



**& WILDFIRE
SAFETY**

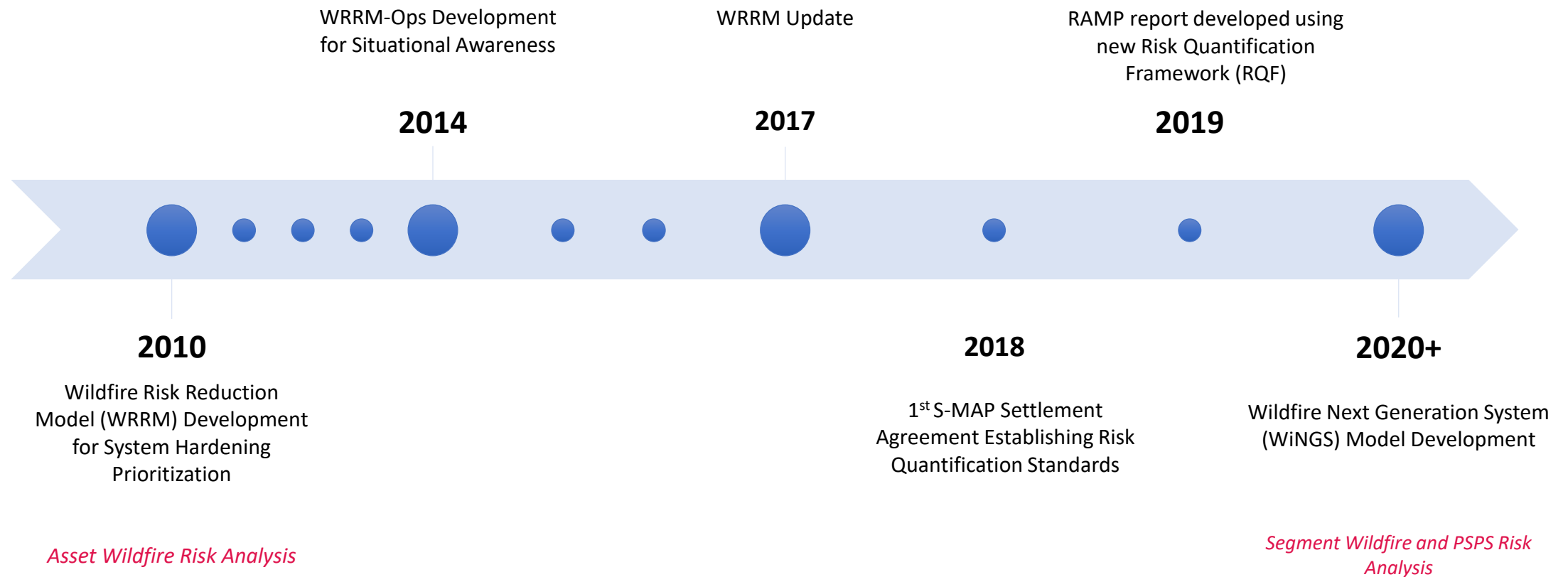
2021 WMP Update Workshop

Risk Assessment, Mapping & Resource Allocation Methodology

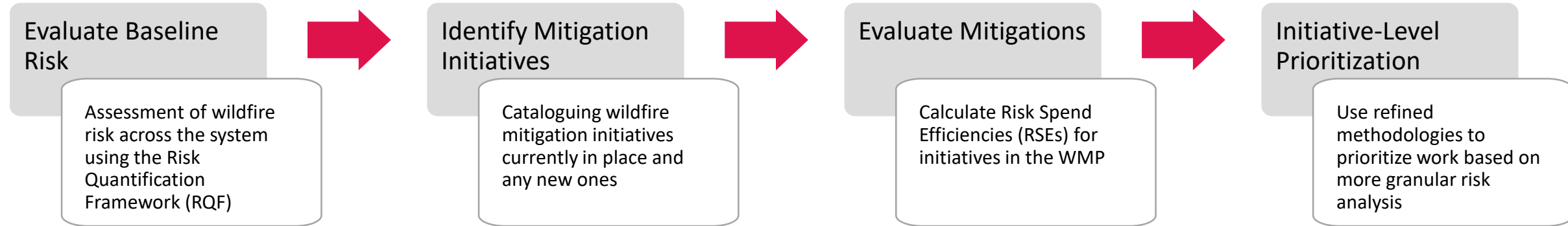
February 23, 2021

Wildfire Risk Modeling Evolution

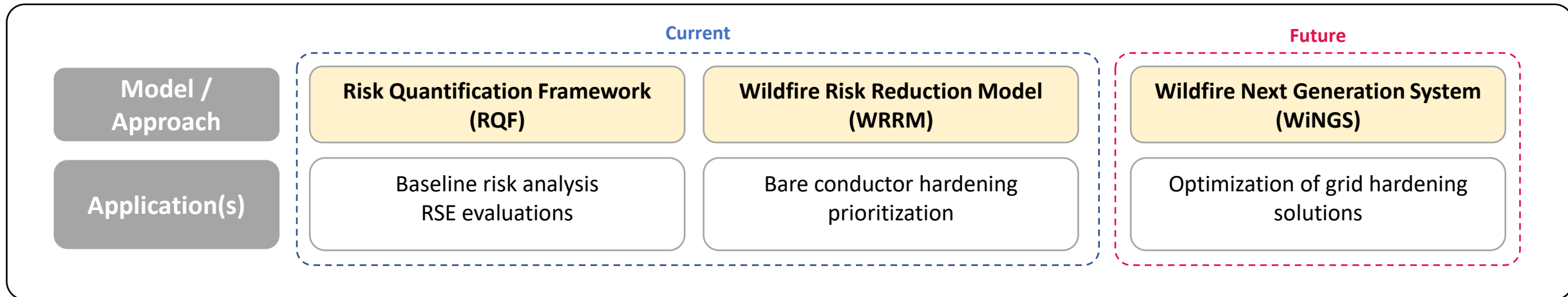
SDG&E continues to evolve its risk modeling capabilities to adapt to emerging challenges



Risk-Informed Decision-Making Approach

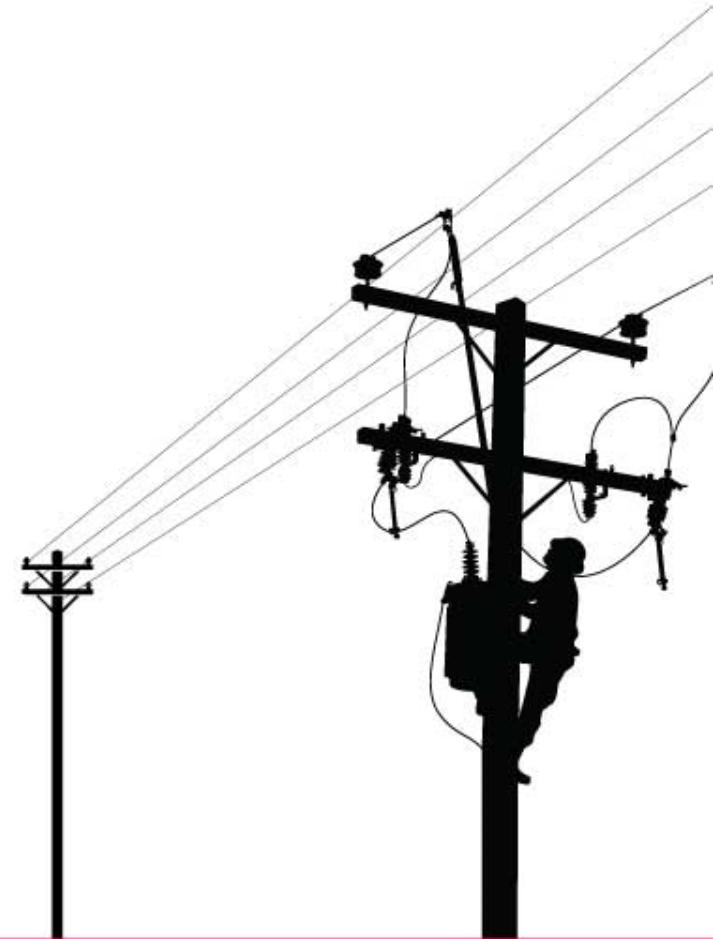


Key Risk Models and Frameworks



Risk Quantification Framework (RQF)

Enterprise risk assessments and RSE calculations



Enterprise-Level: Risk Quantification Framework

Risk Quantification Framework

Attribute	Unit	Range	Weight
Health & Safety	Index	0 - 20	60%
Reliability	Index	0 - 1	20%
Financial	\$M	\$0 - 500M	15%
Stakeholder Impact	Index	0 - 100	5%

Health & Safety Index

Sub Attribute	Value
Fatality	1
Serious Injury	0.25
Acres Burned*	0.00005

*Applies to wildfire risk only

Stakeholder Impact

Stakeholders Affected*	Severity	Duration	Value
Five Stakeholders	Extreme	6+ Months	100
Three to Four Stakeholders	Major	1 - 6 Months	50
Two to Three Stakeholders	Moderate	<1 Month	25
One Stakeholder	Minor	<1 Week	5

*Stakeholders: customers, employees, public, government, and regulators

Reliability Index (SDG&E / SoCalGas)

Sub Attribute	Unit	Range	Weight
Gas Curtailment (80 / 250)	# MMcf	0 – 250 / 0 - 500	25% / 50%
Meters Loss of Service	# of meters	0 - 50,000 / 0 - 100,000	25% / 50%
Electric Outage Count	SAIFI Outages	0 – 1	25% / 0%
Electric Outage Duration	SAIDI Minutes	0 – 100	25% / 0%

Enterprise Risk Assessments

Line No.	2021 RAMP Risk	LoRE	CoRE	Risk Score
1	Wildfires Involving SDG&E Equipment (WF/PSPS)	22/4	579/1,366	18,085 (12,623/5,462)
2	Electric Infrastructure Integrity	1,500	4	6,423
3	High Pressure Gas Incident (Excluding Dig-in)	0.88	2,117	1,866
4	Incident Involving a Contractor	1.67	1,061	1,768
5	Contact with Electric Equipment	1.09	1,375	1,500

Wildfire Risk Assessment by Region

	Wildfire Risk Score			PSPS Impact		
	Non-HFTD	Tier 2	Tier 3	Non-HFTD	Tier 2	Tier 3
Pre-Mitigation Risk Score	323	6,265	11,497	0	1,639	3,824
LoRE	9.2	7.2	5.4	0	4	4
CoRE	35	643	1,421	N/A	410	956

Enterprise-Level: Risk Quantification Framework

Illustrative Example

Mitigation: Hot Line Clamp Replacement – Tier 3 Tranche

Mitigation Overview: Hot line clamps (HLC) are identified as being potential ignition sources when they fail. A failure leads to a wire down situation. The replacement clamp system reduces the chances of a wire down even if there is a failure.

Risk Discussion: Hot line clamps are estimated to be responsible for 1.13 wires down per year in Tier 3. Removing the HLC reduces the likelihood of these events which lead to ignitions.

Mitigation: Hot Line Clamp Replacement		
Annual Reduction of Likelihood of Risk Event		.008
Cost		\$2M
Life of Benefits		25 years

	Pre-Mitigation	Post-Mitigation
LoRE	21.8	21.792
CoRE	$((0.067 / 20) * 60\% + (0.002) * 20\% + (10.56 / 500) * 15\% + (0.5 / 100) * 5\%) * 100000 = 579$	$((0.067 / 20) * 60\% + (0.002) * 20\% + (10.56 / 500) * 15\% + (0.5 / 100) * 5\%) * 100000 = 579$
Risk Score	LORE * CORE = 21.8 * 579= 12,623	New LORE * CORE = 21.792 * 579= 12,618
RSE	-	$(12623 - 12618) * 25 / \$2M = 58$

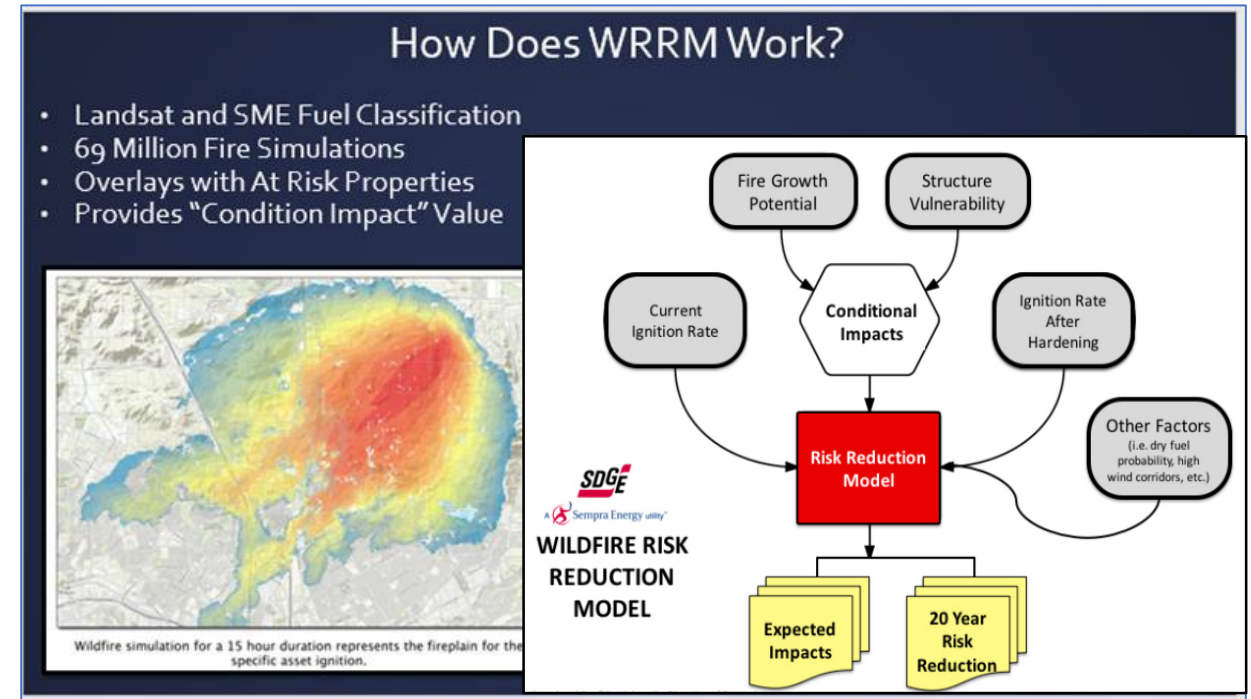
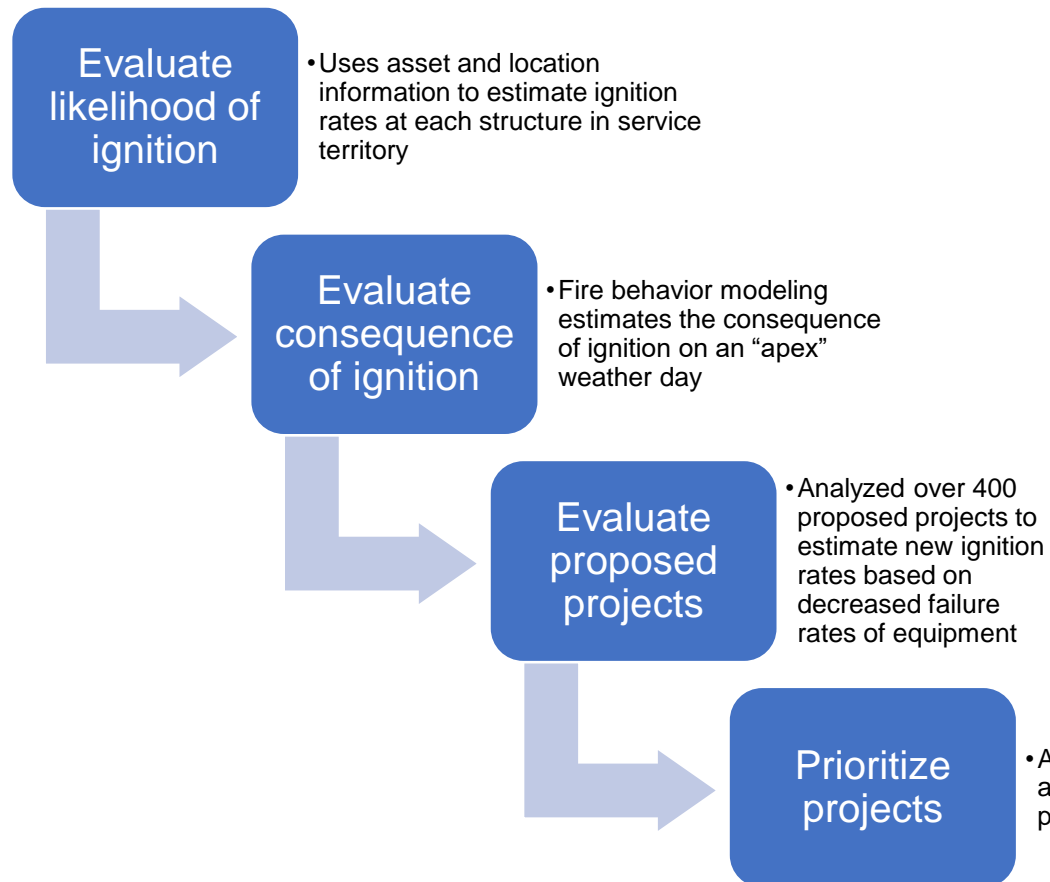
Wildfire Risk Reduction Model (WRRM)

Asset Risk Analysis



Wildfire Risk Reduction Model (WRRM)

Identification of scope of work and priorities for overhead hardening in the 2020 WMP relied heavily on the WRRM)



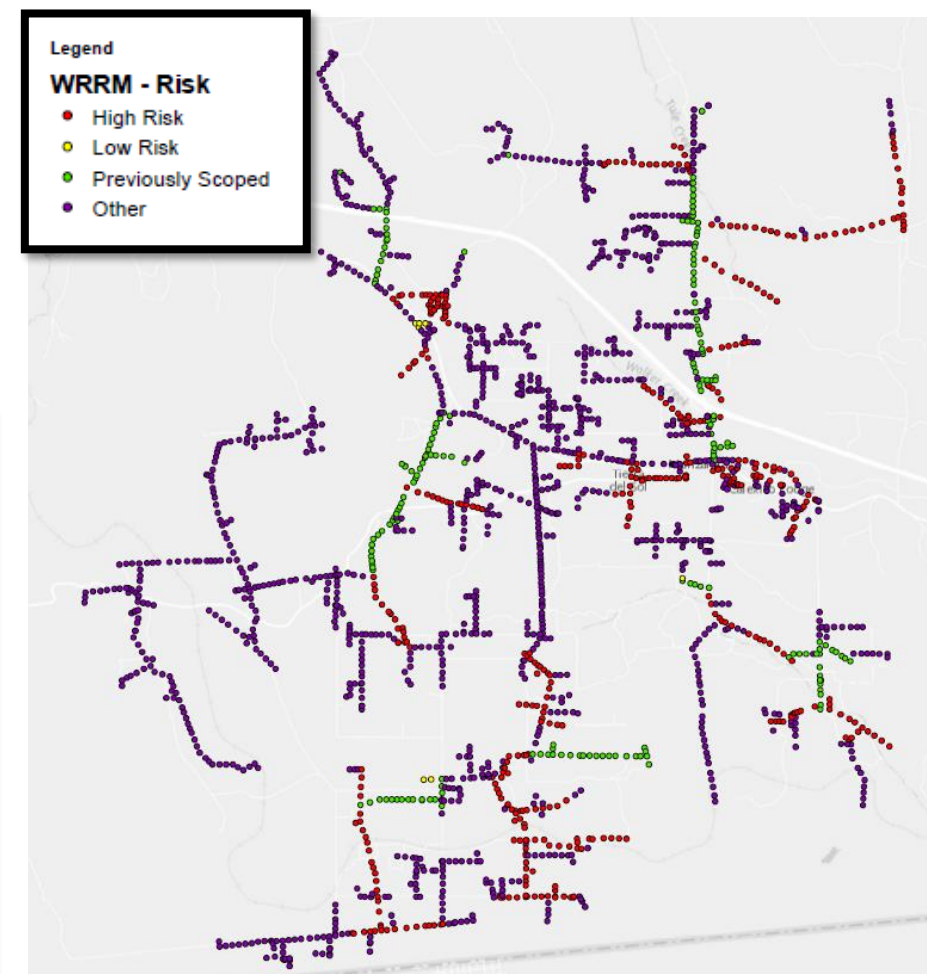
Wildfire Risk Reduction Model (WRRM)

Grid Hardening Using WRRM:

- Model outputs provide prioritized list of assets to target for mitigation through the FiRM program
- Analysis updates made to evaluate additional datasets for circuit-by-circuit grid hardening prioritization
- 2020 efficacy studies conducted showed 47% effectiveness of implemented grid hardening projects

Wildfire Risk Reduction Model											
Asset Class Risk Summary											
Project name	Risk Study										
Date created	8/24/2017 14:20										
Created by	DAS										
Description											
Date exported	8/24/2017 14:28										
Baseline Risk						Replacement Risk					
Asset Class	No. of Assets	Asset Type	Asset Age	Asset Subtype	Current Relative Failure Rate	Mean Expected Annual Impact	Replacement Asset	Replacement Relative Failure Rate	Mean Replacement Expected Impact	Mean 20 Year Risk Reduction	Total 20 Year Risk Reduction
PL1605Aa40T49W01P00	1	Distribution Pole	40-49 years	Wood	0.531		PL1605Aa00T51SFOH00	0.255			
PL1605Aa40T49W05C00	2	Distribution Pole	40-49 years	Wood	0.864		PL1605Aa00T51SFOH00	0.255		6	12
PL1605Aa40T49W05P00	1	Distribution Pole	40-49 years	Wood	0.579		PL1605Aa00T51SFOH00	0.255			
PL1605Aa40T49W07P00	1	Distribution Pole	40-49 years	Wood	0.603		PL1605Aa00T51SFOH00	0.255		1	1
PL1605Aa50T49W03P00	2	Distribution Pole	50 years or older	Wood	0.616		PL1605Aa00T51SFOH00	0.255		2	3
PL1605Aa50T49W01P00	4	Distribution Pole	50 years or older	Wood	0.59		PL1605Aa00T51SFOH00	0.255		1	6
PL1605Aa50T49W05P00	4	Distribution Pole	50 years or older	Wood	0.643		PL1605Aa00T51SFOH00	0.255			2
PL1605Aa50T49W03O00	2	Distribution Pole	50 years or older	Wood	0.616		PL1605Aa00T51SFOH00	0.255		1	2
PL1605Aa50T49W02O00	2	Distribution Pole	50 years or older	Wood	0.603		PL1605Aa00T51SFOH00	0.255			1
PL1605Aa50T49W05O00	2	Distribution Pole	50 years or older	Wood	0.643		PL1605Aa00T51SFOH00	0.255			
PL1605AunkT50SFOO00	11	Distribution Pole	Unknown	Steel & Weath	0.3		PL1605Aa00T51SFOH00	0.255			
PL1605AunkT50SFOH00	5	Distribution Pole	Unknown	Steel & Weath	0.3		PL1605Aa00T51SFOH00	0.255			

WRRM Map Sample



Wildfire Next Generation System (WiNGS)

Analysis of segment-level risk for grid hardening optimization



Risk Modeling Granularity

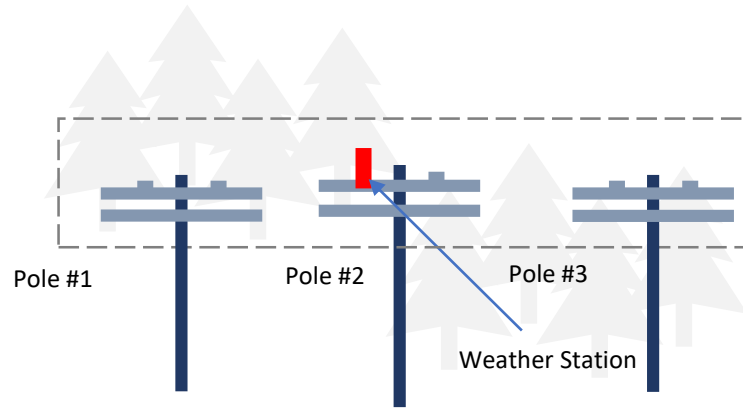
Developed WiNGS to assess segment-level risk with the objective of reducing PSPS and wildfire risk



Asset-Level Strategies

- Targeted investments in replacing high risk equipment
- Use of PSPS to further reduce risk during fire season

WRRM Model



Segment-Level Strategies*

- Targeted investments based on segment-level risk
- Includes a look at both wildfire risk reduction as well as PSPS risk reduction

WiNGS Model



System-Level Strategies

- Annual enterprise risk management process
- Risk Spend Efficiency assessments at the program level (RAMP)

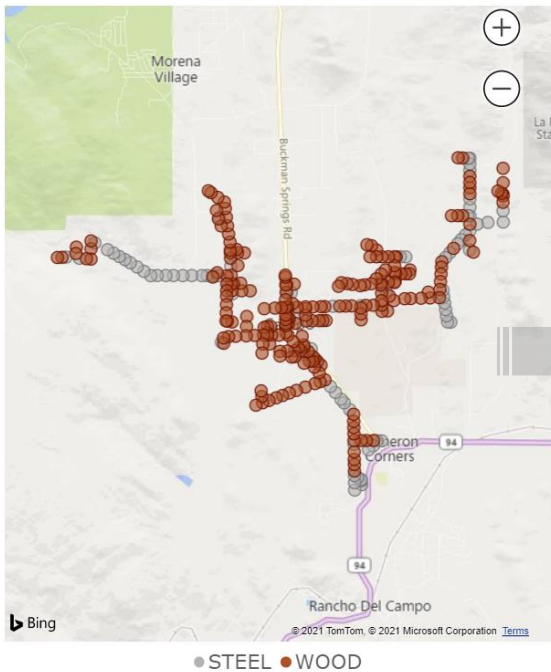
Spectrum of Granularity

*Segments are comprised of multiple spans and structures between two isolation points and are typically thought of in terms of how SDG&E operates PSPS

Illustrative Shift in Strategies

Before WiNGS

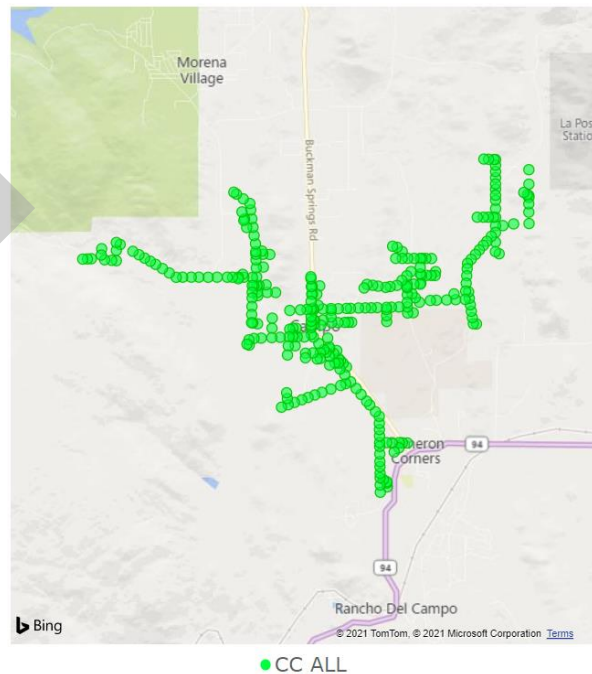
Targeted hardening of assets at risk



Illustrative maps from one segment

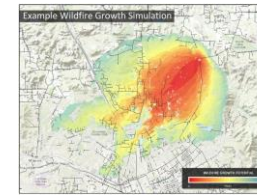
With WiNGS

Comprehensive segment hardening

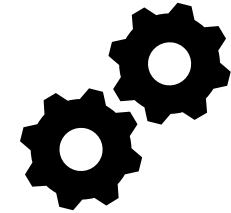


WRRM asset risk analysis is integrated into WiNGS' segment risk analysis

WRRM



WiNGS



WiNGS Facts

- Over 600 distribution segments
- ~90K poles in those segments
- ~3,600 miles of distribution overhead
- Average length of segments ~6 miles

WiNGS Benefits

- Reduces PSPS impacts by identifying whole-segment solutions
- Builds on prior models and integrates their outputs
- Utilizes the same MAVF used in RAMP

WiNGS Overview

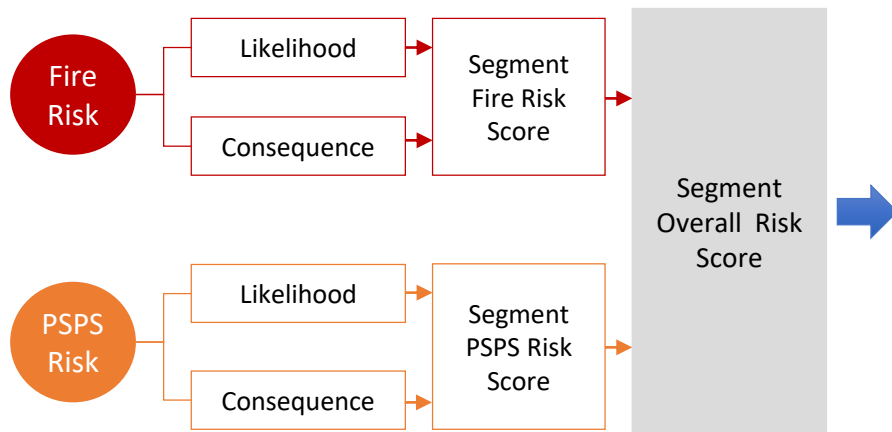
A risk-based decision-support tool to determine **most cost-effective wildfire and PSPS risk reduction investments**

What's our current risk level today?

Which mitigation is most cost-effective?

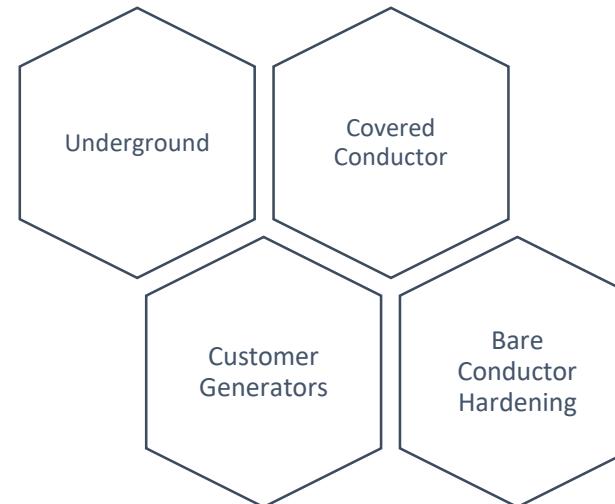
What's the right mix of strategies to deploy?

Baseline Risk Level



Segment-by-Segment Risk Analysis

Alternatives Analysis



Segment-by-Segment RSE Analysis

Portfolio Analysis



Aggregated Portfolio Analysis

WiNGS Model Inputs and Outputs

Inputs


Wildfire

Likelihood

- Historic ignitions
- Wind speed
- Tree strikes
- Hardening status
- Vegetation density ★
- Critical Health Index (CHI) ★
- Conductor age ★

Consequence

- Maximum WRRM conditional impact


PSPS

Likelihood

- Annual RFW data
- Historic wind speed patterns
- Circuit connectivity ★

Consequence

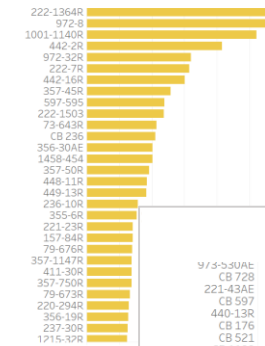
- Number of customers
- Customer type ★

★ Recent Improvement

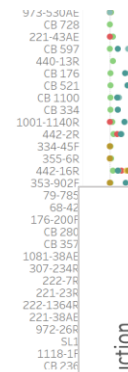
WiNGS Model

Outputs

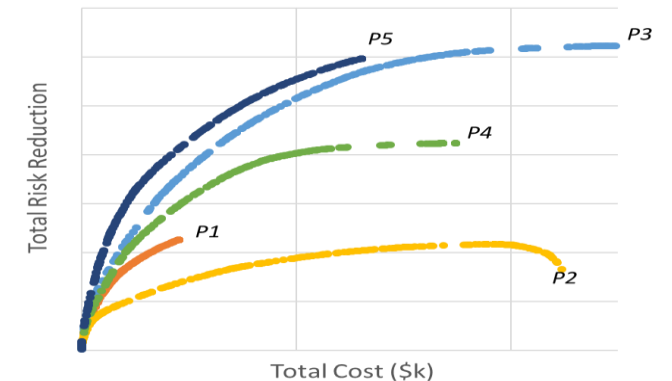
Segment Risk Ranking



Segment RSE Analysis



Portfolio Analysis



WiNGS Application in 2020

Pivoting Mitigation Strategies

- Early analysis of segments in WiNGS informed part of the scope of work currently in the 2020 WMP (2022+)
- Pivoting in-flight work is not always feasible which is why it takes time to fully transition grid hardening scoping to the WiNGS framework

Segment ID	CC RSE	UG RSE	TH RSE	Recommended Mitigation	Reason for Deviation
448-9R	49	23	37	TH	Designed
448-11R	214	100	152	TH	Designed
448-13R	40	17	40	TH	Designed
448-23R	139	67	85	CC	
448-19R	138	78	93	CC	
448-37	178	83	116	CC	
448-33R	93	45	86	TH	Designed

 Top RSE
 Deviation from Top RSE
 Recommended Mitigation

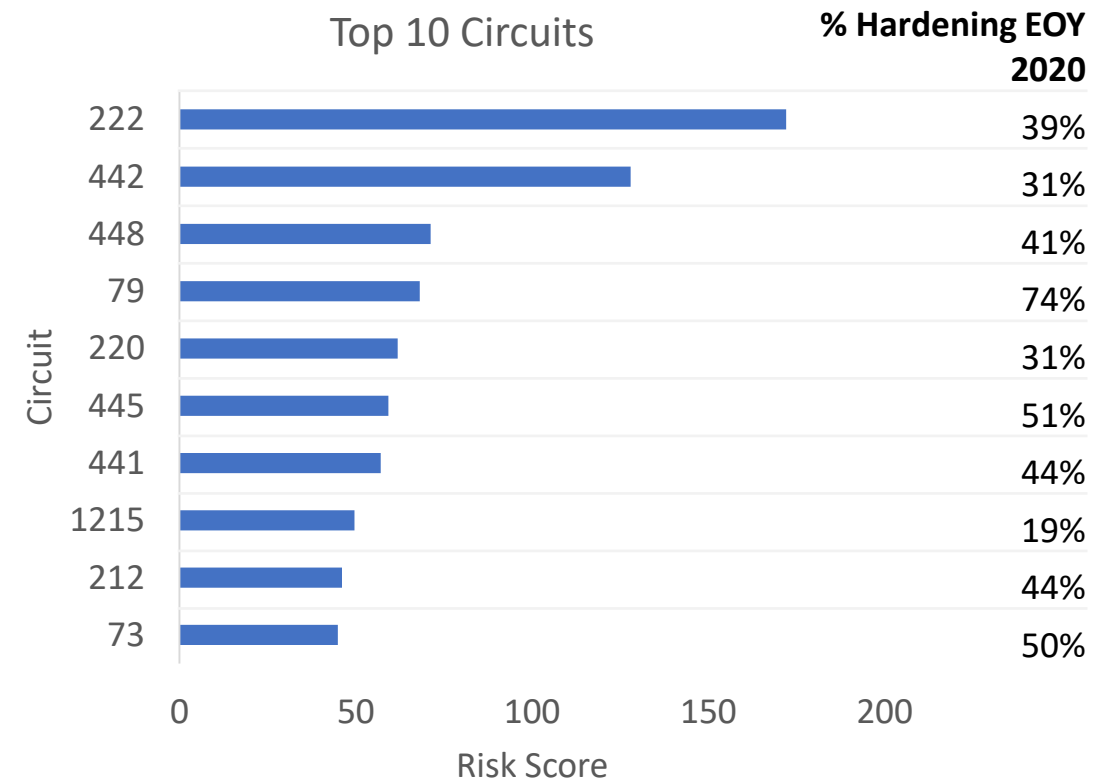
CC: Covered Conductor

UG: Underground

TH: Traditional Hardening (Bare Conductor Hardening)

Validation of WRRM Targeting Approach

- WiNGS circuit priorities align well with previously targeted circuits for hardening through WRRM



Key Takeaways and Next Steps

Key Takeaways:

- History of using risk modeling to inform mitigation efforts
- Risk modeling needs to continue to evolve with emerging challenges
- Flexibility is important to determine appropriate models to use for various functions
- SME input is crucial to making final decisions
- It takes time to transition to new frameworks and shift operations and decision-making to new standards

Next Steps:

- WiNGS was updated at the end of 2020 and will be used to refresh assessments for future scoping of grid hardening
- The use of WiNGS to evaluate vegetation management will be explored this year
- Additional enhancements will be identified; a roadmap will be developed for the continuous improvement
- WiNGS is expected to inform majority of grid hardening scope in 2023 and beyond