



Risk Assessment and Mitigation Phase

(Chapter SDG&E-Risk-7-QWP)

Excavation Damage (Dig-In)

on the Gas System

Workpapers

May 17, 2021

Overall Workpaper Description	This workpaper file explains the risk scoring and Risk Spend Efficiency (RSE) quantification. It contains necessary information and sources for calculating the risk score and RSE for respective mitigations and controls filed in the 2021 RAMP.
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"Master Inputs" Tab	This sheet contains the major MAVF inputs for risk scoring
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"RSE Summary" Tab	This sheet presents a summarized view of RSE scoring
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RSE Equation	$\text{Risk Reduction} = (\text{Pre - Mitigated LoRE} * \text{Pre - Mitigated CoRE}) - (\text{Post - Mitigated LoRE} * \text{Post - Mitigated CoRE})$ $\text{Discounted Time} = 1 - \left(\frac{1}{\frac{(1 + \text{Benefit Discount Rate})^{\text{Benefits Lifetime}}}{\text{Benefit Discount Rate}}} \right)$ $\text{RSE per \$M} = \frac{\text{Risk Reduction} * \text{Discounted Time}}{\text{Total Cost (\$M)}}$
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Master Inputs

Discount Factors

Benefit Discount Factor 3.00%

MAVF Framework

	Range	Weight
Safety Index	20	60%
Reliability Index	1	23%
Financial Cost	500	15%
Stakeholder Satisfaction Index	100	2%

2021 RAMP
SDG&E-RISK-7-QWP
High Pressure Excavation Damage RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)
SDG&E-RISK-7-A04	ALTERNATIVE - GPS Tracking of Excavation Equipment	1.0	\$340
SDG&E-RISK-7-A02	ALTERNATIVE - Virtual Reality Training	1.0	\$104
SDG&E-RISK-7-M2	Automate Third Party Excavation Incident Reporting	5.0	\$4
SDG&E-RISK-7-C12	Damage Prevention Analyst Program	1.0	\$48
SDG&E-RISK-7-C32	Enhance Ticket Management Software	5.0	\$23
SDG&E-RISK-7-C04	Locate and Mark Activities	1.0	\$1,491
SDG&E-RISK-7-C06	Locate and Mark Annual Refresher Training and Competency Program	1.0	\$1
SDG&E-RISK-7-C10	Locate and Mark Quality Assurance	1.0	\$84
SDG&E-RISK-7-C14	Locating Equipment	5.0	\$142
SDG&E-RISK-7-C24	Pipeline Patrol and Pipeline Markers	1.0	\$721
SDG&E-RISK-7-C16-T1	Public Awareness	1.0	\$58
SDG&E-RISK-7-C16-T2	Public Awareness	1.0	\$1
SDG&E-RISK-7-C16-T3	Public Awareness	1.0	\$4
SDG&E-RISK-7-C16-T4	Public Awareness*	1.0	\$5
SDG&E-RISK-7-C30	Ticket Risk Assessment, and evaluating City permit data	1.0	\$9
SDG&E-RISK-7-C28	Warning Mesh	50.0	\$55

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.

2021 RAMP
SDG&E-RISK-7-QWP
High Pressure Excavation Damage RSE Summary

ID	Mitigation Name	% Change in LoRE	Pre-Mitigated LoRE	CoRE Safety
SDG&E-RISK-7-A04	ALTERNATIVE - GPS Tracking of Excavation Equipment	0%	0.19	693.79
SDG&E-RISK-7-A02	ALTERNATIVE - Virtual Reality Training	0%	0.19	693.79
SDG&E-RISK-7-M2	Automate Third Party Excavation Incident Reporting	0%	0.19	693.79
SDG&E-RISK-7-C12	Damage Prevention Analyst Program	0%	0.19	693.79
SDG&E-RISK-7-C32	Enhance Ticket Management Software	0%	0.19	693.79
SDG&E-RISK-7-C04	Locate and Mark Activities	11%	0.19	693.79
SDG&E-RISK-7-C06	Locate and Mark Annual Refresher Training and Competency Program	0%	0.19	693.79
SDG&E-RISK-7-C10	Locate and Mark Quality Assurance	0%	0.19	693.79
SDG&E-RISK-7-C14	Locating Equipment	2%	0.19	693.79
SDG&E-RISK-7-C24	Pipeline Patrol and Pipeline Markers	1%	0.19	693.79
SDG&E-RISK-7-C16-T1	Public Awareness	0%	0.19	693.79
SDG&E-RISK-7-C16-T2	Public Awareness	0%	0.19	693.79
SDG&E-RISK-7-C16-T3	Public Awareness	0%	0.19	693.79
SDG&E-RISK-7-C16-T4	Public Awareness*	0%	0.19	693.79
SDG&E-RISK-7-C30	Ticket Risk Assessment, and evaluating City permit data	0%	0.19	693.79
SDG&E-RISK-7-C28	Warning Mesh	1%	0.19	693.79

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.

2021 RAMP
SDG&E-RISK-7-QWP
High Pressure Excavation Damage RSE Summary

ID	Mitigation Name	CoRE Financial	CoRE Reliability	CoRE Stakeholder Satisfaction
SDG&E-RISK-7-A04	ALTERNATIVE - GPS Tracking of Excavation Equipment	32.50	3,169.19	340.00
SDG&E-RISK-7-A02	ALTERNATIVE - Virtual Reality Training	32.50	3,169.19	340.00
SDG&E-RISK-7-M2	Automate Third Party Excavation Incident Reporting	32.50	3,169.19	340.00
SDG&E-RISK-7-C12	Damage Prevention Analyst Program	32.50	3,169.19	340.00
SDG&E-RISK-7-C32	Enhance Ticket Management Software	32.50	3,169.19	340.00
SDG&E-RISK-7-C04	Locate and Mark Activities	32.50	3,169.19	340.00
SDG&E-RISK-7-C06	Locate and Mark Annual Refresher Training and Competency Program	32.50	3,169.19	340.00
SDG&E-RISK-7-C10	Locate and Mark Quality Assurance	32.50	3,169.19	340.00
SDG&E-RISK-7-C14	Locating Equipment	32.50	3,169.19	340.00
SDG&E-RISK-7-C24	Pipeline Patrol and Pipeline Markers	32.50	3,169.19	340.00
SDG&E-RISK-7-C16-T1	Public Awareness	32.50	3,169.19	340.00
SDG&E-RISK-7-C16-T2	Public Awareness	32.50	3,169.19	340.00
SDG&E-RISK-7-C16-T3	Public Awareness	32.50	3,169.19	340.00
SDG&E-RISK-7-C16-T4	Public Awareness*	32.50	3,169.19	340.00
SDG&E-RISK-7-C30	Ticket Risk Assessment, and evaluating City permit data	32.50	3,169.19	340.00
SDG&E-RISK-7-C28	Warning Mesh	32.50	3,169.19	340.00

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.

2021 RAMP
SDG&E-RISK-7-QWP
High Pressure Excavation Damage RSE Summary

ID	Mitigation Name	CoRE	Post-Mitigated LoRE	Risk Reduction
SDG&E-RISK-7-A04	ALTERNATIVE - GPS Tracking of Excavation Equipment	4235.48	0.19	0.00
SDG&E-RISK-7-A02	ALTERNATIVE - Virtual Reality Training	4235.48	0.19	0.00
SDG&E-RISK-7-M2	Automate Third Party Excavation Incident Reporting	4235.48	0.19	0.03
SDG&E-RISK-7-C12	Damage Prevention Analyst Program	4235.48	0.19	0.94
SDG&E-RISK-7-C32	Enhance Ticket Management Software	4235.48	0.19	0.20
SDG&E-RISK-7-C04	Locate and Mark Activities	4235.48	0.17	93.44
SDG&E-RISK-7-C06	Locate and Mark Annual Refresher Training and Competency Program	4235.48	0.19	0.33
SDG&E-RISK-7-C10	Locate and Mark Quality Assurance	4235.48	0.19	1.63
SDG&E-RISK-7-C14	Locating Equipment	4235.48	0.19	14.13
SDG&E-RISK-7-C24	Pipeline Patrol and Pipeline Markers	4235.48	0.19	4.22
SDG&E-RISK-7-C16-T1	Public Awareness	4235.48	0.19	2.30
SDG&E-RISK-7-C16-T2	Public Awareness	4235.48	0.19	0.05
SDG&E-RISK-7-C16-T3	Public Awareness	4235.48	0.19	0.16
SDG&E-RISK-7-C16-T4	Public Awareness*	4235.48	0.19	1.48
SDG&E-RISK-7-C30	Ticket Risk Assessment, and evaluating City permit data	4235.48	0.19	0.07
SDG&E-RISK-7-C28	Warning Mesh	4235.48	0.19	5.78

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.

2021 RAMP
SDG&E-RISK-7-QWP
High Pressure Excavation Damage RSE Summary

ID	Mitigation Name	Discounted Time	RSE per \$Million	Data Sources
SDG&E-RISK-7-A04	ALTERNATIVE - GPS Tracking of Excavation Equipment	0.97	0.00	> Internal DIRT Database > SME Input
SDG&E-RISK-7-A02	ALTERNATIVE - Virtual Reality Training	0.97	0.02	> Internal DIRT Database > SME Input
SDG&E-RISK-7-M2	Automate Third Party Excavation Incident Reporting	4.58	30.81	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C12	Damage Prevention Analyst Program	0.97	19.05	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C32	Enhance Ticket Management Software	4.58	38.96	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C04	Locate and Mark Activities	0.97	60.85	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C06	Locate and Mark Annual Refresher Training and Competency Program	0.97	316.63	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C10	Locate and Mark Quality Assurance	0.97	18.85	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C14	Locating Equipment	4.58	455.57	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C24	Pipeline Patrol and Pipeline Markers	0.97	5.68	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C16-T1	Public Awareness	0.97	38.49	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C16-T2	Public Awareness	0.97	50.94	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C16-T3	Public Awareness	0.97	39.33	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C16-T4	Public Awareness*	0.97	287.00	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C30	Ticket Risk Assessment, and evaluating City permit data	0.97	7.92	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C28	Warning Mesh	25.73	2701.75	> Internal DIRT Database > SME Input > National PHMSA Data

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.

2021 RAMP

SDG&E-RISK-7-QWP

Medium Pressure Excavation Damage RSE Summary

ID	Mitigation Name	Lifetime Benefit	Total Cost (\$k)	% Change in LoRE
SDG&E-RISK-7-A03	ALTERNATIVE - GPS Tracking of Excavation Equipment	1.0	\$340	0%
SDG&E-RISK-7-A01	ALTERNATIVE - Virtual Reality Training	1.0	\$104	0%
SDG&E-RISK-7-M1	Automate Third Party Excavation Incident Reporting	5.0	\$28	0%
SDG&E-RISK-7-C11	Damage Prevention Analyst Program	1.0	\$254	3%
SDG&E-RISK-7-C31	Enhance Ticket Management Software	5.0	\$102	0%
SDG&E-RISK-7-C23	Excess Flow Valve or Curb Valve Installation	67.0	\$325	0%
SDG&E-RISK-7-C03	Locate and Mark Activities*	1.0	\$5,249	1010%
SDG&E-RISK-7-C05	Locate and Mark Annual Refresher Training and Competency Program	1.0	\$5	0%
SDG&E-RISK-7-C09	Locate and Mark Quality Assurance	1.0	\$641	0%
SDG&E-RISK-7-C13	Locating Equipment	5.0	\$668	8%
SDG&E-RISK-7-C15-T2	Public Awareness	1.0	\$3	0%
SDG&E-RISK-7-C15-T4	Public Awareness	1.0	\$21	1%
SDG&E-RISK-7-C15-T3	Public Awareness	1.0	\$17	0%
SDG&E-RISK-7-C15-T1	Public Awareness	1.0	\$256	1%
SDG&E-RISK-7-C29	Ticket Risk Assessment, and evaluating City permit data	1.0	\$38	0%
SDG&E-RISK-7-C27	Warning Mesh*	50.0	\$238	0%

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.

2021 RAMP

SDG&E-RISK-7-QWP

Medium Pressure Excavation Damage RSE Summary

ID	Mitigation Name	Pre-Mitigated LoRE	CoRE Safety	CoRE Financial	CoRE Reliability
SDG&E-RISK-7-A03	ALTERNATIVE - GPS Tracking of Excavation Equipment	300.20	0.55	0.20	0.17
SDG&E-RISK-7-A01	ALTERNATIVE - Virtual Reality Training	300.20	0.55	0.20	0.17
SDG&E-RISK-7-M1	Automate Third Party Excavation Incident Reporting	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C11	Damage Prevention Analyst Program	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C31	Enhance Ticket Management Software	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C23	Excess Flow Valve or Curb Valve Installation	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C03	Locate and Mark Activities*	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C05	Locate and Mark Annual Refresher Training and Competency Program	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C09	Locate and Mark Quality Assurance	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C13	Locating Equipment	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C15-T2	Public Awareness	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C15-T4	Public Awareness	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C15-T3	Public Awareness	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C15-T1	Public Awareness	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C29	Ticket Risk Assessment, and evaluating City permit data	300.20	0.55	0.20	0.17
SDG&E-RISK-7-C27	Warning Mesh*	300.20	0.55	0.20	0.17

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.

2021 RAMP

SDG&E-RISK-7-QWP

Medium Pressure Excavation Damage RSE Summary

ID	Mitigation Name	CoRE Stakeholder Satisfaction	CoRE
SDG&E-RISK-7-A03	ALTERNATIVE - GPS Tracking of Excavation Equipment	0.13	1.05
SDG&E-RISK-7-A01	ALTERNATIVE - Virtual Reality Training	0.13	1.05
SDG&E-RISK-7-M1	Automate Third Party Excavation Incident Reporting	0.13	1.05
SDG&E-RISK-7-C11	Damage Prevention Analyst Program	0.13	1.05
SDG&E-RISK-7-C31	Enhance Ticket Management Software	0.13	1.05
SDG&E-RISK-7-C23	Excess Flow Valve or Curb Valve Installation	0.13	1.05
SDG&E-RISK-7-C03	Locate and Mark Activities*	0.13	1.05
SDG&E-RISK-7-C05	Locate and Mark Annual Refresher Training and Competency Program	0.13	1.05
SDG&E-RISK-7-C09	Locate and Mark Quality Assurance	0.13	1.05
SDG&E-RISK-7-C13	Locating Equipment	0.13	1.05
SDG&E-RISK-7-C15-T2	Public Awareness	0.13	1.05
SDG&E-RISK-7-C15-T4	Public Awareness	0.13	1.05
SDG&E-RISK-7-C15-T3	Public Awareness	0.13	1.05
SDG&E-RISK-7-C15-T1	Public Awareness	0.13	1.05
SDG&E-RISK-7-C29	Ticket Risk Assessment, and evaluating City permit data	0.13	1.05
SDG&E-RISK-7-C27	Warning Mesh*	0.13	1.05

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.

2021 RAMP
SDG&E-RISK-7-QWP
Medium Pressure Excavation Damage RSE Summary

ID	Mitigation Name	Post-Mitigated LoRE	Risk Reduction
SDG&E-RISK-7-A03	ALTERNATIVE - GPS Tracking of Excavation Equipment	300.20	0.00
SDG&E-RISK-7-A01	ALTERNATIVE - Virtual Reality Training	300.20	0.00
SDG&E-RISK-7-M1	Automate Third Party Excavation Incident Reporting	300.10	0.10
SDG&E-RISK-7-C11	Damage Prevention Analyst Program	290.29	10.42
SDG&E-RISK-7-C31	Enhance Ticket Management Software	299.84	0.38
SDG&E-RISK-7-C23	Excess Flow Valve or Curb Valve Installation	299.30	0.94
SDG&E-RISK-7-C03	Locate and Mark Activities*	3332.73	3189.34
SDG&E-RISK-7-C05	Locate and Mark Annual Refresher Training and Competency Program	300.08	0.13
SDG&E-RISK-7-C09	Locate and Mark Quality Assurance	299.60	0.63
SDG&E-RISK-7-C13	Locating Equipment	275.43	26.05
SDG&E-RISK-7-C15-T2	Public Awareness	300.14	0.06
SDG&E-RISK-7-C15-T4	Public Awareness	297.66	2.67
SDG&E-RISK-7-C15-T3	Public Awareness	299.96	0.25
SDG&E-RISK-7-C15-T1	Public Awareness	295.97	4.45
SDG&E-RISK-7-C29	Ticket Risk Assessment, and evaluating City permit data	300.17	0.03
SDG&E-RISK-7-C27	Warning Mesh*	300.15	0.24

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.

2021 RAMP

SDG&E-RISK-7-QWP

Medium Pressure Excavation Damage RSE Summary

ID	Mitigation Name	Discounted Time	RSE per \$Million	Data Sources
SDG&E-RISK-7-A03	ALTERNATIVE - GPS Tracking of Excavation Equipment	0.97	0.00	> Internal DIRT Database > SME Input
SDG&E-RISK-7-A01	ALTERNATIVE - Virtual Reality Training	0.97	0.01	> Internal DIRT Database > SME Input
SDG&E-RISK-7-M1	Automate Third Party Excavation Incident Reporting	4.58	17.04	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C11	Damage Prevention Analyst Program	0.97	39.82	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C31	Enhance Ticket Management Software	4.58	17.01	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C23	Excess Flow Valve or Curb Valve Installation	28.73	83.29	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C03	Locate and Mark Activities*	0.97	589.91	> Internal DIRT Database > SME Input > National PHMSA Data (Pre-1976)
SDG&E-RISK-7-C05	Locate and Mark Annual Refresher Training and Competency Program	0.97	24.52	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C09	Locate and Mark Quality Assurance	0.97	0.96	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C13	Locating Equipment	4.58	178.57	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C15-T2	Public Awareness	0.97	20.08	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C15-T4	Public Awareness	0.97	123.48	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C15-T3	Public Awareness	0.97	14.33	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C15-T1	Public Awareness	0.97	16.88	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C29	Ticket Risk Assessment, and evaluating City permit data	0.97	0.73	> Internal DIRT Database > SME Input
SDG&E-RISK-7-C27	Warning Mesh*	25.73	26.41	> Internal DIRT Database > SME Input > National PHMSA Data

* Mitigation has adjustment in "% Change in LoRE" field to account for variance in RSE calculation.