Risk Assessment and Mitigation Phase

(Chapter SDG&E-Risk-2)

Electric Infrastructure Integrity

May 17, 2021

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RISK: ELECTRIC INFRASTRUCTURE INTEGRITY

I. INTRODUCTION

The purpose of this chapter is to present SDG&E's risk control and mitigation plan for the Electric Infrastructure Integrity (EII) risk. Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014 and the Settlement Agreement included therein (the Settlement Decision).[1]

SDG&E has identified and defined RAMP risks in accordance with the process described in further detail in Chapter RAMP-B of this RAMP Report. On an annual basis, SDG&E's Enterprise Risk Management (ERM) organization facilitates the Enterprise Risk Registry (ERR) process. The ERR process influenced how risks were selected for inclusion in this 2021 RAMP Report, consistent with the Settlement Decision's directives, as discussed in Chapter RAMP-C.

The RAMP Report's purpose is to present a current assessment of key safety risks and the proposed activities for mitigating those risks. The RAMP Report does not request funding. Any funding requests will be made in SDG&E's General Rate Case (GRC) application. The costs presented in this 2021 RAMP Report are those costs for which SDG&E anticipates requesting recovery in its Test Year (TY) 2024 GRC. SDG&E's TY 2024 GRC presentation will integrate developed and updated funding requests from the 2021 RAMP Report, supported by witness testimony.[2] This 2021 RAMP Report is presented consistent with SDG&E's GRC presentation, in that the last year of recorded data (2020) provides baseline costs and cost estimates are provided for years 2022-2024, as further discussed in Chapter RAMP-A. This 2021 RAMP Report presents capital costs as a sum of the years 2022, 2023, and 2024 as a three-year total; operations and maintenance (O&M) costs are only presented for TY 2024 (consistent with the GRC). Costs for each activity that directly address each risk are provided where those costs are available and within the scope of the analysis required in this RAMP Report.

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[1] D.16-08-018 also adopted the requirements previously set forth in D.14-12-025. D.18-12-014 adopted the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with modifications and contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and GRC.

[2] *See* D.18-12-014, Attachment A at A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Throughout this 2021 RAMP Report activities are delineated between controls and mitigations, consistent with the definitions adopted in the Settlement Decision's Revised Lexicon. A "control" is defined as a "[c]urrently established measure that is modifying risk."[3] A "mitigation" is defined as a "[m]easure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event."[4] Activities presented in this chapter are representative of those that are primarily scoped to address SDG&E's EII risk; however, many of the activities presented herein also help mitigate other areas.

As discussed in Chapters RAMP-A and RAMP-C, SDG&E has endeavored to calculate an RSE for all controls and mitigations presented in this risk chapter. However, for controls and mitigations where no meaningful data or SME opinion exists to calculate the RSE, SDG&E has included an explanation why no RSE can be provided, in accordance with California Public Utilities Commission (CPUC or Commission) Safety Policy Division (SPD) staff guidance.[5] Activities with no RSE value presented in this 2021 RAMP Report are identified in Section V below.

A. Risk Overview

Safety is a core value at SDG&E. SDG&E's safety-first culture focuses on its employees, customers, and the public, and is embedded in every aspect of our work. One of the known safety risks for employees, customers and the public pertain to the electric infrastructure. SDG&E continually aims to improve its electric infrastructure and educate employees, customers and the public about safety measures related to energized lines, both overhead and underground. The residual risk of electric infrastructure failures causing safety, environmental, or major reliability incidents has remained stable over recent years, which is evidenced by SDG&E winning its 15th consecutive ReliabilityOne "Best in the West" award.[6] SDGE has developed strong controls through programs such as the Corrective Maintenance Program (CMP) and its

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3 *Id.* at 16.

4 *Id.* at 17.

5 *See* Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012 (November 25, 2020) at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.").

6 *See article available at* https://sdgenews.com/article/sdge-receives-awards-outstanding-electric-reliability-innovation-and-system-resiliency.

proactive reliability measures such as the pole, cable, switch and aging substation infrastructure replacement programs. Other controls include the consistent review and updating of its Construction Standards. It is through these controls that SDG&E continues to mitigate its EII risk and mitigate substantial growth in residual risks.

The EII risk can be characterized by several possible scenarios. One example of these scenarios is the occurrence of an energized wire-down event which was used for risk impact and frequency scoring that involves asset failures. The energized wire-down event is one of SDG&E's primary concerns with respect to its overhead equipment and involves an energized overhead conductor (*i.e.*, a wire) falling from its intended approved support equipment and resting on the ground or on a foreign object. If an employee, contractor, or the public comes into contact with an energized wire, the results can be fatal. Accordingly, SDG&E is continuing to take proactive measures to determine the cause of any such wire-down events and has a dedicated team reviewing all wire-down events to determine the root cause and to identify any trends to potentially trigger the development of a new program. SDG&E's Electric Engineering department is dedicated to the development and implementation of strategies that support all the unique operations practices, field construction, and microclimate conditions throughout the area served by SDG&E, while assuring electric distribution efficiency, access, control, cost-effectiveness, and safety are being considered in all final decisions. Data analysis suggests there are various drivers of wire-down events, such as third-party contact, acute weather causing foreign object contact, or extensive stress, aged infrastructure, and degradation of connectors. These drivers/triggers are further discussed below. SDG&E's risk control and mitigation plan aims to mitigate these drivers/triggers and thereby reduce potential consequences.

Asset age and equipment characteristics (*e.g.*, wire type) can be predictable and impactful attributes leading to the natural decline of electric infrastructure integrity. Aged assets can be affected by severe wearing due to weathering and electrical and mechanical forces. They may also consist of outdated technologies, not being able to provide the benefits of various improvements made to technology over time such as safer design/installation techniques, technology advancements, material quality, and improved functionality. Also, it may be more difficult to maintain and operate aged assets due to a lack of spare parts and vendor support and reduction in internal experience operating the asset. Given these conditions, aged infrastructure

generally is operated with heightened caution, sometimes using special procedures, for the safety of workers and the public.

SDG&E's risk control and mitigation plan focuses on safety and reliability measures designed to protect its employees, customers, and the public. The controls and mitigations in SDG&E's risk control and mitigation plan are intended to address various EII-related events. Other risks associated with this chapter are discussed in the following risk chapters: Incident Involving an Employee, Incident Involving a Contractor, and Customer and Public Safety-Contact with Electric Equipment. These other risk chapters focus on mitigations that address public outreach, education, communication, training, and other internal procedural enhancements, while this EII risk chapter focuses on infrastructure improvement risk mitigation activities and costs. Risk reduction benefits from the infrastructure improvements discussed in this chapter also impact the human safety risks addressed in SDG&E's Employee Safety and Customer and Public Safety-Contact with Electric Equipment chapters.

This EII Chapter primarily focuses on risks and mitigations unrelated to wildfire mitigation predominately outside of SDG&E's High Fire Threat District (HFTD). Wildfire-related risks and mitigations are covered in SDG&E's "Wildfires Involving SDG&E Equipment" risk Chapter (SDG&E-Risk-1). However, where the same type of mitigation activities are included in both the Wildfire Chapter and this EII Chapter, the costs included herein have been allocated according to HFTD and non-HFTD percentages (unless otherwise noted), consistent with SDG&E's Wildfire Mitigation Plan. For example, vegetation management is performed across SDG&E's entire service territory. Vegetation management, therefore, appears as an activity performed to reduce risk in both SDG&E-Risk-1 and this Chapter, as a reliability mitigation. The costs associated with the vegetation management activities in this chapter only include the non-HFTD percentage of costs.

B. Risk Definition

SDG&E's Electric Infrastructure Integrity risk is defined as "the risk of an asset failure, caused by degradation, age, operation outside of design criteria due to unexpected events or field conditions (*e.g.*, force of nature) or an asset no longer complying with the latest engineering standards, which results in a safety or reliability incident." A potential Risk Scenario assessed as part of this risk is an energized wire-down event caused by a foreign object or failure of an electric component (*e.g.*, a connector). If a member of the public comes into contact with the

energized wire or in close proximity to the energized wire on the ground, the results could be loss of power to customers and injury and/or possibly death.

C. Scope

This EII RAMP Risk Chapter is focused on the programs outside of the HFTD; programs addressing issues inside the HFTD are addressed in the RAMP risk of the Wildfire RAMP Risk Chapter (SDG&E-Risk-1). Table 1 below provides what is considered in and out of scope for the Electric Infrastructure Integrity risk in this RAMP Application.

Table 1: Risk Scope

In-Scope:	The risk of an electric asset failure due to internal or external factors, which results in serious injuries, fatalities, or reliability impacts.
Data Quantification Sources:	Company data was used, reviewed, and adjusted by SMEs as appropriate. See Appendix B for additional information.

II. RISK ASSESSMENT

In accordance with the Settlement Decision,[7] this section describes the risk bow tie, possible drivers, potential consequences, and the risk score for the EII risk. SDG&E meets the Settlement Decision requirements for the EII risk by presenting controls and mitigations that have been subdivided by asset groupings and by specific activities related to the electric system, consistent with how SDG&E manages its risks and assets.[8] Certain asset groupings were further divided by characteristics of the asset. For many controls and mitigations, the amount of activity presented is a subset of the entire system. For example, the amount of work discussed in the activity with ID "C1" (Overhead Public Safety) focuses on 30 miles of overhead system. These 30 miles are considered to be their own tranche because they have a similar risk profile in both likelihood and consequence. Other controls, such as those that are part of compliance programs, have a large portion of the electric system as their scope. For example, the activity with ID "C7" (Restoration of Service) is applicable to the entire distribution system, and SDG&E's activities to restore service when outages occur.

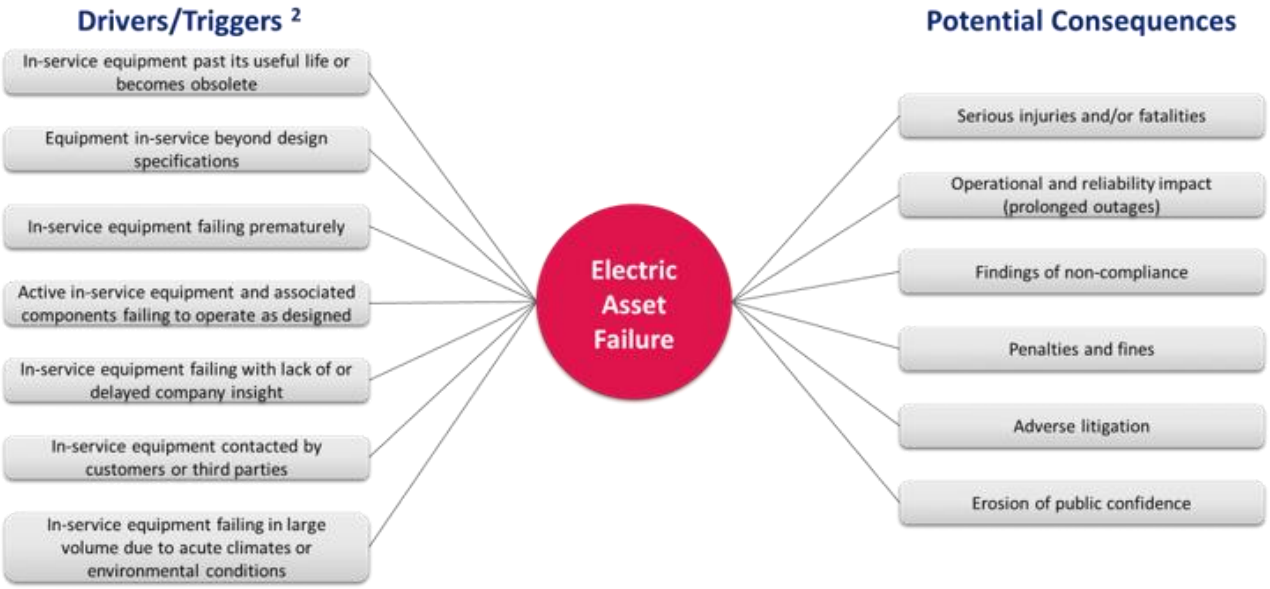
[7] D.18-12-014 at 33 and Attachment A at A-11 (Bow Tie).

[8] *See Id.*, Attachment A at A-11 (Definition of Risk Events and Tranches).

A. Risk Bow Tie and Risk Event Associated with the Risk

The risk bow tie is a commonly used tool for risk analysis, and the Settlement Decision[9] instructs the utility to include a risk bow tie illustration for each risk included in RAMP. As illustrated in the risk bow tie shown below in Figure 1, the risk event (center of the bow tie) is Electric Asset Failure, the left side of the bow tie illustrates drivers/triggers that lead to the Electric Asset Failure, and the right side shows the potential consequences of the Electric Asset Failure. SDG&E applied this framework to identify and summarize the information provided in Figure 1. A mapping of each mitigation to the element(s) of the risk bow tie addressed is provided in Appendix A.

Figure 1: Risk Bow Tie



B. Cross-Functional Factors

This RAMP filing includes separate Cross-Functional Factor Chapters that impact SDG&E's EII and help to further mitigate SDG&E's EII risk. - SDG&E identified the following cross-functional factors that are associated with EII risk. These include:

- **Asset Management (SDG&E-CFF-1):** To safely operate its grid, SDG&E conducts various asset management activities. Asset Management is an enterprise-wide framework that provides a standardized approach for managing risk and safety across assets and activities. Asset

[9] *Id.*, Attachment A at A-11 (Bow Tie).

Management also focuses on data analytics to integrate critical asset data attributes and support alternative replacement strategy analyses and asset health indices for certain critical assets.

- **Climate Change Adaptation, Energy System Resilience and GHG Emissions (SDG&E-CFF-2):** SDG&E recognizes the need to ensure safety and reliability of its services to customers and to adapt to weather- and climate-related threats to its system. Climate hazards are expected to increase the severity and frequency of adverse weather and other natural events and create or enhance risks to SDG&E's system as a result. For example, the threat of a rising sea level poses safety risks to coastal regions, and SDG&E's safety risks can come in the form of damaged assets in its coastal regions as well as extended outages due to damaged assets. To build comprehensive mitigations to wildfire and other climate hazards, SDG&E has combined the best available science (and has spearheaded scientific development where it is lacking), cutting-edge situational awareness technology, integration of sustainability principles, and subject matter expertise dedicated to solving complex climate change-related issues.
- **Emergency Preparedness and Response and Pandemic (SDG&E-CFF-3):** SDG&E's Emergency Preparedness and Response (EP&R) programs provide a standardized approach for managing risk and safety across assets and activities. The Emergency Management Department's programs and processes include planning, training, exercising, and supporting responses and recovery efforts related to incidents, emergencies, disasters, and catastrophes. EP&R is a factor in protecting operational reliability, ensuring the safety of employees and the public, and maintaining compliance with government regulations or guidelines.
- **Foundational Technology Systems (SDG&E-CFF-4):** The safe operation of electric infrastructure depends on many technological tools and applications for asset monitoring and awareness in the field. For example, SDG&E's outage and distribution management systems are

systems used by distribution operators to support safe operations related to outage restoration. Supervisory Control and Data Acquisition (SCADA) provides operational data from electric assets in order to proactively monitor for and remediate asset failure. SCADA reduces the need for field personnel to perform manual operations, thus minimizing the safety risks to employees and/or contractors. The health of SDG&E's foundational technology systems, therefore, impacts EII-related activities.

- **Records Management (SDG&E-CFF-6):** SDG&E implemented various recordkeeping controls for its system in accordance with CPUC regulations, decisions and directives. For EII-related activities, this includes compliance with the General Orders (GO) (*e.g.*, GO 95).
- **Safety Management Systems (SMS) (SDG&E-CFF-7):** SDG&E's SMS provides a systematic, cohesive framework which builds upon SDG&E's strong safety culture and integrates new and existing processes. By taking an integrated, systematic approach to safety, SDG&E is better able to assess and manage risk across the entire organization. Enhancing our communication, collaboration, feedback and documentation and using data and analytics to regularly measure our effectiveness and make continuous improvements will help make each of our current and future safety programs more effective. SDG&E's SMS framework, as referenced in the SMS Cross Functional Factor Chapter, includes the Five Pillars of Safety, to focus on both individual safety behaviors and process safety management. Activities to effectively manage the risks SDG&E faces, including mitigation and prevention activities for EII-related risks, are integrated throughout the SMS Framework and its Five Pillars of Safety.
- **Workforce Planning / Qualified Workforce (SDG&E-CFF-8):** A highly qualified workforce positions a utility to efficiently and effectively manage operations to ensure safety, compliance, and reliability, and fosters confidence in those who regulate these activities. Additionally, workers are provided training to gain knowledge to perform their role safely, effectively, and efficiently.

C. Potential Drivers/Triggers[10]

The Settlement Decision instructs the utility to identify which element(s) of the associated risk bow tie each mitigation addresses.[11] When performing the risk assessment for Electric Infrastructure Integrity, SDG&E identified potential leading indicators, referred to as drivers or triggers. These include, but are not limited to:

- **DT.1 – In-service equipment past its useful life or that becomes obsolete:** Electric assets are usually in service for several decades and possibly for several years beyond the book life of the asset. The age of a specific asset is a common key indicator for sudden failure of the electric asset because the mechanical strength and characteristics of the asset may have diminished over time. These assets can also be considered obsolete when new or updated safety, construction, and operational standards have been established in the industry or within the Company.
- **DT.2 – Equipment in-service beyond design specifications:** Electric assets are designed and constructed per SDG&E standards and in accordance with CPUC General Orders and other local or national requirements. Assets often are designed and constructed to exceed the requirements set forth by these standards; however, field conditions, such as excessive forces exerted on poles due to acute natural forces (*e.g.*, high winds above recorded values), may stress the infrastructure and cause failures.
- **DT.3 – In-service equipment failing prematurely:** SDG&E's electric assets such as underground cables, substation transformers, and overhead connectors are supplied by various manufacturers. These assets undergo routine quality testing from their respective manufacturers and operate within their design criteria; however, it is reasonable to expect some subsets to fail over time, under conditions near the upper limits of their design ratings, or for reasons unknown to SDG&E.

[10] An indication that a risk could occur. It does not reflect actual or threatened conditions.

[11] *See* D.18-12-014, Attachment A at A-11 (Bow Tie).

- **DT.4 – Active in-service equipment and associated components failing to operate as designed:** Due to their sensitive nature, electric assets that are expected to operate based on protection settings to mitigate or reduce the impacts of an asset failure can be expected either to fail periodically or not to operate as designed. These failures or delays in operation may cause the assets the protection settings are designed to protect to experience more damage or to extend an expected isolated event.
- **DT.5 – In-service equipment failing with lack of or delayed company insight:** Assets outside of design standards or original construction that does not result in an outage or visibility to SDG&E can lead to an extended exposure to the public (*e.g.*, a leaking transformer). Failure of these systems may cause prolonged or undetected risk exposure to the public.
- **DT.6 – In-service equipment contacted by customers or third parties:** SDG&E's electric facilities may be contacted by members of the public or other third parties. An incident of this type may involve energized overhead distribution primary conductor during the occurrence of a wire-down event or while the conductor is intact and operating under normal operating conditions.
- **DT.7 – In-service equipment failing in large volume (*i.e.*, simultaneous failure of numerous assets) due to acute climates or environmental conditions:** Although it is reasonable to expect some subsets of in-service electric assets to fail, acute weather events or environmental conditions may pose added risks to SDG&E's operations. Adverse weather events may lead to large volumes of failures that extend the normal outage response time, due to limited resources or unsafe field conditions to assess and mitigate damage.

D. Potential Consequences of Risk Event

- Potential consequences[12] are listed to the right side of the risk bow tie illustration provided above. If one or more of the drivers/triggers listed above were to result

[12] D.18-12-014 at 16 and Attachment A at A-8 ("Identification of Potential Consequences of Risk Event").

in an incident, the potential consequences, in a reasonable worst-case scenario, could include:

- PC.1 - Serious injuries and/or fatalities
- PC.2 - Operational and reliability impacts
- PC.3 - Findings of non-compliance
- PC.4 - Penalties and fines
- PC.5 - Adverse litigation
- PC.6 - Erosion of public confidence

These potential consequences were used in the scoring of Electric Infrastructure Integrity that occurred during the development of SDG&E's 2020 Enterprise Risk Registry.

E. Risk Score

The Settlement Decision requires a pre- and post-mitigation risk calculation.[13] Chapter RAMP-C of this RAMP Application explains the Risk Quantitative Framework which underlies this Chapter, including how the Pre-Mitigation Risk Score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[14]

	LoRE	CoRE	Risk Score
Electric Infrastructure Integrity	1,632	6	9,177

Pursuant to Step 2A of the Settlement Decision, the utility is instructed to use actual results, available and appropriate data.[15] The primary source of data used for this risk is based on internal data, please see Appendix B.

[13] D.18-12-014, Attachment A at A-11 ("Calculation of Risk").

[14] The term "pre-mitigation analysis," in the language of the Settlement Decision refers to required pre-activity analysis conducted prior to implementing control or mitigation activity. *See* D.18-12-014, Attachment A at A-12 ("Determination of Pre-Mitigation LoRE by Tranche," "Determination of Pre-Mitigation CoRE," and "Measurement of Pre-Mitigation Risk Score").

[15] *Id.,* Attachment A at A-8 ("Identification of Potential Consequences of Risk Event").

III. 2020 CONTROLS

This section describes the controls currently in place as required by the Settlement Decision.[16] The Settlement Decision's lexicon defines a "control" as a "[c]urrently established measure that is modifying risk."[17] The activities in this section were in place as of December 31, 2020. Controls that will continue as part of the Plan are addressed in Section IV.

A. C1: Overhead Public Safety (OPS) Program

The OPS program[18] effectively replaces the overhead assets most prone to failure. The OPS program uses historical data collected from actual wire-down events to estimate failure rates of overhead infrastructure. Applying these failure rates to all non-HFTD areas and outside of the scope of the Distribution Overhead System Hardening program provides SDG&E's subject matter experts with an estimate of an individual circuit's expected likelihood of experiencing a wire-down event over a given period of time. SDG&E ranks these individual circuits by the total expected number of wire-down events, to identify the top quartile circuits where risk reductions may be concentrated. The top quartile of circuits have the most exposure of high-risk assets, primarily small wire (*e.g.*, #6 Cu and #4 Cu). Other environmental factors are considered when estimating failure rates and potential for risk reduction, including high winds, accelerated corrosion in coastal areas, likelihood of public contact, and areas where wire-down events have occurred more than usual.

SDG&E's OPS program is intended to proactively replace high-risk overhead conductors prone to wire-down events measured by failure rates, historic wire-down events, CMP records and lack of protection (fuse or advanced technology) that are in proximity to the public (*e.g.*, schools, freeways, high profile areas) that could put the public at risk of energized contact. SDG&E utilizes new construction standards, such as stronger (*i.e*. higher tensile strength) and/or covered conductor, to decrease the likelihood of a wire-down event, and designs risk mitigation strategies for each circuit to achieve the greatest risk reduction for energized wire-down events

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16 Settlement Decision at 33.

17 Settlement Decision at 16.

18 As previously stated in Section I of this Chapter, SDG&E's OPS program was identified in SDG&E's previous RAMP and GRC filings as the WiSE Central program. With the Commission's recent rulemaking on Wildfire Mitigation Plan (R.18-10-007), SDG&E reduced the scope of the WiSE program to align with wildfire mitigation activities outside of SDG&E's HFTD. Therefore, the OPS program is separate and distinct form the WiSE program.

by reconductoring and deploying advanced protection and/or detection schemes. This program replaces existing assets with assets that have been designed to current and updated construction standards. The assets targeted in this scope (typically small wire copper spans) were designed and constructed decades ago. Therefore, the replacement of these assets with those designed to current construction standards provides the benefit of improved design techniques and modern equipment and construction methods.

This program also evaluates overhead distribution lines that cross major or high-traffic freeways. Overhead distribution crossings that have poor structural integrity or high-risk conductors will be hardened to avoid a wire-down event in the roadway that could put motorists at risk.

The main scope of the program is to replace remaining small wire with conductor that is known to be statistically less prone to failure. In other areas, where small wire may not feasibly be replaced, at-risk connectors, sleeves, and single-phase spans of small wire (*i.e.*, commonly known failure points) are replaced as needed. In addition to the OPS infrastructure replacement program, SDG&E also has an enhanced public safety communication campaign (SDG&E-5-C1), as further described in SDG&E's Customer and Public Safety – Contact with Electric Equipment Chapter of this RAMP Report (SDG&E-Risk-5). This robust public safety awareness campaign aims to educate and provide a deeper level of understanding to the public with respect to safe practices around electric infrastructure. Associated costs for SDG&E-5-C1 are included in the Customer and Public Safety–Contact with Electric Equipment RAMP Chapter.

B. C2: GO165 Pole Replacement Reinforcement

SDG&E's GO 165 Distribution Inspect and Repair program replaces wood poles after identifying compromised poles from GO 165 wood pole intrusive inspections. In lieu of the existing program, short- and long-term deterioration of overhead equipment could increase the likelihood of asset failure (*e.g.*, broken poles) and cause potential risks, including injury or death, to the public and workers. Degraded equipment could also increase the volume and frequency of forced distribution outages, creating risks for public safety. As this program is mandated per GO 165, non-compliance poses a risk of regulatory action, including fines.

SDG&E's Overhead (OH) Visual Inspection program utilizes GO 95, Rules for Overhead Electric Line Construction, as its basis for identifying non-conformances. The OH Visual Inspection looks for a variety of conditions that could impact public and employee safety,

structural integrity, and system reliability. The OH Visual Inspection consists of a detailed, walk-around inspection of all distribution poles, pole-mounted facilities with primary and secondary conductors, CIP attachments, and distribution equipment on transmission poles. These inspections identify conditions that are out of compliance with GO 95. On average, SDG&E performs approximately 45,000 OH visual inspections on its electric distribution system per year. For an OH visual inspection, the top five conditions found are as follows:

- Damaged/Missing Sign;
- Damaged/Missing/Incorrect Station Pole ID;
- Damaged Ground Molding;
- Damaged/Missing High Voltage signs; and
- Pole steps lower than 10 feet.

SDG&E also performs a Pole Intrusive Inspection on each wood electric distribution pole. Any pole 15 years of age or older is inspected intrusively. The form of the intrusive inspection is normally an excavation about the pole base and/or a sound and bore inspection of the pole at ground line. Currently, treatment is applied in the form of ground-line pastes and/or internal pastes. SDG&E performs these inspections on a 10-year cycle. The 10-year cycle fulfills the requirements of GO 165, which are: (1) all poles over 15 years of age are intrusively inspected within ten years; and (2) all poles that previously passed intrusive inspection are to be inspected intrusively again on a 20-year cycle.

SDG&E is responsible for performing the wood pole integrity inspections, applying wood preservative treatments, and installing mechanical (steel) reinforcements. The type of treatment is dependent upon the age of the pole, the individual inspection history, and the overall condition of the structure. SDG&E's Vegetation Management group administers the wood pole intrusive inspection and treatment program. For this program, SDG&E performs approximately 20,000 wood pole intrusive inspections annually. There are three findings from this type of inspection. They are:

- Pole replacement;
- Pole reinforcement (with steel); and
- No corrective action needed.

C. C3: 4 kV Modernization Program – Distribution

The purpose of SDG&E's 4 kV modernization program is to systematically remove the 4 kV distribution system from service and replace it or upgrade to modern 12 kV standards. The 4 kV system makes up over 20% of SDG&E distribution circuits (by circuit count) and represents approximately 5% of SDG&E system load and overall distribution system length. Half of the 4 kV substations are more than 50 years old, an age for which replacement components are no longer available. The operation of 4 kV substations presents safety concerns, for example, because the company is facing a shortage of qualified crews and electricians who are familiar with and knowledgeable about design and operation of those aging and obsolete substations. The maintenance cost for the 4 kV substations is unusually high and continues to increase. The 4 kV substations also present reliability and safety risks for customers due to higher failure rates, lack of replacement parts, and limited options to transfer load to adjacent circuits. All of these factors create the potential for more frequent and extended duration outages. In addition, 4 kV overhead circuits are more likely to experience a wire-down event compared to 12 kV circuits, due to a higher percentage of small wire (*e.g.*, #6 Cu and #4 Cu) aging conductors and smaller conductor clearances. SDG&E's 4 kV modernization plan addresses all areas of 4 kV substation and distribution infrastructure removals and upgrades.

The scope of the program includes removing 4 kV packages or "unit" substations, modernizing other aging substation infrastructure as needed; cutting over existing 4 kV assets to 12 kV assets, replacing small and aging wire, and completely rebuilding, if deemed necessary, based on the asset.

D. C4: Distribution Overhead Switch Replacement Program

- **C4-T1: SCADA; C4-T2: Gang; C4-T3: Hook**

SDG&E's Distribution Overhead Switch Replacement Program aims to replace overhead distribution switches that have shown signs of severe or quickly emerging corrosion that may lead to catastrophic switch failure. SDG&E has identified through quantitative risk modeling various data attributes that characterize high-risk switches and has prioritized several switches that can be removed in the near term to avoid failure. For example, SDG&E's engineering analyses of failed overhead switches have determined that various switches, such as hooksticks, often fail due to excessive corrosion of major components. Switches have failed in as little as eight years of operation along the dense salt fog coast.

Distribution switches have a higher propensity for failure and/or inoperability in high corrosion areas, for example, in the area SDG&E identifies as "Contamination District One" (which includes assets within two miles of the coast). While switches within Contamination District One experience the highest rate of failure, failures can and do occur across the service territory. Distribution switch inoperability during an outage can extend the impact of an outage to the next upstream protection device, causing a prolonged forced outage when crews are required to install additional jumpers or other workarounds. Switches that are not consistently exercised are at increased risk of being inoperable when needed. The inoperable state of the switch poses safety risks to field operating personnel, due to potential flash or overexertion by the employee. Antiquated single phase disconnect switches are targeted to be replaced with newer model disconnects with superior material specifications, three-phase gang-operated switches (mitigating ferroresonance over-voltages and flashovers, both SCADA and Non-SCADA), as well as remote operable SCADA tie switches, for improved reliability. Switch replacements may also require simultaneous or subsequent upgrades to relevant equipment such as poles, crossarms, wires, guys, and other hardware.

E. C5: Management of Overhead Distribution Service (Non-CMP)

This project is required to reinforce the electric overhead distribution system infrastructure by responsive action to system damages, deterioration, and unsafe conditions outside normal restoration of service. The overall objective is to maintain continuity of safe and reliable customer service.

This project provides for the reconstruction of existing overhead distribution facilities as necessary, to:

- Correct improper voltage conditions;
- Replace overhead facilities that are non-compliant with OH safety and reliability standards;
- Make emergency repairs not normally associated with restoration of service;
- Repair or replace deteriorated or unsafe equipment not found through the "Corrective Maintenance Program;"
- Install fault indicators/fusing/switching equipment as necessary; and
- Install a barrier around the pole to prevent reoccurrence.

F. C6: Vegetation Management (non-HFTD)

SDG&E's Vegetation Management Program is responsible for inspecting and maintaining an inventory of approximately 450,000 trees that have the potential to encroach within the minimum required compliance distance between vegetation and overhead power lines. This work includes pruning healthy trees growing into overhead power lines as well as the pruning or removal of dead, dying, diseased, or structurally unsound trees that have the potential to fall into overhead lines. SDG&E is responsible for compliance with CPUC GO 95, Rule 35; Public Resources Code, sections 4292 and 4293; and NERC FAC-003-4. Compliance with these rules and regulations mandate a minimum clearance between vegetation and SDG&E facilities and are the primary cost drivers of the program.

SDG&E's vegetation activities are coordinated through a centralized Vegetation Management Program within the Wildfire Mitigation and Vegetation Management department, under the Electric Operations organization. The Vegetation Program Manager and staff set the standards, guidelines, and processes for the overall program to see that the company is in compliance with all rules, laws, and regulations governing SDG&E practices. There are two types of work that drive the tree program costs: (1) routine work and (2) field memos and hazard tree work. Routine work includes annual-cycle pruning and removal of trees. Pre-inspection contractors perform the overhead power line patrols, which identify trees to be pruned and removed. Routine tree pruning and removal is typically done by a contractor and is compensated on a unit price basis. Field memos and/or unscheduled tree pruning are reactive work, and include customer refusals, hazard tree pruning and removal, environmentally or culturally sensitive pruning activities, trees which require priority pruning, district requests, and customer safety checks, and may require time and equipment compensation instead of a per-unit price, due to the nature of the work activity.

To confirm the above activities are completed in accordance with the company's contracted scopes of work, SDG&E has a quality control program to verify the completion and certification of each work activity. An automated random sampling method is used to create audit work packages, and then the auditor field reviews records for adherence to contract specifications, quality, and compliance. In conjunction with the post-prune audit, auditing activity includes a patrol of all spans of overhead power lines for any trees that may have

encroached the minimum clearance zones since the last pre-inspection activity. This activity provides a higher level of compliance for the duration of the annual cycle.

G. C7: Restoration of Service

SDG&E, as an investor-owned utility, has an obligation to serve. This control is required to accomplish restoration of electric service due to system interruptions caused by severe inclement weather conditions, fires, equipment failures, damages caused by a third party and any other event that results in a customer loss of power caused the assets owned by SDG&E. This project provides for the reconstruction of existing overhead and underground distribution facilities as necessary to restore electric service to customers. The funds within this budget cover all costs associated with the following factors:

- Storm Damage (rain/wind/fire, for example);
- Extensive damage to electric distribution facilities by others (car/equipment contacts, for example); or
- Emergency repairs of facilities that are required for service restoration (cable or equipment failures, for example).

H. C8: Avian Protection Program

SDG&E's Avian Protection Program involves identifying and retro-fitting, rearranging, or building-to standard distribution poles in SDG&E's service territory to prevent electrocution of birds and to facilitate compliance with the following federal and state laws: (1) Migratory Bird Treaty Act (16 U.S.C. §§ 703-712), (2) Bald and Golden Eagle Protection Act (16 U.S.C. §§ 668-668d), and (3) the California Fish and Game Code (Cal. Fish and Game Code §§ 3503, 3503.5, 3511, 3513). The project will also harden the system and reduce the risk of wire-down events associated with avian electrocutions, improve SDG&E reliability and customer service, and align with Avian Power Line Interaction Committee (APLIC) Guidelines.[19] The plan will primarily address known bird contacts, in which case we will identify and resolve potential avian risk.

I. C9: Underground Cable Replacement Program - Reactive

SDG&E's underground cable replacement program is designed to identify and reactively replace equipment during outages on the distribution system. This program provides funding for

[19] *See* APLIC guidelines, *available at* https://www.aplic.org/.

the replacement of underground cable involved in a forced outage. This project is required to support SDG&E's obligation to serve, by funding the restoration of electric service after system interruptions caused by underground cable failures involved in severe inclement weather conditions, equipment failures and damages caused by a third party.

J. C10: Underground Cable Replacement Program – Proactive

- **C10-T1: UG Feeder; C10-T2: UG Branch; C10-T3: North Harbor Project**

SDG&E currently performs reactive replacement of underground unjacketed cable. There are currently approximately 65 circuit miles of unjacketed feeder cable and roughly 1,308 circuit miles of unjacketed lateral cable remaining on the SDG&E electric distribution system. The reactive program (C9, above) identifies and replaces failed equipment. This program takes a proactive approach by replacing underground cable that has been identified to have a high probability of failure based on electric reliability circuit analysis and cable failure data. It also provides quality customer service and reliability to existing customers by proactively replacing cable in the underground system before it fails and an outage occurs. In addition, this proactive control will assist in mitigating future outages caused by the failure of unjacketed cable to major customers (*e.g.*, San Diego International Airport).

K. C11: Tee Modernization Program – Underground

SDG&E's Tee Modernization Program involves the proactive at-risk identification and replacement of 600-amp tee connectors. 600-amp tees are used as underground connections in handholes, manholes, and at-switch terminations. Tee failures often occur along feeder cables, causing forced outages to large customer counts that require extensive reconstruction to permanently restore the outage. Tee connector failures have become one of the largest contributors to increasing the duration of customer outages in the last few years. The modernization of tees through this program provides a more reliable system that has more sectionalizing capability. Additionally, tees can fail violently (*e.g.*, tee failure could lead to an arc flash), which poses a serious safety risk to our field personnel and the public.

L. C12: Replacement of Live Front Equipment – Reactive

"Live front" equipment is equipment that has primary connections exposed, with no insulation covering. Live front equipment contains electric components enclosed in a protective (usually steel) cabinet that does not have additional protective barriers. Thus, when the cabinet

is opened, energized (or live) electric connections are exposed. This has been and still is a safety concern for employees required to work around these energized exposed parts within the confined space. Live front equipment was primarily installed on SDG&E's electric distribution system during the 1960's and 1970's and has since become obsolete and is no longer approved for installations with new construction. It is now being replaced by "dead front" equipment with additional safety barriers, such as removable fiberglass, composite plates, protective covers or additional compartmentalization. The dead front also provides additional locations to safely sectionalize equipment, assisting with troubleshooting and restoring partial load during outage events. SDG&E's Live Front Equipment Replacement Project replaces live front pad-mounted distribution equipment with dead front pad-mounted distribution equipment, when it is encountered during normal SDG&E work and not the main driver.

M. C13: Replacement of Live Front Equipment – Proactive

As described above in C12, "live front" equipment has the primary connections exposed with no insulative covering. Thus, when the equipment is opened, there are energized (or live) conductors present. SDG&E has a current live front terminator replacement program that is reactive; *i.e*., when there is a job on the SDG&E distribution system that involves working with live front equipment, the equipment that is involved will be replaced with dead front equipment at that time. The specific program described in this section aims to proactively identify and replace live front equipment before employees are deployed to the job, thereby further reducing the potential for employee injury and/or outage.

Continued use of live front terminators causes risks to workers who rely on limited tools to operate the live equipment. As an alternative to operating live front equipment, switching plans are used to operate dead front or remote-operated equipment elsewhere on the system, to create electric isolation for a job or for safe operation of the live front equipment. However, this typically exposes additional customers to unnecessary outages. And, if the limited switching tools are insufficient, workers may be dangerously exposed to live primary voltage, potentially resulting in serious risk of injury or death.

N. C14: DOE Switch Replacement

SDG&E's "do not operate energized" (DOE) Switch Replacement Program aims to systematically replace underground and overhead switches that are deemed unsafe for energized operation of the internal mechanical units. SDG&E utilizes inspection programs to identify these

types of switches. These inspections include visual inspections, infrared (IR) inspection to detect points of potential overheating, measurement of switch lubrication, and physical exercising. Upon inspection, if a switch is found to not be safe for continued operation, field experts will make the determination to replace the switch with an appropriately superior or equivalent asset, depending on field conditions and reliability impact. This program improves worker safety while operating these switches and prevents premature failures of these assets, avoiding potential for injuries and damages to adjacent facilities. In addition, replacement of these switches allows for a reduced customer impact when isolation devices are needed during planned and unplanned outages.

O. C15: GO165 Corrective Maintenance Program - Underground

Short- and long-term deterioration of underground equipment could increase likelihood of asset failure (*e.g.*, a broken cable rack) and cause potential risks, including injury or death, to the public and workers. Degraded equipment would also increase volume and frequency of forced distribution outages, creating risks for public safety. As this program is mandated per GO 165, non-compliance poses risk of regulatory action, including fines. Underground equipment/connectors are inspected by infrared technology (upon entry of facility) per an internal standard Engineering Standard Practice 120 (ESP 120) and replaced accordingly.

This inspection of AGDF/AGLF (above ground, dead front and live front pad-mounted equipment) consists of a detailed external and internal visual inspection of pad-mounted facilities to identify conditions out of compliance with GO 128. The most obvious types of condition that presents a significant hazard to the public and employees are severe corrosion, possible wire entry, and identifying oil leaks. These are the types of conditions that SDG&E is continually looking for.

SDG&E performs this type of inspection on approximately 25,000 structures per year. The top five conditions found on this type of inspection are as follows:

- EXT/INT High Voltage Sign Missing;
- External Working Space Sign Missing;
- Weeds/Trees/Bushes/Dirt or Obstacle;
- Possible Wire Entry to Energized/Exposed Parts; and
- Weeds/Grass/Dirt Inside Unit.

P. C16: GO 165 Manhole, Vault Restoration Program

Short- and long-term structural deterioration of manholes, handholes, and vaults cause potential risks, including the risk of injury or death, to the public and workers. As this program is mandated per GO 165 (Inspection Requirements for Electric Distribution and Transmission Facilities), non-compliance poses risk of regulatory action, including fines.

This program includes detailed inspection of subsurface structures (manholes, vaults, primary hand-holes and subsurface enclosures) containing electric distribution equipment. Structures with only cable taps, splices or pass-throughs are not required by GO 165, but are still inspected as part of SDG&E's inspection program. The program's detailed inspection of these facilities identifies conditions out of compliance with GO 128 (Rules for Construction of Underground Electric Supply and Communication Systems). The most obvious examples of a condition that could present a significant hazard to the public and employees are severe structural deterioration, an unsecure entryway, and working space issues.

On average, SDG&E performs this type of detailed inspection on approximately 400 structures per year. The top five conditions found on this type of inspection are as follows:

- Weeds/Trees/Bushes/Dirt or Obstacle;
- EXT/INT High Voltage Sign Missing;
- Weeds/Grass/Dirt Inside Unit;
- ID/Circuit/Switch Number Missing or Incorrect; and
- External Working Space Sign Missing.

Q. C17: Management of Underground Distribution Service (Non-CMP)

This project is required to reinforce the electric underground distribution system infrastructure by responsive action to system damages, deterioration and unsafe conditions outside normal restoration of service. The overall objective is to maintain continuity of safe and reliable customer service. This project provides for the reconstruction of existing underground distribution facilities as necessary to:

- Correct improper voltage conditions;
- Replace non-compliant underground facilities;
- Make emergency repairs not normally associated with restoration of service;
- Repair or replace deteriorated or unsafe equipment not found through the Corrective Maintenance Program; and

- Install fault indicators, fusing, or switching equipment as necessary to maintain service reliability.

R. C18: Distribution Circuit Reliability

This program helps mitigate the Electric Infrastructure Integrity Risk by expanding the distribution SCADA-switching infrastructure and/or removing reliability deficiencies on a distribution circuit. This program allows for the addition of equipment necessary to improve service reliability of electric customers and maintain reliability standards. Electric service reliability will deteriorate in the absence of comprehensive remedial solutions offered by these projects and consistent review of distribution circuits.

S. C19: Minor Distribution Substation Reliability Projects

This is a reactive project for electrical distribution substation facilities that have failed, intended to maintain the integrity and reliability of the distribution substation. General project categories include:

- Safety related improvements; and
- Replacement of failed equipment.

T. C20: Substation Reliability for Distribution Components

The following projects focuses primarily on distribution substation transformers, capacitors, and circuit breaker replacements. Substations are essential to the daily operation of the electric system and must be kept in reliable condition. Modern substation infrastructure can rely on protective relaying devices to operate correctly and strategically isolate substation equipment in order to minimize the impact of an outage and increase reliability. Failure to maintain a substation in reliable condition can impact reliability and limit operational flexibility. Qualified Electric Workers (QEW) can also be subject to electric safety hazards such as arcing, high voltage induction stray voltages, and mechanical safety hazards associated with working with heavy equipment (*e.g.*, circuit breakers) and in confined spaces, such as in metal clad switchgear.

Proactive planning is therefore required for the replacement of equipment that has exhausted its useful life. Proactive planning and replacement will allow the distribution system to continue operating at optimum conditions and maintain its reliability, shorten outage times, and allow for operational flexibility to the system.

The following substations have been identified as having limited operational flexibility and needing work to be performed under this program. Below is a list of individual substations planned to perform a proactive replacement:

- C20-T1: Chicarita 12 kV Breaker and Capacitor Replacements;
- C20-T2: Laguna Niguel 12 kV Breaker and Capacitor Replacements;
- C20-T3: Scripps 12 kV Breaker and Capacitor Replacements;
- C20-T4: Coronado 69/12 kV Transformer Replacement;
- C20-T5: Batiquitos 12 kV Breaker and Capacitor Replacements;
- C20-T6: Bernardo 12 kV Breaker Replacements;
- C20-T7: Miramar 12 kV Breaker Replacements; and
- C20-T8: Pacific Beach 12 kV Bus Tie Replacements.

U. C21: Distribution Substation Obsolete Equipment

This is a proactive distribution substation equipment replacement or addition program that will improve safety and reliability related to the replacement of obsolete and problematic substation equipment with costs under or around roughly $1M. Similar to C20, this program covers individual equipment with limited spare parts and introduces significant risk to the system.

V. C22: Emergency Transformer and Switchgear

This is a reactive spare/portable project intended for a speedier restoration of service to our customers following outages caused by equipment failures. The number of aging transformers and switchgear on the SDG&E system is at a level for which additional failures can be expected, despite efforts to replace the equipment before failure. In addition, there can be lengthy lead times for replacement units, during which time the spares and portable equipment are necessary. This project addresses long lead time by purchasing emergency spare and mobile equipment as needed.

W. C23: San Mateo Substation Rebuild

The purpose of this project is to enhance reliability and reduce the number of transmission and distribution outages impacting the San Clemente Area. The scope of this project includes replacing all aging infrastructure inside the substation past its useful life and functioning beyond design specifications. The San Mateo Substation rebuild project involves replacing capacitor banks, transformer banks and circuit breakers. San Mateo Substation will

approach or exceed its normal operating life in several years, and SDG&E has determined that replacing this aging equipment will be needed to address reliability concerns. The need to obtain optimum operating conditions to maintain substation reliability and to reduce outage times is a key driver for this project.

X. C24: Urban Substation

The purpose of this project is to enhance reliability and to reduce the number of transmission and distribution outages impacting the area. The scope of this project is significant as it includes replacing an impactful amount of equipment within the substation including replacing all aging infrastructure inside the substation as equipment is past its useful life and functioning beyond design specifications. The scope involves replacing capacitor banks, transformer banks and circuit breakers.

SDG&E's existing Urban Substation will approach or exceed its normal operating life in several years, and SDG&E has determined that replacing this aging equipment will be needed to address reliability concerns. The need to obtain optimum operating conditions to maintain substation reliability and to reduce outage times is a key driver for this project.

Y. C25: Substation Inspection & Repair GO-174

SDG&E's Substation System Inspection and Maintenance Program promotes safety for SDG&E personnel and contractors by providing a safe operating and construction environment, within the substation fence. Additional goals include: meeting all of the requirements of GO 174, achieving a level of station availability satisfactory to SDG&E's health and safety programs and maintenance standards, and assuring compliance with all sections of the California Independent System Operator (CAISO) Transmission Control Agreement (TCA). This is accomplished through routine inspections at reoccurring cycles. A security check is planned once per week, and a more detailed inspection is planned monthly or bimonthly, which takes a visual look at equipment and attempts to identify any problems, like oil leaks.

Z. C26: Power Quality Monitor Deployment and Replacement

SDG&E's Power Quality (PQ) Monitor Deployment and Replacement project is the continued deployment of power quality monitors that can remotely monitor and capture data that support distribution and substation asset management, operations, and power quality investigations. These devices are foundational to SDG&E's ability to monitor the system and develop root cause analysis to investigate issues on the system. Applications are under

development to support advanced capabilities, including predictive fault analytics and automated fault locating, which will have a direct positive impact on the system reliability, customer service and asset management.

The PQ monitoring system provides benefits, as follows:

- Provides distribution system health information, including RMS voltage, voltage and current transient events, system harmonics (including spectra), real and reactive power flow, power factor, flicker, and others.
- Provides logging and notification for events occurring on transmission, distribution and customer systems that are perceptible at the distribution substation.
- Provides advanced analytics processes, including incipient fault detection (fault anticipation or predictive fault analysis) and advanced fault locating.
- Provides a data source with analytics for historical events and steady state trends.
- Provides data collected via the substation PQ monitoring system that is regularly utilized by several engineering and other departments within the company.

AA. C27: Distribution Substation SCADA Expansion

This budget provides funding for the installation, upgrades, and expansion of the SCADA system at SDG&E's distribution substations, which is foundational to how SDG&E monitors the system and enhances SDG&E's situational awareness. Benefits of installing SCADA within the substation includes faster faulted circuit identifications, faster isolation of faulted electric distribution circuits, and improved system performance. This program replaces aging obsolete remote terminal units (RTUs), relays, and associated interdependent equipment with state-of-the-art devices, which improve SCADA integration and protection features in a small footprint, providing for more cost-effective design, installation, and maintenance.

BB. C28: Field SCADA RTU Replacement

Older SCADA RTUs that support communication to distribution field devices such as switches, regulators and capacitors have poor reliability, often complicating outages or requiring field crews to manually switch devices that normally could be remotely switched. SDG&E's Field SCADA RTU Replacement Project replaces distribution field-deployed RTUs (outside substations) that are past their useful life and no longer supported by the vendor.

This project resolves issues with the current SCADA system, thereby allowing SDG&E to move away from legacy communication protocols that are no longer supported and to improve communication reliability. This project also allows for a more transparent view to the grid, which will enhance SDG&E's reliability. Proactively modernizing SDG&E's SCADA RTUs by replacing old legacy equipment better enables operability of the distribution network, including faster circuit outage restorations.

CC. C29: SCADA Capacitors

The supervisory control and data acquisition (SCADA) capacitors program will replace existing non-SCADA capacitors with a more modern SCADA switchable capacitor. The current capacitors are designed to provide continuous voltage and power factor correction for the distribution system. During a failure of a capacitor from either mechanical, electrical, or environmental overstress, an internal fault is created resulting in internal pressure and the potential to rupture the casing, which could create a potential safety hazard to employees and the public.

The modernization of these capacitors will introduce a monitoring system to check for imbalances and internal faults and to open based on the protection settings. In addition, the SCADA capacitor will provide a method for remote isolation and monitoring of the system, providing additional situational awareness during extreme weather conditions. The program first prioritizes replacing or removing from service fixed capacitors within the system and then addressing capacitors with switches. Both types of capacitors will be modernized to a SCADA switchable capacitor.

This program focuses on construction outside the HFTD. SDG&E expects that system faults and ignitions associated with capacitor failures would decrease over time as a result of this program.

DD. Transmission-related Projects

SDG&E notes that there are non-CPUC jurisdictional mitigation activities performed that further mitigate the EII risk, but the costs and narrative associated with these activities will not be presented, as funding authorization of such projects fall under the jurisdiction of a non-CPUC authority (*e.g.*, CAISO and FERC). Such non-CPUC jurisdictional activities include, but are not limited to:

- Transmission OH Reliability projects;

- Transmission UG Reliability projects;
- Transmission Substation projects;
- Transmission Compliance projects; and
- Transmission Safety projects.

IV. 2022-2024 CONTROL & MITIGATION PLAN

This section contains a table identifying the controls and mitigations comprising the portfolio of mitigations for this risk.[20] The activities listed below have been tranched as described in section II above. Certain activities that have been subdivided further within their asset class are identified by adding a "T" to their control/mitigation ID, such as C4-T1.

All of the activities discussed in Section III above are expected to continue during the TY 2024 GRC. A current activity that is included in the risk control and mitigation plan may be referred to as either a control or a mitigation. For purposes of this RAMP, a control that will continue as a mitigation retains its control ID unless that the size and/or scope of that activity will be modified, in which case that activity's control ID will be replaced with a mitigation ID. The table below shows which activities are expected to continue.

Table 3: Control and Mitigation Plan Summary

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
1	C1	Overhead Public Safety (OPS) Program	X	X
2	C2	GO165 Pole Replacement Reinforcement	X	X
3	C3	4 kV Modernization Program – Distribution	X	X
4	C4-T1	Distribution Overhead Switch Replacement Program - SCADA	X	X
5	C4-T2	Distribution Overhead Switch Replacement Program - Gang	X	X
6	C4-T3	Distribution Overhead Switch Replacement Program - Hook	X	X
7	C5	Management of Overhead Distribution Service (Non-CMP)	X	X
8	C6	Vegetation Management (non-HFTD)	X	X
9	C7	Restoration of OH Service	X	X
10	C8	Avian Protection Program	X	X

[20] *See* D.18-12-014, Attachment A at A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
11	C9	Underground Cable Replacement Program - Reactive	X	X
12	C10-T1	Underground Cable Replacement Program (Proactive) – UG Feeder	X	X
13	C10-T2	Underground Cable Replacement Program (Proactive) – UG Branch	X	X
14	C10-T3	Underground Cable Replacement Program (Proactive) – UG North Harbor	X	X
15	C11	Tee Modernization Program - Underground	X	X
16	C12	Replacement of Live Front Equipment – Reactive	X	X
17	C13	Replacement of Live Front Equipment – Proactive	X	X
18	C14	DOE Switch Replacement	X	X
19	C15	GO165 Corrective Maintenance Program - Underground	X	X
20	C16	GO165 Manhole, Vault Restoration Program	X	X
21	C17	Management of Underground Distribution Service (Non-CMP)	X	X
22	C18	Distribution Circuit Reliability	X	X
23	C19	Minor Distribution Substation Reliability Projects	X	X
24	C20-T1	Substation Reliability for Distribution Components – Batiquitos 12kV Replacements	X	X
25	C20-T2	Substation Reliability for Distribution Components – Bernardo 12kV Replacements	X	X
26	C20-T3	Substation Reliability for Distribution Components – Chicarita 12kV Replacements	X	X
27	C20-T4	Substation Reliability for Distribution Components – Laguna Niguel 12kV Replacements	X	X
28	C20-T5	Substation Reliability for Distribution Components – Miramar 12kV Replacements	X	X
29	C20-T6	Substation Reliability for Distribution Components – Scripps 12kV Replacements	X	X
30	C20-T7	Substation Reliability for Distribution Components – Pacific Beach Bus Tie Replacements	X	X
31	C20-T8	Substation Reliability for Distribution Components – Coronado 69/12kV Replacements	X	X
32	C21	Distribution Substation Obsolete Equipment	X	X

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
33	C22	Emergency Transformer and Switchgear	X	X
34	C23	San Mateo Substation Rebuild	X	X
35	C24	Urban Substation	X	X
36	C25	Substation Inspection GO-174	X	X
37	C26	Power Quality Monitor Deployment and Replacement	X	X
38	C27	Distribution Substation SCADA Expansion	X	X
39	C28	Field SCADA RTU Replacement	X	X
40	C29	SCADA Capacitors	X	X
41	M1	Non-HFTD Wireless Fault Indicator	-	X
42	M2	UG Fault Detection	-	X

For activities SDG&E plans to perform that remain unchanged, please refer to the description in Section III. If changes to the various activities are anticipated, such modifications are further described in this section, below.

A. Changes to 2020 Controls

SDG&E does not anticipate any significant changes to the scope of the existing controls that are anticipated to continue into years 2022-2024.

B. 2022 – 2024 Mitigations

1. M1: Non-HFTD Wireless Fault Indicator

This program installs wireless fault indicators and necessary network devices and software to strengthen and modernize the Low Power Communication Network (LPCN) coverage and reliability on SDG&E's electric distribution system outside of the HFTD. This sensing capability is foundational to SDG&E's ability to monitor and sense faults and normal loading on our system, providing enhanced situational awareness. These installations may also require simultaneous or subsequent upgrades to relevant equipment such as poles and other hardware to conform to existing construction standards. Wireless fault indicators are a proven technology that help narrow the search area to determine where a system failure has occurred, so SDG&E can quickly identify a search area and dispatch crews to find system failures.

In instances where large areas are de-energized due to protective relay settings, wireless fault indicators are used to concentrate focus on a much smaller portion of the electric circuit, which allows for:

- a faster response to the site; and
- a greater chance of determining and correcting a fault cause (when damage on the overhead electric system is not immediately obvious).

2. M2: UG Fault Detection

A significant number of outages are caused by failing underground conductors and terminations. These facilities are in conduits or handhole/manholes where damage is not readily apparent. Early fault detection systems will monitor the electric discharge from the system and identify specific segments of cable or terminations that have failed. Similar to M1, this detection system will assist in concentrating focus on a small portion of the electric circuit allowing for strategic troubleshooting. This sensing capability is foundational to SDG&E's ability to monitor and sense faults and normal loading on our system, providing enhanced situational awareness.

V. COSTS, UNITS, AND QUANTITATIVE SUMMARY TABLES

The tables in this section summarize the risk control and mitigation plan, including the associated costs, units, and the RSEs, by tranche. When an RSE could not be performed, an explanation is provided. SDG&E does not account for and track costs by activity or tranche; rather, SDG&E accounts for and tracks costs by cost center and capital budget code. The costs shown were estimated using assumptions provided by SMEs and available accounting data.

Table 4: Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[21]
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars[22]		Forecast Dollars			
		2020 Capital[23]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)[24]	TY 2024 O&M (High)
C1	Overhead Public Safety (OPS) Program	53	0	18,470	22,817	0	0
C2	GO165 Pole Replacement Reinforcement	7,222	0	22,103	27,304	0	0
C3	4kV Modernization Program – Distribution	2,951	0	17,492	21,606	0	0
C4-T1	Distribution Overhead Switch Replacement Program – SCADA	154	0	525	649	0	0
C4-T2	Distribution Overhead Switch Replacement Program - Gang	77	0	358	442	0	0
C4-T3	Distribution Overhead Switch Replacement Program - Hook	579	0	1,403	1,734	0	0
C5	Management of Overhead Distribution Service (Non-CMP)	6,487	0	23,656	29,222	0	0

[21] Recorded costs and forecast ranges are rounded. Additional cost-related information is provided in workpapers. Costs presented in the workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollars and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

[22] SDG&E does not currently track all Capital and O&M costs at the RAMP activity level and is unable to provide Capital and O&M historical costs for all activities.

[23] Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2020 "baseline" capital costs associated with Controls. The 2020 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

[24] SDG&E is not currently proposing associated O&M cost forecasts for activities where costs are not currently tracked at the level of detail presented in this 2021 RAMP Report. SDG&E will address this issue in its TY 2024 GRC Application.

ID	Control/Mitigation Name	Recorded Dollars[22]		Forecast Dollars			
		2020 Capital[23]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)[24]	TY 2024 O&M (High)
C6	Vegetation Management (non-HFTD)	0	31,900	0	0	37,201	45,954
C7	Restoration of Service	7,401	0	30,078	37,154	0	0
C8	Avian Protection Program	209	0	1,591	1,967	0	0
C9	Underground Cable Replacement Program – Reactive	5,407	0	17,250	21,309	0	0
C10-T1	Underground Cable Replacement Program (Proactive) - UG Feeder	213	0	450	555	0	0
C10-T2	Underground Cable Replacement Program (Proactive) - UG Branch	4,047	0	13,205	16,314	0	0
C10-T3	Underground Cable Replacement Program (Proactive) - North Harbor Project	0	0	12,674	15,657	0	0
C11	Tee Modernization Program	1,750	0	9,750	12,042	0	0
C12	Replacement of Live Front Equipment - Reactive	522	0	1,131	1,399	0	0
C13	Replacement of Live Front Equipment - Proactive	442	0	1,490	1,839	0	0
C14	DOE Switch Replacement	5,731	0	16,516	20,402	0	0
C15	GO165 Corrective Maintenance Program – Underground	16,365	0	37,937	46,865	0	0
C16	GO 165 Manhole, Vault Restoration Program	4,794	0	8,220	10,153	0	0
C17	Management of Underground Distribution Service (Non-CMP)	3,750	0	9,639	11,908	0	0
C18	Distribution Circuit Reliability	4,337	0	9,947	12,288	0	0
C19	Minor Distribution Substation Reliability Projects	1,218	0	4,503	5,565	0	0

ID	Control/Mitigation Name	Recorded Dollars[22]		Forecast Dollars			
		2020 Capital[23]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)[24]	TY 2024 O&M (High)
C20-T1	Substation Reliability for Distribution Components – Batiquitos 12kV Replacements	0	0	6,334	7,825	0	0
C20-T2	Substation Reliability for Distribution Components – Bernardo 12kV Breakers Replacements	0	0	846	1,045	0	0
C20-T3	Substation Reliability for Distribution Components – Chicarita 12kV Replacements	0	0	3,588	4,432	0	0
C20-T4	Substation Reliability for Distribution Components – Laguna Niguel 12kV Replacements	0	0	7,397	9,137	0	0
C20-T5	Substation Reliability for Distribution Components – Miramar 12kV Replacements	0	0	1,112	1,374	0	0
C20-T6	Substation Reliability for Distribution Components – Scripps 12kV Replacements	0	0	10,476	12,940	0	0
C20-T7	Substation Reliability for Distribution Components – Pacific Beach Bus Tie Replacements	0	0	1,950	2,409	0	0
C20-T8	Substation Reliability for Distribution Components – Coronado 69/12kV Transformer Replacements	0	0	1,402	1,731	0	0
C21	Distribution Substation Obsolete Equipment	4,126	0	6,663	8,232	0	0
C22	Emergency Transformer and Switchgear	739	0	658	812	0	0
C23	San Mateo Substation Rebuild	6	0	11,813	14,592	0	0
C24	Urban Substation Rebuild	916	0	3,498	4,322	0	0

ID	Control/Mitigation Name	Recorded Dollars[22]		Forecast Dollars			
		2020 Capital[23]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)[24]	TY 2024 O&M (High)
C25	Substation Inspection GO-174	0	1,580	0	0	1,500	1,853
C26	Power Quality Monitor Deployment and Replacement	889	0	1,332	1,647	0	0
C27	Distribution Substation SCADA Expansion	226	0	4,787	5,914	0	0
C28	Field SCADA RTU Replacement	1,729	0	1,924	2,378	0	0
C29	SCADA Capacitors	61	0	2,028	2,504	0	0
M1	Non-HFTD Wireless Fault Indicator	0	0	2,805	3,465	0	0
M2	UG Fault Detection	0	0	1,500	1,851	0	0

Table 5: Risk Control & Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Recorded Units[25]		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C1	Overhead Public Safety (OPS) Program	Number of reconductor miles		0	0	27	34	0	0
C2	GO165 Pole Replacement Reinforcement	Number of poles		0	0	1,350	1,665	0	0
C3	4kV Modernization Program – Distribution	Number of reconductor miles		0	0	20	25	0	0
C4-T1	Distribution Overhead Switch Replacement Program – SCADA	Number of OH SCADA switch		4	0	9	11	0	0

[25] SDG&E does not currently track units at the RAMP activity level and is unable to provide units for all activities.

ID	Control/Mitigation Name	Units Description		Recorded Units[25]		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C4-T2	Distribution Overhead Switch Replacement Program - Gang	Number of OH gang switch		2	0	11	14	0	0
C4-T3	Distribution Overhead Switch Replacement Program - Hook	Number of OH hookstick		15	0	59	73	0	0
C5	Management of Overhead Distribution Service (Non-CMP)	Number of OH distribution equipment		768	0	1,665	2,058	0	0
C6	Vegetation Management (non-HFTD)	Number of trims and removals		0	123,042	0	0	127,124	157,036
C7	Restoration of Service	Number of distribution equipment		2,814	0	6,759	8,349	0	0
C8	Avian Protection Program	Number of avian covers		22	0	255	315	0	0
C9	Underground Cable Replacement Program – Reactive	Number of cable circuit miles		243	0	96	120	0	0
C10-T1	Underground Cable Replacement Program (Proactive) – UG Feeder	Number of feeder cable circuit miles		0	0	3	3	0	0
C10-T2	Underground Cable Replacement Program (Proactive) - UG Branch	Number of branch cable circuit miles		0	0	90	112	0	0
C10-T3	Underground Cable Replacement Program (Proactive) – North Harbor Project	Number of cable feet		0	0	38,446	47,492	0	0
C11	Tee Modernization Program	Number of tee sets		75	0	384	474	0	0
C12	Replacement of Live Front Equipment - Reactive	Number of live front terminators		0	0	30	39	0	0
C13	Replacement of Live Front Equipment - Proactive	Number of live front terminators		7	0	39	48	0	0
C14	DOE Switch Replacement	Number of DOE switch		26	0	80	99	0	0
C15	GO165 Corrective Maintenance Program – Underground	N/A		2,184	0	5,448	6,729	0	0

ID	Control/Mitigation Name	Units Description		Recorded Units[25]		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C16	GO 165 Manhole, Vault Restoration Program	N/A		763	0	1,386	1,710	0	0
C17	Management of Underground Distribution Service (Non-CMP)	Number of underground equipment		472	0	3	3	0	0

ID	Control/Mitigation Name	Units Description		Recorded Units[26]		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C18	Distribution Circuit Reliability	Number of switches		22	0	57	71	0	0
C19	Minor Distribution Substation Reliability Projects	Number of substation equipment		0	0	6	9	0	0
C20-T1	Substation Reliability for Distribution Components – Batiquitos 12kV Replacements	Number of substation equipment		0	0	26	33	0	0
C20-T2	Substation Reliability for Distribution Components – Bernardo 12kV Breakers Replacements	Number of substation equipment		0	0	13	16	0	0
C20-T3	Substation Reliability for Distribution Components – Chicarita 12kV Replacements	Number of substation equipment		0	0	19	23	0	0

[26] SDG&E does not currently track units at the RAMP activity level and is unable to provide units for all activities.

ID	Control/Mitigation Name	Units Description		Recorded Units[26]		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C20-T4	Substation Reliability for Distribution Components – Laguna Niguel 12kV Replacements	Number of substation equipment		0	0	29	36	0	0
C20-T5	Substation Reliability for Distribution Components – Miramar 12kV Replacements	Number of substation equipment		0	0	14	17	0	0
C20-T6	Substation Reliability for Distribution Components – Scripps 12kV Replacements	Number of substation equipment		0	0	23	30	0	0
C20-T7	Substation Reliability for Distribution Components – Pacific Beach Bus Tie Replacements	Number of substation equipment		0	0	6	7	0	0
C20-T8	Substation Reliability for Distribution Components – Coronado 69/12kV Transformer Replacements	Number of substation equipment		0	0	2	2	0	0
C21	Distribution Substation Obsolete Equipment	Number of substation equipment		0	0	9	10	0	0
C22	Emergency Transformer and Switchgear	Number of transformer and switchgear		0	0	2	2	0	0
C23	San Mateo Substation Rebuild	Number of substation equipment		0	0	2	2	0	0
C24	Urban Substation Rebuild	Number of substation equipment		0	0	4	4	0	0
C25	Substation Inspection GO-174	Number of inspection and repairs		0	0	0	0	1,458	1,801
C26	Power Quality Monitor Deployment and Replacement	Number of PQ meters		0	0	27	34	0	0

ID	Control/Mitigation Name	Units Description		Recorded Units[26]		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C27	Distribution Substation SCADA Expansion	Number of relays		0	0	10	12	0	0
C28	Field SCADA RTU Replacement	Number of RTUs		25	0	69	86	0	0
C29	SCADA Capacitors	Number of SCADA capacitors		0	0	45	57	0	0
M1	Non-HFTD Wireless Fault Indicator	Number of wireless faults installed		0	0	4,080	5,040	0	0
M2	UG Fault Detection	Number of fault indicators		0	0	9	12	0	0

Table 6: Risk Control & Mitigation Plan - Quantitative Analysis Summary

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C1	Overhead Public Safety (OPS) Program	1,620.93	6	9,114	78
C2	GO 165 Pole Replacement Reinforcement	See Table 7			
C3	4 kV Modernization Program – Distribution	1,630.73	6	9,169	11
C4-T1	Distribution Overhead Switch Replacement Program - SCADA	1,631.78	6	9,175	101
C4-T2	Distribution Overhead Switch Replacement Program - Gang	1,631.67	6	9,174	190
C4-T3	Distribution Overhead Switch Replacement Program - Hook	1,629.56	6	9,163	241
C5	Management of Overhead Distribution Service (Non-CMP)	See Table 7			
C6	Vegetation Management (non-HFTD)	1,972.52	6	11,091	15
C7	Restoration of Service	See Table 7			
C8	Avian Protection Program	1,637.29	6	9,206	409
C9	Underground Cable Replacement Program – Reactive	See Table 7			
C10-T1	Underground Cable Replacement Program (Proactive) – UG Feeder	1,630.42	6	9,167	465
C10-T2	Underground Cable Replacement Program (Proactive) - UG Branch	1,613.53	6	9,072	166
C10-T3	Underground Cable Replacement Program (Proactive) – North Harbor Project	1,610.46	6	9,055	201
C11	Tee Modernization Program	1,561.76	6	8,781	938
C12	Replacement of Live Front Equipment - Reactive	See Table 7			

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C13	Replacement of Live Front Equipment - Proactive	1,632.13	6	9,177	6
C14	DOE Switch Replacement	1,632.20	6	9,130	60
C15	GO165 Corrective Maintenance Program – Underground	1,651.98	6	9,289	61
C16	GO 165 Manhole, Vault Restoration Program	1,634.10	6	9,188	27
C17	Management of Underground Distribution Service (Non-CMP)	See Table 7			
C18	Distribution Circuit Reliability	1,632.20	6	9,170	15
C19	Minor Distribution Substation Reliability Projects	See Table 7			
C20-T1	Substation Reliability for Distribution Components – Batiquitos 12 kV Replacements	1,630.47	6	9,168	34
C20-T2	Substation Reliability for Distribution Components – Bernardo 12kV Breakers Replacements	1,631.20	6	9,172	146
C20-T3	Substation Reliability for Distribution Components – Chicarita 12 kV Replacements	1,630.48	6	9,168	60
C20-T4	Substation Reliability for Distribution Components – Laguna Niguel 12 kV Replacements	1,629.52	6	9,162	45
C20-T5	Substation Reliability for Distribution Components – Miramar 12kV Replacements	1,631.22	6	9,172	101

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C20-T6	Substation Reliability for Distribution Components – Scripps 12kV Replacements	1,630.08	6	9,165	25
C20-T7	Substation Reliability for Distribution Components – Pacific Beach Bus Tie Replacements	1,630.93	6	9,170	81
C20-T8	Substation Reliability for Distribution Components – Coronado 69/12kV Transformer Replacements	1,632.07	6	9,177	12
C21	Distribution Substation Obsolete Equipment	1,631.77	6	9,175	8
C22	Emergency Transformer and Switchgear	-	-	-	-
C23	San Mateo Substation Rebuild	1,630.78	6	9,169	15
C24	Urban Substation Rebuild	1,630.42	6	9,167	63
C25	Substation Inspection GO-174	See Table 7			
C26	Power Quality Monitor Deployment and Replacement	See Table 7			
C27	Distribution Substation SCADA Expansion	See Table 7			
C28	Field SCADA RTU Replacement	1,632.20	6	9,169	91
C29	SCADA Capacitors	1,630.88	6	9,170	31
M1	Non-HFTD Wireless Fault Indicator	See Table 7			
M2	UG Fault Detection	See Table 7			

Table 7-SDG&E MP: Risk Control & Mitigation Plan - Quantitative Analysis Summary for RSE Unavailability

ID	Control/Mitigation Name	RSE Unavailability Rationale
C2	GO165 Pole Replacement Reinforcement	SDG&E performs these activities in accordance with CPUC General Order 165 and has been doing so for many years. Therefore, SDG&E does not have reliable data that can be used to estimate the increase in risk if the GO165 program were ceased. There is no comparable data that could be used to provide such an estimate, because each utility runs their compliance programs differently. SME judgment is also unavailable, as any estimate solely would be built upon pure assumptions (*i.e.*, not on data or subject matter expertise and judgment) with no confidence to those estimates.
C5	Management of Overhead Distribution Service (Non-CMP)	SDG&E has not conducted an RSE analysis on this baseline control. This program represents mandated compliance and safety per CPUC General Order 95; Cal. Pub. Util. Code §§ 451, 761, 762, 768, and 770 (Obligation to Serve). Therefore, it is not feasible for SDG&E to stop performing these activities. Similarly, SDG&E cannot reasonably estimate the rise in risk from not adhering to these programs, because there has never been a time when SDG&E has not remedied known imminent threats to its equipment. For similar reasons, there is also no comparable data. SME judgment is also unavailable, because any estimates solely would

ID	Control/Mitigation Name	RSE Unavailability Rationale
		be built upon assumptions and not on data or subject matter expertise and judgment.
C7	Restoration of Service	SDG&E, as a public utility, has an obligation to serve as a provider of last resort. This program represents mandated activity per Cal. Pub. Util. Code §§ 451, 761, 762, 768, and 770 (Obligation to Serve). SDG&E therefore has not performed an RSE analysis because it is not feasible for SDG&E to stop performing this activity or to calculate the risk reduction benefits received from performing this activity. For similar reasons, there is also no comparable data to use in calculating an RSE. SME judgment would also be unavailable for performing an RSE, because any estimates solely would be built upon assumptions and not on data or subject matter expertise and judgment.
C9	Underground Cable Replacement Program – Reactive	SDG&E has an obligation to serve and this program replaces underground cable necessary to restore service to customers. This program represents mandated activity per; Cal. Pub. Util. Code §§ 451, 761, 762, 768, and 770 (Obligation to Serve). SDG&E does not know the impacts of discontinuing this activity or to calculate the risk reduction benefits received from performing this activity, because it is not feasible for SDG&E to stop performing it. Similarly, there are also no comparable data or SME judgment to use in calculating an RSE, because any estimates solely would be built

ID	Control/Mitigation Name	RSE Unavailability Rationale
		upon assumptions and not on data or subject matter expertise and judgment.
C12	Replacement of Live Front Equipment - Reactive	SDG&E has not performed an RSE analysis on this activity. This control occurs when new business activities provide the opportunity to replace non-standard equipment. It is included in this RAMP chapter due to its distribution engineering nature and as information to the CPUC.
C17	Management of Underground Distribution Service (Non-CMP)	SDG&E has not conducted an RSE analysis on this baseline control. This program is a mandated compliance activity per CPUC General Order 128; Cal. Pub. Util. Code §§ 451, 761, 762, 768, and 770 (Obligation to Serve). SDG&E cannot reasonably know the rise in risk from not adhering to these programs, because there has never been a time when SDGE did not remedy known imminent threats to its equipment. For similar reasons, there is also no comparable data. Therefore, it is not feasible for SDG&E to stop performing this activity.
C22	Emergency Transformer and Switchgear	SDG&E, as a public utility, has an obligation to serve as a provider of last resort. This program represents mandated activity per Cal. Pub. Util. Code §§ 451, 761, 762, 768, and 770 (Obligation to Serve). SDG&E therefore has not performed an RSE analysis because it is not feasible for SDG&E to stop performing this activity or to calculate the risk reduction benefits received from performing this activity.

ID	Control/Mitigation Name	RSE Unavailability Rationale
		For similar reasons, there is also no comparable data.
C25	Substation Inspection GO-174	SDG&E has not conducted an RSE analysis on this baseline control, because substation inspections are not a risk-reducing activity by themselves. This program is a mandated compliance activity per CPUC General Order 174; NERC Reliability Standards. The inspections determine if follow up work is needed; and if it is needed, SDG&E typically creates a program to address the need, as described above in C20.
C26	Power Quality Monitor Deployment and Replacement	SDG&E has not performed an RSE analysis, as the function of the control is to perform a routine operation that is foundational to monitor the system. This activity does not directly reduce risk but gives information to engineering and operations teams for real-time and planning purposes.
C27	Distribution Substation SCADA Expansion	This activity does not have an RSE because it is considered foundational to supporting daily mitigation efforts. Quantifying an RSE for such a mitigation would be difficult and not beneficial, because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. The activity supports various initiatives by providing better information to make risk-informed mitigation decisions. This activity does not directly reduce risk but gives information to engineering and operations.

ID	Control/Mitigation Name	RSE Unavailability Rationale
M1	Non-HFTD Wireless Fault Indicator	This mitigation does not have an RSE because it is considered foundational to supporting daily mitigation efforts. Quantifying an RSE for such a mitigation would be difficult and not beneficial, because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. It supports various initiatives by providing better information to make risk-informed mitigation decisions. This activity does not directly reduce risk but gives information to engineering and operations.
M2	UG Fault Detection	This mitigation does not have an RSE because it is considered foundational to supporting daily mitigation efforts. Quantifying an RSE for such a mitigation would be difficult and not beneficial, because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. It supports various initiatives by providing better information to make risk-informed mitigation decisions. This activity does not directly reduce risk but gives information to engineering and operations.

VI. ALTERNATIVES

Pursuant to D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the risk control and mitigation plan for the Electric Infrastructure Integrity risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for SDG&E's risk control and mitigation plan also considered possible modifications and constraints, such as budget and resources.

A. A1 – Customer Owned E-Structure Reconfigure

"Enclosed" structures are electric facilities that contain a non-pad mount transformer located at ground level on customer property enclosed by a customer fence. They vary in state of repair but generally have exposed or aged components. Moving these transformers to pad mount or overhead facilities will mitigate the risk of exposed components. This project is not currently included in SDG&E's risk control and mitigation plan, given the minimal history of issues, challenges with requiring modifications by customers, obtaining property easements, and minimal reliability benefit.

B. A2 – Modernize Manual Switches

To increase reliability on the distribution system and enhance optimal reliability, SDG&E considered a program that would replace every overhead and underground manual distribution switch within its system with a SCADA switch. These enhancements would provide further visibility of the distribution system and improve situational awareness. The program would consist of prioritizing work by starting with circuits that have the highest customer count and replacing every single manual switch to a SCADA switch. This project is not currently included in SDG&E's risk control and mitigation plan for this risk, given it does not directly impact public safety, and the associated cost to perform such a replacement on every switch would provide diminishing returns for reliability and in many situations be redundant. Rather than proposing a program to replace all manual distribution switches at this time, SDG&E instead put forth a plan for strategic, prioritization-targeted replacement. SDG&E's Enterprise Asset Management – Distribution program, as presented in the risk control and mitigation plan will allow SDG&E to identify which assets have a higher likelihood of failure. Based on this information, asset replacement strategies would be evaluated, prioritized and implemented to manage the asset in a manner that aligns with SDG&E's overall risk management strategy,

supports risk-informed platform for managing assets, and reinforces safe operations, maintenance and proactive replacement strategies.

C. A3 – Avian Protection Program

Bird and other wildlife contact on overhead distribution facilities must closely be managed to protect wildlife from accidental death, prevent electric outages and utility facility damage, and to prevent regulatory impacts (*e.g.*, fines). Expand avian protection equipment installation and related procedures to install mitigations on all overhead equipment. This project is not currently included in SDG&E's risk control and mitigation plan for this risk, given it does not impact public safety, and SDG&E already requires installing covers in specific locations (*e.g.*, the Avian Protection Zone), in compliance with federal and state law.

Table 8: Alternative Mitigation Plan - Recorded and Forecast Dollars Summary[27]
(Direct After Allocations, In 2020 $000)

ID	Alternative Mitigation Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Customer Owned E-Structure Reconfigure	714	882	0	0
A2	Modernize Manual Switches	64,767	80,004	0	0
A3	Avian Protection Program	10,347	12,783	0	0

Table 9: Alternative Mitigation Plan - Units Summary

ID	Alternative Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
A1	Customer Owned E-Structure Reconfigure	Number of E-Structures		11	14	0	0
A2	Modernize Manual Switches	Number of switches		399	492	0	0
A3	Avian Protection Program	Number of poles		8,463	10,455	0	0

[27] Recorded costs and forecast ranges are rounded. Additional cost-related information is provided in workpapers. Costs presented in the workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollars and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

Table 10: Alternative Mitigation Plan - Quantitative Analysis Summary
(Direct After Allocations, In 2020 $000)

ID	Alternative Mitigation Name	Forecast				
		Total Dollars[28]	LoRE	CoRE	Risk Score	RSE
A1	Customer Owned E-Structure Reconfigure	840	1,632.18	6	9,177	2
A2-T1	Modernize Manual Switches - OH	33,896	1,629.48	6	9,162	12
A2-T2	Modernize Manual Switches - UG	42,300	1,631.44	6	9,173	2
A3	Avian Protection Program	12,173	1,631.01	6	9,171	15

[28] The total dollars used to calculate RSE values equal the sum of forecasted O&M and Capital.

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

Appendix A: Summary of Elements of the Risk Bow Tie

Electric Infrastructure Integrity: Summary of Elements of the Risk Bow Tie

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
SDG&E-2-C1	Overhead Public Safety (OPS) Program	DT.1, DT.2, DT.3, DT.6 PC.1, PC.2
SDG&E-2-C2	GO165 Pole Replacement Reinforcement	DT.1, DT.2, DT., DT.5, DT.6, DT.7 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-2-C3	4kV Modernization Program – Distribution	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 PC.1, PC.2
SDG&E-2-C4	Distribution Overhead Switch Replacement Program	DT.1, DT.2, DT.3, DT.4 PC.1, PC.2
SDG&E-2-C5	Management of Overhead Distribution Service (Non-CMP)	DT1, DT.2, DT.3, DT.6, DT.7 PC.1, PC.2
SDG&E-2-C6	Vegetation Management (non-HFTD)	DT.3, DT.7 PC.1, PC.2, PC.3, PC.4
SDG&E-2-C7	Restoration of Service	DT.1, DT.2, DT.3, DT.5, DT.6, DT.7 PC.2, PC.3, PC.6
SDG&E-2-C8	Avian Protection Program	DT.6 PC.2, PC.3, PC.4, PC.6
SDG&E-2-C9	Underground Cable Replacement Program – Reactive	DT.1, DT.2, DT.3, DT.7 PC.2, PC.6
SDG&E-2-C10	Underground Cable Replacement Program – Proactive	DT.1, DT.2, DT.3, DT.5, DT.7 PC.2, PC.6
SDG&E-2-C11	Tee Modernization Program	DT.1, DT.2, DT.3, DT.5, DT.7 PC.2, PC.6
SDG&E-2-C12	Replacement of Live Front Equipment - Reactive	DT.1, DT.6 PC.1, PC.2
SDG&E-2-C13	Replacement of Live Front Equipment - Proactive	DT.1, DT.6 PC.1, PC.2
SDG&E-2-C14	DOE Switch Replacement	DT.1, DT.2, DT.3 PC.1, PC.2
SDG&E-2-C15	GO165 Corrective Maintenance Program – Underground	DT.1, DT.2, DT.3, DT.5, DT.7 PC.1, PC.2

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
SDG&E-2-C16	GO165 Manhole, Vault Restoration Program	DT.1, DT.1, DT.3, DT.5, DT.7 PC.1, PC.2, PC.3, PC.4
SDG&E-2-C17	Management of Underground Distribution Service (Non-CMP)	DT.1, DT.2, DT.3, DT.5, DT.7 PC.1, PC.2
SDG&E-2-C18	Distribution Circuit Reliability	DT.1, DT.2 PC.2
SDG&E-2-C19	Minor Distribution Substation Reliability Projects	DT.1, DT.2, DT.3, DT.4, DT.5 PC.2,
SDG&E-2-C20	Substation Reliability for Distribution Components	DT.1, DT.2, DT.3, DT.4, DT.5 PC.2
SDG&E-2-C21	Distribution Substation Obsolete Equipment	DT.1, DT.2, DT.3, DT.4, DT.5 PC.2
SDG&E-2-C22	Emergency Transformer and Switchgear	DT.1, DT.2, DT.3, DT.4, DT.5 PC.2, PC.6
SDG&E-2-C23	San Mateo Substation Rebuild	DT.1, DT.2, DT.3, DT.4, DT.5 PC.2,
SDG&E-2-C24	Urban Substation Rebuild	DT.1, DT.2, DT.3, DT.4, DT.5 PC.2
SDG&E-2-C25	Substation Inspection GO-174	DT.1, DT.2, DT.3, DT.4, DT.5, PC.1, PC.2
SDG&E-2-C26	Power Quality Monitor Deployment and Replacement	DT.5, PC.3, PC.6
SDG&E-2-C27	Distribution Substation SCADA Expansion	DT.5 PC.3, PC.6
SDG&E-2-C28	Field SCADA RTU Replacement	DT.1, DT.2, DT.5 PC.2, PC.6
SDG&E-2-C29	SCADA Capacitors	DT.4, DT.3, DT.5, PC.1, PC.2
SDG&E-2-M1	Non-HFTD Wireless Fault Indicator	DT.5, PC.3, PC.6
SDG&E-2-M2	UG Fault Detection	DT.5, PC.3, PC.6

APPENDIX B: QUANTITATIVE ANALYSIS SOURCE DATA REFERENCES

Appendix B: Quantitative Analysis Source Data References

The Settlement Decision directs the utility to identify potential consequences of a risk event using available and appropriate data.[29] The list below provides the inputs used as part of this assessment.

San Diego Gas & Electric, Annual Serious Injuries and Fatalities (SIFs) Incidents

- 2015 –2020 internal SIF data

San Diego Gas & Electric, Electric Reliability Database

- 2016 –2020 internal reliability data

[29] D.18-12-014, Attachment A at A-8 (Identification of Potential Consequences of Risk Event).