*Avista Utilities*

# Wildfire Resiliency
# 2021 Year End Report



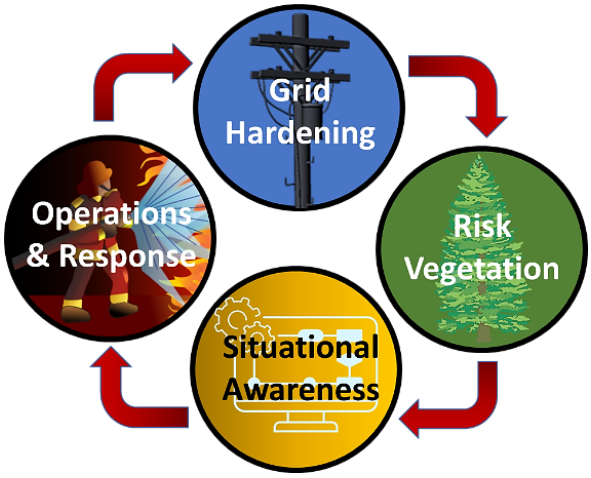


*Version 2 January 2022*

# Contents

# The Wildfire Resiliency Plan

Avista responded to the increasing threat of wildfires with a robust and practical Wildfire Plan focused on reducing the likelihood of a wildfire caused by Avista's electric operations, protecting the safety of our employees and customers, and preparing ourselves, the electrical system, and external partners for a wildfire event. The Plan addresses these challenges through four primary program areas:




1) Infrastructure Grid Hardening
2) Risk-Base Vegetation Management
3) Situational Awareness
4) Emergency Operations and Response

The 2021 program results will be detailed in this report.

Avista's Wildfire Plan leverages several existing asset programs and operating practices, building upon them whenever possible. Many of these programs already have demonstrated benefits related to reducing the risk of fire or in making the electric system more resilient, such as vegetation management and steel pole replacements. The 2020 Wildfire Plan adds additional funding and creates a focus for these programs specifically related to high fire threat areas. Other programs suggested by the Plan are new to Avista, including LiDAR and satellite imaging, cross-training with external fire professionals, and the creation of a fire-weather risk monitoring system. All of the Wildfire programs, new or re-tooled, work in concert to provide a well-rounded and robust approach.

## Infrastructure Grid Hardening

This portion of the Wildfire Plan includes transmission and distribution infrastructure upgrades targeted at reducing both spark ignition events and protecting infrastructure from the impacts of wildfire. Elements of Grid Hardening include:


- *Distribution Infrastructure Upgrades*
- *Conversion of Transmission Wood to Steel Poles*
- *Fire Resistant Wood Pole Wraps*
- *Transmission Inspections*

## Distribution Infrastructure Upgrades/Grid Hardening.

*Fiberglass Crossarm*


*Many of Avista's copper wire conductors are between 80-100 years old*

Distribution grid hardening represents the single largest capital investment in the Plan. Though Avista has well-established conditioned-based replacement programs such as Wood Pole Management and Grid Modernization, these programs are broadly aligned with customer service reliability objectives. The Wildfire Distribution Grid Hardening program targets portions of circuits located in high risk fire areas with the goal of reducing spark ignition outages. This work includes: replacing wood crossarms with fiberglass units,[1] replacing end-of-life wood poles (and at times replacing them with steel poles),[2] changing out obsolete small copper wire with modern steel reinforced aluminum wire, the installation of wildlife guards to reduce animal related events, eliminating open wire secondary districts, installing wedge connected stirrups[3] to provide protection and additional strength at hot tap connection points, and undergrounding conductor when cost-justified.

Grid Hardening is now up to its expected pace but was slowed during the first quarter of 2021 due to limited contract crew availability.[4] Even so, 146 miles will be addressed by year end, including 6 circuits in their entirety. (66 miles were treated in 2020.)

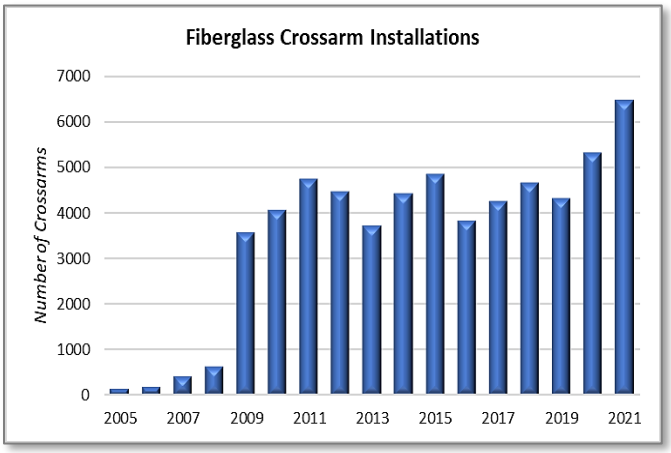



*Figure 1. Number of Fiberglass Crossarms Installed* [4]

An important goal of grid hardening is to reduce the number of pole fires, which can lead to wildfires under the right conditions. Pole fires, together

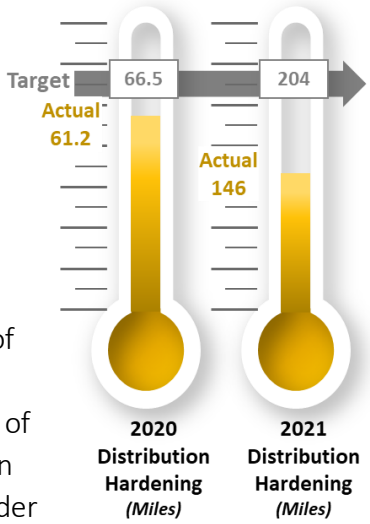



*Figure 2. Distribution Grid Hardening Work*

[1] For more information on this, see: Terry Shank, "Fiberglass Crossarms as the Wood Alternative: More than the Simple Reasons," June 5, 2020, https://www.creativecompositesgroup.com/blog/fiberglass-crossarms-as-the-wood-alternative-more-than-the-simple-reasons

[2] Avista typically uses steel distribution poles in "high value" locations such as high-volume traffic areas, railroad, highway, and river crossings, at hard angles, or if access for maintenance is particularly difficult.

[3] The traditional hot line tap is attached via a bolt. Over time this type of connection can come loose and arc and spark and can melt through the conductor, dropping it to the ground. The wedge connected stirrup device prevents the hot tap from being directly connected to the conductor, reducing spark potential, and the stirrup attaches in such a way that if the connection loosens and if the stirrup melts, the conductor is still intact and does not fall to the ground.

[4] Crews were in short supply across the state after a winter windstorm went through, creating significant damage for utilities statewide and creating a huge demand for crews to repair the system.

[5] Note that this is a representative graph, as it includes approximately 60,000 crossarm installations. The Company has over 265,000 poles and crossarms in the field. It will take several years to replace all of our wood crossarms.

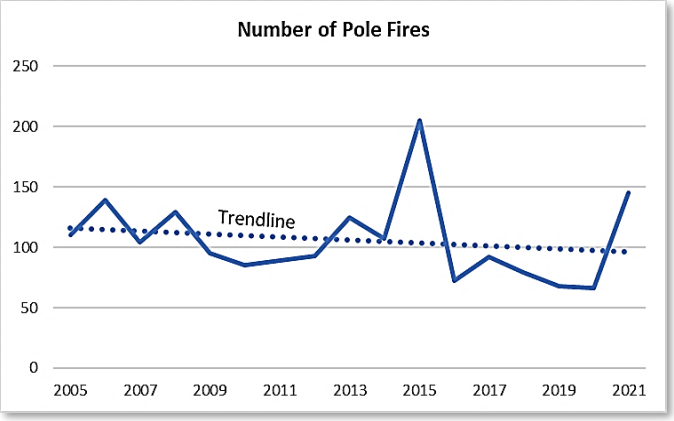



*Figure 3. Number of Avista Pole Fires. Note that both 2015 and 2021 had record breaking heat waves along with long periods of dry spells & intermittent light rain, ideal conditions for pole fires.*

with equipment failures, are mitigated by replacing aging and deteriorated poles, wood crossarms, obsolete conductor, and other select equipment. On average, there are approximately 92[6] pole fires annually, and the vast majority are related to wood on wood contact between crossarms and poles. Over time insulators and wood crossarms become contaminated by dust and dirt creating a path for leakage current. When a period of hot-dry weather is followed by a light rain, leakage current increases, creating the right conditions for pole fires.[7] The excessive number of pole fires in 2021 highlights this issue, as our service territory experienced exceptionally hot, dry weather starting in late spring (March) interspersed with a few light rain showers at the end of August. This created ideal conditions for the pole fires.[8]

Avista, like many utilities, has been replacing wood crossarms with fiberglass crossarms since the early 2000s. Fiberglass crossarms are smooth and resistant to contamination, do not rot or degrade over time, and are much lighter while being up to six times stronger than wood.[9] In addition, fiberglass crossarms are inherently self-extinguishing, so perform well in fire situations.[10] **Avista has never experienced a pole fire with a fiberglass crossarm.**

**Transmission Steel Pole Replacement.** Avista has systematically replaced wood transmission poles with steel since 2006, typically for poles which were damaged or failed, or during routine transmission line build projects. With the Wildfire Plan, this practice is also focused on making the transmission system more resilient to the threat of wildfire in high fire risk areas. From 2020-2022, Avista will use the Wildland Urban Interface Map (WUI) to determine transmission segments slated for conversion to steel (fire ignition model). However, starting in 2023, we plan to include a historic fire-based model and will focus on converting wood to steel in areas that have been routinely impacted by wildfires (fire impact model) in addition to being in high fire threat zones.

---

[6] Based on the five-year average from 2017 to 2021.
[7] Steve Torres, "Utility Extinguishes Risk for Pole-Top Fires," T&D World, January 27, 2014, https://www.tdworld.com/electric-utility-operations/tools-and-technologies/article/20963905/utility-extinguishes-risk-for-poletop-fires
[8] Weather data sources: https://weather.wsu.edu/index.php?page=AWN_June_2015_Weather_Review, https://www.krem.com/article/weather/historic-heat-wave-could-break-spokane-area-records/293-b78a4735-d9f9-4b27-9463-007a7cefb2fe, https://www.kxly.com/summer-2021-was-the-hottest-in-spokane-ever/
[9] Terry Shank, "Fiberglass Crossarms as the Wood Alternative: More than the Simple Reasons," June 5, 2020, https://www.creativecompositesgroup.com/blog/fiberglass-crossarms-as-the-wood-alternative-more-than-the-simple-reasons
[10] Megan Headley, "Utilities Ready to Invest in FRP Solutions," March 5, 2020, http://compositesmanufacturingmagazine.com/2020/03/utilities-ready-to-invest-in-frp-solutions/

In 2021 we overestimated the number of projects that could be completed for a variety of reasons including crew availability (early year storms on the west side of the state diverted significant resources) and the inclusion of condition-based programs in addition to those dictated by the Wildfire Plan. Fortunately, all of the primary transmission replacement projects were completed this year and a more realistic steel conversion goal was developed for 2022. We plan to replace over 850 wood poles with steel in the coming year.

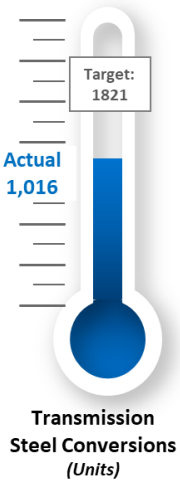



*Figure 4. Steel Pole Replacement Status*

**Transmission Wood Pole Fire Mesh Wrap.** Avista is using Genics fire mesh wrap to protect wood poles in low level grassland and range areas. It is more durable than the fire-resistant paint[11] and is considerably less expensive than replacing a wood pole with steel.[12] Pole wraps will be used in areas subject to routine grassland or sage-shrub fires such as the Big Bend region between Davenport and Othello, areas around Clarkston, and west and south of Spokane. This new program has been tremendously successful, with over 1,350 poles wrapped in 2021 compared to a target of 860 poles.

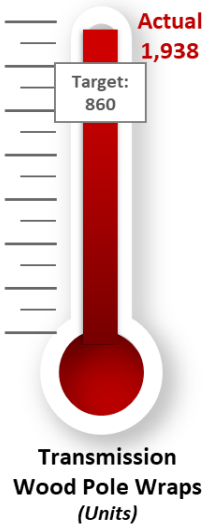



*Figure 5. Wood Pole Mesh Wrap Status*

This program has also developed the ability for rapid response. This summer as a wildfire headed toward the Noxon - Pinecreek 230 kV line, Avista partnered with the Idaho Department of Lands and US Forest Service fire crews to determine where and when the fire might impact our line. Working in partnership, the group deployed fire mesh wrap crew to protect transmission structures ahead of the fire.

*Fire resistant paint tends to fail in about 3-5 years and must be reapplied.*

*Fire mesh can last more than 20 years and requires no maintenance.*

[11] Avista has found their fire-resistant paint effective for about 5 years before it must be replaced, where wire mesh wrap is expected to last at least 20 years.

[12] Replacing a steel pole averages about $25,000 to $35,000 per pole. Steel mesh wrap costs about $200 per pole.

**Transmission Inspections.** Avista's Transmission Engineering Department has conducted annual aerial and ground inspections for many years, as required by FERC regulations.[13] Avista is leveraging that experience to mitigate against potential spark-ignition events. In 2020, Avista conducted detailed inspections of all lattice type steel structures to identify both structural and electrical defects that might result in a spark-ignition incident. In 2021, the focus turned towards close inspection of conductor splices on specific 230 kV lines. By supplementing aerial and ground patrols with additional fire-focused inspections such as thermal imaging, high resolution photography and direct electrical testing, Avista is better able to identify potential fire hazards.

## Grid Hardening Summary

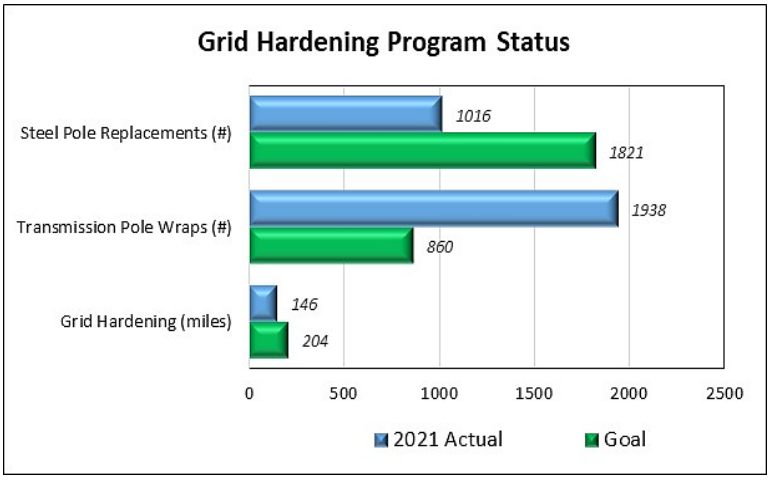



*Figure 6. Grid Hardening Program Status 2021*

| Infrastructure Grid Hardening Program Status | Goal | 2021 Actual |
|---|---|---|
| Grid Hardening (miles) | 204 | 146 |
| Transmission Pole Wraps (#) | 860 | 1938 |
| Steel Pole Replacements (#) | 1821 | 1016 |

*Table 1. Grid Hardening Program Status 2021*

| Infrastructure Grid Hardening Related Outages | 5-Yr Ave. | 2021 Actual |
|---|---|---|
| Pole Fires | 91.8 | 154 |
| OH Equipment Failures | 643.4 | 622 |
| Bird/Animal Outages | 582.4 | 595 |
| Spark Events | 128.6 | 118 |

*Table 2. Grid Hardening Related Events 2021*

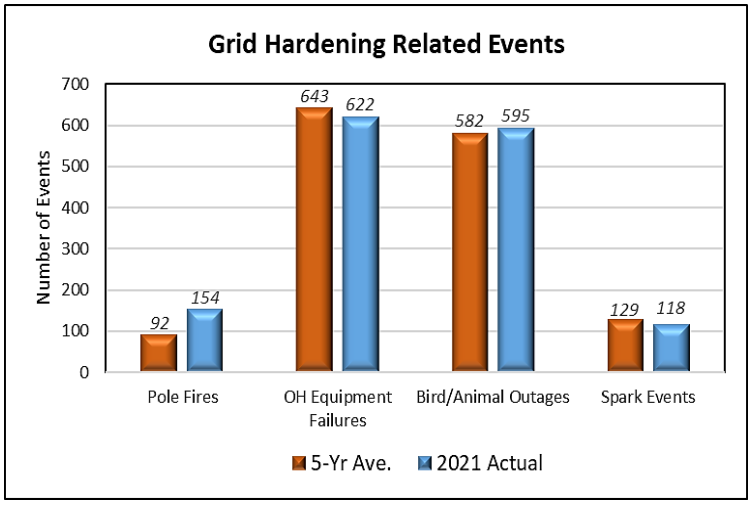



*Figure 7. Grid Hardening Related Events 2021*

[13] FERC Reliability Standard FAC-003, https://www.nerc.com/pa/Stand/Reliability%20Standards/FAC-003-4.pdf requires inspection of 100% of the interconnected transmission grid annually. Avista's Transmission Maintenance Inspection Plan (TIMP) further requires inspection of all transmission lines each year.

## Risk-Based Vegetation Management

Avista performs routine annual vegetation management that consists of cycle-trimming and risk tree (danger tree) inspections every five years. Avista's definition of "risk tree" is a tree with the potential of imminent fall-in hazard to energized facilities.

Historically, these two programs were conducted in tandem with one line-clearance contractor, focused on about 1,500 miles (20% of the system) annually. In 2020 the program was separated into two distinct programs with routine maintenance (cycle trimming) remaining in the general program but risk or danger tree aligning with the Wildfire Plan. Avista's Wildfire Plan goal is to perform risk tree inspections and removals across 100% of the transmission and distribution system on an annual basis rather than a five-year cycle. This a marked departure from the previous practice of assessing only 20% of the electric distribution system for danger trees.

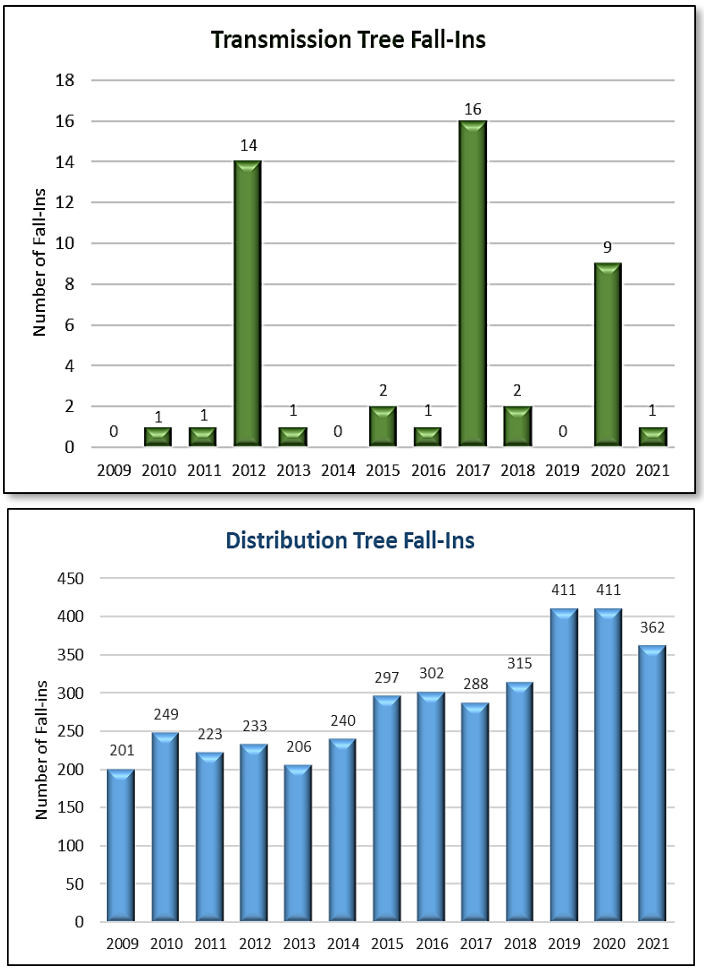



*Figure 8. Transmission and Distribution Number of Tree Fall-in Events*

Metrics indicate that trees are three times more likely to fall into distribution lines than grow into them. And, in many cases, trees that fall into lines are located outside of prescribed rights-of-ways and are not subject to routine maintenance. Like most utilities, Avista targets the dead, dying, and defective trees which are more likely to fail than green, healthy trees. Annual risk tree mitigation is a significant element of Avista's overall Wildfire Resiliency Plan and should have a significant impact on tree-related events over time.

2021 was a challenging year for fully executing the vegetation work plan. Several large storms in January took six-weeks of planned work from crews so they could help with cleanup for both Avista and several other utilities. Also, fire season started early in June and several areas that were identified and prioritized as requiring risk tree work were closed to crew access subject to Washington Department of Lands fire restrictions. To keep the crews working, they were reassigned to less critical areas. Once the restrictions were lifted in mid-October, they were sent back to work before the weather deteriorated, as

many of these areas are in high and heavily forested inaccessible locations with snow levels above 2,500 feet, making access extremely expensive and difficult.

The Company's Vegetation Management Program has been enhanced with focus on protecting lives and property from wildfire. Additional measures include:

- *100% (Systemwide) Annual Risk Tree Identification*
- *Transmission System LiDAR Imaging*
- *Distribution System Satellite Imaging*
- *Customer Choice Right Tree Right Place*
- *Fuel Reduction Partnerships*

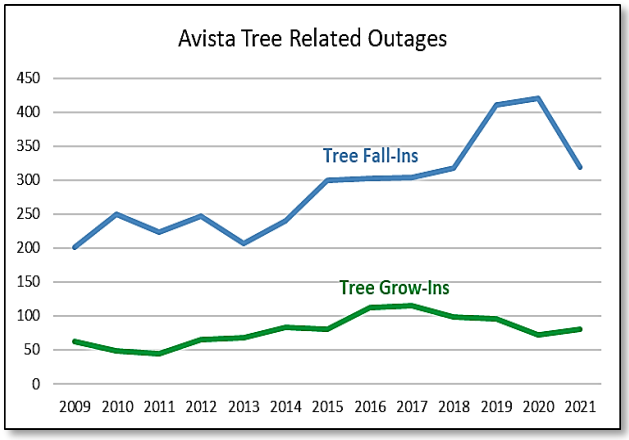



*Figure 9. Tree Related Outages*

**Distribution Annual Risk Tree.** Outage statistics indicate that trees are three times more likely to fall into electric lines from outside the right-of-way as compared to trees that grow into powerlines (Figure 9). Based on the Wildfire Plan recommendations, the Risk Tree Program has been re-tooled to inspect and mitigate 100% of our distribution system. In 2021 we worked with a satellite imaging consultant to obtain satellite images of Avista's 7,675 miles of overhead distribution system. This is now an annual program and Avista will continue to use satellite data when inspecting the distribution system.

In 2021 Avista completed vegetation-based inspections over the entire distribution system using both ground-based and satellite imagery. We remediated over 2,800 miles of risk tree work.

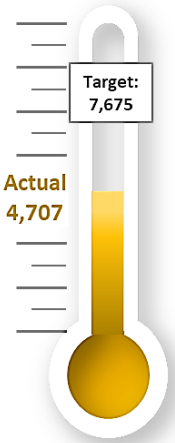
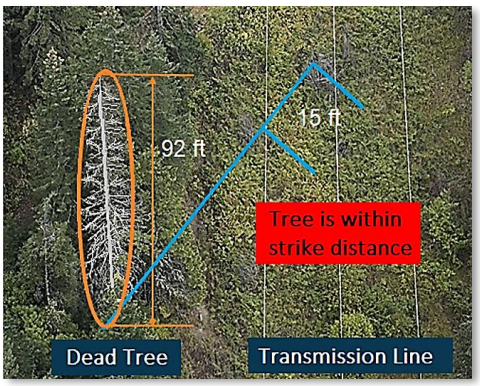



*Figure 10. Distribution Risk Tree Miles Patrolled*

**Transmission LiDAR Imaging.** Historically, Avista inspects transmission powerlines via ground and aerial patrols annually as mentioned earlier. As part of enhancing vegetation inspections related to wildfire risk, Avista added the additional layer of LiDAR data collection for the transmission grid to identify both vegetation encroachment and risk trees. LiDAR works well for transmission because most transmission lines have open linear rights-of-way like roads and railways. LiDAR data is generally collected via a fixed wing aircraft or helicopter. The survey grade data collected has sub-centimeter accuracy and when combined with high resolution photographs (see GeoDigital inset) provides vegetation planners with a very robust assessment of both encroachment and risk tree hazards. In 2020




*GeoDigital LiDAR image showing a dying tree outside the right-of-way that is still within strike zone of the conductor that will be mitigated.*

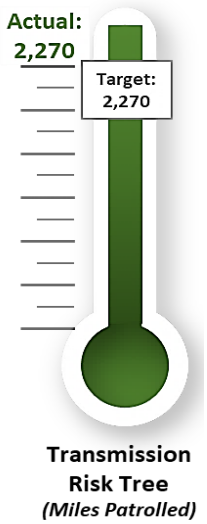



*Figure 11. Transmission Risk Tree Miles Patrolled*

and 2021, Avista collected LiDAR data on approximately 1,100 miles of transmission line and used ground-based methods only in heavily incorporated areas, patrolling 2,270 miles.

**Distribution Satellite Imaging.** For the Distribution system, Avista partnered with a satellite imaging company called AiDash. Satellite images will be taken in both the spring and the fall of each year. Though satellite-based data is not as precise as LiDAR, it is a much more effective tool for collecting data over a wide and often convoluted area such as the trunk and lateral configurations of most electric distribution systems. Satellite data is processed through machine learning algorithms to detect system changes over time. The advantage of this system-wide approach is that vegetation planners receiving 100% of the data at the same time, so field activities can be prioritized using a risk-based strategy rather than simply relying on cycle-based methods. In short, resources can be focused in the areas of highest risk.


*AiDash satellite technology can identify the height & health of trees as well as distance from a powerline.*

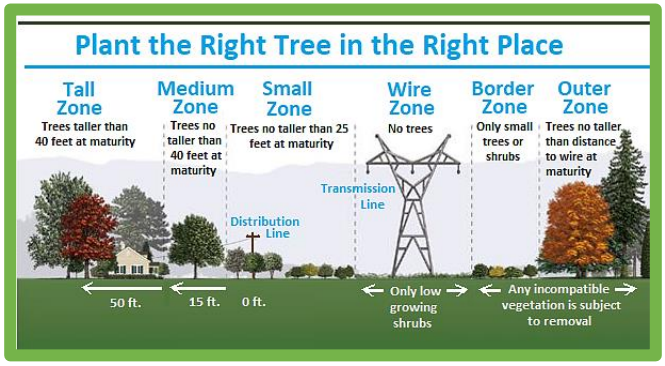
From a value proposition, using satellites is much more cost effective than either human-based or LiDAR inspections. Satellite collection costs are $70/mile compared to LiDAR at $400/mile and manual inspections for risk tree at about $150/mile. Using a blended approach of all methods seems to be the most practical solution given the differing characteristics of the transmission and distribution systems. Both the LiDAR and satellite images are taken on a regular basis and will indicate where vegetation risk exceeds both reliability and fire mitigation thresholds. Both tools provide valuable information regarding the location of vegetation encroachment and fall-in risks. This high-tech approach takes vegetation management to the next level. Rather than relying upon human inspections, the data collection is automated, highly accurate, and aided by computer-based artificial intelligence analytics. This helps vegetation planners make better informed decisions on the scope and extent of field treatments.

**AVISTA FUEL REDUCTION PARTNERSHIPS**

- Washington Department Natural Resources (DNR)
- Idaho Department of Lands (IDL)
- The Bureau of Land Management (BLM)
- The United States Forest Service (USFS)
- The Colville Confederated Tribes
- The Spokane Tribe
- The Coeur d' Alene Tribe
- The Nez Perce Tribe

**Fuel Reduction Partnerships.** We are actively engaged with several land management agencies to financially assist them with fuel reduction near our facilities. This includes mitigating dead trees on or adjacent to Avista owned facilities and corridors, thinning small diameter trees, and removing brush. As an example, the State of Idaho identified several communities

that Avista serves with overhead electrical service that they classify as communities at risk of wildfire. Some of these areas receive funding through state grants. For those that do not, are located near our facilities, and are in high risk fire zones, Avista can work with the State to help pay for fuels reduction to reduce the potential for spark events. While this benefits the customers in that area directly, it also will have a positive impact in developing additional partnerships in Idaho counties, which would ideally lead to partnerships with fire suppression and prevention agencies. Avista plans to work with state and federal agencies along with several tribal governments including those shown in the text box above on fuel reduction efforts. Current discussions are also underway with the Washington Department of Natural Resources.




**Customer Choice Right Tree Right Place.** Vegetation contacts with powerlines are a significant source of spark-ignition potential. In response, Avista is developing a new program called "Customer Choice - Right Tree Right Place." This program is designed to work proactively with customers in elevated fire risk areas who have tall-growing trees under or adjacent to our powerlines. Over the next few months, we will be piloting a program to contact these specifically identified customers with an offer to replace trees which are likely to fall into or grow into our lines with a low growing variety at no cost to the customer. We see a real win-win here as we protect our customers from a potential hazard situation or spark event, and also reduce the risk to the reliability of our system, with the added bonus of reducing the continuing need to mitigate trees that grow or fall into our lines over time. A pilot program will be in place in 2022.

## Risk Vegetation Management Summary

| *Enhanced Vegetation Mgmt. Program Status* | *Goal* | *2021 Actual* |
|---|---|---|
| Dist. Risk Tree Patrols (miles) | 7,685 | 5,245 |
| Dist. Risk Tree Mitigated (miles) | 2,500 | 2,815 |
| Trans. Risk Tree Patrols (miles) | 2,270 | 2,270 |
| Trans. Risk Tree Mitigated (#) | 1,288 | 1,362 |
| Corridor Treatment (acres) | 1,848 | 1,848 |
| Transmission LiDAR (miles) | 1,143 | 1,143 |
| Distribution Satellite (miles) | 7,675 | 7,675 |

*Table 3. Risk Vegetation Status 2021*

| *Enhanced Vegetation Mgmt. Related Outages* | *5-Yr. Ave. 2016-2020* | *2021 Actual* |
|---|---|---|
| Tree Fall-Ins | 285 | 363 |
| Tree Grow-Ins | 79 | 83 |

*Table 4. Risk Vegetation Related Events 2021*

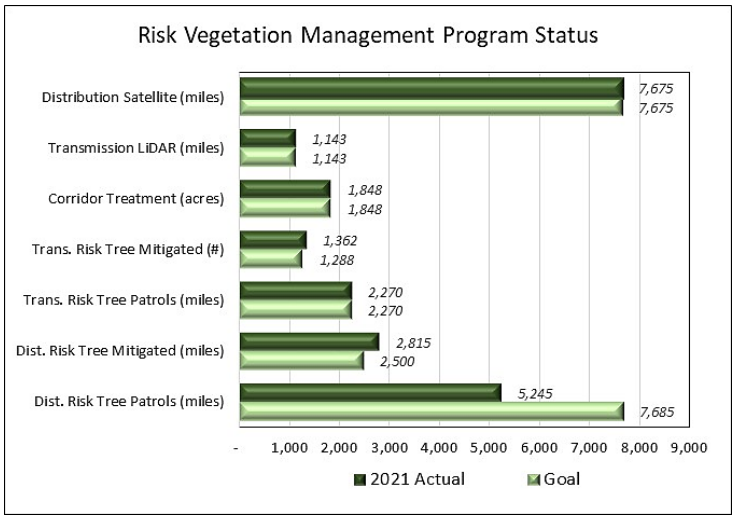



*Figure 12. Risk Vegetation Management Program Status 2021*

## Situational Awareness

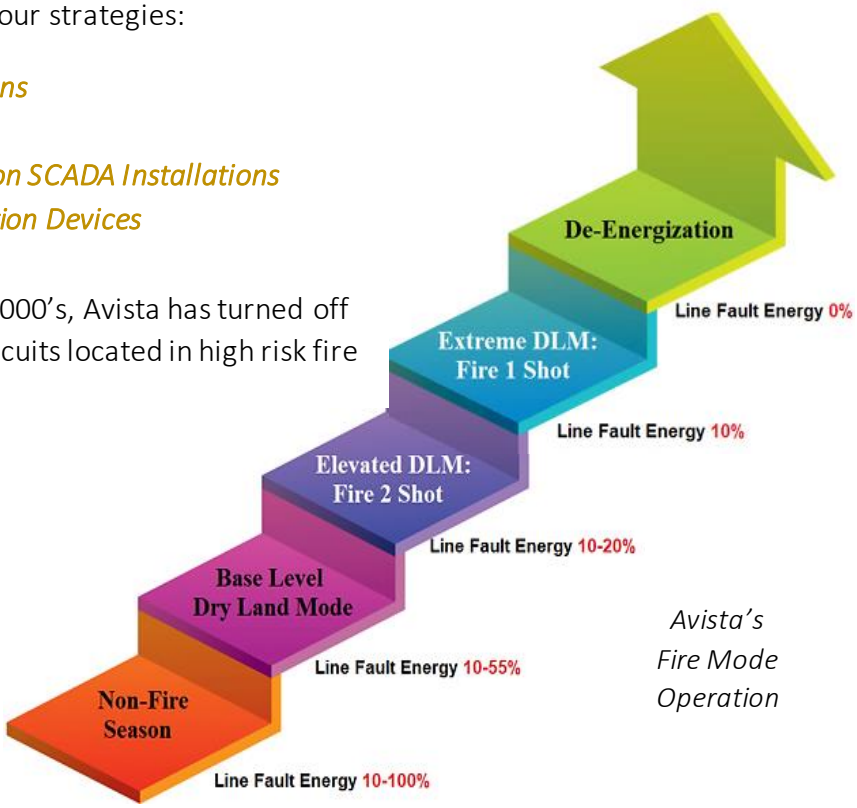
Avista's Situational Awareness strategies are designed to enable remote monitoring and control of equipment and to provide operating horizon risk analytics. Automation equipment provides "eyes" on critical infrastructure located in high risk areas. Many of Avista's circuit breakers do not support monitoring or control, which means they cannot be remotely operated and require manual intervention to make changes to settings or to identify an issue. This may take several hours depending on location and crew availability. In fire situations, delay is never a good thing.

The Wildfire Resiliency Plan plans to install modern circuit reclosers capable of remote monitoring and operation. This supports Avista's "Dry Land Mode Operations," which can reduce spark potential up to 90%. This program is informed by Avista's Wildfire Fire Weather Dashboard, a computer-based risk analysis system that combines elements of the 7-day National Weather Service forecast with metrics associated with infrastructure performance and underlying fire risk.

Situational Awareness encompasses four strategies:

- *Dry Land Mode Operations*
- *Fire Weather Dashboard*
- *Dry Land Mode Substation SCADA Installations*
- *Dry Land Mode Automation Devices*

**Dry Land Mode.** Since the early 2000's, Avista has turned off automatic reclosing on distribution circuits located in high risk fire prone areas. Historically, this has been a manual process of turning on the system at the beginning of fire season (typically early July) and then returning to normal operation at the end of fire season (usually early October). An important element of the Wildfire Resiliency Plan involves modernizing the system so that reclosers can support higher modes of protection. The ladder diagram illustrates this concept, with base level Dry Land Mode replacing the historic system. Fire modes show as levels above the base where spark ignition potential is significantly reduced to 10-20% (Fire 2 Shot) and then to 10% (Fire 1 Shot).




*Avista's Fire Mode Operation*

The 2020 Wildfire Plan recommends Dry land Mode with four levels of reclosing operations:

1) Non-Fire Season Mode –Normal operations where circuit breakers automatically reclose 2-3 times (or more) before locking out.
2) Base Level Dry Land Mode – If a circuit is set to this level, when it trips it waits a predetermined length of time then recloses to test the circuit. If it tests bad the second time it will stay off until manually inspected before being placed back in service.
3) Elevated Risk: Fire 2 Shot – When a circuit is placed at this level, when it trips off it will stay off if it tests bad. There is no time delay. This allows the circuit to close back in for temporary faults but de-energizes for permanent faults by tripping off the breaker.
4) Extreme Risk: Fire 1 Shot – Circuits considered in extreme danger are configured so if the circuit trips, it does not test or try to reclose. It stays off until it is inspected and released back into service.

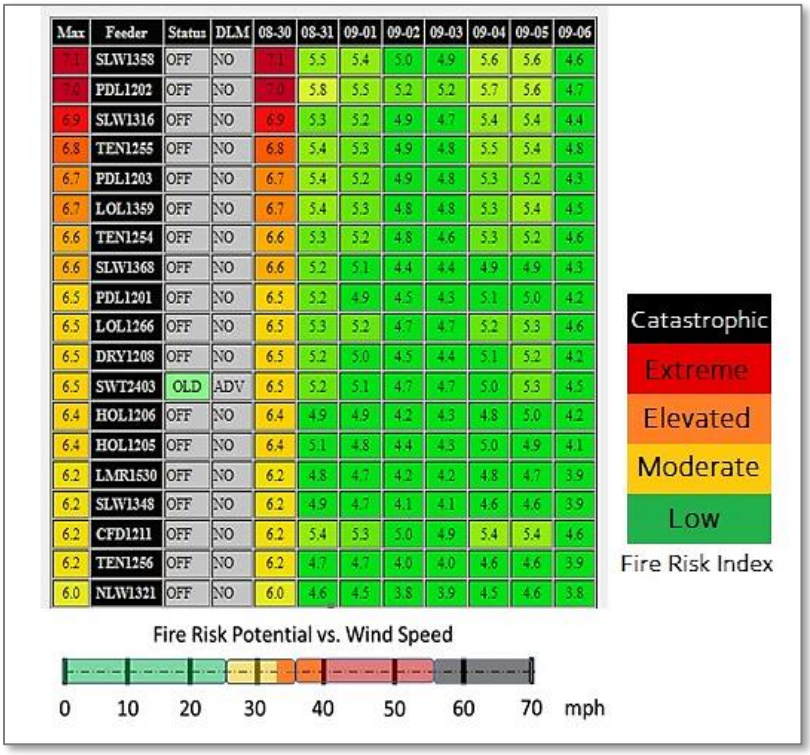
For extreme weather events exceeding Fire One Shot, the Company will selectively implement de-energization on feeders or sections of feeders as a measure of last resort, in coordination with our partners and first responders. This will only be done in a situation where there are no customer impacts or if no other mitigation actions are available, and when it is clear that the safety benefits exceed the cost of shutting off power. Avista has historically selectively de-energized circuits throughout our history based on a spectrum of criteria, primarily impacts to customer service and safety, or as requested by fire commanders, but is a measure of last resort. In 2021 we responded to eight separate fire incidents, opening fuses on our distribution facilities to protect firefighters. In addition, we also de-energized two transmission lines at the request of fire commanders last fire season.

Avista is not currently planning on implementing a formalized public safety power shutoff (PSPS) such as those that have been used in California, although this concept is not off the table. When administering protection using a PSPS, circuits are preemptively removed from service based on calculated level of fire risk. Circuits can be out of service for several hours to several days depending upon conditions. *The major difference between Dry Land Mode Operations and PSPS is that Dry Land circuits are only removed from service when an actual fault is experienced on the line, while PSPS circuits are proactively disconnected based on an assessment of risk.*

Implementing a PSPS is complex and multi-dimensional process. As we have learned from our contemporaries, it also has widespread ripple effects on customers, placing especially heavy burdens on vulnerable households with medical devices, those lacking transportation, or customers facing food insecurity. The risk calculation of initiating a PSPS must also account for the fact that restoration of service can take time, extending customer outage duration, because the de-energized system must be physically inspected for damage before being turned back on. Avista learned from the heat-related outages of last summer that customers simply do not understand outages based on projected risk or circumstances they cannot directly see and experience (such as a snowstorm or high winds), making PSPS outages especially hard for customers to accept and tolerate. Thus, the Company believes that the trade-off between a perceived and a real threat must be carefully considered.

**Fire Weather Dashboard.** Avista's Fire Weather Dashboard is a risk-based computer program that combines elements of the 7-day weather forecast with infrastructure performance and underlying fire risk metrics. The Dashboard provides high wind and fire risk alerts for each operating district as well as a system overview. It indicates the risk level for the upcoming week and highlights the maximum expected daily risk. It indicates the status of Dry Land Mode (DLM) equipment[14] and also indicates whether the circuit is enabled for Dry Land Mode operations. The dynamic approach offered by the Dashboard allows system operators to better understand timing and extent of the risk, providing notice for the Company to take action in order to mitigate potential spark-ignition events. It also includes fire mapping to track current fire paths, relationships to facilities and provides a historical record of fires and their impacts.

*The figure to the right is a sample of the dashboard from August 2021. It indicates several non-DLM circuits that were exhibiting high fire risk. In this particular situation, several urban circuits were indicating elevated fire risk. However, most urban circuits are not subject to DLM operation due to their short length, proximity to irrigated and hard-scape areas, and access to firefighting resources.*




*Avista's Fire Weather Dashboard showing the risk factors by day for each feeder*

2020 was the first year that Avista began running wildfire risk modeling. The initial structure was a linear scale model that addressed dynamic and static risk at the circuit level. Avista's Weather Dashboard and modeling was updated from its original form and function in 2021. The 2021 system incorporates more static and dynamic variables and was restructured into a logarithmic model. The change in modeling root mathematics allowed isolating the days of the year when we see truly catastrophic events versus those for which there is typically very little utility risk. Fire risk to utilities primarily exists during extreme weather events because strong wind speeds increase the likelihood of a utility-caused spark event exponentially, and at the same time exponentially increase the rate of fire spread depending on existing conditions. By looking at the risk in a non-linear fashion, it allows us to isolate the days of fire to a very

[14] As shown in the Dashboard screen shot, Base Level is often called "Old" because it is the original Dry Land Mode operation used for many years prior to the Wildfire additional DLM levels being added to operations.

small subset. This change should significantly decrease false alarm scenarios, increasing customer reliability while balancing risk to communities.

For 2022 we plan to continue to use this mathematical approach and will also revamp our variable inputs to improve accuracy. We are seeking options for more precise fuel moisture data and real-time dead-fuel analysis throughout our service territory. These changes should allow us to be even more accurate than before with minimal changes to the type of modeling we do. We are also going to incorporate real-time wind direction analysis. This will allow us to assess risk in the predominate wind direction of each hour of a forecast. By doing this, we should continue to narrow our focus to areas that will truly experience those risks during those forecasted times.

**Dry Land Mode Substation SCADA Installations.** Fifteen Avista substations are located in high fire threat districts and lack communications equipment. Another thirty substations require hardware upgrades to support a fully automated Dry Land Mode operating system. The St. Maries Substation (St. Maries, Idaho) is one of these stations lacking modern control and monitoring systems. In 2021 this substation was updated with SCADA electronics. We plan to modernize 4-5 substations per year, with the goal of forty-five stations capable of remote monitoring and control by 2030.

*Midline Recloser*

**Dry Land Mode Automation.** Avista has over 240 circuit reclosers (both midline and substation) that require upgraded hardware or software in order to be Dry Land Mode capable and able to aid in implementing wildfire protection measures. These 240 devices were selected based on the downstream WUI tier zones that are served (Tiers 2 and 3 were mandated by the Program, while some Tier 1 were also included based on historical events). 101 of the 240 circuit reclosers are modern units and will support automated Dry Land Mode but require software upgrades. To date, 65 of those units have been upgraded. All of the 101 units will be upgraded by the start of the 2022 fire season.

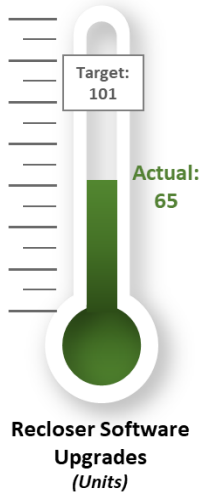



*Figure 13. Circuit Recloser Upgrades*

There are also 129 substation breakers that serve downstream WUI 2 or 3 zones. This includes about 51 midline and substation breakers already deployed in elevated fire threat areas that must be upgraded with new dynamic protection settings (we call these "Fire Mode Ready"

*Substation work being completed at the St. Maries Substation*

devices) in order to operate during fire season automatically and remotely. Remaining units both on the distribution grid (e.g. midline devices) and those located in substations require some level of hardware upgrades such as recloser replacement and/or upgrades to electronics up to and including major installations, such as SCADA monitoring systems. Upgrading these units is a significant project and is expected to run the term of the Wildfire Resiliency Plan.

Automating these devices allows operators to remotely reconfigure protection settings and implement the Fire 2 and Fire 1 shot modes. This represents the **state of the art** with respect to electric distribution operations to mitigate the risk of fire combustion.

## Situational Awareness Summary

| Situational Awareness | Goal | Actual |
|---|---|---|
| Dry Land Mode Fire Ready Design (units) | 101 | 65 |
| Dry Land Mode Fire Ready Design (units) | 10 | 9 |
| Substation SCADA Upgrades | 1 | 1 |

*Table 5. Situational Awareness Program Status 2021*

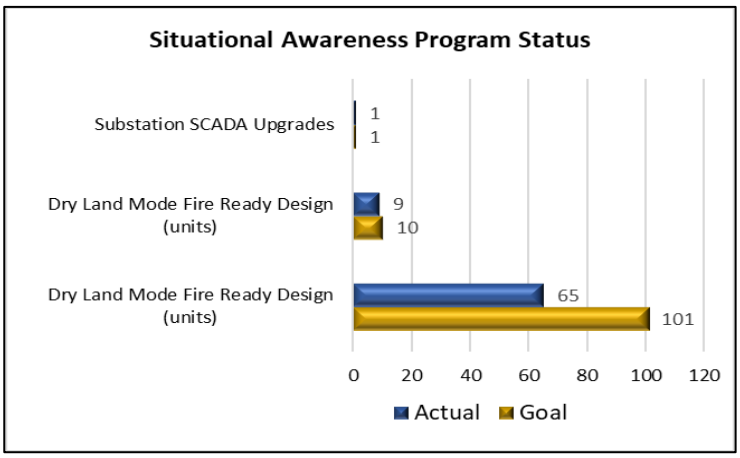
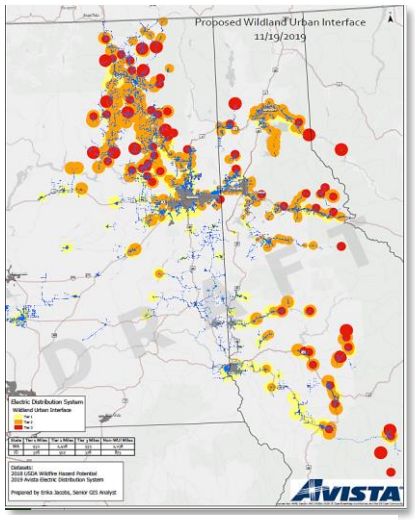



*Figure 14. Situational Awareness Program Status 2021*

## Operations & Emergency Response

This part of the Plan encompasses both internal and external resources with a goal of reacting to wildfire threat in a thoughtful and proactive manner. This program has a number of elements:

- *Wildland Urban Interface Maps*
- *Weekly Fire Threat Assessment Meetings*
- *Formalized Wildfire Emergency Operating Plan & Procedures (EOP)*
- *Wildfire Performance Metrics*
- *Emergency First Responder Training*
- *Expedited Fire Response*
- *Fire Ignition Tracking System*




*Avista's 2019 Wildland Urban Interface (WUI) Risk Map*

**Wildland Urban Interface (WUI).** The interface area between forest lands and human development is referred to as Wildland Urban Interface (WUI). Homes and businesses located WUI zones are most at-risk from the impact of wildfires and are often located in rural areas lacking adequate fire suppression resources. The WUI map helps to identify and prioritize areas of greatest risk and serves to inform the recommendations and operational

decisions related to wildfire resiliency. Using this map, we can target our programs where they have the potential to reduce the most risk and have the greatest positive impact in the safety and protection of our customers and our infrastructure.

In 2019, Avista's GIS Technical Group created a WUI map for the electric service territory based on the following principles:

- Fuel Concentration – Areas identified as having moderate to high fuel concentrations were considered. Fuels data was derived from the U.S. Department of Agriculture's Wildfire Hazard Potential map.[15]
- Housing Density – Parcels smaller than 20 acres were included in the analysis, but highly-developed, incorporated urban areas were excluded.[16]

The WUI map helps to identify and prioritize areas of greatest risk and serves to inform the recommendations and operational decisions related to wildfire resiliency. Avista has delegated four primary risk tiers (see WUI map on previous page): Low (0-not colored), Moderate (1-yellow), Elevated (2-orange), and Extreme (3-red). The 2020 Wildfire Plan declares the combination of WUI Risk Tiers 2 & 3 as "elevated fire threat areas." These areas comprise approximately 40% of Avista's electric distribution and 20% of transmission lines. Portions of the WUI map that are not highlighted are classified as Non-WUI areas and represent areas with low fuel concentrations, very low housing densities, or are large urban areas (> 10,000 population).

Avista's original Wildland Urban Interface tiers worked with Wildland Hazard Potential[17] data to assign potential for wildfire severity in conjunction with population density data. The original data did not reflect the potential impact to communities as well as newly available data does. Because of this, we are currently working on a revision to our wildfire risk tiers.

The new wildfire risk tiers will incorporate data from the USDA and U.S. Forest Service called the "Wildfire Risk to Communities Housing Unit Impact Data."[18] This data reflects the potential for housing to be impacted by a wildfire. This third-party data appears to adequately summarize the potential for loss of structures. This better meets Avista's wildfire goals, as we intend to work towards a static risk map that sufficiently considers the impact to communities in and around our service territory. We have also incorporated wind direction data to better understand the everyday risks near our facilities in each direction.

---

[15] "Wildfire Hazard Potential for the United States," https://www.firelab.org/project/wildfire-hazard-potential

[16] Urban areas do not meet the definition of Wildland Urban Interface because fuel canopies are interspersed with hard-scape non-burnable areas, and in most cases, professional fire protection is available.

[17] Dillion, Greg. "Wildfire Hazard Potential." Wildfire Hazard Potential | Missoula Fire Sciences Laboratory, https://www.firelab.org/project/wildfire-hazard-potential.

[18] Scott, Joe H.; Brough, April M.; Gilbertson-Day, Julie W.; Dillon, Gregory K.; Moran, Christopher. 2020. Wildfire Risk to Communities: Spatial datasets of wildfire risk for populated areas in the United States. Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2020-0060

The wind direction and Housing Unit Impact data is then added to feeder outages as well as vegetation and feeder health data to calculate the probability of a fault that may lead to a spark event. Finally, we consider the location of the feeder related to burnable/non-burnable areas to assess the ignition potential of an electric facility. This new map should give us better insight into risk locations at a more granular level, allowing us to better understand the transformation of wildfire risk across our electric system.

**Weekly Fire Threat Assessment Meetings.** During the 2021 fire season, Avista convened weekly fire risk meetings to provide information and gather feedback from operations managers and other internal stakeholders. Approximately 75 people were invited to these calls including district managers, corporate communications, system and distribution operations, line operations staff, claims/legal, together with fire managers from the Washington Department of Natural Resources (WA DNR) and the Idaho Department of Lands (IDL). These meetings were highly interactive and allowed Avista district managers to report on fires in their operating districts including impacts to infrastructure.

In 2022, Avista plans to formalize the process for escalating from Base Level Dry Land Mode (non-reclosing) to the higher levels of Fire Mode protection associated with Fire 2 and Fire 1 Shot modes. This represents a marked departure from a reliability-based model and will help managers and system operators shift towards a safety-first model. As noted, this is a vitally important element of Avista's wildfire plan. These weekly meetings will be the forum for discussing appropriate levels of protection.

*Working in close partnership many parties proved to be incredibly useful, as evidenced by the Idaho Department of Lands helping Avista crews pinpoint areas for pole wraps on the Noxon-Pinecreek transmission line threated by the Character Complex Fire.*

**Formalized Wildfire Emergency Operations Planning and Procedures.** In 2021 the Wildfire team held regular meetings and developed initial policies for working with outside agencies and internal stakeholders during wildfire events. In 2022 the Wildfire Team will formalize the Emergency Operations Procedures (EOP) similar to those that exist for storm situations but specific to issues related to wildfire. The goal is to formalize the internal and external processes and develop a consistent approach going forward. This includes defining key roles and responsibilities for personnel, identifying communications channels, and developing strategies for engaging with fire protection professional and emergency operating agency staff. *In Washington and Idaho, responses to fires larger than 100 acres triggers a Fire Incident Command Structure (ICS). Avista remains committed to embedding Avista personnel with Fire ICS to serve as the primary point of contact.*

WILDFIRE METRICS INCLUDE:

- Tree Fall-Ins
- Tree Grow-Ins
- Pole Fires
- Overhead Equipment Failures
- Spark Ignition Events
- Transmission Steel Pole Conversions
- Transmission Fire Resistant Pole Wraps Installed
- Miles of Distribution Grid Hardening
- Number of Dry Land Mode Automation Devices Installed
- Risk Tree Miles Patrolled
- Number of Risk Trees Identified/Mitigated
- Acres of Transmission Corridors Cleared
- Miles of LiDAR Imaging Completed
- Miles of Satellite Imaging Completed

**Wildfire Performance Metrics.** A vital element of the Wildfire Plan is to collect data related to wildfire investments, system performance and fire events. This includes tracking a variety of data, statistics, and achievements related to programs. For example, a declining number of tree related outages will prove the benefits of the Risk-Based Vegetation Management program. We're also tracking overhead equipment outages and pole fires, as these will be positively impacted by grid hardening investments. Most of the benefits of the Wildfire programs will not show up immediately. It takes time for long-term projects such as vegetation management and grid hardening to have a measurable impact on the system. With some metrics it is difficult to judge the overall impact, as it is based upon how many events may have been avoided. Much like putting snow tires on your car, you know it is a good idea and increases your safety, but you do not know how many accidents you avoided by making that choice.

Avista places a strong emphasis on data collection as a means of tracking the progress and success of our programs and will continue to refine the data collected and collection methods over time.

**First Responder Training.** Another element of the Wildfire Plan is to partner directly with fire protection agencies and to cross-train personnel so that Avista first-responders understand fire incident command structures and their role during an active event and, in turn, fire professionals understand the hazards associated with electric operations.

When COVID restrictions are lifted and it is possible for in-person events, Avista plans to conduct joint training exercises with fire agencies across our service territory. Fire professionals will train Avista first responders (typically line crews and servicemen) in basic fire safety, and our utility professionals will train fire crews about working safely near powerline equipment. This program is designed to help ensure the safety of everyone involved in a wildfire situation. It also strengthens the partnerships and relationships the Company has developed with the fire protection community.

**Expedited Fire Response.** In 2020, a Memorandum of Understanding was executed with the Spokane County Fire Department which included the dispatch of fire patrol personnel to transmission-level outage locations during fire season. This was a pilot program with Spokane County intended to be extended to other counties. However, COVID has made it difficult to hold in person meetings to discuss this program and has diverted attention away from fully executing this plan element. Regardless we are moving forward in developing relationships and contacts with fire agencies within our service territory, building the foundation needed to move this program forward. Avista recognizes and applauds the willingness of fire protection agencies to work with us to prevent and mitigate wildfires. Face to face meetings with fire professionals has shaped Avista's Wildfire Resiliency Plan from the outset and these professionals continue to be instrumental in our Plan.

**Fire Ignition Tracking System.** Avista's Outage Management System (OMS) is used to track electric outages including causation information such as: tree fall-ins, car-hit-poles, wind, animal, underground cable, overhead equipment, pole fires, etc. Fire is listed as an outage category, but

generally relates to structure fires and is not typically related to Avista equipment.[19] The OMS was designed to record actual events based upon cause, not impact, with the goal of repairing or replacing equipment that has or could lead to an outage. Currently we can use the OMS dataset to capture spark-ignition and fire events by searching the text strings of Dispatcher comments. Going forward we plan to develop on a more formalized way of capturing spark events from the dataset. This may require software or equipment upgrades. The current outage management system is essentially frozen (no major changes) until it is replaced with a commercial off the shelf system which is expected to occur within the next five years.

## Operations & Emergency Response Summary

These programs do not have defined budget amounts as they are primarily relationship-based and/or part of staff routine workload.

# 2021 Fire Season - "Lessons Learned"

**Automated Dry Land Mode**. This has been a cultural change because it can have impacts to service reliability. Historically, the system has been used in a binary fashion, turned on in July when fire season traditionally begins and then back off in October when it ends. Avista is moving ahead with plans to automate our fire season with Dry Land Mode (DLM) operations, which is a multi-faceted operation versus simply on or off. Approximately half of Avista's distribution system is impacted by DLM. We now have capacity to use two additional fire modes (Fire 2 and Fire 1 Shot) which significantly reduces fire risk potential but also puts customers at greater risk for service disruptions due to the potential for extended duration of the outage (12-36 hours or more). Our people are trained to maintain reliability at all costs, so there have been some challenges moving to this new strategy. Garnering internal support for using these fire modes requires careful change management. In 2021, we convened a weekly fire status meeting, and the ensuing discussions helped lay the groundwork for implementing these fire modes in the 2022 season.

Through these discussions we are learning the critical aspects of balancing reliability with safety but also that crew availability is a significant factor, as these new Dry Land Mode steps require manual inspections for every circuit impacted. As we go forward with the new Dry Land Mode operations and elevate our system protections, we will learn and adjust to ensure that this balance of reliability and safety is maintained and honed with experience.

[19] Structure fires often require Avista to respond and turn off the power at the meter to protect firefighters, thus "fire" may be noted in the comments.

**2022 WUI Map "Refresh".** We are in the process of updating the WUI model for 2022. In this analysis, we intend to use the USDA Housing Unit Impact[20] dataset along with outage performance (ignition probability). This will provide a much more tractable solution than the 2019 WUI model. This updated WUI will then inform the target areas for distribution grid hardening starting in 2023.

**Transmission Steel Pole Conversion Prioritization**. Metrics indicate that electric transmission assets are vulnerable to the impact of fire but are generally not a significant driver of fire ignition events.[21] The 2020 Wildfire Plan identified 20% of the transmission system as located in Wildland Urban Interface Tiers 2 and 3 (elevated and extreme). Starting in 2023, we will transition from the WUI model to including a fire history model. This will help us readily identify those segments of transmission lines most threatened by wildfire with more accuracy, enabling us to prioritize replacement based on risk.

**Partnerships are Key.** Internal and external partners have been the key to our Wildfire Plan from the beginning, including fire protection experts, engineering consultants, federal agencies, peer utilities, and material suppliers, in addition to city, county, state, and tribal governments and state utility commissions. As Avista began developing the Wildfire strategy, we hosted a series of workshops that included Avista personnel as well as a variety of external experts including other utilities, the Washington Department of Natural Resources and the Idaho Department of Lands, regional fire professionals, the U.S. Forest Service, Commission staff, emergency managers, service and data analytics providers, University of Idaho experts, weather services, and utility institutes such as the Western Energy Institute and Edison Electric Institute, among others, to ensure that our Plan was as thorough and realistic as possible. We have built on this expertise and continued to rely on it during Plan implementation.

**Digital Data Value.** Avista partnered with aerial LIDAR (GeoDigital) and satellite imagery providers (AiDASH) to quantify the vegetation encroachment and fall-in risk for both transmission and distribution systems. This is a valuable addition to manual inspection methods, providing data and analytics across the system. We believe that this is the future of vegetation inspection, combining a high level of accuracy, speed of data collection, and ability to use the data in other areas of the Company, a benefit we are only beginning to explore.

**Fire Mesh Can Be Installed on an Emergency Basis.** Our fire mesh installation team and project managers have developed a high level of speed and efficiency as well as rapid deployment skills. This past summer as a rapidly spreading wildfire headed toward our Cabinet-Noxon 230 kV line, the Wildfire Program Specialist joined with Avista's Transmission Mesh Wrap Project Managers and the Idaho Department of Lands fire crews to determine where and when the fire might impact our line.

[20] https://www.fs.usda.gov/rmrs/datasets/wildfire-risk-communities-spatial-datasets-wildfire-risk-populated-areas-united-states
[21] From 2009 to 2020 the Company experienced 5 individual spark events on the Transmission System.

Working in partnership, the group deployed the mesh wrap crew ahead of the fire to protect these structures. The ability to rapidly deploy this protective mechanism adds to our skills and ability to protect our infrastructure as it is needed.

**Resource Constraints.** Most western state utilities are engaged in some form of wildfire mitigation and many of them have increased their use of line contractors for system hardening and vegetation management. Getting contractors on-board has been a challenge and is amplified during and after storm situations. Avista is committed to building strong relationships with our line contractor partners. In 2022 we plan to employ 8-10 construction line contractors on distribution grid hardening as compared to the 3-5 used during the 2021 season. Conversely, we plan to employ 30 vegetation crews in 2022 as compared to 24 in 2021. At least ten of these crews will be assigned to Risk Tree work versus the 5 we had available for this work in 2021. We will add more hand crews or mechanized options to increase capacity if warranted (and available).

# Appendix A: Current and Future Program Summary

| Infrastructure Grid Hardening | | | |
|---|---|---|---|
| Plan Element | Current State | Future State | Benefits |
| Transmission Fire Retardant (FR) Program | Fire resistant pole paint program, replaced every 3-5 years | Genic Fire-Mesh wrap with 20-year expected life | Will reduce operating expense to maintain fire protection of transmission wood poles |
| Transmission Line Inspection | Aerial and ground surveys to identify structure defects (reliability based) | Additional aerial and ground inspections via LiDAR to identify defects (fire risk based) | Reduce transmission fire ignition events which, though less likely than distribution sourced fires, are generally larger |
| Transmission Steel Pole Replacement | Based on WUI model (20% system total) | Based on historic fire data | Reduce likelihood of damage to Avista transmission assets. 20% of Avista's transmission assets are located in elevated fire threat areas |
| Distribution Grid Hardening | Restricted to WUI Tier 2 and 3 of the 2019 WUI map | Transition to the 2022 WUI map starting in 2023. | Reduce the probability of distribution fire ignition in high fire threat districts. |

| Risk-Based Vegetation Management | | | |
|---|---|---|---|
| Plan Element | Current State | Future State | Benefits |
| Digital Data Collection | Human based ground and aerial inspections | Satellite inspections with computer-based analysis to identify vegetation encroachment and tree fall-in risks | Allows for scenario-planning of treatment options and serves as the QA tool to assess the efficacy of previous field work |
| Fuel Reduction Partnerships | No program | Partnering with state and tribal agencies to remove fuels near critical infrastructure | Strengthens relationships between Avista and fire first responders and reduces fire severity threats to infrastructure |
| 100% Annual Risk Tree | Combined with routine maintenance (5-year cycle) | System-wide effort to annually identify and remove dead, dying, diseased or structurally defective trees | Reduce tree fall-ins, which are 3 times more likely to occur than grow-ins |
| Customer Choice Right Tree, Right Place | No program | Engage with customers in high fire risk areas to remove tall growing trees underneath powerlines | Reduces the risk of tree grow-ins and subsequent spark-ignition sources |

| Situational Awareness | | | |
|---|---|---|---|
| Plan Element | Current State | Future State | Benefits |
| Fire-Weather Risk Monitoring System (Dashboard) | Weather forecast data subject to individual interpretation (prior to 2020 fire season) | By combing weather forecast and fire threat condition data, operating personnel now have clear guidance relative to the likelihood and potential impact of fires | Promotes a more consistent and data-focused approach for decision makers |
| Additional Distribution Circuit Reclosers | Condition based replacements | Combined with the overall project to fully automate Avista DLM system | Supports Fire Mode operations that significantly reduce the risk of spark-ignition |
| Substation Supervisory Control & Data Acquisition (SCADA) | Condition based | Combined with the overall project to fully automate Avista DLM system | Supports Fire Mode operations that significantly reduce the risk of spark-ignition |
| Dry Land Operating Mode (DLM) | Seasonal implementation (single mode) | DLM mode based on fire risk level, a dynamic, risk-based system | Improves fire safety margins during periods of elevated fire risk |

| Emergency Operations and Response | | | |
|---|---|---|---|
| Plan Element | Current State | Future State | Benefits |
| Fire specific Emergency Operating Procedures | No formal wildfire policy | Avista Wildfire-specific EOP to delineate wildfires from other storm events. | Improved coordination with fire protection and other emergency first responders |
| Avista representative assigned to Fire Protection Incident command | Adhoc policy | A commitment to involve Avista personnel in 100% of Fire Incident Command meetings | Improved coordination with fire protection and other emergency first responders |
| Wildfire Performance Metrics | General outage related metrics | Develop fire-specific performance metrics and ensure that Plan objectives are being met | Supports the evolution of the Resiliency Plan to align with future operating and environmental conditions |
| Wildland Urban Interface (WUI) Map | WUI 2019 based on USDA Fuels Model (wildfire hazard potential) | WUI 2022 based on USDA housing unit impact dataset and Avista electric system performance data. | Provides a more direct and tractable WUI map |
| Emergency First Responder Training | No formal program | Annual fire safety training for Avista field personnel and electrical hazard training to fire protection personnel | Promotes safety of first responders and supports a variety of partnering activities including fuel reduction and fire adapted communities |
| Expedited Fire Response | Spokane County pilot projects in 2020 and 2021 | Expand expedited response to other jurisdictions | Suppress electric transmission line fires before they can spread |