Versant Power

Climate Change Resilience Plan

December 2023

CONTENTS

1 INTRODUCTION

1.1 CONTEXT

Maine Climate Council's "*Maine Won't Wait*" presents Maine's unequivocal commitments to addressing climate change by "reducing emissions, advancing clean energy, and protecting Maine's infrastructure and environment from climate effects." Climate change threatens to increase the intensity and frequency of hazards that will affect Versant Power's ("Versant") transmission and distribution ("T&D") infrastructure, business operations, and the communities it serves.

Versant recognizes that the impact of climate change on our customers is increasing and is committed to collaborating with the communities we serve and other stakeholders to enhance our infrastructure's resilience and improve our business operations, aligning our mission and vision with Maine's climate goals.[1]

Energy resilience has two related but distinct aspects: (1) withstanding events that cause power outages and (2) restoring power when outages occur. The United States Department of Energy ("DOE") defines "energy resilience" as follows:

> Energy resilience is the ability of the grid, buildings, and communities to withstand and rapidly recover from power outages and continue operating with electricity, heating, cooling, ventilation, and other energy-dependent services. A resilient power system reduces the likelihood of long-duration outages over large service areas, limits the scope and impact of outages when they occur, and rapidly restores power after an outage.[2]

The DOE definition is not narrowly focused on electricity delivery or supply. Instead, it incorporates overall energy outcomes for communities and buildings that rely on a portfolio of energy sources to provide resilience.

Enhancing "resilience" in a more general sense (what we typically refer to as reliability) has always been a central part of Versant's mission. However, as recognized by the Maine legislature, it is undeniable that climate change is having an increasing impact on the

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1 This includes, but is not limited to, actions that contribute to *Maine Won't Wait's* community-centric Strategies F ("Build Healthy and Resilient Communities") and G ("Invest in Climate-Ready Infrastructure"). Maine Climate Council, Annual Report, December 1, 2023.

2 United States Department of Energy, Office of Energy Efficiency & Renewable Energy, Energy Resilience, downloaded December 4, 2023.

communities we serve. Thus, Versant's Climate Change Protection Plan ("CCRP") is being filed pursuant to the following 2022 energy legislation:

> §3146. Climate change protection plan. No later than December 31, 2023, and every 3 years thereafter, a transmission and distribution utility shall submit to the commission a 10-year plan that includes specific actions for addressing the expected effects of climate change on the utility's assets needed to transmit and distribute electricity to its customers. The commission shall provide a process to allow for the input from interested parties on the transmission and distribution utility's plan. The commission may use the plan and the input received from interested parties in rate cases or other proceedings involving the transmission and distribution utility.[3]

Versant's CCRP will examine: (1) the vulnerability of electricity infrastructure, which is one aspect of Maine's overall vulnerability to climate change, focusing on potential climate impacts for communities we serve, and (2) potential investments in electricity infrastructure and other related actions that will enhance the resilience of these assets against climate change impacts. The CCRP is designed to support Versant's vision:

Provide a durable, flexible, and sustainable electricity system that is climate-resilient and carbon-free.

Versant's resilience strategies are organized around three pillars to facilitate the assessment, planning, and eventual implementation of the best strategies.

A) Infrastructure: Enhance the design, construction, and application of technology to address vulnerabilities of backbone infrastructure, including transmission lines, distribution lines, and substations.

B) Operations: Implement operations and technology "best practices" that either increase resilience (withstanding events that cause power outages) or improve Versant's ability to restore power more efficiently and expediently when significant outages occur, per our System Emergency Operations Plan (SEOP).

C) Communities: Consult and collaborate with communities to support resilience planning in ways that allow communities to leverage Versant's role and capabilities.

[3] "An Act Regarding Utility Accountability and Grid Planning for Maine's Clean Energy Future," LD 1959, signed into law on May 2, 2022.

As implied by Versant's vision statement and Maine's policy and regulatory frameworks, resilience is one of several objectives defining the contribution that utilities make to the public interest. Other objectives include public safety, reliability, and affordability of energy delivery. The legislature recognized the increasing importance of energy supply[4], delivery, and consumption on the environment, and seeks insight into the role Versant sees for itself in facilitating adjustments needed to minimize impacts on its customers.

To provide a framework for these efforts, the legislature has determined as part of the 2022 energy legislation that specific investments, programs, and other actions to enhance resilience should be assessed as an integral part of comprehensive "Integrated Grid Planning" (§3147. Integrated grid planning). Therefore, in addition to this CCRP, this new statutory section requires that, pursuant to a schedule to be determined by the Maine Public Utilities Commission ("Commission"), Versant will submit a 10-year integrated grid plan ("IGP") that addresses improvements to resilience while also being designed to "improve system reliability" and "enable the cost-effective achievement of the greenhouse gas reduction obligations."[5]

Resilience vs. Reliability

Resilience, defined above, is distinct from reliability. "Reliability" refers to the ability of an electric distribution utility to deliver the desired quantity of quality power to all customers when needed. Reliability is typically measured and reported for a specified period using a set of widely accepted industry metrics that are measured with and without major storms. These metrics include the average duration of experienced power interruptions ("CAIDI"), the average number of interruptions per customer ("SAIFI"), and the average duration of interruptions per customer in a year ("SAIDI").

Versant endorses this integrated planning approach because many solutions will contribute to more than one objective and should be developed in consideration of those multiple objectives to maximize "value for money"[6] for overall spending at any given time. The CCRP and IGP each provide an opportunity for stakeholder input and feedback. The final documents will provide important context and understanding for formal requests for approval of investments and other actions to be determined in rate case proceedings.[7]

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[4] Versant Power does not procure or control energy supply.

[5] This CCRP will serve as a critical input to our first IGP to address resilience.

[6] "Value for Money" is a principle that is employed by the United Kingdom regulator, Ofgem. According to Ofgem, the objective is to achieve the best possible level of output of acceptable quality at the lowest long-term cost.

[7] Subsection 4 of §3147 states in part with reference to IGP filings, "[t]he commission may use the filing and the input received from interested parties in rate cases or other proceedings involving the covered utility."

Versant puts forth this CCRP for Commission and stakeholder feedback, which will allow Versant to refine its planning for climate resilience and ensure effective participation in its related key role(s) in supporting Maine's Climate Council plans and the programs that the Commission is implementing and overseeing. Versant will support Maine's climate initiatives and pursue opportunities to save our customers money and enhance the affordability of Maine's energy supply and delivery system.

1.2 PLAN ORGANIZATION

Following this Introduction, the balance of the report consists of five sections.

Section 2 discusses the impact of climate change on the State of Maine and Maine's strategies for responding to these challenges based on the efforts of the Maine Climate Council. This section will then address the likely vulnerability to climate hazards in the areas served by Versant, followed by a discussion of the Company's approach to resilience planning in this report. The new planning approach enables the Commission and other stakeholders to follow the line of sight from "hazards" to climate "vulnerability" to potential resilience strategies to enhance resilience.

Sections 3, 4, and 5 apply the approach to Versant's infrastructure (separately addressing substations, transmission lines, and distribution lines), business operations, and communities.

Finally, Section 6 presents conclusions and recommendations, identifying the types of investments, programs, and other strategies that are likely to be appropriate in response to the impacts of climate change on Versant's communities. CCRP resilience solutions will be further assessed as part of IGP to identify specific Versant investments. The recommendations will also identify any potential changes to policy or regulation that Versant believes might contribute to its overall "value for money" objective.

2 CLIMATE VULNERABILITY: MAINE AND VERSANT POWER

2.1 CLIMATE CHANGE AND MAINE

The Maine Climate Council has studied the effects of climate change on the State of Maine with a report prepared under the direction of its Scientific and Technical Subcommittee published in August 2020.[8] This comprehensive study examined the effects of several climate hazards, including extreme weather, rising sea levels, extreme precipitation and flooding, high winds, and warming temperatures. The effects are specific to the topography of Maine, including the extraordinary percentage of the state that is forested (89%) and the prevalence of coastal communities where much of the population resides.

The report noted that there has been an increase in storm frequency and intensity throughout the Northeast, including an increase in the number of events with heavy precipitation in Maine over the past 15 years. This trend is expected to continue, particularly during the winter and spring.[9] Maine has also experienced several major wind storms since 2017, causing widespread power outages.[10] Recent major windstorms have produced gusts over 90 mph[11], and climate research finds a significant positive trend in the frequency of "bomb cyclones."[12] In October 2017, a bomb cyclone devastated Maine, resulting in more power outages than the infamous Ice Storm of 1998.[13]

The rate of sea level rise along the Maine coastline exceeds historical levels, consistent with the experience around the globe. Over the last century, about half of the sea level rise has occurred since the early 1990s.[14] Historically, power outages due to coastal flooding have been limited. However, rising sea levels and storm surges from coastal storms are likely to make things worse. As witnessed during the recent December 2023 Windstorm, interior and riverine flooding also have the potential to cause severe damage and power outages.

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[8] *Scientific Assessment of Climate Change and Its Effects in Maine*, Scientific and Technical Subcommittee of the Maine Climate Council. August 2020.

[9] Pages 22-24

[10] Page 24.

[11] The township of Trescott, near Eastport and Lubec, recorded a 93-mph wind gust during the December 2023 Windstorm.

[12] *What is a bomb cyclone? Five fast facts about the winter storm*, Megan Loe, News Center Maine, December 21, 2022.

[13] *October 2017 North American storm complex*, Wikipedia, accessed December 10, 2023.

[14] *Scientific Assessment of Climate Change and Its Effects in Maine*, Scientific and Technical Subcommittee of the Maine Climate Council. August 2020. Page 71.

Table 1 summarizes notably severe storms that have struck Maine in the past 30 years. As shown in the table, ice storms and high winds have affected hundreds of thousands of Mainers with outages of up to two weeks.

Table 1. Severe storms in Maine in the past 30 years.

Storm	Storm Type	Maine Customers Affected	Length of Outage
Ice Storm of 1998	Ice	Over 500,000	Two weeks
2013 Ice Storm	Ice	Over 120,000	Several days
Tropical Storm Arthur (2014)	High Winds	Over 19,000	Several days
2017 Bomb Cyclone	High Winds	Over 400,000	One week
2019 Halloween Windstorm	High Winds	Over 130,000	Several days
2020 April Nor'easter	High Winds	Nearly 250,000	Several days
2022 December Nor'easter	High Winds; Heavy Wet Snow	Over 100,000	Several days
2023 December Windstorm	High Winds; Rain; Flooding	Over 400,000	One week

Maine's geography and historical storms indicate that ice and coastal flooding could be the most consequential for Maine communities in the future. Experience shows that these hazards are usually accompanied by high winds, which increases the damage to infrastructure. As shown in Figure 1, risks[15] from ice storms and coastal flooding have typically been concentrated in the eastern part of Maine. "High Risk" is defined as the second quintile, and "Moderate Risk" refers to the third quintile.

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[15] *National Risk Index Technical Documentation*, Federal Emergency Management Agency, March 2023, p. 3-1. The National Risk Index defines risk as "the potential for negative impacts as a result of a natural hazard."

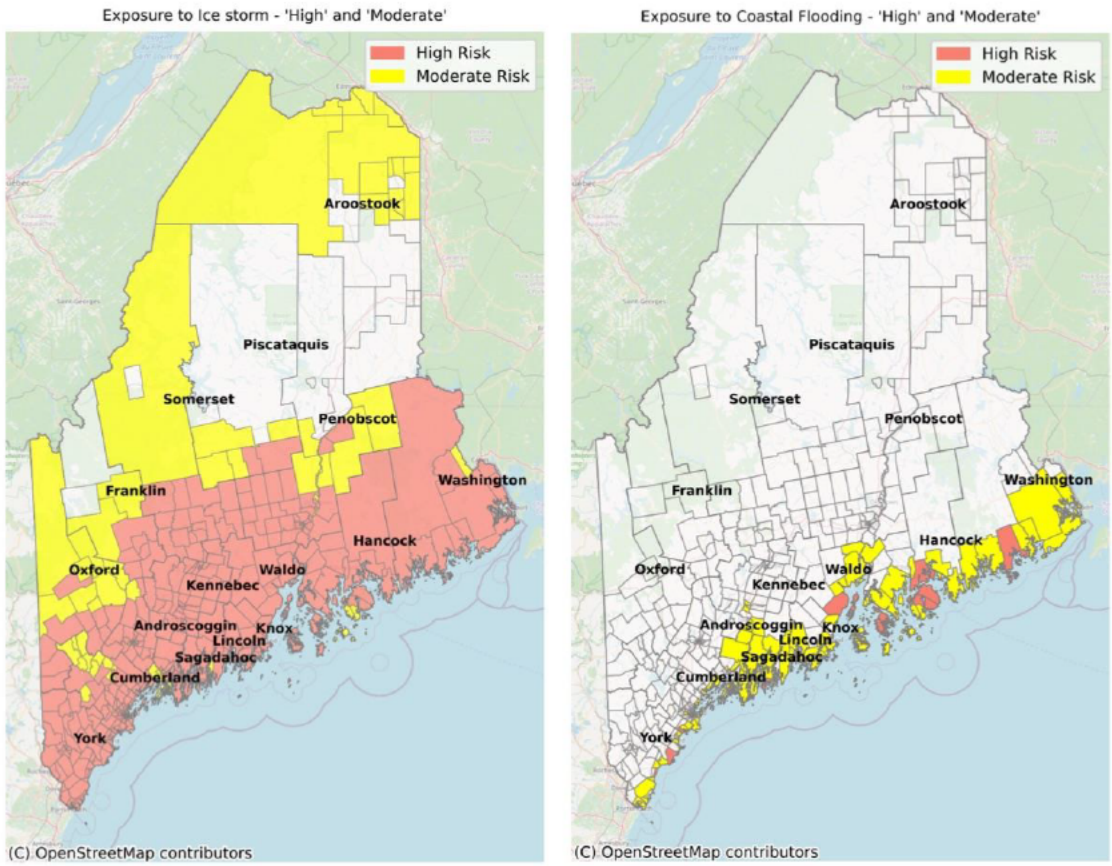

Figure 1. State of Maine – Exposure to Ice Storms and Coastal Flooding.

2.1.1 Maine's Response to Climate Change

Maine Won't Wait represents a four-year plan to address climate change. The initial report was published in December 2020, with the most recent update published earlier this month. *Maine Won't Wait* includes two strategies that align closely with Versant's CCRP.

- "Strategy F" - Build Healthy and Resilient Communities, calls for the State to support communities to be proactive in "understanding, planning, and acting" to reduce their risk to climate change.
- "Strategy "G" – Invest in Climate-Ready Infrastructure, acknowledges the role of energy infrastructure, including the electricity infrastructure that produces and delivers electricity to homes and businesses.

Strategy F reflects the fact that most Maine communities are small. *Maine Won't Wait* notes that "[o]nly 11% of communities in Maine have a town planner on staff, while 72% have no local planner and insufficient or no regional planning support".[16]Strategy G highlights the

[16] *Maine Won't Wait*, December 2020, p. 85.

importance of “vulnerability assessments” to inform adaptation strategies and investment plans. These elements are incorporated into Versant’s approach to its resilience plan. Moreover, as reflected throughout this report, Versant’s resilience plan includes three pillars: infrastructure, operations, and communities.

2.2 CLIMATE CHANGE AND VERSANT POWER

2.2.1 Overview

Versant Power serves over 165,000 customer accounts in northern and eastern Maine. Our Maine Public District (MPD) serves communities in Aroostook County and is electrically connected to the New Brunswick transmission system. Our Bangor Hydro District (BHD) supports communities in Hancock County, Piscataquis County, Washington County, most of Penobscot County, and a small portion of Waldo County. BHD includes over 1,000 miles of coastline and several island communities. Both service areas cover large geographic areas and numerous small communities. In developing this plan, Versant paid close attention to how climate hazards would affect our communities and how our operations over a sparse service territory may need to change. This is in addition to how climate hazards affect our T&D system.

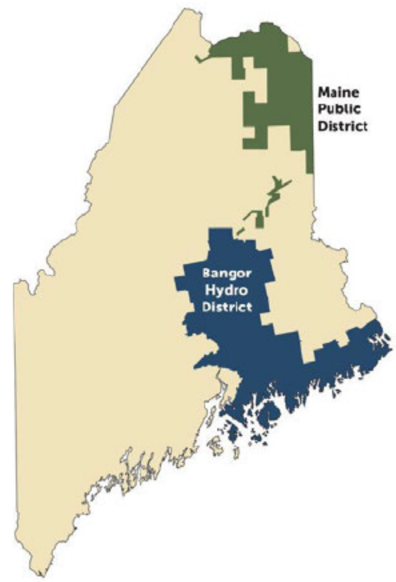

Figure 2. Versant service territories, Bangor Hydro District and Maine Public District.

Both service territories will be vulnerable to climate hazards and severe storms in the coming years. The Bangor Hydro District will see increasing threats from rising sea levels and coastal storm surges. The Maine Public District will continue to see extreme cold affecting our communities and service crews during winter. Higher temperatures, drought conditions, and potential wildfires are also of increasing concern for our communities throughout Maine.

2.2.2 Resilience Planning Approach

Versant’s approach to resilience planning is designed to evaluate climate impacts and apply resilience measures to reduce vulnerabilities. Our approach helps define our objectives, identify improvement opportunities, and pursue solutions to offer our stakeholders the best value.

Versant's climate resilience planning process will identify a prioritized collection of strategies that address the most significant threats to energy resilience in its communities. These strategies will improve our ability to reduce the vulnerability of our infrastructure and business operations and support our communities in responding to climate hazards.

Ideally, the plan will be:

- EFFICIENT: Designed to enhance resilience cost-effectively.
- TRANSPARENT: Provides a clear line of sight to the Commission and all stakeholders from climate "hazards" to specific strategies that Versant can employ to increase resilience.
- ACHIEVABLE: Uses strategies that Versant can realistically design and implement, with stakeholder support and Commission approval.

As previously mentioned, Versant's resilience strategies are organized around three pillars (Infrastructure, Operations, and Communities) to facilitate the assessment, planning, and eventual implementation of the preferred strategies. Versant has applied a simple analysis framework for developing the high-level vulnerability assessment of our T&D infrastructure for this CCRP. The framework is summarized in Figure 3.

Terminology for Infrastructure Vulnerability Assessment

Hazard: The potential occurrence of climate-related physical events or trends that may cause damage and loss.

Vulnerability: The propensity or predisposition to be adversely affected by a Hazard.

Exposure: Indicates the presence of assets, services, resources, and infrastructure that could be adversely affected by a hazard.

Consequence: Resulting diminishment of the assets, services, resources, and infrastructure to serve customers.

Strategy: A particular category of solutions designed to reduce vulnerability.

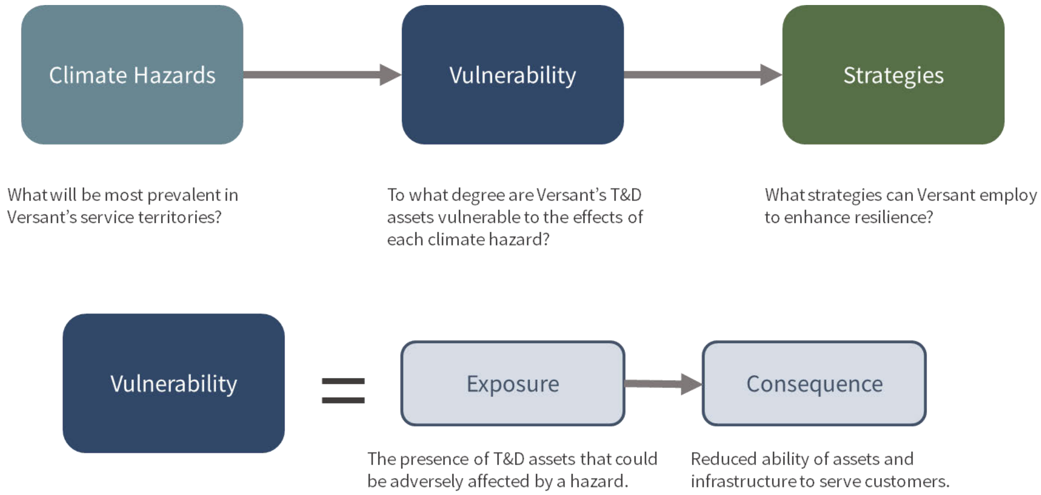

Figure 3. Basic framework for aligning infrastructure resilience strategies with climate hazards.

2.2.3 Climate Hazards

Versant's identification of the critical hazards that will impact its communities leverages the work done by the Maine Climate Council.[17] Versant relied on this work to identify six critical climate hazards described in Table 2. Hazards often occur simultaneously during major weather events, increasing the complexity of our preparation, response, and recovery. For example, hurricanes can bring high winds, heavy precipitation, and a coastal storm surge, compounding the impact on communities and infrastructure.

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17 *Scientific Assessment of Climate Change and Its Effects in Maine*, Scientific and Technical Subcommittee of the Maine Climate Council. August 2020.

Table 2. Critical climate hazards and descriptions.

Critical Hazard	Description
Ice Storms and Winter Weather	Higher ice load on infrastructure and vegetation due to ice storms poses a substantial risk to Versant's infrastructure. Winter weather and cold waves place greater strain on Versant's operations and communities.
High Winds and Gusts	Higher than normal wind speeds and gusts caused by thunderstorms, hurricanes, and other extreme weather events can place high loads on overhead infrastructure. When combined with vegetation, high winds and gusts can cause falling branches and toppled trees, resulting in devastation to the system and requiring massive restoration efforts and critical community support.
Sea Level Rise and Coastal Storm Surges	Increases of 1.5 to 3.0 feet in sea level will lead to inundation in low-lying areas closest to the Maine coast. Storm surges of eight feet or more driven by more frequent and intense hurricanes could flood significant portions of coastal communities, damaging infrastructure and cutting off access to Versant service crews and emergency responders.
Drought and Wildfire	Higher summer temperatures and less rainfall cause forests to dry out, increasing the risk of fires started by lightning and human activity. The 2023 Canadian wildfires provide a glimpse of the conditions that Maine could face as the most forested state in the US. Fires present new challenges for infrastructure hardening and new strategies to protect Versant's workforce and communities.
Higher Temperatures	Higher average ambient temperature and higher daily maximum temperature may decrease the effective capacity and the useful life of infrastructure, such as power transformers and overhead lines. Higher temperatures also increase customers' electrical load for cooling and may reduce Versant's workforce's productivity.
Heavy Precipitation and Inland Flooding	Heavy rain and melting snow can cause flash flooding, damaging infrastructure in low-lying areas. Flooding can cause severe damage to roads and access for Versant's service crews and emergency responders. Vulnerable communities may require extensive support during extended restoration efforts.

3 INFRASTRUCTURE

3.1 VISION

Versant's vision for our Infrastructure pillar is as follows:

Versant Power's electricity system is built to be durable against climate change, flexible for reconfiguration and integration of energy resources, and sustainable for economical, carbon-free energy delivery.

Versant Power's electricity system is built to be robust and durable against climate impacts, able to serve changing requirements from electrification and distributed energy resources reliably. It ensures an economical source of clean energy for Maine's communities and citizens. Versant's system is designed to exhibit three attributes:

- DURABILITY: Structures, wires, and equipment are designed and built to standards that withstand the physical impacts of the hazards intensified by climate change. These improvements are often associated with "hardening" programs.
- FLEXIBILITY: T&D systems are designed with topology and automation, enabling reconfiguration and more easily integrating distributed energy resources that can provide electricity following power outages.
- SUSTAINABILITY: The system can deliver electricity economically and sustainably to provide carbon-free energy to our communities and customers.

3.2 VULNERABILITY

3.2.1 System-wide Exposure

The initial step in determining the vulnerability of Versant Power's infrastructure is identifying T&D infrastructure and assets most exposed to climate hazards. We examined vulnerability in three main categories: transmission lines, distribution lines, and substations.

Transmission Lines

Transmission lines are used to deliver large amounts of electricity between substations. Versant's transmission system includes lines operated at 34.5 kV, 69 kV, and 115 kV. Transmission lines in our system are overwhelmingly overhead construction, with bare wire suspended from wood poles and structures. Much of Versant's transmission system is on rights-of-way, away from roads, buildings, and other facilities. These rights-of-way are maintained to keep trees and ground vegetation away from the overhead lines. Some transmission lines run alongside roads. A small portion of our transmission system includes underground lines. The transmission system includes switches, circuit breakers, and sectionalizers that can disconnect and reconnect transmission lines for system operations.

Distribution Lines

Distribution lines deliver smaller amounts of electricity between substations and the communities and customers we serve. Versant's distribution system includes lines operated between 4 kV and 13.2 kV. Distribution lines are primarily overhead construction, with conductors suspended from wood poles. Most conductors are bare wire, but Versant has been installing covered conductors ("tree wire") in locations with heavy tree cover. The distribution system includes switching devices, voltage regulation equipment, and distribution transformers that step down the voltage to serve homes and businesses.

Substations

Substations are the main connection points between generators, transmission lines, and distribution lines. Most substations include large transformers that transform system voltages from high (transmission lines) to low (distribution lines) and connect large generators to the transmission system. Some substations are used only for connecting and switching transmission lines. Substations also include numerous devices for switching, protection and control, and voltage regulation.

Table 3 summarizes infrastructure quantities by county.

Table 3. T&D infrastructure quantity summary by county.[18]

Assets	Aroostook	Hancock	Penobscot	Piscataquis	Washington	Total
Transmission line miles	370	274	387	20	242	1,293
Transmission structures	7,455	5,883	8,241	412	6,242	28,233
Distribution line miles	1,803	1,615	1,785	268	864	6,335
Distribution poles	58,957	46,260	54,514	7,445	22,570	189,746
Substations	48	23	50	2	12	135

3.2.2 Hazard-specific Exposure and Consequences

We considered the FEMA Risk Indices and Versant Power's past experiences to evaluate the consequence of climate hazards on infrastructure. For example, while many line miles of

[18] Infrastructure quantities for Waldo County are not included.

conductor might be exposed to high winds, switching devices might be less exposed since they are far fewer in number. Versant has diligently planned its system to account for some hazards, such as flooding, by locating infrastructure above flood plains. This tends to reduce the exposure of some infrastructure compared to what the FEMA Risk Indices suggest.

As shown in Table 2 in Section 2.2.3, Versant's infrastructure is most vulnerable to six types of climate hazards:

- Ice Storms and Winter Weather
- High Winds and Gusts
- Sea Level Rise and Coastal Storm Surges
- Drought and Wildfire
- Higher Temperatures
- Heavy Precipitation and Inland Flooding

The following sections examine which areas have the highest exposure and risk to each hazard. We have developed a high-level estimate of the amount of infrastructure that could be exposed to each hazard. The results are presented in summary tables, and additional details are included in the appendix.

FEMA's National Risk Indices

FEMA employs a comprehensive risk-assessment approach, incorporating three key components: a natural hazards component (Expected Annual Loss), a consequence-enhancing component (Social Vulnerability), and a consequence-reduction component (Community Resilience) to develop their risk indices. The community risk factor, derived from Social Vulnerability and Community Resilience, is used to scale the Expected Annual loss values.[19]

Ice Storms and Winter Weather

Maine has a history of heavy snow and freezing rain that has devastated vast areas of the state. The FEMA Risk Index for ice storm exposure indicates that regions of Versant's Bangor Hydro District are at "High" and "Very High" risk of ice storms (Figure 4). With increasing precipitation, this exposure is likely to get worse.

[19] "Higher social vulnerability for a community result in a higher risk index while higher community resilience for a community result in a lower risk index value" https://hazards.fema.gov/determining-risk

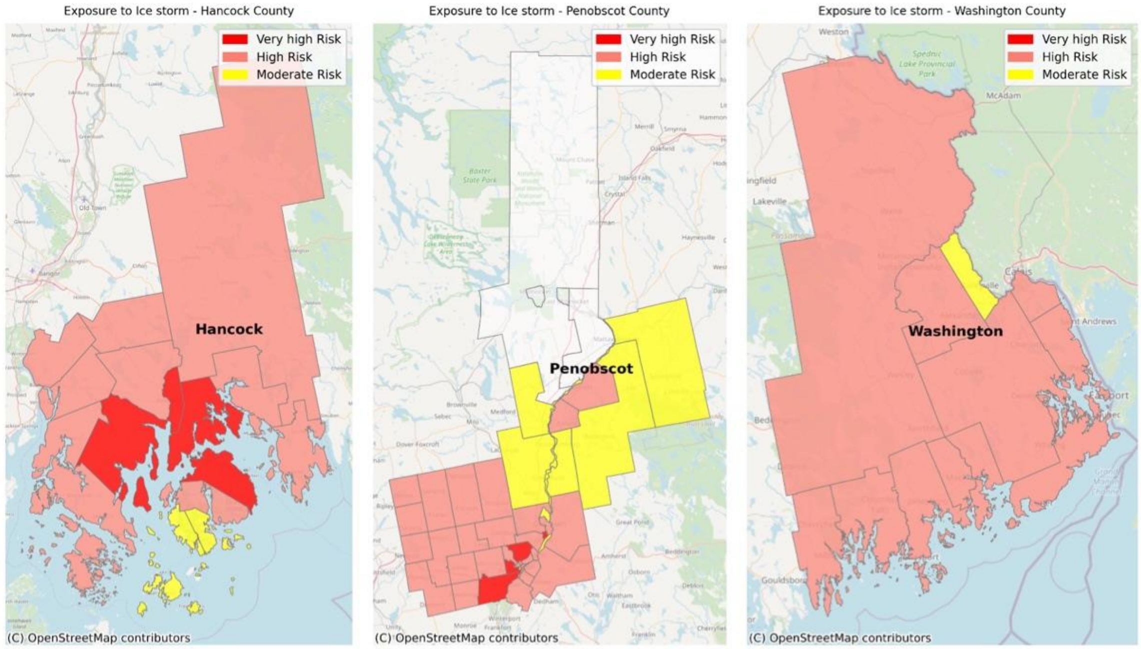

Figure 4. Exposure to ice storm risks in Hancock, Penobscot, and Washington Counties.

Ice accumulation from freezing rain can cover T&D lines and structures in thick ice, increasing weight beyond design specifications. Ice and snow can also build up on tree branches, causing them to bend or fall onto distribution lines throughout our service territory.

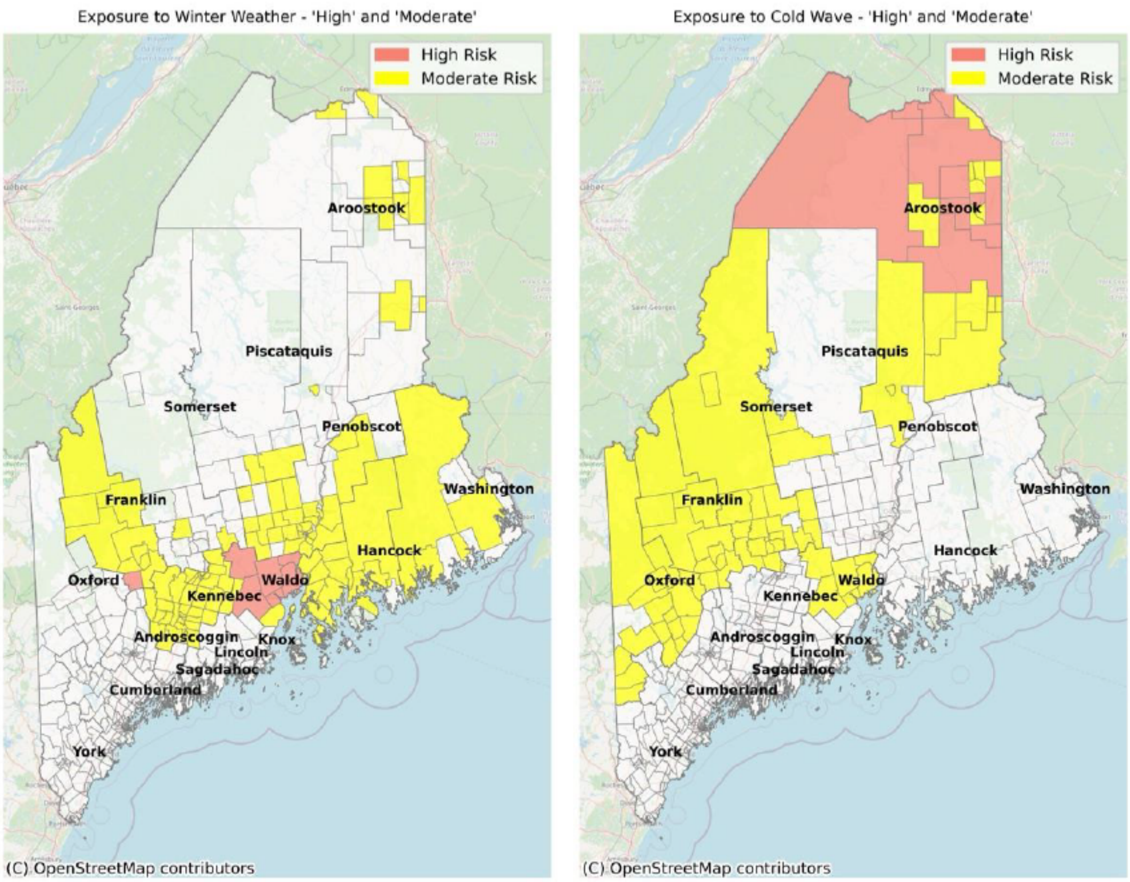

Figure 5. Winter Weather and Cold Wave exposure in Maine.

Table 4 summarizes the exposure and vulnerability of Versant's T&D infrastructure to FEMA's Ice Storm, Winter Weather, and Cold Wave risks.[20] The combination of these three climate hazards (Figures 4 and 5) is the most significant for our overhead T&D lines. Over 95% of our infrastructure is exposed to these hazards, resulting in a "Higher" vulnerability rating.

Table 4. Ice storm, winter weather, and cold wave exposure and vulnerability.

Category	Asset	Exposure to Climate Hazard		Vulnerability
		Count	% of System	
Transmission	Line Miles	1,243	96%	Higher
	Structures	26,989	96%	Higher
Distribution	Line Miles	6,208	98%	Higher
	Poles	186,588	98%	Higher
Substations	Substations	129	96%	Lower

[20] Versant has applied three winter-related risks tracked by the FEMA Risk Indices. These are Ice Storm, Winter Weather, and Cold Wave.

High Winds and Gusts

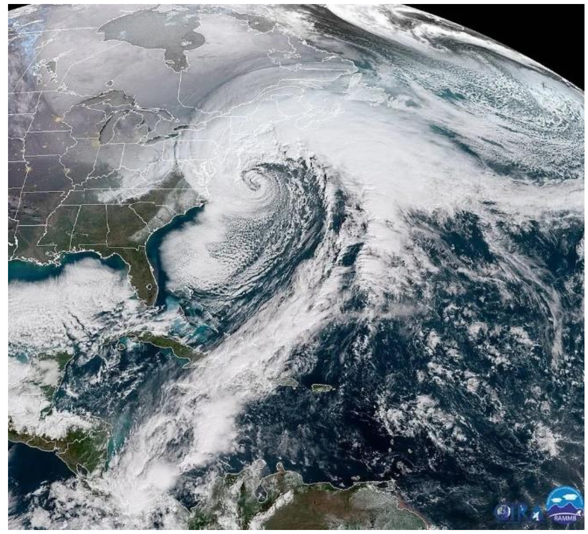

Figure 6. 2017 Bomb Cyclone. Credits: NOAA/CIRA

High winds and gusts can place extraordinary physical loads on overhead infrastructure. When combined with heavy tree cover, winds from severe storms can produce extensive damage, as evidenced by the wind and rain storm on December 18, 2023. More frequent and intense storms from climate change could threaten large areas of Versant's service territory. Climate models make various predictions about the frequency of hurricanes and tropical storms that may reach the northeastern United States. However, research[21] indicates that storms that reach Maine may form more quickly and intensify due to increasing air temperatures and ocean warming. Another notable example was the bomb cyclone that hit Maine in 2017 (Figure 6).

High winds and gusts from severe storms occur throughout our service territory, exposing most of our T&D lines to this hazard. Substations are less exposed to the effects of high winds. The local conditions and unpredictability of storms make it difficult to predict which areas are most exposed and vulnerable based on FEMA's Risk Indices. Versant's engineers have applied a "Higher" exposure rating to T&D lines and a "Lower" exposure rating to substations for this hazard.

Sea Level Rise and Coastal Storm Surges

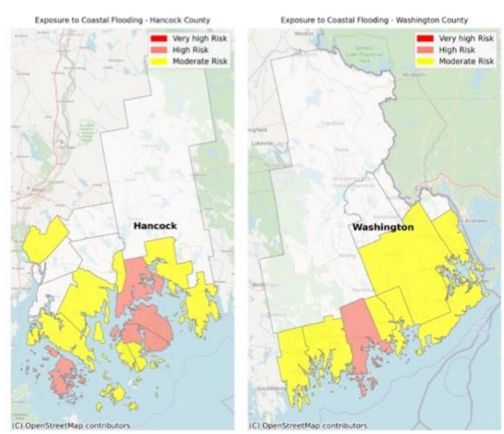

Figure 7.Coastal flooding risk in Hancock and Washington Counties.

The rise in sea level will increasingly affect our coastline over time. Moreover, the storm surges that accompany hurricanes, tropical storms, and bomb cyclones have the potential to inundate our coastal communities in the near term. Fortunately, Versant has worked to avoid placing our T&D lines and substations in low-lying areas along the coast, reducing exposure. However, coastal flooding will

[21] *A Force of Nature: Hurricanes in a Changing Climate*, NASA, June 1, 2022.

affect roads, bridges, and causeways that we use to reach our infrastructure and communities. This hazard could affect our ability to restore service quickly following a major event. Table 5 summarizes the exposure and vulnerability of Versant's T&D infrastructure to sea level rise and coastal storm surges. Twenty to thirty percent of our infrastructure is exposed to this hazard, and the vulnerability is "Medium" or "Lower."

Table 5. Exposure to sea level rise and coastal storm surges and resulting vulnerability.

Category	Asset	Exposure to Climate Hazard		Vulnerability
		Count	% of System	
Transmission	Line Miles	313	24%	Lower
	Structures	8,152	29%	Lower
Distribution	Line Miles	1,931	30%	Lower
	Poles	54,050	28%	Lower
Substations	Substations	27	20%	Lower

Drought and Wildfire

While severe drought and wildfires have not occurred regularly in Versant's service territory, Maine has experienced devastating fires. As the most forested state in the country, Maine could see more fires with increasing drought and temperatures. Some experts indicate that Maine may not see wildfires of the intensity and scale of what our neighbors in the western United States and Canada have experienced in recent years.[22] However, the potential impact of wildfire combined with our heavily forested service territory poses a significant risk.

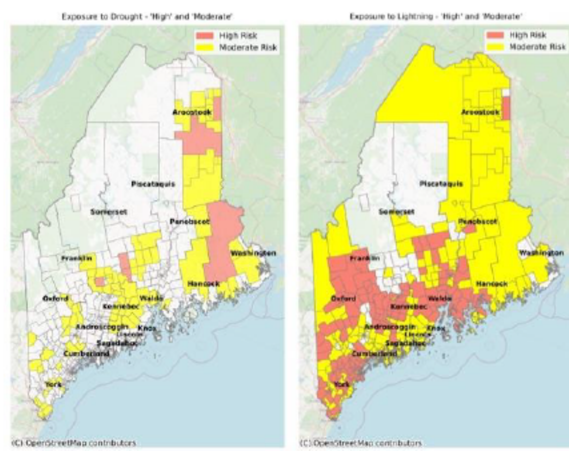

Figure 8.Maine's exposure to drought and lightning.

Versant has evaluated the risk of wildfire by using FEMA's "Drought" and "Lightning" risks (Figure 8). Research indicates that lightning is a leading cause of wildfires and will increase with climate change.[23] Table 6 summarizes the exposure and vulnerability of Versant's T&D infrastructure to drought and lightning. Over 90% of our infrastructure is exposed to these

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[22] *What Does the Future Hold for Maine and Wildfire?* Down East, July 2021.

[23] *Lightning identified as a leading cause of wildfires in boreal forests, threatening carbon storage,* University of East Anglia, November 9, 2023. Source: ScienceDaily.

conditions. However, our experience has been that wildfires in Maine have tended to be smaller than those experienced in the western United States and Canada. Therefore, we have currently rated the vulnerability of our T&D system as "Medium" to "Lower."

Table 6. Exposure to drought and lightning and the resulting wildfire vulnerability.

Category	Asset	Exposure to Climate Hazard		Vulnerability
		Count	% of System	
Transmission	Line Miles	1,212	94%	Medium
	Structures	26,264	93%	Medium
Distribution	Line Miles	5,841	92%	Lower
	Poles	175,294	92%	Lower
Substations	Substations	127	94%	Lower

Higher Temperatures

Maine enjoys cooler summers than many areas of the country. However, climate models project that the state could see temperature increases by 2 to 4°F by 2050 and up to 10°F by 2100.[24] Thermal ratings are primary determinants of T&D line and transformer capacity. Lines that get too hot can sag below their design clearances, and overheated transformers can suffer damage that eventually leads to failure. Higher temperatures will also increase electricity demand for air conditioning and cooling. Increased demand will further stress lines and equipment. Fortunately, we anticipate that these changes will occur, perhaps not gradually, but over time, and Versant will be able to monitor system capacity closely and upgrade infrastructure as needed.

Our entire service territory will be exposed to higher temperatures over time. Infrastructure vulnerabilities range from Lower to Higher depending on asset type. Ambient temperatures can significantly affect capacity ratings for transmission lines and substation transformers. Versant's engineers have applied a "Medium" vulnerability rating to transmission lines and a "Higher" exposure rating to substation transformers for this hazard.

[24] *Scientific Assessment of Climate Change and Its Effects in Maine*, Maine Climate Council, Scientific and Technical Subcommittee, 2020, p. 22.

Heavy Precipitation and Inland Flooding

Heavy rains and snow melt may become more intense with climate change. The associated runoff may increase the risk of flash flooding in low-lying areas near rivers. FEMA indicates a "Moderate" risk of exposure to riverine flooding in a significant area of Versant's service territory. However, as with coastal regions, Versant's engineers have worked to avoid locating our infrastructure in at-risk areas.

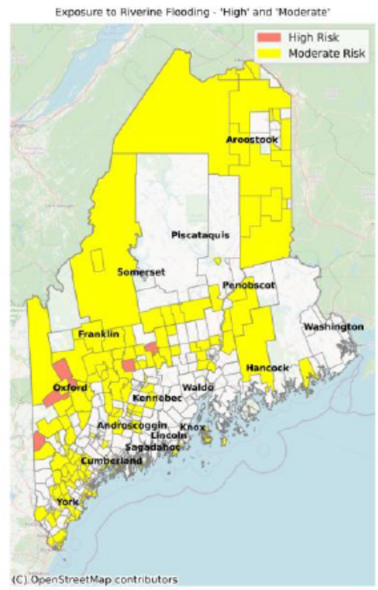

Figure 9. Exposure to riverine flooding in Maine.

Table 7. Exposure and vulnerability to heavy precipitation and inland flooding.

Category	Asset	Exposure to Climate Hazard		Vulnerability
		Count	% of System	
Transmission	Line Miles	506	39%	Lower
	Structures	10,301	36%	Lower
Distribution	Line Miles	2304	36%	Lower
	Poles	71,233	38%	Lower
Substations	Substations	48	36%	Lower

3.2.3 Infrastructure Vulnerability Summary

Table 9 summarizes the infrastructure vulnerability assessment. Ratings for each infrastructure category are summarized for the assets within the category. Ratings for individual assets are provided in the appendix.

Table 8. Summary of infrastructure category exposure and vulnerability by hazard.

Hazard	Exposure to a Hazard			Impact of Exposure			Vulnerability of Infrastructure		
	T-Lines	D-Lines	Subs	T-Lines	D-Lines	Subs	T-Lines	D-Lines	Subs
Ice Storms and Winter Weather	Higher	Higher	Lower	Higher	Higher	Lower	Higher	Higher	Lower
High Winds and Gusts	Higher	Higher	Lower	Medium	Higher	Lower	Medium	Higher	Lower
Sea Level Rise and Coastal Storm Surges	Lower	Lower	Lower	Medium	Medium	Higher	Lower	Lower	Lower
Drought and Wildfire	Medium	Medium	Lower	Higher	Medium	Medium	Medium	Lower	Lower
Higher Temperatures	Lower	Medium	Medium	Medium	Lower	Higher	Medium	Lower	Higher
Heavy Preciptation and Inland Flooding	Lower	Lower	Lower	Medium	Medium	Higher	Lower	Lower	Lower

Exposure ratings indicate how much infrastructure is subject to the potential effects of a climate hazard.
Higher: Large numbers or miles of assets will be directly exposed to the climate hazard, which will likely increase with time.
Medium: Moderate numbers or miles of assets will be exposed to the climate hazard, and the exposure may increase with time.
Lower: Few assets will be exposed to the climate hazard, and the exposure is unlikely to increase significantly over time.

Impact ratings indicate how infrastructure sensitivity to climate hazards and the result of degradation or failure.
Higher: Infrastructure is highly sensitive to a hazard, and degradation or failure would affect many customers.
Medium: Infrastructure is sensitive to hazards, and failure would affect a significant number of customers.
Lower: Infrastructure can generally withstand a hazard, or failure would affect a relatively small number of customers.

Vulnerability ratings indicate the likelihood that a climate hazard will cause a negative impact on a significant portion of infrastructure.
Higher: Exposure to the hazard is highly likely to cause damage or failure to exposed infrastructure.
Medium: Exposure to the hazard is likely to impact the performance of a significant portion of the exposed infrastructure.
Lower: Exposure to this hazard is not likely to impact the performance of a significant portion of the exposed infrastructure.

3.3 STRATEGIES

Versant's planners and engineers have identified nine potential strategies that could reduce the climate vulnerability of T&D infrastructure. Versant started by considering three main approaches for reducing vulnerability:

1) Reduce exposure by moving or shielding T&D lines and equipment from hazards. Example: relocate a line or substation to higher ground to avoid coastal or inland flooding. (Durability)

2) Reduce sensitivity by strengthening or hardening infrastructure. Example: Strengthen T&D structures to support higher loads or resist fire damage. (Durability)

3) Reduce the impact of damage or failure. Example: Provide an alternate power source by automatically reconfiguring a distribution line or providing a mobile backup generator. (Flexibility)

Versant identified ten potential strategies for improving infrastructure resilience through greater durability and flexibility.

- I.1. Complete a detailed Vulnerability Assessment of T&D infrastructure.
- I.2. Explore new distribution system topology options with distribution automation.
- I.3. Explore new structure designs and materials to resist ignition and fire damage.
- I.4. Install stronger distribution poles to support more weight and resist breaking.
- I.5. Install more T&D system monitoring.
- I.6. Strategically underground T&D lines in high-risk areas.
- I.7. Redesign conductor configurations to reduce ice accumulation and wind load.
- I.8. Increase line and equipment ratings to withstand higher ambient temperatures.
- I.9. Reinforce transmission structures to increase physical load ratings and flood resistance.
- I.10. Apply protection and control (P&C) technologies to reduce T&D ignitions.

Versant has provided a brief description for each strategy and identified the primary climate hazards the strategy addresses. As summarized in the table below, we have also indicated a project category and timeframe for each strategy. The strategies are organized first by timeframe, then by project category.

Table 9. Factors for organizing strategies for improving Infrastructure resilience.

Project Categories	Timeframes
Study: Research, analysis, or a report to answer a fundamental question about improving climate resilience. **Process:** Modification of an infrastructure planning, engineering, design, or operational process to reduce infrastructure vulnerability to climate hazards. **Infrastructure Investment:** Installation, upgrade, or modification of equipment, infrastructure, or technology.	**Early Action:** a project could begin within the next 18 months. **Near-term:** a project could begin within the next two to five years. **Longer-term:** a project could begin within the next six to ten years.

Strategy I.1	Complete a detailed Vulnerability Assessment of T&D infrastructure.
Description	This first CCRP identifies high-level vulnerabilities to our infrastructure. A detailed Vulnerability Assessment will determine the infrastructure vulnerability for each area, transmission line, substation, and distribution feeder. This will help Versant identify and prioritize the most critical projects for addressing each climate hazard and reducing vulnerability.
Primary Climate Hazards	All priority climate hazards
Project Category	Study
Timeframe	Early Action (0-18 months)

Strategy I.2	Explore new distribution system topology options with distribution automation.
Description	Circuit breakers and sectionalizers are electrical devices that allow utilities to connect and disconnect portions of a distribution circuit to an upstream power source. Versant can install these devices to help isolate faulted line sections to reduce the number of customers that lose power when a fault occurs. Where possible, communication systems are also employed to enable automated switching that makes it possible to quickly transfer some homes and businesses to an alternate power source using Automatic Load Transfer ("ALT") schemes that could reduce interruption times.
Primary Climate Hazards	Ice Storms and Winter Weather; High Winds and Gusts
Project Category	Study
Timeframe	Early Action (0-18 months)

Strategy I.3	Explore new line designs and materials to resist ignition and fire damage.
Description	Traditional line designs can be improved to reduce the risk of ignition and damage from fire. Covered conductor and undergrounding are hardening techniques that can reduce the risk of fire from energized lines. Modifications to pole and structure designs using new configurations or materials such as steel, concrete, or composites can resist damage from fire. Versant can study the lessons learned from utilities in other fire-prone regions and develop plans to improve infrastructure designs.
Primary Climate Hazards	Drought and Wildfire
Project Category	Study
Timeframe	Early Action (0-18 months)

Strategy I.4	Install stronger distribution poles to support more weight and resist breaking.
Description	Stronger poles resist breaking under the heavy loads from ice and high winds. They can also withstand contact from larger branches and small trees. Versant will review its distribution design standards and determine if increasing the strength rating would improve resilience. Following that, new poles and replacement poles would use the new specification.
Primary Climate Hazards	Ice Storms and Winter Weather; High Winds and Gusts
Project Category	Infrastructure investment
Timeframe	Near-term (2-5 years)

Strategy I.5	Install more T&D system monitoring.
Description	Versant's service territory is extensive and sparsely populated, making locating faults and damage on the T&D systems difficult, especially during major storms that affect large areas. Monitoring technologies such as Supervisory Control and Data Acquisition ("SCADA"), line sensors, and faulted circuit indicators can alert grid operators and repair crews when trouble occurs and help locate the source of the problem more quickly. This will increase our ability to respond more rapidly and efficiently.
Primary Climate Hazards	Ice Storms and Winter Weather; High Winds and Gusts
Project Category	Infrastructure investment
Timeframe	Near-term (2-5 years)

Strategy I.6	Strategically underground T&D lines in high-risk areas.
Description	Undergrounding electric distribution lines can help reduce the exposure of overhead infrastructure to damage from high winds and ice, particularly in areas where tree contact is a problem. Undergrounding could also be an attractive solution for increasing the resilience of feeders that serve critical community infrastructure. The downsides of this strategy include significantly higher initial cost, less adaptability to system changes, and longer repair time. Underground infrastructure can also be more susceptible to damage from flooding. While it is unlikely that Versant would implement it widely, undergrounding could be a best-value solution in some areas.
Primary Climate Hazards	Ice Storms and Winter Weather; High Winds and Gusts; Wildfire
Category	Infrastructure investment
Timeframe	Longer-term (6-10 years)

Strategy I.7	Redesign conductor configurations to reduce ice accumulation and wind load.
Description	As ice accumulates on overhead wires, the weight of the ice and the higher aerodynamic drag from the thicker conductors can exceed the design specifications of attachment hardware and support structures. Wind load on wires can cause "galloping," which can further increase stress, and ice and snow shedding can cause similar forces. Technologies that resist ice formation or reduce wind drag can prevent damage or failure of T&D lines. Modifying overhead line design and specifications could make new or replacement infrastructure less vulnerable to ice and wind loads.
Primary Climate Hazards	Ice Storms and Winter Weather; High Winds and Gusts
Project Category	Process change
Timeframe	Near-term (2-5 years)

Strategy I.8	Increase line and equipment ratings to withstand higher ambient temperatures.
Description	Thermal limits typically determine the ratings of T&D lines and equipment. These limits are set to prevent overheating that can cause excessive line sagging or equipment damage. Higher ambient temperatures will tend to increase the temperature of conductors and the internal components of equipment, effectively reducing their power ratings. Higher electrical demand from air conditioners will put greater strain on this equipment. Increasing the effective thermal ratings of lines and equipment will be critical to maintaining reliability and infrastructure life. Dynamic line ratings (DLR), auxiliary cooling, and equipment health sensors can ensure that Versant can deliver the most value from its infrastructure while ensuring reliability, resilience, and flexibility for our communities and customers.
Primary Climate Hazards	Higher Temperatures
Project Category	Process change
Timeframe	Near-term (2-5 years)

Strategy I.9	Reinforce transmission structures to increase physical load ratings and flood resistance.
Description	Hazards that increase physical loads or weaken structures can cause damage and failure, resulting in critical transmission outages that affect entire areas of our service territory. Reinforcements to strengthen structures to support higher loading and reduce damage from flooding will increase transmission resilience to multiple climate hazards.
Primary Climate Hazards	Ice Storms and Winter Weather; High Winds and Gusts; Coastal Flooding and Storm Surges; High Precipitation and Inland Flooding;
Project Category	Infrastructure investment
Timeframe	Longer-term (6-10 years)

Strategy I.10	Apply protection and control (P&C) technologies to reduce T&D ignitions.
Description	Drought will cause grass and other vegetation to dry out and die, making it much easier for fire to start and spread. Some fire ignitions can be caused by sparks from tree contact with energized conductors, a downed power line, or animal contact. Advanced sensors, protective relaying, and control devices can more quickly detect contacts and faults that could start a vegetation fire. Utilities in Victoria, Australia, have been evaluating a Rapid Earth Fault Current Limiter (REFCL) designed to turn off power much faster than traditional distribution system protection schemes. The California Public Utilities Commission and the state's investor-owned utilities have been developing Wildfire Mitigation Plans that incorporate REFCL, Enhanced Fault Detection (EFD), and faster settings on existing protective relaying to prevent ignition of dry vegetation. Versant would study the applications of these and other advanced technologies and identify transmission lines and distribution circuits where ignition risk could be reduced. The Company would identify pilot circuits for testing.
Primary Climate Hazards	Drought and Wildfire
Project Category	Study; Infrastructure investment
Timeframe	Near-term (2-5 years)

4 OPERATIONS

4.1 VISION

Versant's vision as it relates to the Operations pillar is as follows:

We navigate risk through strategic foresight and comprehensive planning, while leveraging innovative technologies to enhance operational agility. Our emphasis is on robust business relationships.

PLANNING: Tackle risk through strategic foresight and comprehensive planning.

TECHNOLOGY AND INNOVATION: Implement innovative technologies to enhance clarity, decision-making, and agility in responding to operational needs.

PEOPLE AND RELATIONSHIPS: Cultivate strong business partnerships to ensure a steady supply of equipment, materials, and services for everyday operations and emergencies.

4.2 VULNERABILITY

Climate change hazards will require significant changes in several areas including, but not limited to:

- Load forecasting and system planning – higher temperatures will change summer load patterns and drive higher air conditioning adoption throughout our service territory. Future grid conditions will cause changes in planning criteria and solutions.
- Asset management and maintenance – exposure to climate hazards will change the physical conditions to which our infrastructure is exposed and potentially accelerate equipment degradation.
- Vegetation management – warmer temperatures and changes in rainfall may affect vegetation growth and the health of trees. Our current practices for managing vegetation will have to adapt to ensure day-to-day reliability and higher resilience.
- Emergency response – more frequent storms will place additional strain on our service crews, customer care representatives, and mutual aid resources. We may also face greater competition and higher costs for spare equipment, poles, and materials.

4.3 STRATEGIES

Versant's business area leaders have identified sixteen potential strategies that could improve the resilience of our business operations while preparing for, responding to, and recovering from critical climate hazards.

- O.1. Complete a detailed Vulnerability Assessment of Operations.
- O.2. Incorporate climate hazard scenarios into system planning, engineering, and asset management.
- O.3. Review the System Emergency Operations Plan to incorporate emerging climate hazards.
- O.4. Revise our System Operations Planning procedures to include climate hazards.
- O.5. Monitor staffing and mutual aid resources to ensure they keep pace with climate hazards.
- O.6. Investigate telecommunications infrastructure and operations.
- O.7. Develop plans for fire breaks.
- O.8. Conduct a study to identify operational approaches and advanced technologies to reduce ignitions.
- O.9. Complete a Contingency Study of the transmission system to evaluate wildfire impacts on grid reliability.
- O.10. Review river draw-down policies and plans to account for riverine flooding.
- O.11. Conduct a detailed floodplain analysis for Versant's infrastructure.
- O.12 Conduct a study to review the potential effects of drought and heavy rainfall on risk trees.
- O.13. Conduct a study to evaluate Public Safety Power Shutoffs (PSPS) to prevent wildfires.
- O.14. Implement technologies to map vegetation clearances more frequently and inexpensively.
- O.15. Implement data analytics to provide insights into environmental and system conditions and to help prioritize system improvements.
- O.16. Apply advanced technologies that support faster response and restoration.

Versant has provided a brief description for each strategy and identified the primary climate hazards the strategy addresses. As summarized in the table below, we have also indicated a project category and timeframe for each strategy. The strategies are organized first by timeframe, then by project category.

Table 10. Factors for organizing potential strategies for improving Operations resilience.

Project Categories	Timeframes
Study: Research, analysis, or a report to answer a fundamental question about improving climate resilience. **People:** Changes to our organization and resource levels. **Process:** New or modified processes. **Technology:** Installation, upgrade, or modification of technologies or infrastructure.	**Early Action:** a project could begin within the next 18 months. **Near-term:** a project could begin within the next two to five years. **Longer-term:** a project could begin within the next six to ten years.

Strategy O.1	Complete a detailed Vulnerability Assessment of Operations.
Description	This first CCRP identifies high-level vulnerabilities to our operations. A detailed Vulnerability Assessment will determine the vulnerability for various business areas and our coordination with communities and partners. This will help Versant identify and prioritize the most critical projects for addressing each climate hazard and reducing vulnerability.
Primary Climate Hazards	All climate hazards
Project Category	Study
Timeframe	Early Action (0-18 months)

Strategy O.2	Incorporate climate hazard scenarios into system planning, engineering, and asset management.
Description	Incorporate climate hazards into scenarios for long-term system planning, leveraging regional and State-planning forecasts. Revise engineering and design standards for transmission, distribution, and substation infrastructure. Evaluate revisions to asset management algorithms and programs to ensure we target the highest value for our asset health and maintenance investments.
Primary Climate Hazards	All climate hazards
Project Category	Process
Timeframe	Early Action (0-18 months)

Strategy O.3	Review the System Emergency Operations Plan to incorporate emerging climate hazards.
Description	Versant maintains the SEOP to ensure a robust and well-coordinated response to system emergencies. Enhance the SEOP to identify leaders and EMAs in each community we serve. Work with our communities to identify touch points for communication and support during emergencies.
Primary Climate Hazards	All climate hazards
Project Category	Process
Timeframe	Early Action (0-18 months)

Strategy O.4	Revise our System Operations Planning procedures to include climate hazards.
Description	Grid operators manage near-term planning and preparation for system emergencies. Incorporating climate hazards and their potential impacts on the system will be essential for maintaining reliability in the future.
Primary Climate Hazards	All climate hazards
Project Category	Process
Timeframe	Early Action (0-18 months)

Strategy O.5	Monitor staffing and mutual aid resources to ensure they keep pace with climate hazards.
Description	Major events often require large mobilizations of repair crews, support staff, equipment, and materials. More frequent and intense storms in Maine and neighboring states will strain resources. Investigate strategies for securing resources and strengthening relationships with partners and suppliers.
Primary Climate Hazards	All climate hazards
Project Category	People
Timeframe	Early Action (0-18 months)

Strategy O.6	Investigate telecommunications infrastructure and operations.
Description	Sustained communications and robust telecommunications infrastructure are essential to a successful resilience plan. Review technologies, applications, and contingencies. One example is the co-location of electrical and telecommunications infrastructure on the same overhead structures. This increases the risk of losing critical communications when electrical infrastructure is damaged. Assess colocation and opportunities for separation.
Primary Climate Hazards	All climate hazards
Project Category	Study
Timeframe	Early Action (0-18 months)

Strategy O.7	Develop plans for fire breaks.
Description	Work with the Maine Forest Service, EMAs, and community leaders to identify the best locations for building fire breaks to protect our communities and facilities.
Primary Climate Hazards	Drought and Wildfire
Project Category	Study
Timeframe	Early Action (0-18 months)

Strategy O.8	Conduct a study to identify operational approaches and advanced technologies to reduce ignitions.
Description	Drought will cause grass and other vegetation to dry out and die, making it much easier for fire to start and spread. Some fire ignitions can be caused by sparks from a downed power line, tree contact with an energized conductor, or animal contact. Identifying approaches to leverage existing and innovative technologies to reduce ignitions will reduce the risk of starting a vegetation fire.
Primary Climate Hazards	Drought and Wildfire
Project Category	Study
Timeframe	Early Action (0-18 months)

Strategy O.9	Complete a Contingency Study of the transmission system to evaluate wildfire impacts on grid reliability.
Description	The transmission planning criteria in New England calls for utilities to study the loss of one transmission element at a time ("N-1"), such as a generator tripping offline or a transmission line fault. Wildfire threatens to affect rights-of-way or transmission structures supporting multiple lines, meaning more than one transmission line could be affected by the same event. We should review our planning criteria to assess the loss of more than one transmission line at one time to account for wildfire risk.
Primary Climate Hazards	Drought and Wildfire
Project Category	Study
Timeframe	Early Action (0-18 months)

Strategy O.10	Review river draw-down policies and plans to account for riverine flooding.
Description	Managing river water levels is essential for the health of Maine's river ecosystems, recreation, and the production of clean hydropower. "Drawdown" levels on some rivers have been raised in recent years, potentially reducing the ability of a river to accommodate runoff from heavy rain and snowmelt.
Primary Climate Hazards	Heavy Precipitation and Inland Flooding
Project Category	Study
Timeframe	Early Action (0-18 months)

Strategy O.11	Conduct a detailed floodplain analysis for Versant's infrastructure.
Description	Maine has used climate research and forecasts to develop models for flooding along our coast and rivers. This information is essential for helping communities plan for sea level rise and riverine flooding. Versant can better evaluate the vulnerability of flooding on our infrastructure by conducting a detailed analysis of floodplains and the location of our lines and substations.
Primary Climate Hazards	Coastal Flooding and Storm Surges; High Precipitation and Inland Flooding
Project Category	Study
Timeframe	Early Action (0-18 months)

Strategy O.12	Conduct a study to review the potential effects of drought and heavy rainfall on risk trees.
Description	"Risk" trees are dead, weakened, or damaged trees that are more likely to break and fall into distribution lines. Climate hazards such as flooding and drought can weaken trees and supporting soils, resulting in more risk trees than we see today. Better understanding the effects of these climate hazards will help Versant plan its vegetation management program.
Primary Climate Hazards	Coastal Flooding and Storm Surges; Drought and Wildfire; Heavy Precipitation and Inland Flooding
Project Category	Study
Timeframe	Early Action (0-18 months)

Strategy O.13	Conduct a study to evaluate Public Safety Power Shutoffs (PSPS) to prevent wildfires.
Description	A Public Safety Power Shutoff (PSPS) is a measure some utilities take to temporarily shut off power in certain areas during periods of high fire danger, such as high winds during drought conditions. Shutting off the power reduces the risk of a downed power line causing a spark and igniting a fire. Versant could evaluate the potential use of PSPS as a mitigation strategy for wildfire hazards.
Primary Climate Hazards	Drought and Wildfire
Project Category	Study
Timeframe	Early Action (0-18 months)

Strategy O.14	Implement technologies to map vegetation clearances more frequently and inexpensively.
Description	Tree contact is a primary cause of power outages for Versant's communities. Maintaining our distribution rights-of-way with vegetation management is essential to maintaining reliability and resilience against hazards that cause tree contact. Higher temperatures and rainfall from climate change may increase tree growth rates. Innovative technologies could help ensure that Versant has better information about vegetation clearance to prioritize vegetation management spending.
Primary Climate Hazards	Ice Storms and Winter Weather; High Winds and Gusts; Drought and Wildfire
Project Category	Technology and Process
Timeframe	Early Action (0-18 months)

Strategy O.15	Implement data analytics to provide insights into environmental and system conditions and to help prioritize system improvements.
Description	Versant prioritizes maintenance and system improvements based on numerous sources of information collected in multiple databases. The new data from climate change hazards will be plentiful, but extracting usable information and insights to guide our maintenance and improvement planning will be challenging. Data analytics and artificial intelligence (AI) offer ways to process large amounts of data and draw inferences to help us prioritize needed work and budgets.
Primary Climate Hazards	All climate hazards
Project Category	Technology and Process
Timeframe	Early Action (0-18 months)

Strategy O.16	Apply advanced technologies that support faster response and restoration.
Description	Investigate applications for drones, mobile command centers, data analytics, and AI for damage assessment, prioritization, and resource deployment. Evaluate ways to provide our communities with better real-time information using technology to support our people.
Primary Climate Hazards	All climate hazards
Project Category	Technology
Timeframe	Early Action (0-18 months)

5 COMMUNITIES

5.1 VISION

Climate hazards strike communities, creating a shared interest among citizens in (1) withstanding events that cause power outages, (2) restoring power when outages occur, and (3) integrating Maine's Climate Council plans for climate hazard mitigation with climate resilience and customer affordability. Extended power outages threaten individual and public safety, particularly if they disrupt the ability of first responders, other public employees, and neighbors to address the urgent safety, health, sustenance, and safety needs of impacted homeowners and businesses.

Resilience, as it relates to Versant's Communities' pillar, is a critical contributor to the "public interest," the overriding standard that regulators apply to utilities subject to their jurisdiction. Versant's Communities' sub-vision reflects this perspective:

> Our employees serve our communities and customers with a deep commitment to the public interest and equity.

5.2 VERSANT PLANNING TO REDUCE COMMUNITY CLIMATE VULNERABILITY

5.2.1 System-Wide Exposure

Maine is home to numerous small rural communities. Versant's resilience plan must reflect these realities. For example, strategies that call for collaboration with individual communities or a group of communities within a region should reflect the resources that communities can bring to the table. Many small communities in Maine do not have a planning function. Therefore, they are unlikely to have plans for addressing climate vulnerabilities and improving resilience.

5.2.2 Hazard-specific Exposure and Consequences

Many of the communities Versant serves are exposed and vulnerable to each climate hazard identified in Section 2.2.3. The impact of these climate conditions on infrastructure is described in Section 3.2.2, which contributes directly to power outages and other consequences that are experienced by entire communities.

Ice Storms and Winter Weather

Ice storms often cause heavy ice to build up on wires. The weight of the ice can exceed design standards, resulting in power outages caused by downed poles, wires, and transformers. These circumstances may hinder first responders and power restoration crews from accessing heavily forested roads or buildings far from the street. Ice storms may also be accompanied by multi-day outages, particularly for communities with low customer density, as these communities are typically assigned a lower restoration priority than larger urban communities.

High Winds and Gusts

High winds and gusts may also result in downed trees and large limbs that fall across wires and result in power outages. These conditions typically affect multiple communities across a region, straining first responders and power restoration crews.

Sea Level Rise and Coastal Storm Surges

Coastal storm surges will often impact many residential and commercial buildings in a coastal community, creating dangerous and life-threatening conditions when storms persist during high tide.

Drought and Wildfire

As recently observed in California and Hawaii, wildfires can cause widespread damage to a community, presenting challenges when emergency evacuation is required.

Higher Temperatures

Warming from climate change will result in more hot summer days and higher average temperatures. Higher temperatures will encourage more customers and communities to install air conditioning, increasing energy costs and adding stress to the grid.

Heavy Precipitation and Flooding

Heavy precipitation and inland flash flooding can wash out roads and bridges, making it challenging to help communities, even if the power stays on. The potential impact on communities was illustrated during the devastating storm that hit Maine in December 2023 and during flooding in Vermont earlier in 2023.[25]

5.2.3 Communities Vulnerability Summary

Vulnerability for communities is relevant concerning the ability to withstand physical damage and power supply interruptions and the efficiency and quality of power restoration activities. Even the smallest communities will have multiple critical infrastructure buildings, including police and fire stations, schools, and other community facilities that serve as temporary

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25 *"Vermont Floods Show Limits of America's Efforts to Adapt to Climate Change," New York Times, July 11, 2023*

shelters for residential customers who cannot safely remain in their homes during an emergency. Small regional hospitals and urgent care facilities may be susceptible to power outages. Tree-lined streets may no longer be passable.

Communication and enabling infrastructure (e.g., cell towers and internet service) are essential during emergencies. Elderly, technology-dependent, and other at-risk customers (and their caregivers) rely on timely and accurate information to make health and safety decisions.

Some, but not all, communities have an emergency response plan ("ERP") that can be employed when there is an extended power outage. Ideally, the design and execution of community ERPs will be coordinated with regional and utility ERPs and reinforced by regular training and practice drills.

5.3 VERSANT SUPPORT FOR MAINE COMMUNITY CLIMATE ACTION

5.3.1 Reduce Greenhouse Gas Emissions

Maine's rural, suburban, and urban communities engage in climate hazard mitigation at different degrees and levels. Versant plans to support these efforts, whether focused on purchasing electric vehicles ("EVs"), planning for electrical vehicle fleet charging, or installing efficient air-source or ground-source heat pumps. For example, Maine's aggressive goals for EVs will necessitate strong support for the installation of home-based chargers. To keep the new EV charging from adding unduly to the system peaks, which drives infrastructure investments and energy supply costs, Versant has implemented an EV off-peak charging discount. This discount will make off-peak electricity more cost-effective for EV charging and other uses, allowing all customers to save money while reducing Maine's transportation greenhouse gas emissions.

5.3.2 Support Beneficial Electrification

Many communities and customers Versant serves are aggressively adopting efficient electric heat pumps. For over a decade, Versant has supported space heating electrification and Maine's beneficial electrification policies. We offer customers a substantial winter heating discount[26] and do not increase electricity rates in the summer for our electric heating customers. This creates a significant affordability benefit for moving to efficient heating and cooling through advanced technologies.

While electricity storage batteries and customer systems to utilize EV batteries are not yet widely adopted in Maine, electricity storage batteries installed at customer premises, at Versant substations, and in EVs have substantial potential to provide enhanced customer and

[26] Thirteen percent of Versant customers have signed up for our optional winter heating rate.

grid resilience in outage situations. Versant plans to continue to explore these options with stakeholders.

5.3.3 Supporting Customer Affordability

Since the long-existing Versant winter heating rate and the new Versant EV charging rate allow customers to save money on their electrical bills and convert to more cost-efficient heating or transportation options, Versant is providing its customers with affordable options. These rates support electrification, increasing electricity usage, allowing Versant to spread its T&D costs and help keep electricity affordable for all customers.

5.3.4 Tracking Maine's Progress

Considering the imperative to support Maine's climate resilience and mitigation plans, Versant submits that no agency or entity fully tracks the emissions reduction, customer affordability, or resilience benefits of these new technologies and supporting utility programs. Versant proposes below that stakeholders work to collect better data on these efforts.

5.4 STRATEGIES

There are a range of strategies that will enhance resilience for the communities served by Versant. A community strategy effectively treats communities as critical customers for reliability and resilience. Identifying and prioritizing the resilience benefits that provide the greatest value to communities is essential. Benefits from this approach:

- Critical community infrastructure doesn't lose power as often.
- Distributed energy resources can provide backup power during restoration and recovery following major events.
- Critical facilities can maintain continuous operation to support community members.

However, assessing each community's circumstances is necessary before refining and adopting any strategy. This foundational effort would include the following:

- Identifying, establishing contact, and meeting with leaders in each community.
- Assessing current planning capabilities and relevant plans for resilience and identifying gaps.
- Gathering information on critical infrastructure.
- Gathering demographic data.
- Learning about prior experiences in recovering from significant outages.
- Developing effective strategies to support Maine communities with climate resilience and climate hazard mitigation consistent with the Maine Climate Council's goals.

As part of this assessment, Versant will consult with community leaders to identify existing functions that are already coordinated among adjacent communities. Developing a single community resilience plan that covers multiple communities may be more efficient and effective, leveraging existing relationships.

Having conducted this foundational work, Versant can engage with the groups of community leaders in each of its service areas to develop a common approach to assess and address resilience needs. Such collaboration could be essential in smaller communities lacking the resources to plan resilience. These strategies would address plans for coordination during and after major outages, with debriefings that identify lessons learned and contribute to improvements in planning and execution. They would manage collaboration with local emergency management agencies ("EMAs").

Versant believes that pilots will help determine and refine the most promising strategies before making them available across Versant's communities. Progress toward enhancing Community resilience could be demonstrated by:

- Providing continuous, reliable power for critical facilities and community centers.
- Supplying backup power when outages happen.
- Tracking the number of people, families, and affected groups.

Table 11. Factors for organizing potential strategies for supporting the resilience of our communities.

Project Categories	Timeframes
Study: Research, analysis, or a report to answer a fundamental question about improving climate resilience. **Process:** New or modified processes. **Collaborative:** Activity involving communities and other stakeholders to explore issues and identify potential actions. **Pilot:** Pilot project or demonstration that may involve investment in infrastructure, technology, or supporting programs.	**Early Action:** a project could begin within the next 18 months. **Near-term:** a project could begin within the next two to five years. **Longer-term:** a project could begin within the next six to ten years.

Strategy C.1	Implement a Climate Planning Stakeholder Communication Plan.
Description	Versant will develop and implement a communication plan to support forthright and transparent relationships and communications with customers, stakeholders, and employees. The plan will provide information and education for stakeholders about climate change hazards and the actions Versant takes to address them. It will facilitate collaboration between Versant and the Communities we serve.
Primary Climate Hazards	All climate hazards
Project Category	Collaborative
Timeframe	Early Action (0-18 months)

Strategy C.2	Develop a community resilience consultation framework and pilots.
Description	This framework and pilots would engage a community, gather information that helps identify and understand community priorities, and explore how to incorporate these into Versant's Resilience Plan. Versant will design and implement pilots in our Bangor Hydro District and Maine Public District.
Primary Climate Hazards	All climate hazards
Project Category	Collaborative; Pilot
Timeframe	Early Action (0-18 months)

Strategy C.3	Perform mock emergency drills.
Description	Collaborate with state EMAs to design and conduct emergency drills that apply to all the communities within a Versant district. Adjust plans and processes based on lessons learned.
Primary Climate Hazards	All climate hazards
Project Category	Process; Collaborative
Timeframe	Near-term (2-5 years)

Strategy C.4	Draft community-specific and joint community resilience plans.
Description	Apply the lessons learned from Strategy C.2 to develop a community-specific resilience plan (for larger communities) or a joint resilience plan for a group of communities.
Primary Climate Hazards	All climate hazards
Project Category	Collaborative
Timeframe	Near-term (2-5 years)

Strategy C.5	Develop a Community Resilience Microgrid Pilot.
Description	The microgrid would be designed to support the needs of a community and critical supporting infrastructure. The microgrid could integrate various clean energy sources, such as solar, wind, or tidal power, alongside energy storage solutions like batteries, serving as a testbed for exploring IGP outcomes.
Primary Climate Hazards	All climate hazards
Project Category	Collaborative; Pilot
Timeframe	Near Term (2-5 years)

Strategy C.6	Develop better tracking metrics for Versant's climate hazard mitigation and resilience efforts.
Description	Currently, the utilities and state agencies are not tracking emissions reductions from efficient electric space heating, EVs, or other advanced technologies. Versant proposes collaborating with stakeholders to explore tracking mechanisms for heat pumps and EVs in its territory and report on an agreed-upon methodology for emissions reductions compared to using fossil fuels for heating and transportation. To continue with appropriate emphasis on customer affordability, Versant also proposes calculating customer savings from beneficial electrification in its service territory from those opting into winter heating and electric transportation rates. Savings would be compared to Versant's standard rates and to what those customers would pay for using fossil fuels for heating and transportation. When electrical battery storage is more widely deployed at customer premises, on the grid, and in EVs, Versant proposes to measure the resilience benefits of customers having access to electricity during outage events.
Primary Climate Hazards	All climate hazards
Project Category	Collaborative; Pilot
Timeframe	Near Term (2-5 years)

6 VERSANT'S ONGOING RESILIENCE PROGRAMS

In 2018, Versant Power implemented a reliability and resilience improvement plan. Since then, we have invested more than $30 million annually in programs that increase power system resilience and improve electric service reliability for our customers; this represents 10-15% of Versant's annual capital expenditures. Our efforts are paying off, and the Commission stated that it "fully expects to see evidence from Versant of reliability performance improvements in the coming months and years."

Versant Power has worked hard to allocate a limited budget to improving resilience around our service territory. Our engineers, planners, and vegetation management specialists look for places where we can apply our resources to make the most significant improvement for the most customers at the lowest cost. Over the past five years, we have identified three program areas that can deliver significant improvements for our customers.

Distribution Hardening: Replacing bare overhead conductor with "tree wire" and replacing older, weaker poles and associated hardware (e.g., crossarms, guy wire, and anchors) with more robust infrastructure to support heavier loads and resist failure.

Distribution Automation: "Automating" distribution switches to enable circuit sectionalizing that limits the scope of a power outage and speeds restoration.

Enhanced Vegetation Management: Reducing the likelihood of tree contact during storms by removing "risk trees" and ensuring better line clearance.

Other Resilience Work: Versant has a sustainable asset management program to keep its system reliable, including routine inspections and condition-based replacements and maintenance. Some of this work promotes reliability and enhances resilience.

6.1 DISTRIBUTION HARDENING

Hardening infrastructure is a critical part of reducing outages from trees. The Distribution Hardening program targets individual line sections within communities most vulnerable to storm damage and resulting tree-caused outages. Versant performs distribution hardening in two ways:

- Replace bare overhead conductor with larger, stronger covered conductor known as "tree wire."
- Replace older, weaker poles and associated hardware (e.g., crossarms, guy wire, and anchors) with stronger infrastructure to support heavier loads and resist failure.

6.1.1 Tree Wire

Tree wire can be used in areas where tree encroachment is likely. Tree wire is an aluminum conductor covered with multiple layers of material that provide electrical insulation and physical protection from incidental tree contact. Tree wire has been shown to reduce electrical faults from tree contact dramatically, reducing power outages and the risk of ignition.

Many outages and a significant portion of customer outage hours are caused by trees and large branches falling into lines with enough force to break the conductor. In some cases, existing conductors are smaller or weaker than Versant Power's current engineering standards. Replacing smaller, older conductors will help prevent conductors from breaking, avoiding outages and the time needed to splice wires.

In some places, Versant Power replaces smaller bare conductors with larger, covered conductors. This helps increase distribution capacity to accommodate electrification and distributed energy resources.

6.1.2 Pole Replacement

Where appropriate, Versant replaces selected poles while performing conductor replacement. This helps ensure the overhead distribution system can better withstand physical contact from trees during major storms and the added weight from icing and heavy snow.

6.2 DISTRIBUTION AUTOMATION

Versant's distribution system topology is radial (i.e., no alternate supply exists) in most areas. This means distribution circuits are designed to receive power from a substation and deliver electricity to customers via three-phase or single-phase lines. Long lines often serve entire communities and are exposed to many miles of trees along the right-of-way. A single tree branch can affect numerous homes, businesses, and public safety infrastructure, creating a critical resilience challenge. This circumstance is exacerbated during major storms when multiple damage sites may occur along a circuit.

6.2.1 Automatic Load Transfer ("ALT") Schemes

Circuit breakers and sectionalizers are electrical devices that allow utilities to connect and disconnect portions of a distribution circuit to an upstream power source. Versant installs these devices to help isolate faulted line sections to reduce the number of customers who lose power when a fault occurs. Where possible, communication systems are also employed to enable automated switching that makes it possible to quickly transfer some homes and businesses to an alternate power source so that the interruption they experience is short.

6.2.2 Protection and Coordination ("P&C")

Versant engineers conduct P&C studies to determine how to configure and coordinate distribution automation equipment such as circuit breakers, protective relaying, and supporting communications. These studies determine the number, location, and size of automation devices. P&C studies are needed before finalizing resilience plans and related procurement of equipment.

6.3 ENHANCED VEGETATION MANAGEMENT

Enhanced vegetation management (EVM) presents a significant opportunity for strengthening the reliability and resilience of the electric grid in northern and eastern Maine. Maine is the most heavily forested state in the nation, and the people of Maine love the trees that grace the rural landscapes and beautify our urban and suburban neighborhoods. In addition to the prevalence of trees, there are other critical environmental characteristics of Maine that result in trees presenting a particular threat to electric lines. These conditions include shallow soils and shallow-rooting tree species, snow and ice loading, long rural circuits, windy coastal conditions, and the prevalence of coastal storms such as Nor'easters.

Versant currently employs a quality vegetation management program (VMP) for its distribution system, which includes maintaining a safe clearance of vegetation away from wires and removing whole trees that are likely to fall into the lines. Between 1,500 and 1,800 miles of this maintenance is conducted each year. Despite this maintenance, a significant opportunity exists to remove more vegetation threats and enhance the system's resilience. This is true primarily because most outages are caused by vegetation originating outside our typical clearance zone and the public right-of-way. The VMP is the largest operating expense for Versant and our customers.

Additional clearance and tree removal, especially from outside the right-of-way and especially when coupled with extra protection and control systems, offers the opportunity for a step-change in system performance and the potential to take the distribution system to a new level of reliability necessary for the future grid. This incremental vegetation control would include the following four key components:

1) Additional "risk tree" removal for trees growing outside the right-of-way.
2) Enhanced identification and mitigation of structural risks. This includes the removal of weak branching and overhanging branching.
3) Right-of-Way reclamation: removal of whole trees that are growing within 10 feet of the conductors.

4) With landowner and community support, widening roadside rights-of-way will provide a much-improved clearance zone. This would remove both structural threats and most risk trees.

7 RECOMMENDATIONS

7.1 INFRASTRUCTURE

7.1.1 Priority Resilience Actions

I.1 Complete a detailed Vulnerability Assessment of T&D Infrastructure.

I.2 Explore new distribution system topology options with distribution automation.

I.3 Explore new line designs and materials to resist ignition and fire damage.

I.4 Install stronger distribution poles to support more weight and resist breaking.

I.5 Install more T&D system monitoring.

I.6 Strategically underground T&D lines in high-risk areas.

7.1.2 Policy Support

- Review enabling policies supporting non-traditional solutions such as undergrounding and microgrids that improve resilience and reduce exposure to climate hazards.

7.1.3 Critical Next Steps

- Review and revise our design standards to reflect priority climate hazards.
- Review and revise the Distribution Planning Criteria for climate hazards and Community resilience.
- Apply revised standards to the existing capital plan to identify opportunities to adjust the plan and inform Versant's IGP.

7.2 OPERATIONS

7.2.1 Priority Resilience Actions

O.1 Complete a detailed Vulnerability Assessment of Operations.

O.2 Incorporate climate hazards into system planning, engineering, and asset management.

O.3 Review the System Emergency Operations Plan to incorporate emerging climate hazards.

O.4 Revise our System Operations Planning procedures to include climate hazards.

O.5 Monitor staffing and mutual aid resources to ensure they keep pace with climate hazards.

7.2.2 Policy Support

- Review existing policy and performance metrics to account for a focus on climate hazards and resilience. Versant will make future investment and operational decisions emphasizing Communities and Resilience. This will supplement our ongoing focus on reliability and cost.

7.2.3 Critical Next Steps

- Prepare a white paper on staffing and resources for severe storms.

7.3 COMMUNITIES

7.3.1 Priority Resilience Actions

C.1 Implement a Climate Planning Stakeholder Communication Plan.

C.2 Develop a Community Resilience Consultation Framework and pilot.

C.3 Perform mock emergency drills.

C.4 Draft community-specific and joint community resilience plans.

C.5 Develop a Community Resilience Microgrid Pilot.

7.3.2 Policy Support

- Develop supporting policies for resilience projects focused on communities such as microgrids. These policies will leverage the capabilities and roles that utilities can play to improve climate resilience for small communities.

7.3.3 Critical Next Steps

- Initiate the Climate Planning Stakeholder Communication Plan.
- Identify communities well-suited for resilience projects and investments in the next two to three years. In the last year, Versant has applied for federal resilience funding with projects that included communities in Deer Isle, Lincoln, Lee, Presque Isle, and Eastport.
- Consult with the OPA and NWA Coordinator to identify ways to incorporate community resilience into solutions evaluation.

8 APPENDIX

Appendix A. High-Level Infrastructure Vulnerability Assessment

Appendix B. Potential Resilience Strategies, Actions, and Recommendations

APPENDIX A. HIGH LEVEL INFRASTRUCTURE VULNERABILITY ASSESSMENT

Exposure is informed by the FEMA Risk Indices and Versant's experience.

ICE STORMS AND WINTER WEATHER (and associated tree contacts)		Exposure	Detailed Ratings Impact	Vulnerability
TRANSMISSION	Structures (poles, towers, and attachment hardware)	Higher	Higher	Higher
	Overhead conductors	Higher	Higher	Higher
	Underground conductors	Lower	Higher	Higher
	Switching devices (switches, circuit breakers, and sectionalizers)	Medium	Higher	Higher
DISTRIBUTION	Structures (poles, crossarms, and attachment hardware)	Higher	Higher	Higher
	Overhead conductors	Higher	Higher	Higher
	Underground conductors	Lower	Medium	Lower
	Overhead switching devices (switches, circuit breakers, and sectionalizers)	Medium	Medium	Medium
	Underground switching devices (switchgear)	Lower	Medium	Lower
	Transformers (pole mounted)	Medium	Medium	Lower
	Transformers (pad mounted)	Lower	Medium	Lower
	Voltage regulators (pole mounted)	Medium	Medium	Lower
	Capacitors (pole mounted)	Medium	Lower	Lower
SUBSTATIONS	Substation equipment and infrastructure	Lower	Lower	Lower

HIGH WINDS AND GUSTS CAUSED BY SEVERE STORMS		Exposure	Detailed Ratings Impact	Vulnerability
TRANSMISSION LINES	Structures (poles, towers, and attachment hardware)	Higher	Medium	Medium
	Overhead conductors	Higher	Medium	Medium
	Underground conductors	N/A	N/A	N/A
	Switching devices (switches, circuit breakers, and sectionalizers)	Lower	Medium	Lower
DISTRIBUTION LINES	Structures (poles, crossarms, and attachment hardware)	Higher	Higher	Higher
	Overhead conductors	Higher	Higher	Higher
	Underground conductors	N/A	N/A	N/A
	Overhead switching devices (switches, circuit breakers, and sectionalizers)	Lower	Medium	Medium
	Underground switching devices (switchgear)	Lower	Medium	N/A
	Transformers (pole mounted)	Lower	Lower	Lower
	Transformers (pad mounted)	N/A	N/A	N/A
	Voltage regulators (pole mounted)	Lower	Medium	Lower
	Capacitors (pole mounted)	Lower	Lower	Lower
SUBSTATIONS	Substation equipment and infrastructure	Lower	Lower	Lower

SEA LEVEL RISE AND COASTAL STORM SURGES		Exposure	Detailed Ratings Impact	Vulnerability
TRANSMISSION	Structures (poles, towers, and attachment hardware)	Lower	Medium	Lower
	Overhead conductors	N/A	N/A	N/A
	Underground conductors	N/A	N/A	N/A
	Switching devices (switches, circuit breakers, and sectionalizers)	N/A	N/A	N/A
DISTRIBUTION	Structures (poles, crossarms, and attachment hardware)	Lower	Medium	Lower
	Overhead conductors	N/A	N/A	N/A
	Underground conductors	Lower	Medium	Lower
	Overhead switching devices (switches, circuit breakers, and sectionalizers)	N/A	N/A	N/A
	Underground switching devices (switchgear)	Lower	Medium	Lower
	Transformers (pole mounted)	N/A	N/A	N/A
	Transformers (pad mounted)	Lower	Medium	Lower
	Voltage regulators (pole mounted)	N/A	N/A	N/A
	Capacitors (pole mounted)	N/A	N/A	N/A
SUBSTATIONS	Substation equipment and infrastructure	Lower	Higher	Lower

APPENDIX A. HIGH LEVEL INFRASTRUCTURE VULNERABILITY ASSESSMENT

DROUGHT AND WILDFIRE		Exposure	Impact	Vulnerability
TRANSMISSION	Structures (poles, towers, and attachment hardware)	Medium	Higher	Medium
	Overhead conductors	Medium	Higher	Medium
	Underground conductors	Medium	Higher	Medium
	Switching devices (switches, circuit breakers, and sectionalizers)	Medium	Higher	Medium
DISTRIBUTION	Structures (poles, crossarms, and attachment hardware)	Medium	Medium	Medium
	Overhead conductors	Medium	Medium	Medium
	Underground conductors	Lower	Medium	Lower
	Overhead switching devices (switches, circuit breakers, and sectionalizers)	Medium	Medium	Lower
	Underground switching devices (switchgear)	Lower	Medium	Lower
	Transformers (pole mounted)	Medium	Medium	Lower
	Transformers (pad mounted)	Medium	Medium	Lower
	Voltage regulators (pole mounted)	Medium	Medium	Lower
	Capacitors (pole mounted)	Medium	Medium	Lower
SUBSTATIONS	Substation equipment and infrastructure	Lower	Medium	Lower

Detailed Ratings

HIGHER TEMPERATURES		Exposure	Impact	Vulnerability
TRANSMISSION	Structures (poles, towers, and attachment hardware)	Lower	Lower	Medium
	Overhead conductors	Medium	Medium	Medium
	Underground conductors	Lower	Lower	Medium
	Switching devices (switches, circuit breakers, and sectionalizers)	Lower	Lower	Higher
DISTRIBUTION	Structures (poles, crossarms, and attachment hardware)	Lower	Lower	Lower
	Overhead conductors	Medium	Medium	Medium
	Underground conductors	Lower	Lower	Lower
	Overhead switching devices (switches, circuit breakers, and sectionalizers)	Lower	Medium	Lower
	Underground switching devices (switchgear)	Lower	Lower	Lower
	Transformers (pole mounted)	Medium	Medium	Medium
	Transformers (pad mounted)	Medium	Medium	Medium
	Voltage regulators (pole mounted)	Medium	Medium	Medium
	Capacitors (pole mounted)	Medium	Lower	Lower
SUBSTATIONS	Substation equipment and infrastructure	Medium	Higher	Higher

Detailed Ratings

HEAVY PRECIPITATION AND INLAND FLOODING		Exposure	Impact	Vulnerability
TRANSMISSION	Structures (poles, towers, and attachment hardware)	Lower	Medium	Lower
	Overhead conductors	N/A	N/A	N/A
	Underground conductors	N/A	N/A	N/A
	Switching devices (switches, circuit breakers, and sectionalizers)	N/A	N/A	N/A
DISTRIBUTION	Structures (poles, crossarms, and attachment hardware)	Lower	Medium	Lower
	Overhead conductors	N/A	N/A	N/A
	Underground conductors	Lower	Medium	Lower
	Overhead switching devices (switches, circuit breakers, and sectionalizers)	N/A	N/A	N/A
	Underground switching devices (switchgear)	Lower	Medium	Lower
	Transformers (pole mounted)	N/A	N/A	N/A
	Transformers (pad mounted)	Lower	Medium	Lower
	Voltage regulators (pole mounted)	N/A	N/A	N/A
	Capacitors (pole mounted)	N/A	N/A	N/A
SUBSTATIONS	Substation equipment and infrastructure	Lower	Higher	Lower

APPENDIX B. POTENTIAL RESILIENCE STRATEGIES, ACTIONS, AND RECOMMENDATIONS

Versant Power considered various potential strategies and actions for addressing climate hazards and mitigating the associated risks. Sections 3, 4, and 5 of the CCRP present the possible strategies for reducing vulnerability to our infrastructure, operations, and communities. The recommendations presented in Section 6 were selected using a prioritization framework designed to account for several factors. This appendix describes the prioritization factors and provides detailed scores for each potential strategy. The table below explains the framework categories and factors.

Category	Factor	Description
Resilience Strategy or Action	Name	A short title
	Index	Label for each Strategy or Resilience Action
CCRP Organization	Pillar	Infrastructure, Operations, or Communities
	Category	Study, Process, Collaborative, or Capital Investment
	Timeframe	The period during which work could begin. Early Action (0-18 months), Near Term (2-5 years), Longer Term (6-10 years).
	Recommend	Recommended for consideration in Section 7 of the CCRP
Prioritization Factor	Cost	Relative estimate cost ($ being lowest, $$$$ being highest)
	Duration	Relative estimated time to complete the work
	Difficulty	Relative difficulty or complexity of completing the work
	Overall Vulnerability	The degree of vulnerability addressed
	Resilience Value	Relative improvement in resilience
	EEE Justice	Potential Environmental, Equity, and Environmental Justice impacts or benefits
	Other Benefits	Notable benefits to public safety, operational efficiency, or state and local policy initiatives
Climate Hazard Exposure and Vulnerability	Ice Storms	Addresses risks from Ice Storms and Winter Weather
	Coastal Flooding	Addresses risks from Sea Level Rise and Coastal Storm Surges
	Wildfire	Addresses risks from Drought and Wildfire
	High Wind	Addresses risks from High Winds and Gusts from severe storms
	Inland Flooding	Addresses risks from Heavy Precipitation and Inland Flooding
	Higher Temperature	Addresses risks from Higher Temperature (ambient)
Infrastructure Category	Transmission	Improves the resilience of Transmission Lines
	Distribution	Improves the resilience of Distribution Lines
	Substation	Improves the resilience of Substations

Strategy or Res lience Action		CCRP Organ zation				Prioritization Factor							Cl mate Hazard Exposure and Vulnerability						Infrastructure Category		
Name	ndex	Pillar	Category	Timeframe	Recommend	Cost	Duration	Difficu ty	Overall Vulnerability	Resilience Value	EEE Justice	Other Benefits	Ice Storms	Coastal Flooding	Wi dfire	High Wind	Inland Flood ng	Higher Temperature	Transmission	Distribution	Substation
Complete a deta led Vulne ab l ty Assessment of T&D Inf ast uctu e.	I.1	Inf ast uctu e	Study	EA	YES	$	Sho te	Eas e	H ghe	H ghe	YES	YES	YES	YES	YES	YES	YES	YES	H ghe	H ghe	H ghe
Explo e new d st but on system topo ogy opt ons w th d st but on automat on.	I.2	Inf ast uctu e	Study	EA	YES	$	Sho te	Eas e	H ghe	H ghe		YES	YES			YES			N/A	H ghe	N/A
Explo e new l ne des gns and mate als to es st gn t on and f e damage.	I.3	Inf ast uctu e	Study	EA	YES	$	Sho te	Eas e	Med um	Med um		YES			YES				Med um	Lowe	Lowe
Insta l st onge d st but on po es to suppo t mo e we ght and es st b eak ng.	I.4	Inf ast uctu e	Cap Invest	NT	YES	$$$$	Longe	Mode ate	H ghe	H ghe		YES	YES			YES			N/A	YES	N/A
Insta l mo e T&D system mon to ng.	I.5	Inf ast uctu e	Cap Invest	NT	YES	$$$$	Longe	Mode ate	H ghe	H ghe		YES	YES			YES			Lowe	H ghe	Lowe
St ateg cally unde g ound T&D l nes n h gh- sk a eas.	I.6	Inf ast uctu e	Cap Invest	LT	YES	$$$$	Longe	Ha de	H ghe	H ghe		YES	YES			YES			Med um	H ghe	N/A
Redes gn conducto conf gu at ons to educe ce accumulat on and w nd load.	I.7	Inf ast uctu e	P ocess	NT		$$	Med um	Mode ate	H ghe	Med um			YES			YES			H ghe	H ghe	N/A
Inc ease l ne and equ pment at ngs to w thstand h ghe amb ent tempe atu es.	I.8	Inf ast uctu e	P ocess	NT		$$	Longe	Ha de	H ghe	Med um		YES						YES	Med um	Lowe	H ghe
Re nfo ce t ansm ss on st uctu es to nc ease phys cal oad at ngs and f ood es stance.	I.9	Inf ast uctu e	Cap Invest	LT		$$$$	Longe	Ha de	H ghe	Med um			YES			YES			H ghe	N/A	N/A
Apply P&C technolog es to educe T&D gn t ons.	I.10	Inf ast uctu e	Cap Invest	NT		$$$$	Longe	Ha de	Med um	Lowe					YES				Med um	H ghe	H ghe
Complete a detailed Vulnerabi ity Assessment of Operat ons.	O.1	Operat ons	Study	EA	YES	$	Shorter	Easier	Higher	Higher	YES		YES	YES	YES	YES	YES		Higher	Higher	H gher
Incorporate c imate hazards into system planning, engineering, and asset management.	O.2	Operat ons	Process	EA	YES	$$	Medium	Moderate	Higher	Higher			YES	YES	YES	YES	YES		Higher	Higher	H gher
Review the System Emergency Operations Plan to incorporate emerging c imate hazards.	O.3	Operat ons	Process	EA	YES	$$	Shorter	Easier	Higher	Higher			YES	YES	YES	YES	YES		Higher	Higher	H gher
Revise our System Operations Planning procedures to include climate hazards.	O.4	Operat ons	Process	EA	YES	$$	Medium	Moderate	Higher	Higher			YES	YES	YES	YES	YES		Higher	Higher	H gher
Mon tor staffing and mutual a d resources to ensure they keep pace with climate hazards.	O.5	Operat ons	Process	NT	YES	$	Shorter	Easier	Medium	Higher		YES	YES			YES			Lower	Med um	Lower
Investigate telecommunications infrastructure and operations.	O.6	Operat ons	Study	EA		$	Shorter	Easier	Medium	Med um		YES	YES		YES	YES			Medium	Med um	N/A
Develop plans for fire breaks	O.7	Operat ons	Study	EA		$	Shorter	Easier	Medium	Lower		YES			YES				Medium	Lower	Lower
Conduct a study to identify operational approaches and advanced techno ogies to reducing ignitions.	O.8	Operat ons	Study	EA		$	Shorter	Easier	Medium	Lower					YES				Medium	Lower	N/A
Complete a Contingency Study of the transm ssion system to eva uate wildfire impacts on grid re iability.	O.9	Operat ons	Study	EA		$	Shorter	Easier	Medium	Lower		YES			YES				Medium	N/A	Lower
Review river draw-down policies and plans to account for riverine flooding.	O.10	Operat ons	Study	EA	YES	$	Shorter	Easier	Lower	Lower		YES					YES		Lower	Lower	Lower
Conduct a detailed flood plain analysis for Versant's infrastructure.	O.11	Operat ons	Study	EA	YES	$	Shorter	Easier	Lower	Lower		YES		YES			YES		Lower	Lower	Lower
Conduct a study to review the potential e fects of drought and heavy rainfall on risk trees.	O.12	Operat ons	Study	EA		$	Shorter	Easier	Lower	Lower				YES	YES		YES		Lower	Lower	N/A
Conduct a study to evaluate Pub ic Safety Power Shutoffs (PSPS) to prevent w ldfires.	O.13	Operat ons	Study	EA		$	Shorter	Easier	Lower	Lower					YES				Lower	Lower	Lower
Implement technologies to map vegetation c earances more frequent y and inexpens vely.	O.14	Operat ons	Cap Invest	NT	YES	$$$	Medium	Moderate	Higher	Higher		YES	YES		YES	YES			Medium	Higher	N/A
Implement data analytics to provide ins ghts into environmental and system condition, and to help prioritize system improvements.	O.15	Operat ons	Cap Invest	NT	YES	$$$	Medium	Moderate	Higher	Higher		YES	YES	YES	YES	YES	YES		Higher	Higher	H gher
Apply advanced technolog es that supo t faste esponse and esto at on.	O.16	Ope at ons	Cap Invest	LT	YES	$$$	Med um	Mode ate	H ghe	H ghe			YES			YES			Lowe	H ghe	Lowe
Implement a Cl mate Plann ng Stakeholde Commun cat on P an.	C.1	Commun ty	Collabo at ve	EA	YES	$	Sho te	Eas e	H ghe	H ghe			YES	YES	YES	YES	YES	YES	Med um	Med um	Med um
Develop a Commun ty Res l ence Consultat on F amewo k and p lots.	C.2	Commun ty	Collabo at ve	EA	YES	$$	Sho te	Eas e	H ghe	H ghe	YES		YES	YES	YES	YES	YES	YES	H ghe	H ghe	H ghe
Pe fo m mock eme gency d ls.	C.3	Commun ty	Collabo at ve	NT	YES	$$	Sho te	Eas e	Med um	Med um			YES	YES	YES	YES	YES	YES	Med um	Med um	Med um
D aft commun ty-spec f c and o nt commun ty es l ence plans.	C.4	Commun ty	Collabo at ve	NT	YES	$$	Med um	Mode ate	Med um	Med um			YES	YES	YES	YES	YES	YES	Med um	Med um	Med um
Develop a Commun ty Res l ence M c og d P lot	C.5	Commun ty	Collabo at ve	NT	YES	$$	Longe	Ha de	Med um	Med um		YES	YES	YES	YES	YES	YES	YES	Med um	Med um	Med um
Develop bette t ack ng met cs fo Ve sant's cl mate haza d m t gat on and es l ence effo ts.	C.6	Commun ty	Collabo at ve	NT	YES	$	Med um	Mode ate	Med um	Med um	YES	YES	YES	YES	YES	YES	YES	YES	Med um	Med um	Med um