STATE OF CALIFORNIA GAVIN NEWSOM, *Governor*

PUBLIC UTILITIES COMMISSION
505 VAN NESS AVENUE

March 31, 2020

Advice Letter 4180-G

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P.O. Box 770000
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SUBJECT: Updated Revised Retrofit Schedule in Compliance with Decision 19-09-025

Dear Mr. Jacobson:

Advice Letter 4180-G is effective as of December 14, 2019.

Sincerely,

Edward Randolph
Deputy Executive Director for Energy and Climate Policy/
Director, Energy Division

Pacific Gas and Electric Company

Erik Jacobson
Director
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Fax: 415-973-3582

November 14, 2019

Advice 4180-G
(Pacific Gas and Electric Company ID U 39 G)

Public Utilities Commission of the State of California

<u>Subject:</u> **Updated Revised Retrofit Schedule in Compliance with Decision 19-09-025**

Purpose

This advice letter complies with a directive in Decision (D.) 19-09-025 (the Decision) in Pacific Gas and Electric's (PG&E) 2019 Gas Transmission and Storage (GT&S) a revised retrofit schedule for its Well Reworks and Retrofit Program.

Background

On November 17, 2017, PG&E filed an application at the California Public Utilities Commission (CPUC or Commission) requesting that the Commission adopt its gas transmission (GT&S) revenue requirement, cost allocation, and rate design for the period of 2019-2022. On September 12, 2019, the CPUC voted to adopt the Decision and address the issues before the Commission related to PG&E's application.[1] In Section 6.1.1. Reworks and Retrofits Program of the Decision, the CPUC agreed with TURN and PG&E's arguments that the expenses and capital expenditures for the Reworks and Retrofit program should be based on the compliance period designated in the final Division of Oil, Gas, and Geothermal Resources (DOGGR) May 2019 Rule. The DOGGR May 2019 Rule allows PG&E to retrofit wells over a seven-year timeline instead of two years. PG&E submits this Advice Letter in compliance with directive on page 91 of the Decision to "file a revised retrofit schedule based on the seven-year compliance timeline."

Revised Retrofit Schedule

Implementation plans to conform to the DOGGR construction requirements were provided to DOGGR on March 29, 2019. PG&E's implementation plan included a proposal to convert well configuration to tubing and packer over a seven-year implementation period

[1] The CPUC issued the decision on September 23, 2019.

beginning in 2019. The three field specific plans are included in this Advice Letter and titled:

- Attachment A – McDonald Island Underground Storage Field: Well Risk Evaluation and Construction Standard Implementation Plan
- Attachment B – Los Medanos Underground Storage Field: Well Risk Evaluation and Construction Standard Implementation Plan
- Attachment C – Pleasant Creek Underground Storage Field: Well Risk Evaluation and Construction Standard Implementation Plan

These attached documents detail the process and application of the risk evaluation at the well level, and describe PG&E's current plan to complete baseline casing inspections. While the well selection is subject to change based on risk mitigation inputs gathered throughout the year, the planned units targeted for completion during the DOGGR compliance period remain unchanged (October 1 to October 1 of the year following). Further, plans for compliance at both the Los Medanos and Pleasant Creek fields have also been furnished as the timing of conversion to production field status impacts the units required to comply at each facility under the DOGGR regulations.

This submittal would not increase any current rate or charge, cause the withdrawal of service, or conflict with any rate schedule or rule.

<u>Protests</u>

Anyone wishing to protest this submittal may do so by letter sent via U.S. mail, facsimile or E-mail, no later than December 4, 2019, which is 20 days after the date of this submittal. Protests must be submitted to:

CPUC Energy Division
ED Tariff Unit
505 Van Ness Avenue, 4^{th} Floor
San Francisco, California 94102

Facsimile: (415) 703-2200
E-mail: EDTariffUnit@cpuc.ca.gov

Copies of protests also should be mailed to the attention of the Director, Energy Division, Room 4004, at the address shown above.

The protest shall also be sent to PG&E either via E-mail or U.S. mail (and by facsimile, if possible) at the address shown below on the same date it is mailed or delivered to the Commission:

Erik Jacobson
Director, Regulatory Relations
c/o Megan Lawson
Pacific Gas and Electric Company
77 Beale Street, Mail Code B13U
P.O. Box 770000
San Francisco, California 94177

Facsimile: (415) 973-3582
E-mail: PGETariffs@pge.com

Any person (including individuals, groups, or organizations) may protest or respond to an advice letter (General Order 96-B, Section 7.4). The protest shall contain the following information: specification of the advice letter protested; grounds for the protest; supporting factual information or legal argument; name, telephone number, postal address, and (where appropriate) e-mail address of the protestant; and statement that the protest was sent to the utility no later than the day on which the protest was submitted to the reviewing Industry Division (General Order 96-B, Section 3.11).

Effective Date

Pursuant to General Order (GO) 96-B, Rule 5.2, and OP 82 of D.19-09-025, this advice letter is submitted with a Tier 2 designation. PG&E requests that this Tier 2 advice submittal become effective on regular notice, December 14, 2019 which is 30 calendar days after the date of submittal.

Notice

In accordance with General Order 96-B, Section IV, a copy of this advice letter is being sent electronically and via U.S. mail to parties shown on the attached list and the parties on the service list for A.17-11-009. Address changes to the General Order 96-B service list should be directed to PG&E at email address PGETariffs@pge.com. For changes to any other service list, please contact the Commission’s Process Office at (415) 703-2021 or at Process_Office@cpuc.ca.gov. Send all electronic approvals to PGETariffs@pge.com. Advice letter submittals can also be accessed electronically at: http://www.pge.com/tariffs/.

/S/

Erik Jacobson
Director, Regulatory Relations

Attachments:

Attachment A – McDonald Island Underground Storage Field: Well Risk Evaluation and Construction Standard Implementation Plan

Attachment B – Los Medanos Underground Storage Field: Well Risk Evaluation and Construction Standard Implementation Plan

Attachment C – Pleasant Creek Underground Storage Field: Well Risk Evaluation and Construction Standard Implementation Plan

cc: Service List A.17-11-009

ADVICE LETTER SUMMARY

ENERGY UTILITY

MUST BE COMPLETED BY UTILITY (Attach additional pages as needed)

Company name/CPUC Utility No.: Pacific Gas and Electric Company (ID U39G)

Utility type:

☐ ELC ☑ GAS ☐ WATER
☐ PLC ☐ HEAT

Contact Person: Kimberly Loo
Phone #: (415)973-4587
E-mail: PGETariffs@pge.com
E-mail Disposition Notice to: KELM@pge.com

EXPLANATION OF UTILITY TYPE

ELC = Electric GAS = Gas WATER = Water
PLC = Pipeline HEAT = Heat

(Date Submitted / Received Stamp by CPUC)

Advice Letter (AL) #: 4180-G Tier Designation: 2

Subject of AL: Updated Revised Retrofit Schedule in Compliance with Decision 19-09-025

Keywords (choose from CPUC listing): Compliance

AL Type: ☐ Monthly ☐ Quarterly ☐ Annual ☑ One-Time ☐ Other:

If AL submitted in compliance with a Commission order, indicate relevant Decision/Resolution #:
D.19-09-025

Does AL replace a withdrawn or rejected AL? If so, identify the prior AL: No

Summarize differences between the AL and the prior withdrawn or rejected AL:

Confidential treatment requested? ☐ Yes ☑ No

If yes, specification of confidential information:
Confidential information will be made available to appropriate parties who execute a nondisclosure agreement. Name and contact information to request nondisclosure agreement/access to confidential information:

Resolution required? ☐ Yes ☑ No

Requested effective date: 12/14/19 No. of tariff sheets: 0

Estimated system annual revenue effect (%): N/A

Estimated system average rate effect (%): N/A

When rates are affected by AL, include attachment in AL showing average rate effects on customer classes (residential, small commercial, large C/I, agricultural, lighting).

Tariff schedules affected: N/A

Service affected and changes proposed[1]: N/A

Pending advice letters that revise the same tariff sheets: N/A

[1]Discuss in AL if more space is needed.

Clear Form

Protests and all other correspondence regarding this AL are due no later than 20 days after the date of this submittal, unless otherwise authorized by the Commission, and shall be sent to:

CPUC, Energy Division Attention: Tariff Unit 505 Van Ness Avenue San Francisco, CA 94102 Email: EDTariffUnit@cpuc.ca.gov	Name: Erik Jacobson, c/o Megan Lawson Title: Director, Regulatory Relations Utility Name: Pacific Gas and Electric Company Address: 77 Beale Street, Mail Code B13U City: San Francisco, CA 94177 State: California Zip: 94177 Telephone (xxx) xxx-xxxx: (415)973-2093 Facsimile (xxx) xxx-xxxx: (415)973-3582 Email: PGETariffs@pge.com
	Name: Title: Utility Name: Address: City: State: District of Columbia Zip: Telephone (xxx) xxx-xxxx: Facsimile (xxx) xxx-xxxx: Email:

Clear Form

Advice 4180-G
November 14, 2019

Attachment A

McDonald Island Underground Storage Field: Well Risk Evaluation and Construction Standard Implementation Plan

Pacific Gas and Electric Company

McDonald Island Underground Storage Field: Well Risk Evaluation and Construction Standard Implementation Plan

Gas Storage Asset Management Department

Publication Date: March 29, 2019

Table of Contents

1. Introduction....................3
2. Relative Risk Well Model Approach and Data Sources....................3
2.1. Roles and Responsibilities.................... 3
2.2. Publication Schedule of the Relative Risk Model.................... 4
2.3. Relative Risk Model Attributes Inputs.................... 4
2.4. Likelihood Scoring Components.................... 5
2.4.1. Usage Factor:.................... 5
2.4.3. Adjusted Rework Factor.................... 6
2.4.4. Production Casing/Inner String Condition Factor:.................... 6
2.4.5. Tubing & Packer Condition Factor.................... 8
2.4.6. Monitoring and Inspection Condition Factors:.................... 9
2.4.8. Wellhead Security Factor.................... 11
2.4.9. Natural Force Factors.................... 11
2.5. Consequence Scoring Components.................... 12
2.5.2. Well Rate Factor.................... 13
2.5.3. Well Operation Factor.................... 13
2.5.4. Proximity Factors.................... 13
2.5.5. Valve Factor.................... 15
3. McDonald Island Construction Standard Implementation Plan....................17
4. Baseline and Reassessment Schedule & Methodology for Casing Inspection....................19
Appendix A – McDonald Island Relative Risk Well Evaluation....................23
Appendix B - McDonald Island Well Construction Standard Implementation Plan and Assessment Schedule....................56

1. Introduction

This plan provides the applied individual well risk assessment as detailed in PG&E's Underground Storage Risk and Integrity Management Plan and is specific to the Pleasant Creek Storage Field Facility wells. This plan is a companion document to the Underground Storage Risk and Integrity Management Plan and is intended to be used in conjunction with the preventative and mitigation (P&M) measures included in the noted plan.

Under the Interim Final Rule (effective January 2017) issued by the Pipeline and Hazardous Materials Safety Administration (PHMSA) and API RP 1171 incorporated by reference, operators shall develop a program to manage risk that includes a process to assess risk related to the storage operation on a consistent basis. Additionally, under the Final Regulations (effective October 2018) issued by Division of Oil, Gas, and Geothermal Resources (DOGGR) require operators to perform a risk assessment on a well-by-well basis (§1726.3(c)(2)(4)).

Contained within this implementation plan is the planned schedule to convert PG&E's storage wells at Pleasant Creek to conform with the construction requirements of dual barriers required in Final Regulations (effective October 2018) issued by Division of Oil, Gas, and Geothermal Resources (DOGGR).

Lastly, this plan provides the performance based reassessment methodology and plan for wells following baseline and subsequent inspections.

2. Relative Risk Well Model Approach and Data Sources

Individual well-by-well risk ranking allows PG&E to manage P&M programs to adequately address highest risk assets and prioritize capital projects accordingly. The relative risk ranking model database manages and tracks the inputs, both static and dynamic, to evaluate the relative risk of each well.

Continuous Evaluation (CE) is used to evaluate the integrity of each well based on data integration from both integrity assessments performed and routine maintenance, operations, and testing performed to evaluate asset condition and subsequent risk profile. Data collected from the P&M measures are used to inform the scoring assignments. Additionally, baseline casing assessment and reinspection data are input into the model. Reinspection frequency is based on the Underground Storage Risk and Integrity Management Plan, Appendix C – Casing Inspection Survey Frequency Tree.

2.1. Roles and Responsibilities

Reservoir Engineering is responsible for analyzing all the available asset data collected in the practices outlined in the Underground Storage Risk & Integrity Management Plan to evaluate the overall condition and exposure of each well asset.

2.2. Publication Schedule of the Relative Risk Model

The model is maintained throughout the year as new data becomes available and the following schedule guides the formal publication/snapshot of the relative risk model.

Publication	Purpose
By July 31	Identifies/confirms well population scheduled for next two-year rework cycles
By January 31	Integrates previous season rework Integrates year end data to identify any emergent or break in work to be addressed in the coming year and confirms five-year outlook

2.3. Relative Risk Model Attributes Inputs

The following sections below outline the various attributes and inputs that are considered in the relative risk ranking analysis. The data includes both static and dynamic data; static data is unchanging and does not require annual review, whereas dynamic data is dependent on testing result inputs.

The risk score for each well is computed by summing the score components that impact likelihood of loss of containment and multiplying that value by the sum of the consequence score impacts to safety, environment, and reliability.

Likelihood Score Components	Consequence Score Components
• Usage Factor • Adjusted Rework Factor • Production Casing Condition Factor • Tubing and Packer Condition Factor • Monitoring and Inspection Condition Factor • Wellhead Security Factor • Natural Force Factor	• Well Rate Factor • Well Operation Factor • Wind Direction Impact • Proximity Factors: Occupied Structure, Offset Well, Road and Railway Proximity, Local/Adjacent Land Use, Water Proximity, Response to Well Incident • Well Configuration • Valve Factor

2.4. Likelihood Scoring Components

The likelihood scoring components include the following factors are a defined in the following subsections. The scoring component is shown in the shaded box within the section.

The scoring components are combined in the following equation:

Likelihood = (Usage Factor/5) + (Adjusted Rework Factor x 5)
+ (Production Casing Condition Factors)
+ (Tubing and Packer Condition Factors)
+ (Monitoring and Inspection Condition Factors)
+ (Well Security Factor)
+ (Natural Force Factors)

2.4.1. Usage Factor:

The usage factor is computed as described below:

- Usage Factor: This score considers the impact of the duration of use over a well's life cycle, the prospect for human error via intervention activities, how the well has been used to account for levels of stresses the well has been subject to.

$$\text{Usage Factor} = \text{Average}\left\{\begin{array}{c}\text{Number of Years in Operation}\\ \text{Years since last well rework}\\ 20 \times \text{Well Operation}\end{array}\right\}$$

  - Well Operation: The current operational state in which the well is used. Wells will be identified as Injection and withdrawal (Inj/Wd), withdrawal only (Wd only), or observation (obs). The use of the well is dependent on construction and surface facility installments. Wells that are used for both Inj/Wd have a higher likelihood score as the stresses from injection and withdrawal activities are the highest. Wells used for Wd only do not experience injection forces, thus are scored lower. Wells used of observation do not experience dynamic loading and are scored lower at a 1.

    The following likelihood scoring is given based on identified well operation:

    Injection/Withdrawal (IW) = 3

    Withdrawal only (wd only) = 2

    Observation (obs) = 1

2.4.3. Adjusted Rework Factor

This score is based on the knowledge of the casing condition and assigns a higher risk score to wells that have had intervention or rework activity and have not had a casing assessment performed. This accounts for the human impact and risk associated with rework activity, and elevates opportunities where the casing could have been impacted but the condition is unknown.

Rework Factor =	If casing condition not known	→	Number of Well Reworks
	If casing condition not known	→	0.5 x Number of Reworks

2.4.4. Production Casing/Inner String Condition Factor:

The production casing condition factor is a summation of the following inputs for the production casing string. In wells that have been converted to tubing and packer, this element is considered the secondary barrier.

- Original Production Casing Wall Thickness: This score is based on the worst-case metal loss identified in a casing inspection survey (i.e. MFL or ultrasonic). In the case where a well has not been assessed, the highest score is assigned.

  Unknown = 4

  Class 3 or 4 = 3

  Class 2 or general = 2

  Isolated Class 1 or 2 = 1

- Inner String Production Casing Wall Thickness: This score is based on the worst-case metal loss identified in a casing inspection survey (i.e. MFL or ultrasonic) where an inner string has been cemented into place. In the case where a well has not been assessed, the highest score is assigned.

  Unknown = 4

  Class 3 or 4 = 3

  Class 2 or general = 2

  Isolated Class 1 or 2 = 1

- Production Casing Wall Thickness: If an inner string is in place to remediate an original production casing, this pulls the inner string production casing identified

above. If the original production casing is still the active production casing string, this pulls the production casing from two items above.

Unknown = 4
Class 3 or 4 = 3
Class 2 or general = 2
Isolated Class 1 or 2 = 1

- Source of Metal Loss on Production Casing: This identifies the source of any known metal loss and assigns the score to metal loss due to corrosion as 3. For wells where the condition is unknown, the highest score of 4 is assigned to elevate the risk for wells where the condition is unknown.

Corrosion (IC or EC) = 5
Mechanical = 2
None = 0

- Potential Production Casing Mechanical Leak Path: This score identifies possible leak paths that could lead to a loss of containment incident based on the construction of a well or known historic leak prone connections. This score takes into account the well's construction and whether or not a potential leak path is present. Uncovered perforations, such that they have not been remediated with a scab liner to mitigate risk, are given a score of 5. Uncovered stage collars, those not proactively or in mitigation covered with a scab liner, also present a potential leak path and are assigned a 4. Stage collars that have been remediated with an inner string, while still can be a potential leak path, are considered less risky and a score of 3 is assigned. A casing thread leak is scored as a 2.

Uncovered Perforations = 5
Uncovered Stage collar or thread leak = 4
Isolated (by cement or Inner String) Stage Collar = 3
Isolated casing thread Leak = 2
None Identified/Not Applicable = 1

- Dogleg Severity: This score is based on the percentage of dogleg severity(DLS). DLS is considered as the combined stresses across sections of high deviation are higher and are also prone to greater amount of casing wear from pipe

tripping. The maximum % of DLS is considered in the risk score as a well with a section of pipe that has a high degree of DLS impacts the allowable stress limit of a well and reduces the amount of tolerable wall loss at the same performance rating.

0% -5% = 1
5% -10% = 2
> 10% = 3

- Inner String Installed: The presence of an inner string is included in the scoring as it adds risk by creating another potential leak path and additional element that requires monitoring.

Yes, Installed = 2
No = 1

- Cement Bond Log TOC: The cement bond log uses the input value from the TOC identifying the highest top of well bonded cement with relation to the surface casing shoe depth.

Full - 1
Inside SC - 2
Below SC - 3

2.4.5. Tubing & Packer Condition Factor

The tubing & packer condition factor is a summation of the following inputs:

- Tubing Wall Thickness: This score is based on the worst-case metal loss identified in an inspection survey (i.e. MFL or ultrasonic). This will only impact the score of wells that are converted to tubing and packer configuration.

Class 3 or 4 = 3
Class 2 or general = 2
Isolated Class 1 or 2 = 1
Not Applicable = 0

- Potential Tubing Mechanical Leak Path: This score is based on known thread leaks of the tubing.

Tubing thread Leak = 2
None Identified/Not Applicable = 0

- Packer Condition: This score is based on how well a packer is sealing and if a known packer leak is present.

Known Leak=2
Sealing/Not Applicable = 0

2.4.6. Monitoring and Inspection Condition Factors:

The following monitoring and inspection data points/trends are combined for each well evaluation:

- Annular Condition Monitoring Plan: This score uses the presence of an annular condition monitoring plan to elevate the risk of a given well.

  Note: based on the annular testing performed, annular pressure can be managed and is typically not considered a hazardous situation.

Yes = 3
No = 1

- Sand Production: The sand inspections of each well is typically performed twice each year during withdrawal season. This score uses the historical sand inspection data and counts the number of inspections that have been a grade 3 or higher. This elevates the risk score of a well as it can be associated with higher erosion rates and gravel pack degradation.

Count of # of Grade 3 or more that have occurred since last rework

- Gas Composition: This score takes into account the type of gas in the storage system and if corrosive constituents are present and could cause/accelerate metal loss features.

None = 0
CO2 = 1
H2S = 5

- Wellhead Flange Condition- known leak: This score uses the monitoring data from the quarterly wellhead inspections and identify if there are known leaks.

Yes, leak = 2
No= 1

- Wellhead Tubing head Condition- known leak: This score uses the monitoring data from the quarterly wellhead inspections and identify if there are known leaks.

Yes, leak = 2
No= 1

- Wellhead Hydraulic Port Leak Condition: This score uses the monitoring data from the quarterly wellhead inspections and identify if there are known leaks.

Yes, leak = 2
No= 1

- Known Hydrate Potential: This score is factored in for wells where hydrate formation on the system has been identified historically.

Yes, historically observed = 1
No= 0

2.4.8. Wellhead Security Factor

The Wellhead security factor is a summation of the following inputs:

- Well Security: This score is based on security features installed at a given wellhead site or group of proximate wellheads. This score impacts the likelihood by taking into account the presence of a barrier that would limit access, thus reducing the likelihood of an external influence triggering a loss of containment event. Wells that have a fencing system are scored with a 1 and those without any type of physical barrier limiting access would be a 2.

  All of PG&E's wellhead sites are gated and fenced.

  Gated/Fenced = 1

  No= 2

- Wellhead Surface Impact Damage Protection: This score is based on security features installed at a given wellhead site to minimize opportunity for surface impact to the wellhead to occur and lead to an uncontrolled flow event. If no measures are employed, then the highest score is assigned as the wellhead has a higher risk of exposure to surface impact (i.e. vehicular). The likelihood score is reduced based on the level of surface protection provided whether a full circumferential system (i.e.. Bollards) be in place or partial (i.e. k-rail system on one side). Wells that are enclosed by a fence but do not have a barrier in place have a higher risk as maintenance vehicles drive within the fenced area.

  Full Barricade (k-rail/bollard) =1

  Partial Barricade (k-rail/bollard) = 2

  None (Fenced only) = 3

2.4.9. Natural Force Factors

The following factors are included and take into account naturally occurring outside force threats.

- Flooding: This score is based on the potential to experience flooding at a given storage facility.

  No= 0

  Yes=1

- Seismic: This score is based on the potential seismicity a given storage facility.

Low = 1
Med = 2
High =3

- Subsidence: This score consider is there is active subsidence at the facility.

No= 0
Yes=1

- Tsunami: This score considers the opportunity for a tsunami to impact the facility.

No= 0
Yes=1

- Landslide: This score considers if the facility and well site is situated where it could be impacted by landslides.

No= 0
Yes=1

2.5. Consequence Scoring Components

The consequence scoring components include the following factors as defined in the following subsections. The scoring component is shown in the shaded box within the section.

The scoring components are combined in the following equation:

Consequence = [(0.25 x Well Rate Factor) + (Well Operation Factor)
+ Σ (Proximity Factors)]
– [5x ((0.5 Configuration) + (Valve Factor))]

2.5.2. Well Rate Factor

- Rate Factor: This is based on the max current rate at the time of publishing the risk plan. Twenty-five percent of the rating factors into the consequence score to account for the reliability impact with the loss of a well.

2.5.3. Well Operation Factor

- Well Operation: The operational consequence of an event is also impacted that renders the well unusable has a greater implication on operations and use of the storage field. Withdrawal only wells carry an intermediate scoring as the unavailability of the well poses a risk to deliverability. Observation wells are assigned the lowest value in this category as unavailability would not impose a risk to operations.

Injection/Withdrawal (IW) = 3

Withdrawal only (wd only) = 2

Observation (obs) = 1

2.5.4. Proximity Factors

- Wind Direction Impact: This score looks at a well's surface location with respect to the nearest located structure and the predominant wind direction. This score is considered high such that a large release of gas could have severe impact with ignition on an adjacent facility. The score is low such that the predominant wind direction is away from adjacent structures.

High = 3

Low = 1

- Occupied Structure: This score is based on the well's surface location and its proximity to an occupied structure.

>1000 ft = 1

500-1000 ft = 2

0-500 ft = 3

- Offset Wells: This score is based on the well's surface location and its proximity to an adjacent wellhead.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3

- Proximity to Roads: This score is based on the well's surface location and its proximity to a road as noted in the scoring.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3
0-500 ft of Major Highway = 4

- Proximity to Railroads: This score is based on the well's surface location and its proximity to a railroad as noted in the scoring.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3

- Proximity to Major Airport: This score is based on the well's surface location and its proximity to a major airport as noted in the scoring.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3

- Proximity to Population Centers: This score is based on the facility's location and the buffer rings indicated in the scoring.

> 1 Mile =3
1-2 Mile =2
2-5 Mile =1
>5 Mile = 0

- Proximity to Body of Water: This score is based on the facility's location and the buffer rings indicated in the scoring.

> 1 Mile =3
1-2 Mile =2
2-5 Mile =1
>5 Mile = 0

- Local Area/Land Use: This score is based on the facility's location and the surrounding area activity.

Urban = 4
Residential = 3
Crop farming (Irrigation/fertilizer / Plane) = 2
Cattle farming = 1

- Response to Well Incident: This score is based on proximity of employees to recognize and be able to respond in the event of a well emergency. Manned facilities have a higher likelihood that a response would be fairly soon after an event started or signs of an event could be recognized to minimize the impact.

Unmanned-2
Facility Manned-1

2.5.5. Valve Factor

This factor is used to reduce the consequence score by the mitigation employed by the presence and performance of a DHSV. The factor is computed in the following manner; each scoring component is listed and explained below.

$$\text{Valve Factor} = \left(\frac{\text{DHSV-Csg deployed}}{\text{DHSV-Csg Condition}} \right) + \left(\frac{\text{DHSV-Tbg deployed}}{\text{DHSV-Tbg Condition}} \right) + \left(\frac{1}{1 + \text{DHSV CL-cond}} \right)$$

- Well Configuration Factor: This score is used to reduce the consequence such that the dual barrier configuration would reduce the impact on the consequence.

  This score is factored by 50% in the final algorithm.

T&C Flow -1
T&P - 4

- DHSV Casing (Csg) Deployment: This score considers the presence of a DHSV on the casing side. Once wells are converted to tubing and packer, there is only a DHSV installed on the tubing side.

Yes -1
No - 0

- DHSV Tubing (Tbg) Deployment: This score considers the presence of a DHSV on the tubing side. Once wells are converted to tubing and packer, there is only a DHSV installed on the tubing side. Note: not all wells require a DHSV to be installed based on the critical well definition.

Yes -1
No - 0

- DHSV Casing (Csg) Condition: This score sums the number of level 4 leak by tests results a valve has received since installation.

# of Level 4 since installation

- DHSV Tubing (Tbg) Condition: This score sums the number of level 4 leak by tests results a valve has received since installation.

# of Level 4 since installation

- DHSV Control Line Condition: This score sums the number of level 4 leak by tests results the control line has received since installation.

# of Level 4 since installation

3. McDonald Island Construction Standard Implementation Plan

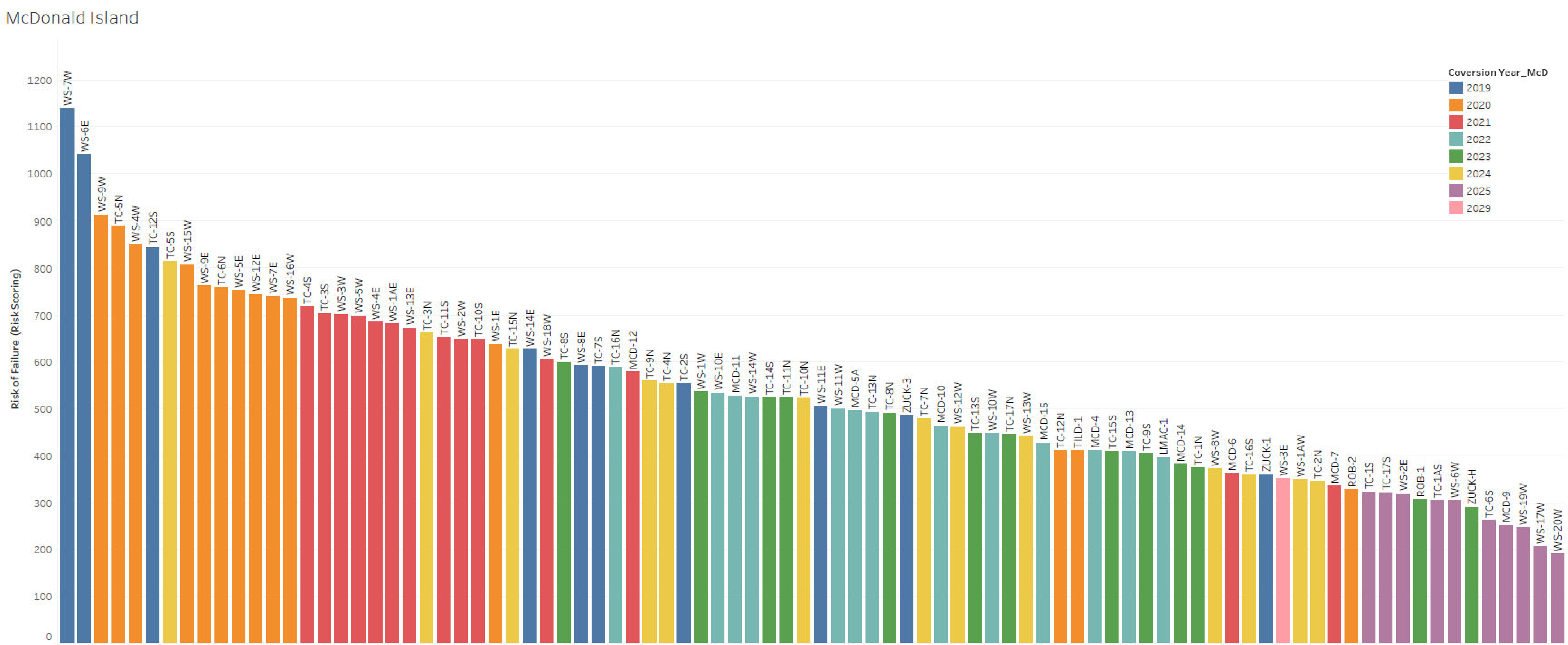
PG&E's wells located at McDonald Island are typically completed with open ended tubing and flow gas in both the tubing and casing annuli. In accordance with the construction standard in the DOGGR final regulations §1726.5, PG&E is phasing in the retrofits and/or permanent plug and abandonment as shown below in the schedule by year. Refer to the well specific schedule shown in Appendix B – McDonald Island Well Implementation and Assessment Schedule for the planned year of conversion. Additionally, Figure 3-1 shows the planned year of conversion and relative risk of a given well.

The well-by-well planned schedule is a living document and is based on the current data and inspection information known at the time this plan was published. The planned schedule is subject to change following the annual ranking update and where continuous evaluation activities necessitate advancing a well ahead of the planned date to address issues accordingly. Table 1 below shows the number of wells targeted by year to accomplish the conversion to tubing and packer configuration or plug and abandon by the end of 2025.

Table 1

McDonald Island 2019-2025 Well Construction Standard Implementation Plan			
Year	**Planned Number of Wells**	**% of Total Wells**	**Cumulative Count**
2018	0	0	1*
2019	10	11%	11
2020	14	16%	25
2021	14	16%	39
2022	13	15%	52
2023	13	15%	65
2024	13	15%	78
2025	10	11%	88
*Note: One well at McDonald Island was completed with T&P prior to the regulations.			

Figure 3-1: T&P Conversion shown by year and Risk Rank



4. Baseline and Reassessment Schedule & Methodology for Casing Inspection

PG&E commenced performing baseline inspections in 2013 and has completed a baseline casing inspection log on 35 wells (40% of field) at the start of 2019. As the program advanced, additional logs and tests were grouped into the suite of testing to establish a baseline in 2016. The suite of testing is provided in the Risk and Integrity Management Plan in Appendix Z. The status of well assessments can be grouped into three categories based on the time period when the assessment occurred:

1. **Pending Assessments:** Wells have not yet been inspected using advanced casing inspection tools. These wells have been inspected for baseline gas behind pipe using GRN tools. The wells have continued to be monitored annually via noise and temp (N&T) inspection. Additional daily and weekly monitoring activities (i.e. leak inspection and annular pressure monitoring) have been performed in alignment with the Risk and Integrity Management Plan Practices.

2. **Pre-2016 Assessments:** Wells were typically assessed using MFL tools for inspections, GRN tools during well work and also were monitored using the noise & temperature tools (N&T) annually. Additional daily and weekly monitoring activities (i.e. leak inspection and annular pressure monitoring) have been performed in alignment with the Risk and Integrity Management Plan Practices.

3. **2016-Current Assessments:** Wells were assessed using the full suite of inspections including MFL, CBL, N&T, GRN/RST, ultrasonic, caliper, and pressure testing. Additional daily and weekly monitoring activities (i.e. leak inspection and annular pressure monitoring) have been performed in alignment with the Risk and Integrity Management Plan Practices.

A key finding from the groups of wells that have casing assessment data demonstrates that current field wide conditions at McDonald Island do not appear indicate active corrosion is present. Inspection data from MFL and ultrasonic support the conclusion that neither internal or external corrosion appear to be prevalent or common at this time. PG&E uses the guidance in Appendix C of the Risk and Integrity Management Plan to determine the reinspection frequency for a given well following a baseline or reinspection of casing condition. The typical casing frequency return period continues to fall into “12-15 year” re-assessment window based on limited metal loss (class 3 and below) and isolated condition. PG&E will be returning to the well that was previously assessed for conversion to tubing and packer ahead of follow up inspection and planned reassessment period.

PG&E plans to complete the remainder of the baseline inspections at McDonald Island during the well conversion to tubing and packer configuration. PG&E uses a methodology that is prioritized by risk and coupled with the ability to effectively and efficiently conduct the work, minimization of unnecessary equipment mobilization, and coordination with station projects (i.e. pipeline work, platform equipment maintenance/rebuilds) to reduce impact to deliverability and station outage. Figure 4-1 maps this approach and uses the results of the risk model, PG&E prioritizes the wells in the based on the risk score and looks at each of the following categories:

1. **Assessment Status of "Pending**": wells pending assessment are targeted in the first group to be converted to tubing and packer configuration. During that conversion activities, wells will be inspected using the full suite of inspection tools identified in Appendix Z.

2. **Assessment Status "Pre-2016"**: wells that are slated for re-inspection following their baseline metal thickness inspection will be targeted

3. **Assessment Status "2016- Current":** These wells have been evaluated using the full suite of logs in Appendix Z. Wells in this category typically have a re-assessment internal of 12-15years and PG&E will be returning to these wells to reconfigure them in a tubing and packer status ahead of the targeted re-assessment interval.

Using this approach, all wells at McDonald Island will have had an initial baseline casing condition inspection by the end of 2023. Additionally, PG&E plans to run a thru-tubing casing inspection log on wells that are pending assessment and not planned for work in 2020. This logging activity will continue every two years until the well has been assessed. This allows PG&E to identify if any of the wells pending assessment have any features that require remediation ahead of the planned schedule and can advance those wells accordingly. Further, for wells that have been previously assessed with a casing inspection, a thru-tubing surveillance logging program will commence in 2020 and cycle every two years until the well is converted to tubing and packer. The planned cadence for each group is also show in Figure 4-1.

Following a well's baseline inspection and/or conversion to tubing and packer, PG&E will identify the well's casing reassessment frequency per Appendix C of the Risk and Integrity Management Plan. PG&E plans to deploy a casing inspection surveillance program using thru-tubing technology to monitor for any changes in condition; note, this surveillance activity is in addition to the routine integrity monitoring practice (i.e. sand inspection, pressure monitoring, annual noise and temperature survey).

Figure 4-2 illustrates the frequency of the thru-tubing inspection and pressure testing, per Appendix K of Risk and Integrity Management Plan. After the first two cycles of thru-tubing logging are performed, PG&E will space the 3rd logging activity halfway between the next planned reassessment. For example, a well scheduled on a 12-15 year reassessment interval will have a thru-tubing log run in year 2 and year 4 following conversion to T&P. The next thru-tubing log will be run in year 8, halfway between year 4 and year 12. Refer to Appendix B for additional information regarding thru-tubing logging and scheduling methodology.

Refer to Appendix B for the planned schedule based on the methodology presented above.

Figure 4-1: Assessment in Year & T&P Conversion Risk Informed Methodology

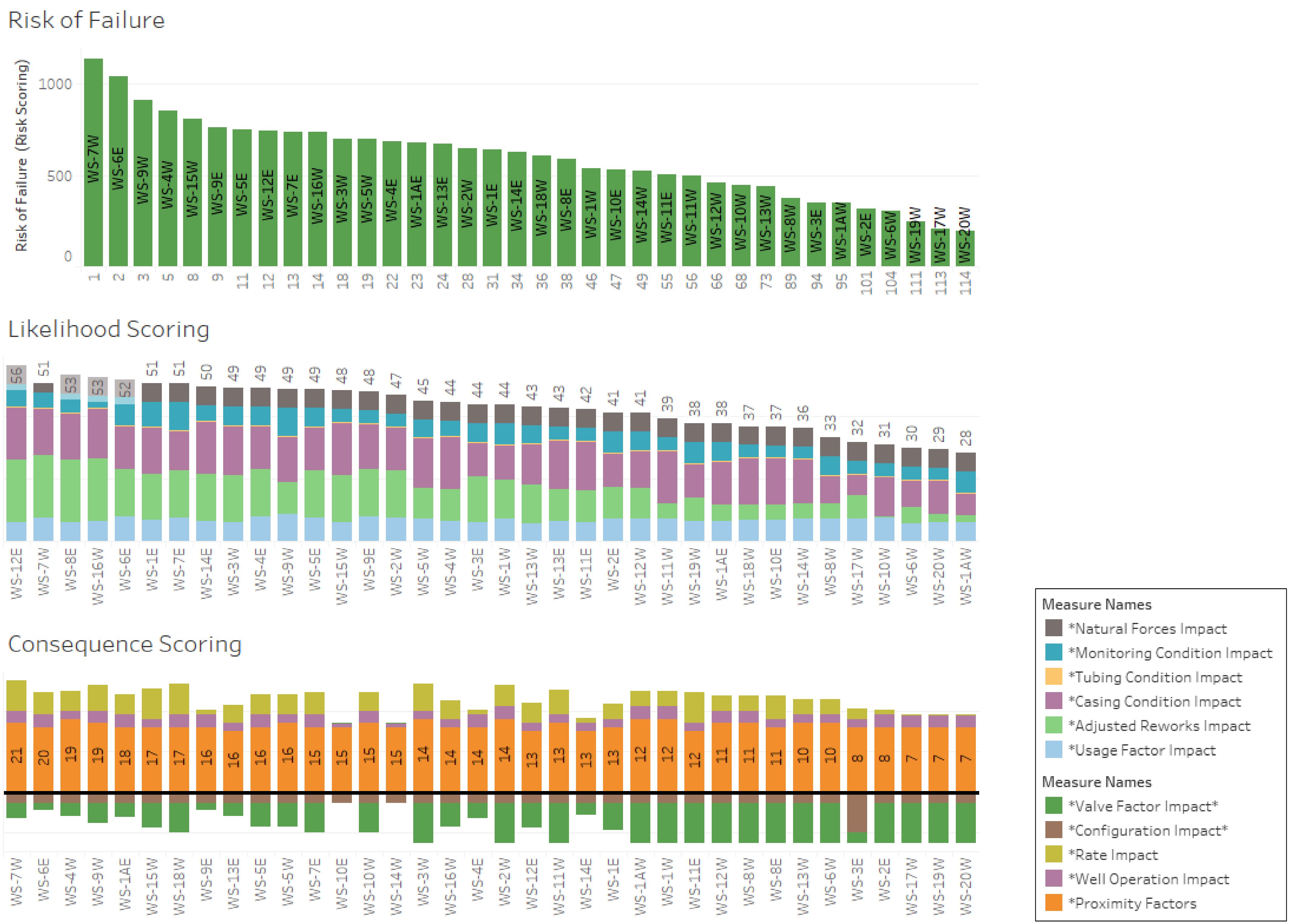
Year of Assessment	Assessment in Year & T&P Conversion						
	2019	2020	2021	2022	2023	2024	2025
Pending	2019 Planned Wells: Full Assessment with T&P Conversion						
Pending	N&T	2020 Full Assessment with T&P Conversion					
Pending	N&T Thru - Tubing	N&T	2021 Full Assessment with T&P Conversion				
Pending	N&T Thru - Tubing	N&T	N&T Thru - Tubing	2022 Full Assessment with T&P Conversion			
Pending	N&T Thru - Tubing	N&T	N&T Thru - Tubing	N&T	2023 Full Assessment with T&P Conversion		
2013 – mid 2016	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	2023 Full Assessment with T&P Conversion		
2013 – mid 2016	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	N&T	2024 Full Assessment with T&P Conversion	
2016 – 2018	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	N&T	2025 Full Assessment with T&P Conversion	
2016 – 2018	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	N&T	N&T Thru- Tubing	Full Assessment with T&P Conversion

Figure 4-2: Assessments performed in Year Following T&P Conversion

Re-Assessment Interval	Assessment in Year Following T&P Conversion														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3-5 Years	N&T	N&T	Full Assessment: Casing Inspection & Pressure Test Establish Re-Assessment Interval												
5-8 Years	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	Full Assessment: Casing Inspection & Pressure Test Establish Re-Assessment Interval										
8-12 Years	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	N&T Pressure Testing	N&T	N&T	Full Assessment: Casing Inspection & Pressure Test Establish Re-Assessment Interval							
12-15 Years	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	N&T Pressure Testing	N&T	N&T	N&T Thru Tubing	N&T	N&T Pressure Testing	N&T	Full Assessment: Casing Inspection & Pressure Test Establish Re-Assessment Interval			

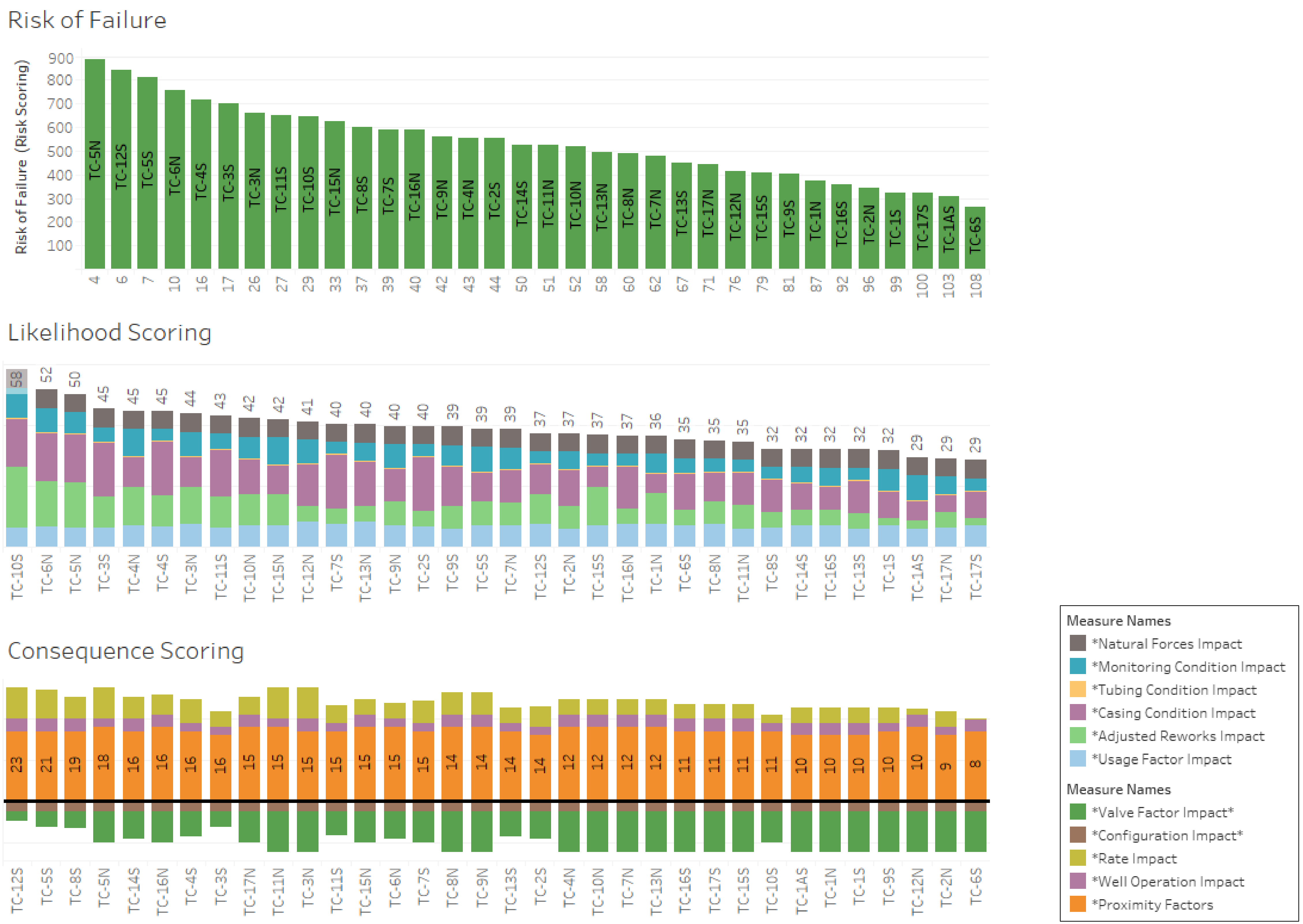
Appendix A – McDonald Island Relative Risk Well Evaluation

Figure A-1: Well by Well Risk of Failure Scoring – Whiskey Slough Station



**Note: The consequence scoring chart above shows a black line serving as the "zero" axis as the score components graphed below are mitigation components and reduce consequence.

Figure A-2: Well by Well Risk of Failure Scoring – Turner Cut Station



**Note: The consequence scoring chart above shows a black line serving as the "zero" axis as the score components graphed below are mitigation components and reduce consequence.

Figure A-3: Well by Well Risk of Failure Scoring – Peripheral Wells

**Note: The consequence scoring chart above shows a black line serving as the "zero" axis as the score components graphed below are mitigation components and reduce consequence.

Table 2 - Whiskey Slough – West Side Risk Evaluation (Input Data)

Well Name	API	Well Operation IW Wd only OBS	Well Operation IW = 3 Wd only = 2 OBS = 1	Spud Date	Completion Date	Years in Operation	Year of last Well Rework	Years since last Well Rework	# of Well Rework Performed	Measured Cement Bond Log TOC (feet)	Surface Csg (SC) Shoe, ft	Est. Distance to nearest offset well (feet)	Proximity to Roads (feet)	Proximity to Railroad (feet)	Proximity to Major Airport (feet)	Distance to Occupied Sturcture (HCA / Residence / Employee office-RE/Contrl Room building) (feet)	Proximity to Water (feet)
WS-7W	07720193	I/W	3	5/30/1973	6/14/1973	46	2011	8	4	860	632	25	560	5000	5000	364	4257
WS-9W	07720195	I/W	3	4/18/1973	5/6/1973	46	1994	25	2	1300	906	25	610	5000	5000	408	4303
WS-4W	07720214	WD	2	10/26/1973	11/12/1973	45	2008	11	2	1760	623	25	485	5000	5000	302	4185
WS-15W	07720233	WD	2	4/22/1974	5/4/1974	45	2011	8	3	3640	898	25	760	5000	5000	546	4447
WS-16W	07720231	WD	2	4/2/1974	4/20/1974	45	2005	14	4	3912	628	25	785	5000	5000	569	4472
WS-3W	07720213	WD	2	11/16/1973	12/1/1973	45	2012	7	3	3290	843	25	460	5000	5000	280	4161
WS-5W	07720211	WD	2	9/18/1973	10/22/1973	46	1999	20	2	935	896	25	510	5000	5000	322	4209
WS-2W	07720212	I/W	3	12/5/1973	12/19/1973	45	2009	10	3	3040	605	25	435	5000	5000	264	4138
WS-18W	07720465	I/W	3	6/27/1985	9/1/1985	34	2011	8	1	3200	620	25	835	5000	5000	620	4520
WS-1W	07720215	I/W	3	3/16/1974	3/31/1974	45	2015	4	5	3990	709	25	410	5000	5000	246	4114
WS-14W	07720238	OBS	1	5/6/1974	6/12/1975	45	1975	44	1	2750	916	25	685	5000	5000	477	4376
WS-11W	07720265	WD	2	7/21/1975	8/12/1975	44	1995	24	1	3210	883	25	660	5000	5000	453	4353
WS-12W	07720264	I/W	3	6/30/1975	7/20/1975	44	2018	1	4	2850	894	25	685	5000	5000	477	4376
WS-10W	07720534	I/W	3	4/3/1990	6/30/1990	29	1990	29	0	770	877	25	635	5000	5000	431	4329
WS-13W	07720241	WD	2	6/12/1975	9/2/1975	44	2018	1	5	2499	889	25	710	5000	5000	499	4399
WS-8W	07720194	I/W	3	5/8/1973	5/24/1973	46	2018	1	2	980	924	25	585	5000	5000	386	4281
WS-1AW	07720544	I/W	3	6/12/1991	7/1/1991	28	2018	1	1	1070	892	25	385	5000	5000	232	4090
WS-6W	07720192	WD	2	6/19/1973	7/8/1973	46	2018	1	2	780	860	25	535	5000	5000	342	4233
WS-19W	07720467	I/W	3	7/29/1985	9/19/1985	34	2018	1	3	2678	617	25	860	5000	5000	641	4543
WS-17W	07720166	I/W	3	9/7/1972	9/27/1972	47	2018	1	3	740	630	25	810	5000	5000	594	4495
WS-20W	07720535	I/W	3	4/19/1990	8/18/1990	29	2018	1	1	267	849	25	885	5000	5000	667	4569

Table 3 - Whiskey Slough – West Side Risk Evaluation (Likelihood Data)

Well Name	**Well Operation** IW = 3 (Likelihood) Wd only = 2 OBS = 1	**Usage Factor**	**Adjusted # of Well Reworks**	**Original Production Casing Wall Thickness** Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	**Inner String Production Casing Wall Thickness** Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	**Production Casing Wall Thickness** Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	**Source of Metal Loss on Production Casing** Unknown = 4 Corrosion = 3 Mechanical = 2 None = 0	**Potential Production Casing Mechanical Leak Path** Uncovered Perforations = 5 Uncovered Stage collar = 4 Isolated (by cement or Inner String) Stage Collar = 3 Casing thread Leak = 2 None Identified/Not Applicable = 1	**Dogleg Severity** 0-5 %= 1 5-10% = 2 >10 % = 3	**Inner String Installed** Yes -2 No -1	**Cement Bond Log TOC** Full - 1 Inside SC - 2 Below SC - 3
WS-7W	3	38	4	4	0	4	4	1	2	1	3
WS-9W	3	44	2	4	0	4	4	1	2	1	3
WS-4W	2	32	2	4	0	4	4	3	2	1	3
WS-15W	2	31	3	4	0	4	4	3	2	1	3
WS-16W	2	33	4	4	0	4	4	3	1	1	3
WS-3W	2	31	3	4	0	4	4	3	1	1	3
WS-5W	2	35	2	4	0	4	4	3	1	1	3
WS-2W	3	38	3	4	0	4	4	1	1	1	3
WS-18W	3	34	1	4	0	4	4	1	2	1	3
WS-1W	3	36	2.5	1	1	1	0	3	2	2	3
WS-14W	1	36	1	4	0	4	4	1	1	1	3
WS-11W	2	36	1	4	0	4	4	3	2	1	3
WS-12W	3	35	2	3	1	1	0	3	3	2	3
WS-10W	3	39	0	4	0	4	4	1	1	1	2
WS-13W	2	28	2.5	2	0	2	2	3	2	1	3
WS-8W	3	36	1	1	0	1	0	1	3	1	3
WS-1AW	3	30	0.5	1	0	1	0	1	1	1	3
WS-6W	2	29	1	1	0	1	0	3	2	1	2
WS-19W	3	32	1.5	2	0	2	2	1	2	1	3
WS-17W	3	36	1.5	1	0	1	0	1	1	1	3
WS-20W	3	30	0.5	2	0	2	2	1	3	1	2

Table 4 - Whiskey Slough – West Side Risk Evaluation (Likelihood Data- Cont)

Well Name	**Tubing Wall Thickness** Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1 Not Applicable = 0	**Potential Tubing Mechanical Leak Path** Tubing thread Leak = 2 None Identified/Not Applicable = 0	**Packer Condition** Known Leak=2 Sealing/Not Applicable = 0	**Annular Condition Monitoring Plan In Place** Yes - 3 No - 1	**Sand Production** # of Grade 3 or more since last rework	**Gas Composition** None = 0 CO2 = 1 H2S = 5	**Wellhead Tbg Head Condition - Known Leak** Yes - 2 No- 1	**Wellhead flange Condition - Known Leak** Yes - 2 No - 1	**Wellhead hydraulic Port leak** Yes -2 No- 1	**Known Hydrate Formation** No = 0 Yes = 1
WS-7W	0	0	0	1	1	0	1	1	1	0
WS-9W	0	0	0	3	0	0	2	2	2	0
WS-4W	0	0	0	1	1	0	1	1	1	0
WS-15W	0	0	0	1	0	0	1	1	1	0
WS-16W	0	0	0	1	0	0	1	1	1	0
WS-3W	0	0	0	1	0	0	2	1	2	0
WS-5W	0	0	0	1	0	0	2	1	2	0
WS-2W	0	0	0	1	0	0	1	1	1	0
WS-18W	0	0	0	1	0	0	1	1	1	0
WS-1W	0	0	0	3	0	0	1	1	2	0
WS-14W	0	0	0	1	0	0	1	1	1	0
WS-11W	0	0	0	1	0	0	1	1	1	0
WS-12W	0	0	0	1	0	0	2	1	2	0
WS-10W	0	0	0	1	0	0	1	1	1	0
WS-13W	0	0	0	1	0	0	1	2	2	0
WS-8W	0	0	0	1	0	0	2	2	1	0
WS-1AW	0	0	0	1	0	0	2	2	2	0
WS-6W	0	0	0	1	0	0	1	1	1	0
WS-19W	0	0	0	1	0	0	2	2	2	0
WS-17W	0	0	0	1	0	0	1	1	1	0
WS-20W	0	0	0	1	0	0	1	1	1	0

Table 5 - Whiskey Slough – West Side Risk Evaluation (Likelihood Data- Cont)

Well Name	**Well Security** Gated/fenced = 1 No = 2	**Wellhead Surface Damage Protection** **Full** Barricade (k-rail/bollard) =1, **Partial** Barricade (k-rail/bollard) = 2 **None** (Fenced only) = 3	**Natural Force Flooding** No= 0 Yes = 1	**Natural Force Seismic** Low PGA = 1 Med PGA = 2 High PGA =3	**Natural Force Subsidence** No= 0 Yes = 1	**Natural Force Tsunami** No= 0 Yes= 1	**Natural Force Lanslide** No= 0 Yes = 1
WS-7W	1	2	1	1	1	0	0
WS-9W	1	2	1	1	1	0	0
WS-4W	1	2	1	1	1	0	0
WS-15W	1	2	1	1	1	0	0
WS-16W	1	2	1	1	1	0	0
WS-3W	1	2	1	1	1	0	0
WS-5W	1	2	1	1	1	0	0
WS-2W	1	2	1	1	1	0	0
WS-18W	1	2	1	1	1	0	0
WS-1W	1	2	1	1	1	0	0
WS-14W	1	2	1	1	1	0	0
WS-11W	1	2	1	1	1	0	0
WS-12W	1	2	1	1	1	0	0
WS-10W	1	2	1	1	1	0	0
WS-13W	1	2	1	1	1	0	0
WS-8W	1	2	1	1	1	0	0
WS-1AW	1	2	1	1	1	0	0
WS-6W	1	2	1	1	1	0	0
WS-19W	1	2	1	1	1	0	0
WS-17W	1	2	1	1	1	0	0
WS-20W	1	2	1	1	1	0	0

Table 6 - Whiskey Slough – West Side Risk Evaluation (Consequence Data)

Well Name	**Max Rate** MMcf/d	**Well Operation** IW = 3 (Consequence) Wd only = 2 OBS = 1	**Wind Direction Impact** High - 3 Low - 1	**Occupied Sturcture** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Offset wells Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Roads Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 0-500 ft of Major Highway = 4	**Proximity to Railroad Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Major Airport** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Population Centers** > 1 Mile =3 1-2 Mile =2 2-5 Mile =1 >5 Mile = 0	**Proximity to Body of Water Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 Water Well = 4, Navigable Waterway = 5	**Local Area Activities/Land Use** Urban = 4 Residential = 3 Crop farming (Irrigation/fertilizer / Plane) = 2 Cattle farming = 1	**Response to Well Incident** Unmanned-2 Facility Manned-1
WS-7W	30	3	3	3	3	2	1	1	0	1	2	1
WS-9W	25	3	3	3	3	2	1	1	0	1	2	1
WS-4W	20	2	3	3	3	3	1	1	0	1	2	1
WS-15W	30	2	3	2	3	2	1	1	0	1	2	1
WS-16W	18	2	3	2	3	2	1	1	0	1	2	1
WS-3W	27	2	3	3	3	3	1	1	0	1	2	1
WS-5W	20	2	3	3	3	2	1	1	0	1	2	1
WS-2W	22	3	3	3	3	3	1	1	0	1	2	1
WS-18W	30	3	3	2	3	2	1	1	0	1	2	1
WS-1W	15	3	3	3	3	3	1	1	0	1	2	1
WS-14W	0	1	3	2	3	2	1	1	0	1	2	1
WS-11W	25	2	3	3	3	2	1	1	0	1	2	1
WS-12W	15	3	3	3	3	2	1	1	0	1	2	1
WS-10W	18	3	3	3	3	2	1	1	0	1	2	1
WS-13W	15	2	3	3	3	2	1	1	0	1	2	1
WS-8W	15	3	3	3	3	2	1	1	0	1	2	1
WS-1AW	15	3	3	3	3	3	1	1	0	1	2	1
WS-6W	15	2	3	3	3	2	1	1	0	1	2	1
WS-19W	0	3	3	2	3	2	1	1	0	1	2	1
WS-17W	0	3	3	2	3	2	1	1	0	1	2	1
WS-20W	0	3	3	2	3	2	1	1	0	1	2	1

Table 7 - Whiskey Slough – West Side Risk Evaluation (Consequence Data)

Well Name	Configuration T&C Flow -1 T&P - 4	DHSV Csg Deployment Yes -1 No- 0	DHSV Tbg Deployment Yes -1 No- 0	DHSV Tbg Condition # of Level 4 since installation	DHSV Csg Condition # of Level 4 since installation	DHSV Control Line Condition # of Level 4 since installation	Valve Factor	Likehood of Failure	Consequence of Failure	Risk of Failure (Risk Scoring)
WS-7W	1	1	1	3	1	0	0.75	**54**	**21**	**1,139**
WS-9W	1	1	1	0	0	1	1.00	**49**	**19**	**913**
WS-4W	1	1	1	5	1	0	0.67	**44**	**19**	**852**
WS-15W	1	1	1	3	0	0	1.25	**48**	**17**	**807**
WS-16W	1	1	1	4	0	0	1.20	**53**	**14**	**736**
WS-3W	1	1	1	0	0	0	2.00	**49**	**14**	**701**
WS-5W	1	1	1	4	0	0	1.20	**45**	**16**	**698**
WS-2W	1	1	1	0	0	0	2.00	**47**	**14**	**649**
WS-18W	1	1	1	1	0	0	1.50	**37**	**17**	**607**
WS-1W	1	1	1	0	0	0	2.00	**44**	**12**	**536**
WS-14W	1	0	0	0	0	0	-	**36**	**15**	**526**
WS-11W	1	1	1	0	0	0	2.00	**39**	**13**	**500**
WS-12W	1	1	1	0	0	0	2.00	**41**	**11**	**461**
WS-10W	1	1	1	1	0	0	1.50	**31**	**15**	**448**
WS-13W	1	1	1	0	0	0	2.00	**43**	**10**	**442**
WS-8W	1	1	1	0	0	0	2.00	**33**	**11**	**373**
WS-1AW	1	1	1	0	0	0	2.00	**28**	**12**	**348**
WS-6W	1	1	1	0	0	0	2.00	**30**	**10**	**305**
WS-19W	1	1	1	0	0	0	2.00	**38**	**7**	**246**
WS-17W	1	1	1	0	0	0	2.00	**32**	**7**	**206**
WS-20W	1	1	1	0	0	0	2.00	**29**	**7**	**192**

Table 8 – Whiskey Slough- East Side Risk Evaluation (Input Data)

Well Name	API	Well Operation IW Wd only OBS	Well Operation IW = 3 Wd only = 2 OBS = 1	Spud Date	Completion Date	Years in Operation	Year of last Well Rework	Years since last Well Rework	# of Well Rework Performed	Measured Cement Bond Log TOC (feet)	Surface Csg (SC) Shoe, ft	Est. Distance to nearest offset well (feet)	Proximity to Roads (feet)	Proximity to Railroad (feet)	Proximity to Major Airport (feet)	Distance to Occupied Sturcture (HCA / Residence / Employee office-RE/Contrl Room building) (feet)	Proximity to Water (feet)
WS-6E	07720185	I/W	3	2/7/1973	2/23/1973	46	2007	12	3	1372	908	25	255	5000	5000	416	4137
WS-9E	07720189	I/W	3	4/9/1973	4/21/1973	46	2007	12	3	950	886	25	330	5000	5000	475	4211
WS-5E	07720179	I/W	3	1/6/1973	1/24/1973	46	2012	7	3	620	908	25	230	5000	5000	398	4113
WS-12E	07720255	WD	2	1/14/1975	7/9/1975	44	2012	7	4	2523	587	25	405	5000	5000	538	4284
WS-7E	07720187	I/W	3	3/2/1973	3/17/1973	46	2012	7	3	0	891	25	280	5000	5000	437	4162
WS-4E	07720178	I/W	3	12/5/1972	1/3/1973	46	2007	12	3	740	1013	25	205	5000	5000	380	4088
WS-1AE	07720536	I/W	3	5/6/1990	6/15/1990	29	2009	10	1	1100	875	25	105	5000	5000	319	3989
WS-13E	07720256	WD	2	1/27/1975	4/2/1975	44	2005	14	2	3560	934	25	430	5000	5000	562	4309
WS-1E	07720168	WD	2	10/3/1972	10/22/1972	47	2005	14	3	1150	606	25	130	5000	5000	334	4016
WS-14E	07720257	WD	2	2/8/1975	2/25/1975	44	2005	14	3	3020	881	25	455	5000	5000	584	4334
WS-8E	07720188	WD	2	3/20/1973	4/3/1973	46	2012	7	4	1300	920	25	305	5000	5000	455	4187
WS-10E	07720190	OBS	1	4/26/1973	5/16/1973	46	1984	35	1	1170	913	25	355	5000	5000	496	4236
WS-11E	07720253	WD	2	12/7/1974	7/23/1975	44	2011	8	2	250	1231	25	380	5000	5000	517	4261
WS-3E	07720173	WD	2	11/21/1972	12/12/1972	46	2017	2	6	3991	598	25	180	5000	5000	365	4065
WS-2E	07720169	I/W	3	10/27/1972	11/17/1972	46	2017	2	4	3945	613	25	155	5000	5000	349	4041

Table 9 – Whiskey Slough- East Side Risk Evaluation (Likelihood Data)

Well Name	**Well Operation** IW = 3 (Likelihood) Wd only = 2 OBS = 1	**Usage Factor**	**Adjusted # of Well Reworks**	**Original Production Casing Wall Thickness** Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	**Inner String Production Casing Wall Thickness** Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	**Production Casing Wall Thickness** Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	**Source of Metal Loss on Production Casing** Unknown = 4 Corrosion = 3 Mechanical = 2 None = 0	**Potential Production Casing Mechanical Leak Path** Uncovered Perforations = 5 Uncovered Stage collar = 4 Isolated (by cement or Inner String) Stage Collar = 3 Casing thread Leak = 2 None Identified/Not Applicable = 1	**Dogleg Severity** 0-5 %= 1 5-10% = 2 >10 % = 3	**Inner String Installed** Yes -2 No -1	**Cement Bond Log TOC** Full - 1 Inside SC - 2 Below SC - 3
WS-6E	3	39	3	4	0	4	4	1	1	1	3
WS-9E	3	39	3	4	0	4	4	1	2	1	3
WS-5E	3	38	3	4	0	4	4	1	2	1	2
WS-12E	2	30	4	4	0	4	4	3	2	1	3
WS-7E	3	38	3	4	0	4	4	1	2	1	1
WS-4E	3	39	3	4	0	4	4	1	2	1	2
WS-1AE	3	33	1	4	0	4	4	1	1	1	3
WS-13E	2	33	2	4	0	4	4	3	1	1	3
WS-1E	2	34	3	4	0	4	4	1	2	1	3
WS-14E	2	33	3	4	0	4	4	3	2	1	3
WS-8E	2	31	4	4	0	4	4	2	1	1	3
WS-10E	1	34	1	4	0	4	4	1	2	1	3
WS-11E	2	31	2	4	0	4	4	3	2	1	2
WS-3E	2	29	3	1	1	1	0	3	2	2	3
WS-2E	3	36	2	3	1	1	0	3	2	2	3

Table 10 – Whiskey Slough- East Side Risk Evaluation (Likelihood Data - Cont)

Well Name	**Tubing Wall Thickness** Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1 Not Applicable = 0	**Potential Tubing Mechanical Leak Path** Tubing thread Leak = 2 None Identified/Not Applicable = 0	**Packer Condition** Known Leak=2 Sealing/Not Applicable = 0	**Annular Condition Monitoring Plan In Place** Yes - 3 No - 1	**Sand Production** # of Grade 3 or more since last rework	**Gas Composition** None = 0 CO2 = 1 H2S = 5	**Wellhead Tbg Head Condition - Known Leak** Yes - 2 No- 1	**Wellhead flange Condition - Known Leak** Yes - 2 No - 1	**Wellhead hydraulic Port leak** Yes -2 No- 1	**Known Hydrate Formation** No = 0 Yes = 1
WS-6E	0	0	0	3	1	0	2	1	2	0
WS-9E	0	0	0	1	0	0	1	1	1	0
WS-5E	0	0	0	1	0	0	2	1	2	0
WS-12E	0	0	0	3	0	0	1	2	1	0
WS-7E	0	0	0	3	0	0	2	2	2	0
WS-4E	0	0	0	1	0	0	2	1	2	0
WS-1AE	0	0	0	1	0	0	2	1	2	0
WS-13E	0	0	0	1	0	0	1	1	1	0
WS-1E	0	0	0	3	0	0	2	2	1	0
WS-14E	0	0	0	1	0	0	1	2	1	0
WS-8E	0	0	0	3	0	0	1	1	1	0
WS-10E	0	0	0	1	0	0	1	1	1	0
WS-11E	0	0	0	1	0	0	1	1	1	0
WS-3E	0	0	0	1	0	0	2	1	2	0
WS-2E	0	0	0	1	0	0	2	2	2	0

Table 11 – Whiskey Slough- East Side Risk Evaluation (Likelihood Data)

Well Name	**Well Security** Gated/fenced = 1 No = 2	**Wellhead Surface Damage Protection** **Full** Barricade (k-rail/bollard) =1, **Partial** Barricade (k-rail/bollard) = 2 **None** (Fenced only) = 3	**Natural Force Flooding** No= 0 Yes = 1	**Natural Force Seismic** Low PGA = 1 Med PGA = 2 High PGA =3	**Natural Force Subsidence** No= 0 Yes = 1	**Natural Force Tsunami** No= 0 Yes= 1	**Natural Force Lanslide** No= 0 Yes = 1
WS-6E	1	2	1	1	1	0	0
WS-9E	1	2	1	1	1	0	0
WS-5E	1	2	1	1	1	0	0
WS-12E	1	2	1	1	1	0	0
WS-7E	1	2	1	1	1	0	0
WS-4E	1	2	1	1	1	0	0
WS-1AE	1	2	1	1	1	0	0
WS-13E	1	2	1	1	1	0	0
WS-1E	1	2	1	1	1	0	0
WS-14E	1	2	1	1	1	0	0
WS-8E	1	2	1	1	1	0	0
WS-10E	1	2	1	1	1	0	0
WS-11E	1	2	1	1	1	0	0
WS-3E	1	2	1	1	1	0	0
WS-2E	1	2	1	1	1	0	0

Table 12 – Whiskey Slough- East Side Risk Evaluation (Consequence Data)

Well Name	Max Rate MMcf/d	Well Operation IW = 3 (Consequence) Wd only = 2 OBS = 1	Wind Direction Impact High - 3 Low - 1	Occupied Sturcture >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	Proximity to Offset wells Score >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	Proximity to Roads Score >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 0-500 ft of Major Highway = 4	Proximity to Railroad Score >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	Proximity to Major Airport >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	Population Centers > 1 Mile =3 1-2 Mile =2 2-5 Mile =1 >5 Mile = 0	Proximity to Body of Water Score >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 Water Well = 4, Navigable Waterway = 5	Local Area Activities/Land Use Urban = 4 Residential = 3 Crop farming (Irrigation/fertilizer / Plane) = 2 Cattle farming = 1	Response to Well Incident Unmanned-2 Facility Manned-1
WS-6E	22	3	1	3	3	3	1	1	0	1	2	1
WS-9E	5	3	1	3	3	3	1	1	0	1	2	1
WS-5E	20	3	1	3	3	3	1	1	0	1	2	1
WS-12E	20	2	1	2	3	3	1	1	0	1	2	1
WS-7E	22	3	1	3	3	3	1	1	0	1	2	1
WS-4E	5	3	1	3	3	3	1	1	0	1	2	1
WS-1AE	20	3	1	3	3	3	1	1	0	1	2	1
WS-13E	18	2	1	2	3	3	1	1	0	1	2	1
WS-1E	15	2	1	3	3	3	1	1	0	1	2	1
WS-14E	5	2	1	2	3	3	1	1	0	1	2	1
WS-8E	22	2	1	3	3	3	1	1	0	1	2	1
WS-10E	0	1	1	3	3	3	1	1	0	1	2	1
WS-11E	30	2	1	2	3	3	1	1	0	1	2	1
WS-3E	10	2	1	3	3	3	1	1	0	1	2	1
WS-2E	5	3	1	3	3	3	1	1	0	1	2	1

Table 13 – Whiskey Slough- East Side Risk Evaluation (Consequence Data)

Well Name	Configuration T&C Flow -1 T&P - 4	DHSV Csg Deployment Yes -1 No- 0	DHSV Tbg Deployment Yes -1 No- 0	DHSV Tbg Condition # of Level 4 since installation	DHSV Csg Condition # of Level 4 since installation	DHSV Control Line Condition # of Level 4 since installation	Valve Factor	Likehood of Failure	Consequence of Failure	Risk of Failure (Risk Scoring)
WS-6E	1	1	1	4	4	0	0.40	**52**	**20**	**1,040**
WS-9E	1	1	1	5	4	0	0.37	**48**	**16**	**762**
WS-5E	1	1	1	4	0	0	1.20	**49**	**16**	**753**
WS-12E	1	1	1	3	0	0	1.25	**56**	**13**	**743**
WS-7E	1	1	1	1	0	0	1.50	**51**	**15**	**739**
WS-4E	1	1	1	3	1	0	0.75	**49**	**14**	**684**
WS-1AE	1	1	1	4	1	0	0.70	**38**	**18**	**681**
WS-13E	1	1	1	6	1	0	0.64	**43**	**16**	**672**
WS-1E	1	1	1	2	0	0	1.33	**51**	**13**	**638**
WS-14E	1	1	1	3	0	1	0.63	**50**	**13**	**625**
WS-8E	1	1	1	0	0	0	2.00	**53**	**11**	**591**
WS-10E	1	0	0	0	0	0	-	**37**	**15**	**533**
WS-11E	1	1	1	0	0	0	2.00	**42**	**12**	**506**
WS-3E	4	0	1	1	0	0	0.50	**44**	**8**	**351**
WS-2E	1	1	1	0	0	0	2.00	**41**	**8**	**320**

Table 14- Turner Cut Station – North Side Risk Evaluation (Input Data)

Well Name	API	Well Operation IW Wd only OBS	Well Operation IW = 3 Wd only = 2 OBS = 1	Spud Date	Completion Date	Years in Operation	Year of last Well Rework	Years since last Well Rework	# of Well Rework Performed	Measured Cement Bond Log TOC (feet)	Surface Csg (SC) Shoe, ft	Est. Distance to nearest offset well (feet)	Proximity to Roads (feet)	Proximity to Railroad (feet)	Proximity to Major Airport (feet)	Distance to Occupied Sturcture (HCA / Residence / Employee office-RE/Contrl Room building) (feet)	Proximity to Water (feet)
TC-5N	07720207	WD	2	8/1/1973	8/23/1973	46	2013	6	3	4637	614	25	465	5000	5000	450	1144
TC-6N	07720208	WD	2	8/29/1973	9/7/1973	46	2006	13	3	4550	898	25	440	5000	5000	425	1130
TC-3N	07720201	I/W	3	7/3/1973	7/17/1973	46	2016	3	5	4960	901	25	515	5000	5000	499	1174
TC-15N	07720239	I/W	3	7/12/1974	1/8/1975	45	2017	2	4	2790	904	25	215	5000	5000	228	1023
TC-16N	07720240	I/W	3	7/30/1974	12/19/1975	45	2010	9	1	2450	915	25	190	5000	5000	208	1015
TC-9N	07720227	I/W	3	2/7/1974	2/28/1974	45	2016	3	3	2915	897	25	365	5000	5000	356	1090
TC-4N	07720202	I/W	3	7/19/1973	8/3/1973	46	2016	3	5	1170	907	25	490	5000	5000	473	1158
TC-11N	07720229	WD	2	3/18/1974	4/1/1974	45	2013	6	3	870	897	25	315	5000	5000	311	1066
TC-10N	07720228	I/W	3	3/1/1974	3/16/1974	45	2017	2	4	4658	910	25	340	5000	5000	333	1079
TC-13N	07720234	I/W	3	4/18/1974	5/11/1974	45	2000	19	1	3330	794	25	265	5000	5000	267	1045
TC-8N	07720226	I/W	3	1/19/1974	2/5/1974	45	2014	5	3	3004	885	25	390	5000	5000	382	1103
TC-7N	07720225	I/W	3	12/12/1973	12/29/1973	45	2017	2	3	4674	605	25	415	5000	5000	404	1117
TC-17N	07720548	I/W	3	7/5/1991	7/25/1991	28	2014	5	2	570	863	25	165	5000	5000	190	1007
TC-12N	07720230	I/W	3	4/2/1974	4/17/1974	45	2000	19	1	2200	619	25	290	5000	5000	290	1055
TC-1N	07720196	I/W	3	5/23/1973	6/7/1973	46	2013	6	4	85	906	25	565	5000	5000	546	1203
TC-2N	07720199	WD	2	6/9/1973	6/29/1973	46	2018	1	3	210	882	25	540	5000	5000	522	1188

Table 15- Turner Cut Station – North Side Risk Evaluation (Likelihood Data)

Well Name	Well Operation IW = 3 (Likelihood) Wd only = 2 OBS = 1	Usage Factor	Adjusted # of Well Reworks	Original Production Casing Wall Thickness Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	Inner String Production Casing Wall Thickness Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	Production Casing Wall Thickness Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	Source of Metal Loss on Production Casing Unknown = 4 Corrosion = 3 Mechanical = 2 None = 0	Potential Production Casing Mechanical Leak Path Uncovered Perforations = 5 Uncovered Stage collar = 4 Isolated (by cement or Inner String) Stage Collar = 3 Casing thread Leak = 2 None Identified/Not Applicable = 1	Dogleg Severity 0-5 %= 1 5-10% = 2 >10 % = 3	Inner String Installed Yes -2 No -1	Cement Bond Log TOC Full - 1 Inside SC - 2 Below SC - 3
TC-5N	2	31	3	4	0	4	4	3	1	1	3
TC-6N	2	33	3	4	0	4	4	3	1	1	3
TC-3N	3	36	2.5	3	1	1	0	3	1	2	3
TC-15N	3	36	2	2	0	2	2	1	1	1	3
TC-16N	3	38	1	4	0	4	4	1	1	1	3
TC-9N	3	36	1.5	3	1	1	0	3	2	2	3
TC-4N	3	36	2.5	2	1	1	0	3	1	2	3
TC-11N	2	30	1.5	2	0	2	2	2	2	1	2
TC-10N	3	36	2	1	1	1	0	3	3	2	3
TC-13N	3	41	1	4	0	4	4	1	2	1	3
TC-8N	3	37	1.5	2	0	2	2	1	1	1	3
TC-7N	3	36	1.5	1	1	1	0	3	2	2	3
TC-17N	3	31	1	1	0	1	0	1	1	1	2
TC-12N	3	41	1	4	0	4	4	1	1	1	3
TC-1N	3	37	2	1	0	1	0	2	1	1	2
TC-2N	2	29	1.5	2	0	2	2	3	2	1	2

Table 16- Turner Cut Station – North Side Risk Evaluation (Likelihood Data - Cont)

Well Name	**Tubing Wall Thickness** Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1 Not Applicable = 0	**Potential Tubing Mechanical Leak Path** Tubing thread Leak = 2 None Identified/Not Applicable = 0	**Packer Condition** Known Leak=2 Sealing/Not Applicable = 0	**Annular Condition Monitoring Plan In Place** Yes - 3 No - 1	**Sand Production** # of Grade 3 or more since last rework	**Gas Composition** None = 0 CO2 = 1 H2S = 5	**Wellhead Tbg Head Condition - Known Leak** Yes - 2 No- 1	**Wellhead flange Condition - Known Leak** Yes - 2 No - 1	**Wellhead hydraulic Port leak** Yes -2 No- 1	**Known Hydrate Formation** No = 0 Yes = 1
TC-5N	0	0	0	3	0	0	1	1	2	0
TC-6N	0	0	0	3	0	0	2	2	1	0
TC-3N	0	0	0	3	0	0	2	2	1	0
TC-15N	0	0	0	3	0	0	2	2	2	0
TC-16N	0	0	0	1	0	0	1	1	1	0
TC-9N	0	0	0	3	0	0	2	2	1	0
TC-4N	0	0	0	3	0	0	2	2	2	0
TC-11N	0	0	0	1	0	0	1	1	1	0
TC-10N	0	0	0	3	0	0	2	1	1	0
TC-13N	0	0	0	1	2	0	1	1	1	0
TC-8N	0	0	0	1	0	0	1	1	1	0
TC-7N	0	0	0	3	0	0	2	1	1	0
TC-17N	0	0	0	1	2	0	1	1	1	0
TC-12N	0	0	0	1	4	0	1	1	1	0
TC-1N	0	0	0	1	1	0	1	2	1	0
TC-2N	0	0	0	1	0	0	1	2	2	0

Table 17- Turner Cut Station – North Side Risk Evaluation (Likelihood Data - Cont)

Well Name	**Well Security** Gated/fenced = 1 No = 2	**Wellhead Surface Damage Protection** **Full** Barricade (k-rail/bollard) =1, **Partial** Barricade (k-rail/bollard) = 2 **None** (Fenced only) = 3	**Natural Force Flooding** No= 0 Yes = 1	**Natural Force Seismic** Low PGA = 1 Med PGA = 2 High PGA =3	**Natural Force Subsidence** No= 0 Yes = 1	**Natural Force Tsunami** No= 0 Yes= 1	**Natural Force Lanslide** No= 0 Yes = 1
TC-5N	1	2	1	1	1	0	0
TC-6N	1	2	1	1	1	0	0
TC-3N	1	2	1	1	1	0	0
TC-15N	1	2	1	1	1	0	0
TC-16N	1	2	1	1	1	0	0
TC-9N	1	2	1	1	1	0	0
TC-4N	1	2	1	1	1	0	0
TC-11N	1	2	1	1	1	0	0
TC-10N	1	2	1	1	1	0	0
TC-13N	1	2	1	1	1	0	0
TC-8N	1	2	1	1	1	0	0
TC-7N	1	2	1	1	1	0	0
TC-17N	1	2	1	1	1	0	0
TC-12N	1	2	1	1	1	0	0
TC-1N	1	2	1	1	1	0	0
TC-2N	1	2	1	1	1	0	0

Table 18- Turner Cut Station – North Side Risk Evaluation (Consequence Data)

Well Name	**Max Rate** MMcf/d	**Well Operation** IW = 3 (Consequence) Wd only = 2 OBS = 1	**Wind Direction Impact** High - 3 Low - 1	**Occupied Sturcture** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Offset wells Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Roads Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 0-500 ft of Major Highway = 4	**Proximity to Railroad Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Major Airport** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Population Centers** > 1 Mile =3 1-2 Mile =2 2-5 Mile =1 >5 Mile = 0	**Proximity to Body of Water Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 Water Well = 4, Navigable Waterway = 5	**Local Area Activities/Land Use** Urban = 4 Residential = 3 Crop farming (Irrigation/fertilizer / Plane) = 2 Cattle farming = 1	**Response to Well Incident** Unmanned-2 Facility Manned-1
TC-5N	31	2	3	3	3	3	1	1	0	1	2	1
TC-6N	15	2	3	3	3	3	1	1	0	1	2	1
TC-3N	30	3	3	3	3	2	1	1	0	1	2	1
TC-15N	15	3	3	3	3	3	1	1	0	1	2	1
TC-16N	20	3	3	3	3	3	1	1	0	1	2	1
TC-9N	22	3	3	3	3	3	1	1	0	1	2	1
TC-4N	15	3	3	3	3	3	1	1	0	1	2	1
TC-11N	31	2	3	3	3	3	1	1	0	1	2	1
TC-10N	15	3	3	3	3	3	1	1	0	1	2	1
TC-13N	15	3	3	3	3	3	1	1	0	1	2	1
TC-8N	22	3	3	3	3	3	1	1	0	1	2	1
TC-7N	15	3	3	3	3	3	1	1	0	1	2	1
TC-17N	17	3	3	3	3	3	1	1	0	1	2	1
TC-12N	6	3	3	3	3	3	1	1	0	1	2	1
TC-1N	15	3	3	2	3	2	1	1	0	1	2	1
TC-2N	15	2	3	2	3	2	1	1	0	1	2	1

Table 19- Turner Cut Station – North Side Risk Evaluation (Consequence Data)

Well Name	Configuration T&C Flow -1 T&P - 4	DHSV Csg Deployment Yes -1 No- 0	DHSV Tbg Deployment Yes -1 No- 0	DHSV Tbg Condition # of Level 4 since installation	DHSV Csg Condition # of Level 4 since installation	DHSV Control Line Condition # of Level 4 since installation	Valve Factor	Likehood of Failure	Consequence of Failure	Risk of Failure (Risk Scoring)
TC-5N	1	1	1	1	0	0	1.50	**50**	**18**	**889**
TC-6N	1	1	1	2	0	0	1.33	**52**	**15**	**758**
TC-3N	1	1	1	0	0	0	2.00	**44**	**15**	**662**
TC-15N	1	1	1	1	0	0	1.50	**42**	**15**	**626**
TC-16N	1	1	1	0	1	0	1.50	**37**	**16**	**588**
TC-9N	1	1	1	0	0	0	2.00	**40**	**14**	**559**
TC-4N	1	1	1	0	0	0	2.00	**45**	**12**	**554**
TC-11N	1	1	1	0	0	0	2.00	**35**	**15**	**523**
TC-10N	1	1	1	0	0	0	2.00	**42**	**12**	**521**
TC-13N	1	1	1	0	0	0	2.00	**40**	**12**	**493**
TC-8N	1	1	1	0	0	0	2.00	**35**	**14**	**490**
TC-7N	1	1	1	0	0	0	2.00	**39**	**12**	**478**
TC-17N	1	1	1	1	0	0	1.50	**29**	**15**	**445**
TC-12N	1	1	1	0	0	0	2.00	**41**	**10**	**412**
TC-1N	1	1	1	0	0	0	2.00	**36**	**10**	**374**
TC-2N	1	1	1	0	0	0	2.00	**37**	**9**	**345**

Table 20- Turner Cut Station South Side Wells Risk Evaluation (Input Data)

Well Name	API	Well Operation IW Wd only OBS	Well Operation IW = 3 Wd only = 2 OBS = 1	Spud Date	Completion Date	Years in Operation	Year of last Well Rework	Years since last Well Rework	# of Well Rework Performed	Measured Cement Bond Log TOC (feet)	Surface Csg (SC) Shoe, ft	Est. Distance to nearest offset well (feet)	Proximity to Roads (feet)	Proximity to Railroad (feet)	Proximity to Major Airport (feet)	Distance to Occupied Sturcture (HCA / Residence / Employee office- RE/Contrl Room building) (feet)	Proximity to Water (feet)
TC-12S	07720248	I/W	3	10/16/1974	5/16/1975	44	2014	5	4	1220	874	25	285	5000	5000	278	673
TC-5S	07720204	I/W	3	8/25/1973	9/8/1973	46	2016	3	3	4556	813	25	460	5000	5000	385	805
TC-4S	07720203	WD	2	9/21/1973	10/7/1973	46	2004	15	2	1400	916	25	485	5000	5000	402	824
TC-3S	07720216	WD	2	10/9/1973	10/27/1973	45	2010	9	2	5290	898	25	510	5000	5000	425	845
TC-11S	07720250	WD	2	10/29/1974	5/25/1975	44	2009	10	2	3022	926	25	310	5000	5000	291	692
TC-10S	07720251	WD	2	11/9/1974	3/6/1975	44	2010	9	4	0	599	25	335	5000	5000	303	710
TC-8S	07720533	I/W	3	3/15/1990	7/14/1990	29	2014	5	2	460	881	25	385	5000	5000	330	747
TC-7S	07720206	WD	2	7/10/1973	7/27/1973	46	1993	26	1	818	637	25	410	5000	5000	349	764
TC-2S	07720219	WD	2	10/31/1973	11/19/1973	45	2004	15	1	4470	888	25	535	5000	5000	444	864
TC-14S	07720244	I/W	3	9/9/1974	3/19/1975	45	2015	4	2	770	860	25	235	5000	5000	262	641
TC-13S	07720247	WD	2	9/20/1974	5/9/1975	45	2014	5	2	710	615	25	260	5000	5000	269	657
TC-15S	07720245	I/W	3	8/28/1974	6/15/1975	45	2015	4	5	920	919	25	210	5000	5000	258	625
TC-9S	07720252	WD	2	11/22/1974	2/16/1975	44	2014	5	3	830	710	25	360	5000	5000	315	728
TC-16S	07720243	I/W	3	8/10/1974	6/30/1975	45	2018	1	2	3020	880	25	185	5000	5000	253	607
TC-1S	07720218	I/W	3	11/21/1973	12/9/1973	45	2018	1	1	3140	770	25	560	5000	5000	464	886
TC-17S	07720258	I/W	3	4/3/1975	4/22/1975	44	2018	1	1	1270	904	25	160	5000	5000	254	594
TC-1AS	07720551	I/W	3	7/27/1991	8/15/1991	28	2017	2	1	1790	898	25	585	5000	5000	488	906
TC-6S	07720205	I/W	3	7/31/1973	8/22/1973	46	2018	1	2	5792	580	25	435	5000	5000	365	785

Table 21- Turner Cut Station South Side Wells Risk Evaluation (Likelihood Data)

Well Name	Well Operation IW = 3 (Likelihood) Wd only = 2 OBS = 1	Usage Factor	Adjusted # of Well Reworks	Original Production Casing Wall Thickness Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	Inner String Production Casing Wall Thickness Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	Production Casing Wall Thickness Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	Source of Metal Loss on Production Casing Unknown = 4 Corrosion = 3 Mechanical = 2 None = 0	Potential Production Casing Mechanical Leak Path Uncovered Perforations = 5 Uncovered Stage collar = 4 Isolated (by cement or Inner String) Stage Collar = 3 Casing thread Leak = 2 None Identified/Not Applicable = 1	Dogleg Severity 0-5 %= 1 5-10% = 2 >10 % = 3	Inner String Installed Yes -2 No -1	Cement Bond Log TOC Full - 1 Inside SC - 2 Below SC - 3
TC-12S	3	36	2	2	0	2	2	1	1	1	3
TC-5S	3	36	1.5	3	1	1	0	3	1	2	3
TC-4S	2	34	2	4	0	4	4	4	2	1	3
TC-3S	2	31	2	4	0	4	4	4	2	1	3
TC-11S	2	31	2	4	0	4	4	3	1	1	3
TC-10S	2	31	4	4	0	4	4	4	2	1	1
TC-8S	3	31	1	2	0	2	2	1	3	1	2
TC-7S	2	37	1	4	0	4	4	3	3	1	3
TC-2S	2	33	1	4	0	4	4	4	2	1	3
TC-14S	3	36	1	2	0	2	2	1	1	1	2
TC-13S	2	30	1	1	0	1	0	3	3	1	3
TC-15S	3	36	2.5	1	0	1	0	1	1	1	3
TC-9S	2	30	1.5	2	0	2	2	3	2	1	3
TC-16S	3	35	1	1	0	1	0	1	2	1	3
TC-1S	3	35	0.5	1	0	1	0	1	3	1	3
TC-17S	3	35	0.5	1	0	1	0	3	1	1	3
TC-1AS	3	30	0.5	1	0	1	0	1	1	1	3
TC-6S	3	36	1	1	1	1	0	3	3	2	3

Table 22- Turner Cut Station South Side Wells Risk Evaluation (Likelihood Data - Cont)

Well Name	**Tubing Wall Thickness** Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1 Not Applicable = 0	**Potential Tubing Mechanical Leak Path** Tubing thread Leak = 2 None Identified/Not Applicable = 0	**Packer Condition** Known Leak=2 Sealing/Not Applicable = 0	**Annular Condition Monitoring Plan In Place** Yes - 3 No - 1	**Sand Production** # of Grade 3 or more since last rework	**Gas Composition** None = 0 CO2 = 1 H2S = 5	**Wellhead Tbg Head Condition - Known Leak** Yes - 2 No- 1	**Wellhead flange Condition - Known Leak** Yes - 2 No - 1	**Wellhead hydraulic Port leak** Yes -2 No- 1	**Known Hydrate Formation** No = 0 Yes = 1
TC-12S	0	0	0	1	0	0	1	1	1	0
TC-5S	0	0	0	3	0	0	2	2	1	0
TC-4S	0	0	0	1	0	0	1	1	1	0
TC-3S	0	0	0	1	0	0	2	1	1	0
TC-11S	0	0	0	1	0	0	1	1	2	0
TC-10S	0	0	0	1	5	0	1	1	2	0
TC-8S	0	0	0	1	0	0	1	1	1	0
TC-7S	0	0	0	1	0	0	1	1	1	0
TC-2S	0	0	0	1	0	0	1	1	1	0
TC-14S	0	0	0	1	0	0	1	2	1	0
TC-13S	0	0	0	1	0	0	1	1	1	0
TC-15S	0	0	0	1	0	0	1	1	1	0
TC-9S	0	0	0	3	0	0	1	1	2	0
TC-16S	0	0	0	1	0	0	2	1	2	0
TC-1S	0	0	0	1	0	0	2	2	2	0
TC-17S	0	0	0	1	0	0	1	1	1	0
TC-1AS	0	0	0	1	1	0	2	2	2	0
TC-6S	0	0	0	1	0	0	1	1	2	0

Table 23- Turner Cut Station South Side Wells Risk Evaluation (Likelihood Data - Cont)

Well Name	**Well Security** Gated/fenced = 1 No = 2	**Wellhead Surface Damage Protection** **Full** Barricade (k-rail/bollard) =1, **Partial** Barricade (k-rail/bollard) = 2 **None** (Fenced only) = 3	**Natural Force Flooding** No= 0 Yes = 1	**Natural Force Seismic** Low PGA = 1 Med PGA = 2 High PGA =3	**Natural Force Subsidence** No= 0 Yes = 1	**Natural Force Tsunami** No= 0 Yes= 1	**Natural Force Lanslide** No= 0 Yes = 1
TC-12S	1	2	1	1	1	0	0
TC-5S	1	2	1	1	1	0	0
TC-4S	1	2	1	1	1	0	0
TC-3S	1	2	1	1	1	0	0
TC-11S	1	2	1	1	1	0	0
TC-10S	1	2	1	1	1	0	0
TC-8S	1	2	1	1	1	0	0
TC-7S	1	2	1	1	1	0	0
TC-2S	1	2	1	1	1	0	0
TC-14S	1	2	1	1	1	0	0
TC-13S	1	2	1	1	1	0	0
TC-15S	1	2	1	1	1	0	0
TC-9S	1	2	1	1	1	0	0
TC-16S	1	2	1	1	1	0	0
TC-1S	1	2	1	1	1	0	0
TC-17S	1	2	1	1	1	0	0
TC-1AS	1	2	1	1	1	0	0
TC-6S	1	2	1	1	1	0	0

Table 24- Turner Cut Station South Side Wells Risk Evaluation (Consequence Data)

Well Name	**Max Rate** MMcf/d	**Well Operation** IW = 3 (Consequence) Wd only = 2 OBS = 1	**Wind Direction Impact** High - 3 Low - 1	**Occupied Sturcture** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Offset wells Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Roads Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 0-500 ft of Major Highway = 4	**Proximity to Railroad Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Major Airport** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Population Centers** > 1 Mile =3 1-2 Mile =2 2-5 Mile =1 >5 Mile = 0	**Proximity to Body of Water Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 Water Well = 4, Navigable Waterway = 5	**Local Area Activities/Land Use** Urban = 4 Residential = 3 Crop farming (Irrigation/fertilizer / Plane) = 2 Cattle farming = 1	**Response to Well Incident** Unmanned-2 Facility Manned-1
TC-12S	30	3	1	3	3	3	1	1	0	2	2	1
TC-5S	29	3	1	3	3	3	1	1	0	2	2	1
TC-4S	23	2	1	3	3	3	1	1	0	2	2	1
TC-3S	15	2	1	3	3	2	1	1	0	2	2	1
TC-11S	17	2	1	3	3	3	1	1	0	2	2	1
TC-10S	8	2	1	3	3	3	1	1	0	2	2	1
TC-8S	21	3	1	3	3	3	1	1	0	2	2	1
TC-7S	22	2	1	3	3	3	1	1	0	2	2	1
TC-2S	20	2	1	3	3	2	1	1	0	2	2	1
TC-14S	22	3	1	3	3	3	1	1	0	2	2	1
TC-13S	15	2	1	3	3	3	1	1	0	2	2	1
TC-15S	15	3	1	3	3	3	1	1	0	2	2	1
TC-9S	15	2	1	3	3	3	1	1	0	2	2	1
TC-16S	15	3	1	3	3	3	1	1	0	2	2	1
TC-1S	15	3	1	3	3	2	1	1	0	2	2	1
TC-17S	15	3	1	3	3	3	1	1	0	2	2	1
TC-1AS	15	3	1	3	3	2	1	1	0	2	2	1
TC-6S	0	3	1	3	3	3	1	1	0	2	2	1

Table 25- Turner Cut Station South Side Wells Risk Evaluation (Consequence Data)

Well Name	Configuration T&C Flow -1 T&P - 4	DHSV Csg Deployment Yes -1 No- 0	DHSV Tbg Deployment Yes -1 No- 0	DHSV Tbg Condition # of Level 4 since installation	DHSV Csg Condition # of Level 4 since installation	DHSV Control Line Condition # of Level 4 since installation	Valve Factor	Likehood of Failure	Consequence of Failure	Risk of Failure (Risk Scoring)
TC-12S	1	1	1	5	2	0	0.50	**37**	**23**	**844**
TC-5S	1	1	1	0	1	1	0.75	**39**	**21**	**814**
TC-4S	1	1	1	3	0	0	1.25	**45**	**16**	**718**
TC-3S	1	1	1	1	0	1	0.75	**45**	**16**	**702**
TC-11S	1	1	1	5	0	0	1.17	**43**	**15**	**651**
TC-10S	1	1	1	0	1	0	1.50	**58**	**11**	**647**
TC-8S	1	1	1	1	2	0	0.83	**32**	**19**	**599**
TC-7S	1	1	1	1	0	0	1.50	**40**	**15**	**589**
TC-2S	1	1	1	2	0	0	1.33	**40**	**14**	**552**
TC-14S	1	1	1	2	0	0	1.33	**32**	**16**	**525**
TC-13S	1	1	1	3	0	0	1.25	**32**	**14**	**448**
TC-15S	1	1	1	0	0	0	2.00	**37**	**11**	**409**
TC-9S	1	1	1	0	0	0	2.00	**39**	**10**	**404**
TC-16S	1	1	1	0	0	0	2.00	**32**	**11**	**360**
TC-1S	1	1	1	0	0	0	2.00	**32**	**10**	**324**
TC-17S	1	1	1	0	0	0	2.00	**29**	**11**	**321**
TC-1AS	1	1	1	0	0	0	2.00	**29**	**10**	**306**
TC-6S	1	1	1	0	0	0	2.00	**35**	**8**	**263**

Table 26- McDonald Island Peripheral Wells Risk Evaluation (Input Data)

Well Name	API	Well Operation IW Wd only OBS	Well Operation IW = 3 Wd only = 2 OBS = 1	Spud Date	Completion Date	Years in Operation	Year of last Well Rework	Years since last Well Rework	# of Well Rework Performed	Measured Cement Bond Log TOC (feet)	Surface Csg (SC) Shoe, ft	Est. Distance to nearest offset well (feet)	Proximity to Roads (feet)	Proximity to Railroad (feet)	Proximity to Major Airport (feet)	Distance to Occupied Sturcture (HCA / Residence / Employee office-RE/Contrl Room building) (feet)	Proximity to Water (feet)
MCD-12	07700087	I/W	3	9/28/1960	10/12/1960	59	2008	11	1	111	882	366	100	5000	5000	598	226
MCD-11	07700086	I/W	3	9/13/1960	9/24/1960	59	2007	12	1	109	881	505	60	5000	5000	638	1461
MCD-5A	07720552	I/W	3	8/17/1991	9/4/1991	28	1991	28	0	1000	1000	367	970	5000	5000	870	1218
ZUCK-3	07700093	I/W	3	10/28/1949	11/14/1949	69	1967	52	1	2840	490	1416	245	5000	5000	2215	5637
MCD-10	07700085	I/W	3	8/27/1960	9/9/1960	59	1986	33	1	117	878	1412	60	5000	5000	1324	4219
MCD-15	07720444	I/W	3	10/10/1984	12/5/1984	34	1984	35	0	800	883	122	1,225	5000	5000	737	2629
TILD-1	07700090	OBS	1	1/14/1937	2/24/1937	82	1985	34	1	3549	500	170	1,220	5000	5000	1516	2511
MCD-4	07700080	OBS	1	10/23/1949	11/17/1949	69	1971	48	1	2920	510	1232	990	5000	5000	1607	2381
MCD-13	07700088	I/W	3	10/16/1960	10/26/1960	58	1982	37	1	0	887	1308	645	5000	5000	1206	3662
LMAC-1	07720609	I/W	3	7/18/1999	8/23/1999	20	1999	20	0	950	835	1046	1,940	5000	5000	1791	2165
MCD-14	07720441	I/W	3	8/23/1984	10/6/1984	35	1984	35	0	850	897	1756	1,110	5000	5000	777	2684
MCD-6	07700082	OBS	1	10/18/1949	11/8/1949	69	1985	34	1	3520	501	1540	1,060	5000	5000	1931	3812
ZUCK-1	07700091	OBS	1	7/9/1936	8/6/1936	83	1967	52	1	2880	508	1920	1,240	5000	5000	2516	4961
MCD-7	07700083	OBS	1	11/10/1949	11/29/1949	69	1965	54	1	3520	492	1427	1,030	5000	5000	1915	5544
ROB-2	07720523	OBS	1	10/31/1989	5/16/1990	29	1990	29	0	910	844	127	1,475	5000	5000	1770	2687
ROB-1	07720524	OBS	1	10/12/1989	5/5/1990	29	1990	29	0	850	875	226	1,350	5000	5000	1647	2601
ZUCK-H	07720010	OBS	1	6/16/1967	8/4/1967	52	1967	52	0	3650	980	3310	4,475	5000	5000	2104	5389
MCD-9	07700084	OBS	1	8/11/1960	8/24/1960	59	2016	3	1	0	874	1560	405	5000	5000	968	2945

Table 27- McDonald Island Peripheral Wells Risk Evaluation (Likelihood Data)

Well Name	**Well Operation** IW = 3 (Likelihood) Wd only = 2 OBS = 1	**Usage Factor**	**Adjusted # of Well Reworks**	**Original Production Casing Wall Thickness** Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	**Inner String Production Casing Wall Thickness** Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	**Production Casing Wall Thickness** Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	**Source of Metal Loss on Production Casing** Unknown = 4 Corrosion = 3 Mechanical = 2 None = 0	**Potential Production Casing Mechanical Leak Path** Uncovered Perforations = 5 Uncovered Stage collar = 4 Isolated (by cement or Inner String) Stage Collar = 3 Casing thread Leak = 2 None Identified/Not Applicable = 1	**Dogleg Severity** 0-5 %= 1 5-10% = 2 >10 % = 3	**Inner String Installed** Yes -2 No -1	**Cement Bond Log TOC** Full - 1 Inside SC - 2 Below SC - 3
MCD-12	3	43	1	4	0	4	4	1	1	1	2
MCD-11	3	44	1	4	0	4	4	1	1	1	2
MCD-5A	3	39	0	4	0	4	4	1	1	1	2
ZUCK-3	3	60	1	4	0	4	4	1	1	1	3
MCD-10	3	51	1	4	0	4	4	1	1	1	2
MCD-15	3	43	0	4	0	4	4	1	2	1	2
TILD-1	1	45	1	4	0	4	4	1	1	1	3
MCD-4	1	46	1	4	0	4	4	4	1	1	3
MCD-13	3	52	1	4	0	4	4	1	1	1	1
LMAC-1	3	33	0	4	0	4	4	1	1	1	3
MCD-14	3	43	0	4	0	4	4	1	2	1	2
MCD-6	1	41	1	4	0	4	4	1	1	1	3
ZUCK-1	1	52	1	4	1	4	4	3	1	1	3
MCD-7	1	48	1	4	0	4	4	1	1	1	3
ROB-2	1	26	0	4	0	4	4	1	1	1	3
ROB-1	1	26	0	4	0	4	4	1	1	1	2
ZUCK-H	1	41	0	4	0	4	4	1	2	1	3
MCD-9	1	27	0.5	1	0	1	0	1	1	1	1

Table 28- McDonald Island Peripheral Wells Risk Evaluation (Likelihood Data - Cont)

Well Name	**Tubing Wall Thickness** Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1 Not Applicable = 0	**Potential Tubing Mechanical Leak Path** Tubing thread Leak = 2 None Identified/Not Applicable = 0	**Packer Condition** Known Leak=2 Sealing/Not Applicable = 0	**Annular Condition Monitoring Plan In Place** Yes - 3 No - 1	**Sand Production** # of Grade 3 or more since last rework	**Gas Composition** None = 0 CO2 = 1 H2S = 5	**Wellhead Tbg Head Condition - Known Leak** Yes - 2 No- 1	**Wellhead flange Condition - Known Leak** Yes - 2 No - 1	**Wellhead hydraulic Port leak** Yes -2 No- 1	**Known Hydrate Formation** No = 0 Yes = 1
MCD-12	0	0	0	1	1	0	2	1	1	0
MCD-11	0	0	0	1	1	0	1	1	1	0
MCD-5A	0	0	0	1	0	0	1	1	1	0
ZUCK-3	0	0	0	1	0	0	1	1	1	0
MCD-10	0	0	0	1	0	0	1	1	1	0
MCD-15	0	0	0	1	0	0	1	1	1	0
TILD-1	0	0	0	1	0	0	1	1	1	0
MCD-4	0	0	0	1	0	0	2	1	1	0
MCD-13	0	0	0	1	0	0	2	1	1	0
LMAC-1	0	0	0	1	0	0	1	1	1	0
MCD-14	0	0	0	1	0	0	1	1	1	0
MCD-6	0	0	0	1	0	0	1	1	1	0
ZUCK-1	0	0	0	1	0	0	1	1	1	0
MCD-7	0	0	0	1	0	0	1	1	1	0
ROB-2	0	0	0	1	0	0	1	2	1	0
ROB-1	0	0	0	1	0	0	1	1	1	0
ZUCK-H	0	0	0	1	0	0	1	1	1	0
MCD-9	0	0	0	1	0	0	1	1	1	0

Table 29- McDonald Island Peripheral Wells Risk Evaluation (Likelihood Data - Cont)

Well Name	**Well Security** Gated/fenced = 1 No = 2	**Wellhead Surface Damage Protection** **Full** Barricade (k-rail/bollard) =1, **Partial** Barricade (k-rail/bollard) = 2 **None** (Fenced only) = 3	**Natural Force Flooding** No= 0 Yes = 1	**Natural Force Seismic** Low PGA = 1 Med PGA = 2 High PGA =3	**Natural Force Subsidence** No= 0 Yes = 1	**Natural Force Tsunami** No= 0 Yes= 1	**Natural Force Lanslide** No= 0 Yes = 1
MCD-12	1	3	1	1	1	0	0
MCD-11	1	3	1	1	1	0	0
MCD-5A	1	3	1	1	1	0	0
ZUCK-3	1	3	1	1	1	0	0
MCD-10	1	3	1	1	1	0	0
MCD-15	1	3	1	1	1	0	0
TILD-1	1	3	1	1	1	0	0
MCD-4	1	3	1	1	1	0	0
MCD-13	1	3	1	1	1	0	0
LMAC-1	1	3	1	1	1	0	0
MCD-14	1	3	1	1	1	0	0
MCD-6	1	3	1	1	1	0	0
ZUCK-1	1	3	1	1	1	0	0
MCD-7	1	3	1	1	1	0	0
ROB-2	1	3	1	1	1	0	0
ROB-1	1	3	1	1	1	0	0
ZUCK-H	1	3	1	1	1	0	0
MCD-9	1	3	1	1	1	0	0

Table 30- McDonald Island Peripheral Wells Risk Evaluation (Consequence Data)

Well Name	**Max Rate** MMcf/d	**Well Operation** IW = 3 (Consequence) Wd only = 2 OBS = 1	**Wind Direction Impact** High - 3 Low - 1	**Occupied Sturcture** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Offset wells Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Roads Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 0-500 ft of Major Highway = 4	**Proximity to Railroad Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Major Airport** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Population Centers** > 1 Mile =3 1-2 Mile =2 2-5 Mile =1 >5 Mile = 0	**Proximity to Body of Water Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 Water Well = 4, Navigable Waterway = 5	**Local Area Activities/Land Use** Urban = 4 Residential = 3 Crop farming (Irrigation/fertilizer / Plane) = 2 Cattle farming = 1	**Response to Well Incident** Unmanned-2 Facility Manned-1
MCD-12	8	3	1	2	3	3	1	1	0	3	2	1
MCD-11	17	3	1	2	2	3	1	1	0	1	2	1
MCD-5A	21	3	1	2	3	2	1	1	0	2	2	1
ZUCK-3	16	3	1	1	1	3	1	1	0	1	2	1
MCD-10	17	3	1	1	1	3	1	1	0	1	2	1
MCD-15	17	3	1	2	3	1	1	1	0	1	2	1
TILD-1	0	1	1	1	3	1	1	1	0	1	2	1
MCD-4	0	1	1	1	1	2	1	1	0	1	2	1
MCD-13	16	3	1	1	1	2	1	1	0	1	2	1
LMAC-1	20	3	1	1	1	2	1	1	0	2	2	1
MCD-14	11	3	1	2	3	1	1	1	0	1	2	1
MCD-6	0	1	1	1	1	2	1	1	0	1	2	1
ZUCK-1	0	1	1	1	1	1	1	1	0	1	2	1
MCD-7	0	1	1	1	1	1	1	1	0	1	2	1
ROB-2	0	1	1	1	3	1	1	1	0	1	2	1
ROB-1	0	1	1	1	3	1	1	1	0	1	2	1
ZUCK-H	0	1	1	1	1	1	1	1	0	1	2	1
MCD-9	0	1	1	1	1	3	1	1	0	1	2	1

Table 31- McDonald Island Peripheral Wells Risk Evaluation (Consequence Data)

Well Name	Configuration T&C Flow -1 T&P - 4	DHSV Csg Deployment Yes -1 No- 0	DHSV Tbg Deployment Yes -1 No- 0	DHSV Tbg Condition # of Level 4 since installation	DHSV Csg Condition # of Level 4 since installation	DHSV Control Line Condition # of Level 4 since installation	Valve Factor	Likehood of Failure	Consequence of Failure	Risk of Failure (Risk Scoring)
MCD-12	1	0	0	0	0	0	-	40	20	777
MCD-11	1	0	0	0	0	0	-	39	19	721
MCD-5A	1	0	0	0	0	0	-	32	21	656
ZUCK-3	1	0	0	0	0	0	-	42	17	697
MCD-10	1	0	0	0	0	0	-	39	17	660
MCD-15	1	0	0	0	0	0	-	34	18	596
TILD-1	1	0	0	0	0	0	-	39	11	410
MCD-4	1	0	0	0	0	0	-	43	10	410
MCD-13	1	0	0	0	0	0	-	39	15	606
LMAC-1	1	0	0	0	0	0	-	32	18	554
MCD-14	1	0	0	0	0	0	-	34	16	549
MCD-6	1	0	0	0	0	0	-	38	10	363
ZUCK-1	1	0	0	0	0	0	-	42	9	360
MCD-7	1	0	0	0	0	0	-	40	9	336
ROB-2	1	0	0	0	0	0	-	31	11	328
ROB-1	1	0	0	0	0	0	-	29	11	307
ZUCK-H	1	0	0	0	0	0	-	34	9	291
MCD-9	1	0	0	0	0	0	-	24	11	251

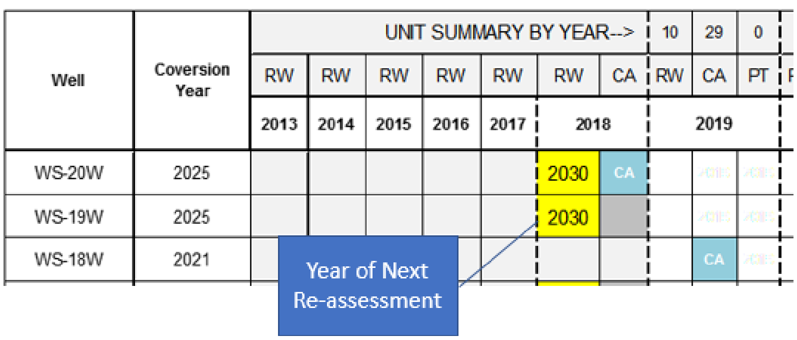
Appendix B - McDonald Island Well Construction Standard Implementation Plan and Assessment Schedule

The following figures provide an overview of the applied methodology from Section 4 that includes conversion of PG&E's wells to tubing and packer and brings them into conformance with §1726.5 of the final regulations put forth by the Division. Additionally, the figures demonstrate the assessment methodology – both pre- and post-conversion to tubing and packer configuration. The plan shown below for each well is based on addressing wells with the highest risk identified in the risk analysis shown in Appendix A. The planned schedules in the following figures are based on current data in the risk model. As new monitoring data is received, the plan below is subject to change.

The charts below show three possible activities for each well by year from 2019 thru 2025:

1. Thru-tubing casing assessment (blue)
2. T&P conversion/full assessment (green)
3. 5-year re-assessment pressure test (purple)

Additionally, for wells previously assessed, the schedule is shaded with yellow and the planned reassessment year based on casing condition observed is noted.



For wells previously assessed, the decision to run a third thru-tubing log will rest with PG&E Reservoir Engineering following review of 2 sequential cycles thru-tubing logging results; note Example 1 shown below. If the analysis indicates a change in condition that requires

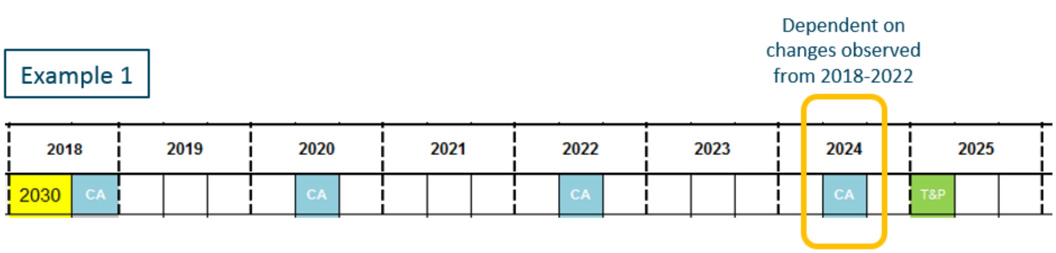


Figure B.1: Well Implementation and Assessment Schedule – Whiskey Slough West

Well	Coversion Year	UNIT SUMMARY BY YEAR-->							10	29	0	14	33	0	14	27	0	13	45	0	13	22	0	13	35	10	10	26	12
		RW	RW	RW	RW	RW	RW	CA	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT
		2013	2014	2015	2016	2017	2018		2019			2020			2021			2022			2023			2024			2025		
WS-20W	2025						2030	CA					CA						CA						CA		T&P		
WS-19W	2025						2030						CA						CA						CA		T&P		
WS-18W	2021									CA					T&P							CA						CA	
WS-17W	2025						2030						CA						CA						CA		T&P		
WS-16W	2020											T&P							CA						CA				PT
WS-15W	2020											T&P							CA						CA				PT
WS-14W	2022									CA						CA		T&P							CA				
WS-13W	2024						2030						CA						CA					T&P					
WS-12W	2024						2030						CA						CA					T&P					
WS-11W	2022									CA						CA		T&P							CA				
WS-10W	2022									CA						CA		T&P							CA				
WS-9W	2020											T&P							CA						CA				PT
WS-8W	2024						2030						CA						CA					T&P					
WS-7W	2019								T&P							CA						CA				PT			
WS-6W	2025						2030						CA						CA						CA		T&P		
WS-5W	2021									CA					T&P							CA						CA	
WS-4W	2020											T&P							CA						CA				PT
WS-3W	2021									CA					T&P							CA						CA	
WS-2W	2021									CA					T&P							CA						CA	
WS-1W	2023			2027									CA						CA		T&P							CA	
WS-1AW	2024						2030						CA						CA					T&P					

Legend

RW Casing Assessment	Year of Relog
Thru-Tubing Casing Assessment	CA
Tubing & Packer Conversion Rework	T&P
Pressure Test (T&P)	PT
Reinspection Rework	RW
Plug & Abandon	P&A

Figure B.2: Well Implementation and Assessment Schedule – Whiskey Slough East

Well	Coversion Year	UNIT SUMMARY BY YEAR-->							10	29	0	14	33	0	14	27	0	13	45	0	13	22	0	13	35	10	10	26	12
		RW	RW	RW	RW	RW	RW	CA	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT
		2013	2014	2015	2016	2017	2018		2019			2020			2021			2022			2023			2024			2025		
WS-14E	2019								T&P							CA						CA				PT			
WS-13E	2021									CA					T&P							CA						CA	
WS-12E	2020											T&P							CA						CA				PT
WS-11E	2019								T&P							CA						CA				PT			
WS-10E	2022									CA						CA		T&P							CA				
WS-9E	2020											T&P							CA						CA				PT
WS-8E	2019								T&P							CA						CA				PT			
WS-7E	2020											T&P							CA						CA				PT
WS-6E	2019								T&P							CA						CA				PT			
WS-5E	2020											T&P							CA						CA				PT
WS-4E	2021									CA					T&P							CA						CA	
WS-3E	2029			na	2029	T&P		CA		CA						CA												CA	
WS-2E	2025					2029							CA						CA						CA		T&P		
WS-1E	2020											T&P							CA						CA				PT
WS-1AE	2021									CA					T&P							CA						CA	

Legend

RW Casing Assessment	Year of Relog
Thru-Tubing Casing Assessment	CA
Tubing & Packer Conversion Rework	T&P
Pressure Test (T&P)	PT
Reinspection Rework	RW
Plug & Abandon	P&A

Figure B.3: Well Implementation and Assessment Schedule – Turner Cut North

Well	Coversion Year	UNIT SUMMARY BY YEAR-->							10	29	0	14	33	0	14	27	0	13	45	0	13	22	0	13	35	10	10	26	12
		RW	RW	RW	RW	RW	RW	CA	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT
		2013	2014	2015	2016	2017	2018		2019			2020			2021			2022			2023			2024			2025		
TC-1N	2023	2021											CA						CA		T&P							CA	
TC-2N	2024	2021					2030						CA						CA					T&P					
TC-3N	2024				2028								CA						CA					T&P					
TC-4N	2024				2028			CA					CA						CA					T&P					
TC-5N	2020											T&P							CA						CA				PT
TC-6N	2020											T&P							CA						CA				PT
TC-7N	2024				2028	2029							CA						CA					T&P					
TC-8N	2023		2026										CA						CA		T&P							CA	
TC-9N	2024				2028			CA					CA						CA					T&P					
TC-10N	2024	2025			2028	2029							CA						CA					T&P					
TC-11N	2023	2025											CA						CA		T&P							CA	
TC-12N	2020											T&P							CA						CA				PT
TC-13N	2022									CA						CA		T&P							CA				
TC-15N	2024					2025							CA						CA					T&P					
TC-16N	2022									CA						CA		T&P							CA				
TC-17N	2023		2026										CA						CA		T&P							CA	

Legend

RW Casing Assessment	Year of Relog
Thru-Tubing Casing Assessment	CA
Tubing & Packer Conversion Rework	T&P
Pressure Test (T&P)	PT
Reinspection Rework	RW
Plug & Abandon	P&A

Figure B.4: Well Implementation and Assessment Schedule – Turner Cut South

Well	Coversion Year	UNIT SUMMARY BY YEAR-->							10	29	0	14	33	0	14	27	0	13	45	0	13	22	0	13	35	10	10	26	12
		RW	RW	RW	RW	RW	RW	CA	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT
		2013	**2014**	**2015**	**2016**	**2017**	**2018**		**2019**			**2020**			**2021**			**2022**			**2023**			**2024**			**2025**		
TC-1AS	2025				2028								CA						CA						CA		T&P		
TC-1S	2025						2030						CA						CA						CA		T&P		
TC-2S	2019								T&P							CA						CA				PT			
TC-3S	2021									CA					T&P							CA						CA	
TC-4S	2021									CA					T&P							CA						CA	
TC-5S	2024				2024								CA						CA					T&P					
TC-6S	2025						2030						CA						CA						CA		T&P		
TC-7S	2019								T&P							CA						CA				PT			
TC-8S	2023		2026										CA						CA		T&P							CA	
TC-9S	2023		2026										CA						CA		T&P							CA	
TC-10S	2021									CA					T&P							CA						CA	
TC-11S	2021									CA					T&P							CA						CA	
TC-12S	2019		2026						T&P							CA						CA				PT			
TC-13S	2023		2026										CA						CA		T&P							CA	
TC-14S	2023			2027									CA						CA		T&P							CA	
TC-15S	2023			2027									CA						CA		T&P							CA	
TC-16S	2024						2030						CA						CA					T&P					
TC-17S	2025						2030						CA						CA						CA		T&P		

Legend	
RW Casing Assessment	Year of Relog
Thru-Tubing Casing Assessment	CA
Tubing & Packer Conversion Rework	T&P
Pressure Test (T&P)	PT
Reinspection Rework	RW
Plug & Abandon	P&A

Figure B.5: Well Implementation and Assessment Schedule – Peripheral

Well	Coversion Year	UNIT SUMMARY BY YEAR-->							10	29	0	14	33	0	14	27	0	13	45	0	13	22	0	13	35	10	10	26	12
		RW	RW	RW	RW	RW	RW	CA	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT
		2013	2014	2015	2016	2017	2018		2019			2020			2021			2022			2023			2024			2025		
LMac-1	2022									CA						CA		T&P							CA				
MCD-10	2022									CA						CA		T&P							CA				
MCD-11	2022									CA						CA		T&P							CA				
MCD-12	2021									CA					T&P							CA						CA	
MCD-13	2022									CA						CA		T&P							CA				
MCD-14	2023									CA						CA					T&P							CA	
MCD-15	2022									CA						CA		T&P							CA				
MCD-4	2022									CA						CA		T&P							CA				
MCD-5A	2022									CA						CA		T&P							CA				
MCD-6	2021														P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A
MCD-7	2021														P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A
MCD-9	2025				2028			CA					CA						CA						CA		T&P		
ROB-1	2023									CA						CA					T&P							CA	
ROB-2	2020											P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A
TILD-1	2020											P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A
ZUCK-1	2019								T&P							CA						CA				PT			
ZUCK-3	2019								T&P							CA						CA				PT			
ZUCK-H	2023									CA						CA					T&P							CA	

Legend

RW Casing Assessment	Year of Relog
Thru-Tubing Casing Assessment	CA
Tubing & Packer Conversion Rework	T&P
Pressure Test (T&P)	PT
Reinspection Rework	RW
Plug & Abandon	P&A

Advice 4180-G
November 14, 2019

Attachment B

Los Medanos Underground Storage Field:
Well Risk Evaluation and Construction Standard
Implementation Plan

Los Medanos Underground Storage Field: Well Risk Evaluation and Construction Standard Implementation Plan

Gas Storage Asset Management Department

Publication Date: March 29, 2019

Table of Contents

1. Introduction....3

2. Relative Risk Well Model Approach and Data Sources....3

2.1. Roles and Responsibilities.... 3

2.2. Publication Schedule of the Relative Risk Model.... 4

2.3. Relative Risk Model Attributes Inputs.... 4

2.4. Likelihood Scoring Components.... 5

2.4.1. Usage Factor:.... 5

2.4.3. Adjusted Rework Factor.... 6

2.4.4. Production Casing/Inner String Condition Factor:.... 6

2.4.5. Tubing & Packer Condition Factor.... 8

2.4.6. Monitoring and Inspection Condition Factors:.... 9

2.4.8. Wellhead Security Factor.... 11

2.4.9. Natural Force Factors.... 11

2.5. Consequence Scoring Components.... 12

2.5.2. Well Rate Factor.... 13

2.5.3. Well Operation Factor.... 13

2.5.4. Proximity Factors.... 13

2.5.5. Valve Factor.... 15

3. Los Medanos Construction Standard Implementation Plan....17

4. Baseline and Reassessment Schedule & Methodology for Casing Inspection....19

Appendix A – Los Medanos Relative Risk Well Evaluation....23

Appendix B - Los Medanos Well Construction Standard Implementation Plan and Assessment Schedule....30

1. Introduction

This plan provides the applied individual well risk assessment as detailed in PG&E's Underground Storage Risk and Integrity Management Plan and is specific to the Pleasant Creek Storage Field Facility wells. This plan is a companion document to the Underground Storage Risk and Integrity Management Plan and is intended to be used in conjunction with the preventative and mitigation (P&M) measures included in the noted plan.

Under the Interim Final Rule (effective January 2017) issued by the Pipeline and Hazardous Materials Safety Administration (PHMSA) and API RP 1171 incorporated by reference, operators shall develop a program to manage risk that includes a process to assess risk related to the storage operation on a consistent basis. Additionally, under the Final Regulations (effective October 2018) issued by Division of Oil, Gas, and Geothermal Resources (DOGGR) require operators to perform a risk assessment on a well-by-well basis (§1726.3(c)(2)(4)).

Contained within this implementation plan is the planned schedule to convert PG&E's storage wells at Pleasant Creek to conform with the construction requirements of dual barriers required in Final Regulations (effective October 2018) issued by Division of Oil, Gas, and Geothermal Resources (DOGGR).

Lastly, this plan provides the performance based reassessment methodology and plan for wells following baseline and subsequent inspections.

2. Relative Risk Well Model Approach and Data Sources

Individual well-by-well risk ranking allows PG&E to manage P&M programs to adequately address highest risk assets and prioritize capital projects accordingly. The relative risk ranking model database manages and tracks the inputs, both static and dynamic, to evaluate the relative risk of each well.

Continuous Evaluation (CE) is used to evaluate the integrity of each well based on data integration from both integrity assessments performed and routine maintenance, operations, and testing performed to evaluate asset condition and subsequent risk profile. Data collected from the P&M measures are used to inform the scoring assignments. Additionally, baseline casing assessment and reinspection data are input into the model. Reinspection frequency is based on the Underground Storage Risk and Integrity Management Plan, Appendix C – Casing Inspection Survey Frequency Tree.

2.1. Roles and Responsibilities

Reservoir Engineering is responsible for analyzing all the available asset data collected in the practices outlined in the Underground Storage Risk & Integrity Management Plan to evaluate the overall condition and exposure of each well asset.

2.2. Publication Schedule of the Relative Risk Model

The model is maintained throughout the year as new data becomes available and the following schedule guides the formal publication/snapshot of the relative risk model.

Publication	Purpose
By July 31	Identifies/confirms well population scheduled for next two-year rework cycles
By January 31	Integrates previous season rework Integrates year end data to identify any emergent or break in work to be addressed in the coming year and confirms five-year outlook

2.3. Relative Risk Model Attributes Inputs

The following sections below outline the various attributes and inputs that are considered in the relative risk ranking analysis. The data includes both static and dynamic data; static data is unchanging and does not require annual review, whereas dynamic data is dependent on testing result inputs.

The risk score for each well is computed by summing the score components that impact likelihood of loss of containment and multiplying that value by the sum of the consequence score impacts to safety, environment, and reliability.

Likelihood Score Components	Consequence Score Components
• Usage Factor • Adjusted Rework Factor • Production Casing Condition Factor • Tubing and Packer Condition Factor • Monitoring and Inspection Condition Factor • Wellhead Security Factor • Natural Force Factor	• Well Rate Factor • Well Operation Factor • Wind Direction Impact • Proximity Factors: Occupied Structure, Offset Well, Road and Railway Proximity, Local/Adjacent Land Use, Water Proximity, Response to Well Incident • Well Configuration • Valve Factor

2.4. Likelihood Scoring Components

The likelihood scoring components include the following factors are a defined in the following subsections. The scoring component is shown in the shaded box within the section.

The scoring components are combined in the following equation:

Likelihood = (Usage Factor/5) + (Adjusted Rework Factor x 5)
+ (Production Casing Condition Factors)
+ (Tubing and Packer Condition Factors)
+ (Monitoring and Inspection Condition Factors)
+ (Well Security Factor)
+ (Natural Force Factors)

2.4.1. Usage Factor:

The usage factor is computed as described below:

- Usage Factor: This score considers the impact of the duration of use over a well's life cycle, the prospect for human error via intervention activities, how the well has been used to account for levels of stresses the well has been subject to.

$$\text{Usage Factor} = \text{Average}\left\{\begin{array}{c}\text{Number of Years in Operation}\\ \text{Years since last well rework}\\ 20 \times \text{Well Operation}\end{array}\right\}$$

  - Well Operation: The current operational state in which the well is used. Wells will be identified as Injection and withdrawal (Inj/Wd), withdrawal only (Wd only), or observation (obs). The use of the well is dependent on construction and surface facility installments. Wells that are used for both Inj/Wd have a higher likelihood score as the stresses from injection and withdrawal activities are the highest. Wells used for Wd only do not experience injection forces, thus are scored lower. Wells used of observation do not experience dynamic loading and are scored lower at a 1.

    The following likelihood scoring is given based on identified well operation:

    Injection/Withdrawal (IW) = 3

    Withdrawal only (wd only) = 2

    Observation (obs) = 1

2.4.3. Adjusted Rework Factor

This score is based on the knowledge of the casing condition and assigns a higher risk score to wells that have had intervention or rework activity and have not had a casing assessment performed. This accounts for the human impact and risk associated with rework activity, and elevates opportunities where the casing could have been impacted but the condition is unknown.

Rework Factor =	If casing condition not known	→	Number of Well Reworks
	If casing condition not known	→	0.5 x Number of Reworks

2.4.4. Production Casing/Inner String Condition Factor:

The production casing condition factor is a summation of the following inputs for the production casing string. In wells that have been converted to tubing and packer, this element is considered the secondary barrier.

- Original Production Casing Wall Thickness: This score is based on the worst-case metal loss identified in a casing inspection survey (i.e. MFL or ultrasonic). In the case where a well has not been assessed, the highest score is assigned.

  Unknown = 4
  Class 3 or 4 = 3
  Class 2 or general = 2
  Isolated Class 1 or 2 = 1

- Inner String Production Casing Wall Thickness: This score is based on the worst-case metal loss identified in a casing inspection survey (i.e. MFL or ultrasonic) where an inner string has been cemented into place. In the case where a well has not been assessed, the highest score is assigned.

  Unknown = 4
  Class 3 or 4 = 3
  Class 2 or general = 2
  Isolated Class 1 or 2 = 1

- Production Casing Wall Thickness: If an inner string is in place to remediate an original production casing, this pulls the inner string production casing identified

above. If the original production casing is still the active production casing string, this pulls the production casing from two items above.

Unknown = 4
Class 3 or 4 = 3
Class 2 or general = 2
Isolated Class 1 or 2 = 1

- Source of Metal Loss on Production Casing: This identifies the source of any known metal loss and assigns the score to metal loss due to corrosion as 3. For wells where the condition is unknown, the highest score of 4 is assigned to elevate the risk for wells where the condition is unknown.

Corrosion (IC or EC) = 5
Mechanical = 2
None = 0

- Potential Production Casing Mechanical Leak Path: This score identifies possible leak paths that could lead to a loss of containment incident based on the construction of a well or known historic leak prone connections. This score takes into account the well's construction and whether or not a potential leak path is present. Uncovered perforations, such that they have not been remediated with a scab liner to mitigate risk, are given a score of 5. Uncovered stage collars, those not proactively or in mitigation covered with a scab liner, also present a potential leak path and are assigned a 4. Stage collars that have been remediated with an inner string, while still can be a potential leak path, are considered less risky and a score of 3 is assigned. A casing thread leak is scored as a 2.

Uncovered Perforations = 5
Uncovered Stage collar or thread leak = 4
Isolated (by cement or Inner String) Stage Collar = 3
Isolated casing thread Leak = 2
None Identified/Not Applicable = 1

- Dogleg Severity: This score is based on the percentage of dogleg severity(DLS). DLS is considered as the combined stresses across sections of high deviation are higher and are also prone to greater amount of casing wear from pipe

tripping. The maximum % of DLS is considered in the risk score as a well with a section of pipe that has a high degree of DLS impacts the allowable stress limit of a well and reduces the amount of tolerable wall loss at the same performance rating.

0% -5% = 1
5% -10% = 2
> 10% = 3

- Inner String Installed: The presence of an inner string is included in the scoring as it adds risk by creating another potential leak path and additional element that requires monitoring.

Yes, Installed = 2
No = 1

- Cement Bond Log TOC: The cement bond log uses the input value from the TOC identifying the highest top of well bonded cement with relation to the surface casing shoe depth.

Full - 1
Inside SC - 2
Below SC - 3

2.4.5. Tubing & Packer Condition Factor

The tubing & packer condition factor is a summation of the following inputs:

- Tubing Wall Thickness: This score is based on the worst-case metal loss identified in an inspection survey (i.e. MFL or ultrasonic). This will only impact the score of wells that are converted to tubing and packer configuration.

Class 3 or 4 = 3
Class 2 or general = 2
Isolated Class 1 or 2 = 1
Not Applicable = 0

- Potential Tubing Mechanical Leak Path: This score is based on known thread leaks of the tubing.

Tubing thread Leak = 2 *None Identified/Not Applicable = 0*

- Packer Condition: This score is based on how well a packer is sealing and if a known packer leak is present.

Known Leak=2 *Sealing/Not Applicable = 0*

2.4.6. Monitoring and Inspection Condition Factors:

The following monitoring and inspection data points/trends are combined for each well evaluation:

- Annular Condition Monitoring Plan: This score uses the presence of an annular condition monitoring plan to elevate the risk of a given well.

  Note: based on the annular testing performed, annular pressure can be managed and is typically not considered a hazardous situation.

Yes = 3 *No = 1*

- Sand Production: The sand inspections of each well is typically performed twice each year during withdrawal season. This score uses the historical sand inspection data and counts the number of inspections that have been a grade 3 or higher. This elevates the risk score of a well as it can be associated with higher erosion rates and gravel pack degradation.

Count of # of Grade 3 or more that have occurred since last rework

- Gas Composition: This score takes into account the type of gas in the storage system and if corrosive constituents are present and could cause/accelerate metal loss features.

None = 0
CO2 = 1
H2S = 5

- Wellhead Flange Condition- known leak: This score uses the monitoring data from the quarterly wellhead inspections and identify if there are known leaks.

Yes, leak = 2
No= 1

- Wellhead Tubing head Condition- known leak: This score uses the monitoring data from the quarterly wellhead inspections and identify if there are known leaks.

Yes, leak = 2
No= 1

- Wellhead Hydraulic Port Leak Condition: This score uses the monitoring data from the quarterly wellhead inspections and identify if there are known leaks.

Yes, leak = 2
No= 1

- Known Hydrate Potential: This score is factored in for wells where hydrate formation on the system has been identified historically.

Yes, historically observed = 1
No= 0

2.4.8. Wellhead Security Factor

The Wellhead security factor is a summation of the following inputs:

- Well Security: This score is based on security features installed at a given wellhead site or group of proximate wellheads. This score impacts the likelihood by taking into account the presence of a barrier that would limit access, thus reducing the likelihood of an external influence triggering a loss of containment event. Wells that have a fencing system are scored with a 1 and those without any type of physical barrier limiting access would be a 2.

  All of PG&E's wellhead sites are gated and fenced.

  Gated/Fenced = 1

  No= 2

- Wellhead Surface Impact Damage Protection: This score is based on security features installed at a given wellhead site to minimize opportunity for surface impact to the wellhead to occur and lead to an uncontrolled flow event. If no measures are employed, then the highest score is assigned as the wellhead has a higher risk of exposure to surface impact (i.e. vehicular). The likelihood score is reduced based on the level of surface protection provided whether a full circumferential system (i.e.. Bollards) be in place or partial (i.e. k-rail system on one side). Wells that are enclosed by a fence but do not have a barrier in place have a higher risk as maintenance vehicles drive within the fenced area.

  Full Barricade (k-rail/bollard) =1

  Partial Barricade (k-rail/bollard) = 2

  None (Fenced only) = 3

2.4.9. Natural Force Factors

The following factors are included and take into account naturally occurring outside force threats.

- Flooding: This score is based on the potential to experience flooding at a given storage facility.

  No= 0

  Yes=1

- Seismic: This score is based on the potential seismicity a given storage facility.

Low = 1
Med = 2
High =3

- Subsidence: This score consider is there is active subsidence at the facility.

No= 0
Yes=1

- Tsunami: This score considers the opportunity for a tsunami to impact the facility.

No= 0
Yes=1

- Landslide: This score considers if the facility and well site is situated where it could be impacted by landslides.

No= 0
Yes=1

2.5. Consequence Scoring Components

The consequence scoring components include the following factors as defined in the following subsections. The scoring component is shown in the shaded box within the section.

The scoring components are combined in the following equation:

$$\text{Consequence} = [\,(0.25 \times \text{Well Rate Factor}) + (\text{Well Operation Factor}) + \Sigma\,(\text{Proximity Factors})\,] - [\,5\text{x}\,(\,(0.5\ \text{Configuration}) + (\text{Valve Factor})\,)\,]$$

2.5.2. Well Rate Factor

- Rate Factor: This is based on the max current rate at the time of publishing the risk plan. Twenty-five percent of the rating factors into the consequence score to account for the reliability impact with the loss of a well.

2.5.3. Well Operation Factor

- Well Operation: The operational consequence of an event is also impacted that renders the well unusable has a greater implication on operations and use of the storage field. Withdrawal only wells carry an intermediate scoring as the unavailability of the well poses a risk to deliverability. Observation wells are assigned the lowest value in this category as unavailability would not impose a risk to operations.

Injection/Withdrawal (IW) = 3
Withdrawal only (wd only) = 2
Observation (obs) = 1

2.5.4. Proximity Factors

- Wind Direction Impact: This score looks at a well's surface location with respect to the nearest located structure and the predominant wind direction. This score is considered high such that a large release of gas could have severe impact with ignition on an adjacent facility. The score is low such that the predominant wind direction is away from adjacent structures.

High = 3
Low = 1

- Occupied Structure: This score is based on the well's surface location and its proximity to an occupied structure.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3

- Offset Wells: This score is based on the well's surface location and its proximity to an adjacent wellhead.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3

- Proximity to Roads: This score is based on the well's surface location and its proximity to a road as noted in the scoring.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3
0-500 ft of Major Highway = 4

- Proximity to Railroads: This score is based on the well's surface location and its proximity to a railroad as noted in the scoring.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3

- Proximity to Major Airport: This score is based on the well's surface location and its proximity to a major airport as noted in the scoring.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3

- Proximity to Population Centers: This score is based on the facility's location and the buffer rings indicated in the scoring.

> 1 Mile =3
1-2 Mile =2
2-5 Mile =1
>5 Mile = 0

- Proximity to Body of Water: This score is based on the facility's location and the buffer rings indicated in the scoring.

> 1 Mile =3
1-2 Mile =2
2-5 Mile =1
>5 Mile = 0

- Local Area/Land Use: This score is based on the facility's location and the surrounding area activity.

Urban = 4
Residential = 3
Crop farming (Irrigation/fertilizer / Plane) = 2
Cattle farming = 1

- Response to Well Incident: This score is based on proximity of employees to recognize and be able to respond in the event of a well emergency. Manned facilities have a higher likelihood that a response would be fairly soon after an event started or signs of an event could be recognized to minimize the impact.

Unmanned-2
Facility Manned-1

2.5.5. Valve Factor

This factor is used to reduce the consequence score by the mitigation employed by the presence and performance of a DHSV. The factor is computed in the following manner; each scoring component is listed and explained below.

$$\text{Valve Factor} = \left(\frac{\text{DHSV-Csg deployed}}{\text{DHSV-Csg Condition}} \right) + \left(\frac{\text{DHSV-Tbg deployed}}{\text{DHSV-Tbg Condition}} \right) + \left(\frac{1}{1 + \text{DHSV CL-cond}} \right)$$

- Well Configuration Factor: This score is used to reduce the consequence such that the dual barrier configuration would reduce the impact on the consequence.

  This score is factored by 50% in the final algorithm.

T&C Flow -1
T&P - 4

- DHSV Casing (Csg) Deployment: This score considers the presence of a DHSV on the casing side. Once wells are converted to tubing and packer, there is only a DHSV installed on the tubing side.

Yes -1
No - 0

- DHSV Tubing (Tbg) Deployment: This score considers the presence of a DHSV on the tubing side. Once wells are converted to tubing and packer, there is only a DHSV installed on the tubing side. Note: not all wells require a DHSV to be installed based on the critical well definition.

Yes -1
No - 0

- DHSV Casing (Csg) Condition: This score sums the number of level 4 leak by tests results a valve has received since installation.

# of Level 4 since installation

- DHSV Tubing (Tbg) Condition: This score sums the number of level 4 leak by tests results a valve has received since installation.

# of Level 4 since installation

- DHSV Control Line Condition: This score sums the number of level 4 leak by tests results the control line has received since installation.

# of Level 4 since installation

3. Los Medanos Construction Standard Implementation Plan

PG&E's wells located at Los Medanos are typically completed with open ended tubing and flow gas in both the tubing and casing annuli. In accordance with the construction standard in the DOGGR final regulations §1726.5, PG&E is phasing in the retrofits and/or permanent plug and abandonment as shown below in the schedule by year. Refer to the well specific schedule shown in Appendix B – Los Medanos Well Implementation and Assessment Schedule for the planned year of conversion. Additionally, Figure 3-1 shows the planned year of conversion and relative risk of a given well.

The well-by-well planned schedule is a living document and is based on the current data and inspection information known at the time this plan was published. The planned schedule is subject to change following the annual ranking update and where continuous evaluation activities necessitate advancing a well ahead of the planned date to address issues accordingly. Table 1 below shows the number of wells targeted by year to accomplish the conversion to tubing and packer configuration or plug and abandon by the end of 2025.

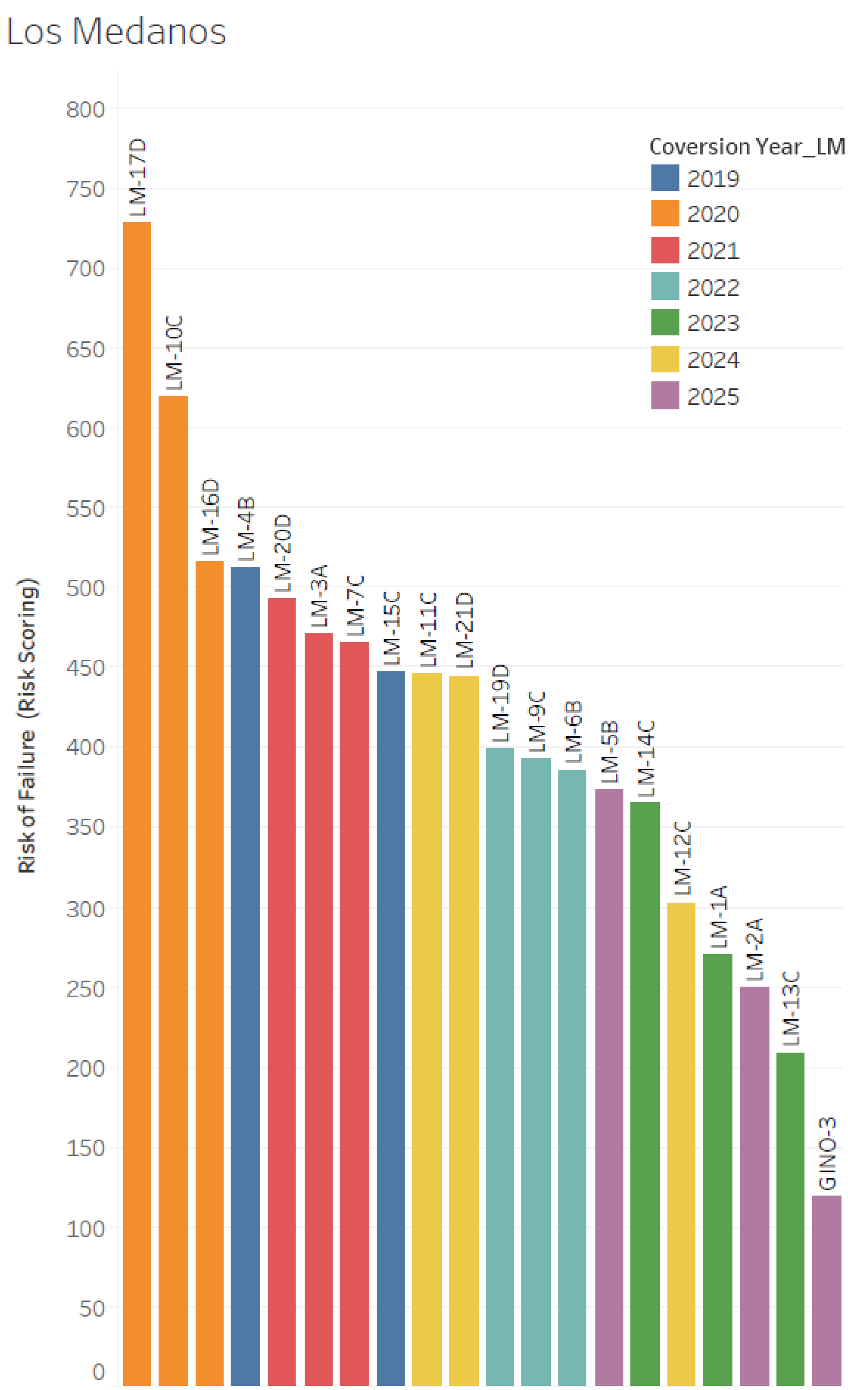
Table 1

Los Medanos 2019-2025 Well Construction Standard Implementation Plan

Year	Planned Number of Wells	% of Total Wells	Cumulative Count
2018	0	0	1*
2019	2	10%	3
2020	3	15%	6
2021	3	15%	9
2022	3	15%	12
2023	3	15%	15
2024	3	15%	18
2025	2	10%	20

*Note: One well at Los Medanos was completed with T&P prior to the regulations.

Figure 3-1: T&P Conversion shown by year and Risk Rank



4. Baseline and Reassessment Schedule & Methodology for Casing Inspection

PG&E commenced performing baseline inspections in 2013 and has completed a baseline casing inspection log on 6 wells (30% of field) at the start of 2019. As the program advanced, additional logs and tests were grouped into the suite of testing to establish a baseline in 2016. The suite of testing is provided in the Risk and Integrity Management Plan in Appendix Z. The status of well assessments can be grouped into three categories based on the time period when the assessment occurred:

1. **Pending Assessments:** Wells have not yet been inspected using advanced casing inspection tools. These wells have been inspected for baseline gas behind pipe using GRN tools. The wells have continued to be monitored annually via noise and temp (N&T) inspection. Additional daily and weekly monitoring activities (i.e. leak inspection and annular pressure monitoring) have been performed in alignment with the Risk and Integrity Management Plan Practices.

2. **Pre-2016 Assessments:** Wells were typically assessed using MFL tools for inspections, GRN tools during well work and also were monitored using the noise & temperature tools (N&T) annually. Additional daily and weekly monitoring activities (i.e. leak inspection and annular pressure monitoring) have been performed in alignment with the Risk and Integrity Management Plan Practices.

3. **2016-Current Assessments:** Wells were assessed using the full suite of inspections including MFL, CBL, N&T, GRN/RST, ultrasonic, caliper, and pressure testing. Additional daily and weekly monitoring activities (i.e. leak inspection and annular pressure monitoring) have been performed in alignment with the Risk and Integrity Management Plan Practices.

A key finding from the groups of wells that have casing assessment data demonstrates that current field conditions at Los Medanos do not appear indicate active corrosion is present. Inspection data from MFL and ultrasonic support the conclusion that neither internal or external corrosion appear to be prevalent or common at this time. PG&E uses the guidance in Appendix C of the Risk and Integrity Management Plan to determine the reinspection frequency for a given well following a baseline or reinspection of casing condition. The typical casing frequency return period continues to fall into “12-15 year” re-assessment window based on limited metal loss (class 3 and below) and isolated condition. PG&E will be returning to the well that was previously assessed for conversion to tubing and packer ahead of follow up inspection and planned reassessment period.

PG&E plans to complete the remainder of the baseline inspections at Los Medanos during the well conversion to tubing and packer configuration. PG&E uses a methodology that is prioritized by risk and coupled with the ability to effectively and efficiently conduct the work, minimization of unnecessary equipment mobilization, and coordination with station projects (i.e. pipeline work, platform equipment maintenance/rebuilds) to reduce impact to deliverability and station outage. Figure 4-1 maps this approach and uses the results of the risk model, PG&E prioritizes the wells in the based on the risk score and looks at each of the following categories:

1. **Assessment Status of "Pending**": wells pending assessment are targeted in the first group to be converted to tubing and packer configuration. During that conversion activities, wells will be inspected using the full suite of inspection tools identified in Appendix Z.

2. **Assessment Status "Pre-2016"**: wells that are slated for re-inspection following their baseline metal thickness inspection will be targeted

3. **Assessment Status "2016- Current":** These wells have been evaluated using the full suite of logs in Appendix Z. Wells in this category typically have a re-assessment internal of 12-15years and PG&E will be returning to these wells to reconfigure them in a tubing and packer status ahead of the targeted re-assessment interval.

Using this approach, all wells at Los Medanos will have had an initial baseline casing condition inspection by the end of 2023. Additionally, PG&E plans to run a thru-tubing casing inspection log on wells that are pending assessment and not planned for work in 2020. This logging activity will continue every two years until the well has been assessed. This allows PG&E to identify if any of the wells pending assessment have any features that require remediation ahead of the planned schedule and can advance those wells accordingly. Further, for wells that have been previously assessed with a casing inspection, a thru-tubing surveillance logging program will commence in 2020 and cycle every two years until the well is converted to tubing and packer. The planned frequency for each group is also show in Figure 4-1.

Following a well's baseline inspection and/or conversion to tubing and packer, PG&E will identify the well's casing reassessment frequency per Appendix C of the Risk and Integrity Management Plan. PG&E plans to deploy a casing inspection surveillance program using thru-tubing technology to monitor for any changes in condition; note, this surveillance activity is in addition to the routine integrity monitoring practice (i.e. sand inspection, pressure monitoring, annual noise and temperature survey).

Figure 4-2 illustrates the frequency of the thru-tubing inspection and pressure testing, per Appendix K of Risk and Integrity Management Plan. After the first two cycles of thru-tubing logging are performed, PG&E will space the 3rd logging activity halfway between the next planned reassessment. For example, a well scheduled on a 12-15 year reassessment interval will have a thru-tubing log run in year 2 and year 4 following conversion to T&P. The next thru-tubing log will be run in year 8, halfway between year 4 and year 12.

Figure 4-1: Assessment in Year & T&P Conversion Risk Informed Methodology

<table>
<tr><th rowspan="2">Year of Assessment</th><th colspan="7">Assessment in Year & T&P Conversion</th></tr>
<tr><th>2019</th><th>2020</th><th>2021</th><th>2022</th><th>2023</th><th>2024</th><th>2025</th></tr>
<tr><td rowspan="5">Pending</td><td colspan="7">2019 Planned Wells: Full Assessment with T&P Conversion</td></tr>
<tr><td>N&T</td><td colspan="6">2020 Full Assessment with T&P Conversion</td></tr>
<tr><td>N&T
Thru - Tubing</td><td>N&T</td><td colspan="5">2021 Full Assessment with T&P Conversion</td></tr>
<tr><td>N&T
Thru - Tubing</td><td>N&T</td><td>N&T
Thru - Tubing</td><td colspan="4">2022 Full Assessment with T&P Conversion</td></tr>
<tr><td>N&T
Thru - Tubing</td><td>N&T</td><td>N&T
Thru - Tubing</td><td>N&T</td><td colspan="3">2023 Full Assessment with T&P Conversion</td></tr>
<tr><td rowspan="2">2013 – mid 2016</td><td>N&T</td><td>N&T
Thru - Tubing</td><td>N&T</td><td>N&T
Thru- Tubing</td><td colspan="3">2023 Full Assessment with T&P Conversion</td></tr>
<tr><td>N&T</td><td>N&T
Thru - Tubing</td><td>N&T</td><td>N&T
Thru- Tubing</td><td>N&T</td><td colspan="2">2024 Full Assessment with T&P Conversion</td></tr>
<tr><td rowspan="2">2016 – 2018</td><td>N&T</td><td>N&T
Thru - Tubing</td><td>N&T</td><td>N&T
Thru- Tubing</td><td>N&T</td><td colspan="2">2025 Full Assessment with T&P Conversion</td></tr>
<tr><td>N&T</td><td>N&T
Thru - Tubing</td><td>N&T</td><td>N&T
Thru- Tubing</td><td>N&T</td><td>N&T
Thru- Tubing</td><td>Full Assessment with T&P Conversion</td></tr>
</table>

Figure 4-2: Assessments performed in Year Following T&P Conversion

Re-Assessment Interval	Assessment in Year Following T&P Conversion														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3-5 Years	N&T	N&T	Full Assessment: Casing Inspection & Pressure Test Establish Re-Assessment Interval												
5-8 Years	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	Full Assessment: Casing Inspection & Pressure Test Establish Re-Assessment Interval										
8-12 Years	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	N&T Pressure Testing	N&T	N&T	Full Assessment: Casing Inspection & Pressure Test Establish Re-Assessment Interval							
12-15 Years	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	N&T Pressure Testing	N&T	N&T	N&T Thru Tubing	N&T	N&T Pressure Testing	N&T	Full Assessment: Casing Inspection & Pressure Test Establish Re-Assessment Interval			

Appendix A – Los Medanos Relative Risk Well Evaluation

Figure A-1: Well by Well Risk of Failure Scoring – Los Medanos

**Note: The consequence scoring chart above shows a black line serving as the "zero" axis as the score components graphed below are mitigation components and reduce consequence.

Table 2 – Los Medanos Risk Evaluation (Input Data)

Well Name	API	Well Operation IW Wd only OBS	Well Operation IW = 3 Wd only = 2 OBS = 1	Spud Date	Completion Date	Years in Operation	Year of last Well Rework	Years since last Well Rework	# of Well Rework Performed	Measured Cement Bond Log TOC (feet)	Surface Csg (SC) Shoe, ft	Est. Distance to nearest offset well (feet)	Proximity to Roads (feet)	Proximity to Railroad (feet)	Proximity to Major Airport (feet)	Distance to Occupied Sturcture (HCA / Residence / Employee office-RE/Contrl Room building) (feet)	Proximity to Water (feet)
LM-17D	01320136	WD	2	1/31/1979	2/28/1979	40	1997	22	1	0	913	87	3,054	5000	5000	840	8484
LM-10C	01320131	I/W	3	7/21/1978	9/29/1978	41	2003	16	1	2136	524	69	3,956	5000	5000	1614	9386
LM-16D	01320133	I/W	3	9/30/1978	10/22/1978	41	2004	15	1	0	932	117	3,027	5000	5000	764	8457
LM-4B	01320093	WD	2	7/17/1973	8/13/1973	46	2013	6	5	1518	1198	15	5,222	5000	5000	2722	10652
LM-20D	01320297	WD	2	6/5/1990	8/31/1990	29	1990	29	0	0	764	107	2,941	5000	5000	715	8371
LM-3A	01320115	I/W	3	10/17/1977	12/9/1977	41	2000	19	3	625	910	79	6,423	5000	5000	3945	11853
LM-7C	01320130	I/W	3	5/25/1978	7/19/1978	41	1992	27	1	720	902	157	4,213	5000	5000	1856	9643
LM-15C	01320121	WD	2	12/12/1977	2/4/1978	41	1999	20	3	3779	893	82	3,883	5000	5000	1573	9313
LM-11C	01320128	I/W	3	3/17/1978	5/24/1978	41	2015	4	2	100	898	145	3,887	5000	5000	1541	9317
LM-21D	01320308	I/W	3	5/6/1991	5/28/1991	28	2015	4	3	250	885	85	3,013	5000	5000	899	8443
LM-19D	01320295	I/W	3	5/23/1990	7/30/1990	29	2007	12	1	1200	756	104	2,962	5000	5000	898	8392
LM-9C	01320123	I/W	3	2/7/1978	3/10/1978	41	2011	8	2	1525	891	69	4,030	5000	5000	1682	9460
LM-6B	01320140	I/W	3	12/20/1978	1/31/1979	40	2006	13	1	386	877	82	5,237	5000	5000	2738	10667
LM-5B	01320144	I/W	3	3/1/1979	4/2/1979	40	2013	6	1	407	501	124	5,206	5000	5000	2750	10636
LM-14C	01320298	I/W	3	6/19/1990	9/21/1990	29	1990	29	0	0	495	58	3,941	5000	5000	1628	9371
LM-12C	01320307	I/W	3	4/15/1991	6/10/1991	28	2016	3	1	780	913	69	4,068	5000	5000	1750	9498
LM-1A	01320373	OBS	1	11/25/2007	12/16/2007	11	2007	12	0	890	901	44	6,422	5000	5000	3971	11852
LM-2A	01320138	I/W	3	11/14/1978	12/14/1978	40	2016	3	2	1570	920	85	6,453	5000	5000	3988	11883
LM-13C	01320299	I/W	3	7/7/1990	10/2/1990	29	1990	29	0	0	770	58	3,999	5000	5000	1686	9429
GINO-3	01300135	OBS	1	12/7/1961	2/2/1962	57	2017	2	3	0	2553	114	6,466	5000	5000	4014	11896

Table 3 – Los Medanos Risk Evaluation (Likelihood Data)

Well Name	**Well Operation** IW = 3 (Likelihood) Wd only = 2 OBS = 1	**Usage Factor**	**Adjusted # of Well Reworks**	**Original Production Casing Wall Thickness** Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	**Inner String Production Casing Wall Thickness** Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	**Production Casing Wall Thickness** Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	**Source of Metal Loss on Production Casing** Unknown = 4 Corrosion = 3 Mechanical = 2 None = 0	**Potential Production Casing Mechanical Leak Path** Uncovered Perforations = 5 Uncovered Stage collar = 4 Isolated (by cement or Inner String) Stage Collar = 3 Casing thread Leak = 2 None Identified/Not Applicable = 1	**Dogleg Severity** 0-5 %= 1 5-10% = 2 >10 % = 3	**Inner String Installed** Yes -2 No -1	**Cement Bond Log TOC** Full - 1 Inside SC - 2 Below SC - 3
LM-17D	2	34	1	4	0	4	4	1	2	1	1
LM-10C	3	39	1	4	0	4	4	3	2	1	3
LM-16D	3	39	1	4	0	4	4	1	2	1	1
LM-4B	2	31	2.5	2	0	2	2	3	0	1	3
LM-20D	2	33	0	4	0	4	4	1	0	1	1
LM-3A	3	40	3	4	0	4	4	1	2	1	2
LM-7C	3	43	1	4	0	4	4	1	3	1	2
LM-15C	2	34	3	4	0	4	4	3	2	1	3
LM-11C	3	35	1	2	0	2	2	1	2	1	2
LM-21D	3	31	1.5	1	0	1	0	1	0	1	2
LM-19D	3	34	1	4	0	4	4	1	0	1	3
LM-9C	3	36	2	4	0	4	4	1	2	1	3
LM-6B	3	38	1	4	0	4	4	1	2	1	2
LM-5B	3	35	0.5	3	0	3	2	1	2	1	2
LM-14C	3	39	0	4	0	4	4	1	0	1	1
LM-12C	3	30	0.5	2	0	2	2	1	2	1	2
LM-1A	1	14	0	4	0	4	4	1	0	1	2
LM-2A	3	34	1	2	0	2	2	1	2	1	3
LM-13C	3	39	0	4	0	4	4	1	0	1	1
GINO-3	1	26	1.5	3	0	3	2	1	0	1	1

Table 4 – Los Medanos Risk Evaluation (Likelihood Data - Cont)

Well Name	**Tubing Wall Thickness** Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1 Not Applicable = 0	**Potential Tubing Mechanical Leak Path** Tubing thread Leak = 2 None Identified/Not Applicable = 0	**Packer Condition** Known Leak=2 Sealing/Not Applicable = 0	**Annular Condition Monitoring Plan In Place** Yes - 3 No - 1	**Sand Production** # of Grade 3 or more since last rework	**Gas Composition** None = 0 CO2 = 1 H2S = 5	**Wellhead Tbg Head Condition - Known Leak** Yes - 2 No- 1	**Wellhead flange Condition - Known Leak** Yes - 2 No - 1	**Wellhead hydraulic Port leak** Yes -2 No- 1	**Known Hydrate Formation** No = 0 Yes = 1
LM-17D	0	0	0	1	0	0	2	1	1	0
LM-10C	0	0	0	1	0	0	2	1	1	0
LM-16D	0	0	0	1	0	0	2	1	1	0
LM-4B	0	0	0	3	0	0	1	1	1	0
LM-20D	0	0	0	1	0	0	2	1	1	0
LM-3A	0	0	0	1	0	0	2	1	1	0
LM-7C	0	0	0	1	0	0	1	1	2	0
LM-15C	0	0	0	1	0	0	2	1	1	0
LM-11C	0	0	0	1	1	0	1	1	1	0
LM-21D	0	0	0	1	0	0	1	1	1	0
LM-19D	0	0	0	1	0	0	2	1	1	0
LM-9C	0	0	0	1	0	0	1	1	1	0
LM-6B	0	0	0	3	0	0	2	1	2	0
LM-5B	0	0	0	1	0	0	1	1	1	0
LM-14C	0	0	0	1	0	0	2	1	1	0
LM-12C	0	0	0	1	0	0	1	1	1	0
LM-1A	0	0	0	1	0	0	1	1	1	0
LM-2A	0	0	0	1	0	0	1	1	1	0
LM-13C	0	0	0	1	0	0	2	1	1	0
GINO-3	0	0	0	1	0	0	1	1	1	0

Table 5 – Los Medanos Risk Evaluation (Likelihood Data - Cont)

Well Name	**Well Security** Gated/fenced = 1 No = 2	**Wellhead Surface Damage Protection** **Full** Barricade (k-rail/bollard) =1, **Partial** Barricade (k-rail/bollard) = 2 **None** (Fenced only) = 3	**Natural Force Flooding** No= 0 Yes = 1	**Natural Force Seismic** Low PGA = 1 Med PGA = 2 High PGA =3	**Natural Force Subsidence** No= 0 Yes = 1	**Natural Force Tsunami** No= 0 Yes= 1	**Natural Force Lanslide** No= 0 Yes = 1
LM-17D	1	1	0	3	0	0	0
LM-10C	1	1	0	3	0	0	0
LM-16D	1	1	0	3	0	0	0
LM-4B	1	1	0	3	0	0	0
LM-20D	1	1	0	3	0	0	0
LM-3A	1	1	0	3	0	0	0
LM-7C	1	1	0	3	0	0	0
LM-15C	1	1	0	3	0	0	0
LM-11C	1	1	0	3	0	0	0
LM-21D	1	1	0	3	0	0	0
LM-19D	1	1	0	3	0	0	0
LM-9C	1	1	0	3	0	0	0
LM-6B	1	1	0	3	0	0	0
LM-5B	1	1	0	3	0	0	0
LM-14C	1	1	0	3	0	0	0
LM-12C	1	1	0	3	0	0	0
LM-1A	1	1	0	3	0	0	0
LM-2A	1	1	0	3	0	0	0
LM-13C	1	1	0	3	0	0	0
GINO-3	1	1	0	3	0	0	0

Table 6 – Los Medanos Risk Evaluation (Consequence Data)

Well Name	**Max Rate** MMcf/d	**Well Operation** IW = 3 (Consequence) Wd only = 2 OBS = 1	**Wind Direction Impact** High - 3 Low - 1	**Occupied Sturcture** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Offset wells Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Roads Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 0-500 ft of Major Highway = 4	**Proximity to Railroad Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Proximity to Major Airport** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	**Population Centers** > 1 Mile =3 1-2 Mile =2 2-5 Mile =1 >5 Mile = 0	**Proximity to Body of Water Score** >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 Water Well = 4, Navigable Waterway = 5	**Local Area Activities/Land Use** Urban = 4 Residential = 3 Crop farming (Irrigation/fertilizer / Plane) = 2 Cattle farming = 1	**Response to Well Incident** Unmanned-2 Facility Manned-1
LM-17D	30	2	3	2	3	1	1	1	2	1	1	1
LM-10C	20	3	1	1	3	1	1	1	2	1	1	1
LM-16D	14	3	3	2	3	1	1	1	2	1	1	1
LM-4B	26	2	1	1	3	1	1	1	2	1	1	1
LM-20D	23	2	3	2	3	1	1	1	2	1	1	1
LM-3A	26	3	1	1	3	1	1	1	2	1	1	1
LM-7C	21	3	1	1	3	1	1	1	2	1	1	1
LM-15C	0	2	1	1	3	1	1	1	2	1	1	1
LM-11C	15	3	1	1	3	1	1	1	2	1	1	1
LM-21D	15	3	3	2	3	1	1	1	2	1	1	1
LM-19D	20	3	3	2	3	1	1	1	2	1	1	1
LM-9C	24	3	1	1	3	1	1	1	2	1	1	1
LM-6B	15	3	1	1	3	1	1	1	2	1	1	1
LM-5B	17	3	1	1	3	1	1	1	2	1	1	1
LM-14C	20	3	1	1	3	1	1	1	2	1	1	1
LM-12C	20	3	1	1	3	1	1	1	2	1	1	1
LM-1A	0	1	1	1	3	1	1	1	2	1	1	1
LM-2A	17	3	1	1	3	1	1	1	2	1	1	1
LM-13C	15	3	1	1	3	1	1	1	2	1	1	1
GINO-3	0	1	1	1	3	1	1	1	2	1	1	1

Table 7 – Los Medanos Risk Evaluation (Consequence Data)

Well Name	Configuration T&C Flow -1 T&P - 4	DHSV Csg Deployment Yes -1 No- 0	DHSV Tbg Deployment Yes -1 No- 0	DHSV Tbg Condition # of Level 4 since installation	DHSV Csg Condition # of Level 4 since installation	DHSV Control Line Condition # of Level 4 since installation	Valve Factor	Likehood of Failure	Consequence of Failure	Risk of Failure (Risk Scoring)
LM-17D	1	1	1	1	2	1	0.42	**35**	**21**	**728**
LM-10C	1	1	1	0	5	1	0.58	**40**	**16**	**620**
LM-16D	1	1	1	0	8	0	1.11	**36**	**14**	**516**
LM-4B	1	1	1	3	0	0	1.25	**41**	**13**	**513**
LM-20D	1	1	1	0	0	2	0.67	**28**	**18**	**493**
LM-3A	1	1	1	0	0	0	2.00	**47**	**10**	**470**
LM-7C	1	1	1	0	2	0	1.33	**39**	**12**	**466**
LM-15C	1	1	1	2	0	1	0.67	**49**	**9**	**447**
LM-11C	1	1	1	2	0	1	0.67	**32**	**14**	**445**
LM-21D	1	1	1	2	1	0	0.83	**28**	**16**	**444**
LM-19D	1	1	1	0	0	0	2.00	**35**	**12**	**399**
LM-9C	1	1	1	0	0	0	2.00	**41**	**10**	**392**
LM-6B	1	1	1	1	0	0	1.50	**40**	**10**	**386**
LM-5B	1	1	1	1	1	0	1.00	**30**	**13**	**373**
LM-14C	1	1	1	5	0	0	1.17	**29**	**13**	**365**
LM-12C	1	1	1	1	0	0	1.50	**28**	**11**	**303**
LM-1A	1	1	0	1	1	11	0.04	**24**	**11**	**270**
LM-2A	1	1	1	0	0	0	2.00	**32**	**8**	**249**
LM-13C	1	1	1	0	0	0	2.00	**29**	**7**	**209**
GINO-3	4	0	0	0	0	0	-	**30**	**4**	**119**

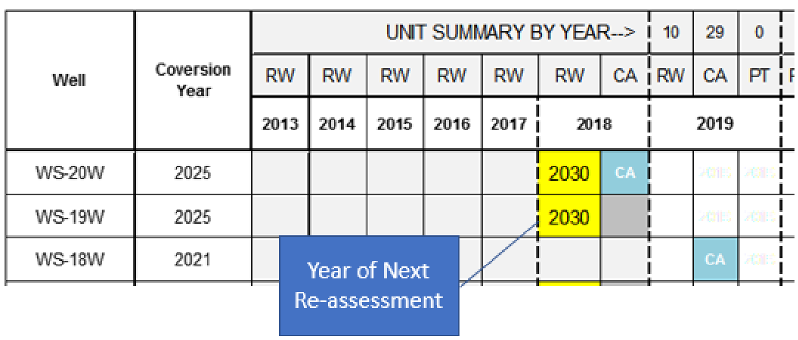
Appendix B - Los Medanos Well Construction Standard Implementation Plan and Assessment Schedule

The following figures provide an overview of the applied methodology from Section 4 that includes conversion of PG&E's wells to tubing and packer and brings them into conformance with §1726.5 of the final regulations put forth by the Division. Additionally, the figures demonstrate the assessment methodology – both pre- and post-conversion to tubing and packer configuration. The plan shown below for each well is based on addressing wells with the highest risk identified in the risk analysis shown in Appendix A. The planned schedules in the following figures are based on current data in the risk model. As new monitoring data is received, the plan below is subject to change.

The charts below show three possible activities for each well by year from 2019 thru 2025:

1. Thru-tubing casing assessment (blue)
2. T&P conversion/full assessment (green)
3. 5-year re-assessment pressure test (purple)

Additionally, for wells previously assessed, the schedule is shaded with yellow and the planned reassessment year based on casing condition observed is noted.



For wells previously assessed, the decision to run a third thru-tubing log will rest with PG&E Reservoir Engineering following review of 2 sequential cycles thru-tubing logging results; note Example 1 shown below.

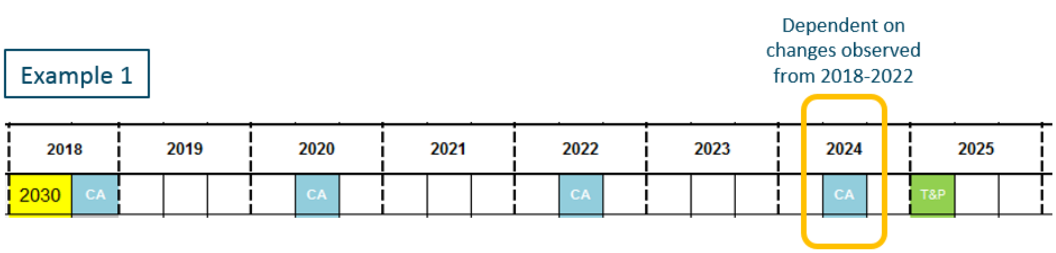


Figure B.1: Well Implementation and Assessment Schedule – Los Medanos

Well	Coversion Year	UNIT SUMMARY BY YEAR-->							2	9	0	3	6	0	3	7	0	3	9	0	3	4	0	3	9	1	3	6	3
		RW	RW	RW	RW	RW	RW	CA	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT
		2013	2014	2015	2016	2017	2018			2019			2020			2021			2022			2023			2024			2025	
GINO-3	2025					2025							CA						CA						CA		T&P		
LM-1A	2023									CA						CA					T&P							CA	
LM-2A	2025				2028								CA						CA						CA		T&P		
LM-3A	2021									CA					T&P							CA						CA	
LM-4B	2019	2025							P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A
LM-5B	2025	2021											CA						CA						CA		T&P		
LM-6B	2022									CA						CA		T&P							CA				
LM-10C	2020											T&P							CA						CA				PT
LM-11C	2024	2027											CA						CA					T&P					
LM-12C	2024				2028								CA						CA					T&P					
LM-13C	2023									CA						CA					T&P							CA	
LM-14C	2023									CA						CA					T&P							CA	
LM-15C	2019								T&P							CA						CA				PT			
LM-7C	2021									CA					T&P							CA						CA	
LM-9C	2022									CA						CA		T&P							CA				
LM-16D	2020											T&P							CA						CA				PT
LM-17D	2020											T&P							CA						CA				PT
LM-19D	2022									CA						CA		T&P							CA				
LM-20D	2021									CA					T&P							CA						CA	
LM-21D	2024												CA						CA					T&P					

Legend

Legend	
RW Casing Assessment	Year of Relog
Thru-Tubing Casing Assessment	CA
Tubing & Packer Conversion Rework	T&P
Pressure Test (T&P)	PT
Reinspection Rework	RW
Plug & Abandon	P&A

Advice 4180-G
November 14, 2019

Attachment C

Pleasant Creek Underground Storage Field: Well Risk Evaluation and Construction Standard Implementation Plan

Pleasant Creek Underground Storage Field: Well Risk Evaluation and Construction Standard Implementation Plan

Gas Storage Asset Management Department

Publication Date: March 29, 2019

Table of Contents

1. Introduction....3
2. Relative Risk Well Model Approach and Data Sources....3
2.1. Roles and Responsibilities 3
2.2. Publication Schedule of the Relative Risk Model 4
2.3. Relative Risk Model Attributes Inputs.... 4
2.4. Likelihood Scoring Components.... 5
2.4.1. Usage Factor:.... 5
2.4.2. Adjusted Rework Factor.... 6
2.4.3. Production Casing/Inner String Condition Factor:.... 6
2.4.4. Tubing & Packer Condition Factor 8
2.4.5. Monitoring and Inspection Condition Factors:.... 9
2.4.6. Wellhead Security Factor 11
2.4.1. Natural Force Factors 11
2.5. Consequence Scoring Components.... 12
2.5.1. Well Rate Factor 13
2.5.2. Well Operation Factor 13
2.5.3. Proximity Factors 13
2.5.4. Valve Factor.... 15
3. Pleasant Creek Construction Standard Implementation Plan 17
4. Baseline and Reassessment Schedule & Methodology for Casing Inspection 19
Appendix A – Pleasant Creek Relative Risk Well Evaluation 23
Appendix B - Pleasant Creek Well Construction Standard Implementation Plan and Assessment Schedule....27

1. Introduction

This plan provides the applied individual well risk assessment as detailed in PG&E's Underground Storage Risk and Integrity Management Plan and is specific to the Pleasant Creek Storage Field Facility wells. This plan is a companion document to the Underground Storage Risk and Integrity Management Plan and is intended to be used in conjunction with the preventative and mitigation (P&M) measures included in the noted plan.

Under the Interim Final Rule (effective January 2017) issued by the Pipeline and Hazardous Materials Safety Administration (PHMSA) and API RP 1171 incorporated by reference, operators shall develop a program to manage risk that includes a process to assess risk related to the storage operation on a consistent basis. Additionally, under the Final Regulations (effective October 2018) issued by Division of Oil, Gas, and Geothermal Resources (DOGGR) require operators to perform a risk assessment on a well-by-well basis (§1726.3(c)(2)(4)).

Contained within this implementation plan is the planned schedule to convert PG&E's storage wells at Pleasant Creek to conform with the construction requirements of dual barriers required in Final Regulations (effective October 2018) issued by Division of Oil, Gas, and Geothermal Resources (DOGGR).

Lastly, this plan provides the performance based reassessment methodology and plan for wells following baseline and subsequent inspections.

2. Relative Risk Well Model Approach and Data Sources

Individual well-by-well risk ranking allows PG&E to manage P&M programs to adequately address highest risk assets and prioritize capital projects accordingly. The relative risk ranking model database manages and tracks the inputs, both static and dynamic, to evaluate the relative risk of each well.

Continuous Evaluation (CE) is used to evaluate the integrity of each well based on data integration from both integrity assessments performed and routine maintenance, operations, and testing performed to evaluate asset condition and subsequent risk profile. Data collected from the P&M measures are used to inform the scoring assignments. Additionally, baseline casing assessment and reinspection data are input into the model. Reinspection frequency is based on the Underground Storage Risk and Integrity Management Plan, Appendix C – Casing Inspection Survey Frequency Tree.

2.1. Roles and Responsibilities

Reservoir Engineering is responsible for analyzing all the available asset data collected in the practices outlined in the Underground Storage Risk & Integrity Management Plan to evaluate the overall condition and exposure of each well asset.

2.2. Publication Schedule of the Relative Risk Model

The model is maintained throughout the year as new data becomes available and the following schedule guides the formal publication/snapshot of the relative risk model.

Publication	Purpose
By July 31	Identifies/confirms well population scheduled for next two-year rework cycles
By January 31	Integrates previous season rework Integrates year end data to identify any emergent or break in work to be addressed in the coming year and confirms five-year outlook

2.3. Relative Risk Model Attributes Inputs

The following sections below outline the various attributes and inputs that are considered in the relative risk ranking analysis. The data includes both static and dynamic data; static data is unchanging and does not require annual review, whereas dynamic data is dependent on testing result inputs.

The risk score for each well is computed by summing the score components that impact likelihood of loss of containment and multiplying that value by the sum of the consequence score impacts to safety, environment, and reliability.

Likelihood Score Components	Consequence Score Components
• Usage Factor • Adjusted Rework Factor • Production Casing Condition Factor • Tubing and Packer Condition Factor • Monitoring and Inspection Condition Factor • Wellhead Security Factor • Natural Force Factor	• Well Rate Factor • Well Operation Factor • Wind Direction Impact • Proximity Factors: Occupied Structure, Offset Well, Road and Railway Proximity, Local/Adjacent Land Use, Water Proximity, Response to Well Incident • Well Configuration • Valve Factor

2.4. Likelihood Scoring Components

The likelihood scoring components include the following factors are a defined in the following subsections. The scoring component is shown in the shaded box within the section.

The scoring components are combined in the following equation:

Likelihood = (Usage Factor/5) + (Adjusted Rework Factor x 5)
+ (Production Casing Condition Factors)
+ (Tubing and Packer Condition Factors)
+ (Monitoring and Inspection Condition Factors)
+ (Well Security Factor)
+ (Natural Force Factors)

2.4.1. Usage Factor:

The usage factor is computed as described below:

- Usage Factor: This score considers the impact of the duration of use over a well's life cycle, the prospect for human error via intervention activities, how the well has been used to account for levels of stresses the well has been subject to.

$$\text{Usage Factor} = \text{Average}\left\{\begin{matrix}\text{Number of Years in Operation}\\ \text{Years since last well rework}\\ 20 \times \text{Well Operation}\end{matrix}\right\}$$

  - Well Operation: The current operational state in which the well is used. Wells will be identified as Injection and withdrawal (Inj/Wd), withdrawal only (Wd only), or observation (obs). The use of the well is dependent on construction and surface facility installments. Wells that are used for both Inj/Wd have a higher likelihood score as the stresses from injection and withdrawal activities are the highest. Wells used for Wd only do not experience injection forces, thus are scored lower. Wells used of observation do not experience dynamic loading and are scored lower at a 1.

    The following likelihood scoring is given based on identified well operation:

Injection/Withdrawal (IW) = 3
Withdrawal only (wd only) = 2
Observation (obs) = 1

2.4.3. Adjusted Rework Factor

This score is based on the knowledge of the casing condition and assigns a higher risk score to wells that have had intervention or rework activity and have not had a casing assessment performed. This accounts for the human impact and risk associated with rework activity, and elevates opportunities where the casing could have been impacted but the condition is unknown.

Rework Factor =	If casing condition not known	→	Number of Well Reworks
	If casing condition not known	→	0.5 x Number of Reworks

2.4.4. Production Casing/Inner String Condition Factor:

The production casing condition factor is a summation of the following inputs for the production casing string. In wells that have been converted to tubing and packer, this element is considered the secondary barrier.

- Original Production Casing Wall Thickness: This score is based on the worst-case metal loss identified in a casing inspection survey (i.e. MFL or ultrasonic). In the case where a well has not been assessed, the highest score is assigned.

  Unknown = 4

  Class 3 or 4 = 3

  Class 2 or general = 2

  Isolated Class 1 or 2 = 1

- Inner String Production Casing Wall Thickness: This score is based on the worst-case metal loss identified in a casing inspection survey (i.e. MFL or ultrasonic) where an inner string has been cemented into place. In the case where a well has not been assessed, the highest score is assigned.

  Unknown = 4

  Class 3 or 4 = 3

  Class 2 or general = 2

  Isolated Class 1 or 2 = 1

- Production Casing Wall Thickness: If an inner string is in place to remediate an original production casing, this pulls the inner string production casing identified

above. If the original production casing is still the active production casing string, this pulls the production casing from two items above.

Unknown = 4
Class 3 or 4 = 3
Class 2 or general = 2
Isolated Class 1 or 2 = 1

- Source of Metal Loss on Production Casing: This identifies the source of any known metal loss and assigns the score to metal loss due to corrosion as 3. For wells where the condition is unknown, the highest score of 4 is assigned to elevate the risk for wells where the condition is unknown.

Corrosion (IC or EC) = 5
Mechanical = 2
None = 0

- Potential Production Casing Mechanical Leak Path: This score identifies possible leak paths that could lead to a loss of containment incident based on the construction of a well or known historic leak prone connections. This score takes into account the well's construction and whether or not a potential leak path is present. Uncovered perforations, such that they have not been remediated with a scab liner to mitigate risk, are given a score of 5. Uncovered stage collars, those not proactively or in mitigation covered with a scab liner, also present a potential leak path and are assigned a 4. Stage collars that have been remediated with an inner string, while still can be a potential leak path, are considered less risky and a score of 3 is assigned. A casing thread leak is scored as a 2.

Uncovered Perforations = 5
Uncovered Stage collar or thread leak = 4
Isolated (by cement or Inner String) Stage Collar = 3
Isolated casing thread Leak = 2
None Identified/Not Applicable = 1

- Dogleg Severity: This score is based on the percentage of dogleg severity(DLS). DLS is considered as the combined stresses across sections of high deviation are higher and are also prone to greater amount of casing wear from pipe

tripping. The maximum % of DLS is considered in the risk score as a well with a section of pipe that has a high degree of DLS impacts the allowable stress limit of a well and reduces the amount of tolerable wall loss at the same performance rating.

0% -5% = 1
5% -10% = 2
> 10% = 3

- Inner String Installed: The presence of an inner string is included in the scoring as it adds risk by creating another potential leak path and additional element that requires monitoring.

Yes, Installed = 2
No = 1

- Cement Bond Log TOC: The cement bond log uses the input value from the TOC identifying the highest top of well bonded cement with relation to the surface casing shoe depth.

Full - 1
Inside SC - 2
Below SC - 3

2.4.5. Tubing & Packer Condition Factor

The tubing & packer condition factor is a summation of the following inputs:

- Tubing Wall Thickness: This score is based on the worst-case metal loss identified in an inspection survey (i.e. MFL or ultrasonic). This will only impact the score of wells that are converted to tubing and packer configuration.

Class 3 or 4 = 3
Class 2 or general = 2
Isolated Class 1 or 2 = 1
Not Applicable = 0

- Potential Tubing Mechanical Leak Path: This score is based on known thread leaks of the tubing.

  Tubing thread Leak = 2

  None Identified/Not Applicable = 0

- Packer Condition: This score is based on how well a packer is sealing and if a known packer leak is present.

  Known Leak=2

  Sealing/Not Applicable = 0

2.4.6. Monitoring and Inspection Condition Factors:

The following monitoring and inspection data points/trends are combined for each well evaluation:

- Annular Condition Monitoring Plan: This score uses the presence of an annular condition monitoring plan to elevate the risk of a given well.

  Note: based on the annular testing performed, annular pressure can be managed and is typically not considered a hazardous situation.

  Yes = 3

  No = 1

- Sand Production: The sand inspections of each well is typically performed twice each year during withdrawal season. This score uses the historical sand inspection data and counts the number of inspections that have been a grade 3 or higher. This elevates the risk score of a well as it can be associated with higher erosion rates and gravel pack degradation.

  Count of # of Grade 3 or more that have occurred since last rework

- Gas Composition: This score takes into account the type of gas in the storage system and if corrosive constituents are present and could cause/accelerate metal loss features.

None = 0
CO2 = 1
H2S = 5

- Wellhead Flange Condition- known leak: This score uses the monitoring data from the quarterly wellhead inspections and identify if there are known leaks.

Yes, leak = 2
No= 1

- Wellhead Tubing head Condition- known leak: This score uses the monitoring data from the quarterly wellhead inspections and identify if there are known leaks.

Yes, leak = 2
No= 1

- Wellhead Hydraulic Port Leak Condition: This score uses the monitoring data from the quarterly wellhead inspections and identify if there are known leaks.

Yes, leak = 2
No= 1

- Known Hydrate Potential: This score is factored in for wells where hydrate formation on the system has been identified historically.

Yes, historically observed = 1
No= 0

2.4.8. Wellhead Security Factor

The Wellhead security factor is a summation of the following inputs:

- Well Security: This score is based on security features installed at a given wellhead site or group of proximate wellheads. This score impacts the likelihood by taking into account the presence of a barrier that would limit access, thus reducing the likelihood of an external influence triggering a loss of containment event. Wells that have a fencing system are scored with a 1 and those without any type of physical barrier limiting access would be a 2.

  All of PG&E's wellhead sites are gated and fenced.

Gated/Fenced = 1
No= 2

- Wellhead Surface Impact Damage Protection: This score is based on security features installed at a given wellhead site to minimize opportunity for surface impact to the wellhead to occur and lead to an uncontrolled flow event. If no measures are employed, then the highest score is assigned as the wellhead has a higher risk of exposure to surface impact (i.e. vehicular). The likelihood score is reduced based on the level of surface protection provided whether a full circumferential system (i.e.. Bollards) be in place or partial (i.e. k-rail system on one side). Wells that are enclosed by a fence but do not have a barrier in place have a higher risk as maintenance vehicles drive within the fenced area.

Full Barricade (k-rail/bollard) =1
Partial Barricade (k-rail/bollard) = 2
None (Fenced only) = 3

2.4.1. Natural Force Factors

The following factors are included and take into account naturally occurring outside force threats.

- Flooding: This score is based on the potential to experience flooding at a given storage facility.

No= 0
Yes=1

- Seismic: This score is based on the potential seismicity a given storage facility.

  Low = 1
  Med = 2
  High =3

- Subsidence: This score consider is there is active subsidence at the facility.

  No= 0
  Yes=1

- Tsunami: This score considers the opportunity for a tsunami to impact the facility.

  No= 0
  Yes=1

- Landslide: This score considers if the facility and well site is situated where it could be impacted by landslides.

  No= 0
  Yes=1

2.5. Consequence Scoring Components

The consequence scoring components include the following factors as defined in the following subsections. The scoring component is shown in the shaded box within the section.

The scoring components are combined in the following equation:

$$\text{Consequence} = [\,(0.25 \times \text{Well Rate Factor}) + (\text{Well Operation Factor}) + \Sigma\,(\text{Proximity Factors})\,] - [\,5\text{x}\,(\,(0.5\ \text{Configuration}) + (\text{Valve Factor})\,)\,]$$

2.5.2. Well Rate Factor

- Rate Factor: This is based on the max current rate at the time of publishing the risk plan. Twenty-five percent of the rating factors into the consequence score to account for the reliability impact with the loss of a well.

2.5.3. Well Operation Factor

- Well Operation: The operational consequence of an event is also impacted that renders the well unusable has a greater implication on operations and use of the storage field. Withdrawal only wells carry an intermediate scoring as the unavailability of the well poses a risk to deliverability. Observation wells are assigned the lowest value in this category as unavailability would not impose a risk to operations.

Injection/Withdrawal (IW) = 3
Withdrawal only (wd only) = 2
Observation (obs) = 1

2.5.4. Proximity Factors

- Wind Direction Impact: This score looks at a well's surface location with respect to the nearest located structure and the predominant wind direction. This score is considered high such that a large release of gas could have severe impact with ignition on an adjacent facility. The score is low such that the predominant wind direction is away from adjacent structures.

High = 3
Low = 1

- Occupied Structure: This score is based on the well's surface location and its proximity to an occupied structure.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3

- Offset Wells: This score is based on the well's surface location and its proximity to an adjacent wellhead.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3

- Proximity to Roads: This score is based on the well's surface location and its proximity to a road as noted in the scoring.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3
0-500 ft of Major Highway = 4

- Proximity to Railroads: This score is based on the well's surface location and its proximity to a railroad as noted in the scoring.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3

- Proximity to Major Airport: This score is based on the well's surface location and its proximity to a major airport as noted in the scoring.

>1000 ft = 1
500-1000 ft = 2
0-500 ft = 3

- Proximity to Population Centers: This score is based on the facility's location and the buffer rings indicated in the scoring.

> 1 Mile =3
1-2 Mile =2
2-5 Mile =1
>5 Mile = 0

- Proximity to Body of Water: This score is based on the facility's location and the buffer rings indicated in the scoring.

> 1 Mile =3
1-2 Mile =2
2-5 Mile =1
>5 Mile = 0

- Local Area/Land Use: This score is based on the facility's location and the surrounding area activity.

Urban = 4
Residential = 3
Crop farming (Irrigation/fertilizer / Plane) = 2
Cattle farming = 1

- Response to Well Incident: This score is based on proximity of employees to recognize and be able to respond in the event of a well emergency. Manned facilities have a higher likelihood that a response would be fairly soon after an event started or signs of an event could be recognized to minimize the impact.

Unmanned-2
Facility Manned-1

2.5.5. Valve Factor

This factor is used to reduce the consequence score by the mitigation employed by the presence and performance of a DHSV. The factor is computed in the following manner; each scoring component is listed and explained below.

$$\text{Valve Factor} = \left(\frac{\text{DHSV-Csg deployed}}{\text{DHSV-Csg Condition}} \right) + \left(\frac{\text{DHSV-Tbg deployed}}{\text{DHSV-Tbg Condition}} \right) + \left(\frac{1}{1 + \text{DHSV CL-cond}} \right)$$

- Well Configuration Factor: This score is used to reduce the consequence such that the dual barrier configuration would reduce the impact on the consequence.

  This score is factored by 50% in the final algorithm.

T&C Flow -1 T&P - 4

- DHSV Casing (Csg) Deployment: This score considers the presence of a DHSV on the casing side. Once wells are converted to tubing and packer, there is only a DHSV installed on the tubing side.

Yes -1 No - 0

- DHSV Tubing (Tbg) Deployment: This score considers the presence of a DHSV on the tubing side. Once wells are converted to tubing and packer, there is only a DHSV installed on the tubing side. Note: not all wells require a DHSV to be installed based on the critical well definition.

Yes -1 No - 0

- DHSV Casing (Csg) Condition: This score sums the number of level 4 leak by tests results a valve has received since installation.

# of Level 4 since installation

- DHSV Tubing (Tbg) Condition: This score sums the number of level 4 leak by tests results a valve has received since installation.

# of Level 4 since installation

- DHSV Control Line Condition: This score sums the number of level 4 leak by tests results the control line has received since installation.

# of Level 4 since installation

3. Pleasant Creek Construction Standard Implementation Plan

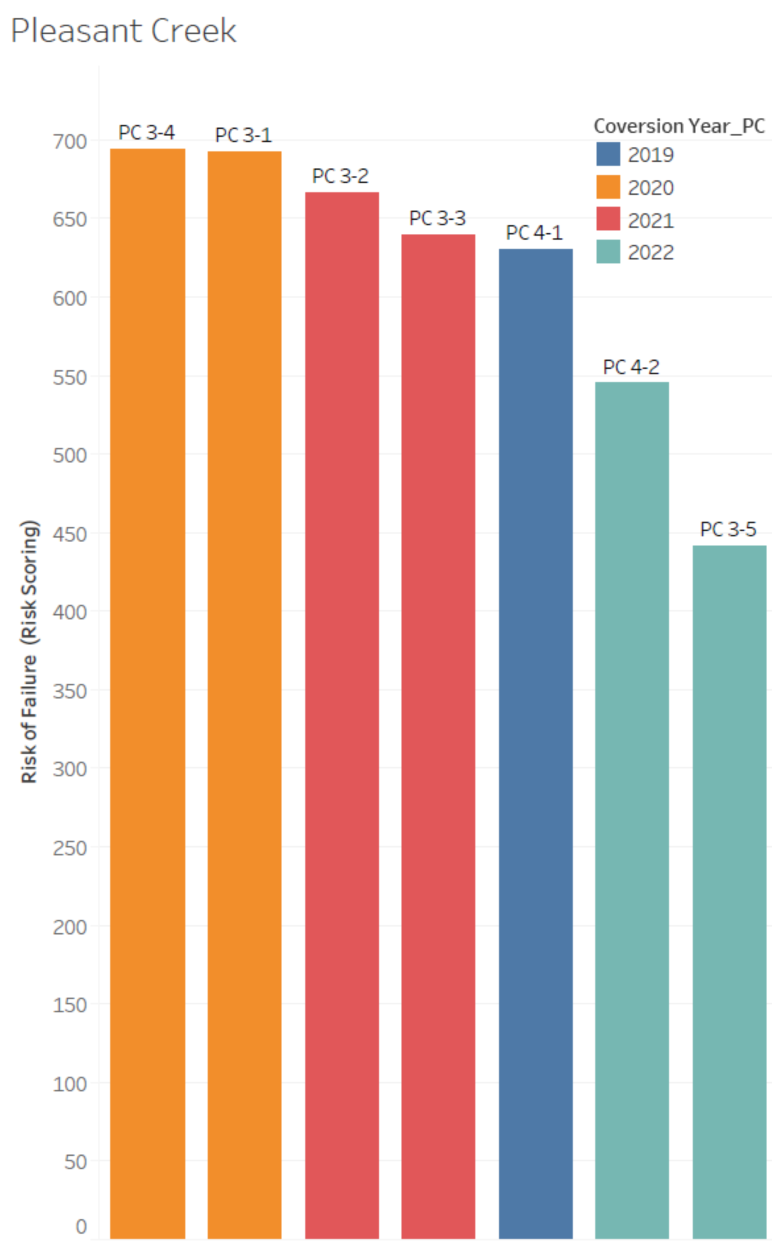
PG&E's wells located at Pleasant Creek are typically completed with open ended tubing and flow gas in both the tubing and casing annuli. In accordance with the construction standard in the DOGGR final regulations §1726.5, PG&E is phasing in the retrofits and/or permanent plug and abandonment as shown below in the schedule by year. Refer to the well specific schedule shown in Appendix B – Pleasant Creek Well Implementation and Assessment Schedule for the planned year of conversion. Additionally, Figure 3-1 shows the planned year of conversion and relative risk of a given well.

The well-by-well planned schedule is a living document and is based on the current data and inspection information known at the time this plan was published. The planned schedule is subject to change following the annual ranking update and where continuous evaluation activities necessitate advancing a well ahead of the planned date to address issues accordingly. Table 1 below shows the number of wells targeted by year to accomplish the conversion to tubing and packer configuration or plug and abandon by the end of 2025.

Table 1

Pleasant Creek 2019-2025 Well Construction Standard Implementation Plan			
Year	**Planned Number of Wells**	**% of Total Wells**	**Cumulative Count**
2019	1	14%	1
2020	2	29%	3
2021	2	29%	5
2022	2	29%	7

Figure 3-1: T&P Conversion shown by year and Risk Rank



4. Baseline and Reassessment Schedule & Methodology for Casing Inspection

PG&E performed a casing inspection in 2012 on 1 well (14% of field) at the time the well was completed; no subsequent or other casing inspections have been performed at Pleasant Creek to date. PG&E commenced the baseline casing inspection effort in 2013 at all fields and as the program advanced, additional logs and tests were grouped into the suite of testing to establish a baseline in 2016. The suite of testing is provided in the Risk and Integrity Management Plan in Appendix Z. The status of well assessments (from all field locations) can be grouped into three categories based on the time period when the assessment occurred:

1. **Pending Assessments:** Wells have not yet been inspected using advanced casing inspection tools. These wells have been inspected for baseline gas behind pipe using GRN tools. The wells have continued to be monitored annually via noise and temp (N&T) inspection. Additional daily and weekly monitoring activities (i.e. leak inspection and annular pressure monitoring) have been performed in alignment with the Risk and Integrity Management Plan Practices.
2. **Pre-2016 Assessments:** Wells were typically assessed using MFL tools for inspections, GRN tools during well work and also were monitored using the noise & temperature tools (N&T) annually. Additional daily and weekly monitoring activities (i.e. leak inspection and annular pressure monitoring) have been performed in alignment with the Risk and Integrity Management Plan Practices.
3. **2016-Current Assessments:** Wells were assessed using the full suite of inspections including MFL, CBL, N&T, GRN/RST, ultrasonic, caliper, and pressure testing. Additional daily and weekly monitoring activities (i.e. leak inspection and annular pressure monitoring) have been performed in alignment with the Risk and Integrity Management Plan Practices.

PG&E uses the guidance in Appendix C of the Risk and Integrity Management Plan to determine the reinspection frequency for a given well following a baseline or reinspection of casing condition. The typical casing frequency return period continues to fall into "12-15 year" re-assessment window based on limited metal loss (class 3 and below) and isolated condition. PG&E will be returning to the well that was previously assessed for conversion to tubing and packer ahead of follow up inspection and planned reassessment period.

PG&E plans to complete the remainder of the baseline inspections at Pleasant Creek during the well conversion to tubing and packer configuration period and may elect to plug and abandon wells. PG&E uses a methodology that is prioritized by risk and coupled with the ability to effectively and efficiently conduct the work, minimization of unnecessary equipment mobilization, and coordination with station projects (i.e. pipeline work, platform equipment maintenance/rebuilds) to reduce impact to deliverability and station outage. Figure 4-1 maps this approach and uses the results of the risk model, PG&E prioritizes the wells in the based on the risk score and looks at each of the following categories:

1. **Assessment Status of "Pending"**: wells pending assessment are targeted in the first group to be converted to tubing and packer configuration. During

that conversion activities, wells will be inspected using the full suite of inspection tools identified in Appendix Z.

2. **Assessment Status "Pre-2016"**: wells that are slated for re-inspection following their baseline metal thickness inspection will be targeted

3. **Assessment Status "2016- Current":** These wells have been evaluated using the full suite of logs in Appendix Z. Wells in this category typically have a re-assessment internal of 12-15years and PG&E will be returning to these wells to reconfigure them in a tubing and packer status ahead of the targeted re-assessment interval.

Using this approach, all wells at Pleasant Creek will have had an initial baseline casing condition inspection by the end of 2023. Additionally, PG&E plans to run a thru-tubing casing inspection log on wells that are pending assessment and not planned for work in 2020. This logging activity will continue every two years until the well has been assessed. This allows PG&E to identify if any of the wells pending assessment have any features that require remediation ahead of the planned schedule and can advance those wells accordingly. Further, for wells that have been previously assessed with a casing inspection, a thru-tubing surveillance logging program will commence in 2020 and cycle every two years until the well is converted to tubing and packer. The planned cadence for each group is also show in Figure 4-1.

Following a well's baseline inspection and/or conversion to tubing and packer, PG&E will identify the well's casing reassessment frequency per Appendix C of the Risk and Integrity Management Plan. PG&E plans to deploy a casing inspection surveillance program using thru-tubing technology to monitor for any changes in condition; note, this surveillance activity is in addition to the routine integrity monitoring practice (i.e. sand inspection, pressure monitoring, annual noise and temp survey).

Figure 4-2 illustrates the frequency of the thru-tubing inspection and pressure testing, per Appendix K of Risk and Integrity Management Plan. After the first two cycles of thru-tubing logging are performed, PG&E will space the 3rd logging activity halfway between the next planned reassessment. For example, a well scheduled on a 12-15 year reassessment interval will have a thru-tubing log run in year 2 and year 4 following conversion to T&P. The next thru-tubing log will be run in year 8, halfway between year 4 and year 12.

Refer to Appendix B for the planned schedule based on the methodology presented above.

Figure 4-1: Assessment in Year & T&P Conversion Risk Informed Methodology

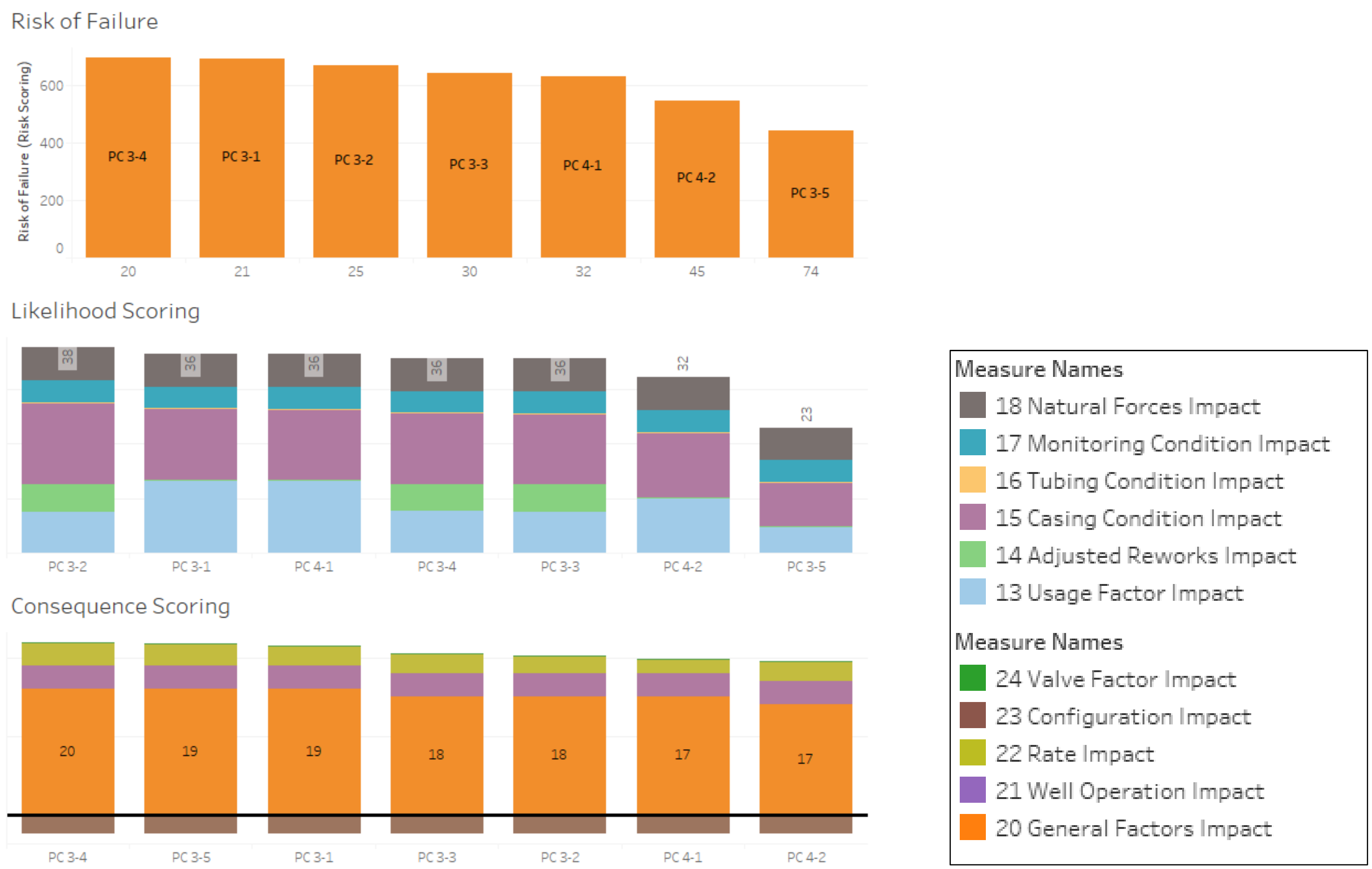
Year of Assessment	Assessment in Year & T&P Conversion						
	2019	2020	2021	2022	2023	2024	2025
Pending	2019 Planned Wells: Full Assessment with T&P Conversion						
	N&T	2020 Full Assessment with T&P Conversion					
	N&T Thru - Tubing	N&T	2021 Full Assessment with T&P Conversion				
	N&T Thru - Tubing	N&T	N&T Thru - Tubing	2022 Full Assessment with T&P Conversion			
	N&T Thru - Tubing	N&T	N&T Thru - Tubing	N&T	2023 Full Assessment with T&P Conversion		
2013 – mid 2016	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	2023 Full Assessment with T&P Conversion		
	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	N&T	2024 Full Assessment with T&P Conversion	
2016 – 2018	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	N&T	2025 Full Assessment with T&P Conversion	
	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	N&T	N&T Thru- Tubing	Full Assessment with T&P Conversion

Figure 4-2: Assessments performed in Year Following T&P Conversion

Re-Assessment Interval	Assessment in Year Following T&P Conversion														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3-5 Years	N&T	N&T	Full Assessment: Casing Inspection & Pressure Test Establish Re-Assessment Interval												
5-8 Years	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	Full Assessment: Casing Inspection & Pressure Test Establish Re-Assessment Interval										
8-12 Years	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	N&T Pressure Testing	N&T	N&T	Full Assessment: Casing Inspection & Pressure Test Establish Re-Assessment Interval							
12-15 Years	N&T	N&T Thru - Tubing	N&T	N&T Thru- Tubing	N&T Pressure Testing	N&T	N&T	N&T Thru Tubing	N&T	N&T Pressure Testing	N&T	Full Assessment: Casing Inspection & Pressure Test Establish Re-Assessment Interval			

Appendix A – Pleasant Creek Relative Risk Well Evaluation

Figure A-1: Well by Well Risk of Failure Scoring – Pleasant Creek



**Note: The consequence scoring chart above shows a black line serving as the "zero" axis as the score components graphed below are mitigation components and reduce consequence.

Table 2 – Pleasant Creek Risk Evaluation (Input Data)

Well Name	API	Well Operation IW Wd only OBS	Well Operation IW = 3 Wd only = 2 OBS = 1	Spud Date	Completion Date	Years in Operation	Year of last Well Rework	Years since last Well Rework	# of Well Rework Performed	Measured Cement Bond Log TOC (feet)	Surface Csg (SC) Shoe, ft	Est. Distance to nearest offset well (feet)	Proximity to Roads (feet)	Proximity to Railroad (feet)	Proximity to Major Airport (feet)	Distance to Occupied Sturcture (HCA / Residence / Employee office-RE/Contrl Room building) (feet)	Proximity to Water (feet)
PC 3-4	11320194	I/W	3	10/15/1973	10/25/1973	45	2010	9	1	1320	527	272	4,955	5000	5000	2301	0
PC 3-1	11300063	I/W	3	11/27/1948	12/22/1948	70	1948	71	0	1720	524	962	3,053	5000	5000	986	0
PC 3-2	11320192	I/W	3	9/4/1973	9/20/1973	46	2011	8	1	1330	540	2098	2,094	5000	5000	1179	0
PC 3-3	11320193	I/W	3	9/22/1973	10/3/1973	46	2011	8	1	1335	493	951	3,996	5000	5000	1561	0
PC 4-1	11300064	I/W	3	6/12/1949	6/29/1949	70	1949	70	0	1932	498	957	7,180	5000	5000	4462	0
PC 4-2	11320195	I/W	3	10/4/1973	10/14/1973	46	1973	46	0	470	485	1293	5,860	5000	5000	3221	0
PC 3-5	11321279	I/W	3	4/20/2012	5/10/2012	7	2012	7	0	500	580	703	4,725	5000	5000	2111	0

Table 3 – Pleasant Creek Risk Evaluation (Likelihood Data)

Well Name	Well Operation IW = 3 (Likelihood) Wd only = 2 OBS = 1	Usage Factor	Adjusted # of Well Reworks	Original Production Casing Wall Thickness Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	Inner String Production Casing Wall Thickness Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	Production Casing Wall Thickness Unknown = 4 Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1	Source of Metal Loss on Production Casing Unknown = 4 Corrosion = 3 Mechanical = 2 None = 0	Potential Production Casing Mechanical Leak Path Uncovered Perforations = 5 Uncovered Stage collar = 4 Isolated (by cement or Inner String) Stage Collar = 3 Casing thread Leak = 2 None Identified/Not Applicable = 1	Dogleg Severity 0-5 %= 1 5-10% = 2 >10 % = 3	Inner String Installed Yes -2 No -1	Cement Bond Log TOC Full - 1 Inside SC - 2 Below SC - 3
PC 3-4	3	38	1	4	0	4	4	1	0	1	3
PC 3-1	3	67	0	4	0	4	4	1	0	1	3
PC 3-2	3	38	1	4	0	4	4	1	2	1	3
PC 3-3	3	38	1	4	0	4	4	1	0	1	3
PC 4-1	3	67	0	4	0	4	4	1	0	1	3
PC 4-2	3	51	0	4	0	4	4	1	0	1	2
PC 3-5	3	25	0	1	0	1	0	1	3	1	2

Table 4 – Pleasant Creek Risk Evaluation (Likelihood Data - Cont)

Well Name	**Tubing Wall Thickness** Class 3 or 4 = 3 Class 2 or general = 2 Isolated Class 1 or 2 = 1 Not Applicable = 0	**Potential Tubing Mechanical Leak Path** Tubing thread Leak = 2 None Identified/Not Applicable = 0	**Packer Condition** Known Leak=2 Sealing/Not Applicable = 0	**Annular Condition Monitoring Plan In Place** Yes - 3 No - 1	**Sand Production** # of Grade 3 or more since last rework	**Gas Composition** None = 0 CO2 = 1 H2S = 5	**Wellhead Tbg Head Condition - Known Leak** Yes - 2 No- 1	**Wellhead flange Condition - Known Leak** Yes - 2 No - 1	**Wellhead hydraulic Port leak** Yes -2 No- 1	**Known Hydrate Formation** No = 0 Yes = 1
PC 3-4	0	0	0	1	0	0	1	1	1	0
PC 3-1	0	0	0	1	0	0	1	1	1	0
PC 3-2	0	0	0	1	0	0	1	1	1	0
PC 3-3	0	0	0	1	0	0	1	1	1	0
PC 4-1	0	0	0	1	0	0	1	1	1	0
PC 4-2	0	0	0	1	0	0	1	1	1	0
PC 3-5	0	0	0	1	0	0	1	1	1	0

Table 5 – Pleasant Creek Risk Evaluation (Likelihood Data - Cont)

Well Name	**Known Hydrate Formation** No = 0 Yes = 1	**Well Security** Gated/fenced = 1 No = 2	**Wellhead Surface Damage Protection** **Full** Barricade (k-rail/bollard) =1, **Partial** Barricade (k-rail/bollard) = 2 **None** (Fenced only) = 3	**Natural Force Flooding** No= 0 Yes = 1	**Natural Force Seismic** Low PGA = 1 Med PGA = 2 High PGA =3	**Natural Force Subsidence** No= 0 Yes = 1	**Natural Force Tsunami** No= 0 Yes= 1	**Natural Force Lanslide** No= 0 Yes = 1
PC 3-4	0	1	3	0	2	0	0	0
PC 3-1	0	1	3	0	2	0	0	0
PC 3-2	0	1	3	0	2	0	0	0
PC 3-3	0	1	3	0	2	0	0	0
PC 4-1	0	1	3	0	2	0	0	0
PC 4-2	0	1	3	0	2	0	0	0
PC 3-5	0	1	3	0	2	0	0	0

Table 6 – Pleasant Creek Risk Evaluation (Consequence Data)

Well Name	Max Rate MMcf/d	Well Operation IW = 3 (Consequence) Wd only = 2 OBS = 1	Wind Direction Impact High - 3 Low - 1	Occupied Sturcture >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	Proximity to Offset wells Score >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	Proximity to Roads Score >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 0-500 ft of Major Highway = 4	Proximity to Railroad Score >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	Proximity to Major Airport >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3	Population Centers > 1 Mile =3 1-2 Mile =2 2-5 Mile =1 >5 Mile = 0	Proximity to Body of Water Score >1000 ft = 1 500-1000 ft = 2 0-500 ft = 3 Water Well = 4, Navigable Waterway = 5	Local Area Activities/Land Use Urban = 4 Residential = 3 Crop farming (Irrigation/fertilizer / Plane) = 2 Cattle farming = 1	Response to Well Incident Unmanned-2 Facility Manned-1
PC 3-4	12	3	1	1	3	1	1	1	1	3	2	2
PC 3-1	10	3	1	2	2	1	1	1	1	3	2	2
PC 3-2	9	3	1	1	2	1	1	1	1	3	2	2
PC 3-3	10	3	1	1	2	1	1	1	1	3	2	2
PC 4-1	8	3	1	1	2	1	1	1	1	3	2	2
PC 4-2	10	3	1	1	1	1	1	1	1	3	2	2
PC 3-5	11	3	1	1	3	1	1	1	1	3	2	2

Table 7 – Pleasant Creek Risk Evaluation (Consequence Data - Cont)

Well Name	Configuration T&C Flow -1 T&P - 4	DHSV Csg Deployment Yes -1 No- 0	DHSV Tbg Deployment Yes -1 No- 0	DHSV Tbg Condition # of Level 4 since installation	DHSV Csg Condition # of Level 4 since installation	DHSV Control Line Condition # of Level 4 since installation	Valve Factor	Likehood of Failure	Consequence of Failure	Risk of Failure (Risk Scoring)
PC 3-4	1	0	0	0	0	0	-	**36**	**20**	**695**
PC 3-1	1	0	0	0	0	0	-	**36**	**19**	**692**
PC 3-2	1	0	0	0	0	0	-	**38**	**18**	**667**
PC 3-3	1	0	0	0	0	0	-	**36**	**18**	**640**
PC 4-1	1	0	0	0	0	0	-	**36**	**17**	**631**
PC 4-2	1	0	0	0	0	0	-	**32**	**17**	**546**
PC 3-5	1	0	0	0	0	0	-	**23**	**19**	**441**

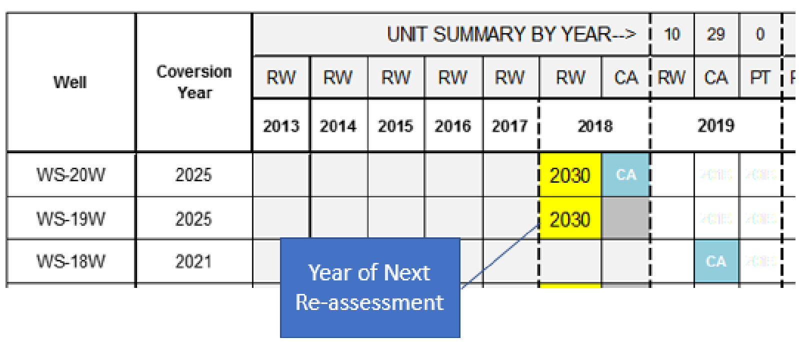
Appendix B - Pleasant Creek Well Construction Standard Implementation Plan and Assessment Schedule

The following figures provide an overview of the applied methodology from Section 4 that includes conversion of PG&E's wells to tubing and packer and brings them into conformance with §1726.5 of the final regulations put forth by the Division. Additionally, the figures demonstrate the assessment methodology – both pre- and post-conversion to tubing and packer configuration. The plan shown below for each well is based on addressing wells with the highest risk identified in the risk analysis shown in Appendix A. The planned schedules in the following figures are based on current data in the risk model. As new monitoring data is received, the plan below is subject to change.

The charts below show three possible activities for each well by year from 2019 thru 2025:

1. Thru-tubing casing assessment (blue)
2. T&P conversion/full assessment (green)
3. 5-year re-assessment pressure test (purple)

Additionally, for wells previously assessed, the schedule is shaded with yellow and the planned reassessment year based on casing condition observed is noted.



For wells previously assessed, the decision to run a third thru-tubing log will rest with PG&E Reservoir Engineering following review of 2 sequential cycles thru-tubing logging results; note Example 1 shown below.

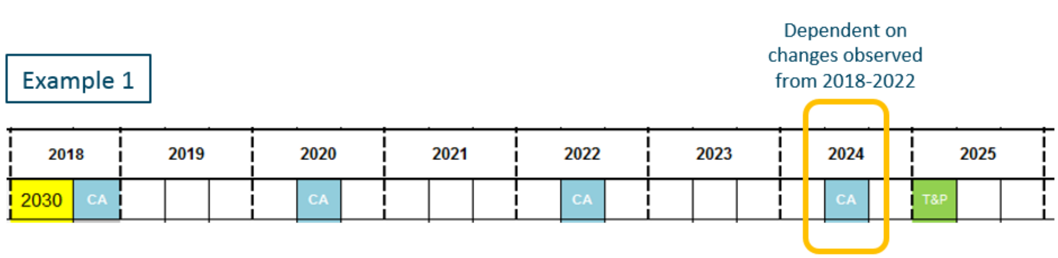


Figure B.1: Well Implementation and Assessment Schedule – Pleasant Creek

Well	Coversion Year	2012	2013	2014	2015	2016	2017	2018		2019			2020			2021			2022			2023			2024			2025		
		UNIT SUMMARY BY YEAR-->								1	3	0	2	1	0	2	1	0	2	2	0	0	2	0	0	4	0	0	2	2
		RW	RW	RW	RW	RW	RW	RW	CA	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT	RW	CA	PT
PC 3-1	2020												T&P							CA						CA				PT
PC 3-2	2021										CA					T&P							CA						CA	
PC 3-3	2021										CA					T&P							CA						CA	
PC 3-4	2020												T&P							CA						CA				PT
PC 3-5	2022	2024												CA					T&P							CA				
PC 4-1	2019									P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A	P&A
PC 4-2	2022										CA						CA		T&P							CA				

Legend

RW Casing Assessment	Year of Relog
Thru-Tubing Casing Assessment	CA
Tubing & Packer Conversion Rework	T&P
Pressure Test (T&P)	PT
Reinspection Rework	RW
Plug & Abandon	P&A

PG&E Gas and Electric
Advice Submittal List
General Order 96-B, Section IV

AT&T
Albion Power Company
Alcantar & Kahl LLP

Alta Power Group, LLC
Anderson & Poole

Atlas ReFuel
BART

Barkovich & Yap, Inc.
P.C. CalCom Solar
California Cotton Ginners & Growers Assn
California Energy Commission
California Public Utilities Commission
California State Association of Counties
Calpine

Cameron-Daniel, P.C.
Casner, Steve
Cenergy Power
Center for Biological Diversity

Chevron Pipeline and Power
City of Palo Alto

City of San Jose
Clean Power Research
Coast Economic Consulting
Commercial Energy
County of Tehama - Department of Public Works
Crossborder Energy
Crown Road Energy, LLC
Davis Wright Tremaine LLP
Day Carter Murphy

Dept of General Services
Don Pickett & Associates, Inc.
Douglass & Liddell

Downey & Brand
East Bay Community Energy
Ellison Schneider & Harris LLP
Energy Management Service
Engineers and Scientists of California
Evaluation + Strategy for Social Innovation
GenOn Energy, Inc.
Goodin, MacBride, Squeri, Schlotz & Ritchie
Green Charge Networks
Green Power Institute
Hanna & Morton
ICF
International Power Technology
Intestate Gas Services, Inc.
Kelly Group
Ken Bohn Consulting
Keyes & Fox LLP
Leviton Manufacturing Co., Inc. Linde
Los Angeles County Integrated Waste Management Task Force
Los Angeles Dept of Water & Power
MRW & Associates
Manatt Phelps Phillips
Marin Energy Authority
McKenzie & Associates

Modesto Irrigation District
Morgan Stanley
NLine Energy, Inc.
NRG Solar

Office of Ratepayer Advocates
OnGrid Solar
Pacific Gas and Electric Company
Peninsula Clean Energy

Pioneer Community Energy
Praxair

Redwood Coast Energy Authority
Regulatory & Cogeneration Service, Inc.
SCD Energy Solutions

SCE
SDG&E and SoCalGas

SPURR
San Francisco Water Power and Sewer
Seattle City Light
Sempra Utilities
Southern California Edison Company
Southern California Gas Company
Spark Energy
Sun Light & Power
Sunshine Design
Tecogen, Inc.
TerraVerde Renewable Partners
Tiger Natural Gas, Inc.

TransCanada
Troutman Sanders LLP
Utility Cost Management
Utility Power Solutions
Utility Specialists

Verizon
Water and Energy Consulting Wellhead Electric Company
Western Manufactured Housing Communities Association (WMA)
Yep Energy