles in 2022.<sup>13</sup> Thus, the target for 2020-2022 is now 992 miles, not the 1,060 miles referenced in the 2020 WMP.<sup>14</sup> The prioritization of these revised miles is described in Section 7.3.3.17.1 of the 2021 WMP.

Because of the changes in risk modeling and approach, the references to 1,060 miles and the targeted approaches described in the 2020 WMP are no longer current or applicable to PG&E's System Hardening Program.

- 2) See the response to subpart (1). As noted above, the GIS locations of all miles anticipated to be hardened from 2020-2022, now 992 miles, are not available as all projects for this time period have not been identified and mapped, particularly the 2021 and 2022 project plan which remains under development.

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<sup>11</sup> First Quarterly Report at pp. 111-112.

<sup>12</sup> 2021 WMP at p. 557.

<sup>13</sup> 2021 WMP at p. 559, n. 6.

<sup>14</sup> 2021 WMP at p. 559, n. 6.



## **ACTION PGE-45 (Class B)**

- 1) *Provide the internal cost/benefit analysis being conducted in the interim while a program is being developed.*

### **Response:**

Weather stations are instrumental to situational awareness, managing PSPS events and understanding wildfire risk. With regard to PSPS events, weather stations are used to more accurately predict if, and when, a PSPS event needs to be called as well as to determine the areas to be included in or excluded from the PSPS event. Given the WSD's feedback in Resolution WSD-002, Appendix A, A1 that "electrical corporations shall not rely on RSE calculations as a tool to justify the use of PSPS," PG&E has not developed a risk reduction quantification associated with calling PSPS events at this time, including how calling PSPS events is impacted by weather stations. However, PG&E has analyzed how much more accurate meteorological guidance reduces the consequence when a PSPS event is called. Overall, it is difficult to separate incremental reductions per weather station, but documentation of the incremental reduction of PSPS consequence can be seen in our 2021 WMP summarized in Supplemental Table 12 (Class B).

With regard to reducing wildfire risk, PG&E is working with the California Energy Commission (CEC) on a project analyzing the density of PG&E's weather station network. By the end of Q1 2021, PG&E expects to be able to use the CEC's pilot project to determine the effectiveness of the array of weather stations in characterizing the near-surface weather variables that impact fire ignition and spread. PG&E should also be able to analyze array effectiveness in the same proxy but focused on the biota and topography rather than just the weather alone. This analysis will help quantify how much any individual new proposed station helps characterize the weather and climate of the region. These analyses will be done from 4 km to 1 km resolutions and will cover PG&E's entire service territory. This analysis will likely contribute to the data being built that evaluates a station's location and its value in the overall mission to mitigate the risk of catastrophic wildfire.

With the latest climate trends for longer, drier, and hotter wildfire seasons, it is a critical investment to install weather station networks in the proper locations and ultimately at the proper density to provide the most value in mitigating wildfire risk. Similar programs are also in progress with the other IOUs, as seen in Table 6 below. Due to the size of PG&E's service territory and asset base, our weather station array is currently less dense in covering assets in HFTDs than other California IOUs, so it is important to benchmark with other utilities and continue working through analysis with the CEC to find the proper installation density and optimization of current stations to maximize the fire mitigation benefits.

**TABLE 6: DENSITY OF WEATHER STATIONS IN IOU HFTD AREAS**

Line No.	Utility	Weather Stations	HFTD Dx OH Miles	HFTD Tx OH Miles	HFTD OH Miles	WS/HFTD Dx OH (Per 1,000 Mile)	WS/HFTD T&D OH (Per 1,000 Mile)
1	PG&E	1,006	25,439	5,869	31,308	39.55	32.13
2	SCE	1,049	9,829	4,353	14,182	106.72	73.97
3	SDG&E	220	3,486	1,102	4,588	63.11	47.95

## **ACTION PGE-60 (Class B)**

- 1) *Describe what WV consists of when comparing the 2019 audit to the 2020 audit.*
- 2) *Provide all criteria for both the 2019 and 2020 pass rates.*

### **Response:**

- 1) From August 2019 to February 2020, PG&E conducted audits of our EVM Work Verification (WV). The scope of the 2019 audit was to assess the performance of third-party contractors performing EVM WV. The 2019 audit was based on a sample of 227 miles out of 2,455 miles in the 2019 EVM plan.

From September 2020 to November 2020, PG&E conducted an audit of our EVM WV. The audit was based on a sample of 42 miles out of 1455 miles as having met the WV 'pass' criteria from January 1, 2020 to August 31, 2020. The scope of the 2020 audit was to assess the EVM WV performed by a third-party vendor. The vendor performed WV audits following PG&E's completion of EVM work.

- 2) The pass-rate criteria for the 2019 and 2020 EVM WV audits changed in several ways. First, the EVM procedure changed in 2020 and no longer included inspection for vegetation causing strain or abrasion on secondary conductors. However, this issue was still addressed under normal routine work. Accordingly, the Quality Management (QM) team passed a line segment "with observation" when a strain or abrasion on a secondary conductor was observed during the 2020 audit. Second, in 2020, PG&E began using the Tree Assessment Tool to assess the risks associated with hazard trees. Thus, PG&E no longer evaluated hazard trees pursuant to professional judgment. Third, in 2020, PG&E assessed field conditions generally rather than at established vegetation points. Finally, PG&E decided to formally include assessment information regarding debris present and potential ANSI issues from current EVM work. These issues had previously been assessed informally and had never been rated as part of the inspection process.

Table 7 below shows the criteria for determining whether a line segment failed an EVM WV audit or "passed with observation" (Pass w/Obs) in the 2019 and 2020 audits.

**TABLE 7: CRITERIA FOR 2019 AND 2020 EVM WORK VERIFICATION AUDITS**

Finding	2019 Audit		2020 Audit	
	Pass/Fail	Pass W/Obs	Pass/Fail	Pass W/Obs
Vegetation within 4' of primary/high voltage conductors	x		x	
Vegetation causing strain or abrasion on secondary conductors	x			x
Vegetation within the 4' overhang zone	x		x	
Hazard trees present that would strike and damage facilities	x		x	
Hazard trees present which rated in professional judgment white area of the HTRS		x		
Vegetation with potential to encroach within 4' before next routine cycle (including the overhang zone in 2020)		x		x
Trees with the potential for overhangs to encroach within 18 months (included in the category above in 2020)		x		
Missing Inventory Tree		x		
Debris present from current EVM work activity (in or out of waterway)				x
ANSI A300 issues from current EVM work				x

**ACTION PGE-61 (Class B)**

- 1) *Define what “Pass w/ Observations” consists of, including all supporting procedures and criteria, and*
- 2) *Provide a list of the observations made that “Pass w/ Observations” consists of from Table 21.*

**Response:**

- 1) Please see Table 7 in response to PGE-60 (Class B) above for information showing the criteria for determining whether a line segment failed the EVM WV audit or “passed with observation” (Pass w/Obs) in 2019 or 2020.
- 2) “Pass with Observations” as described in the PG&E EVM WV Audit Results from February 2020, identified in Table 21 of PG&E’s First Quarterly Report, included the following observations in Table 8.

**TABLE 8: OBSERVATION TYPES FOR “PASS WITH OBSERVATION”**

Line No.	Pass w/Risk Observation by Type	Miles	Percent
1	Hazard trees present, rating in white area	4.16	22.26%
2	4’ Encroachment within 12 Mo	5.96	31.86%
3	Overhangs within the next 18 Mo	0.95	5.06%
4	Missing Inventory Tree	7.63	40.81%
5	Total	18.69	100.00%

## **ACTION PGE-62 (Class B)**

- 1) *Provide details on specific capabilities being implemented to improve inspection pass rates,*
- 2) *The cost increase or savings of each capability, and*
- 3) *The timeline for implementation of each capability, including past dates for any already implemented.*

### **Response:**

- 1) PG&E plans to achieve our stated goal of a 92 percent rate of “meets expectations” on the “first pass” by assuring our pre-inspectors and tree crews have proper training and knowledge to perform job duties. To support continued knowledge enhancement, PG&E has developed a new training course specific to WV. This training provides employees and contractors with in-depth information on how to inspect High Voltage lines for EVM WV. Additionally, in 2021 all PG&E prime vendors will be subject to an annual documentation review. This is a new requirement for prime vendors that will allow PG&E to stay informed and aligned on our partners’ operational and organizational structures, relevant work experience and reference checks, along with their employees’ trainings and certifications.
- 2) The development of the training course specific to WV required a one-time cost of \$50,000 for course development. Additional costs will be associated with building out the WV workforce coupled with supporting our new prime vendor requirements. Determining the costs associated with increasing the WM workforce and implementing new prime vendor requirements is still under review. Alternately, increasing our WV pass rate will result in less rework and greater resource efficiency which may result in cost savings.
- 3) The training course specific to WV was fully implemented in 2020 and is in place for 2021 EVM work. Additional prime vendor controls will be fully implemented by the third quarter of 2021.

### **ACTION PGE-63 (Class B)**

- 1) *Provide the 2019 and 2020 monthly passing rate both in miles and percent, including the breakdown between “Pass” and “Pass w/Observation,”*
- 2) *Explain whether criteria for pass rate changed, along with the month in which new criteria was utilized, and*
- 3) *Continue providing monthly results in PG&E’s future WMP and QR filings.*

#### **Response:**

- 1) In prior quarterly responses, PG&E processes for WV, Quality Assurance (QA), and Quality Verification (QV) have often been referred to in similar capacities. However, WV is a standalone process that serves as an independent function of Vegetation Management with its own scope of work.

Monthly pass rates for 2019 and 2020 are only available for EVM WV work completed. The EVM WV scope of work does not include a category for “pass with observation.” The “pass with observation” category is a feature of PG&E’s QA/QV scope of work, and this data is not collected monthly. The personnel performing PG&E’s QA/QV work participated in PG&E’s 2019 and 2020 audits of the EVM WV work. For this reason, the 2019 and 2020 EVM WV *audits* included a category for “pass with observation” even though routine EVM WV work does not include that category.

The 2019 and 2020 monthly pass rates for EVM WV are included in Table 9 below. These results are separate from the EVM WV audit results.

**TABLE 9: 2019-2020 MONTHLY PASS RATES FOR EVM WV**

Row Labels	Sum of TOTAL_WV_FIRST_PASS_MILES	Sum of TOTAL_WV_FIRST_MILES	Sum of WV_FirstPassMiles_Percent
2019	1,761	2,573	68.4%
Jan	-	-	0.0%
Feb	-	-	0.0%
Mar	-	-	0.0%
Apr	-	-	0.0%
May	-	-	0.0%
Jun	-	-	0.0%
Jul	-	-	0.0%
Aug	-	-	0.0%
Sep	231	259	89.3%
Oct	348	477	73.0%
Nov	490	763	64.2%
Dec	692	1,075	64.4%
2020	1,576	1,835	85.9%
Jan	237	291	81.6%
Feb	167	211	79.0%
Mar	6	8	77.3%
Apr	194	218	89.0%
May	176	195	90.4%
Jun	180	197	91.4%
Jul	145	150	97.0%
Aug	144	165	87.1%
Sep	90	103	87.0%
Oct	155	201	77.2%
Nov	50	60	83.6%
Dec	33	37	87.1%
<b>Grand Total</b>	<b>3,337</b>	<b>4,408</b>	<b>75.7%</b>

- 2) The criteria for the initial EVM WV pass rate has not changed. However, the criteria for PG&E’s pass rate “with observation” set forth in the 2019 and 2020 EVM WV audits changed slightly on or about January 1, 2020. Please see Table 7 in response to Action PGE-60 (Class B) for information showing the criteria for determining whether a line segment failed an EVM WV audit or “passed with observation” in 2019 and 2020.
  
- 3) PG&E will continue to provide monthly pass rate information for EVM WV in future filings.



**ACTION PGE-64 (Class B)**

- 1) *Explain where the numbers in Table 22 originated and why they differ from Table 11-2.*
- 2) *Provide a revision of Table 22 showing only transmission-related ignitions caused by vegetation contact.*
- 3) *Include an additional ROW showing transmission-related ignitions caused by vegetation contact that led to fires greater than 500-acres.*

**Response:**

- 1) The numbers in Table 22 originated from Table 11-2. Table 11-2 provides a comprehensive list of all ignitions attributable to PG&E transmission assets between 2015 and 2019. Table 22 in PG&E’s First Quarterly Report also identifies all ignitions attributable to PG&E transmission assets from 2015 to 2019. Table 22 does not separate out ignitions attributable to PG&E transmission assets caused by vegetation contacts only.
- 2) Table 10 below displays ignitions caused by vegetation contact relating to PG&E’s transmission assets only between 2015-2019.

**TABLE 10: TRANSMISSION ASSET IGNITIONS CAUSED BY VEGETATION CONTACT**

Category of Ignition	2015	2016	2017	2018	2019
Transmission Ignitions – Veg Contact	0	0	0	0	1

- 3) PG&E has not identified any vegetation-caused ignitions relating to transmission assets that have caused a fire greater than 500 acres from 2015 to 2019 to add to the above chart.

**ACTION PGE-65 (Class B)**

- 1) *Include an estimated change from 2019 to 2020 in personnel hours for a) distribution EVM work and b) TVM work*
- 2) *Provide the targeted miles for 2019 and 2020 of TVM.*

**Response:**

- 1) PG&E's distribution EVM personnel hours increased by approximately 15,346 hours from 2019 to 2020. Additionally, PG&E's Transmission Vegetation Management (TVM) personnel hours increased by approximately 14,573 hours from 2019 to 2020.
- 2) PG&E targeted approximately 18,140 miles for TVM work in 2019. PG&E targeted approximately 18,220 miles for TVM work in 2020.

**ACTION PGE-67 (Class B)**

- 1) *Provide the number of OH circuit miles tested in the transmission ROW Expansion Program*
- 2) *Break down the number of vegetation-caused outages per year for the ten years prior to the 2017 ROW expansion pilot*
- 3) *Provide the number of vegetation-caused outages along the circuit miles demonstrating the ROW Expansion Program pilot in the ten years prior to the pilot*
- 4) *Provide data on any ignition(s) that have occurred in areas that have undergone TVM outside of the pilot.*

**Response:**

- 1) PG&E interprets this request to ask for the number of OH miles completed in the Transmission right-of-way (ROW) expansion program: 207 miles of Transmission ROW Expansion were completed in 2020.
- 2) Table 11 below provides the total vegetation caused outages on PG&E’s Transmission facilities in the 10 years prior to the ROW Expansion pilot.

**TABLE 11: TRANSMISSION ASSET OUTAGES CAUSED BY VEGETATION PRIOR TO THE ROW EXPANSION PILOT**

<u>Outage Type</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>
Vegetation caused outages	53	66	45	82	98	60	38	40	58	52

- 3) Table 12 below provides the total outages on the facilities where the ROW Expansion pilot has been conducted in the 10 years prior to the pilot.

**TABLE 12: TRANSMISSION ASSET OUTAGES CAUSED BY VEGETATION ON FACILITIES IN ROW EXPANSION PILOT**

<u>Transmission Facility</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>
Drum-Grass Valley-Weimar	2	1	1	2	11	1	0	0	0	0

- 4) There was 1 vegetation caused ignition in 2020 on Transmission facilities. The ignition was on Elk-Gualala 60kV. The approximate 100 square foot fire was suppressed by South Coast Fire Protection District.

## **ACTION PGE-68 (Class B)**

- 1) *Explain the resource shift from distribution EVM to TVM with the support of quantitative data and figures demonstrating increased effectiveness for decreasing catastrophic wildfire risk.*

### **Response:**

PG&E did not shift resources from distribution EVM to TVM. As noted in the response to PGE-65 above, resource deployment in man hours increased from 2019 to 2020 for both distribution EVM and TVM. Financially, the entire EVM budget was spent following an increased cost of work for each mile within the EVM program driven primarily by Senate Bill (SB) 247 driving increased minimum wage requirements for tree workers. This resulted in an increase in cost associated with the EVM program. The cost of TVM resources were not as significantly impacted by SB 247 because the TVM scope of work does not always require the hiring of the most qualified, "line clearance certified" tree workers given the distance of the work from the electrical conductors. This allowed TVM units to be completed with the same budget. Given that resources have not shifted, we do not have quantitative data to demonstrate increased effectiveness for decreasing catastrophic wildfire risk responsive to this request.

**ACTION PGE-69 (Class B)**

- 1) *Provide the percentage of all VM resources (labor, costs, etc.) being allocated to TVM.*

***Response:***

In 2020, approximately 9% of PG&E's VM costs and approximately 12% of PG&E's VM labor hours were allocated to TVM.

## **ACTION PGE-82 (Class B)**

- 1) *Provide an update and explanation as to how its hardening initiatives have directly impacted its threshold values for initiating de-energization events, giving a) particular locations & b) quantitative data showing such changes.*

### **Response:**

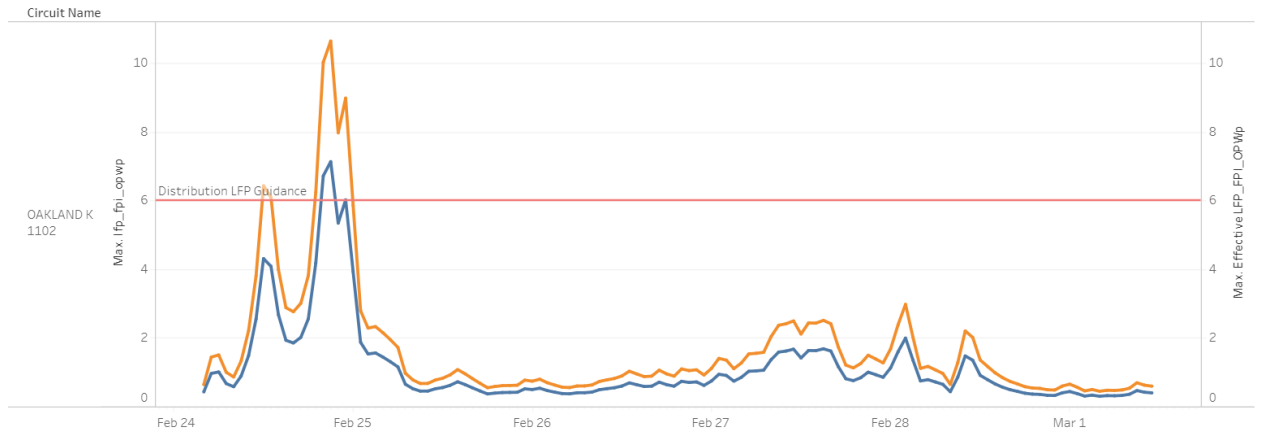
- 1) As outlined in Action PGE-16 (Class A), the Distribution PSPS descoping criteria identifies candidate distribution circuit segments for descoping during de-energization events. These criteria are scheduled to be applied and operationalized to descope distribution circuit segments during the 2021 Wildfire season. In order to be considered for de-scoping, circuit segments will be pre-identified as meeting the criteria. The Distribution PSPS de-scoping criteria is met when a circuit segment has an adjusted Distribution Large Fire Potential (LFPD) value below the PSPS threshold and there are no strike potential trees or open maintenance tags on the segment. Completion of hardening activities on a circuit do not change the threshold for initiating a de-energization event but may adjust the LFPD for that circuit segment to fall below the PSPS threshold. As detailed in Sections 4.2.A(c) – 4.2.A(g) of the 2021 WMP<sup>15</sup>, the probability of a distribution line failing during a given weather event is based on historical performance of the line. For pre-identified lines, effectiveness factors to account for the improvement from hardening are determined. For example, if covered conductor is installed on a circuit segment this mitigation will reduce the probability of certain failure modes causing an ignition. The effectiveness factor represents the improvement to historical probability of ignition. These effectiveness factors are applied to the circuit segment within the PSPS scoping tools. If the effectiveness factor reduces the historical probability of a catastrophic fire below the PSPS threshold, it is identified for de-scoping. The second part of the criteria concerning the absence of strike potential trees and open maintenance tags is confirmed by a review of LiDAR data and a site visit by Public Safety Specialists and Arborists.

An example is provided for the Oakland K 1102 circuit in the chart below. The red line represents the PSPS threshold, and the orange line represents the LFPD of the circuit under weather conditions without the benefit of system hardening. The blue line shows the reduction to the LFPD for that circuit segment due to system hardening. In cases where the orange line exceeds the red PSPS threshold, these circuits are identified for de-energization. If, however, the reduction due to system hardening shown by the blue line drops the LFPD below the red PSPS threshold then the circuits will be considered for descoping from the de-energization event.

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**15** 2021 WMP at pp. 70-78.

**FIGURE 1: SYSTEM HARDENING IMPACT ON LARGE FIRE POTENTIAL**



## **ACTION PGE-83 (Class B)**

- 1) *Provide the calculations used to determine the percent outage reduction of the five categories (all, high, medium, low, and none) presented on pg. 194 of PG&E's QR.*

### **Response:**

In the First Quarterly Report, PG&E explained that our distribution line exclusion model was based on subject matter expert input as to whether system hardening would eliminate or reduce certain types of outages. That input was divided into five reduction categories and each category was assigned a percentage likelihood outage of reduction.<sup>16</sup> This was a qualitative analysis and thus there was not a specific calculation used to define these thresholds. The review by subject matter experts was grounded in the ranges defined by the all, high, medium, low, and none thresholds. The probability of an outage to produce an ignition on a hardened system is not easily calculated given that OH hardening still constitutes less than 2% of the total at risk distribution infrastructure and outages have not yet happened on hardened lines in a frequency necessary to support a calculation. As the hardened facilities become more widespread and PG&E gains further experience with their performance and we will further refine our analysis with this data.

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<sup>16</sup> First Quarterly Report at p. 194.



## **ACTION PGE-84 (Class B)**

- 1) *Incorporate lessons learned from the 2020 WMP filing into its discussion of each initiatives.*

### ***Response:***

In the WSD's January 8, 2021 evaluation of PG&E's First Quarterly Report, a Class B Action was identified regarding Cooperation and Sharing of Best Practices. WSD identified PG&E's First Quarterly Report response as being sufficient but also directed PG&E to incorporate lessons learned from the 2020 WMP filing into its discussion of each initiative. Attachment 2021WMP\_ClassB\_Action-PGE-84\_Atch01 lists all initiatives and explains lessons learned from 2020, if available.