

SCG-02-WP

**Workpapers Supporting the Prepared Direct Testimony of Thomas D. McMahon
(Technical – Well Inspection and Mitigation)**

SCG-02-WP

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I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 32	API	04-037-00686-03
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	08/19/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	06/10/1948; Redrill1 08/01/1948 (Sidetrack1); Redrill2 10/18/1948 (Sidetrack2); Redrill3 10/30/1948 (Sidetrack3)		
Initial Completion	12/22/1948		
Ground Elevation	1994 ft.		
Caprock Depth	6902 ft.		
Measured Depth	7435 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (c, casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 32. This project planned to pull the 2-7/8" completion string, uncemented 5-1/2" inner string, run casing inspection logs and a Gyro survey, install new inner string, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well Fernando Fee 32 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation.
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7070 ft. of 2-3/8" (4.7#, J55 & N80, EUE) tubing, bottom hole assembly, and 5-1/2" (Otis "BWB") packer from 7067 ft.
 - iii. Pull existing 7085 ft. of 5-1/2" (20#, J55 & N80, Hydril TS & AB Flush) inner string and 7" (Baker Model "FB") packer from 7085 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to liner top at 7109 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection log (CBL) from approximately 7100 ft to surface on the production casing
 - c. Zonal Remediation
 - i. Cement squeeze critical zones, per DOGGR requirements
 - ii. Drift and redress 7" production casing for new inner string installation
 - d. Inner string Installation
 - i. Install and cement approximately 7095 ft. of 5-1/2" (20#, L80, TSH 513) inner string.
 - e. Well Reassessment/Re-evaluation
 - i. Perform pressure integrity test on inner string to 1.15 MAOP
 - ii. Drill out cement to top of production liner at 7109 ft.
 - iii. Run inspection logs (MFL, MAC, UT, CBL) from approximately 7095 ft to surface
 - f. Well Completion
 - i. Install approximately 6981 ft of 3-1/2" (9.3#, L80, TSH 563) new tubing completion string, bottom hole assembly, and 5-1/2" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead.
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	09/12/2016 02/08/2017
2	Noise and Temp Survey	03/08/2016 03/09/2017
3	Ultrasonic (UT)	05/25/2017
4	Cement Bond Log (CBL)	04/10/2017 05/25/2017
5	Multi-Arm Caliper (MAC)	05/26/2017
6	Magnetic Flux Leakage (MFL)	05/26/2017
7	Pressure Integrity Test	05/30/2017
8	Annular and Tubing Pressure Test – Final	06/05/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	06/12/2017
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	03/20/2017	06/06/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP work.
 - b. The well was successfully isolated from the storage zone with a plug in the completion string and pressure tested to 1100 psi for 1 hour
2. Rig Work included the decompletion of existing production equipment and inner string, perforating and cement squeezing five critical zones, installing new inner string, running inspection logs, pressure testing new inner string, and running new completion tubing and equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 7070 ft of 2-3/8" (4.7#, J55 & N80, EUE) tubing, bottom hole assembly, and 5-1/2" (Otis "BWB") packer from 7067 ft., as well as 7085 ft of 5-1/2" (20#, J55 & N80, TSH & AB Flush) inner string and 7" (Baker Model "FB") packer from 7085 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 7415 ft. The CBL from the liner top (7109 ft) to surface. The Gyro survey was run from 7395 ft to surface
 - c. *Zonal Remediation:* Per DOGGR requirements, five zones were perforated and cement squeezed, from 5030 ft to 5035 ft (UP), from 4700 ft to 4705 ft (A36), from 3920 ft to 3925 ft (A1/USDW), from 1595 ft to 1600 ft (PGS), and from 805 ft to 810 ft (BFW)
 - d. *Inner String Installation:* The production casing was drifted to prepare for a new inner string installation. A new 5-1/2" (20#, L80, TSH 513) inner string consisting of 7090 ft was installed and cemented. A new spool was installed to accommodate the inner string
 - e. *Well Reassessment/Re-evaluation:* The cement shoe was drilled out to 7090 ft. The pressure integrity test was performed on the new inner string. Casing inspection logs (UT, CBL, MFL, MAC) were run from 7090 ft to surface. The well was cleaned out to 7414 ft.
 - f. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7009 ft. of 3-1/2" (L80, 9.3#, FlushMax) tubing with flow control components, and a 5-1/2" (HES, D&L, AS1-X) Packer set at 7058 ft. The final installation integrity test was completed. A new wellhead was installed and tested

3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

After initial inspections, and per DOGGR requirements, five zones were perforated, and cement squeezed in the production casing before running the new inner string. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$18,333	\$175	\$18,508
Contract Costs	\$13,901	\$16,022	\$29,924
Material	\$310,158	\$3,604	\$313,762
Other Direct Charges	\$1,528,732	\$62,348	\$1,591,080
Total Direct Cost	\$1,871,124	\$82,150	\$1,953,274

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$65,482	\$666	\$66,148
AFUDC	\$11,932	\$0	\$11,932
Property Taxes	\$3,083	\$0	\$3,083



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Storage Integrity Management Program
Aliso Canyon – Fernando Fee 32

Total Indirect Costs	\$80,497	\$666	\$81,163
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Total Loaded Costs	\$1,951,621	\$82,816	\$2,034,437²
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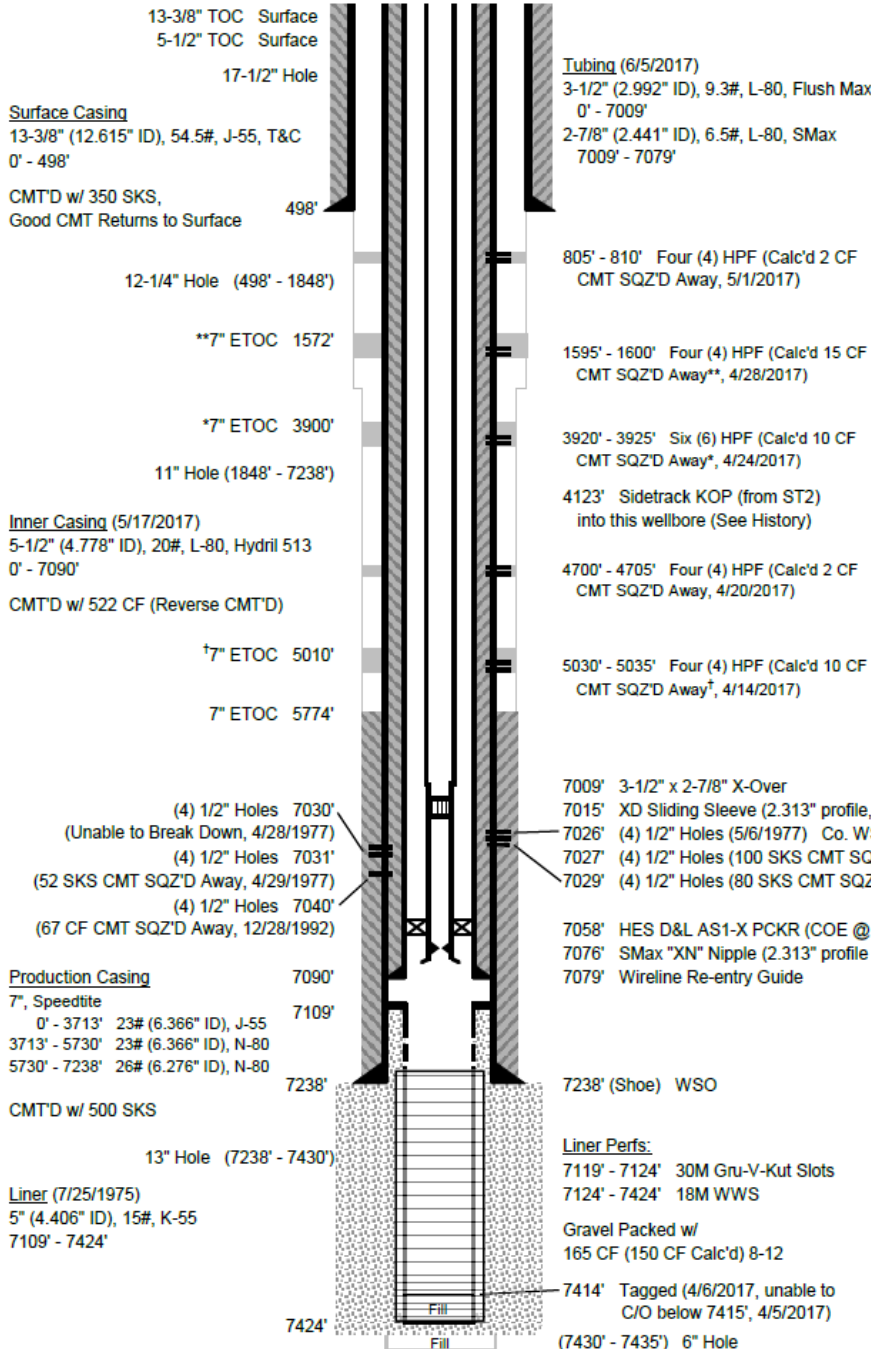
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Fernando Fee 32 ST3

API #: 04-037-00686-03
Sec 27, T3N, R16W

Operator: So. California Gas Co.



Lease: Fernando Fee
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 3926' (3926')

Ground Elevation: 1994.89' asl
Datum to Ground: 7.1' KB

Spud Date: 6/10/1948
Sidetrack Kick-off Date: 10/30/1948
Completion Date: 12/22/1948
Last Rework Date: 6/6/2017

Junk: None

Wellbore History

Orig. Hole (OH) TD @ 7403'
(See Fernando Fee 32 Orig. Hole,
ST1 & ST2 combined diagram
for all sidetracks)
1st Sidetrack (ST1) KOP @ 4975'
TD @ 7484'
2nd Sidetrack (ST2) KOP @ 4274'
TD @ 4564'
3rd Sidetrack (ST3) KOP @ 4123'
TD @ 7435'

Notes

Caliper Log run in 7" CSG, 10/17/1972,
showed 0.20" wall remaining @ 978', 0.19"
wall remaining @ top, less than 1/4" wall
remaining @ 8503', 2568', 2566', 1470'

Top of Zone Markers	md (tvd)
A1	3926' (3926')
A36	4714' (4712')
UP	5229' (5219')
LP	5504' (5487')
UDA1	5900' (5857')
MDA	6402' (6313')
LDA	6685' (6575')
MP	6888' (6766')
S1	7184' (7044')
S4	7282' (7136')
S8	7360' (7209')
S12	7423' (7268')

TD 7435'
TVD (7280')
Directionally Drilled: Yes (TD is 678' W, 652' S of Surf)

Prepared by: CAM/LD (6/3/2016)
Updated by: LD (5/9/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 32A	API	04-037-21872-01
Project Type	Steel Liner Recompletion		
Well Status	Active	NOP:	09/25/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	07/06/1978; Redrill 11/26/2008 (Sidetrack)		
Initial Completion	09/13/1978; Redrill Completion 12/30/2008		
Ground Elevation	1995 ft.		
Caprock Depth	6861 ft.		
Measured Depth	7500 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171, SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109) which prescribed specific testing requirements for all wells at Aliso Canyon. These testing requirements were above and beyond the advanced Storage Integrity Management Program (SIMP) inspections proposed in the 2016 GRC.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin** – Published on February 5, 2016: Concurrent with state regulatory mandates, federal guidance for underground gas storage facilities was issued by PHMSA in February 2016 through an Advisory Bulletin.¹ The advisory bulletin referenced the American Petroleum Industry (API) Recommended Practice 1171 Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommend practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Among other things, adopts API Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law, Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 and began to regulate downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. The IFR has not been amended since its initial publication and the regulations have yet been finalized as of January 2019.
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: The Governor approved SB 380, which imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR with concurrence from the California Public Utilities Commission (CPUC) determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this program was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 32A. This project planned to pull the current 3-1/2" completion string, run inspection logs and Gyro survey, pressure test casing, run new completion string, and convert well to tubing flow only. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well Fernando Fee 32A used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or replacement

- ii. Pull existing completion consisting of 7090 ft of 3-1/2" (9.3#, L80, EUE) tubing, bottom hole assembly, and 7" (Halliburton G-6) packer from 7080 ft.
 - b. Well Assessment/Evaluation
 - i. Clean wellbore out to target depth of 7479 ft.
 - ii. Run Gyro survey from 7479 ft to surface
 - iii. Run inspection logs (UT, CBL, MFL and MAC) from approximately 7108 ft. to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 6900 ft. of new 5-1/2" (20#, L80, TCPC) and 100 ft. of 4-1/2" (12.6#, L80, TCPC) new tubing and bottom hole assembly, with a 7" packer set at approximately 7000 ft., thereby converting the well to tubing flow only
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations.
4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	04/18/2016
2	Noise and Temp Survey	03/08/2016 04/03/2017
3	Ultrasonic (UT)	03/30/2016
4	Cement Bond Log (CBL)	03/30/2016
5	Multi-Arm Caliper (MAC)	03/30/2016 09/01/2016
6	Magnetic Flux Leakage (MFL)	04/01/2016
7	Block Test	04/04/2016
8	Annular and Tubing Pressure Test – Final	09/07/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	09/16/2016
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work Phase 1	03/22/2016	04/18/2016
Rig Work Phase 2	08/24/2016	09/07/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by DOGGR Safety Review Team, determining that it was safe to move forward with the SIMP work.
2. The Rig Work for Fernando Fee 32A was completed in two phases.
 - a. Phase 1
 - i. *Well Decompletion*: This step included the removal of the wellhead and production equipment consisting of 7090 ft of 3-1/2" (9.3#, N80, EUE) tubing, bottom hole assembly, and 7" (HES G6 Mechanical Packer) from 7080 ft.
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 7474 ft. Gyro survey was run from 7470 ft to surface, MAC from 7086 ft to surface, MFL from 7089 ft. to surface, and UT/CBL from 7090 ft to surface. The block test was performed
 - iii. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7031 ft. of 3-1/2" (9.3#, N80, EUE) tubing with flow control components and a 7" (HES, PLT, V-2) Packer set at 7087 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
 - b. Phase 2 involved the installation of a steel liner across anomalies detected in the 8-5/8" production casing
 - i. *Well Decompletion*: This step included removal of the wellhead and previously installed completion string consisting of 7031 ft. of 3-1/2" (9.3#, N80, EUE) tubing with 7" (HES PLT V-2) Packer from 7087 ft.
 - ii. *Well Assessment/Evaluation*: The production casing was conditioned and drifted from 912 ft. to 1167 ft.
 - iii. *Steel Liner Installation*: A steel liner was installed in the 8-5/8" casing from 869 to 1133 ft.
 - iv. *Well Assessment/Evaluation*: A MAC log was run to confirm steel liner installation from 6566 ft to surface
 - v. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7109 ft of 3-1/2" (9.3#, L80, EUE) tubing with flow control components, and a 7" (HES PLT-V2) set at 7091 ft. The final installation integrity test was performed. The wellhead was re-installed and tested

3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

The well workover was completed in two phases to evaluate inspection results, select remedial option, and prepare well for installation of steel liner materials. The second phase of rig work involved the installation of a steel liner after standards were updated, requiring additional remediation. The tubing string was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

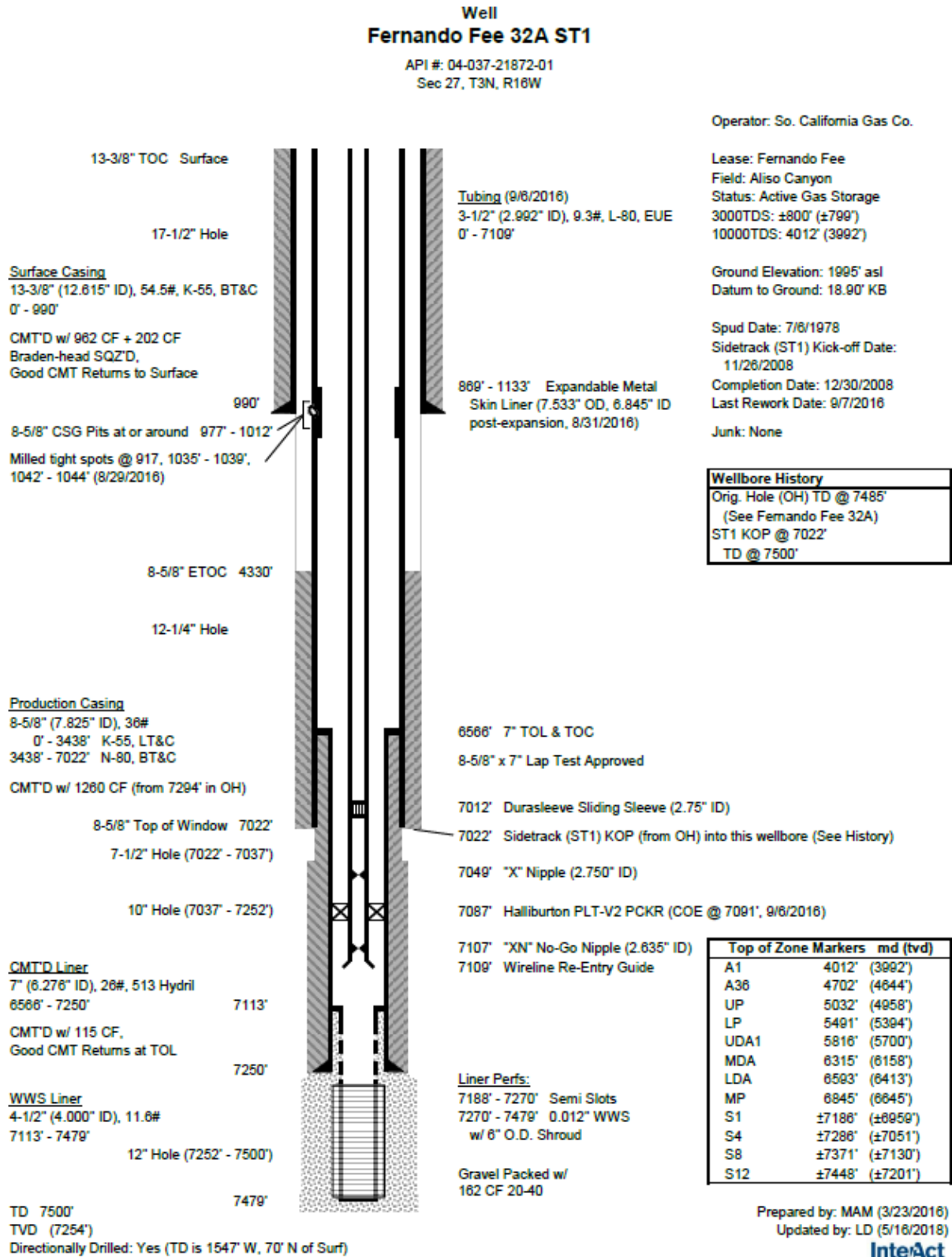
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$2,846	\$0	\$2,846
Contract Costs	\$13,435	\$0	\$13,435
Material	\$279,273	\$0	\$279,273
Other Direct Charges	\$736,179	\$70,849	\$807,028
Total Direct Cost	\$1,031,733	\$70,849	\$1,102,582

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$28,756	\$11,323	\$40,079
AFUDC	\$10,530	\$0	\$10,530
Property Taxes	\$2,030	\$0	\$2,030
Total Indirect Costs	\$41,316	\$11,323	\$52,639

Total Loaded Costs	\$1,073,049	\$82,172	\$1,155,221²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 32B	API	04-037-21358-02
Project Type	Steel Liner Recompletion		
Well Status	Active	NOP:	02/15/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	06/29/1973; Redrill 1 07/29/1973 (Sidetrack 1), Redrill 2 08/31/1973 (Sidetrack 2)		
Initial Completion	09/16/1973		
Ground Elevation	1995 ft.		
Caprock Depth	7016 ft.		
Measured Depth	7680 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 32B. This project planned to pull 2-7/8" completion string and steel liner, run casing inspection logs, install new inner string, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well Fernando Fee 32B used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7354 ft of 2-7/8" (6.5#, J55, N80) tubing, bottom hole assembly, and 6-5/8" (Baker Retrieval "D") packer from 7350 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to target depth of 7677 ft.
 - ii. Isolate storage zone with two retrievable bridge plugs set at 6706 ft. and 7400 ft.
 - c. Well Decompletion
 - i. Remove steel liner from 2971 ft. to 2993 ft.
 - d. Inner String Installation
 - i. Run casing drift to liner top at 6696 ft.
 - ii. Run and cement approximately 6676 ft of 6-5/8" (28#, L80, BTC) inner string
 - iii. Install new wellhead component for inner string
 - e. Well Assessment/Evaluation
 - i. Perform pressure integrity test to 1.15 MAOP
 - ii. Clean out production casing to liner top at 6696 ft.
 - iii. Run inspection logs (UT, CBL and MFL) from 7400 ft to surface
 - iv. Run Gyro survey and MAC from total depth to surface
 - f. Well Completion
 - i. Install approximately 7221 ft. of new 4-1/2" (12.6#, L80, TCPC) completion string, bottom hole assembly, and 6-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	08/11/2016
2	Noise and Temp Survey	03/09/2016 08/29/2017
3	Ultrasonic (UT)	01/03/2017
4	Cement Bond Log (CBL)	01/03/2017
5	Multi-Arm Caliper (MAC)	01/05/2017 01/26/2017
6	Magnetic Flux Leakage (MFL)	12/29/2016
7	Block Test	01/24/2017
8	Annular and Tubing Pressure Test – Final	02/02/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	02/06/2017
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	10/21/2016	02/03/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to isolate the well and move forward with the SIMP work.
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 500 psi for 1 hour
2. Rig Work included the removal of existing completion equipment, running inspection logs, pressure testing casing, performing zone remedial, installing new steel liner and running new completion
 - a. *Well Decompletion*: This step included the removal of wellhead components and production equipment, consisting of 7354 ft of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, a 6-5/8" (Baker Retrieval "D") packer from 7350 ft, and steel liner at 2971 ft.
 - b. *Well Assessment/Evaluation*: The well was cleaned out to 7675 ft. Gyro survey was run from 7652 ft to surface. MFL was run from 6668 ft. to surface; UT and CBL were run in the liner and production casing from 6696 ft to surface, and MAC from 7375 ft to surface. Block testing was performed
 - c. *Zonal Remediation*: Per DOGGR requirements, one critical zone from 7016 to 7018 ft. was perforated and cement squeezed (MP)
 - d. *Steel liners Installation/Evaluation*: CBL was run from 6950 ft to 7050 ft, the remediated zone was pressure tested with 822 psi for one hour, and the production casing was cleaned out and drifted. The 7" steel liner was installed from 2960 ft to 2998 ft. The installation was confirmed by running a MAC log
 - e. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7209 ft of 4-1/2" (12.6#, L80, TSH513) tubing with flow control components, and a 6-5/8" (WEA D&L Arrowset) Packer set at 7299 ft. The final installation integrity test was performed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

A steel liner was installed instead of an inner string in the area of interest. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$13,618	\$0	\$13,618
Contract Costs	\$45,833	\$3,951	\$49,784
Material	\$94,085	\$0	\$94,085
Other Direct Charges	\$1,666,809	\$60,622	\$1,727,431
Total Direct Cost	\$1,820,345	\$64,573	\$1,884,918

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$58,823	\$444	\$59,267
AFUDC	\$6,950	\$0	\$6,950
Property Taxes	\$1,000	\$0	\$1,000
Total Indirect Costs	\$66,773	\$444	\$67,217



A Sempra Energy utility[®]

Storage Integrity Management Program
Aliso Canyon – Fernando Fee 32B

Total Loaded Costs	\$1,887,118	\$65,017	\$1,952,135²
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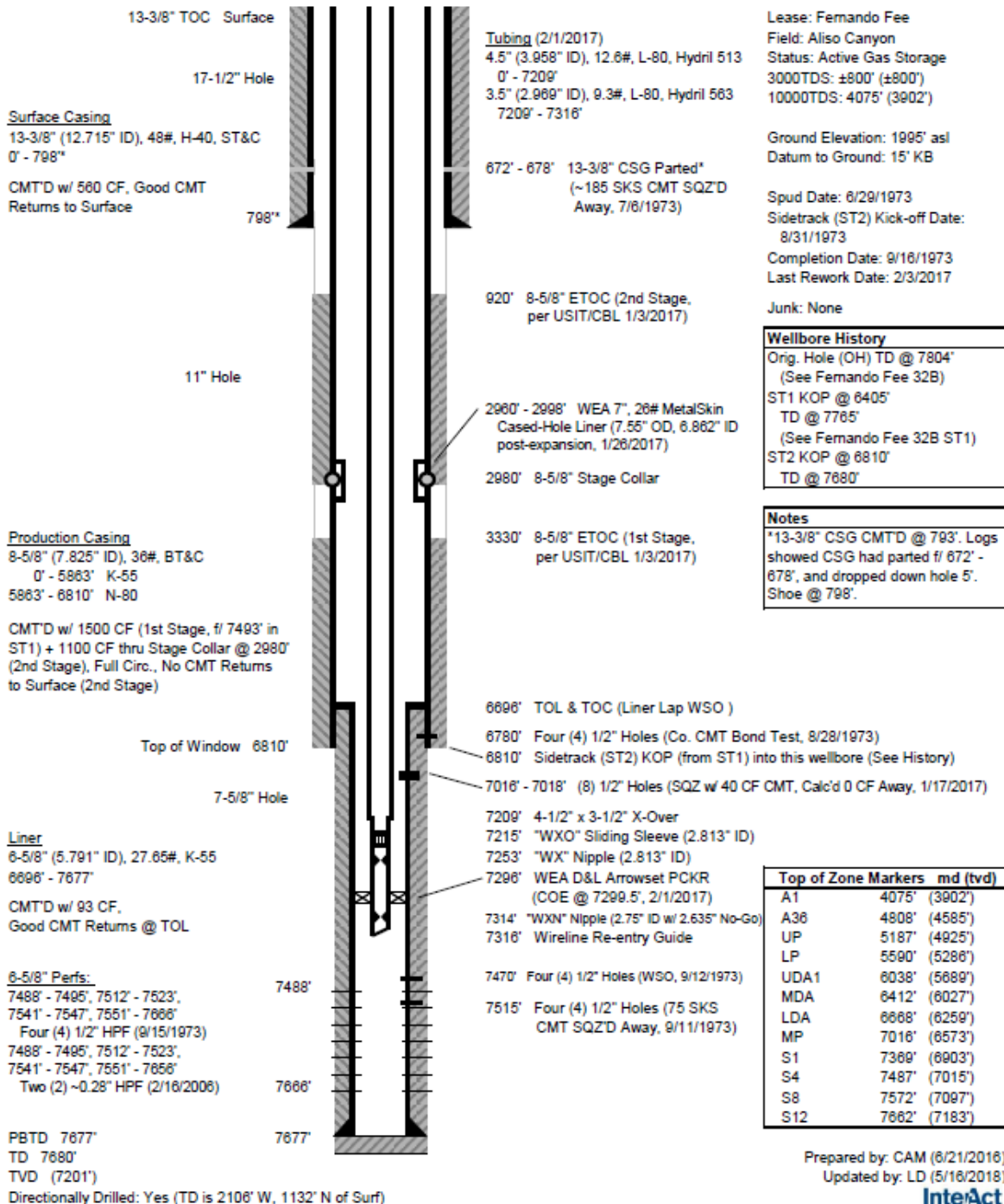
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Fernando Fee 32B ST2

API #: 04-037-21358-02
Sec 27, T3N, R16W

Operator: So. California Gas Co.



Prepared by: CAM (6/21/2018)
Updated by: LD (5/16/2018)



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 32C	API	04-037-21359-01
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	11/10/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	05/16/1973; Redrill 05/27/1973 (Sidetrack)		
Initial Completion	06/26/1973		
Ground Elevation	1995 ft.		
Caprock Depth	6880 ft.		
Measured Depth	7676 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this program was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 32C. This project planned to pull the 2 7/8" completion string and steel liner, run inspection logs and a Gyro survey, pressure test casing, install and cement a new inner string and new completion string, and convert well to tubing flow only. The plan was to gather baseline assessment data on the casing. The following describes the well workover plan for well Fernando Fee 32C used to acquire the necessary DOGGR NOI:

1. Initial Well assessment
 - a. Noise and Temperature survey
2. Rig work
 - Phase 1
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or replacement

- ii. Pull existing completion consisting of 7163 ft. of 2-7/8" (6.5# N80/L80 EUE) tubing, bottom hole assembly, and 8-5/8" (Otis "Permatrieve") packer from 7163 ft.
- iii. Pull Homco steel liner from 3718 to 3758 ft.
- b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7676 ft.
 - ii. Run Gyro survey from 7194 ft to surface
 - iii. Run inspection logs (UT, CBL, MFL, MAC) from 7194 ft to surface
 - iv. Perform pressure test to 1.15 MAOP
- c. Well Isolation
 - i. Install isolation equipment and perform pressure test
 - ii. Install wellhead
- Phase 2
- d. Well Decompletion
 - i. Remove wellhead components
 - ii. Pull isolation equipment
- e. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7204 ft.
 - ii. Drift and redress 8-5/8" production casing for new inner string installation
- f. Inner string Installation
 - i. Install and cement approximately 7204 ft. of 6-5/8" (28#, L80, LT&C) inner string
- g. Well Reassessment/Re-evaluation
 - i. Perform pressure integrity test on inner string to 1.15 MAOP.
 - ii. Run inspection logs (MFL, MAC, UT, CBL) from approximately 7204 ft. to surface
 - iii. Clean out well bore to target depth of 7676 ft.
 - iv. Run a Gyros survey from total depth to surface
- h. Well Completion
 - i. Install approximately 7134 ft. of 341/2" (12.6#, L80, TSH513) new tubing completion string, bottom hole assembly, and 6-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations.
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	06/22/2016
2	Noise and Temp Survey	02/10/2016 03/09/2016 10/28/2016 11/08/2017
3	Ultrasonic (UT)	05/25/2016 10/11/2016
4	Cement Bond Log (CBL)	05/25/2016 10/11/2016
5	Multi-Arm Caliper (MAC)	10/08/2016
6	Magnetic Flux Leakage (MFL)	05/26/2016
7	Pressure Integrity Test	10/07/2016
8	Annular and Tubing Pressure Test – Final	10/20/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	10/28/2016
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work Phase 1	04/19/2016	06/22/2016
Rig Work Phase 2	09/19/2016	10/21/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to move forward with the SIMP work
2. Rig Work
 - a. Phase 1 included the removal of existing completion equipment, initial inspection logs, pressure testing, and well isolation
 - i. *Well Decompletion:* This step included the planned removal of production equipment consisting of 7163 ft. of 2-7/8" (6.5# N80/L80 EUE) tubing, bottom hole assembly, and 8-5/8" (Otis Perma-Trieve) packer from 7163 ft. The steel liner was removed in the 8-5/8" production casing from 3718 ft to 3758 ft.
 - ii. *Well Assessment/Evaluation:* The well was cleaned out to 7672 ft. and a Gyro survey and MAC were run from 7204 ft. to surface. UT was run from 7160 ft. to surface and MFL from 7138 ft. to surface. The block test failed when pressure testing from 5738 ft to 3509 ft.
 - iii. *Well Isolation:* The well was isolated from storage zone, and wellhead re-installed and tested
 - b. Phase 2 included installing new inner string, re-running inspection logs, pressure testing inner string and running new completion
 - i. *Well Decompletion:* The wellhead was removed for inspection, and isolation equipment removed
 - ii. *Inner String Installation:* The production casing was drifted to prepare for a new inner string installation. New inner string consisting of 7184 ft. of 6-5/8" (28#, L80, BTC) was installed and cemented. A new spool was added to accommodate the inner string
 - iii. *Well Reassessment/Re-evaluation:* The pressure integrity test was done on the inner string, and the casing shoe was drilled out. MAC log was run from 7184 ft to surface, then UT and CBL logs were run from 7184 ft. to surface. The wellbore was cleaned out to 7674 ft.
 - iv. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7163 ft. of 4-1/2" (12.6#, L80, TSH 513) tubing with flow control components and 6-5/8" (WFT AS1-X) packer set at 7163 ft. The final installation integrity test was performed. The wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

The scope of work was completed in two phases of rig work to evaluate inspection results and select best remedial recompletion, as well as prepare well completion and inner string materials. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$2,658	\$769	\$3,427
Contract Costs	\$21,525	\$11,453	\$32,978
Material	\$314,682	\$0	\$314,682
Other Direct Charges	\$1,563,635	\$130,507	\$1,694,142
Total Direct Cost	\$1,902,500	\$142,729	\$2,045,229

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$49,836	\$17,885	\$67,721
AFUDC	\$26,119	\$0	\$26,119
Property Taxes	\$4,801	\$0	\$4,801
Total Indirect Costs	\$80,756	\$17,885	\$98,641

Total Loaded Costs	\$1,983,256	\$160,614	\$2,143,870²
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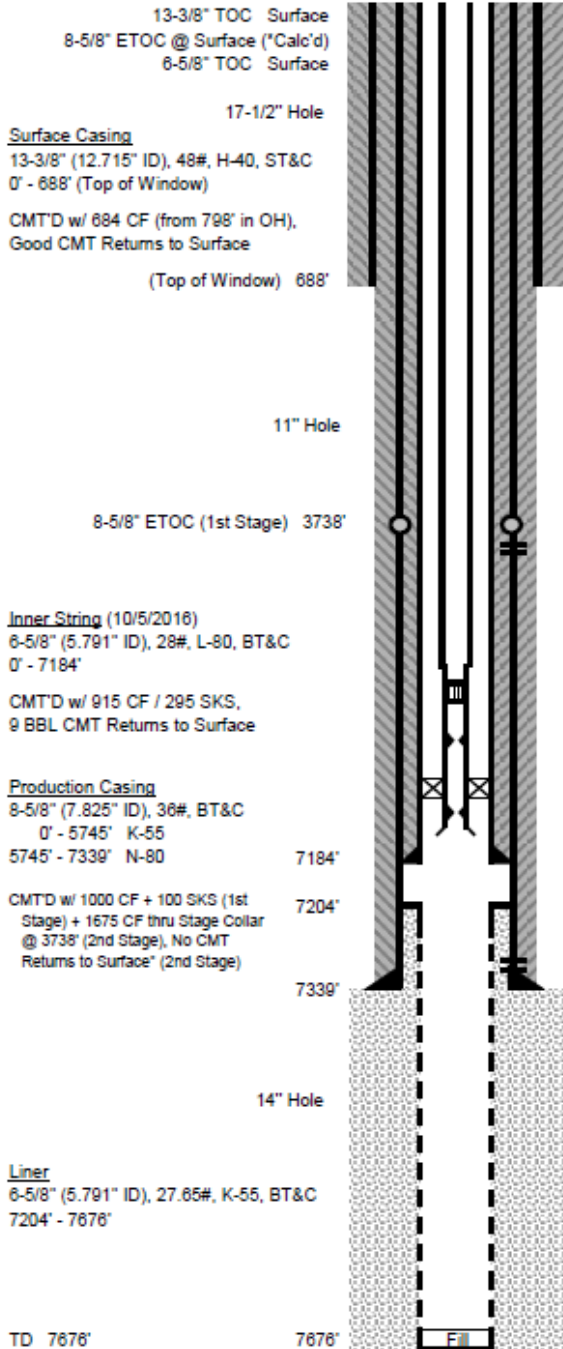
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Fernando Fee 32C ST1

API #: 04-037-21350-01
Sec 27, T3N, R16W

Operator: So. California Gas Co.



Tubing (10/19/2016)
4-1/2" (3.958" ID), 12.6#, L-80 TSH 513
0' - 7079'
3-1/2" (2.992" ID), 9.3#, L-80, TCPC
7079' - 7179'

Lease: Fernando Fee
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±799')
10000TDS: 4059' (3910')

Ground Elevation: 1995' asl
Datum to Ground: 15' KB

Spud Date: 5/16/1973
Sidetrack (ST1) Kick-off Date:
5/27/1973
Completion Date: 8/26/1973
Last Rework Date: 10/21/2016

Junk: None

Wellbore History	
Orig. Hole (OH) TD @	1077'
(See Fernando Fee 32C)	
ST1 KOP @	688'
TD @	7676'

688' Sidetrack (ST1) KOP (from OH)
into this wellbore (See History)

3738' Stage Collar
3739' - 3741' Four (4) 1/2" Holes
(65 CF CMT SQZD Away, 5/4/1974)

7079' 4-1/2" x 3-1/2" X-Over
7085' W XO Sliding Sleeve (2.812" ID)

7122' WX Nipple (2.812" ID)

7163' WEA AS1-X PCKR (COE @ 7167', 10/19/2016)
7177' WXN Nipple (2.75" w/ 2.66" No-Go)
7179' Wireline Re-entry Guide

7324' Four (4) 1/2" Holes (6/13/1973) WSO
7325' Four (4) 1/2" Holes
(84 SKS CMT SQZD Away,
bled back 5 CF, 6/11/1973)

Liner Perfs:
7210' - 7339' & 7592' - 7633'
2" x 30M, 12R, 6" C Slots
7339' - 7592' & 7633' - 7676'
2" x 30M, 28R, 6" C Slots

Gravel Packed w/
335 CF (115% of Calc'd) 6-9

7674' Top of Fill (Unable to circ out
deeper, 10/14/2016)

Top of Zone Markers	md (tvd)
A1	4059' (3910')
A36	4776' (4593')
UP	5206' (5002')
LP	5531' (5312')
UDA1	6007' (5762')
MDA	6351' (6079')
LDA	6598' (6308')
MP	6880' (6570')
S1	7234' (6896')
S4	7338' (6992')
S8	7411' (7059')
S14	7518' (7159')
CR	7557' (7196')

TD 7676'
TVD (7308')
Directionally Drilled: Yes (TD is 2065' W, 696' N of Surf)

Prepared by: MAM (4/15/2016)
Updated by: LD (5/16/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 32D	API	04-037-21356-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	08/22/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	04/05/1973		
Initial Completion	05/14/1973		
Elevation	1995 ft.		
Caprock Depth	6846 ft.		
Measured Depth	7358 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 32D. This project planned to pull the completion string, run inspection logs and a Gyro survey, install, cement, and pressure test 6-5/8" inner string, run casing inspection logs, install new completion string, and convert well to tubing flow only. The plan was to gather baseline assessment data on the casing. The following describes the well workover plan for well Fernando Fee 32D used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig work
 - a. Well Decompletion

- i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 7072 ft. of 2-7/8" (6.5#, L80, EUE) tubing, bottom hole assembly, and 8-5/8" (WEA 1X) packer from 7032 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7241 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run casing drift to 7120 ft.
 - c. Inner String Installation
 - i. Run and cement 7105 ft of 6-5/8" (24#, L80, BT&C/LT&C) inner string
 - ii. Install new wellhead component for inner string
 - d. Well Reassessment/Re-evaluation
 - i. Perform integrity test to 1.15 MAOP on inner string
 - ii. Drill out inner string shoe
 - iii. Run inspection logs (UT, MFL, MAC, CBL) on the inner string from approximately 7105 ft to surface
 - e. Well Completion
 - i. Install approximately 7000 ft of 4-1/2" (12.6#, L80, Hydril 563) of a new completion string and bottom hole assembly converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	09/26/2016 03/17/2017 08/25/2017 02/13/2018
2	Noise and Temp Survey	03/10/2016 03/21/2017 10/01/2017 02/12/2018
3	Ultrasonic (UT)	08/17/2017

4	Cement Bond Log (CBL)	06/19/2017 08/17/2017
5	Multi-Arm Caliper (MAC)	08/15/2017
6	Magnetic Flux Leakage (MFL)	08/16/2017
7	Pressure Integrity Test	08/18/2017
8	Annular and Tubing Pressure Test – Final	08/14/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	08/22/2018
10	Return to Service	10/11/2018

2. Project timeline

Major Milestone	Start	Finish
Rig Work Phase 1	02/06/2017	03/20/2017
Rig Work Phase 2	06/07/2017	08/30/2017
Rig Work Phase 3	07/16/2018	08/15/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to isolate the well and move forward with the SIMP work
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 500 psi for 1 hour

2. Rig Work: The planned work for well Fernando Fee 32D was completed in three phases
 - a. Phase 1 involved decompletion of existing production equipment, cleaning out the wellbore, remediating the liner top and holes in the casing at 6314 ft, and isolating the well
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7072 ft. of 2-7/8" (6.5#, L80, EUE) tubing, bottom hole assembly, and 8-5/8" (WFT 1X) packer from 7032 ft.
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 7243 ft. After completing planned pressure tests on the production casing, damage on the liner top was discovered
 - iii. *Isolation*: Liner top and holes at 6314 ft were repaired. The well was then isolated from storage zone. The wellhead re-installed and tested
 - b. Phase 2 involved removal and inspection of wellhead, performing additional remediation on production casing, installing new inner string, pressure testing inner string and re-running casing inspection logs.
 - i. *Well Decompletion*: The wellhead was removed and replaced with a new one at the end of rig work phase 3. Isolation equipment removed
 - ii. *Well Assessment/Evaluation*: A CBL log was run from 7095 ft to surface
 - iii. *Zonal Remediation*: Per DOGGR requirements, seven zones were perforated and cement squeezed, from 6840 ft to 6845 ft (MP), from 6550 ft to 6555 ft (LDA), from 5835 ft to 5840 ft (UDA1), from 5480 ft to 5485 ft (LP), from 5155 ft to 5160 ft (UP), from 4815 ft to 4820 ft (A36), and from 4130 ft to 4135 ft (A1)
 - iv. *Inner String or Liner Installation*: Drift was performed on the production casing from the top of the liner to the surface. A new inner string of 7104 ft of 6-5/8" (L80, 24#, LT&C) was installed, cemented, and cement shoe drilled out. A new spool was installed to accommodate the inner string.
 - v. *Well Reassessment/Re-evaluation*: MAC was run from 7104 ft to surface, CBL and UT from 7101 ft to surface, MFL was run from 7101 ft to surface. Integrity pressure test on the inner string was performed. Gyro survey run from 7159 ft. The well was then isolated. The wellhead was re-installed and tested
 - c. Phase 3 involved removal of isolation equipment, and running new completion.
 - i. *Well Decompletion*: The wellhead and isolation equipment were removed
 - ii. *Well Assessment/Evaluation*: The wellbore was cleaned out to 7210 ft.

iii. *Well completion:* A new completion string and bottom hole assembly were installed consisting of 6991 ft of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components, and 6-5/8" (HES VTA) Packer set at 6991 ft. The final installation integrity test was performed. A new wellhead was installed and tested

3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.

D. Changes During Workover

After initial inspections in the first phase, it was determined the well needed an inner string. Per DOGGR requirements, seven zones were perforated and cement squeezed in the production casing before running the new inner string, incurring additional costs. The well was completed in two additional phases so the rig could address annular pressures in other wells once the storage field returned to injection, as well as development of new completion procedures. In addition, the tubing size was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$38,987	\$0	\$38,987
Contract Costs	\$192,339	\$0	\$192,339
Material	\$375,286	\$0	\$375,286
Other Direct Charges	\$2,029,010	\$73,083	\$2,102,093
Total Direct Cost	\$2,635,622	\$73,083	\$2,708,705

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
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Storage Integrity Management Program
Aliso Canyon – Fernando Fee 32D

Overheads	\$119,562	\$682	\$120,244
AFUDC	\$116,900	\$0	\$116,900
Property Taxes	\$16,231	\$0	\$16,231
Total Indirect Costs	\$252,693	\$682	\$253,375

Total Loaded Costs	\$2,888,315	\$73,765	\$2,962,080²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Fernando Fee 32D**

API #: 04-037-21358-00
Sec 27, T3N, R16W

Operator: So. California Gas Co.

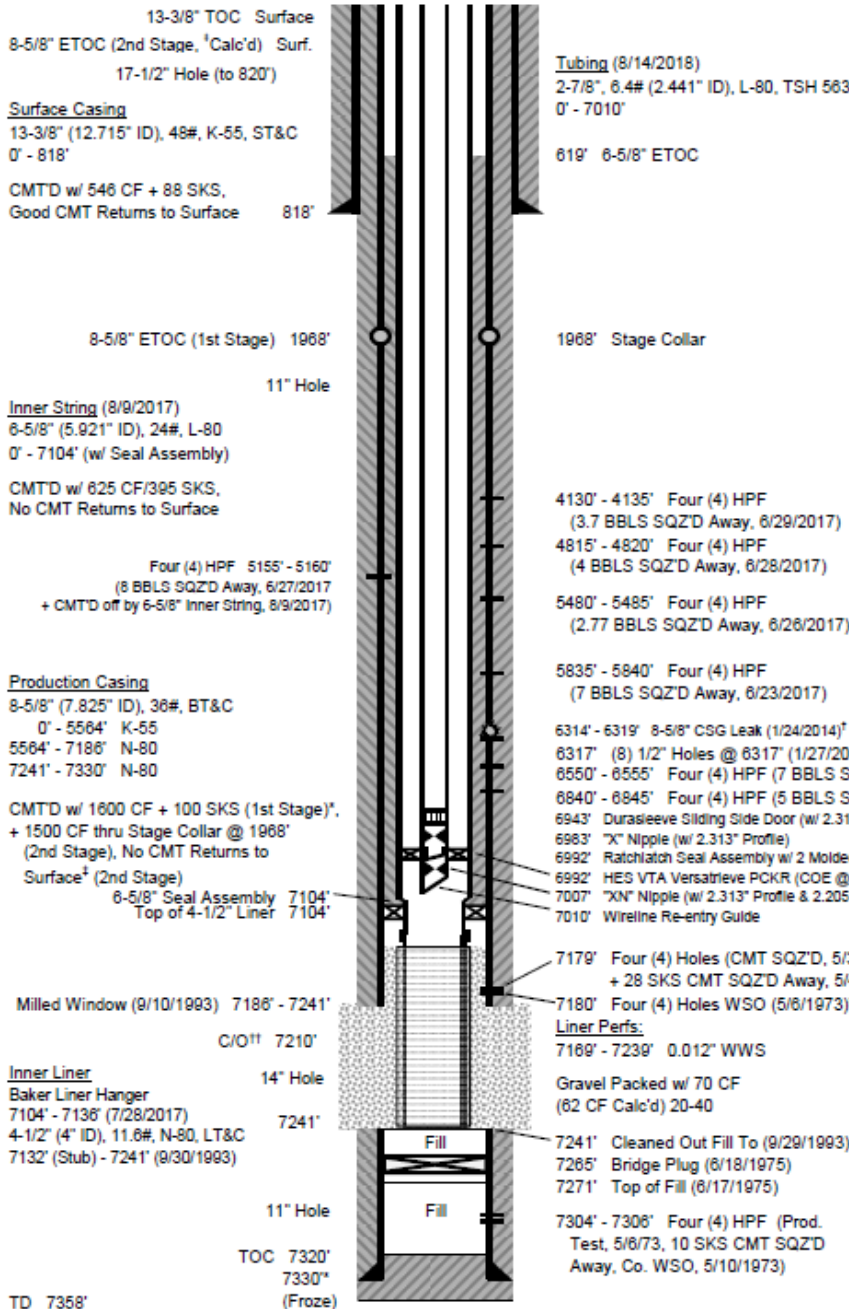
Lease: Fernando Fee
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±797')
10000TDS: 4137' (4119')

Ground Elevation: 1995' asl
Datum to Ground: 15' KB

Spud Date: 4/5/1973
Completion Date: 5/14/1973
Last Rework Date: 8/15/2018

Junk: None

Notes
*Casing froze. Circulated 15 minutes prior to CMT'ing & lost circulation. Partial circulation at end of job (1st Stage)
**SQZ'D Holes @ 7180' & 7179' w/ 100 SKS + 69 SKS CMT SQZ'D Away, 5/7/1973. WSO Approved for holes @ 7179' & 7180', 5/9/1973.
†90 CF + 90 CF CMT SQZ'D 1/29/2014, + SQZ'D w/ 12 BBLS (Held Solid, 3/16/2017)
††C/O w/ 3-1/2" Bit to 7210' (metal cuttings in returns, 8/2/2018)



Top of Zone Markers md (tvd)		
A1	4137'	(4119')
A36	4821'	(4802')
UP	5163'	(5145')
LP	5485'	(5468')
UDA1	5839'	(5820')
MDA	6305'	(6286')
LDA	6555'	(6535')
MP	6846'	(6826')
S1	7115'	(7094')
S4	7191'	(7170')
S6	7218'	(7197')
S8	7268'	(7247')
S12	±7337'	(±7316')

Prepared by: CAM (7/27/2016)
Updated by: MAM (8/27/2018)



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 32F	API	04-037-21313-02
Project Type	Inner String recompletion		
Well Status	Active	NOP:	10/05/2016; 11/03/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	09/23/1972; Redrill 1 10/17/1972 (Sidetrack 1); Redrill 2 03/17/2006 (Sidetrack 2)		
Initial Completion	11/07/1972; Redrill 2 Completion 04/05/2006		
Elevation	1995 ft.		
Caprock Depth	6748 ft.		
Measured Depth	7404 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 32F. This project planned to pull 2-7/8" completion string, 6-5/8" inner string, run casing inspection logs and a Gyro survey, install and cement new inner string, install a new completion string, pressure test casing, and convert well to tubing flow. The plan was to gather baseline assessment data on casing and other well components. The following describes the well workover plan for well Fernando Fee 32F used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion

- i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 6930 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 6-5/8" (HES G-6) packer from 6926 ft.
 - iii. Pull existing inner string consisting of 6-5/8" (24#, L80, SLF) casing from 6954 ft. from liner top packer
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to top of production liner at 6954 ft.
 - ii. Drift and redress 8-5/8" production casing for inner string installation
 - c. Inner string Installation
 - i. Install and cement approximately 6954 ft. of 6-5/8" (24#, L80, LT&C) inner string
 - d. Well Assessment/Evaluation
 - i. Drill out cement and clean out to production liner top 6954 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Perform pressure integrity test to 1.15 MAOP on inner string
 - iv. Run inspection logs on inner string from approximately 6944 ft.
 - e. Well Completion
 - i. Install approximately 6888 ft. of 4-1/2" (12.6#, L80, TSH513) tubing completion string, bottom hole assembly, and 6-5/8" packer at 6940 ft. depth, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations.
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	08/02/2016
2	Noise and Temp Survey	03/10/2016 09/22/2016
3	Ultrasonic (UT)	07/19/2016
4	Cement Bond Log (CBL)	07/19/2016
5	Multi-Arm Caliper (MAC)	07/21/2016

6	Magnetic Flux Leakage (MFL)	N/A
7	Pressure Integrity Test	07/22/2016
8	Annular and Tubing Pressure Test – Final	09/17/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	10/05/2016
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work Phase 1	06/23/2016	08/03/2016
Rig Work Phase 2	09/08/2016	09/19/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to move forward with the SIMP work
2. Rig Work was completed in two phases. Completion equipment was not available, so a second workover was planned
 - a. Phase 1 involved removing the existing production equipment and inner string, running inspection logs, and installing a new inner string
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 6930 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, 6-5/8" (HES G-6) packer from 6926 ft, and the inner string consisting of 6954 ft. of 6-5/8" (24#, L80, SLF) with packer seals at 6954 ft. from liner top packer
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to liner top at 6954 ft.
 - iii. *Inner string Installation*: The production casing was drifted to prepare for a new inner string installation. A new 6-5/8" (24#, L80, SLF) inner string consisting of 6954 ft. was installed and cemented. A new spool was installed to accommodate the inner string
 - iv. *Well Re-assessment/Re-evaluation*: The inner string was cleaned out and the cement shoe was drilled out to 6952 ft. Casing inspection logs (UT, CBL) were run on the inner string from 6947 ft. to surface; MAC was run from 6930 ft. to surface. The pressure integrity test was performed. The cement shoe was drilled out; the well was cleaned out to 7372 ft. Gyro survey was run from 7357 ft. to surface
 - v. *Well Isolation*: The well was isolated from the storage zone. The wellhead was re-installed and tested
 - b. Phase 2 of rig work included running new completion
 - i. *Well Decompletion*: The wellhead and isolation equipment were removed
 - ii. *Well Completion*: A new completion string and bottom hole assembly were installed consisting 6861 ft of 4-1/2" (12.6#, L80, TSH 513) tubing with flow control components, and 6-5/8" (WFT AS1X) Packer at 6916 ft. The final installation pressure test was performed. A new wellhead was installed

3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

Due to completion equipment availability, a second workover was required. Also, the MFL log could not be run on this well because the tool could not pass below the inner string spool. The tubing and flow components were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$2,841	\$0	\$2,841
Contract Costs	\$29,960	\$0	\$29,960
Material	\$414,347	\$0	\$414,347
Other Direct Charges	\$1,189,407	\$35,155	\$1,224,562
Total Direct Cost	\$1,636,555	\$35,155	\$1,671,710

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$44,719	\$35,155	\$79,874
AFUDC	\$9,471	\$0	\$9,471
Property Taxes	\$2,124	\$0	\$2,124
Total Indirect Costs	\$56,314	\$35,155	\$91,469

Total Loaded Costs	\$1,692,869	\$70,310	\$1,763,179²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Fernando Fee 32F ST2

API #: 04-037-21313-02
 Sec 27, T3N, R16W

Operator: So. California Gas Co.

13-3/8" TOC Surface
 6-5/8" ETOC Surface
 17-1/2" Hole (0' - 730')

Surface Casing
 13-3/8" (12.715" ID), 48#, H-40, ST&C
 0' - 724'

CMT'D w/ 563 SKS,
 Good CMT Returns to Surface

724'

8-5/8" ETOC (Stage 2) 978'

8-5/8" Stage Collar 2001'

11" Hole (730' - 7029')

Tie-Back Casing (7/14/2016)
 6-5/8" (5.791" ID), 28#, L-80, SLF
 0' - 6954'

CMT'D w/ 865 CF/440 SKS thru
 Stage Collar @ 6940'

8-5/8" ETOC (Stage 1) 4307'

Production Casing

8-5/8", BT&C
 0' - 5811' 36# (7.825" ID), K-55
 5811' - 7029' 36# (7.825" ID), N-80

CMT'D w/ 417 SKS (1st Stage f/
 7190' in OH) + 130 SKS thru Stage
 Collar @ 2001' (2nd Stage)

6954'

Top of Milled Window 7029'

7-5/8" Hole (7029' - 7200')

Liner

4-1/2" (4" ID), 11.6#, L-80
 6954' - 7385'

12" Hole (7200' - 7400')

4-1/2" Bad Spot (unable to work past) 7372'
 7385'

TD 7404'

TVD (7292')

Directionally Drilled: Yes (TD is 1109' W, 0' N of Surf)

Tubing (9/16/2016)

4-1/2" (3.958" ID), 12.6#, L-80, TSH 513
 0' - 6861'
 3-1/2" (2.992" ID), 9.3#, L-80, TCPC
 6861' - 6936'

Lease: Fernando Fee

Field: Aliso Canyon

Status: Active Gas Storage

3000TDS: ±800' (±799')

10000TDS: 4119' (4094')

Ground Elevation: 1995' asl

Datum to Ground: 15' KB

Spud Date: 9/23/1972

Sidetrack (ST2) Kick-off Date: 3/17/2008

Completion Date: 6/2/2008

Last Rework Date: 9/17/2016

Junk: None

Wellbore History

Orig. Hole (OH) TD @ 5966'
 (See Fernando Fee 32F)
 ST1 KOP @ 5550'
 TD @ 7423'
 (See Fernando Fee 32F ST1)
 ST2 KOP @ 7029'
 TD @ 7404'

6861' 4-1/2" x 3-1/2" X-Over
 6866' WJO Sliding Sleeve (2.812" ID)

6904' WX Nipple (2.812" ID)

6916' WEA D&L AS1X PCKR (COE @ 6920', 9/16/2016)

6934' WXN Nipple (2.812" w/ 2.668" No-Go)

6936' Wireline Re-Entry Guide

6940' 6-5/8" Stage Collar

6954' - 6958' WEA Sealbore PCKR w/ PBR

7029' Sidetrack (ST2) KOP (from ST1) into this wellbore (See History)

Liner Perfs:

7066' - 7217' Semi Slots
 7217' - 7337' 0.16" Armored Screen

Gravel Packed w/
 159 CF (140 CF of Calc'd) 20x40

7352' - 7361' CMT Plug (6 Gals., 8/1/2016)

7361' Tagged Fill (Pea gravel coming in)

(7400' - 7404') 7-5/8" Hole

Top of Zone Markers md (tvd)	
A1	4119' (4094')
A36	4688' (4642)
UP	5102' (5043)
LP	5475' (5408)
UDA1	5800' (5727)
MDA	6278' (6196)
LDA	6558' (6469)
MP	6748' (6653)
S1	7097' (6990)
S4	7206' (7097)
S8	7281' (7171)
S10	7307' (7196)
S14	7392' (7280)

Prepared by: MAM (5/5/2016)

Updated by: LD (5/15/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 32G	API	04-037-30374-00
Project Type	Recompletion		
Well Status	Active	NOP:	09/28/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	08/03/2014		
Initial Completion	01/19/2015		
Ground Elevation	1999 ft.		
Caprock Depth	7008 ft.		
Measured Depth	7616 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a rigless plan was developed to evaluate the integrity of well Fernando Fee 32G since it was newly drilled and new completion equipment was installed. Laterals had not yet been constructed. The plan was to gather baseline assessment data on the casing and other well components. Through-tubing pulsed eddy current logging was planned to assess the integrity of the casing. The following describes the rigless plan for well Fernando Fee 32G used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment
 - a. Run Noise and Temperature survey
 - b. Perform through-tubing inspection
 - c. Perform installation integrity test on completion
2. Post Rigless Work
 - a. Unload well and turn over to operations
3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	08/03/2016
2	Noise and Temp Survey	04/04/2016
3	Ultrasonic (UT)	N/A
4	Cement Bond Log (CBL)	N/A
5	Multi-Arm Caliper (MAC)	N/A
6	Magnetic Flux Leakage (MFL)	N/A
7	Pulsed Eddy Current	07/28/2016
8	Pressure Integrity Test	N/A
9	Annular and Tubing Pressure Test – Final	08/03/2016
Approvals and Return to Service		
10	DOGGR Safety Review Team Approval	09/28/2016
11	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rigless Assessment	07/26/2016	08/03/2016
Post Rigless Work	10/26/2017	11/08/2017

C. Workover Explanation

1. Initial Rigless Assessment
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to isolate the well and move forward with the SIMP work
 - b. The through-tubing inspection was performed from 7166 ft to surface
 - c. The final installation pressure test was performed on the completion
2. Post Rigless Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

Changes were not necessary because the well was newly drilled, with newly installed completion equipment, and never operated.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$0	\$0	\$0
Contract Costs	\$33,425	\$0	\$33,425
Material	\$45,225	\$0	\$45,225
Other Direct Charges	\$122,580	\$34,903	\$157,483
Total Direct Cost	\$201,230	\$34,903	\$236,133

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$6,077	\$4,543	\$10,620
AFUDC	\$0	\$0	\$0
Property Taxes	\$0	\$0	\$0
Total Indirect Costs	\$6,077	\$4,543	\$10,620

Total Loaded Costs	\$207,307	\$39,446	\$246,753²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Fernando Fee 32G

API #: 04-037-30374-00
Sec 27, T3N, R16W

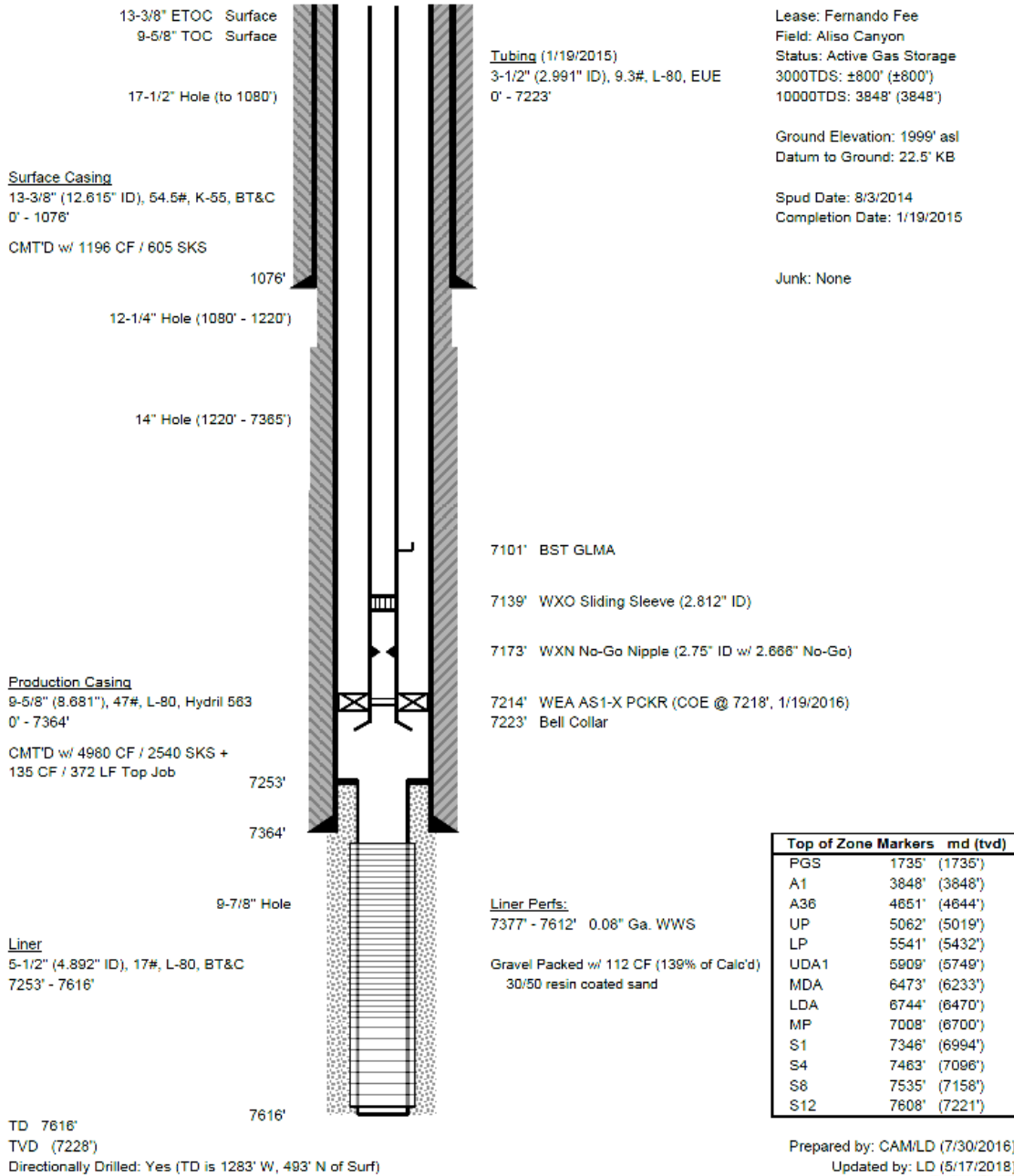
Operator: So. California Gas Co.

Lease: Fernando Fee
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 3848' (3848')

Ground Elevation: 1999' asl
Datum to Ground: 22.5' KB

Spud Date: 8/3/2014
Completion Date: 1/19/2015

Junk: None



Prepared by: CAMLD (7/30/2016)
Updated by: LD (5/17/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 32H	API	04-037-30456-00
Project Type	Recompletion		
Well Status	Active	NOP:	09/25/2016; 04/24/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	06/30/2015		
Initial Completion	10/19/2015		
Ground Elevation	1999 ft.		
Caprock Depth	7060 ft.		
Measured Depth	7969 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a rigless plan was developed to evaluate the integrity of well Fernando Fee 32H since it was newly drilled and new completion equipment installed. Laterals had not yet been constructed. The plan was to gather baseline assessment data on the casing and other well components. Through-tubing pulsed eddy current logging was planned to assess the integrity of the casing. The following describes the well rigless plan for well Fernando Fee 32H used to acquire the necessary DOGGR NOI:

1. Initial Rigless assessment
 - a. Run Noise and Temperature survey
 - b. Perform through-tubing inspection
 - c. Perform installation integrity test on completion
2. Post Rigless Work
 - a. Unload well and turn over to operations
3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	08/03/2016
2	Noise and Temp Survey	04/04/2016 08/07/2017
3	Ultrasonic (UT)	03/26/2018
4	Cement Bond Log (CBL)	03/26/2018
5	Multi-Arm Caliper (MAC)	03/27/2018
6	Magnetic Flux Leakage (MFL)	03/27/2018
7	Pulsed Eddy Current	07/26/2016
8	Block Test	03/28/2018
9	Annular and Tubing Pressure Test – Final	08/01/2016 04/12/2018
Approvals and Return to Service		
10	DOGGR Safety Review Team Approval	09/28/2016
	DOGGR District Approval	05/03/2018
11	Return to Service	07/31/2017 05/29/2018

2. Project timeline

Major Milestone	Start	Finish
Rigless Assessment	07/26/2016	08/01/2016
Post Rigless Work	10/25/2017	11/19/2017
Rig Work	02/21/2018	04/17/2018

C. Workover Explanation

1. Rigless Assessment

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to isolate the well and move forward with the SIMP work
- b. The through-tubing inspection was performed from 7300 ft to surface
- c. The final installation pressure test was performed on the completion

2. Post Rigless Work: The well was unloaded to a calculated fluid depth. However, one of the flow control components was non-operational preventing the well from being put back in operation. A second workover was necessary to replace the completion equipment

3. Rig Work included running inspection logs and upgrading the completion equipment

- a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 7348 ft. of 3-1/2" (9.3#, L80, EUE) tubing, bottom hole assembly, and 9-5/8" (WFT AS1X) production packer from 7339 ft.
- b. *Well Assessment/Evaluation:* The well was cleaned out to 7953 ft. Inspection logs (UT, CBL) were run on the production casing from 7330 ft. to surface. MAC was run from 7344 ft to surface. MFL was run from 5833 ft to surface because of well deviation. The block test was performed
- c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7345 ft of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components, and a 9-5/8" (Baker SC) Packer set at 7313 ft. The final installation integrity test was performed. The wellhead was re-installed and tested

4. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

A damaged flow control component was identified during the post rigless work assessment, prompting a rig workover.

SIMP workover operations were shut down for an extended period in the beginning of 2018 until the development and implementation of a new emission avoidance protocol, and development of new completion procedures. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$13,242	\$0	\$13,242
Contract Costs	\$436,708	\$61,169	\$497,877
Material	\$173,004	\$0	\$173,004
Other Direct Charges	\$647,855	\$30,742	\$678,597
Total Direct Cost	\$1,270,809	\$91,911	\$1,362,720

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$70,684	\$5,773	\$76,457
AFUDC	\$1,758	\$0	\$1,758
Property Taxes	\$0	\$0	\$0
Total Indirect Costs	\$72,442	\$5,773	\$78,215

Total Loaded Costs	\$1,343,251	\$97,684	\$1,440,935²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Fernando Fee 32H**

API #: 04-037-30456-00
Sec 27, T3N, R16W

Operator: So. California Gas Co.

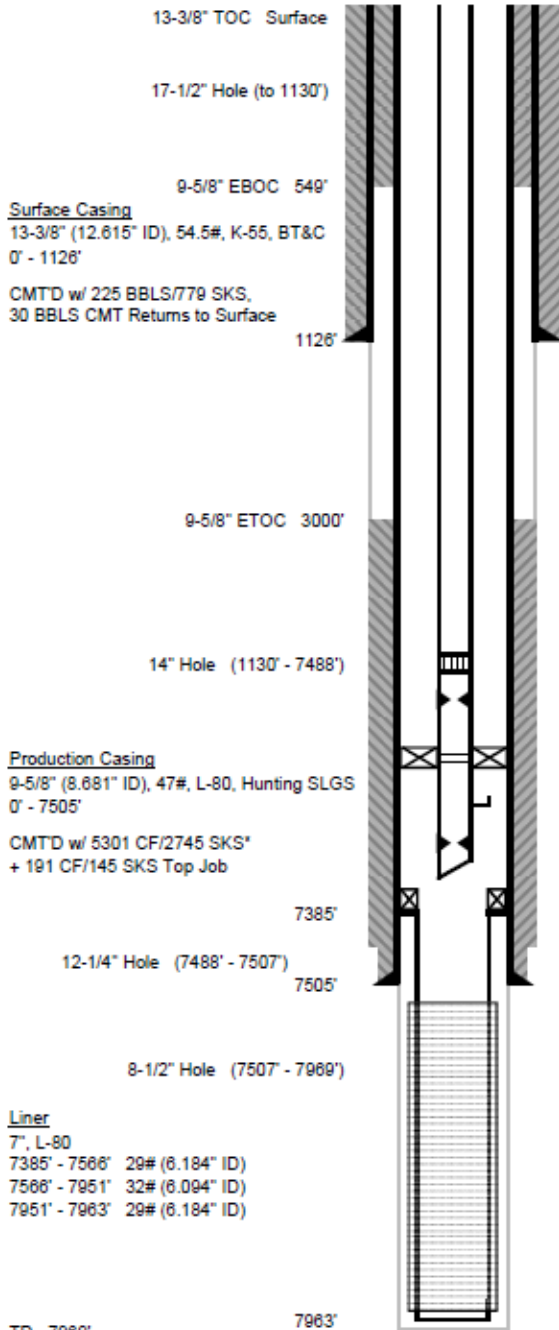
Lease: Fernando Fee
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 3803' (3803')

Ground Elevation: 1999' asl
Datum to Ground: 22.5' KB

Spud Date: 6/30/2015
Completion Date: 10/19/2015
Last Rework Date: 4/17/2018

Junk: None

Notes
*Returns were lost half way through displacement.



Tubing (4/10/2018)
3-1/2" (2.992" ID), 9.3#, HydriL 563
0' - 7345'

- 7255' Baker CD 8000 Sliding Sleeve (w/ 2.812" BX Profile)
- 7299' Baker BX Seating Nipple (2.812" ID)
- 7312' Anchor Latch Seal Assembly (4.84" ID)
- 7313' Baker SC-2 PCKR (COE @ 7315', 4/5/2018)
- 7318' Seal Bore Extension (6" ID)
- 7326' Western Wireline Gauge Carrier (dummy installed per Western, 2.992" ID)
- 7339' Baker BXN Seating Nipple (2.812" w/ 2.666" No-Go)
- 7345' Wireline Re-entry Guide
- 7380' - 7385' PBR

Liner Perfs:
7566' - 7952' 120 Micron ESS
(7568' - 7952' Post-expansion)

Top of Zone Markers	md	(tvd)
A1	3803'	(3803')
A36	4728'	(4724')
UP	5063'	(5037')
LP	5515'	(5452')
UDA1	5915'	(5776')
MDA	6496'	(6235')
LDA	6756'	(6440')
MP	7080'	(6672')
S1	7510'	(6994')
S4	7658'	(7088')
S8	7807'	(7179')
S12	7945'	(7264')

TD 7969'
TVD (7279')
Directionally Drilled: Yes (TD is 1824' W, 473' S of Surf)

Prepared by: MAM (7/30/2018)
Updated by: CAM (8/29/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 33	API	04-037-00687-02
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	06/22/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	03/04/1949; Redrill1 01/29/1981 (Sidetrack1); Redrill2 02/02/1981 (Sidetrack2)		
Initial Completion	05/09/1949; Redrill2 03/11/1981		
Ground Elevation	2060 ft.		
Caprock Depth	7353 ft.		
Measured Depth	7740 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171, SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The original intent of this project was to permanently abandon the well as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a preliminary scope was developed to permanently abandon well Fernando Fee 33. This project planned to pull the 2-7/8" completion string and steel liners, clean out wellbore, run a Gyro survey, and plug back the well with cement and abandon to surface. The following describes the well workover plan for well Fernando Fee 33 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 7491 ft of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, 7" (Baker "Retrieva D") packer

- from 7481 ft, and steel liners from 6285 ft to 6327 ft, and from 102.5 ft to 122.5 ft.
- b. Well Assessment/Evaluation
 - i. Run CBL from top of liner to surface
 - ii. Run Gyro survey from bottom of the well to surface
 - c. Abandonment
 - i. Cement production liner from bottom of the well to 100 ft. above caprock depth at 7353 ft.
 - ii. Lay cement plugs and abandonment mud plugs to surface as per permit for each hydrocarbon zone
 - iii. Cut and remove 7" production casing at approximately 950 ft. and perform casing shoe remediation
 - iv. Cement surface casing up to 10 ft. below surface
 - v. Cut 13-3/8" surface casing 5 to 10 ft. below surface
 - vi. Install and weld well identification plate
 - 3. Post Rig Work
 - a. Site restoration
 - 4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/04/2016 01/27/2017 07/31/2017
2	Noise and Temp Survey	04/04/2016 01/18/2017 07/21/2017
3	Ultrasonic (UT)	10/27/2017 12/19/2017 05/21/2018
4	Cement Bond Log (CBL)	10/27/2017 12/19/2017 05/21/2018
5	Multi-Arm Caliper (MAC)	12/20/2017 05/23/2018
6	Magnetic Flux Leakage (MFL)	12/20/2017 05/23/2018
7	Pressure Integrity Test	05/25/2018
8	Annular and Tubing Pressure Test – Final	06/19/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	06/22/2018
10	Return to Service	09/13/2018

2. Project timeline

Major Milestone	Start	Finish
Rig Work	09/25/2017	06/27/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed and approved, determining that it was safe to isolate the well and move forward with the SIMP work
 - b. The well was successfully isolated from the storage zone with a plug in the completion string and pressure tested to 1100 psi for 1 hour
2. Rig work: The scope of work changed from abandonment to recompletion with installation of inner string
 - a. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7491 ft of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, 7" (Baker Retrieval) packer from 7481 ft, and steel liners at 102.5 ft and 6285 ft were removed
 - b. *Well Assessment/Evaluation*: The well was cleaned out to 7730 ft and a Gyro survey was run from 7730 ft to surface. CBL was run from 7474 to surface
 - c. *Zonal Remediation*: Per DOGGR requirements, two zones were perforated and cement squeezed, from 5330 to 5335 ft. depth (UP) and from 4310 to 4315 ft. depth (A1/USDW)
 - d. *Inner String Installation*: The production casing was drifted to prepare for a new inner string installation. A new 5-1/2" (20#, L80, FlushMaxII) inner string consisting of 7493 ft was installed and cemented. A new wellhead spool was installed to accommodate the inner string
 - e. *Well Reassessment/Re-evaluation*: Inspection logs (UT, CBL, MAC, MFL) were run from 7494 ft to surface. A pressure integrity test was performed on the new inner string. The casing shoe was drilled out, and wellbore was cleaned out to 7730 ft.
 - f. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7448 ft of 2-3/8" (4.7#, L80, EUTT) tubing with flow control components, a 5-1/2" packer (HES Sealbore VBA) at 7428 ft, and SSSV at 375 ft. The final installation integrity test was completed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

The updated project scope included zonal remediations, new inner string, tubing, and SSSV installations, thereby converting the well to tubing flow only.

Moreover, quality concerns required new material to be ordered, verified and delivered to make sure standards were met.

SIMP workover operations were shut down for an extended period in the beginning of 2018 until the development and implementation of mandatory emission avoidance protocol was complete, and development of new completion procedures. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$38,133	\$411	\$38,544
Contract Costs	\$356,261	\$44,531	\$400,792
Material	\$347,362	\$0	\$347,362
Other Direct Charges	\$2,063,048	\$65,609	\$2,128,657
Total Direct Cost	\$2,804,804	\$110,551	\$2,915,355

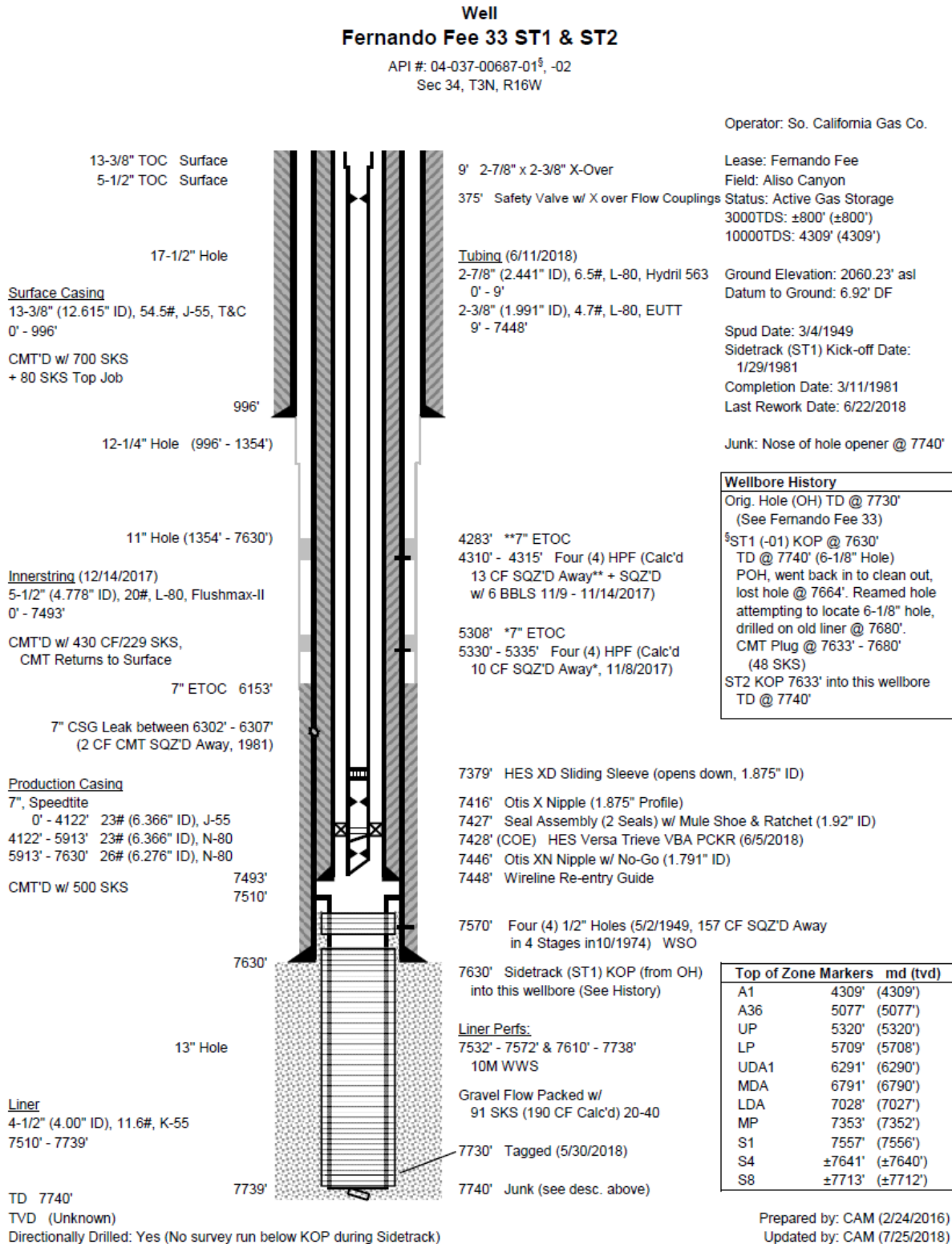
Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$147,787	\$1,525	\$149,312
AFUDC	\$45,562	\$0	\$45,562
Property Taxes	\$7,969	\$0	\$7,969
Total Indirect Costs	\$201,318	\$1,525	\$202,843

Total Loaded Costs	\$3,006,122	\$112,076	\$3,118,198²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

Storage Integrity Management Program Aliso Canyon – Fernando Fee 33

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 34A	API	04-037-22044-01
Project Type	Recompletion		
Well Status	Active	NOP:	11/18/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	10/05/1979, Redrill 02/14/2009 (Sidetrack)		
Initial Completion	12/20/1979; Redrill Completion 03/30/2009		
Elevation	2212 ft.		
Caprock Depth	7340 ft.		
Measured Depth	7850 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171, SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

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3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 34A. This project planned to pull 2-7/8" completion string, run casing inspection logs, a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the casing. The following describes the well workover plan for Fernando Fee 34A used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig Work

- a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 7485 ft of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 7" (HES G6) packer set at 7483 ft.
- b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7845 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (MFL, MAC, UT, CBL) from 7510 ft to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
- c. Well Completion
 - i. Install approximately 7460 ft. of 3-1/2" (9.3#, L80, TCPC) tubing of a new completion string and bottom hole assembly with 7" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload the well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	10/05/2016
2	Noise and Temp Survey	03/09/2016 11/08/2017
3	Ultrasonic (UT)	10/26/2016
4	Cement Bond Log (CBL)	10/26/2016
5	Multi-Arm Caliper (MAC)	10/25/2016
6	Magnetic Flux Leakage (MFL)	10/27/2016
7	Block Test	11/03/2016
8	Annular and Tubing Pressure Test – Final	11/14/2016

Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	11/16/2016
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	10/15/2016	11/16/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to isolate the well and move forward with the SIMP work
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 1100 psi for 1 hour
2. Rig Work included removing equipment, running inspection logs, and installing new completion equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 7485 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 7" (HES G-6) packer from 7483 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 7845 ft. Gyro survey was run from 7840 ft. to surface. MAC inspection log was run from 7500 ft. to surface. Inspection logs (UT, CBL) were run from 7476 ft. to surface; MFL inspection log was run from 7100 ft. to surface. The block test was performed
 - c. *Well Completion:* A new completion string and bottom hole assembly was installed consisting of 7463 ft. of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components, and a 7" (HES AS1X) Packer set at 7443 ft. The final installation pressure test was completed. The well head was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.
 2. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

Final completion tubing connection was upgraded to TSH threads from original plan. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$3,983	\$0	\$3,983
Contract Costs	\$43,795	\$2,592	\$46,387
Material	\$140,877	\$0	\$140,877
Other Direct Charges	\$498,055	\$56,019	\$554,074
Total Direct Cost	\$686,710	\$58,611	\$745,321

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$22,240	\$375	\$22,615
AFUDC	\$508	\$0	\$508
Property Taxes	\$227	\$0	\$227
Total Indirect Costs	\$22,975	\$375	\$23,350

Total Loaded Costs	\$709,685	\$58,986	\$768,671²
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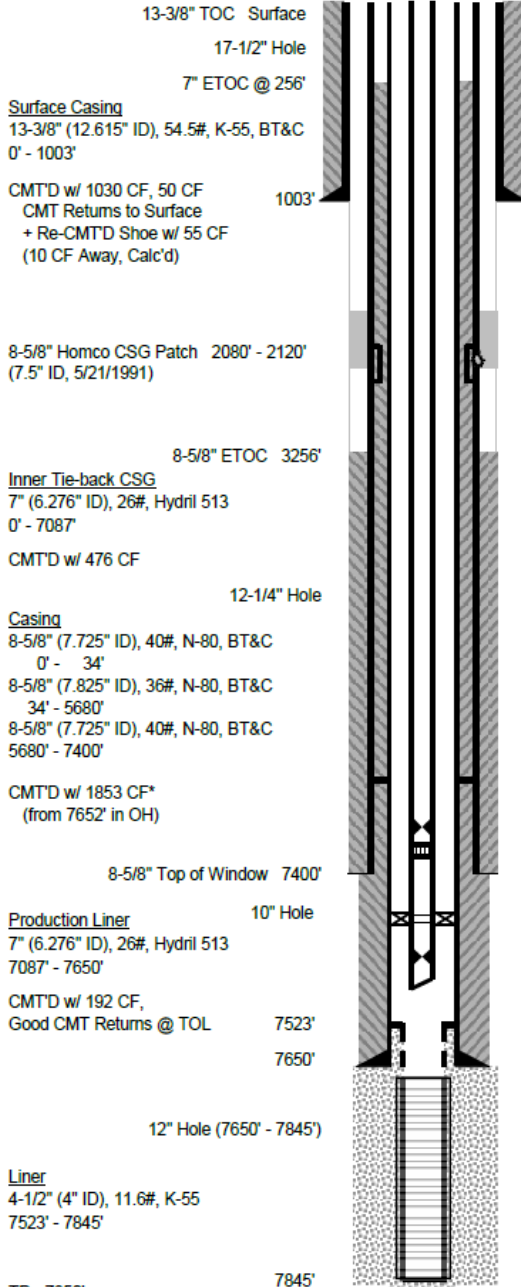
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Fernando Fee 34-A ST1

API #: 04-037-22044-01
Sec 34, T3N, R16W

Operator: So. California Gas Co.



Tubing (11/14/2016)
3-1/2" (2.992" ID), 9.3#, L-80, Hydril 563
0' - 7463'

Lease: Fernando Fee
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 4470' (4465')

Ground Elevation: 2212' asl
Datum to Ground: 21' KB

Spud Date: 10/5/1979
Sidetrack (ST1) Kick-off Date:
2/14/2009
Completion Date: 3/30/2009
Last Rework Date: 11/18/2016

Junk: None

1953' **8-5/8" ETOC
2093' - 2098' Holes in CSG (Calc'd
60 CF CMT SQZ'D Away**, 5/16/91)

Wellbore History	
Orig. Hole (OH) TD @ 7855'	(See Fernando Fee 34-A)
ST1 KOP @ 7400'	TD @ 7850'

Notes	
Lost returns while CMTing - full returns when CMT was in place.	

7087' 7" TOL & TOC
7357' "X" Nipple (2.813" ID)
7394' "XD" Sliding Sleeve (Opens Down, 2.813" ID)
7400' Sidetrack (ST1) KOP (from OH) into this wellbore (See History)

7443' HES AS1X PCKR (COE @ 7447', 11/14/2016)
7461' "XN" Nipple (2.75" Profile w/ 2.635" No-Go)
7463' Wireline Re-entry Guide

Top of Zone Markers md (tvd)		
A1	4470'	(4465')
A36	5187'	(5179')
UP	5498'	(5484')
LP	5838'	(5813')
UDA1	6390'	(6345')
MDA	6854'	(6796')
LDA	7079'	(7016')
MP	7340'	(7270')
S1	±7583'	(±7506')
S4	±7670'	(±7591')
S8	±7778'	(±7696')
S12	±7838'	(±7754')

Liner Perfs:
7598' - 7679' Semi-slots
7679' - 7845' 0.008" WWS

Gravel Packed w/
82 CF 30-50 resin coated
(126 CF Calc'd)

(7845' - 7850') 8" Hole

Prepared by: CAM (6/27/2016)
Updated by: LD (5/17/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 34BR	API	04-037-22302-01
Project Type	Recompletion		
Well Status	Active	NOP	02/14/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	12/19/1980; Redrill 11/15/1993 (Sidetrack)		
Initial Completion	02/03/1981; Redrill Completion 12/17/1993		
Ground Elevation	2212 ft.		
Caprock Depth	7234 ft.		
Measured Depth	7800 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this program is to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 34BR. This project planned to pull the 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new 3 1/2" completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the casing. The following describes the well workover plan for well Fernando Fee 34BR used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig work
 - a. Well Decompletion

-
- i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 7350 ft of 2-7/8" (6.5#, L80, EUE) tubing, bottom hole assembly, and 8-5/8" (Halliburton "WB") packer from 7350 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7795 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL, MAC) from top of liner to surface
 - iv. Perform pressure integrity test to a 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7335 ft. of 5-1/2" (20#, L80, TCPC) of a new completion string and bottom hole assembly with an 8-5/8" packer set at 7335 ft., thereby converting the well to tubing flow.
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
 3. Post Rig Work
 - a. Unload the well and turn over to operations
 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	09/01/2016
2	Noise and Temp Survey	03/09/2016 10/28/2016
3	Ultrasonic (UT)	12/29/2016
4	Cement Bond Log (CBL)	12/29/2016
5	Multi-Arm Caliper (MAC)	12/30/2016
6	Magnetic Flux Leakage (MFL)	01/04/2017
7	Block Test	01/09/2017
8	Annular and Tubing Pressure Test – Final	01/24/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	01/26/2017
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	11/21/2016	02/06/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to isolate the well and move forward with the SIMP work
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 1000 psi for 1 hour
2. Rig Work involved removing the completion string, running casing inspection logs, pressure testing, and running a new completion string
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 7350 ft of 2-7/8" (6.5#, L80, EUE) tubing and bottom hole assembly. The 8-5/8" (Halliburton "WB") packer was milled and pushed down to 7736 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 7736 ft. and a Gyro survey was run from 7726 ft to surface. CBL and UT were run from 7395 ft to surface; MAC and MFL were run from 7401 ft to surface. The block test was performed
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7321 ft of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components, and 8-5/8" (Weatherford AS1-X) packer set at 7296 ft. The final installation integrity test was completed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

Existing completion packer could not be removed, so it was milled and pushed to bottom of the well to complete the rig work. Final tubing connections were upgraded from TCPC to TSH, and downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$10,736	\$0	\$10,736
Contract Costs	\$17,110	\$6,099	\$23,209
Material	\$131,936	\$0	\$131,936
Other Direct Charges	\$917,187	\$62,527	\$979,714
Total Direct Cost	\$1,076,969	\$68,626	\$1,145,595

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$27,926	\$457	\$28,383
AFUDC	\$2,505	\$0	\$2,505
Property Taxes	\$441	\$0	\$441
Total Indirect Costs	\$30,872	\$457	\$31,329

Total Loaded Costs	\$1,107,841	\$69,083	\$1,176,924²
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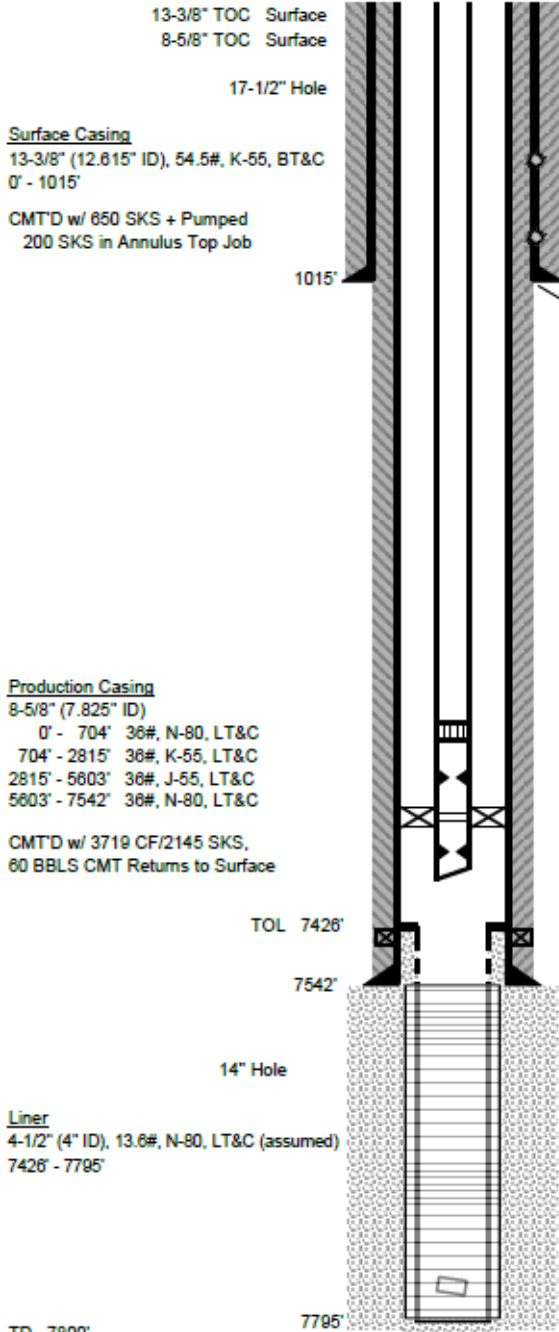
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Fernando Fee 34BR ST1

API #: 04-037-22302-01
Sec 34, T3N, R16W

Operator: So. California Gas Co.



Tubing (1/23/2017)
3-1/2" (2.991" ID), 9.2#, L-80, Hydril 563
0' - 7321'

±570' 13-3/8" CSG Leak (300 SKS
CMT SQZD, 11/18/1993)

872' - ±905' 13-3/8" CSG Leaks Btwn.
(300 SKS + 250 SKS + 230 SKS
CMT SQZD, 11/17-20/1993)

1015' Sidetrack (ST1) KOP (from OH)
into this wellbore (See History)

Lease: Fernando Fee
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 4380' (4308')

Ground Elevation: 2212' asl
Datum to Ground: 23' KB
¹OH Datum to Ground: 19' KB

Spud Date: 12/19/1980
Sidetrack (ST1) Kick-off Date:
11/15/1993
Completion Date: 12/17/1993
Last Rework Date: 1/25/2017

Junk: PCKR Junk Milled to 7736'
(12/21/2016)

Wellbore History	
Orig. Hole (OH) TD @	8410'
(See Fernando Fee 34BR)	
ST1 KOP @	1015'
TD @	7800'

7216" "WXO" Sliding Sleeve (2.81" ID)

7254" "WX" Nipple (2.81" ID)

7296" WEA D&L AS1-X PCKR (COE @ 7300', 1/23/2017)

7318" "WXN" Nipple (2.75" w/ 2.635" No-Go)

7321" Wireline Re-entry Guide

7435' - 7445' 8-5/8", 40# ECP
(Inflated w/ 95 CF/83 SKS)

Liner Perfs:
7459' - 7539' 1.5" x 0.012", 12R, 6°C Slots
7539' - 7791' 0.012", 90 Wire WWS

Gravel Packed w/ 274 CF (118% of
Caliper Volume) 20-40 resin coated

7736' Top of Junk (see desc. above)

Top of Zone Markers md (tvd)		
A1	4380'	(4308')
A36	5113'	(5020')
UP	5425'	(5323')
LP	5800'	(5688')
UDA1	6334'	(6215')
MDA	6742'	(6618')
LDA	7006'	(6878')
MP	7234'	(7103')
S1	7550'	(7415')
S4	7644'	(7508')
S8	7720'	(7583')
S12	7786'	(7648')

TD 7800'
TVD (7662')
Directionally Drilled: Yes (TD is 190' W, 1253' N of Surf)

Prepared by: CAM (6/29/2016)
Updated by: LD (5/17/2018)



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 35A	API	04-037-21457-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP	09/30/2016; 09/28/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	07/16/1974		
Initial Completion	08/18/1974		
Ground Elevation	1674 ft.		
Caprock Depth	6725 ft.		
Measured Depth	7232 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

o Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ Pipeline and Hazardous Materials Safety Administration PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 35A. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for well Fernando Fee 35A used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 6976 ft of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 8-5/8" (Otis Permatrieve) Packer from 6977 ft.
- b. Well Assessment/Evaluation
 - i. Clean out production casing to liner top at 6990 ft.
 - ii. Run inspection logs, MFL and MAC, from 6990 ft to surface
 - iii. Run Gyro survey from total depth to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - v. Clean out wellbore to target depth of 7223 ft.

Based on inspection logs, two options were proposed.

Option A (Run inner string)

- c. Well Assessment/Evaluation
 - i. Drift and prepare production casing for installation of new 6-5/8" inner string to top of production liner
- d. Inner string Installation
 - i. Run and install new 6-5/8" (28#, L80, LTC/BTC) inner string at approximately 6990 ft.
 - ii. Cement 6-5/8" inner string in place
- e. Well Reassessment/Re-evaluation
 - i. Install new spool to accommodate inner string
 - ii. Perform integrity test to 1.15 MAOP on inner string
 - iii. Run inspection logs (UT, CBL, MFL, MAC) from approximately 6990 ft to surface
 - iv. Clean out cement and wellbore to total depth
- f. Well Completion
 - i. Install approximately 6900 ft. of 4-1/2" (12.6#, L80, TCPC) of new completion string and bottom hole assembly, with 6-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead

Option B (Do Not Run inner string)

- g. Well Reassessment/Re-evaluation
 - i. Remove wellhead components for refurbishing and inspection, or for replacement if necessary
 - ii. Run inspection logs (UT and CBL) from approximately 6990 ft to surface
- h. Well Completion
 - i. Install approximately 6900 ft of 4-1/2" (12.6#, L80, TCPC) of a new completion string and bottom hole assembly, with 8-5/8" packer, thereby converting the well to tubing flow

- ii. Perform installation integrity test on completion
- iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/02/2016 03/21/2016 10/25/2016 10/23/2017
3	Ultrasonic (UT)	08/18/2016 07/19/2018 08/14/2018
4	Cement Bond Log (CBL)	08/18/2016 07/19/2018 08/14/2018
5	Multi-Arm Caliper (MAC)	08/13/2016 08/16/2018
6	Magnetic Flux Leakage (MFL)	08/12/2016 08/17/2018
7	Block Test	08/19/2016 08/20/2018
8	Annular and Tubing Pressure Test – Final	09/12/2016 08/30/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval DOGGR District Approval	09/13/2016 09/26/2018
10	Return to Service	07/31/2017 11/19/2018

2. Project timeline

Major Milestone	Start	Finish
Rig Work Phase 1	08/01/2016	09/12/2016
Rig Work Phase 2	10/26/2016	11/09/2016
Rig Work Phase 3	06/27/2018	08/31/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to move forward with the SIMP work
2. Rig work was completed in three phases
 - a. Phase 1 involved removing the existing production string, running inspection logs, and installing a new completion string
 - i. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 6976 ft of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 8-5/8" (Otis Pematrieve) Packer from 6977 ft.
 - ii. *Well Assessment/Evaluation:* The well was cleaned out to the target depth of 7223 ft. Gyro survey and MAC were run from 7207 ft to surface, and MFL from 7000 ft to surface. UT and CBL inspection logs were run from 6975 ft to surface, and the block test was performed on casing
 - iii. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 6926 ft of 4-1/2" (12.6#, L80, TCPC) tubing with flow control components, and 8-5/8" (WFT AS1-X) Packer set at 6903 ft. The final installation integrity test was performed. The wellhead was re-installed and tested

- b. Phase 2 included resetting the completion string
 - i. *Well Decompletion:* Wellhead was removed
 - ii. *Well Completion:* The tubing string was reset in the packer with additional compressive weight to complete the installation and meet field operating conditions. The final installation integrity test was performed. The wellhead was re-installed and tested
 - iii. *Post Rig Work:* The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth.
- c. Phase 3 included removing the existing completion string, running inspection logs, performing zonal remediations, and installing a new inner string and completion string
 - i. *Well Decompletion:* This step included the removal of wellhead components and completion production equipment consisting of 6926 ft of 4-1/2" (12.6#, L80, TCPC) tubing, flow components, and 8-5/8" (WFT AS1-X) packer from 6903 ft.
 - ii. *Well Assessment/Evaluation:* The well was cleaned out to 7223 ft. Casing inspection logs (UT, CBL, MFL) were run from 6990 ft to surface
 - iii. *Zonal Remediation:* Per DOGGR requirements, one zone was perforated and cement squeezed from 800 ft to 815 ft (BFW)
 - iv. *Inner String Installation:* The production casing was drifted to prepare for inner string installation. A new inner string consisting of 6990 ft of 6-5/8" (24#, L80, LTC) casing was installed and cemented. A new spool was installed to accommodate the inner string
 - v. *Well Reassessment/Re-evaluation:* The inner string was cleaned out to top of cement at 6830 ft and was drilled out to 6963 ft. Casing inspection logs were run on the inner string (UT and CBL) from 6962 ft to surface, and MFL and MAC from 6963 ft to surface. The block test was performed; the cement shoe was drilled out. The wellbore was cleaned out to 7216 ft and a Gyro survey was run from 7216 ft to surface
 - vi. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 6876 ft. consisting of 2-7/8" (6.5#, L80, TSH 563) tubing with flow control components, and a 6-5/8" (HES VTA) Packer set at 6860 ft. The final installation integrity test was performed. A new wellhead was installed and tested

3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

After Initial rig work, the well experienced pressure build-up and resetting of completion equipment was required to keep it in service. Once the field returned to normal operating conditions, a third rig work was needed due to annular pressures. Inspection logs were rerun on the production casing. A new inner string was installed. Per DOGGR, one zonal remediation was required. The tubing, flow components, and wellhead were enhanced for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$41,251	\$0	\$41,251
Contract Costs	\$538,456	\$92,724	\$631,180
Material	\$693,922	\$0	\$693,922
Other Direct Charges	\$1,535,721	\$55,761	\$1,591,482
Total Direct Cost	\$2,809,350	\$148,485	\$2,957,835

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$149,536	\$5,284	\$154,820
AFUDC	\$13,894	\$0	\$13,894
Property Taxes	\$0	\$0	\$0
Total Indirect Costs	\$163,430	\$5,284	\$168,714

Total Loaded Costs	\$2,972,780	\$153,769	\$3,126,549²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Fernando Fee 35A

API #: 04-037-21457-00
Sec 34, T3N, R16W

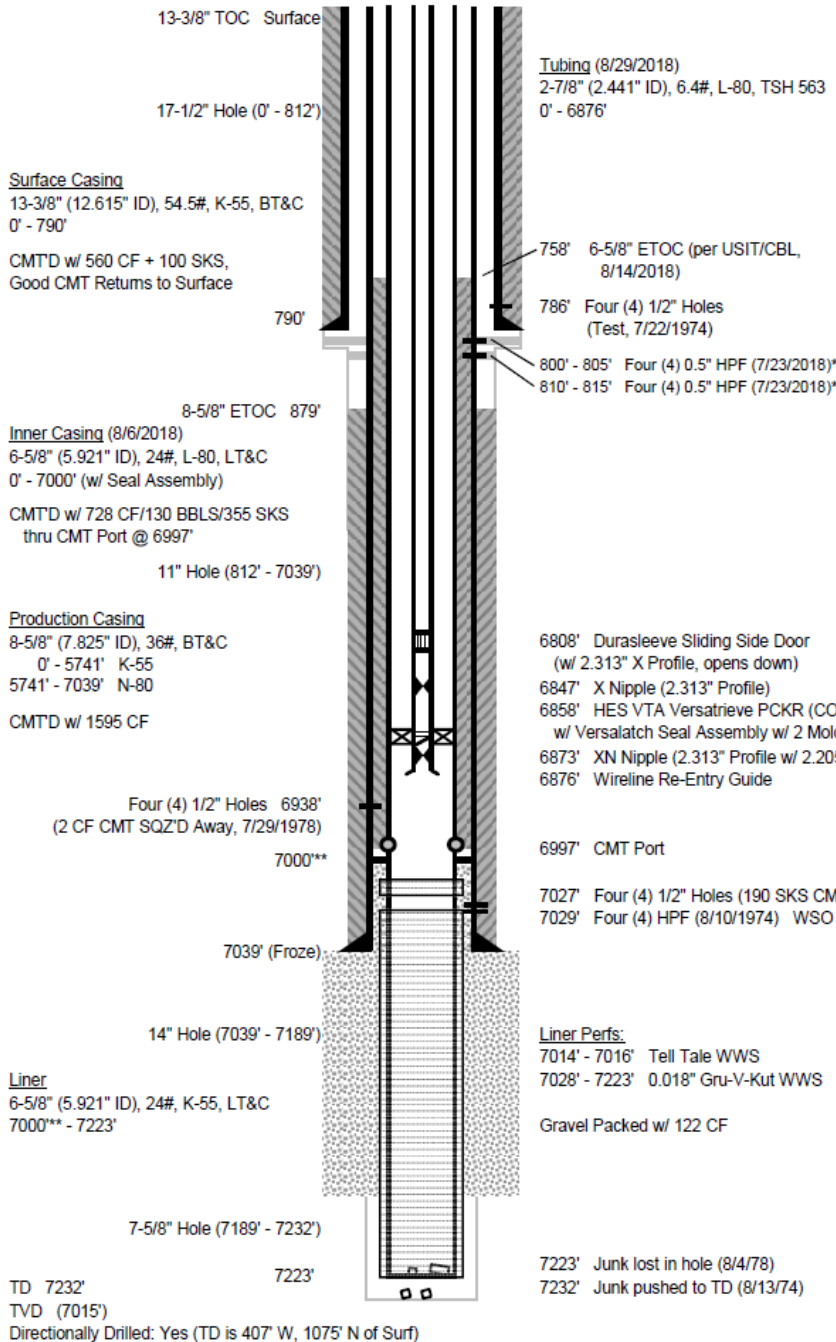
Operator: So. California Gas Co.

Lease: Fernando Fee
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 3847' (3835')

Ground Elevation: 1674' asl
Datum to Ground: 15' KB

Spud Date: 7/16/1974
Completion Date: 8/18/1974
Last Rework Date: 8/31/2018

Junk: Cone & nose fl hole opener @ 7232' (8/13/74).
(1) 3/4" x 3-1/4" slips section, 3" of TBG seal divider (guide ring 5-1/2" OD), & 2" of X-locking mandrel fishing neck @ 7223' (8/4/78)



Notes
**Attempted to establish injection rate. Pressured up to 200 psi solid @ frac gradient w/ no injection.* Calc'd 5 CF CMT Away, 7/23/2018.
**Top of Liner orig. @ 6990', 2018 workover indicates the innerstring stacked out on top of lower liner @ 7000'.

Top of Zone Markers	md	(tvd)
A1	3847'	(3835')
A36	4434'	(4390')
UP	4902'	(4820')
LP	5304'	(5192')
UDA1	5724'	(5584')
MDA	6187'	(6017')
LDA	6416'	(6233')
MP	6725'	(6528')
S1	6963'	(6756')
S4	7040'	(6830')
S8	7108'	(6895')
S14	7218'	(7001')

Prepared by: MAM (4/5/2016)
Updated by: CAM (9/6/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 35B	API	04-037-21458-00
Project Type	Steel Liner Recompletion		
Well Status	Active	NOP:	10/23/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	08/20/1974		
Initial Completion	09/28/1974		
Ground Elevation	1674 ft.		
Caprock Depth	6900 ft.		
Measured Depth	7335 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171, SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this program was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 35B. This project planned to pull the 2-7/8" completion string, steel liner, run inspection logs and a Gyro survey, pressure test casing, install steel liners and a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on production casing. The following describes the well workover plan for well Fernando Fee 35B used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

-
- ii. Pull existing completion consisting of 7025 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, 8-5/8" (Otis "WB") packer from 7021 ft., and steel liner from 3976 ft. to 3999 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth 7331 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (MAC, MFL) from 7100 ft. to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - v. Run inspection logs (UT, CBL) from 7090 ft. to surface
 - c. Steel Liner Installation
 - i. Run and install steel liners from 7015 ft. to 7091 ft. and from 3950 ft. to 4026 ft.
 - d. Well Completion
 - i. Install approximately 7025 ft. of 3-1/2" (9.3#, L80, TCPC) new tubing completion string, bottom hole assembly, and 8-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
 3. Post Rig Work.
 - a. Unload well and turn over to operations.
 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/30/2016 02/08/2017
2	Noise and Temp Survey	03/22/2016 03/13/2017 09/24/2017 10/23/2017
3	Ultrasonic (UT)	06/01/2017
4	Cement Bond Log (CBL)	06/01/2017
5	Multi-Arm Caliper (MAC)	07/13/2017 07/25/2017
6	Magnetic Flux Leakage (MFL)	07/14/2016
7	Block Test	06/05/2017
8	Annular and Tubing Pressure Test – Final	07/28/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	08/04/2017
10	Return to Service	09/12/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work Phase 1	06/08/2016	08/02/2016
Rig Work Phase 2	05/26/2017	07/31/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by DOGGR Safety Review Team, determining that it was safe to move forward with the SIMP work
2. Rig Work was completed in two phases
 - a. Phase 1 involved removing the existing production equipment and steel liner, pushing the packer to the liner top, running the MFL inspection log, and isolating the well
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7025 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and steel liner from 3976 ft. The 8-5/8" (Otis WB) packer was milled and pushed to 7098 ft.
 - ii. *Well Assessment/Evaluation*: MFL log was run from 7060 ft. to surface
 - iii. *Well Isolation*: The well was isolated from storage zone. The wellhead was re-installed and tested
 - b. Phase 2 involved removing the wellhead, running casing inspection logs, block test casing, running Gyro survey, installing new steel liners, running a new completion and new wellhead
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and isolation equipment
 - ii. *Well Assessment/Evaluation*: Inspection logs were run (UT, CBL) from 7060 ft. to surface. Block test was performed. The milled packer was pushed to 7260 ft. Gyro survey was ran from 7245 ft. to surface and MAC log was run from 7089 ft. to surface
 - iii. *Steel Liner Installation*: Steel liners were installed from 7043 ft. to 7080 ft and from 3961 ft to 3998 ft. MAC log was run from 7088 ft. to surface
 - iv. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 6993 ft of 4-1/2" (12.6#, L80, TSH 513) new tubing, flow control components, and a 7" (WFT AS-1X) Packer set at 7054 ft. The final installation integrity test was performed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

Due to material delays, the rig was utilized on another well. The existing production packer could not be recovered, so it was pushed down into the liner. The final completion tubing was upsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Storage Integrity Management Program
Aliso Canyon – Fernando Fee 35B

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$24,420	\$0	\$24,420
Contract Costs	\$78,883	\$2,830	\$81,713
Material	\$104,649	\$0	\$104,649
Other Direct Charges	\$2,119,986	\$65,464	\$2,185,450
Total Direct Cost	\$2,327,938	\$68,294	\$2,396,232

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$85,481	\$434	\$85,915
AFUDC	\$75,708	\$0	\$75,708
Property Taxes	\$13,210	\$0	\$13,210
Total Indirect Costs	\$174,399	\$434	\$174,833

Total Loaded Costs	\$2,502,337	\$68,728	\$2,571,065²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Fernando Fee 35B

API #: 04-037-21458-00
Sec 34, T3N, R16W

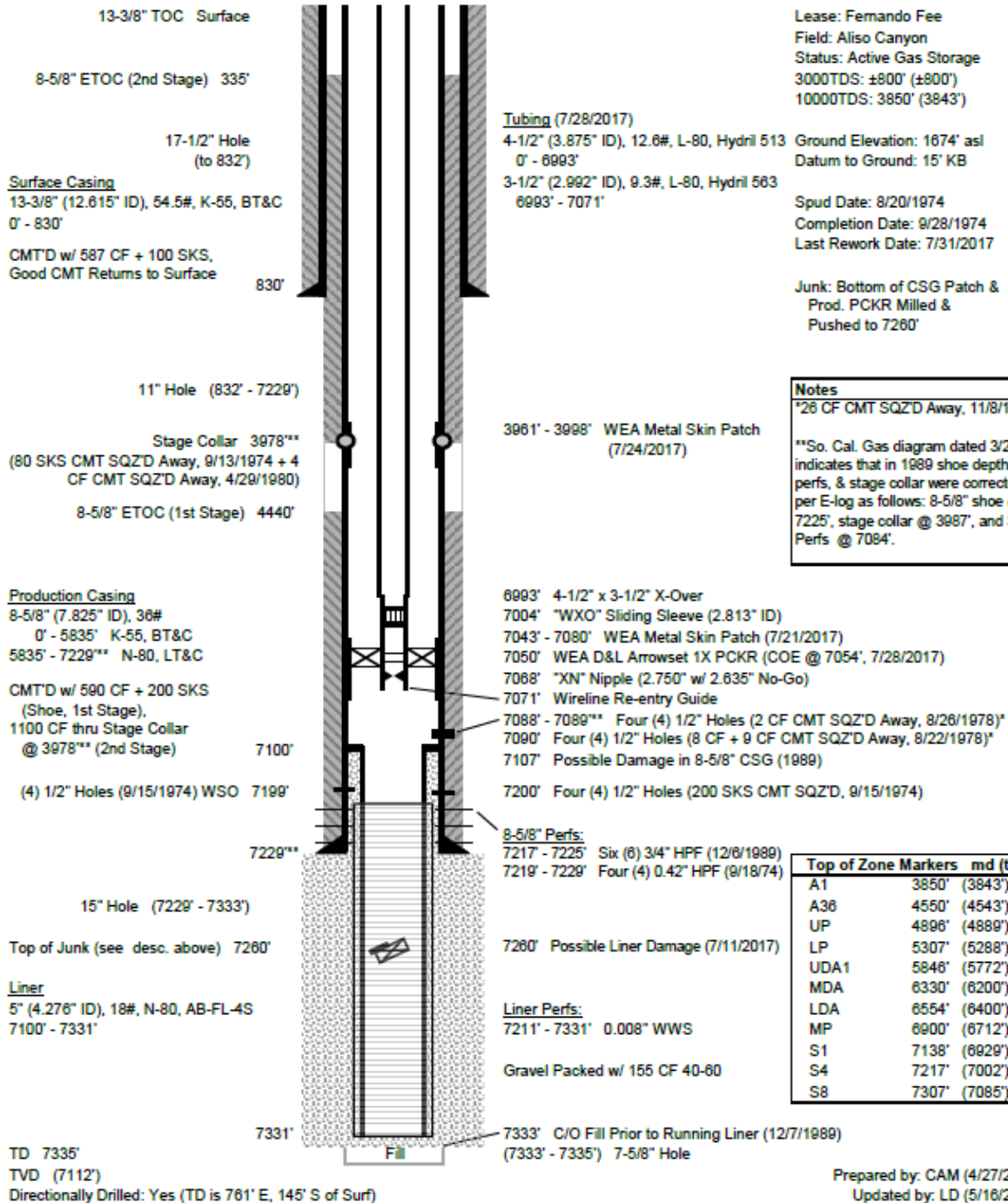
Operator: So. California Gas Co.

Lease: Fernando Fee
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 3850' (3843')

Ground Elevation: 1674' asl
Datum to Ground: 15' KB

Spud Date: 8/20/1974
Completion Date: 9/28/1974
Last Rework Date: 7/31/2017

Junk: Bottom of CSG Patch &
Prod. PCKR Milled &
Pushed to 7260'



Notes
*28 CF CMT SQZ'D Away, 11/8/1980
**So. Cal. Gas diagram dated 3/28/80 indicates that in 1989 shoe depth, perfs, & stage collar were corrected per E-log as follows: 8-5/8" shoe @ 7225', stage collar @ 3987', and SQZ Perfs @ 7084'.

Zone Marker	md	(tvd)
A1	3850'	(3843')
A36	4550'	(4543')
UP	4896'	(4889')
LP	5307'	(5288')
UDA1	5846'	(5772')
MDA	6330'	(6200')
LDA	6554'	(6400')
MP	6900'	(6712')
S1	7138'	(6929')
S4	7217'	(7002')
S8	7307'	(7085')

Prepared by: CAM (4/27/2016)
Updated by: LD (5/16/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 35C	API	04-037-21279-01
Project Type	Recompletion		
Well Status	Active	NOP	06/02/2017; 04/06/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	09/14/1972; Redrill 01/09/2008 (Sidetrack)		
Initial Completion	11/27/1972; Redrill Completion 02/11/2008		
Ground Elevation	1674 ft.		
Caprock Depth	6745 ft.		
Measured Depth	7277 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 35C. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for well Fernando Fee 35C used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey
 - b. Well Isolation
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 6857 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 7" (HES G6) packer from 6853 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7189 ft.
 - ii. Run inspection logs (MFL, MAC, UT, CBL) from 6879 ft to surface
 - iii. Run Gyro survey from total depth to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 6764 ft of 4-1/2" (12.6#, L80, TSH 513), and 99 ft of 3-1/2" (9.3#, L80, TCPC) of a new tubing completion string, bottom hole assembly, and 7" packer set at 6843 ft., thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	10/01/2016
2	Noise and Temp Survey	03/02/2016 03/11/2016 08/07/2017 08/09/2017
3	Ultrasonic (UT)	11/29/2016 03/18/2018
4	Cement Bond Log (CBL)	11/29/2016 03/18/2018
5	Multi-Arm Caliper (MAC)	11/28/2016 03/19/2018
6	Magnetic Flux Leakage (MFL)	11/28/2016 03/20/2018
7	Block Test	11/30/2016 03/20/2018
8	Annular and Tubing Pressure Test – Final	12/19/2016 04/02/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval DOGGR District Approval	12/27/2016 04/06/2018
10	Return to Service	07/31/2017 08/08/2018

2. Project timeline

Major Milestone	Start	Finish
Rig Work Phase 1	11/17/2016	12/20/2016
Rig Work Phase 2	12/16/2017	04/03/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to isolate the well and move forward with the SIMP work
 - b. The well was successfully isolated from the storage zone with a plug in the completion string and pressure tested to 1000 psi for 1 hour
2. Rig Work was completed in two phases
 - a. Phase 1 involved removing the completion equipment, cleaning out the well bore to bottom, running inspection logs and block test, and running a new completion string
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 6857 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and an 7" (HES G6) packer from 6853 ft.
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 7184 ft. Inspection logs were run MAC and MFL from 6857 ft to surface, and UT and CBL from 6846 ft to surface. Gyro survey was run from 6879 ft to surface, and block test performed
 - iii. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 6764 ft of 4-1/2" (12.6#, L80, TSH 513) and 99 ft. of 3-1/2" (9.3#, L80, TSH 563) tubing, bottom hole assembly and 7" (HES AS1) Packer set at 6832 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
 - b. Phase 2 involved removing the completion equipment and running a new packer
 - i. *Well Decompletion*: This step included the removal of the wellhead components and production equipment consisting of 6764 ft of 4-1/2" (12.6#, L80, TSH 513) and 99 ft. of 3-1/2" (9.3#, L80, TSH 563) tubing, bottom hole assembly and 7" (HES AS1) Packer from 6832 ft.
 - ii. *Well Reassessment/Re-evaluation*: Inspection logs were rerun (MAC, MFL, UT, CBL) from 6850 ft to surface, and block test performed
 - iii. *Well Completion*: A new completion and bottom hole assembly were installed consisting of 6809 ft of 3-1/2" (9.3#, L80, TSH 563) tubing, bottom hole assembly, and 7" (Baker SC) Packer set at 6780 ft. The final installation integrity test was also performed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

After Initial rig work and once the field returned to normal operating conditions, the well experienced pressure build-up and new completion equipment was required to keep it in service. The tubing was downsized to optimize well operation and inspection logs were rerun. SIMP workover operations were shut down for an extended period in the beginning of 2018 until the development and implementation of mandatory emission avoidance protocol was complete, and development of new completion procedures. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$32,301	\$0	\$32,301
Contract Costs	\$329,091	\$62,652	\$391,743
Material	\$308,845	\$0	\$308,845
Other Direct Charges	\$1,411,293	\$18,620	\$1,429,913
Total Direct Cost	\$2,081,530	\$81,272	\$2,162,802

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$107,044	\$649	\$107,693
AFUDC	\$11,562	\$0	\$11,562
Property Taxes	\$4,662	\$0	\$4,662
Total Indirect Costs	\$123,268	\$649	\$123,917

Total Loaded Costs	\$2,204,798	\$81,921	\$2,286,719²
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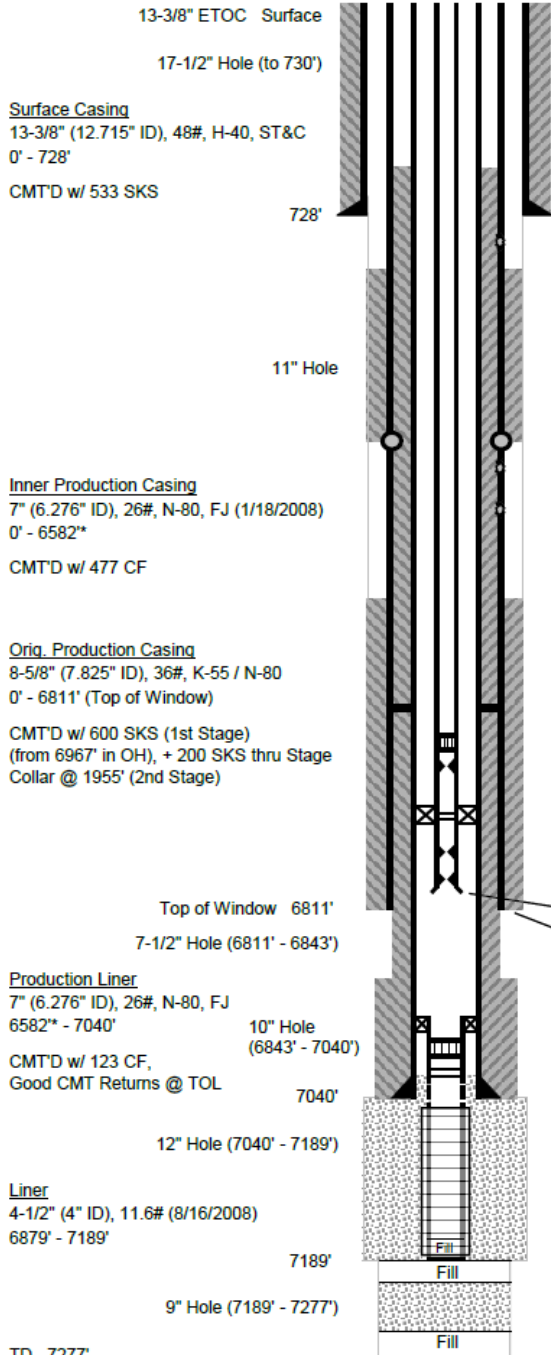
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Fernando Fee 35C ST1

API #: 04-037-21279-01
Sec 34, T3N, R16W

Operator: So. California Gas Co.



Tubing (4/2/2018)
3-1/2" (2.992" ID), 9.3#, L-80, Hydril 563
0' - 6809'

594' 7" (Inner String) ETOC

966' 8-5/8" CSG Corrosion (9/19/90)

1050' 8-5/8" ETOC (2nd Stage)

1955' 8-5/8" Stage Collar

2160' -2170' 8-5/8" CSG Hole Btwn.
(CMT'D Off by Inner CSG, 3/27/2007)

2350' 8-5/8" CSG Corrosion (9/19/90)

4358' 8-5/8" ETOC (1st Stage)

6582* 7" TOL & TOC

6726' CD 6000 Sliding Sleeve (w/ 2.813" ID X Profile)

6766' BX Nipple (2.813" ID w/ "X" Profile)

6777' Anchor Seal Assembly (3" ID)

6778' SC PCKR (COE @ 6780', 3/28/2018)

6782' Seal Bore w/ Box & Extension (4" ID)

6795' BXN Nipple (2.813" w/ 2.666" No-Go)

6806' Nipple w/ Collar (1.5" ID)

6809' Wireline Re-entry Guide

6811' Sidetrack (ST1) KOP (from OH) into this wellbore (See History)

6879' PCKR

6891' Sliding Sleeve

6892' Seal bore

Liner Perfs:

6974' - 7053' Semi-perfs

7053' - 7184' WWS (w/ 6" Shroud)

Gravel Packed w/ 132 CF 20/40
(100 CF Calc'd)

7184' Tagged (unable to work past, 3/17/2018**)

7189' Top of Fill (8/13/2008)

7200' - 7258' Sand Plug
(25 CF 20/40)

7258' Top of Fill (assumed)

Lease: Fernando Fee
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±799')
10000TDS: 3895' (3886')

Ground Elevation: 1674' asl
Datum to Ground: 15' KB

Spud Date: 9/14/1972

Sidetrack (ST1) Kick-off Date: 1/9/2008

Completion Date: 2/11/2008

Last Rework Date: 4/3/2018

Junk: None

Wellbore History

Orig. Hole (OH) TD @ 7487'
(See Fernando Fee 35C)
ST1 KOP @ 6811'
TD @ 7277'

Notes

*Caliper & vertilog found 6' gap
between 7" CSG Strings f/ 6584' -
6590', 11/28/2016.

**Re-tagged on 3/17/2018

Top of Zone Markers	md	(tvd)
A1	3895'	(3886')
A36	4577'	(4551')
UP	4925'	(4876')
LP	5336'	(5261')
UDA1	5787'	(5684')
MDA	6220'	(6095')
LDA	6445'	(6310')
MP	6745'	(6599')
S1	±6985'	(±6829')
S4	±7065'	(±6906')
S8	±7148'	(±6985')
S14	±7250'	(±7083')
CR	±7261'	(±7094')

Prepared by: LD (8/8/2016)

Updated by: LD (5/15/2018)

InteAct

TD 7277'
TVD (7107')
Directionally Drilled: Yes (TD is 91' E, 930' N of Surf)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 35D	API	04-037-21453-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP	05/30/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	04/16/1974		
Initial Completion	06/14/1974		
Ground Elevation	1674 ft.		
Caprock Depth	6807 ft.		
Measured Depth	7270 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 35D. This project planned to pull 2-7/8" completion string, run casing inspection logs and Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for well Fernando Fee 35D used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7098 ft of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 8-5/8" Baker model "D" Packer from 7087 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7270 ft.
 - ii. Perform pressure integrity test to 1.15 MAOP
 - iii. Run Gyro survey from total depth to surface
 - iv. Run inspection logs (MFL, MAC, UT, CBL) from approximately 7082 ft to surface
 - c. Well Completion
 - i. Install approximately 7020 ft of 4-1/2" (12.6#, L80, TSH 513) of a new completion string, 8-5/8" packer set at 7000 ft., and bottom hole assembly, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/19/2016 01/31/2017
2	Noise and Temp Survey	03/02/2016 03/22/2016 01/28/2017 11/08/2017
3	Ultrasonic (UT)	04/12/2017 05/15/2017
4	Cement Bond Log (CBL)	04/12/2017 05/15/2017
5	Multi-Arm Caliper (MAC)	04/12/2017 05/12/2017
6	Magnetic Flux Leakage (MFL)	04/06/2017 05/16/2017
7	Pressure Integrity Test	05/16/2017
8	Annular and Tubing Pressure Test – Final	05/25/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	06/08/2017
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	03/14/2017	05/26/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP work
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 500 psi for 1 hour
2. Rig Work involved removing existing production equipment, running inspection logs, performing zonal remediation, and installing a new inner string and completion
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and completion production equipment consisting of 7098 ft of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 8-5/8" (Baker model "D") packer from 7087 ft.
 - b. *Well Assessment/Evaluation:* An MFL log was run from 7105 ft to surface. The well was cleaned out to 7252 ft. Gyro survey was run from 7182 ft. to surface. Casing inspection logs (UT, CBL, MAC) were run from 7069 ft to surface
 - c. *Zonal Remediation:* Per DOGGR requirement, two zones were perforated and cement squeezed, from 5900 ft to 5905 ft (UDA1) and from 795 ft to 800 ft (BFW)
 - d. *Inner String Installation:* The production casing was drifted to prepare for a new inner string installation. A new 6-5/8" (24#, L80, LT&C) inner string consisting of 7082 ft was installed and cemented. A new spool was installed to accommodate the inner string
 - e. *Well Reassessment/Re-evaluation:* The inner string was cleaned out to top of cement at 6991 ft. MFL and MAC were run from 6973 ft. to surface; UT and CBL were run from 6970 ft. to surface. A pressure integrity test was performed on the new inner string. The cement shoe was drilled out
 - f. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7000 ft of 4-1/2" (12.6#, L80, TSH 513) tubing with flow control components, and a 6-5/8" (HES AS1-X) Packer set at 7051 ft. The final installation integrity test was performed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

During well assessment, casing anomalies were identified, and installation of an inner string was required. Two zones were perforated and cement squeezed in the production casing before running the new inner string. The tubing, flow components, and wellhead were enhanced for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$20,445	\$0	\$20,445
Contract Costs	\$56,859	\$0	\$56,859
Material	\$229,246	\$0	\$229,246
Other Direct Charges	\$1,449,417	\$120,845	\$1,570,262
Total Direct Cost	\$1,755,967	\$120,845	\$1,876,812

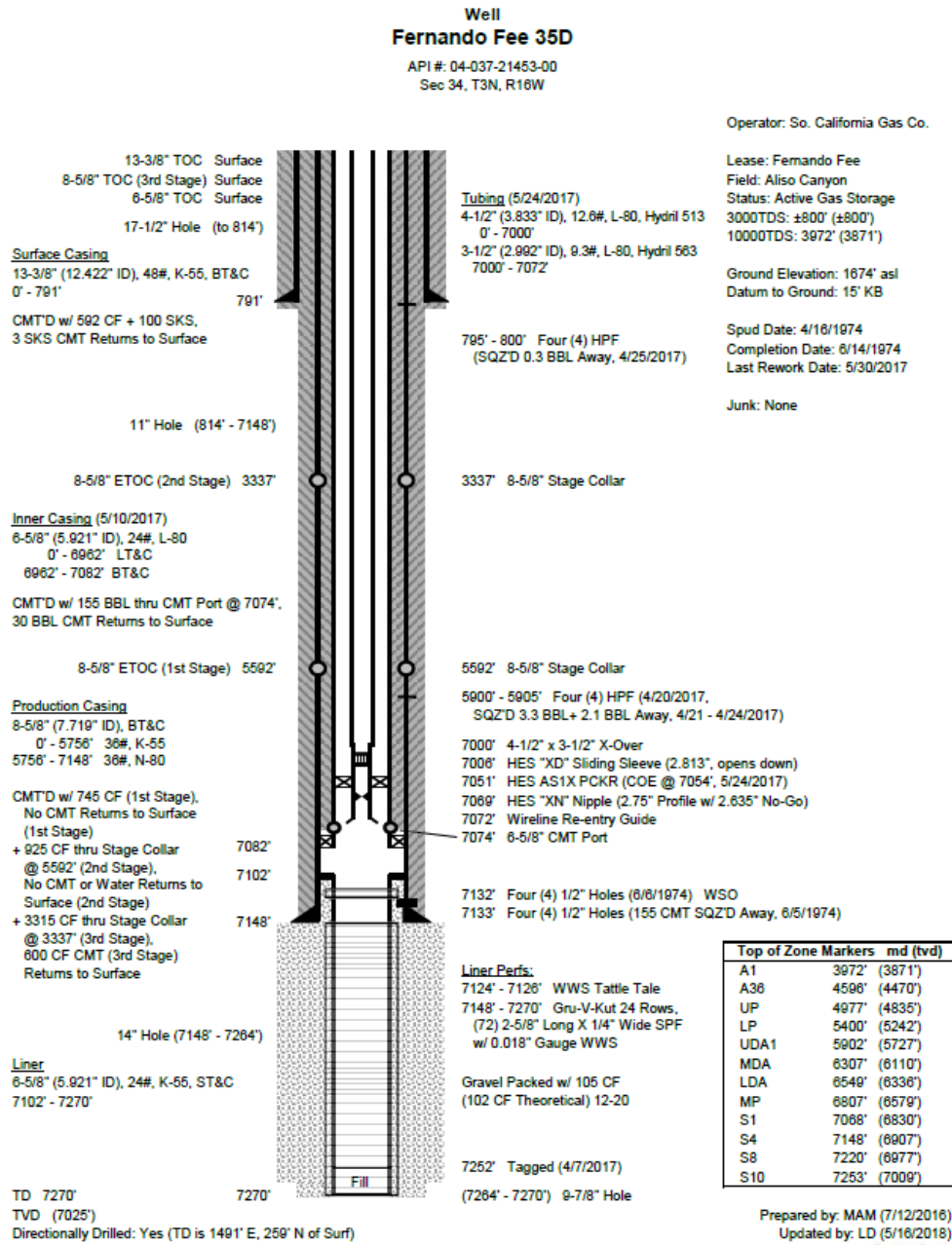
Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$66,889	\$746	\$67,635
AFUDC	\$2,377	\$0	\$2,377
Property Taxes	\$5,380	\$0	\$5,380
Total Indirect Costs	\$74,645	\$746	\$75,392

Total Loaded Costs	\$1,830,612	\$121,592	\$1,952,204²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

Storage Integrity Management Program Aliso Canyon – Fernando Fee 35D

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 35E	API	04-037-21278-01
Project Type	Inner String Recompletion		
Well Status	Active	NOP	06/02/2017; 05/10/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	08/06/1972; Redrill 09/28/1977 (Sidetrack)		
Initial Completion	11/15/1972; Redrill Completion 10/23/1977		
Ground Elevation	1674 ft.		
Caprock Depth	6790 ft.		
Measured Depth	7350 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 35E. This project planned to pull 2-7/8" completion string and 7" inner string, run casing inspection logs, perform zonal remediations, install new inner string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for well Fernando Fee 35E used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey
 - b. Well Isolation
2. Rig work
 - a. Well Decompletion

- i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion 6877 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 7" (Baker Retrieva "D") packer from approximately 6875 ft.
 - iii. Pull 6899 ft. of existing 7" (26#, N80, LTC) inner string and 8-5/8" (Otis "WC") packer from approximately 6890 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 6894 ft.
 - ii. Run inspection logs (UT, CBL) on the production casing and liner from 6894 ft to surface
 - c. Zonal Remediation
 - i. Cement squeeze critical zones as required by DOGGR.
 - ii. Drift and redress 8-5/8" production casing for new inner string installation
 - d. Inner String Installation
 - i. Install and cement approximately 6889 ft. of 7" (26#, L80, TSH513) inner string
 - e. Well Assessment/Evaluation
 - i. Drift and clean out cement on new inner string to liner top at 6904 ft.
 - ii. Run inspection logs (CBL, UT, MFL, MAC) from 6889 ft to surface and Gyro survey from total depth to surface
 - iii. Perform pressure integrity test to 1.15 MAOP on inner string
 - f. Well Completion
 - i. Install 6796 ft of 4-1/2" (12.6#, L80, TSH513) and 99 ft of 3-1/2" (9.3#, L80, TSH563) of a new completion string, 7" packer set at 6875 ft., and bottom hole assembly, converting the well to tubing flow.
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work.
 - a. Unload well and turn over to operations
4. Preparation of DOGGR Notice of Intent and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	10/01/2016
2	Noise and Temp Survey	04/04/2016 08/16/2017
3	Ultrasonic (UT)	01/25/2017 03/03/2017 04/26/2018
4	Cement Bond Log (CBL)	01/25/2017 03/03/2017 04/26/2018
5	Multi-Arm Caliper (MAC)	03/02/2017 04/24/2018
6	Magnetic Flux Leakage (MFL)	03/02/2017 04/25/2018
7	Pressure Integrity Test Block Test	03/01/2017 05/02/2018
8	Annular and Tubing Pressure Test – Final	03/10/2017 05/09/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval DOGGR District Approval	04/10/2017 05/10/2018
10	Return to Service	07/31/2017 08/08/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	12/20/2016	03/10/2017
Rig Work Phase 2	04/04/2018	05/09/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP work
 - b. The well was successfully isolated from the storage zone with a plug in the completion string and pressure tested to 1100 psi for 1 hour
2. Rig work was completed in two phases
 - a. Phase 1 involved removing the existing production equipment and inner string, running initial inspection logs, performing zonal remediation, installing a new inner string, re-running inspection logs, and installing a new completion string
 - i. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 6877 ft. 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, 7" (Baker "Retrieva D") packer from 6875 ft., and 6899 ft. of 7" (26#, N80, LTC) inner string with 8-5/8" (Otis "WC") packer from 6899 ft.
 - ii. *Well Assessment/Evaluation:* Gyro survey was run from liner top at 7012 ft. to surface. The wellbore was cleaned out to liner top at 7012 ft. Initial inspection logs (CBL, UT) were run from 6904 ft. to surface
 - iii. *Zonal Remediation:* Per DOGGR requirements, three zones were perforated and cement squeezed, from 5277 ft to 5280 ft and 5280 ft to 5282 ft (LP), from 4950 ft to 4955 ft (UP), and 780 ft to 785 ft (BFW)
 - iv. *Inner String Installation:* The production casing was cleaned out and drifted for the new inner string installation. A new 7" (26#, L80, FlushMaxII) inner string consisting of 6891 ft. was installed and cemented. A new spool was installed to accommodate the inner string
 - v. *Well Reassessment/Re-evaluation:* The inner string was cleaned out and the cement was drilled out to 6840 ft. The pressure integrity test was performed. Cement shoe was drilled out. Casing inspection logs (MFL, MAC) were run from 6880 ft. to surface; UT and CBL were run from 6889 ft. to surface
 - vi. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 6781 ft. of 4-1/2" (12.6#, L80, TSH513) tubing with flow control components, and 7" (WFT AS1-X) Packer set at 6864 ft. The final installation integrity test was performed. A new wellhead was installed and tested
 - vii. *Post Rig Work:* The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal

- viii. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth
- b. Phase 2 included removing existing completion equipment, re-running inspection logs, performing block test, and running new completion
 - i. *Well Decompletion:* This step included the planned removal of wellhead components and completion production equipment consisting of 6781 ft. of 4-1/2" (12.6#, L80, TSH513) tubing, bottom hole assembly, and 7" (WFT AS1-X) packer from 6864 ft.
 - ii. *Well Assessment/Evaluation:* The wellbore was cleaned out to total depth at 7344 ft. Inspection logs were run (MFL, UT, CBL, MAC) from 6989 ft. to surface. Gyro survey was run from 7325 ft. to surface. The block test was performed
 - iii. *Well Completion:* The new completion string and bottom hole assembly were installed consisting of 6850 ft. of 3-1/2" (9.3# L80, TSH563) tubing with flow control components, and 7" (Baker SC) Packer set at 6818 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
- 3. *Post Rig Work:* The well was unloaded to a calculated fluid column depth intended and turned over to SoCalGas Operations for field operation conditions for injection and withdraw.

C. Changes During Workover

Once the field returned to normal operating conditions, the well experienced pressure build-up and replacement of completion equipment was necessary. The new completion procedure was followed. The tubing was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

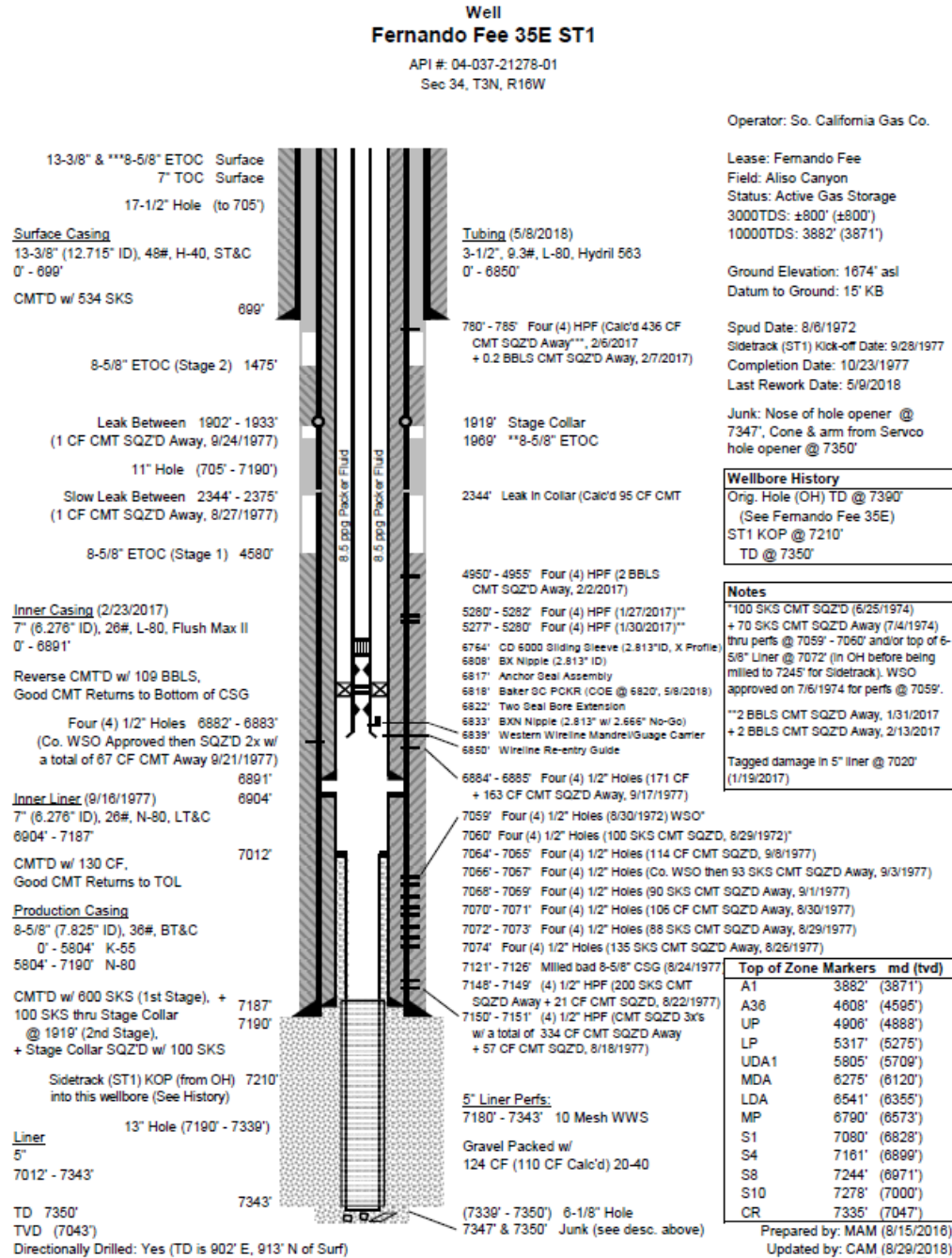
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$37,306	\$411	\$37,716
Contract Costs	\$286,600	\$36,224	\$322,824
Material	\$281,586	\$0	\$281,586
Other Direct Charges	\$1,838,021	\$94,357	\$1,932,378
Total Direct Cost	\$2,443,512	\$130,992	\$2,574,504

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$115,261	\$1,374	\$116,635
AFUDC	\$31,053	\$0	\$31,053
Property Taxes	\$5,402	\$0	\$5,402
Total Indirect Costs	\$151,716	\$1,374	\$153,091

Total Loaded Costs	\$2,595,228	\$132,367	\$2,727,595²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 38A	API	04-037-24230-00
Project Type	Recompletion		
Well Status	Active	NOP	06/30/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	10/05/2001		
Initial Completion	01/31/2002		
Ground Elevation	1716 ft.		
Caprock Depth	6815 ft.		
Measured Depth	7565 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 38A. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for well Fernando Fee 38A used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7023 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Baker SC1) seals from packer liner top from 7029 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7354 ft.
 - ii. Run Gyro survey from top of liner to surface
 - iii. Run MFL and MAC inspection logs from top of liner to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - v. Run UT and CBL inspection logs from 7020 ft. to surface
 - c. Well Completion
 - i. Install approximately 7023 ft. of 5-1/2" (20#, L80, TCPC) new tubing completion string, bottom hole assembly, and new 9-5/8" SC1 seals on packer liner top, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead.
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/11/2016 10/26/2016 08/11/2017
3	Ultrasonic (UT)	05/11/2016
4	Cement Bond Log (CBL)	05/11/2016
5	Multi-Arm Caliper (MAC)	05/04/2016
6	Magnetic Flux Leakage (MFL)	05/04/2016
7	Block Test	05/07/2016
8	Annular and Tubing Pressure Test – Final	06/02/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	06/14/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	04/28/2016	06/04/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determine that it was safe to move forward with the SIMP work
2. Rig work involved removing the existing completion, running inspection logs, and installing a new completion

- a. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7023 ft. 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly and 9-5/8" (SC1) seals packer liner top from 7029 ft.
 - b. *Well Assessment/Evaluation*: The well was cleaned out to 7359 ft. Gyro survey was run from 7260 ft. to surface. MFL and MAC were run from 6992 ft to surface. The block test was performed. UT and CBL inspections were run from 7010 ft to surface
 - c. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 6869 ft. of 3-1/2" (9.3#, L80, EUE) tubing with flow control components, and 9-5/8" (Baker ASX-1) Packer set at 6951 ft. The final installation integrity test was completed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

A new production packer was installed, and the tubing was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

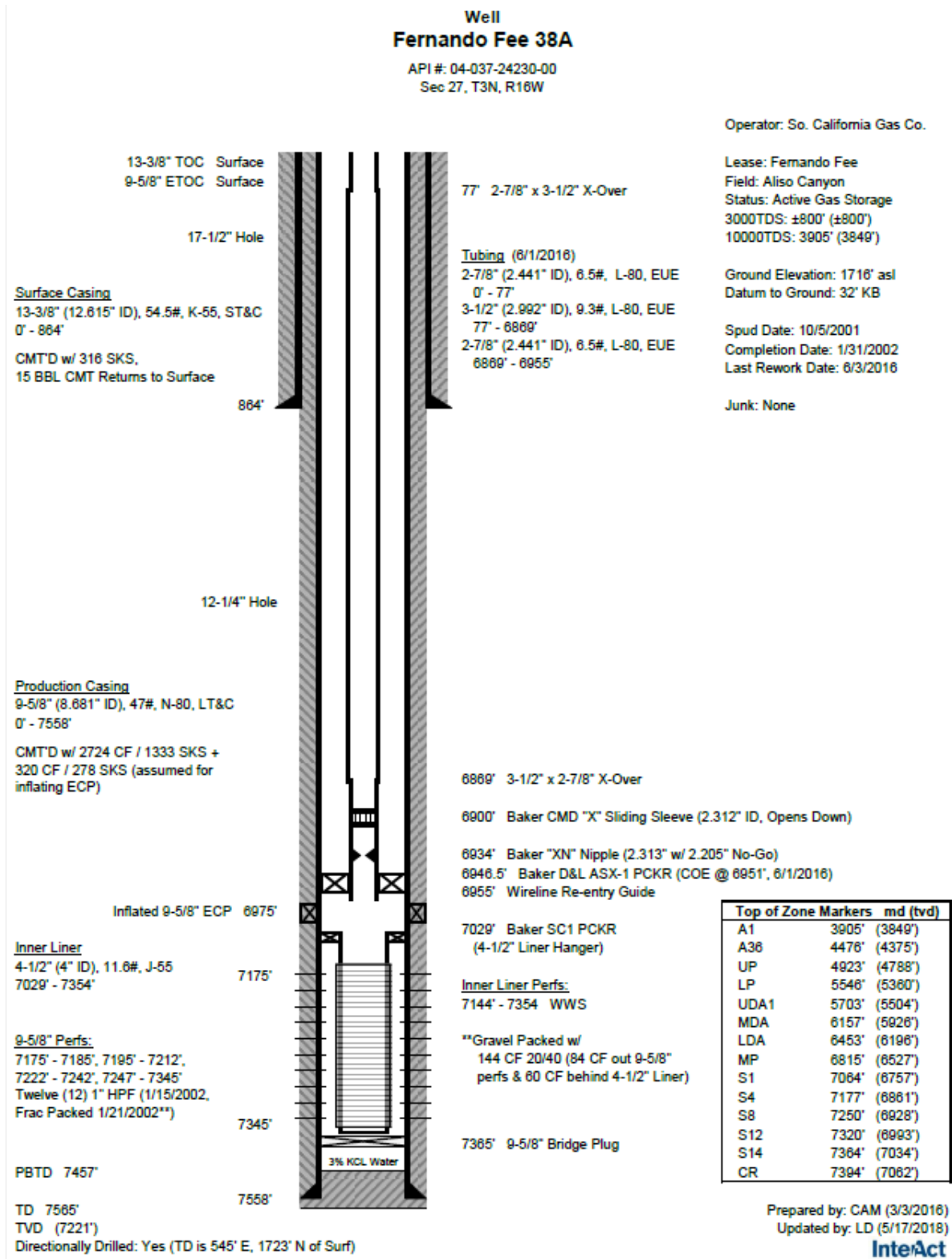
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$271	\$0	\$271
Contract Costs	\$34,372	\$1,820	\$36,192
Material	\$54,255	(\$4,616)	\$49,639
Other Direct Charges	\$553,703	\$61,246	\$614,950
Total Direct Cost	\$642,602	\$58,450	\$701,052

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$17,741	\$5,499	\$23,240
AFUDC	\$981	\$0	\$981
Property Taxes	\$813	\$0	\$813
Total Indirect Costs	\$19,535	\$5,499	\$25,033

Total Loaded Costs	\$662,137	\$63,948	\$726,085²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 38B	API	04-037-24231-00
Project Type	Recompletion		
Well Status	Active	NOP:	06/30/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	10/31/2001		
Initial Completion	11/17/2001		
Ground Elevation	1708 ft.		
Caprock Depth	6636 ft.		
Measured Depth	7503 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171, SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 38B. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for Fernando Fee 38B used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement if necessary

- ii. Pull existing completion consisting of 6826 ft of 2-7/8" (6.5#, N80, EUE) of tubing, bottom hole assembly, and 9-5/8" (HES G6) packer from 6827 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7389 ft.
 - ii. Run Gyro from liner top to surface
 - iii. Run inspection logs (UT, CBL, MFL, MAC) from 6844 ft. to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 6844 ft. of 5-1/2" (20#, L80, TCPC) of a new completion string, bottom hole assembly, and 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations.
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/03/2016 03/11/2016 10/26/2016 05/23/2017
3	Ultrasonic (UT)	04/16/2016
4	Cement Bond Log (CBL)	04/16/2016
5	Multi-Arm Caliper (MAC)	04/18/2016
6	Magnetic Flux Leakage (MFL)	04/18/2016
7	Block Test	04/19/2016
8	Annular and Tubing Pressure Test – Final	04/28/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	06/14/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	04/11/2016	04/28/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determine that it was safe to move forward with the SIMP work

2. Rig Work involved removing existing completion, running inspection logs, and installing a new completion.
 - a. *Well Decompletion:* This phase included the planned removal of wellhead components and production equipment consisting of 6826 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (HES G-6) packer from 6827 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 7374 ft., Gyro survey was run from 7353 ft. to surface. Inspection logs (MFL, MAC) were run from 6832 ft to surface. UT and CBL were run from 6831 ft to surface. The block test was performed.
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 6667 ft. of 3-1/2" (9.3#, L80, EUE) tubing with flow control components, and a 9-5/8" (HES G-6) Packer set at 6819 ft. The final installation integrity test was performed. The wellhead was reinstalled and tested.
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

The tubing was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$0	\$0	\$0
Contract Costs	\$15,198	\$6,070	\$21,267
Material	\$69,509	\$0	\$69,509
Other Direct Charges	\$275,990	\$52,757	\$328,748
Total Direct Cost	\$360,697	\$58,827	\$419,524

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$9,738	\$10,639	\$20,376
AFUDC	\$630	\$0	\$630
Property Taxes	\$436	\$0	\$436
Total Indirect Costs	\$10,804	\$10,639	\$21,443

Total Loaded Costs	\$371,501	\$69,466	\$440,967²
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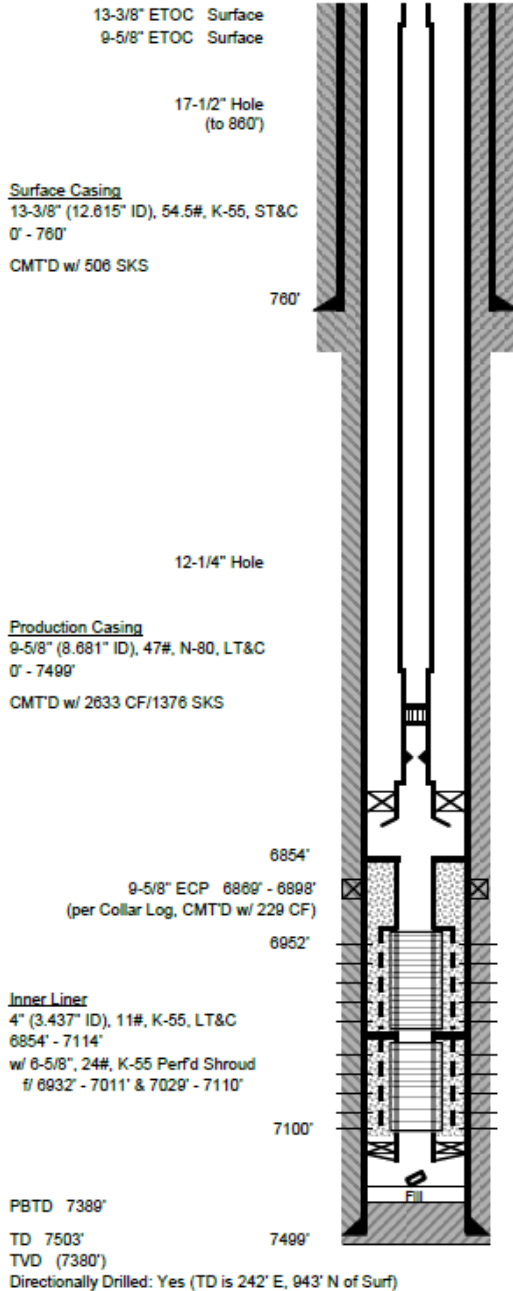
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Fernando Fee 38B

API #: 04-037-24231-00
Sec 27, T3N, R16W

Operator: So. California Gas Co.



75' 2-7/8" x 3-1/2" X-Over
Tubing (4/27/2016)
2-7/8" (2.441" ID), 6.5#, L-80, EUE
0' - 75'
3-1/2" (2.992" ID), 9.3#, L-80, EUE
75' - 6742'
2-7/8" (2.441" ID), 6.5#, L-80, EUE
6742' - 6818'
4-1/2" X-Over, PCKR & WLRG
6818' - 6825'

Lease: Fernando Fee
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 3887' (3884')

Ground Elevation: 1708' asl
Datum to Ground: 32' KB

Spud Date: 10/31/2001
Completion Date: 11/17/2001
Last Rework Date: 4/27/2016

Junk: Rubber bottom packing element off of BP pushed to 7374' (4/25/2016)

Top of Zone Markers	md	(tvd)
A1	3887'	(3884')
A36	4483'	(4471')
UP	4872'	(4849')
LP	5367'	(5325')
UDA1	5716'	(5661')
MDA	6119'	(6049')
LDA	6366'	(6286')
MP	6636'	(6546')
S1	6868'	(6769')
S4	6954'	(6852')
S8	7023'	(6918')
S10	7080'	(6953')
S14	7134'	(7025')
CR	7150'	(7040')

6742' 3-1/2" x 2-7/8" X-Over

6773' "XD" Sliding Sleeve (2.313" ID, Open Down)

6806' "XN" Nipple (2.313" ID w/ 2.205" No-Go)

6818' 2-7/8" x 4-1/2" X-Over

6819' 9-5/8" x 4-1/2" HES G-6 PCKR (COE @ 6821', 4/27/2016)

6825' 4-1/2" Wireline Re-entry Guide

9-5/8" Perfs:
6952' - 7002' Six (6) 1/2" HPF (1/21/2003)
(Frac'd on 1/28/2003, Pumped Away ~2,250 lbs. 20/40 Gravel)
7035' - 7100' Six (6) 5/8" HPF (5/11/2002)
(Frac'd on 1/17/2003, Pumped Away 25,000 lbs. 20/40 Resin Coated Sand)

7028' 4" Adapter

Inner Liner Perfs:
6832' - 7015' & 7034' - 7114' 0.012" ga. WWS

Frac Packed w/ See Perfs for Details

7114' - 7122' AWD Sump PCKR w/ Mule Shoe

7374' Junk (see desc. above)

7374' Tagged Fill (4/13/2016)

Prepared by: CAM (3/29/2016)
Updated by: LD (5/17/2018)



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Fernando Fee 38C	API	04-037-24232-00
Project Type	Recompletion		
Well Status	Active	NOP:	07/30/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/19/2001		
Initial Completion	05/14/2002		
Elevation	1708 ft.		
Caprock Depth	6753 ft.		
Measured Depth	7380 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Plan (SIMP). After reviewing well history, available directional surveys, inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Fernando Fee 38C. This project planned to pull 2-7/8" completion string, run inspection logs on original production casing, run Gyro survey, pressure test casing, install new completion string, and convert well to tubing flow. The following describes the well workover plan for well Fernando Fee 38C used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 6785 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (HES "G-6") packer from 6785 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7278 ft.

- ii. Run Gyro survey from 7278 ft to surface
- iii. Run UT and CBL logs from 6778 ft to surface
- iv. Run MFL and MAC from 6781 ft to surface
- v. Perform pressure integrity test to 1.15 MAOP
- c. Well Completion
 - i. Install a new completion string consisting of 6777 ft. of 5-1/2" (20#, N80, EUE), bottom hole assembly, and 9-5/8" packer, thereby converting well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation Pressure Test	N/A
2	Noise and Temp Survey	03/03/2016 03/10/2016 03/23/2017
3	Ultrasonic (UT)	03/22/2016
4	Cement Bond Log (CBL)	03/22/2016
5	Multi-Arm Caliper (MAC)	03/23/2016
6	Magnetic Flux Leakage (MFL)	03/23/2016
7	Block Test	03/25/2016
8	Annular and Tubing Pressure Test – Final	04/10/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	07/08/2016
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	03/16/2016	04/10/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP work
2. Rig Work included removing the existing completion, running inspection logs, and installing a new completion
 - a. Well Decompletion: This step included the planned removal of wellhead components and production equipment consisting of 6785 ft of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (HES "G-6") packer.
 - b. Well Assessment/Evaluation: The well was cleaned out to 7276 ft. Gyro survey was run 7278 ft. to surface. MAC and MFL were run from 6781 ft. to surface, UT and CBL were run from 6778 ft. to surface. The block test was performed
 - c. Well Completion: A new completion string and bottom hole assembly were installed consisting of 6777 ft. of 3-1/2" (9.3#, L80, EUE) tubing with flow control components, and 9-5/8" (HES "G-6") Packer set at 6770 ft. The final installation integrity test was performed. The wellhead was reinstalled and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

The tubing was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

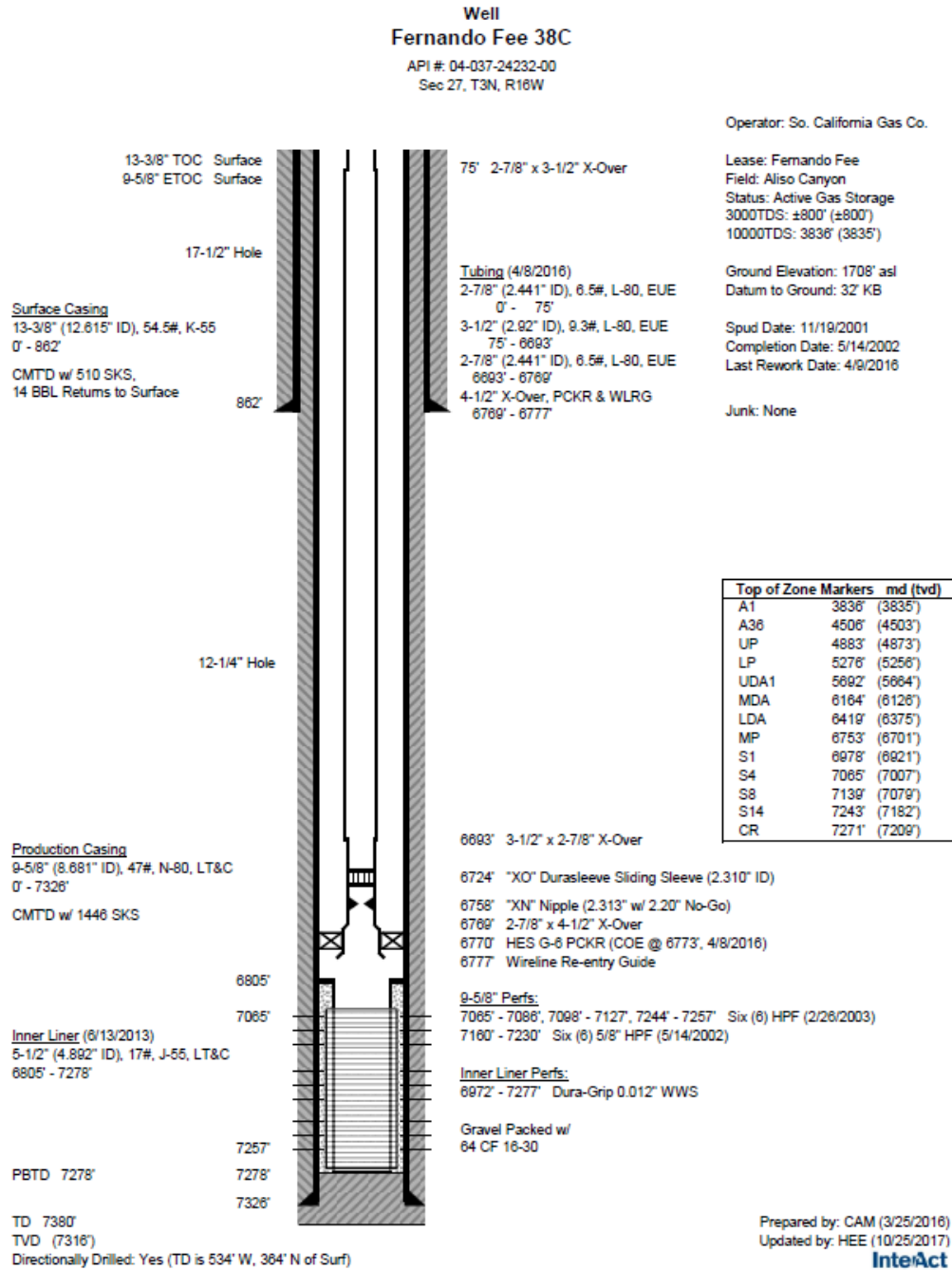
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$2,563	\$0	\$2,563
Contract Costs	\$29,793	\$2,808	\$32,600
Material	\$77,527	\$0	\$77,527
Other Direct Charges	\$574,868	\$59,400	\$634,267
Total Direct Cost	\$684,749	\$62,207	\$746,956

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$21,347	\$6,591	\$27,938
AFUDC	\$7,577	\$0	\$7,577
Property Taxes	\$1,530	\$0	\$1,530
Total Indirect Costs	\$30,454	\$6,591	\$37,045

Total Loaded Costs	\$715,203	\$68,798	\$784,002²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Mission Adrian 1B	API	04-037-21892-01
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	08/23/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	06/30/1979, Redrill 09/27/1979 (Sidetrack)		
Initial Completion	07/15/1980		
Ground Elevation	1725 ft.		
Caprock Depth	7028 ft.		
Measured Depth	7512 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Mission Adrian 1B. This project planned to pull 2-7/8" completion string and 6-5/8" inner string, run casing inspection logs and a Gyro survey, install new inner string, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on production casing. The following describes the well workover plan for well Mission Adrian 1B used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or replacement

-
- ii. Pull existing completion consisting of 7191 ft. of 2-7/8" (6.5# N80/J55, EUE) tubing, bottom hole assembly, and 6-5/8" (Baker) packer from 7182 ft.
 - iii. Pull existing 7218 ft of 6-5/8" (24#, N80, Hydril Triple Seal) inner string and 8-5/8" (Baker Model "D") packer from 7218 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to approximately 7511 ft.
 - ii. Run Gyro from total depth to surface
 - iii. Run inspection logs (UT and CBL) from approximately 7200 ft. to surface
 - iv. Drift and redress 8-5/8" production casing for new inner string installation
 - c. Inner string Installation
 - i. Install and cement approximately 7233 ft of 6-5/8" (28#, L80, LT&C) inner string
 - d. Well Assessment/Evaluation
 - i. Run inspection logs (UT, CBL, MFL, MAC) from approximately 7210 ft. to surface
 - ii. Perform pressure integrity test to 1.15 MAOP on inner string
 - e. Well Completion
 - i. Install a new completion string and bottom hole assembly consisting of 7180 ft of 3-1/2" (9.3#, L80, TCPC) tubing, and 6-5/8" packer at 7180 ft. thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
 3. Post Rig Work
 - a. Unload well and turn over to operations
 4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	10/04/2016 03/23/2017
2	Noise and Temp Survey	03/22/2016 09/19/2016 03/22/2017
3	Ultrasonic (UT)	05/15/2017 07/27/2017
4	Cement Bond Log (CBL)	05/15/2017 07/27/2017
5	Multi-Arm Caliper (MAC)	06/30/2017 07/28/2017
6	Magnetic Flux Leakage (MFL)	07/28/2017
7	Pressure Integrity Test	07/25/2017
8	Annular and Tubing Pressure Test – Final	08/04/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	08/10/2017
10	Return to Service	09/12/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	04/19/2017	08/07/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP work
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 500 psi for 1 hour
2. *Rig Work included removing existing production equipment and inner string, running inspection logs, installing a new inner string, re-running inspection logs, and installing a new completion*
 - a. *Well Decompletion: This step included the planned removal of wellhead components and production equipment consisting of 7191 ft of 2-7/8" (6.5#, N80/ J55, EUE) tubing, bottom hole assembly, and 6-5/8" (Baker Model "D") packer from 7182 ft., as well as 7164 ft of 6-5/8" (24#, N80, Hydril Triple Seal) inner string. The 8-5/8 (Baker Model "D") packer at 7218 ft. was milled and pushed to bottom of the well*
 - b. *Well Assessment/Evaluation: Inspection logs (UT, CBL) were run from 7180 ft to surface. MAC and Gyro were run from 7385 ft. to surface. The production casing was drifted and restrictions were redressed from 6287 ft. to 5538 ft.*
 - c. *Inner string Installation: A new inner string consisting of 7200 ft of 5-1/2" (20#, L80, TCPC) was installed and cemented. A new spool was installed to accommodate the inner string*
 - d. *Well Reassessment/Re-evaluation: The inner string shoe was drilled out. The pressure integrity test was performed on the new inner string. Inspection (MFL, MAC, UT, CBL) logs were run from 7192 ft. to surface. The well was cleaned out to 7508 ft.*
 - e. *Well Completion: A new completion string and bottom hole assembly were installed consisting of 7123 ft. of 2-7/8" (6.5#, L80, TSH563) tubing with flow control components, and a 5-1/2" (WFT AS1-X) Packer set at 7102 ft. The final installation integrity test was performed. A new wellhead was installed and tested*
3. *Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal*
 - a. *Post Injection Work: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth.*

D. Changes During Workover

The new inner string and completion tubing were downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$26,811	\$0	\$26,811
Contract Costs	\$22,044	\$780	\$22,824
Material	\$214,207	\$0	\$214,207
Other Direct Charges	\$1,701,202	\$103,623	\$1,804,825
Total Direct Cost	\$1,964,264	\$104,403	\$2,068,667

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$78,536	\$690	\$79,226
AFUDC	\$8,973	\$0	\$8,973
Property Taxes	\$3,033	\$0	\$3,033
Total Indirect Costs	\$90,542	\$690	\$91,232

Total Loaded Costs	\$2,054,806	\$105,093	\$2,159,899²
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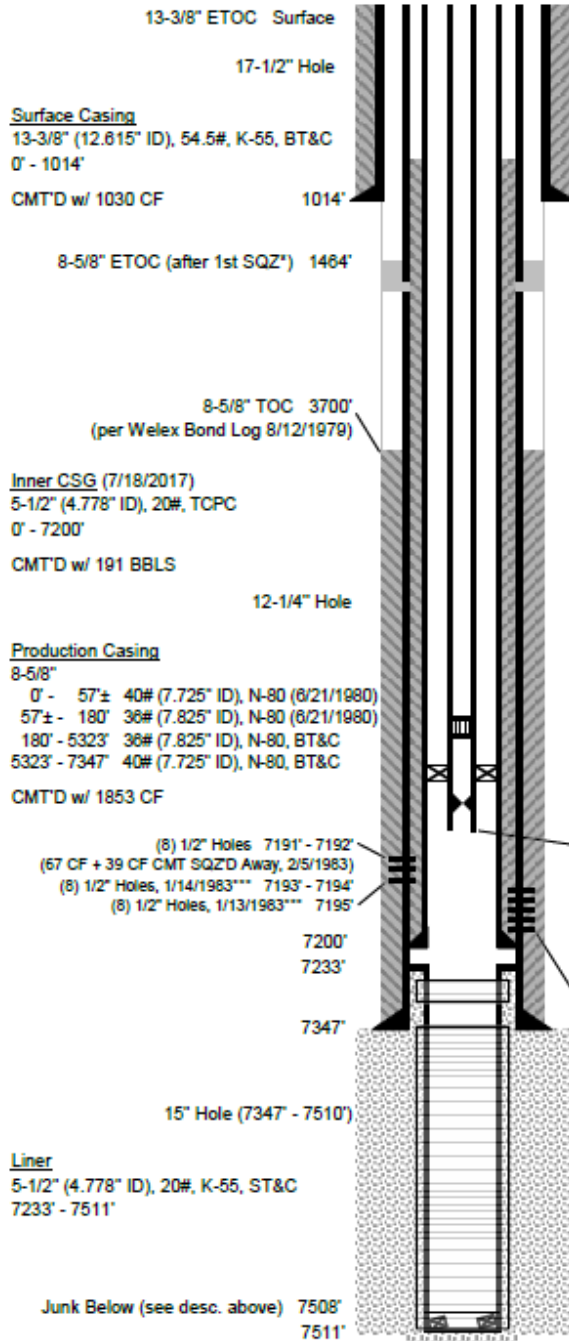
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Mission Adrian 1B ST1

API #: 04-037-21892-01
Sec 34, T3N, R16W

Operator: So. California Gas Co.



Tubing (8/4/2017)
2-7/8" (2.441" ID), 6.4#, L-80, Hydril 563
0' - 7123'

854' 5-1/2" ETOC

1594' - 1596' 8-5/8" CSG Leak
(*62 CF CMT SQZ'D Away, 10/12/1979
+ SQZ'D 7x's more w/ a total of 395 CF,
10/13 - 10/18/1979 CMT SQZ'D Away)**

7051' Sliding Sleeve
(2.313" Profile, opens down)

7102' WEA AS1X PCKR
(7105' COE, 8/4/2017)

7120' WXN Nipple (2.313" Profile w/ 2.205" No-Go)

7123' Wireline Re-entry Guide

7203' - 7204' Four (4) 1/2" Holes WSO (8/22/1979)***

7204' - 7205' Four (4) 1/2" Holes (115 CF + 100 CF CMT SQZ'D
Away, 8/13/1979)***

7205' - 7206' Four (4) 1/2" Holes (57 CF CMT SQZ'D, 8/17/1979)***

7206' - 7207' Four (4) 1/2" Holes (57 CF CMT SQZ'D, 8/18/1979)***

7207' - 7208' Four (4) 1/2" Holes (38 CF CMT SQZ'D Away, 8/20/1979)***

7400' Sidetrack (ST1) KOP (from OH) into this wellbore (See History)

Liner Perfs:

7240' - 7280', 7343' - 7510'
10 Mesh WWS

Gravel Packed w/
243 CF 20-40

7508' Cleaned Out (7/31/2017)
(7510' - 7512') 7-5/8" Hole

Lease: Mission Adrian
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 4131' (4059')

Ground Elevation: 1725' asl
Datum to Ground: 21' KB

Spud Date: 6/30/1979
Sidetrack (ST1) Kick-off Date: 9/27/1979
Completion Date: 7/15/1980
Last Rework Date: 8/7/2017
Junk: Baker Large Bore Model "D"
PCKR Milled & Pushed Below 7508'

Wellbore History	
Orig. Hole (OH) TD @ 7716'	(See Mission Adrian 1B)
ST1 KOP @ 7400'	TD @ 7512'

Notes
**Operations were suspended on 10/20/1979 until SQZ'D again 3X's more w/ a total of 300 SKS CMT, 6/27 - 6/30/1980 (received circulation between 8-5/8" x 13-3/8" annulus during first of three SQZ's), leak @ 1594' - 1596' SQZ'D Again w/ 44 CF CMT SQZ'D Away, 1/13/1982.
***15 CF CMT SQZ'D Away thru shot holes, 1/17/1983.

Top of Zone Markers	md	(tvd)
A1	4131'	(4059')
A36	4860'	(4724')
UP	5146'	(4984')
LP	5560'	(5365')
UDA1	6064'	(5829')
MDA	6490'	(6219')
LDA	6703'	(6415')
MP	7028'	(6718')
S1	7263'	(6938')
S4	7340'	(7010')

TD 7512'
TVD (Unknown, survey not run below KOP @ 7400')
Directionally Drilled: Yes (7400' MD is ±27' E, ±1623' N of Surf, ±7086' TVD)

Prepared by: CAM (8/16/2016)
Updated by: LD (5/16/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 24A	API	04-037-24143-00
Project Type	Recompletion		
Well Status	Active	NOP:	10/20/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	08/05/1993		
Initial Completion	10/23/1993		
Ground Elevation	2182 ft.		
Caprock Depth	7142 ft.		
Measured Depth	7850 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 24A. This project planned to pull 2-7/8" completion string, run casing inspection logs, a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on production casing. The following describes the well workover plan for Porter 24A used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or replacement

- ii. Pull existing completion consisting of 7270 ft of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 9-5/8" (Guiberson Magnum H) packer from 7269 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7850 ft.
 - ii. Run inspection logs (MFL, MAC, UT, CBL) from top of the liner to surface
 - iii. Run Gyro survey from total depth to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install 7229 ft. of 5-1/2" (20#, L80, TCPC) of a new completion string, bottom hole assembly, and 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/23/2016
3	Ultrasonic (UT)	09/23/2016
4	Cement Bond Log (CBL)	09/23/2016
5	Multi-Arm Caliper (MAC)	09/21/2016
6	Magnetic Flux Leakage (MFL)	09/21/2016
7	Block Test	09/17/2016
8	Annular and Tubing Pressure Test – Final	10/11/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	10/13/2016
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	08/30/2016	10/12/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP work.

2. Rig Work involved removing the existing completion, running inspection logs, pressure testing, and installing new completion
 - a. *Well Decompletion:* This step included the removal of the wellhead and its components for inspection and refurbishment. It also included the planned removal of production equipment consisting of 7270 ft. of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 9-5/8" (Guiberson Magnum packer) from 7269 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 7850 ft. Initial inspection logs and a Gyro survey were performed. The block testing was performed. Inspection logs (MAC, MFL, UT, CBL) were run from 7331 ft. to surface
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7170 ft. of 5-1/2" (20#, L80, TCPC) new tubing with flow control components, and a 9-5/8" (WFT AS1) Packer set at 7328 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
3. Post Rig Work: *The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.*
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required pumping packer fluid to a calculated depth.

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$1,103	\$1,077	\$2,179
Contract Costs	\$47,691	\$0	\$47,691
Material	\$133,747	\$0	\$133,747
Other Direct Charges	\$785,121	\$55,545	\$840,666
Total Direct Cost	\$967,661	\$56,622	\$1,024,283

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$26,337	\$1,235	\$27,573
AFUDC	\$3,086	\$0	\$3,086
Property Taxes	\$1,781	\$0	\$1,781
Total Indirect Costs	\$31,204	\$1,235	\$32,439

Total Loaded Costs	\$998,865	\$57,857	\$1,056,722²
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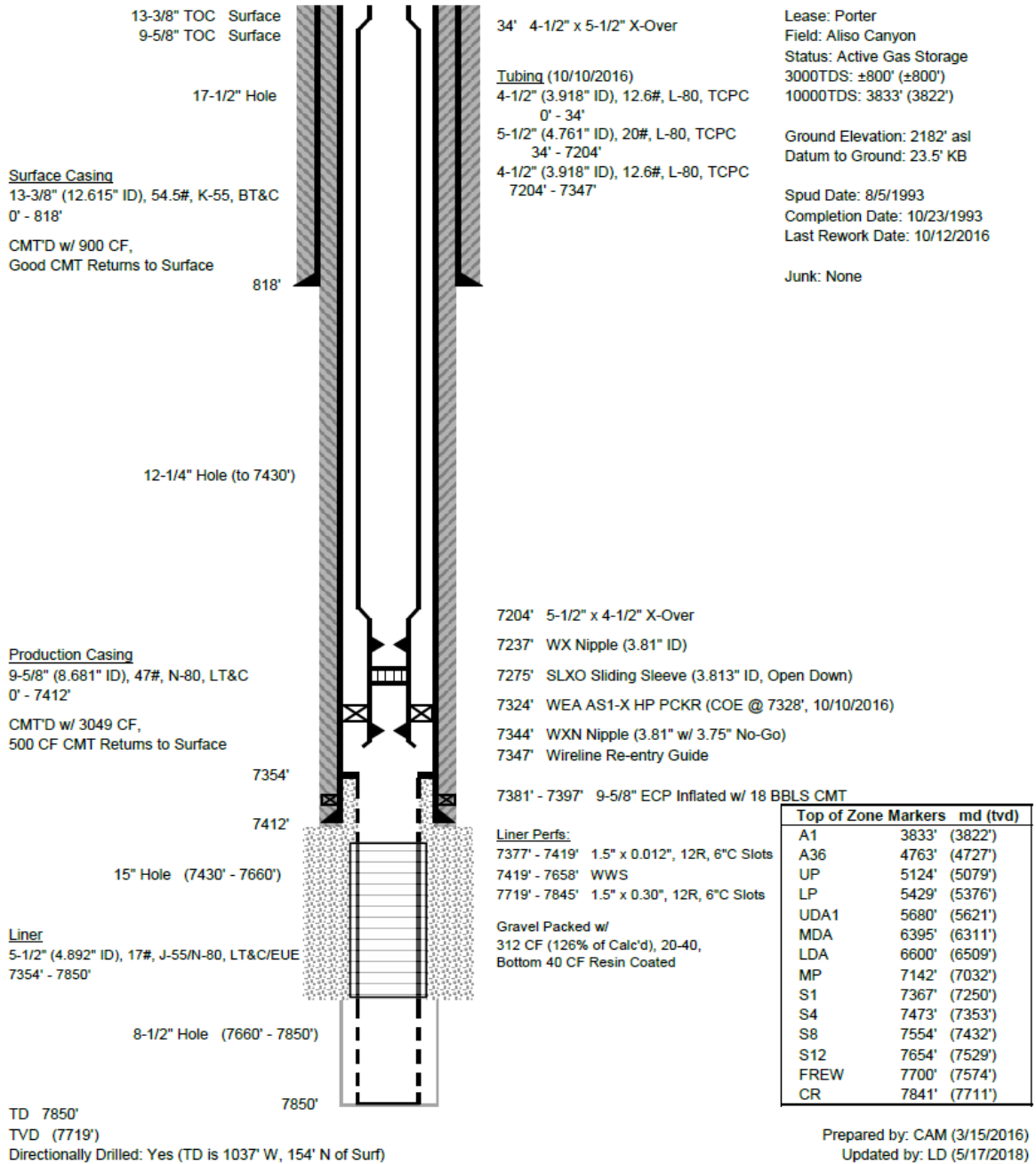
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Porter 24A**

API #: 04-037-24143-00
Sec 27, T3N, R16W

Operator: So. California Gas Co.



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 24B	API	04-037-24144-00
Project Type	Recompletion		
Well Status	Active	NOP:	08/05/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	07/17/1993		
Initial Completion	11/09/1993		
Ground Elevation	2182 ft.		
Caprock Depth	6664 ft.		
Measured Depth	7675 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced SIMP inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ Pipeline and Hazardous Materials Safety Administration PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an Interim Final Rule (IFR) in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 24B. This project planned to pull 2-7/8" completion string, run casing inspection logs and Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on production casing. The following describes the well workover plan for well Porter 24B used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 6848 ft. of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 9-5/8" (Guiberson Magnum "H") Packer from 6845 ft.
 - b. Well Assessment/Evaluation

- i. Clean out well bore to target depth of 7607 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (MFL, MAC, UT, CBL) from 6907 ft to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 6700 ft of 5-1/2" (20#, L80, TCPC) new completion string, bottom hole assembly, and 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations.
4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/23/2016 06/09/2017 06/26/2017
3	Ultrasonic (UT)	05/19/2016
4	Cement Bond Log (CBL)	05/19/2016
5	Multi-Arm Caliper (MAC)	05/16/2016
6	Magnetic Flux Leakage (MFL)	05/16/2016
7	Block Test	07/14/2016
8	Annular and Tubing Pressure Test – Final	07/22/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	07/29/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	04/23/2016	07/26/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP work.

2. Rig Work involved decompletion of existing production equipment, clean out wellbore, perform inspection logs on production casing, block test, install scab liner and run new completion
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 6848 ft. of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 9-5/8" (Guiberson Magnum "H") packer from 6845 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 7552ft. Gyro survey was run from 7552 ft. to surface. The block test was performed, but not accepted. MAC was run from 5904 ft. to surface. MFL was run from 6904 ft. to surface. UT and CBL from 6898 ft. to surface
 - c. *Scab Liner Installation:* A 5-1/2" (17#, L80, LT&C) new scab liner was installed and set from 6755 ft. to 6900 ft. with SC-1R casing packers at the top and bottom
 - d. *Well Reassessment/Re-evaluation:* A second block test was performed on steel liner and production casing
 - e. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 6599 ft. of 5-1/2" (20#, L80, TCPC) tubing with flow control components, and a 9-5/8" (WFT AS1-X) Packer set at 6727 ft. The final installation integrity test was performed. The wellhead was re installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required pumping packer fluid to a calculated depth

D. Changes During Workover

During the inspection phase, an anomaly was discovered on the production casing. A scab liner was proactively placed across this interval to enhance the safety of the well. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

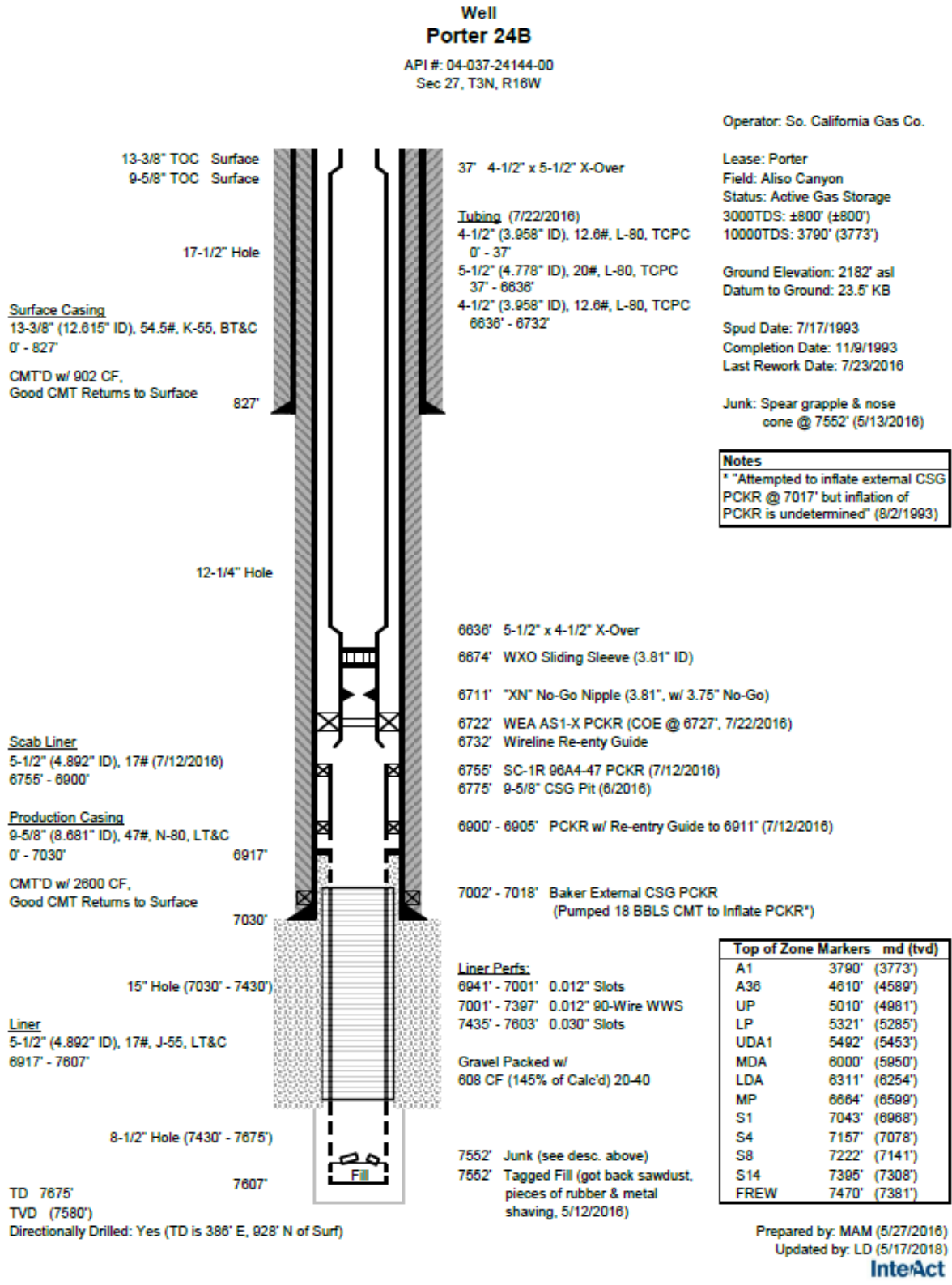
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$1,010	\$0	\$1,010
Contract Costs	\$21,484	\$0	\$21,484
Material	\$72,212	\$0	\$72,212
Other Direct Charges	\$1,273,269	\$57,700	\$1,330,969
Total Direct Cost	\$1,367,974	\$57,700	\$1,425,675

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$36,317	\$9,288	\$45,605
AFUDC	\$7,325	\$0	\$7,325
Property Taxes	\$822	\$0	\$822
Total Indirect Costs	\$44,464	\$9,288	\$53,752

Total Loaded Costs	\$1,412,439	\$66,988	\$1,479,427²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 25R	API	04-037-00712-02
Project Type	Recompletion		
Well Status	Active	NOP	07/28/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/12/1949; Deepen 12/10/1961; Redrill 10/11/1993 (Sidetrack)		
Initial Completion	01/13/1950; Redrill Completion 11/09/1993		
Ground Elevation	2680 ft.		
Caprock Depth	7520 ft.		
Measured Depth	8125 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

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4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 25R. This project planned to pull 2-7/8" completion string, run casing inspection logs and Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on production casing. The following describes the well workover plan for well Porter 25R used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 7628 ft. of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 9-5/8" (HES BWD) packer from 7624 ft.

- b. Well Assessment/Evaluation
 - i. Clean out production liner to target depth
 - ii. Run Gyro survey from total depth to surface
 - iii. Perform pressure integrity test on casing to 1.15 MAOP
 - iv. Run inspection logs (UT, MFL, CBL) from approximately 7691 ft to surface
- c. Well Completion
 - i. Install 7662 ft of 5-1/2" (20#, L80, TCPC) of new completion string, bottom hole assembly, and a 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	04/05/2016 04/12/2016 04/05/2017
3	Ultrasonic (UT)	04/29/2016
4	Cement Bond Log (CBL)	04/29/2016
5	Multi-Arm Caliper (MAC)	04/28/2016
6	Magnetic Flux Leakage (MFL)	04/28/2016
7	Block Test	04/27/2016
8	Annular and Tubing Pressure Test – Final	05/13/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	05/18/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	04/13/2016	05/15/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP work.
2. Rig Work included the decompletion of existing production equipment, cleaning out the wellbore, pressure testing the casing, running casing inspection logs, and installing a new completion string
 - a. *Well Decompletion:* This step included the removal of the wellhead and its components for inspection and refurbishment. It also included the planned removal of production equipment consisting of 7628 ft of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 9-5/8" (BWD) packer at 7624 ft.
 - b. *Well Assessment/Evaluation:* Well was cleaned out to 8117 ft. Gyro survey was run from 8017 ft to surface. The block test was performed. Inspection logs (UT, MFL, CBL) were run from 7660 ft to surface. MAC was run from 7661 ft to surface. The wellbore was cleaned out again to 8117 ft.
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7662 ft of 3-1/2" (9.3#, L80, EUE) tubing with flow control components, and a 9-5/8" (WFT AS1-X) packer set at 7656 ft. The final installation integrity test was performed. The wellhead was re installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required pumping packer fluid to a calculated depth

D. Changes During Workover

The production tubing size was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$202	\$0	\$202
Contract Costs	\$15,040	\$1,597	\$16,637
Material	\$91,989	\$0	\$91,989
Other Direct Charges	\$738,057	\$54,093	\$792,150
Total Direct Cost	\$845,288	\$55,689	\$900,978

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$22,234	\$9,334	\$31,568
AFUDC	\$4,467	\$0	\$4,467
Property Taxes	\$1,065	\$0	\$1,065
Total Indirect Costs	\$27,766	\$9,334	\$37,101

Total Loaded Costs	\$873,055	\$65,024	\$938,078²
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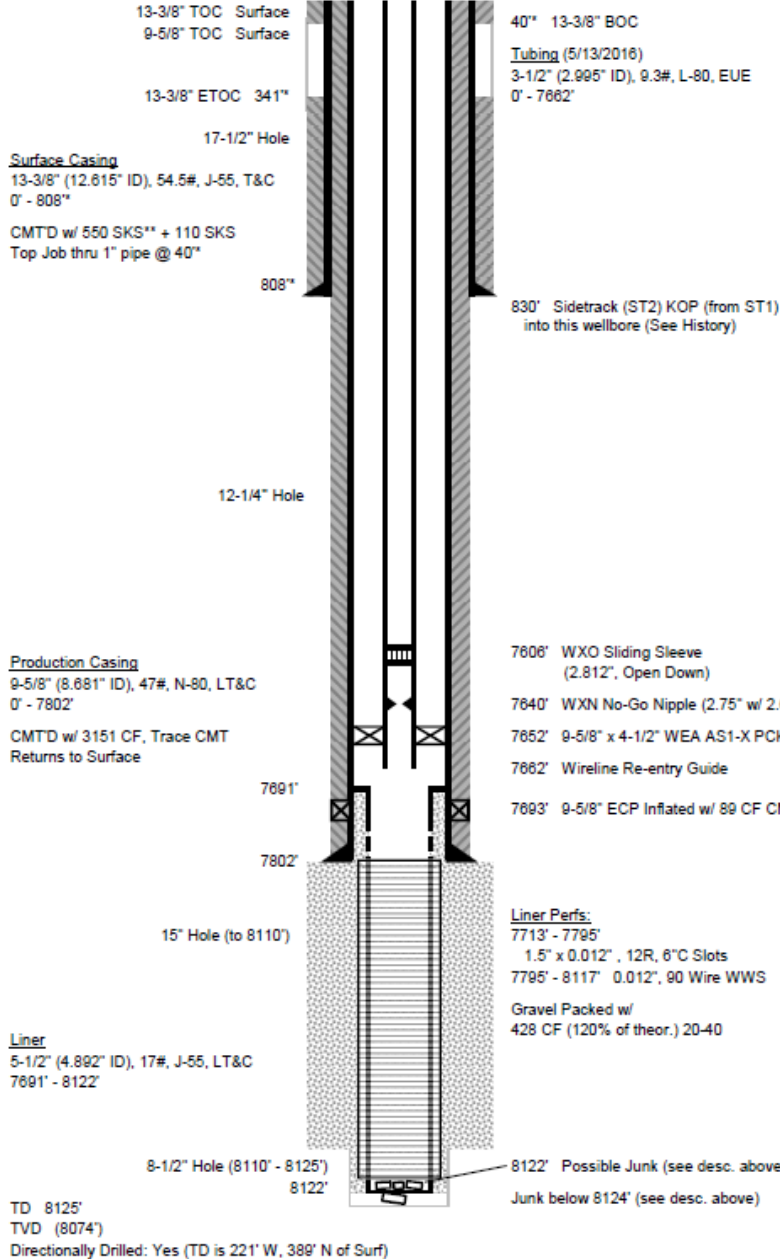
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Porter 25R ST2**

API #: 04-037-00712-02
Sec 28, T3N, R16W

Operator: So. California Gas Co.



Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: TBD

Ground Elevation: 2680.44' asl
Datum to Ground: 24' KB*
*OH Datum to Ground: 6.92' DF
Spud Date: 11/12/1949
Sidetrack (ST2) Kick-off Date: 10/11/1993
Completion Date: 11/9/1993
Last Rework Date: 5/13/2016

Junk: Possible Slip Segment f/ PCKR (4" x 4-1/2" x 1/2") (4/22/2016) & Possible Lower Element, 1 & 1/2 Upper Slips, f/ RBP @ 8122' (5/6/2016); Nose from hole opener below 8124' (11/5/1993)

7606'	WXO Sliding Sleeve (2.812", Open Down)
7640'	WXN No-Go Nipple (2.75" w/ 2.635" No-Go)
7652'	9-5/8" x 4-1/2" WEA AS1-X PCKR (COE @ 7656', 5/13/2016)
7662'	Wireline Re-entry Guide
7693'	9-5/8" ECP Inflated w/ 89 CF CMT

PGS	3027'	(3027')
A36	5283'	(5281')
UP	5480'	(5475')
LP	5812'	(5801')
UDA1	6043'	(6028')
MDA	6748'	(6721')
LDA	6963'	(6933')
MP	7520'	(7480')
S1	7719'	(7678')
S4	7821'	(7775')
S8	7917'	(7870')
S14	8068'	(8018')

Prepared by: LD (4/11/2016)
Updated by: LD (8/2/2018)
InterAct

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 26	API	04-037-00713-01
Project Type	Inner String Recompletion		
Well Status	Active	NOP	03/13/2017; 09/15/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	08/08/1941; Redrill 10/01/1962 (Sidetrack)		
Initial Completion	01/16/1942; Redrill Completion 11/10/1962		
Ground Elevation	2504 ft.		
Caprock Depth	7336 ft.		
Measured Depth	8297 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 26. This project planned to pull 2-7/8" completion string and 6-5/8" inner casing, run casing inspection logs and Gyro survey, install and cement new inner string, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on production casing. The following describes the well workover plan for well Porter 26 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey
 - b. Well Isolation
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or replacement

- ii. Pull existing completion consisting of 5826 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 6-5/8" (Otis "BWB") packer from 5823 ft.
- iii. Pull existing 5844 ft. of 6-5/8" (24#, K55/N80, LT&C) inner string and 9-5/8" (Otis "WD") packer from 5840 ft.
- b. Well Assessment/Evaluation
 - i. Clean out well bore to total depth
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection log (CBL) from liner top at 6007 ft. to surface.
- c. Zonal Remediation
 - i. Cement squeeze critical zones per DOGGR requirements
 - ii. Drift and redress 9-5/8" production casing for new inner string installation
- d. Inner String Installation
 - i. Install and cement approximately 5987 ft of 7" (26#, L80, TSH513) inner string
- e. Well Assessment/Evaluation
 - i. Perform pressure integrity test to 1.15 MAOP
 - ii. Drill out cement in new inner string
 - iii. Run inspection logs (UT, CBL, MAC, MFL) from approximately 7513 ft. to surface
- f. Well Completion
 - i. Install approximately 5950 ft. of 4-1/2" (12.6#, L80, TSH563) and 1570 ft. 2-3/8" (4.7#, L80, TSH563) of a new tubing completion string, bottom hole assembly, and 5" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	10/01/2016
2	Noise and Temp Survey	03/07/2016 03/17/2016 09/05/2017
3	Ultrasonic (UT)	02/27/2017
4	Cement Bond Log (CBL)	01/13/2017 02/27/2017
5	Multi-Arm Caliper (MAC)	02/23/2017
6	Magnetic Flux Leakage (MFL)	02/24/2017
7	Pressure Integrity Test Block Test	02/21/2017 06/06/2018 08/03/2018
8	Annular and Tubing Pressure Test – Final	03/06/2017 08/15/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval DOGGR District Approval	03/06/2017 09/19/2018
10	Return to Service	07/31/2017 10/02/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	12/01/2016	03/13/2017
Rig Work Phase 2	05/25/2018	08/17/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program

- b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 500 psi for 1 hour
2. Rig work for well Porter 26 was completed in two phases.
 - a. Phase 1 of the rig work involved decompletion of existing production equipment and inner casing, initial inspection logs, zonal remediation, inner string installation, final inspection logs, and running a new completion string
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 5826 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, 6-5/8" (Otis "BWB") packer from 5823 ft., and 5844 ft. of 6-5/8" (24#, K55/N80, LT&C) inner string with a 9-5/8" (Otis "WD") packer from 5840 ft.
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 8156 ft. Gyro survey and CBL were run from 7351 ft. to surface
 - iii. *Zonal Remediation*: Per DOGGR requirement, three zones were perforated and cemented squeezed, from 5286 ft to 5288 ft (UP) from 4100 ft to 4102 ft (A1), and from 800 ft to 805 ft (BFW)
 - iv. *Inner String Installation*: The production casing was cleaned out and drifted. A new inner string consisting of 5987 ft of 7" (26#, L80, Supermax) was installed and cemented. A new spool was installed to accommodate the inner string
 - v. *Well Reassessment/Re-evaluation*: The cement was drilled out to 5987 ft. The pressure integrity test was performed on the new inner string. Casing inspection logs (UT, CBL, MFL and MAC) were run from 7480 ft. to surface
 - vi. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 5930 ft. of 4-1/2" (12.6#, L80, TSH 513) tubing and 1511 ft. of 2-3/8" (4.7#, L80, EUE) tubing with flow control components, and a 5" (Baker SC Packer) set at 7422 ft. The final installation integrity test was performed. A new wellhead was installed and tested
 - vii. *Post Rig Work*: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - b. Phase 2 included pulling completion, installing a tie-back liner, performing block test, and running new completion equipment
 - i. *Well Decompletion*: The second phase of well decompletion included the removal of wellhead components and completion production equipment consisting of 5930 ft. of 4-1/2" (12.6#, L80, TSH 513) and 1511 ft of 2-3/8" (4.7#, L80, EUE) tubing, bottom hole assembly, and a 5" (HES AS1-X) Packer from 7422 ft.

- ii. *Well Assessment/Evaluation:* The wellbore was cleaned out to 8121 ft. A block test on the wellbore identified the need to install a tie-back liner
- iii. *Tie-Back Liner Installation:* The wellbore was cleaned out and drifted for the new tie-back liner. The new 5" tie-back liner (18#, J55, TSH 513) consisted of 450 ft. was installed from 6007 ft. to 5557 ft and cemented
- iv. *Well Reassessment/Re-evaluation:* The tie-back liner was cleaned out to 6009 ft. The Pressure Integrity test was performed on the tie-back liner. The cement shoe was drilled out and the wellbore was cleaned out to 8191 ft.
- v. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 5463 ft. of 2-7/8" (6.5#, L80, TSH 563) and 1983 ft. of 2-3/8" (4.7", L80, IntegMAX) tubing with flow control components, and a 5" (Baker SC) Packer set at 7418 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
- c. *Post Rig Work:* The well was unloaded to a calculated fluid depth and turned over to SoCalGas Operations

D. Changes During Workover

Porter 26 involved a two-phase rig operation. After initial inspections in the first phase of rig work, and as per DOGGR requirements, three zones were perforated and cement squeezed in the production casing before running the new inner string. The second phase of rig work was required to remediate annular pressure and replace the packer. During this second phase of rig work, a tie-back liner was required to remediate an anomaly. The production equipment was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

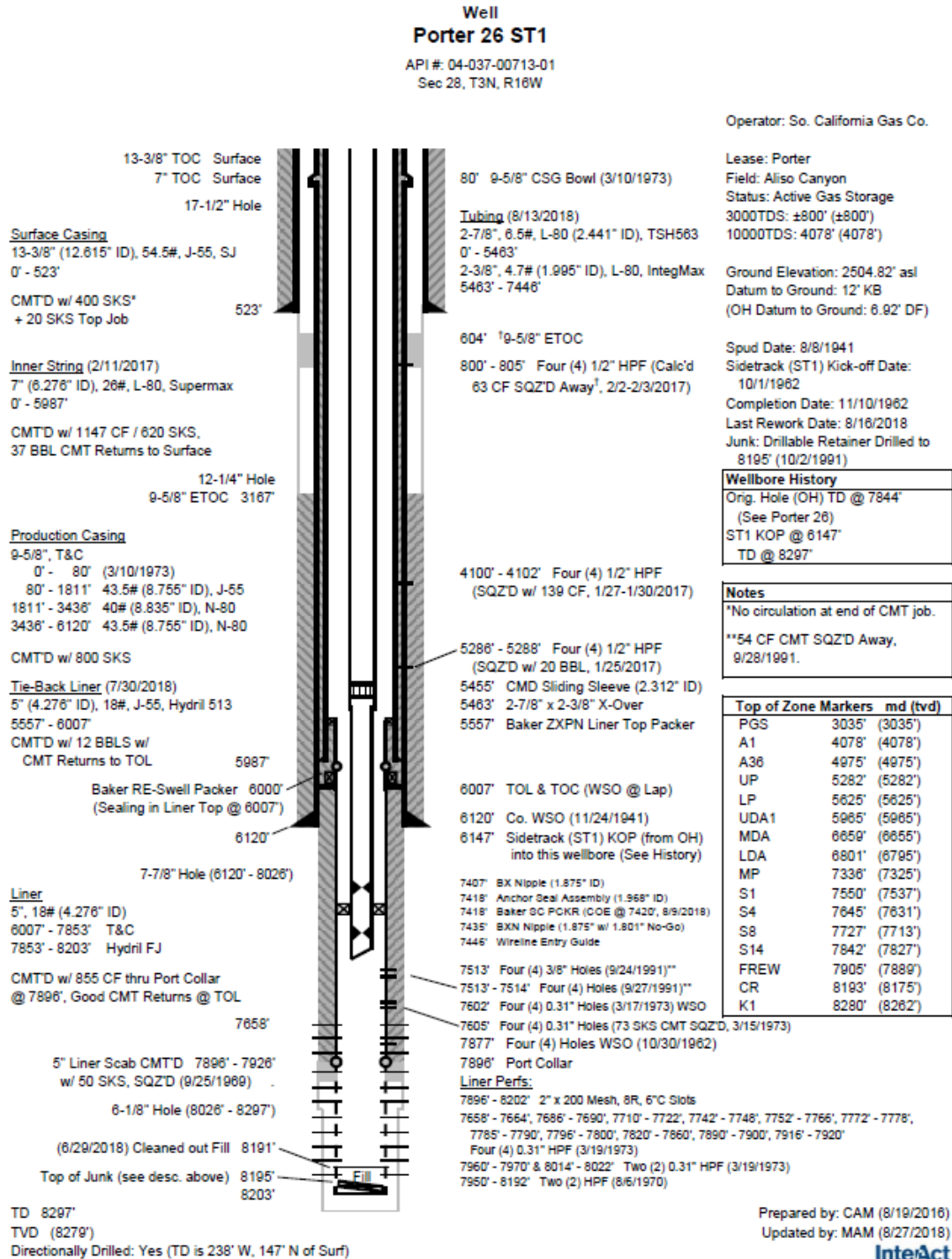
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$33,433	\$0	\$33,433
Contract Costs	\$415,559	\$0	\$415,559
Material	\$451,606	\$0	\$451,606
Other Direct Charges	\$2,026,829	\$77,851	\$2,104,680
Total Direct Cost	\$2,927,427	\$77,851	\$3,005,279

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$129,514	\$472	\$129,986
AFUDC	\$14,203	\$0	\$14,203
Property Taxes	\$5,338	\$0	\$5,338
Total Indirect Costs	\$149,055	\$472	\$149,526

Total Loaded Costs	\$3,076,482	\$78,323	\$3,154,805²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 26A	API	04-037-21362-01
Project Type	Steel Liner Recompletion		
Well Status	Active	NOP	02/13/2017; 11/16/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	07/17/1973; Redrill 12/28/2001 (Sidetrack)		
Initial Completion	08/23/1973; Redrill Completion 01/17/2002		
Elevation	2505 ft.		
Caprock Depth	7520 ft.		
Measured Depth	8072 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 26A. This project planned to pull 2-7/8" completion string, run casing inspection logs and Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on production casing. The following describes the well workover plan for well Porter 26A used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or replacement
 - ii. Pull existing completion consisting of 7681 ft of 2-7/8" (6.5#, N80/J55, EUE) tubing, bottom hole assembly, and 8-5/8" (Baker SC-1) seal assembly from liner top packer at 7687 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 8072 ft.

- ii. Run Gyro survey from total depth to surface
- iii. Run inspection logs (MFL, MAC, UT, CBL) from 7687 ft. to surface
- iv. Perform pressure integrity test to 1.15 MAOP
- c. Well Completion
 - i. Install approximately 7609 ft of 4-1/2" (12.6#, L80, TCPC) new tubing completion string, bottom hole assembly, and a 8-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install well head
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	09/16/2016
2	Noise and Temp Survey	03/18/2016 10/03/2016 09/27/2017 11/06/2017
3	Ultrasonic (UT)	08/10/2016
4	Cement Bond Log (CBL)	08/10/2016
5	Multi-Arm Caliper (MAC)	08/02/2016 08/31/2016
6	Magnetic Flux Leakage (MFL)	08/05/2016
7	Block Test	08/19/2016
8	Annular and Tubing Pressure Test – Final	11/30/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	02/13/2017
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work Phase 1	07/18/2016	09/16/2016
Rig Work Phase 2	11/11/2016	12/01/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program

2. Rig Work for well Porter 26A was completed in two phases
 - a. Phase 1 of the rig work involved decompletion of existing production equipment, cleaning out the wellbore, running inspection logs, performing block test, installing steel liners, running and pulling new completion, and isolating the well
 - i. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 7681 ft of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 8-5/8" (Baker SC1) seal assembly from liner top packer at 7687 ft.
 - ii. *Well Assessment/Evaluation:* The well was cleaned out to 8068 ft. Gyro survey was run from 8051 ft to surface. MAC and MFL were run from 7700 ft. to surface; UT and CBL were run from 7667 ft. to surface. The block test was performed
 - iii. *Steel Liner Installation:* Three steel liners were installed and pressure tested
 - iv. *Well Reassessment/Re-evaluation:* The steel liners were validated by running MAC from 7612 ft. to 7651 ft., 5024 ft. to 5139 ft. and 2370 ft. to 2522 ft.
 - v. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7588 ft. of 4-1/2" (12.6#, L80, TCPC) tubing with flow control components, and a 7-5/8" (HES AS1-X) Packer. The packer failed to set, so it was pulled out of the hole with the completion equipment
 - vi. *Well Isolation:* The well was isolated from the storage zone and an isolation test was performed. A new wellhead was installed and tested
 - b. Phase 2 included running a new completion string and setting it in the existing liner top packer
 - i. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7588 ft. of 4-1/2" (12.6#, L80 TSH 513) tubing with flow control components, and a 8-5/8" Baker seal assembly set in liner top packer at 7687 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required pumping packer fluid to a calculated depth

D. Changes During Workover

After integrity inspections, Porter 26A required three steel liners which were not originally planned. In addition, because the packer had to be removed, a new tubing string was installed. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$7,482	\$0	\$7,482
Contract Costs	\$87,336	\$0	\$87,336
Material	\$196,019	\$0	\$196,019
Other Direct Charges	\$1,302,910	\$68,201	\$1,371,112
Total Direct Cost	\$1,593,746	\$68,201	\$1,661,948

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$49,319	\$696	\$50,015
AFUDC	\$13,892	\$0	\$13,892
Property Taxes	\$51,672	\$0	\$51,672
Total Indirect Costs	\$114,883	\$696	\$115,579

Total Loaded Costs	\$1,708,629	\$68,897	\$1,777,527²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Porter 26A ST1

API #: 04-037-21362-01
Sec 28, T3N, R16W

Operator: So. California Gas Co.

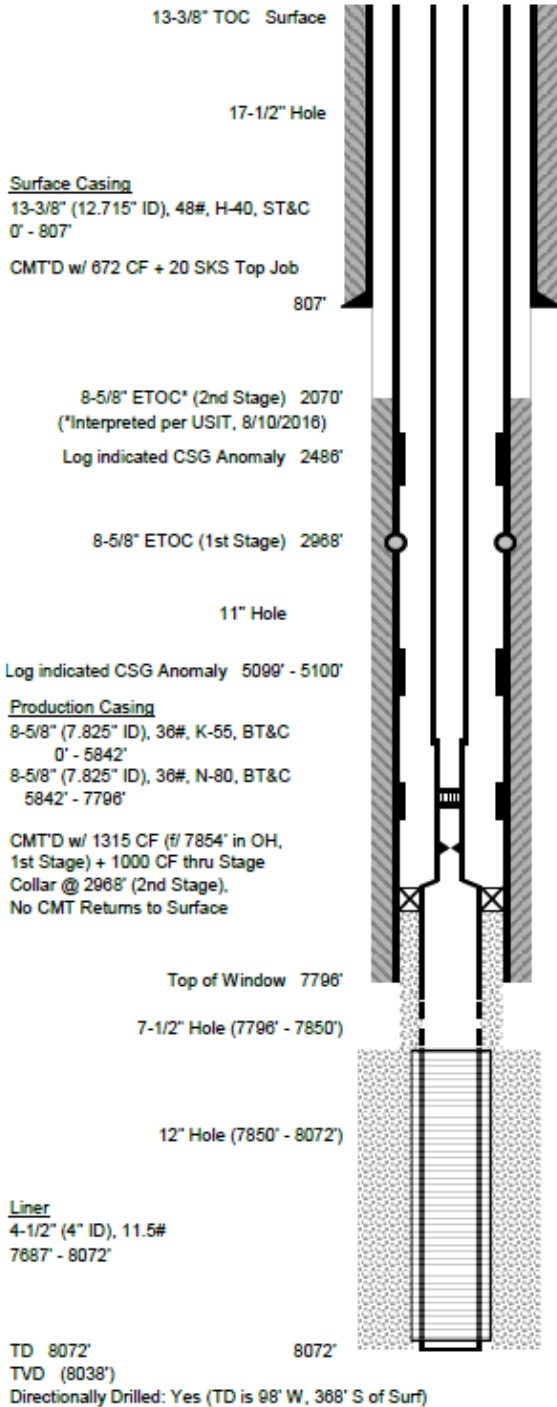
Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 4103' (4102')

Ground Elevation: 2505' asl
Datum to Ground: 12' KB

Spud Date: 7/17/1973
Sidetrack (ST1) Kick-off Date:
12/28/2001
Completion Date: 1/17/2002
Last Rework Date: 11/30/2016

Junk: None

Wellbore History	
Orig. Hole (OH) TD @ 8189'	(See Porter 26A)
ST1 KOP @ 7796'	
TD @ 8072'	



Tubing (11/28/2016)
4-1/2" (3.958" ID), 12.75#, Hydril 513
0' - 7588'
3-1/2" (2.992" ID), 9.3#, TCPC
7588' - 7687'

Surface Casing
13-3/8" (12.715" ID), 48#, H-40, ST&C
0' - 807'

CMT'D w/ 672 CF + 20 SKS Top Job
807'

8-5/8" ETOC* (2nd Stage) 2070'
(*Interpreted per USIT, 8/10/2016)
Log indicated CSG Anomaly 2486'

8-5/8" ETOC (1st Stage) 2968'

11" Hole

Log indicated CSG Anomaly 5099' - 5100'

Production Casing
8-5/8" (7.825" ID), 36#, K-55, BT&C
0' - 5842'
8-5/8" (7.825" ID), 36#, N-80, BT&C
5842' - 7796'

CMT'D w/ 1315 CF (f/ 7854' in OH,
1st Stage) + 1000 CF thru Stage
Collar @ 2968' (2nd Stage).
No CMT Returns to Surface

Top of Window 7796'

7-1/2" Hole (7796' - 7850')

12" Hole (7850' - 8072')

Liner
4-1/2" (4" ID), 11.5#
7687' - 8072'

TD 8072'
TVD (8038')
Directionally Drilled: Yes (TD is 98' W, 368' S of Surf)

2370' - 2522' Metal Skin Liner
(8/30/2016)

2968' 8-5/8" Stage Collar

5024' - 5139' Metal Skin Liner (8/27/2016)

7588' 4-1/2" x 3-1/2" X-Over

7612' - 7651' Metal Skin Liner (8/26/2016)
7628' Baker CD-6000 Sliding Sleeve (2.812" ID)

7675' "BXN" Nipple (2.812" w/ 2.660" No-Go)
7686' Baker 4.75" Anchor Latch Seal Unit OAL 3.62 (3" ID)
7687' Baker SC-1 PCKR

7796' Sidetrack (ST1) KOP (from OH) into this wellbore (See History)

Liner Perfs:
7812' - 7854' Slotted
7854' - 8066' 0.12 Ga. WWS

Gravel Packed w/
165 SKS 20-40

8068' Cleaned out to (7/30/2016)

Top of Zone Markers md (tvd)	
A1	4103' (4102')
A36	4999' (4997')
UP	5294' (5292')
LP	5643' (5641')
UDA1	5984' (5982')
MDA	6745' (6742')
LDA	6898' (6894')
MP	7520' (7496')
S1	7762' (7731')
S4	±7854' (±7821')
S8	7945' (7916')
S14	±8068' (±8033')

Prepared by: MAM (6/23/2016)
Updated by: LD (5/16/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 26B	API	04-037-21357-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP	08/16/2017; 10/21/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	06/06/1973		
Initial Completion	07/15/1973		
Ground Elevation	2505 ft.		
Caprock Depth	7110 ft.		
Measured Depth	7932 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

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4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 26B. This project planned to pull 2-7/8" completion string, 8-5/8" steel liner, run casing inspection logs and Gyro survey, install new inner string, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on production casing. The following describes the well workover plan for well Porter 26B used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey
 - b. Well Isolation
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7379 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 8-5/8" (Otis "Permatrivia") packer from 7370 ft.
 - iii. Pull existing 8-5/8" (Pengo) steel liner from 2726 ft. to 2773 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to bottom
 - ii. Run Gyro from total depth to surface
 - iii. Run inspection log (CBL) from liner top to surface
 - c. Zonal Remediation
 - i. Cement squeeze critical zones, per DOGGR requirements.
 - ii. Drift and redress 8-5/8" production casing for new inner string installation
 - d. Inner string Installation
 - i. Install and cement approximately 7372 ft of new 6-5/8" (28#, L80, TSH563) inner string
 - e. Well Assessment/Evaluation
 - i. Perform integrity pressure test on inner string to 1.15 MAOP
 - ii. Drill out cement shoe
 - iii. Run inspection logs (MFL, MAC, UT, CBL) from approximately 7273 ft to surface
 - iv. Clean out well bore to bottom
 - f. Well Completion
 - i. Install approximately 7313 ft of 2-7/8" (6.5#, L80, TSH563) of a new completion string, bottom hole assembly, and 6-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead.
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	09/13/2016 03/22/2017
2	Noise and Temp Survey	03/04/2016 03/21/2016 03/27/2017 09/26/2017 10/31/2017
3	Ultrasonic (UT)	07/26/2017
4	Cement Bond Log (CBL)	06/21/2017 07/26/2017
5	Multi-Arm Caliper (MAC)	07/25/2017
6	Magnetic Flux Leakage (MFL)	07/25/2017
7	Pressure Integrity Test	07/24/2017
8	Annular and Tubing Pressure Test – Final	08/03/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	08/08/2017
10	Return to Service	09/11/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	05/10/2017	08/04/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program

-
- b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 500 psi for 1 hour
 2. Rig Work included the planned decompletion of existing production equipment and steel liner, perforate and cement squeeze five critical zones, install new inner string, run inspection logs, pressure test new inner string, and run new completion tubing and equipment
 - a. *Well Decompletion/Assessment:* This step included the planned removal of wellhead components and production equipment consisting of 7379 ft. 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly and 8-5/8" (Otis "Permatrieve") packer from 7370 ft., as well as 46 ft of 8-5/8" steel liner.
 - b. *Well Assessment/Evaluation:* The wellbore was cleaned out to 7912 ft., Gyro survey was run from 7912 ft. to surface, the CBL from 7352 ft. to surface
 - c. *Zonal Remediation:* Per DOGGR requirements, five zones were perforated and cement squeezed, from 6604 ft. to 6609 ft. (LDA), from 5653 ft. to 5658 ft. (UDA1), from 5246 ft. to 5251 ft. (UP), from 4819 ft. to 4824 ft. (A36), and from 4250 ft. to 4255 ft. (MPupth)
 - d. *Inner string Installation:* The production casing was drifted to prepare for a new inner string installation. A new 6-5/8" (24#, L80 LTC) inner string consisting of 7375 ft was installed and cemented. A new spool was installed to accommodate the inner string
 - e. *Well Assessment/Evaluation:* The cement shoe was drilled out to 7375 ft. The pressure integrity test was performed on the new inner string. Casing inspection logs (UT, CBL) were run from 7374 ft. to surface. MFL and MAC were run from 7380 ft. to surface. The well was cleaned out to 7922 ft.
 - f. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7290 ft. of 4-1/2" (12.6#, L80, TSH 513) tubing with flow control components, and a 6-5/8" (HES, AS1-X) Packer set at 7344 ft. The final installation integrity test was completed. A new wellhead was installed and tested
 3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required pumping packer fluid to a calculated depth.

D. Changes During Workover

After initial inspections, and per DOGGR requirements, five zones were perforated and cement squeezed in the production casing before running the new inner string. The tubing string was upsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

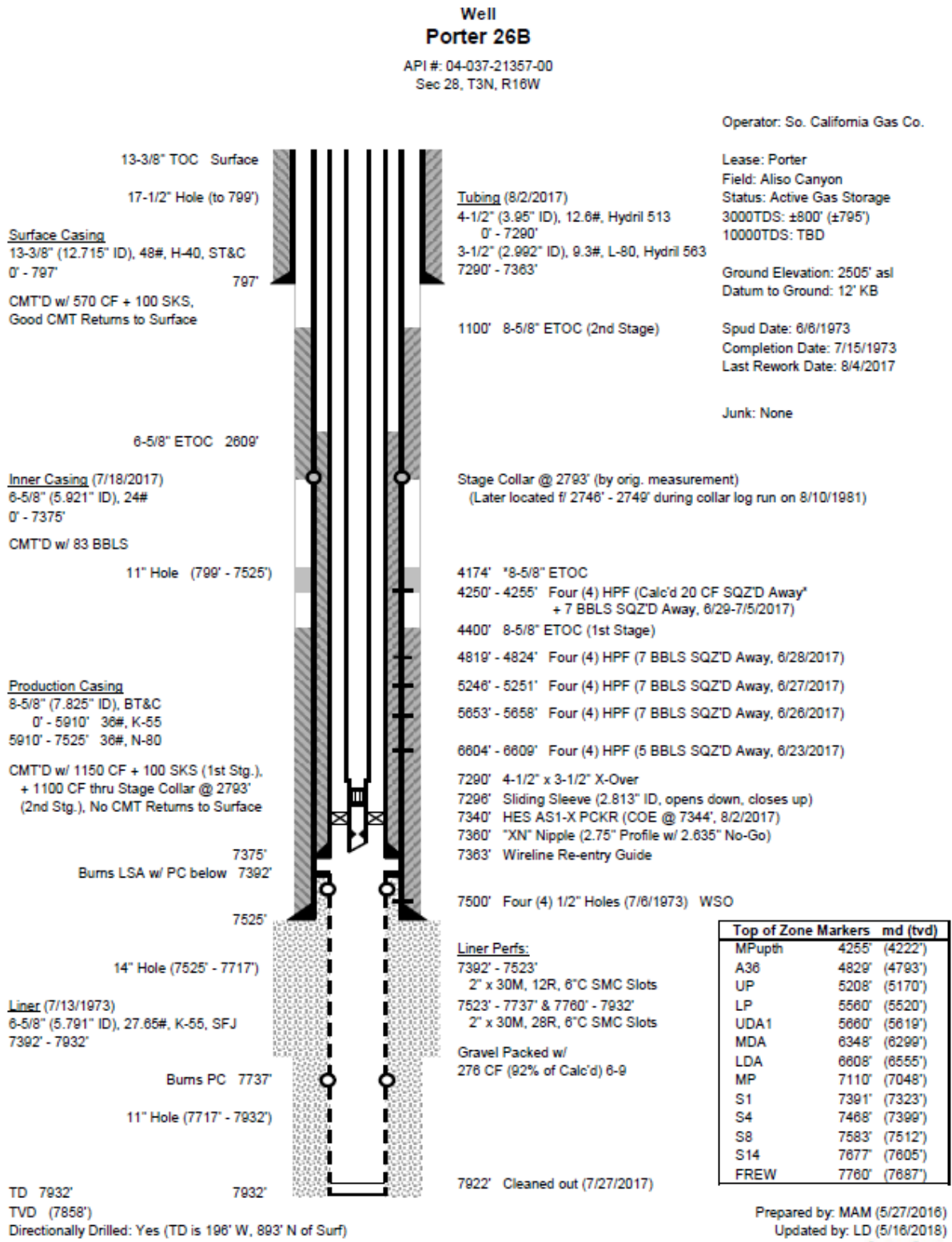
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$17,165	\$438	\$17,603
Contract Costs	\$42,078	\$100	\$42,178
Material	\$245,854	\$0	\$245,854
Other Direct Charges	\$1,474,410	\$66,721	\$1,541,131
Total Direct Cost	\$1,779,507	\$67,260	\$1,846,767

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$63,768	\$1,049	\$64,817
AFUDC	\$3,102	\$0	\$3,102
Property Taxes	\$1,415	\$0	\$1,415
Total Indirect Costs	\$68,284	\$1,049	\$69,333

Total Loaded Costs	\$1,847,791	\$68,308	\$1,916,100²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 26C	API	04-037-21353-02
Project Type	Steel Liner Recompletion		
Well Status	Active	NOP:	11/12/2016
Well Characteristics			
Spud Date	04/08/1973; Redrill 1 05/03/1973 (Sidetrack 1); Redrill 2 05/19/2006 (Sidetrack 2)		
Initial Completion	06/04/1973; Redrill 2 Completion 06/22/2006		
Elevation	2505 ft.		
Caprock Depth	7595 ft.		
Measured Depth	8210 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 26C. This project planned to pull 2-7/8" completion string and steel liner, run casing inspection logs and Gyro survey, install steel liner, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on production. The following describes the well workover plan for well Porter 26C used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or replacement.

- ii. Pull existing completion consisting of 7835 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hold assembly, and 7" (HES G6) packer from 7831 ft.
- iii. Remove existing 8-5/8" (Homco) steel liner from 1670 to 1740 ft.
- b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 8197 ft.
 - ii. Run inspection logs (MFL, MAC) from production liner top to surface
 - iii. Run Gyro survey from total depth to surface
 - iv. Run inspection logs (UT, CBL) on the production liner and casing to surface
 - v. Perform pressure integrity test to 1.15 MAOP
- c. Steel Liner Installation
 - i. Install and test steel liner from 1670 ft. to 1710 ft.
- d. Well Reassessment/Re-evaluation
 - i. Perform pressure integrity test on steel liner
- e. Well Completion
 - i. Install 7835 ft of 4-1/2" (12.6#, L80, FJ) of a new completion string, bottom hole assembly, and 7" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/12/2016 08/08/2016
2	Noise and Temp Survey	03/31/2016 11/21/2017
3	Ultrasonic (UT)	10/25/2016
4	Cement Bond Log (CBL)	10/25/2016
5	Multi-Arm Caliper (MAC)	07/09/2016 10/24/2016 11/01/2016
6	Magnetic Flux Leakage (MFL)	07/11/2016
7	Block Test	10/10/2016
8	Annular and Tubing Pressure Test – Final	11/07/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	12/06/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	06/13/2016	07/18/2016
Rig Work Phase 2	10/06/2016	11/08/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program

2. Rig Work for well Porter 26C was completed in two phases
 - a. Phase 1 of rig work involved decompletion of existing production equipment and steel liner, cleaning out wellbore, performing initial inspection logs, and isolating the well
 - i. *Well Decompletion:* This step included the removal of the wellhead and its components for inspection and refurbishment. It also included the planned removal of production equipment consisting of 7835 ft of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 7" (HES G6) packer from 7831 ft., as well as the existing steel liner from 1670 ft. to 1714 ft.
 - ii. *Well Assessment/Evaluation:* The well was cleaned out to 7983 ft. Gyro survey and MAC were run from 7983 ft to surface; MFL from 7865 ft. to surface
 - iii. *Well Isolation:* The well was isolated from the storage zone. The wellhead was re-installed and tested
 - b. Phase 2 included performing block test, installing steel liners, running final inspection logs, and installing new completion
 - i. *Well Decompletion:* This step included the removal of the wellhead and its components for inspection and isolation equipment
 - ii. *Well Reassessment/Re-evaluation:* The block test was performed. UT and CBL inspection logs were run from 7820 ft. to surface
 - iii. *Steel liners Installation:* A steel liner was installed from 2308 ft. to 1740.17 ft. and confirmed with the MAC. Based on the UT log, a second steel liner was installed from 890 ft. to 814 ft. and confirmed with the MAC
 - iv. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7704 ft. of 4-1/2" (12.6#, L80, TSH 513) tubing with flow control components, and a 7" (HES AS1) Packer set at 7817 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. Post Injection Work: Once the storage field returned to injection, annular pressures required pumping packer fluid to a calculated depth

D. Changes During Workover

Porter 26C was completed in two phases due to material availability. Based on inspection logs the well required a second steel liner. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$4,543	\$0	\$4,543
Contract Costs	\$38,494	\$4,579	\$43,073
Material	\$84,695	\$0	\$84,695
Other Direct Charges	\$1,419,450	\$78,071	\$1,497,520
Total Direct Cost	\$1,547,182	\$82,650	\$1,629,831

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$42,959	\$5,314	\$48,273
AFUDC	\$5,761	\$0	\$5,761
Property Taxes	\$1,804	\$0	\$1,804
Total Indirect Costs	\$50,524	\$5,314	\$55,838

Total Loaded Costs	\$1,597,705	\$87,964	\$1,685,670²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Porter 26C ST2 & ST3**

API #: 04-037-21353-02, -03
Sec 28, T3N, R16W

Operator: So. California Gas Co.

13-3/8" TOC Surface
8-5/8" ETOC (3rd Stage) Surface

17-1/2" Hole (to 803')

Surface Casing
13-3/8" (12.715" ID), 48#, K-55, ST&C
0' - 801'

CMTD w/ 494 CF + 100 SKS
+ 5 C.Y. Ready Mix Pea Gravel Top Job

Stage Collar 1684'

8-5/8" ETOC (2nd Stage) 2593'

11" Hole (803' - 7574')

Production Casing
8-5/8" (7.825" ID), 36#, BT&C
0' - 5379' K-55
5379' - 7574' N-80

CMTD w/ 700 CF (from 8247'
1st Stage, see Porter 26C),
1015 CF thru Stage Collar
@ 6586' (2nd Stage),
1440 CF thru Stage Collar
@ 1684' (3rd Stage)

(Top of Window) 7574'

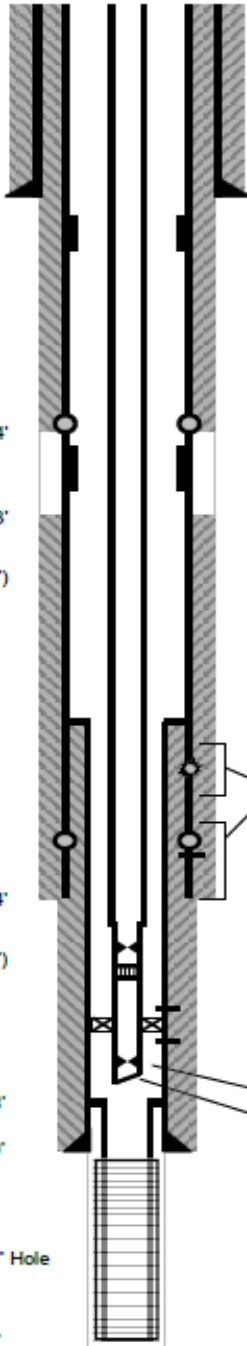
10" Hole (7574' - 7955')

Production Liner
7" (6.276" ID), 26#, L-80, SFL/Hydrill 511
4968' - 7950'

CMTD w/ 339 CF,
Good CMT Returns @ TOL 7868'

Liner
5-1/2" (4.950" ID), 15.5#, L-80, FJL
7868' - 7975'
4-1/2" (4" ID), 11.6#, L-80 6-1/8" Hole
7975' - 8197'

TD 8210'
TVD (7804')
Directionally Drilled: Yes (TD is 1589' E, 428' S of Surf)



Tubing (11/5/2016)
4-1/2" (3.958" ID), 12.6#, L-80, Hydril 513
0' - 7704'
3-1/2" (2.992" ID), 9.3#, L-80, TCPC
7704' - 7833'

814' - 890' 7" MetalSkin Liner
(10/31/2016)

1740' - 2308' 7" MetalSkin Liner
(10/24/2016)

4968' 7" Liner Lap (Press. Test
approved by DOGGR)

8-5/8" CSG Hole Between 5028' - 5161' (42 CF CMT SQZ'D Away, 5/2/2006)
8-5/8" CSG Leak between 6554' - 7574' (CMTD off by 7" Liner 6/2/2006)

6586' Stage Collar & ETOC (1st Stage)
6606' Four (4) 1/2" Holes (3 CF CMT SQZ'D Away, 7/23/1980)

7574' Sidetrack (ST2) KOP (from ST1) into this wellbore (See History)

7704' 4-1/2" x 3-1/2" X-Over

7736' "X" Nipple (2.813" ID)

7771' "XD" Sliding Sleeve (2.813" ID, Open Down)

7819' - 7821' Four (4) Holes (2 BBLS CMT SQZ'D, 9/29/2011)

7813' HES AS1-X PCKR (COE @ 7817, 11/5/2016)

7822' - 7824' Four (4) Holes (Press. up
to 1500 psi, no break down, 9/27/2011)

7831' "XN" Nipple (2.75" w/ 2.635" No-Go)

7833' Wireline Re-entry Guide

Liner Perfs:
7977' - 8197' 150 Micron ESS

Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 4088' (4086')

Ground Elevation: 2505' asl
Datum to Ground: 12' KB

Spud Date: 4/8/1973
Sidetrack (ST2) Kick-off Date: 5/19/200
Completion Date: 6/22/2006
Last Rework Date: 11/7/2016

Junk: None

Wellbore History	
Orig. Hole (OH) TD @	5431'
(See Porter 26C)	
ST1 KOP @	5070'
TD @	8255'
(See Porter 26C ST1)	
ST2 KOP @	7574'
TD @	7818' (7-5/8" Hole).
Ran gyro-survey to 7818' & found new wellbore was approx. 6' from abandoned wellbore (too close)	
CMT Plug @	7580' - 7757'
(109 CF, C/O fl 7559')	
ST3 KOP @	7580' into this wellbore.
TD @	8210'

Top of Zone Markers md (tvd)	
A1	4088' (4086')
A36	5017' (4991')
UP	5334' (5283')
LP	5755' (5648')
UDA1	6095' (5939')
MDA	6920' (6841')
LDA	7076' (6774')
MP	±7595' (±7225')
S1	±7868' (±7475')
S4	±7957' (±7561')
S8	±8044' (±7843')
S14	±8170' (±7763')
FREW	±8180' (±7772')

Prepared by: CAM (5/27/2016)
Updated by: LD (5/16/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 26D	API	04-037-21320-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP	09/04/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	12/18/1972		
Initial Completion	02/19/1973		
Ground Elevation	2505 ft.		
Caprock Depth	7440 ft.		
Measured Depth	8110 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 26D. This project planned to pull 2-7/8" completion string, run casing inspection logs and Gyro survey, install inner string casing, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on production casing. The following describes the well workover plan for well Porter 26D used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey
 - b. Well isolation
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

-
- ii. Pull completion equipment consisting of 7456 ft. of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 7" (Otis Permatrieve) packer from 7450 ft.
 - iii. Pull existing 7502 ft. of 7" (36#, K55/N80, BT&C) inner string, and 8-5/8" (Otis Perm-Drill) packer from 7502 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to target depth of 8006 ft.
 - ii. Run a Gyro survey from total depth to surface
 - iii. Run a CBL log from 7624 ft to surface
 - c. Zonal Remediation as applicable
 - i. Cement squeeze critical zones, per DOGGR requirements.
 - ii. Drift and redress 8-5/8" production casing for new inner string installation
 - d. Inner String Installation
 - i. Install and cement approximately 7540 ft. of new 6-5/8" (24#, L80, TSH563) inner string
 - ii. Install new spool to accommodate inner string
 - e. Well Reassessment/Re-evaluation
 - i. Perform pressure integrity test to 1.15 MAOP
 - ii. Run inspection logs (MFL, MAC, UT, CBL) from approximately 7540 ft. to surface
 - f. Well Completion
 - i. Install 7485 ft of 4-1/2" (12.6#, L80, TSH 513) of a new completion string, bottom hole assembly, and 6-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
 3. Post Rig Work
 - a. Unload well and turn over to operations
 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	10/01/2016 03/22/2017 10/19/2017 03/30/2018
2	Noise and Temp Survey	03/18/2016 03/27/2017 10/19/2017 03/13/2018
3	Ultrasonic (UT)	10/11/2017
4	Cement Bond Log (CBL)	09/14/2017 10/11/2017
5	Multi-Arm Caliper (MAC)	10/12/2017
6	Magnetic Flux Leakage (MFL)	10/16/2017
7	Pressure Integrity Test	10/09/2017
8	Annular and Tubing Pressure Test – Final	08/29/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	09/04/2018
10	Return to Service	10/17/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	08/07/2017	10/23/2017
Rig Work Phase 2	08/20/2018	08/31/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program
 - b. The well was successfully isolated from the storage zone with a plug in the completion string. The casing was pressure tested to 600 psi for 1 hour; the uncemented inner string was pressure tested to 1100 psi for 1 hour
2. Rig Work for Porter 26D was completed in two phases
 - a. Phase 1 of rig work involved removing existing production equipment, performing remedial work, installing a new inner string, running inspection logs, pressure testing the new inner string, and isolating the well
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7456 ft. of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 7" (Otis Permatrieve) packer from 7450 ft. and existing 7502 ft. of 7" (36#, K55/N80, BT&C) inner string, and 8-5/8" (Otis Perm-Dril) packer from 7502 ft.
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 7980 ft. The Gyro survey was run from 7980 ft to surface; CBL was run from 7624 ft to surface
 - iii. *Zonal Remediation*: Per DOGGR requirements, three intervals were perforated and cement squeezed, from 6021 ft. to 6026 ft. (UDA1), from 5329 ft. to 5334 ft. (UP), and from 4030 ft. to 4035 ft. (A1/USDW)
 - iv. *Inner String Installation*: A new inner string consisting of 7525 ft of 6-5/8" (24#, L80, LT&C) was installed and cemented. A new spool was installed to accommodate the inner string
 - v. *Well Reassessment/Re-evaluation*: UT, CBL, MAC and MFL logs were run from 7524 ft to surface. The pressure integrity test on the inner string was performed
 - vi. *Well Isolation*: The well was isolated from storage zone. A new wellhead was installed and tested
 - b. Phase 2 of the rig work involved installation of the new completion
 - i. *Well Decompletion*: The wellhead was removed for inspection, and isolation equipment removed
 - ii. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7505 ft. of 2-7/8" (6.5#, L80, TSH 563) tubing with flow control components, and a 6-5/8" (HES

- VTA) Packer set at 7490 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded to a calculated fluid depth. The well was turned over to SoCalGas Operations

D. Changes During Workover

The well was completed in two phases so the rig could address annular pressures in other wells once the storage field returned to injection, as well as development of new completion procedures. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$26,574	\$0	\$26,574
Contract Costs	\$255,623	\$0	\$255,623
Material	\$208,324	\$0	\$208,324
Other Direct Charges	\$1,467,875	\$80,319	\$1,548,194
Total Direct Cost	\$1,958,396	\$80,319	\$2,038,715

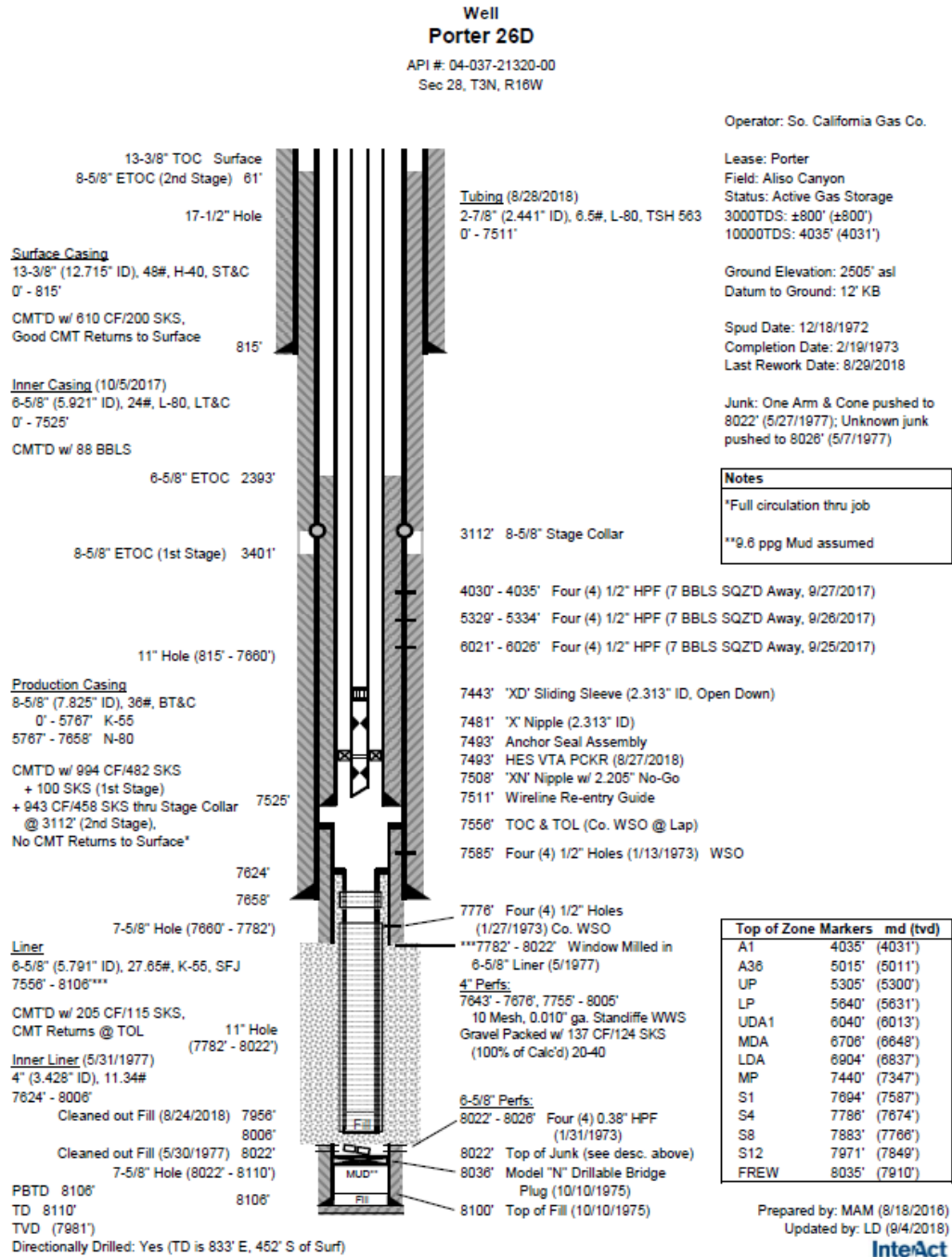
Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$92,806	\$578	\$93,384
AFUDC	\$74,906	\$0	\$74,906
Property Taxes	\$10,789	\$0	\$10,789
Total Indirect Costs	\$178,501	\$578	\$179,079

Total Loaded Costs	\$2,136,897	\$80,898	\$2,217,794²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

Storage Integrity Management Program Aliso Canyon – Porter 26D

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 26E	API	04-037-21319-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	05/29/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	10/26/1972		
Initial Completion	12/11/1972		
Elevation	2505 ft.		
Caprock Depth	7190 ft.		
Measured Depth	7916 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 26E. This project will be completed in two phases to enable field injection. The first phase planned to pull the 2-7/8" completion string, top packer, and install a 60-ft. scab liner for isolation. Second phase planned to remove the scab liner and bottom packer, run inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on production casing. The following describes the well workover plan for Porter 26E used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig work
 - a. Phase 1
 - i. Well Decompletion

- a. Remove wellhead components for refurbishing and inspection, or for replacement
- b. Pull existing completion consisting of 7359 ft of 2-7/8" (6.5#, L80, EUE) tubing, bottom hole assembly, and 8-5/8" (AS1-X) packer (top packer) from 7329 ft.
- ii. Well Assessment/Evaluation
 - a. Clean out wellbore to target depth of 7359 ft.
- iii. Well Isolation with a Scab Liner
 - a. Perform an integrity test above and below the stage collar at 2943 ft. using a test packer set at 2973 ft.
 - b. Run and install a second packer at approximately 2913 ft. with 60 ft. of 3-1/2" tubing connected to the bottom packer
 - c. Perform isolation pressure test
- b. Phase 2
 - i. Well Decompletion
 - a. Pull existing scab liner, remaining 35 ft. of 2-7/8" (6.5#, L80, EUE) tubing, and bottom 8-5/8" (Baker Model "D") packer from 7394 ft.
 - ii. Well Assessment/Evaluation
 - a. Clean out wellbore to target depth of 7912 ft.
 - b. Run Gyro survey from total depth to surface
 - c. Perform pressure integrity test to 1.15 MAOP
 - d. Run inspection logs (UT, CBL, MFL, MAC) from approximately 7355 ft. to surface
 - iii. Well Completion
 - a. Install approximately 7350 ft of 4-1/2" (12.6#, L80, TSH 563) of a new completion string, bottom hole assembly, and 8-5/8" packer, thereby converting the well to tubing flow
 - b. Perform installation integrity test on completion
 - c. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	08/06/2016 02/28/2017 09/11/2017
2	Noise and Temp Survey	04/12/2016 10/03/2016 03/13/2017 10/14/2017
3	Ultrasonic (UT)	11/16/2017 05/04/2018
4	Cement Bond Log (CBL)	11/16/2017 05/04/2018
5	Multi-Arm Caliper (MAC)	05/07/2018
6	Magnetic Flux Leakage (MFL)	05/08/2018
7	Pressure Integrity Test	05/01/2018
8	Annular and Tubing Pressure Test – Final	05/22/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	05/29/2018
10	Return to Service	11/16/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	09/17/2016	09/28/2016
Rig Work Phase 2	10/24/2017	05/24/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program

2. Rig Work for well Porter 26E was completed in two phases
 - a. Phase 1 of the rig work involved partial decompletion of existing production equipment, cleaning out the wellbore, and isolating the well.
 - i. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 2-7/8" (6.5#, L80, EUE) tubing from 7356 ft, bottom hole assembly, and top 8-5/8" (AS-1X) packer from 7329 ft.
 - ii. *Well Assessment/Evaluation:* The well was cleaned out to 7360 ft.
 - iii. *Well Isolation:* The well was isolated from storage zone, and the wellhead was re-installed
 - b. Phase 2 of rig work included removing the remaining production equipment, performing critical zone remediation, installing new inner string, running inspection logs, pressure testing new inner string, and running a new completion
 - i. *Well Decompletion:* This step included the removal of wellhead components and production equipment consisting of isolation equipment and the bottom packer 8-5/8" (Baker Model "D") from 7394 ft.
 - ii. *Well Assessment/Evaluation:* The well was cleaned out to 7837 ft. A Gyro survey was run from 7833 ft. to surface. Inspection logs (UT, CBL) were run from 7380 ft. to surface
 - iii. *Zonal Remediation:* Per DOGGR requirements, seven zones were perforated and cement squeezed, from 6708 ft. to 6713 ft. (LDA), from 6520 ft. to 6525 ft. (MDA), from 5622 ft. to 5627 ft. (LP), from 5318 ft. to 5323 ft. (UP), from 4985 ft. to 4990 ft. (A36), from 4069 ft. to 4074 ft. (A1), and from 800 ft. to 805 ft. (BFW)
 - iv. *Inner string Installation:* The production casing was cleaned out and drifted. A new 6-5/8" inner string (24#, L80, LT&C) consisting of 7377 ft was installed and cemented. A new spool was installed to accommodate the inner string
 - v. *Well Reassessment/Re-evaluation:* The pressure integrity test was performed on the new inner string. Casing inspection logs (UT, CBL) were run from 7250 ft. to surface, and MFL and MAC from 7350 ft. to surface. The well was cleaned out to 7361 ft.
 - vi. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7335 ft of 2-7/8" (6.5#, L80, TSH 563) tubing with flow control components, and a 6-5/8" (Baker SC1) packer set at 7305 ft. The final installation integrity test was performed. A new wellhead was installed and tested

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3. Post Rig Work: The well was unloaded to a calculated fluid depth and turned over to SoCalGas Operations

D. Changes During Workover

After running initial inspection logs, it was determined the well required a new inner string. Per DOGGR requirements, seven zones were perforated and cement squeezed in the production casing before running the new inner string. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

SIMP workover operations were shut down for an extended period in the beginning of 2018 until the development and implementation of mandatory emission avoidance protocol was complete.

III. Project Costs

A. Actual Costs

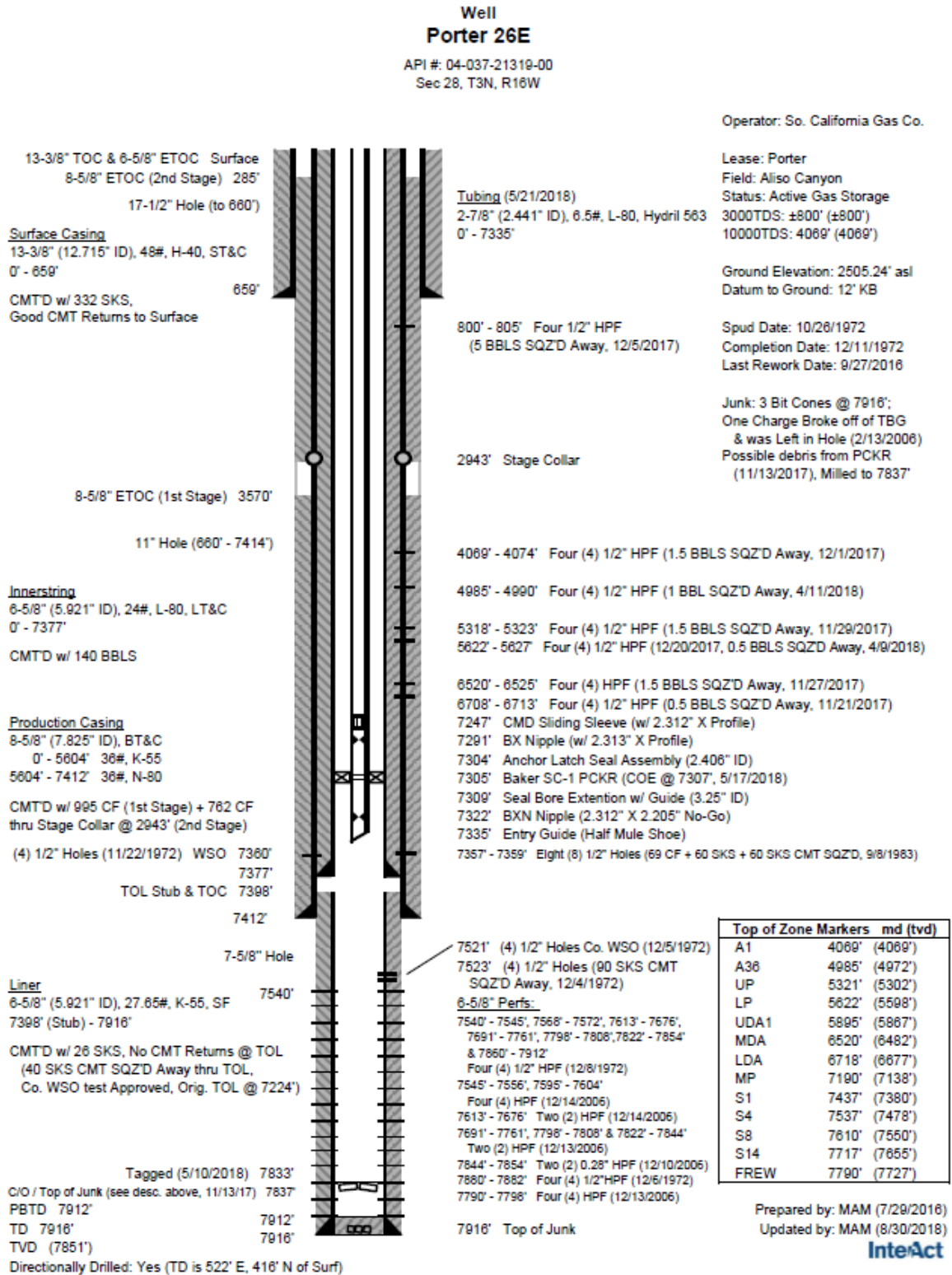
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$27,381	\$368	\$27,749
Contract Costs	\$409,167	\$66,658	\$475,825
Material	\$453,271	\$0	\$453,271
Other Direct Charges	\$1,621,274	\$33,559	\$1,654,832
Total Direct Cost	\$2,511,093	\$100,584	\$2,611,677

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$127,197	\$1,237	\$128,434
AFUDC	\$35,566	\$0	\$35,566
Property Taxes	\$4,971	\$0	\$4,971
Total Indirect Costs	\$167,735	\$1,237	\$168,971

Total Loaded Costs	\$2,678,828	\$101,821	\$2,780,649²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 32	API	04-037-00719-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP	03/03/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	06/01/1944		
Initial Completion	09/01/1944		
Ground Elevation	2079 ft.		
Caprock Depth	7275 ft.		
Measured Depth	7994 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 32. This project was planned in two phases to enable field injection. The first phase planned to pull the 2-3/8" completion string, redress seal assembly and isolate. The second phase planned to remove 2-3/8" completion string and 5-1/2" inner string, run casing inspection logs, install new inner string, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well Porter 32 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey
2. Rig work
 - a. Phase 1
 - i. Well Decompletion

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- a. Remove wellhead components for refurbishing and inspection, or for replacement
 - b. Pull existing completion consisting of 7438 ft of 2-3/8" (4.7#, J55, EUE) tubing and 7" seal assembly from 7438 ft.
 - c. Install new seal assembly and perform isolation pressure test
- b. Phase 2
- i. Well Decompletion
 - a. Remove wellhead components
 - b. Pull existing completion consisting of 7445 of 2-3/8" (4.7#, J55, EUE) tubing, and 7" (Baker "D") packer from 7438 ft.
 - c. Pull existing 5440 ft. of 5-1/2" (17#, J55, X-Line) inner string and 7" (Otis "XLB") packer from 5440 ft.
 - ii. Well Assessment/Evaluation
 - a. Run inspection log (UT, CBL) from 7400 ft to surface.
 - iii. Zonal Remediation
 - a. Cement squeeze critical zones, per DOGGR requirements
 - b. Drift and redress 7" production casing for new inner string installation
 - iv. Inner String Installation
 - a. Install and cement approximately 7435 ft of 5-1/2" (20#, L80, TSH 513) inner string
 - v. Well Reassessment/Re-evaluation
 - a. Install new spool to accommodate inner string.
 - b. Drill out cement shoe completely to 7435 ft. depth
 - c. Run inspection logs (MFL, MAC) from approximately 7455 ft to surface
 - d. Run inspection logs (UT, CBL) from approximately 7435 ft to surface
 - e. Perform pressure integrity test to 1.15 MAOP on inner string
 - vi. Well Completion
 - a. Install approximately 7400 ft of 2-7/8" (6.5#, L-80, EUE) new tubing completion string, bottom hole assembly, and 5-1/2" packer at 7400 ft.
 - b. Perform installation integrity test on completion
 - c. Install wellhead
3. Post Rig Work
- a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/07/2016 03/17/2016 03/23/2016 01/25/2018
3	Ultrasonic (UT)	10/18/2016 01/04/2017
4	Cement Bond Log (CBL)	10/18/2016 11/16/2016 11/22/2016 12/08/2016 01/04/2017
5	Multi-Arm Caliper (MAC)	01/03/2017
6	Magnetic Flux Leakage (MFL)	01/04/2017
7	Pressure Integrity Test	12/27/2016
8	Annular and Tubing Pressure Test – Final	01/18/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	02/08/2017
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	09/23/2016	01/19/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program
2. Rig work involved decompletion of existing production equipment, running inspection logs, performing zonal remediation, installing new inner string, pressure testing casing and re-running inspection logs and running new completion tubing and equipment
 - a. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7445 ft 2-3/8" (4.7#, J55, EUE) tubing, bottom hole assembly and 7" (Baker "D") production packer from 7438 ft, as well as 5440 ft of 5-1/2" (20#, J55, X-Line) inner string with 7" (Otis "XLB") casing packer from 5440 ft.
 - b. *Well Assessment/Evaluation*: The well was cleaned out to 7440 ft. UT and CBL inspection logs were run from 7400 ft to surface. Anomalies were identified in production casing between 1300 ft and 1323 ft and from 645 ft to 845 ft.
 - c. *Zonal Remediation*: Casing holes were cement squeezed at various depths from 645 ft to 845 ft and from 1300 ft to 1323 ft to remediate anomalies. Per DOGGR requirements, two zones were perforated and cement squeezed from 774 ft to 820 ft (BFW) and from 5970 ft to 5980 ft (UDA1)
 - d. *Inner String Installation*: The production casing was drifted to prepare for the new inner string installation. A new 5-1/2" (20#, L80, TSH 513) inner string consisting of 7435 ft was installed and cemented. A new spool was installed to accommodate the inner string
 - e. *Well Reassessment/Re-evaluation*: The pressure integrity test was performed. The cement shoe was drilled out completely to 7435 ft. Inspection logs (MFL, MAC) were run from 7430 ft to surface, and UT, CBL were run from 7435 ft to surface. The well was cleaned out to 7770 ft.
 - f. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7392 ft of 2-7/8" (6.5#, L80, EUE) tubing with flow control components and 5-1/2" (Baker Hornet) packer set at 7378 ft. The final installation integrity test was completed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required pumping packer fluid to a calculated depth

D. Changes During Workover

Anomalies discovered were remediated and two zones were perforated and cement squeezed. The tubing, flow control components, and wellhead were enhanced to higher standards for gas injection and withdrawal

III. Project Costs

A. Actual Costs

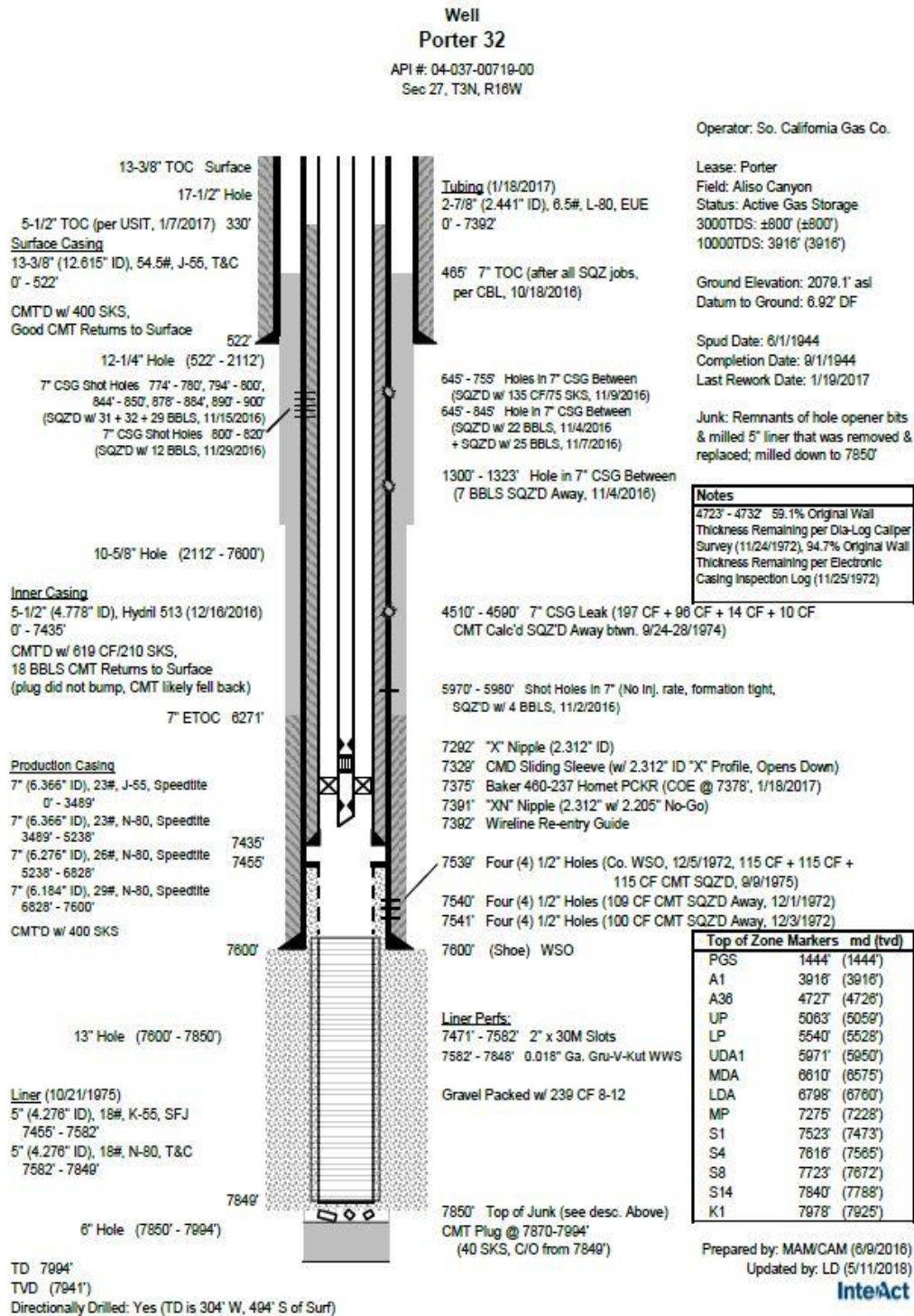
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$10,946	\$0	\$10,946
Contract Costs	\$69,716	\$1,569	\$71,285
Material	\$207,466	\$0	\$207,466
Other Direct Charges	\$1,996,138	\$83,976	\$2,080,114
Total Direct Cost	\$2,284,266	\$85,546	\$2,369,811

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$69,571	\$565	\$70,135
AFUDC	\$18,703	\$0	\$18,703
Property Taxes	\$2,614	\$0	\$2,614
Total Indirect Costs	\$90,888	\$565	\$91,452

Total Loaded Costs	\$2,375,153	\$86,110	\$2,461,264²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 32B	API	04-037-21276-02
Project Type	Recompletion		
Well Status	Active	NOP:	03/07/2017; 11/02/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	09/12/1972; Redrill 1 02/14/2006 (Sidetrack 1); Redrill 2 03/07/2006 (Sidetrack 2)		
Initial Completion	11/14/1972; Redrill 2 Completion 05/05/2006		
Ground Elevation	2076 ft.		
Caprock Depth	7040 ft.		
Measured Depth	7655 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

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3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 32B. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for Porter 32B used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7214 ft. of 2-7/8" (6.5#, L80, EUE) tubing, bottom hole assembly, and 7" (HES G6) packer from 7212 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to liner top at 7275 ft.
 - ii. Run inspection log (MFL) from liner top to surface
 - iii. Perform pressure integrity test to 1.15 MAOP
 - iv. Run Gyro survey and MAC from total depth to surface
 - v. Run inspection logs (UT, CBL) from 7255 ft. to surface
 - c. Well Completion
 - i. Install approximately 7150 ft. of 4-1/2" of (12.6#, L80, TSH 563) of a new completion string, bottom hole assembly, and 7" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install Wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	10/05/2016
2	Noise and Temp Survey	03/24/2016 08/03/2017 09/28/2017 11/02/2017 11/28/2017
3	Ultrasonic (UT)	02/07/2017
4	Cement Bond Log (CBL)	02/07/2017
5	Multi-Arm Caliper (MAC)	02/08/2017
6	Magnetic Flux Leakage (MFL)	02/09/2017
7	Block Test	02/03/2017
8	Annular and Tubing Pressure Test – Final	02/25/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	03/06/2017
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	01/20/2017	02/26/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program
 - b. The well was successfully isolated from the storage zone with a plug in the completion string and pressure tested to 600 psi for 1 hour

2. Rig Work involved removing existing completion equipment, running inspection logs, performing pressure test, and installing new completion.
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 7214 ft of 2-7/8" (6.5#, L80, EUE) tubing, bottom hole assembly, and 7" (HES G-6) packer from 7212 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 7627 ft. Gyro survey was run from 7627 ft to surface. The block test was performed. UT and CBL were run from 7246 ft. to surface, and MAC and MFL were run from 7257 ft. to surface
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7174 ft of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components, and 7" (WFT AS1-X) Packer set at 7143 ft. The final installation integrity test was performed. A new wellhead was installed and tested

3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required pumping packer fluid to a calculated depth.

D. Changes During Workover

Final completion tubing was downsized to optimize well operation. The tubing, flow control components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$17,053	\$0	\$17,053
Contract Costs	\$28,908	\$0	\$28,908
Material	\$164,614	\$0	\$164,614
Other Direct Charges	\$402,105	\$70,120	\$472,224
Total Direct Cost	\$612,679	\$70,120	\$682,799

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$32,128	\$451	\$32,579
AFUDC	\$1,456	\$0	\$1,456
Property Taxes	\$1,889	\$0	\$1,889
Total Indirect Costs	\$35,473	\$451	\$35,924

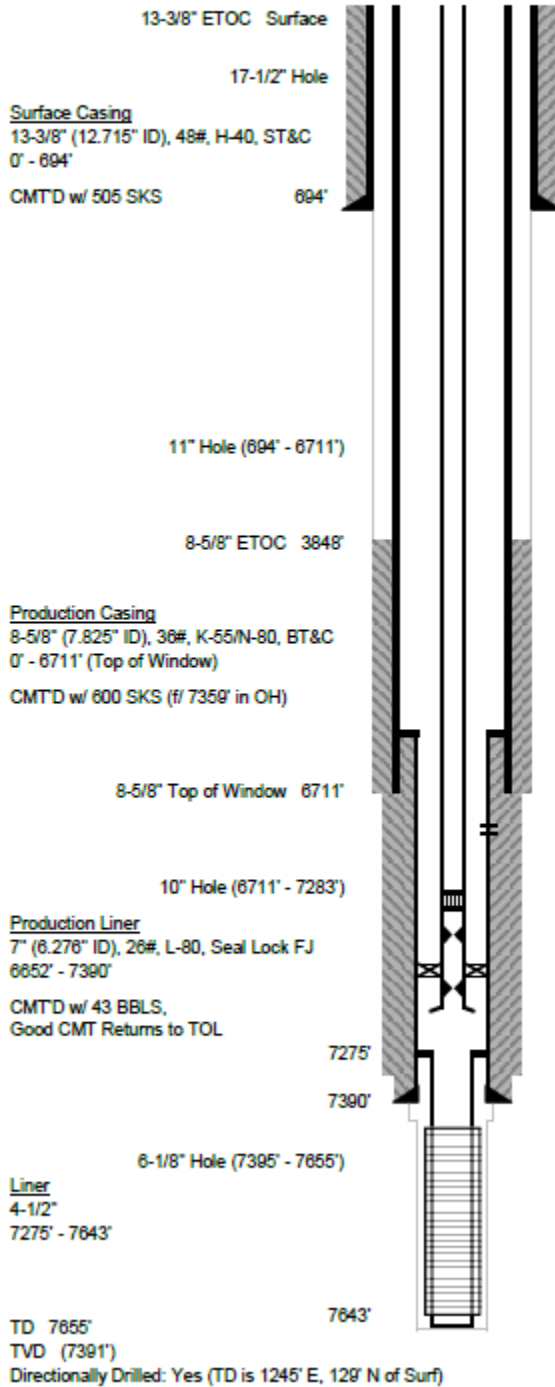
Total Loaded Costs	\$648,152	\$70,571	\$718,723²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Porter 32B ST2
API #: 04-037-21276-02
Sec 27, T3N, R16W

Operator: So. California Gas Co.



Tubing (2/24/2017)
3-1/2" (2.992" ID), 9.2#, L-80, Hydril 563
0' - 7174'

Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 3883' (3882')

Ground Elevation: 2076' asl
Datum to Ground: 12' KB

Spud Date: 9/12/1972
Sidetrack (ST2) Kick-off Date:
3/7/2006
Completion Date: 5/5/2006
Last Rework Date: 2/26/2017

Junk: None

Wellbore History	
Orig. Hole (OH) TD @	7582'
(See Porter 32B OH & ST1)	
ST1 KOP @	7115'
TD @	7270'
(See Porter 32B OH & ST1)	
ST2 KOP @	6711'
TD @	7655'

6652' 7" TOL & TOC
6711' Sidetrack (ST2) KOP (from ST1) into this wellbore (See History)
6858' - 6860' Eight (8) 1/2" Holes (3 BBLs CMT SQZD Away, 7/6/2009)
7066' WXS Sliding Sleeve (2.81" ID)
7104' WX Nipple (2.81" ID)
7143' WEA D&L AS1-X PCKR (COE @ 7147', 2/24/2017)
7161' WXN Nipple (2.75" ID w/ 2.635" No-Go)
7174' Wireline Re-entry Guide

(7283' - 7390') 9" Hole
(7390' - 7395') 7-1/2" Hole

Liner Perfs:
7404' - 7631'
150 Micron ESS (Expanded to 5-1/2")

7627' Tight Spot (unable to work below, 1/31/2017)

Top of Zone Markers	md	(tvd)
A1	3883'	(3882')
A36	4735'	(4723')
UP	5145'	(5096')
LP	5502'	(5411')
UDA1	5935'	(5805')
MDA	6423'	(6256')
LDA	6650'	(6473')
MP	±7040'	(±6837')
S1	±7302'	(±7075')
S4	±7391'	(±7156')
S8	±7475'	(±7233')
S14	±7576'	(±7326')

Prepared by: CAM (8/5/2016)
Updated by: LD (5/15/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 32C	API	04-037-21360-01
Project Type	Inner String Recompletion		
Well Status	Active	NOP	06/14/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/20/1973; Redrill 12/28/1973 (Sidetrack)		
Initial Completion	01/13/1974		
Last Rework	10/12/1989		
Ground Elevation	2075 ft.		
Caprock Depth	6767 ft.		
Measured Depth	7850 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 32C. This project planned to pull 2-7/8" completion string, 6-5/8" uncemented inner string, run casing inspection logs and a Gyro survey, install new inner string, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for well Porter 32C used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey
 - b. Well Isolation

2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 7164 ft. 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 6-5/8" (Otis) seals from 8-5/8" casing packer at 7160 ft.
 - iii. Pull existing 7160 ft. of 6-5/8" (24#, N80, AB Flush) inner string and 8-5/8" (Otis "WCB") packer from 7160 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7436 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run CBL from approximately 7271 ft to surface
 - c. Zonal Remediation
 - i. Cement squeeze critical zones, per DOGGR requirements
 - ii. Drift and redress 8-5/8" production casing for new inner string installation
 - d. Inner String Installation
 - i. Install and cement approximately 7246 ft of 6-5/8" (24#, L80, LT&C) inner string
 - e. Well Reassessment/Re-evaluation
 - i. Install new spool to accommodate inner string
 - ii. Run inspection logs (MFL, MAC, UT, CBL) from 7246 ft to surface
 - iii. Perform pressure integrity test to 1.15 MAOP
 - f. Well Completion
 - i. Install 7230 ft of 3-1/2" (9.3#, L80, TSH 563) of a new completion string, bottom hole assembly, and 6-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	10/05/2016
2	Noise and Temp Survey	03/25/2016 03/31/2016 03/17/2017
3	Cement Bond Log (CBL)	05/05/2017 05/31/2017
4	Ultrasonic (UT)	05/31/2017
6	Multi-Arm Caliper (MAC)	06/01/2017
7	Magnetic Flux Leakage (MFL)	06/01/2017
8	Pressure Integrity Test	06/02/2017
9	Annular and Tubing Pressure Test – Final	06/13/2017
Approvals and Return to Service		
10	DOGGR Safety Review Team Approval	06/14/2017
11	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	03/30/2017	06/14/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program
 - b. The well was successfully isolated from the storage zone with a plug in the completion string and pressure tested to 1100 psi for 1 hour

2. Rig work involved removing the existing completions and uncemented inner string, running inspection logs, remediating critical zones, installing new inner string, re-running inspection logs, pressure testing, and running new completion
 - a. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7160 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 8-5/8" (Otis WCB) packer from 7160 ft., and removing the uncemented inner string 6-5/8" (24#, N80, AB Flush) from 7160 ft.
 - b. *Well Assessment/Evaluation*: The well was cleaned out to 7427 ft. A Gyro survey was run from 7400 ft to surface and a CBL was run from 7251 ft.
 - c. *Zonal Remediation*: Per DOGGR requirements, one zone was perforated and cement squeezed, from 795 ft. to 800 ft. (BFW)
 - d. *Inner String Installation*: The production casing was drifted to prepare for the new inner string installation. A new 6-5/8" (24#, L-80, LT&C/BT&C) inner string consisting of 7230 ft was installed and cemented. A new spool was installed to accommodate the inner string
 - e. *Well Reassessment/Re-evaluation*: The cement shoe was drilled out to 7160 ft. Inspection logs (UT, CBL, MFL, and MAC) were run from 7160 ft to surface. The pressure Integrity test performed on inner string. The wellbore was cleaned out to 7303 ft.
 - f. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7158 ft of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components and a 6-5/8" (HES AS1) Packer set at 7141 ft. The final installation integrity test was performed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required pumping packer fluid to a calculated depth

D. Changes During Workover

Because of the existing uncemented inner string casing, the decision was made to pre-emptively run a new cemented inner string without running SIMP inspection logs on the production casing. After initial inspections, and per DOGGR requirements, one zone was perforated and cement squeezed in the production casing before running the new inner string. The tubing, flow control components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Cost

A. Actual Costs

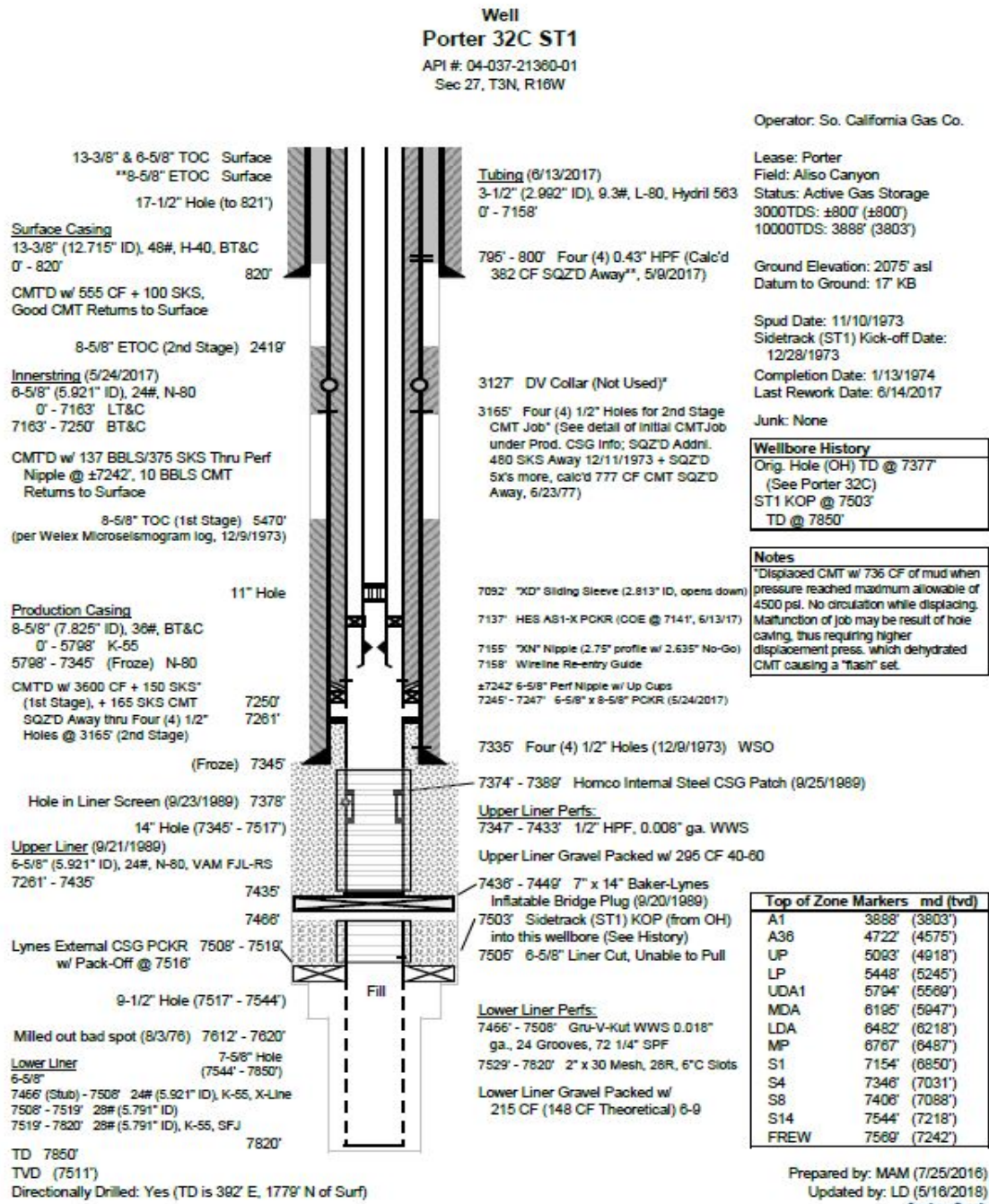
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$16,218	\$0	\$16,218
Contract Costs	\$21,408	\$7,750	\$29,159
Material	\$206,525	\$0	\$206,525
Other Direct Charges	\$1,295,547	\$57,359	\$1,352,906
Total Direct Cost	\$1,539,699	\$65,109	\$1,604,808

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$54,787	\$408	\$55,195
AFUDC	\$2,515	\$0	\$2,515
Property Taxes	\$5,147	\$0	\$5,147
Total Indirect Costs	\$62,449	\$408	\$62,857

Total Loaded Costs	\$1,602,148	\$65,517	\$1,667,665²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 32D	API	04-037-21355-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP	12/06/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	09/26/1973		
Initial Completion	11/03/1973		
Ground Elevation	2075 ft.		
Caprock Depth	7179 ft.		
Measured Depth	7750 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 32D. This project planned pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, install new inner string, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for Porter 32D used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement if necessary

- ii. Pull existing completion consisting of 7361 ft. of 2-7/8" (6.5#, L80, EUE) tubing, bottom hole assembly, and top 8-5/8" (WFT AS-1X) packer from 7293 ft. and bottom 8-5/8" (Baker Retrieval "D") packer from 7352 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7748 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Drift and prepare production casing for installation of new inner string
 - c. Zonal Remediation
 - i. Perforate and cement squeeze critical zones per DOGGR requirements
 - d. Inner string Installation
 - i. Install and cement approximately 7348 ft. of 6-5/8" (24#, L80, BT&C & LT&C) inner string
 - e. Well Reassessment/Re-evaluation
 - i. Install new spool to accommodate inner string
 - ii. Run inspection logs (UT, MAC and CBL) from approximately 7348 ft. to surface
 - iii. Perform pressure integrity test to 1.15 MAOP
 - iv. Clean out wellbore to 7726 ft.
 - f. Well Completion
 - i. Install approximately 7261 ft. of 4-1/2" (12.6#, L80, TSH 513) new completion string, bottom hole assembly, and 6-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install Wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	09/09/2016 02/15/2017 09/26/2017
2	Noise and Temp Survey	03/28/2016 02/28/2017 11/02/2018
3	Ultrasonic (UT)	09/26/2017 11/06/2018
4	Cement Bond Log (CBL)	09/26/2017 11/06/2018
5	Multi-Arm Caliper (MAC)	09/25/2017
6	Magnetic Flux Leakage (MFL)	09/25/2017 11/05/2018
7	Pressure Integrity Test Block Test	09/26/2017 11/04/2018
8	Annular and Tubing Pressure Test – Final	11/20/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	12/06/2018
10	Return to Service	07/19/2019

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	06/15/2017	09/29/2017
Rig Work Phase 2	10/25/2018	11/27/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program
- b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 650 psi for 1 hour

1. Rig Work was completed in two phases.
 - a. Phase 1 of the rig work involved the decompletion of the existing production string, running initial inspection logs, performing zonal remediation, and installing a new inner string.
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7361 ft. of 2-7/8" (6.5#, L80, EUE) tubing, bottom hole assembly, and two packers 8-5/8" (WFT "AS1-X") at 7293 ft. and 8-5/8" (Baker Retrieval "D") at 7352 ft.
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 7726 ft. Gyro survey was run from 7720 ft. to surface. The production casing was drifted to prepare for inner string installation.
 - iii. *Zonal Remediation*: Per DOGGR requirements, one zone was perforated and cement squeezed from 795 ft to 800 ft (BFW); additional cement was placed in the annular space between the surface and production casing string.
 - iv. *Inner string Installation*: The production casing was drifted to prepare for a new inner string installation. A new 6-5/8" inner string (24#, L80, LT&C) consisting of 7360 ft was installed and cemented. A new spool was installed to accommodate the inner string.
 - v. *Well Reassessment/Re-evaluation*: The inner string was cleaned out to the top of cement at 7252 ft. Casing inspection logs (UT and CBL) were run on the inner string from 7260 ft. to surface. MFL and MAC were run from 7264 ft. to surface. The pressure integrity test was performed.
 - vi. *Well Isolation*: The well was isolated from the storage zone. A new wellhead was installed and tested
 - b. Phase 2 of the rig work included re-running inspection logs, pressure testing, and installing a new completion
 - i. *Well Decompletion*: Remove wellhead components and isolation equipment
 - ii. *Well Assessment/Evaluation*: The cement shoe was drilled out and the inner string was drifted. MFL was run from 7360 ft. to surface. UT and CBL were run from 7365 ft. to surface. The block test was performed. The well was cleaned out to 7722 ft.

- iii. *Well Completion:* The new completion string and bottom hole assembly were installed consisting of 7256 ft. of 3-1/2" (9.2#, L80, TSH 563) tubing with flow control components, and a 6-5/8" (HES AHC) Packer set at 7227 ft. The final installation integrity test was completed. A new wellhead was installed and tested
 3. Post Rig Work: The well was unloaded to a calculated fluid depth and turned over to SoCalGas Operations.

D. Changes During Workover

The well was completed in two phases so the rig could address annular pressures in other wells once the storage field returned to injection. New completion procedures were developed and implemented to finish the workover. Additional cement was placed in the annulus between surface and production casing strings. The production tubing installed was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to accommodate tubing flow only for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

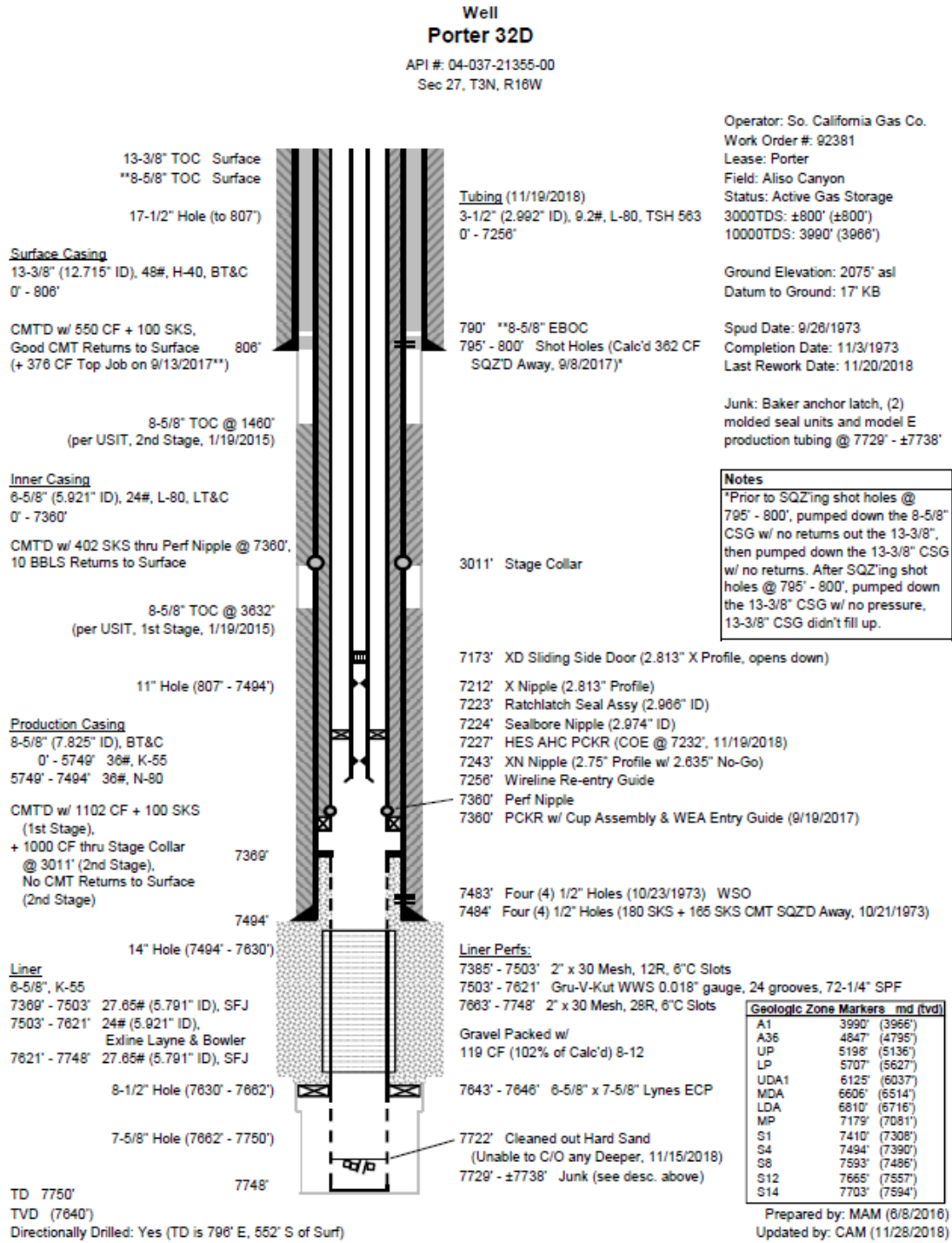
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$25,403	\$0	\$25,403
Contract Costs	\$164,086	\$79,079	\$243,165
Material	\$289,667	\$0	\$289,667
Other Direct Charges	\$2,082,022	\$65,593	\$2,147,615
Total Direct Cost	\$2,561,178	\$144,672	\$2,705,850

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$103,057	\$1,000	\$104,057
AFUDC	\$126,045	\$0	\$126,045
Property Taxes	\$18,594	\$0	\$18,594
Total Indirect Costs	\$247,697	\$1,000	\$248,696

Total Loaded Costs	\$2,808,875	\$145,672	\$2,954,546²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 37	API	04-037-00724-01
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	01/23/2018; 10/13/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	06/12/1946, Redrill 05/31/1956 (Deepened)		
Initial Completion	08/26/1946, Redrill Completion 06/18/1956		
Ground Elevation	1900 ft.		
Caprock Depth	7341 ft.		
Measured Depth	7881 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 37. This project planned to pull the 2-3/8" completion string and 5-1/2" uncemented inner string, run casing inspection logs and Gyro survey, install new inner string, re-run casing inspection logs, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for Porter 37 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7438 ft. of 2-3/8" (4.7#, N80, EUE) tubing, bottom hole assembly, and 5-1/2" (Otis "WC overshot") packer from approximately 7434 ft.
 - iii. Pull existing inner string consisting of 7434 ft. of 5-1/2" (20#, N80, AB FL-4S) casing and 7" (Baker Model "WCB") packer from approximately 7434 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7740 ft.
 - ii. Run inspection log CBL from liner top at 7592 ft. to surface
 - iii. Run Gyro survey from total depth to surface
 - c. Zonal Remediation
 - i. Cement squeeze critical zones, per DOGGR requirements
 - ii. Drift and redress 7" production casing for new inner string installation
 - d. Inner string Installation
 - i. Install and cement approximately 7570 ft of 5-1/2" (20#, L80, TSH 513) inner string
 - e. Well Reassessment/Re-evaluation
 - i. Drift and clean out cement in new inner string
 - ii. Run inspection logs (MFL, MAC, UT and CBL) from approximately 7525 ft. to surface
 - iii. Perform pressure integrity test to 1.15 MAOP
 - iv. Drill out cement to top of production liner at 7592 ft.
 - f. Well Completion
 - i. Install approximately 7481 ft. of 3-1/2" (9.3#, L80, FlushMax) of a new completion string, bottom hole assembly, and 5-1/2" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/06/2016 01/30/2017
2	Noise and Temp Survey	03/29/2016 01/23/2017 06/22/2017
3	Ultrasonic (UT)	09/06/2017 11/13/2017
4	Cement Bond Log (CBL)	09/06/2017 11/13/2017
5	Multi-Arm Caliper (MAC)	08/21/2017 11/10/2017
6	Magnetic Flux Leakage (MFL)	11/09/2017
7	Pressure Integrity Test Block Test	11/14/2017 09/17/2018
8	Annular and Tubing Pressure Test – Final	12/13/2017 10/03/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval DOGGR District Approval	01/23/2018 11/07/2018
10	Return to Service	09/05/2018 10/30/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	08/01/2017	12/19/2017
Rig Work Phase 2	09/11/2018	10/05/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 1100 psi for 1 hour.
2. Rig Work was completed in two phases
 - a. Phase 1 involved removing existing production equipment and inner string, running initial inspection logs, performing zonal remediation, installing a new inner string, re-running inspection logs, and installing a new completion
 - i. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 7438 ft. of 2-3/8" (4.7#, N80, EUE) tubing, bottom hole assembly, 5-1/2" (Otis "WC overshoot") packer from 7434 ft., and 7434 ft. of 5-1/2" (N80 20# AB FL-4S) inner string with 7" (Baker "WCB") packer at 7434 ft.
 - ii. *Well Assessment/Evaluation:* The well was cleaned out to 7743 ft. A Gyro survey was run from 7640 ft. to surface. The CBL was run from 7560 ft. to surface. The production casing was pressure tested to identify anomalies requiring remediation
 - iii. *Zonal Remediation:* Per DOGGR requirement, nine zones were perforated and cement squeezed, from 7330 ft. to 7335 ft. (MP), from 6695 ft. to 6700 ft. (MDA), from 5568 ft. to 5573 ft. (LP), from 5080 ft. to 5085 ft. (UP), from 4785 ft. to 4790 ft. (A36), from 3970 ft. to 3975 ft. (A1), from 800 ft. to 805 ft. (BFW); as well as 2 zones where anomalies were detected, from 6350 ft. to 6355 ft. and from 529 ft. to 536 ft.
 - iv. *Inner string Installation:* The production casing was drifted to prepare for a new inner string. A new 5-1/2" (20#, L80, TSH 513) inner string consisting of 7550 ft was installed and cemented. A new spool was installed to accommodate the inner string
 - v. *Well Reassessment/Re-evaluation:* The cement shoe was drilled out to 7506 ft. UT and CBL inspection logs were run on the inner string from 7479 ft. to surface; MFL and MAC were run from 7506 ft. to surface. The pressure integrity test was performed. The cement shoe was drilled out to 7550 ft.

- vi. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7388 ft. of 3-1/2" (9.2#, L80, FlushMax) tubing with flow control components with 5-1/2" (WFT ArrowPac) Packer set at 7444 ft. The final installation integrity test was performed. A new wellhead was installed and tested
- b. Phase 2 of rig work included the removal and replacement of completion equipment
 - i. *Well Decompletion/Inspection*: Well decompletion included the removal of wellhead and production equipment consisting of 7388 ft. of 3-1/2" (9.3#, L80, F-Max) tubing, bottom home assembly, and the seals from the 5-1/2" (WFT ArrowPac) packer from 7444 ft. The seal bore assembly was inspected and required replacement
 - ii. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7457 ft. of 2-7/8" (L80, 6.5#, TSH 563) tubing with flow control components, and new seals for the 5-1/2" (WFT ArrowPac) Packer set at 7444 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded to a calculated fluid depth and turned over to SoCalGas Operations

D. Changes During Workover

After initial inspections, and per DOGGR requirements, nine zones were perforated and cement squeezed in the production casing before running a new inner string. After running completion and preparing to unload the well, a restriction was discovered in the production packer requiring equipment to be replaced. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

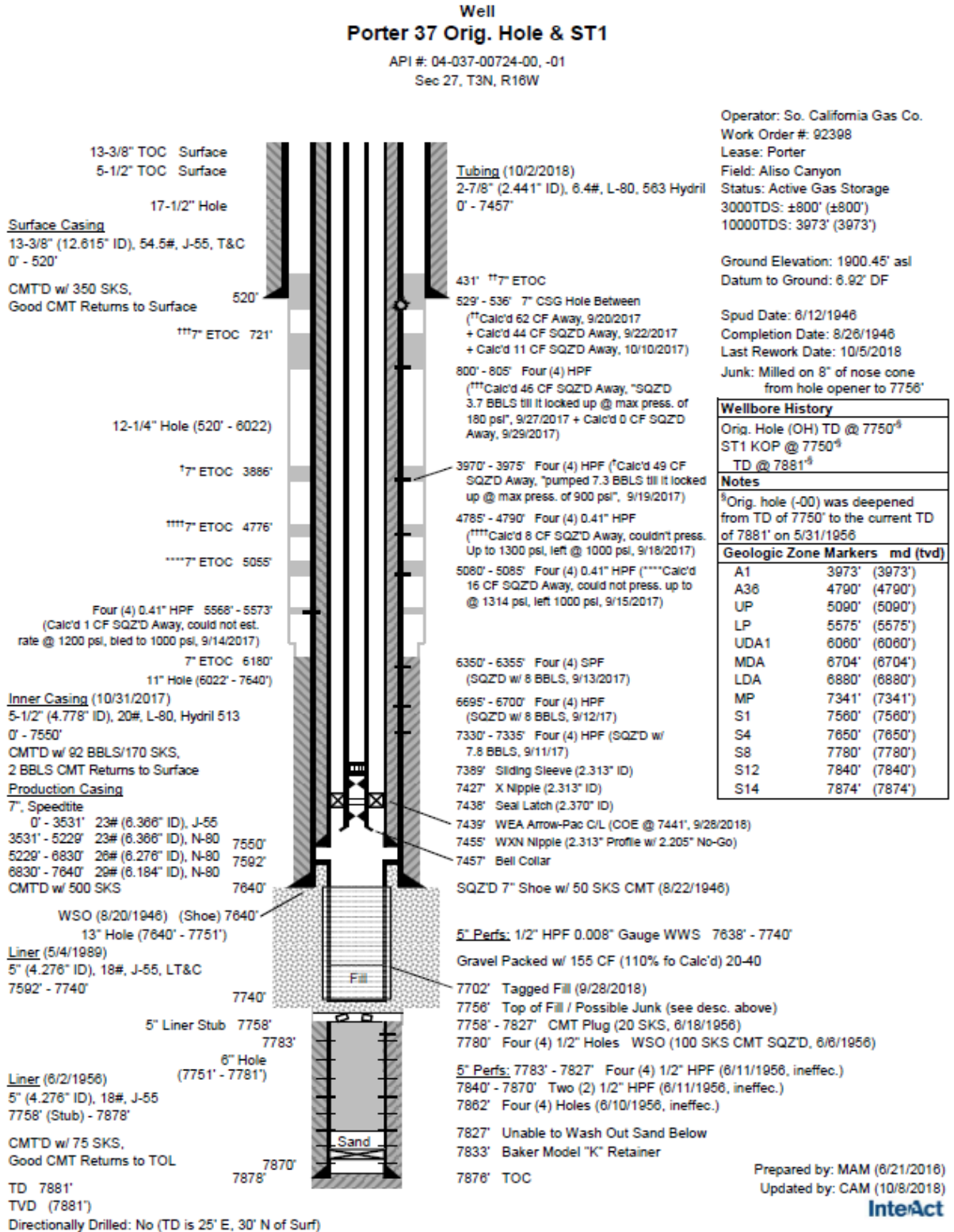
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$35,763	\$200	\$35,962
Contract Costs	\$209,559	\$0	\$209,559
Material	\$217,973	\$0	\$217,973
Other Direct Charges	\$2,552,925	\$32,260	\$2,585,185
Total Direct Cost	\$3,016,220	\$32,460	\$3,048,679

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$134,184	\$740	\$134,924
AFUDC	\$24,483	\$0	\$24,483
Property Taxes	\$3,673	\$0	\$3,673
Total Indirect Costs	\$162,340	\$740	\$163,080

Total Loaded Costs	\$3,178,560	\$33,200	\$3,211,760²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 42A	API	04-037-21876-00
Project Type	Inner String/Liner Recompletion		
Well Status	Active	NOP:	03/24/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	09/22/1978		
Initial Completion	12/03/1978		
Ground Elevation	1963 ft.		
Caprock Depth	7250 ft.		
Measured Depth	7718 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171, SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 42A. This project planned to pull 3-1/2" completion string, run inspection logs and Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for Porter 42A used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7351 ft. of 3-1/2" (9.3#, J55/N80, EUE) tubing, bottom hole assembly, and 8-5/8" (Baker "Retrieva-D") packer from 7347 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7713 ft.
 - ii. Run Gyro survey and MAC from total depth to surface
 - iii. Run inspection log MFL from 7447 ft. to surface
 - iv. Run inspection logs (UT, CBL) from 7468 ft. to surface
 - v. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7400 ft. of 3-1/2" (9.3#, L80, TCPC) new tubing completion string, bottom hole assembly, and a 8-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	09/25/2016
2	Noise and Temp Survey	03/08/2016 03/24/2016 06/20/2017 09/18/2017 09/06/2018
3	Ultrasonic (UT)	12/12/2016 02/14/2017
4	Cement Bond Log (CBL)	09/22/2016 12/12/2016 02/14/2017
5	Multi-Arm Caliper (MAC)	12/16/2016 02/15/2017
6	Magnetic Flux Leakage (MFL)	12/16/2016 02/15/2017
7	Block Test	02/16/2017
8	Annular and Tubing Pressure Test – Final	03/10/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	03/16/2017
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	08/23/2016	09/26/2016
Rig Work Phase 2	12/06/2016	03/13/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed and passed, which determined that it was safe to move forward with the SIMP program
2. Rig Work for well Porter 42A was completed in two phases
 - a. Rig Work Phase 1 of the rig work involved partial decompletion of existing production equipment, running CBL, and well isolation.
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7351 ft of 3-1/2" (9.3#, J55/N80, EUE) tubing and bottom hole assembly. The 8-5/8" (Baker "Retrieva-D") was pushed down to 7451 ft.
 - ii. *Well Assessment/Evaluation*: CBL was run from 7450 ft to surface
 - iii. *Well Isolation*: The well was isolated from the storage zone. The wellhead was re-installed and tested
 - b. Rig Work Phase 2 involved running inspection logs, pressure testing, removing the completion packer, perforating and cement squeezing three critical zones, installing new inner string, re-running inspection logs, pressure testing inner string, recompleting production liner with a new gravel pack system, and installing a new completion
 - i. *Well Decompletion*: This step included the removal of wellhead components, production equipment, and isolation equipment
 - ii. *Well Assessment/Evaluation*: The block test was performed. Gyro survey and UT inspection log were run from 7400 ft. to surface; MFL and MAC inspection logs were run from 7410 ft. to surface. The 8-5/8" (Baker "Retrieva-D") packer was removed from 7451 ft. The wellbore was cleaned out to 7713 ft.
 - iii. *Zonal Remediation*: Per DOGGR requirements, two zones were perforated and cement squeezed, from 4930 ft. to 4935 ft. and 4920 ft. to 4940 ft. (A36), and from 4045 ft. to 4050 ft. (A1/USDW)
 - iv. *Inner String Installation*: The production casing was drifted to prepare for new inner string installation. A new 6-5/8" (24#, L80, LT&C) inner string consisting of 7430 ft. was installed and cemented. A new tubing spool was installed for the inner string
 - v. *Well Reassessment/Re-evaluation*: Cement was drilled out to 7386 ft. for the inspection logs. Casing inspection logs (UT, CBL, MAC, MFL) were run from 7380 ft. to surface. A block test was performed. The shoe was drilled to 7713 ft. A Gyro survey was run from 7682 ft. to surface

- vi. *Gravel Pack Liner Installation:* Additional perforations were made in the production liner from 7705 ft. to 7593 ft. A new 2-7/8" perforated liner was installed inside the 5-1/2" production liner and gravel packed from 7715 ft. to 7411 ft.
 - vii. *Well completion:* A new completion string and bottom hole assembly were installed consisting of 7205 ft. of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components, and 6-5/8" (Baker SC1) Packer set at 7317 ft. The final installation integrity test was performed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
- a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required pumping packer fluid to a calculated depth

D. Changes During Workover

The well workover was completed in two phases. During the initial assessment, it was determined a new inner string was required. A new inner production liner was installed to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$24,624	\$0	\$24,624
Contract Costs	\$47,159	\$50	\$47,209
Material	\$360,827	\$0	\$360,827
Other Direct Charges	\$2,013,134	\$124,532	\$2,137,666
Total Direct Cost	\$2,445,744	\$124,582	\$2,570,326

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$84,281	\$1,555	\$85,836
AFUDC	\$25,905	\$0	\$25,905
Property Taxes	\$5,569	\$0	\$5,569
Total Indirect Costs	\$115,754	\$1,555	\$117,310

Total Loaded Costs	\$2,561,498	\$126,138	\$2,687,636²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

Storage Integrity Management Program Aliso Canyon – Porter 42A

IV. Wellbore Diagram after SIMP Work

Well Porter 42A

API #: 04-037-21876-00
Sec 28, T3N, R16W

Operator: So. California Gas Co.

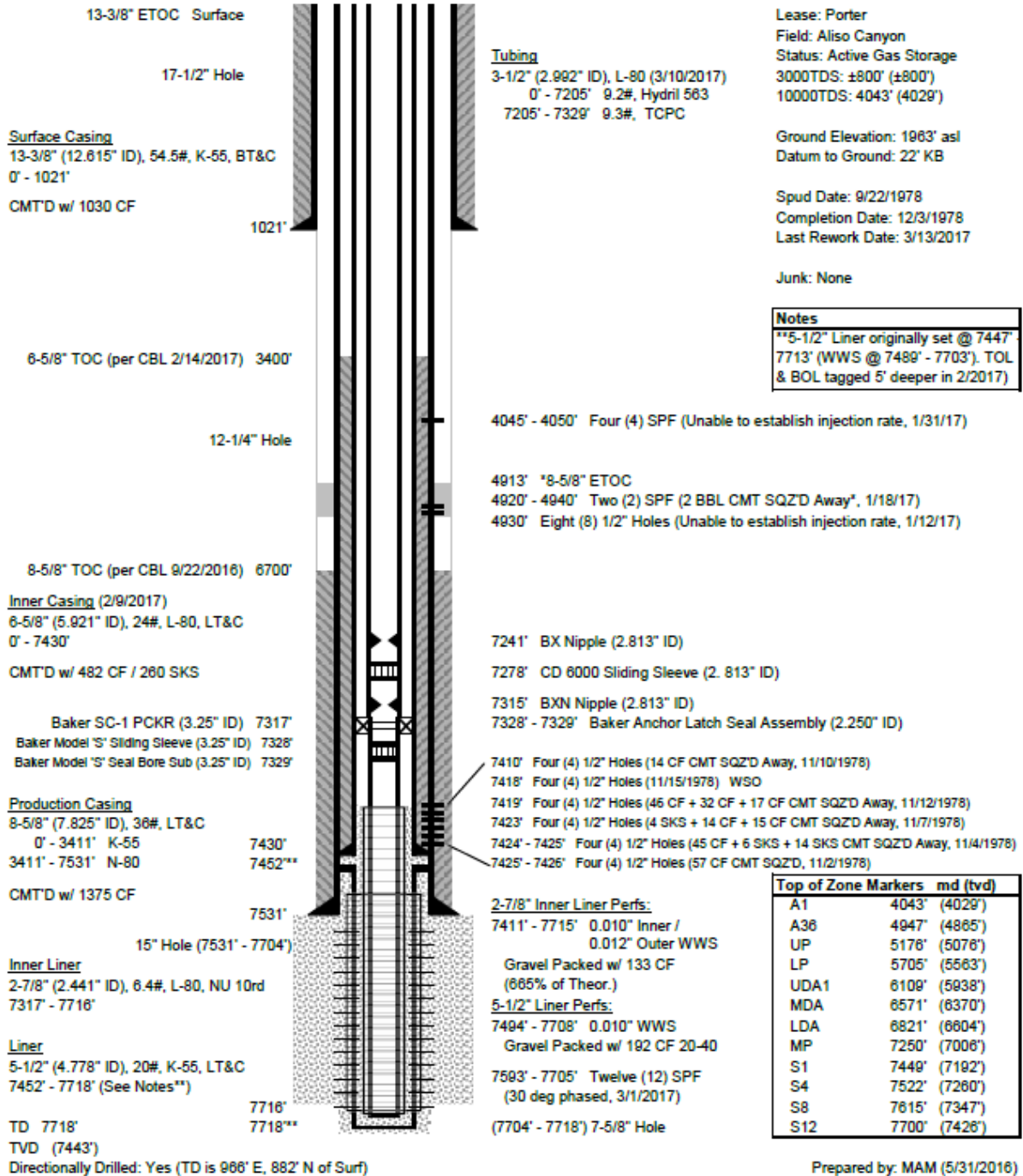
Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 4043' (4028')

Ground Elevation: 1963' asl
Datum to Ground: 22' KB

Spud Date: 9/22/1978
Completion Date: 12/3/1978
Last Rework Date: 3/13/2017

Junk: None

Notes
**5-1/2" Liner originally set @ 7447'
7713' (WWS @ 7489' - 7703'). TOL
& BOL tagged 5' deeper in 2/2017)



Prepared by: MAM (5/31/2018)
Updated by: LD (5/16/2018)

InterAct

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 44	API	04-037-00731-01
Project Type	Steel Liner Recompletion		
Well Status	Active	NOP:	06/30/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/11/1955; Redrill 03/05/1978 (Sidetrack)		
Initial Completion	01/06/1956; Redrill completion 04/18/1978		
Elevation	2195 ft.		
Caprock Depth	7515 ft.		
Measured Depth	8100 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 44. This project planned to pull 2-7/8" completion string and steel liner, run casing inspection logs, Gyro survey, install steel liner, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well Porter 44 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7614 ft. of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 7" (Baker "Retrieva-D") packer from 7600 ft.
 - iii. Remove steel liner from 3971 to 4012 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 8039 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL) from 7629 ft. to surface
 - iv. Perform pressure integrity test above and below removed steel liner depths (3971 to 4012 ft) to 1.15 MAOP
 - c. Well Completion/Install Steel Liner
 - i. Install new 7" packer at approximately 7600 ft.
 - ii. Install steel liner from approximately 3971 to 4012 ft.
 - iii. Install approximately 7600 ft of 3-1/2" (9.3#, N80, EUE) of a new completion string, and bottom hole assembly, thereby converting the well to tubing flow
 - iv. Perform installation integrity test on completion
 - v. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/30/2016 04/19/2016 04/12/2017
3	Ultrasonic (UT)	02/29/2016
4	Cement Bond Log (CBL)	02/16/2016
5	Multi-Arm Caliper (MAC)	02/13/2016 02/25/2016
6	Magnetic Flux Leakage (MFL)	02/15/2016
7	Block Test	02/18/2016
8	Annular and Tubing Pressure Test – Final	03/15/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	04/12/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	01/26/2016	03/15/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program

2. Rig Work involved removing the existing completion equipment, running inspection logs, performing pressure testing, installing new steel liners, and installing a new completion.
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 7614 ft of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 7" (Baker Retrieval D) packer from 7600 ft., and the steel liner from 3971 ft. to 4012 ft.
 - b. *Well Assessment/Evaluation:* The Gyro survey was run from 7015 ft. to surface. Inspection logs (MAC, MFL) were run from 7639 ft. to surface, and CBL from 7630 ft. to 3800 ft. The block test was completed. The MAC was re-run from 7639 ft. to surface. Production casing was drifted to install steel liners. The inspection log (UT) was run from 7639 ft. to surface. The well was cleaned out to 8039 ft.
 - c. *Steel liners Installation / Evaluation:* Two steel liners were run and installed. The first steel liner was installed for packer setting from 7599 ft. to 7620 ft., the second one was installed from 3971 ft. to 4032 ft.; both steel liners were pressure tested.
 - d. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7530 ft. of 3-1/2" (9.3#, L80, EUE) tubing with flow control components and 6-5/8" (WFT AS-1X) Packer at 7609 ft. The final installation integrity test was performed. The wellhead was re-installed and tested.
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

A second steel liner was installed to allow packer removal if required, without removing top steel liner. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Cost

A. Actual Costs

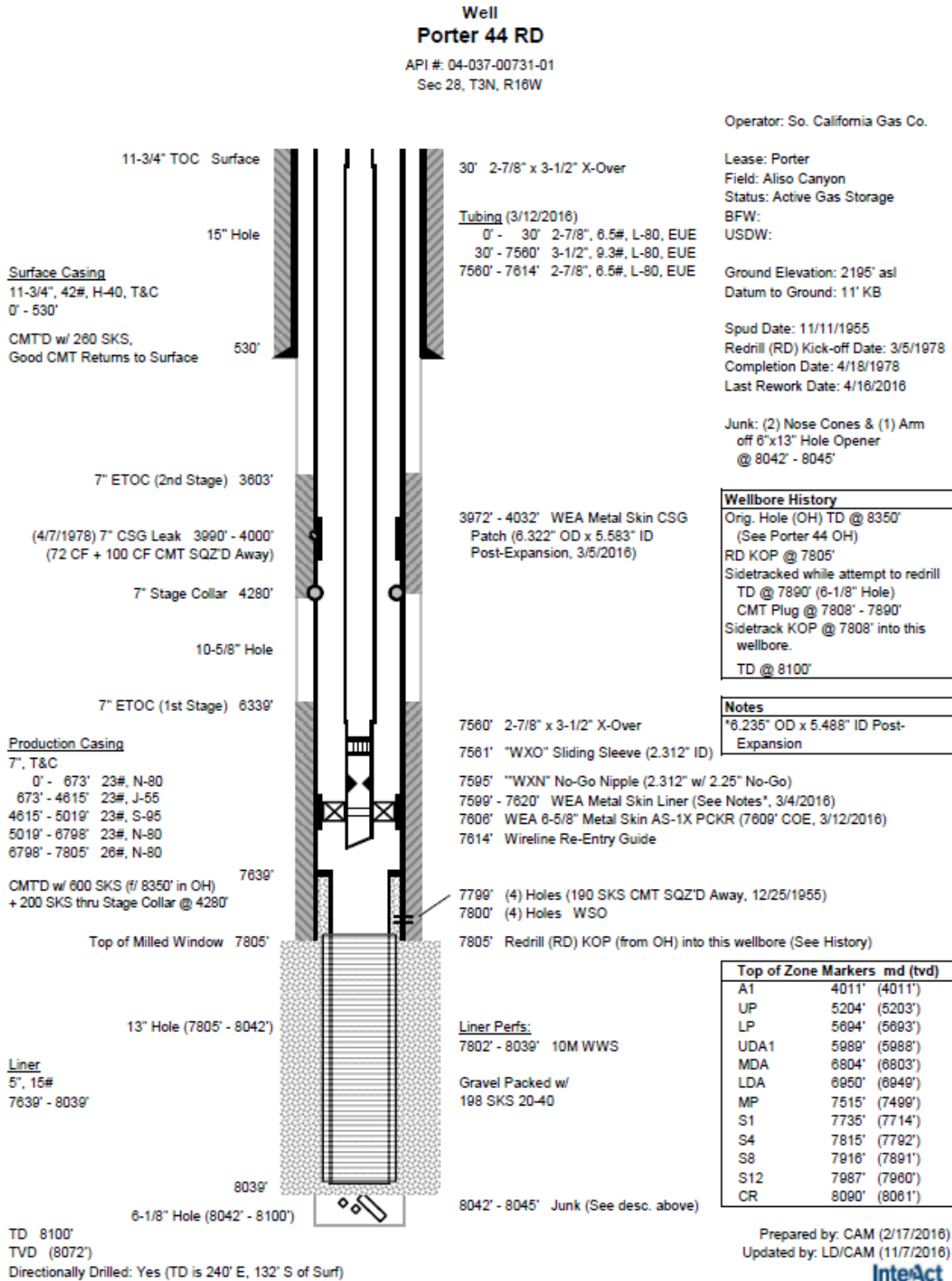
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$1,750	\$0	\$1,750
Contract Costs	\$5,264	\$2,872	\$8,136
Material	\$84,116	\$0	\$84,116
Other Direct Charges	\$907,903	\$64,447	\$972,351
Total Direct Cost	\$999,033	\$67,319	\$1,066,352

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$28,263	\$3,922	\$32,184
AFUDC	\$13,630	\$0	\$13,630
Property Taxes	\$3,543	\$0	\$3,543
Total Indirect Costs	\$45,436	\$3,922	\$49,357

Total Loaded Costs	\$1,044,469	\$71,241	\$1,115,709²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 46	API	04-037-00733-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP	05/15/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/02/1943		
Initial Completion	02/27/1944		
Ground Elevation	2254 ft.		
Caprock Depth	7446 ft.		
Measured Depth	7963 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 46. This project planned to pull 2-7/8" completion string, run casing inspection logs and Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well Porter 46 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey
 - b. Well Isolation
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7665 ft. of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 7" (Otis "PW") packer from 7660 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7929 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (MFL, MAC, UT, and CBL) from approximately 7660 ft. to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7640 ft. of 2-7/8" (6.5#, L80, TSH 563) new tubing completion string, bottom hole assembly, and 7" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/01/2016 01/30/2017 10/11/2017 02/09/2018
2	Noise and Temp Survey	04/12/2016 04/19/2016 09/12/2016 01/25/2017 06/22/2017 10/13/2017
3	Ultrasonic (UT)	08/16/2017 10/09/2017
4	Cement Bond Log (CBL)	08/16/2017 10/09/2017
5	Multi-Arm Caliper (MAC)	08/17/2017 10/10/2017
6	Magnetic Flux Leakage (MFL)	08/17/2017 10/10/2017
7	Pressure Integrity Test	10/11/2017
8	Annular and Tubing Pressure Test – Final	05/11/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	05/15/2018
10	Return to Service	07/24/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	07/31/2017	10/16/2017
Rig Work Phase 2	04/25/2018	05/15/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program
 - b. The well was successfully isolated from the storage zone with a plug in the completion string and pressure tested to 1100 psi for 1 hour
2. Rig work was completed in two phases
 - a. Phase 1 included pulling existing production equipment, cleaning out wellbore, running inspection logs, performing zonal remediations, installing and cementing a new inner string, re-running inspection logs, and pressure testing the inner string.
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7665 ft. of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 7" (Otis "PW") packer from 7660 ft.
 - ii. *Well Assessment/Evaluation*: The well bore was cleaned out to 7929 ft. Gyro survey was run from 7915 ft to surface. Inspection logs (MAC, MFL, UT, CBL) were run from 7617 ft. to surface
 - iii. *Zonal Remediation*: Per DOGGR requirements, six zones were perforated and cement squeezed, from 6880 ft. to 6885 ft. (LDA), from 6705 ft. to 6710 ft. (MDA), from 5950 ft. to 5955 ft. (UDA1), from 5200 ft. to 5205 ft. (UP), from 3965 ft. to 3970 ft. (A1/USDW), and from 2900 ft. to 2905 ft. (PGS); additionally, WSO holes from 7666 ft. to 7668 ft. were cement squeezed
 - iv. *Inner String Installation*: The production casing was drifted to prepare for a new inner string. A new 5-1/2" (20#, L80, TSH 513) inner string consisting of 7662 ft. was installed and cemented. A new spool was installed to accommodate the inner string
 - v. *Well Reassessment/Re-evaluation*: The well bore was cleaned out to 7620 ft. Inspection logs (UT, CBL, MAC, MFL) were run from 7620 ft. to surface. Pressure integrity test was performed
 - vi. *Well Isolation*: The well was isolated from the storage zone. The wellhead was re-installed and tested
 - b. Phase 2 included cleaning out the wellbore and running new completion equipment
 - i. *Well Decompletion/Assessment/Evaluation*: This step included removal of wellhead components, drilling out the cement shoe to 7682 ft., and cleaning out to 7929 ft.
 - ii. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7591 ft. of 2-7/8" (6.5#, L80, TSH 563) tubing with flow control components with 5-1/2" (WFT ArrowSet-Pac)

sealbore packer set at 7564 ft. The final installation integrity test was performed. A new wellhead was installed and tested

3. Post Rig Work: The well was unloaded to a calculated fluid depth and turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

A new inner string was installed based on the age of the well. The well was completed in two phases so the rig could address annular pressures in other wells once the storage field returned to injection. New completion procedures were developed and implemented to finish the workover. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

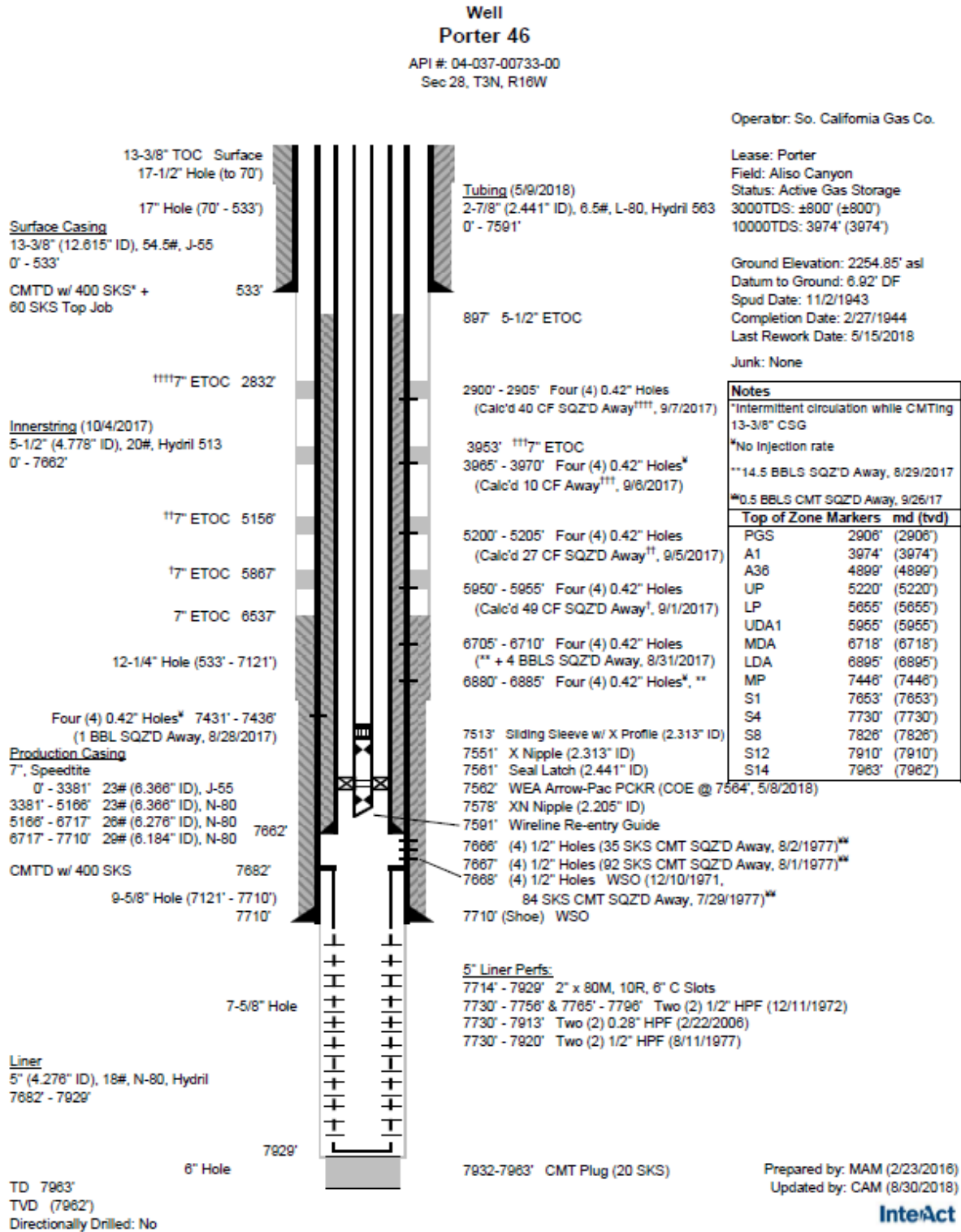
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$19,494	\$0	\$19,494
Contract Costs	\$257,575	\$7,650	\$265,225
Material	\$293,396	\$0	\$293,396
Other Direct Charges	\$1,507,113	\$103,321	\$1,610,434
Total Direct Cost	\$2,077,578	\$110,971	\$2,188,549

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$89,114	\$974	\$90,088
AFUDC	\$50,912	\$0	\$50,912
Property Taxes	\$7,485	\$0	\$7,485
Total Indirect Costs	\$147,511	\$974	\$148,485

Total Loaded Costs	\$2,225,089	\$111,945	\$2,337,034²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 50B	API	04-037-24336-01
Project Type	Recompletion		
Well Status	Active	NOP	06/30/2016; 11/02/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	06/30/2010; Redrill 08/15/2010 (Sidetrack)		
Initial Completion	08/28/2010		
Ground Elevation	1954 ft.		
Caprock Depth	6788 ft.		
Measured Depth	8520 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 50B. This project planned to pull the 3-1/2" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing pipe and other well components. The following describes the well workover plan for well Porter 50B used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 6615 ft. of 3-1/2" (9.3#, L80, EUE) tubing, bottom hole assembly, and 9-5/8" (HES AS1-X) packer from 6606 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 8500 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL, MAC) from top of liner to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 6615 ft. of 5-1/2" (20#, N80, EUE) tubing of a new completion string, bottom hole assembly, and a 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
 3. Post Rig Work
 - a. Unload well and turn over to operations
 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/08/2016 05/22/2017
3	Ultrasonic (UT)	04/14/2016
4	Cement Bond Log (CBL)	04/14/2016
5	Multi-Arm Caliper (MAC)	04/15/2016
6	Magnetic Flux Leakage (MFL)	04/16/2016
7	Block Test	04/18/2016
8	Annular and Tubing Pressure Test – Final	04/29/2016
Approvals and Return to Service		Date
9	DOGGR Safety Review Team Approval	06/09/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	04/08/2016	04/30/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program

2. Rig Work involved removing existing completion equipment, running inspection logs, pressure testing, and installing new completion.
 - b. Well Decompletion: This step included the planned removal of wellhead components and production equipment consisting of 6615 ft. of 3-1/2" (9.3#, L80, EUE) tubing, bottom hole assembly, and 9-5/8" HES AS1-X packer from 6606 ft.
 - c. Well Assessment/Evaluation: The well was cleaned out to 6629 ft. Gyro survey was run from 7656 ft due to 60-degree well inclination. Inspection logs (CBL, UT, MAC, MFL) were run from 6605 ft. to surface. The block test was performed. The wellbore was cleaned out to 8494 ft.
 - d. Well Completion: A new completion string and bottom hole assembly were installed consisting of 6621 ft. of 3-1/2" (9.3#, L80, EUE) tubing with flow control components and a 9-5/8" (HES AS1X) Packer set at 6615 ft. The final installation pressure test was performed. The wellhead was re-installed and tested.

3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth.

D. [Changes During Workover](#)

Final tubing string was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$854	\$0	\$854
Contract Costs	\$24,425	\$5,153	\$29,579
Material	\$107,529	\$0	\$107,529
Other Direct Charges	\$399,515	\$70,562	\$470,077
Total Direct Cost	\$532,324	\$75,715	\$608,039

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$15,592	\$14,058	\$29,650
AFUDC	\$3,523	\$0	\$3,523
Property Taxes	\$1,075	\$0	\$1,075
Total Indirect Costs	\$20,190	\$14,058	\$34,247

Total Loaded Costs	\$552,513	\$89,773	\$642,286²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Porter 50B ST1**

API #: 04-037-24336-01
Sec 27, T3N, R16W

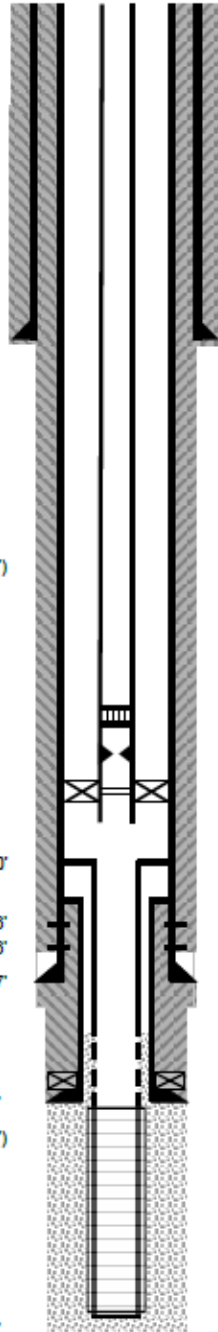
Operator: So. California Gas Co.

13-3/8" TOC Surface
9-5/8" TOC Surface

17-1/2" Hole (0 - 925')

Surface Casing
13-3/8" (12.615" ID), 54.5#, K-55,
BT&C (per program)
0' - 921'

CMT'D w/ 1074 CF, Good CMT
Returns to Surface 921'



Tubing (4/28/2016)
3-1/2" (2.992" ID), 9.3#, L-80, EUE
0' - 6621'

Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 3589' (3515')

Ground Elevation: 1954' asl
Datum to Ground: 22.5' KB

Spud Date: 6/30/2010
Sidetrack (ST1) Kick-off Date:
8/15/2010
Completion Date: 8/28/2010
Last Rework Date: 4/29/2016

Junk: None

Wellbore History	
Orig. Hole (OH) TD @	7437'
(See Porter 50B)	
ST1 KOP @	7190'
TD @	8520'

Notes	
*9-5/8" CSG Stuck @ 7177'. Shot Perfs & CMT'D CSG thru perfs as depicted.	

12-1/4" Hole (925' - 7190')

Production Casing
9-5/8" (8.681" ID), 47#, L-80, SLGS
0' - 7177'

CMT'D w/ 2894 CF, thru Perfs*,
Good CMT Returns to Surface

6620'

*(4) 1/2" HPF (8/1/2010) 6884' - 6886'
*(4) 1/2" HPF (8/1/2010) 7084' - 7086'

7177'

6565' Durasleeve Sliding Sleeve (2.813" ID)
6600' "XN" Nipple (2.75" w/ 2.635" No-Go)
6611' HES D&L ASI-X PCKR (COE @ 6615', 4/28/2016)
6621' Wireline Re-entry Guide

6748' ETOC (Top of 7" Liner)

CMT'D Liner
7" (6.276" ID), 26#, L-80, SLFJ
6754' - 7480'

CMT'D w/ 135 CF 7480'

8-1/2" Hole (7190' - 8520')

Inner Liner
5" (4.408" ID), 15#, N-80, Hyd 511
6620' - 7493'
5-1/2" (4.974" ID), 15#, N-80, Hyd 511
7493' - 8494'
5" (4.408" ID), 15#, N-80, Hyd 511
8494' - 8500'

7190' Sidetrack (ST1) KOP (from OH)
into this wellbore (See History)

7448' - 7479' Baker ECP

5" & 5-1/2" Liner Perfs:
7383' - 7472' Slots (Specs not reported)
7493' - 8494' 0.012" ga. WWS

Gravel Packed w/ 256 CF
(103% of theor.) 20x40

Top of Zone Markers md (tvd)		
A1	3580'	(3515')
A36	4492'	(4399')
UP	4815'	(4721')
LP	5133'	(5039')
UDA1	5533'	(5437')
MDA	5987'	(5859')
LDA	6384'	(6238')
MP	6788'	(6561')
S1	7260'	(6878')
S4	7515'	(7002')
S6	7580'	(7027')
S8	8245'	(7179')

TD 8520' 8500'

TVD (7294')

Directionally Drilled: Yes (TD is 636' W, 1145' S of Surf)

Prepared by: MAM (3/2/2016)
Updated by: LD (5/17/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 50C	API	04-037-24337-00
Total Project Type	Recompletion		
Well Status	Active	NOP:	04/20/2016; 04/20/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	06/07/2014		
Completion	07/26/2014		
Ground Elevation	1953 ft.		
Caprock Depth	6869 ft.		
Measured Depth	8751 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 50C. This project planned to pull 3-1/2" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for Porter 50C used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7095 ft. of 3-1/2" (9.3#, L80, EUE) tubing, bottom hole assembly, and 9-5/8" (WEA ASI-X) packer from 7086 ft.
 - b. Well Assessment/Evaluation
 - i. Run Gyro survey from total depth to surface
 - ii. Run inspection logs (UT, CBL, MFL and MAC) from approximately 7126 ft to surface
 - iii. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7090 ft. of 3-1/2" (9.3#, L80, EUE) new tubing completion string, bottom hole assembly, and 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/08/2016 04/03/2017 08/11/2017
3	Ultrasonic (UT)	03/16/2016
4	Cement Bond Log (CBL)	03/16/2016
5	Multi-Arm Caliper (MAC)	03/17/2016
6	Magnetic Flux Leakage (MFL)	03/17/2016
7	Block Test	03/20/2016
8	Annular and Tubing Pressure Test – Final	04/06/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	04/20/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	03/07/2016	04/07/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the integrity program

2. Rig Work involved removing existing completion equipment, running inspection logs, pressure testing, and installing new completion
 - a. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7095 ft. of 3-1/2" (9.3#, L80, EUE) tubing from, bottom hole assembly, and 9-5/8" (WFT AS1X) packer from 7086 ft.
 - b. *Well Assessment/Evaluation*: Gyro survey equipment failed so it could not be run as planned. Inspection logs were run (UT and CBL) from 7122 ft. to surface; MFL and MAC were run from 7106 ft. to surface. A block test was performed
 - c. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7096 ft. of 3-1/2" (9.3#, L80, EUE) tubing with flow control components and 9-5/8" (WFT AS1X) Packer set at 7086 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

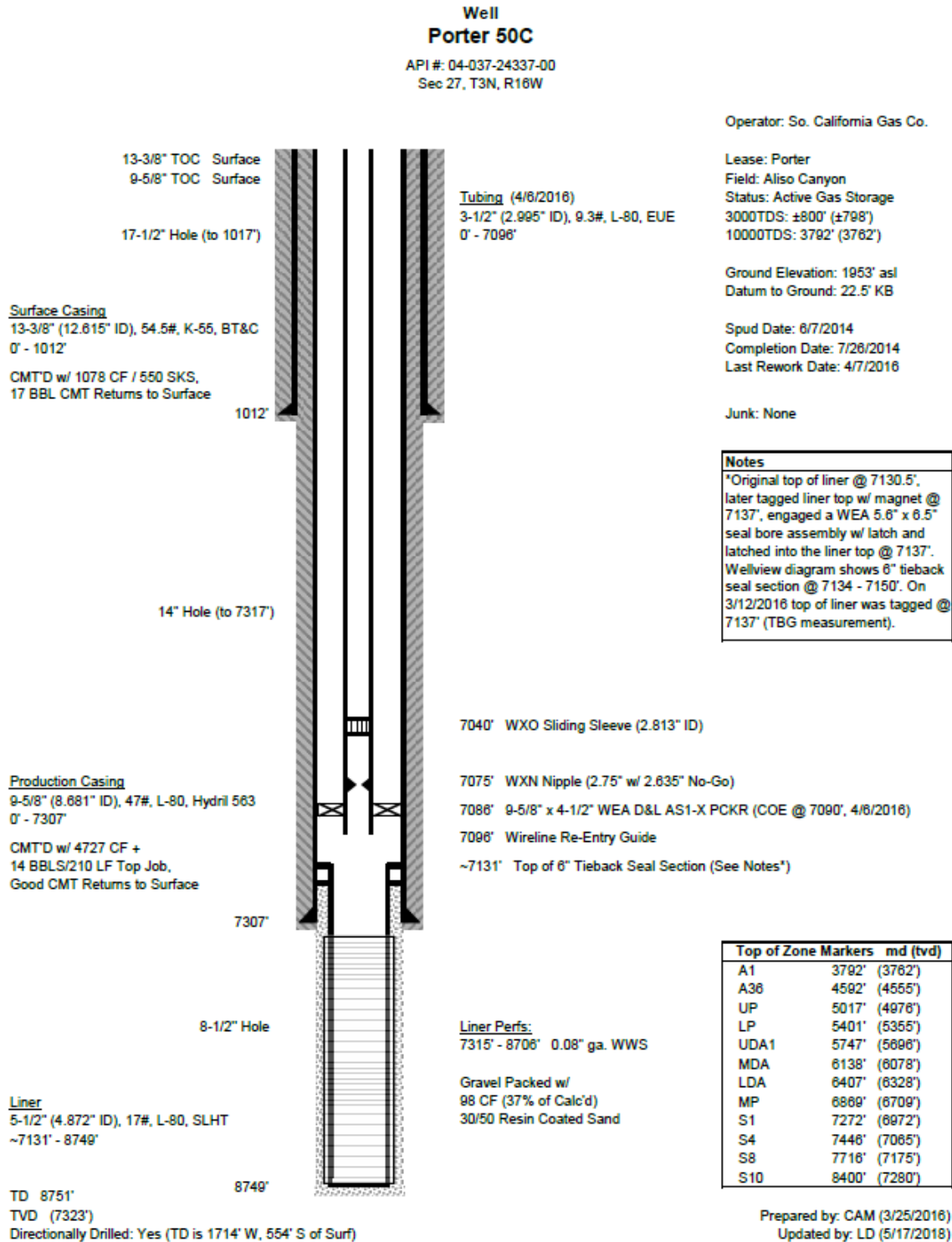
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$853.91	\$0	\$854
Contract Costs	\$33,226	\$7,071	\$40,297
Material	\$72,718	\$0	\$72,718
Other Direct Charges	\$616,968	\$55,991	\$672,960
Total Direct Cost	\$723,766	\$63,063	\$786,829

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$21,764	\$9,898	\$31,661
AFUDC	\$3,718	\$0	\$3,718
Property Taxes	\$1,783	\$0	\$1,783
Total Indirect Costs	\$27,264	\$9,898	\$37,161

Total Loaded Costs	\$751,029	\$72,960	\$823,990²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 68A	API	04-037-22742-00
Project Type	Recompletion		
Well Status	Active	NOP:	07/30/2016; 10/31/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	05/23/1983		
Initial Completion	07/04/1983		
Elevation	2080 ft.		
Caprock Depth	6682 ft.		
Measured Depth	7315 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171, SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 68A. This project planned to pull 2-7/8" completion string, run casing inspection logs, a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the casing and other well components. The following describes the well workover plan for Porter 68A used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

-
- ii. Pull existing completion consisting of 6930 ft of 2-7/8" (6.5# J55 EUE) tubing, flow control components, and 9-5/8" Baker Model "D" packer from 6881 ft, and 9-5/8" Otis WB Perma-drill packer from 6894 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7304 ft.
 - ii. Run Gyro from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL, MAC) from top of liner to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 6890 ft. of 3-1/2" (9.3# L80 TCPC) tubing of a new completion string, bottom hole assembly, and 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
 3. Post Rig Work
 - a. Unload well and turn over to operations
 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/09/2016 03/10/2016 06/13/2017
3	Ultrasonic (UT)	05/24/2016
4	Cement Bond Log (CBL)	05/24/2016
5	Multi-Arm Caliper (MAC)	05/25/2016
6	Magnetic Flux Leakage (MFL)	05/26/2016
7	Block Test	05/21/2016
8	Annular and Tubing Pressure Test – Final	06/10/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	06/28/2016
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	04/26/2016	06/11/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program

2. Rig Work included removing the existing completion, running inspection logs, pressure testing, and installing new completion
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 6930 ft of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, a 9-5/8" (Baker Model "D") packer from 6881 ft, and 9-5/8" (Otis WB Perma-drill) packer from 6894 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to target depth of 7304 ft. Gyro survey was run from 7304 ft. to surface. The block test was performed. CBL and UT were run from 6920 ft. to surface. MAC and MFL were run from 6912 ft. to surface
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 6769 ft. of 5-1/2" (20#, L80, TCPC) tubing with flow control components and a 9-5/8" (WEA AS1X) Packer set at 6896 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

The tubing string was upsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$0.00	\$0	\$0
Contract Costs	\$25,762	\$0	\$25,762
Material	\$71,385	\$0	\$71,385
Other Direct Charges	\$1,228,505	\$72,208	\$1,300,713
Total Direct Cost	\$1,325,652	\$72,208	\$1,397,861

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$23,209	\$13,500	\$36,709
AFUDC	\$4,975	\$0	\$4,975
Property Taxes	\$1,868	\$0	\$1,868
Total Indirect Costs	\$30,052	\$13,500	\$43,552

Total Loaded Costs	\$1,355,704	\$85,708	\$1,441,413²
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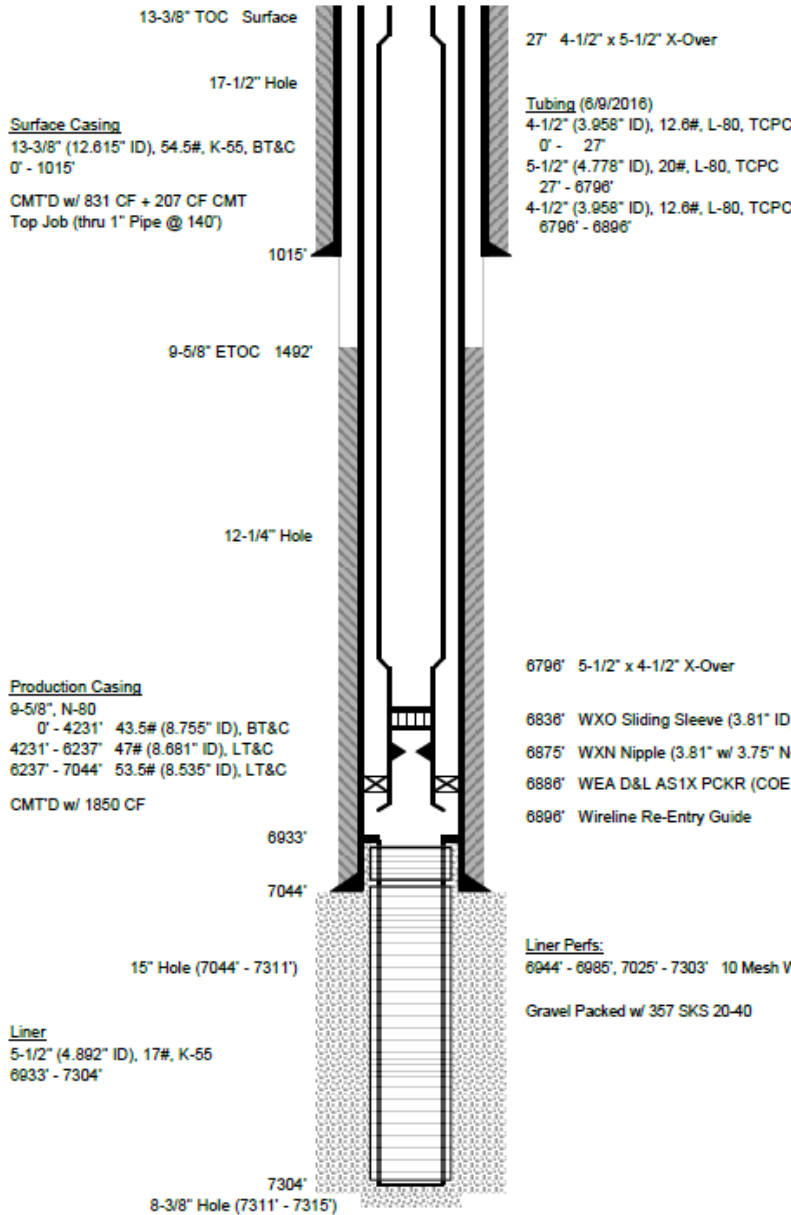
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Porter 68A**

API #: 04-037-22742-00
Sec 27, T3N, R16W

Operator: So. California Gas Co.



Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 3798' (3795')
Ground Elevation: 2080' asl
Datum to Ground: 18' KB
Spud Date: 5/23/1983
Completion Date: 7/4/1983
Last Rework Date: 6/11/2016

Junk: None

Top of Zone Markers	md	(tvd)
A1	3798'	(3795')
A36	4450'	(4447')
UP	4858'	(4855')
LP	5199'	(5195')
UDA1	5478'	(5475')
MDA	5886'	(5883')
LDA	6189'	(6186')
MP	6682'	(6672')
S1	6953'	(6938')
S4	7054'	(7038')
S8	7127'	(7109')
S14	7244'	(7224')
FREW	7272'	(7252')

TD 7315'
TVD (7294')
Directionally Drilled: Yes (TD is 127' W, 173' S of Surf)

Prepared by: MAM (4/14/2016)
Updated by: LD (5/17/2018)

InterAct

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 68B	API	04-037-24136-01
Project Type	Recompletion		
Well Status	Active	NOP:	08/08/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	05/19/1993; Redrill 05/28/1993 (Sidetrack)		
Initial Completion	7/27/1993		
Ground Elevation	2077 ft.		
Caprock Depth	6205 ft.		
Measured Depth	7330 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 68B. This project planned to pull 2-7/8" completion string, run casing inspection logs, a Gyro survey, pressure testing casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing and other well components. The following describes the well workover plan for Porter 68B used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 6570 ft of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, flow control components, and 9-5/8" (G6) packer from 6561 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7183 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL, MAC) from top of liner to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 6616 ft. of 2-7/8 (6.5# L80 EUE) tubing of a new completion string, bottom hole assembly, and 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/31/2016 05/22/2017
3	Ultrasonic (UT)	04/13/2016
4	Cement Bond Log (CBL)	04/16/2016
5	Multi-Arm Caliper (MAC)	04/14/2016
6	Magnetic Flux Leakage (MFL)	04/14/2016
7	Block Test	04/15/2016
8	Annular and Tubing Pressure Test – Final	04/24/2016
Approvals and Return to Service		Date
9	DOGGR Safety Review Team Approval	06/02/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	04/04/2016	04/24/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the integrity program

2. Rig Work included removing the existing completion, running inspection logs, pressure testing, installing new completion
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 6570 ft of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 9-5/8" (G6) packer from 6561 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 7195 ft. Gyro survey was run from 7138 ft to surface. UT and CBL were run from 6600 ft. to surface. MFL and MAC were run from 6603 ft. to surface. The block test was performed. Additional logs, CIT (Casing Imaging Tool) and MSC (Multi Sensor Caliper), were run from 6604 ft. to surface; URS (Ultrasonic Radial Scanner) and CBL from 6604 ft. to surface
 - c. *Well Completion:* A new completion string and bottom hole assembly was installed consisting of 6579 ft. of 2-7/8" (6.5#, L80, EUE) tubing with flow control components and 9-5/8" (Baker ASX-1) Packer set at 6625 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$1,276.16	\$0	\$1,276
Contract Costs	\$87,390.44	\$9,263.69	\$96,654
Material	\$98,455.32	\$0	\$98,455
Other Direct Charges	\$660,294.48	\$5,709.70	\$666,004
Total Direct Cost	\$847,416	\$14,973	\$862,390

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$25,266	\$8,632	\$33,898
AFUDC	\$4,313	\$0	\$4,313
Property Taxes	\$1,093	\$0	\$1,093
Total Indirect Costs	\$30,673	\$8,632	\$39,304

Total Loaded Costs	\$878,089	\$23,605	\$901,694²
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²Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Porter 68B ST1**

API #: 04-037-24136-01
Sec 28, T3N, R16W

Operator: So. California Gas Co.

Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 3365' (3339')

Ground Elevation: 2077' asl
Datum to Ground: 23.5' KB

Spud Date: 5/19/1993
Sidetrack (ST1) Kick-off Date:
5/28/1993
Completion Date: 7/27/1993
Last Rework Date: 04/24/2016

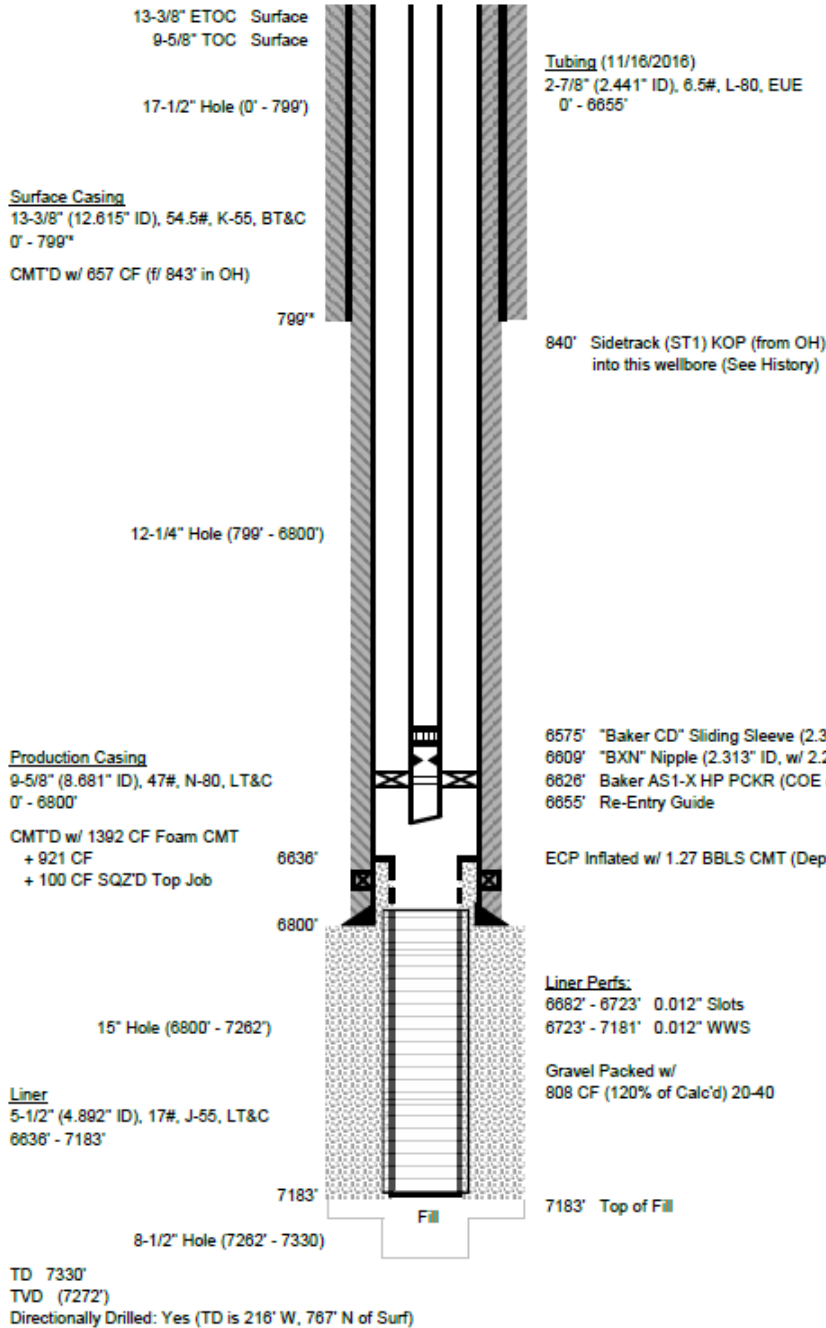
Junk: None

Wellbore History

Orig. Hole (OH) TD @ 2209'
(See Porter 68B)
ST1 KOP @ 840'
TD @ 7330'

Notes

*13-3/8" originally CMTD @ 843':
While drilling 12-1/4" hole,
discovered 13-3/8" CSG & float
shoe had screwed off @ 990' -
1034' in orig. hole



Top of Zone Markers	md (tvd)
A1	3365' (3339')
A36	4381' (4339')
UP	4698' (4652')
LP	4951' (4904')
UDA1	5117' (5069')
MDA	5328' (5278')
LDA	5786' (5736')
MP	6205' (6153')
S1	6774' (6718')
S4	6853' (6797')
S8	6924' (6867')
S14	7170' (7112')
FREW	7272' (7214')

Prepared by: MAM (6/9/2016)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 69A	API	04-037-22051-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	04/21/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	01/03/1980		
Initial Completion	03/21/1980		
Ground Elevation	2368 ft.		
Caprock Depth	7365 ft.		
Measured Depth	8398 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys, inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 69A. This project planned to pull 2-7/8" completion string and uncemented 7" inner string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new inner string and completion string, perform casing inspection logs, and convert well to tubing flow. The following describes the well workover plan for well Porter 69A used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - Phase 1
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7553 ft. of 2-7/8" (6.5#, N80, EUE), bottom hole assembly, and on/off tool from 7554 ft.
- b. Well Assessment/Evaluation
 - i. Clean out wellbore to target depth 7553 ft.
- c. Well Isolation
 - i. Run in the hole with isolation equipment, perform isolation test, re-install wellhead and test.

Phase 2

- a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull isolation equipment
 - iii. Pull existing un-cemented inner string consisting of 7556 ft. of 7" (26#, L80, LT&C), bottom hole assembly, and 9-5/8" (Baker "F-1") packer from 7514 ft.
 - iv. Pull 9-5/8" (Baker SC-1) seals from packer liner top at 7556 ft.
- b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7876 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (MFL, MAC, UT, CBL) from liner top to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
- c. Contingency Plan
 - i. Upon casing inspection evaluation, inner string, steel liner or scab liner will be considered and new NOI will be submitted
- d. Well Completion
 - i. Install 7350 ft. of 4-1/2" (12.6#, L80, TCPC) of a new completion string, bottom hole assembly, and 9-5/8" packer, thereby converting well to tubing flow
 - ii. Perform installation integrity test
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection Activities		Date
1	Isolation Pressure Test	06/16/2016 06/22/2016
2	Noise and Temp Survey	03/09/2016 03/14/2016 09/27/2017
3	Ultrasonic (UT)	01/24/2017 03/17/2017
4	Cement Bond Log (CBL)	01/24/2017 03/17/2017
5	Multi-Arm Caliper (MAC)	01/24/2017 03/20/2017
6	Magnetic Flux Leakage (MFL)	01/25/2017 03/21/2017
7	Block Test Pressure Integrity Test	01/20/2017 03/21/2017
8	Annular and Tubing Pressure Test – Final	04/13/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	04/17/2017
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	06/15/2016	06/25/2016
Rig Work Phase 2	11/16/2016	04/18/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to rework the well and move forward with the SIMP program
2. Rig Work was completed in two phases
 - a. Phase 1 included the partial removal of completion equipment and well isolation.
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7552 ft. of 2-7/8" (6.5#, N80, EUE) tubing, and on/off tool from 7553 ft.
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to the planned depth at 7553 ft.
 - iii. *Well Isolation*: The well was isolated from the storage zone. The wellhead was re-installed and tested
 - b. Phase 2 consisted of removing remaining completion equipment and inner string, pressure testing, running inspection logs, performing zonal remediations, installing and cementing new inner string, re-running inspection logs, pressure testing inner string, and running new completion equipment
 - i. *Well Decompletion*: The step consisted of removing the wellhead, isolation equipment, 7556 ft. of 7" (26#, L80, LT&C) of inner string, bottom hole assembly, 9-5/8" (Baker "F-1") packer from 7514 ft., and 9-5/8" (Baker SC-1) seals from packer liner top at 7556 ft.
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 7876 ft. Gyro survey was run from 7876 ft. The block test was performed. Inspection logs (UT, CBL, MFL, MAC) were run from 7515 ft. to surface
 - iii. *Zonal Remediation*: Per DOGGR requirements, four zones were perforated and cement squeezed, from 6630 ft. to 6635 ft. (MDA), from 6150 ft. to 6155 ft. (UDA1), from 3990 ft. to 3995 ft. (A1/USDW), and from 793 ft. to 798 ft. (BFW)
 - iv. *Inner String Installation*: The production casing was drifted to prepare for a new inner string installation. A new 7" (26#, L80, LT&C) inner string consisting of 7468 ft. was installed and cemented. A spool was re-installed to accommodate the inner string
 - v. *Well Reassessment/Re-evaluation*: The cement shoe was drilled out to 7423 ft. Inspection logs (UT, CBL, MAC) were run from 7423 ft. to surface. MFL was run from 7159 ft. to surface. A pressure integrity test was performed. The cement shoe was drilled out and the wellbore was cleaned out to 7876 ft.

- vi. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7422 ft. of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components, and a 7" (Baker SC-2) Sealbore packer set at 7399 ft. The final installation integrity test was completed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

After casing inspections were completed, it was determined a new inner was needed. Per DOGGR requirements, four zones were perforated and cement squeezed in the production casing before running the new inner string. The tubing was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$23,575	\$0	\$23,575
Contract Costs	\$42,121	\$9,559	\$51,680
Material	\$346,697	\$0	\$346,697
Other Direct Charges	\$2,092,584	\$92,892	\$2,185,477
Total Direct Cost	\$2,504,977	\$102,451	\$2,607,428

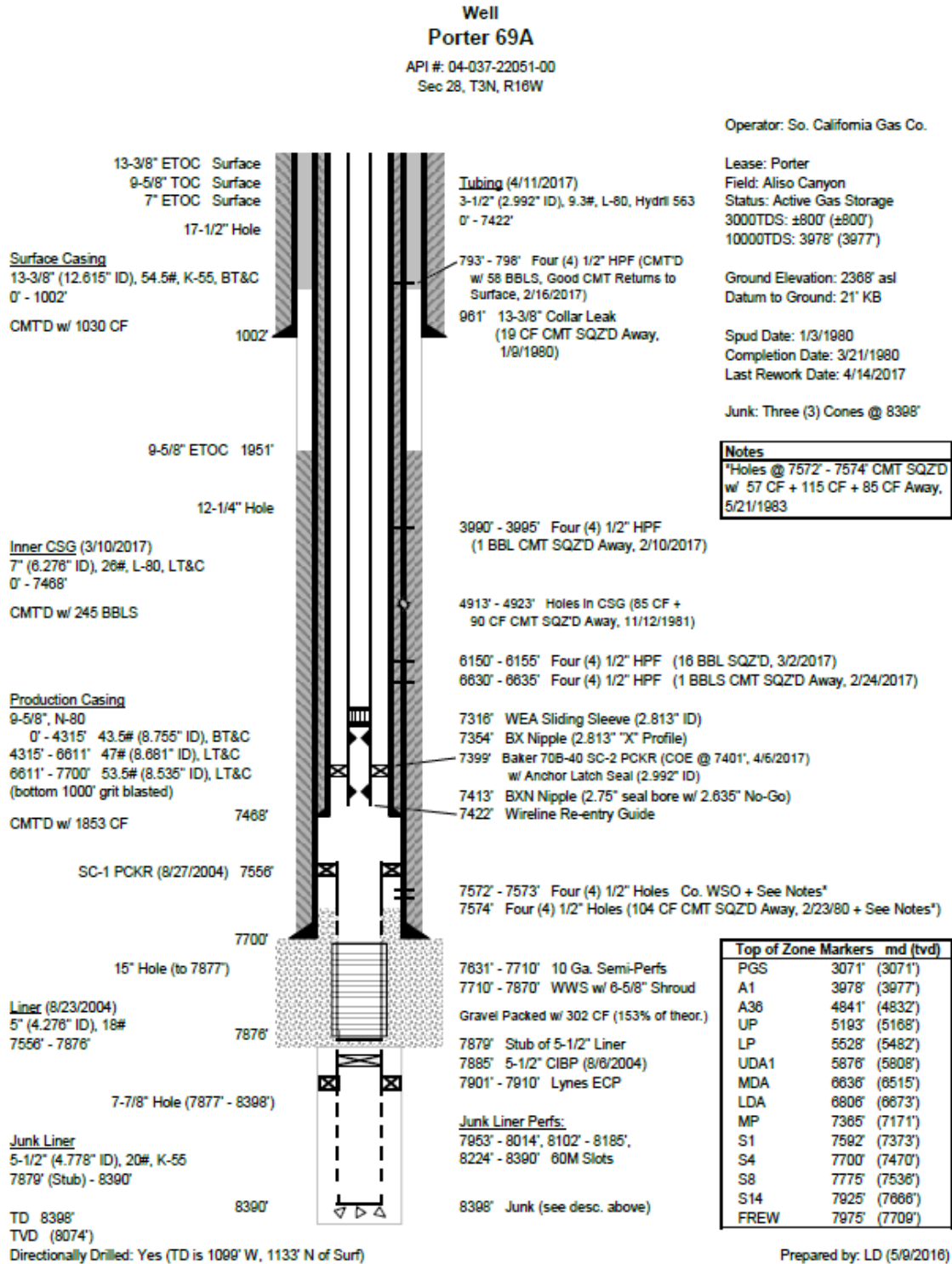
Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$85,193	\$3,545	\$88,738
AFUDC	\$12,106	\$0	\$12,106
Property Taxes	\$1,858	\$0	\$1,858
Total Indirect Costs	\$99,157	\$3,545	\$102,702

Total Loaded Costs	\$2,604,134	\$105,996	\$2,710,130²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

Storage Integrity Management Program Aliso Canyon – Porter 69A

IV. Wellbore Diagram after SIMP Work



Prepared by: LD (5/9/2016)
Updated by: LD (5/17/2018)
InteAct

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 69B	API	04-037-24127-00
Project Type	Recompletion		
Well Status	Active	NOP:	07/30/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	01/28/1992		
Initial Completion	03/16/1992		
Elevation	2366 ft.		
Caprock Depth	7025 ft.		
Measured Depth	7881 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys, inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 69B. This project planned to pull 2-7/8" completion string, run casing inspection logs and Gyro survey, pressure test casing, install new completion string, and convert well to tubing flow. The following describes the well workover plan for well Porter 69B used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 7204 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Otis "BWD") packer from 7200 ft.
 - b. Well Assessment/Evaluation

- i. Clean out well bore to liner top at 7275 ft.
 - ii. Run Gyro survey from approximately 7270 ft. to surface
 - iii. Run (UT, CBL, MFL, MAC) logs on casing from approximately 7270 ft. to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7088 ft. of 5-1/2" (20#, N80, EUE) of a new completion string, bottom hole assembly, and a 9-5/8" packer, thereby converting well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation Pressure Test	N/A
2	Noise and Temp Survey	03/14/2016 05/22/2017
3	Ultrasonic (UT)	04/05/2016
4	Cement Bond Log (CBL)	04/05/2016
5	Multi-Arm Caliper (MAC)	04/04/2016
6	Magnetic Flux Leakage (MFL)	04/04/2016
7	Block Pressure Test	04/06/2016
8	Annular and Tubing Pressure Test – Final	04/19/2016 06/07/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	06/10/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	03/18/2016	04/20/2016
Rig Work Phase 2	06/03/2016	06/08/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program

2. Rig Work
 - a. Phase 1 consisted of removing existing completion equipment, running inspection logs, pressure testing, and installing new completion
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7204 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Otis "BWD") Packer from 7200 ft.
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 7811 ft. Gyro survey was run from 7784 ft. to surface; CBL and UT were run from 7258 ft. to surface; MFL and MAC were run from 7257 ft. to surface. The block test was performed
 - iii. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7214 ft. of 3-1/2" (9.3#, L80, EUE) tubing with flow control components and 9-5/8" (WFT AS1-X) Packer set at 7205 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
 - b. Phase 2 involved resetting the packer
 - i. *Well Decompletion*: The wellhead was removed
 - ii. *Well Completion*: The packer was released from 7205 ft. and reset at 7082 ft. The installation integrity test was performed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

Tubing string was downsized to optimize well operation. The packer had to be reset due to annular pressures. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

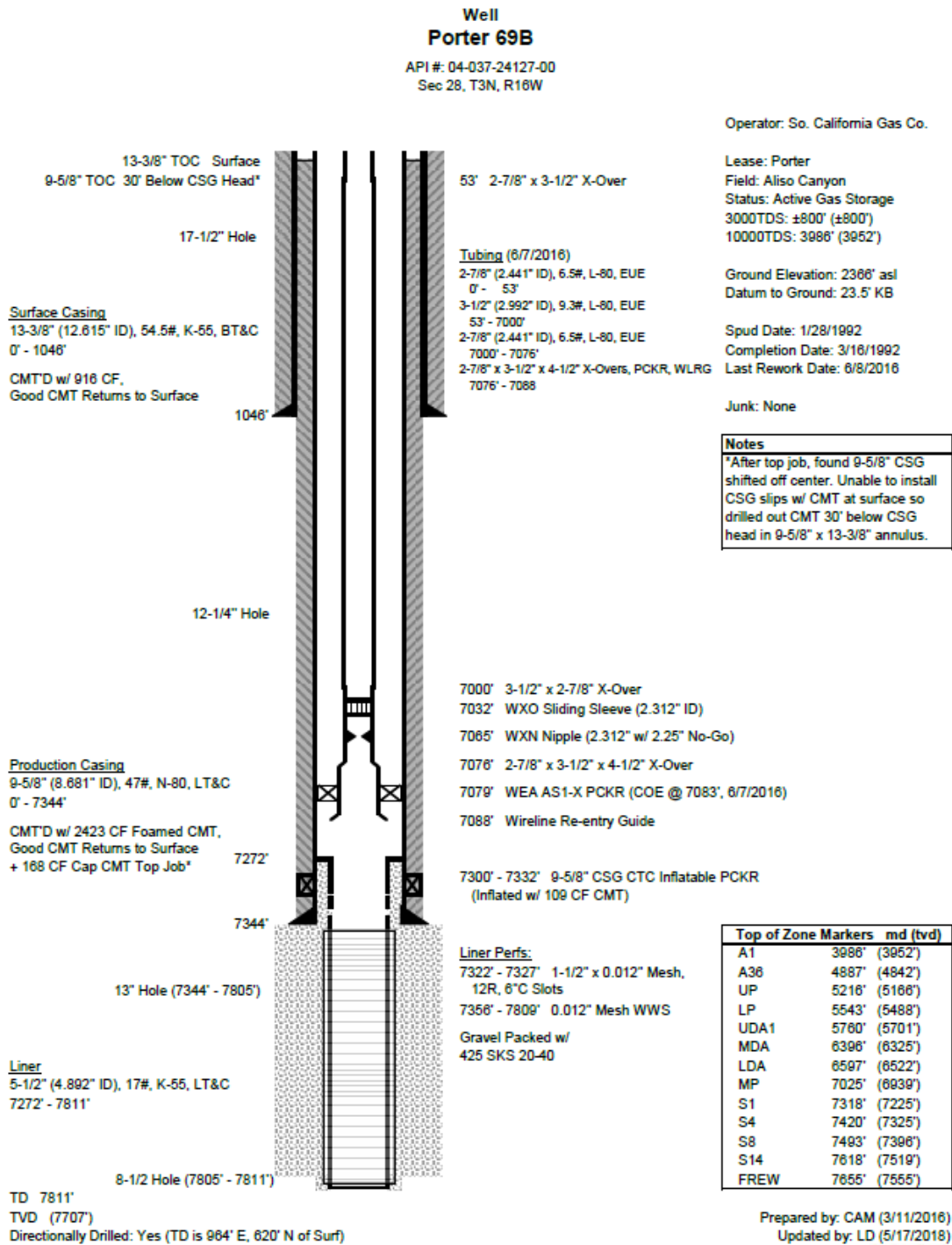
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$0	\$0	\$0
Contract Costs	\$27,000	\$1,820	\$28,820
Material	\$68,083	\$0	\$68,083
Other Direct Charges	\$1,020,467	\$73,587	\$1,094,054
Total Direct Cost	\$1,115,550	\$75,406	\$1,190,956

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$30,110	\$12,635	\$42,745
AFUDC	\$7,120	\$0	\$7,120
Property Taxes	\$2,413	\$0	\$2,413
Total Indirect Costs	\$39,643	\$12,635	\$52,278

Total Loaded Costs	\$1,155,193	\$88,041	\$1,243,235²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



Prepared by: CAM (3/11/2016)
Updated by: LD (5/17/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 69C	API	04-037-24128-00
Project Type	Recompletion		
Well Status	Active	NOP:	08/05/2016; 10/26/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	03/19/1992		
Initial Completion	04/25/1992		
Elevation	2366 ft.		
Caprock Depth	7339 ft.		
Measured Depth	7882 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171, SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 69C. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, convert well to tubing flow. The plan was to gather baseline assessment data on the casing. The following describes the well workover plan for Porter 69C used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7458 ft of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (HES G6) packer from 7455 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7881 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (MFL, MAC, UT, CBL) from top of liner to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7500 ft. of 3-1/2" (9.3#, L80, EUE) tubing of a new completion string, bottom hole assembly, and 9-5/8" Packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/15/2016 07/17/2017
3	Ultrasonic (UT)	07/15/2016
4	Cement Bond Log (CBL)	07/15/2016
5	Multi-Arm Caliper (MAC)	07/08/2016
6	Magnetic Flux Leakage (MFL)	07/09/2016
7	Block Test	07/11/2016
8	Annular and Tubing Pressure Test – Final	07/27/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	08/03/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	06/24/2016	07/27/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program

-
2. Rig Work included removing the existing completion, running inspection logs, pressure testing, and installing new completion
 - a. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7458 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (HES G-6) packer from 7455 ft.
 - b. *Well Assessment/Evaluation*: The well was cleaned out to 7881 ft. Gyro survey was run from 7873 ft. to surface. MAC was run from 7526 ft. to surface. MFL was run from 7520 ft. to surface. The block test was performed. UT and CBL were run from 7500 ft. to surface
 - c. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7293 ft. of 3-1/2" (L80, 9.3#, EUE) tubing with flow control components and a 9-5/8" (HES D&L AS1X) Packer set at 7400 ft. The final installation integrity test was completed. The wellhead was re-installed and tested
 3. Post Rig Work: The well was unloaded and turned over to operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required pumping packer fluid to a calculated depth

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

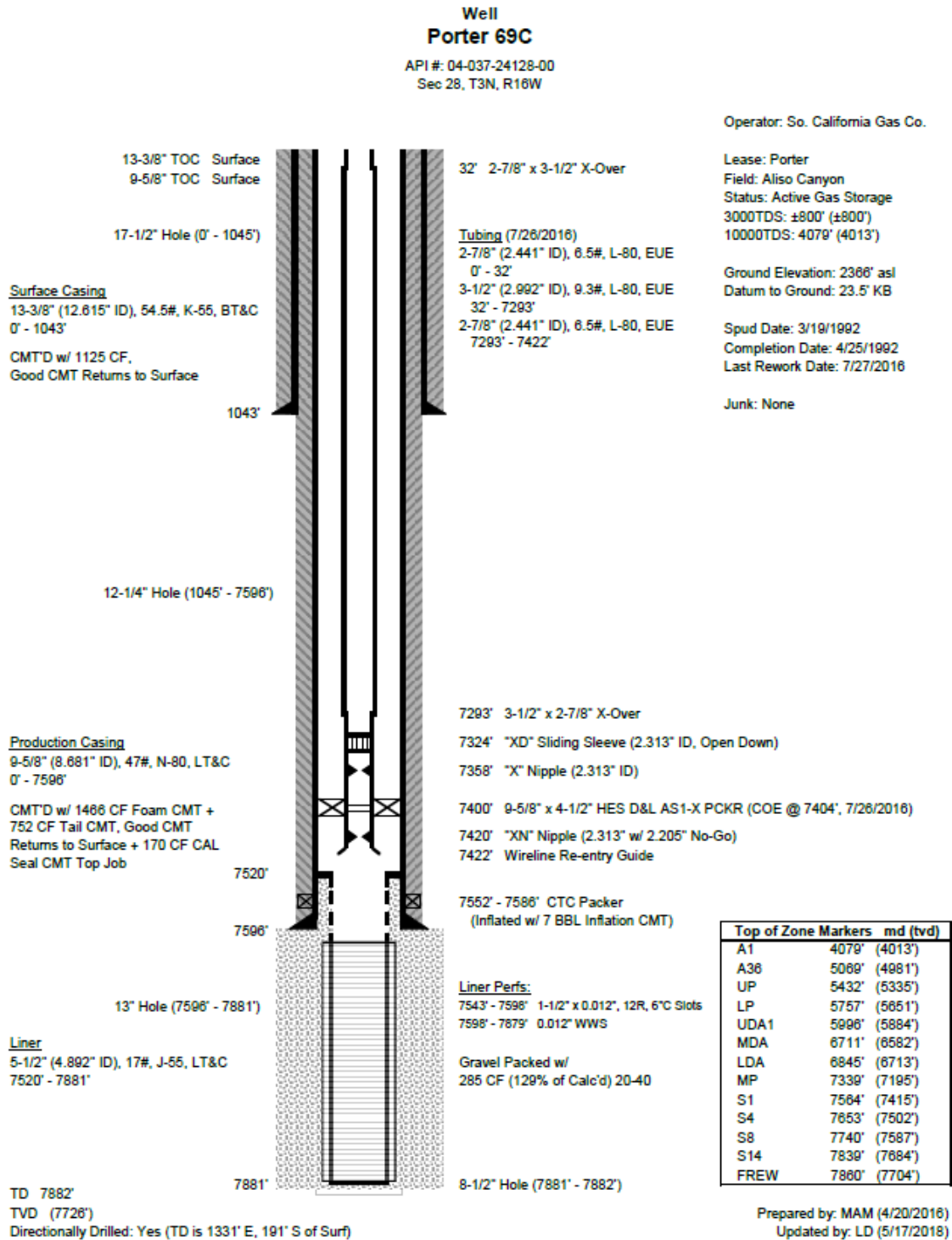
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$808	\$0	\$808
Contract Costs	\$43,393	\$5,153	\$48,546
Material	\$58,406	\$0	\$58,406
Other Direct Charges	\$588,701	\$50,911	\$639,612
Total Direct Cost	\$691,308	\$56,064	\$747,372

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$20,133	\$9,288	\$29,421
AFUDC	\$1,513	\$0	\$1,513
Property Taxes	\$407	\$0	\$407
Total Indirect Costs	\$22,054	\$9,288	\$31,341

Total Loaded Costs	\$713,361	\$65,352	\$778,713²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 69D	API	04-037-24130-00
Project Type	Recompletion		
Well Status	Active	NOP	07/01/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	04/28/1992		
Initial Completion	06/04/1992		
Ground Elevation	2366 ft.		
Caprock Depth	7505 ft.		
Measured Depth	8120 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 69D. This project planned to pull 2-7/8" completion string, run casing inspection logs, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing and other well components. The following describes the workover plan for well Porter 69D used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7647 ft of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Baker model "D") packer from 7642 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 8120 ft.
 - ii. Run inspection logs (MFL, MAC, UT, CBL) from 7701 ft to surface
 - iii. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7701 ft of 5-1/2" (20#, L80, TCPC) of a new completion string, bottom hole assembly and 9-5/8" Packer at 7695 ft, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/15/2016 03/20/2016 05/24/2017
3	Ultrasonic (UT)	05/24/2016
4	Cement Bond Log (CBL)	05/24/2016
5	Multi-Arm Caliper (MAC)	06/10/2016
6	Magnetic Flux Leakage (MFL)	05/21/2016
7	Block Test	05/20/2016
8	Annular and Tubing Pressure Test – Final	06/14/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	06/14/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	05/14/2016	06/22/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to move forward with the SIMP program

2. Rig work included removing existing production tubing, leaving the existing packer in place, running inspection logs, pressure testing, and installing a new completion
 - a. *Well Decompletion*: This step included the removal of wellhead components and production equipment consisting of 7647 ft of 2-7/8" (6.5#, N80, EUE) tubing string, flow control components, and 9-5/8" (Baker, Model D) seals from 7642 ft.
 - b. *Well Assessment/Evaluation*: The well was cleaned out to 8107 ft thru packer. The block test was performed. MAC log was run from 7641 ft to surface and MFL from 7628 ft to surface. UT and CBL logs were run from 7620 ft to surface
 - c. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7532 ft of 3-1/2" (9.3#, L80, EUE) tubing with flow control components and 9-5/8" Baker Model "D" seals. The final installation integrity test was completed
 - d. *Well Decompletion*: the 3-1/2" tubing string and 9-5/8" Baker seals were removed
 - e. *Well Re-assessment*: After reviewing the initial MAC results, the log was re-run from 7644 ft to surface
 - f. *Well Completion*: The new completion string and bottom hole assembly were re-installed consisting of 7532 ft of 3-1/2" (9.3#, L80, EUE) tubing with flow control components and 9-5/8" Baker Model "D" seals. The final installation integrity test was completed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

Existing packer could not be removed as planned, so new completion equipment was installed on it. The tubing string was downsized to optimize well operation. Per DOGGR's requirement, MAC log had to be re-run after completion string was installed and tested. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

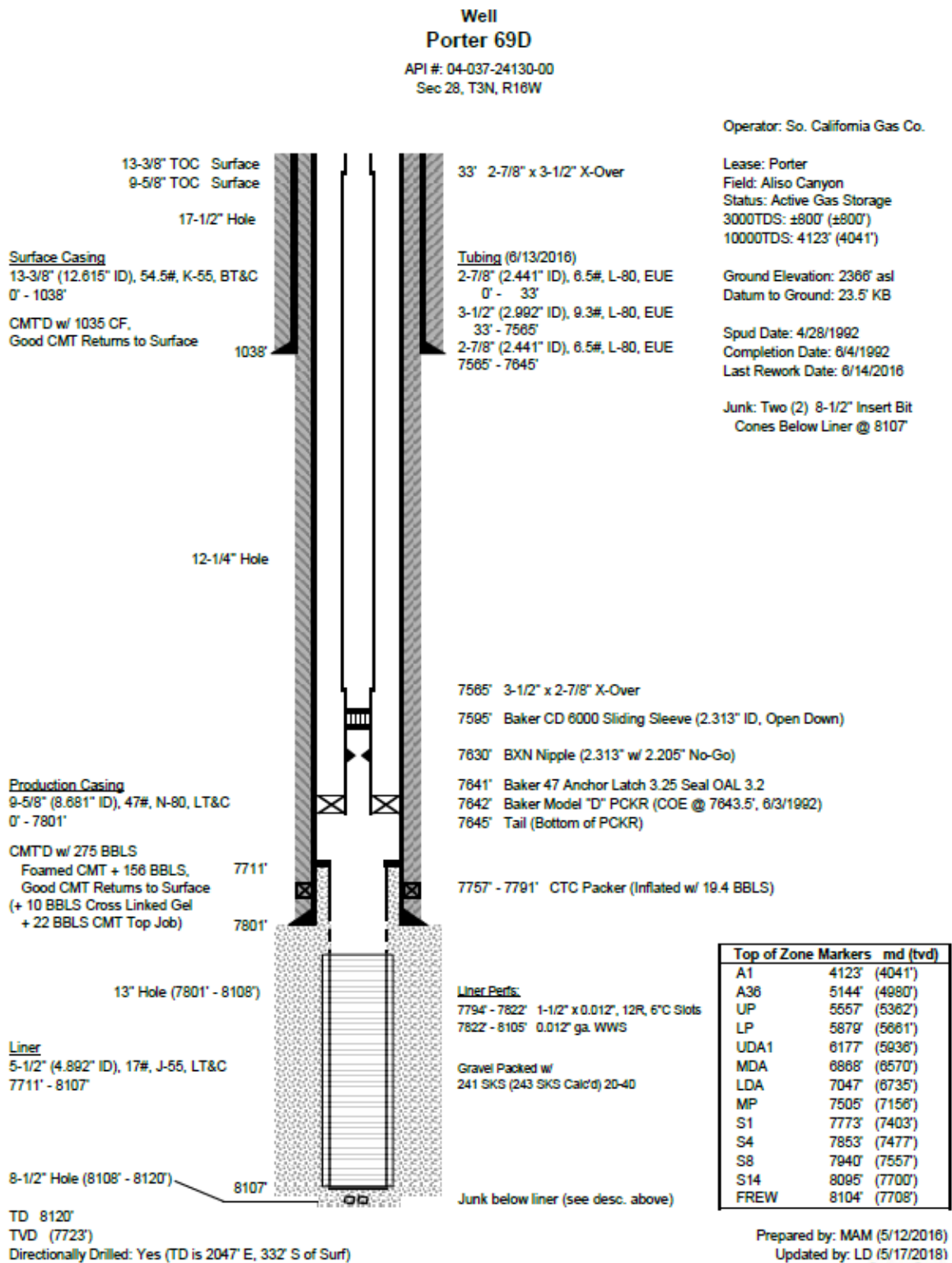
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$0	\$0	\$0
Contract Costs	\$23,292	\$0	\$23,292
Material	\$90,719	\$0	\$90,719
Other Direct Charges	\$565,647	\$43,671	\$609,317
Total Direct Cost	\$679,658	\$43,671	\$723,328

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$18,029	\$3,143	\$21,172
AFUDC	\$2,085	\$0	\$2,085
Property Taxes	\$0	\$0	\$0
Total Indirect Costs	\$20,114	\$3,143	\$23,257

Total Loaded Costs	\$699,772	\$46,814	\$746,585²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 69E	API	04-037-24138-00
Project Type	Recompletion		
Well Status	Active	NOP:	10/10/2016
Actual Cost	\$903,911		
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	06/23/1993		
Initial Completion	08/17/1993		
Elevation	2366 ft.		
Caprock Depth	6963 ft.		
Measured Depth	7848 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171, SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 69E. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for Porter 69E used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7159 ft of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (HES G6) packer from 7155 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7836 ft.
 - ii. Run inspection logs (MFL, MAC, UT, CBL) from top of liner to surface
 - iii. Run Gyro survey from total depth to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7170 ft. of 4-1/2" (12.6#, L80, TCPC) tubing of a new completion string, bottom hole assembly, and 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	08/04/2016
2	Noise and Temp Survey	03/16/2016 03/31/2016 10/02/2017
3	Ultrasonic	09/07/2016
4	Cement Bond Log	09/07/2016
5	Multi-Arm Caliper	09/01/2016
6	Magnetic Flux Leakage	08/31/2016
7	Pressure Integrity Test	09/02/2016
8	Annular and Tubing Pressure Test – Final	09/20/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	10/03/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	08/19/2016	09/26/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program

- b. The well was successfully isolated from the storage zone with a plug in the completion string and pressure tested to 1100 psi for 1 hour
2. Rig Work included removing existing completion, running inspection logs, pressure testing, and running new completion
 - a. *Well Decompletion:* This step included the planned removal of production equipment consisting of 7159 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (HES G-6) packer from 7155 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 7836 ft. The first inspection logs (MAC, MFL) were run from 7204 ft. to surface. Gyro survey was run from 7836 ft. to surface. The block test was performed. The second set of inspection logs (UT, CBL) were run from 7166 ft. to surface
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7163 ft. of 4-1/2" (12.6#, L80, TCPC) tubing with flow control components and a 9-5/8" (WFT AS1X) Packer set at 7140 ft. The final installation pressure test was completed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$4,214	\$0	\$4,214
Contract Costs	\$18,593	\$0	\$18,593
Material	\$304,638	\$0	\$304,638
Other Direct Charges	\$610,493	\$62,460	\$672,953
Total Direct Cost	\$937,938	\$62,460	\$1,000,399

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$27,822	\$501	\$28,323
AFUDC	\$188	\$0	\$188
Property Taxes	\$17	\$0	\$17
Total Indirect Costs	\$28,027	\$501	\$28,528

Total Loaded Costs	\$965,966	\$62,961	\$1,028,927²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Porter 69E**

API #: 04-037-24138-00
Sec 28, T3N, R16W

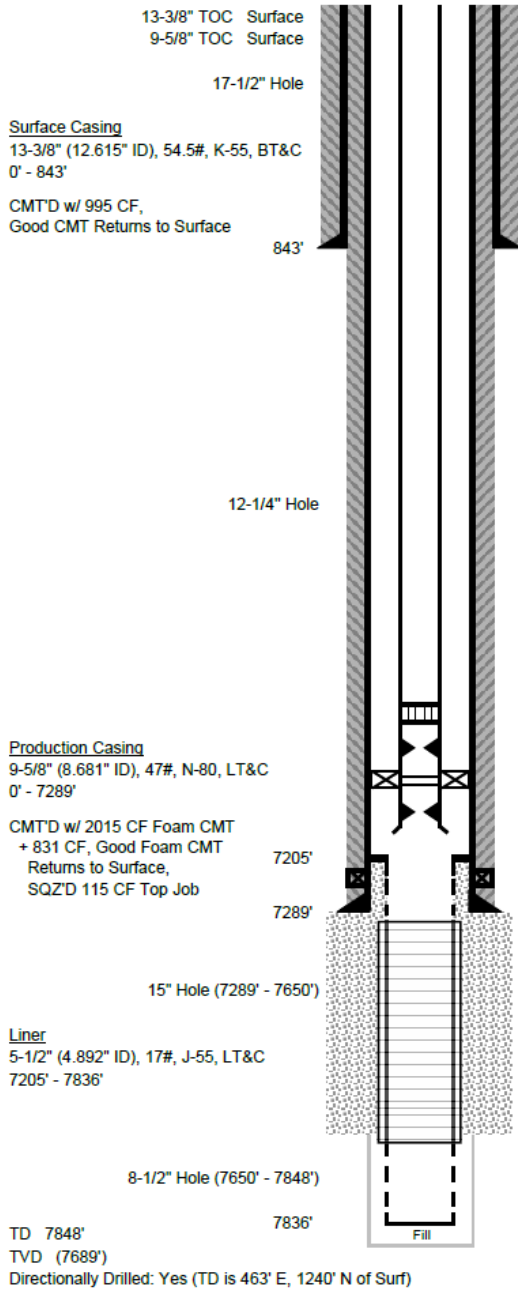
Operator: So. California Gas Co.

Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 4002' (3931')

Ground Elevation: 2366' asl
Datum to Ground: 23.5' KB

Spud Date: 6/23/1993
Completion Date: 8/17/1993
Last Rework Date: 9/21/2016

Junk: None



Tubing (9/19/2016)
4-1/2" (3.918" ID), 12.6#, L-80, TCPC
0' - 7163'

- 7058' SLXO Sliding Sleeve (3.813" ID)
- 7096' WX Nipple (3.813" ID)
- 7140' WEA AS1-X (7.5K) PCKR (COE @ 7144', 9/19/2016)
- 7160' WXN Nipple (3.813" w/ 3.725" No-Go)
- 7163' Wireline Re-entry Guide
- 7227' - 7243' 9-5/8" ECP (Inflated w/ 1.5 BBLs CMT)

Liner Perfs:
7220' - 7300' 0.012" Slots
7300' - 7666' 0.012" WWS
7684' - 7836' 0.030" Slots
Gravel Packed w/ 388 CF, 20-40,
Bottom 40 SKS Resin Coated

Top of Zone Markers md (tvd)	
A1	4002' (3931')
A36	4763' (4663')
UP	5205' (5092')
LP	5477' (5359')
UDA1	5639' (5518')
MDA	6240' (6106')
LDA	6498' (6360')
MP	6963' (6818')
S1	7298' (7147')
S4	7420' (7267')
S8	7488' (7334')
S14	7613' (7458')
FREW	7686' (7529')

Prepared by: MAM (3/23/2016)
Updated by: LD (5/17/2018)



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 69F	API	04-037-24226-00
Project Type	Recompletion		
Well Status	Active	NOP:	08/01/2016; 10/28/2017
Actual Cost	\$588,254		
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	10/07/2001		
Initial Completion	10/29/2001		
Ground Elevation	2366 ft.		
Caprock Depth	7268 ft.		
Measured Depth	7986 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 69F. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for Porter 69F used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7413 ft. of 2-7/8" (6.5#, N80, EUE) tubing, 441 ft. of 1-1/4" dip tube, bottom hole assembly, and 9-5/8" (HES G6) packer from 7385 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7878 ft.
 - ii. Run Gyro from top of liner to surface
 - iii. Run inspection logs (UT, CBL, MFL, MAC) from approximately 7471 ft to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7462 ft. of 3-1/2" (9.3#, L80, EUE) of a new completion string, bottom hole assembly, and 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/16/2016 08/11/2017
3	Ultrasonic (UT)	04/07/2016
4	Cement Bond Log (CBL)	04/07/2016
5	Multi-Arm Caliper (MAC)	04/06/2016
6	Magnetic Flux Leakage (MFL)	04/06/2016
7	Block Test	04/08/2016
8	Annular and Tubing Pressure Test – Final	04/22/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	06/30/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	03/28/2016	04/24/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward

2. Rig Work was included removing the existing completion, running inspection logs, pressure testing, and installing new completion
 - a. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7413 ft. of 2-7/8" (6.5#, N80, EUE) tubing from, bottom hole assembly, 9-5/8" (HES G-6) packer from 7385 ft., and 441 ft. of 1-1/4" dip tube
 - b. *Well Assessment/Evaluation*: The well was cleaned out to 7878 ft. Gyro survey was run from 7878 ft. to surface. Inspection logs (MFL, MAC) were run from 7455 ft. to surface; UT and CBL were run from 7451 ft. to surface. The block test was performed
 - c. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7329 ft. of 3-1/2" (9.3#, L80, EUE) tubing with flow control components, and 9-5/8" (HES G-6) Packer set at 7416 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$808	\$0	\$808
Contract Costs	\$19,563	\$4,250	\$23,813
Material	\$90,927	\$0	\$90,927
Other Direct Charges	\$497,330	\$80,931	\$578,261
Total Direct Cost	\$608,628	\$85,181	\$693,809

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$16,769	\$12,863	\$29,633
AFUDC	\$4,941	\$0	\$4,941
Property Taxes	\$1,201	\$0	\$1,201
Total Indirect Costs	\$22,910	\$12,863	\$35,774

Total Loaded Costs	\$631,538	\$98,045	\$729,583²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Porter 69F**

API #: 04-037-24226-00
Sec 28, T3N, R16W

Operator: So. California Gas Co.

Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 4000' (3992')

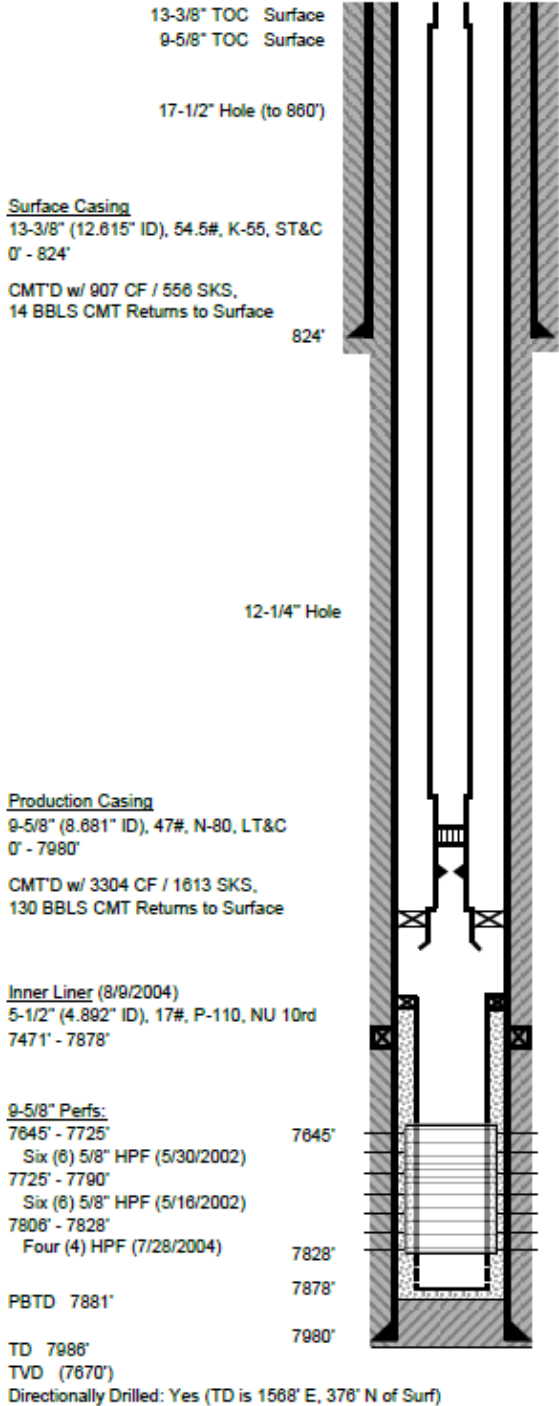
Ground Elevation: 2366' asl
Datum to Ground: 29' KB

Spud Date: 10/7/2001
Completion Date: 10/29/2001
Last Rework Date: 4/23/2016

Junk: None

Notes
*Armoured Screen Shroud is 7",
17#, w/ 1" Holes @ 88 HPF

Top of Zone Markers	md	(tvd)
A1	4000'	(3992')
A36	4977'	(4893')
UP	5306'	(5197')
LP	5606'	(5474')
UDA1	5948'	(5791')
MDA	6673'	(6461')
LDA	6820'	(6596')
MP	7268'	(7004')
S1	7550'	(7267')
S4	7645'	(7355')
S4	7667'	(7375')
S8	7724'	(7428')
S14	7821'	(7517')
FREW	7870'	(7562')



50' 2-7/8" x 3-1/2" X-Over
Tubing (4/22/2016)
2-7/8" (2.441" ID), 6.5#, L-80, EUE
0' - 50'
3-1/2" (2.992" ID), 9.3#, L-80, EUE
50' - 7329'
2-7/8" (2.441" ID), 6.5#, L-80, EUE
7329' - 7415'
4-1/2" X-Over, PCKR & WLRG
7415' - 7422'

7329' 3-1/2" x 2-7/8" X-Over
7359' "XD" Sliding Sleeve (2.312" ID)
7403' "XN" Nipple (2.313" w/ 2.205" No-Go)
7415' 2-7/8" x 4-1/2" X-Over
7416' HES G-6 PCKR (COE @ 7418', 4/22/2016)
7422' 4-1/2" Wireline Re-entry Guide

7471' Baker F-1 PCKR (10/21/2004)
7498' - 7518' 9-5/8" ECP

Inner Liner Perfs:
7639' - 7839' 0.012" Ga. Armoured Screen*
7839' - 7877' 0.012" Ga. Semi Slots
Frac Packed w/ 7725' - 7790' w/ 287 BBL / 63,300 LB 20/40
Ottawa Sand (7/20/2004)

Prepared by: CAM (3/28/2016)
Updated by: LD (5/17/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 69G	API	04-037-24225-00
Project Type	Recompletion		
Well Status	Active	NOP	10/10/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	10/29/2001		
Initial Completion	05/18/2002		
Ground Elevation	2366 ft.		
Caprock Depth	7074 ft.		
Measured Depth	8500 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 69G. This project planned to pull 2-7/8" completion string, run casing inspection logs, pressure test casing and well laterals, and install a new completion string. The plan was to gather baseline assessment data on casing and other well components. The following describes the well workover plan for well Porter 69G used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

-
- ii. Pull existing 7402 ft of 2-7/8" (6.5#, N80, EUE) tubing and disconnect on/off tool at 7402 ft from bottom hole assembly.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to top of on/off tool at 7390 ft.
 - ii. Perform pressure integrity test to 1.15 MAOP
 - iii. Run inspection logs (CBL, UT, MAC, MFL) from approximately 7390 ft to surface
 - c. Well Completion
 - i. Install approximately 7402 ft of 2-7/8" (6.5#, L80, EUE) new tubing and connect on/off onto bottom hole assembly
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
 3. Post Rig Work
 - a. Unload well and turn over to operations
 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	08/18/2016
2	Noise and Temp Survey	03/14/2016 08/01/2017
3	Ultrasonic (UT)	08/08/2017
4	Cement Bond Log (CBL)	08/08/2016
5	Multi-Arm Caliper (MAC)	08/04/2016
6	Magnetic Flux Leakage (MFL)	08/03/2016
7	Block Test	08/05/2016
8	Annular and Tubing Pressure Test – Final	08/18/2016 10/04/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	08/31/2016
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work Phase 1	07/28/2016	08/18/2016
Rig Work Phase 2	09/28/2016	10/05/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature survey were completed, reviewed and approved by DOGGR safety Review Team, which determined that it was safe to move forward with the SIMP program
2. SIMP rig work was completed in two phases

- a. Phase 1 included the removing the existing production string, performing well inspections, pressure testing, and installing a new completion
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and most of production equipment consisting of 7388 ft. of 2-7/8" (6.5#, N80, EUE) tubing and flow control components from upper completion equipment. However, the on/off could not be disconnected from bottom hole assembly
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 7406 ft. MAC and MFL were run from 7365 ft to surface. Block test was performed. CBL and UT were run from 7338 ft to surface
 - iii. *Well Completion*: A new completion string and bottom hole assembly were installed on top of existing lower completion. The new equipment consisted of 7388 ft of 2-7/8" (6.5#, L80, EUE) tubing with flow control components and a 9-5/8" (HES AS1-X) Packer set at 7346 ft. The final integrity test was performed. The wellhead was re-installed and tested
- b. Rig Work Phase 2 included resetting the completion string
 - i. *Well Decompletion*: The wellhead was removed
 - ii. *Well Completion*: The tubing string was reset in the packer under additional compression. The final installation integrity test was performed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

The existing completion string could not be completely removed as planned. New downhole completion equipment was run on top of lower completion. Additionally, after initial rig work, the well experienced pressure build-up and resetting of the completion tubing was required. The tubing, flow components, and wellhead were enhanced for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

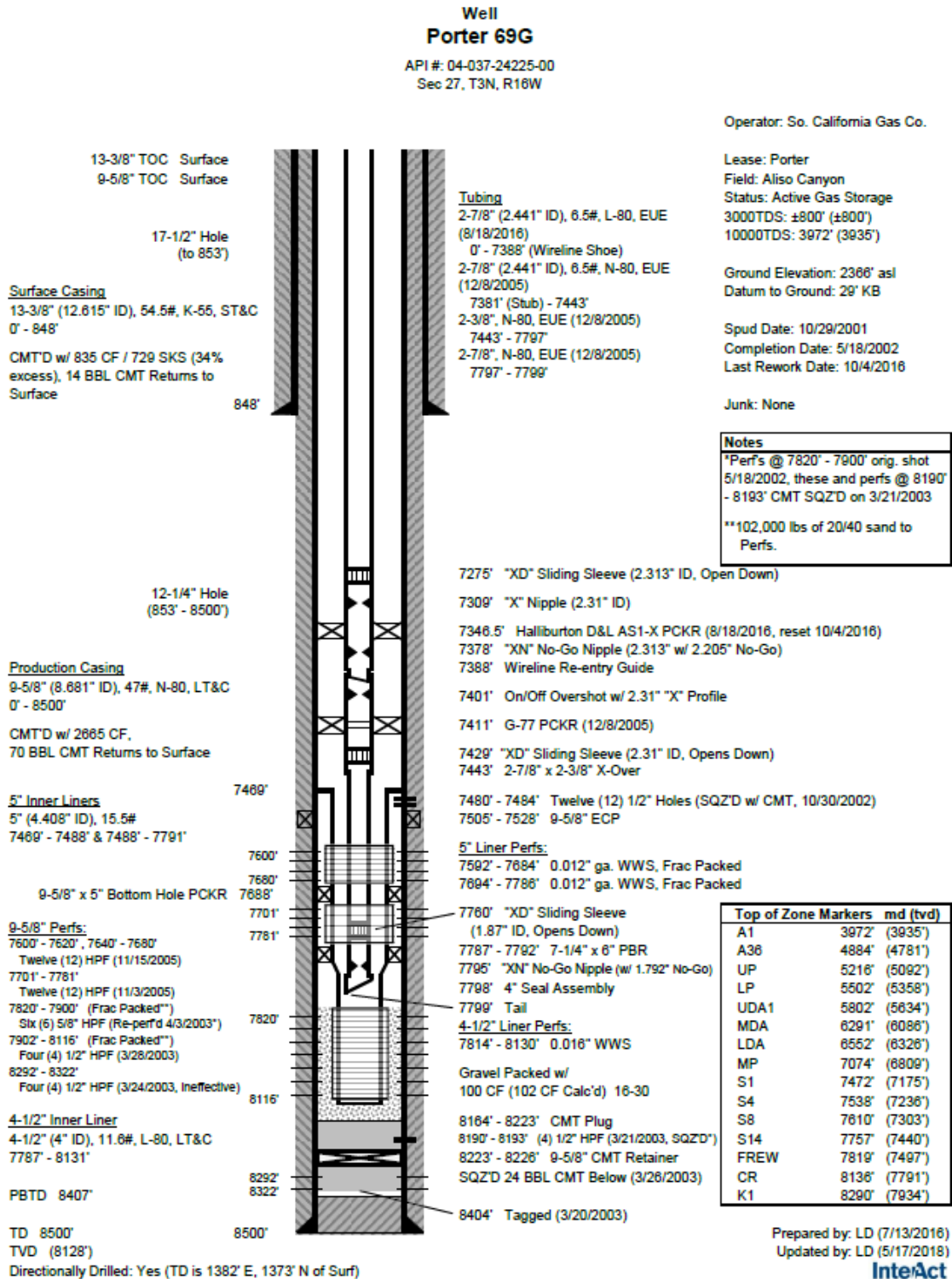
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$2,646	\$0	\$2,646
Contract Costs	\$72,171	\$4,279	\$76,450
Material	\$101,412	\$0	\$101,412
Other Direct Charges	\$761,749	\$58,985	\$820,733
Total Direct Cost	\$937,978	\$63,263	\$1,001,241

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$29,067	\$6,103	\$35,170
AFUDC	\$2,714	\$0	\$2,714
Property Taxes	\$412	\$0	\$412
Total Indirect Costs	\$32,193	\$6,103	\$38,296

Total Loaded Costs	\$970,170	\$69,366	\$1,039,537²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 69H	API	04-037-24223-00
Project Type	Recompletion		
Well Status	Active	NOP	08/01/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/23/2001		
Initial Completion	12/11/2001		
Ground Elevation	2366 ft.		
Caprock Depth	7189 ft.		
Measured Depth	7980 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 69H. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for well Porter 69H used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7430 ft of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Baker G6) packer from 7402 ft., and 313 ft of 1.66" dip tube
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7772 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Perform pressure integrity test to 1.15 MAOP
 - iv. Run inspection logs (MFL, MAC, UT, CBL) from liner top to surface
 - c. Well Completion
 - i. Install approximately 7433 ft. of 3-1/2" (9.3#, L80, EUE) tubing of a new completion string, bottom hole assembly, and 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/17/2016 06/21/2017
3	Ultrasonic (UT)	06/11/2016
4	Cement Bond Log (CBL)	06/11/2016
5	Multi-Arm Caliper (MAC)	06/13/2016
6	Magnetic Flux Leakage (MFL)	06/17/2016
7	Block Test	06/09/2016
8	Annular and Tubing Pressure Test – Final	06/22/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	07/05/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	06/02/2016	06/23/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program

2. Rig Work included removing the existing completion equipment, performing inspection logs, pressure testing and installing new completion
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 7430 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, 9-5/8" (Baker G-6) packer from 7402 ft, and 313 ft. of 1.66" dip tube
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 7772 ft. Gyro survey was run from 7750 ft. to surface. Block test was performed. Inspection logs (CBL, UT, MAC) were run from 7447 ft. to surface. MFL was run from 7380 ft. to surface.
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7304 ft. of 3-1/2" (9.3#, L80, EUE) tubing with flow control components, and a 9-5/8" (HES G6) Packer at 7411 ft. The final installation pressure test was completed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$269	\$0	\$269
Contract Costs	\$10,603	\$0	\$10,603
Material	\$72,635	\$0	\$72,635
Other Direct Charges	\$428,887	\$57,408	\$486,294
Total Direct Cost	\$512,394	\$57,408	\$569,801

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$14,852	\$5,211	\$20,063
AFUDC	\$2,588	\$0	\$2,588
Property Taxes	\$294	\$0	\$294
Total Indirect Costs	\$17,734	\$5,211	\$22,944

Total Loaded Costs	\$530,128	\$62,618	\$592,746²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

Storage Integrity Management Program Aliso Canyon – Porter 69H

IV. Wellbore Diagram after SIMP Work

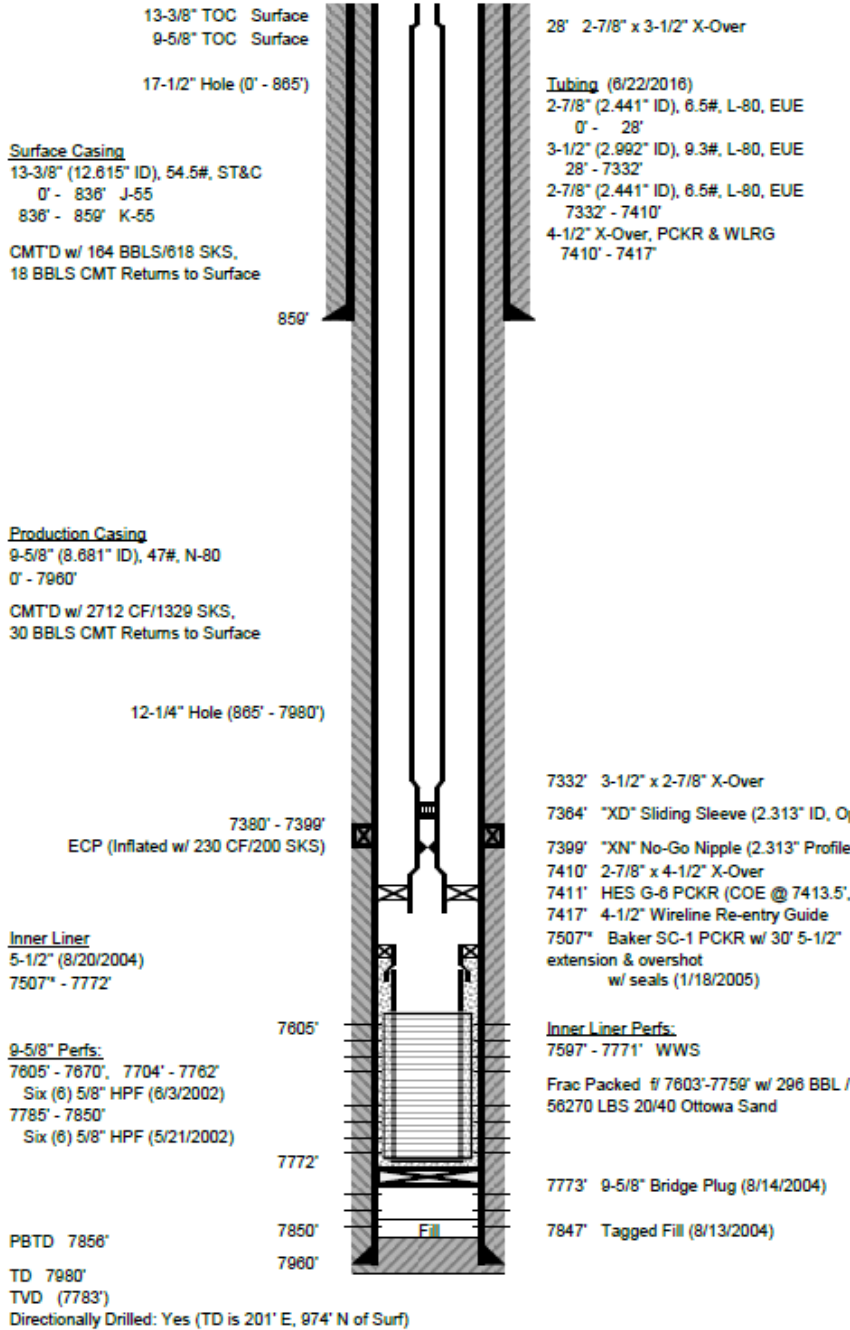
**Well
Porter 69H**
API #: 04-037-24223-00
Sec 27, T3N, R16W

Operator: So. California Gas Co.

Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 3983' (3982')
Ground Elevation: 2366' asl
Datum to Ground: 29' KB
Spud Date: 11/23/2001
Completion Date: 12/11/2001
Last Rework Date: 6/22/2016

Junk: None

Notes
*Top of 5-1/2" liner/SC-1 PCKR could be as high as 7464', drilling report referenced multiple tags that were unclear



Top of Zone Markers md (tvd)		
A1	3983'	(3983')
A36	4855'	(4854')
UP	5163'	(5161')
LP	5492'	(5486')
UDA1	5916'	(5886')
MDA	6567'	(6481')
LDA	6715'	(6617')
MP	7189'	(7052')
S1	7432'	(7276')
S4	7530'	(7366')
S8	7605'	(7435')
S14	7730'	(7551')
FREW	7805'	(7620')

Prepared by: CAM (4/15/2016)
Updated by: LD (5/17/2018)

InteAct

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 69J	API	04-037-24224-01
Project Type	Recompletion		
Well Status	Active	NOP:	08/01/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	12/12/2001; Redrill 01/25/2004 (Sidetrack)		
Initial Completion	05/23/2002; Redrill Completion 02/11/2004		
Elevation	2366 ft.		
Caprock Depth	7440 ft.		
Measured Depth	8035 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate identified conditions as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys, inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 69J. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing and other well components. The following describes the well workover plan for well Porter 69J used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for wellhead replacement

- ii. Pull existing completion consisting of 7552 ft of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 5" seals at 7552 ft from 5" SC-1 liner top packer
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 8019 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL, MAC) from approximately 7542 ft to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7542 ft of 5-1/2" (20#, N80, EUE) of a new completion string and bottom hole assembly, thereby converting well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	04/29/2016
2	Noise and Temp Survey	03/19/2016 03/16/2016 04/18/2016 04/23/2016 10/31/2016 11/02/2016 11/06/2017
3	Ultrasonic (UT)	03/31/2016
4	Cement Bond Log (CBL)	03/31/2016
5	Multi-Arm Caliper (MAC)	03/30/2016 04/02/2016
6	Magnetic Flux Leakage (MFL)	03/31/2016
7	Block Test	04/05/2016
8	Annular and Tubing Pressure Test – Final	04/29/2016 11/11/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	11/14/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	03/18/2016	04/29/2016
Rig Work Phase 2	11/03/2016	11/14/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program
2. Rig Work
 - a. Phase 1 included removing existing completion, performing inspection logs, pressure testing, performing a tracer survey, pressure testing the liner top and running a new completion
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7562 ft of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 5" seals at 7552 ft from SC-1 liner top packer
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 8019 ft. Gyro survey was run from 7990 ft to surface. MAC was run 7521 ft to surface, MFL was run 7503 ft to surface; UT and CBL were run 7518 ft to surface. The block test was performed. MAC was rerun from 7521 ft to surface and liner top pressure tested
 - iii. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7373 ft of 3-1/2" (9.3#, L80, EUE) and 162 ft of 2-7/8" (6.5#, L80, EUE) tubing with flow control components, and 9-5/8" (Baker AS1-X) Packer at 7531 ft. The final installation integrity test was performed on tubing and annulus. The wellhead was re-installed and tested
 - iv. *Post Rig Work*: The well was unloaded, and based on initial injection/withdrawal tests, a wellbore clean out was necessary with a Coil Tubing unit through existing completion
 - b. Phase 2: Included decompletion and running a new completion
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7373 ft of 3-1/2" (9.3#, L80, EUE) and 162 ft of 2-7/8" (6.5#, L80, EUE) tubing with flow control components, and 9-5/8" (Baker AS1-X) Packer at 7531 ft.
 - ii. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7418 ft of 3-1/2" (9.3#, L80, EUE) with flow control components, and 9-5/8" (WEA AS1-X) Packer at 7396 ft. The final installation integrity test was performed on tubing and annulus. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

Additional integrity tests were performed as requested by DOGGR. A supplemental wellbore clean out was necessary to optimize well operation. Replacement of completion equipment was necessary to maintain equipment integrity, after the coil tubing clean out. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$1,521	\$0	\$1,521
Contract Costs	\$94,414	\$433	\$94,847
Material	\$114,233	\$0	\$114,233
Other Direct Charges	\$1,160,180	\$78,544	\$1,238,724
Total Direct Cost	\$1,370,348	\$78,977	\$1,449,325

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$39,469	\$16,126	\$55,595
AFUDC	\$9,506	\$0	\$9,506
Property Taxes	\$1,977	\$0	\$1,977
Total Indirect Costs	\$50,952	\$16,126	\$67,078

Total Loaded Costs	\$1,421,300	\$95,103	\$1,516,403²
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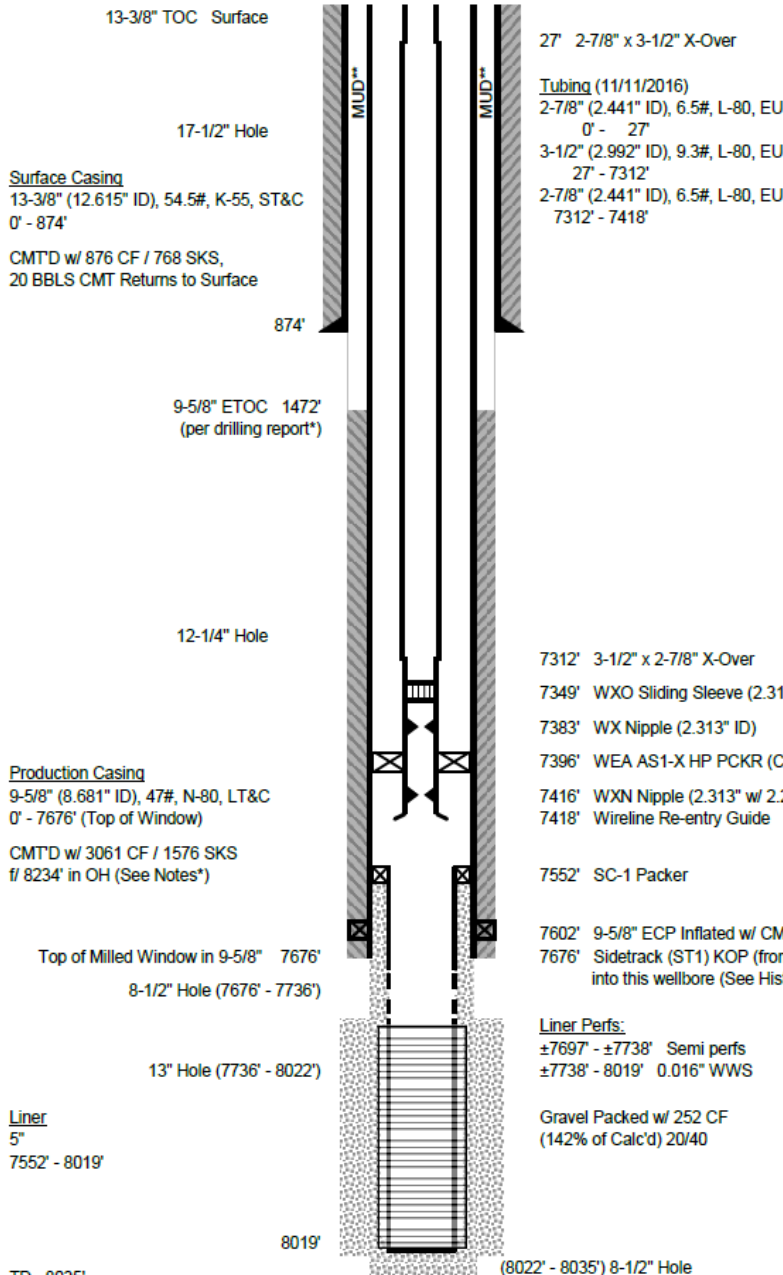
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Porter 69J ST1

API #: 04-037-24224-01
Sec 28, T3N, R16W

Operator: So. California Gas Co.



Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: ±3998' (±3998')
Ground Elevation: 2366' asl
Datum to Ground: 29' KB

Spud Date: 12/12/2001
Sidetrack (ST1) Kick-off Date:
1/25/2004
Completion Date: 2/11/2004
Last Rework Date: 11/12/2016

Junk: None

Wellbore History	
Orig. Hole (OH) TD @	8254'
(See Porter 69J)	
ST1 KOP @	7676'
TD @	8035'

Notes	
*Lost returns to surface w/ 506 BBL of displacement. Estimated leak off pressure of 236 psi @ shoe.	
**Filled 13-3/8" x 9-5/8" annulus w/ 30 BBL 9.4 ppg mud, 12/31/2001	

Top of Zone Markers md (tvd)		
A1	±3998'	(±3998')
A36	±4866'	(±4865')
UP	±5165'	(±5164')
LP	±5536'	(±5535')
UDA1	±5922'	(±5917')
MDA	±6718'	(±6671')
LDA	±6872'	(±6814')
MP	7440'	(7343')
S1	7647'	(7536')
S4	±7742'	(±7623')
S8	±7830'	(±7704')
S14	±7952'	(±7818')
FREW	±8033'	(±7895')

TD 8035'
TVD (Unknown, directional survey not run below ST1 Kick-off point)
Directionally Drilled: Yes (7615' MD is 522' W, 378' N or Surf, 7503' TVD)

Prepared by: MAM (3/15/2016)
Updated by: LD (5/17/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 69K	API	04-037-24236-00
Total Project Type	Recompletion		
Well Status	Active	NOP:	08/01/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	01/03/2002		
Initial Completion	05/25/2002		
Ground Elevation	2796 ft.		
Caprock Depth	7890 ft.		
Measured Depth	9339 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 69K. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing pipe and other well components. The following describes the well workover plan for well Porter 69K used to acquire the necessary DOGGR NOI:

1. Initial Well Assessment
 - a. Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement if necessary

- ii. Pull existing completion consisting of 7716 ft of 2-7/8" (6.5#, N80, EUE) and 356 ft of 2-7/8" (6.5#, N80, TSH511) tubing, bottom hole assembly, and 4-1/2" seals at 8072 ft from liner top packer
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 8274 ft.
 - ii. Run Gyro survey from 8274 ft to surface
 - iii. Run inspection logs (UT, CBL, MFL, MAC) from 7716 ft to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7622 ft of 4-1/2" (12.6#, L80, TCPC) of a new completion string, bottom hole assembly, and 9-5/8" Packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead.
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/09/2016 03/17/2016 03/20/2016 06/21/2017
3	Ultrasonic (UT)	05/22/2016
4	Cement Bond Log (CBL)	05/22/2016
5	Multi-Arm Caliper (MAC)	05/24/2016
6	Magnetic Flux Leakage (MFL)	05/24/2016
7	Block Test	05/18/2016
8	Annular and Tubing Pressure Test – Final	07/07/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	07/08/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	04/29/2016	07/07/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program
2. Rig Work included removing existing completion equipment, running inspection logs, pressure testing, and running new completion
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and most of production equipment consisting of 7890 ft of 2-7/8" (6.5#, N80, EUE & TSH511) tubing and bottom hole components. The 4-1/2" seal assembly could not be removed as planned
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 8048 ft. A block test was performed. The Gyro survey was run from 7961 ft to surface. Inspection logs (UT, CBL) were run from 7705 ft to surface; MFL and MAC were run from 7703 ft to surface
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7519 ft. of 3-1/2" (9.3#, L80, EUE) tubing with flow control components, and 9-5/8" (HES AS1-X HT) packer set at 7622 ft. The final installation integrity test was performed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

Seal assembly at 8072 ft could not be removed. Completion tubing was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

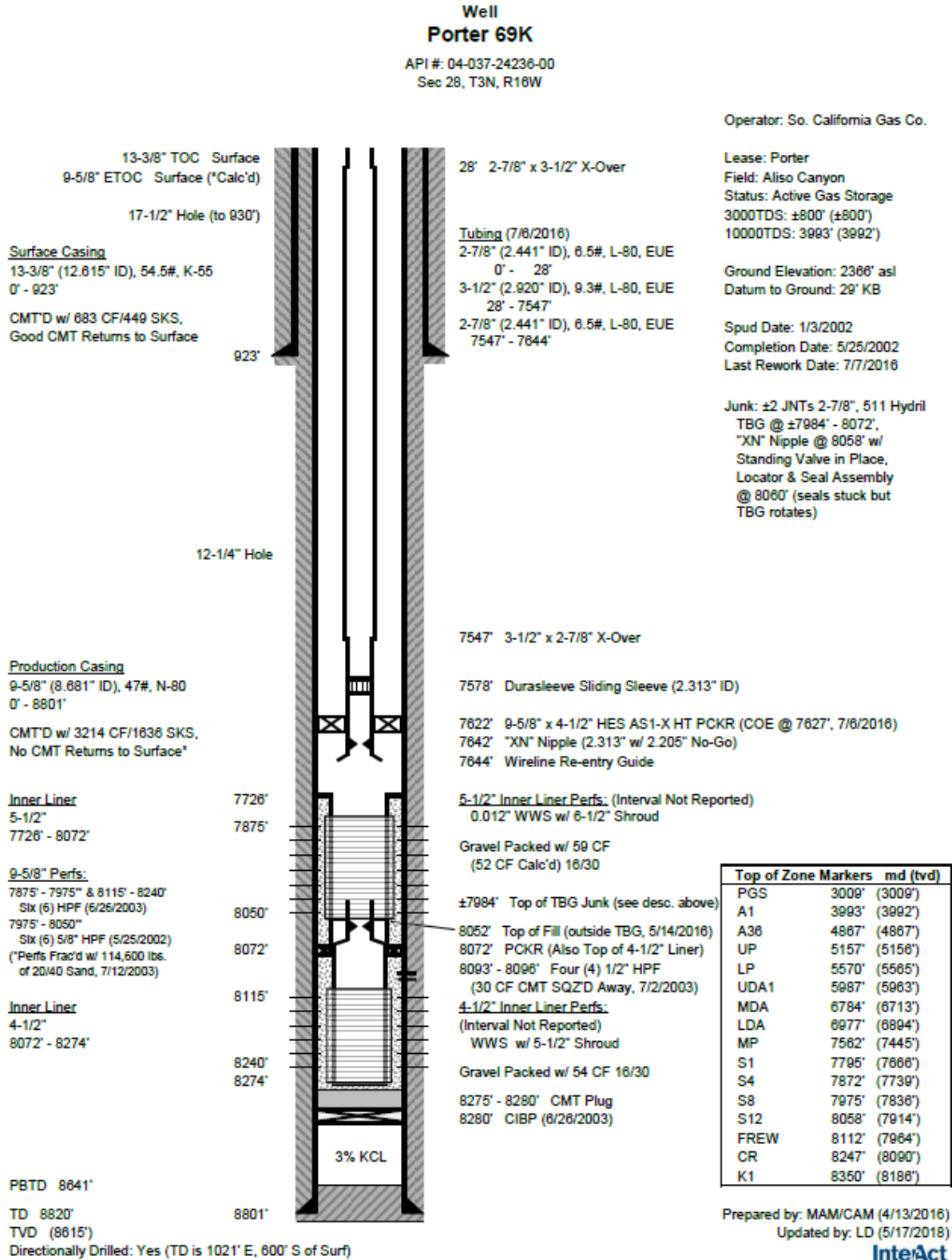
Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$1,010	\$0	\$1,010
Contract Costs	\$13,704	\$10,147	\$23,851
Material	\$45,027	\$0	\$45,027
Other Direct Charges	\$830,943	\$58,566	\$889,509
Total Direct Cost	\$890,684	\$68,713	\$959,397

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$23,606	\$11,662	\$35,268
AFUDC	\$7,341	\$0	\$7,341
Property Taxes	\$1,591	\$0	\$1,591
Total Indirect Costs	\$32,538	\$11,662	\$44,200

Total Loaded Costs	\$923,222	\$80,375	\$1,003,597²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 72A	API	04-037-24145-00
Project Type	Recompletion		
Well Status	Active	NOP:	09/25/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	09/20/1993		
Initial Completion	12/13/1993		
Ground Elevation	1909 ft.		
Caprock Depth	6588 ft.		
Measured Depth	7170 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate identified conditions as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 72A. This project planned to pull 3-1/2" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing and other well components. The following describes the well workover plan for well Porter 72A used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 6770 ft of 3-1/2" (9.3#, J55&N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Otis "BWD") packer from 6766 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth 7170 ft.
 - ii. Run Gyro from total depth to surface
 - iii. Run inspection logs (MFL, MAC, UT, CBL) from liner top to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 6770 ft. of 5-1/2" (20#, L80, TCPC) tubing of a new completion string, bottom hole assembly, and 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
 3. Post Rig Work
 - a. Unload well and turn over to operations
 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	06/08/2016
2	Noise and Temp Survey	03/11/2016 07/21/2017
3	Ultrasonic (UT)	05/18/2016
4	Cement Bond Log (CBL)	05/18/2016
5	Multi-Arm Caliper (MAC)	05/19/2016
6	Magnetic Flux Leakage (MFL)	05/19/2016
7	Block Test	05/14/2016
8	Annular and Tubing Pressure Test – Final	08/29/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	08/30/2016
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work Phase 1	05/02/2016	06/10/2016
Rig Work Phase 2	08/07/2016	08/30/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program
2. Rig Work was performed in two phases
 - a. Phase 1 included removing existing completion, running inspection logs, pressure testing, and isolating the well
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 6770 ft. of 3-1/2" (9.3#, J55&N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Otis "BWD") packer from 6766 ft.
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 7170 ft. Gyro run from 7170 ft. to surface. The block test was performed. Inspection logs (MFL, MAC, UT, CBL) were run from 6800 ft. to surface
 - iii. *Well Isolation*: The well was isolated from the storage zone. The well head re-installed and tested
 - b. Phase 2 included running a new completion
 - i. *Well Decompletion*: The wellhead components and isolation equipment were removed
 - ii. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 6541 ft. of 5-1/2" (20#, L80, TCPC) tubing with flow control components, and a 9-5/8" (WFT AS1X HP) Packer set at 6691 ft. The final installation pressure test was performed. The wellhead was re-installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

Porter 72A was completed in two phases due to material availability. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$1,587	\$0	\$1,587
Contract Costs	\$16,317	\$1,780	\$18,097
Material	\$141,247	\$0	\$141,247
Other Direct Charges	\$1,220,923	\$66,529	\$1,287,452
Total Direct Cost	\$1,380,074	\$68,309	\$1,448,383

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$36,561	\$9,974	\$46,535
AFUDC	\$13,105	\$0	\$13,105
Property Taxes	\$2,659	\$0	\$2,659
Total Indirect Costs	\$52,325	\$9,974	\$62,299

Total Loaded Costs	\$1,432,399	\$78,283	\$1,510,682²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

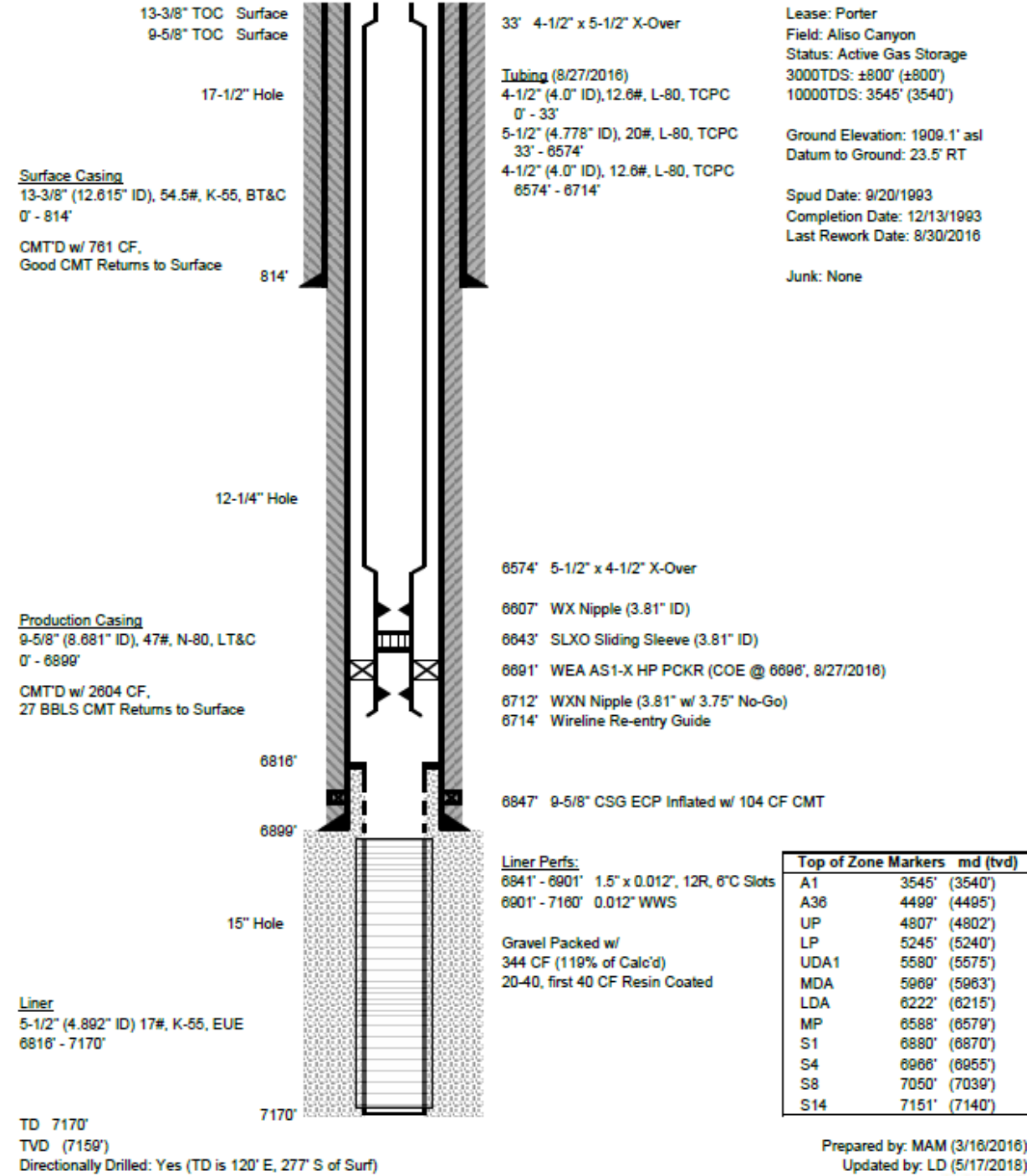
Storage Integrity Management Program Aliso Canyon – Porter 72A

IV. Wellbore Diagram after SIMP Work

Well Porter 72A

API #: 04-037-24145-00
Sec 27, T3N, R18W

Operator: So. California Gas Co.



Prepared by: MAM (3/16/2016)
Updated by: LD (5/17/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Porter 72B	API	04-037-24146-00
Project Type	Recompletion		
Well Status	Active	NOP:	08/17/2016
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	09/01/1993		
Initial Completion	11/27/1993		
Elevation	1909 ft.		
Caprock Depth	6515 ft.		
Measured Depth	7225 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171, SB380		

C. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Porter 72B. This project planned to pull 3-1/2" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing and other well components. The following describes the well workover plan for Porter 72B used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 6649 ft of 3-1/2" (9.3#, N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Otis "BWD") packer from 6646 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7168 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (MFL, MAC, UT, CBL) from liner top to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 6691 ft. of 4-1/2" (12.6#, L80, TCPC) tubing of a new completion string, bottom hole assembly, and 9-5/8" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/08/2016 03/21/2016 07/21/2017
3	Ultrasonic (UT)	06/28/2016
4	Cement Bond Log (CBL)	06/28/2016
5	Multi-Arm Caliper (MAC)	06/29/2016
6	Magnetic Flux Leakage (MFL)	06/30/2016
7	Block Test	06/24/2016
8	Annular and Tubing Pressure Test – Final	08/04/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	08/08/2016
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	06/10/2016	08/05/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to move forward with the SIMP program
2. Rig Work included removal of existing completion equipment, running inspection logs, pressure test casing, running new completion, and re-running a new completion
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 6649 ft. of 3-1/2" (9.3#, J55&N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Otis "BWD") packer from 6646 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 7162 ft. Gyro survey was run from 7162 ft. to surface. The block test was performed. Inspection logs (CBL, UT, MAC, MFL) were run from 6693 ft. to surface
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 6653 ft. of 5-1/2" (20#, L80, TCPC) tubing with flow control components and a 9-5/8" (WFT AS1X HP) Packer set at 6686 ft. The installation integrity test failed, and equipment was pulled
 - d. *Well Recompletion:* A new completion string and bottom hole assembly was installed consisting of 6495 ft. of 5-1/2" (20#, L80, TCPC) tubing with flow control components, and a 9-5/8" (WFT AS1X HP) Packer set at 6616 ft. The final installation integrity test was performed
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - b. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

Porter 72B required a second completion after final integrity test failure as a result of a damaged connection on one of the components. The tubing was upsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$2,725	\$0	\$2,725
Contract Costs	\$18,670	\$0	\$18,670
Material	\$96,409	\$0	\$96,409
Other Direct Charges	\$1,200,797	\$51,729	\$1,252,526
Total Direct Cost	\$1,318,601	\$51,729	\$1,370,330

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$37,451	\$8,900	\$46,351
AFUDC	\$2,614	\$0	\$2,614
Property Taxes	\$640	\$0	\$640
Total Indirect Costs	\$40,705	\$8,900	\$49,605

Total Loaded Costs	\$1,359,306	\$60,629	\$1,419,935²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Porter 72B**

API #: 04-037-24146-00
Sec 27, T3N, R16W

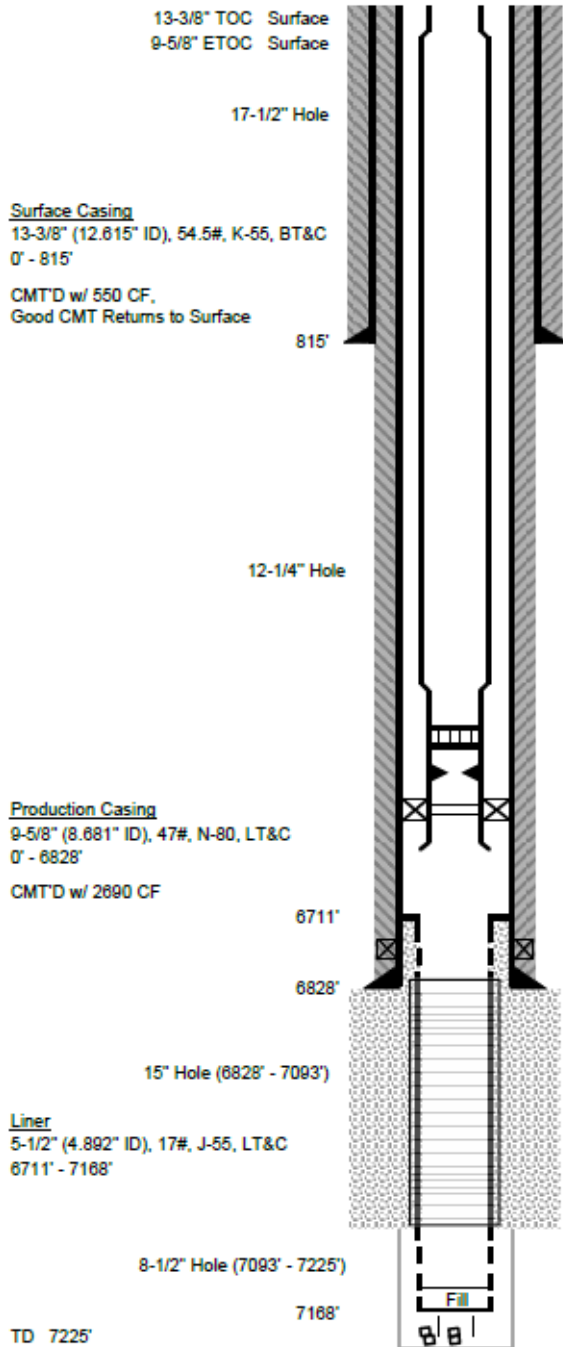
Operator: So. California Gas Co.

Lease: Porter
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 3594' (3592')

Ground Elevation: 1909.1' asl
Datum to Ground: 23.5' KB

Spud Date: 9/1/1993
Completion Date: 11/27/1993
Last Rework Date: 8/5/2016

Junk: Bottom part of logging tool, caliper tool (5.1'), two split shells (1/8" thick x 3.73' long), & 15.79' wash pipe, Top @ 7194'



33' 4-1/2" x 5-1/2" X-Over

Tubing (8/4/2016)
4-1/2" (4.0" ID), 12.6#, L-80, TCPC
0' - 33'
5-1/2" (4.778" ID), 20#, L-80, TCPC
33' - 6528'
4-1/2" (4.0" ID), 12.6#, L-80, TCPC
6528' - 6625'

6528' 5-1/2" x 4-1/2" X-Over

6566' SLXO Sliding Sleeve (3.81" ID)

6605' WXN Nipple (3.81" w/ 3.75" No-Go)

6616' WEA AS1-X HP PCKR (COE @ 6620', 8/4/2016)

6625' Wireline Re-Entry Guide

6746' - 6762' Baker ECP (Inflated w/ 103 CF CMT)

Liner Perfs:
6734' - 6798' 1.5" x 0.012", 12R, 6°C Slots
6798' - 7092' 0.012", 90 Wire SSWW
7122' - 7163' 1.5" x 0.030", 12R, 6°C Slots

Gravel Packed w/
389 CF (108% of Calc'd) 20-40

7162' Cleaned out Fill (6/22/2016)

7194' Top of Junk

Top of Zone Markers md (tvd)	
A1	3594' (3592')
A36	4409' (4406')
UP	4765' (4762')
LP	5159' (5155')
UDA1	5494' (5488')
MDA	5862' (5852')
LDA	6149' (6136')
MP	6515' (6497')
S1	6794' (6772')
S4	6910' (6886')
S8	6980' (6954')
S14	±7093' (±7065')
FREW	±7107' (±7078')

Prepared by: MAM (4/20/2016)
Updated by: LD (5/17/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Standard Sesnon 4-0	API	04-037-22063-05
Project Type	Recompletion		
Well Status	Active	NOP:	04/11/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	08/11/1980; Redrill 1 10/23/1980; Redrill 1 04/12/1994 (Sidetrack 1); Redrill 1 05/04/1994 (Sidetrack 2); Redrill 1 07/03/1994 (Sidetrack 3); Redrill 2 09/21/1995		
Initial Completion	01/16/1981; Redrill 2 Completion: 12/15/1995		
Elevation	2886 ft.		
Caprock Depth	7820 ft.		
Measured Depth	10691 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Standard Sesnon 4-0. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for Standard Sesnon 4-0 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig Work
 - a. Well Decompletion

- i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 7880 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 7" (HES PLT) packer from 7874 ft. depth
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 9755 ft.
 - ii. Run inspection MAC log and Gyro from total depth to surface
 - iii. Run inspection logs MFL, UT and CBL from 8160 ft. to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7881 ft. of 2-7/8" (6.5#, L80, TCPC) new tubing completion string, bottom hole assembly, and 7" packer thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
3. Post Rig Work
 - a. Unload well and turn over to operations
4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/18/2016
2	Noise and Temp Survey	03/08/2016 04/23/2016 08/01/2017
3	Ultrasonic (UT)	12/12/2016
4	Cement Bond Log (CBL)	12/12/2016
5	Multi-Arm Caliper (MAC)	12/14/2016
6	Magnetic Flux Leakage (MFL)	12/14/2016
7	Pressure Integrity Test	12/09/2016
8	Annular and Tubing Pressure Test – Final	01/04/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	01/06/2017
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	11/22/2016	01/05/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 1100 psi for 1 hour.
2. Rig Work involved removing the existing completion, performing inspections, and running new completion
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 7880 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 7" (HES PLT) packer from 7874 ft. depth
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 9737 ft. Gyro survey was run from 9725 ft. to surface. The pressure integrity test was completed. Inspection logs (UT and CBL) were run on the production casing from 7942 ft. to surface, and MAC and MFL were run from 7940 ft. to surface
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 7883 ft. of 2-7/8" (6.5#, L80, EUE) tubing with flow control components, and 7" (WFT AS1-X) Packer set at 7867 ft. The final installation integrity test was performed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$13,415	\$0	\$13,415
Contract Costs	\$47,305	\$1,637	\$48,942
Material	\$133,610	\$0	\$133,610
Other Direct Charges	\$636,144	\$54,259	\$690,403
Total Direct Cost	\$830,474	\$55,896	\$886,370

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$32,243	\$338	\$32,581
AFUDC	\$10,138	\$0	\$10,138
Property Taxes	\$1,752	\$0	\$1,752
Total Indirect Costs	\$44,133	\$338	\$44,471

Total Loaded Costs	\$874,607	\$56,234	\$930,841²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Standard Sesnon 4-0 ST5

API #: 04-037-22063-05
Sec 29, T3N, R16W

Operator: So. California Gas Co.

16" TOC Surface
10-3/4" ETOC Surface
16" BOC 90'
16" ETOC 180'
20-1/2" Hole (to 1300')

Surface Casing

16" (15.124" ID), 75#, K-55, BT&C
0' - 1296'
CMT'D w/ 1050 CF*
+ 75 CF thru 1-1/8" TBG hung
@ 90' Top Job

7" ETOC 2434'

14-3/4" Hole (1300' - 4852')

Intermediate CSG

10-3/4" (9.85" ID), 51#, N-80, BT&C
0' - 4852'
CMT'D w/ 3075 CF

9-1/2" Hole (4852' - 8145')

Production Casing

7" (6.184" ID), LT&C
0' - 3578' 29#, L-80
3578' - 4130' 29#, N-80
4130' - 4173' 29#, L-80
4173' - 4289' 29#, N-80
4289' - 4329' 29#, L-80
4329' - 5377' 29#, N-80
5377' - 5841' 29#, L-80
5841' - 6831' 29#, N-80
6831' - 6874' 29#, L-80
6874' - 8100' 29#, N-80

CMT'D w/ 248 BBLS

Liner

4-1/2" (4" ID), 11.6#, N-80, 8rd
7940*** - 10691'
CMT'D w/ 63 BBLS CMT,
25 CF CMT Returns @ TOL

Inner Liner

2-7/8" (10/18/2005)
9722' - 9755'

6" Hole (8145' - 10691')

PBTD 10593'

TD 10691'
TVD (9136')

Directionally Drilled: Yes (TD is 565' W, 1073' S of Surf)

Tubing (1/4/2017)

2-7/8" (2.441" ID), 6.5#, EUE
0' - 7883'

Top of Zone Markers md (tvd)	
PEupth	±2700' (±2699')
FREWupth	3945' (3931')
A36	5628' (5517')
UP	5991' (5847')
LP	6383' (6199')
UDA1	6702' (6484')
MDA	7266' (6991')
LDA	7445' (7079')
MP	±7820' (±7443')
S1	±8070' (±7684')
S4	8221' (7824')
S8	8408' (7982')

3116' - 3130' 10-3/4" Split in CSG
(87 CF CMT SQZD Away, 9/18/1995)

4855' Sidetrack (ST5) KOP (from ST1)
into this wellbore (See History)

7819' "WXO" Sliding Sleeve (2.313" ID)

7852' "WX" Nipple (2.313" ID)

7883' WEA AS1-X PCKR (COE @ 7887', 1/4/2017)

7881' "WXN" Nipple (2.313" w/ 2.205" No-Go)

7883' Wireline Re-entry Guide

7940*** TOL & TOC

8042' - 8058' Baker 7" XL-10 CRX ECP
(CMT'D w/ 9.2 BBLS CMT, Did Not Inflate)

8162' Possible Junk (see desc. above)

4-1/2" Perfs:

8183' - 8194', 8228' - 8360', 8408' - 8423', 8480' - 8592', 8644' - 8906',
8926' - 9075', 9092' - 9124', 9158' - 9200', 9565' - 9700'
(1.2) 1/2" HPF (12/6/1995)
9739' - 9741' Twenty Four (24) 1/2" Holes (Frac'd, 11/27/1995)

2-7/8" Perfs: 9725' - 9754' WWS

9737' Tagged Fill*** (12/1/2016)

9830' Tagged Fill (10/10/2005)

10141' - 10143' Twelve (12) 1/2" Holes
(Unable to Break Down, 11/18/1995)

Lease: Standard Sesnon
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: ±2700' (±2699')

Ground Elevation: 2886' asl
Datum to Ground: 20' KB

Spud Date: 8/11/1980
Sidetrack (ST5) Kick-off Date:
9/21/1995
Completion Date: 12/15/1995
Last Rework Date: 1/5/2017

Junk: Lost 2 elements f BP
(Pulled f/ 8162', 12/21/2016)

Wellbore History

Org. Hole (OH) TD @ 7649'
(See Standard Sesnon 4-0)
ST1 KOP @ 5290'
TD @ 9670'
(See Standard Sesnon 4-0 ST1)
ST2 KOP @ 7008'
TD @ 7056'
(See Standard Sesnon 4-0 ST2)
ST3 KOP @ 7008'
TD @ 7292'
(See Standard Sesnon 4-0 ST3)
ST4 KOP @ 7008'
TD @ 7690' (Re-entered ST1)
(See Standard Sesnon 4-0 ST4)
ST1 Re-entry Point @ 7690'
(see Standard Sesnon 4-0 ST1)
ST5 KOP @ 4855'
TD @ 10691'

Notes

***Observed No Fluid to Surface** while CMT'ing
16" CSG. Lost circulation in numerous locations
while drilling 20-1/2" Hole.

***Tagged Top of Liner @ 7936' (11/7/2005)

***Unable to clean out due to no returns when
circulating

Prepared by: CAM (8/16/2016)
Updated by: LD (5/17/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Standard Sesnon 4A	API	04-037-21375-01
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	04/05/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/12/1974; 11/14/1974 (Sidetrack 1)		
Initial Completion	03/15/1975		
Ground Elevation	2885 ft.		
Caprock Depth	7980 ft.		
Measured Depth	8771 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this program was to inspect the well integrity and remediate identified conditions as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Standard Sesnon 4A. This project planned to pull the 2 7/8" & 3-1/2" completion string, run inspection logs and a Gyro survey, pressure test casing and well laterals, install a new inner liner in the existing 6-5/8" liner, install new completion string, and convert the well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for well Standard Sesnon 4A used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement.

- ii. Pull existing completion consisting of 3931 ft of 2-7/8" (6.5#, N80, EUE) & 4279 ft of 3-1/2" (9.2#, N80, F.J. Hydril) tubing, bottom hole assembly, and two packers, a 8-5/8" (Otis Permatrieve) packer from 3915 ft. and a 6-5/8" (Otis Permatrieve) packer from 8206 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 8737 ft.
 - ii. Run Gyro survey and MAC from total depth to surface.
 - iii. Run inspection logs MFL, CBL and UT from 3927 ft. to surface.
 - iv. Perform pressure integrity test to 1.15 MAOP on production casing.
 - c. Inner Liner Installation
 - i. Install and cement new 4-1/2" (11.6#, L80) inner liner from approximately 8200 ft to 3900 ft.
 - d. Well Reassessment/Re-evaluation
 - i. Drill and clean out cement.
 - ii. Perform pressure integrity test to 1.15 MAOP.
 - iii. Run inspection logs (UT, CBL, MFL and MAC) from 8200 ft to 3900 ft.
 - e. Well Completion
 - i. Install approximately 4225 ft. of 2-3/8" (4.6#, L80, TSH 563) and 3796 ft. of 2-7/8" (6.5#, L80, TSH 563) tubing of a new completion string, bottom hole assembly, and 4-1/2" packer, thereby converting the well to tubing flow.
 - ii. Perform installation integrity test on completion.
 - iii. Install wellhead.
- 3. Post Rig Work
 - a. Unload well and turn over to operations.
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/18/2016 09/29/2016
2	Noise and Temp Survey	03/08/2016 04/18/2016 11/04/2016 08/01/2017
3	Ultrasonic (UT)	09/22/2016 03/06/2017
4	Cement Bond Log (CBL)	09/22/2016 03/06/2017
5	Multi-Arm Caliper (MAC)	09/16/2016 03/08/2017
6	Magnetic Flux Leakage (MFL)	09/22/2016 03/07/2017
7	Pressure Integrity Test	02/24/2017
8	Annular and Tubing Pressure Test – Final	03/16/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	03/24/2017
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	09/07/2016	09/29/2016
Rig Work Phase 2	01/09/2017	03/20/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 1100 psi for 1 hour
2. Rig Work was performed in two phases
 - a. Phase 1 consisted of removing existing completion, running initial inspections, and isolating the well
 - i. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisted of 8210 ft of 2-7/8" (6.5#, N80, EUE) and 3-1/2" (9.3#, F.J. Hydril) tubing, bottom hole assembly, and two packers, a 8-5/8" (Otis Permatrieve) packer from 3915 ft. and a 6-5/8" (Otis Permatrieve) packer from 8206 ft.
 - ii. *Well Assessment/Evaluation:* The well was cleaned out to 8737 ft. Gyro survey and MAC were run from 8737 ft. to surface. The MFL was run on production casing from 3927 ft. to surface. A pressure integrity test was performed on the production casing. Additional inspection logs (UT, CBL) were run from 8217 ft. to surface
 - iii. *Well Isolation:* The storage zone and casing defects were isolated. A wellhead was installed and tested
 - b. Phase 2 consisted of running a new inner liner, zonal remediation, running new inner string, performing final inspections, and running new completion equipment
 - i. *Well Decompletion:* This step included the removal of wellhead components, and isolation equipment
 - ii. *Inner Liner Installation:* The well was cleaned out to 8737 ft. and the production liner was drifted to prepare for a new inner liner installation. A new 4-1/2" (L80, 12.6#, TSH 513) inner liner from 8200 ft. to 3897 ft. was installed and cemented
 - iii. *Zonal remediation:* Per DOGGR requirements, one zone was perforated and cement squeezed, from 815 ft to 825 ft (BFW)
 - iv. *Inner String Installation:* The production casing was drifted to prepare for a new inner string installation. A new 6-5/8" (28#, L80, BT&C) inner string consisting of 3897 ft. was installed and cemented. A new spool was installed to accommodate the inner string

- v. *Well Re-assessment/Re-evaluation:* The first cement shoe at 3836 ft was drilled out completely. The pressure integrity test was performed. The second cement shoe at 8198 ft was drilled out. Casing inspection logs (UT, MFL, CBL) were run from 8135 ft. to surface. MAC was run from 8235 ft. to surface. The well was cleaned out to 8695 ft.
 - vi. *Well Completion:* A new completion string and bottom hole assembly was installed consisting of 3786 ft. of 2-7/8" (6.5#, L80, EUE) and 4231 ft. of 2-3/8" (4.7#, L80, EUE) tubing with flow control components, and a 4-1/2" (WFT AS1X) Packer set at 8001 ft. The final installation pressure test was performed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
- a. *Post Injection Work:* Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

After initial inspections on original production casing, it was determined an inner string was required. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$12,523	\$0	\$12,523
Contract Costs	\$57,314	\$1,267	\$58,581
Material	\$227,720	\$0	\$227,720
Other Direct Charges	\$1,794,531	\$130,213	\$1,924,744
Total Direct Cost	\$2,092,088	\$131,480	\$2,223,568

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$64,600	\$792	\$65,392
AFUDC	\$21,341	\$0	\$21,341
Property Taxes	\$3,526	\$0	\$3,526
Total Indirect Costs	\$89,467	\$792	\$90,259

Total Loaded Costs	\$2,181,555	\$132,272	\$2,313,827²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
Standard Sesnon 4A Orig. Hole & ST1

API #: 04-037-21375-00, -01
 Sec 29, T3N, R16W

Operator: So. California Gas Co.

13-3/8" & 6-5/8" TOC Surface
 8-5/8" ETOC 219'
 17-1/2" Hole (to 962')

Surface Casing
 13-3/8" (12.615" ID), 54.5#, K-55, BT&C
 0' - 928'

CMT'D w/ 500 CF + 150 SKS* +
 *Pumped 17 yds of 6 SK Pre
 Gravel Mix* Top Job

11" Hole (962' - 4665')

Inner CSG (2/14/2017)
 6-5/8" (5.791" ID), 28#, L-80, BT&C
 0' - 3897' (w/ Tie Back Seals & Ports)

CMT'D w/ 483 CF/220 SKS,
 15 BBLs Returns to Surface

Production Casing
 8-5/8" (7.825" ID), 36#, K-55, LT&C
 0' - 4065'

CMT'D w/ 1140 CF

Inner Liner (1/25/2017)
 4-1/2" (3.96" ID), 12.6#, L-80, Hydril 513
 3897' - 8200'

CMT'D w/ 415 CF, CMT Returns to TOL

9-7/8" Hole (4665' - 6526')

CMT'D Liner
 6-5/8", K-55, FJ
 3927' - 4214' 24# (5.921" ID)
 4214' - 5097' 28# (5.791" ID)
 5097' - 8248' 24# (5.921" ID)

CMT'D w/ 493 CF + SQZ'D TOL
 5X's w/ total of 1069 CF Away
 (Calc'd)

8200'
 8217'

7-5/8" Hole (6526' - 8248')

8248'

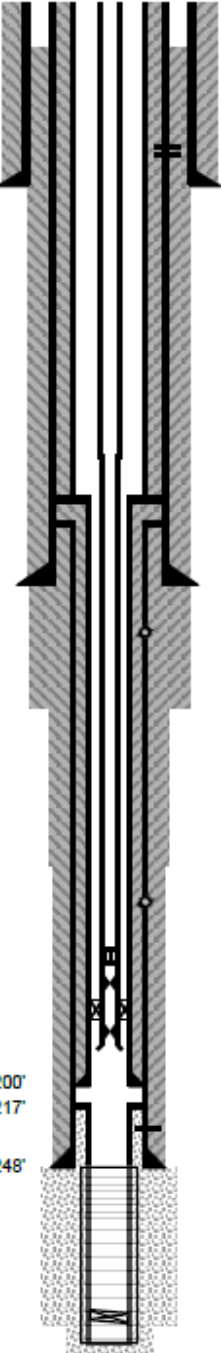
8" Hole (8248' - 8715')

WWS Liner
 4-1/2" (4.0" ID), 11.6#, K-55, ST&C
 8217' - 8737'

5-5/8" Hole (8715' - 8771')

TD 8771'
 TVD (8153')

Directionally Drilled: Yes (TD is 2847' W, 597' N of Surf)



181' Sidetrack (ST1) KOP (f/ Orig. Hole)
 into this wellbore (see WB History)

815' - 825' Four (4) 1/2" HPF (SQZ'D
 3x's w/ a total of 1611 CF CMT, Calc'd,
 SQZ'D Away, last SQZ had water returns
 btwn. 8-5/8" & 13-3/8", 1/31/2017)

Tubing (3/16/2017)
 2-7/8" (2.441" ID), 6.5#, L-80, EUE
 0' - 3786'
 2-3/8" (1.991" ID), 4.7#, L-80, EUE
 3786' - 8017'

3786' 2-7/8" x 2-3/8" X-Over

3897' 4-1/2" TOL & TOC

3927' 6-5/8" TOL & TOC (WSO, Apprvd
 then SQZ'D w/ 50 SKS, 1/23/1975.
 WSO Re-Apprvd 1/28/1975)

4291' - 4296' Holes in 6-5/8" btwn.
 (25 SKS + 3 CF CMT SQZ'D Away,
 1/13/1979)

7488' - 7518' Holes in 6-5/8" btwn.
 (2 CF CMT SQZ'D Away, 1/11/1979)

7926' WSO Sliding Sleeve (1.875" ID)
 7961' WX Nipple (1.875" ID)
 8001' WEA AS1-X PCKR (COE @ 8004', 3/16/17)
 8016' WXN Nipple (1.875" w/ 1.791" No-Go)
 8017' Wireline Re-entry Guide

8220' Four (4) 1/2" Holes WSO (1/18/1975)
 (20 SKS CMT SQZ'D, 1/19/75 + 100 SKS CMT SQZ'D, 1/27/1975)

4-1/2" Perfs:
 8244' - 8737' Gru-V-Kut 0.018" Gauge

8695' Top of Junk/Fill (see desc. above)

Lease: Standard Sesnon
 Field: Aliso Canyon
 Status: Active Gas Storage
 3000TDS: ±800' (±797')
 10000TDS: 2954' (2812')

Ground Elevation: 2885.58' asl
 Datum to Ground: 17' KB

Spud Date: 11/12/1974
 Completion Date: 3/15/1975
 Last Rework Date: 3/20/2017

Junk: Cast Iron BP Milled & Pushed
 to 8695' (3/9/2017)

Wellbore History	
Orig. Hole (-00) TD @ 455±	(11" Hole drifted 2' f/ IW-59 Cellar)
181' - 408' CMT Plug	(422 SKS, C/O f/ 134')
Sidetrack (ST1) KOP @ 181'	into current wellbore (-01)

Notes

Many problems w/ lost circ. during drilling. CMTing, WSO's obtained w/ difficulty

*No circulation throughout job

**No circulation while displacing CMT

Top of Zone Markers	md (tvd)
PEupth	2954' (2812')
FREWupth	4295' (4029')
CRupth	4520' (4239')
A36	5751' (5401')
UP	6107' (5738')
LP	6590' (6186')
UDA1	6828' (6406')
MDA	7402' (6935')
LDA	7692' (7195')
MP	7980' (7449')
S1	8334' (7766')
S4	8428' (7851')
S8	8534' (7945')
S14	8674' (8089')

Prepared by: MAM (7/7/2016)
 Updated by: LD (5/16/2018)



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Standard Sesnon 5	API	04-037-00758-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	11/17/2016
Well Characteristics			
Well Type	Injection/Withdrawal/Observation		
Spud Date	02/05/1945		
Initial Completion	05/26/1945		
Ground Elevation	2651 ft.		
Caprock Depth	8156 ft.		
Measured Depth	8700 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

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4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Standard Sesnon 5. This project was planned to be completed in two phases because the well is an observation well, not an active injection or withdrawal well. The first phase planned to pull the 2-3/8" completion string, run casing inspection logs and a Gyro survey, cement existing inner string in place, pressure test casing, and isolate for field injection. Second phase will include installing a new completion string and converting the well to tubing flow. The plan was to gather baseline assessment data on casing and other well components. The following describes the well workover plan for Standard Sesnon 5 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig Work
 - a. Well Decompletion

- i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 8310 ft. of 2-3/8" (4.3#, N80, EUE) tubing, bottom hole assembly, and 5-1/2" (Baker Model "F") packer from 8300 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to approximately 8300 ft.
 - ii. Run inspection log (UT) from approximately 8300 ft. to surface
 - c. Inner string cementing
 - i. Perforate inner string from 8250 ft to 8260 ft.
 - ii. Cement existing 5-1/2" (20#, K55, Hydril Super Flush) inner string to surface
 - d. Well Reassessment/Re-evaluation
 - i. Tag top of cement and clean out to 8270 ft.
 - ii. Perform pressure test on inner string to 1000 psi for 1 hour
 - iii. Run inspection logs (UT and CBL) from approximately 8300 ft. to surface
 - e. Well Isolation
 - i. Isolate well
 - ii. Install wellhead
3. Preparation of DOGGR NOI submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/20/2016
2	Noise and Temp Survey	03/10/2016 03/15/2016 04/19/2016 11/09/2017
3	Ultrasonic (UT)	09/20/2016 10/01/2016 11/02/2016
4	Cement Bond Log (CBL)	09/20/2016 10/01/2016 11/02/2016
5	Multi-Arm Caliper (MAC)	10/01/2016 11/03/2016
6	Magnetic Flux Leakage (MFL)	11/03/2016
7	Pressure Integrity Test	11/01/2016
8	Annular and Tubing Pressure Test – Final	11/14/2016
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	11/18/2016
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	09/13/2016	11/17/2016

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 1100 psi for 1 hour
2. Rig Work included removing existing completion and uncemented inner string, running inspection logs, installing a new inner string, re-running inspection logs, pressure testing, and installing a new completion
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment and 8250 ft. of 2-3/8" (4.3#, N80, EUE) tubing and seal assembly
 - b. *Well Assessment/Evaluation:* A pressure integrity test was performed. A UT inspection log was run in the inner string from 8230 ft. to the surface
 - c. *Well Decompletion:* This step included removal of 8340 ft. of 5-1/2" (20#, K55, Hydril Super Flush) inner string, seal assembly, and 5-1/2" (Baker "F") packer from 8300 ft.
 - d. *Well Reassessment/Re-evaluation:* The well was cleaned out to 8322 ft. MAC and CBL inspection logs were run from 8290 ft. to surface. A pressure test was performed to identify potential anomalies between 4685 ft and 4622 ft.
 - e. *Well Decompletion:* This step included the removal of existing completion equipment of 7" (Baker "FB-1") packer from 8340 ft.
 - f. *Well Reassessment/Re-evaluation:* The well was cleaned out to 8692 ft. A Gyro survey was run from 8673 ft. to surface. The production casing was redressed and drifted for new inner string installation. The liner top was pressure tested
 - g. *Inner string Installation:* A new 5-1/2" (L80, 20#, TSH 513) inner string consisting of 8348 ft was installed and cemented. A new spool was installed to accommodate the inner string
 - h. *Well Reassessment/Re-evaluation:* UT and CBL inspection logs were run on the inner string from 8300 ft. to surface. MFL and MAC were run from 8292 ft. to surface. A pressure integrity test was performed on the inner string

- i. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 8304 ft. of 2-7/8" (6.5#, L80, EUE) tubing with flow control components, and 5-1/2" (WFT AS1-X) packer set at 8288 ft. The final installation integrity test was performed. A new wellhead was installed and tested
 - j. *Well Unload:* The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
3. **Post Injection Work:** Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

The rig work was done in one phase instead of two, as originally planned. During the casing inspection, anomalies were found in the existing inner string; consequently it was necessary to remove it and install a new inner string. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$4,716	\$0	\$4,716
Contract Costs	\$59,534	\$0	\$59,534
Material	\$271,443	\$0	\$271,443
Other Direct Charges	\$1,346,655	\$106,742	\$1,453,397
Total Direct Cost	\$1,682,348	\$106,742	\$1,789,090

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$47,801	\$633	\$48,434
AFUDC	\$67	\$0	\$67
Property Taxes	\$0	\$0	\$0
Total Indirect Costs	\$47,868	\$633	\$48,501

Total Loaded Costs	\$1,730,216	\$107,375	\$1,837,591²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Standard Sesnon 5**

API #: 04-037-00758-00
Sec 28, T3N, R18W

Operator: So. California Gas Co.

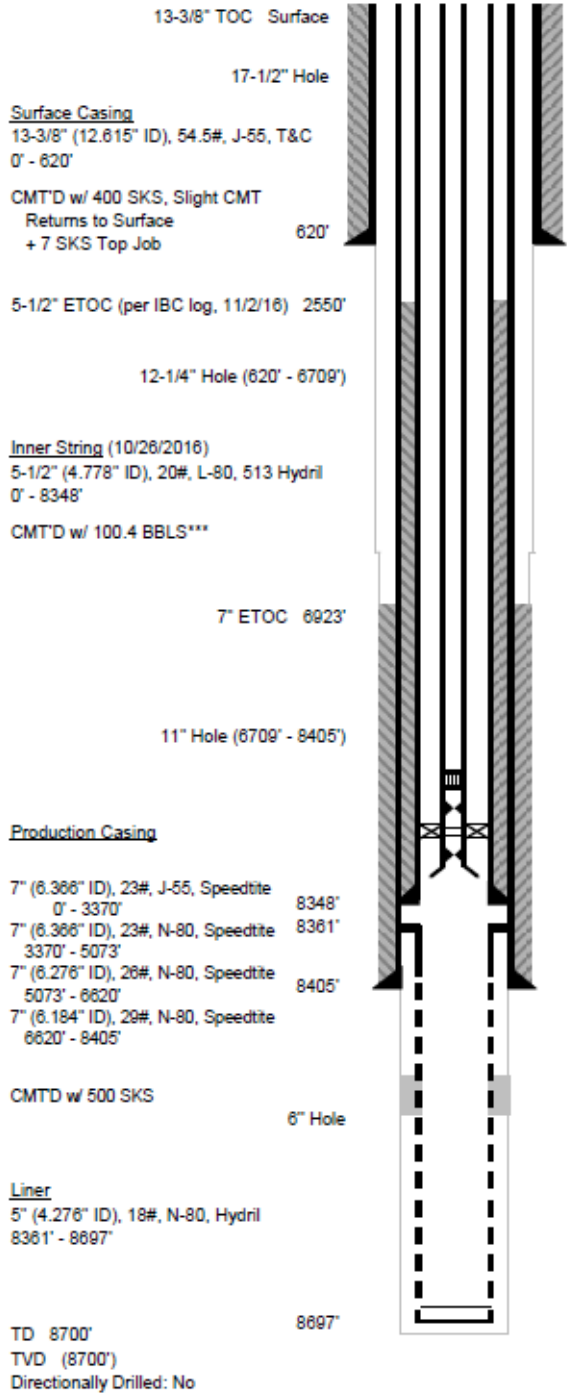
Lease: Standard Sesnon
Field: Aliso Canyon
Status: Active Observation Gas Cap*
3000TDS: ±800' (±800')
10000TDS: 4350' (4350')

Ground Elevation: 2851.38' asl
Datum to Ground: 6.92' DF

Spud Date: 2/5/1945
Completion Date: 5/28/1945
Last Rework Date: 11/17/2016

Junk: None

Notes
*Converted to Observation 6/6/1999. This well is used infrequently for I&W; it is used to monitor the field pressure in the western area of the field.
**Scab CMTD (SQZ'D 5x's w/ a total of 79 SKS) f/ 8530' to 8490', interval f/ 8530' - 8522' held 1500# pressure, interval f/ 8490' - 8522' "packed off", 2/1952
*** "Lost circ. & shut down w/ 171 BBLS displaced. 13 BBLS short."



Tubing (11/12/2016)
2-7/8" (2.441" ID), 6.5#, N-80, EUE
0' - 8304'

4080' - ±4180' 7" CSG Damage (dressed w/ power swivel multiple times till smoothed out, 10/14/2016)
4663' - 4685' 7" CSG Leak Interval (CMTD off by Innerstring, 10/26/2016)

8242' WEA Sliding Sleeve (2.313" ID)
8274' WEA "X" Nipple (2.313" ID)
8285' WEA AS1-X PCKR (COE @ 8288', 11/12/2016)
8302' WEA "XN" Nipple (2.313" w/ 2.205" No-Go)
8304' Wireline Re-entry Guide

8405' (Shoe) WSO
8490' - 8522' 5" Liner Packed Off**
8522' - 8530' 5" Liner Scab CMTD**

Liner Perfs:
8393' - 8697'
2" x 80 Mesh Kobe, 12R, 6°C Slots

8692' Cleaned out Fill (unable to work below, 10/10/2016)

Top of Zone Markers	md	(tvd)
A1	4350'	(4350')
A36	5360'	(5360')
UP	5700'	(5700')
LP	6100'	(6100')
UDA1	6495'	(6495')
MDA	7345'	(7345')
LDA	7580'	(7580')
MP	8156'	(8156')
S1	8350'	(8350')
S4	8422'	(8422')
S8	8527'	(8527')
S14	8663'	(8663')
FREW	8694'	(8694')

Prepared by: MAM (5/27/2016)
Updated by: LD (5/14/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Standard Sesnon 6	API	04-037-00759-01
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	04/18/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	06/06/1945; Redrill 01/24/1962 (Sidetrack)		
Initial Completion	09/29/1945; Redrill Completion 03/15/1962		
Elevation	2684 ft.		
Caprock Depth	8146 ft.		
Measured Depth	9207 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Standard Sesnon 6. This project planned to pull the 2-7/8" completion string, run inspection logs and a Gyro survey, perforate and cement squeeze identified zones, install and cement 5-1/2" inner string, pressure test inner string, run casing inspection logs, install a new 2-7/8" completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing and other well components. The following describes the well workover plan for Standard Sesnon 6 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run noise and Temperature survey
 - b. Well Isolation
2. Rig work
 - a. Well Decompletion

-
- i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 8232 ft of 2-7/8" (6.5#, N80, EUE) tubing, and 195 ft. of 2-3/8" (4.6#, L80, EUE) tubing, bottom hole assembly, and 5" (Otis "PW") packer from 8422 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to target depth 9200 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run UT and CBL on production liner and casing from approximately 8300 ft. to surface
 - c. Zone Remediation
 - i. Cement squeeze critical zones, per DOGGR requirements
 - ii. Drift and redress 7" production casing for new 5-1/2" inner string installation
 - d. Inner String Installation
 - i. Install and cement approximately 8286 ft. of 5-1/2" (20#, L80, TSH 513) inner string
 - ii. Install new spool to accommodate inner string
 - e. Well Reassessment/Re-evaluation
 - i. Drill out inner string shoe
 - ii. Perform pressure integrity test to 1.15 MAOP
 - iii. Run inspection logs (UT, MFL, MAC, CBL) from approximately 8280 ft. to surface
 - f. Well Completion
 - i. Install approximately 8230 ft. of 2-7/8" (6.5#, L80, TSH 563) of new tubing completion string, bottom hole assembly and 5-1/2" (Baker SC) packer at approximately 8200 ft, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
 3. Post Rig Work
 - a. Unload well and turn over to operations
 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/08/2016 01/30/2017 08/22/2017
2	Noise and Temp Survey	03/04/2016 04/21/2016 02/06/2017 07/26/2017
3	Ultrasonic (UT)	09/29/2017 01/09/2018
4	Cement Bond Log (CBL)	09/29/2017 01/10/2018
5	Multi-Arm Caliper (MAC)	02/21/2018
6	Magnetic Flux Leakage (MFL)	02/23/2018
7	Pressure Integrity Test	12/20/2017
8	Annular and Tubing Pressure Test – Final	04/16/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	04/18/2018
10	Return to Service	06/01/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	09/13/2017	04/19/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 1100 psi for 1 hour
2. Rig work included removing the existing completion, running initial inspections, performing zone remediations, installing a new inner string, re-running inspections, pressure testing, and installing a new completion
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 8232 ft. of 2-7/8" (6.5#, N80, EUE) and 195 ft. of 2-3/8" (4.6#, L80, EUE) tubing, bottom hole assembly, and 5" (Otis "PW") packer from 8422 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 9099 ft. Gyro survey was run from 9061 ft to surface. UT and CBL logs were run from 8270 ft. to surface
 - c. *Zone Remediation:* Per DOGGR requirements, seven zones were perforated and cement squeezed, from 8146 ft. to 8141 ft. (MP), from 7598 ft. to 7593 ft. (LDA), from 7345 ft. to 7340 ft (MDA), from 6535 ft. to 6530 ft. (UDA1), from 5741 ft. to 5736 ft. (UP), from 5416 ft. to 5411 ft. (A36), and from 4558 ft. to 4553 ft. (Intermediate Casing shoe)
 - d. *Inner String Installation:* The wellbore was drifted to top of liner at 8286 ft and prepared for new inner string installation. A new 5-1/2" (L80, 20#, TSH 513) inner string consisting of 8286 ft was installed and cemented. A new spool was installed to accommodate the inner string. The inner string shoe was drilled out
 - e. *Well Reassessment/Re-evaluation:* A pressure integrity test was performed. Casing inspection logs (UT, CBL, MAC, MFL) were run from 8260 ft to surface. The wellbore was cleaned out to 9190 ft.
 - f. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 8224 ft. of 2-7/8" (6.5#, L80, TSH 563) tubing with flow control components, and 5-1/2" (Baker SC2) Packer set at 8196 ft. The final installation integrity test was also performed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.

D. Changes During Workover

After initial inspections, and per DOGGR requirements, seven zones were perforated, and cement squeezed in the production casing before running the new inner string. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

SIMP workover operations were shut down for an extended period in the beginning of 2018 until the development and implementation of mandatory emission avoidance protocol was complete.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$30,559	\$0	\$30,559
Contract Costs	\$340,981	\$7,650	\$348,631
Material	\$336,142	\$0	\$336,142
Other Direct Charges	\$2,075,298	\$31,969	\$2,107,267
Total Direct Cost	\$2,782,980	\$39,619	\$2,822,599

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$126,797	\$354	\$127,151
AFUDC	\$43,180	\$0	\$43,180
Property Taxes	\$6,466	\$0	\$6,466
Total Indirect Costs	\$176,443	\$354	\$176,797

Total Loaded Costs	\$2,959,423	\$39,973	\$2,999,396²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

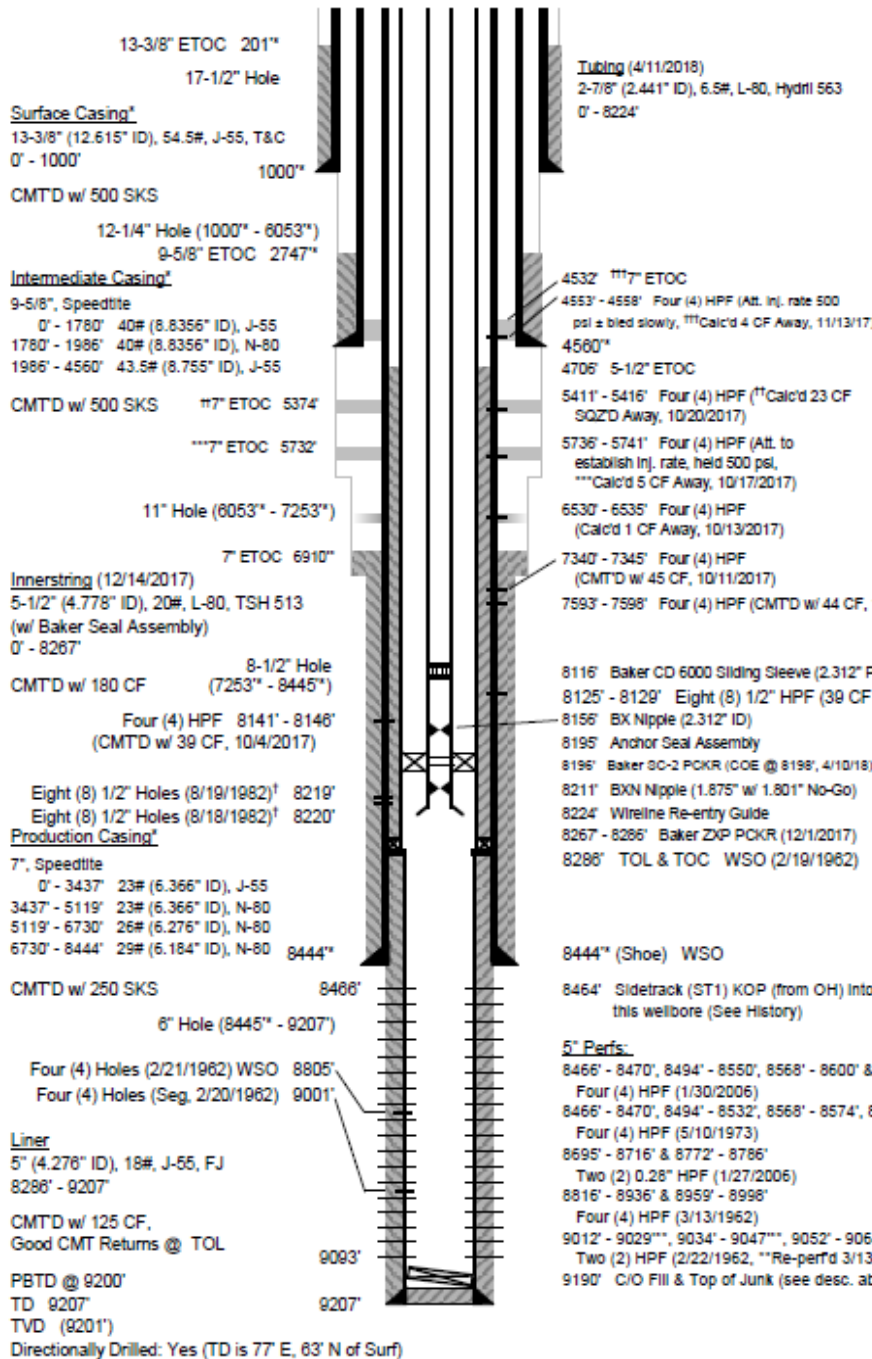
Well
Standard Sesnon 6 ST1

API #: 04-037-00750-01
Sec 28, T3N, R16W

Operator: So. California Gas Co.

Lease: Standard Sesnon
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 4288' (4288')

Ground Elevation: 2684.22' asl
Datum to Ground: 11.5' KB
*OH Datum to Ground: 8.92' DF
Spud Date: 6/6/1945
Sidetrack (ST1) Kick-off Date: 1/24/1962
Completion Date: 3/15/1962
Last Rework Date: 4/18/2018
Junk: Milled & Pushed BP to 9190'



Wellbore History	
Orig. Hole (OH) TD @ 8720'	
(See Standard Sesnon 6)	
ST1 KOP @ 8464'	
TD @ 9207'	
Notes	
150 SKS CMT SQZD (8/20/1982)	
13-3/8\", 9-5/8\", & 7\"/>	

Top of Zone Markers md (tvd)	
PGB	1454' (1454')
FREWupth	2941' (2941')
A1	4288' (4288')
A36	5411' (5411')
UP	5741' (5741')
LP	6205' (6205')
UDA1	6535' (6535')
MDA	7348' (7348')
LDA	7600' (7600')
MP	8146' (8146')
S1	8376' (8376')
S4	8452' (8452')
S8	8556' (8556')
S14	8687' (8685')
FREW	8870' (8867')

Prepared by: MAM (7/3/2016)
Updated by: LD (5/14/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Standard Sesnon 9	API	04-037-00762-00
Project Type	Inner String Completion		
Well Status	Active	NOP	11/14/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/13/1946		
Initial Completion	02/04/1947		
Ground Elevation	2835 ft.		
Caprock Depth	8360 ft.		
Measured Depth	8864 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Standard Sesnon 9. This project planned to pull 3-1/2" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string and sub surface safety valve (SSSV), and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for well Standard Sesnon 9 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig work
 - a. Well Decompletion

-
- i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 644 ft of 3-1/2" (9.3#, N80, EUE) and 7907 ft of 4-1/2" (11.6 #, N80, EUE) tubing, SSSV at 477 ft, bottom hole assembly, and 7" (Baker Retrieva-D) packer from 8544 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 8864 ft.
 - ii. Run Gyro survey and MAC log from total depth to surface
 - iii. Run inspection log MFL from liner top to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - v. Run inspection logs (CBL, UT) from 8570 ft to surface
 - c. Well Completion
 - i. Install approximately 8544 ft of 3-1/2" (9.3#, L80, TSH 563) new tubing completion string, bottom hole assembly and 7" (3-1/2", TSH 563) Packer at approximately 8514 ft, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
 3. Post Rig Work
 - a. Unload well and turn over to operations
 4. Preparation of DOGGR NOI and submittal for permit to conduct operation

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/08/2016 02/03/2017 07/27/2017 02/12/2018
2	Noise and Temp Survey	03/08/2016 04/01/2016 06/06/2016 02/06/2017 07/31/2017 01/25/2018
3	Ultrasonic (UT)	09/07/2018 10/24/2018
4	Cement Bond Log (CBL)	09/07/2018 10/24/2018
5	Multi-Arm Caliper (MAC)	09/06/2018 10/26/2018
6	Magnetic Flux Leakage (MFL)	09/06/2018 10/26/2018
7	Pressure Integrity Test	10/27/2018
8	Annular and Tubing Pressure Test – Final	11/08/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	11/14/2018
10	Return to Service	12/11/2018

2. Project timeline

Major Milestone	Start	Finish
Rig Work	07/26/2018	11/11/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determined that it was safe to isolate the well and move forward with the SIMP program
 - b. The well was successfully isolated from the storage zone with a plug in the completion string and pressure tested to 1100 psi for 1 hour
2. Rig Work involved removing the existing completion, running inspection logs, performing remedial work, installing new inner string, re-running inspection logs, performing a pressure integrity test, and running new completion string
 - a. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 644 ft of 3-1/2" (9.3#, N80, EUE) and 7907 ft of 4-1/2" (11.6 #, N80, EUE), SSSV at 477 ft, bottom hole assembly, and 7" (Baker Retrieva-D) packer from 8544 ft.
 - b. *Well Assessment/Evaluation*: The wellbore was cleaned out to 8859 ft. The Gyro survey was run from 8830 ft to surface. Inspection logs (MAC, MFL) were run from 8590 ft to surface; CBL and UT were run from 8593 ft to surface
 - c. *Zonal Remediation*: Per DOGGR requirements, four zones were perforated and cement squeezed, from 4580 ft to 4590 ft (USDW/A1), from 2575 ft to 2585 ft (PGS), from 805 ft to 815 ft (BFW), and from 610 ft to 615 ft (surface casing shoe)
 - d. *Inner String Installation*: The production casing was drifted to prepare for a new inner string installation. A new 5-1/2" (20#, L80, TSH 513) inner string consisting of 8599 ft was installed and cemented. A new spool was installed to accommodate the inner string
 - e. *Well Reassessment/Re-evaluation*: The cement shoe was drilled out. Inspection logs (UT and CBL) were run from 8560 ft to surface; MFL and MAC were run from 8565 ft to surface. The pressure integrity test was performed
 - f. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 8410 ft of 2-7/8" (6.5#, L80, TSH 563) tubing with flow control components, SSSV at 439 ft, and a 5-1/2" (WEA Arrow-Pak) packer set at 8394 ft. The final installation integrity test was performed, and a new wellhead was installed
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

After initial inspections on the original production casing, it was determined a new inner string was required. Per DOGGR requirements, four zones were perforated and cement squeezed in the production casing before running the new inner string. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$44,309	\$0	\$44,309
Contract Costs	\$707,671	\$0	\$707,671
Material	\$527,403	\$0	\$527,403
Other Direct Charges	\$1,038,384	\$1,584	\$1,039,968
Total Direct Cost	\$2,317,767	\$1,584	\$2,319,351

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$146,820	\$14	\$146,834
AFUDC	\$30,304	\$0	\$30,304
Property Taxes	\$4,662	\$0	\$4,662
Total Indirect Costs	\$181,786	\$14	\$181,800

Total Loaded Costs	\$2,499,553	\$1,598	\$2,501,151²
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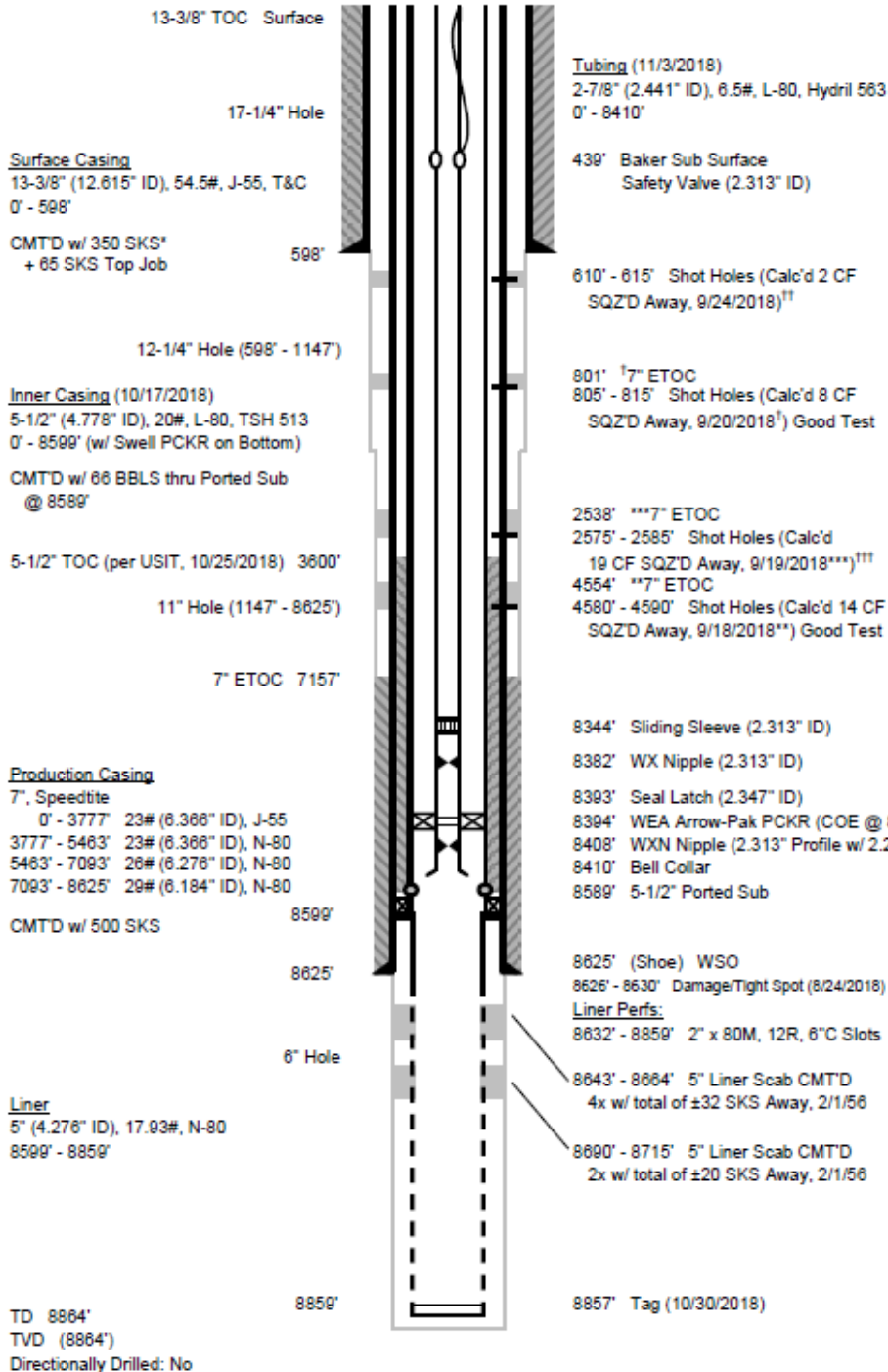
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

Storage Integrity Management Program Aliso Canyon – Standard Sesnon 9

IV. Wellbore Diagram after SIMP Work

Well Standard Sesnon 9

API #: 04-037-00762-00
Sec 28, T3N, R16W



Operator: So. California Gas Co.
Work Order #: 92340
Lease: Standard Sesnon
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 4580' (4580')

Ground Elevation: 2835.71' asl
Datum to Ground: 6.92' DF

Spud Date: 11/13/1946
Completion Date: 2/4/1947
Last Rework Date: 11/13/2018

Junk: None

Notes

[†]Lost circ. shortly before bumping plugs.

^{††}Press. test to 150 psi for 10 min, good test. Increased press. to 250 psi, press. bled off to 150 psi in 10 min. (9/25/2018).

^{†††}Press. test to 250 psi held for 5 min, good test. Increased press. to 500 psi, held for 2 min. After 2 min., holes broke down (9/28/2018).

Geologic Zone Markers md (tvd)		
PGS	2564'	(2564')
A1	4580'	(4580')
A36	5800'	(5800')
UP	5900'	(5900')
LP	6380'	(6380')
UDA1	6695'	(6695')
MDA	7534'	(7534')
LDA	7768'	(7768')
MP	8360'	(8360')
S1	8534'	(8534')
S4	8615'	(8615')
S8	8713'	(8713')
S14	8812'	(8812')

Prepared by: CAM (6/1/2016)
Updated by: CAM (11/13/2018)

I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Standard Sesnon 10	API	04-037-00040-01
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	06/14/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	04/20/1947; Redrill 12/02/1962 (Sidetrack)		
Initial Completion	06/21/1947; Redrill Completion 01/15/1963		
Ground Elevation	2622 ft.		
Caprock Depth	8315 ft.		
Measured Depth	9336 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this program was to inspect the well integrity and remediate identified conditions as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Standard Sesnon 10. This project planned to pull the 4-1/2" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for well Standard Sesnon 10 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
Well Isolation
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

Storage Integrity Management Program
Aliso Canyon – Standard Sesnon 10

-
- ii. Pull existing completion consisting of 576 ft of 3-1/2" (9.3#, L80, EUE), 7373 ft. of 4-1/2" (11.6#, N80, LTC) tubing, SSSV at 415 ft, bottom hole assembly, and 7" (Otis "PW" Permanent) packer from 7951 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 8900 ft
 - ii. Run Gyro survey and MAC from total depth to surface
 - iii. Run MFL log from 8600 ft to surface
 - iv. Run UT and CBL logs from 8700 ft to surface.
 - v. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 7900 ft. of 3-1/2" (9.3#, L80, TSH 563) tubing, and 522 ft of 2-7/8" (6.5#, L80, TSH 563) tubing of a new completion string, bottom hole assembly, and 5" (Baker SC) packer at 8400 ft. thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
 3. Post Rig Work
 - a. Unload well and turn over to operations
 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/20/2016 02/10/2017
2	Noise and Temp Survey	03/08/2016 06/02/2016 04/24/2017
3	Ultrasonic (UT)	05/26/2017
4	Cement Bond Log (CBL)	04/20/2017 05/26/2017
5	Multi-Arm Caliper (MAC)	05/24/2017
6	Magnetic Flux Leakage (MFL)	05/25/2017
7	Block Test	05/30/2017
8	Annular and Tubing Pressure Test – Final	06/13/2017
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	06/14/2017
10	Return to Service	07/31/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	03/08/2017	06/20/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to isolate the well and move forward with the SIMP program
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 1000 psi for 1 hour
2. Rig Work included removing existing completion and the steel liner, running the initial inspection logs, performing zonal remediation, installing a new inner string, performing the well reassessment, and running new completion
 - a. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 576 ft of 3-1/2" (9.3#, L80, EUE), 7373 ft. of 4-1/2" (11.6#, N80, LTC) tubing, SSSV at 415 ft, bottom hole assembly, 7" (Otis "PW" Permanent) packer from 7951 ft, and steel liner from 4464 ft to 4524 ft.
 - b. *Well Assessment/Evaluation*: The well was cleaned out to 8748 ft. Gyro survey and CBL were run from 8748 ft. to surface
 - c. *Zonal Remediation*: Per DOGGR requirements, four zones were perforated and cement squeezed from 5729 ft to 5734 ft and from 5620 ft to 5625 ft (UP), from 2245 ft to 2250 ft (PERupth), from 1142 ft to 1147 ft (PGS), and from 795 ft to 800 ft (BFW)
 - d. *Inner string Installation*: The production casing was drifted to prepare for the inner string installation. A new 5-1/2" (20#, L80, TSH 513) inner string consisting of 7949 ft was installed and cemented. A new spool was installed to accommodate the inner string
 - e. *Well Reassessment/Re-evaluation*: The cement shoe was drilled out. Casing inspection logs (MFL and MAC) were run from 7950 ft to surface. The block test was performed on the inner string. Final inspection logs (CBL and UT) were run from 8390 ft to surface. The well was cleaned out to 8900 ft.
 - f. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 8432 ft. of 2-7/8" (6.5#, L80, TSH 563 & 511) tubing with flow control components, a SSSV at 436 ft, and a 5" (Baker SC) Packer set at 8411 ft. The final installation integrity test was completed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. Post Injection Work: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

The existing steel liner was removed to properly inspect production casing, determining that an inner string was required. The tubing was downsized to optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$37,580	\$0	\$37,580
Contract Costs	\$31,431	\$8,358	\$39,789
Material	\$293,699	\$0	\$293,699
Other Direct Charges	\$1,703,368	\$81,557	\$1,784,925
Total Direct Cost	\$2,066,078	\$89,915	\$2,155,993

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$92,159	\$548	\$92,707
AFUDC	\$4,563	\$0	\$4,563
Property Taxes	\$4,459	\$0	\$4,459
Total Indirect Costs	\$101,181	\$548	\$101,729

Total Loaded Costs	\$2,167,259	\$90,463	\$2,257,722²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

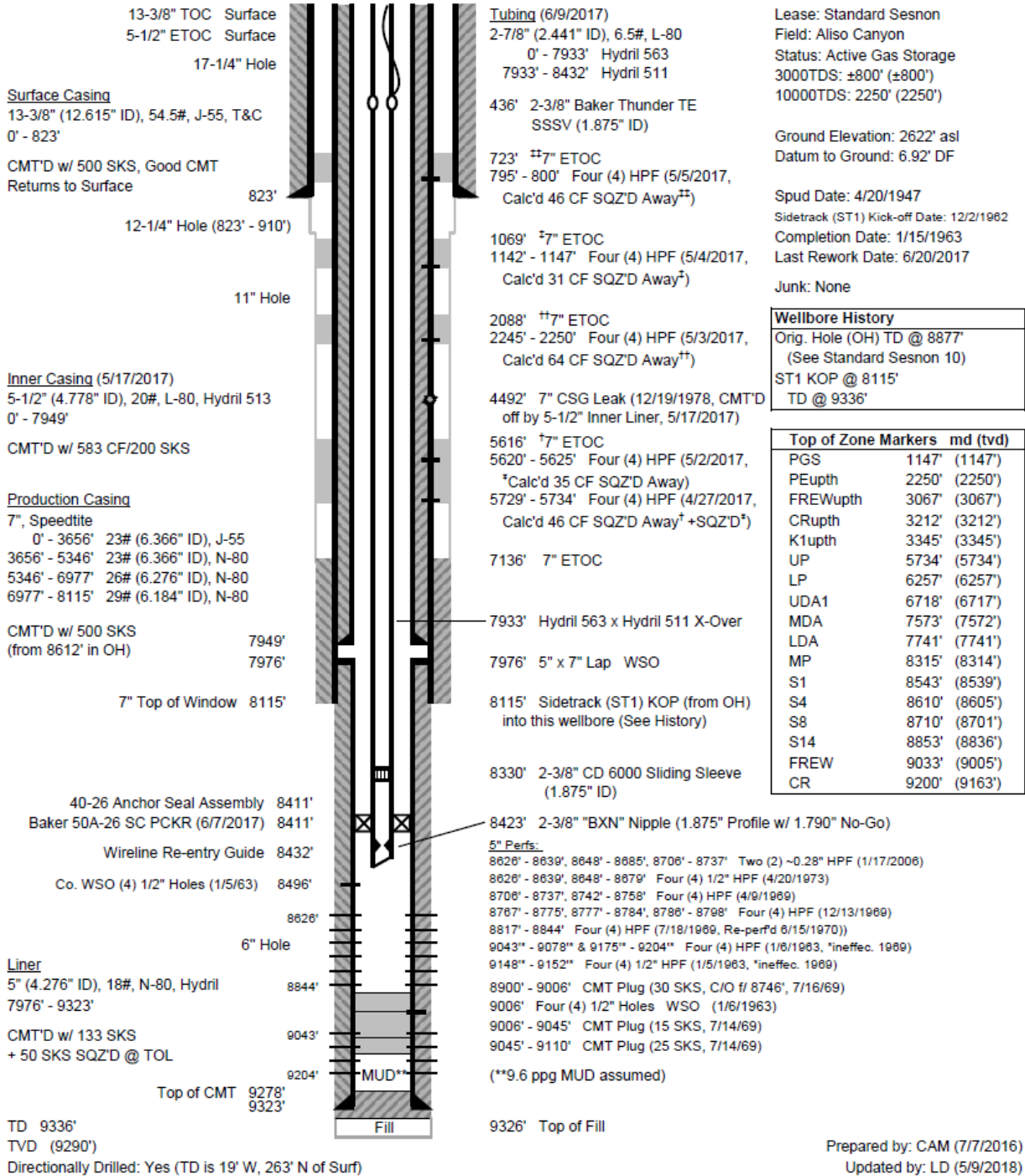
Storage Integrity Management Program Aliso Canyon – Standard Sesnon 10

IV. Wellbore Diagram after SIMP Work

Well Standard Sesnon 10 ST1

API #: 04-037-00040-01
Sec 29, T3N, R16W

Operator: So. California Gas Co.



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Standard Sesnon 31	API	04-037-00781-00
Project Type	Inner String/Liner Recompletion		
Well Status	Active	NOP:	08/07/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	09/14/1953		
Initial Completion	11/09/1953		
Elevation	2577 ft.		
Caprock Depth	8588 ft.		
Measured Depth	9130 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Standard Sesnon 31. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for well Standard Sesnon 31 used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 8824 ft of 2 7/8" (6.5#, J-55, EUE) tubing, bottom hole assembly, and 7" (Otis "WB") packer from 8817 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to 9128 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run UT, CBL, MFL, and MAC inspection logs from 8840 ft to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
 - c. Well Completion
 - i. Install approximately 8810 ft of 2-7/8" (6.5#, L80, TSH 563) tubing completion string, bottom hole assembly and 7" production packer, thereby converting the well to tubing flow.
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
 3. Post Rig Work
 - a. Unload Well and turn over to operations
 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	07/20/2016 02/01/2017 09/19/2017 02/13/2018
2	Noise and Temp Survey	04/06/2016 09/14/2016 02/08/2017 07/25/2017 09/19/2017 02/12/2018
3	Ultrasonic (UT)	08/11/2017 09/15/2017
4	Cement Bond Log (CBL)	08/11/2017 09/15/2017
5	Multi-Arm Caliper (MAC)	09/18/2017
6	Magnetic Flux Leakage (MFL)	09/18/2017
7	Pressure Integrity Test	09/19/2017
8	Annular and Tubing Pressure Test – Final	08/06/2018
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	08/07/2018
10	Return to Service	09/25/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	07/27/2017	09/21/2017
Rig Work Phase 2	06/28/2018	08/08/2018

C. Workover Explanation

1. Initial Rigless Assessment and Preparation
 - a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, determining that it was safe to isolate the well and move forward with the SIMP program
 - b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 1100 psi for 1 hour
2. Rig Work: The planned work for well Standard Sesnon 31 was completed in two phases
 - a. Phase 1 involved removing the existing production equipment, performing initial assessment and remedial work, installing production liner and inner string, re-running inspection logs, testing new inner string, and isolating the well
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 8824 ft of 2-7/8" (6.5#, J55, EUE) tubing, bottom hole assembly, and 7" (Otis "WB") packer from 8817 ft.
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 9116 ft. Gyro survey was run from 9116 ft. to surface. The UT and CBL inspection logs were run from 8840 ft to surface.
 - iii. *Zonal Remediation*: Per DOGGR requirements, three zones were perforated and cement squeezed, from 6775 ft to 6780 ft (UDA1), from 6017 ft to 6022 ft (UP), and from 4615 ft to 4620 ft (A1/USDW)
 - iv. *Inner String and Production Liner Installation*: The production casing was drifted to prepare for a new production liner and inner string. A new slotted liner consisting of 315 ft of 5" (18#, L80, TSH 513) was installed at 9041 ft, and a new 5-1/2" (20#, L80, TSH 513) inner string consisting of 8726 ft was installed and cemented. A new spool was installed to accommodate the inner string
 - v. *Well Reassessment/Re-evaluation*: The inner string shoe was drilled out. MAC and MFL were run from 8643 ft to surface. UT and CBL were run from 8646 ft to surface. A pressure integrity test was performed on the inner string
 - vi. *Well Isolation*: An isolation pressure test was performed. The wellhead was installed and tested
 - b. Phase 2 included cleaning out the well bore and running a new completion
 - i. *Well Decompletion*: The wellhead was removed
 - ii. *Well completion*: The wellbore was cleaned out to 9039 ft. A new completion string and bottom hole assembly were installed consisting of 8625 ft. of 2-7/8" (6.5#, L80, TSH 563) tubing with flow control

components, and a 5-1/2" (WFT Sealbore Arrowpac) Packer set at 8631 ft. The final installation integrity test was performed. A new wellhead was installed and tested

3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

The well was completed in two phases so the rig could address annular pressures in other wells once the storage field returned to injection. Initial inspection on 7" production casing detected anomalies, thus requiring a new inner string. In order to maintain full bore access throughout the well, a new production liner was installed. New completion procedures were developed and implemented to finish the workover. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$31,792	\$0	\$31,792
Contract Costs	\$244,985	\$45,673	\$290,658
Material	\$328,981	\$0	\$328,981
Other Direct Charges	\$1,465,201	\$73,102	\$1,538,303
Total Direct Cost	\$2,070,959	\$118,775	\$2,189,734

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$104,414	\$830	\$105,244
AFUDC	\$74,226	\$0	\$74,226
Property Taxes	\$10,806	\$0	\$10,806
Total Indirect Costs	\$189,446	\$830	\$190,276

Total Loaded Costs	\$2,260,405	\$119,605	\$2,380,010²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
 Standard Sesnon 31**

API #: 04-037-00781-00
 Sec 28, T3N, R16W

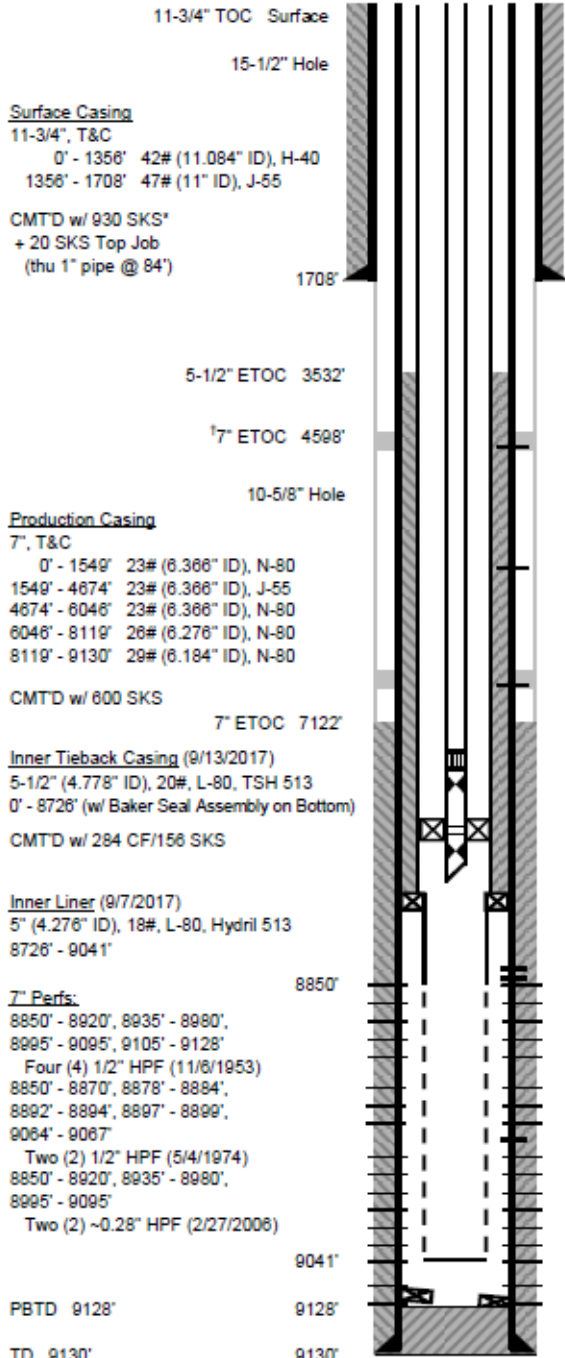
Operator: So. California Gas Co.

Lease: Standard Sesnon
 Field: Aliso Canyon
 Status: Active Gas Storage
 3000TDS: ±800' (±800')
 10000TDS: 4620' (4620')

Ground Elevation: 2577.47' asl
 Datum to Ground: 9.80' DF

Spud Date: 9/14/1953
 Completion Date: 11/9/1953
 Last Rework Date: 8/8/2018

Junk: Otis WB PCKR Milled &
 Pushed to 9116' (8/9/2017)



Tubing (8/3/2018)
 2-7/8" (2.441" ID), 6.5#, L-80, Hydrill 563
 0' - 8649'

Surface Casing
 11-3/4", T&C
 0' - 1356' 42# (11.084" ID), H-40
 1356' - 1708' 47# (11" ID), J-55

CMTD w/ 930 SKS*
 + 20 SKS Top Job
 (thu 1" pipe @ 84')

Production Casing
 7", T&C
 0' - 1549' 23# (6.366" ID), N-80
 1549' - 4674' 23# (6.366" ID), J-55
 4674' - 6046' 23# (6.366" ID), N-80
 6046' - 8119' 26# (6.276" ID), N-80
 8119' - 9130' 29# (6.184" ID), N-80

CMTD w/ 600 SKS
 7" ETOC 7122'

Inner Tieback Casing (9/13/2017)
 5-1/2" (4.778" ID), 20#, L-80, TSH 513
 0' - 8726' (w/ Baker Seal Assembly on Bottom)
 CMTD w/ 284 CF/156 SKS

Inner Liner (9/7/2017)
 5" (4.276" ID), 18#, L-80, Hydril 513
 8726' - 9041'

7" Perfs:
 8850' - 8920', 8935' - 8980',
 8995' - 9095', 9105' - 9128'
 Four (4) 1/2" HPF (11/6/1953)
 8850' - 8870', 8878' - 8884',
 8892' - 8894', 8897' - 8899',
 9064' - 9067'
 Two (2) 1/2" HPF (5/4/1974)
 8850' - 8920', 8935' - 8990',
 8995' - 9095'
 Two (2) ~0.28" HPF (2/27/2006)

PBTD 9128'
 TD 9130'
 TVD (9130')
 Directionally Drilled: No

4615' - 4620' Shot Perfs
 (Calc'd 8 CF SQZ'D Away[†], 8/17/2017)

6017' - 6022' Shot Perfs (Calc'd 0 CF SQZ'D Away, 8/16/2017,
 CMTD by Inner Tieback, 9/13/2017)

6767' **7" ETOC
 6775' - 6780' Four (4) HPF (Calc'd 4 CF SQZ'D Away**, 8/15/2017)

8582' Sliding Sleeve (2.313" ID)
 8620' X Nipple (2.313" ID)
 8631' Seal Latch (2.370" ID)
 8631.5' WEA Arrow-Pac PCKR (COE @ 8633', 7/31/2018)
 8647' XN Nipple (2.205" ID)
 8649' Tail
 8726' Baker ZXP Liner Top PCKR (9/7/2017)

8848' (4) Holes (test inconclusive)
 8849' (2) Holes WSO
 8850' (4) Holes (100 SKS CMT SQZ'D Away)

Inner Liner Perfs:
 ±8881' - ±9041' 2" x 80M, 12R, 6°C Slots
 8990' (4) 1/2" Holes (Co. WSO)

9108' Milled unknown Junk (8/29/2017)
 9116' Top of Junk (see desc. above)

Notes
 *Lost circ. w/ 50 CF of CMT to displace
 Used two centralizers each on 7" joints @ 9000' & 8832'

Top of Zone Markers	md	(tvd)
PGS	1700'	(1700')
A1	4620'	(4620')
A36	5606'	(5606')
UP	6020'	(6020')
LP	6480'	(6480')
UDA1	6780'	(6780')
MDA	7760'	(7760')
LDA	8040'	(8040')
MP	8588'	(8588')
S1	8790'	(8790')
S4	8854'	(8854')
S8	8992'	(8992')
S14	9104'	(9104')

Prepared by: LD (2/3/2016)
 Updated by: CAM (8/9/2018)



I. Background

Project Overview			
Field	Aliso Canyon		
Well Name	Ward 3A	API	04-037-22306-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	04/05/2017
Actual Cost	\$2,546,602		
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	10/10/1981		
Initial Completion	11/30/1981		
Ground Elevation	2226 ft.		
Caprock Depth	7075 ft.		
Measured Depth	7663 ft.		
Subject Regulations	DOGGR Order 1109; DOGGR UGS §1724.9; PHMSA IFR; API 1171; SB380		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)
4. **Senate Bill (SB) 380** – Signed into law May 10, 2016: Imposed a moratorium on injecting natural gas into Aliso Canyon until DOGGR, with concurrence from the California Public Utilities Commission (CPUC), determined a comprehensive safety review was completed on the facility. The comprehensive safety review utilized similar testing requirements developed under DOGGR Order 1109.

II. Workover Development

A. Plan

The intent of this program was to inspect the well integrity and remediate conditions identified as part of the Storage Integrity Management Program (SIMP). After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Ward 3A. This project planned to pull the 3-1/2" completion string, run inspection logs and a Gyro survey, pressure test casing and well laterals, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on casing pipe. The following describes the well workover plan for well Ward 3A used to acquire the necessary DOGGR NOI:

1. Initial Rigless Assessment and Preparation
 - a. Run Noise and Temperature survey
 - b. Well Isolation
2. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement

- ii. Pull existing completion consisting of 7242 ft of 3-1/2” (9.3#, J55, EUE) tubing, bottom hole assembly, and 8-5/8” (Otis “Permatrieve”) packer from 7231 ft.
- b. Well Assessment/Evaluation
 - i. Clean out well bore to target depth of 7658 ft.
 - ii. Run Gyro survey and MAC from total depth to surface
 - iii. Run inspection logs (MFL, UT, CBL) from top of liner to surface
 - iv. Perform pressure integrity test to 1.15 MAOP
- c. Well Completion
 - i. Install approximately 7220 ft. of 3-1/2” (9.3#, L80, TCPC) tubing of a new completion string, bottom hole assembly and 8-5/8” Packer at 7220 ft, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 3. Post Rig Work
 - a. Unload well and turn over to operations
- 4. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	08/11/2016
2	Noise and Temp Survey	03/09/2016 03/14/2016 04/01/2016 04/06/2017
3	Ultrasonic (UT)	02/28/2017
4	Cement Bond Log (CBL)	01/06/2017 02/28/2017
5	Multi-Arm Caliper (MAC)	02/27/2017
6	Magnetic Flux Leakage (MFL)	02/27/2017
7	Pressure Integrity Test	03/01/2017
8	Annular and Tubing Pressure Test – Final	03/28/2017
Approvals and Return to Service		

9	DOGGR Safety Review Team Approval	04/10/2017
10	Return to Service	07/31/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	11/15/2016	03/29/2017

C. Workover Explanation

1. Initial Rigless Assessment and Preparation

- a. Noise and Temperature surveys were completed, reviewed and approved by the DOGGR Safety Review Team, which determine that it was safe to isolate the well and move forward with the SIMP work
- b. The well was successfully isolated from the storage zone with a plug in the completion string as well as pressure tested to 1100 psi for 1 hour

2. Rig Work included removing existing production equipment, running inspection logs, perforating zone remedial, installing a new inner string, re-running inspection logs, pressure testing, and running new completion
 - a. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 7242 ft 3-1/2" (9.3#, J55, EUE) tubing, bottom hole assembly, and 8-5/8" (Otis "Permatrieve") packer from 7231 ft.
 - b. *Well Assessment/Evaluation*: The wellbore was cleaned out to 7658 ft. The Gyro survey was run from 7650 ft to surface. The CBL was run from 7278 ft. to surface
 - c. *Zonal Remediation*: Per DOGGR requirements, one zone (USDW) was perforated in two intervals and cement squeezed, from 2530 ft to 2550 ft, and from 2510 ft to 2530 ft, and 13-3/8" and 8-5/8" annular space perforated at 2055 ft and cemented to surface
 - d. *Inner string Installation*: The production casing was drifted to prepare for a new inner string installation. A new 6-5/8" (24#, L80, LT&C) inner string consisting of 7256 ft was installed and cemented. A new spool was installed to accommodate the inner string
 - e. *Well Reassessment/Re-evaluation*: The cement shoe was drilled out to 7224 ft. MAC was run from 7224 ft to surface. MFL inspection log was run from 5700 ft. to surface. Inspection logs (CBL and UT) were run from 7220 ft. to surface. The pressure integrity test was performed on the new inner string. The well was cleaned out to 7658 ft.
 - f. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 7166 ft. of 3-1/2" (L80, 9.3#, TSH 563) tubing with flow control components, and a 6-5/8" (HES, AS1-X) Packer set at 7145 ft. The final installation integrity test was completed. A new wellhead was installed and tested
3. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. *Post Injection Work*: Once the storage field returned to injection, annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

After initial inspections, it was determined a new inner string was required. As per DOGGR requirement, one zone was perforated and cement squeezed in the production casing. The annular space between the production and surface casing was cemented before running the new inner string. The tubing, flow



A  Semptra Energy utility®

Storage Integrity Management Program
Aliso Canyon – Ward 3A

components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	O&M Cost	Total Actual Costs
Company Labor	\$30,730	\$0	\$30,730
Contract Costs	\$42,346	\$0	\$42,346
Material	\$352,457	\$0	\$352,457
Other Direct Charges	\$2,145,972	\$77,679	\$2,223,651
Total Direct Cost	\$2,571,505	\$77,679	\$2,649,184

Indirect Costs	Capital (CAP) Cost	Actuals O&M	Total Actual Costs
Overheads	\$96,343	\$501	\$96,844
AFUDC	\$15,728	\$0	\$15,728
Property Taxes	\$2,302	\$0	\$2,302
Total Indirect Costs	\$114,373	\$501	\$114,874

Total Loaded Costs	\$2,685,878	\$78,180	\$2,764,058²
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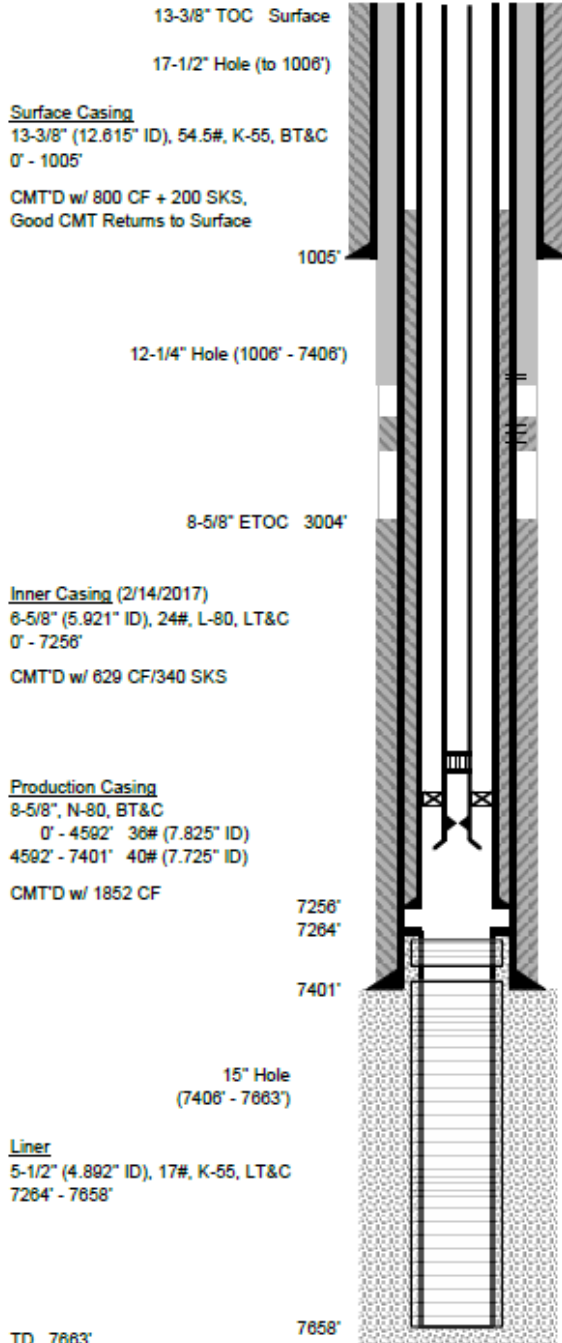
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Ward 3A**

API #: 04-037-22306-00
Sec 27, T3N, R16W

Operator: So. California Gas Co.



Surface **8-5/8" ETOC

Tubing (3/27/2017)
3-1/2" (2.992" ID), 9.3#, L-80, Hydril 563
0' - 7166'

907' 6-5/8" ETOC

2055' - 2060' Four (4) 0.43" HPF
(Calc'd 942 CF CMT SQZ'D Away**, 2/1/2017)
2510' - 2530' Two (2) 0.4" HPF (1/27/2017, See Notes*)
2530' - 2550' Two (2) 0.4" HPF (1/25/2017, See Notes*)

Lease: Ward
Field: Aliso Canyon
Status: Active Gas Storage
3000TDS: ±800' (±799')
10000TDS: TBD

Ground Elevation: 2226' asl
Datum to Ground: 19' KB

Spud Date: 10/10/1981
Completion Date: 11/30/1981
Last Rework Date: 3/29/2017

Junk: None

Notes
**No communication between 8-5/8" & 13-3/8". Calc'd 28 CF/ 62 LF CMT SQZ'D Away during CMTing of 6-5/8" Inner CSG on 2/14/2017.

7097' "XD" Sliding Sleeve (2.813" ID, Open Down)
7145' HES AS1-X PCKR (COE @ 7150', 3/27/2017)
7163' "XN" Nipple (2.813" Profile w/ 2.75" No-Go)
7166' Wireline Re-entry Guide

Liner Perfs:
7274' - 7311' & 7384' - 7658'
10-Mesh WWS

Gravel Packed w/
381 SKS (115% of Calc'd) 20-40

Top of Zone Markers	md	(tvd)
UP	4720'	(4704')
LP	5030'	(4998')
UDA1	5705'	(5639')
MDA	6367'	(6273')
LDA	6738'	(6632')
MP	7075'	(6958')
S1	7330'	(7205')
S4	7450'	(7321')
S8	7505'	(7375')
S14	7623'	(7489')

TD 7663'
TVD (7527')
Directionally Drilled: Yes (TD is 702' E, 738' S of Surf)

Prepared by: MAM (3/23/2016)
Updated by: LD (5/17/2018)

I. Background

Project Overview			
Field	Honor Rancho		
Well Name	WEZU 14	API	04-037-07606-00
Total Project Type	Recompletion		
Well Status	Active	NOP:	10/25/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	07/08/1956		
Initial Completion	09/03/1956		
Ground Elevation	1185 ft.		
Caprock Depth	5190 ft.		
Measured Depth	9512 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well WEZU 14. This project planned to pull the 2-7/8" completion string, run casing inspection logs, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well WEZU 14 used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 8906 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 7" (Otis "PW" Permatrieve) packer from 8900 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to liner top at 8953 ft.
 - ii. Run inspection logs (UT, CBL) from approximately 8953 ft. to surface.
 - iii. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - c. Well Completion
 - i. Install new 3-1/2" tubing completion string, bottom hole assembly, and 7" packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead

2. Post Rig Work
 - a. Unload well and turn over to operations
3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	10/24/2017
3	Ultrasonic (UT)	09/29/2017
4	Cement Bond Log (CBL)	09/29/2017
5	Multi-Arm Caliper (MAC)	09/27/2017
6	Magnetic Flux Leakage (MFL)	09/28/2017
7	Block Test	10/04/2017
8	Annular and Tubing Pressure Test – Final	10/13/2017
Approvals and Return to Service		
9	DOGGR Approval	10/18/2017
10	Return to Service	11/21/2017

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	08/09/2017	10/24/2017

C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing and running new completion equipment.
 - b. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 8906 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 7" (Otis "PW" Permatrieve) packer from 8900 ft.
 - c. *Well Assessment/Evaluation:* The well was cleaned out to 9512 ft. Gyro survey run from 9425 ft. to surface. Inspection logs (MAC, MFL) were run from 8926 ft. to surface; UT and CBL were run from 8920 ft. to surface, and the block test was performed
 - d. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 8895 ft. of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components and 7" (WFT AS) Packer set at 8869 ft. The final installation integrity test was performed. A new wellhead was installed and tested
 - e. *Well Unload:* The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.
2. Post Rig Work: Annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$12,414	\$0	\$12,414
Contract Costs	\$6,503	\$0	\$6,503
Material	\$161,174	\$0	\$161,174
Other Direct Charges	\$1,127,157	\$63,717	\$1,190,874
Total Direct Cost	\$1,307,248	\$63,717	\$1,370,965

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$47,287	\$494	\$47,781
AFUDC	\$1,833	\$0	\$1,833
Property Taxes	\$2,323	\$0	\$2,323
Total Indirect Costs	\$51,443	\$494	\$51,937

Total Loaded Costs	\$1,358,691	\$64,211	\$1,422,902²
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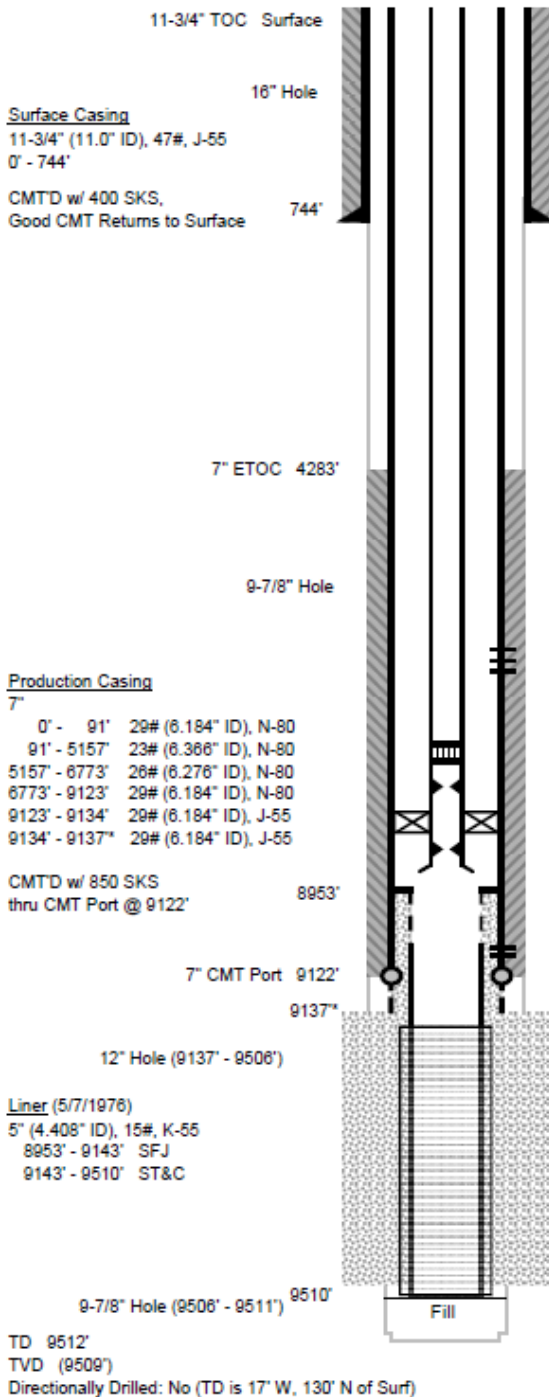
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
WEZU 14**

API #: 04-037-07608-00
Sec 8, T4N, R16W

Operator: So. California Gas Co.



Tubing (10/12/2017)
3-1/2" (2.992" ID), 9.3#, L-80
0' - 8813' Hydriil 563
8813' - 8895' Vam Top

Lease: WEZU
Field: Honor Rancho
Status: Active Gas Storage
3000TDS: ±600' (±800')
10000TDS: TBD

Ground Elevation: 1184.84' asl
Datum to Ground: 10.6' KB

Spud Date: 7/8/1956
Completion Date: 9/3/1956
Last Rework Date: 10/24/2017

Junk: None

Notes
*7" CSG originally ran to 9510' & CMT'D thru CMT Port @ 9122'. Slotted portion of 7" CSG was later milled out fr/ 9137' to 9512' in 4/1976 and replaced with new liner.

7983' Four (4) 1/2" Holes (30 SKS SQZ'D Away, 8/31/1956)
7995' Four (4) 1/2" Holes (8/31/1956) WSO
8000' Four (4) 1/2" Holes (30 SKS SQZ'D Away, 8/29/1956)

8820' W XO Sliding Sleeve (2.813" ID)
8856' WX Nipple (2.813" ID)
8865' WEA D&L Arrowset PCKR (COE @ 8869', 10/12/2017)
8883' WXN Nipple (2.75" w/ 2.635" No-Go)
8895' Wireline Re-entry Guide

9095' Four (4) 1/2" Holes (9/1/1956) WSO
9100' Four (4) 1/2" Holes (WSO 8/28/1956, 24 SKS SQZ'D Away, 8/30/1956)

7" CSG Perfs: 9134' - 9137' 2" x 80M, 16R, 6"C Slots

Liner Perfs:
8959' - 9082' 1-1/2" x 20M, 20R, 6"C Slots
9142' - 9510' 0.015" WWS

Gravel Packed w/ 323 SKS (135% of Calc'd) 10-16

Top of Zone Markers	md (tvd)
Yule	2966' (2966')
Towsley	5190' (5189')
Wayside '13'	9150' (9148')

9510' Cleaned Out Fill
(Prior to Running Liner, 5/7/1976)
(9511' - 9512') 8-1/2" Hole

Prepared by: MAM (2/9/2017)
Updated by: CAM (3/15/2018)

I. Background

Project Overview			
Field	Honor Rancho		
Well Name	WEZU 15	API	04-037-07607-01
Total Project Type	Recompletion		
Well Status	Active	NOP:	09/22/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	09/02/1956; Redrill 02/16/1976 (Sidetrack 1)		
Initial Completion	10/31/1956; Redrill Completion 04/27/1976		
Ground Elevation	1216 ft.		
Caprock Depth	5490 ft.		
Measured Depth	9675 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well WEZU 15. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well WEZU 15 used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 9037 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 7" (Otis "PW" Permatrieve) packer from 9030 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to liner top at 9069 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL and MAC) from approximately 9060 ft. to surface
 - iv. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - c. Well Completion

- i. Install new 3-1/2” tubing completion string, bottom hole assembly, and 7” packer thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	08/01/2017
3	Ultrasonic (UT)	08/01/2017
4	Cement Bond Log (CBL)	08/01/2017
5	Multi-Arm Caliper (MAC)	07/26/2017
6	Magnetic Flux Leakage (MFL)	07/27/2017
7	Block Test	08/09/2017
8	Annular and Tubing Pressure Test – Final	08/29/2017
Approvals and Return to Service		
9	DOGGR Approval	08/31/2017
10	Return to Service	10/09/2017

2. Project timeline

Major Milestone	Start	Finish
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Rig Work	07/05/2017	09/22/2017
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C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing and running new completion equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 9037 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 7" (Otis "PW" Permatrieve) packer from 9030 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 9660 ft. Gyro survey run from 9650 ft. to surface. Inspection logs (MAC, MFL) were run from 9055 ft. to surface; UT and CBL were run from 9040 ft. to surface, and the block test was performed
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 9020 ft. of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components and 7" (WFT AS) Packer set at 8997 ft. The final installation integrity test was performed. A new wellhead was installed and tested
 - d. *Well Unload:* The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
2. Post Rig Work: Annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

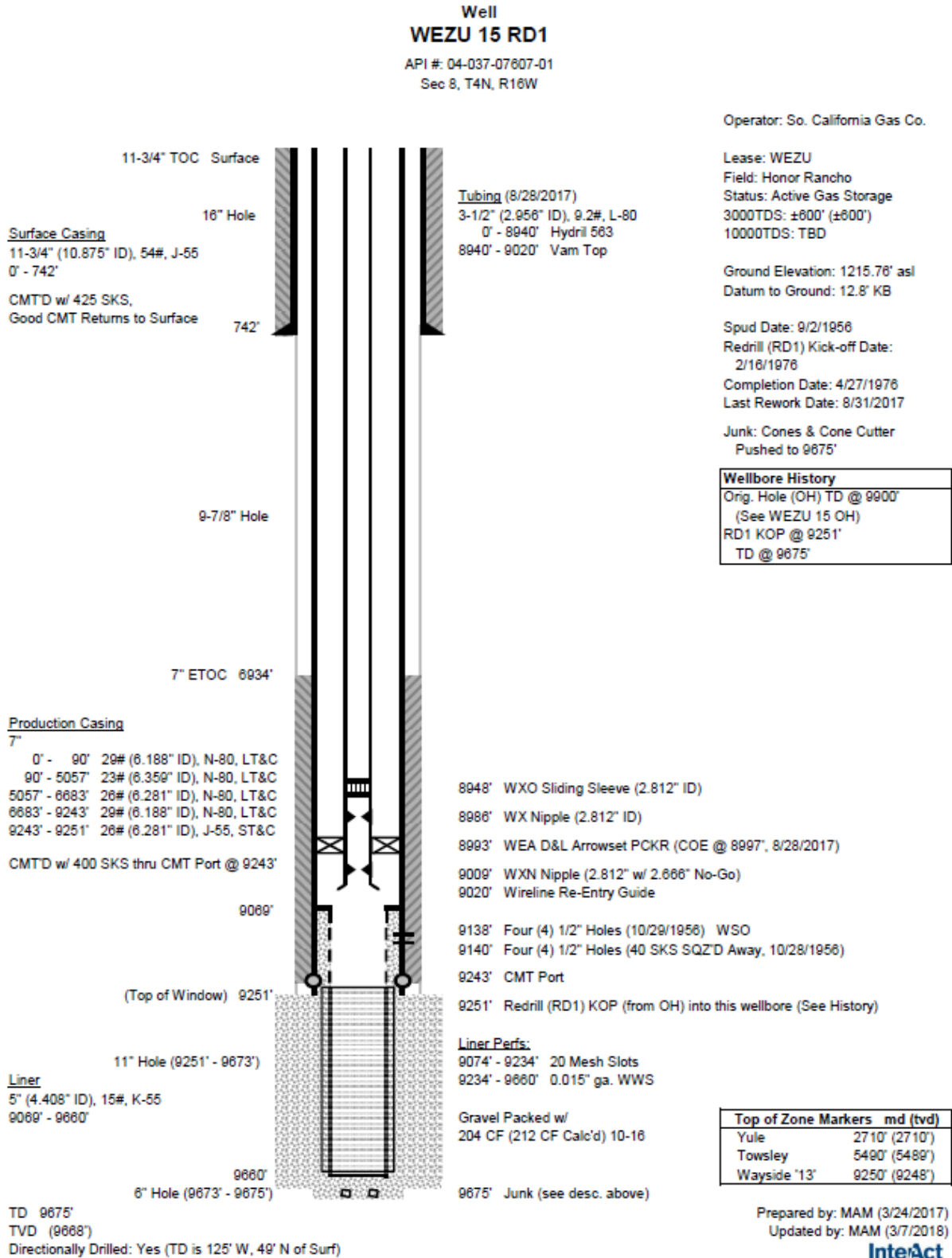
Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$7,860	\$18,070	\$25,930
Contract Costs	\$0	\$3,919	\$3,919
Material	\$177,950	\$269	\$178,219
Other Direct Charges	\$843,044	\$160,447	\$1,003,491
Total Direct Cost	\$1,028,854	\$182,705	\$1,211,559

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$38,622	\$12,485	\$51,107
AFUDC	\$117	\$0	\$117
Property Taxes	\$4,168	\$0	\$4,168
Total Indirect Costs	\$42,907	\$12,485	\$55,392

Total Loaded Costs	\$1,071,761	\$195,190	\$1,266,951²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Honor Rancho		
Well Name	WEZU 16	API	04-037-07608-00
Project Type	Steel Liner Recompletion		
Well Status	Active	NOP:	08/31/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/16/1956		
Initial Completion	01/11/1957		
Ground Elevation	1166 ft.		
Caprock Depth	6070 ft.		
Measured Depth	9780 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well WEZU 16. This project planned to pull 2-3/8" completion string and uncemented 5-1/2" inner string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well WEZU 16 used to acquire the necessary DOGGR NOI:

1. Rig Work

a. Well Decompletion

- i. Remove wellhead components for refurbishing and inspection, or for replacement
- ii. Pull existing completion consisting of 8813 ft. of 2-3/8" (4.7#, N80, EUE) tubing and bottom hole assembly
- iii. Pull existing inner string consisting of 2870 ft. of 5-1/2" (20#, N80, FL4S) casing, 7" (HES WC) packer from 2870 ft, and 7" (HES BWB) packer from 8800 ft.

b. Well Assessment/Evaluation

- i. Clean out wellbore to liner top at 9121 ft.
- ii. Run Gyro survey from total depth to surface
- iii. Run inspection logs (UT, CBL, MAC, MFL) from approximately 9120 ft. to surface
- iv. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)

- v. Based on log results supplementary work may be needed
- c. Well Completion
 - i. Install 3-1/2" new tubing completion string, bottom hole assembly, and 7" packer thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	08/30/2018
3	Ultrasonic (UT)	04/30/2018
4	Cement Bond Log (CBL)	04/30/2018
5	Multi-Arm Caliper (MAC)	05/01/2018 08/16/2018
6	Magnetic Flux Leakage (MFL)	05/01/2018
7	Block Test	08/01/2018
8	Annular and Tubing Pressure Test – Final	08/22/2018
Approvals and Return to Service		
9	DOGGR Approval	11/09/2018
10	Return to Service	10/06/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	03/21/2018	08/30/2018

C. Workover Explanation

1. Rig Work included the planned decompletion of existing production equipment and inner string, well bore clean out, running inspection logs, installing new steel liners, block testing, and running new completion tubing and equipment.
 - a. *Well Decompletion/Assessment:* This step included the planned removal of wellhead components and production equipment consisting of 8813 ft. of 2-3/8" (4.7#, N80, EUE) tubing, bottom hole assembly, 2870 ft. of 5-1/2" (20#, N80, FL4S) casing, 7" (HES WC) from 2870 ft, and 7" (HES BWB) packer from 8800 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 9720 ft. The Gyro survey was run from 9720 ft. to surface. The CBL and UT were run from 9111 ft. to surface. MAC and MFL were run from 9089 ft. to surface. Block test suspended to run new steel liner
 - c. *Steel Liner Installation:* The production casing was drifted to prepare for a new steel liner installation. Two new sets of steel liner were installed from 9020 ft. to 8983 ft. and from 2779 ft. to 1144 ft.
 - d. *Well Reassessment/Re-evaluation:* The block test was performed
 - e. *Well Completion:* A new completion string and bottom hole assembly were run but restrictions were encountered
 - f. *Well Reassessment/Re-evaluation:* The production casing and steel liners were drifted to prepare for completion installation. A MAC was run from 9020 ft. to surface
 - g. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 8959 ft. of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components, and a 7" (WFT AS) Packer set at 9012 ft. The final installation integrity test was completed. A new wellhead was installed and tested
 - h. *Well Unload:* The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
2. Post Rig Work: Annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

After initial inspections, the well required steel liner installation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$22,283	\$108	\$22,391
Contract Costs	\$177,476	\$0	\$177,476
Material	\$539,830	\$0	\$539,830
Other Direct Charges	\$2,225,989	\$48,285	\$2,274,274
Total Direct Cost	\$2,965,578	\$48,393	\$3,013,971

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$140,686	\$572	\$141,258
AFUDC	\$26,043	\$0	\$26,043
Property Taxes	\$7,815	\$0	\$7,815
Total Indirect Costs	\$174,544	\$572	\$175,116

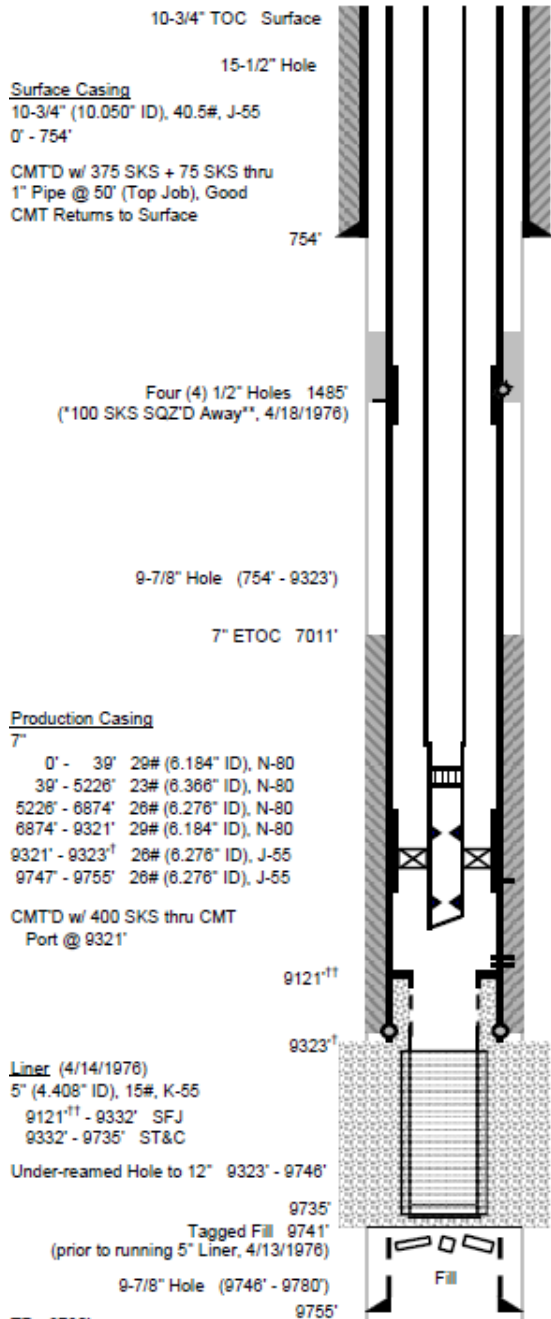
Total Loaded Costs	\$3,140,122	\$48,965	\$3,189,087²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
WEZU 16

API #: 04-037-07808-00
Sec 8, T4N, R16W



Tubing (8/21/2018)
3-1/2" (2.992" ID), 9.2#, L-80, Hydril 563
0' - 8959'
2-7/8" (2.441" ID), 6.4#, L-80, VAM Top
8959' - 9037'

Operator: So. California Gas Co.
Work Order #: 92915
Lease: WEZU
Field: Honor Rancho
Status: Active Gas Storage
3000TDS: ±600' (±600')
10000TDS: 2327' (2327')
Ground Elevation: 1166.97' asl
Datum to Ground: 12.53' KB
Spud Date: 11/16/1956
Completion Date: 1/11/1957
Last Rework Date: 8/30/2018

Junk: One Arm & Two Cones; Nose Cone & Unknown Junk, All Pushed to 9747'

1050' **7" ETOC
1144' - 2779' 5-1/2", 17# MCL/Metal Skin Liner (5.623" ID, 7/25/2018)
1456' - 1503' CSG Leak Between (see Shot Holes @ 1485' for Remediation Details*, 4/16/1976)

Notes
[†]9323' - 9747' Milled Window in 7" CSG (3/17/1976)
^{††}Top of 5" liner originally reported @ 9121', tagged at 9127' on 4/20/2018

8959' 3-1/2" x 2-7/8" X-Over
8964' WXO Sliding Sleeve (2.313" ID)
8983' - 9020' 5-1/2", 17# MCL/Metal Skin Packer Seat (5.440" ID, 7/12/2018)
8998' WX Nipple (2.313" ID)
9007' - 9015' WEA Metal Skin Arrowset PCKR (COE @ 9012', 8/21/2018)
9016' Four (4) 1/2" Holes (3/26/1976) WSO
9025' WXN Nipple (2.313" w/ 2.205" No-Go)
9037' Wireline Re-entry Guide
9096' Four (4) 1/2" Holes (1/10/1957) WSO
9098' Four (4) 1/2" Holes (10 SKS SQZ'D Away, 1/9/1957)

9321' CMT Port
5" Perfs:
9137' - 9268' 1-1/2" x 20M, 20R, 6°C Slots
9334' - 9733' 0.015" ga. WWS
Gravel Packed w/ 327 SKS (108% of Calc'd) 10-16

9720' Unable to C/O Below (4/24/2018)
9747' Junk (See desc. above)
7" Perfs:
9747' - 9755' 2" x 80M, 16R, 6°C Slots

Geologic Zone Markers md (tvd)	
Yule	2910' (2910')
Towsley	6070' (6087')
Wayside '13'	9345' (9340')

TD 9780'
TVD (9774')
Directionally Drilled: No (TD is 47° E, 168° N of Surf)

Prepared by: MAM (3/27/2017)
Updated by: LD (11/13/2018)

I. Background

Project Overview			
Field	Honor Rancho		
Well Name	WEZU 16A	API	04-037-21678-00
Total Project Type	Recompletion		
Well Status	Active	NOP:	12/18/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	10/19/1975		
Initial Completion	12/30/1975		
Ground Elevation	1179 ft.		
Caprock Depth	6010 ft.		
Measured Depth	9365 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well WEZU 16A. This project planned to pull 3-1/2" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well WEZU 16A used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 8890 ft. of 3-1/2" (9.3#, J55/N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Otis "PW" Permatrieve) packer from 9030 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to liner top at 8905 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL and MAC) from approximately 8900 ft. to surface
 - iv. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - c. Well Completion

- i. Install new 3-1/2” tubing completion string, bottom hole assembly, and 9-5/8” packer thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	11/20/2017
3	Ultrasonic (UT)	10/06/2017
4	Cement Bond Log (CBL)	10/06/2017
5	Multi-Arm Caliper (MAC)	10/09/2017
6	Magnetic Flux Leakage (MFL)	10/16/2017
7	Block Test	10/24/2017
8	Annular and Tubing Pressure Test – Final	11/09/2017 12/01/2017
Approvals and Return to Service		
9	DOGGR Approval	11/13/2017 12/06/2017
10	Return to Service	01/19/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	09/05/2017	12/18/2017

C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing, running new completion equipment and resetting packer
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 8890 ft. of 3-1/2" (9.3#, J55/N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Otis "PW" Permatrieve) packer from 9030 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 9329 ft. Gyro survey run from 9329 ft. to surface. Inspection logs (CBL, UT) were run from 8880 ft. to surface; MAC and MFL were run from 8872 ft. to surface. The block test was performed
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 8781 ft. of 4-1/2" (12.6#, L80, VAM TOP) tubing with flow control components and 9-5/8" (WFT ASX-1) Packer set at 8754 ft. The final installation integrity test was performed. A new wellhead was installed and tested
 - d. *Well Unload:* Well was unloaded, but packer fluid would not remain at calculated depth. Noise and Temperature log was run, determining the packer needed to be re-set
 - e. *Well Re-completion:* The wellhead was removed, and the tubing string was reset in the packer with additional compressive weight to complete the installation. The final installation integrity test was performed, and the wellhead was re-installed and tested
 - f. *Well Unload:* The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
2. Post Rig Work: Annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

Tubing string was upsized to optimize well operation. The completion string was required to be reset because the fluid column in the annulus could not be sustained. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$7,726	\$0	\$7,726
Contract Costs	\$0	\$0	\$0
Material	\$259,386	\$0	\$259,386
Other Direct Charges	\$1,590,671	\$46,952	\$1,637,623
Total Direct Cost	\$1,857,783	\$46,952	\$1,904,735

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$62,761	\$322	\$63,083
AFUDC	\$6,758	\$0	\$6,758
Property Taxes	\$1,178	\$0	\$1,178
Total Indirect Costs	\$70,697	\$322	\$71,019

Total Loaded Costs	\$1,928,480	\$47,274	\$1,975,754²
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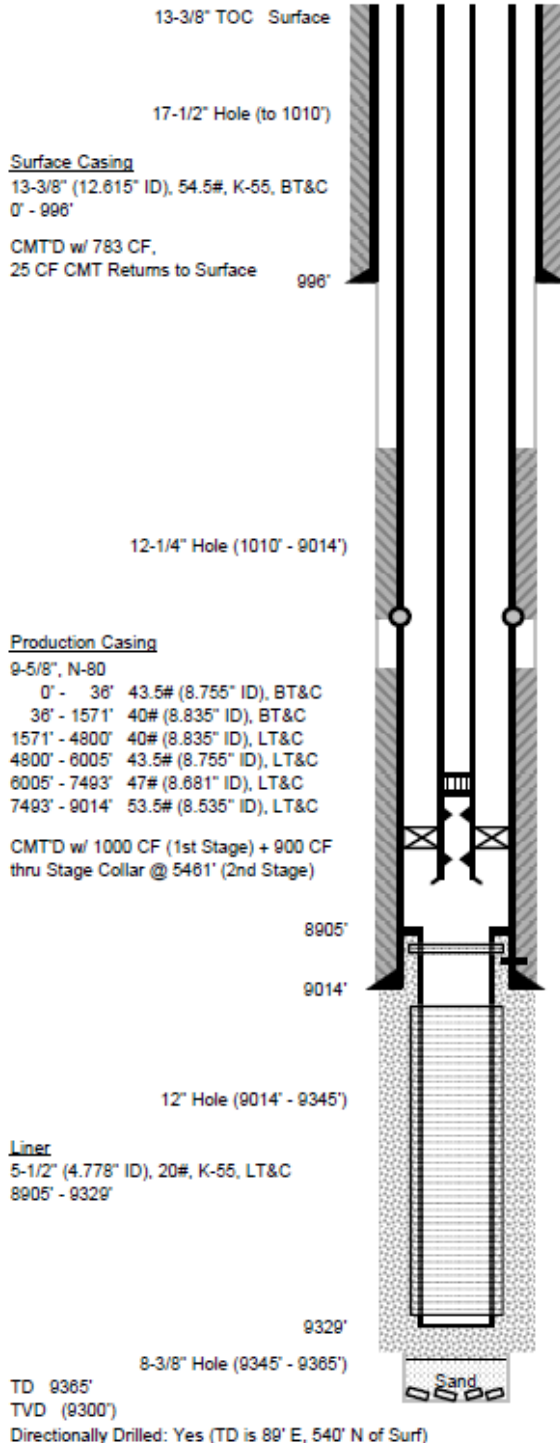
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
WEZU 16A

API #: 04-037-21678-00
Sec 8, T4N, R16W

Operator: So. California Gas Co.



Tubing (11/30/2017)
4-1/2" (3.958" ID), 12.6#, L-80, VAM Top
0' - 8781'

Lease: WEZU
Field: Honor Rancho
Status: Active Gas Storage
3000TDS: ±600' (±800')
10000TDS: TBD

Ground Elevation: 1179' asl
Datum to Ground: 15' KB

Spud Date: 10/19/1975
Completion Date: 12/30/1975
Last Rework Date: 12/18/2017

Junk: 4 cones from underreamer
@ 9365'

2767' 9-5/8" ETOC (2nd Stage)

12-1/4" Hole (1010' - 9014')

5641' Stage Collar

5987' 9-5/8" ETOC (1st Stage)

Production Casing

9-5/8", N-80
0' - 36' 43.5# (8.755" ID), BT&C
36' - 1571' 40# (8.835" ID), BT&C
1571' - 4800' 40# (8.835" ID), LT&C
4800' - 6005' 43.5# (8.755" ID), LT&C
6005' - 7493' 47# (8.681" ID), LT&C
7493' - 9014' 53.5# (8.535" ID), LT&C

CMTD w/ 1000 CF (1st Stage) + 900 CF
thru Stage Collar @ 5461' (2nd Stage)

8701' W XO Sliding Sleeve (3.81" ID)
8743' WX Nipple (3.81" ID)
8750' WEA D&L ASX-1 PCKR (COE @ 8754'; 11/30/2017)
8769' WXN Nipple (3.81" w/ 3.725" No-Go)
8781' Wireline Re-entry Guide

8905'

8970' - 8971' Four (4) 1/2" Holes (12/1/1975) WSO

9014'

12" Hole (9014' - 9345')

Liner Perfs:

8942' - 8944' 0.015" Tattletale Screen
9033' - 9316' 0.015" WWS

Liner

5-1/2" (4.778" ID), 20#, K-55, LT&C
8905' - 9329'

Gravel Packed w/ 281 SKS (114% of Calc'd) 0.040" x 0.060"

9329'

8-3/8" Hole (9345' - 9365')

9348' - 9365' Sand Plug (7 CF, 12/22/1975)
9365' Junk (see desc. above)

TD 9365'
TVD (9300')

Directionally Drilled: Yes (TD is 89' E, 540' N of Surf)

Top of Zone Markers	md (tvd)
Yule	2910' (2909')
Towsley	6010' (6007')
Wayside '13'	9000' (8941')

Prepared by: MAM (2/8/2017)
Updated by: MAM (3/14/2018)

I. Background

Project Overview			
Field	Honor Rancho		
Well Name	WEZU 22	API	04-037-07611-00
Total Project Type	Recompletion		
Well Status	Active	NOP:	03/20/2018
Well Characteristics			
Well Type	Withdrawal Only		
Spud Date	11/05/1956		
Initial Completion	01/03/1957		
Ground Elevation	1233 ft.		
Caprock Depth	5985 ft.		
Measured Depth	10086 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
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¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well WEZU 22. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well WEZU 22 used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 9393 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 7" (Baker Retrieva-D) packer from 9382 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to liner top at 9441 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL and MAC) from approximately 9440 ft. to surface
 - iv. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - c. Well Completion

- i. Install new 3-1/2” tubing completion string, bottom hole assembly, and 7” packer thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/19/2018
3	Ultrasonic (UT)	01/24/2018
4	Cement Bond Log (CBL)	01/24/2018
5	Multi-Arm Caliper (MAC)	01/26/2018
6	Magnetic Flux Leakage (MFL)	01/26/2018
7	Block Test	02/15/2018
8	Annular and Tubing Pressure Test – Final	03/13/2018
Approvals and Return to Service		
9	DOGGR Approval	03/19/2018
10	Return to Service	05/01/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	12/19/2017	03/20/2018

C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing and running new completion equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 9393 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 7" (Baker Retrieva-D) packer from 9382 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 9844 ft. Gyro survey run from 9834 ft. to surface. Inspection logs (CBL, UT) were run from 9417 ft. to surface; MAC and MFL were run from 9402 ft. to surface. The block test was performed
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 9323 ft. of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components and 7" (WFT AP) Packer set at 9294 ft. The final installation integrity test was performed. A new wellhead was installed and tested
 - d. *Well Unload:* The well was unloaded to a calculated fluid depth and turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$25,458	\$0	\$25,458
Contract Costs	\$126,375	\$0	\$126,375
Material	\$444,924	\$0	\$444,924
Other Direct Charges	\$982,928	\$37,964	\$1,020,892
Total Direct Cost	\$1,579,685	\$37,964	\$1,617,649

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$76,583	\$263	\$76,846
AFUDC	\$8,327	\$0	\$8,327
Property Taxes	\$2,227	\$0	\$2,227
Total Indirect Costs	\$87,137	\$263	\$87,400

Total Loaded Costs	\$1,666,822	\$38,227	\$1,705,049²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
WEZU 22**

API #: 04-037-07611-00
Sec 7, T4N, R16W

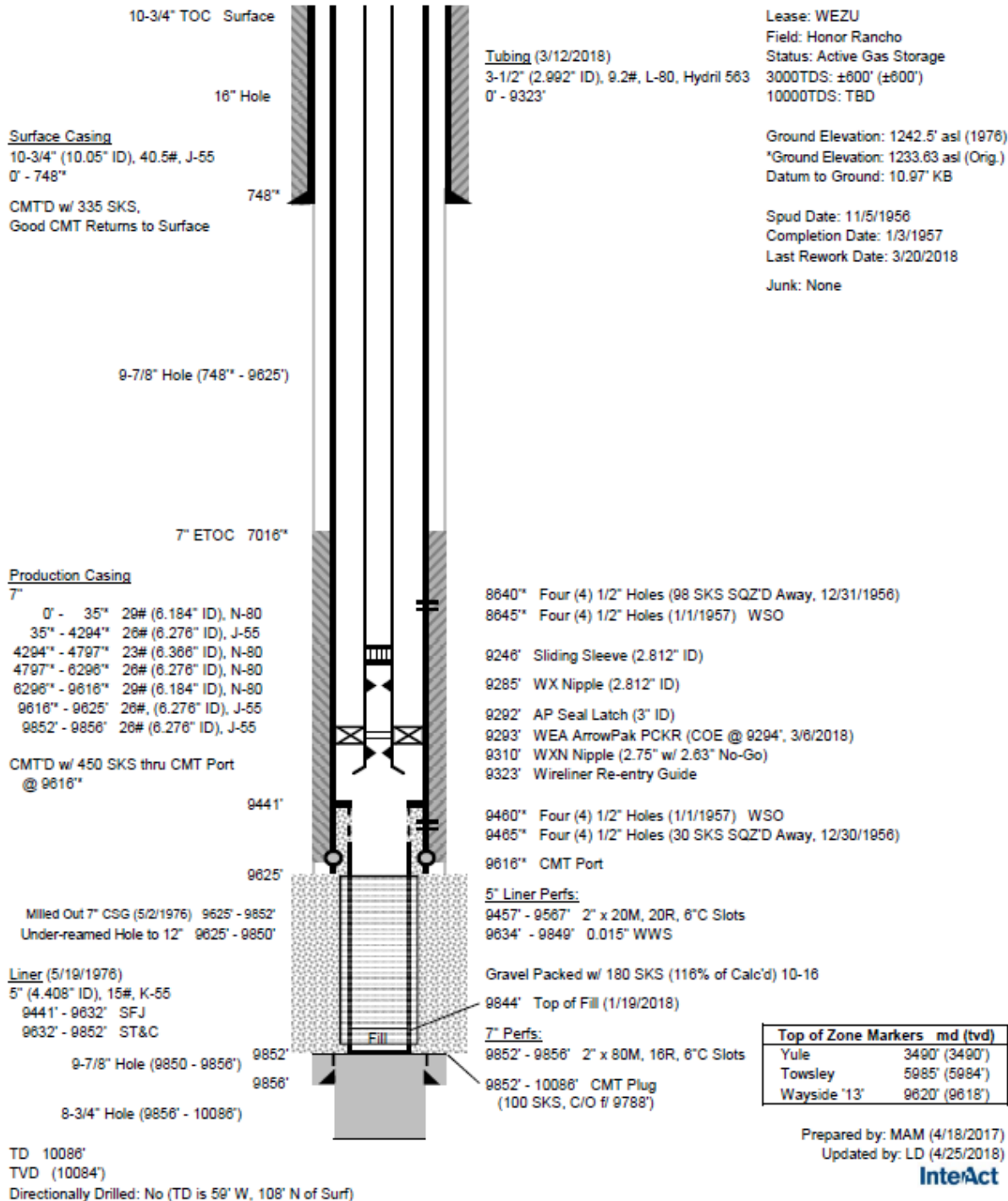
Operator: So. California Gas Co.

Lease: WEZU
Field: Honor Rancho
Status: Active Gas Storage
3000TDS: ±600' (±600')
10000TDS: TBD

Ground Elevation: 1242.5' asl (1976)
*Ground Elevation: 1233.63 asl (Orig.)
Datum to Ground: 10.97' KB

Spud Date: 11/5/1956
Completion Date: 1/3/1957
Last Rework Date: 3/20/2018

Junk: None



I. Background

Project Overview			
Field	Honor Rancho		
Well Name	WEZU 23	API	04-037-07612-01
Total Project Type	Recompletion		
Well Status	Active	NOP:	04/23/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/24/1957; Redrill 11/07/1996 (Sidetrack 1)		
Initial Completion	01/22/1958; Redrill Completion 12/01/1996		
Ground Elevation	1234 ft.		
Caprock Depth	7790 ft.		
Measured Depth	10897 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well WEZU 23. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well WEZU 23 used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 9494 ft. of 2-7/8" (6.5#, 13Cr, Fox) tubing, bottom hole assembly, and 7" (Baker "HB") packer from 9494 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to liner top at 9605 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL and MAC) from approximately 9600 ft. to surface
 - iv. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - c. Well Completion

- i. Install new 2-7/8” tubing completion string, bottom hole assembly, and 7” packer thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
2. Post Rig Work
 - a. Unload well and turn over to operations
3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	04/19/2018
3	Ultrasonic (UT)	02/09/2018
4	Cement Bond Log (CBL)	02/09/2018
5	Multi-Arm Caliper (MAC)	02/12/2018
6	Magnetic Flux Leakage (MFL)	02/13/2018
7	Block Test	02/22/2018
8	Annular and Tubing Pressure Test – Final	04/11/2018
Approvals and Return to Service		
9	DOGGR Approval	05/01/2018
10	Return to Service	06/17/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work	01/22/2018	04/27/2018

C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing and running new completion equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 9494 ft. of 2-7/8" (6.5#, 13Cr, Fox) tubing, bottom hole assembly, and 7" (Baker "HB") packer from 9494 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 10399 ft. Gyro survey was run from 10299 ft. to surface. Inspection logs (UT, CBL) were run from 9568 ft. to surface; MAC was run from 9564 ft. to surface and MFL was run from 9568 ft. to surface. The block test was performed
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 9351 ft. of 2-7/8" (6.5#, 13Cr, VAM TOP) tubing with flow control components and 7" (WFT AS) Packer set at 9328 ft. The final installation integrity test was performed. A new wellhead was installed and tested
 - d. *Well Unload:* The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
2. Post Rig Work: Annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$5,912	\$3,992	\$9,904
Contract Costs	\$120,321	\$6,672	\$126,993
Material	\$779,758	\$1,744	\$781,502
Other Direct Charges	\$929,683	\$50,422	\$980,105
Total Direct Cost	\$1,835,674	\$62,830	\$1,898,504

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$75,522	\$11,810	\$87,332
AFUDC	\$7,122	\$0	\$7,122
Property Taxes	\$1,091	\$0	\$1,091
Total Indirect Costs	\$83,735	\$11,810	\$95,545

Total Loaded Costs	\$1,919,409	\$74,640	\$1,994,049²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
WEZU 23 ST1
API #: 04-037-07812-01
Sec 7, T4N, R16W

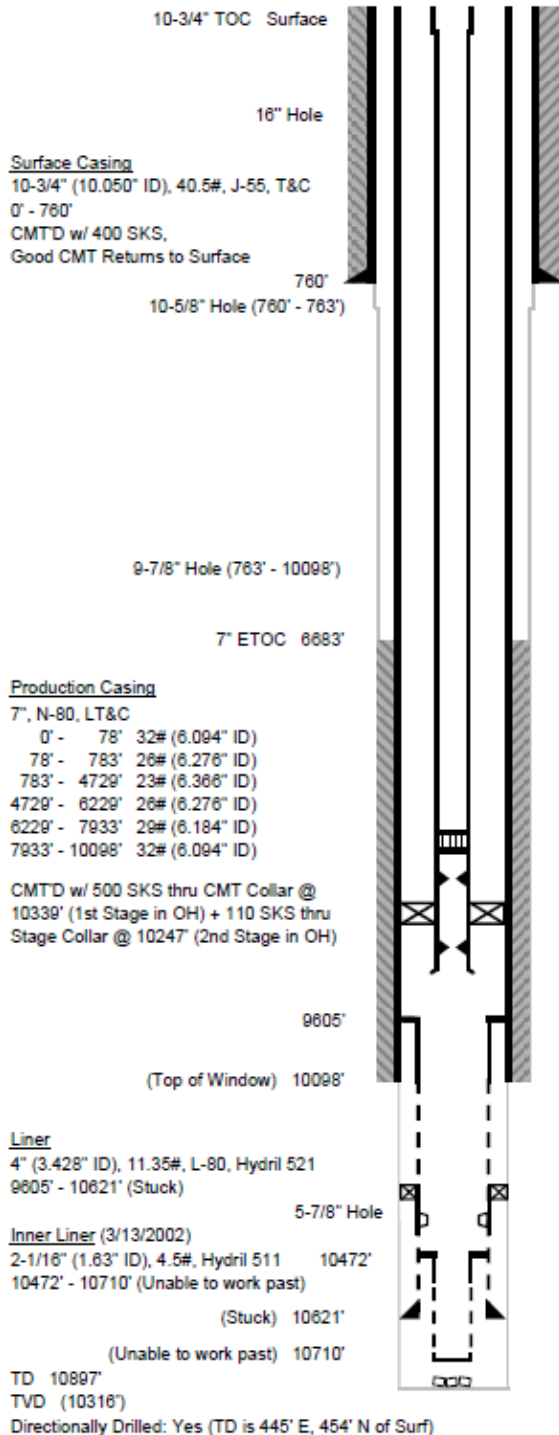
Operator: So. California Gas Co.
Work Order #: 20712
Lease: WEZU
Field: Honor Rancho
Status: Active Gas Storage
3000TDS: ±600' (±600')
10000TDS: TBD

Ground Elevation: 1234.2' asl
Datum to Ground: 11' KB

Spud Date: 11/24/1957
Sidetrack (ST1) Kick-off Date:
11/7/1996
Completion Date: 12/1/1996
Last Rework Date: 4/20/2018

Junk: Three (3) Cones & Bullnose f/
Hole Opener Pushed to 10897'

Wellbore History	
Orig. Hole (OH) TD @ 10790'	(See WEZU 23)
ST1 KOP @ 10098'	TD @ 10897'



24' 3-1/2" x 2-7/8" X-Over
Tubing (4/10/2018)
3-1/2" (2.892" ID), 9.2#, 13CH, Vam Top
0' - 24'
2-7/8" (2.441" ID), 6.4#, 13CH, Vam Top
24' - 9351'

9272' WXO Sliding Sleeve (2.313" ID)
9317' WX Nipple (2.313" ID)
9324' WEA Arrowset (COE @ 9328', 4/10/2018)
9340' WXN Nipple (2.313" w/ 2.205" No-Go)
9351' Wireline Re-entry Guide

10098' Sidetrack (ST1) KOP (from OH) into this wellbore (See History)
4" Liner Perfs:
10189' - 10297', 10407' - 10621' 32-2-6-23-0 Slots
10297' - 10340' 32-2-6-23-0 Blank/Slotted
10340' Baker CMX External CSG PCKR (not inflated)
10399' Polish Bore Receptacle

2-1/16" Liner Perfs:
Slotted (Specs not reported)

10897' Junk (see desc. above)

Geologic Zone Markers	md (tvd)
Yule	4525' (4524')
Towsley	7790' (7787')
Wayside '13'	10390' (10295')

Prepared by: HEE (3/20/2018)
Updated by: CAM (9/26/2018)



I. Background

Project Overview			
Field	Honor Rancho		
Well Name	WEZU 24	API	04-037-07613-01
Total Project Type	Recompletion		
Well Status	Active	NOP:	10/22/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	05/01/1958; 06/12/1976 (Sidetrack 1)		
Initial Completion	06/13/1958; Redrill Completion 07/14/1976		
Ground Elevation	1274 ft.		
Caprock Depth	6380 ft.		
Measured Depth	10190 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well WEZU 24. This project planned to pull 2-7/8" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well WEZU 24 used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 9618 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 7" (Baker Retrieva-D) packer from 9610 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to liner top at 9672 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL and MAC) from approximately 9670 ft. to surface
 - iv. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - c. Well Completion

- i. Install new 3-1/2” tubing completion string, bottom hole assembly, and 7” packer thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	10/22/2018
3	Ultrasonic (UT)	09/18/2018
4	Cement Bond Log (CBL)	09/18/2018
5	Multi-Arm Caliper (MAC)	09/20/2018
6	Magnetic Flux Leakage (MFL)	09/21/2018
7	Block Test	09/26/2018
8	Annular and Tubing Pressure Test – Final	10/09/2018
Approvals and Return to Service		
9	DOGGR Approval	11/07/2020
10	Return to Service	12/21/2018

2. Project timeline

Major Milestone	Start	Finish
Rig Work	08/16/2018	10/22/2018

C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing and running new completion equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 9618 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 7" (Baker Retrieva-D) packer from 9610 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 10176 ft. Gyro survey run from 10173 ft. to surface. Inspection logs (CBL, UT) were run from 9635 ft. to surface; MAC was run from 9635 ft. to surface and MFL was run from 9637 ft. to surface. The block test was performed
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 9568 ft. of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components and 7" (HES AHC) Packer set at 9550 ft. The final installation integrity test was performed. A new wellhead was installed and tested
 - d. *Well Unload:* The well was unloaded to a calculated fluid depth and turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$4,507	\$420	\$4,927
Contract Costs	\$35,925	\$0	\$35,925
Material	\$46,276	\$0	\$46,276
Other Direct Charges	\$1,152,428	\$84,710	\$1,237,138
Total Direct Cost	\$1,239,136	\$85,130	\$1,324,266

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$52,335	\$998	\$53,333
AFUDC	\$3,650	\$0	\$3,650
Property Taxes	\$1,961	\$0	\$1,961
Total Indirect Costs	\$57,946	\$998	\$58,944

Total Loaded Costs	\$1,297,082	\$86,128	\$1,383,210²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
WEZU 24 ST1
API #: 04-037-07813-01
Sec 7, T4N, R16W

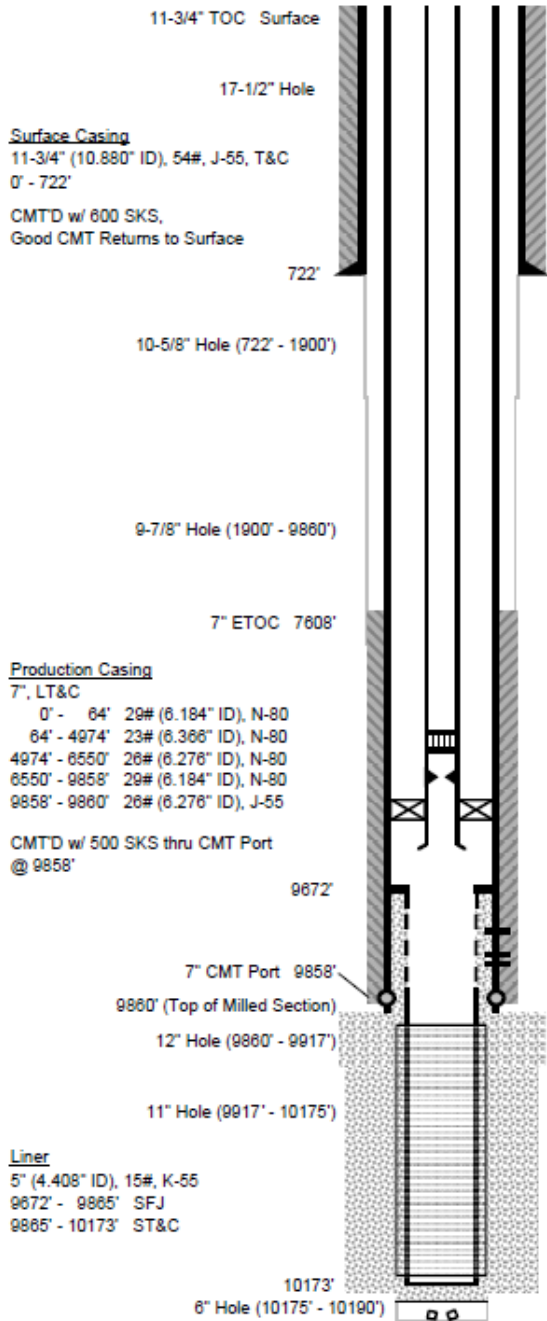
Operator: So. California Gas Co.
Work Order #: 92952
Lease: WEZU
Field: Honor Rancho
Status: Active Gas Storage
3000TDS: ±800' (±800')
10000TDS: 2670' (2670')

Ground Elevation: 1273.91' asl
Datum to Ground: 12.5' KB

Spud Date: 5/11/1958
Sidetrack (ST1) Kick-off Date:
6/12/1976
Completion Date: 7/14/1976
Last Rework Date: 10/22/2018

Junk: Two (2) Cones & Nose Piece
f/ Under-reamer, Milled & Pushed to
10190' (6/27/1976)

Wellbore History	
Orig. Hole (OH) TD @	10307'
(See WEZU 24)	
ST1 KOP @	9860'
TD @	10190'



Tubing (10/8/2018)
3-1/2" (2.992" ID), 9.2#, N-80
0' - 9491' TSH 563
9491' - 9568' Vam Top

9498' Durasleeve Sliding Side Door (2.813" X Profile, opens down)
9537' X Nipple (w/ 2.813" Profile)
9546' HES AHC PCKR (COE @ 9550', 10/8/2018)
9566' XN Nipple (2.75" Profile w/ 2.635" No-Go)
9568' Wireline Re-entry

9758' Four (4) 1/2" Holes (6/17/1976) Co. WSO
9789' Four (4) 1/2" Holes (6/10/1958) WSO
9790' Four (4) 1/2" Holes (35 SKS SQZD Away, 6/9/1958)
9860' Sidetrack (ST1) KOP (from OH) into this wellbore (See History)

Liner Perfs:
9868' - 9803' 1-1/2" x 20M, 20R, 6"C Slots
9868' - 10167' 0.015" WWS

Gravel Packed w/ 174 SKS
(95% of Calc'd) 0.040" x 0.060"

Geologic Zone Markers md (tvd)	
Yule	3560' (3559')
Towsley	6380' (6373')
Wayside '13'	9850' (9823')

10185' Top of Fill (7/1/1976)
10190' Junk (see desc. above)

Prepared by: MAM (2/19/2018)
Updated by: CAM (10/24/2018)



TD 10190'
TVD (10160')
Directionally Drilled: Yes (TD is 221' W, 75' N of Surf)

I. Background

Project Overview			
Field	Honor Rancho		
Well Name	WEZU 25A	API	04-037-21683-00
Total Project Type	Recompletion		
Well Status	Active	NOP:	06/13/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/06/1976		
Initial Completion	01/06/1977		
Ground Elevation	1151 ft.		
Caprock Depth	5742 ft.		
Measured Depth	9841 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well WEZU 25A. This project planned to pull 3-1/2" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well WEZU 25A used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 9242 ft. of 3-1/2" (6.5#, L80, EUE) tubing, bottom hole assembly, and 9-5/8" (WFT Hydrow-1) packer from 9237 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to target depth 9824 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL and MAC) from approximately 9300 ft. to surface
 - iv. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - c. Well Completion

- i. Install 3-1/2” new tubing completion string, bottom hole assembly, and 9-5/8” packer thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	01/08/2018
2	Noise and Temp Survey	06/07/2018
3	Ultrasonic (UT)	11/07/2017
4	Cement Bond Log (CBL)	11/07/2017
5	Multi-Arm Caliper (MAC)	11/03/2017
6	Magnetic Flux Leakage (MFL)	11/08/2017
7	Block Test	11/20/2017
8	Annular and Tubing Pressure Test – Final	05/23/2018
Approvals and Return to Service		
9	DOGGR Approval	05/30/2018
10	Return to Service	07/02/2018

2. Project timeline

Major Milestone	Start	Finish
Rig Work Phase 1	10/09/2017	01/10/2018
Rig Work Phase 2	05/03/2018	06/13/2018

C. Workover Explanation

1. Rig Work was performed in two phases due to a brush fire and completion equipment availability
 - a. Phase 1 of rig work consisted of completion equipment removal and well assessment/evaluation
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 9242 ft. of 3-1/2" (6.5#, L80, EUE) tubing, bottom hole assembly, and 9-5/8" (WFT Hydrow-1) packer from 9237 ft.
 - ii. *Well Assessment/Evaluation*: The well was cleaned out to 9824 ft. Gyro survey run from 9810 ft. to surface. Inspection logs (MAC, CBL, UT, MFL) were run from 9275 ft. to surface. The block test was performed
 - iii. *Well Isolation*: The well was isolated from storage zone and wellhead was re-installed and tested
 - b. Phase 2 of rig work consisted on new completion equipment installation.
 - i. *Well Decompletion*: This step included the removal of wellhead components and isolation equipment
 - ii. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 9213 ft. of 3-1/2" (9.3#, L80, TSH 563) tubing with flow control components and 9-5/8" (WFT AP) Packer set at 9183 ft. The final installation integrity test was performed. A new wellhead was installed and tested
 - iii. *Well Unload*: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
2. Post Rig Work: Annular pressures required placing packer fluid.

D. Changes During Workover

The rig work took place in two phases. A brushfire swept through the storage field pausing operations.² Once the field was safe and equipment was available, the second phase of rig work was performed. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

² Rye Fire (12/5/17 - 12/12/17); Rye Fire 25 percent contained after charring 7K acres in Santa Clarita, <https://abc7.com/rye-fire-15-percent-contained-after-charring-7k-acres-in-santa-clarita/2752786/>

III. Project Costs

A. Actual Costs

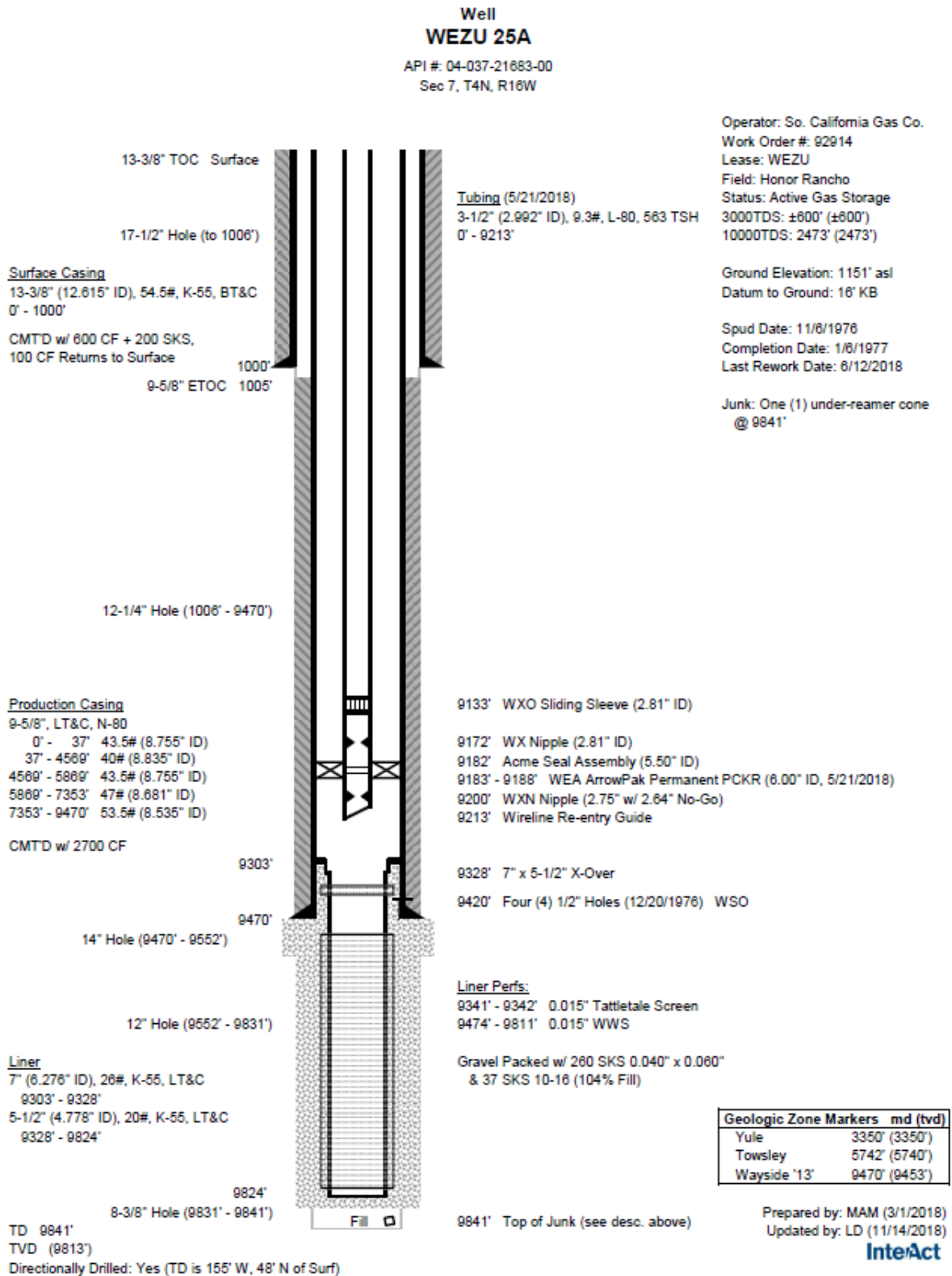
Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$8,747	\$3,997	\$12,744
Contract Costs	\$105,881	\$2,428	\$108,309
Material	\$288,944	\$0	\$288,944
Other Direct Charges	\$1,533,154	\$688	\$1,533,842
Total Direct Cost	\$1,936,726	\$7,113	\$1,943,839

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$78,937	\$3,362	\$82,299
AFUDC	\$31,066	\$0	\$31,066
Property Taxes	\$4,521	\$0	\$4,521
Total Indirect Costs	\$114,524	\$3,362	\$117,886

Total Loaded Costs	\$2,051,250	\$10,475	\$2,061,725³
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³ Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Honor Rancho		
Well Name	WEZU C2E	API	04-037-21711-00
Project Type	Inner String Recompletion		
Well Status	Active	NOP:	09/21/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	10/13/1976		
Initial Completion	01/21/1977		
Ground Elevation	1142 ft.		
Caprock Depth	7750 ft.		
Measured Depth	10030 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well WEZU C2E. This project planned to pull 2-7/8" completion string and uncemented 7" inner string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well WEZU C2E used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 9463 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Baker "D") packer from 9455 ft.
 - iii. Pull existing inner string consisting of 2730 ft. of 7" (23#, N80, Hydril TS) casing, and 9-5/8" (Otis "WC" XLB Perma-Drill) from 2730 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to total depth 9943 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL) from approximately 9504 ft. to surface
 - iv. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - c. Well Completion

- i. Install approximately 9455 ft. of 2-7/8” new tubing completion string, bottom hole assembly, and 9-5/8” packer thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/21/2018 09/17/2018
3	Ultrasonic (UT)	01/31/2018 08/06/2018
4	Cement Bond Log (CBL)	01/31/2018 08/06/2018
5	Multi-Arm Caliper (MAC)	02/01/2018 08/08/2018
6	Magnetic Flux Leakage (MFL)	02/01/2018 08/10/2018
7	Block Test	08/01/2018
8	Annular and Tubing Pressure Test – Final	09/05/2018
Approvals and Return to Service		
9	DOGGR Approval	10/26/2020
10	Return to Service	11/21/2018

2. Project timeline

Major Milestone	Start	Finish
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Rig Work	10/11/2017	09/18/2018
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C. Workover Explanation

1. Rig Work included the planned decompletion of existing production equipment and inner string, well was cleaned out, inspection logs were run, but block test could not be performed at the casing splice and inner string was required. Then rig work included perforating and cement squeezing critical zones, new inner string installed and cemented, re-running inspection logs, pressure testing new inner string, and running new completion tubing and equipment
 - a. *Well Decompletion/Assessment:* This step included the planned removal of wellhead components and production equipment consisting of 9463 ft. of 2-7/8" (6.5#, J55/N80, EUE) tubing, bottom hole assembly, 9-5/8" (Baker "D") packer from 9455 ft. and 2730 ft. of 7" (23#, N80, Hydril TS) casing, and 9-5/8" (Otis "WC" XLB Perma-Drill) from 2730 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 9943 ft. The Gyro survey was run from 9925 ft. to surface. The CBL and UT were run from 9495 ft. to surface. MAC and MFL were run from 9475 ft. to surface. When attempting to block test, casing tie back at 1020 ft. did not pass
 - c. *Zonal Remediation:* Per DOGGR requirements, four zones were perforated and cement squeezed, from 7550 ft. to 7555 ft. (Towsley), from 6240 ft. to 6245 ft. (Yule Btm), from 4960 ft. to 4965 ft. (Yule), and from 1015 ft. to 1020 ft. (casing tie back)
 - d. *Inner string Installation:* The production casing was drifted to prepare for a new inner string installation. A new 7" (29#, L80, VAM TOP) inner string consisting of 9503 ft. was installed and cemented. A new spool was installed to accommodate the inner string

- e. *Well Reassessment/Re-evaluation:* The cement shoe was drilled out to 9506 ft. The block test was performed on the new inner string. The well was cleaned out to 9943 ft. Casing inspection logs (UT, CBL) were run from 9500 ft to surface. Mac was run from 9943 ft. to surface. MFL was run from 9481 ft. to surface.
 - f. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 9479 ft. of 3-1/2" (9.3#, L80, TSH 563/VAM TOP) tubing with flow control components, and a 7" (WFT AP) Packer set at 9448 ft. The final installation integrity test was completed. A new wellhead was installed and tested
 - g. *Well Unload:* The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
2. Post Rig Work: Annular pressures required placing packer fluid to a calculated depth

D. Changes During Workover

After initial inspections, the well required an inner string. Per DOGGR requirements, four zones were perforated and cement squeezed in the production casing. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$32,932	\$0	\$32,932
Contract Costs	\$346,375	\$0	\$346,375
Material	\$1,167,372	\$0	\$1,167,372
Other Direct Charges	\$4,628,869	\$75,081	\$4,703,950
Total Direct Cost	\$6,175,548	\$75,081	\$6,250,629

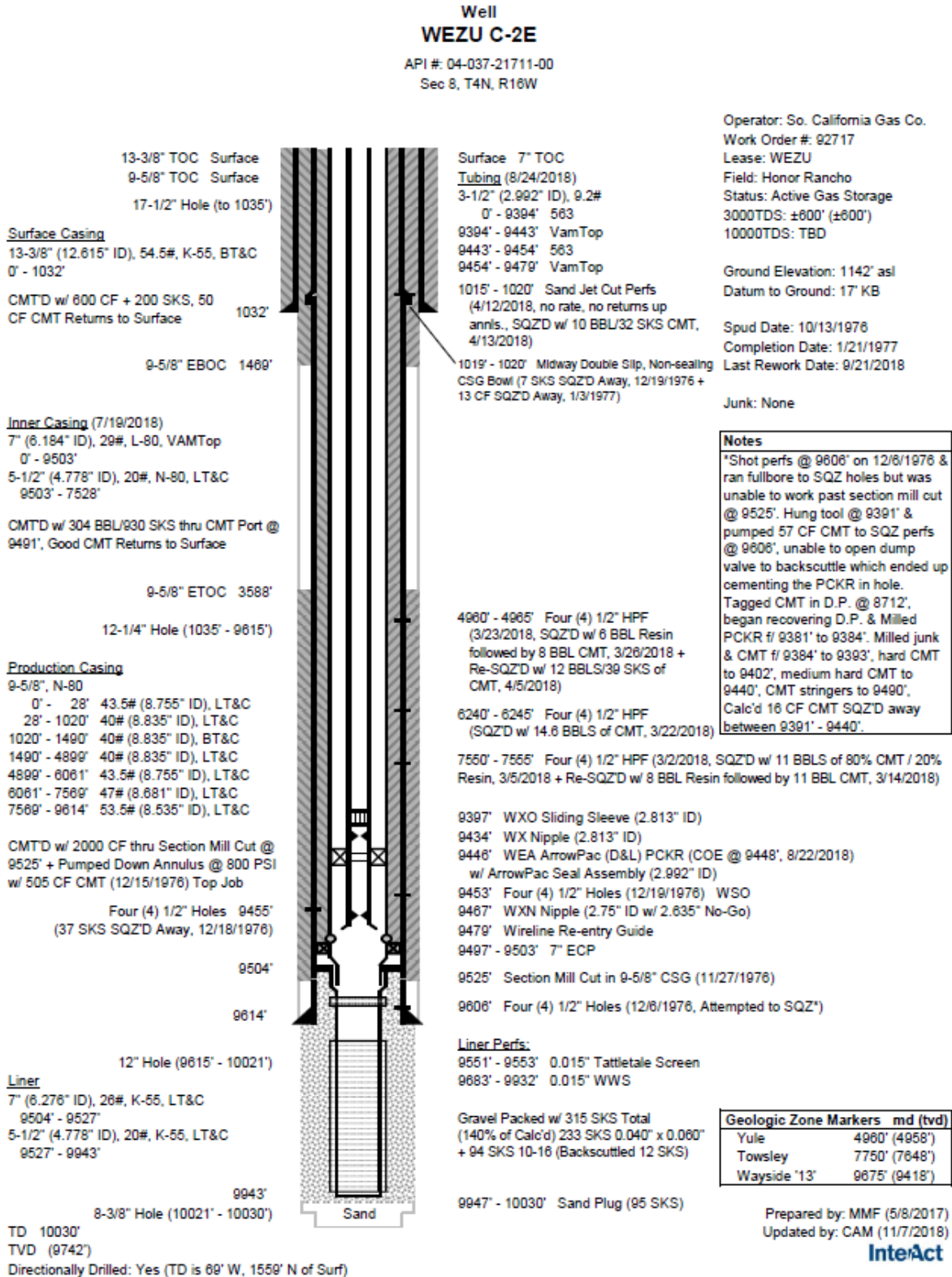
Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$263,951	\$658	\$264,609
AFUDC	\$108,847	\$0	\$108,847
Property Taxes	\$19,819	\$0	\$19,819
Total Indirect Costs	\$392,617	\$658	\$393,275

Total Loaded Costs	\$6,568,165	\$75,739	\$6,643,904²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

Storage Integrity Management Program Honor Rancho – WEZU C2E

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Honor Rancho		
Well Name	WEZU C2F	API	04-037-21713-00
Project Type	Recompletion		
Well Status	Active	NOP:	06/14/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	8/10/1976		
Initial Completion	10/8/1976		
Elevation	1143 ft.		
Caprock Depth	7790 ft.		
Measured Depth	10130 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well WEZU C2F. This project planned to pull 3-1/2" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well WEZU C2F used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 9668 ft. of 3-1/2" (9.3#, J55/N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Baker Retrieval-D) packer from 9655 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to liner top at 9687 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL) from approximately 9680 ft. to surface
 - iv. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - v. Clean out wellbore to target depth at 10078 ft.
 - c. Well Completion

- i. Install approximately 9655 ft. of 3-1/2” (9.3#, L80) new tubing completion string, bottom hole assembly, and 9-5/8” packer thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations.
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	N/A
3	Ultrasonic (UT)	04/21/2017
4	Cement Bond Log (CBL)	04/21/2017
5	Multi-Arm Caliper (MAC)	04/25/2017
6	Magnetic Flux Leakage (MFL)	04/26/2017
7	Block Test	05/01/2017
8	Annular and Tubing Pressure Test – Final	05/25/2017
Approvals and Return to Service		
9	DOGGR Approval	06/07/2017
10	Return to Service	07/06/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	02/23/2017	05/31/2017

C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing and running new completion equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 9668 ft. of 3-1/2" (9.3#, J55/N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Baker Retrieva-D) packer from 9655 ft.
 - b. *Well Assessment/Evaluation:* The well was clean out to 9986 ft. Gyro was run from 9986 ft. to surface. Inspection logs (UT, CBL, MAC, MFL) were run from 9660 ft. to surface. The block test was performed. Then wellbore was cleaned out to 10007 ft.
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 9583 ft. of 3-1/2" (9.3#, L80, VAM TOP) tubing with flow control components and 9-5/8" (WTF AS1-X) Packer set at 9555 ft. The final installation integrity test was performed. A new wellhead was installed and tested
2. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.
 - a. Annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$58,760	\$299	\$59,059
Contract Costs	\$27,887	\$0	\$27,887
Material	\$31,124	\$0	\$31,124
Other Direct Charges	\$1,789,368	\$103,067	\$1,892,435
Total Direct Cost	\$1,907,139	\$103,366	\$2,010,505

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$108,048	\$857	\$108,905
AFUDC	\$0	\$0	\$0
Property Taxes	\$1,686	\$0	\$1,686
Total Indirect Costs	\$109,734	\$857	\$110,591

Total Loaded Costs	\$2,016,873	\$104,223	\$2,121,096²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

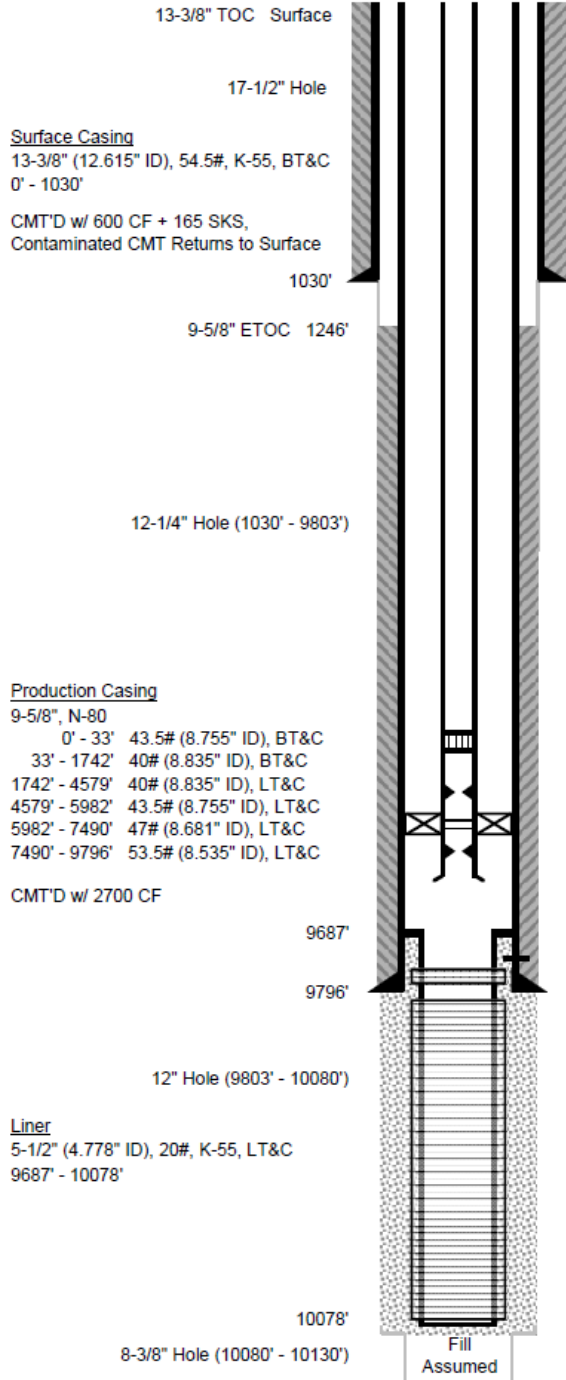
Storage Integrity Management Program Honor Rancho – WEZU C2F

IV. Wellbore Diagram after SIMP Work

Well WEZU C-2F

API #: 04-037-21713-00
Sec 8, T4N, R16W

Operator: So. California Gas Co.



Tubing (5/24/2017)
3-1/2" (2.992" ID), 9.2#, L-80, Vam Top
0' - 9583'

Lease: WEZU
Field: Honor Rancho
Status: Active Gas Storage
3000TDS: ±600' (±600')
10000TDS: TBD

Ground Elevation: 1143' asl
Datum to Ground: 17' KB

Spud Date: 8/10/1976
Completion Date: 10/8/1976
Last Rework Date: 5/31/2017

Junk: None

9509' W XO Sliding Sleeve (2.812" ID)
9545' WX Nipple (2.812" ID)
9552' WEA Arrowset 1-X PCKR (COE @ 9555.5', 5/24/2017)
9570' WXN Nipple (2.75" ID w/ 2.635" No-Go)
9583' Wireline Re-entry Guide
9672' Tight Spot (5/3/2017)
9710' Four (4) 1/2" Holes (9/24/1976) WSO

Liner Perfs:
9725' - 9726' Tattletale Screen
9815' - 10065' 0.015" WWS

Gravel Packed w/ 167 SKS (94% of Calc'd) 0.040" x 0.060"

Top of Zone Markers	md (tvd)
Yule	4861' (4859')
Towsley	7790' (7685')
Wayside '13'	9805' (9564')

Prepared by: MAM (2/9/2017)
Updated by: LD (3/13/2018)

InteAct

TD 10130'
TVD (9866')
Directionally Drilled: Yes (TD is 459' W, 1394' N of Surf)

I. Background

Project Overview			
Field	Honor Rancho		
Well Name	WEZU C3A	API	04-037-21677-00
Total Project Type	Recompletion		
Well Status	Active	NOP:	05/31/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/01/1976		
Initial Completion	01/14/1977		
Ground Elevation	1137 ft.		
Caprock Depth	7125 ft.		
Measured Depth	9767 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well WEZU C3A. This project planned to pull 3-1/2" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well WEZU C3A used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 9324 ft. of 3-1/2" (9.3#, J55/N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Otis Permatrieve) packer from 9310 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to liner top at 9345 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL and MAC) from approximately 9340 ft. to surface
 - iv. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - c. Well Completion

- i. Install new 3-1/2” tubing completion string, bottom hole assembly, and 9-5/8” packer thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead.
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	03/24/2017 05/31/2017
3	Ultrasonic (UT)	04/24/2017
4	Cement Bond Log (CBL)	04/24/2017
5	Multi-Arm Caliper (MAC)	04/21/2017
6	Magnetic Flux Leakage (MFL)	04/25/2017
7	Block Test	05/02/2017
8	Annular and Tubing Pressure Test – Final	05/10/2017
Approvals and Return to Service		
9	DOGGR Approval	06/02/2017
10	Return to Service	06/27/2017

2. Project timeline

Major Milestone	Start	Finish
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Rig Work	03/23/2017	05/11/2017
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C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing and running new completion equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 9324 ft. of 3-1/2" (9.3#, J55/N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Otis Permatrieve) packer from 9310 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 9751 ft. Gyro survey was run from 9746 ft. to surface. Inspection logs (MAC, CBL, UT, MFL) were run from 9325 ft. to surface. The block test was performed
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 9265 ft. of 3-1/2" (9.3#, L80, VAM TOP) tubing with flow control components and 9-5/8" (WFT AS1-X) Packer set at 9238 ft. The final installation integrity test was performed. A new wellhead was installed and tested
2. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. Annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

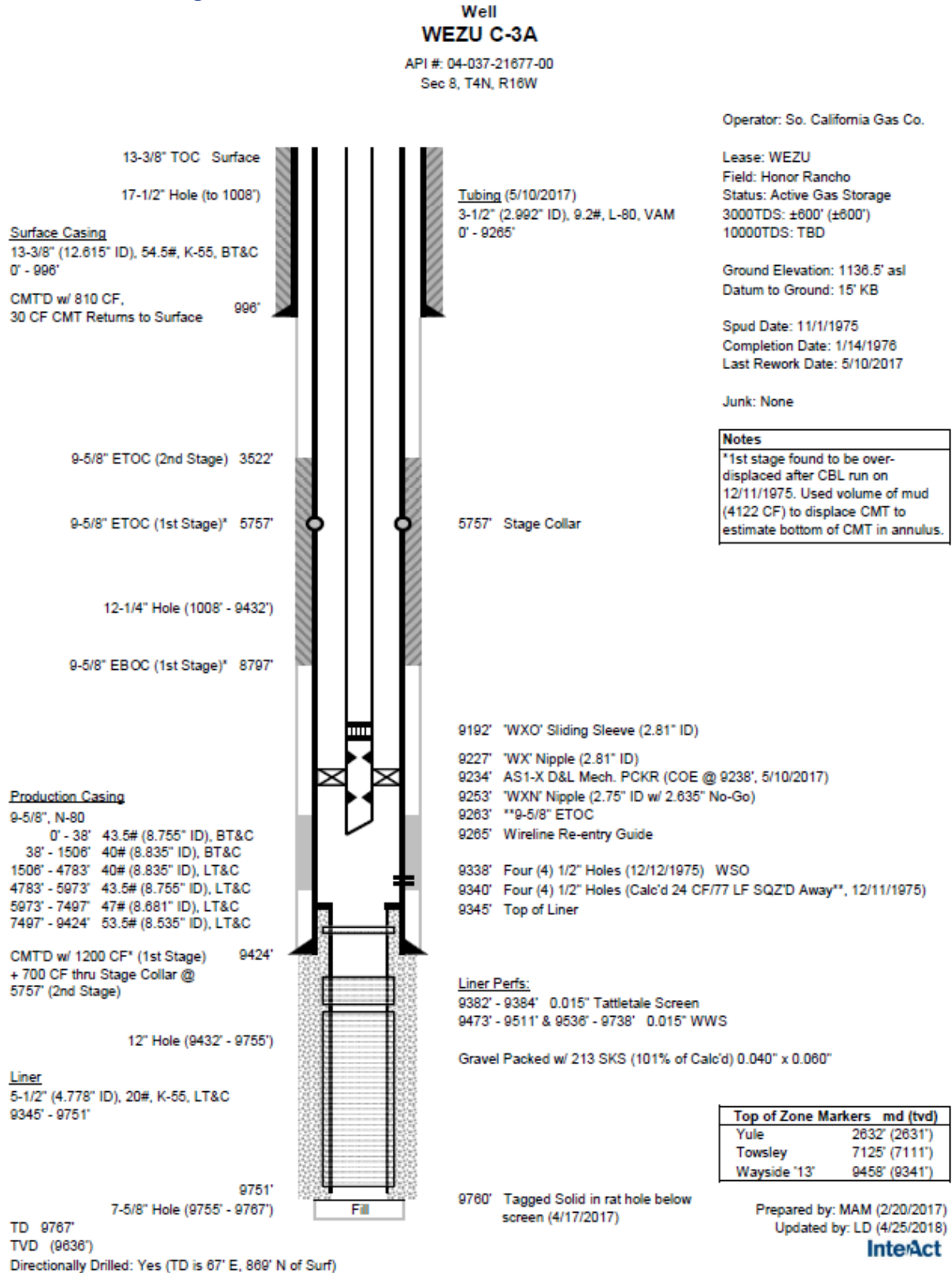
Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$3,552	\$4,734	\$8,286
Contract Costs	\$0	\$9,609	\$9,609
Material	\$396,905	\$869	\$397,774
Other Direct Charges	\$766,405	\$172,303	\$938,708
Total Direct Cost	\$1,166,862	\$187,515	\$1,354,377

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$40,709	\$4,280	\$44,989
AFUDC	\$0	\$0	\$0
Property Taxes	\$1,093	\$0	\$1,093
Total Indirect Costs	\$41,802	\$4,280	\$46,082

Total Loaded Costs	\$1,208,664	\$191,795	\$1,400,459²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Honor Rancho		
Well Name	WEZU C3B	API	04-037-21697-00
Total Project Type	Recompletion		
Well Status	Active	NOP:	06/20/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	01/21/1976		
Initial Completion	03/25/1976		
Ground Elevation	1160 ft.		
Caprock Depth	5535 ft.		
Measured Depth	9340 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
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3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well WEZU C3B. This project planned to pull 3-1/2" completion string, run casing inspection logs and a Gyro survey, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well WEZU C3B used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 8944 ft. of 3-1/2" (9.3#, J55/N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Baker Retrieva-D) packer from 8931 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to liner top at 8965 ft.
 - ii. Run Gyro survey from total depth to surface
 - iii. Run inspection logs (UT, CBL, MFL and MAC) from approximately 8960 ft. to surface
 - iv. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - v. Clean out wellbore to total depth at 9329 ft.
 - c. Well Completion

- i. Install new 3-1/2” tubing completion string, bottom hole assembly, and 9-5/8” packer thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	N/A
3	Ultrasonic (UT)	05/17/2017
4	Cement Bond Log (CBL)	05/17/2017
5	Multi-Arm Caliper (MAC)	05/18/2017
6	Magnetic Flux Leakage (MFL)	05/19/2017
7	Block Test	05/24/2017
8	Annular and Tubing Pressure Test – Final	06/05/2017
Approvals and Return to Service		
9	DOGGR Approval	06/07/2017
10	Return to Service	07/19/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	03/13/2017	06/06/2017

C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing and running new completion equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 8944 ft. of 3-1/2" (9.3#, J55/N80, EUE) tubing, bottom hole assembly, and 9-5/8" (Baker Retrieva-D) packer from 8931 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 9319 ft. Gyro survey was run from 9310 ft. to surface. Inspection logs (CBL, UT) were run from 8937 ft. to surface. MAC and MFL were run from 8940 ft. to surface. The block test was performed
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 8939 ft. of 3-1/2" (9.3#, L80, VAM TOP) tubing with flow control components and 9-5/8" (WFT AS1-X) Packer set at 8911 ft. The final installation integrity test was performed. A new wellhead was installed and tested
2. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
 - a. Annular pressures required placing packer fluid to a calculated depth.

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. PROJECT COSTS

A. Actual Costs

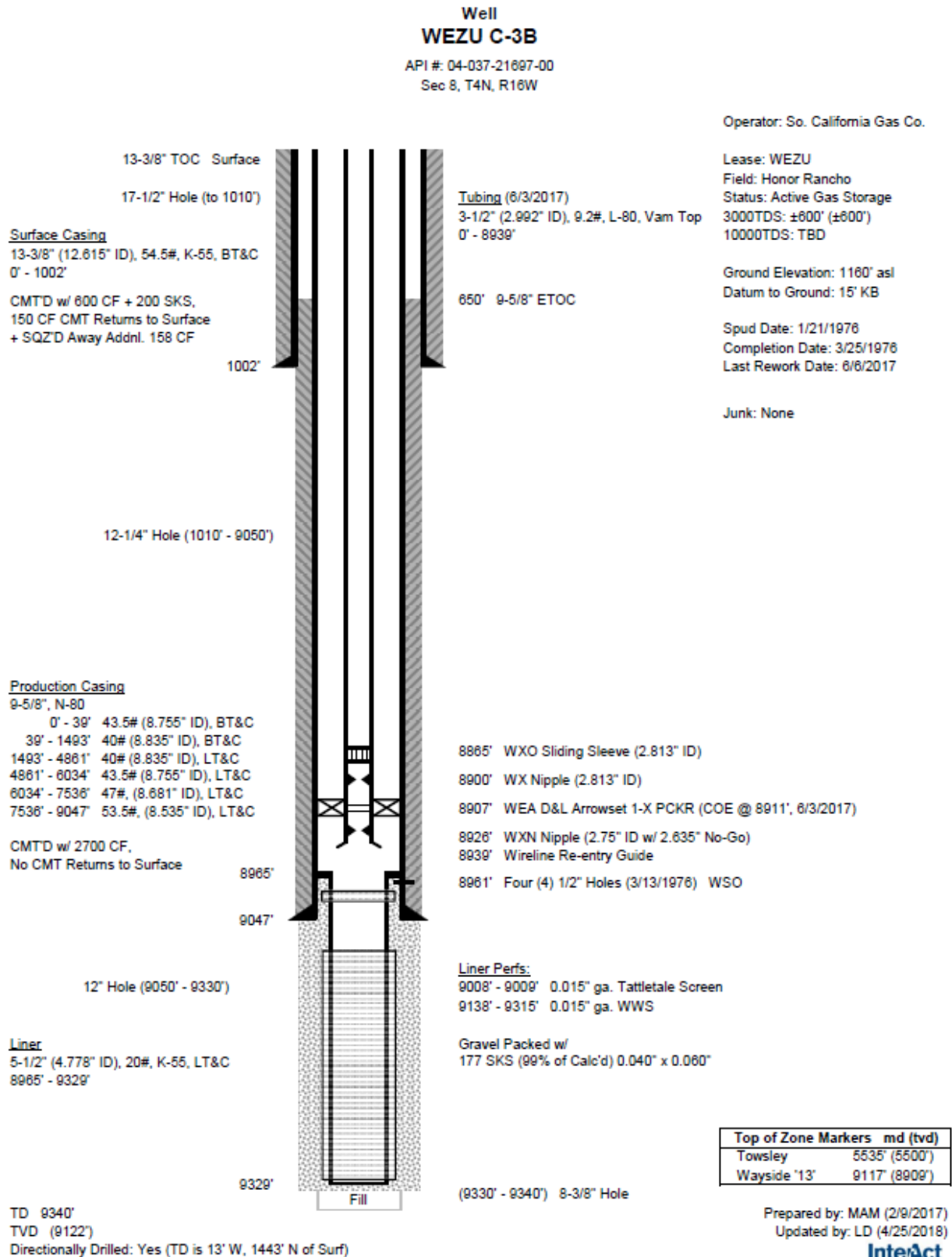
Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$11,114	\$310	\$11,424
Contract Costs	\$16,831	\$0	\$16,831
Material	\$258,507	\$0	\$258,507
Other Direct Charges	\$1,472,933	\$38,889	\$1,511,822
Total Direct Cost	\$1,759,385	\$39,199	\$1,798,584

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$64,592	\$495	\$65,087
AFUDC	\$0	\$0	\$0
Property Taxes	\$644	\$0	\$644
Total Indirect Costs	\$65,236	\$495	\$65,731

Total Loaded Costs	\$1,824,621	\$39,694	\$1,864,315²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	La Goleta		
Well Name	Miller 1	API	04-083-03404-02
Total Project Type	Recompletion		
Well Status	Active	NOP:	12/19/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	08/02/1944; Redrill 1 01/22/1975 (Sidetrack 1); Redrill 2 11/13/2001 (Sidetrack 2)		
Initial Completion	10/14/1944; Redrill 1 Completion 03/26/1975; Redrill 2 Completion 03/05/2002		
Ground Elevation	18 ft.		
Caprock Depth	2512 ft.		
Measured Depth	6460 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Miller 1. This project planned to pull 2-3/8" and 2-7/8" completion string, run casing inspection logs and a Gyro survey, abandon lower perforations, pressure test casing, install a new completion string and sub surface safety valve (SSSV), and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for Miller 1 used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 480 ft. of 2-3/8" (4.6#, J55, EUE) and 4491 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 5-1/2" (HES G-77) packer from 4897 ft., 8-5/8" (HES G-77) packer from 4457 ft. and 8-5/8" (HES G-77) packer from 4093 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to target depth 6291 ft.
 - ii. Run inspection logs (UT and CBL) from total depth to surface
 - c. Zone Isolation
 - i. Place cement plugs from total depth to approximately 4841 ft.

- d. Well Reassessment/Re-evaluation
 - i. Clean out wellbore to top of cement at approximately 4841 ft.
 - ii. Pressure test cement plug from 4800 ft.
 - iii. Run inspection logs (MFL and MAC) from approximately 4841 ft. to surface
 - iv. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP).
- e. Well Completion
 - i. Install approximately 4450 ft. of 3-1/2" new tubing completion string, bottom hole assembly, 3-1/2" SSSV, and two 8-5/8" packers at approximately 4040 ft. and 4450 ft., thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
2. Post Rig Work
 - a. Unload well and turn over to operations
3. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	12/18/2017
3	Ultrasonic (UT)	11/01/2017
4	Cement Bond Log (CBL)	11/01/2017
5	Multi-Arm Caliper (MAC)	11/07/2017
6	Magnetic Flux Leakage (MFL)	11/06/2017 11/27/2017
7	Block Test	11/21/2017
8	Annular and Tubing Pressure Test – Final	12/08/2017 02/20/2018 (SCSSV)
Approvals and Return to Service		
9	DOGGR Approval	04/24/2018
10	Return to Service	02/26/2018

2. Project timeline

Major Milestone	Start	Finish
Rig Work	09/07/2017	12/18/2017

C. Workover Explanation

1. Rig Work included removing existing completion equipment, cleaning out wellbore, performing inspection logs, setting isolation cement plugs, pressure testing casing, and running new completion
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 480 ft. of 2-3/8" (4.6#, J55, EUE) and 4491 ft. of 2-7/8" (6.5#, N80, EUE) tubing, bottom hole assembly, and 5-1/2" (HES G-77) packer from 4897 ft., 8-5/8" (HES G-77) packer from 4457 ft. and 8-5/8" (HES G-77) packer from 4093 ft.
 - b. *Well Assessment/Evaluation:* The well was cleaned out to 6223 ft. Gyro survey run from 6200 ft. to surface. Inspection logs (CBL, UT) were run from 6200 ft. to surface; MFL and MAC were run from 6220 ft. to surface
 - c. *Zone Isolation:* A series of cement plugs were placed, and pressure tested from 6223 ft. to 4450 ft.
 - d. *Well Reassessment/Re-evaluation:* Block test was performed. MFL was run from 562 ft. to surface
 - e. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 4133 ft. of 3-1/2" (9.3#, L80, VAM TOP) tubing with flow control components, 3-1/2" SSSV at 156 ft. and 8-5/8" (WFT AS1X) Packer set at 4102 ft. The final installation integrity test was performed. A new wellhead was installed and tested
 - f. *Well Unload:* The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal.

D. Changes During Workover

Final cement plugs were set higher than originally planned to cover additional perforations and optimize well operation. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

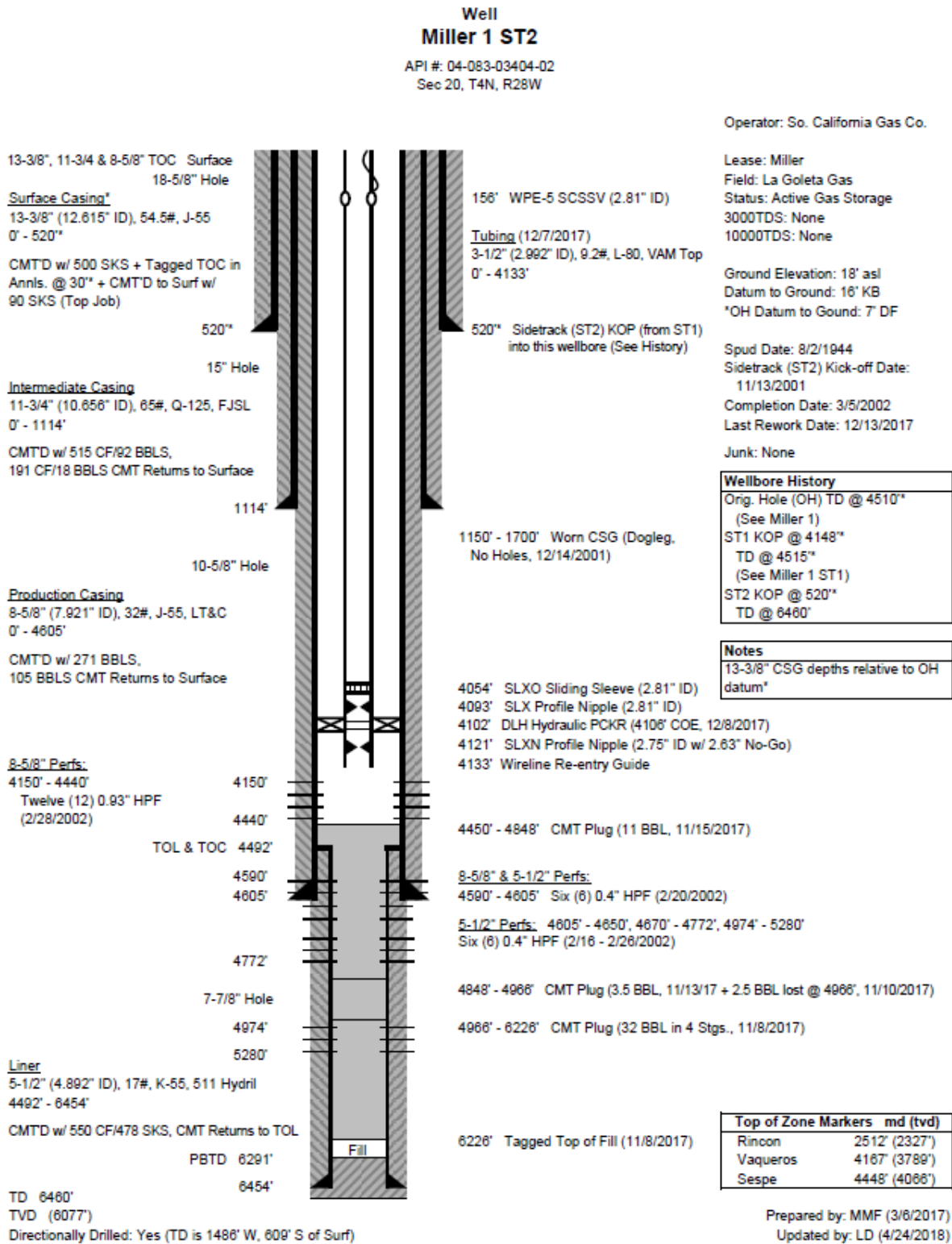
Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$22,602	\$1,615	\$24,217
Contract Costs	\$13,889	\$0	\$13,889
Material	\$140,874	\$0	\$140,874
Other Direct Charges	\$1,521,724	\$125,946	\$1,647,670
Total Direct Cost	\$1,699,089	\$127,561	\$1,826,650

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$74,906	\$2,130	\$77,036
AFUDC	\$2,887	\$0	\$2,887
Property Taxes	\$993	\$0	\$993
Total Indirect Costs	\$78,786	\$2,130	\$80,916

Total Loaded Costs	\$1,777,875	\$129,691	\$1,907,566²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	La Goleta		
Well Name	Miller 10	API	04-083-20755-00
Project Type	Steel Liner Recompletion		
Well Status	Active	NOP:	02/07/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	06/02/1976		
Initial Completion	07/06/1976		
Elevation	18 ft.		
Caprock Depth	2330 ft.		
Measured Depth	4425 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
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Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Miller 10. This project planned to pull 2-7/8" completion string, run casing inspection logs, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for well Miller 10 used to acquire the necessary DOGGR NOI:

1. Rig work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 3800 ft. of 2-7/8" (6.5#, L80, EUE) tubing, bottom hole assembly, and 9-5/8" (HES G-6) packer from 3792 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to liner top at 3907 ft.
 - ii. Run inspection logs (UT, CBL) from 3907 ft. to surface
 - iii. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - iv. Clean out wellbore to target depth 4407 ft.
 - c. Well Completion

- i. Install approximately 3792 ft. of 4-1/2” new tubing completion string, bottom hole assembly, and 9-5/8” packers, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	01/22/2018 02/02/2018
3	Ultrasonic (UT)	07/20/2017
4	Cement Bond Log (CBL)	07/20/2017
5	Multi-Arm Caliper (MAC)	07/24/2017 08/14/2017 01/10/2018
6	Magnetic Flux Leakage (MFL)	07/24/2017
7	Block Test	07/27/2017
8	Annular and Tubing Pressure Test – Final	08/29/2017 01/17/2018 01/24/2018 02/20/2018 (SCSSV)
Approvals and Return to Service		
9	DOGGR Approval	10/05/2017 02/02/2018 05/10/2018
10	Return to Service	02/26/2018

2. Project Timeline

Major Milestone	Start	Finish
Rig Work Phase 1	06/19/2017	08/31/2017
Rig Work Phase 2	12/19/2017	02/06/2018

C. Workover Explanation

1. Rig Work was completed in two phases
 - a. Phase 1 of rig work consisted of removing existing completion equipment, running inspection logs, pressure testing casing, performing remedial work, installing new steel liner and new completion equipment.
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 3800 ft. of 2-7/8" (6.5#, L80, EUE) tubing, bottom hole assembly, and 9-5/8" (HES G-6) packer from 3792 ft.
 - ii. *Well Assessment/Evaluation*: The wellbore was cleaned out to 3907 ft. The Gyro survey was run from 3900 ft. to surface. Wellbore was cleaned out to 4407 ft. Inspection logs (UT, CBL) were run from 3885 ft. to surface. MFL and MAC were run from 3892 ft. to surface. The block test was completed. Additional pressure testing was performed between 3820 ft and 3835 ft. The Gyro survey was re-run from 4390 ft. to surface
 - iii. *Zonal Remediation*: A cement plug was set from 3905 ft. to 3884 ft., and the casing was drifted and redressed from 3766 ft. to 3884 ft. for steel liner installation
 - iv. *Steel liners Installation*: A 9-5/8" steel liner consisting of 79 ft. was run and installed from 3867 ft. to 3788 ft.
 - v. *Well Reassessment/Re-evaluation*: The steel liner was confirmed with MAC log and pressure tested. The cement plug was drilled out, and the wellbore was cleaned out to 4412 ft.
 - vi. *Well Completion*: A new completion string and bottom hole assembly were installed consisting of 3770 ft. of 4-1/2" (12.6#, L80, TCPC) tubing with flow control components, 4-1/2" SSSV, and 9-5/8" (WFT AS1X) Packer set at 3747 ft. The final installation integrity test was performed. A new wellhead was installed and tested

- b. Post Rig Work: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal
- c. Phase 2 of rig work consisted of removing existing completion equipment, drifting and dressing steel liner and production casing, cleaning out wellbore, running completion equipment, and re-setting completion equipment
 - i. *Well Decompletion*: This step included the planned removal of wellhead components and production equipment consisting of 3770 ft. of 4-1/2" (12.6#, L80, TCPC) tubing with flow control components, 4-1/2" SSSV, and 9-5/8" (WFT AS1X) Packer set at 3747 ft.
 - ii. *Well Assessment/Evaluation*: The steel liner, and production casing at 3558 ft, were drifted and redressed. The wellbore was cleaned out to 4411 ft. MAC was run from 3900 ft. to 3490 ft.
 - iii. *Well Completion*: The existing completion string and bottom hole assembly were installed consisting of 3764 ft. of 4-1/2" (12.6#, L80, TCPC) tubing with flow control components, 4-1/2" SSSV at 155 ft., and 9-5/8" (WFT AS1X) Packer set at 3745 ft. The final installation integrity test was performed. The wellhead was installed and tested.
 - iv. *Well Unload*: The well was unloaded.
 - v. *Well Evaluation/Assessment*: A Noise-Temperature log was run to identify fluid path at the packer
 - vi. *Well Decompletion*: Wellhead was removed
 - vii. *Well Completion*: The tubing string was reset in the packer with additional compressive weight to complete the installation and meet field operating conditions. The final installation integrity test was performed. The wellhead was re-installed and tested
 - viii. *Well Unload*: The well was unloaded and turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

Initial inspections revealed that the well required remedial work and installation of steel liner. After rig work, and during unloading operations, a restriction was found at the steel liner and the well required a second phase of rig work. During the second phase of rig work and unloading operations, resetting completion equipment was required to keep it in service. The tubing, flow components, and wellhead were enhanced for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

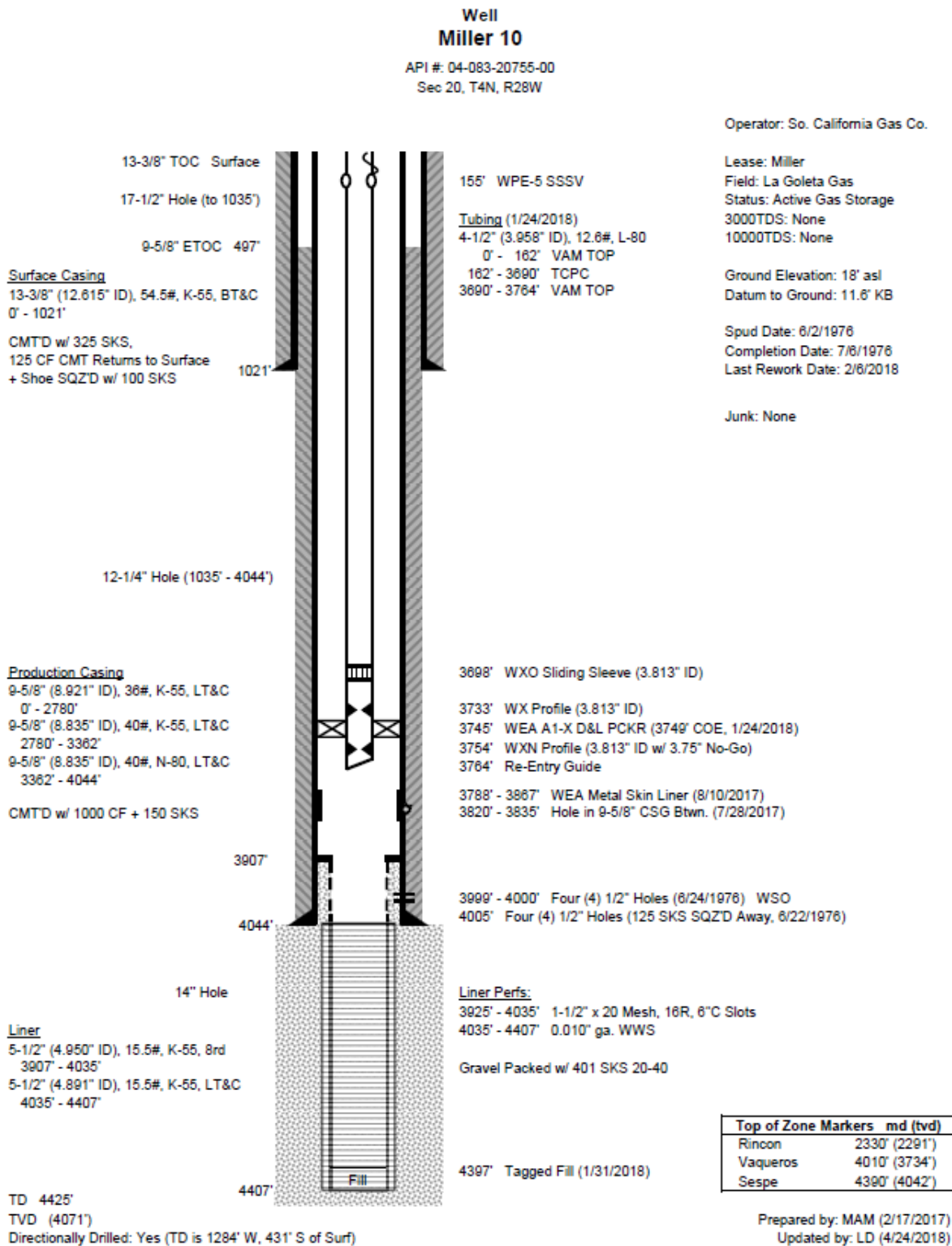
Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$11,710	\$2,365	\$14,075
Contract Costs	\$45,537	\$0	\$45,537
Material	\$117,394	\$77	\$117,471
Other Direct Charges	\$2,132,301	\$98,101	\$2,230,402
Total Direct Cost	\$2,306,942	\$100,543	\$2,407,485

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$86,694	\$2,728	\$89,422
AFUDC	\$20,571	\$0	\$20,571
Property Taxes	\$8,052	\$0	\$8,052
Total Indirect Costs	\$115,317	\$2,728	\$118,045

Total Loaded Costs	\$2,422,259	\$103,271	\$2,525,530²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Playa del Rey		
Well Name	McAdams 1	API	04-037-14038-02
Total Project Type	Recompletion		
Well Status	Active	NOP:	05/21/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	01/16/1935; Redrill1 06/06/1956 (Sidetrack 1); Redrill2 04/04/1990 (Sidetrack 2)		
Initial Completion	03/14/1935; Redrill1 Completion 07/20/1956; Redrill2 Completion 05/04/1990		
Ground Elevation	69 ft.		
Caprock Depth	6060 ft.		
Measured Depth	6397 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB–2016–02), Issued February 6, 2016.

3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API) Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well McAdams 1. This project planned to pull 5-1/2" completion string, run casing inspection logs, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for McAdams 1 used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 5814 ft. of 5-1/2" (20#, N80, Hydril SLX) and 183 ft. of 3-1/2" (9.3#, N80, Hydril CS) tubing, bottom hole assembly, and 7" (Guiberson G-1 Magnum) packer from 5993 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out wellbore to target depth of 6388 ft.
 - ii. Run inspection logs (UT, CBL, MAC and MFL) from approximately 6040 ft. to surface
 - iii. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - c. Well Completion

- i. Install a new 4-1/2” tubing completion string, bottom hole assembly, and 7” packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations.

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	05/21/2018
3	Ultrasonic (UT)	04/20/2018
4	Cement Bond Log (CBL)	04/20/2018
5	Multi-Arm Caliper (MAC)	04/19/2018
6	Magnetic Flux Leakage (MFL)	04/19/2018
7	Block Test	04/27/2018
8	Annular and Tubing Pressure Test – Final	05/16/2018
Approvals and Return to Service		
9	DOGGR Approval	08/23/2018
10	Return to Service	07/02/2018

2. Project timeline

Major Milestone	Start	Finish
Rig Work	03/16/2018	05/21/2018

C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing and running new completion equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 5814 ft. of 5-1/2" (20#, N80, Hydril SLX) and 183 ft. of 3-1/2" (9.3#, N80, Hydril CS) tubing, bottom hole assembly, and 7" (Guiberson G-1 Magnum) packer from 5993 ft.
 - b. *Well Assessment/Evaluation:* The wellbore was cleaned out to 6388 ft. Gyro survey was run from 6382 ft. to surface. MAC was run from 6023 ft. to surface; MFL run from 5997 ft. to surface. UT and CBL were run from 6024 ft. to surface. The block test was performed.
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 5718 ft. of 4-1/2" (12.6#, L80, VAM TOP) and 258 ft. of 3-1/2" (9.3#, L80, VAM TOP) tubing with flow control components, 3-1/2" SSSV at 115 ft. and 7" (Baker HS) packer set at 5960 ft. A new wellhead installed and tested
 - d. *Well Unload:* The well was unloaded. The final installation integrity test was performed. Then the well was turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

A SSSV was installed. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

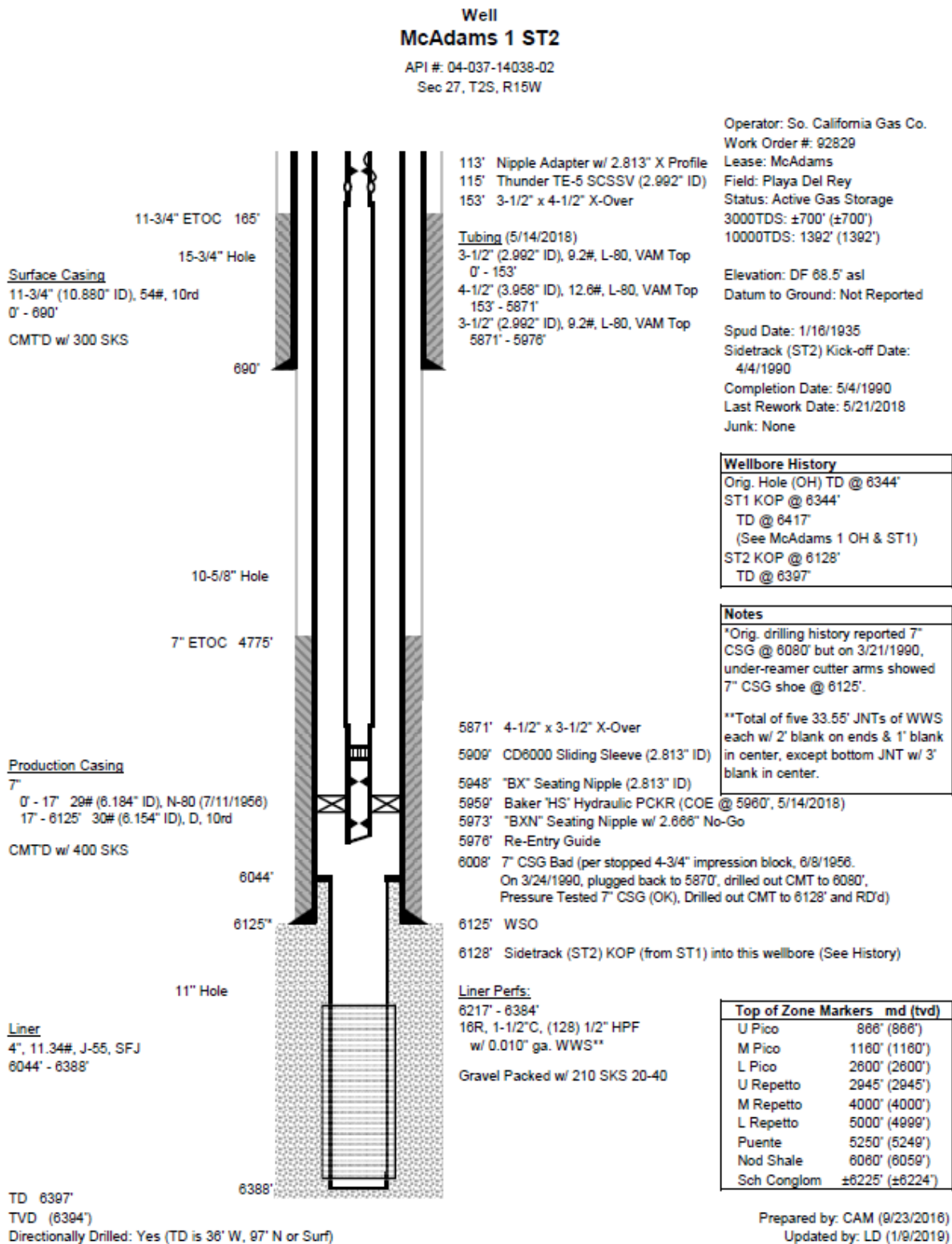
Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$20,629	\$0	\$20,629
Contract Costs	\$3,862	\$0	\$3,862
Material	\$32,932	\$0	\$32,932
Other Direct Charges	\$1,185,894	\$56,363	\$1,242,257
Total Direct Cost	\$1,243,317	\$56,363	\$1,299,680

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$71,221	\$572	\$71,793
AFUDC	\$337	\$0	\$337
Property Taxes	\$1,255	\$0	\$1,255
Total Indirect Costs	\$72,813	\$572	\$73,385

Total Loaded Costs	\$1,316,130	\$56,935	\$1,373,065²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Playa del Rey		
Well Name	SCP 1	API	04-037-14044-00
Total Project Type	Recompletion		
Well Status	Active	NOP:	07/24/2018
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	01/01/1935		
Initial Completion	02/26/1935		
Ground Elevation	154 ft.		
Caprock Depth	6045 ft.		
Measured Depth	6575 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well SCP 1. This project planned to pull 5" completion string and steel liner, run casing inspection logs, pressure test casing, install a new completion string and SSSV, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for SCP 1 used to acquire the necessary DOGGR NOI:

1. Rig Work

- a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 5837 ft. of 5" (15#, N80, NLAB FL-4S), 169 ft. of 3-1/2" (9.3#, N80, Hydril CS), and 149 ft. of 2-7/8" (6.5#, N80, Hydril CS) tubing, 4-1/2" SSSV at 109 ft., bottom hole assembly, and 7" (Baker FB-1) packer from 6116 ft.
 - iii. Remove existing 6" Pengo steel liner from 1524 ft. to 1546 ft.
- b. Well Assessment/Evaluation
 - i. Clean out wellbore to target depth 6575 ft.
 - ii. Run inspection logs (UT, CBL, MAC and MFL) from approximately 6185 ft to surface
 - iii. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
- c. Well Completion

- i. Install 4-1/2” new tubing completion string, 3-1/2” SSSV, bottom hole assembly, and 7” packer, thereby converting the well to tubing flow.
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	07/23/2018
3	Ultrasonic (UT)	06/04/2018
4	Cement Bond Log (CBL)	06/04/2018
5	Multi-Arm Caliper (MAC)	06/07/2018
6	Magnetic Flux Leakage (MFL)	06/05/2018
7	Block Test	06/12/2018
8	Annular and Tubing Pressure Test – Final	07/19/2018
Approvals and Return to Service		
9	DOGGR Approval	08/24/2018
10	Return to Service	10/31/2018

2. Project timeline

Major Milestone	Start	Finish
Rig Work	04/30/2018	07/24/2018

C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing and running new completion equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 5837 ft. of 5" (15#, N80, NLAB FL-4S), 169 ft. of 3-1/2" (9.3#, N80, Hydril CS), and 149 ft. of 2-7/8" (6.5#, N80, Hydril CS) tubing, 4-1/2" SSSV at 109 ft., bottom hole assembly, 7" (Baker FB-1) packer from 6116 ft, and 6" Pengo steel liner from 1524 ft. to 1546 ft.
 - b. *Well Assessment/Evaluation:* The wellbore was cleaned out to liner top at 6190 ft. Casing tie back was pressure tested from 1561 ft. to 1507 ft. The wellbore was cleaned out to 6525 ft. and the Gyro survey run from total depth to surface. Inspection logs were run (UT, CBL, MFL) from 6170 ft. to surface. MAC was run from 6175 ft. to surface. The block test was performed. The wellbore was cleaned out to 6570 ft.
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 5850 ft. of 4-1/2" (12.6#, L80, VAM TOP) and 275 ft. of 3-1/2" (9.3#, L80, VAM TOP) tubing with flow control components, 3-1/2" SSSV at 123 ft. and 7" (WFT HYDROW) packer set at 6099 ft. A new wellhead installed and tested
 - d. *Well Unload:* The well was unloaded. The final installation integrity test was performed. The well was turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

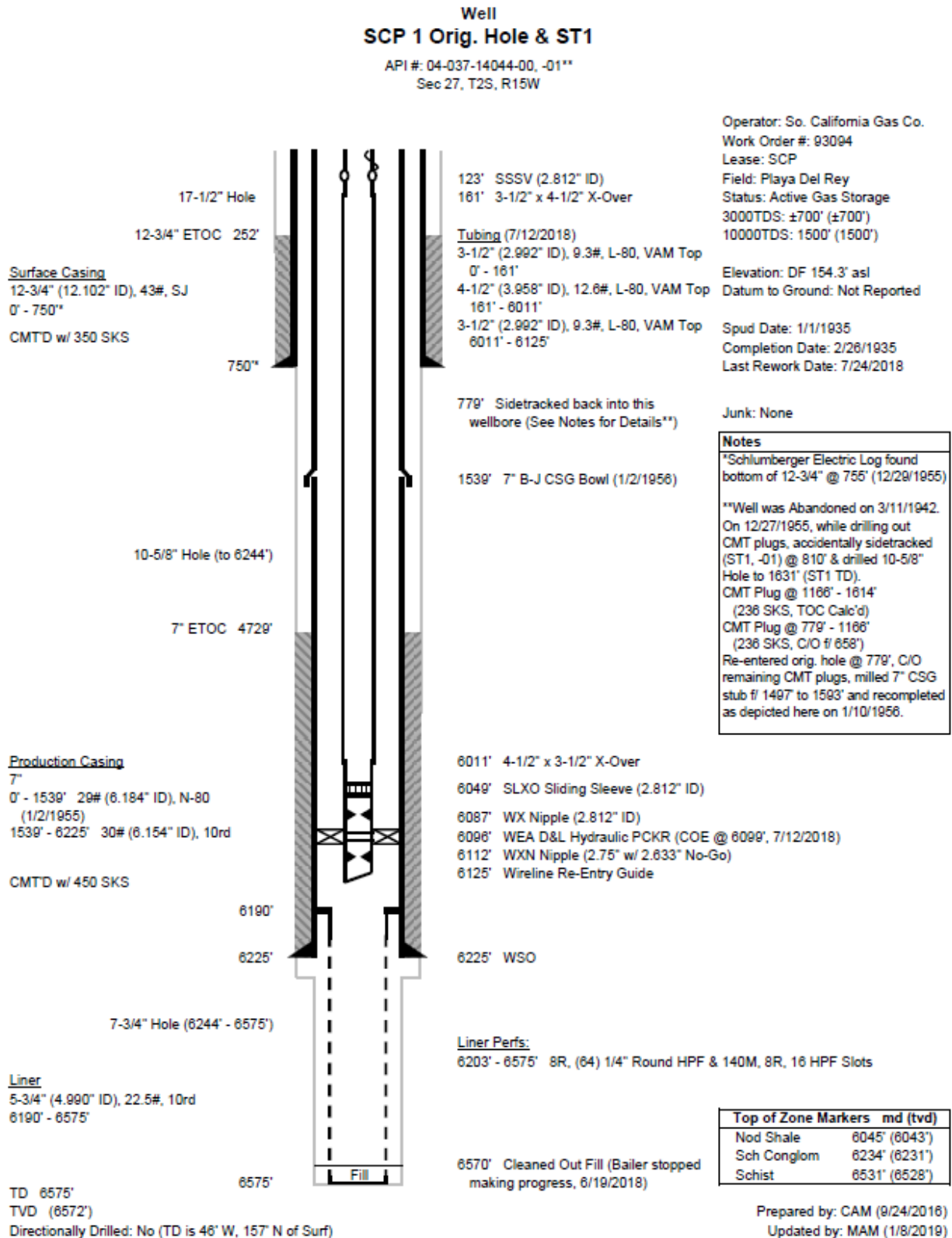
Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$26,551	\$474	\$27,025
Contract Costs	\$0	\$0	\$0
Material	\$8,596	\$0	\$8,596
Other Direct Charges	\$1,448,021	\$60,265	\$1,508,286
Total Direct Cost	\$1,483,168	\$60,739	\$1,543,907

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$86,460	\$971	\$87,431
AFUDC	\$5,433	\$0	\$5,433
Property Taxes	\$976	\$0	\$976
Total Indirect Costs	\$92,869	\$971	\$93,840

Total Loaded Costs	\$1,576,037	\$61,710	\$1,637,747²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work



I. Background

Project Overview			
Field	Playa del Rey		
Well Name	SoCal 1	API	04-037-14046-00
Total Project Type	Recompletion		
Well Status	Active	NOP:	12/29/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	11/12/1955		
Initial Completion	12/14/1955		
Ground Elevation	12 ft.		
Caprock Depth	5950 ft.		
Measured Depth	6250 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well SoCal 1. This project planned to pull 6-5/8" completion string, run casing inspection logs, pressure test casing, install a new completion string and SSSV, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for SoCal 1 used to acquire the necessary DOGGR NOI:

1. Rig Work

- a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 5705 ft. of 6-5/8" (24#, N80, FL-4S) and 318 ft. of 4-1/2" (13.5#, N80, Hydril CS) tubing, 4-1/2" SSSV at 109 ft., bottom hole assembly, and 8-5/8" (Otis WC) packer from 5986 ft.
- b. Well Assessment/Evaluation
 - i. Clean out wellbore to liner top at 6078 ft.
 - ii. Run inspection logs (UT, CBL, MAC and MFL) from approximately 6075 ft to surface
 - iii. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - iv. Clean out wellbore to target depth of 6249 ft.
- c. Well Completion

- i. Install a new 4-1/2” tubing completion string, 4-1/2” SSSV, bottom hole assembly, and 8-5/8” packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	12/26/2017
3	Ultrasonic (UT)	11/28/2017
4	Cement Bond Log (CBL)	11/28/2017
5	Multi-Arm Caliper (MAC)	11/29/2017
6	Magnetic Flux Leakage (MFL)	11/30/2017
7	Block Test	12/04/2017
8	Annular and Tubing Pressure Test – Final	12/20/2017
Approvals and Return to Service		
9	DOGGR Approval	03/06/2018
10	Return to Service	02/02/2018

2. Project timeline

Major Milestone	Start	Finish
Rig Work	10/10/2017	12/28/2017

C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing and running new completion equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 5705 ft. of 6-5/8" (24#, N80, FL-4S) and 318 ft. of 4-1/2" (13.5#, N80, Hydril CS) tubing, 4-1/2" SSSV at 109 ft., bottom hole assembly, and 8-5/8" (Otis WC) packer from 5986 ft.
 - b. *Well Assessment/Evaluation:* The wellbore was cleaned out to 6246 ft. Gyro survey was run from total depth to surface. Inspection logs were run (UT, CBL) from 6060 ft. to surface; MAC was run from 6047 ft. to surface. MFL was run from 6042 ft. to surface. The block test was performed
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 5998 ft. of 4-1/2" (12.6#, L80, VAM TOP) tubing with flow control components, 4-1/2" SSSV at 121 ft. and 8-5/8" (WFT D&L HYDROW) packer set at 5980 ft. A new wellhead was installed and tested
 - d. *Well Unload:* The well was unloaded. The final installation integrity test was performed. The well was turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$5,638	\$0	\$5,638
Contract Costs	\$0	\$0	\$0
Material	\$244,749	\$0	\$244,749
Other Direct Charges	\$1,513,594	\$48,552	\$1,562,146
Total Direct Cost	\$1,763,981	\$48,552	\$1,812,533

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$61,866	\$337	\$62,203
AFUDC	\$2,389	\$0	\$2,389
Property Taxes	\$3,160	\$0	\$3,160
Total Indirect Costs	\$67,415	\$337	\$67,752

Total Loaded Costs	\$1,831,396	\$48,889	\$1,880,285²
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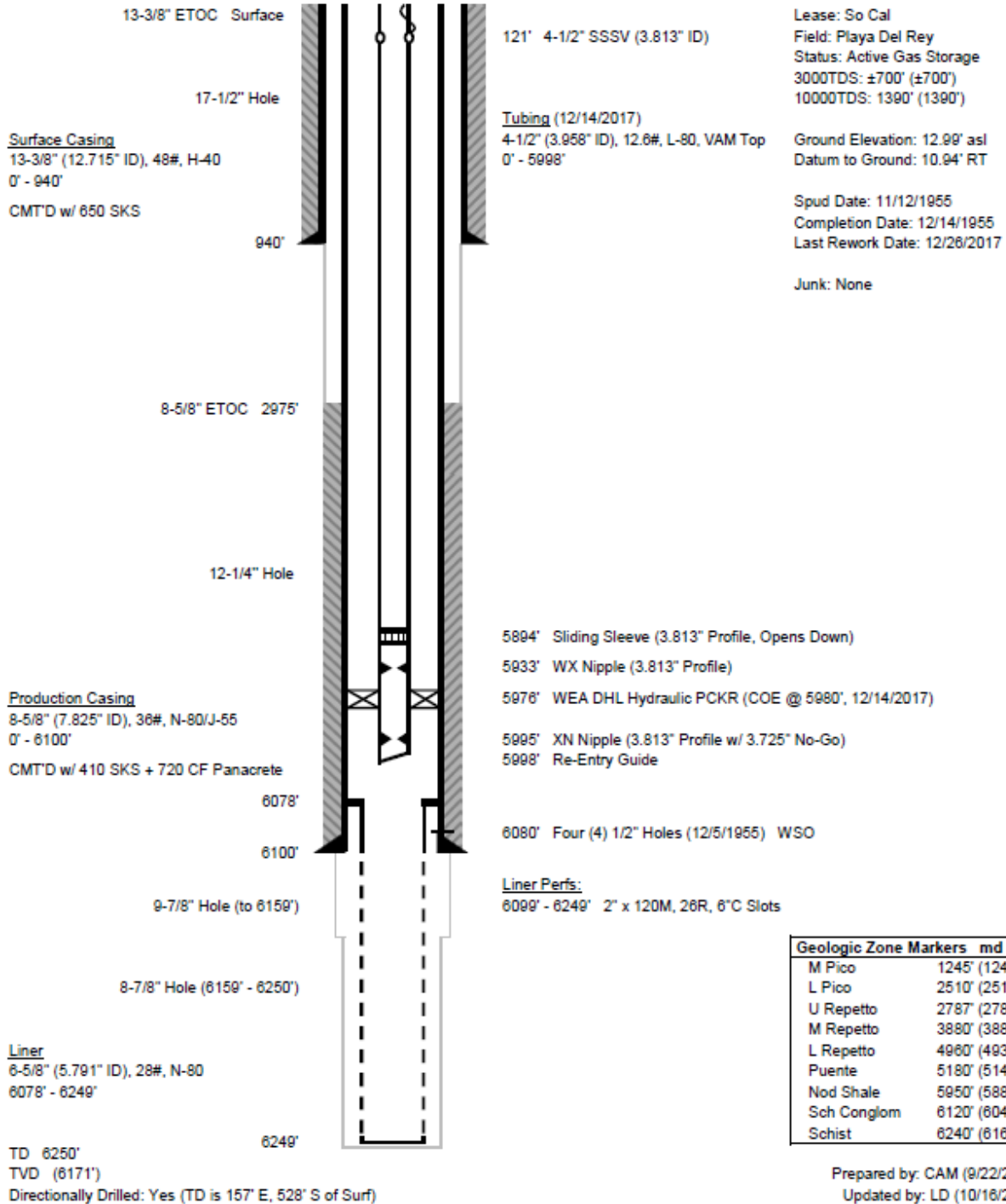
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

Well
So Cal 1

API #: 04-037-14046-00
Sec 27, T2S, R15W

Operator: So. California Gas Co.



I. Background

Project Overview			
Field	Playa del Rey		
Well Name	Vidor 9	API	04-037-14065-00
Project Type	Steel Liner Recompletion		
Well Status	Active	NOP:	09/08/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	03/19/1935		
Initial Completion	05/19/1935		
Elevation	12 ft.		
Caprock Depth	6023 ft.		
Measured Depth	6311 ft.		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Vidor 9. This project planned to pull 4-1/2" completion string, run casing inspection logs, pressure test casing, install a new completion string, and convert well to tubing flow. The plan was to gather baseline assessment data on the production casing. The following describes the well workover plan for Vidor 9 used to acquire the necessary DOGGR NOI:

1. Rig Work

- a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 5715 ft. of 4-1/2" (11.6#, L80, LT&C) and 162 ft. of 3-1/2" (9.3#, L80, EUE) tubing, bottom hole assembly, and 6-5/8" (Otis AWB) packer from 5880 ft.
- b. Well Assessment/Evaluation
 - i. Clean out wellbore to liner top at 5971 ft.
 - ii. Run inspection logs (UT, CBL, MAC and MFL) from approximately 5971 ft to surface
 - iii. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - iv. Clean out wellbore to target depth 6310 ft
- c. Well Completion
 - i. Install a new 4-1/2" tubing completion string, bottom hole assembly, and 6-5/8" packer, thereby converting the well to tubing flow

- ii. Perform installation integrity test on completion
- iii. Install wellhead
- 2. Post Rig Work
 - a. Unload well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	N/A
3	Ultrasonic (UT)	07/11/2017
4	Cement Bond Log (CBL)	07/11/2017
5	Multi-Arm Caliper (MAC)	07/12/2017 07/21/2017 08/17/2017
6	Magnetic Flux Leakage (MFL)	07/13/2017 07/20/2017
7	Block Test	07/20/2017
8	Annular and Tubing Pressure Test – Final	08/29/2017
Approvals and Return to Service		
9	DOGGR Approval	10/31/2017
10	Return to Service	10/13/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	06/19/2017	08/31/2017

C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing, installing a steel liner and running new completion
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 5715 ft. of 4-1/2" (11.6#, L80, LT&C) and 162 ft. of 3-1/2" (9.3#, L80, EUE) tubing, bottom hole assembly, and 6-5/8" (Otis AWB) packer from 5880 ft.
 - b. *Well Assessment/Evaluation:* The wellbore was cleaned out to 5971 ft. Inspection logs were run (UT, CBL) from 5945 ft. to surface. MAC was run from 5947 ft. to surface. MFL was run from 5927 ft. to surface. Gyro survey was run from 5945 ft. to surface. The block test was performed. MFL and MAC were re-run from 5927 ft. to surface. The wellbore was cleaned out to total depth at 6310 ft.
 - c. *Steel Liner Installation/Evaluation:* The production casing was drifted and dressed from 5960 ft. to 5705 ft., 5644 ft. to 5630 ft., and 314 ft. to 137 ft. to install steel liner. The steel liner was installed from 5900 ft. to 5800 ft. and confirmed with MAC log and pressure test
 - d. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 5544 ft. of 4-1/2" (12.6#, L80, VAM TOP) and 263 ft. of 3-1/2" (9.3#, L80, VAM TOP) tubing, flow control components, 3-1/2" SSSV at 120 ft. and 6-5/8" (WFT DHL) packer set at 5790 ft. new wellhead installed and tested
2. Post Rig Work: The well was unloaded. The final installation integrity test was performed. The well was turned over to SoCalGas Operations for injection and withdrawal

D. Changes During Workover

A steel liner was installed across anomalies detected on the production casing. A SSSV was also installed. The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$5,762	\$399	\$6,161
Contract Costs	\$0	\$0	\$0
Material	\$276,846	\$0	\$276,846
Other Direct Charges	\$1,080,989	\$110,517	\$1,191,506
Total Direct Cost	\$1,363,597	\$110,916	\$1,474,513

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$49,156	\$1,075	\$50,231
AFUDC	\$0	\$0	\$0
Property Taxes	\$719	\$0	\$719
Total Indirect Costs	\$49,875	\$1,075	\$50,950

Total Loaded Costs	\$1,413,472	\$111,991	\$1,525,463²
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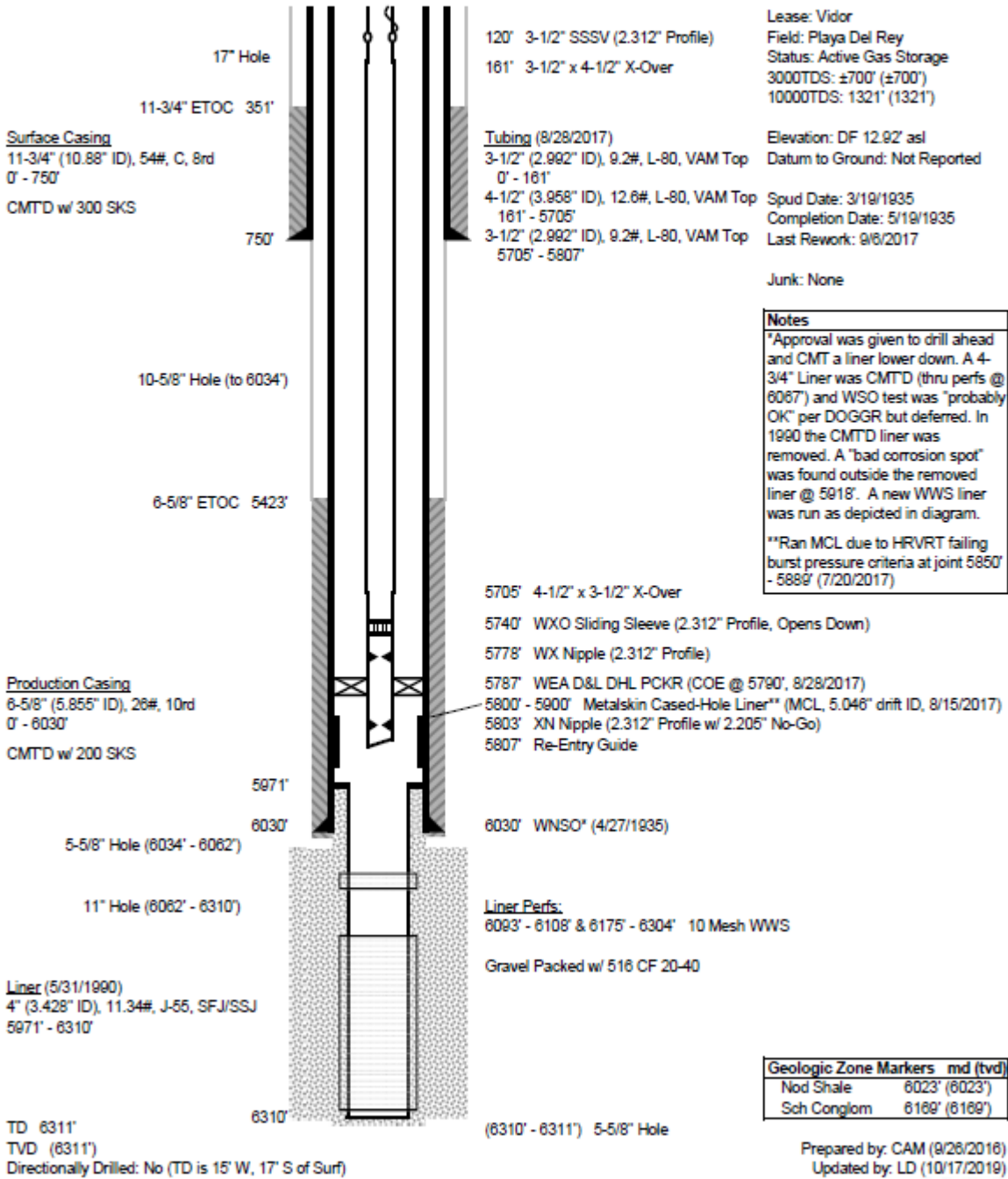
² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

**Well
Vidor 9**

API #: 04-037-14065-00
Sec 27, T2S, R15W

Operator: So. California Gas Co.



I. Background

Project Overview			
Field	Playa del Rey		
Well Name	Vidor 16	API	04-037-14072-00
Project Type	Recompletion		
Well Status	Active	NOP:	06/05/2017
Well Characteristics			
Well Type	Injection/Withdrawal		
Spud Date	05/08/1936		
Initial Completion	06/24/1936		
Elevation	13 ft.		
Caprock Depth	5885 ft		
Measured Depth	6049 ft		
Subject Regulations	DOGGR UGS §1724.9; PHMSA IFR; API 1171		

A. Regulatory Requirements and Recommended Practice

1. **Department of Oil, Gas, and Geothermal Resources (DOGGR) Emergency Regulations** – effective on February 5, 2016: DOGGR undertook an emergency rulemaking action in January 2016 and finalized changes under §1724.9 (Emergency UGS Regulations) in February 2016. Under the emergency rulemaking, DOGGR mandated numerous requirements specific to underground gas storage facilities. These requirements were further supplanted through a DOGGR Order (Order 1109), which prescribed specific testing requirements for all wells at Aliso Canyon; these requirements were also implemented at the other fields (Honor Rancho, Playa del Rey and La Goleta). These testing requirements were incremental to the advanced Storage Integrity Management Program (SIMP) inspections proposed and approved in the 2016 General Rate Case (GRC) Decision (D.) 16-06-054.
2. **Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletin¹** – Published on February 5, 2016: Recommended Practice 1171 - Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs and provided guidance to adopt the recommended practices.
3. **PHMSA 2016 Underground Storage Interim Final Rule (IFR)** – Published on December 19, 2016: Adopts the American Petroleum Industry (API)

¹ PHMSA, Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas, Advisory Bulletin (ADB-2016-02), Issued February 6, 2016.

Recommended Practice 1171, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs, as a mandatory regulation. On June 22, 2016, the Protecting our Infrastructure of Pipelines and Enhancing Safety (PIPES) Act became law. Section 12 of the act mandated that PHMSA issue regulations for underground gas storage facilities within two years from the date of enactment. Using API RP 1171 through a mandatory incorporation-by-reference, PHMSA issued an IFR in December 2016 to begin regulating downhole portions of underground gas storage. In addition, the IFR added reporting requirements for underground gas storage facilities. (A Final Rule was issued in January 2020.)

II. Workover Development

A. Plan

The intent of this project was to inspect the well integrity and remediate conditions identified as part of the SIMP. After reviewing well history, available directional surveys and inspection logs, and current wellbore configuration (e.g., casing size, restrictions, perforations, liner, etc.), a plan was developed to evaluate the integrity of well Vidor 16. This project planned to pull 5" completion string, run casing inspection logs, pressure test casing, install a new completion string and SSSV, and convert well to tubing flow. The plan was to gather baseline assessment data on casing. The following describes the well workover plan for Vidor 16 used to acquire the necessary DOGGR NOI:

1. Rig Work
 - a. Well Decompletion
 - i. Remove wellhead components for refurbishing and inspection, or for replacement
 - ii. Pull existing completion consisting of 5734 ft. of 5" (17.93#, N80, A-B FL4S), 92' of 3-1/2" (9.3#, N80, EUE), and 150' of 2-7/8" (6.5#, N80, EUE) tubing, 3-1/2" SSSV, bottom hole assembly, and 6-5/8" (Otis Permadrill) packer from 5970 ft.
 - b. Well Assessment/Evaluation
 - i. Clean out well bore to liner top at 5981 ft.
 - ii. Run inspection logs (UT, CBL, MAC and MFL) from approximately 5975 ft. to surface
 - iii. Perform pressure integrity test to 1.15 Maximum Allowable Operating Pressure (MAOP)
 - c. Well Completion

- i. Install a new 4-1/2” tubing completion string, 3-1/2” SSSV, bottom hole assembly, and 6-5/8” packer, thereby converting the well to tubing flow
 - ii. Perform installation integrity test on completion
 - iii. Install wellhead
- 2. Post Rig Work
 - a. Unloaded well and turn over to operations
- 3. Preparation of DOGGR NOI and submittal for permit to conduct operations

B. Well Workover

1. Well Assessments

SIMP Inspection and Assessment Activities		Date
1	Isolation and Pressure Test	N/A
2	Noise and Temp Survey	09/13/2017 09/21/2017 09/26/2017
3	Ultrasonic (UT)	05/04/2017
4	Cement Bond Log (CBL)	05/04/2017
5	Multi-Arm Caliper (MAC)	05/08/2017
6	Magnetic Flux Leakage (MFL)	05/08/2017
7	Block Test	05/10/2017
8	Annular and Tubing Pressure Test – Final	05/22/2017 05/31/2017 (SCSSV)
Approvals and Return to Service		
9	DOGGR Safety Review Team Approval	06/01/2017
10	Return to Service	06/14/2017

2. Project timeline

Major Milestone	Start	Finish
Rig Work	03/30/2017	05/23/2017

C. Workover Explanation

1. Rig Work included the decompletion of existing production equipment, running inspection logs, pressure testing casing and running new completion equipment
 - a. *Well Decompletion:* This step included the planned removal of wellhead components and production equipment consisting of 5734 ft. of 5" (17.93#, N80, A-B FL4S), 92' of 3-1/2" (9.3#, N80, EUE), and 150' of 2-7/8" (6.5#, N80, EUE) tubing, 3-1/2" SSSV, bottom hole assembly, and 6-5/8" (Otis Permadrill) packer from 5970 ft.
 - b. *Well Assessment/Evaluation:* The wellbore was cleaned out to total depth of 6049 ft. Inspection logs were run (UT, CBL) from 5962 ft. to surface. The Gyro survey was run from 5960 ft. to surface; MAC and MFL were run from 5967 ft. to surface. The block test was performed
 - c. *Well Completion:* A new completion string and bottom hole assembly were installed consisting of 5710 ft. of 4-1/2" (12.6#, L80, VAM TOP) and 271 ft. of 3-1/2" (9.3#, L80, VAM TOP) tubing, flow control components, 3-1/2" SSSV at 116 ft. and 6-5/8" (WFT DHL) packer set at 5942 ft. A new wellhead installed and tested
2. Post Rig Work: The well was unloaded. The final installation integrity test was performed. The well was turned over to SoCalGas Operations for injection and withdrawal
 - a. Post Injection Work: Well developed pressure build up in the annulus and required placing packer fluid to a calculated depth

D. Changes During Workover

The tubing, flow components, and wellhead were enhanced to higher standards for gas injection and withdrawal.

III. Project Costs

A. Actual Costs

Direct Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Company Labor	\$10,602	\$0	\$10,602
Contract Costs	\$0	\$0	\$0
Material	\$236,557	\$0	\$236,557
Other Direct Charges	\$1,318,567	\$88,659	\$1,407,226
Total Direct Cost	\$1,565,726	\$88,659	\$1,654,385

Indirect Costs	Capital (CAP) Cost	(O&M) Cost	Total Actual Costs
Overheads	\$60,277	\$580	\$60,857
AFUDC	\$0	\$0	\$0
Property Taxes	\$1,293	\$0	\$1,293
Total Indirect Costs	\$61,570	\$580	\$62,150

Total Loaded Costs	\$1,627,296	\$89,239	\$1,716,535²
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² Balanced costs form the basis for the revenue requirement requested in this Application as discussed in the Prepared Direct Testimony of Jenny Chhuor (Chapter III). Non-balanced costs are subject to separate balancing account mechanisms or GRC funding.

IV. Wellbore Diagram after SIMP Work

