In The Matter of the Application of San Diego Gas & Electric Company (U 902 G) and Southern California Gas Company (U 904 G) for a Certificate of Public Convenience and Necessity for the Pipeline Safety & Reliability Project	Application 15-09-013

Application No: A.15-09-013
Exhibit No.:
Witness: Norm G. Kohls

CHAPTER I

PREPARED PHASE 2 DIRECT TESTIMONY OF

NORM G. KOHLS

ON BEHALF OF

SAN DIEGO GAS & ELECTRIC COMPANY

AND

SOUTHERN CALIFORNIA GAS COMPANY

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

August 12, 2020

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I. PURPOSE AND OVERVIEW

The purpose of my testimony is to provide the Class Three cost forecasts for the 19 independent Pipeline Safety Enhancement Plan (PSEP) projects (Line 1600 projects) identified in the September 26, 2018 Line 1600 Test or Replacement Plan approved by the Safety and Enforcement Division (SED) on January 15, 2019 (Line 1600 Plan or Plan), in compliance with Ordering Paragraph 4 of Decision (D.) 20-02-024.[1] The approved Plan identifies pipe located in more populated areas for replacement and pipe located in less populated areas for pressure testing. The Line 1600 Plan provides the general scope of work for the projects, the standards to which such work will be performed, and the schedule and pace for performing such work. The cost forecasts are based upon this scope of work, standards, and schedule.

I will describe the activities associated with the development and execution of the Line 1600 Plan, their estimated cost, and the proactive cost management measures undertaken by San Diego Gas & Electric Company (SDG&E) and Southern California Gas Company (SoCalGas) (collectively, the Utilities). My testimony will demonstrate that the cost forecast is reasonable and, along the Ronn Gonzalez' testimony, follows the same forecasting methodology and processes used for all PSEP projects. The Line 1600 Plan enables SDG&E and SoCalGas to comply with State safety enhancement directives and continue to meet the overarching objectives of SDG&E's and SoCalGas' PSEP to: (1) enhance public safety; (2) comply with Commission directives; (3) minimize customer impacts; and (4) maximize the cost effectiveness of safety investments.[2]

[1] A copy of the public version of the Line 1600 Plan is included as Attachment 1.
[2] R.11-02-019, Amended Testimony of Southern California Gas Company and San Diego Gas and Electric Company in Support of Proposed Natural Gas Pipeline Safety Enhancement Plan (December 2, 2011) at 10.

SDG&E and SoCalGas forecast $563.3 million in capital and $55.9 million[3] in operating and maintenance (O&M) costs on an aggregate basis for the 19 Line 1600 PSEP individual projects identified in the Plan. Detailed workpapers included in Appendix A describe planned project activities, a glossary of key terms, illustrative photographs, and project descriptions, segment maps, and assumptions used for the major cost components of all 19 Line 1600 PSEP projects that comprise the Plan.

In Section II of my testimony, I provide an overview of the historical and procedural history of PSEP and Line 1600. In Section III, I review the Plan to describe the 19 individual Line 1600 PSEP pressure test and replacement projects and describe key technical considerations for the projects. Sections IV and V discuss project cost components and identify disallowed costs. Section VI describes accelerated and incidental mileage. Sections VII through X provides a summary of the 14 replacement and 5 hydrotest projects, and the capital and O&M costs associated with the projects.[4] Section XI reviews cost containment strategies and systems implemented by SDG&E and SoCalGas to maximize the cost effectiveness of Line 1600 PSEP safety investments. Finally, Section XII sets forth the Utilities' proposed schedule for seeking reasonableness review and cost recovery through the 2028 General Rate Case, with interim 50% recovery of the costs booked to the applicable PSEP balancing accounts, subject to refund, pending reasonableness review.

Ordering Paragraph 4 and pages 38-40 of D.20-02-024 identify specific types of information to be included with the cost forecast for the Plan. For ease of reference, Table 1

[3] These values include escalation and overheads, but do not include Allowance for Funds Used During Construction (AFUDC) and capitalized property tax (property tax incurred before each project is placed into service). See Casey Butler Direct Testimony, Chapter IV, for discussion of AFUDC/Capitalized Property Tax and revenue requirements.

[4] Detailed information regarding each project is contained in the workpapers provided concurrently with this testimony.

identifies where each category of information is primarily addressed in testimony (though many topics are addressed by the testimony as a whole):

Table 1
D.20-02-024 Filing Information

Topic	Testimony Location
D.20-02-024 Ordering Paragraph 4	
"Class III Cost Forecasts for all Line 1600 Segments"	Chapter I and Workpapers (Kohls); Chapter II (Gonzalez)
"Cost Estimating Methodology"	Chapter II (Gonzalez)
"Proposed Accounting Treatment"	Chapter III (Olegario)/Chapter IV (Butler)
"Contingency Factor Assumptions"	Chapter II (Gonzalez)
"Cost Containment Strategies"	Chapter I (Kohls)
"Proposed Schedules for Reasonableness Review and Cost Recovery"	Chapter I (Kohls)
D.20-02-024; Pages 38-40	
"I. Whether Applicants' forecast of capital and operations and maintenance costs associated with the completion of the 19 Line 1600 pipeline segments is reasonable"	Chapter I (Kohls) Chapter II (Gonzalez)
"II. Whether management decisions regarding the scope and pace of "segment" work, including amortization schedules, are reasonable"	Chapter I and Workpapers (Kohls) [Scope and Pace]; Chapter III (Olegario) [Amortization]
"III. Whether Applicants have made a reasonable proposed determination of ratepayer versus shareholder funding as defined by D.14-06-007 and D.15-12-020"	Chapter I (Kohls)
"IV. Whether disallowances are properly identified and calculated"	Chapter I and Workpapers (Kohls)
"V. Whether Applicants' proposed regulatory accounting treatment of forecasted and actual costs on an aggregate basis, associated with the 19 projects in the pending cost proposal is appropriate"	Chapter III (Olegario)/Chapter IV (Butler)
"VI. If applicable, whether the information provided by Applicants adequately supports the inclusion of accelerated and incidental miles in the forecast"	Chapter I and Workpapers (Kohls)
"VII. Whether specific cost information, inputs and outputs of estimated tools, assumptions including contingency factors, and other methods of forecasting costs, in support of requested funding and/or	Chapter I (Kohls)/Chapter II (Gonzalez)

forecasted costs for its projects, are reasonable"	
"VIII. Whether risk models and risk-based decisions for the projects are reasonable"	Chapter II (Gonzalez)/Chapter I (Kohls) Appendix A [Workpapers]
"IX. Whether cost comparisons of similar or previous work done by Applicants or other utilities, in order to determine the Applicants based cost estimates for the PSEP projects upon similar work in the industry are reasonable"	Chapter I (Kohls)/Chapter II (Gonzalez)
"X. Whether cost containment (e.g., one-way balancing account) or cost avoidance strategies are reasonable"	Chapter I (Kohls)/ Chapter II (Gonzalez), Section IV/Chapter III (Olegario)
"XI. The proposed phasing for Applicants' submission of reasonableness reviews and recovery requests in future GRCs, based on the cost forecasts determined in this second phase"	Chapter I (Kohls)

II. PROCEDURAL HISTORY AND BACKGROUND

The Commission initiated a second phase in this proceeding to evaluate the forecasted cost to implement the Utilities' plan to pressure test Line 1600 segments located in less populated areas and replace Line 1600 segments located in more populated areas, under their Commission approved PSEP. In this section, I provide the procedural history and background regarding the Utilities' PSEP, to facilitate greater understanding of the purpose and need for this Plan to pressure test or replace Line 1600, and the Commission's prior guidance and relevant orders that govern the development and implementation of this plan.

A. The Commission's Order Directing All California Natural Gas Pipeline Operators to Pressure Test or Replace All Transmission Pipelines That Do Not Have Sufficient Documentation of a Post-Construction Pressure Test

On September 9, 2010, a 30-inch diameter natural gas transmission pipeline ruptured and caught fire in the city of San Bruno, California. In response, on February 25, 2011, the Commission initiated Rulemaking (R.)11-02-019, "a forward-looking effort to establish a new

model of natural gas pipeline safety regulation applicable to all California pipelines."[5] In this Rulemaking, the Commission committed to enhance the safety of natural gas pipelines and concluded that "all natural gas transmission pipelines in service in California must be brought into compliance with modern standards for safety."[6] Historic exemptions must come to an end with an orderly and cost-conscious implementation plan. To achieve this objective, the Commission ordered "all California natural gas transmission pipeline operators to prepare Implementation Plans to either pressure test or replace all segments of natural gas pipelines which were not pressure tested or lack sufficient details related to performance of any such test.

These plans were required to "provide for testing or replacing all such pipeline as soon as practicable" and were further required to comply with several specific directives by the Commission, including:

- "The analytical nucleus of the Implementation Plan will be a list of all transmission segments that have not been previously pressure tested, with prioritized designation for replacement or pressure testing;"[7]
- "The Implementation Plan should start with pipeline segments located in Class 3 and Class 4 locations and Class 1 and Class 2 high consequence areas, with pipeline segments in other locations given lower priority for pressure testing;"[8]
- "The Implementation Plan must set forth the criteria on which pipeline segments were identified for replacement instead of pressure testing;"[9]
- "Replacements should be prioritized and the prioritization criteria explained;"[10] and

[5] R.11-02-019 at 1.
[6] D.11-06-017 at 18.
[7] D.11-06-017 at 20.
[8] *Id.*
[9] *Id.*
[10] *Id.*

- "The Implementation Plan must also address retrofitting pipeline to allow for in-line inspection tools and, where appropriate, automated or remote controlled shut off valves."[11]

On August 26, 2011, all California transmission pipeline operators, including SDG&E and SoCalGas filed proposed plans to implement the Commission's directives. The Utilities' proposed plan, the PSEP, included a Decision Tree to guide whether specific pipeline segments should be pressure tested, replaced, or abandoned; a list of pipelines for which the Utilities had not yet located pressure test records; a prioritization process to address pipelines in more populated areas ahead of pipelines in less populated areas; a valve enhancement plan; a technology plan; and preliminary cost forecasts. Line 1600 was included in the list of pipelines to be addressed under PSEP.[12]

On December 2, 2011, the Utilities amended their PSEP to include supplemental testimony addressing ratemaking issues identified in a November 2, 2011 Amended Scoping Memo and Ruling of the Assigned Commissioner.[13]

B. Commission Decision Approving SDG&E and SoCalGas' PSEP

In June 2014, the Commission approved SDG&E and SoCalGas's proposed PSEP, but did not pre-approve the costs to implement the plan. Specifically, the Commission "adopt[ed] the concepts embodied in the Decision Tree," "adopt[ed] the intended scope of work as summarized by the Decision Tree," and "adopt[ed] the Phase 1 analytical approach for Safety Enhancement… as embodied in the Decision Tree…and related descriptive testimony."[14]

[11] *Id.* at 21. The requirements of D.11-06-017 were subsequently enacted by the California State Legislature as part of the Natural Gas Safety Act of 2011, and are codified at California Public Utilities Code Sections 957 and 958.
[12] cited.D.18-06-028 at 8.
[13] R.11-02-019 at 126-127. Amended Testimony of Southern California Gas Company and San Diego Gas & Electric Company in Support of Proposed Natural Gas Pipeline Safety Enhancement Plan.
[14] D.14-06-007 at 59 (Ordering Paragraph 1).

Because SDG&E and SoCalGas's PSEP cost estimates were preliminary in nature, rather than pre-approve cost recovery based on those preliminary cost forecasts, the Commission adopted a process for reviewing PSEP implementation costs after-the-fact prior to authorizing recovery of PSEP implementation costs in rates.[15]

The Commission further determined that specific categories of PSEP implementation costs may not be recovered in rates (i.e., should be "disallowed.") Specifically, the following costs may not be recovered in rates:[16]

- Costs associated with pressure testing pipeline segments installed after January 1, 1956 where pressure test records are not available that provide the minimum information to demonstrate compliance with the then-applicable industry or regulatory strength testing and record keeping requirements. In the case where the pipe segment is replaced, an amount equal to the average cost of pressure testing is disallowed.
- Remaining undepreciated book value for test and replacement projects addressing post-1955 pipe without sufficient records of a pressure test.
- Cost associated with searching for records of pipeline testing.
- PSEP Executive Incentive Compensation.

To enable after-the-fact review of PSEP costs prior to recovery in rates, the Commission ordered SDG&E and SoCalGas to establish balancing accounts to record PSEP expenditures. SDG&E and SoCalGas were ordered to "file an application with testimony and work papers to demonstrate the reasonableness of the costs incurred which would justify rate recovery."[17]

There have been four closed proceedings and one pending proceeding that have been filed in accordance with D.14-06-007.[18] These proceedings have guided our current, adopted forecasting methodology, and our development of the cost estimates for the Line 1600 projects.

[15] cited.D.14-06-007 at 9 (Ordering Paragraph #2).
[16] D.14-06-007 at 33-36, 56-58. Section V addresses PSEP Line 1600 disallowed costs.
[17] D.14-06-007 at 60 (Ordering Paragraph #5).
[18] Past proceedings include: A.14-12-016; A.16-09-005; A.18-11-010; A.17-03-021; A.17-10-008.

Procedural History of Line 1600

In D.14-06-007, the Commission ruled that SDG&E and SoCalGas's proposal to address Line 1600 by installing a new 36-inch high pressure gas transmission line (known as Line 3602) should be addressed in a new application.[19] As a result, following further engineering and environmental review, the Utilities filed Application (A.) 15-09-013 for a Certificate of Public Convenience and Necessity (CPCN) to construct the Pipeline Safety Reliability Project (PSRP). The PSRP proposed to bring Line 1600 into compliance with Public Utilities Code § 958 and D.11-06-017 by constructing a new 36-inch natural gas transmission pipeline (Line 3602) to replace Line 1600's transmission capacity and enhance reliability, and de-rate existing Line 1600 to distribution service.

As required by Commission Rules of Practice and Procedure 3.1 and 2.4, the Utilities engaged in substantial engineering design work, environmental review (including consideration of alternatives), and outreach to the public and stakeholders to prepare and file A.15-09-013 and its Proponents' Environmental Assessment (PEA). Subsequently, a January 22, 2016 Joint Assigned Commissioner and Administrative Law Judge's Ruling Requiring An Amended Application and Seeking Protests, Responses, and Replies required the Utilities to submit additional information, including a Cost-Effectiveness Analysis (CEA), that evaluated eleven specified alternatives and updates to the PEA. In response, the Utilities filed an amendment to Application 15-09-013 on March 21, 2016. Thereafter, among other things, the Utilities worked with the Commission's Energy Division to conduct the significant environmental review necessary to create an Environmental Impact Report, responded to intervenor discovery, prepared testimony, participated in evidentiary hearings, and prepared numerous filings for the

[19] D.14-06-007 at 16-17.

Commission regarding the PSRP, alternatives to it, and bringing Line 1600 into compliance with Public Utilities Code § 958 and D.11-06-017. These incurred costs have been included in the cost estimates for the Line 1600 projects.

In D.18-06-028, the Commission denied A. 15-09-013, rejecting the Utilities' proposed PSRP and its Line 1600 solution. Instead, the Commission ordered the Utilities to submit to SED, within three months, a hydrostatic test or replacement plan for Line 1600. The Commission provided detailed instruction for such a plan, including discussion of two options: "1. Hydrotest the entire 49.7 miles of line and replace those segments that fail the test; and 2. Replace all pipeline segments in HCAs [High Consequence Areas] along Line 1600, thus ensuring a new pipeline without vintage pipeline characteristics that are perceived to increase the risk of Line 1600. Hydrotest in solely non-HCA segments would ensure less impact if there was a failure during hydrotesting."[20] The Utilities also were required to "identify proposed rerouting of the line in specific segments and/or removal or moving of specific physical structures, known at this time, due to safety compliance reasons."[21]

The Utilities utilized studies, engineering work and environmental review performed for A. 15-09-013, including analysis of the PSRP and alternative pipeline routing, to help design and develop the alternatives presented to SED in the Line 1600 Test or Replacement Plan. The availability of such information helped the Utilities meet the three month turnaround time for submitting the required plan to SED.

In accordance with D.18-06-028, on September 26, 2018, the Utilities submitted to SED the "Line 1600 Test or Replacement Plan" (Attachment 1), which included four design alternatives to pressure test or replace Line 1600 in compliance with Public Utilities Code §§ 957

[20] D.18-06-028 at 92.
[21] D.18-06-028 at 92.

and 958. SDG&E and SoCalGas proposed to implement Design Alternative 1 (Replace in HCAs, Test in Non-HCAs). SED approved the Line 1600 Plan on January 15, 2019 (Attachment 2).

On May 31, 2019, Protect our Communities Foundation (POC), Sierra Club, Southern California Generation Coalition (SCGC), and The Utility Reform Network (TURN) filed a Petition for Modification (PFM) of D.18-06-028. D.20-02-024 approved the PFM in part, ordering a review of a Class Three cost forecast for implementing Line 1600 Design Alternative 1. As stated in Ordering Paragraph 3:

> "Within six months of the issuance of the Decision Approving Limited Modifications To Decision 18-06-028, to supplement the above, it is reasonable for Applicants to file cost information that includes, but is not limited to: the Class Three cost forecast for all Line 1600 segments, cost estimating methodology, proposed accounting treatment, contingency factor assumptions, cost containment strategies, and proposed schedule for applications for reasonableness review and cost recovery, supported by direct testimony and work papers, of the work to implement the SED-approved hydrostatic test or replacement plan to the Commission to review, with service to the parties in this proceeding."[22]

As previously stated, Line 1600 and PSEP are founded upon four overarching objectives. First, PSEP is designed to enhance the safety of SDG&E and SoCalGas's integrated natural gas transmission system. SDG&E and SoCalGas remain mindful of the purpose and objectives of PSEP, which stem from the Commission's directive to all California pipeline operators in D.11-06-017 to prepare plans to pressure test or replace all transmission pipelines that do not have documentation of a pressure test, or where the pressure test does not meet certain regulatory standards, as soon as practicable, and to consider retrofitting pipelines to allow for inline inspections and enhanced shutoff valves as part of those plans.

[22] D.20-02-024, at 59 (Ordering Paragraph #3).

Second, SDG&E and SoCalGas strive to fully comply with the directives of the Commission. Accordingly, the PSEP establishes a process for meeting the safety enhancement directives set forth by the Commission in D.11-06-017. Third, the PSEP is designed to minimize customer and community impacts. We are proud of our long history of providing reliable service to our customers and remain mindful that our customers depend on the reliability of our service not only to heat their homes and fuel essential appliances, but also to maintain the reliable operation of California's electrical grid, the production of fuel, and other commercial and industrial uses that support California's economy.

Fourth, through prudent and thoughtful execution of the PSEP, the Utilities strive to maximize the cost effectiveness of infrastructure investments for the benefit of our customers. Having been in the business of providing reliable natural gas service to our customers for over 100 years, we recognize the need to carefully invest in our system in a manner that complements previous investments in our system, avoids short-sighted or reactive actions that could result in unnecessary or duplicative expenditures, and enhances the long-term safety and reliability of our system.

III. APPROVED TEST OR REPLACEMENT PLAN FOR LINE 1600

A. Scope

Through the Line 1600 Plan, the Utilities will replace approximately 37 miles of existing Line 1600 located in HCAs and through secured federal lands,[23] and pressure test approximately 13 miles of existing Line 1600 located in non-HCAs. The approved scope of work is divided into 19 projects, each of which can be constructed separately, to enable the Utilities to minimize

[23] Approximately 2.1 miles of vintage Line 1600 located within a non-HCA area within MCAS Miramar is also planned to be replaced to address airfield security, access, and environmental concerns raised by MCAS Miramar.

customer and community impacts and meet the Commission's directive to execute PSEP as soon as practicable.[24] The initial focus will be on the replacement projects within the HCAs which is consistent with the Commission's directive.

The Plan identifies the work required to complete the replacement and testing of Line 1600 while maintaining gas supply to the current customer base. The following sections provide a summary of estimated costs as well as describe key elements of the Line 1600 Plan that support the reasonableness of the cost forecasts and compliance with internal and external standards.

B. Cost Summary and Comparison

The initial estimating step completed was to estimate the future direct costs associated with each of the 19 projects described in the Line 1600 Plan. Table 2 below summarizes the direct costs for the 19 individual Line 1600 projects described in my testimony and included in Mr. Butler's illustrative revenue requirement testimony (Chapter IV). These costs do not reflect the impact of loaders, escalation, allowance for funds used during construction ("AFUDC"), or capitalized property tax.

Table 2: Direct Costs
(In Millions, 2020$)

	2019 & Prior	2020	2021	2022	2023	2024	Total
Capital	**$40**	**$122**	**$153**	**$101**	**$65**	**$9**	**$490**
O&M	**$3**	**$0**	**$0**	**$5**	**$23**	**$17**	**$48**
Total	**$43**	**$122**	**$153**	**$106**	**$88**	**$26**	**$538**

In addition to direct costs, it is also necessary to include indirect costs and account for escalation. Unless otherwise noted, the cost forecast contained in my testimony is fully loaded and escalated, including applicable company overheads, except for the exclusion of Allowance for Funds used During Construction (AFUDC) and capitalized property tax. The Utilities'

[24] D.11-06-017 at 19.

internal process calculates values for AFUDC and capitalized property tax in a separate step after the individual project estimates are completed. Presentation without AFUDC and capitalized property tax also allows total aggregate costs in my testimony to be compared to values presented in the approved Line 1600 Plan as those values also did not include AFUDC or capitalized property tax. Tables 3 and 4 below provide that comparison.

Table 3: Original Loaded & Escalated Costs (2018 Class 4 Estimates, September 26, 2018 Line 1600 Test or Replacement Plan p.62)
(In Millions, includes escalation, overheads, excludes AFUDC and capitalized property tax)

	2019 & Prior	2020	2021	2022	2023	2024	Total
Capital	**$71**	**$152**	**$193**	**$134**	**$72**	**$8**	**$630**
O&M	**$2**	**$0**	**$0**	**$7**	**$22**	**$16**	**$47**
Total[25]	**$74**	**$152**	**$193**	**$141**	**$94**	**$24**	**$677**

Table 4: Updated Loaded & Escalated Costs (2020 Class 3 Estimates)
(In Millions, includes escalation, overheads, excludes AFUDC and capitalized property tax)

	2019 & Prior	2020	2021	2022	2023	2024	Total
Capital	**$50**	**$136**	**$175**	**$114**	**$78**	**$10**	**$563**
O&M	**$3**	**$0**	**$0**	**$6**	**$27**	**$20**	**$56**
Total[26]	**$53**	**$136**	**$175**	**$120**	**$105**	**$30**	**$619**

For the calculation of the illustrative revenue requirement, it is necessary to include AFUDC and capitalized property tax. Table 5 below summarizes the fully loaded and escalated costs for the 19 individual Line 1600 projects and included in Mr. Butler's illustrative revenue requirement testimony (Chapter IV). The capital costs include escalation, overhead loaders, AFUDC, and capitalized property tax.

[25] Excludes removal costs for existing assets of $13.0M; not part of basis for calculating revenue requirement.
[26] Excludes removal costs for existing assets of $13.0M; not part of basis for calculating revenue requirement.

Table 5: Total Capital and O&M Costs
(In Millions, includes escalation, overheads, AFUDC, and capitalized property tax)

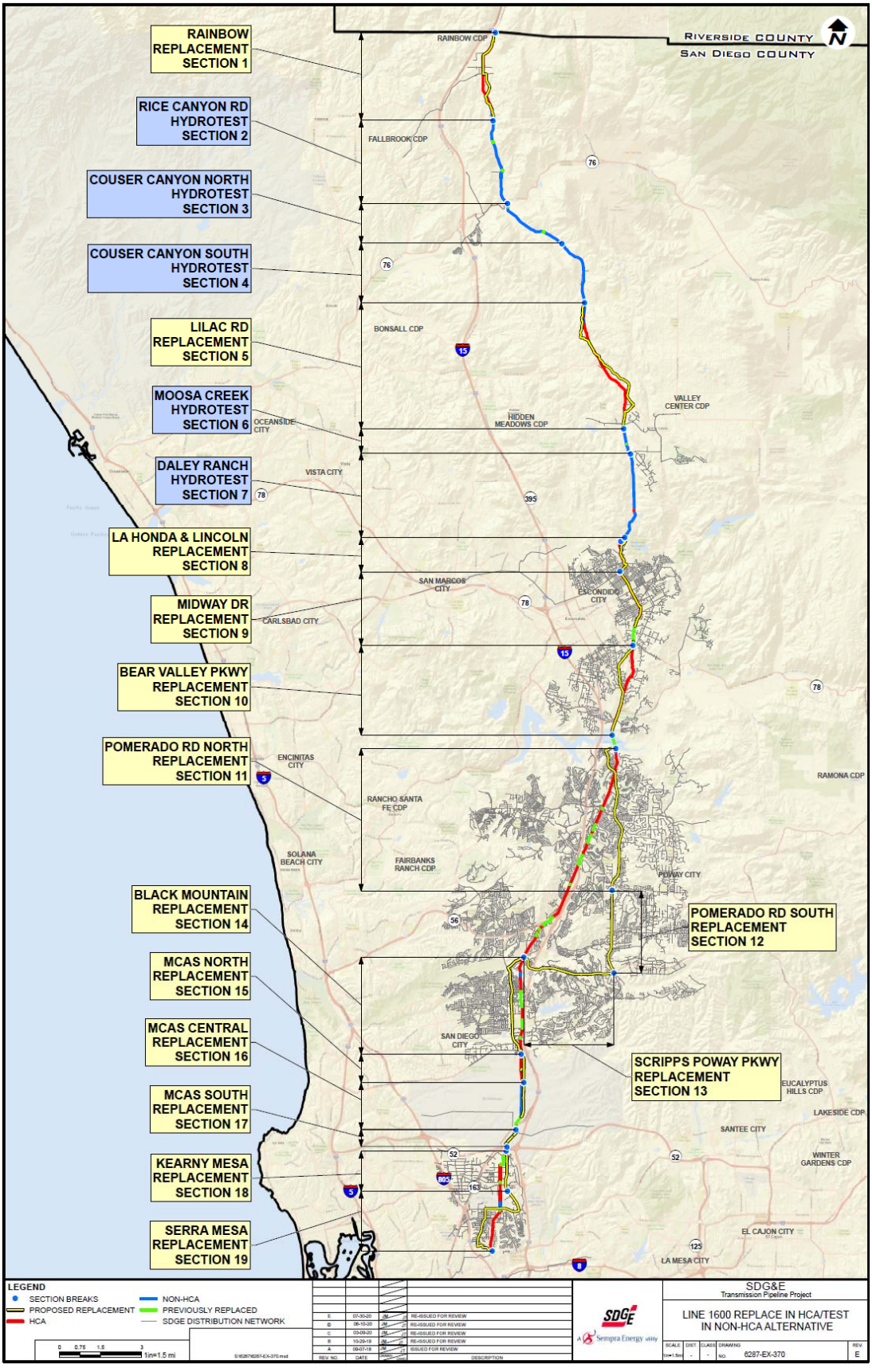
	2019 & Prior	2020	2021	2022	2023	2024	Total
Capital	**$62**	**$142**	**$181**	**$117**	**$75**	**$7**	**$584**
O&M	**$3**	**$0**	**$0**	**$6**	**$27**	**$20**	**$56**
Total[27]	**$65**	**$142**	**$181**	**$123**	**$102**	**$27**	**$640**

C. Descriptions of Each Pressure Test or Replacement Project

The approved Line 1600 Plan is comprised of 19 projects. The projects have been numbered from north to south and also given names to identify the geographic location and to identify whether the project is a replacement or a hydrotest project. As discussed on page 17 of the approved Line 1600 Plan, as SDG&E and SoCalGas transition from high level planning to detailed design, engineering and planning, some refinements may be necessay to address engineering, permitting, community or cost considerations. As of the time of this filing, the 19 projects remain highly consistent with the information conveyed in the approved Line 1600 Plan. To date, only minor project refinements have been required, primarly related to project endpoints or minor route adjustments to improve constructability. Figure 1 below reflects current information related to the 19 Line 1600 projects.

Figure 1
Map of 19 Line 1600 Projects

[27] Excludes removal costs for existing assets of $13.0M; not part of basis for calculating revenue requirement.


RAINBOW REPLACEMENT SECTION 1
RICE CANYON RD HYDROTEST SECTION 2
COUSER CANYON NORTH HYDROTEST SECTION 3
COUSER CANYON SOUTH HYDROTEST SECTION 4
LILAC RD REPLACEMENT SECTION 5
MOOSA CREEK HYDROTEST SECTION 6
DALEY RANCH HYDROTEST SECTION 7
LA HONDA & LINCOLN REPLACEMENT SECTION 8
MIDWAY DR REPLACEMENT SECTION 9
BEAR VALLEY PKWY REPLACEMENT SECTION 10
POMERADO RD NORTH REPLACEMENT SECTION 11
BLACK MOUNTAIN REPLACEMENT SECTION 14
MCAS NORTH REPLACEMENT SECTION 15
MCAS CENTRAL REPLACEMENT SECTION 16
MCAS SOUTH REPLACEMENT SECTION 17
KEARNY MESA REPLACEMENT SECTION 18
SERRA MESA REPLACEMENT SECTION 19
POMERADO RD SOUTH REPLACEMENT SECTION 12
SCRIPPS POWAY PKWY REPLACEMENT SECTION 13
RIVERSIDE COUNTY
SAN DIEGO COUNTY
RAINBOW CDP
FALLBROOK CDP
BONSALL CDP
OCEANSIDE CITY
VISTA CITY
HIDDEN MEADOWS CDP
VALLEY CENTER CDP
SAN MARCOS CITY
ESCONDIDO CITY
CARLSBAD CITY
ENCINITAS CITY
RANCHO SANTA FE CDP
SOLANA BEACH CITY
FAIRBANKS RANCH CDP
POWAY CITY
RAMONA CDP
SAN DIEGO CITY
EUCALYPTUS HILLS CDP
LAKESIDE CDP
SANTEE CITY
WINTER GARDENS CDP
EL CAJON CITY
LA MESA CITY
LEGEND
SECTION BREAKS
PROPOSED REPLACEMENT
HCA
NON-HCA
PREVIOUSLY REPLACED
SDGE DISTRIBUTION NETWORK
1in=1.5 mi
SDG&E
Transmission Pipeline Project
LINE 1600 REPLACE IN HCA/TEST IN NON-HCA ALTERNATIVE
6287-EX-370
E

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To provide additional descriptive reference, each project has been assigned a name that corresponds to a geographic reference and also describes whether the segment is planned to be replaced or hydrotested. These names are also reflected in Table 6 below which presents the projects in chonological order based on estimated in service dates. Key factors considered in planning the scope of work for each project are further described in Table 6 below as well as the corresponding Workpapers. Unique factors associated with each project can influence hydrotest break points, section boundaries, schedule, and other key project attributes.

TABLE 6
Descriptions of Each Project and Estimated In-Service Dates

Project Number	Project Name	HCA	Approx. Mileage	Description	Estimated In-Service Date
9	Midway Dr Replacement	Yes	2.45	Project is located in the City of Escondido and San Diego County. The project is planned in two separate segments with the northern segment starting at the intersection of Lincoln Avenue and Midway Drive, and continues along Bear Valley Parkway ending at Birch Avenue. The southern replacement segment is along Bear Valley Parkway ending south of Highway 78 at an existing mainline valve (MLV).	Q4 2020
14	Black Mountain Replacement	Yes	4.13	Project is located in the City of San Diego. The project will replace and reroute 16-inch pipeline primarily along Black Mountain and Mercy Roads from the intersection of Mercy Road and Branicole Lane to the intersection of Kearny Villa Road and Kearny Mesa Road. The Black Mountain Replacement Project will include the installation of three MLVs.	Q4 2020

Project Number	Project Name	HCA	Approx. Mileage	Description	Estimated In-Service Date
19	Serra Mesa Replacement	Yes	4.23	Project is located in the City of San Diego. The project will replace and reroute 16-inch pipeline and runs along Ruffin Road and Ridgehaven Court to Mission Station. The project will also include the installation of a new 16-inch MLV and two new regulator stations.	Q4 2020
18	Kearny Mesa Replacement	Yes	1.50	Project is located in the City of San Diego and will replace and reroute 16-inch pipeline. It runs along Ruffin Road from Waxie Way to Ridgehaven Court. The project will also install new 10-inch pipe to allow for continuity of service to a large industrial customer who is located farther away from the new pipeline alignment, the installation of two new regulator stations, the tie-over of one existing regulator station, and the extension of a 6-inch distribution main to restore the feed into the distribution system.	Q4 2020
10	Bear Valley Pkwy Replacement	Yes	3.57	Project is located in the City of Escondido, City of San Diego, and San Diego County. The project will replace and partially reroute 16-inch pipeline. It runs along Bear Valley Parkway from the intersection of San Pasqual Valley Road and Bear Valley Parkway to the Lake Hodges area along Mule Hill Trail south of Bear Valley Parkway. The project will tie-over to three existing regulator stations and remove two spans along the existing route.	Q1 2021

Project Number	Project Name	HCA	Approx. Mileage	Description	Estimated In-Service Date
11	Pomerado Rd North Replacement	Yes	5.84	The project is located in the City of San Diego and the City of Poway. The project will reroute and install replacement 16-inch pipe and one new MLV, along Pomerado Road from Highland Valley Road to Ted Williams Parkway. Includes additional distribution work required by rerouted alignment.	Q4 2021
12	Pomerado Rd South Replacement	Yes	3.14	Project is located in the City of Poway. The project will reroute and install replacement 16-inch pipeline along Pomerado Road from Ted Williams Parkway to Scripps-Poway Parkway and two new 16-inch MLVs. Due to the offset of the new alignment, additional distribution work will be required as part of the project scope to allow for existing customers to be served from the rerouted alignment.	Q4 2021
13	Scripps Poway Pkwy Replacement	Yes	3.64	Project is located in the City of San Diego and the City of Poway. The project will reroute and install replacement 16-inch pipeline along Scripps-Poway Parkway and Mercy Road. The project will also install one new MLV. Due to the offset of the new alignment, additional distribution work will be required as part of the project scope to allow for existing customers to be served from the rerouted alignment.	Q1 2022
8	La Honda & Lincoln Replacement	Yes	1.56	Project is in the County of San Diego and the City of Escondido. The project will replace and partially reroute 16-inch pipeline. It runs along La Honda Drive, El Norte Parkway, and ends along Lincoln Avenue at Midway Drive. The project will also include the installation of a new automated MLV. As part of the project scope, some associated distribution work will be completed to	Q2 2022

Project Number	Project Name	HCA	Approx. Mileage	Description	Estimated In-Service Date
				maintain reliability of the system and reconnect gas supply to local customers.	
1	Rainbow Replacement	Yes	3.69	Project is located in the County of San Diego. The project will replace and partially reroute 16-inch pipeline. It runs along Rainbow Valley Boulevard to Rice Canyon Road, ending north of the intersection of Rice Canyon Road and Moon Ridge Road. Due to the offset of the new alignment, additional distribution work will be required as part of the project scope to allow for existing customers to be served from the rerouted alignment.	Q3 2022
5	Lilac Rd Replacement	Yes	5.96	Project is located in the County of San Diego. The project will replace and mostly reroute 16-inch pipeline It runs along Lilac Road, Hideaway Lake Road, and Lamar Road ending south of Betsworth Road along Frace Lane. Distribution work will be required as part of the project scope to allow for existing customers to be served from the rerouted alignment. The Project assumes three jack and bores installations will be required for creek crossings, and includes removal of 11 existing pipeline spans following the abandonment of the existing pipeline.	Q1 2023
6	Moosa Creek Hydrotest	No	0.98	Project is located in the County of San Diego near the unincorporated community of Valley Center. The project will hydrotest existing 16-inch pipeline through rural and agricultural land from Betsworth Road to south of the intersection of Mirar De Valle Road and Frace Lane. Prior to the hydrotest, to improve piggability and the integrity of the line, the project will replace 12	Q2 2023

Project Number	Project Name	HCA	Approx. Mileage	Description	Estimated In-Service Date
				features, which include wrinkle bends, short radius elbows, and existing pressure control fittings (PCFs).	
7	Daley Ranch Hydrotest	No	3.25	Project is located in the City of Escondido the County of San Diego. The project will hydrotest existing 16-inch pipeline from Mirar De Valle along Frace Lane, across the Daley Ranch south to La Honda Drive. Prior to the hydrotest, to improve piggability and the integrity of the line, the project will replace 14 features, which include wrinkle bends, short radius elbows, and existing PCFs.	Q2 2023
15	MCAS North Replacement	Yes	1.07	Project is located in the City of San Diego primarily on MCAS (Marine Corps Air Station) Miramar property. The project will replace and reroute pipeline along Kearny Mesa Road and Kearny Villa Road south of Miramar Road to south of Miramar Way. This will enable the reroute of Line 1600 from within the MCAS military base's high security area and avoid environmentally sensitive areas along the existing right of way (ROW) by placing the replacement line within a new easement to be granted by MCAS Miramar.[28] Due to the offset of the new alignment, additional distribution work will be required as part of the project scope to allow for existing customers to be served from the rerouted alignment. The project includes the installation of a section of 4-inch parallel line for regulator station tie-overs.	Q2 2023

[28] MCAS, Miramar letter from Colonel C. B. Dockery, Commanding Officer of MCAS Miramar, dated September 5, 2018 (Attachment 3).

Project Number	Project Name	HCA	Approx. Mileage	Description	Estimated In-Service Date
16	MCAS Central Replacement	No	1.21	Project is located in the City of San Diego primarily in MCAS Miramar property. The project will reroute pipeline along Kearny Villa Road south of Miramar Way to south of Harris Plant Road. This segment was rerouted from within the MCAS military base's high security area and avoids environmentally sensitive areas along the existing ROW by placing the replacement line within a new easement to be granted by MCAS Miramar. Due to the offset of the new alignment, additional distribution work will be required as part of the project scope to allow for existing customers to be served from the rerouted alignment. The project includes the installation of a section of 4-inch pipeline to reconnect to a regulator station.	Q3 2023
17	MCAS South Replacement	No	0.91	Project is located in the City of San Diego primarily in MCAS Miramar property. The project runs along Kearny Villa Road from the Kearny Villa Pressure Limiting Station (KVPLS) to Highway 52. This segment was rerouted from within the MCAS military base's high security area and avoids environmentally sensitive areas along the existing ROW by placing the replacement line within a new easement to be granted by MCAS Miramar.	Q3 2023
2	Rice Canyon Hydrotest	No	3.22	Project is located in the County of San Diego. The project will hydrotest existing 16-inch pipeline along Rice Canyon Road through agricultural land from Rancho Bavaria Road to Couser Canyon Road near Highway 76. Prior to the hydrotest, the project will install a 10-inch automated valve bridle across an existing MLV and tie-in to an existing	Q1 2024

Project Number	Project Name	HCA	Approx. Mileage	Description	Estimated In-Service Date
				10-inch feed serving a peaker plant. The 10-inch pipe installation includes a cased jack and bore crossing of Caltrans Highway 76. Prior to the hydrotest, to improve piggability and the integrity of the line, the project will replace 26 features, which include wrinkle bends, short radius elbows, and existing PCFs.	
3	Couser Canyon North Hydrotest	No	2.60	Project is located in the County of San Diego. The project will hydrotest existing 16-inch pipeline through agricultural land from Highway 76 along Couser Canyon to Pala Loma Drive. Prior to the hydrotest, to improve piggability and the integrity of the line, the project will replace 23 features, which include wrinkle bends, short radius elbows, and existing pressure PCFs.	Q2 2024
4	Couser Canyon South Hydrotest	No	2.53	Project is located in the County of San Diego. The project will hydrotest existing 16-inch pipeline through agricultural land from Pala Loma Drive to Keys Creek Road. Prior to the hydrotest, to improve piggability and the integrity of the line, the project will replace 23 features, which include wrinkle bends, short radius elbows, elbows, and existing PCFs.	Q2 2024

D. Project Schedule/Prioritization

The approved Line 1600 Plan is comprised of 19 projects that can be completed independently to efficiently address safety, operational, community, environmental, constructability, and cost considerations associated with each distinct portion of Line 1600. The scope of work consists of 14 replacement projects and five hydrotest projects. The total length of new 16-inch diameter pipe to be installed is approximately 42.8 miles. The total length of

existing Line 1600 to be hydrotested is approximately 12.9 miles. Maps showing details of the proposed scope of work are presented in the workpapers (Appendix A).

The 19 Line 1600 projects are prioritized and scheduled so as to achieve the greatest safety enhancement benefits first, focusing on the HCAs, and to complete all of the projects as soon as practicable. Many factors were considered while scheduling the projects, including customer benefits and impacts, operational limitations, potential permit lead time, land rights lead time, and outreach activities.

Generally, projects from the City of Escondido south to the terminus of Line 1600 at Mission Gate Station are prioritized first as this corridor represents the highest concentration of population immediately adjacent to existing Line 1600 and therefore stands to achieve the biggest relative safety benefit. Additionally, the majority of the route for replacement pipeline falls within existing streets, which is anticipated to minimize permitting time due to existing franchise rights and achieves the avoidance of any environmentally sensitive areas.

The following considerations were also taken into account when determining the preliminary Line 1600 schedules: the ability to deliver gas to customers and potential permitting. To facilitate isolating Line 1600 for hydrotesting or connecting replacement pipeline during the winter months when core customer gas use is highest, it may be necessary to schedule gas to be delivered at the Otay Mesa receipt point, if capacity is available. Additionally, during summer months, sections of Line 1600 north of where it meets Line 1601 in Escondido cannot be isolated without consideration of impacts, such as curtailments, due to high peak loads on peaker plants in the area; supply delivered at the Otay Mesa receipt point cannot affrmatively mitigate this concern during summer periods due to pipeline capacity limitations. Therefore, because the hydrotest projects are located north of Escondido, managing the impacts of capacity limitations

on the system will be a main driver when it comes to the actual detailed scheduling of the hydrotest projects, and some schedule adjustments may be required.

Next, several projects are located within jurisdictions that may require long-lead permits or land acquisitions. For scheduling purposes, some projects may require effort early on to begin a potential lengthy permit and/or land rights acquisition process. Given this potential, these projects are scheduled to be constructed in the latter years of the proposed timeline. For example, there are some potential long-lead land acquisitions needed for local municipality-owned, State-owned lands such as Caltrans and Federal-owned lands such as Marine Corp Air Station Miramar. Given the number, scope and complexity of the Line 1600 projects, SDG&E and SoCalGas assume extensive community and customer outreach activities will be necessary to achieve the schedule and timeline set forth in this filing. Figure 2 below shows the preliminary schedule, which may be revised as SDG&E and SoCalGas complete the detailed engineering, design and planning process, for each of the 19 of the Line 1600 projects.

Figure 2: Line 1600 Plan Schedule

Project	Project Name	Project Type	2019 Q1	2019 Q2	2019 Q3	2019 Q4	2020 Q1	2020 Q2	2020 Q3	2020 Q4	2021 Q1	2021 Q2	2021 Q3	2021 Q4	2022 Q1	2022 Q2	2022 Q3	2022 Q4	2023 Q1	2023 Q2	2023 Q3	2023 Q4	2024 Q1	2024 Q2	2024 Q3	2024 Q4
9	Midway Drive Replacement Project	Replacement	E	E	E	E	C	C	C	C	X															
14	Black Mountain Replacement Project	Replacement	E	E	E	E	E	C	C	C	X	X														
19	Serra Mesa Replacement Project	Replacement	E	E	E	E	E	C	C	C	X	X														
18	Kearny Mesa Replacement Project	Replacement		E	E	E	E	C	C	C	X	X														
10	Bear Valley Parkway Replacement Project	Replacement	E	E	E	E	E	E	E	C	C	X	X													
11	Pomerado Road North Replacement Project	Replacement	E	E	E	E	E	E	E	E	E	C	C	C	X	X										
12	Pomerado Road South Replacement Project	Replacement	E	E	E	E	E	E	E	E	E	E	C	C	X	X										
13	Scripps-Poway Replacement Project	Replacement	E	E	E	E	E	E	E	E	E	E	E	C	C	X	X									
8	La Honda - Lincoln Replacement Project	Replacement	E	E	E	E	E	E	E	E	E	E	E	E	C	C	X	X								
1	Rainbow Replacement Project	Replacement	E	E	E	E	E	E	E	E	E	E	E	E	E	C	C	X	X							
5	Lilac Road Replacement Project	Replacement	E	E	E	E	E	E		E	E	P	P	P	E	E	C	C	C	X	X					
6	Moosa Creek Hydrotest Project	Hydrotest		E	E	E	E	E					E	E	P	P	P	E	C	C	X	X				
7	Daley Ranch Hydrotest Project	Hydrotest		E	E	E	E	E					E	E	P	P	P	E	C	C	X	X				
15	MCAS North Replacement Project	Replacement	E	E	E	E	E	E	P	P	P	P	P	P	P	P	P	E	E	C	X	X				
16	MCAS Central Replacement Project	Replacement	E	E	E	E	E	E	P	P	P	P	P	P	P	P	P	E	E	C	C	X	X			
17	MCAS South Replacement Project	Replacement	E	E	E	E	E	E	P	P	P	P	P	P	P	P	P	P	E	E	C	X	X			
2	Rice Canyon Hydrotest Project	Hydrotest		E	E	E	E	E							E	E	P	P	P	E	C	C	X	X		
3	Couser Canyon North Hydrotest Project	Hydrotest		E	E	E	E	E								E	E	P	P	P	C	C	C	X	X	
4	Couser Canyon South Hydrotest Project	Hydrotest		E	E	E	E	E							E	E	P	P	P	E	E	C	C	X	X	

E	Engineering
C	Construction
X	Closeout
P	Potential long lead permit/land rights acquisition time for agencies to review

Schedule may vary based on various permit/land rights acquisition requirements

E. Temporary Service Requirements are Included to Minimize Customer Impacts

To maintain uninterrupted gas supply to customers during replacement/hydrotest of the pipeline, customers may be temporarily fed using compressed natural gas (CNG), liquefied natural gas (LNG) or through construction of a bypass pipeline. The equipment required varies by the volume consumed by each customer. SDG&E's Distribution Region Engineering organization, along with SoCalGas' Gas Control & System Planning organization, evaluated the pipeline and identified the customers that would require isolation and alternate gas supply during replacement/hydrotesting activities.

After analyzing the needs of and potential service impacts to customers, SDG&E and SoCalGas identified the equipment required to maintain service during construction. The types

of equipment identified include CNG pods, medium and large CNG trucks and bypass installations. Isolation of customers is accomplished using stopples and temporary and permanent bypasses. The estimates presented in the workpapers in this filing include estimated costs for necessary bypass pipelines and/or CNG/LNG temporary supply at each site and temporary alternative gas supply cost, based on the known information and assumptions described in workpapers for each project.

a. The Line 1600 Plan Complies with Applicable Regulations and Industry/Company Standards

All testing or replacement projects implemented pursuant to the Line 1600 Plan will be subject to robust guidelines and oversight to comply with SDG&E and SoCalGas' internal standards and applicable laws and regulations. These applicable regulations include the Code of Federal Regulations, Title 49, Part 192, (49 CFR 192), which provides requirements for Materials (Subpart B), Pipe Design (Subpart C), Design of Pipeline Components (Subpart D), Welding of Steel in Pipelines (Subpart E), General Construction Requirements for Transmission Lines and Mains (Subpart G), and Test Requirements (Subpart J). In addition to its specific requirements, the Federal Code also "incorporates by reference" the requirements of industry standards such as the American Society for Mechanical Engineers (ASME), American National Standards Institute (ANSI), American Petroleum Institute (API) and American Society for Testing and Materials (ASMT). These industry standards provide methodologies and calculations for more specific and technical requirements addressed in the Federal Code. In addition, Commission General Order (GO) 112-F provides additional requirements with respect to the design, construction, testing, maintenance, and operation of utility gas gathering, transmission and distribution piping systems.

SDG&E and SoCalGas' Gas Standards (Gas Standards) standards have been developed to address applicable laws and regulations and contain references to the regulations that are addressed. The Gas Standards are regularly reviewed and updated on a periodic basis and ad-hoc basis by SDG&E and SoCalGas personnel and contractors[29] to promote both compliance with laws and regulations and to reflect industry standards and SDG&E and SoCalGas' best practices.[30] For each project, internal standards and practices are employed to govern the design analysis, materials purchased, and construction practices.

SDG&E and SoCalGas' Gas Standards are driven by a dual objective: complying with applicable laws and regulations and promoting safety and operational efficiency. The Gas Standards are the policies and documents that demonstrate compliance with applicable state and federal requirements. The Commission's SED regularly reviews natural gas transmission and distribution functions related to engineering, construction, testing, operations and maintenance for each utility providing natural gas in the state. The Commission compares the functions of transmission and distribution with requirements set forth in GO 112-F as well as federal standards. Through these reviews, SED can evaluate and provide input on the sufficiency of the Gas Standards in complying with GO 112-F and the referenced provisions of 49 CFR. The SED also performs field and virtual inspections of construction activities and has performed reviews of Line 1600 projects currently under construction.

[29] For example, when PSEP was first initiated, PSEP contractors reviewed policies, procedures, technical specifications and work instructions. This review was done to incorporate, where possible, improvements and content enhancements.

[30] When unique situations require additional Gas Engineering guidance, PSEP seeks out the assigned Gas Standard "owner" for solutions. A gas standard owner is the subject matter expert responsible for updating standards for compliance with applicable codes. For example, when situations require an exception to an applicable Gas Standard, the appropriate Gas Standard owner is consulted and, if the exception is an acceptable accommodation, the Gas Standard owner documents his/her approval.

The design, construction, testing, operations and maintenance of Line 1600 as described herein will, at a minimum, meet applicable federal and state safety regulations, rules, and requirements by complying with applicable SDG&E and SoCalGas Gas Standards, and will, in many cases, exceed these requirements. Although the Gas Standards themselves may exceed federal and state safety regulations, rules and requirements, with respect to the Line 1600 projects, SDG&E and SoCalGas identify additional areas where they propose to exceed federal and state safety regulations, rules, and requirements. The Line 1600 Plan (Attachment 1) provides a summary of where the execution of the approved Line 1600 Plan is anticipated to exceed applicable state and federal safety regulations, rules, and requirements, including those set forth in GO 112-F, CFR Parts 191 and 192, and the California Occupational Safety and Health Act (Cal/OSHA).

In addition to the summary provided in Section IV.G.1 to 14 of Attachment 1, SDG&E and SoCalGas provide the following supplemental explanation regarding the applicable Code[31] requirements the approved Line 1600 Plan is anticipated to meet or exceed.

1. SDG&E and SoCalGas Design Standards and Practices

SDG&E and SoCalGas' design standards and practices address materials to be used and proper design in accordance with GO 112-F and applicable federal laws and regulations. These design standards and practices enable: (1) development of specific engineering requirements for materials used in strength test or replacement projects; (2) preparation of designs that comply with applicable laws, permits, such as California Department of Transportation (Caltrans) encroachment permits, and SDG&E/SoCalGas and industry standards; (3) utilization of applicable engineering and design standards developed for strength testing or replacement

[31] As used in this Plan, "Code" refers to 49 CFR Part 192, which governs nearly all aspects of the design, inspection, and testing of a pipeline and its appurtenances.

projects; and (4) implementation of consistent design and material requirements for the various engineering design firms contracted to assist with design development. While many industry standards are incorporated by reference in the Gas Standards,[32] the industry standards generally applied when designing facilities are summarized in Table 7 below.

TABLE 7
Summary of Applicable Industry Design Standards

Steel Line Pipe	API 5L
Steel Line Pipe Grade B	ASTM A 106
Valves	API 6D
High Yield Weld Fittings	Manufacturers Standardization Society (MSS) SP 75
Grade B Weld Fittings	ASTM A234
Flanges	ANSI B16.5
Forged Steel Weld Fittings	ASTM A105
Pressure Vessels	ASME VIII
Welding	API 1104
Cathodic Protection	National Association of Corrosion Engineers (NACE) RP-0169
AC Mitigation	NACE RP-0177
National Electric Code	National Fire Protection Association (NFPA) 70

The design specifications, testing requirements and testing results are documented and retained for well beyond the life of the asset to demonstrate compliance, and support the operation, maintenance, and design level of each new segment of pipeline intended to operate at a pressure greater than 100 pounds per square inch gauge (psig).

2. Spike Test Best Practices: SDG&E Gas Standards G7361, G7365, G7369

Under existing SDG&E Gas Standards, absent an applicable exception, hydrotests of new and existing pipeline require a 5% spike for 30 minutes at the beginning of the test, such that

[32] For example, designs are also reviewed for conformance with ANSI B31.8, "Gas Transmission and Distribution Piping Systems." Additionally, each pipeline section may have additional design components. To illustrate, PSEP pipeline facilities also include, as applicable, cathodic protection systems designed to satisfy the requirements of 49 CFR 192, NACE Standard RPO 0169, NACE Standard TM0497, and applicable Gas Standards.

decreasing the pressure from the spike pressure results in at least a 5% reduction for the entire pipe segment. Exceptions to spike testing requirements must be approved by SDG&E/SoCalGas Pipeline Engineering. Spike testing is not recommended when the spike would exceed the actual or likely mill test pressure, and elevation changes require a significant number of additional spike test sections.

3. Maximum Test Pressure

For those portions of existing Line 1600 that are proposed to be hydrotested, SDG&E and SoCalGas plan to test the existing line to at least 1.5 times a potential Maximum Allowable Operating Pressure (MAOP) of 640 psig.[33] This equates to a minimum test pressure of 960 psig. In order to safely test the existing line, SDG&E and SoCalGas will not exceed 90% of the SMYS of the pipe, by dividing Line 1600 into multiple test projects to address elevation changes that otherwise can significantly increase test pressures at low points. Based on preliminary engineering, SDG&E and SoCalGas anticipate the maximum test pressure that existing segments of Line 1600 will experience will be 1,459 psig, or 89.8% of SMYS, in the Rice Canyon section, which has the highest elevation change. See Attachment 1 (Line 1600 Test or Replacement Plan) for additional information pertaining to the characteristics of existing pipe planned for hydrotest, including the maximum test pressure at the lowest elevation as described in Table 5 in the Line 1600 Plan.

The replacement pipeline projects also will be subject to hydrotest. Newly installed pipe will be tested to satisfy SDG&E and SoCalGas' strength test procedures. The new line will be tested to at least 90% SYMS according to SDG&E standard G7369. SDG&E and SoCalGas plan to install 16-inch diameter, 0.375-inch wall thickness, grade X52 pipe for new installations. The

[33] Until otherwise ordered by the Commission, the MAOP of Line 1600 is 512 psig.

minimum test pressure for this pipe at 90% of SMYS equates to 2194 psig. Should some installations result in a combination of new pipe being interconnected with segments of existing modern 0.250-inch wall, grade X52 pipe (non-A.O. Smith EFW pipe), minimum test pressures will be adjusted accordingly to fall within a range of 1200 psig to 1463 psig, as determined by SDG&E and SoCalGas' Gas Engineering department. This test pressure range equates to 1.5 times the original MAOP rating of 800 psig, at the lower end, to 90% of SMYS for the 0.250-inch wall pipe at the upper end.

4. Materials Standards and Practices

Once a testing or replacement project has been scoped, designed, and approved, materials are ordered that comply with SDG&E and SoCalGas' Materials Specifications for Gas Operations. Unless otherwise specified, API 5L pipe, with the specific approved grades and wall thicknesses, are used. These wall thicknesses and grades for each diameter pipe are as specified in applicable standards and Materials Specifications for Gas Operations. The required wall thicknesses for the various class locations are determined and verified using design data. Table 8 below summarizes the generally applicable Materials Specifications for Gas Operations.

TABLE 8
Generally Applicable Materials Specifications for Gas Operations

Pipe	MSP 41.06.1	Pipe - Steel, Grades A25 Through X70
	MSP 52.83	Fittings - Forged Steel
Fittings	MSP 52.96	Fittings – Butt-Weld Steel
	MSP 58-15.1	Valves - Ball, Small (High Pressure)
Valves	MSP 58-15.2	Valves; Ball, Steel Floating
	MSP 58-20	Valves - Check
	MSP 58-82	Valves; Ball, Steel, Trunnion Mounted
Coatings	MSP 44-50	Fusion Bonded Epoxy External Line Pipe Coating
	MSP 44-50.1	Fusion Bonded Epoxy External Fitting Coating
	MSP 44-50.4	Powder Coating for External Protection of Prefabricated Gas Components

Materials Specifications for Gas Operations are used for each purchase and outline the instructions and expectations for shop inspections and quality assurance. To validate adherence to these standards, SDG&E and SoCalGas may inspect and test materials to help verify the accuracy of the manufacturer's certification and testing, to promote compliance with company requirements and, if applicable, the Materials Specifications for Gas Operations Quality Control Inspection Instructions. Documentation of compliance and certification is retained.

5. Construction Standards and Practices

Construction is subject to extensive standards, practices, and guidelines. First, SDG&E and SoCalGas enforce guidelines on how contractors are qualified to work on the system.[34] Contractors are not permitted to commence working on the SDG&E/SoCalGas system until they

[34] Contractors are thoroughly vetted and must, among other requirements: have a record of job and safety performance; demonstrate approved production and technical equipment and facilities; demonstrate approved Operator Qualification program, as required by 49 CFR 192.801 through 192.809; demonstrate an adequate quality assurance and safety program; have a Department of Transportation (DOT)-and Company-approved Alcohol & Drug Testing Program in accordance with the DOT CFR, Title 49, Part 40 and Part 199 regulated by the Pipeline & Hazardous Materials Safety Administration (PHMSA) or Part 382 if contractor's employees perform commercial motor vehicle driver functions regulated under the DOT Federal Motor Carrier Safety Administration's (FMCSA) Part 382; demonstrate the contractor is meeting State and Federal requirements for the installation and construction of natural gas pipelines (49 CFR 190, 191, 192) Cal Occupational Safety and Health Administration (OSHA) or any other state requirements; and maintain a California Contractors State License.

have demonstrated compliance with applicable requirements and Gas Standards and demonstrated appropriate financial and insurance capabilities.

In addition to these threshold requirements to begin work, SDG&E and SoCalGas implement comprehensive standards that address, among other areas, excavation, coating application and inspection, welding, welding inspection, trenching, cover, and pressure testing. Prior to starting work, as a part of the agreement with the contractor, contractors are provided an index of standards, practices, guidelines, and requirements; as applicable, contractors are provided updates when issued. SDG&E and SoCalGas monitor and document compliance with applicable standards, laws, and requirements.

Direct management of the project construction activities is the responsibility of SDG&E and SoCalGas' Construction Management organization. The organization is structured to provide oversight and monitor whether construction is meeting quality standards in a safe construction environment at an economical total cost. The organization also provides extensive oversight with respect to safety, environmental protection, site security, construction contract management and administration, planning, scheduling, progress control, cost control, inspection, job site material and logistics management and job site customer interface management. For example, during construction, daily inspection reports are generated to document the work performed, photograph aspects of the work, and document compliance with applicable standards for the work being performed during construction. Company employees, as well as third party inspection service providers, verify compliance with standards. The Commission's SED will also perform in-person construction and construction records inspections from time to time and has done so on the first Line 1600 projects to move into construction.

In addition, an assigned Project Manager and other key members of the Project Management Team assist the Construction Management team and provide management and project support, particularly with respect to engineering, constructability, procurement follow-up, inspection/expediting of purchased equipment and materials, and other specialized services as may be required to support construction.

6. Welding, Welding Inspection, and Testing of Pipeline Welds (49 CFR 192.241)

SDG&E and SoCalGas adhere to applicable laws, regulations, and Gas Standards for welder qualification and re-qualification. As such, SDG&E and SoCalGas qualify and re-qualify company and contractor welders in accordance with Title 49 of the Code of Federal Regulations.[35]

SDG&E and SoCalGas prepare a Welder Qualification Test Report when a welder is qualified, maintain a list of qualified personnel, and conduct destructive testing on steel weld samples submitted by welders in accordance with 49 CFR 192 and API 1104 (revision incorporated by reference in 49 CFR Part 192). Subsequently, welders must regularly be requalified. Qualification compliance is monitored by requiring welders to carry proof of certification and verifying their qualifications when performing welding or joining operations.

To provide further oversight, welding inspections are performed by qualified welding inspectors and each weld undergoes non-destructive examination (NDE).[36] Inspection of a weld

[35] 49 CFR Parts 192.227 Qualification of welders, and 192.229 Limitations of welders.
[36] Qualified inspectors must demonstrate knowledge and understanding of high pressure steel pipeline materials and components; be CWI (Certified Welding Inspector), CPWI (Certified Pipeline Welding Inspector) or an equivalent certification or training deemed acceptable; demonstrated experience and knowledge in API Standard 1104; have NDT (non-destructive testing) experience and or certification preferred for RT (radiographic) and PT (penetrant) inspections; passing required PSEP operator qualification (OQ) Covered Common Tasks (CCTs); be qualified to perform visual weld inspection in accordance with the recommendation of ASNT or any recognized certification program that is acceptable to the Company; and qualified under task 0811 to perform Visual Inspection of Welding and Welds.

takes multiple forms. First, the welding inspector performs quality checks prior to and during the welding process. Second, the welding inspector performs a visual inspection of the weld. Finally, an NDE technician inspector performs non-destructive testing, such as radiographic or ultrasonic inspection. Company and contract personnel performing non-destructive testing are certified according to API-1104 and ASNT-SNT-TC-1A and provide, upon request, a current certification record demonstrating qualification for Task 1.25-0601 – Radiography Examination – 49 CFR 192.243 Nondestructive Examination.

The Federal Code requires non-destructive testing for pipelines constructed in Class 1 and Class 2 locations that are not in highway or railroad rights-of-way on 10% and 15% of welds, respectively. SDG&E and SoCalGas plan to exceed the requirement by performing non-destructive testing of 100% of the welds and non-destructive examination by dye penetrant of branch connections for pipelines in these areas.

7. Steel Pipeline Materials (49 CFR 192.55)

SDG&E and SoCalGas utilize greater pipe base metal and pipe toughness than required by API5L. API5L requires the steel pipe to have a minimum average (from a set of three specimens) absorbed energy for each heat based on full-size transverse specimens to 20 ft-lbs. SDG&E and SoCalGas exceed this requirement by applying a Charpy energy equation, which calculates a value greater than 29 ft-lbs. By exceeding the API5L requirements, the approved Line 1600 Plan is designed to provide greater resistance to propagating cracks and increases the pipe's resistance to third party damage.

8. Steel Pipe Design Factors (49 CFR 192.111)

The design factor of a pipe section establishes the safety margin against pipe yielding from its internal pressure.[37] For example, a pipeline in a Class 3 location is required to have a design factor of 0.5 or lower. This limits the maximum pressure in a pipe section to half of its yield pressure, which is equivalent to having a safety factor of 2, based on yield. Table 9 below summarizes the code requirements for design factors based on the class location of a pipe.

TABLE 9
Summary of Minimum Design Factors Required Under Federal Regulations (49 C.F.R. § 192.5)

Class Location	Description of Class Location	Design Factor
1	10 or fewer buildings intended for human occupancy.	0.72
2	More than 10 but fewer than 46 buildings intended for human occupancy.	0.60
3	46 or more buildings intended for human occupancy, or an area where the pipeline lies within 100 yards of either a building or a small, well-defined outside area (such as a playground, recreation area, outdoor theater, or other place of public assembly) that is occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12-month period.	0.50
4	Where buildings with four or more stories above ground are prevalent	0.40

Population densities along the approved Line 1600 Plan vary by location from a mixture of Class 1, Class 2 and Class 3 in the northern reaches of the pipeline to predominately Class 3 and Class 4 in the high-density urban areas in the south. SDG&E and SoCalGas will design the northern pipeline projects between Rainbow and Escondido to meet Class 3 requirements. The southern projects from Escondido to Mission Station will be designed to meet Class 4 requirements. This will satisfy design code requirements and provide an additional safety margin to accommodate future growth and development should the class location change.

[37] For clarity, the term "yielding" does not mean the pipe ruptures but rather refers to permanent deformation. Pipe has additional strength beyond its yield point.

The design and testing of all replacement pipe is being completed in accordance with the approved Line 1600 Plan. Modern replacements of the pipeline will bring an increased margin of safety compared to the vintage A.O. Smith pipe and provide the opportunity for the CPUC to, as needed, increase the MAOP for such pipe from 512 psig up to 800 psig, which aligns with the other transmission pipelines Line 1600 interconnects with and would allow it to provide greater benefit in the event of an outage or pressure reduction on Line 3010. SDG&E and SoCalGas' plan is to continue to operate Line 1600 at its current MAOP so as not to exceed the capacity requirements set forth in D.18-06-028, even though the replacement pipe would be constructed and tested to allow the potential to operate at an MAOP of 800 psig if the CPUC chooses to increase allowable MAOP on modern (non 1949 vintage A.O. Smith pipe) sections of Line 1600 in the future.

9. Transmission Line Valves (49 CFR 192.179)

The approved Line 1600 Plan is designed to enable detection of a significant change in pipeline pressure within two minutes in designated Class 3, Class 4, and/or HCA sections and for full depressurization of the segment within 30 minutes should a failure occur. This design criteria will meet or exceed PSEP objectives for isolation and depressurization of a pipeline, which already exceed Code requirements.[38] With only a few minor exceptions (valves installed to aid in constructability), all new Main Line Valves (MLVs) installed pursuant to the approved Line 1600 Plan will have capabilities for remote operation by SDG&E and SoCalGas' Gas Control Center and/or automatic closure without operator intervention in the event of a significant failure. Further, valves on selected taps, crossovers and bridle assemblies will be equipped with remote

[38] A.11-11-002, Amended Testimony of Southern California Gas Company and San Diego Gas & Electric Company in Support of Proposed Natural Gas Pipeline Safety Enhancement Plan, Chapter V, Proposed Valve Enhancement Plan, dated December 2, 2011, http://www.socalgas.com/regulatory/documents/r-11-02-019/Amended%20Testimony-12.2.11.pdf.

control capabilities to support operation of the pipeline and prevention of back-flow of gas into any main pipeline segment isolated to control an unplanned gas release.

Automated MLVs will have actuators that reside above ground or will be installed below grade within a concrete vault. The actuator will operate using gas pressure provided from the pipeline, supported by pneumatic and electronic controls. The MLVs will be 16-inch, full-opening, to allow for the passage of internal inspection devices. Each automated MLV location will have a blow down valve installed on each side of the MLV to allow for depressurization of the adjoining pipe. The approved Line 1600 Plan calls for a maximum spacing between automated MLVs of five miles unless other constraints require spacing more than 5 miles apart. In all locations, five-mile spacing meets or exceeds Code requirements, which specify maximum valve spacing of 20, 15, 8 and 5 miles for Class 1, Class 2, Class 3 and Class 4 locations, respectively. The reduced valve spacing will enable a faster blow down time for all pipe than would be achieved if the less-stringent valve spacing requirements of the Code were followed.

10. Protection from Hazards (49 CFR 192.317)

The pipeline route in this approved Line 1600 Plan does not cross any active seismic faults. Based on a preliminary assessment, the pipeline also does not traverse any potential landslide areas. Typical mitigation for potential landslides is to slightly reroute the pipeline away from potential landslide areas or to install the pipe at a depth below the slide plane of the landslide. Should any landslides be discovered during detailed design, further site-specific geological investigation will be performed to select the appropriate mitigation method. Any pipeline segments installed across open creeks will be designed and installed to avoid exposure of, or damage to, the pipe caused by flooding or erosion.

11. Strength Test Requirements (49 CFR 192.505)

The approved Line 1600 Plan will traverse Class 1, Class 2, Class 3 and potential future Class 4 locations. The pipe material (16-inch diameter by 0.375-inch wall, Grade X52) to be used in replacement projects provides enhanced safety benefits as it satisfies the more rigorous requirements for Class 4 locations. As a result, the pipeline will have greater strength and safety margins than is required by the Code in Class 1, Class 2, and Class 3 areas.

Another safety factor anticipated to be incorporated into the final design of each replacement project is at the pressure testing phase. Where practical, the new installed pipe is planned to be tested to more than 2.5 times the potential MAOP, which provides an additional 66% safety factor beyond even the minimum testing requirements for Class 3 and Class 4 locations. The pressure testing will also include a short duration pressure spike, discussed above, to provide an additional factor of safety.

12. Patrolling of Line 1600 (49 CFR 192.705)

Consistent with SDG&E and SoCalGas standards, where feasible, new 16-inch pipeline installed as part of the approved Line 1600 Plan will be equipped throughout its routing with an advanced right-of-way intrusion detection/monitoring fiber optics system to provide early warning when digging, drilling, boring, cutting, compacting, or unplanned heavy vehicle operations by third parties pose a threat to pipeline integrity. The fiber optic system is installed above the pipeline in addition to yellow warning mesh. The system will also continuously monitor for ground movement and temperature gradients associated with an unplanned release of gas from the pipeline. This fiber optics monitoring program is consistent with the company standard requiring new and replacement pipelines to be outfitted with fiber monitoring technology. This requirement applies to pipelines that are being installed that are one mile or greater in length, 12 inches or greater in diameter, and operate above 20% SMYS. Fiber optic

cable will be installed during construction and will be coupled to a computer-based monitoring station for detection and alerting purposes. The system of sensors is intended to allow for preemptive identification and mitigation of pipeline threats, and enhance SDG&E and SoCalGas' ability to manage pipeline risk.

IV. PROJECT COST COMPONENTS

All costs associated with the Line 1600 PSEP Plan, including the costs incurred to date as well as forecasted costs, are included within the cost estimates presented in my testimony and supporting workpapers. Unless otherwise indicated, the cost forecast discussed in my testimony is fully loaded and escalated, including applicable company overheads, but excluding Allowance for AFUDC and property tax incurred before the asset is placed into service (Capitalized Property Tax).[39]

For each project, as described in the Phase 2 direct testimony of Ronn Gonzalez, SDG&E and SoCalGas prepared a Total Installed Cost (TIC) estimate that reflects the anticipated un-escalated direct costs for that project as of the date of cost estimate. These estimated costs include costs to complete activities associated with project management, engineering, design and planning, environmental review, permitting, land and right-of-way acquisition, material and equipment procurement, and construction. The Workpaper Introduction and the project workpapers provided concurrently herewith describe in detail the individual project components that form the basis of each estimate.

The fully loaded project costs are determined by escalating the direct costs from the TIC estimate, calculating associated indirect costs, and summing them to arrive at a fully loaded and escalated total cost. For budgeting purposes, as reflected in the cost tables provided in the

[39] See Casey Butler's Direct Testimony, Chapter IV for discussion on AFUDC/Capitalized Property Tax.

supporting Workpapers, costs are separated into Direct Labor, Direct Non-Labor, Total Direct Costs and Indirect Costs. Direct Labor represents salaries of Company (SDG&E and SoCalGas) management and represented employees. Direct Non-Labor represents costs for activities and services that support execution of a specific project, which include costs for contract labor, purchased services, and materials required to complete a project. Indirect costs are determined separately and represent costs for activities and services that are associated with direct costs—such as payroll taxes, property taxes and pension costs that benefit a project but are not directly charged to a project. Combined, direct and indirect costs constitute the "total cost." As explained above and in the testimony of Casey Butler, the total costs discussed in my testimony do not include AFUDC or Capitalized Property Tax.

The Workpapers supporting my testimony present the project cost forecasts for activities in six general categories: Material, Construction, Environmental Survey/Permitting/Monitoring, Land & Right-of-Way Acquisition, Company Labor, and Other Costs. These activities are discussed in greater detail, along with illustrative photographs depicting common construction activities, in the Workpaper Introduction Appendix A- Section II. Project costs are either directly charged to an individual project or are allocated on a prorata basis across the 19 Line 1600 projects based on the estimated cost to complete each individual project compared to the estimated total aggregate cost to complete all 19 projects.

In D.20-02-024, the Commission directed SDG&E and SoCalGas to prepare and file Class Three estimates and associated supporting information for the PSEP Line 1600 Plan. As discussed in the testimony of Ronn Gonzalez, a minimum level of project engineering, design and planning work must be undertaken to develop estimates of sufficient reliability to be categorized as Class Three level estimates under industry standards. When these estimates were

prepared over the first half of 2020, all 19 projects were at least at an overall level of design development of approximately 30%, enabling SDG&E and SoCalGas to prepare Class Three estimates for all 19 projects. The total project cost forecasts presented in this testimony therefore reflect both the actual project development costs previously incurred to engineer, design and plan the projects,[40] along with estimated future costs to complete and closeout the projects.

Significant project development activities related to achieving compliance with PU Code § 958 through testing and/or replacing Line 1600 have already occurred and those costs are included in project cost estimates. Project development activities include evaluating engineering factors and information related to the unique characteristics of Line 1600, including the condition of the pipeline, integrity analysis and risks associated with A.O. Smith flash-welded pipe, operational characteristics of the line, including supply to local distribution customers as well as its role related to capacity and reliability of the transmission system, review of pipeline operation and maintenance records, evaluation of hydrotest feasibility, line shutdown and system feed analysis, evaluation of test and replacement alternatives, routing considerations and route evaluation, gathering and evaluating environmental data, assessment of potential customer and community impacts, including community and stakeholder input and communication regarding potential projects and alternatives, constructability analysis of alternatives, engineering and survey activities, cost estimating activities, cost effectiveness analysis, as well as activities necessary to support the Commission's oversight and review of SDG&E and SoCalGas'

[40] Project execution is underway. Actual costs reflected in the total cost forecast are as of May 31, 2020.

implementation of PSEP, including preparation of testimony, briefs, workpapers, exhibits, data request responses, and participating in hearings.[41]

At the time each estimate was performed, the estimate was based on information known about the project at the time, along with assumptions about future work and project execution activities. Project development and execution activities are continuing for the Line 1600 projects and actual costs are being incurred and will continue to be incurred as time passes and work is completed. As project execution activities continue, new information may become available which could cause changes to the project compared to what was estimated and impact total project costs. The Commission will review the actual costs for reasonableness in the future.

V. DISALLOWED COSTS

As discussed in Section II above, when the Commission approved SDG&E and SoCalGas' PSEP, the Commission determined that certain specific categories of PSEP implementation costs may not be recovered from customers in rates. In this section of my testimony, I review those categories of disallowances and describe SDG&E and SoCalGas' compliance with the Commission's orders disallowing certain PSEP costs.

A. Post-1955 PSEP Costs

D.14-06-007 (as modified by D.15-12-020) disallowed costs associated with pressure testing pipeline segments installed after January 1, 1956 where pressure test records are not available that provide the minimum information to demonstrate compliance with the then-applicable industry or regulatory strength testing and record keeping requirements. In the case

[41] Project development work, and the resulting costs, performed to prepare and support A.15-09-013 enabled the Utilities to meet the three-month timeframe to submit the Line 1600 Test or Replacement Plan to SED in compliance with D.18-06-028. Such work provided foundational and directly-applicable information that has been valuable, beneficial, and continues to be utilized in the development and execution of the 19 projects that comprise the SED-approved Plan.

where the pipe segment is replaced, an amount equal to the average cost of pressure testing is disallowed.

One replacement segment within one PSEP Line 1600 project is subject to this cost disallowance under D.14-06-007 (as modified by D.15-12-020). Specifically, the Black Mountain Replacement project includes 26 feet of pipe manufactured after 1955 for which SDG&E and SoCalGas do not have documentation of a post-construction pressure test. As summarized in Table 10 below, this project is therefore subject to a disallowance in the amount of $8,625, representing the system average cost of pressure testing the 26-foot segment of pipe. While the project cost forecasts in my testimony and the testimony of Ronn Gonzalez include this anticipated cost, the forecasted amount of this disallowance is excluded from the illustrative revenue requirement presented in the testimony of Casey Butler, because it may not be recovered from customers in rates. Pending completion of the project, this forecasted disallowed cost is excluded from the PSEP balancing accounts. Once construction is complete, the amount excluded from the balancing account is adjusted to reflect the actual amount of the disallowed costs.

Table 10

San Diego Gas & Electric Disallowed Post-55 PSEP Forecasted Costs

Project	Capital
L1600-P1B-BLACK MTN	$8,625
Total	**$8,625**

B. Undepreciated Book Value For Post-1955 Replacement or Abandonment Projects Without Sufficient Record of a Pressure Test

The Commission also disallowed costs associated with any remaining undepreciated book value of post-1955 pipe without sufficient record of a pressure test. The 26-foot section

associated with the disallowance in Section A above is fully depreciated; therefore, there is no associated undepreciated book value to disallow.

C. PSEP Executive Incentive Compensation

In compliance with the Commission's directive in D.14-06-007, the Utilities have not included any executive incentive compensation costs in the cost forecast for the PSEP Line 1600 projects.

D. Costs Associated with Searching For Test Records of Pipeline Testing

The Utilities tracked costs associated with their search for pressure test records in a memorandum account for future review. These record search costs were excluded as disallowed costs in the Utilities' prior PSEP after-the-fact reasonableness reviews – A.14-12-016 and A.16-09-005. SDG&E and SoCalGas have not incurred records search costs after March 2016, the date through which costs were incurred and presented for review in A.16-09-005; thus, the forecasted costs do not include disallowances related to searching for pressure test records.

VI. ACCELERATED AND INCIDENTAL MILEAGE

The Commission directed the utilities to develop plans that "provide for testing or replacing all [segments of natural gas pipelines which were not pressure tested or lack sufficient details related to performance of any such test] *as soon as practicable*" (emphasis added)[42] and that address "all natural gas transmission pipeline…even low priority segments,"[43] while also "[o]btaining the greatest amount of safety value, i.e., reducing safety risk, for ratepayer expenditures."[44] The inclusion of "accelerated" and "incidental" miles,

[42] D.11-06-017, mimeo., at 19.
[43] D.11-06-017, mimeo., at 20.
[44] D.11-06-017, mimeo., at 22.

defined below, is driven by efforts to achieve these goals while also adhering to the objective of minimizing customer impacts.

Accelerated miles are miles that otherwise would be addressed in a later phase of PSEP under the Decision Tree prioritization process but are being advanced to realize operating and cost efficiencies. For the projects included in this filing, there are 16.18 miles of Phase 2A accelerated pipe.

Incidental miles are those which are not scheduled to be addressed in PSEP, but are included where it is determined that addressing them improves cost and program efficiency, addresses implementation constraints, or facilitates continuity of testing.[45] Incidental miles are included (1) to minimize customer impacts, (2) in response to operational constraints, or (3) because of the cost and operational efficiencies gained by incorporating them into the project scope rather than executing a project circumventing them.[46]

VII. SUMMARY OF REPLACEMENT PROJECT COSTS

For efficiency purposes and to facilitate the review process, detailed information for each project is contained in the accompanying project workpapers. The information below provides a summary of the Line 1600 replacement projects, presented in sequential order of their expected construction, and their associated total costs. The total cost in Table 11 reflects direct labor, direct non-labor, indirect costs and escalation, but does not include AFUDC or Capitalized Property Tax.

[45] An additional benefit of incidental mileage is to further confirm the integrity of the pipeline.
[46] Incidental and accelerated miles may be included in a pressure test or replacement project but are significantly more likely to occur with a pressure test project because of the efficiencies realized by pressure testing longer segments of pipeline.

Table 11 –Estimated Replacement Project Costs (000's)

Project Name	Project Number	Action	Total Estimated Cost
L1600-P1B-MIDWAY DR	9	Replace	$33,963
L1600-P1B-BLACK MTN	14	Replace	$43,851
L1600-P1B-SERRA MESA	19	Replace	$46,719
L1600-P1B-KEARNY MESA	18	Replace	$34,544
L1600-P1B-BEAR VALLEY PKWY	10	Replace	$36,592
L1600-P1B-POMERADO RD NORTH	11	Replace	$61,274
L1600-P1B- POMERADO RD SOUTH	12	Replace	$53,552
L1600-P1B-SCRIPPS POWAY PKWY	13	Replace	$41,590
L1600-P1B-LA HONDA AND LINCOLN	8	Replace	$25,621
L1600-P1B-RAINBOW	1	Replace	$40,438
L1600-P1B-LILAC RD	5	Replace	$62,329
L1600-P1B- MCAS NORTH	15	Replace	$20,403
L1600-P1B- MCAS CENTRAL	16	Replace	$20,585
L1600-P1B-MCAS SOUTH	17	Replace	$19,530
Total Estimated Capital Cost			**$540,992**

VIII. INDIVIDUAL REPLACEMENT PROJECTS

Below are short descriptions of the individual replacement projects and the estimated cost, in their expected order of construction. The total cost in the Tables for each project reflects direct labor, direct non-labor, indirect costs and escalation, but does not include AFUDC or Capitalized Property Tax. Details of each project are presented in the corresponding work papers.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B-MIDWAY DR	9	2.451	$33,963

The Line 1600 Midway Drive Replacement Project is located in the City of Escondido and San Diego County. The project will replace approximately 2.451 miles of existing 16-inch pipeline with 2.407 miles of new 16-inch pipeline. Approximately 0.576 miles of incidental existing pipe will be hydrotested along with the replacement sections to facilitate the post-completion pressure testing process in order to reduce the need for multiple pressure tests and to minimize community impacts.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B-BLACK MTN	14	3.692	$43,851

The Line 1600 Black Mountain Replacement Project is located in the City of San Diego. The project will replace and reroute approximately 3.692 miles of existing 16-inch pipeline with 4.129 miles of new 16-inch pipeline along Black Mountain Road from the intersection of Mercy Road and Branicole Lane to the intersection of Kearny Villa Road and Kearny Mesa Road.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B-SERRA MESA	19	1.978	$46,719

The Line 1600 Serra Mesa Replacement Project is located in the City of San Diego. The project will replace and reroute approximately 1.978 miles of existing 16-inch pipeline with 4.228 miles of new 16-inch pipeline along Ruffin Road and Ridgehaven Court to Mission Station.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B-KEARNY MESA	18	2.020	$34,544

The Line 1600 Kearny Mesa Replacement Project is located in the City of San Diego and will replace and reroute approximately 2.020 miles of existing 16-inch pipeline with 1.501 miles of new 16-inch pipeline along Ruffin Road from Waxie Way to Ridegehaven Court.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B-BEAR VALLEY PKWY	10	3.494	$36,592

The Line 1600 Bear Valley Replacement Project is located in the City of Escondido, City of San Diego, and San Diego County. The project will replace and partially reroute approximately 3.494 miles of existing 16-inch pipeline with 3.574 miles of new 16-inch pipeline along Bear Valley Parkway from the intersection of San Pasqual Valley Road and Bear Valley Parkway to the Lake Hodges area along Mule Hill Trail south of Bear Valley Parkway.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B-POMERADO RD NORTH	11	5.304	$61,274

The Line 1600 Pomerado North Replacement Project is located in the City of San Diego and the City of Poway. The project will replace and reroute approximately 5.304 miles of 16-inch pipeline with 5.837 miles of new 16-inch pipe and one MLV, along Pomerado Road from Highland Valley Road to Ted Williams Parkway.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B-POMERADO RD SOUTH	12	1.893	$53,552

The Line 1600 Pomerado South Replacement Project is located in the City of Poway. The project will replace and reroute 1.893 miles of existing 16-in pipeline with approximately 3.136

miles of new 16-inch pipeline along Pomerado Road from Ted Williams Parkway to Scripps-Poway Parkway, two new 16-inch MLVs, and one fiber optic monitoring station.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B-SCRIPPS POWAY PKWY	13	1.473	$41,590

The Line 1600 Scripps-Poway Replacement Project is located in the City of San Diego and the City of Poway. The project will replace and reroute approximately 1.473 miles of existing 16-inch pipeline with 3.64 miles of new 16-inch pipeline along Scripps-Poway Parkway and Mercy Road. The project will also install one new MLV.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B-LA HONDA AND LINCOLN	8	1.486	$25,621

The Line 1600 La Honda-Lincoln Replacement Project is in the County of San Diego and the City of Escondido. The project will replace and partially reroute 1.486 miles of existing 16-inch pipeline with 1.560 miles of new 16-inch pipeline from just south of Daley Ranch along La Honda Drive, El Norte Parkway, and end along Lincoln Avenue at Midway Drive.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B-RAINBOW	1	3.453	$40,438

The Line 1600 Rainbow Replacement Project is located in the County of San Diego. The project will replace and partially reroute approximately 3.453 miles of existing 16-inch pipeline with 3.686 miles of new 16-inch pipeline along Rainbow Valley Boulevard to Rice Canyon Road, ending north of the intersection of Rice Canyon Road and Moon Ridge Road.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B-LILAC RD	5	5.121	$62,329

The Line 1600 Lilac Road Replacement Project is located in the County of San Diego. The project will replace mostly reroute approximately 5.121 miles of existing 16-inch pipeline with 5.958 miles of new 16-inch pipeline along Lilac Road, Hideaway Lake Road, and Lamar Road ending south of Betsworth Road along Frace Lane.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B- MCAS NORTH	15	1.038	$20,403

The Line 1600 MCAS North Replacement Project is located in the City of San Diego primarily on MCAS (Marine Corps Air Station) Miramar property. The project will replace and reroute approximately 1.038 miles of existing 16-inch pipeline with 1.067 miles of new 16-inch pipeline along Kearny Mesa Road and Kearny Villa Road south of Miramar Road to south of Miramar Way. This will enable the reroute of Line 1600 from within the MCAS military base's high security area and avoid environmentally sensitive areas along the existing ROW by placing the replacement line within a new easement to be granted by MCAS Miramar.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B- MCAS CENTRAL	16	1.212	$20,585

The Line 1600 MCAS Central Replacement Project is located in the City of San Diego primarily in MCAS Miramar property. The project will replace and reroute approximately 1.212 miles of existing 16-inch pipeline with 1.300 miles of new pipeline along Kearny Villa Road south of Miramar Way to south of Harris Plant Road. This will reroute Line 1600 from within the MCAS

military base's high security area and avoid environmentally sensitive areas along the existing ROW by placing the replacement line within a new easement to be granted by MCAS Miramar.

Project	Project Number	Mileage To Be Replaced	Estimated Cost ($000's)
L1600-P1B-MCAS SOUTH	17	0.912	$19,530

The Line 1600 MCAS South Replacement Project is located in the City of San Diego primarily in MCAS Miramar property. The project will replace approximately 0.912 miles of existing 16-inch pipeline with 0.91 miles of new pipeline along Kearny Villa Road from the Kearny Villa Pressure Limiting Station (KVPLS) to Highway 52. This will reroute Line 1600 from within the MCAS military base's security area and avoid environmentally sensitive areas along the existing ROW by placing the replacement line within a new easement to be granted by MCAS Miramar.

IX. SUMMARY OF PRESSURE TEST PROJECT COSTS

For efficiency purposes and to facilitate the review process, detailed information for each project is contained in the accompanying project workpapers. The information below is designed to provide a summary of the projects and associated costs. The total cost in Table 12 reflects direct labor, direct non-labor, indirect costs and escalation, but does not include any AFUDC or Capitalized Property Tax.

Table 12 – Estimated Pressure Test Project Costs (000's)

Line	Action	Total Estimated O&M Cost	Total Estimated Capital Costs	Total Estimated Project Cost
L1600-P1B-MOOSA CREEK	Hydrotest	$8,991	$3,587	$12,578
L1600-P1B-DALEY RANCH	Hydrotest	$9,816	$3,912	$13,728
L1600-P1B-RICE CYN	Hydrotest	$13,367	$5,312	$18,679

Line	Action	Total Estimated O&M Cost	Total Estimated Capital Costs	Total Estimated Project Cost
L1600-P1B-COUSER CYN NORTH	Hydrotest	$11,564	$4,598	$16,162
L1600-P1B-COUSER CYN SOUTH	Hydrotest	$12,228	$4,857	17,086
Total Estimated Cost		**$55,966**	**$22,266**	**$78,232**

A. Hydrotest Failures

Cost estimates for a hydrotest failure are not included in the Line 1600 hydrotest project cost estimates due to the unpredictability of whether a hydrotest failure may occur, the nature of the failure, or the consequences of such a failure. Therefore, it is not possible to determine with any level of certainty which project might experience a hydrotest failure and what the resulting cost impact could be. This is also due to the varying geography of each of the individual hydrotests and the unpredictable nature of the magnitude and rate of release of hydrotest water during a failure, the damage that may be caused, and the resulting costs to repair the pipe, restore damage and retest. However, using past PSEP hydrotest failure data, for illustrative purposes, the estimating team has assembled a low, medium, and high remediation effort cost model based on certain assumptions of what could occur during a potential hydrotest failure. These variables and their associated costs are described for illustrative purposes in the Line 1600 Phase 2 Testimony Chapter II (Gonzalez) and are presented in Table 13 below. Any costs incurred due to a hydrotest failure, including capital costs of replacing damaged pipe joints and O&M costs for performing a subsequent test, would be incremental to the costs estimates presented in my testimony and would be submitted for reasonableness review in a future filing, most likely the 2028 General Rate Case. Given the significant uncertainty of whether a hydrotest failure will

occur during the execution of the five Line 1600 hydrotest projects included in the Line 1600 Test or Replacement Plan, the estimates do not include these possible costs to avoid the risk of overinflating the estimates.

Table 13 – Rough Order of Magnitude (ROM) of a Hydrotest Failure ($000's)

Remediation Effort	Hydrotest Failure Assumptions	ROM ($000's)
Low	• Up to 18,000 gallons of water released; no vacuum formed in pipeline. • Access via existing dirt roads. • Seven to eight days of response time required. • Potential action items post-hydrotest for land, environmental, CNG/LNG, and gas purchase required.	$1,400
Medium	• Up to 128,000 gallons of water released; no vacuum formed in pipeline. • Access via existing paved roads. • 12 to 14 days of response time required. • Potential action items post-hydrotest for land, environmental, CNG/LNG, and gas purchase required.	$2,500
High	• Up to 50,000 gallons of water released; no vacuum formed in pipeline. • Vegetation trimming, grading, and temporary stream crossings required for access. • 14 to 20 days of response time required. • Potential action items post-hydrotest for land, environmental, CNG/LNG, and gas purchase required.	$3,300

X. INDIVIDUAL HYDROTEST SECTIONS

Below are short descriptions of the individual hydrotest projects and the estimated cost in their expected order of construction. The total cost in the Tables for each project reflects direct labor,

direct non-labor, indirect costs and escalation, but does not include any AFUDC or Capitalized Property Tax. Details of each project are presented in the corresponding work papers.

Project	Project Number	Mileage To Be Hydrotested	O&M	Capital	Estimated Cost ($000's)
L1600-P1B-MOOSA CREEK	6	0.980	$8,911	$3,587	$12,578

The Line 1600 Moosa Creek Hydrotest Project is located in the County of San Diego near the unincorporated community of Valley Center. The project will hydrotest approximately 0.980 miles of existing 16-inch pipeline through agricultural land from Betsworth Road to south of the intersection of Mirar De Valle Road and Frace Lane. Prior to the hydrotest, to improve piggability and the integrity of the line, the project will replace 12 features, which include wrinkle bends, short radius elbows, and existing pressure control fittings (PCFs).

Project	Project Number	Mileage To Be Hydrotested	O&M	Capital	Estimated Cost ($000's)
L1600-P1B-DALEY RANCH	7	3.250	$9,816	$3,912	$13,728

The Line 1600 Daley Ranch Hydrotest Project is located in the City of Escondido and in the County of San Diego. The project will hydrotest approximately 3.250 miles of existing 16-inch pipeline from Mirar De Valle along Frace Lane to La Honda Drive. Prior to the hydrotest, to improve piggability and integrity of the line, the project will replace 14 features, which include wrinkle bends, short radius elbows, and existing PCFs.

Project	Project Number	Mileage To Be Hydrotested	O&M	Capital	Estimated Cost ($000's)
L1600-P1B-RICE CYN	2	3.223	$13,367	$5,312	$18,679

The Line 1600 Rice Canyon Hydrotest Project is located in the County of San Diego. The project will hydrotest approximately 3.223 miles of existing 16-inch pipeline along Rice Canyon Road through agricultural land from Rancho Bavaria Road to Couser Canyon Road near Highway 76. Prior to the hydrotest, to improve piggability and the integrity of the line, the project will replace 26 features, which include wrinkle bends, short radius elbows, and existing PCFs.

Project	Project Number	Mileage To Be Hydrotested	O&M	Capital	Estimated Cost ($000's)
L1600-P1B-COUSER CYN NORTH	3	2.600	$11,564	$4,598	$16,162

The Line 1600 Couser Canyon North Hydrotest Project is located in the County of San Diego. The project will hydrotest approximately 2.600 miles of 16-inch pipeline through agricultural land from Highway 76 along Couser Canyon to Pala Loma Drive. Prior to the hydrotest, to improve piggability and the integrity of the line, the project will replace 23 features, which include wrinkle bends, short radius elbows, and existing PCFs.

Project	Project Number	Mileage To Be Hydrotested	O&M	Capital	Estimated Cost ($000's)
L1600-P1B-COUSER CYN SOUTH	4	2.527	$12,228	$4,857	$17,086

The Line 1600 Couser Canyon South Hydrotest Project is located in the County of San Diego. The project will hydrotest approximately 2.527 miles of existing 16-inch pipeline through agricultural land from Pala Loma Drive to Keys Creek Road. Prior to the hydrotest, to improve

piggability and the integrity of the line, the project will replace 23 features, which include wrinkle bends, short radius elbows, and existing PCFs.

XI. COST CONTAINMENT STRATEGIES

In compliance with D.20-02-024, the following section describes the cost containment strategies considered in the development of the cost forecasts.

A. The Line 1600 Plan Follows PSEP's Prudent Program and Project Oversight Objectives

The scope of work scheduled to be completed under the Line 1600 Plan is extensive, both in terms of the volume of projects, engineering and design complexity, and the time necessary to complete each project. A PSEP organization dedicated to the execution of the Line 1600 Plan provides prudent oversight to manage this large and complex volume of work safely and cost effectively, incorporate continuous improvement, and manage a large pool of both company and contracted employees.

The following is an overview of the primary ways PSEP and the Line 1600 organization promote prudent program and project oversight.

B. Line 1600 Governance/Guiding PSEP Principles

PSEP is a large and complex program that requires appropriate governance and management to achieve its goal of cost effectively enhancing safety. The PSEP governance and management strategy is to comply with applicable regulatory requirements, continuously improve the program, and establish proper controls and management across PSEP functional areas to verify that each component of a PSEP project, including design, material procurement, construction, and closeout, is performed correctly and consistently.

To accomplish the above goals, various PSEP-specific governance and management efforts are undertaken. At the organizational level, PSEP-specific policies are developed and

maintained to promote oversight and accountability, documentation and monitoring of lessons learned and the impacts, and the development of reporting metrics to keep SDG&E and SoCalGas management apprised of PSEP progress.

In addition, program level governance provides functional guidance on project design and construction to cost effectively meet or exceed compliance requirements; follow, as appropriate, industry best practices; and identify and incorporate process improvements. The development of standards and procedures for PSEP allows PSEP to be executed in a consistent manner across projects. Through the management and facilitation of the stage gate process, the PSEP standards and procedures are adhered to so that PSEP projects are consistently executed, and procedural deviations are authorized and documented. Finally, reports and Key Performance Indicators (KPIs) are developed at both the granular project level and the overall PSEP level.

C. The Stage Gate Review Process Promotes Efficient PSEP Project Oversight and Execution

The Stage Gate Review Process sequences and schedules PSEP project workflow deliverables at the project level. The workflow deliverables are detailed by stage in a PSEP Work Process Map.[47] The Stage Gate Review Process consists of five stages, with specific objectives for each stage and an evaluation at the end of each stage to verify that objectives have been met before proceeding to the next stage.[48] During the Stage Gate Review Process, there are numerous notable activities, but the decisions most affecting project scope include the decision to test or replace and, as applicable, whether to divide the project into sections and include

[47] The Work Process Map details the deliverables by stage and has been formally updated 13 times since the inception of PSEP.

[48] Evaluations are gate reviews or completion check lists. Certain stages are condensed or combined for valve and small pipeline projects.

accelerated and/or incidental mileage.[49] Below is a description of the common activities that occur within the PSEP Five Stage Review Process[50]:

Stage 1: (Project Initiation) The Project Team develops a preliminary project scope, cost estimate and baseline schedule. The initial funding (Phase 1 WOA) is authorized to support the analysis and design of preliminary options. The Project Team assesses and validates the Category 4 Criteria mileage. The mileage originally included for remediation[51] may be modified due to scope validation efforts, due to reduction in MAOP, or abandonment of lines that are no longer required from a gas operating system perspective. A high-level assessment is also developed to identify potential permitting requirements and environmental risks. For Line 1600, many of the project initiation and scoping elements were determined and completed within the regulatory process associated with Line 1600, with the scope of work for testing or replacing further refined in the approved Line 1600 Plan.

Stage 2: (Preliminary Design and Option Selection) Typically, for Stage 2, the Project Team analyzes the proposed options (replace, test, abandon or de-rate) and makes the selection based on scope, cost, schedule and risk. For Line 1600, the approved Line 1600 Plan served to define which segments would be replaced and which segments would be hydrotested. In Stage 2, the preliminary design is initiated, and secondary funding (Phase 2 WOA) is submitted and

[49] Accelerated miles are miles that would otherwise be addressed in a later phase of PSEP under the approved prioritization process but are advanced to Phase 1A to realize operating and cost efficiencies. Incidental miles are miles not scheduled to be addressed in PSEP but are included where their inclusion is determined to improve cost and program efficiency, address implementation constraints, and/or facilitate continuity of testing.

[50] A Seven Stage PSEP Review Process was implemented by the PSEP Organization in 2013. The process was updated and revised in 2018 into the Five Stage Review Process that incorporating the elements from seven stage process.

[51] Mileage identified as Category 4 Criteria in the Amended PSEP of SoCalGas and SDG&E, submitted December 2, 2011, in R.11-02-019 and subsequently transferred to A.11-11-002.

authorized. The project scope, cost, and schedule are baselined. Procurement and permitting activities are initiated.

Stage 3: (Project Development) The Project Team refines and finalizes the project design, secures any necessary permits and completes procurement activities. The Project Team initiates the Construction Contractor selection process. The design and construction documents are completed, and the estimate and schedule are refined as needed.

Stage 4: (Construction) The Project Team selects a Construction Contractor and initiates construction mobilization. Throughout the construction process, the Project Team monitors the scope, cost and schedule and ensures safety requirements are followed. Upon completion and once all inspections are complete, the pipeline is commissioned and placed back into service. The construction site is demobilized and the site is restored.

Stage 5: (Closeout) The Project Team performs regulatory, contractual, archival activities to close the project in an orderly manner and issue acceptance certificates.

D. The PSEP Project Review Process Prudently Includes Collaboration with Relevant Stakeholders

To achieve the goal of minimizing impacts to customers and communities, it is important to assess how various PSEP project options and approaches may impact the SDG&E and SoCalGas transmission system and the customers and communities served. An integral part of the analysis that results in prudent decision making is the collaboration by PSEP project teams with other knowledgeable groups within SDG&E and SoCalGas (*e.g.*, Region Operations, Gas Engineering, Gas Transmission Planning, Gas Control, Commercial Industrial Services, Regional Public Affairs, etc.) to route, design, and schedule pipeline and valve work to minimize costs and accommodate capacity impacts or restrictions. For example, these groups provide information to guide project-specific decisions including: (1) the feasibility of shut-ins and

alternate feeds to regulator stations or customers, (2) customer and community impacts, (3) planned projects to coordinate with PSEP, and (4) environmental requirements, rights-of-way, and permitting needs. This information is used to help determine the scope and constructability of the project.

E. PSEP Has Implemented Prudent Community Outreach Efforts

The Line 1600 projects are primarily located in populated areas. As such, in order to reach as many stakeholders, residents and businesses in each of the communities where the Line 1600 projects will be executed, SDG&E and SoCalGas' outreach team developed and implemented targeted, community-specific outreach plans. The target groups for briefings and presentations included elected officials, city and county staff, school districts and specific school locations, fire stations, hospitals and other community stakeholders.

SDG&E and SoCalGas believe a proactive community outreach effort is an integral part of keeping customers, elected officials, and government entities informed about projects taking place in their communities. Numerous meetings were held with elected officials and municipal agencies to provide advance notice and ongoing updates regarding the Line 1600 projects. These outreach efforts were instrumental in avoiding project delays and, in some instances, resulted in more reasonable permit conditions being imposed on SDG&E and SoCalGas. Additionally, a web page was established to provide background information, construction activities, and project status updates to provide customers and stakeholders easier access to information.

In addition, presentations were made to community organizations in order to apprise active community members and circulate project information through their channels. For example, for the Black Mountain Replacement Project in the Mira Mesa community of the City of San Diego, presentations were made in January 2020 to two key community organizations – the Mira Mesa Community Planning Group and the Mira Mesa Town Council. Project updates

have been and will continue to be sent to the community groups for their announcements at their monthly meetings and circulation to their community email distribution lists. Also, periodic email updates of construction progress are sent by the outreach team to a broad distribution list that includes the stakeholders identified in each project-specific outreach plan.

Further, the outreach team holds community open houses in the communities adjacent to the project areas. To date, open houses were held in the City of Escondido for the Midway Replacement Project and in the Mira Mesa community for the Black Mountain Replacement Project. Team members representing project management, construction, environmental, land and outreach manned stations to provide information and answer questions from the public. A popular Geographic Information Systems (GIS) station provides residents and businesses with map views of where the construction alignment will be in comparison to their homes or businesses. The community open houses are part of the outreach plans and have also been requested by the elected officials and senior leadership staff from the cities and county where the projects will take place.

The outreach activities have resulted in cost efficiencies and savings on the projects, which directly benefits customers. For example, outreach team coordination with local municipalities has resulted in adjustments to ongoing repaving programs, which has eliminated duplicative repaving projects and provided efficient project management benefits. The County of San Diego has a formal five-year planning horizon for its future repaving projects throughout the region. SDG&E's outreach team presented the Line 1600 projects to the County and persuaded the County to postpone a repaving project on the Bear Valley Replacement Project road right-of-way to take place immediately following the completion of the Line 1600 project. Similarly, the City of Poway has a seven-year cycle where they repave one-seventh of the city's

streets each year. SDG&E's outreach team coordinated with the City of Poway to reschedule and synchronize their repaving rotation with SDG&E's Pomerado North and Pomerado South Replacement Projects. These cost containment strategies are an example of maximizing the cost efficiency of PSEP safety investments.

The outreach activities have also delivered non-financial benefits that have been achieved by coordination and rescheduling efforts to take advantage of the school and business closures during the current COVID-19 pandemic. Due to the schools being closed, SDG&E revised the construction schedules on multiple 2020 projects in order to complete construction in front of specific schools while they have been closed. Similarly, with many businesses closed and employees working from home, traffic in communities has been reduced significantly. The outreach team has coordinated with cities and the county to extend work hours and reduce night work in light of the reduced traffic impacts that would otherwise take place. These types of outreach activities provide a direct benefit to the residents, businesses and students in the communities where the Line 1600 projects are being constructed.

Additionally, specific project communications have been developed for each of the PSEP Line 1600 projects to assist in educating communities. These direct mail letters, community flyers and fact sheets are especially helpful during the COVID-19 timeframe where in person briefings are not possible. A 24/7 project hotline is also monitored so that residents have an immediate way to get information on the projects. These calls are handled immediately with any questions or issues being answered or resolved promptly. Feedback from the communities involved has been very positive, including appreciation from elected and city officials and planning supervisors from the City of Escondido, Escondido City Fire Department, County of

San Diego staff, and community groups from the community of Mira Mesa in the City of San Diego and the Serra Mesa Community Council.

F. PSEP Line 1600 Is Designed and Constructed in Adherence to SDG&E and SoCalGas Gas Standards to Promote Safety

In addition to the Utilities' own internal oversight efforts, SED has independently overseen the Utilities' successful execution of PSEP projects and will continue to do so with Line 1600. As ordered by D.14-06-007,[52] SED provides oversight on various aspects of PSEP implementation, with emphasis on construction activities and recordkeeping. Before the COVID-19 pandemic, SED personnel routinely were onsite at PSEP construction projects and monitor compliance with applicable regulations; the Utilities expect that to resume as health concerns allow. In the interim, the SED performs virtual inspections of construction activities and has performed reviews of Line 1600 projects currently under construction.

PSEP has had an outstanding safety record with an OSHA incident rate of 0.42 over a total of 13,395,980 man-hours, well below the industry average of 0.7.[53] In 2019, PSEP had two OSHA Recordable incidents over a total of 1,324,163 man-hours. For the first four months of 2020, PSEP had one OSHA Recordable incident over a total of 425,821 man-hours. Company employees and contractors alike are held to the same safety standards and are thoroughly trained prior to the beginning of projects.

[52] D.14-06-007 at 29 "Specific to SDG&E and SoCalGas' Safety Enhancement we delegate to Safety Div. the specific authority to directly observe and inspect the testing, maintenance and construction, and all other technical aspects of Safety Enhancement to ensure public safety both during the immediate maintenance or construction activity and to ensure that the pipeline system and related equipment will be able to operate safely and efficiently for their service lives."

[53] Bureau of Labor Statistics data for 2018, Industry Injury and Illness Data, Supplemental News Release Tables, SNR05. Injury cases – rates, counts, and percent relative standard errors – detailed industry; available to the public at https://www.bls.gov/iif/oshsum.htm#16Summary_Tables.

G. PSEP Line 1600 Construction Cost Avoidance

During Stage 2 and 3, the project management and construction teams look for unique ways to maximize efficiencies and avoid costs where safe to do so. In addition to the cost efficiencies previously described related to coordination of paving, and collaborating with City officials to get enhanced working hours during the COVID-19 pandemic, other examples of cost avoidance opportunities identified during project development include:

The Performance Partner Program is a contractual agreement between SDG&E/SoCalGas and the construction contractor that stipulates a level of shared project risk. By sharing the risk on a project, the construction contractor bears part of the cost overruns associated with project scope changes due to unforeseen project risks. This ultimately lessens the amount of costs that are then borne by customers.

Another example of a cost containment strategy is utilizing the same construction contractor for two adjacent projects. The project and construction management teams can potentially use the same contractor for two simultaneous, adjacent projects, which will achieve cost savings compared to constructing them individually. Cost savings can be actualized by coordinating on and sharing construction yard costs, security costs, tie in costs, and hydrotest costs. This strategy has been implemented for the Line 1600 Serra Mesa and Kearny Mesa projects.

An additional example of a cost containment strategy and is in fact being implemented by the Line 1600 team, is to review project material needs to see if orders can be aggregated into a large bulk orders where more competitive pricing can be negotiated. This strategy was used for purchasing the pipe for the first four Line 1600 projects currently being constructed and is in the process of being implemented for the projects scheduled to be constructed in 2021.

XII. PROPOSED COST RECOVERY SCHEDULE

Ordering Paragraphs 3 and 4 of D.20-02-024 directed SDG&E and SoCalGas to include in this review a proposed schedule for applications for reasonableness review and cost recovery. As indicated in Table 6, it is anticipated that the first of the 19 projects will be placed into service in the Fourth Quarter of 2020 and the last of the 19 projects will be placed into service in the Second Quarter of 2024. None of the 19 projects are projected to be placed in service and completely closed out with sufficient time to include them for reasonableness review in the 2024 GRC (which is due to be filed in May of 2022). Therefore, in order to provide adequate time for technical and financial closeout as described in the Five Stage Review Process, all 19 projects are anticipated to be submitted for cost review and recovery in the Test Year 2028 GRC (currently scheduled for filing in May 2026). This is consistent with D.16-08-003, which established a long-term schedule to transition PSEP to the General Rate Case. As described in Ms. Olegario's testimony (Chapter III), the Utilities are authorized 50% interim cost recovery of the costs booked to the applicable PSEP balancing accounts, subject to refund, pending reasonablenesss review.[54] [55]

XIII. CONCLUSION

My testimony satisfies the Commission's order for the Utilities to submit Class Three cost estimates for the 19 Line 1600 test and replacement projects. Based upon the Utilites' past forecast applications, reasonableness reviews, and General Rate Case filings, the Commission has found that the Utilities' costs associated with meeting the PSEP Objectives are in fact reasonable. SDG&E and SoCalGas submit that the aggregate capital and O&M cost forecasts

[54] D.20-02-024 at 14.
[55] See Chapter III (Regulatory Accounts) for discussion of amortization of rates.

described within my testimony and attached workpapers demonstrate that the expected costs to implement the Line 1600 Plan are reasonable.

In addition, it is imperative that, as prudent pipeline operators and consistent with the SED's approval of the Line 1600 Plan, SDG&E and SoCalGas continue to plan, execute, and closeout the 19 Line 1600 PSEP projects with the understanding that future cost recovery will be sought through reasonableness review in a future General Rate Case. Approval of these cost forecasts will enable SDG&E and SoCalGas to continue to accomplish the Commission's and Legislature's pipeline safety objectives and meet the PSEP objectives to: (1) enhance public safety; (2) comply with Commission directives; (3) minimize customer impacts; and (4) maximize the cost effectiveness of safety investments.

XIV. WITNESS QUALIFICATIONS

My name is Norm G. Kohls. I am employed by San Diego Gas & Electric Company (SDG&E) as the Manager of the Line 1600 Project Portfolio. My business address is 6875 Consolidated Way, San Diego, California 92121.

I joined SDG&E in 1992 as an Engineer and have worked in several diversified areas of the utility business with increasing leadership responsibility. While with SDG&E, I have held various positions in the functional areas of both Gas and Electric Operations and Engineering. These areas include Gas Transmission Major Projects, Gas System Planning, Gas Engineering, Gas Design, Gas Operations and Maintenance, Gas Mapping and Records, and Gas Geographic Information Systems. Other areas include Project Management, Construction Services, Electric Distribution System Capacity Planning, Electric System Reliability, Overhead to Underground Conversion Programs, New Business Extensions and Service Establishment, Distributed Generation Interconnections, Emergency Operations, Compliance as well as Asset Management and Information Management Support for Electric Distribution Operations. Prior to moving into my current position in September of 2018, I was the Manager of the Pipeline Safety & Reliability Project.

My current management responsibilities include the development of the scope, detailed design and engineering, construction planning, construction management, cost and schedule management and close out of the 19 projects associated with the Line 1600 Test or Replacement Plan as well as other related administrative matters.

In 1988, I earned a Bachelor of Science Degree in Mechanical Engineering with a Minor in Economics from San Diego State University. In 1992, I earned my California State License as a Registered Professional Engineer in Mechanical Engineering. I have been a member of the American Society of Mechanical Engineers for approximately 30 years.

I have over 32 years of engineering and management experience of which over 28 years are in the utility industry.

I have previously testified before the California Public Utilities Commission.

This concludes my prepared direct testimony.

Attachment 1

Line 1600 Test or Replacement Plan (September 26, 2018) (Public Version)

Line 1600 Test or Replacement Plan

September 26, 2018

I. EXECUTIVE SUMMARY

In compliance with California Public Utilities Commission (Commission) Decision (D.) 18-06-028, San Diego Gas & Electric Company (SDG&E) and Southern California Gas Company (SoCalGas) submit this proposed Line 1600 Test or Replacement Plan.[1] SDG&E and SoCalGas evaluated four potential design alternatives for the pressure test or replacement of 49.7 miles of Line 1600 in its present corridor: (1) replacing Line 1600 pipeline in High Consequence Areas (HCAs)[2] and hydrotesting Line 1600 pipeline in non-HCAs (Replace in HCA/Test in Non-HCA alternative); (2) hydrostatic strength testing (hydrotest or test) the entire length of Line 1600 (Full Hydrotest alternative); (3) full replacement of Line 1600, routing in nearby streets in the north (Full Replacement in Nearby Streets alternative); and (4) full replacement of Line 1600, routing along Highway 395 in the north (Full Replacement Along Highway 395 alternative). The alternative designs evaluated by SDG&E and SoCalGas in preparing this Plan are summarized in Table 1 below. Unless otherwise indicated, the estimated costs presented in this Plan are loaded and escalated.

[1] D.18-06-028 at 128, Ordering Paragraph 7. *See also id*. at 90-92.

[2] HCAs are defined in 49 CFR 192.903. Generally, an HCA is defined to include Class 3 and 4 locations, as well as any area in a Class 1 or 2 location where the potential impact radius is greater than 660 feet and the area within the potential impact radius includes 20 or more buildings intended for human occupancy or a site identified as occupied by 20 or more persons on at least 50 days in any twelve-month period.

TABLE 1
Line 1600 Test or Replace Alternative Designs Evaluated

Alternative Design	Loaded and Escalated Cost[3] ($ millions)			Description
	Capital	O&M	Total	
Replace in HCAs/ Test in Non-HCAs[4]	630	47	677	Replace pipeline in 14 replacement sections (*i.e.*, replace 37 miles primarily in HCAs with installation of ~43 miles of new, modern design, thicker 16-inch pipe); retrofit and hydrotest pipeline in 5 hydrotest sections; achieves compliance with Public Utilities Code section 958; enhances safety and extends lifespan of the pipeline by removing all vintage A.O. Smith flash-welded pipe in more populated areas; leaves vintage A.O. Smith flash-welded pipe in service in non-HCAs.
Full Hydrotest[5]	92	233	325	Hydrotest entire pipeline in 22 sections, retrofit line to make fully piggable; achieves compliance with Public Utilities Code section 958 but leaves vintage A.O. Smith flash-welded pipe in service.
Full Replacement in Nearby Streets	778	-	778	Replace all vintage A.O. Smith flash-welded pipe (install ~56 miles of new, modern design, thicker 16-inch pipe); achieves maximum safety, reliability and operational enhancement and extends lifespan of the entire pipeline by abandoning or derating all vintage A.O. Smith flash-welded pipe; achieves compliance with Public Utilities Code section 958.
Full Replacement Along Highway 395	725	-	725	Replace all vintage A.O. Smith flash-welded pipe (install ~55 miles of new, modern design, thicker pipe); achieves maximum safety, reliability and operational enhancement and extends lifespan of entire pipeline by abandoning or derating all vintage A.O. Smith flash-welded pipe; achieves compliance with Public Utilities Code section 958; reduces costs and realizes construction efficiencies by installing replacement pipe in Old Highway 395.

[3] Costs shown are loaded and escalated. Loaded costs are the sum of direct costs and indirect costs. Direct costs are costs for labor, material, services and other expenses incurred to design, engineer, plan, execute and document the Line 1600 testing and replacement work described in this document. This includes project development costs, project management, materials, construction, inspection, environmental and other project execution activities. Indirect costs are for Administrative & General, purchasing, warehousing, pension and benefits, payroll tax, and other costs that are overhead in nature. Allowance for Funds Used During Construction (AFUDC) and property taxes are not included in the costs presented for review in this Plan.

[4] Identified as "Option 2" in D.18-06-028.

[5] Identified as "Option 1" in D.18-06-028.

Each design alternative divides the scope of work into separate sections that can be completed independently to meet statutory and Commission directives to execute SDG&E and SoCalGas' Pipeline Safety Enhancement Plan (PSEP) as soon as practicable and manage potential impacts to customers. SDG&E and SoCalGas evaluated the design alternatives consistent with the requirements set forth in D.18-06-028, SDG&E and SoCalGas' approved PSEP Decision Tree, and the overarching objectives of PSEP to: (1) comply with the Commission's directives [subsequently codified in Public Utilities Code section 958]; (2) enhance public safety; (3) minimize customer impacts; and (4) maximize the cost effectiveness of safety investments.[6] As required by D.18-06-028, SDG&E and SoCalGas coordinated with the Commission's Safety and Enforcement Division (SED) in developing and evaluating this Plan and alternative designs.

After carefully evaluating each alternative design and the Commission's direction in D.18-06-028, SDG&E and SoCalGas propose to replace approximately 37 miles of existing Line 1600 primarily located in HCAs and hydrotest the remaining approximately 13 miles of existing Line 1600 located in non-HCAs through execution of 19 separate project sections (Replace in HCAs/Test in Non-HCAs). A map of the proposed scope of work for the Plan is presented below in Figure 1. As summarized in Table 1 above, the estimated loaded and escalated cost of the proposed Plan, based on preliminary engineering, design and planning is approximately $677 million. Of the total estimated cost, SDG&E and SoCalGas anticipate recording approximately $630 million as a capital expenditure and approximately $47 million as an operating expense.

[6] Rulemaking (R.) 11-02-019, *Amended Testimony of Southern California Gas Company and San Diego Gas & Electric Company in Support of Proposed Natural Gas Pipeline Safety Enhancement Plan* (December 2, 2011) at 10.

Figure 1: Map of Plan to Primarily Replace in HCAs, Hydrotest in Non-HCAs[7]

Detailed planning, engineering, and permitting activities for the proposed Plan are already underway, and SDG&E and SoCalGas anticipate that the first construction and testing

[7] Approximately 2.1 miles of vintage Line 1600 located within a non-HCA area within the Marine Corp Air Station (MCAS) Miramar is planned to be replaced to address airfield security, access and environmental concerns raised by MCAS Miramar.

field work will commence in the first quarter of 2020, with an initial focus on HCAs. Construction and testing activities are anticipated to span approximately four years. SDG&E and SoCalGas intend to present costs incurred for projects completed prior to 2022 for reasonableness review in a General Rate Case application and to include forecasts of testing and replacement costs for years 2022 and beyond in General Rate Case applications, consistent with D.16-08-003.

The Commission requires SDG&E and SoCalGas' Plan to include specific information as outlined in D.18-06-028 (at 90-92). SDG&E and SoCalGas' Plan complies with D.18-06-028 by providing the requisite information organized as follows:

TABLE 2
Plan Requirements Index

Plan Requirement	Location of Required Information in Report
Interim Safety Enhancement Measures	Section VI
Spike Test Best Practices	Section IV
Compliance with Applicable Regulations and Industry/Company Standards	Section IV
Maximum Test Pressure	Section IV
Prioritization List and Test/Replace Section Schedule	Section IV
Completion Timeline	Section IV
Test Section Prioritization Criteria	Section IV
Public Safety and Property/Environment Protection Measures	Section VI
Temporary Service Requirements (including location of temporary lateral pipelines if applicable)	Section IV
Cost Forecast (O&M and Capital) by Section and Year	Section VII
Test vs Replace Rationale for Each Section	Section IV

Plan Requirement	Location of Required Information in Report
Listing and GPS Coordinates of Existing Commercial and Residential Structures that abut the Easement (including potential encroachments)	Section VI
Identification of Potential Reroutes and/or Removal/Moving of Structures	Section IV

Introductory and background information in support of the proposed Plan is provided in Section II below. Throughout the development of this Plan, SDG&E and SoCalGas worked closely with SED, and those activities are described in Section III. In Section IV, SDG&E and SoCalGas describe the proposed Plan in greater detail, describing each individual project section, the prioritization process used to develop a construction schedule for each section, the routing criteria used to evaluate the alternatives considered in preparing the Plan, temporary service requirements to minimize service disruptions to customers during construction, and how implementation of the Plan is designed to meet or exceed current regulatory and industry standards. In Section V, a summary of technical considerations, including the attributes of Line 1600, its installation and assessment history, as well as the operating and maintenance history is provided. In Section VI, additional public safety and environmental protection measures, including interim safety enhancement measures, are described. In Section VII, SDG&E and SoCalGas present preliminary cost estimates for the proposed Plan and describe the methodology used to calculate them. In Section VIII, other alternative designs that were considered are discussed. SDG&E and SoCalGas address potential future Plan modifications in Section IX. Additional maps, illustrative materials, and other supporting information are provided in Section X as an Appendix.

II. BACKGROUND

A. Introduction

SDG&E and SoCalGas own and operate an integrated backbone natural gas transmission system consisting of pipelines, compressor stations, and underground storage facilities (Gas System). With their network of transmission pipelines and four interconnected underground storage facilities, SDG&E and SoCalGas deliver natural gas to a regional population of over 24 million energy consumers.

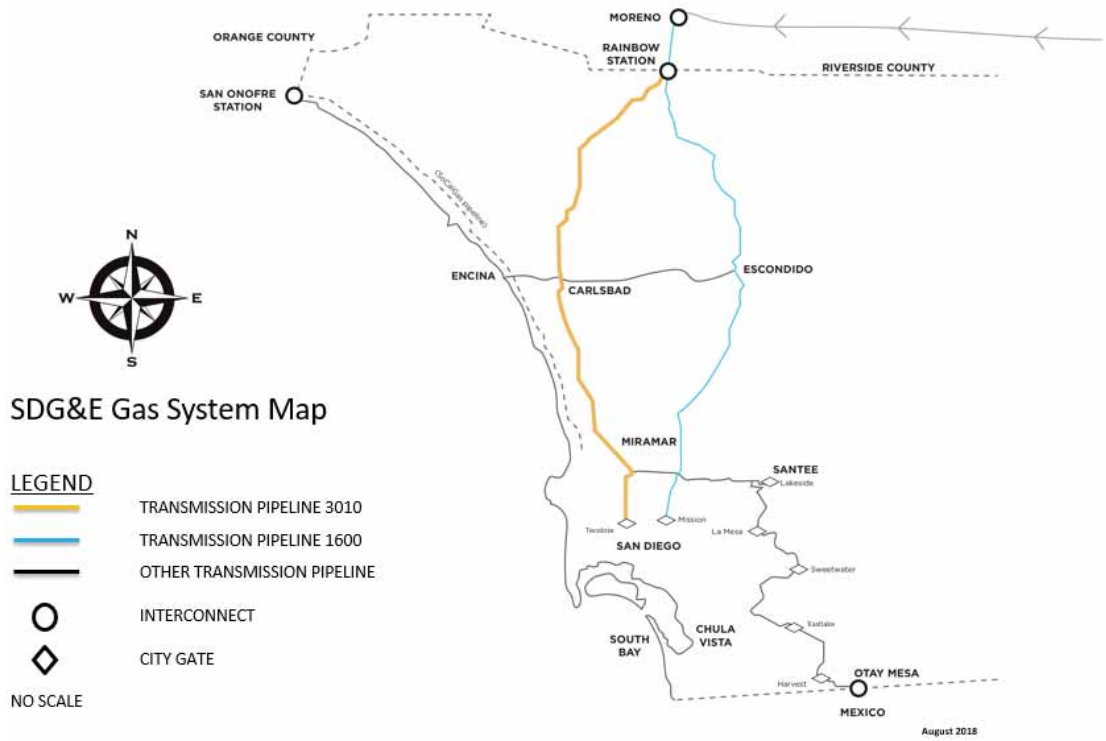
SDG&E's service territory for natural gas is the County of San Diego, which has a growing population of over 3.3 million, a $200 billion economy, and home to the largest concentration of military assets and personnel in the world. Including its electric service territory in southern Orange County, SDG&E safely and reliably provides natural gas and electric service to approximately 3.6 million residential, commercial, and Electric Generation (EG) consumers, including the military, hospitals, universities and schools, through over 870,000 natural gas meters and 1.4 million electric meters.

Continuous enhancement of the safety of the natural gas transmission pipeline system through the execution of programs such as PSEP is an integral part of the safety culture at SDG&E and SoCalGas. As described above, two overarching objectives of PSEP are to enhance public safety and comply with the Commission's directives. This commitment to public and employee safety while complying with Commission orders and Public Utilities Code section 958 has not wavered.

B. The SDG&E Gas System

The SDG&E gas transmission system, which is part of SDG&E and SoCalGas' integrated natural gas system, is illustrated in Figure 2 below. The SDG&E gas transmission system consists primarily of two high-pressure, large-diameter pipelines that originate at Rainbow Station, located at the Riverside and San Diego County border, and extend south terminating within the core of the San Diego metropolitan area. The SDG&E system also has a receipt point at Otay Mesa which has historically only been used intermittently.

Figure 2: SDG&E Gas Transmission System



The SDG&E gas transmission system is designed to flow gas supplies from north to south, starting at the Riverside County line, and south to north, starting at the Mexican border, to meet consumer demand for heating homes on peak winter days, providing gas service to commercial and industrial operations, and to generate electricity to meet cooling demands on the hottest

days of summer. Gas supplies originating in the southwestern United States are transported on the SoCalGas system to San Diego first using a compressor station located in Moreno Valley, California known as the Moreno Compressor Station, and then using the two major transmission pipelines mentioned previously and described in more detail below.

Line 1600 is a 16-inch diameter natural gas transmission pipeline that runs from Rainbow Station in the north to Mission Station in the south. Line 1600's transmission function is important, not only for its contribution to system capacity, but also as a supply source for the portions of the gas distribution system that it directly feeds. Line 1600 also contributes to gas transmission system reliability should other elements of the system be out of service or require pressure reduction. While Line 1600 tends to contribute 65 million cubic feet per day (MMcfd) to the SDG&E system capacity with Line 3010 in service, Line 1600 could supply 115 MMcfd at a Maximum Allowable Operating Pressure (MAOP) of 512 pounds per square inch gauge (psig), 150 MMcfd at an MAOP of 640 psig, or 160 MMcfd at an MAOP of 800 psig, if Line 3010 were out of service.

Line 1600 works in conjunction with another north-to-south running pipeline, Line 3010, a 30-inch diameter transmission pipeline running from the Rainbow Station to the Tecolote Station. Line 3010 was placed into service in 1961 and provides approximately 90 percent of SDG&E's capacity, assuming compression is available. Line 3010 and Line 1600 also interconnect via transmission cross-tie pipelines between Oceanside and Escondido and between Miramar and Santee.

In addition to Lines 3010 and 1600, the third major component of the SDG&E system bringing gas from the north is the Moreno Compressor Station. The Moreno Compressor Station

is located in the SoCalGas service territory approximately 35 miles north of the San Diego County line in Moreno Valley in Riverside County. Essentially, all gas supplies that come into San Diego County from the north pass through the Moreno Compressor Station. This is a critical facility in meeting gas supply requirements for SDG&E.

C. Overview of Line 1600

Line 1600 operates as a transmission pipeline, supplies approximately 10% of the natural gas volumetric demand in San Diego County and serves as the sole or primary supply of natural gas for customers in the inland valley communities of Rainbow, eastern Fallbrook, Valley Center, Escondido, Rancho Bernardo, Rancho Peñasquitos, Poway, Scripps Ranch, Kearny Mesa, and Serra Mesa. These communities represent about 17% (~150,000) of San Diego's customers who depend on Line 1600 for reliable natural gas supply.

Currently, Line 1600 has a Maximum Operating Pressure (MOP) and MAOP of 512 psig along its entire 50-mile length. Line 1600 distributes gas to customers along its length via approximately 60 pipeline interconnections that feed local gas distribution systems or directly feed customers at high pressure meter sets.

The distribution supply line systems (defined as greater than 60 psig) depend on Line 1600 for a steady supply of high pressure natural gas to support the local demands downstream. Each of the distribution supply systems has been designed, sized, and planned to reliably serve customer peak demand based on existing, as well as anticipated, system growth in the areas they serve. As considered in this Plan, the "Line 1600 corridor" constitutes those areas served by the natural gas distribution system along the 50-mile length of Line 1600, where Line 1600

supplies significant amounts of natural gas to those areas. The Line 1600 corridor is generally represented by the area displayed in the map included in Section X, Appendix, Figure 10.

A foremost consideration in conjunction with replacing and testing Line 1600 is that Line 1600 is the primary, and in many cases, the only natural gas supply source for the local gas distribution systems that serve well over 100,000 customers along the Line 1600 corridor. Given that there are no other supply sources, any work identified for Line 1600 requires significant efforts and must be carefully planned to avoid customer service interruptions. The pipeline infrastructure required to be installed to replace Line 1600 must be interconnected to the existing gas distribution system at select locations to ensure that pipeline capacity, and therefore reliability of service to customers, is not compromised. This will require modifications to the gas distribution system to interconnect new supply sources to portions of Line 1600, and these interconnections will require some new distribution pipeline extensions as well as new pressure regulator stations and "tie-overs" that connect the new infrastructure to the remaining existing infrastructure.

III. COORDINATION WITH THE COMMISSION'S SAFETY AND ENFORCEMENT DIVISION

In D.18-06-028, the Commission directs SDG&E and SoCalGas to coordinate with SED on the future treatment of existing Line 1600. Specifically, the Decision requires:

- The Director of the Safety and Enforcement Division, or designee, is delegated the following authority to:
    a) Review all activities of any kind related to the hydrotesting of Line 1600;
    b) Inspect, inquire, review, examine and participate in all activities related to Line 1600;
    c) Order San Diego Gas & Electric and Southern California Gas Company to take any actions necessary to protect public safety. (OP15)

- The Applicants shall work with SED to prepare the Plan. (p. 91)
- Applicants shall work with SED to determine:
    a) The maximum test pressure commensurate with the MAOP deemed safe for Line 1600; and
    b) A prioritization list and schedule for testing of sections. (p. 91)

In compliance with the Decision's directives, SDG&E and SoCalGas coordinated with SED throughout the development of this Plan. Between the Decision date of June 21, 2018 and the Plan submission date of September 26, 2018, SDG&E and SoCalGas met with SED both telephonically and in person more than six times and facilitated an on-site examination by SED staff of the existing Line 1600 easements and several identified locations for replacement sections in nearby streets.

During these coordination meetings, SED emphasized that it is SDG&E and SoCalGas' responsibility, as the system operator, to make determinations about which sections to replace and which to test, considering the best interest of safety related to existing Line 1600, as well as aspects of any re-route of the replacement sections. SED advised SDG&E and SoCalGas to include all issues and factors that influence decisions to replace or test sections of Line 1600 in the Plan.

Throughout the three-month coordination period, SDG&E and SoCalGas frequently shared Plan development objectives, challenges and proposed treatment of section projects with SED, and received ongoing feedback and guidance from SED to inform the development of this final Plan. SDG&E and SoCalGas have incorporated SED's input from the three-month coordination into this proposed Plan.

IV. PROPOSED TEST AND REPLACEMENT PLAN FOR LINE 1600

A. Scope

Through this test and replacement Plan, SDG&E and SoCalGas propose to replace approximately 37 miles of existing Line 1600 located in HCAs and through secured federal lands,[8] and pressure test approximately 13 miles of existing Line 1600 located in non-HCAs. The proposed scope of work is divided into 19 sections, each of which has independent utility and can be constructed separately to enable SDG&E and SoCalGas to minimize customer and community impacts and meet the Commission's directive to execute PSEP as soon as practicable.[9] The initial focus will be on the HCA sections. The following sections provide additional information supporting the proposed Plan.

The proposed Plan is the result of following the PSEP Decision Tree analysis and applying sound judgment and working knowledge of Line 1600 and the San Diego natural gas transmission and distribution systems. It identifies the work required to complete the replacement and testing of Line 1600 while maintaining gas supply to the current customer base. The overarching objectives of this Plan are consistent with the overarching objectives of PSEP: (1) comply with the Commission's directives [subsequently codified in Public Utilities Code section 958]; (2) enhance public safety; (3) minimize customer impacts; and (4) maximize the cost effectiveness of safety investments.[10]

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[8] Approximately 2.1 miles of vintage Line 1600 located within a non-HCA area within MCAS Miramar is also planned to be replaced to address airfield security, access, and environmental concerns raised by MCAS Miramar.

[9] D.11-06-017 at 19.

[10] R.11-02-019, *Amended Testimony of Southern California Gas Company and San Diego Gas & Electric Company in Support of Proposed Natural Gas Pipeline Safety Enhancement Plan* (December 2, 2011) at 10.

B. SDG&E and SoCalGas Considered Testing or Replacement Alternatives Consistent with the Approved PSEP Decision Tree and the Commission's Directives in D.18-06-028.

As indicated above, SDG&E and SoCalGas evaluated four test or replacement alternatives in preparing the proposed Plan. The four alternatives evaluated by SDG&E and SoCalGas are rooted in the approved PSEP Phase 1 Decision Tree process, which guides the determination of whether a pipeline should be tested or replaced. The PSEP Phase 1 Decision Tree was approved by the Commission in D.14-06-007[11] and represents SDG&E and SoCalGas' analytical approach to testing or replacing pipelines to enhance the safety of their integrated natural gas transmission system. SDG&E and SoCalGas use the Decision Tree and its concepts to guide their decision-making process, and ultimately apply professional judgment, as knowledgeable operators of their system, to determine what is prudent, best achieves safety enhancement objectives, and maximizes the cost effectiveness of customers' safety investments. Relevant considerations include costs associated with pressure testing, including managing customer impacts, costs of replacing the existing pipeline, and other engineering factors, depending on the unique conditions and circumstances of each pipeline project.

SDG&E and SoCalGas apply the following guiding principles to complete this PSEP test versus replacement analysis: (1) SDG&E and SoCalGas will not interrupt service to core customers in order to pressure test a pipeline; (2) SDG&E and SoCalGas will work with noncore customers to determine if an extended outage is possible; (3) SDG&E and SoCalGas will, where necessary, temporarily interrupt noncore customers as provided for in their tariffs; (4) SDG&E and SoCalGas will work with noncore customers to plan, where possible, service interruptions

[11] D.14-06-007 at 59, Ordering Paragraph 1.

during scheduled maintenance, down time or off-peak seasons; and (5) SDG&E and SoCalGas will consider cost and engineering factors along with the improvement of the pipeline asset. These principles were explained in SDG&E and SoCalGas' amended PSEP and at hearings in A.11-11-002. It is important to note that no industry-wide standard exists that balances the risk of a pipeline failure with the cost of testing or replacing such pipeline. SDG&E and SoCalGas are in the best position to make this determination on a project-by-project basis, based on the unique characteristics and circumstances of each pipeline, applying their engineering expertise and knowledge of the pipelines they operate.

Applying the Commission-approved Decision Tree and professional judgment, and the limitations imposed by the Commission in D.18-06-023, SDG&E and SoCalGas determined that replacing vintage Line 1600 pipe in current and anticipated HCAs and pressure testing in non-HCAs is reasonable, enhances public safety, and complies with Commission and statutory requirements and benefits customers. Having evaluated the characteristics of Line 1600 and the environment in which it operates, SDG&E and SoCalGas propose to replace sections of Line 1600 in HCAs because this allows the greatest opportunity to significantly improve safety in populated areas by eliminating known flaws associated with the A.O. Smith electric flash welded (EFW) pipe and incorporate new, significant safety features (*e.g.*, modern manufacturing methods, heavier wall thickness, improved grade with better fracture control, and installation of modern safety features, such as warning mesh above the pipeline to alert excavators they are near the pipeline). These safety improvements could not be achieved through hydrotesting alone. Moreover, replacing 1949-vintage pipeline in the HCA sections of Line 1600 avoids the significant costs associated with hydrotesting the entire existing line (including any repairs

identified during hydrotesting), the costs to retrofit Line 1600 to accommodate in-line inspection tools, and additional costs to replace those sections of the nearly 70-year-old Line 1600 in the future. In addition, ongoing operations and maintenance costs for the new sections of pipeline are anticipated to be lower than historical costs.

This Plan assumes that all customers who currently have natural gas service will continue to have the same level of service after Line 1600 is replaced/tested. The enhancements included as part of the Plan are intended to avoid existing customers experiencing a reduction in reliability, capacity, or pressure compared to what they have historically experienced. The final design of improvements will incorporate good engineering judgment related to gas transmission and distribution system reliability and capacity and should allow for reasonable long-term future operating conditions.

Engineering factors associated with the vintage A.O. Smith EFW pipe that influence pipeline safety, especially in populated areas, are the primary driver for the proposed replacement of sections of Line 1600 in HCAs. The approach set forth in this proposed Plan recognizes the additional value of the installation of new pipeline sections in densely populated areas, including enhancement of the overall safety and reliability of the pipeline, because new pipe is manufactured to modern standards and has physical characteristics that enhance safety as compared to the earlier vintage pipelines. This is consistent with PSEP and Commission General Order (GO) 112-F, which requires escalating margins of safety as population density increases.

The scope of work required to replace/test Line 1600 includes new transmission main, some new supply lines and new distribution mains, and new or rebuilt pressure regulating

stations that must be connected to the modified system. Also included in this analysis is the abandonment of existing infrastructure, including pressure regulator stations that would no longer be needed.

Testing work includes the work necessary to perform the test, including a spike test, and keep existing customers in service while this work is performed. Test section preparation work also includes removal of wrinkle bends as well as shorter radius bends and other features which prevent in-line-inspections of the legacy pipeline using commercially available circumferential magnetic flux leakage (CMFL) smart pigging tools.

The proposed Plan is a prudent approach to achieving compliance with the directives of the Commission and Public Utilities Code section 958. Factors such as potential environmental impacts, impacts to private property, potential growth, project costs, and feasibility were considered as part of determining replacement routes for each project section. As SDG&E and SoCalGas transition from high-level planning to detailed design, engineering and planning, additional analysis will be completed, and some refinement and modification of the Plan may be necessary to address engineering, permitting, community, or cost considerations.

C. Descriptions of Each Pressure Test or Replacement Project Section

The proposed test and replacement Plan for Line 1600 is comprised of 19 project sections. The sections have been numbered from north to south as shown on Figure 1 above. To provide additional descriptive reference, each project section has been assigned a name that corresponds to a geographic reference and also describes whether the section is planned to be replaced or hydrotested. These names are also reflected in Figure 1 above. Each of these sections is further described in Table 3 below, which summarizes key factors considered in

planning the scope of work for each section. Unique factors associated with each section can influence hydrotest break points, section boundaries, schedule, and other key project attributes.

TABLE 3
Descriptions of Each Test or Replace Project Section and Estimated In-Service Dates

Section Number	Section Name	HCA	Approx. Mileage	Description	Estimated In-Service Date
1	Rainbow Replacement	Yes	3.7	Section starts at Rainbow Station (beginning of line) and will tie into existing line about 2,000 feet past non-HCA alignment due to easier access to land and more level laydown area for water tanks. The south point also serves as a breaking point due to tap to a power plant which will minimize impact.	Q4 2022
2	Rice Canyon Hydrotest	No	3.2	Section starts after Rainbow Replacement section and ends at Main Line Valve (MLV) 1601 due to valve isolation point and adjacent laydown yard a couple feet from MLV.	Q1 2024
3	Couser Canyon North Hydrotest	No	2.6	Section begins after MLV 1601 and ends at Pala Loma Dr., the midpoint of increasing elevation.	Q2 2024
4	Couser Canyon South Hydrotest	No	2.6	Section starts at Pala Loma Dr. and goes southbound until reaching Keyes Creek Rd. Keyes Creek Road is a little over 2,000 feet north of the start of the HCA section (Lilac Rd. Replacement). Keyes Creek Rd. was selected as the break point because it provides adequate level work space for hydrotest equipment and working area. Utilizing Keyes Creek Rd. location also minimizes environmental impacts.	Q3 2024
5	Lilac Rd Replacement	Yes	5.9	Section starts at Keyes Creek Rd. and ends south of Betsworth Rd., where non-HCA segment starts. Southern break sits on private property, which is planned to be used as a laydown yard.	Q1 2023

Section Number	Section Name	HCA	Approx. Mileage	Description	Estimated In-Service Date
6	Moosa Creek Hydrotest	No	0.9	Section starts at the beginning of non-HCA near Betsworth Rd. and runs south until break point at Mirar De Valle Rd. Mirar De Valle Rd. is used as a breaking point because it is the mid-point of rising elevation with the adjacent hydrotest and has a yard within a couple feet from the line.	Q2 2023
7	Daley Ranch Hydrotest	No	3.5	Section starts at Mirar De Valle Rd. and ends about 1,000 feet north of MLV 1604 where HCA starts.	Q2 2023
8	La Honda & Lincoln Replacement	Yes	1.6	Section starts about 1,000 feet north of MLV 1604 where HCA starts and ends at the crossing of Lincoln Ave. & Midway Dr. due to gas handling purposes.	Q2 2022
9	Midway Dr Replacement	Yes	2.2	Section starts at the crossing of Lincoln Ave. & Midway Dr., runs south of Midway Dr. and ends north of Birch Ave. due to tie in to previously-tested pipe and close to laydown yards.	Q3 2020
10	Bear Valley Pkwy Replacement	Yes	3.7	Section starts north of San Pasqual Valley Rd. where previously replaced pipe ends and HCA starts. Section runs south of Bear Valley Pkwy. and ends at Mule Hill where it meets previously tested pipe. Replacement route resolves narrow 20-foot ROW issues near homes and sensitive habitat by placing pipeline in major roadway.	Q3 2021
11	Pomerado Rd North Replacement	Yes	5.8	Section starts at MLV 1606 near Highland Valley Rd. and runs south along Pomerado Rd., ending at Ted Williams Pkwy. Ted Williams Pkwy. is used as a break point because it is the midpoint of the entire Pomerado Rd. replacement and is close to a laydown yard. Scope of work removes the pipe from close proximity to commercial and residential structures in the Rancho Bernardo, Carmel Mountain Ranch and Rancho Peñasquitos communities.	Q4 2021

Section Number	Section Name	HCA	Approx. Mileage	Description	Estimated In-Service Date
12	Pomerado Rd South Replacement	Yes	3.1	Section starts at Ted Williams Pkwy. and runs south in large four-lane streets using Pomerado Rd. and Scripps Poway Pkwy. Break point was selected due to large available roadways and having a potential laydown yard at the south end of the section. Section routing does not traverse sensitive habitat associated with Peñasquitos Creek and removes the pipe from close proximity to commercial and residential structures in the Carmel Mountain Ranch and Rancho Peñasquitos communities.	Q1 2022
13	Scripps Poway Pkwy Replacement	Yes	3.0	Section starts at the intersection of Pomerado Rd. and Scripps Poway Pkwy. and runs along Scripps Poway Pkwy and remains inside Miramar Ranch North neighborhood until reaching 15 Freeway. The section ends near 15 Freeway due to proximity to a potential laydown yard within Miramar Ranch North neighborhood.	Q1 2022
14	Black Mountain Replacement	Yes	4.5	Section starts near intersection of Scripps Poway Pkwy. and 15 Freeway, runs south on Black Mountain Rd. until reaching Miramar Rd. This route was selected to remain inside the Miramar neighborhood to interconnect feeds to existing distribution system, and to relocate pipe away from close proximity to existing commercial and residential structures.	Q4 2020
15	MCAS North Replacement	Yes	1.3	Section starts at the intersection of Miramar Rd. and Kearny Villa Rd. and runs south on Kearny Villa Rd. until reaching Miramar Way at the location of the tap that feeds MCAS Miramar.	Q3 2023

Section Number	Section Name	HCA	Approx. Mileage	Description	Estimated In-Service Date
16	MCAS Central Replacement	No	1.3	Section starts on MCAS Miramar near Miramar Way and extends southward along Kearny Villa Rd. to the Kearny Pressure Limiting Station. Section ties into existing previously tested pipe that crosses under Highway 163. Although this section is not within HCA, this section is a replacement section due to limitations in the current alignment. The current alignment crosses through MCAS Miramar base and the current easement is set to expire in 2022. Replacement provides a new easement in a public road, is compatible with base operations as it removes Line 1600 from within the high security area, and avoids environmentally-sensitive areas along existing ROW. MCAS Miramar sent a letter to SDG&E stating their concerns with hydrotesting within the secured base perimeter and their preference for replacement in the public Kearny Villa Road.[12]	Q3 2023
17	MCAS South Replacement	No	0.8	Section starts at the Kearny Villa Pressure Limiting station cross tie and continues south in Kearny Villa Rd. to Highway 52, where it ties into previously tested pipe that crosses under Highway 52. Although this section is not within HCA, this section is identified for replacement due to limitations in the current alignment. The current alignment crosses through MCAS Miramar base across environmentally sensitive areas. Installing a replacement section at this location significantly reduces downstream customer service impacts compared to hydrotesting. Because of these factors, along with access issues to the existing ROW, SDG&E and SoCalGas propose to replace the line within the adjacent street ROW.	Q4 2023

[12] MCAS, Miramar letter from Colonel C. B. Dockery, Commanding Officer of MCAS Miramar, dated September 5, 2018.

Section Number	Section Name	HCA	Approx. Mileage	Description	Estimated In-Service Date
18	Kearny Mesa Replacement	Yes	1.4	Section starts south of 52 Freeway near the intersection of Ruffin Rd. and Kearny Villa Rd. New replacement reconnects to previously-tested pipe at Chesapeake Dr. and continues again at the intersection of Overland Ave. and Farnham St., where HCA section starts. Replacement runs south of Overland Ave., Spectrum Center Blvd., and Ruffin Rd., until reaching Ridgehaven Ct. Section is split at this intersection due to the need to maintain service to a large industrial customer.	Q1 2021
19	Serra Mesa Replacement	Yes	4.4	Section begins near the intersection of Ridgehaven Ct. and Ruffin Rd. Alignment runs through Ruffin Rd., Aero Dr., Sandrock Rd., Murray Ridge Rd., and Sandmark Ave., until reaching the terminus of L1600 at Mission Station.	Q1 2021

D. Section Schedule/Prioritization

The proposed Plan is comprised of groupings of 19 independent project sections that can be completed independently to efficiently address safety, operational, community, environmental, constructability, and cost considerations associated with each distinct portion of Line 1600. The scope of work consists of 14 replacement sections and five hydrotests. For the hydrotest work, four of the tests will be grouped into adjacent pairs that will be managed together, resulting in a total of three hydrotest projects. If added together, the total length of new 16-inch diameter pipe to be installed is approximately 42.6 miles. Cumulatively, the total length of existing Line 1600 to be hydrotested is approximately 12.9 miles. Maps showing details of the proposed scope of work are presented in the Appendix.

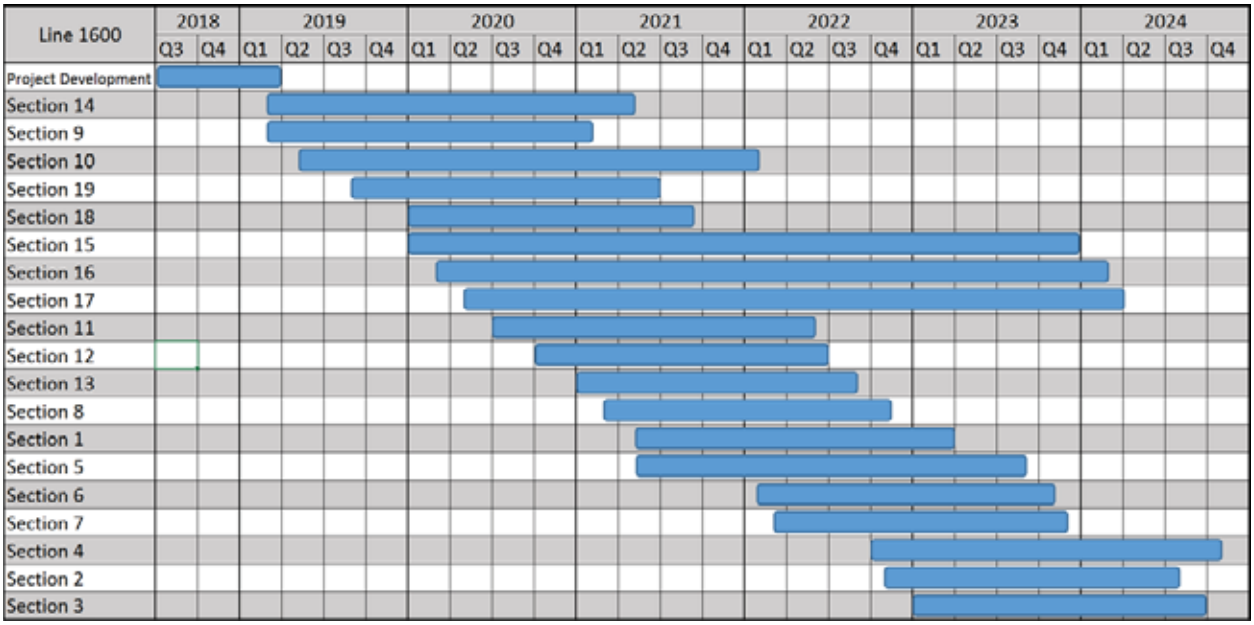
The 19 sections are prioritized and scheduled so as to achieve the greatest safety enhancement benefits and complete the replacement and testing of Line 1600, with an initial

focus on HCAs, as soon as practicable. Many factors were considered while scheduling the projects, including customer impacts, permit lead time, land rights lead time, potential environmental impacts, outreach activities, and operational limitations. Generally, sections from the City of Escondido south to the terminus of Line 1600 at Mission Gate Station are prioritized first as this corridor represents the highest concentration of population immediately adjacent to existing Line 1600 and therefore stands to achieve the biggest relative safety benefit. Additionally, the majority of the route for replacement pipeline sections falls within existing streets, which is anticipated to minimize permitting time. The construction schedule presented in this Plan will enable SDG&E and SoCalGas to bring Line 1600 into compliance with the requirements of Public Utilities Code section 958 "as soon as practicable," and prioritizes project sections to achieve the greatest safety enhancement in areas with the highest concentrations of people and property.

To facilitate isolating Line 1600 for hydrotesting or connecting sections of replacement pipeline during the winter months when core customer gas use is highest, it may be necessary to schedule gas to be delivered at the Otay Mesa receipt point. During summer months, sections of Line 1600 north of where it meets Line 1601 in Escondido cannot be isolated due to high peak loads on peaker plants in the area; supply delivered at the Otay Mesa receipt point cannot mitigate this concern during summer periods due to pipeline capacity limitations. Because the hydrotest sections are located north of Escondido, this is a main driver for scheduling the hydrotest sections. Several project sections are located within jurisdictions that are anticipated to require long-lead permits or land acquisitions. For scheduling purposes, some projects will require effort early on to begin a potential lengthy permit and/or land rights acquisition process

and which will lead the project to be constructed in the latter years of the proposed timeline. For example, there are some potential long-lead land acquisitions needed from local municipality-owned, State-owned and Federal-owned lands. There are also some potentially long-lead time permits that may be required. For example, a project within an environmentally-sensitive area may require an incidental take permit due to the potential for an endangered and/or listed species occuring within the proposed construction work areas. The acquisition of these permits may take one-to-two years of field work, environmental documents preparation and negotiations with agencies before a permit is granted to the utilities. Given the size, scope and complexity of the project, SDG&E and SoCalGas assume extensive community and customer outreach activities will be necessary to achieve the schedule and timeline set forth in this Plan. Figure 3 below shows the preliminary schedule, which may be revised as SDG&E and SoCalGas complete the detailed engineering, design and planning process, for all 19 sections.

Figure 3: Plan Schedule



E. Routing Criteria

As described above, the overarching objectives of PSEP are to: (1) comply with the Commission's directives [subsequently codified in Public Utilities Code section 958]; (2) enhance public safety; (3) minimize customer impacts; and (4) maximize the cost effectiveness of safety investments. Consistent with these overarching objectives and the requirements set forth in D.18-06-028, SDG&E and SoCalGas' Plan considers the following factors to address Line 1600 as soon as practicable, execute the Plan through efficient use of resources, and minimize potential impacts to customers and communities. These factors are incorporated in the proposed routing criteria utilized to evaluate alternatives and ultimately to develop the final Plan.

- Follow generally accepted principles for siting infrastructure.
- Avoid unnecessary impacts to the environment.
- Avoid unnecessary acquisition of private property.
- Allow for safe and efficient construction and testing activities.
- Provide all-weather accessibility for operations, maintenance, and emergency response.
- Allow replacement pipelines to integrate into the existing natural gas pipeline infrastructure serving customers along the existing Line 1600 corridor.
- Avoid impacts to critical operations at MCAS Miramar.
- Meet current and near-term energy needs in a cost-effective and efficient manner.

Of the approximately 43 miles of new pipeline planned for installation as part of the replacement scope of work outlined in this Plan, approximately 41 miles will be routed in nearby streets, minimizing potential impacts to environmentally sensitive areas and private property, consistent with SDG&E and SoCalGas' routing criteria. Where possible, the replacement pipeline will be installed in larger multi-lane streets that are most suitable for larger-scale utility

infrastructure. This allows for safe and efficient construction and future inspections and maintenance of the pipeline to be completed with minimal disruption to the community. Construction in existing roadways typically limits environmental impacts, as the work area is paved over and has been previously disturbed. Placing the pipeline in existing roadways also avoids the need to acquire private property, which can be time-consuming and costly if property owners are not interested in selling and eminent domain is required. Photographs representative of the streets proposed for replacement construction are provided in the Appendix.

In the evaluation of alternative designs, SDG&E and SoCalGas considered the reasonableness of potentially constructing replacement pipe in existing 20-foot-wide Line 1600 easements. SDG&E and SoCalGas concluded it is not feasible, prudent nor reasonable to build a new replacement pipeline entirely within the existing Line 1600 rights-of-way. Accordingly, the Plan calls for the relocation of replacement pipeline sections to nearby public roadways, as appropriate. Adequate space for new construction (40-50 feet to 50-100 feet) does not generally exist along the Line 1600 centerline because the area surrounding the existing 20-foot-wide rights-of-way has been heavily developed in many locations since the line was originally constructed in 1949. Photographs that illustrate the development that has occurred along the existing rights-of-way are presented in the Appendix.

In most locations, constructing in the existing right-of-way would be very difficult and would potentially have a large impact on the community and the environment due to the need to obtain additional right-of-way to perform construction safely. To complete construction in a reasonably safe and efficient manner, as mentioned above, a minimum of 40-to-50 feet, and in

some areas, between 50 and 100 feet, of clear right-of-way is normally required. Construction would be complicated, and there would be additional risk and safety complexity, and extensive heavy equipment operations in close proximity to the existing 16-inch diameter pipeline.

The costs to acquire additional rights-of-way necessary to safely and efficiently complete construction are anticipated to be significant and could require SDG&E and SoCalGas to invoke the eminent domain process. When this concept was studied as part of developing the proposal for SDG&E and SoCalGas' Pipeline Safety & Reliability Project (PSRP) Application (A.15-09-013), it was determined that approximately 500 parcels are located within 35 feet of the existing rights-of-way. Approximately 125 residences, 24 commercial buildings, and seven apartment buildings are anticipated to possibly require acquisition for construction of a new pipeline within the Line 1600 rights-of-way. The effort and cost of expanding the existing rights-of-way for pipeline replacement construction is anticipated to be considerable, as well as disruptive to the property owners and tenants. In addition, by law, the success of an eminent domain action is determined by balancing various factors, including whether the property is necessary for the public project for which it is condemned. Existing roadways would not pose these challenges and costs, as SDG&E has existing franchise rights that permit installation of pipeline in streets and disruption would be limited.

In preparing this Plan, SDG&E and SoCalGas sought input from two reputable gas pipeline contractors with experience working in southern California regarding constructability of different alternatives, including attempting to construct replacement pipeline sections within Line 1600's existing 20-foot rights-of-way. Both contractors noted the challenges of potentially constructing in the existing rights-of-way and the impacts to productivity. Both noted that construction in

nearby roads would be more efficient. Copies of letters provided to SDG&E and SoCalGas from these contractors are provided in the Appendix.

Because of the identified constraints, construction of replacement sections of pipeline entirely within the existing Line 1600 rights-of-way would not be consistent with the routing criteria described in this Plan and would be infeasible from a constructability, environmental, social, economic, and site-suitability perspective. As such, SDG&E and SoCalGas determined the most suitable and preferred location for the majority of the replacement pipe is in existing nearby streets.

F. Temporary Service Requirements

To maintain uninterrupted gas supply to customers during replacement/hydrotest of the pipeline, customers may be temporally fed using compressed natural gas (CNG), liquefied natural gas (LNG) or through construction of a bypass pipeline. The equipment required varies by the volume consumed by each customer. SDG&E's Distribution Region Engineering organization, along with SoCalGas' Gas Control & System Planning organization, evaluated the pipeline and identified the customers that would require isolation and alternate gas supply during replacement/hydrotesting activities. After analyzing the needs of and potential service impacts to customers, SDG&E and SoCalGas identified the equipment required to maintain service during construction. The types of equipment identified include CNG pods, medium and large CNG trucks and bypass installations. Isolation of customers is accomplished using stopples and temporary and permanent bypasses. The estimates presented in this Plan include estimated costs for a hook-up at each site and a temporary alternative gas supply cost, based on the type of equipment required.

G. Compliance with Applicable Regulations and Industry/Company Standards

All testing or replacement projects implemented under this Plan will be subject to robust guidelines and oversight to comply with SDG&E and SoCalGas' internal standards and applicable laws and regulations. These applicable regulations include the Code of Federal Regulations, Title 49, Part 192, (49 CFR 192), which provides requirements for Materials (Subpart B), Pipe Design (Subpart C), Design of Pipeline Components (Subpart D), Welding of Steel in Pipelines (Subpart E), General Construction Requirements for Transmission Lines and Mains (Subpart G), and Test Requirements (Subpart J). In addition to its specific requirements, the Federal Code also "incorporates by reference" the requirements of industry standards such as the American Society for Mechanical Engineers (ASME), American National Standards Institute (ANSI), American Petroleum Institute (API) and American Society for Testing and Materials (ASMT). These industry standards provide methodologies and calculations for more specific and technical requirements addressed in the code. In addition, Commission GO 112-F provides additional requirements with respect to the design, construction, testing, maintenance, and operation of utility gas gathering, transmission and distribution piping systems.

SDG&E and SoCalGas' internal standards have been developed to address applicable laws and regulations and contain references to the regulations that are addressed. These internal standards are reviewed both on a periodic basis and ad-hoc basis as regulations are changed and updated. For each project, internal standards and practices are employed to govern the design analysis, materials purchased, and construction practices.

SDG&E and SoCalGas' Gas Standards are driven by a dual objective: complying with applicable laws and regulations and promoting safety and operational efficiency. The Gas

Standards are the policies and documents that demonstrate compliance with applicable state and federal requirements. The Commission's SED regularly reviews the natural gas transmission and distribution functions for each utility providing natural gas in the state. The Commission compares the functions of transmission and distribution with requirements set forth in GO 112-F as well as federal standards. Through these reviews, SED is able to evaluate and provide input on the sufficiency of the Gas Standards in complying with GO 112-F and the referenced provisions of Title 49 of the Code of Federal Regulations (49 CFR).

Additionally, the Gas Standards are regularly reviewed and updated by SDG&E and SoCalGas personnel and contractors[13] to promote both compliance with laws and regulations and to reflect industry standards and SDG&E and SoCalGas' best practices.[14] These Gas Standards form the foundation for SDG&E and SoCalGas' PSEP standards and practices.

The Plan will, at a minimum, meet applicable federal and state safety regulations, rules, and requirements by complying with applicable SDG&E and SoCalGas Gas Standards, and will, in many cases, exceed these requirements. SDG&E and SoCalGas' Gas Standards comprise the policy and procedures that govern the design, construction, operations, and maintenance of the Transmission and Distribution systems and are based on the relevant regulatory codes and ordinances. Although the Gas Standards themselves may exceed federal and state safety

[13] For example, when PSEP was first initiated, PSEP contractors reviewed policies, procedures, technical specifications and work instructions. This review was done to incorporate, where possible, improvements and content enhancements.

[14] When unique situations require additional Gas Engineering guidance, PSEP seeks out the assigned Gas Standard "owner" for solutions. A gas standard owner is the subject matter expert responsible for updating standards for compliance with applicable codes. For example, when situations require an exception to an applicable Gas Standard, the appropriate Gas Standard owner is consulted and, if the exception is an acceptable accommodation, the Gas Standard owner documents his/her approval.

regulations, rules, and requirements, for this Plan, SDG&E and SoCalGas identify additional areas where they propose to exceed federal and state safety regulations, rules, and requirements. Section D of the Appendix provides a summary of where the execution of the proposed Plan is anticipated to exceed applicable state and federal safety regulations, rules, and requirements, including those set forth in GO 112-F, CFR Parts 191 and 192, and the California Occupational Safety and Health Act (Cal/OSHA).

In addition to the summary provided in Section D of the Appendix, SDG&E and SoCalGas provide the following supplemental explanation regarding the applicable Code[15] requirements the proposed Plan is anticipated to meet or exceed.

1. SDG&E and SoCalGas Design Standards and Practices

SDG&E and SoCalGas' design standards and practices address materials to be used and proper design in accordance with GO 112-F and applicable federal laws and regulations. These design standards and practices enable: (1) development of specific engineering requirements for materials used in strength test or replacement projects; (2) preparation of designs that comply with applicable laws, permits, SDG&E/SoCalGas, and industry standards; (3) utilization of applicable engineering and design standards developed for strength testing or replacement projects; and (4) implementation of consistent design and material requirements for the various engineering design firms contracted to assist with design development. While many industry

[15] As used in this Plan, "Code" refers to 49 CFR Part 192, which governs nearly all aspects of the design, inspection, and testing of a pipeline and its appurtenances.

standards are incorporated by reference in the Gas Standards,[16] the industry standards generally applied when designing facilities are summarized in Table 4 below.

TABLE 4
Summary of Applicable Industry Design Standards

Steel Line Pipe	API 5L
Steel Line Pipe Grade B	ASTM A 106
Valves	API 6D
High Yield Weld Fittings	Manufacturers Standardization Society (MSS) SP 75
Grade B Weld Fittings	ASTM A234
Flanges	ANSI B16.5
Forged Steel Weld Fittings	ASTM A105
Pressure Vessels	ASME VIII
Welding	API 1104
Cathodic Protection	National Association of Corrosion Engineers (NACE) RP-0169
AC Mitigation	NACE RP-0177
National Electric Code	National Fire Protection Association (NFPA) 70

The design specifications, testing requirements and testing results are documented and retained for the life of the asset to demonstrate compliance, and support the operation, maintenance, and design level of each new section of pipeline intended to operate at a pressure greater than 100 psig.

2. Spike Test Best Practices: SDG&E Gas Standards G7361, G7365, G7369

Under existing SDG&E Gas Standards, absent an applicable exception, hydrotests of new and existing pipeline sections require a 5% spike for 30 minutes at the beginning of the test, such

[16] For example, designs are also reviewed for conformance with ANSI B31.8, "Gas Transmission and Distribution Piping Systems." Additionally, each pipeline section may have additional design components. To illustrate, PSEP pipeline facilities also include, as applicable, cathodic protection systems designed to satisfy the requirements of 49 CFR 192, NACE Standard RPO 0169, NACE Standard TM0497, and applicable Gas Standards.

that decreasing the pressure from the spike pressure results in at least a 5% reduction for the entire pipe section. Exceptions to spike testing requirements must be approved by SDG&E/SoCalGas Pipeline Engineering. Spike testing is not recommended when the spike would exceed the actual or likely mill test pressure, and elevation changes require a significant number of additional spike test sections.

3. Maximum Test Pressure

For those portions of existing Line 1600 that are proposed to be hydrotested, SDG&E and SoCalGas plan to test the existing line to at least 1.5 times its desired MAOP of 640 psig. This equates to a minimum test pressure of 960 psig. In order to safely test the existing line, SDG&E and SoCalGas will not exceed 90% of the SMYS of the pipe, by dividing Line 1600 into multiple test sections to address elevation changes that otherwise can significantly increase test pressures at low points. Based on preliminary engineering, SDG&E and SoCalGas anticipate the maximum test pressure that existing sections of Line 1600 will experience will be 1,459 psig, or 89.8% of SMYS, in the Rice Canyon section, which has the highest elevation change. Table 5 below summarizes the characteristics of each of the sections of existing pipe planned for hydrotest, including the maximum test pressure at the lowest elevation.

TABLE 5
Summary of Hydrotest Project Sections

Hydrotest Section	Start Elev (ft)	High Elev (ft)	Low Elev (ft)	Elev Change (ft)	Part 192 Test Range (psi)	Spike Test Range (psi)	Max Spike Press @ Low Elev (psi)	% SMYS @ Low Elev
Rice Canyon	1159	1159	289	870	30	20	1459	89.8%
Couser Canyon North	289	935	283	652	30	20	1360	83.7%
Couser Canyon South	898	1374	722	652	30	20	1360	83.7%
Moosa Creek	713	713	686	27	30	20	1075	66.2%
Daley Ranch	704	731	625	106	30	20	1111	68.4%

The replacement sections of pipeline also will be subject to hydrotest. Newly installed pipeline sections will be tested to satisfy SDG&E and SoCalGas strength test procedures. The new line will be tested to at least 90% SYMS according to SDG&E standard G7369. SDG&E and SoCalGas plan to install 16-inch diameter, 0.375-inch wall thickness, grade X52 pipe for new installations. The minimum test pressure for this pipe at 90% of SMYS equates to 2194 psig. Should some installations result in a combination of new pipe being interconnected with sections of existing modern 0.250-inch wall, grade X52 pipe (non-A.O. Smith EFW pipe), minimum test pressures will be adjusted accordingly to fall within a range of 1200 psig to 1463 psig, as determined by SDG&E and SoCalGas' Gas Engineering department. This test pressure range equates to 1.5 times the original MAOP rating of 800 psig, at the lower end, to 90% of SMYS for the 0.250-inch wall pipe at the upper end.

4. Materials Standards and Practices

Once a testing or replacement project has been scoped, designed, and approved, materials are ordered that comply with SDG&E and SoCalGas' Materials Specifications for Gas

Operations. Unless otherwise specified, API 5L pipe, with the specific approved grades and wall thicknesses, are used. These wall thicknesses and grades for each diameter pipe are as specified in applicable standards and Materials Specifications for Gas Operations. The required wall thicknesses for the various class locations are determined and verified using design data. Table 6 below summarizes the generally applicable Materials Specifications for Gas Operations.

TABLE 6
Generally Applicable Materials Specifications for Gas Operations

Pipe	MSP 41.06.1	Pipe - Steel, Grades A25 Through X70
	MSP 52.83	Fittings - Forged Steel
Fittings	MSP 52.96	Fittings – Butt-Weld Steel
	MSP 58-15.1	Valves - Ball, Small (High Pressure)
Valves	MSP 58-15.2	Valves; Ball, Steel Floating
	MSP 58-20	Valves - Check
	MSP 58-82	Valves; Ball, Steel, Trunnion Mounted
Coatings	MSP 44-50	Fusion Bonded Epoxy External Line Pipe Coating
	MSP 44-50.1	Fusion Bonded Epoxy External Fitting Coating
	MSP 44-50.4	Powder Coating for External Protection of Prefabricated Gas Components

Materials Specifications for Gas Operations are used for each purchase and outline the instructions and expectations for shop inspections and quality assurance. To validate adherence to these standards, SDG&E and SoCalGas may inspect and test materials to help verify the accuracy of the manufacturer's certification and testing, to promote compliance with company requirements and, if applicable, the Materials Specifications for Gas Operations Quality Control Inspection Instructions. Documentation of compliance and certification is retained.

5. Construction Standards and Practices

Construction is subject to extensive standards, practices, and guidelines. First, SDG&E and SoCalGas enforce guidelines on how contractors are qualified to work on the system.[17] Contractors are not permitted to commence working on the SDG&E/SoCalGas system until they have demonstrated compliance with applicable requirements and Gas Standards and demonstrated appropriate financial and insurance capabilities.

In addition to these threshold requirements to begin work, SDG&E and SoCalGas implement comprehensive standards that address, among other areas, excavation, coating application and inspection, welding, welding inspection, trenching, cover, and pressure testing. Prior to starting work, as a part of the agreement with the contractor, contractors are provided an index of standards, practices, guidelines, and requirements; as applicable, contractors are provided updates when issued. SDG&E and SoCalGas monitor and document compliance with applicable standards, laws, and requirements.

Direct management of the project construction activities is the responsibility of SDG&E and SoCalGas' Construction Management organization. The organization is structured to provide oversight and monitor whether construction is meeting quality standards in a safe construction

[17] Contractors are thoroughly vetted and must, among other requirements: have a record of job and safety performance; demonstrate approved production and technical equipment and facilities; demonstrate approved Operator Qualification program, as required by 49 CFR 192.801 through 192.809; demonstrate an adequate quality assurance and safety program; have a Department of Transportation (DOT)-and Company-approved Alcohol & Drug Testing Program in accordance with the DOT CFR, Title 49, Part 40 and Part 199 regulated by the Pipeline & Hazardous Materials Safety Administration (PHMSA) or Part 382 if contractor's employees perform commercial motor vehicle driver functions regulated under the DOT Federal Motor Carrier Safety Administration's (FMCSA) Part 382; demonstrate the contractor is meeting State and Federal requirements for the installation and construction of natural gas pipelines (49 CFR 190, 191, 192) Cal Occupational Safety and Health Administration (OSHA) or any other state requirements; and maintain a California Contractors State License.

environment at an economical total cost. The organization also provides extensive oversight with respect to safety, environmental protection, site security, construction contract management and administration, planning, scheduling, progress control, cost control, inspection, job site material and logistics management and job site customer interface management. For example, during construction, inspection reports are generated to detail the work, photograph aspects of the work, and document the standards applicable to the work performed during the day (as well as compliance with those standards). Company employees, as well as third party inspection service providers, verify compliance with standards.

In addition, an assigned Project Manager and other key members of the Project Management Team assist the Construction Management team and provide management and project support, particularly with respect to engineering, constructability, procurement follow-up, inspection/expediting of purchased equipment and materials, and other specialized services as may be required to support construction. While each construction activity is subject to extensive guidelines, standards, and requirements, welding in particular is discussed in greater detail below.

6. Welding and Welding Inspection

SDG&E and SoCalGas adhere to applicable laws, regulations, and Gas Standards for welder qualification and re-qualification. As such, SDG&E and SoCalGas qualify and re-qualify company and contractor welders in accordance with Title 49 of the Code of Federal Regulations.[18]

[18] 49 CFR Parts 192.227 Qualification of welders, and 192.229 Limitations of welders.

SDG&E and SoCalGas prepare a Welder Qualification Test Report when a welder is qualified, maintain a list of qualified personnel, and conduct destructive testing on steel weld samples submitted by welders in accordance with 49 CFR 192 and API 1104 (revision incorporated by reference in 49 CFR Part 192). Subsequently, welders must regularly be requalified. Qualification compliance is monitored by requiring welders to carry proof of certification and verifying their qualifications when performing welding or joining operations.

To provide further oversight, welding inspections are performed by qualified welding inspectors and each weld undergoes non-destructive examination (NDE).[19] Inspection of a weld takes multiple forms. First, the welding inspector performs quality checks prior to and during the welding process. Second, the welding inspector performs a visual inspection of the weld. Finally, an NDE technician inspector performs non-destructive testing, such as radiographic or ultrasonic inspection. Company and contract personnel performing non-destructive testing are certified according to API-1104 and ASNT-SNT-TC-1A and provide, upon request, a current certification record demonstrating qualification for Task 1.25-0601 – Radiography Examination – 49 CFR 192.243 Nondestructive Examination.

[19] Qualified inspectors must demonstrate knowledge and understanding of high pressure steel pipeline materials and components; be CWI (Certified Welding Inspector), CPWI (Certified Pipeline Welding Inspector) or an equivalent certification or training deemed acceptable; demonstrated experience and knowledge in API Standard 1104; have NDT (non-destructive testing) experience and or certification preferred for RT (radiographic) and PT (penetrant) inspections; passing required PSEP operator qualification (OQ) Covered Common Tasks (CCTs); be qualified to perform visual weld inspection in accordance with the recommendation of ASNT or any recognized certification program that is acceptable to the Company; and qualified under task 0811 to perform Visual Inspection of Welding and Welds.

7. Steel Pipeline Materials (49 CFR 192.55)

SDG&E and SoCalGas utilize greater pipe base metal and pipe toughness than required by API5L. API5L requires the steel pipe to have a minimum average (from a set of three specimens) absorbed energy for each heat based on full-size transverse specimens to 20 ft-lbs. SDG&E and SoCalGas exceed this requirement by applying a Charpy energy equation which calculates a value greater than 29 ft-lbs. By exceeding the API5L requirements, the proposed Plan is designed to provide greater resistance to propagating cracks and increases the pipe's resistance to third party damage.

8. Steel Pipe Design Factors (49 CFR 192.111)

The design factor of a pipe section establishes the safety margin against pipe yielding from its internal pressure.[20] For example, a pipeline in a Class 3 location is required to have a design factor of 0.5 or lower. This limits the maximum pressure in a pipe section to half of its yield pressure, which is equivalent to having a safety factor of 2, based on yield. Table 7 below summarizes the code requirements for design factors based on the class location of a pipe section.

[20] For clarity, the term "yielding" does not mean the pipe ruptures but rather refers to permanent deformation. Pipe has additional strength beyond its yield point.

TABLE 7
Summary of Minimum Design Factors Required Under Federal Regulations

Class Location	Description of Class Location	Design Factor
1	10 or fewer buildings intended for human occupancy.	0.72
2	More than 10 but fewer than 46 buildings intended for human occupancy.	0.60
3	46 or more buildings intended for human occupancy, or an area where the pipeline lies within 100 yards of either a building or a small, well-defined outside area (such as a playground, recreation area, outdoor theater, or other place of public assembly) that is occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12-month period.	0.50
4	Where buildings with four or more stories above ground are prevalent	0.40

Population densities along the proposed Plan vary by location from a mixture of Class 1, Class 2 and Class 3 in the northern reaches of the pipeline to predominately Class 3 and Class 4 in the high density urban areas in the south. SDG&E and SoCalGas plan to design the northern section of the pipeline between Rainbow and Escondido to meet Class 3 requirements. The southern section from Escondido to Mission Station is planned to be designed to meet Class 4 requirements. This will satisfy design code requirements and provide an additional safety margin to accommodate future growth and development should the class location change.

9. Transmission Line Valves (49 CFR 192.179)

The proposed Plan is designed to enable detection of a significant change in pipeline pressure within two minutes in designated Class 3 and/or HCA sections and for full depressurization of the segment within 30 minutes should a failure occur. This design criteria will meet or exceed PSEP objectives for isolation and depressurization of sections of a pipeline, which

already exceed Code requirements.[21] All new Main Line Valves (MLVs) installed pursuant to this Plan will have capabilities for remote operation by SDG&E and SoCalGas' Gas Control Center and/or automatic closure without operator intervention in the event of a significant failure. Further, valves on selected taps, crossovers and bridle assemblies will be equipped with remote control capabilities to support operation of the pipeline and prevention of back-flow of gas into any main pipeline section isolated to control an unplanned gas release. MLVs will have actuators that reside above ground or will be installed below grade within a concrete vault. The actuator will operate using gas pressure provided from the pipeline, supported by pneumatic and electronic controls. The MLVs will be 16-inch, full-opening, to allow for the passage of internal inspection devices. Each MLV location will have a blow down valve installed on each side of the MLV to allow for depressurization of either of the adjoining pipe sections. The Plan calls for a maximum spacing between MLVs of five miles unless other constraints require spacing more than 5 miles apart. In all locations, five-mile spacing meets or exceeds Code requirements, which specify maximum valve spacing of 20, 15, 8 and 5 miles for Class 1, Class 2, Class 3 and Class 4 locations, respectively. The reduced valve spacing will enable a faster blow down time for all pipe sections than would be achieved if the less-stringent valve spacing requirements of the Code were followed.

10. Inspection and Testing of Pipeline Welds (49 CFR 192.241)

The Federal Code requires non-destructive testing for pipelines constructed in Class 1 and

[21] A.11-11-002, Amended Testimony of Southern California Gas Company and San Diego Gas & Electric Company in Support of Proposed Natural Gas Pipeline Safety Enhancement Plan, Chapter V, Proposed Valve Enhancement Plan, dated December 2, 2011, http://www.socalgas.com/regulatory/documents/r-11- 02-019/Amended%20Testimony-12.2.11.pdf.

Class 2 locations that are not in highway or railroad rights-of-way on 10% and 15% of welds, respectively. SDG&E and SoCalGas plan to exceed the requirement by performing non-destructive testing of 100% of the welds and non-destructive examination by dye penetrant of branch connections for pipelines in these areas.

11. Protection from Hazards (49 CFR 192.317)

The pipeline route in this proposed Plan does not cross any active seismic faults. Based on a preliminary assessment, the pipeline also does not traverse any potential landslide areas. Typical mitigation for potential landslides is to slightly reroute the pipeline away from potential landslide areas or to install the pipe at a depth below the slide plane of the landslide. Should any landslides be discovered during detailed design, further site-specific geological investigation will be performed to select the appropriate mitigation method.

12. Strength Test Requirements (49 CFR 192.505)

The proposed Plan will traverse Class 1, Class 2, Class 3 and Class 4 locations. The pipe material (16-inch diameter by 0.375-inch wall, Grade X52) to be used in replacement projects provides enhanced safety benefits as it satisfies the more rigorous requirements for Class 4 locations. As a result, the pipeline will have greater strength and safety margins than is required by the Code in Class 1, Class 2, and Class 3 areas.

Another safety factor anticipated to be incorporated into the final design of each replacement project section is at the pressure testing phase. Where practical, the new installed pipe is planned to be tested to more than 2.5 times the MAOP, which provides an additional 66% safety factor beyond even the more rigorous testing requirements for Class 3 and Class 4 locations. The pressure testing will also include a short duration pressure spike to provide an

additional factor of safety.

13. Odorization of Natural Gas (49 CFR 192.625)

All natural gas flowed through Line 1600 will be odorized. Odorized gas enhances the ability to detect leaks.

14. Patrolling of Line 1600 (49 CFR 192.705)

Consistent with SDG&E and SoCalGas standards, where feasible, new 16-inch pipeline installed as part of the Plan will be equipped throughout its routing with an advanced right-of-way intrusion detection/monitoring fiber optics system to provide early warning when digging, drilling, boring, cutting, compacting, or unplanned heavy vehicle operations by third parties pose a threat to pipeline integrity. The system will also continuously monitor for ground movement and temperature gradients associated with an unplanned release of gas from the pipeline. This fiber optics monitoring program is consistent with the company standard requiring new and replacement pipelines to be outfitted with fiber monitoring technology. This requirement applies to pipelines that are being installed that are one mile or greater in length, 12 inches or greater in diameter, and operate above 20% SMYS. Fiber optic cable will be installed during construction and will be coupled to a computer-based monitoring station for detection and alerting purposes. The system of sensors is intended to allow for preemptive identification and mitigation of pipeline threats and enhance SDG&E and SoCalGas' ability to manage pipeline risk.

V. TECHNICAL CONSIDERATIONS

In evaluating the four alternatives considered during the preparation of this Plan, SDG&E and SoCalGas carefully considered the technical attributes and installation history of Line 1600,

along with the integrity assessment and operational and maintenance history of the line. A summary of these technical considerations is provided in this section.

A. Pipeline Attributes and Installation History

Line 1600 was placed in service in 1949 and is primarily comprised of 16-inch diameter, 0.250-inch wall, grade X52 pipe. It is approximately 50 miles long, with 46.5 miles (approximately 93%) of the pipe comprised of 1949-vintage electric flash welded (EFW) pipeline sections, with a small percentage of electric resistance welded (ERW) pipe. Additionally, approximately 33 miles (approximately 66% of the total length) of Line 1600 is located in HCAs, with significant residential and commercial development along the pipeline's existing route. Line 1600 contains the largest mileage of flash welded pipeline within HCA in the combined SDG&E/SoCalGas Gas System.

SDG&E and SoCalGas do not have documentation to demonstrate that Line 1600 was pressure tested when it was originally placed into service in 1949, and Line 1600 was grandfathered under federal pressure testing regulations adopted in 1970.[22]

B. Line 1600 Vintage Pipe Material and Manufacturing Related Anomalies

Line 1600 was originally constructed in 1949 with predominantly EFW pipe, and a small percentage of ERW pipe. In February 2017, Kiefner and Associates, Inc. published a technical report (2017 Kiefner Report) which reviewed and analyzed risk factors to evaluate whether Line

[22] *See* D.11-06-017 at 5, n.3.

1600 may prudently be pressure tested and restored to full operating pressure.[23] Some of the salient findings presented in the report are summarized below.

The 2017 Kiefner Report explains that electric flash welding of long seams is an obsolete form of pipe manufacturing where the longitudinal edges of heat softened pipe are forced together to form a welded bond. Excess extruded material is then trimmed away, forming the classic "box-like" appearance of a flash welded seam. This process was only utilized by a single pipe manufacturer—A.O. Smith Corporation—and pipe production using flash welded seams was discontinued by 1969. Process control, material chemistry, and manufacturing-related factors all contribute to EFW seam weld quality issues and related anomalies in such pipe.

The A.O. Smith EFW pipe is associated with a number of well-documented integrity concerns including hook cracking, cold welds, non-metallic inclusions, susceptibility to selective seam corrosion, and a variety of other related issues.[24] Among the types of anomalies listed above, hook cracks associated with the EFW seam welds have been observed on Line 1600.

Hook cracks (also known as upturned fiber imperfections) take their name from the distinctive "J-shaped" flaw that results when metal separations in the steel skelp[25] that are originally oriented parallel to the skelp surfaces are forced together, resulting in flow of the

[23] Rosenfeld, M.J., "Review of Risk Factors for Line 1600," Kiefner Final Report to SDG&E, February 20, 2017. *See also* A.15-09-013, Supplemental Testimony of SDG&E and SoCalGas at Attachment C (2017 Kiefner Report).

[24] J.F. Kiefner and E.B. Clark, *History of Line Pipe Manufacturing in North America* (1996 Kiefner Report), American Society of Mechanical Engineers (ASME) CRTD-Vol. 43 (1996).

[25] Skelp is a strip of metal (such as wrought iron, steel) for making a hollow cylindrical piece or tube by bending it round longitudinally or helically and welding.

material toward either the inner or outer surface of the resultant weld.[26] Additionally, selective seam corrosion - preferential metal loss that occurs at a weld bond line region or heat affected zone (HAZ) – remains a threat to the integrity of Line 1600. This phenomenon is promoted by localized galvanic differences in the weld and surrounding material and, when exposed to a corrosive environment, results in the preferential attack of the weld area at an accelerated rate relative to the surrounding pipe material.[27,28]

The 2017 Kiefner Report further explains that the vintage A.O. Smith flash welded pipe is known to have both hook cracks and low fracture control. The objective of "fracture control" is to prevent leaks and ruptures caused by crack propagation initiated by an event, such as third-party damage. Fracture control has traditionally been categorized as "initiation control" and "propagation control." "Toughness" may be broadly defined as the ability of a material to absorb energy during fracture. Sufficient toughness is an essential component of fracture control, as it increases the likelihood that a failure will be progressive, and not catastrophic.

The 2017 Kiefner Report further states that A.O. Smith pipe installed in 1949 was not manufactured with fracture control in mind because the concept was not known at the time. While the pipe has good mechanical strength, its propagating fracture control properties do not meet modern criteria for gas transmission pipelines. The implication of these inherent properties of Line 1600 is that at its current operating pressure, in the event of a failure on the sections of vintage pipeline that remain in service, particularly in the seam but potentially even

[26] J.F. Kiefner with the assistance of the Interstate Natural Gas Association of America (INGAA), *Evaluating the Stability of Manufacturing and Construction Defects in Natural Gas Pipelines, Department of Transportation Final Report 05-12R*) (2007 Kiefner Report), Table A-1 (Apr. 26, 2007).
[27] *Id.* at Table 3.
[28] 1996 Kiefner Report, at 5-4.

in the pipe body, a failure could result in a rupture and propagating brittle fracture rather than a leak. Although the inherent properties of Line 1600 vintage pipe do not render the line unsafe at current operating pressures, they do increase the vulnerability to certain integrity threats or increase the difficulty of defending against those threats. Consequently, it is accurate to state that a vintage pipeline poses a higher risk to the public than a new pipeline, even when the vintage pipeline appears to be in a safe condition.

The modern 16-inch diameter, 0.375-inch wall thickness Grade X52 pipe proposed as Line 1600 replacement material will provide superior fracture control properties compared to the vintage A.O. Smith pipe material. In addition, SDG&E and SoCalGas' proposed wall thickness (0.375-inch) for the 16-inch replacement pipe will provide greatly improved resistance to mechanical excavation damage compared to the vintage pipe material (0.250-inch wall thickness), further enhancing the long-term safety of the pipeline.

C. Integrity Monitoring and Operations & Maintenance Repair History of Line 1600

Continual and active integrity monitoring is a key component of pipeline safety and will continue to be an important part of SDG&E and SoCalGas' continued safe operation of Line 1600. Integrity monitoring of Line 1600 includes (but is not limited to) monitoring conditions such as selective seam corrosion, corrosion coincident with hook cracks, or other forms of interaction between threats such as third-party damage at otherwise stable defect locations.

Since installation in 1949, a combined total of approximately two dozen repairs associated with routine operations and maintenance (O&M) activities have taken place on Line 1600. These repairs are representative of typical maintenance for a pipeline of this size and vintage, and do not significantly impact the integrity condition of the pipeline. A review of the

repair and maintenance history is incorporated into the assessments conducted as part of SDG&E and SoCalGas' Transmission Integrity Management Program (TIMP).

D. Line 1600 Integrity Assessment History

In accordance with 49 Code of Federal Regulations (CFR) sections 192.921(a)(3) and 192.937(c)(1), three TIMP-related assessments have been conducted on Line 1600: (1) an External Corrosion Direct Assessment (ECDA) in 2007; (2) a series of in-line inspections (also known as "smart pigging") conducted from 2012-2015; and (3) a subsequent in-line inspection in 2016.

E. External Corrosion Direct Assessment

The baseline ECDA of pipe sections within HCAs on Line 1600 was completed on February 23, 2007. Inspections were performed over approximately 20.7 miles, resulting in eleven examinations to investigate the likelihood of active external corrosion. External corrosion and third-party damage were not observed during examinations of the excavated pipe and no repairs were required.

F. In-Line Inspection Phases

A TIMP assessment of Line 1600 was conducted utilizing a series of in-line inspections from December 2012 through December 2015. All pipe sections between the launcher and receiver (*i.e.*, both HCA and non-HCA sections) were inspected using axial magnetic flux leakage (AMFL), circumferential magnetic flux leakage (CMFL, also known as transverse field inspection or TFI), and geometry smart pigs. AMFL technology is sensitive to volumetric flaws, such as metal loss caused by corrosion or third-party damage; CMFL technology is sensitive to some

types of long seam flaws, such as selective seam corrosion and hook cracking; and geometry tools detect areas of deformation.

During the inspection work completed from 2012-2015, the inspection of Line 1600 was performed in three separate phases, primarily due to the break in geometric continuity created by the reduction in pipeline diameter from 16-inch down to 14-inch diameter (near the middle of the pipeline at Lake Hodges), and back up again to 16-inch diameter for the remainder of the pipeline. The phases are numbered from 1 to 3 in the chronological order of inspection. The inspection lengths, in-line inspection tools utilized, and dates for each inspection phase are summarized in Table 8 below.

TABLE 8
In-line Inspections of Line 1600 by Phase (2012-2015)

Phase	Inspection Length (miles)	Inspection Extent	ILI tools	Assessment Date
1	29.1	Rainbow Metering Station to Lake Hodges	• Axial MFL • Geometry	12/5/2012
			• Circumferential MFL	2/6/2013
2	20.1	Lake Hodges to Mission Base	• Axial MFL • Geometry	12/19/2013
			• Circumferential MFL	3/20/2014
3	0.5	Lake Hodges	• Axial MFL • Geometry	12/10/2015

G. Findings from 2012-2015 In-line Inspections

The final reports for each of the in-line inspection phases for Line 1600 identified anomalies:[29] in Phase 1, 1,471 anomalies were identified; in Phase 2, 1,226 anomalies were identified; and in Phase 3, 85 anomalies were found. Reported anomaly types and quantities for

[29] Anomalies refer to unexamined pipe features that are classified as potential deviations from sound pipe material, welds, or coatings. All engineering materials contain anomalies that may or may not be detrimental to material performance.

each phase are listed in Table 9 below. Due to differences in tool sensitivities, the quantity of anomalies listed for the CMFL tool for Phases 1 and 2 contain anomalies that were detected by the AMFL and geometry tools (*i.e.*, anomalies may have been counted twice). Discounting the repairs that have been completed on Line 1600, the AMFL in-line-inspection work completed in 2016 resulted in similar findings as those identified through the 2012-2015 assessments summarized in Table 9 below.

TABLE 9
In-line Inspection Reported Anomalies (2012-2015)

	Phase 1		Phase 2		Phase 3
Reported Anomaly Type	**AMFL and Geometry**	**CMFL**	**AMFL and Geometry**	**CMFL**	**AMFL and Laser Deform.**
Crack-like	0	3	0	14	0
Deformation	47	116	28	33	0
Long Seam	123	265	100	198	0
Manufacturing	18	20	134	40	6
Metal loss	343	536	148	531	79
TOTAL	**531**	**940**	**410**	**816**	**85**

H. Inspection Based Repairs Related to 2012-2015 In-Line Inspections

Validation of smart pig data by direct examination is necessary to correlate the smart pig data against actual findings confirmed in the field by unearthing the pipe. Though smart pigs provide much valuable and accurate data, they are not without limitations. Smart pigs detect many anomalies, but are not infallible, and cannot detect *all* anomalies in a pipeline during an in-line inspection. For Phases 1 and 2, a total of 62 direct examinations (*i.e.*, excavations) of Line 1600 were conducted to validate the anomalies reported by the smart pigs. Nineteen examinations either directly confirmed the presence of hook cracking or were determined to likely be hook crack-related. Six examinations were performed at locations where crack-like

anomalies were reported, and hook cracking was confirmed in all six locations. Thirteen examinations were performed at locations where manufacturing-related metal loss was detected at the longitudinal seam: hook cracking was confirmed at four locations, and hook cracking was determined to be likely at the remaining nine locations. Where appropriate, anomalies associated with the pipe long seam and base metal flaw, as well as mechanical damage, were remediated through a combination of replacing sections of pipe, installing repair bands, or grinding out smaller base metal or workmanship flaws. Findings from the direct examinations resulted in the following remediation activities:

- Ten cylindrical replacements (totaling approximately 290 feet) to remediate[30] a mechanical damage defect and mitigate[31] 140 flaws (approximately 77% were longitudinal seam weld and base metal flaws from the pipe manufacturing process),
- 39 repair bands to remediate 17 defects due to both mechanical/third-party damage and 68 nearby flaws (approximately 87% were longitudinal seam weld and base metal flaws from the pipe manufacturing process), and
- 84 repairs to mitigate workmanship and base metal flaws from the construction and manufacturing process.

I. Existing State of Line 1600

During 2016, SDG&E and SoCalGas completed an additional AMFL in-line inspection of Line 1600. An inspection using CMFL technology was also initially planned, but in-line inspection vendors raised the concern that available CMFL tools were unlikely to successfully navigate Line 1600 due to the presence of shorter radius elbows throughout the pipeline. SDG&E and SoCalGas attempted to obtain the same CMFL tool that previously successfully inspected Line

[30] Remediate means an operation or procedure that transforms an unacceptable condition to an acceptable condition by eliminating the causal factors of a defect.

[31] Mitigate means the limitation or reduction of the probability of occurrence or expected consequence for a particular event.

1600; however, that tool had been decommissioned and permanently retired. SDG&E and SoCalGas worked with the CMFL in-line inspection vendors and selected the tool thought to have the highest chance of successfully negotiating the geometry of Line 1600. In November 2016, an attempt to run the selected tool was initiated but resulted in failure when the tool became lodged in the pipeline. This resulted in a shutdown of a section of the line so the tool could be extracted. To date, the inability to perform in-line inspections of Line 1600 using CMFL technology remains an outstanding concern. Consistent with the Commission's directives in D.11-06-017 and the statutory requirements of Public Utilities Code section 958, the scope of work identified in this Plan includes the work necessary to retrofit or replace shorter radius elbows and other legacy features in Line 1600 that prevent SDG&E and SoCalGas from using CMFL technology to complete in-line inspections of Line 1600.[32]

Assessment data from both in-line inspection technologies demonstrate that for the remaining anomalies in Line 1600, adequate safety margins exist for operation at both its current MAOP of 512 psig and at its previous MAOP of 640 psig. Under 49 CFR section 192.939(a), operators are required to establish a reassessment interval for each covered section and prescribes methods for determining an interval based upon the safety margins calculated for remaining flaws. The maximum reassessment interval allowed under TIMP for any covered section is seven years, although findings may yield longer duration intervals as prescribed in 49 CFR sections 192.939(1) through 192.939(3). A covered section is assigned a maximum

[32] *See* D.11-06-017 at 32, Ordering Paragraph 8 ("The Implementation Plan must consider retrofitting pipeline to allow for in-line inspection tools. . . .") and Cal. Pub. Util. Code § 958 ("At the completion of the implementation period, all California natural gas intrastate transmission line segments shall . . . [w]here warranted, be capable of accommodating in-line inspection devices.").

reassessment interval when the remaining flaws are not expected to exceed acceptable safety limits prior to the next assessment. Each integrity assessment of Line 1600 has resulted in a maximum reassessment interval of seven years.

While Line 1600 is safe for service as it is being operated today, to continue operating the pipeline at a transmission service level, it must be pressure tested or replaced as part of PSEP. As the 2017 Kiefner Report concludes, "While there is no evidence that Line 1600 is unsafe, there is much that is unknowable about the line, including the ability of girth welds to withstand loadings from natural events, and features in the longitudinal seams. Risk is proportional to what is unknown, at least in part."[33] Though the study specifically referred to the 36-inch diameter replacement pipeline proposed in A.15-09-013, the identified concerns pertaining to the operation of vintage pipe sections remain the same. All new sections of modern pipe installed to replace legacy pipe sections will eliminate gaps in integrity data that contribute to risk. As discussed in greater detail in this Plan, although replacement of the entirety of Line 1600 may be a more cost effective investment in the long term, replacing portions of Line 1600 in HCAs and pressure testing portions of Line 1600 in non-HCAs is a reasonable approach to bringing Line 1600 into compliance with the Commission's directives in D.11-06-017, D.14-06-007, D.18-06-028, and Public Utilities Code section 958 as soon as practicable.

[33] 2017 Kiefner Report at 2 and 31.

VI. ADDITIONAL PUBLIC SAFETY AND PROPERTY/ENVIRONMENTAL PROTECTION MEASURES

A. Interim Safety Enhancement Measures

SDG&E and SoCalGas have implemented several safety enhancement measures with respect to Line 1600 to increase the margin of safety and validate the integrity of the line pending completion of pressure testing or replacement activities under PSEP. These interim safety measures include pressure reductions, in-line inspection assessments, and conducting instrumented leak surveys at greater frequencies.

The historic MAOP of Line 1600 was 800 psig. SDG&E and SoCalGas reduced the MAOP to 640 psig in 2011 and then again to 512 psig in July 2016.[34] Lowering the MAOP of Line 1600 to 31.5% of its specified minimum yield strength (SMYS) increases the margin of safety for Line 1600, partially mitigating the integrity risks associated with the pipeline.

In addition to the second pressure reduction noted above, in Resolution SED-1 dated August 18, 2016 (Resolution), the Commission directed SDG&E and SoCalGas to perform several interim safety measures on Line 1600. In compliance with the Resolution, the following actions were or are being taken to enhance the safety of Line 1600 until implementation of the Plan is complete:

- During July 2016, the operating pressure was reduced with maximum limits set not to exceed 512 psig.

[34] In July 2011, the Utilities voluntarily reduced the MAOP of Line 1600 to 640 psig in response to the safety recommendations issued by the National Transportation Safety Board on January 3, 2011. *See* R.11-02-019 *Report of Southern California Gas Company (U 904 G) and San Diego Gas & Electric Company (U 902 G) on Actions Taken in Response to the National Transportation Safety Board Safety Recommendations* (April 15, 2011). On July 8, 2016, the Commission's Executive Director ordered the Utilities to reduce the MAOP of Line 1600 further to 512 psig. This was ratified in Commission Resolution SED-1.

- An additional in-line inspection was performed in 2016 using an axial magnetic flux leakage tool, with the exception of the Lake Hodges crossing, which had just recently been inspected in 2015.
- Replaced the section at Engineering Section 17-31.
- Performing bi-monthly instrumented leak surveys.

In summary, in-line inspection-related repairs coupled with the reduced operating pressure on Line 1600 have already created a significant safety margin to allow the line to continue to operate at its current capacity until replacement and pressure testing can be completed in association with the Plan outlined in this document.

B. List of Structures Abutting or Within Existing Line 1600 Easement

As part of developing the Plan, and in conformance with D.18-06-028, SDG&E and SoCalGas performed an analysis to identify structures that abut or encroach within the existing rights-of-way (ROW) for Line 1600. In D.18-06-028 (at 92), the Commission orders SDG&E and SoCalGas to:

> [P]rovide a detailed summary of existing physical commercial and residential structures that directly abut the edge of the easement (and any possible encroachments that lie within the easement) on Line 1600, including GPS coordinates. Based on this analysis, Applicants shall also identify proposed rerouting of the line in specific sections and/or removal or moving of specific physical structures, known at this time, due to safety compliance reasons.

SDG&E and SoCalGas continuously monitor the rights-of-way of transmission pipelines, including Line 1600, to identify surface conditions on or adjacent to pipeline ROWs, construction activity, encroachments and other factors that could impact the safety and operation of transmission pipelines. Commission GO 112-F, section 143.5, Encroachments, establishes the following requirements for natural gas pipeline operators in California:

> With the exception of gas pipeline facilities related to installations in gas meter rooms or other specially designed indoor locations where an outdoor meter installation is not possible or practical, a utility transporting LNG, natural gas or other gas shall not construct any part of a LNG, natural gas or other gas pipeline system under a building. In addition, the utility shall not allow a building or other encroachments to be constructed on to its pipeline right-of-way that would hinder maintenance activities on the pipeline or cause a lengthy delay in accessing its pipeline facilities during an emergency. If the utility finds a building or other encroachment built over a pipeline facility after the effective date of this section, then the utility may require the party causing the encroachment to remove the building or other encroachment from over the pipeline facility or to reimburse the utility for its costs associated with relocating the pipeline system.[35]

In preparing this Plan, SDG&E and SoCalGas conducted a detailed assessment of the Line 1600 ROWs and adjacent structures to compile the information required to be included in the Plan under D.18-06-028. This assessment confirms there are no known encroachments on Line 1600 that would hinder maintenance activities on the pipeline or cause a lengthy delay in accessing Line 1600 during an emergency.

While the width of the existing Line 1600 varies in some locations, the existing Line 1600 ROW is predominantly 20 feet wide, with the pipeline generally located along the center of the easement. For the purposes of preparing the analysis required under D.18-06-028, SDG&E and SoCalGas identify all structures located within fifteen feet of the pipeline. As described in greater detail below, SDG&E and SoCalGas completed this assessment by analyzing geospatial data and conducting confirmatory field investigations to physically locate the pipeline relative to adjacent structures at identified locations.

[35] Consistent with the requirements of GO 112-F, the majority of the easements for Line 1600 contain a provision that precludes landowners from constructing "any building or other structure within 15 feet of any pipe, or plant any trees over said pipe, or drill or dig any well in a location which would jeopardize the safe use and operation of said pipe lines."

The first step in SDG&E and SoCalGas' process was to analyze available information to identify commercial and residential structures near the pipeline. SDG&E and SoCalGas used the centerline geometry of Line 1600, which is based upon finalized construction completion drawings dimensioned from property boundaries and other land reference points and validated with inertial measurement unit (IMU) results obtained during inline inspection of the pipeline. The source data related to the location of nearby structures is based upon structure geometry that has been digitized as a polygon from orthorectified aerial imagery that is obtained annually through custom flight(s). During this first step, to screen for structures near the pipeline, a conservative buffer of 30 feet was created from the mapped centerline of the pipeline. This screening process identified 250 mapped locations of interest potentially falling within the 30-foot screening buffer.

Next, these locations were further investigated in the field by SDG&E Pipeline Locators who reviewed the sites and marked out and measured the pipeline location relative to the identified sites. Of the 250 identified locations, 216 were confirmed to be located more than 15 feet from the pipeline or of permissible use, such as open space, softball fields, etc. As such, those 216 locations were cleared as not warranting further investigation. SDG&E and SoCalGas identified 34 remaining locations where structures reside within 15 feet from the pipeline. Of these, SDG&E and SoCalGas identified no structures built over the pipeline or in a location that would hinder maintenance activities on the pipeline or cause a lengthy delay in accessing Line 1600 during an emergency.

A summary of these 34 locations is presented in Table 10 below along with GPS points, as required in D.18-06-028. Under the proposed Plan outlined in this document, at any locations

where a structure resides within ten feet of the pipeline, the existing Line 1600 pipeline will be relocated to a new location sufficiently far away from the identified structure.

Table 10
Structures Identified Within or Abutting Line 1600 Easements

ADDRESS/ DESCRIPTION	GPS COORDINATES
[redacted]	

ADDRESS/ DESCRIPTION	GPS COORDINATES
[redacted]	

C. Environmental Protection Measures

During the planning stages of a project, environmental subject matter experts (SMEs) complete a Detailed Environmental Review (DER). A DER provides the project execution team with a summary of the potential environmental constraints and/or conditions required to be addressed prior to clearing the project for construction. It also identifies potential environmental permits that may be required to complete a project. If a project requires a permit from an environmental agency, environmental subject matter experts prepare and submit the required documents and work with the applicable agency to secure the permit.

Prior to construction the environmental experts may deliver an Environmental Clearance to the PSEP Project Manager and construction team. The Environmental Clearance outlines environmental restrictions or allowances (for example, where vegetation clearing may or may not be permitted). The environmental experts may also provide Worker's Environmental Awareness Procedure (WEAP) training materials for use in informing/educating individuals working on the project. If required for a project, the environmental experts may also contract environmental monitors who work with the construction team to ensure compliance with permit conditions and/or local, state or federal regulations.

VII. PROPOSED PLAN PRELIMINARY COST FORECAST AND ESTIMATING METHODOLOGY

SDG&E and SoCalGas prepared preliminary estimates for each of the design alternatives considered in the preparation of this Plan, in accordance with the Commission's directive in D.18-06-028 to "include best available expense and capital cost projections for each prioritized segment and each test year."[36] The preliminary cost estimates presented in this Plan were prepared by a dedicated PSEP cost estimating team[37] using the methodology refined by the team over time to estimate in-service pipeline pressure test and replacement projects. Since first implementing PSEP over six years ago, SDG&E and SoCalGas have continued to enhance estimate accuracy by incorporating actual costs and activity timelines encountered. These continuous improvement enhancements have resulted in a more robust estimating tool and process that incorporates the input of subject matter experts. These subject matter experts apply their respective expertise and professional experience to provide estimate assumptions for their respective areas, which then form the basis of each estimate.

SDG&E and SoCalGas assessed the project parameters, conducted site visits to determine feasibility of construction within existing rights-of-way and relocation routes, developed preliminary designs and reviewed maps, and analyzed environmental restrictions and workspaces. The project cost estimates consider project execution, engineering design, and construction considerations, as further described below. As described in greater detail below, the cost estimates for the alternatives presented in this Plan utilized subject matter expertise and professional experience to develop the assumptions that form the basis of each

[36] D.18-06-028 at 91.

[37] In 2015, SDG&E and SoCalGas formed a dedicated estimating department to increase focus on the quality and accuracy of estimates.

estimate. As also described in further detail below, estimates are based on the best information available at this engineering, design and planning stage and, as such, SDG&E and SoCalGas expect both foreseeable and unforeseeable conditions to be encountered during construction that will result in actual expenditures that vary from these initial preliminary estimates.

A. Proposed Plan Preliminary Cost Forecast

Tables 11a and 11b below summarizes the direct and fully loaded and escalated preliminary cost forecast for SDG&E and SoCalGas' proposed Line 1600 Test and Replacement Plan. Cost estimates are based on the preliminary scoping of the work, validated by field visits to the proposed construction and testing sites. Given that the scope of work described in the Plan is conceptual at this time, and detailed engineering and project planning will not be completed until after the Plan is submitted, the available information only enables development of a Class 4 level estimate. Annual spending forecasts are based on a combination of project estimates and the anticipated work schedule.

Table 11a
Direct ($2018) Proposed Plan Preliminary Cost Forecast
(in Millions)

	Cost to Date	2019	2020	2021	2022	2023	2024	Total
Cap	$ 24	$ 34	$ 124	$ 155	$ 106	$ 56	$ 6	$ 506
O&M	$ 2	-	-	-	$ 6	$ 18	$ 13	$ 39
Total	**$ 26**	**$ 34**	**$ 124**	**$ 155**	**$ 112**	**$ 74**	**$ 19**	**$ 545**

Table 11b
Loaded and Escalated Proposed Plan Preliminary Cost Forecast
(*in Millions*)

	Cost to Date	2019	2020	2021	2022	2023	2024	Total
Cap	$ 30	$ 41	$ 152	$ 193	$ 134	$ 72	$ 8	$ 630
O&M	$ 2	-	-	-	$ 7	$ 22	$ 16	$ 47
Total	**$ 33**	**$ 41**	**$ 152**	**$ 193**	**$ 141**	**$ 94**	**$ 24**	**$ 677**

In addition to reflecting a more refined cost estimating methodology that better reflects actual costs and timelines incurred on prior PSEP projects, this preliminary estimate reflects the overall escalation of pipeline construction costs that has occurred since similar estimates were prepared for A.15-09-013 more than three years ago. Some costs, such as for steel, have significantly increased over the last three years beyond standard escalation rates. Additionally, to accommodate assessment of 1949-vintage portions of Line 1600 using advanced in-line inspection technology, a greater number of pipeline features must be cut out of the pipe and replaced prior to pressure testing than initially contemplated when estimates were prepared for A.15-09-013.

Notwithstanding improvements in and level of rigor of the estimating methodology implemented by SDG&E and SoCalGas, estimates remain estimates. As such, SDG&E and SoCalGas expect conditions to be encountered that will result in actual expenditures varying from estimates. This forecast is therefore subject to adjustment once detailed engineering, project planning and permitting information becomes available as the Plan moves beyond the high-level preliminary scoping phase. Additional detail regarding the estimating methodology employed by SDG&E and SoCalGas to develop the Plan forecast is described below.

B. Planning and Engineering Design

For the purpose of developing the pressure test estimates in this Plan, SDG&E and SoCalGas undertook the following work:

- Assessment and confirmation of project parameters;
- Site visits;
- Review of feature studies;
- Coordination with SoCalGas/SDG&E Gas Engineering and Pipeline Integrity groups to identify repairs/cut-outs for anomalies and in-line inspection compatibility;
- Development of a pipeline profile using ground elevation data for hydrotest planning purposes;
- Determination of maximum and minimum allowable test pressures, and corresponding sectioning of the pipeline into test sections;
- Development of a high-level preliminary routing and design for each section;
- Desktop environmental review of routing options to identify potential environmental constraints and permits;
- Analysis of seasonal restrictions; and
- Determination of additional valve locations, as required.

C. Development of the Project Cost Estimate

As part of the scope definition process described above, subject matter experts representing key areas of the project planning process have contributed to the estimate development.

In alignment with the Association for the Advancement of Cost Engineering (AACE) Recommended Practice 17R-97, the cost estimate for the various options in this Plan were developed under a Class 4 estimate classification. Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are

typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Typically, engineering is from 1% to 15% complete, and would comprise at a minimum the following: plant capacity, block schematics, indicated layout, process flow diagrams (PFDs) for main process systems, and preliminary engineered process and utility equipment lists. In the case of this estimate, the preliminary layout was provided in order to develop quantities and assumptions for construction with support for the project team and construction SMEs.

Class 4 estimates generally use factored estimating methods such as gross unit costs/ratios and other parametric and modeling techniques. In the case of this estimate, a combination of gross unit costs and parametric estimating methods were utilized. Based upon the scope and quantities presented, the estimating department developed construction costs for each key quantity unit. For each option, the quantities were updated to account for high level items with very limited knowledge of the geotechnical conditions, detailed/specific routing, permit or traffic restrictions.

Typical accuracy ranges for Class 4 estimates are -15% to -30% on the low side, and +20% to +50% on the high side, depending on the technological complexity of the project, appropriate reference information, and other risks (after inclusion of an appropriate contingency determination, consistent with industry standard). Ranges could exceed those shown if there are unusual risks.

D. Project Execution

Project Execution subject matter experts provide the following in support of estimate development:

- For replacement projects, analysis of alternatives to replacement (*e.g.*, abandonment, de-rating the line, and non-destructive examination for short sections);
- Validation of appropriate replacement diameter;
- Identification of taps and laterals within pressure test or replacement sections;
- Assessment of potential system and customer impacts and development of mitigation strategies;
- Identification of pipeline features to be cut out prior to a pressure test (*e.g.*, pipeline anomalies, non-piggable features, and obsolete appurtenances);
- Identification of potential valve additions;
- Review and approval of scope of work; and
- Review and approval of project-specific pressure test procedures, when applicable.

E. Engineering Design

Engineering Design consists of performing the planning and engineering design work necessary to provide a scope of work with sufficient detail to develop more robust project cost estimates. The scope of work is intended to facilitate the proximation of all identifiable cost components up to, and including, the completion of construction and close-out. The typical planning and engineering design scope includes the following considerations:

- Assessment and validation of project extent/parameters;
- Physical visit to job site to gain familiarity with the area;
- Development of preliminary design for each work site;
- Development of pipeline profile;
- Identification of pressure test sections based on the minimum and maximum allowable test pressures in order to achieve required test pressures; and
- Identification of any special pipeline crossings for replacement projects (*e.g.*, waterways, railroads, freeways, etc.).

F. Environmental

Environmental subject matter experts conduct a desktop review of the route options, identify potential environmental permits and provide estimated costs for the following items in support of estimate development:

- Environmental Services (consultant support for planning, permitting, field surveys, construction and closeout);
- Abatement of potential asbestos containing material and lead paint, as applicable;
- Water treatment, waste management and disposal costs, as applicable;
- Potential permit fees; and
- Potential mitigation fees.

G. Construction

The forecast of construction costs incorporates input from SDG&E and SoCalGas subject matter experts and impacted organizations including the following elements:

- Input from contractors with construction expertise;
- Field walk with all parties to capitalize on combined expertise for assessment of constructability issues; and
- Review of engineering design package to determine construction assumptions.

H. Land Services

Land Services provides the following in support of estimate development:

- Determination of applicable municipal permit requirements and associated costs;
- Identification of potential laydown/staging yards required for individual projects, and subsequent communication with land owners as required to determine availability; and
- Development of cost estimates associated with laydown yards, temporary construction easements, grants of easement, appraisals, title reports, etc.

I. Compressed Natural Gas/Liquefied Natural Gas (CNG/LNG) Team

The CNG/LNG Team provides the following in support of estimate development:

- Provision of analyses on impacted customer natural gas loads to determine optimal process for keeping customers online; and
- Development of cost estimates for the provision of CNG/LNG.

J. Supply Management

To assist in developing cost estimates, Supply Management provides material and logistics-related cost estimates based on a preliminary bill of material developed by the Project Team.

K. Estimating

Upon receipt of input from the above subject matter experts, a comprehensive estimate is developed incorporating the various teams' analyses. The estimating team works with the subject matter experts to identify potential risks and their potential for occurrence. The results are factored into the project cost estimate.

VIII. ALTERNATIVE DESIGNS

A. Overview

As part of developing the Line 1600 Test or Replacement Plan, SDG&E and SoCalGas considered four alternative designs. The alternative designs were evaluated consistent with the requirements set forth in D.18-06-028 and the overarching objectives of SDG&E and SoCalGas' PSEP to: (1) comply with the Commission's directives; (2) enhance public safety; (3) minimize customer impacts; and (4) maximize the cost effectiveness of safety investments. Engineering factors associated with the unique characteristics of existing Line 1600 were also central to the evaluation. The alternative designs that were considered but not selected include:

- Full hydrostatic strength testing (hydrotesting) of the entire length of Line 1600. Referenced as Line 1600 Full Hydrotest Alternative, or "Full Hydrotest."

- Full replacement of all vintage sections of Line 1600 in existing streets near Line 1600, with a derate of existing Line 1600 in the north. Includes a pressure reduction of existing Line 1600 in the north to distribution pressure. Referenced as Line 1600 Full Replacement Alternative A – Nearby Streets, or "Full Replacement Nearby Streets."

- Full replacement of all vintage sections of Line 1600 using Old Highway 395 in the north and nearby streets in the south. Includes a pressure reduction of existing Line 1600 in the north to distribution pressure. Referenced as Line 1600 Full Replacement Alternative B – Hwy 395 North, Nearby Streets South, or "Full Replacement Hwy 395."

Information regarding these three alternative designs is presented below.

B. Full Hydrotest Alternative

As required under D.18-06-028, SDG&E and SoCalGas considered performing a full hydrostatic test of the entire approximately 50-mile length of Line 1600 as one design alternative. A map of the scope of work associated with the Full Hydrotest alternative design is presented below in Figure 4. In evaluating this alternative, SDG&E and SoCalGas considered the technical aspects of how the entirety of Line 1600 could be hydrotested. The evaluation also considered gas supply to local distribution customers during testing of individual pipeline segments of Line 1600 that is necessary to minimize customer impacts.

The preliminary loaded and escalated cost estimate of the Full Hydrotest alternative based on high level scoping of this work is approximately $325 million. Of the total estimated loaded and escalated cost, SDG&E and SoCalGas anticipate recording approximately $92 million as a capital expense and approximately $233 million as an operating expense. SDG&E and SoCalGas developed a project schedule that factors in time for detailed planning, engineering, and permitting activities, as well as time for construction and testing. This conceptual schedule

is presented below in Figure 5. A corresponding annual spending forecast is presented in Tables 12a and 12b.

Figure 4: Full Hydrotest Alternative

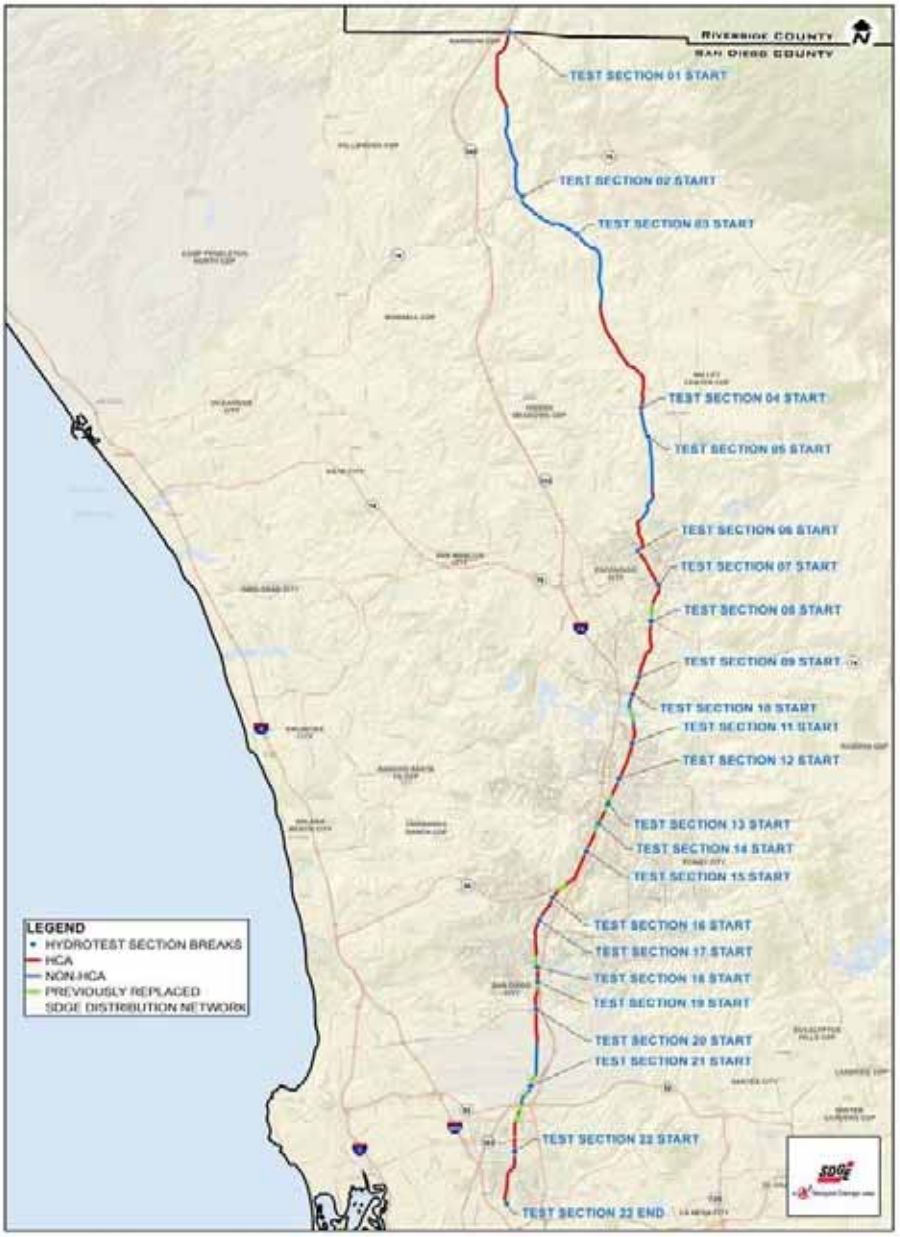
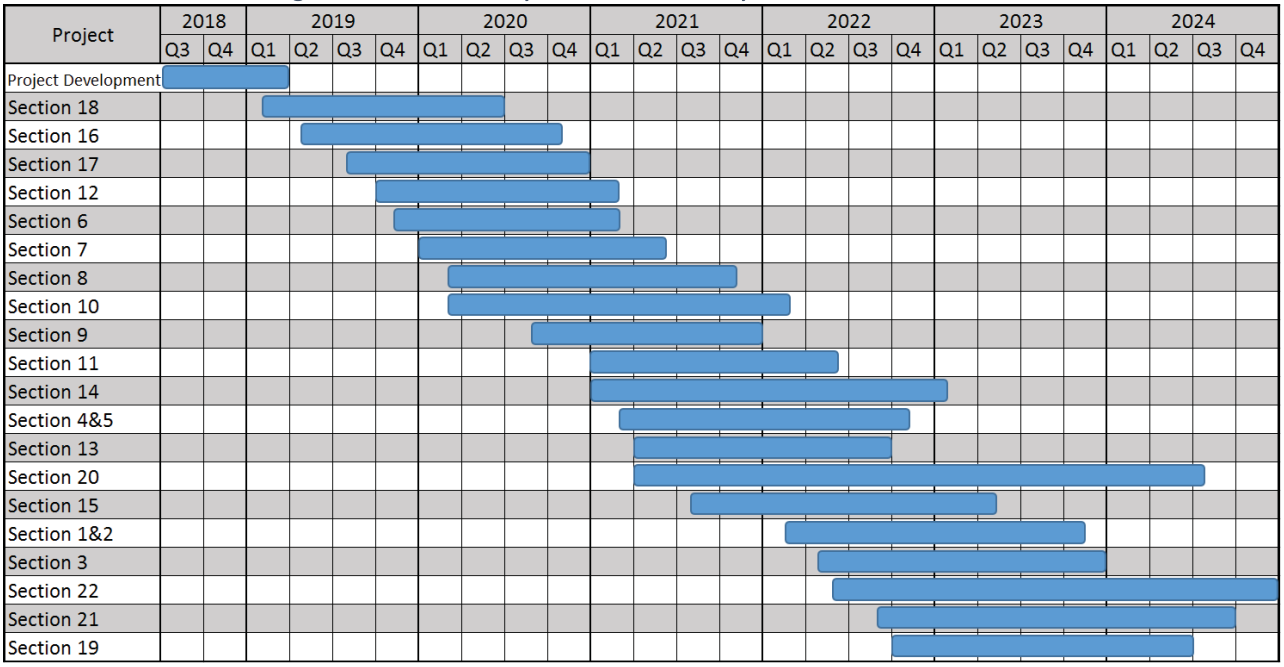


Figure 5: Preliminary Schedule Full Hydrotest Alternative



Hydrotesting the entirety of Line 1600 presents numerous challenges. Line 1600 supplies gas to approximately 150,000 gas meters, many of which have no alternative supply source if Line 1600 is out of service. There are 62 connections on the line that currently provide service to major communities as well as individual customers, including the military, electric generation, and large industrial customers.

To hydrotest Line 1600, 22 separate tests would need to be performed. The 22 test sections are needed to account for elevation changes and to minimize interruption of service to customers. In addition, the scope and schedule needed to account for the high natural gas demands experienced during the summer months due to electric generation prohibit testing of the northern section during that time period. In order to maintain natural gas service during hydrotesting, a combination of various activities will be needed and include back feeding Line 1600, providing temporary supplies via CNG trailers or NG bottles, LNG supplies, or building bypass pipelines. Adequate work space must be secured for test equipment including test

heads, pumps and water storage tanks. As part of the commitment to make Line 1600 fully piggable, preparation of a test section includes the removal of wrinkle bends, shorter radius bends and elbows, pressure control fittings, and other features that prevent the performance of in-line-inspections to assess the integrity of the legacy pipeline using commercially available CMFL (long seam) smart pigging tools.

Test segments were designed according to elevation restrictions, valve sites, large taps, and accessibility/workspace. The tests range from approximately 2,800 feet to 7.5 miles in length, with the average being approximately two miles. The pipeline would be sectionalized at each large tap or valve using either stopples or the main line block valve and installing temporary bypass lines to serve the large customers or major distribution feeder lines.

Since testing requires a flow path from either the north or the south, only one test can be conducted at a time. It is assumed all test water would be filtered and properly disposed of at the end of each test. Each test segment would take approximately four to six weeks to conduct and assumes a separate construction crew would install bypasses concurrently with the hydrotesting effort. Some segments may take longer depending on the specific scope of work on that particular section and permit conditions. If a section of pipe fails the hydrotest, the leak will need to be located, repairs made, and a new test initiated. This could extend the schedule and result in additional costs.

This alternative design contemplates strength-testing by hydrotest with a minimum test pressure of 960 psig, which is 1.5 times the most recent historical MAOP of 640 psig. This minimum test pressure of 960 psi would be held continuously for at least eight hours. A spike test is also included with each test, raising the pressure approximately 5% for one-half hour at

the beginning of the test. The maximum test pressure would be higher in some cases to accommodate elevation differences and is based on an objective to not exceed 90% SMYS or 1462 psig.

Tables 12a and 12b below summarizes the direct and fully loaded and escalated preliminary cost forecast for the Full Hydrotest alternative.

Table 12a
Direct ($2018) Full Hydrotest Alternative Preliminary Cost Forecast
(in Millions)

	Cost to Date	2019	2020	2021	2022	2023	2024	Total
Cap	$ 7	$ 4	$ 12	$ 11	$ 15	$ 14	$ 6	$ 70
O&M	$ 18	$ 11	$ 32	$ 30	$ 41	$ 38	$ 16	$ 186
Total	**$ 26**	**$ 15**	**$ 44**	**$ 41**	**$ 56**	**$ 52**	**$ 22**	**$ 256**

Table 12b
Loaded and Escalated Full Hydrotest Alternative Preliminary Cost Forecast
(in Millions)

	Cost to Date	2019	2020	2021	2022	2023	2024	Total
Cap	$ 9	$ 5	$ 15	$ 15	$ 20	$ 19	$ 8	$ 92
O&M	$ 23	$ 13	$ 39	$ 37	$ 51	$ 49	$ 21	$ 233
Total	**$ 33**	**$ 18**	**$ 54**	**$ 52**	**$ 71**	**$ 68**	**$ 29**	**$ 325**

Following PSEP project evaluation criteria and considering the engineering factors associated with the unique characteristics of the vintage A.O. Smith electric flash welded pipe, SDG&E and SoCalGas determined the Full Hydrotest alternative design is not the best design to pursue. While it is the least expensive, in terms of minimally achieving compliance with Public Utilities Code section 958, it does not resolve long term safety considerations associated with the legacy pipe in populated areas. As discussed earlier in this Plan, these safety considerations, which include lack of fracture control and hook crack anomalies, would remain even if the line

passes the hydrotest. Pressure testing the existing Line 1600 pipeline does not reduce the rupture risk from future mechanical damage, remove sub-critical flaws that may grow or interact with other threats, improve the pipe material's resistance to rupture, or ensure that Line 1600 will remain in transmission service in the future. As such, SDG&E and SoCalGas concluded that the most prudent choice with respect to providing long term safety, reliability and operational benefits is to replace the HCA portions of this legacy pipe. Therefore, the Full Hydrotest alternative design is not proposed by SDG&E and SoCalGas.

C. Full Replacement in Nearby Streets Alternative

SDG&E and SoCalGas also considered performing a full replacement of Line 1600 re-routed in roads and streets near the existing Line 1600. A map of the scope of work associated with the Full Replacement in Nearby Streets alternative design is presented below in Figure 6. The scope of work South of Escondido is identical under the Replace in HCA/Test in Non-HCA, Full Replacement in Nearby Streets and Full Replacement Along Highway 395 alternatives. Because the scope of work South of Escondido is already described above as part of the proposed Plan, this discussion focuses on the scope of work north of Escondido, specifically, the installation of new pipe north of the intersection of Line 1600 and Line 1601, [redacted]. This alternative offers the advantage that all 1949-vintage A.O. Smith pipe would be removed from transmission service in both HCAs and non-HCAs, thereby increasing the margin of safety and long-term reliability of the entire pipeline for the benefit of customers. This also provides the opportunity to restore the MAOP of Line 1600 to 800 psig, which matches that of the other transmission pipelines it will interconnect with and would allow Line 1600 to provide greater benefit in the event of an outage or pressure reduction on Line 3010. SDG&E and

SoCalGas' plan would be to operate so as not to exceed the capacity requirement of the Commission Decision, even though the line would be constructed and tested to allow for the potential to operate at an MAOP of 800 psig.

This alternative includes a pressure reduction and conversion of the old Line 1600 to 60 psig distribution pressure from Rainbow Station in the north to the intersection with Line 1601 in [redacted], thereby eliminating the need for installation of long runs of smaller diameter pipe between the new Line 1600 and the existing old Line 1600.

The Full Replacement in Nearby Streets route requires approximately 56 miles of 16-inch pipeline, as follows:

- Install 25 miles of 16-inch diameter pipe from Rainbow Station to Line 1601.
- Install 31 miles of 16-inch diameter pipe from Line 1601 to Mission Station.

The route involves installation along several narrow, winding, and rocky San Diego County roads, including Rainbow, Rice Canyon, Couser Canyon, Lilac, and Valley Center Roads. The southern terminus of this route is within the jurisdiction of the City of Escondido, with pipe installation in relatively high-traffic volume city streets. A minimum of three (3) jack-and-bore[38] installations and two (2) horizontal directional drill installations[39] would be required. Due to the narrow county roads with widespread potential for rock in the trench line, construction experts anticipate some of the lowest rates of production along these roads, which is expected to

[38] Jack-and-bore is a form of installation that enables construction crews to drill a horizontal hole underground between two points without disturbing the surface between the sending and receiving excavation pits. This method of drilling is costlier than a standard open trench method, and may be necessary to address anticipated site conditions, such as adjacent facilities, and/or permitting requirements.

[39] Horizontal Directional Drilling is a trenchless method of construction. Like jack-and-bore, this construction method is costlier than a standard open trench method, but may be necessary to address anticipated site conditions, such as adjacent facilities, and/or permitting requirements.

increase overall construction costs. For this reason, the Full Replacement in Nearby Streets alternative route is estimated to be the costliest of the full replacement alternatives, at a capital cost of $778 million (loaded and escalated). SDG&E and SoCalGas developed a preliminary schedule that factors in time for detailed planning, engineering, and permitting activities, as well as time for construction and post-construction testing. This preliminary schedule is presented below in Figure 7. A corresponding annual spending forecast is presented in Table 13.

Figure 6: Full Replacement in Nearby Streets Alternative

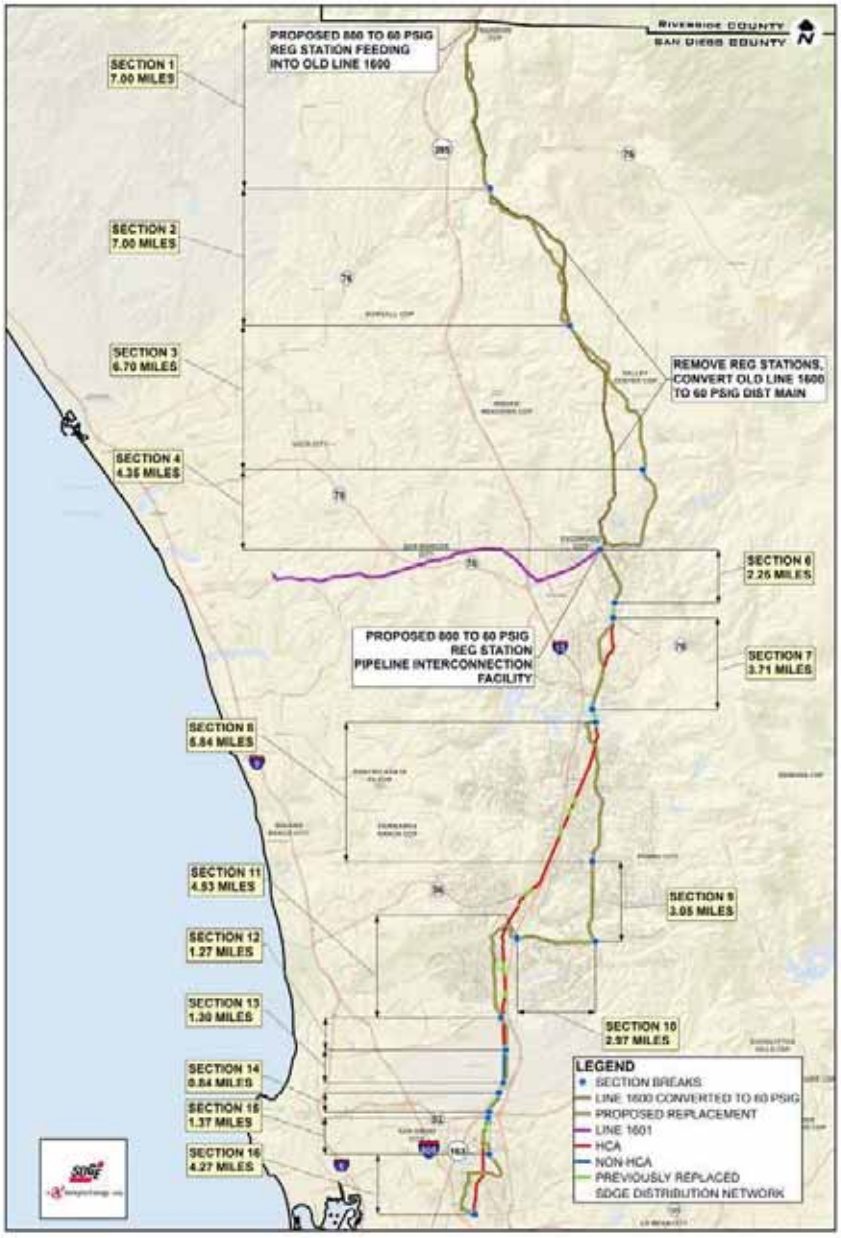
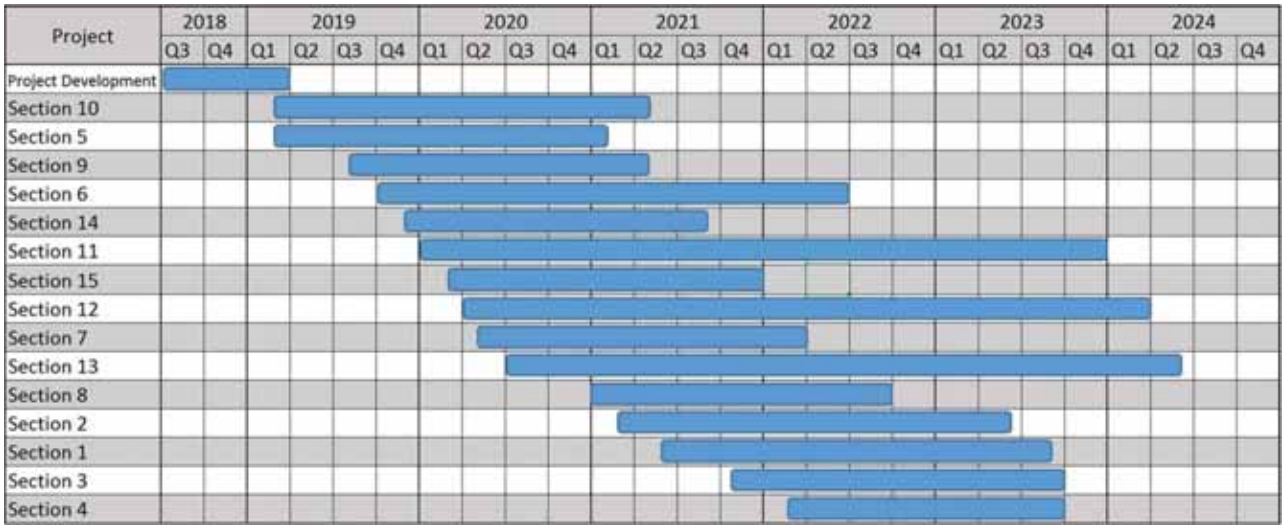


Figure 7: Preliminary Schedule for Full Replacement in Nearby Streets Alternative



The Full Replacement in Nearby Streets alternative is considered a viable and beneficial design alternative in that full replacement of the existing 1949 vintage A.O. Smith pipe enhances safety, improves reliability, and eliminates certain operations and maintenance difficulties. Benefits are summarized below:

- Replacement of 1949 A.O. Smith pipe in non-HCA areas enhances the safety margin in such areas. Although such areas do not fall within the High Consequence Area definition under federal regulations, failure of a natural gas pipeline in non-HCAs still poses risks to people, society and the environment.

- Full replacement of 1949 A.O. Smith pipe in Line 1600 ensures that Line 1600 will remain capable of transmission service in the foreseeable future. The SDG&E natural gas transmission system relies on Line 3010 and Line 1600 to provide reliable service. Line 1600's capacity allows planned maintenance outages or pressure reductions on Line 3010. In the event of an unplanned outage or pressure reduction on Line 3010, Line 1600 provides capacity to maintain gas service to some or all customers, depending upon gas demand at the time.

- Full replacement of 1949 A.O. Smith pipe in Line 1600 would allow the restoration of an 800 psig MAOP on Line 1600, thus enhancing reliability of service to customers.

- Replacement of 1949 A.O. Smith pipe in non-HCAs eliminates the need to cut out pipeline components that are not piggable with CMFL (long seam) inline inspection tools (*e.g.*, shorter radius elbows and certain bend geometries), thereby enhancing

the ability of SDG&E and SoCalGas to assess and maintain the integrity of the pipeline. Many of these cutouts are in environmentally sensitive areas that require long-lead permitting.

- Elimination of hydrotests of 1949 vintage pipe in non-HCAs reduces the risk of environmental damage due to a hydrotest failure in environmentally sensitive areas of north San Diego county, as compared to the Full Hydrotest and Replace in HCA/Test in Non-HCAs alternatives. Hydrotest options, by necessity, require testing of a pipeline at a pressure much higher than the operating pressure.

As depicted in Tables 13a and 13b below, the Full Replacement in Nearby Streets alternative is the most costly alternative considered.

Table 13a
Direct ($2018) Full Replacement in Nearby Streets Preliminary Cost Forecast
(*in Millions*)

	Cost to Date	2019	2020	2021	2022	2023	2024	Total
Cap	$ 26	$ 30	$ 113	$ 184	$ 188	$ 81	$ 2	$ 623
O&M	-	-	-	-	-	-	-	-
Total	**$ 26**	**$ 30**	**$ 113**	**$ 184**	**$ 188**	**$ 81**	**$ 2**	**$ 623**

Table 13b
Loaded and Escalated Full Replacement in Nearby Streets Preliminary Cost Forecast
(in Millions)

	Cost to Date	2019	2020	2021	2022	2023	2024	Total
Cap	$ 33	$ 35	$ 138	$ 228	$ 237	$ 105	$ 2	$ 778
O&M	-	-	-	-	-	-	-	-
Total	**$ 33**	**$ 35**	**$ 138**	**$ 228**	**$ 237**	**$ 105**	**$ 2**	**$ 778**

Consistent with the overarching PSEP objective to maximize the cost effectiveness of safety enhancement investments for the benefit of customers, SDG&E and SoCalGas do not propose the Full Replacement in Nearby Streets alternative due to the higher costs of construction, and lack of discernible safety enhancement advantage above the Full Replacement in Highway 395 alternative described below.

D. Full Replacement Along Highway 395 Alternative

Lastly, SDG&E and SoCalGas considered performing a full replacement of Line 1600 in franchise roads and streets predominantly using old Highway 395 from Rainbow Station to the intersection of Line 1601 in Escondido at [redacted]. A map of the scope of work associated with the Full Replacement Along Highway 395 alternative design is presented below in Figure 8. As this design alternative is identical to the proposed Plan south of Escondido, the focus of this explanation is the pipe installation north of Escondido, specifically north of the intersection of [redacted] at Line 1601.

Like the Full Replacement in Nearby Streets alternative, the Full Replacement Along Highway 395 alternative offers the advantage that all vintage 1949 A.O. Smith pipeline would be removed from transmission service in both HCAs and non-HCAs, thereby increasing the margin of safety and long-term reliability of the entire pipeline for the benefit of customers. This also provides the opportunity to restore the MAOP of Line 1600 to 800 psig, which matches that of the other transmission pipelines with which it will interconnect.

This alternative includes a pressure reduction of the existing Line 1600 to distribution pressure from Rainbow Station in the north to the intersection with Line 1601 in Escondido at [redacted], eliminating the need for installation of long runs of smaller-diameter pipe between the new Line 1600 and the existing old Line 1600.

Installation along the Highway 395 Route requires approximately 57 miles of new large diameter pipeline, as follows:

- Install 24 miles of 16-inch pipe from Rainbow Station to Line 1601.
- Install 31 miles of 16-inch pipe from Line 1601 to Mission Station.

- Install two (2) miles of 10-inch from I-15 tie-in to Rice Canyon tie-in to the existing 10-inch diameter transmission level pressure pipeline that feeds the [redacted] electric generating station along Highway 76.
- Tie-in to and utilize two (2) miles of existing 16-inch Line 1601 from [redacted]. No hydrotest required.

The route requires installation across a small number of agricultural and undeveloped parcels within the jurisdiction of San Diego County. The southern terminus of this northern route section is within the jurisdiction of the City of Escondido, with pipe installation located down relatively high-volume city streets. A minimum of six (6) jack-and-bore installations are required, and one (1) horizontal directional drill installation is required. However, the majority of the replacement is within relatively open, wide, and low-traffic density roadways in the North County. Therefore, construction experts anticipate achieving some of the highest rates of production in these sections, which translates into improved cost efficiency overall for this option. For this reason, the Highway 395 Route is estimated to be the lowest cost of the full replacement design alternatives, at a capital cost of $725 million (loaded and escalated). SDG&E and SoCalGas developed a preliminary schedule that factors in time for detailed planning, engineering, and permitting activities, as well as time for construction and post-construction testing. This conceptual schedule is presented below in Figure 9. A corresponding annual spending direct and fully loaded and escalated forecast is presented in Table 14a and 14b below.

Figure 8: Full Replacement Along Highway 395 Alternative

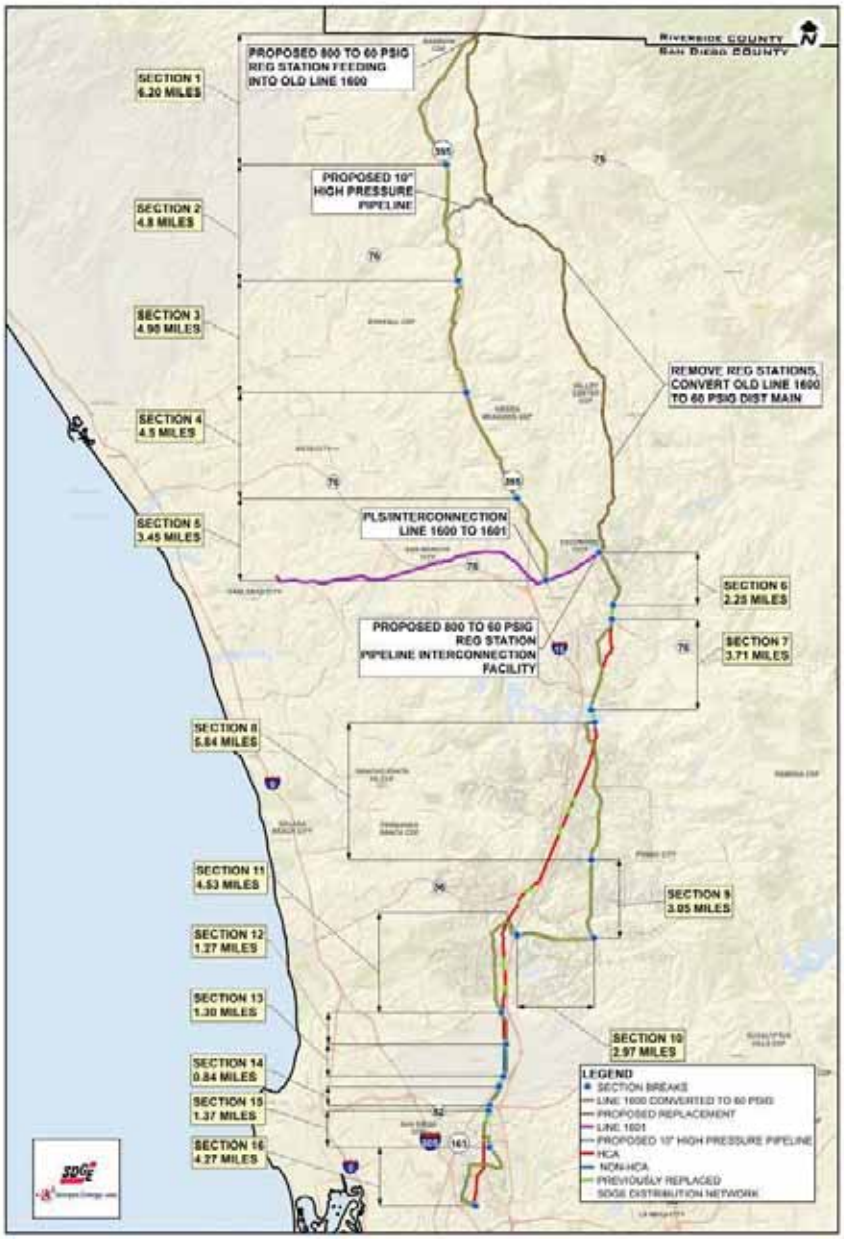
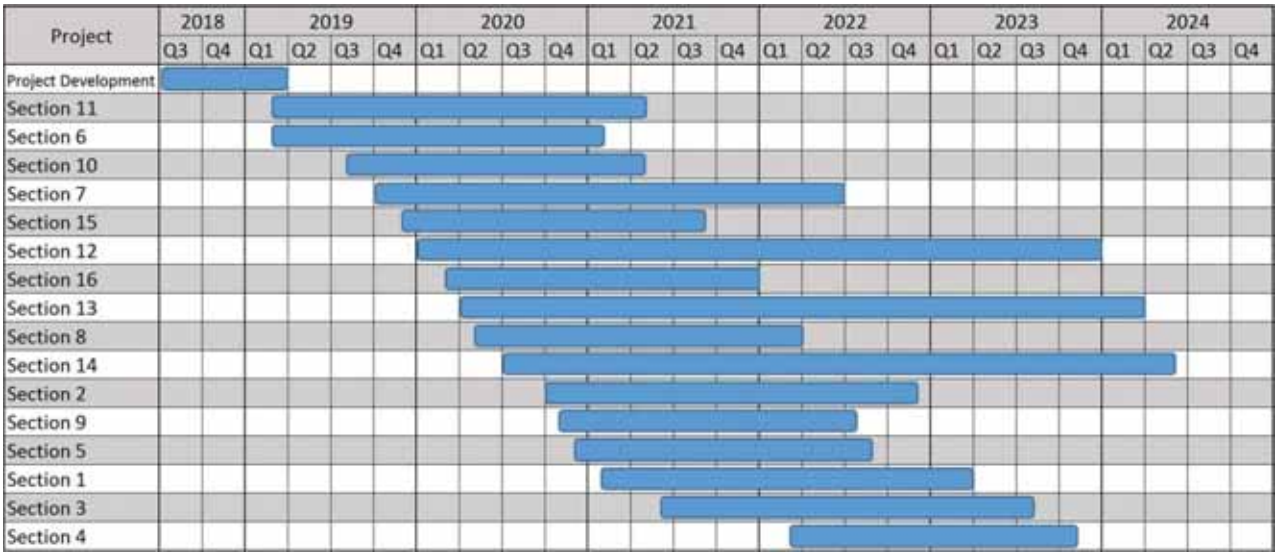


Figure 9: Preliminary Schedule Full Replacement Along Highway 395 Alternative



The Full Replacement Along Highway 395 alternative is considered a viable and beneficial design alternative in that full replacement of the existing 1949 vintage A.O. Smith pipe enhances safety, improves reliability, and eliminates certain operations and maintenance difficulties. These benefits are summarized as follows:

- Replacement of 1949 A.O. Smith pipe in non-HCAs enhances the margin of safety in those areas.

- Full replacement of all Line 1600 1949 A.O. Smith pipe enables Line 1600 to continue to provide reliable transmission service in the foreseeable future. The SDG&E natural gas transmission system relies on Line 3010 and Line 1600 to provide reliable service. Line 1600's capacity allows planned maintenance outages or pressure reductions on Line 3010. In the event of an unplanned outage or pressure reduction on Line 3010, Line 1600 provides capacity to maintain gas service to some or all customers, depending upon gas demand at the time. Full replacement of 1949 A.O. Smith pipe in Line 1600 would allow SDG&E and SoCalGas to potentially restore an 800 psig MAOP on Line 1600, with Commission approval, thus returning the full operational capability to serve customers.

- Replacement of 1949 A.O. Smith pipe in non-HCAs eliminates the need to cut out pipeline components that are not piggable with CMFL (long seam) in-line inspection tools (*e.g.*, shorter radius elbows and certain bend geometries), thereby enhancing the ability of SDG&E and SoCalGas to assess and maintain the integrity of the pipeline.

Many of these cutouts are in environmentally sensitive areas that may require long-lead permitting.

- Elimination of hydrotests of 1949 vintage pipe in non-HCAs reduces the risk of environmental damage due to a hydrotest failure in environmentally sensitive areas of north San Diego county, as compared to the Full Hydrotest and Replace in HCA/Test in Non-HCA alternative. Compliant hydrotests, by nature, require testing of a pipeline at a pressure much higher than the operating pressure.

- Installation along Highway 395, which parallels much of Interstate 15, enhances accessibility to the pipeline for maintenance or in the event of an emergency.

- Highway 395 is a wider road than the roads associated with the northern sections of the Full Replacement in Nearby Streets alternative and thus provides more working space during construction and maintenance, which results in less disruption to the community. Local communities are anticipated to be less affected by the Highway 395 route due to more effective traffic flow, thus causing only moderate traffic delays.

- Relatively wide, open roadways are expected to increase rates of production for this route, resulting in reduced installation cost.

SDG&E and SoCalGas recognize the value of full replacement along the Highway 395

Route, which include:

1) Increased safety margins in non-HCAs;

2) Enhanced reliability of the SDG&E natural gas transmission system;

3) Elimination of the challenges of acquiring specialized integrity assessment equipment to complete in-line inspections of Line 1600;

4) Reduced risk of hydrotest failures in non-HCAs;

5) Enhanced access to the pipeline for operations and maintenance of the new pipeline, thereby increasing safety and reducing future operations and maintenance costs;

6) Reduced construction burden on nearby communities compared to the Full Replacement in Nearby Streets alternative; and

7) Full and safe restoration of Line 1600's transmission function using modern materials, construction methods and safety features.

Table 14a
Direct ($2018) Full Replacement Along Highway 395 Preliminary Cost Forecast
(in Millions)

	Cost to Date	2019	2020	2021	2022	2023	2024	Total
Cap	$ 26	$ 31	$ 134	$ 195	$ 131	$ 61	$ 2	$ 580
O&M	-	-	-	-	-	-	-	-
Total	**$ 26**	**$ 31**	**$ 134**	**$ 195**	**$ 131**	**$ 61**	**$ 2**	**$ 580**

Table 14b
Loaded and Escalated Full Replacement Along Highway 395 Preliminary Cost Forecast
(in Millions)

	Cost to Date	2019	2020	2021	2022	2023	2024	Total
Cap	$ 33	$ 38	$ 164	$ 243	$ 167	$ 79	$ 2	$ 725
O&M	-	-	-	-	-	-	-	-
Total	**$ 33**	**$ 38**	**$ 164**	**$ 243**	**$ 167**	**$ 79**	**$ 2**	**$ 725**

Compared to the cost of the Replace in HCA/Test in Non-HCA alternative proposed, the loaded and escalated incremental cost to replace all the vintage A.O. Smith pipe is anticipated to be approximately $48 million. Although this design alternative offers the greatest safety enhancement benefits for a modest 7% increase in cost, SDG&E and SoCalGas do not propose this alternative.

IX. POTENTIAL PLAN MODIFICATIONS

As explained above, SDG&E and SoCalGas anticipate that the scope and schedule for each testing and replacement project section in this Plan will be refined over time as SDG&E and SoCalGas complete the detailed engineering, design and planning work necessary to safely complete the testing and replacement projects as soon as practicable. As with all Phase 1 PSEP projects, changes in scope that impact the schedule of a Line 1600 test or replacement project

will be reflected in the PSEP status reports submitted to SED and Energy Division on a monthly basis under D.12-04-021.

In the event that additional information or conditions are identified during implementation of this Plan which lead SDG&E and SoCalGas to conclude that it would be more prudent to replace a project section currently identified for pressure testing, SDG&E and SoCalGas propose to submit a revised Replacement plan for that section to SED for review and concurrence with the change in scope. Circumstances that could lead to such changes in scope may include: (1) receipt of new information regarding the condition or integrity of a pipeline section currently identified for pressure testing that indicates replacement would be a more prudent safety enhancement investment for customers; (2) changes in non-HCA status, land use regulations, or development within a pressure-test segment; and (3) identification of customer impacts that cannot be cost-effectively mitigated through the means described above in Section IV.F.

X. APPENDIX

A. Maps of Replace in HCA/Test in Non-HCA Alternative

Figure 10
Replace in HCA/Test in Non-HCA Overview Map

Figure 11
Replace in HCA/Test in Non-HCA Detail Map

Figure 12
Replace in HCA/Test in Non-HCA Detail Map

Figure 13
Replace in HCA/Test in Non-HCA Detail Map

Figure 14
Replace in HCA/Test in Non-HCA Detail Map

Figure 15
Replace in HCA/Test in Non-HCA Detail Map

Figure 16
Replace in HCA/Test in Non-HCA Detail Map

Figure 17
Replace in HCA/Test in Non-HCA Detail Map

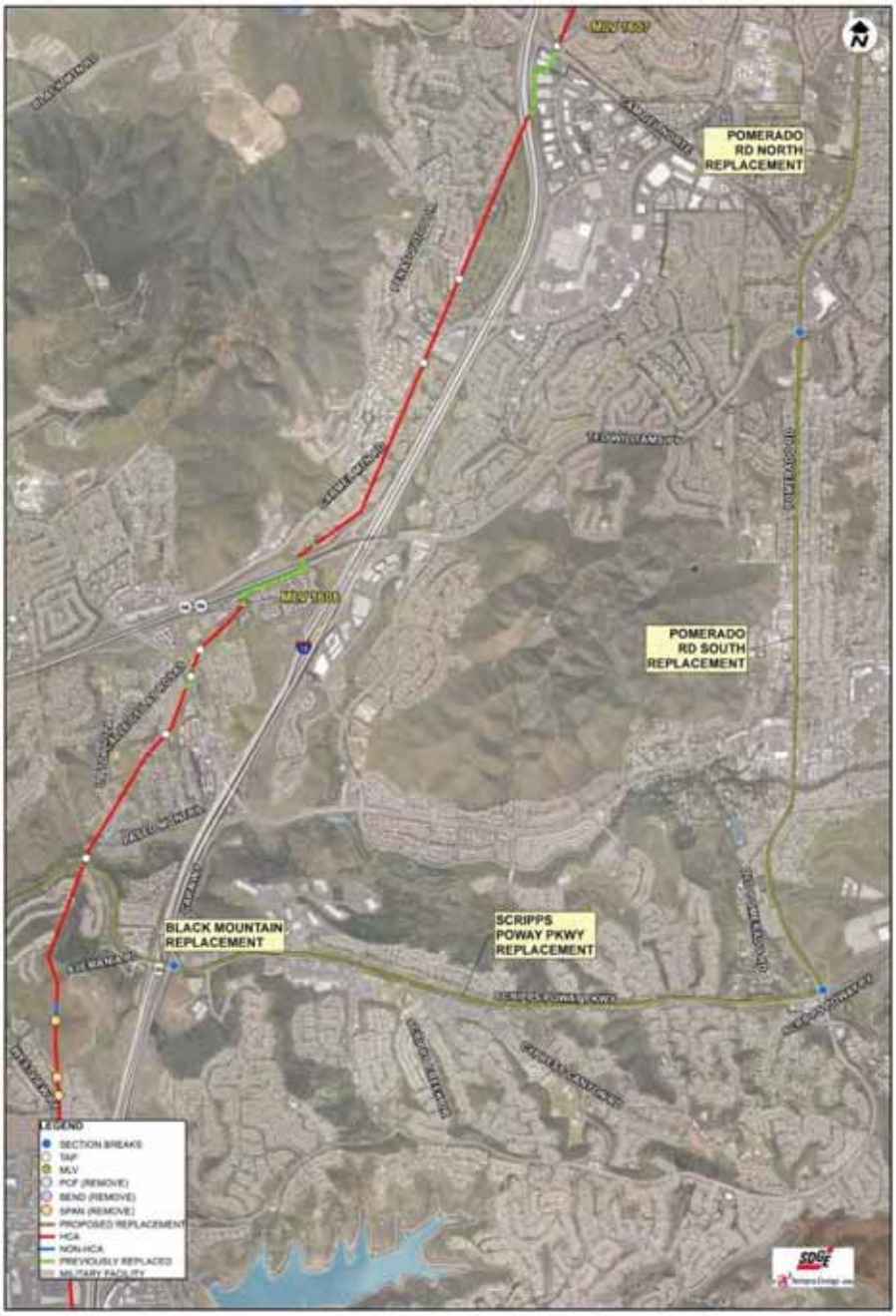


Figure 18
Replace in HCA/Test in Non-HCA Detail Map

Figure 19
Replace in HCA/Test in Non-HCA Detail Map

B. Illustrative Photographs of Nearby Street Route for Replacement Pipe

Figure 20

[redacted]

(Rainbow Replacement Section)

Figure 21

[redacted]

(Rainbow Replacement Section)

Figure 22

[redacted]

(Lilac Road Replacement Section)

Figure 23

[redacted]

(Midway Drive Replacement Section)

Figure 24

[redacted]

(Bear Valley Replacement Section)

Figure 25

[redacted]

(Pomerado Road North Replacement Section)

Figure 26

[redacted]

(Scripps Poway Parkway Replacement Section)

Figure 27

[redacted]

(Black Mountain Replacement Section)

Figure 28

[redacted]

(Black Mountain Replacement Section)

Figure 29

[redacted]

(MCAS Central Replacement Section)

Figure 30

[redacted]

(MCAS South Replacement Section)

Figure 31

[redacted]

(Kearny Mesa Replacement Section)

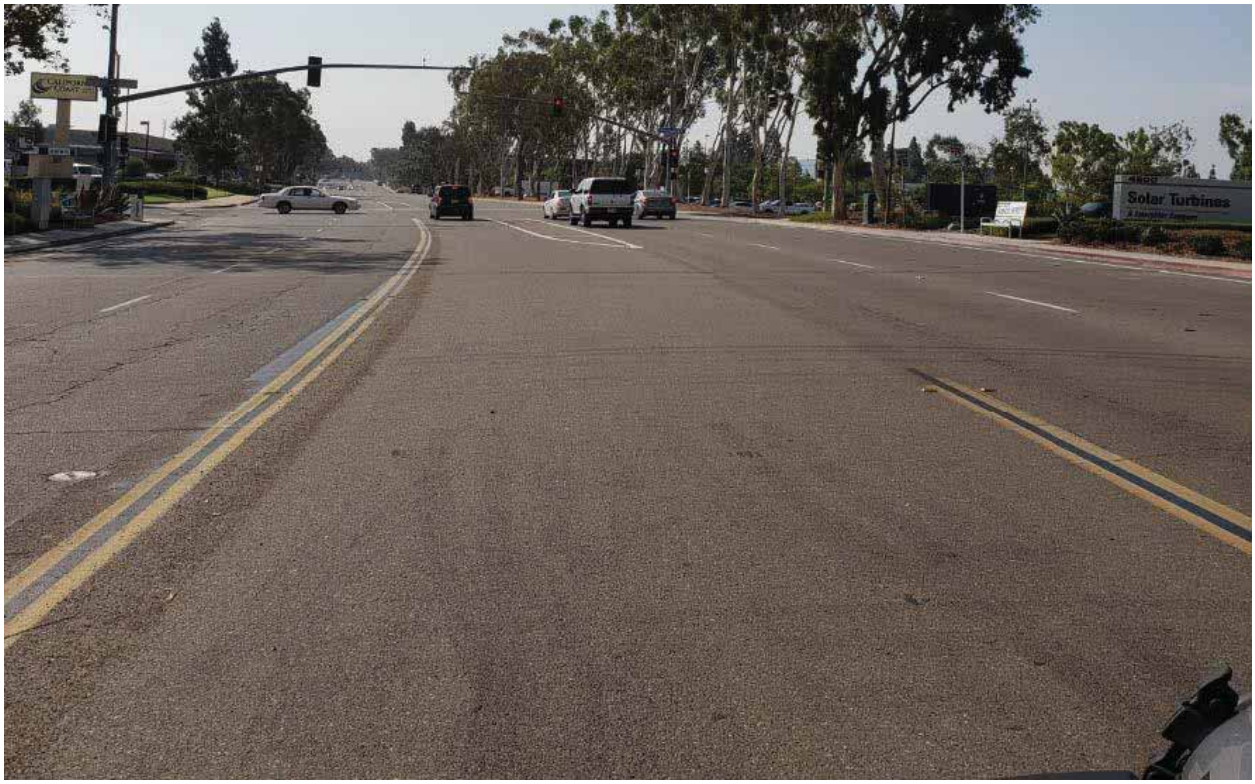


Figure 32

[redacted]

(Sera Mesa Replacement Section)

Figure 33

[redacted]

(Sera Mesa Replacement Section)

C. Illustrative Photographs of Existing Line 1600 Right-of-Way

Figure 34

Approximately [redacted]

Figure 35

[redacted]

Figure 36

[redacted]

Figure 37

Existing Line Near [redacted]

Figure 38

[redacted]

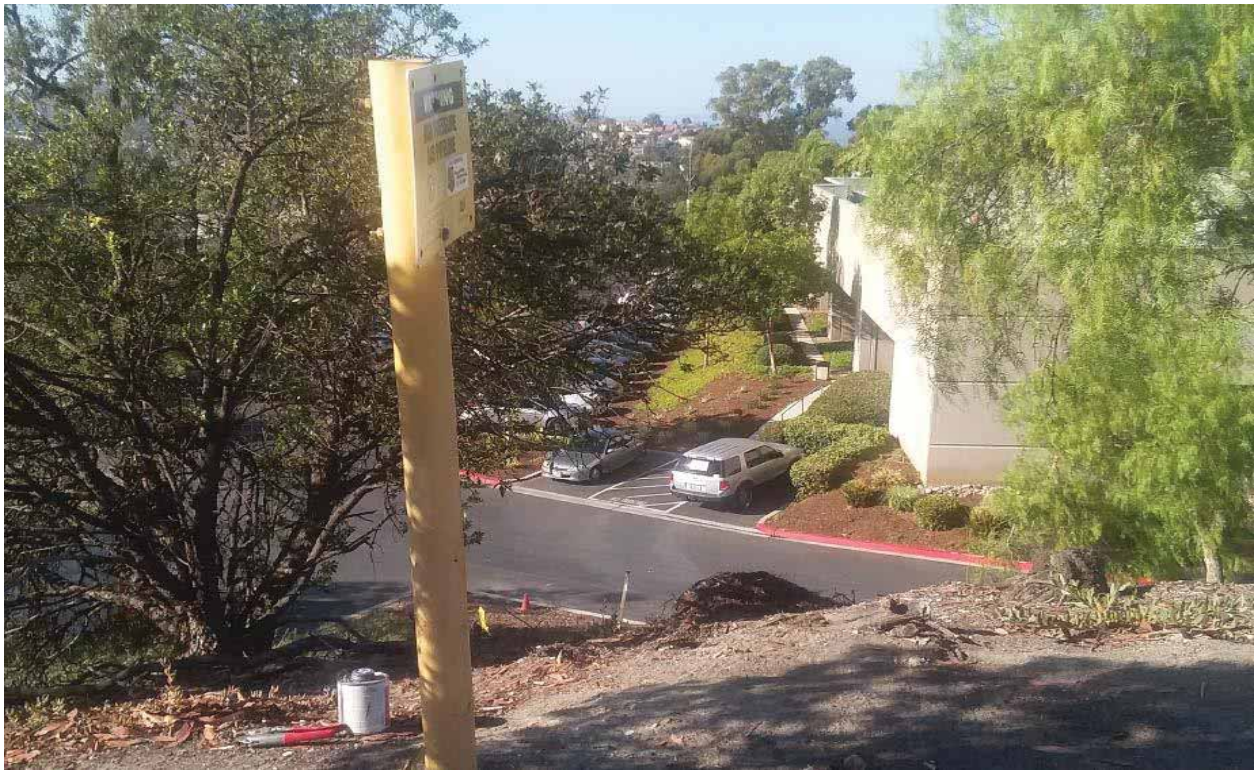


Figure 39

Near [redacted]

Figure 40

Near [redacted]

Figure 41

[redacted]

Figure 42

[redacted]

Figure 43

[redacted]

D. SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations

Table 15

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
CPUC General Order 112-F					
Subpart B-REPORTS	122	Gas Incident Reports		Meet	
Subpart B-REPORTS	123	Annual Reports		Meet	
Subpart B-REPORTS	124	Reporting Safety – Related Conditions		Meet	
Subpart B-REPORTS	125	Proposed Installation Report		Meet	
49 Code of Federal Regulations Part 191					
Reports	§191.5	Immediate notice of certain incidents		Meet	
Reports	§191.7	Report submission requirements		Meet	
Reports	§191.15	Transmission systems; gathering systems; and liquefied natural gas facilities: Incident report		Meet	
Reports	§191.17	Transmission systems; gathering systems; and liquefied natural gas facilities: Annual report		Meet	
Reports	§191.23	Reporting safety-related conditions		Meet	
Reports	§191.25	Filing safety- related condition reports		Meet	
49 Code of Federal Regulations Part 192					
Subpart A - GENERAL	192	General		Meet	
Subpart B – MATERIALS	§192.53	General		Meet	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart B – MATERIALS	§192.55	Steel pipe	Comply with American Petroleum Institute's (API) 5L "Specification for Line Pipe." The required minimum average absorbed energy for each full size specimens is 20 ft- lbs.	Exceed	SDG&E and SoCalGas will exceed API5L by requiring pipe impact toughness greater than 29 ft- lbs. for 16" diameter pipe and a more stringent chemical composition to comply with qualified welding procedures.
Subpart B – MATERIALS	§192.65	Transportation of pipe	Comply with API5L recommended practice RP5L1 and RP5LW	Exceed	SDG&E and SoCalGas also require compliance with API recommended practice RP5LT for Truck Transportation of Line Pipe
Subpart C –PIPE DESIGN	§192.103	General		Meet	
Subpart C –PIPE DESIGN	§192.105	Design formula for steel pipe		Meet	
Subpart C –PIPE DESIGN	§192.109	Nominal wall thickness (t) for steel pipe		Meet	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart C –PIPE DESIGN	§192.111	Design factor (F) for steel pipe	Classes 1, 2, 3 and 4 locations require 0.72, 0.6 0.5, 0.4 Design Factors, respectively.	Exceed	A 0.4 Design Factor, which is only required in Class 4 locations, will be used for all locations where new pipe is installed, resulting in significantly higher safety factors than required in Class 1,2, and 3 locations.
Subpart C –PIPE DESIGN	§192.115	Temperature De-rating Factor (T) for Design of Steel Pipe		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.143	General requirements		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.144	Qualifying metallic components		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.145	Valves		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.147	Flanges and flange accessories		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.150	Passage of internal inspection devices		Meet	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.153	Components fabricated by welding		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.155	Welded branch connections		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.159	Flexibility		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.161	Supports and anchors		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.163	Compressor stations: Design and construction		N/A	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.165	Compressor stations: Liquid removal		N/A	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.167	Compressor stations: Emergency shutdown		N/A	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.169	Compressor stations: Pressure limiting devices		N/A	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.171	Compressor stations: Additional safety equipment		N/A	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.173	Compressor stations: Ventilation		N/A	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.179	Transmission line valves	The required Spacing between Main Line Valves is 20 miles in Class 1, 15 miles for Class 2, and 8 miles for Class 3 locations. Each section of a transmission line must have a blow down valve with enough capacity to blow down a line as rapidly as practicable	Exceed	The pipeline is designed to have 5-mile Main Line Valve spacing between the city of Escondido and the southern terminus of line 1600, which is shorter valve spacing than is required by Code for most locations in this section.
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.183	Vaults: Structural design requirements		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.185	Vaults: Accessibility		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.187	Vaults: Sealing, venting, and ventilation		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.189	Vaults: Drainage and waterproofing		Meet	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.195	Protection against accidental over pressuring	Each pipeline that is connected to a gas source so that the maximum allowable operating pressure could be exceeded as the result of pressure control failure or of some other type of failure, must have pressure relieving or pressure limiting devices that meet the requirements of §§192.199 and 192.201	Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.199	Requirements for design of pressure relief and limiting devices		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.201	Required capacity of pressure relieving and limiting stations		Meet	
Subpart D - DESIGN OF PIPELINE COMPONENTS	§192.203	Instrument, control, and sampling pipe and components		Meet	
Subpart E – WELDING OF STEEL IN PIPELINES	§192.225	Welding procedures		Meet	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart E – WELDING OF STEEL IN PIPELINES	§192.227	Qualification of welders	API 1104, "Welding of Pipelines and Related Facilities"	Exceed	SDG&E and SoCalGas require welders to perform an additional overhead weld for qualification that is not required by API 1104.
Subpart E – WELDING OF STEEL IN PIPELINES	§192.229	Limitations on welders		Meet	
Subpart E – WELDING OF STEEL IN PIPELINES	§192.231	Protection from weather		Meet	
Subpart E – WELDING OF STEEL IN PIPELINES	§192.235	Preparation for welding	API 1104, "Welding of Pipelines and Related Facilities" allows misalignment of 1/8"	Exceed	SDG&E and SoCalGas require more precise alignment by limiting misalignment to 3/32".
Subpart E – WELDING OF STEEL IN PIPELINES	§192.241	Inspection and test of welds		Meet	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart E – WELDING OF STEEL IN PIPELINES	§192.243	Nondestructive testing	Code requires 10% and 15% of welds in Class 1 and 2 locations respectively, that are not in highway or railroad right-of-ways to be non-destructively tested.	Exceed	100% of welds in Class 1 and 2 locations not in highway or railroad rights-of-way will be non-destructively tested.
Subpart E – WELDING OF STEEL IN PIPELINES	§192.245	Repair or removal of defects	API 1104, "Welding of Pipelines and Related Facilities" allows repair of rejected first time repair	Exceed	SDG&E and SoCalGas do not allow subsequent repair of a rejected first-time repair.
Subpart G— GENERAL CONSTRUCTION REQUIREMENTS FOR TRANSMISSION LINES AND MAINS	§192.305	Inspection: General		Meet	
Subpart G— GENERAL CONSTRUCTION REQUIREMENTS FOR TRANSMISSION LINES AND MAINS	§192.307	Inspection of materials		Meet	
Subpart G— GENERAL CONSTRUCTION REQUIREMENTS FOR TRANSMISSION LINES AND MAINS	§192.309	Repair of steel pipe		Meet	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart G—GENERAL CONSTRUCTION REQUIREMENTS FOR TRANSMISSION LINES AND MAINS	§192.313	Bends and elbows		Meet	
Subpart G—GENERAL CONSTRUCTION	§192.317	Protection from hazards		Meet	
REQUIREMENTS FOR TRANSMISSION LINES AND MAINS					
Subpart G—GENERAL CONSTRUCTION REQUIREMENTS FOR TRANSMISSION LINES AND MAINS	§192.319	Installation of pipe in a ditch		Meet	
Subpart G—GENERAL CONSTRUCTION REQUIREMENTS FOR TRANSMISSION LINES AND MAINS	§192.323	Casing	Code does not require coating or cathodic protection of casing pipe.	Exceed	All casing pipe will be coated and cathodically protected regardless of outside agency requirements.
Subpart G—GENERAL CONSTRUCTION REQUIREMENTS FOR TRANSMISSION LINES AND MAINS	§192.325	Underground clearance		Meet	We typically exceed 12" clearance unless impracticable.
Subpart G—GENERAL CONSTRUCTION REQUIREMENTS FOR TRANSMISSION LINES AND MAINS	§192.327	Cover		Meet	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart I—REQUIREMENTS FOR CORROSION CONTROL	§192.453	General		Meet	
Subpart I—REQUIREMENTS FOR CORROSION CONTROL FOR CORROSION CONTROL	§192.455	External corrosion control: Buried or submerged pipelines installed after July 31, 1971		Meet	
Subpart I—REQUIREMENTS FOR CORROSION CONTROL	§192.459	External corrosion control: Examination of buried pipeline when exposed		Meet	
Subpart I—REQUIREMENTS FOR CORROSION CONTROL	§192.461	External corrosion control: Protective coating		Meet	
Subpart I—REQUIREMENTS FOR CORROSION CONTROL	§192.463	External corrosion control: Cathodic protection		Meet	
Subpart I—REQUIREMENTS FOR CORROSION CONTROL	§192.465	External corrosion control: monitoring		Meet	
Subpart I—REQUIREMENTS FOR CORROSION CONTROL	§192.467	External corrosion control: Electrical isolation		Meet	
Subpart I—REQUIREMENTS FOR CORROSION CONTROL	§192.469	External corrosion control: Test stations		Meet	
Subpart I—REQUIREMENTS FOR CORROSION CONTROL	§192.471	External corrosion control: Test leads		Meet	
Subpart I—REQUIREMENTS FOR CORROSION CONTROL	§192.473	External corrosion control: Interference currents		Meet	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart I—REQUIREMENTS FOR CORROSION CONTROL	§192.475	Internal corrosion control: General requirements		Meet	
Subpart I—REQUIREMENTS FOR CORROSION CONTROL	§192.476	Internal corrosion control: Design and construction of transmission line.		Meet	
Subpart I—REQUIREMENTS FOR CORROSION CONTROL	§192.479	Atmospheric corrosion control: General requirements		Meet	
Subpart J—TEST REQUIREMENTS	§192.503	General requirements		Meet	
Subpart J—TEST REQUIREMENTS	§192.505	Strength test requirements for steel pipeline to operate at a hoop stress of 30 percent or more of SMYS	Tests in Class 1 require a test to a pressure of 1.1 x Maximum Allowable Operating Pressure (MAOP); For Class 2 - 1.25 x MAOP; and Class 3 and 4 - 1.5x MAOP.	Exceed	Where possible the pipeline will be tested to 90% of its Yield Pressure (YP), including at least a 5% pressure spike. This will result in a test that is more than 2.5x MAOP, which exceeds the testing requirement for all locations.
Subpart J—TEST REQUIREMENTS	§192.515	Environmental protection and safety requirements		Meet	
Subpart J—TEST REQUIREMENTS	§192.517	Test Documentation		Meet	
Subpart L - OPERATIONS	§192.605	Procedural Manual for operations, maintenance, and emergencies		Meet	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart L - OPERATIONS	§192.613	Continuing surveillance		Meet	
Subpart L - OPERATIONS	§192.614	Damage prevention program	Each operator of a buried pipeline must carry out, in accordance with this section, a written program to prevent damage to that pipeline from excavation activities.	Exceed	Additional pipeline cover is provided to aid in damage prevention. See 192.327 for "cover" details and 192.705 additional monitoring. Warning Mesh will be installed above the pipeline to identify the pipeline below. Fiber optic cabling with real-time monitoring for ground movement and inferential leak detection will be installed along the pipeline route.
Subpart L - OPERATIONS	§192.615	Emergency plans		Meet	
Subpart L - OPERATIONS	§192.616	Public awareness		Meet	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart L - OPERATIONS	§192.619	Maximum allowable operating pressure (MAOP): Steel pipeline	The MAOP is the lowest of the following: 1. Design Pressure of the weakest component; or 2. Pressure obtained by dividing the test pressure by a factor based on Class Location.	Exceed	The pipeline will be operating at a lower pressure than the Code requires in Class 1, 2 and 3 locations due to designing the entire pipeline for a Class 4 location and testing to a higher pressure than required by Code (see sections 192.505 and 192.619).
Subpart L - OPERATIONS	§192.625	Odorization of gas	Odorizing is required for Class 3 and 4 locations.	Exceed	SDG&E and SoCalGas transmission pipelines are odorized regardless of location.
Subpart L - OPERATIONS	§192.629	Purging of pipelines		Meet	
Subpart M— MAINTENANCE	§192.705	Transmission lines: Patrolling	The requirement for the frequency of patrolling varies from 2 - 4 times per year depending on the location.	Exceed	Fiber-optic right-of-way continuous intrusion monitoring is planned to be installed on new pipeline sections where practical to provide early threat warning, consistent with the technology enhancements discussed in SDG&E and SoCalGas' PSEP.

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart M—MAINTENANCE	§192.706	Transmission lines: Leakage surveys	Leakage surveys must be conducted at intervals of 7.5 - 15 months depending on Class Location.	Exceed	Real-time above ground methane sensors will be installed on select sections of the pipeline identified by risk analysis consistent with the technology enhancements discussed in SDG&E and SoCalGas' PSEP for right-of-way leak monitoring. The fiber optic cable monitoring system referenced under 192.705 and 192.614 will also allow for pipeline leak detection in near-real time.
Subpart M—MAINTENANCE	§192.707	Line Markers		Exceed	In addition to the requirement to install above ground pipeline markers, SDG&E and SoCalGas will install Warning Mesh above the pipeline to indicate that there is a pipeline below the mesh.
Subpart M—MAINTENANCE	§192.731	Compressor stations: Inspection and testing of relief devices		N/A	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart M—MAINTENANCE	§192.735	Compressor Station Storage of Combustible materials		N/A	
Subpart M—MAINTENANCE	§192.736	Compressor Station: Gas Detection		N/A	
Subpart M—MAINTENANCE	§192.743	Pressure Limiting and regulating stations; Capacity of relief devices		Meet	
Subpart M—MAINTENANCE	§192.751	Compressor stations: Prevention of accidental ignition		N/A	
Subpart N—QUALIFICATION OF PIPELINE PERSONNEL	§192.801	Scope		Meet	
Subpart N—QUALIFICATION OF PIPELINE PERSONNEL	§192.803	Definitions		Meet	
Subpart N—QUALIFICATION OF PIPELINE PERSONNEL	§192.805	Qualification program		Meet	
Subpart N—QUALIFICATION OF PIPELINE PERSONNEL	§192.807	Recordkeeping		Meet	
Subpart N—QUALIFICATION OF PIPELINE PERSONNEL	§192.809	General		Meet	

SDG&E and SoCalGas Compliance with Applicable State and Federal Regulations					
Code	**Section**	**Title**	**Requirement**	**Meet or Exceed**	**If exceeding, how?**
Subpart O—GAS TRANSMISSION PIPELINE INTEGRITY MANAGEMENT	§192.939	What are the required reassessment intervals	Operators are required to only perform a lesser confirmatory reassessment every 7 years if a longer reassessment period has been obtained.	Exceed	SDG&E and SoCalGas will be performing full integrity reassessments of the pipeline with internal inspection devices called smart pigs at a maximum interval of 7 years.

E. Construction Contractor Assessments and Recommendations

[redacted]

August 1, 2018
Attention: [redacted]
San Diego Gas and Electric

Subject: L-1600 Constructability Review

[redacted]

Pursuant to your request, [redacted] has performed a constructability review of the sixteen inch gas pipeline through an existing right-of-way (ROW). The current ROW occurs at various locations between Rainbow and Mission Stations.

Based on our site observations along the L-1600 easement and based on our review of the documents prepared by SDG&E through various emails, we offer the following comments and opinions.

- The existing route consists primarily of the following site conditions:
    - Two lane rural roads
    - Two and four lane city streets
    - Several golf courses
    - Commercial areas including parking lots
    - Earth ROW
- For all pipe installation activities occurring in two lane roads and city streets, [redacted] does not foresee any issues which could result in production inefficiencies beyond those typically observed (i.e. pedestrian and vehicle traffic). The installation process would be considered standard city street pipeline construction. In areas where traffic control is needed, [redacted] assumes sufficient working room for all construction activities. As a result,

[redacted]

[redacted]

reasonable productions and costs are to be expected.

- Outside the standard two lane roads and city street work areas, the remaining ROW will occur within a 20' wide easement. Consisting primarily of earth landscape, the 20' easement occurs through rolling hills, some brush covered, with trees (which will be removed and/or trimmed), and some deep canyons. Other segments of the ROW are situated between houses in residential areas where landscapes and hardscapes will be affected. Additionally, segments within the ROW are in commercial areas near buildings and in paved parking lots. The ROW also lays in a mobile home park and crosses several golf courses. While reviewing these differing site conditions, many problems/inefficiencies became apparent as described below.
    - In all likelihood, the existing 1949 sixteen inch pipeline is at an insufficient depth for large equipment to operate. Will require mats or additional cover for construction of a parallel pipeline. From our experience, there is an inherent risk associated with excavating next to and under the in service 69 year old, 16" gas line.
    - The 20' wide easement does not provide a sufficient work space area to install a 16" pipeline. Industry standard is 40 to 60 feet.
    - In our experience, installing a second pipeline in this type of ROW adds an additional 30-50% to installation costs.
    - Due to 20' wide ROW, all excavated material will need to be hauled off the work area in order to facilitate pipe stringing, bending, and laying.

[redacted]

- Increased risk of fire hazard while grinding/welding on current ROW.
- Environmental issues through the entire ROW, especially in the deep ravines during the wet seasons.
- Construction through deep ravines would be extremely difficult without additional work space.
- The 20' wide ROW and the limited access creates what is referred to as the "tunnel effect". The tunnel effect occurs when equipment, such as dump trucks, are required to enter and exit the ROW from the same point of access. For instance, during excavation activities, dump trucks will be required to enter the ROW in front of the excavation crew. Once the truck has been fully loaded with soils, it must exit the ROW from the same path it used to enter the section. Similar pathing is required for slurry and/or dump trucks during shade and backfill operations from one access point behind the backfill crew. All other activities are stuck in the middle.
- In some cases, due to site conditions or conflict with existing 16" pipeline, dump trucks are unable to park adjacent to the excavator while occupying the same ROW. As a result, the dump trucks will be required to park behind the excavator, requiring a one joint at a time type construction, which yields low production.
- While in the mobile home Park, difficulties arise due to the narrow streets and close proximity of homes adjacent to the ROW. With the existing 16" line, as well as other utilities in the narrow streets, low production installation should be

[redacted]

expected.

- The golf courses present the same limited access and narrow ROW problems as previously described. Installation will also interrupt play in addition to the difficulties/expenses associated with restoration of sod, sprinklers and electrical.
- In some residential areas the ROW runs between homes and/or accesses private property, in which case, landscape and/or hardscape will be affected. During the restoration process, issues may arise while trying to match or replace existing landscape/hardscape. There will, without doubt, be many disgruntled property owners if current route is selected.
- In the areas where the ROW traverses commercial parking lots, limited accessibility and reduced parking availability will be factors to consider during construction. Commercial parking lot paving is not typically constructed to support heavy trucks and equipment. Therefore, replacement could be extensive, well outside the limits of the trench and bell-holes.

In conclusion, it is our opinion that the new 16" pipeline should not be installed in the existing easement, except for areas which include paved roads & streets routes, as shown to [redacted]on the July 26, 2018.

[redacted]

[redacted]

Thank you for the opportunity to present this constructability review letter. If you have any questions, or require additional information, please do not hesitate to contact me at [redacted]

Regards,

[redacted]

[redacted]

[redacted]

August 7, 2018

SUBJECT: Line 1600 Route Recommendation

[redacted]ecently drove the Right of Way (ROW) for the proposed relocation of SDG&E's Line 1600 with representatives from the Public Utilities Commission (PUC) and SDG&E. We were asked to provide our opinion with regards to the feasibility of replacing the line within the existing ROW and potential alternatives. Below is a constructability comparison with regards both options.

Current ROW:

- The existing ROW is 20' wide and travels through steep and rocky mountainous terrain and close proximity to several residents (through yards and driveways).
- The ROW will need to be cleared and all work will need to be contained within the 20' area.
- There will be limited access to the ROW (one way in, one way out). This will limit production due to the accessibility of dump trucks and methods of excavation. It will also limit pipe and materials are brought to the ROW. Production will be held to 40-80 feet per day.
- The existing pipeline alignment will have constant heavy equipment traveling over it at any given time exposing it to risk for potential integrity issues.
- This pipeline was installed in the 1940's. Over time many oak trees have populated the area of the ROW. Our experience has been that we cannot dig within the "drip line" of the oak trees. This creates the need to find alternative installation methods such as boring to avoid environmental concerns.
- Following the installation in the ROW it has been our experience that hydro-seed is required per SWPPP measures. This also requires silt fence installation and water maintenance for several months beyond the project's completion.

Alternative Alignment:

- Installation in paved roads would greatly improve the installation environment for this project.
- Production rates would be as much as three to four times the rate than within the existing ROW
    - With the exception of Rice Canyon which would be approximately 60-80 feet per day production
        - Hwy 395 would be an additional route that would have higher production rates
    - There is plenty of access to the site due to the proximity of major highways
- There will be less direct impact to the public because we would be within the roadways and not near homes
- Environmental issues are limited (i.e. nesting birds and other inhabitants found in rural areas)
- The overall project duration would be greatly decreased

Our recommendation is that an alternative route be chosen. By installing this pipeline within the roadway we lessen the public and environmental impact along with the overall cost of the project. Please feel free to contact me if you have further questions.

Thank you,

Attachment 2

SED Approval Letter of Line 1600 Test or Replace Plan

PUBLIC UTILITIES COMMISSION
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

January 15, 2019

Roger Schwecke, Senior Vice President
Gas Operations and System Integrity
Southern California Gas Company
555 West 5th Street, GT21C3
Los Angeles, CA 90013

Safety and Enforcement Division's (SED) Response to San Diego Gas and Electric Company's (SDG&E) and Southern California Gas Company's (SoCalGas) Submission of Line 1600 Hydrostatic Test or Replacement Plan in Fulfillment of Pipeline Safety Enhancement Plan (PSEP) for Review and Approval

Dear Mr. Schwecke:

Background

California Public Utilities Commission (Commission) Decision (D.) 18-06-028, Ordering Paragraph (OP) #7 states: "No later than three months from the date of the issuance of this decision, consistent with General Order 112-F Reference, Title 49 Code of Federal Regulations, Part 192—Subpart J and the National Transportation Safety Board recommendations, Pub. Util. Code § 958 and Decision 11-06-017, San Diego Gas & Electric Company and Southern California Gas Company shall submit to Safety and Enforcement Division a hydrostatic test or replacement plan pertaining to the existing 49.7 miles of Line 1600 in its present corridor." Further, D.18-06-028 Conclusion of Law (COL) #14 states: "The Commission's requirement to have a hydrotest plan for Line 1600 is a necessary measure for compliance with Pub. Util. Code § 958." D.18-06-028 Finding of Fact (FOF) #72 states that "the unknowns of test and/or replace plans such as actual costs and ROW issues, should be addressed in the existing Commission PSEP and companion GRC processes."

D.18-06-028 also authorizes SED to "oversee the Applicants' compliance with Pub. Util. Code § 958 and PSEP consistent with directives in prior decisions and OP 15 in this decision. Any costs associated with PSEP work are proposed and managed through PSEP and rate case proceedings according to already existing CPUC institutionalized processes." (D.18-06-028, at 107.)

SDG&E and SoCalGas' Plan

Pursuant to D.18-06-028, OP #7, San Diego Gas & Electric Company (SDG&E) and Southern California Gas Company (SoCalGas) timely submitted the proposed hydrostatic test or replacement plan pertaining to the existing 49.7 miles of Line 1600 to Safety and Enforcement Division (SED) on September 26, 2018.

SDG&E and SoCalGas indicated that the report analyzed and discussed four design alternatives for the hydrostatic testing and/or replacement plan for Line 1600. SDG&E and SoCalGas reported that they approached the four design alternatives with the following objectives: (1) to enhance public safety; (2) apply risk assessment and management principles; (3) comply with the Commission's Directives, Decisions and the Public Utilities Code section 958; (4) maximize the cost effectiveness of safety investments; and (5) minimize customer impacts.

SDG&E and SoCalGas evaluated and submitted the following four design alternatives and proposed one of the design alternatives for SED's review and approval:

(1) Replacing 37 miles of Line 1600 pipeline in High Consequence Areas (HCAs) and hydrotesting approximately 13 miles of Line 1600 pipeline in non-HCAs (Replace in HCA/Test in Non-HCA alternative);

(2) Hydrostatic strength testing (hydrotest or test) of the entire length of Line 1600 (Full Hydrotest alternative);

(3) Full replacement of Line 1600, routing in nearby streets in the north (Full Replacement in Nearby Streets alternative); and

(4) Full replacement of Line 1600, routing along Highway 395 in the north (Full Replacement Along Highway 395 alternative).

SDG&E and SoCalGas identified known specific segments of the Line 1600 pipeline that required rerouting due to safety and serviceability reasons and shared that information with SED. SED conducted a joint field inspection of the identified sites with SDG&E personnel and its contractor to evaluate the existing safety conditions, constructability and serviceability of Line 1600. After the field inspections, SED agreed with SDG&E's and SoCalGas' proposed reroute of many segments of Line 1600 due to safety and serviceability reasons.

SDG&E and SoCalGas reported that after careful evaluation of the four design alternatives, it selected to execute design alternative #1. SED observed in the SoCal Gas /SDG&E analysis that design alternatives #3 and #4 were scored as having the maximum safety margin and reliability. SED inquired the rationale for choosing the design alternative #1. SDG&E and SoCalGas indicated that it chose design alternative #1 after considering the Commission's directives in D.18-06-028.

SED's Approval

SED has reviewed and analyzed the hydrostatic test or replacement plan that SDG&E and SoCalGas submitted, including its proposal to execute the design alternative #1. SED approves the SDG&E and SoCalGas' proposed PSEP replacement of 37 miles of Line 1600 pipeline in High Consequence Areas (HCAs) and hydrotesting approximately 13 miles of the remainder of Line 1600 pipeline in non-HCAs (Replace in HCA/Test in Non-HCA alternative). SED requests to be apprised of any changes in the proposed plan, along with the Management of Change record. SED directs that SDG&E and SoCalGas submit to SED all the required PSEP

construction notifications, scope of work, engineering design data, welding and fabrication information no less than 60 days prior to construction, for SED's safety assurance review and inspections. In addition, SED requests that SDG&E and SoCalGas maintain and submit to SED periodically, a comprehensive management of change records that captures changes, particularly in design, materials and processes. SED further request that appropriate local public officials be notified in accordance with law.

If you have any questions, please contact Matthewson Epuna at (213) 576-7014 or by e-mail at Matthewson.Epuna@cpuc.ca.gov.

Sincerely,

Lee Palmer
Deputy Director - Safety and Enforcement Division
California Public Utilities Commission

Cc:
Elizaveta Malashenko, Deputy Executive Director, CPUC
Kenneth Bruno, Program Manager – GSRB/SED
Matthewson Epuna, Program and Project Supervisor, GSRB/SED
Edward Moldavsky, Staff Counsel
Edward Randolph, Director, Energy Division
Durga Shrestha, Senior Utilities Engineer Specialist GSRB/SED
Shirley Arazi, SoCalGas – Regulatory Affairs

Attachment 3

USMC MCAS Letter

UNITED STATES MARINE CORPS
MARINE CORPS AIR STATION MIRAMAR
P.O. BOX 452001
SAN DIEGO, CALIFORNIA 92145-2001

11011
CO
September 5, 2018

Kevin O'Beirne
Major Projects Development Manager
San Diego Gas & Electric Company
8330 Century Park Court, CP31D
San Diego, CA 92123

Dear Mr. O'Beirne:

Your letter of August 24, 2018, explains that San Diego Gas & Electric (SDG&E) must submit to the California Public Utilities Commission a "test or replace" plan for Line 1600, a natural gas pipeline that crosses Marine Corps Air Station (MCAS) Miramar through an easement running generally parallel to and west of Kearny Villa Road between Miramar Road and State Route 52. You met with my staff on August 17th to present your alternatives, answer questions, and solicit the Marine Corps' preference. I refer below to these plans by the names annotated on the enclosed maps, which you left with my staff.

The "Hydrotest and HCA Replacement Alternative" is not supportable in light of concerns with airfield security, access, and impacts to sensitive natural resources. I trust this does not come as a surprise, as I know my staff discussed these concerns at some length during your meeting.

The "Replacement Only Alternative" appears more supportable, but is not free of concerns. As depicted on the enclosed map, SDG&E would abandon the existing line from Miramar Road until just south of Harris Plant Road. You would install new pipe within the Kearny Villa Road easement before rejoining the existing line between Harris Plant Road and the State Route 163 interchange. As my staff explained during the meeting of August 17th, your plans for the segment south of State Route 163 would likely entail impacts to vernal pools and associated threatened and endangered species. Mitigating such impacts can be a significant challenge because of the scarcity of suitable areas, and any suitable areas aboard MCAS Miramar must be reserved for purposes that serve our military mission.

Based on the information available at this time, I can support the "Replacement Only Alternative" so long as SDG&E activities (1) will not create impacts to sensitive natural

resources requiring formal consultations with the U.S. Fish and Wildlife Service under section 7 of the Endangered Species Act; and (2) will not have impacts to wetlands that cannot be covered by the U.S. Army Corps of Engineers under a Nationwide Clean Water Act Section 404 Permit. I encourage you to explore options to avoid such impacts through engineering and design measures (e.g. tunneling), or by placing the entire pipeline segment under Kearny Villa Road between Miramar Road and State Route 52.

My point of contact for this matter is Lieutenant Commander Travis Brinkman, Public Works Officer, at (858) 577-1085 or travis.brinkman@usmc.mil.

Sincerely,

C. B. DOCKERY
Colonel, U.S. Marine Corps
Commanding Officer

Enclosures: 1. Hydrotest and HCA Replacement Alternative
2. Replacement Only Alternative


City
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