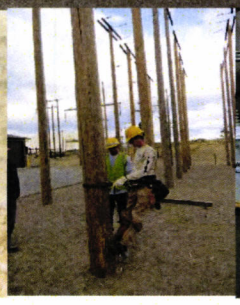
Attachment B

Avista Utilities
Wildfire Risk Analysis Summary
Actions under Consideration
September 2019



David James, Wildfire Resiliency Plan Mgr.

September 2019

Report Summary

In June of 2019, a series of wildfire workshops were convened to evaluate opportunities to **reduce the risk of wildfire** associated with Avista's transmission and distribution systems. Those workshops together with consideration from the Wildfire Steering Committee and the broader Wildfire SME community serve to inform "**Avista's Wildfire Resiliency Plan**". This document is a summary of the effort to date and includes preliminary recommendations for systems & practices along with modifications to existing maintenance & construction programs. The stated goals of the Wildfire Resiliency Plan are:

- **Enhance Emergency Operation Preparedness**: to recognize wildfire as a recurring threat to utility infrastructure, the communities we serve, and our customers.
- **Promote Safety**: to protect physical assets, property, and human lives. To manage the risk of wildfire through design-based, system operations, asset maintenance, and outreach activities.
- **Safeguard Company Assets**: to mitigate the impact of direct financial costs and liability exposure associated with large-scale wildfire events.

In addition to these objectives, a model-framework was identified to promote a comprehensive approach to wildfire risk. The elements of the model include:

Planning	System Operations & Maintenance	Weather & Fire Risk Monitoring	Regulatory & Industry
EOP Response	System Hardening	Situational Awareness	Utility Industry Engagement
Insurance Review	Vegetation Management	Performance Metrics	Partnering with Fire Protection Agencies
Risk Monitoring	Fire Resiliency "Ops Toolkit"		Legislative Opportunities
Communications Plan & Outreach			Commission Engagement

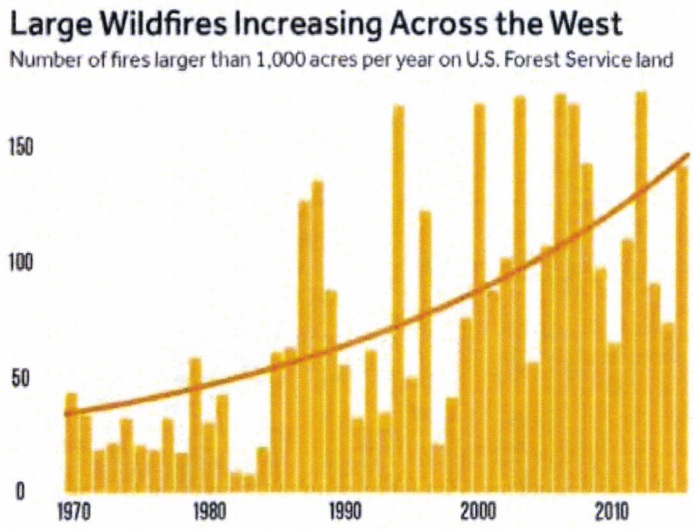
Plan Elements addressed in this report

The table below summarizes the risk cost reduction (risk savings) associated with transmission and distribution treatment options. A detailed listing is included in the report. Be advised, the risk savings and cost estimates are shown as 10 year costs. Most actions are recurring.

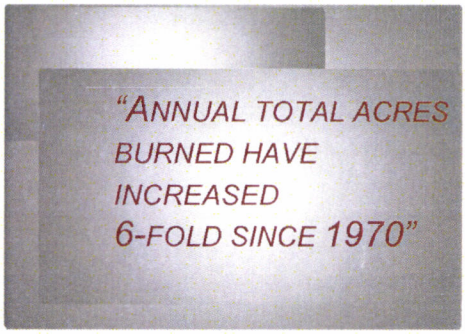
Electric Transmission	**10 Yr. Risk Cost Savings ($M's)**		**10 Yr. Cost Est.**
	Low	High	Implement
Base	8	23	$0.35M
Primary	27	40	$26.5M
Secondary	8	64	$55M
Future	20	112	$126M
Electric Distribution	**10 Yr. Risk Cost Savings ($M's)**		**10 Yr. Cost Est.**
	Low	High	Implement
Base	217	1,332	$1.1M
Primary	3,144	5,667	$31.1M
Secondary	4,131	8,826	192.5M
Future	3,187	6,904	$1,369M

Wildfire Threat Increasing in the Western States

The number of large wildland fires continues to trend upward. Data from Climate Central's 2016 Western Wildfire Report suggests a 3-fold increase in large fires since 1970 and is particularly acute in several states including Wyoming, Idaho, and Montana where a 10-fold increase has occurred. In terms of total acres burned, there has been a 6-fold increase since the 1970's. Both the frequency and scope of wildfires are on the rise.



2016 Climate Central - Western Wildfires



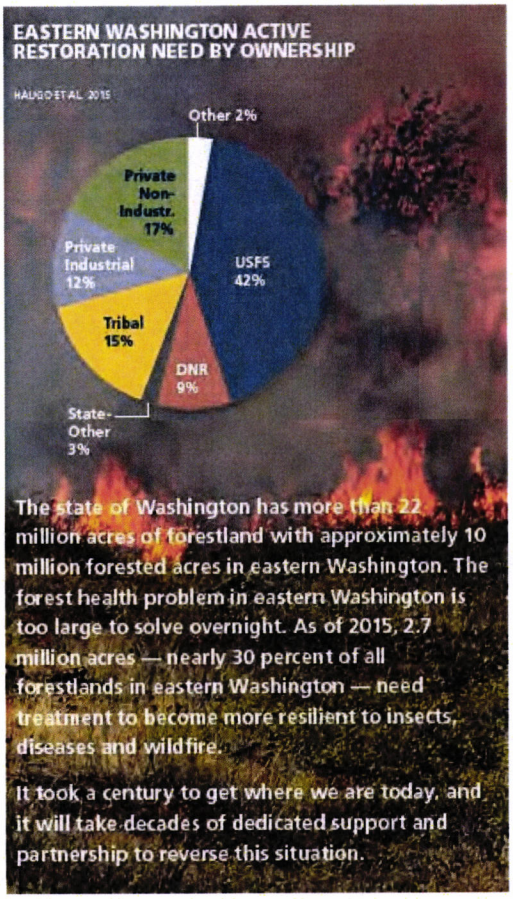
Rank	State	More High Wildfire Potential Days
1	Arizona	34
2	California	24
3	New Mexico	23
4	Utah	23
5	Nevada	20
6	Washington	18
7	Oregon	17
8	Idaho	15
9	Wyoming	8
10	Montana	6

Information from the 2016 Western Wildfires report also indicates that the number of days associated "*High Fire Danger*" or "*Red Flag*" is increasing. Though southwestern states are most at-risk, note that Washington and Idaho are ranked in the top ten. This increases the probability of fire starts and elevates the overall risk of fire impact.

Washington State Responds to Wildfire

In Washington State, the Department of Natural Resources (DNR) takes the lead on most large wildland fires outside of federal lands. In 2015, the DNR published a 20-year "Forest Health & Strategic Plan" for Central and Eastern Washington and identified 2.7 million acres (30%) as 'unhealthy forest'. In these areas, fuel loading and drought conditions have resulted in forests most at risk of catastrophic wildfire.

Treatment plans include, commercial logging activities, thinning, prescribed burning, and re-planting with native species.



2015 DNR 20-Year Forest Health Strategic Plan

An acronym has emerged in the fire vernacular to describe the interaction between forest land and human development: ***Wildland-Urban Interface*** *(WUI). Homes built in or near forest lands add to the costs of fire suppression. In Washington alone, 2.2 million homes are located in WUI areas (Washington DNR, 2018). Avista's fire resiliency plan will focus attention and treatment in these WUI areas.*

Reading this Report

The SME workshops and subsequent analysis has focused on understanding the risk exposure of wildfires in general, but also the opportunity to reduce risk through specific actions. Risk is quantified as the probability an event occurring times the financial impact of the event. (*Risk = Probability X Impact*) In this report, impact is characterized as the sum of:

1) Direct Financial Cost (replacement costs, fire suppression, 1st party damages) +
2) Customer (interruption cost estimate (ICE), 3rd party claims) +
3) Safety (public and employee injuries)

For example, if one considers the risk exposure associated with using fire retardant paint on wood transmission poles, the probability of a wildfire impacting a transmission line is generally 1-2 times per year. (*Probability of Occurrence = 1-2/year)*

The impact costs including the cost of replacement, fire suppression, public and worker safety, and customer disruption ranges between $961,000 and $1,378,000 per event. This translates into an accumulated **10-year inherent risk** value ranging from $9,610,000 to $27,560,000.

Inherent risk indicates the risk exposure before treatment.

Now consider what happens if fire retardant paint is used. In this scenario, the probability of occurrence remains unchanged (1-2/year) but the 10-year **managed risk** ranges between $4,285,000 and $4,830,000. The risk reduction or 'risk savings' is the difference between inherent and managed risk. This report includes both inherent and managed risk costs together with the treatment implementation costs. Again, all costs are indicated as 10-year accumulated amounts and are order of magnitude estimates. For the fire retardant (FR) paint example, the table on page 7 indicates:

	Inherent Risk ($M)		Managed Risk ($M)		Implement
Description	**Low**	**High**	**Low**	**High**	**10-year**
Wood Pole Fire Retardant	9.6	28	4.3	4.8	$2.5M

In the body of this report, proposed treatment actions are identified and grouped as:

- **Base Level** – efforts that support or enable other actions; or standalone actions that can be readily incorporated by the organization.
- **Primary** – actions that represent significant value (risk reduction) and are recognized as industry best-practices.
- **Secondary** – actions that represent the highest risk value but require significant human and or financial commitments.
- **Future** – identified as providing value but of lower priority and therefore, not considered in the initial phase of the Wildfire Resiliency Plan.

Electric Transmission

In 2006, Avista adopted tubular steel poles as the 'standard installation' for 115 and 230 kV powerlines. Approximately 30% of Avista's transmission system is now steel and as circuits are reconstructed and poles replaced, that percentage will continue to increase. In 2009, NERC published the "*Transmission Vegetation Management*" standard FAC-003-2 which fundamentally reshaped the industry's approach to transmission line clearance activities. For Avista, the combination of system hardening and well maintained rights-of-way have increased the fire resiliency of the transmission system.

June 2019 WW-Wanapum Fire

Transmission fire ignition events are rare. From 2014 to 2018 there were 611 sustained outages but only 252 between May and September (fire season). However, there were over 3,000 momentary outages and nearly half of those (1,500) occurred during fire season. Eighty percent (80%) of transmission line faults are momentary (less than 5 minutes) and are generally the result of lightning, wind, and planned switching operations. Conversely, the impact of fire to transmission structures can be significant. The replacement cost of a single wood transmission structure ranges from $7,500 to over $25,000 and damages to conductor can escalate into the millions of dollars.

Transmission

2006 – Avista adopts steel structures as standard construction

2009 – NERC Vegetation Management Standards

2014-2018 System Performance

622 Sustained outages
3,000 Momentary outages

18 Tree Fall-In Incidents
59 Wind Related
89 Pole Fire (distribution underbuild ignitions)

2019 WW-Wanapum Fire Damage, $1.2M

Base Level Actions (transmission system)

	Inherent Risk ($M)		Managed Risk ($M)		Implement
Description	**Low**	**High**	**Low**	**High**	**10-year**
EOP & Fire ICS	9.6	17.7	9.6	17.6	$50k
Fire Weather Dashboard	4.8	8.8	4.3	4.8	$50k
Engineering Review Post Major Event	1.0	6.9	0.9	2.4	$100k
Wildfire Compliance Tracking	9.6	18	2.2	2.7	$150k
Total	**25**	**51**	**17**	**28**	**250k OpX 100k CapX**

1. EOP and Fire ICS- fire events are distinct from other storm-outage scenarios and Avista's Emergency Operating Plan (EOP) should reflect that reality. In most fire situations, outage restoration should be **secondary to employee and public safety**. Restoring power in an active fire area may expose line personnel to unnecessary risks and draw evacuated residents back into homes and businesses. Also, there is broad consensus that Avista should have a **representative in all fire ICS situations**. The representative would serve as the liaison between fire command and utility personnel such as system operations, distribution dispatch, electric operations, and engineering. The division operations manager would serve in this capacity or delegate a staff member.

2. Fire Weather Dashboard- situational awareness is vital to decision making; especially in operations control rooms or emergency operations environments. Weather data is readily available in the public domain as is fire condition information. There is strong consensus that these **public information streams should be combined** to support decision making including public safety power shutoff (PSPS). Though PSPS is recognized as a 'deferred action', actions included in the resiliency plan will support a future deployment.

3. Engineering Review Post Major Event – transmission engineering requests time to conduct damage assessment following a significant event. The **EOP should include a 24-48 hour stand-down period** allowing engineering staff to determine the appropriate scope of reconstruction.

4. Wildfire Compliance Tracking – in order to monitor and measure the effectiveness of the Wildfire Resiliency Plan, the Committee recommends metric monitoring similar to NERC/CIP. This system would provide a clear record of performance and track modifications to the program.

Primary Actions (transmission system)

	Inherent Risk ($M)		Managed Risk ($M)		Implement
Description	**Low**	**High**	**Low**	**High**	**10-year**
Digital Data Collection	9.6	17.7	0.9	2.4	$7.5M
Wood Pole Fire Retardant	9.6	28	4.3	4.8	$2.5M
Fuel Reduction	15	29	3.0	29	$15M
1st Responder Training	1.8	2.3	0.3	0.9	$1.5M
Total	**36**	**77**	**9**	**37**	**$26.5M OpX**

1. Digital Data Collection – Laser Detection & Ranging (LIDAR) is widely recognized as an **industry best practice** and provides accurate locations of structures, vegetation, buildings, roads, and etc. Transmission Engineering currently uses this technology to monitor conductor ground clearance. That data can be used to determine vegetation management work plans and to assess the effectiveness of treatment. This system could become Avista's 'system of record' for both vegetation management and system integrity. LIDAR is quickly becoming the industry de-facto standard for transmission vegetation management due to its ability to quantify tree growth rates, tree fall-in risks, and to accommodate a variety of risk/benefit scenarios. *The tabular estimate reflects standalone data gathering and analysis costs. However, we anticipate cost savings by reducing the need for ground based activities and helicopter aerial patrols.*

2. Wood Pole Fire Retardant – fire resistant paint has been used on Avista's wood transmission structures since the late 1990's, and in most cases, paint is applied from ground-line up to 6-8 feet. This has proven to be an **effective treatment for transmission structures not subject to tree crown fire activity**. However, maintenance funding for this activity has been constrained and the recommended application frequency of once every three to five years has not been met. A new product in-use on SCE's system consists of a fire-activated pole wrap (GENIC Fire Mesh) and does not require follow-on maintenance. Transmission engineering is currently evaluating this product. *The June 2019 Walla Walla-Wanapum fire impacted approximately 17 miles of transmission line. These poles had been treated with FR paint in 2009 and many structures were protected as a result of this application. Total **repairs** associated with the fire totaled **$1.2M** however replacement costs of a 17 mile section of this facility ranges between $13M and $20M dollars.*

3. Fuel Reduction– though State and Federal agencies are actively pursuing fuel reduction strategies, most do not encompass electric transmission facilities nor do they involve local fire protection districts. The Steering Committee recommends that Avista participate with local fire districts to reduce the fuel loading in critical areas such as multi circuit corridors, critical infrastructure areas, and extreme risk fuel zones.

4. 1st Responder Training – line personnel respond to a variety of emergency situation including pole fires and must have basic fire suppression skills. During fire season, fire protection agencies often impose work-site restrictions that involve fire watch and area preparation. Conversely, fire fighters are often tasked with working around utility infrastructure and must have a basic awareness of electric hazards. Joint training with Avista line and fire district personnel currently occurs but only on an as-needed basis. The Steering Committee recommends that joint training occur annually.

Secondary Actions (transmission system)

	Inherent Risk ($M)		Managed Risk ($M)		Implement
Description	**Low**	**High**	**Low**	**High**	**10-year**
Conforming Transmission Rights-of-Ways	4.8	8.8	0.2	1.4	$50M
Engineering Line Patrols Construction follow-up	1.0	4.4	0.2	0.2	$3M
Fire Protection Expedited Response	-	-	-	-	UNK
Additional Line Patrols in WUI Areas	3.0	54	0.9	2.4	$2M
Total	**9**	**68**	**1**	**4**	**50M CapX 5M OpX**

1. Conforming Transmission Rights-of-Way – though, wholesale expansion of transmission corridors is well beyond the scope of this effort, conforming rights-of-ways to established engineering and vegetation management standards should be evaluated on a case by case basis. This effort would be constrained to **WUI areas** or circuits with known vegetation issues.

2. Engineering Line Patrols.... – transmission engineering conducts annual aerial patrols to ensure structural integrity and to monitor other direct hazards such as bird nests and building encroachments. Currently, this is an open loop process and by closing this process, a clear record of treatment is maintained.

3. Fire Protection Expedited Response – 80% of transmission line outages are temporary with the line first tripping and then automatically reclosing. In most scenarios, Avista crews are not dispatched to inspect these lines unless there is a secondary indication of a problem. Recent discussions with local fire districts indicates a willingness to investigate the potential for fire events after a trip-reclose event. This system would be deployed in conjunction with the distribution 'dry land condition' declaration and apply only to participating fire district areas. At this point, it is unknown whether local fire districts would seek compensation.

4. Additional Line Patrols in WUI Areas – a major theme in the California utility plans is the emphasis on structure inspections in fire prone areas. Investments in more frequent patrols would support both engineering and asset maintenance objectives.

Future Actions (transmission system)

	Inherent Risk ($M)		Managed Risk ($M)		Implement
Description	**Low**	**High**	**Low**	**High**	**10-year**
Minor Rebuild	0.5	1.0	0.2	0.8	$30M
T/R Patrols	0.9	2.4	0.8	2.2	$1.8M
Supervised 115 kV MOAS Operation	0.2	0.5	0.1	0.1	$40k
Splices & Obsolete Conductor	7.8	8.7	0.4	0.9	$7.5M
Fire-wise Education	3.8	57	1.0	6.9	$3M
R/W Road System	4.8	13.8	4.3	4.8	$40M
Inspect before re-energizing policy	0.2	0.5	0.4	0.5	$250k
Red Card Certification	4.8	13.8	4.0	4.8	$380k
Fire Prevention Grant Writer	1.8	6.9	0.9	2.4	$700k
In-house fire suppression crews	9.6	17.6	4.4	5.5	$1.5M
Fire training for pre-apprentice tree crews	0.9	2.4	0.4	1.0	$1.5M
Increase ground clearance standards	2.5	28	1.3	11.3	$25M
Dry Land Mode	0.2	0.9	0.4	1.0	$1.8M
Marker Balls on static lines	0.2	0.9	0.1	0.1	$2.5M
Advanced Line Protection	3.6	4.4	3.6	4.4	$10M
Total	**42**	**159**	**22**	**47**	**$126M**

1. Minor Rebuild – to supplement the existing pole replacement program with a focus on wood to steel conversions in the WUI areas.
2. T/R Patrols – similar to expedited fire response but would involve dispatching Avista personnel following an isolated trip-reclose event. Expedited response is a more targeted approach.
3. Supervised 115 kV MOAS – many 115 kV air switches can be remotely operated. If air switches operate incorrectly, arcing may result and could produce an ignition.
4. Splices & Obsolete Conductor – conductor splice failure is rare. From 2014 to 2018, only 4 conductor/connector outages were reported.
5. Firewise Education – combined with distribution 'right tree-right place' public outreach program.
6. R/W Road System – to construct permanent roads on transmission rights-of-ways.
7. Inspect before energizing – to expand existing field practices of ensuring personnel and equipment in the clear before re-energizing a circuit that was taken out of service for maintenance.
8. Red card certification – to provide 3-5 day training to line personnel effectively making them fire fighter qualified.
9. Fire prevention grant writer- paid staff writer to apply for federal and state grant monies.
10. In-house fire suppression crews – dedicated firefighting personnel and equipment.
11. Fire training for pre-apprentice tree crews – an addition to the existing program effectively making tree personnel firefighting qualified.
12. Increase ground clearance standards – to increase 115 and 230 kV ground clearance design standards.

13. Dry Land Mode – to adapt the non-reclosing practice for electric transmission lines.
14. Marker Balls on Static Wires – In the 1990's, several aerial marker balls failed associated with electric field stress.
15. Advance line protection – adding line relays and communication equipment to existing transmission lines.

Electric Distribution

The vast majority of electric outages occur on the distribution system but the impact to customers is restricted by line fuse action (1-100 customers typical). To contrast this situation, transmission outages are infrequent (low probability) but often impact thousands of customers. The exact opposite is true in a majority of distribution outages where the fuse protection scheme limits the impact to outages to lateral circuits. However, from a fire prevention standpoint, the distribution system is the ignition source for most utility caused fires. Data from the Outage Management System (OMT) indicates that annually, one hundred (100) fire ignition events are associated with overhead distribution lines. In almost all cases, these fires are extinguished by 1st responders including Avista line servicemen. It is the distribution system that requires more focus with respect to fire ignition and this risk is especially acute in the wildland-urban interface (WUI).

Distribution

2000 – Fiberglass Xarms adopted system wide (reduces pole fires)

2003 – Dry Land Mode Protection developed

2014-2018 System Performance (outages)

873 Car Hit Poles (3%)
646 Public Fire (2%)
462 Pole Fire (1%)
2,785 Animal (9%)
1,933 Tree (6%)
8,108 Wind (26%)
3,248 Unknown (10%)
30,780 Total Contingency

Tussock Moth (attacks fir trees)

Fire ignition sources include tree contacts with powerlines but also include animal contacts, equipment failure, and electrical pole fires. Between 2014 and 2018 there were 1,933 tree related outages with 1,011 occurring during fire season. Over that time period there 462 reported pole fires (see inset). Though vegetation management spends $5-7M annually, there is a $3M work backlog and the number of danger trees continues to increase.

A warming climate and drought conditions have stressed trees resulting in widespread damage from insects and disease. In many cases, trees subject to insect damage die within six to eighteen months making it difficult to identify dead or dying trees with ground patrols.

Whereas the risk profile of transmission is largely associated to the costs of fire impact to transmission lines, the risk profile of distribution is aligned with ignition. The 1991 Firestorm involved over ninety (90) ignition events. A majority of those fire starts were related to distribution lines.

Base Level Actions (distribution system)

	Inherent Risk ($M)		Managed Risk ($M)		Implement
Description	**Low**	**High**	**Low**	**High**	**10-year**
Comprehensive Fuse Coordination Study	41	107	1.6	8.2	$200k
Formalize event reporting	21	82	1.3	8.4	$400k
Fire ignition tracking system	132	547	46	213	$300k
Incorporate Veg Mngt in CPC designs	20	278	10	21	$100k
Fire Suppression Wetting Agent	53	582	11	66	$50k
Dry Land Mode 'effectiveness' study	21	57	.6	4.2	$50k
GIS WUI Design Layer	0	0.11	0	0.11	Complete
Dry Land Mode 'trigger'					Complete
ARCOS WF Notification					Complete
Total	**288**	**1,653**	**71**	**321**	**1.1M OpX**

1. Comprehensive Fuse Coordination – distribution faults are a known source of fire ignition. Miscoordination of fuses may transfer more energy to a fault and increase the probability of a fire start. Ensuring proper fuse sizing is an important component of the distribution protection system.

2. Formalize event reporting – protection engineering conducts analysis for all transmission breaker activity. This would extend that analysis to the distribution system and ensure that circuit breakers/reclosers are functioning properly. Again, fire ignition is directly related to line fault activity and ensuring 'as-designed' operation of equipment helps to reduce probability of fire ignition.

3. Fire Ignition Tracking System – to implement a computerized tracking system for fire ignition events.

4. Incorporate Veg. Mngt in CPC Design – trees are often overlooked during the distribution design process and subsequent unplanned treatment is often expensive and disruptive.

5. Fire Suppression Wetting Agent – additives are commercially available that extend the 'wetting' properties of water. During periods of high fire danger, crews often use water to spray down an area prior to performing work. Water additives such as Cold Fire significantly increase the effectiveness of this procedure.

6. Dry Land Mode 'effectiveness study – report by Protection Engineering on the overall effectiveness of DLM together with recommendations for future enhancements.

7. GIS WUI Design Layer- Engineering services has developed a Wildfire Urban Interface layer based on the national wildfire hazard potential (WHP – 2018). This layer will be used to identify fire risk areas and help prioritize maintenance and reconstruction efforts.

8. Dry Land Mode 'trigger' – the USFS publishes a daily 'fire threat index' ranging from low to extreme. This system is in use at Avista now determines when we reconfigure distribution circuits to operate without automatic reclosing.

9. ARCOS WF Notification – Distribution Dispatch uses a computerized notification system to call-out crew resources during outages. That system is now being used to notify key personnel, including senior management, in the event of a fire that threatens customers or infrastructure.

Primary Actions (distribution system)

	Inherent Risk ($M)		Managed Risk ($M)		Implement
Description	**Low**	**High**	**Low**	**High**	**10-year**
Annual Risk Tree	2,816	5,722	264	1,226	$5M
"Right Tree-Right Place"	563	1,145	2.25	28.2	$15.5M
Midline Recloser Communications	14.6	29	0.25	0.28	$600k
Additional Midline Reclosers	22.6	39	5.63	13.2	$10M
Total	**3,416**	**6,935**	**272**	**1,268**	**10.6M CapX 20.5M OpX**

1. Annual Risk Tree – to conduct annual inspections and treatment programs in WUI areas. Currently, hazard tree assessments are conducted as part of the 5-year routine maintenance program.

2. "Right Tree-Right Place" – this is an established program throughout the industry and promotes the planting of Type I trees near powerlines. Type I trees mature at heights less than 20 feet and pose no threat of fall-in or grow-in to electric lines. Avista has worked with city officials, arborists, developers, and individual landowners promoting this concept but has not conducted a wide-spread public campaign nor offered an incentive program to promote the removal of Type II/III trees. Right Tree-Right Place is a vehicle, a brand that we can broadly support and has the potential of drastically reducing the need for vegetation management maintenance in out-years.

3. Midline Recloser Communications – modern electronic circuit reclosers are capable of remote operation and monitoring via cell modem, 4-wire telephone, or fiber optic communications. Though our current standard includes communications, many existing units operate locally. Adding 'comms' is a cost effective solution to support various functions including emergency operations, system planning, and distribution system management functions such as integrated volt-var control.

4. Additional Midline Reclosers – the ability to limit fault exposure on the distribution system is a well-established risk mitigation technique. The fire ignition potential of a line fault is related to current and clearing times. By adding circuit breakers to the system, both quantities are reduced.

Secondary Actions (distribution system)

	Inherent Risk ($M)		Managed Risk ($M)		Implement
Description	**Low**	**High**	**Low**	**High**	**10-year**
Digital Data Collection	2,816	5,722	132	564	* $20M
100% Substation SCADA	132	547	0	1.6	$22.5M
WUI Grid Hardening	1,326	3,189	11	66	$150M
Total	**4,274**	**9,458**	**143**	**632**	**172.5M CapX 20M OpX**

1. Digital Data Collection – note that the values shown for inherent risk reflect the lack of a purely objective 'system of record' for trees near distribution lines. It is also indicates the constraints associated with public rights-of-way and the lack of property rights adjacent to most distribution lines. Although the inherent risk is likely overstated, vegetation management is the **largest risk element** associated with distribution lines. LIDAR imaging is commonly used on transmission lines and many utilities are now extending that practice to distribution circuits. Portland General is investing in distribution LIDAR as are most California Utilities including SMUD. ** The 10-year, $20M dollar cost does not include offset costs associated with fewer ground patrols and labor savings in the field.*

2. 100% Substation SCADA – Though we've slowly reduced the number on non-scada substations, there are several remaining stations without visibility. The inability to monitor or control equipment in these stations is a significant risk component. Substation scada is widely recognized as an industry best practice.

3. WUI Grid Hardening – during the workshops, several hardware components were singled out such as fiberglass x-arms, hot tap connections, steel poles, and obsolete copper wire. Rather than list them individually, the group consensus is to modify the **GridMod program to fire harden system in WUI areas**. For example, portions of the Colville 12F4 circuit route through WUI zones. Design scope in that area would include elements to mitigate fire ignition.

Future Actions

	Inherent Risk ($M)		Managed Risk ($M)		Implement
Description	**Low**	**High**	**Low**	**High**	**10-year**
Overhead Conversion to Underground	2,816	5,723	113	195	$500M
Develop Crew "Standby" System	332	797	66	282	$15M
Fiberglass pole top pin	11	26	.5	2.6	$65M
Video Surveillance in WUI	1.0	1.0	0.2	2.5	$1.35M
Arc Sensing Protective Relays	23	39	1.1	6.6	$6.5M
Scarify Poles Bases in WUI Zones	8.3	132	1.1	6.6	$14M
S&C Intellirupter	23	39	1.3	6.6	$13M
Create Internal Fire Work Restrictions	1.0	5.0	0	0.5	$750K
Non Expulsive Fuses	0.5	2.6	0.2	0.8	$10M
Full Length Treated Poles	41	164	16	82	$5M
Inset Poles Reduce Span Lengths	16	63	0.6	2.6	$250M
Insulated Primary Tree Wire	11.3	21	0.5	2.1	$30M
Avian Covers in WUI	0.3	2.7	0.13	0.17	$72M
50-CL1 Poles in WUI	3.3	16	2.3	11.3	$36M
Aerial Cable in WUI	11.3	26	0.1	1.1	$300M
Amend Forest Practice to remove powerline adjacent trees	132	613	41	164	$50k
FR 3 Oil Transformers	0.1	1	0.1	0.5	$50M
Total	**3,431**	**7,671**	**244**	**767**	**$1,369M**

1. Overhead to Underground Conversion –the systematic conversion of overhead facilities to underground. Virtually all new distribution construction is underground and GridMod is converting circuit segments when feasible and cost effective.
2. Develop Crew Standby – Avista's after-hours crew call-out is strictly voluntary. By paying for crew stand-by time, personnel would be pre-selected for call-out and reduce overall response during contingency events.
3. Fiberglass pole top pin – not included in the WUI GridMod proposal, current pole top pin assemblies are made from steel and are a possible source of fire ignitions. However, analysis of distribution pole fires indicates that the wood x-arm contact is the primary ignition point for most pole fires.
4. Video Surveillance – many California utilities are using video surveillance to detect fire starts but we believe the risk value proposition is low.
5. Arc Sensing relays – though pilot work is currently underway to develop the next generation of distribution relays, this technology is in its infancy.
6. Scarify pole bases - this is a common practice in dry scrubland environments (sage brush) but a majority of Avista's rural distribution lines route through forested and agricultural areas.

7. S&C Intellirupter – an alternative device to a conventional circuit breaker. Adding conventional midline breakers is a recommended action.
8. Create internal fire restrictions – to mirror work restrictions issued by forest land managers. Deemed as low value by workshop attendees.
9. Non-expulsive fuses – though conventional fuse action does represent an ignition source, observational feedback does not support replacing them at this time.
10. Full length treated poles – treated poles offer some fire resistant characteristics but are not supported by engineering, supply chain, or field operations.
11. Inset poles – reducing span lengths increases overall circuit strength and minimize wire-wire contacts due to wind and storm events.
12. Insulated primary tree wire – focus will be on improved vegetation management.
13. Avian covers – extending avian covers in WUI would reduce ignition by animal contacts.
14. 50 Cl-1 poles – increases ground clearance
15. Aerial cable in WUI – Insulted OH cable provides significant insulation but is very expensive and presents hazards if supporting structures fail.
16. Amend Forest Practices... - when commercial timber harvest is conducted near powerlines, trees near electric facilities are often left. These become risk/danger trees to the facilities. Requiring that these trees be removed helps to minimize fall-in issues.
17. FR 3 Transformers – FR 3 oil does not support combustion but transformer tanks rarely fail during an electrical fault.

Addendum

Q & A:

Q: Why isn't Public Safety Power Shutoff listed?

A: Pre-emptive power shutoff (PSPS) is a system in-use in California (SDGE, SCE, PG&E, PAC, and others) and while it was discussed during the SME Workshops, it requires systems and processes not yet available at Avista. However, the concept will be addressed in the April 2020, Avista *Wildfire Resiliency Plan* and this plan does include recommendations that would support a future deployment of PSPS.

Q: Why is 100% Substation SCADA identified as a fire risk?

A: Supervisory control systems are common throughout substation and power generating facilities and allow for equipment monitoring, unit dispatch, and operational control over equipment including power circuit breakers, voltage regulators, power transformers, and generating equipment. The inability to de-energize a transmission or distribution circuit is a general safety risk and may prevent Avista system operations to de-energize circuits.

Core Logic Study

In 2018, Avista hired the Core Logic Company to study the financial impacts of a large scale, utility-caused wildfire event. They estimate the property loss of a 100 year event at $24 million dollars and a 500 year event at $69 million. These values pale in comparison to the $30 billion dollar damage estimate associated with the 2018 'Camp Fire' in Paradise, CA. However, it should be noted that the Core Logic study **did not** consider loss of **human lives nor other indirect costs such as human displacement, economic disruption, or fire suppression**. The societal costs associated with catastrophic wildfire is difficult to forecast and subject to a number of factors.

Return Period (Years)	Non-Exceedance Probability (%)	Damage ($)
500	99.8	68,727,712
250	99.6	47,317,308
100	99	23,969,406
50	98	12,137,863
25	96	5,360,076

SME Wildfire Risk Workshops

In the Wildfire Resiliency Plan Charter, March 2019, it was noted that recommended actions would be based on risk-reduction whether directly financial, safety related, or related to customer impacts. A series of workshops were held to identify opportunities to reduce risk on the overhead transmission and distribution systems. The primary goal of the workshops were to:

1) Identify actions to reduce the probability of electric ignition
2) Quantify the consequence or impact of potential actions

The workshops were divided into three sub-sections:

1) Design based (material and construction standards)
2) Operations (control center and field operations)
3) Maintenance (programmatic asset maintenance and vegetation management)

During the course of the six (6) workshops, over one hundred and sixty (160) actions were identified. The Business Process Improvement (BPI) department assisted with the workshops and assisted with the exercises. An 'affinity exercise' was used to identify actions. During the affinity exercise, individuals are asked to use post-it notes to note individual actions such as (examples):

a) Widen transmission rights-of-ways
b) Use steel poles on distribution lines
c) Develop a non-reclosing program (DLM) for transmission
d) Employ a dedicated firefighting crew at Avista
e) Convert overhead distribution lines to underground facilities
f) Develop a fire-weather forecast and monitoring system

In many cases, workshop attendees had similar items and were asked to group and agree on a central idea. This provided an opportunity to discuss and clarify the proposed actions.

The group then identified the effort and benefit associated with each idea. Effort is associated with financial commitment, complexity, sustainability, and manpower requirements. Benefit was based on the relative risk reduction to reduce the likelihood and or impact associated with wildfire. Items with high benefit, low effort were noted as the most likely to produce cost effective results while low benefit, high effort items were discarded. Items deemed as cost effective and prudent, moved on to the risk evaluation exercise.

The risk evaluation was modeled after the Asset Management Risk Matrix and the Enterprise Risk Registry. In this treatment, a before and after probability was assigned along with the impacts:

a) Financial (e.g. direct impact to infrastructure, 1st party claims, fire suppression)
b) Customer (the disruption to customers as monetized by multiplying customer*hours by the interruption cost estimate (ICE, Avista $63/customer*hour) and 3rd party claims)
c) Safety (the potential for injury to both Avista employees, 1st responders, and the public)

For example, conversion to underground significantly reduces the probability of electric ignition with the before or 'inherent' risk associated directly to overhead distribution lines. Outage statistics indicate that Avista's distribution system is involved with approximately one-hundred fire ignition events per year. Subsequent impact is related to fuel loading and weather conditions. However, conversion of circuits in the wildland urban interface (WUI) virtually eliminates tree to wire contacts which is the majority of fire ignition events related to powerlines.

During the workshop, the inherent risk associated with "OH/UG Conversion" was 78 or 90 possible points and though the risk was reduced by 38 points, the costs of conversion was estimated at $500 million dollars over a 10-year period.

A subsequent 'scoring' exercise was conducted by indentifying items associated with:

1. Highest Inherent Risk --- items with significant risk should be considered for treatment
2. Highest Risk Reduction – opportunities that significantly reduce risk should be promoted
3. Lowest Overall Cost – low cost items should be considered before high cost alternatives

Scoring was based on the delineation of:

Gold – Best value (2 points)
Silver – Good value (1 point)
Bronze – Moderate value (0.5 points)

Scores were assigned based on the outcome of the "BPI" lead workshops. In addition, the Wildfire Steering Group were asked to identify their top three (gold, silver, bronze) opportunities for electric distribution. A subsequent employee workshop involving T&D subject matter experts was convened to gather feedback on opportunities. Again, a review exercise was conducted to ensure that recommended actions were supported by the broader engineering, operations, and maintenance communities. Indeed, this report is a summarized version of those outcomes with Low & No Cost items listed together with Recommended Actions (Should Do), while those identified as Advised or Deferred did not receive consensus support or are cost prohibitive.

The Legacy of Firestorm

The October 16, 1991 Firestorm is firmly etched into the minds of local residents and WWP employees. Though October is not generally considered 'high fire season', drought conditions prevailed and 60 mph winds caused trees to fall through powerlines. The majority of October-1991 fire ignitions were related to trees contacting powerlines.

Between 1970 and 1990, population growth in Spokane grew by 25% to 360,000 and during that time frame, homes were built in unincorporated areas 11 times faster than in cities for a total of 24,000 new homes in the wildland urban interface.

Firestorm Facts

- 114 homes destroyed
- 60 mph wind
- 42 days without rain
- 35,000 acres burned
- 90 fires
- 3,000 calls to 911, 24 hours
- 2 fatalities
- WWP Call Center – 11,000 calls in 2 hours
- WWP pays over $10 million in fire suppression costs, $50 million in infrastructure costs

---

Avista has a long history of responding to fire events such as the 2005-06 fires that burned significant portions of the Benton-Othello line, the 2015 Carpenter Road Fire (Colville), and the 2019 fire that impacted seventeen (17) miles of the Walla Walla-Wanapum 230 kV line. Nearly every year there is a fire that impacts the Lolo-Oxbow 230 line. The 'Oxbow' line is Avista's interconnection with Idaho Power and is an important asset connecting north and south Idaho. The line routes through extremely rugged terrain in the Salmon and Snake River country. Many structures are accessed via jet boat while others require road building and hours of slow travel to reach. The impact of wildfire is an ever-present risk to Avista infrastructure, our employees, and customers.

However, fire is unlike other storms that disrupt power and utility experts recognize that service restoration must be in coordination with fire protection activities and in many instances, be postponed until it is safe to enter an area. One of the recommended actions is to delineate fire in Avista's Emergency Operations Procedure to ensure close coordination with fire incident command and to promote the safety of employees and 1st responders above service restoration.