MC-20 Options and Risk
Workshop Report

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October 2019

Revision	Date	By	Check	Approve	Remarks
0	October	CG		Couvillion	Initial Document

Couvillion Group / Boxley Group LLC

MC20 TEC Response

Options and Risk Workshop Report

October 2019

Contents

1 Executive Summary

Based on the Risk and Option review it is recommended to begin with Option 1 (Excavation to Access the Wells and Intervention) to assess the wells and attempt to achieve abandonment or source control. If it is determined that only a top plug can be set or access cannot be achieved, then Option 2 (Intersecting Intercept Wells) would be employed. All the while, containment and offloading of the oil would continue with Option 2 – Depletion, until source control is achieved. This progression also has the advantage of being able to detect which wells are actually leaking prior to simply drilling costly intercept wells. Additional advantages in using this progression include it being the lowest cost option with the most optimum schedule and least risk.

While the recommended options for the way forward are deemed to be safe and viable, it is recognized that more detailed engineering must be done for further development and refinement. Front End Engineering Design (FEED) is recommended for Options 1 (Excavation to Access the Wells and Intervention) & 2 (Intersecting Intercept Wells) along with the Mobile Containment System to mitigate any additional plumes or failure to the current Rapid Response Containment System.

2 Introduction

2.1 Purpose and Scope

The Risk and Option Ranking exercise as part of MC 20 Task 9 is intended to provide a framework to inform recommendations and decision-making moving forward to achieve sub-surface source control and/or achieving plugging and abandonment standards. Any recommendation proposed will address whether such activity can be conducted in a manner that is safe, does not interfere with other uses of the Outer Continental Shelf (OCS), and does not cause undue or serious harm or damage to the human, marine, or coastal environment. It is recognized that there may not be a one size fits all solution, different options of a combination of options may be warranted. Additionally, as more detailed engineering and planning occur additional ideas, information, risk assessments and mitigations should be considered prior to executing options.

Note that any environmental characterizations contained in this risk register (and the risk and option ranking exercise) do not represent other applications for environmental risks or environmental harm such as Natural Resource Damage Assessment or Environmental Assessments, as those are separate processes. The definition for environment was defined specifically for source control at the MC-20 site

The purpose of the risk assessment was to identify the nature and scale of hazards that might occur during the operation of the proposed MC20 intervention. This included the potential for release of hydrocarbons or other pollutants, or any other hazardous operations identified for each option. Also included in the scope of the study were the effects of natural events such as hurricanes, mudslides etc.

The risk assessment focused primarily on operational hazards related to the proposed MC20 intervention options. As a result, it did not consider construction specific hazards. These should be covered closer to the time of construction and should utilize the expert knowledge of the proposed construction contractors. It was not considered appropriate to include construction hazards in this risk assessment, as insufficient detail regarding construction methods and requirements were available to allow the development of meaningful findings.

Final recommendations from this process will be made by the decision-making body. The document provides a brief outline and recommendation for the ranking process. Firms with Industry Specific Technical Expertise (FISTE) were not part of the Project Team and were not involved in selection of the decision-making criteria or the weightings of that criteria. FISTE may be made aware of the criteria, but not the weighting of the criteria

2.2 Timeline, Key Dates and Team Members

A review of HAZID by Option and Consequence Description with project team was conducted Sept 9th & 10th, 2019 at the BSEE offices in New Orleans LA. At this session initial work was conducted, inputting risks by option and evaluating consequence description. During the Sept 8th & 9th review, the project team also experimented with ranking criteria and took part in a mock option ranking exercise for understanding of the process.

A meeting was conducted on September 13, 2019 to review the option ranking process that was applied to rank long term solutions for MC20 hydrocarbon leak. The review included an example scoring exercise with participants representing USCG, BSEE, and NOAA.

A session was held on Sept 30th to reach final decision on the Option Ranking Criteria, Applicability and Weighting. These results were built into the MC 20 Task 8 & 9 Option Ranking Tool and used during the Oct 8th through 10th Option Ranking Session.

Risk Assessment by Option & Risk Validation by FISTE – Couvillion and BSEE visited with FISTE in the period 1-3 October, to review the options to achieve long-term source control of the MC 20 wells. The review incorporated HAZARD ID, Risk Ranking, and Mitigations. A Risk Picture by Option incorporating work done by the project team and FISTE was performed for review with the Decision-Making Body.

The Decision-Making body weighed in with feedback, input, adjustments to the Risk Assessment which was used as background information for the October 8th, 9th & 10th Option Ranking Exercise and finalized for addition into the Task 8 & Task 9 report.

October 8th Morning – The project team gathered and reviewed the option ranking tool, FISTE and the options for long-term source control. The morning session was designed to prepare the project team to assess the FISTE in a systematic, objective and fair manner.

October 8th Afternoon – FISTE sessions began and continued through the afternoon. Approximately 2-hour sessions were provided to each FISTE for the review and Q&A.

October 9th – FISTE sessions continued throughout the day until. At the end of the day a high-level review of the aggregated responses was conducted. The following Options and FISTE were assessed:

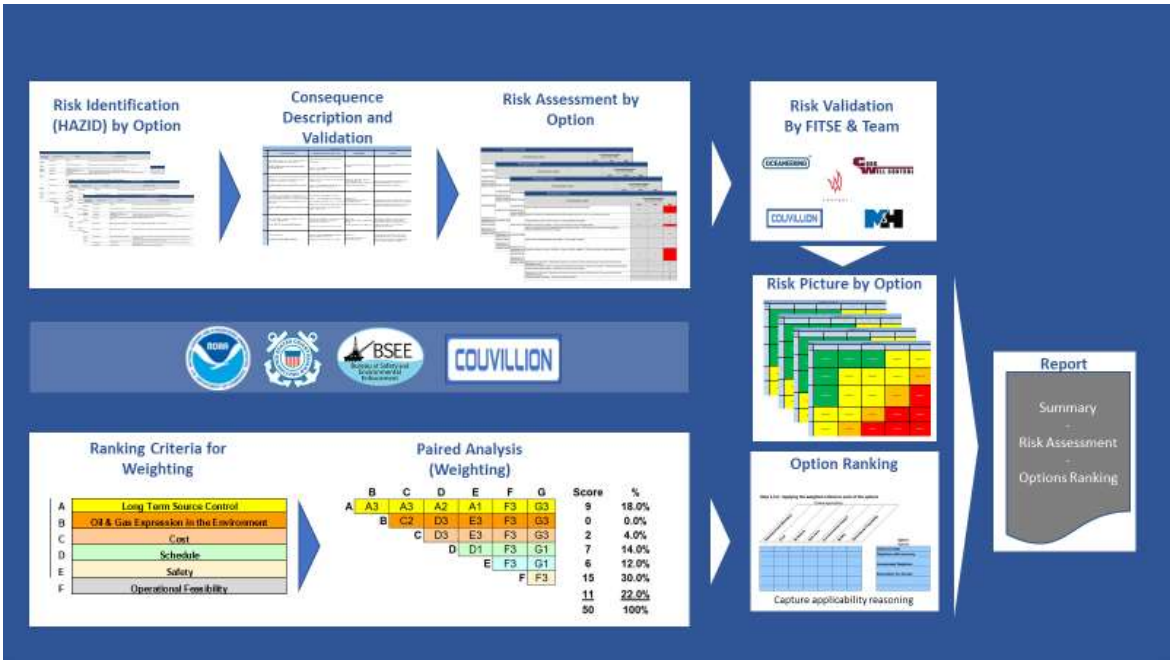
- Excavation – M&H Engineering & GeoMaxEd (Geo-Technical Expert)
- Intercept Wells – Wild Well Control & Cudd Energy Services
- Intervention Wells (Wireline) – Oceaneering
- Intervention Wells (Coiled Tubing) – Cudd Energy Services
- Depletion with and without acceleration – Couvillion Group

October 10th – Results and Recommendation. Most of this day was for the Decision-Making Body, to review the analysis and, to document and determine next steps. As articulated in the Task 8 final and Task 9 Interim Report, the overall recommended path forward is not envisioned as a “one size fits all solution” rather how some options may be best fit for specific scenarios or an order in which to proceed to secure the source and/or achieve Plugging and Abandonment.

Entity / Company	Position
USCG, BSEE & NOAA	Decision-Making Body:
Couvillion Group and the Decision-Making Body	Project Team:
M&H Engineering & GeoMaxEd (Geo-Technical Expert)	Firms with Industry Specific Technical Expertise
Wild Well Control	Firms with Industry Specific Technical Expertise
Cudd Energy Services	Firms with Industry Specific Technical Expertise
Oceaneering	Firms with Industry Specific Technical Expertise

3 Methodology –

This section provides an overview of the risk assessment and option ranking process, a guide to understanding the steps needed to generate an objective outcome. Ensuring integrity of process and unbiased results requires that steps be completed in a certain order and that the capture of input from participants is based on data and not individual opinions.



MC 20 Task 8 & 9 Risk Assessment and Option Ranking Process

3.1 Options Ranking

Understanding priority is an important part of making good decisions. An increasing number of priorities / criteria will raise the level of complexity associated with the decision. Introducing more stakeholders to the decision will further multiply the complexity and possibly to a point where a decision through consensus is difficult to achieve. Pairwise Analysis is applied as a way of deconstructing complexity into smaller components and pairs where subjective and objective data can more easily be prioritized, and biases minimized.

3.1.1 Criteria Identification:

- The process requires the following:
- Clearly capture a description of the criteria by the Project Team
- Fully agree to the criteria and description by the Decision-Making body
- Criteria (but not weighting) can be shared with FISTE as part of Risk Assessment and Option Ranking

While criteria were shared with FISTE, the pairwise analysis of criteria and discussions by the Decision-Making Body remained confidential and was not shared at any time with FISTE.

The following criteria were identified by the Project team and reviewed with Decision-Making Body.

- Long-term Source Control
- Oil & Gas Expression in the Environment
- Costs
- Schedule
- Safety
- Operational Feasibility

3.1.2 Pairwise Analysis of Criteria (Prioritization):

Several pairwise analysis were conducted with the project team as a review of the options ranking process. The reviews served to create awareness and understanding. The outcome provided several revisions to the criteria to more clearly define these. Upon acceptance of the criteria by the Decision-Making Body the following was achieved to ensure integrity of the process:

- Discarded any results from prior reviews of the options ranking process.
- Restricted input into the pairwise analysis to the Decision-Making Body only.
- Restricted access to the results from pairwise analysis to Decision-Making Body only to ensure integrity of ranking process. Results was not shared with FISTE as this would impact subsequent parts of the process.
- The Decision-making Body met after the pairwise analysis was complete to further discuss the process and share insights and further refine decision-making.

3.1.3 Applicability of Criteria to Options (Grid Analysis)

Several grid analyses were performed by determining applicability of the criteria to each of the four identified options. These exercises served to create awareness and understanding of the process and generated results to rank the options based on identified criteria and weighting. Upon completion of the Pairwise Analysis of Criteria by the Decision-Making Body the following was achieved to ensure integrity of the process:

- Discard any results from prior reviews of the options ranking process.
- Ensure FISTE understand the criteria prior to conducting grid analysis with each FISTE. This excludes any results (weighting) from Pairwise Analysis to ensure integrity of process.
- Conduct separate Grid Analysis of the options with each of the FISTE to determine the applicability of the criteria to each of the four options.
- Conduct Grid Analysis without sharing weighting from pairwise analysis or providing any information relating to calculation on how results are ranked to avoid bias.
- Collect applicability of criteria score in a manner that can be recommended by each FISTE.
- Collate all the information to determine variances and spread across FISTE to determine the options ranking.

In order to provide understanding and give some guidance to the criteria the following parameters were developed. These parameters assisted in defining the criteria and aided in the weighting of the criteria to the options.

Criteria	Applicability of Parameters
Long-term Source Control[1]	3 – Meet the standard or 1 Bottom plug + 1 Top plug (above the top most sand with the ability to flow, c. 4000' BML) 2 – 1 Bottom Plug and / or 1 Other Plug (in 7" casing) 1 – No Plugs
Oil & Gas Expression in the Environment[1]	3 – No new increase in Oil & Gas Expression in the Environment 2 – Intermittent new increase in Oil & Gas Expression in the Environment 1 – Continuous or Multiple incidents of new Oil & Gas Expression in the Environment
Costs	3 – Cost $400m or less 2 – Cost $400m to $800m 1 – Cost over $800m
Schedule	3 – Takes 3 years or less 2 – Takes 3 to 5 years 1 – Takes 5 years or more
Safety	3 – Minor injury and/or Recordable Incident 2 – Multiple minor injuries and/or Recordable Incidents 1 – Fatality or Serious Injury
Operational Feasibility	3 – Proven Reliable Methodology that has been done successfully multiple occasions 2 – Methodology has been done successfully with varying result 1 – Methodology is new and not tested

[1] While achieving isolation from subsurface sources does not necessarily meet the abandonment standard it can give a high level of assurance of stopping the flow of reservoir fluids from the subsurface source to the surface. Note: Subsurface Source is defined as the completed, producing reservoir and any sands or zones above the completed interval which can potentially flow Oil or Gas.

[2] To aid in a common understanding of this criteria and the associated applicability; a "good" outcome "3" was considered that during operations the current rapid response system would continue to contain, capture and store the Oil (even if the amounts were to increase) during remedial operations. A "not so good" outcome "2" would be an event such as a new plume or the current containment system failure causing an increase in Oil & Gas expression that could be contained within relatively short time, e.g. 1

month. A “bad” outcome “1” would be a continuous or multiple event such as a new plume or failure to the rapid response systems causing Oil & Gas Expressions in the Environment.

3.2 Risk

A risk identification workshop is carried out by a multi-disciplinary team of personnel. The procedure aims to systematically generate questions about the risk of the particular option under review. Although it is a comprehensive risk identification tool, it cannot provide assurance that all risks / hazards (both major and minor) will be identified.

The study aims to systematically search a design or procedure, option by option, to identify risk. The risk identification uses a set of categories that are carefully chosen to promote creative thought about all possible hazards.

For each category, the team considers whether there are realistic consequences for that category and whether the consequences are significant. The team then considers whether the existing safeguards are adequate and may make recommendations for corrective action / mitigations or further study as appropriate.

The composition of the team is important. Where possible, the team should comprise representatives from stakeholder groups involved with the project and any other specialists as required. The team members should be knowledgeable and experienced in the field they represent.

The best method for dealing with hazards is not always obvious. In this case, a simple risk analysis and hazard ranking exercise was used to highlight the level of attention each risk requires. Each risk is assigned a frequency of occurrence and a consequence severity. Using these frequency and severity rankings, the risk is determined on a simple matrix, and a risk level of Acceptable, Moderate, Serious and Critical is assigned.

Identifying risks during the early stages of a project minimizes risk by early identification of critical hazards, allowing the design to effectively eliminate or mitigate these. This can also reduce the cost of any modifications, which will only increase the later in the project that they are made.

3.2.1 Risk Matrix

The Matrix used to rank each of the risks and the definitions of each frequency and severity increment are shown below.

	Probability of Occurrence (P)				
	1	2	3	4	5
Consequence	Acceptable (1)	Acceptable (2)	Acceptable (3)	Moderate (4)	Moderate (5)
	Acceptable (2)	Moderate (4)	Moderate (6)	Moderate (8)	Serious (10)
	Acceptable (3)	Moderate (6)	Moderate (9)	Serious (12)	Critical (15)
	Moderate (4)	Moderate (8)	Serious (12)	Critical (16)	Critical (20)
	Moderate (5)	Serious (10)	Critical (15)	Critical (20)	Critical (25)

3.2.2 Risk Categories

The categories and severity of consequence that were used in the risk identification sessions are listed below. Each of the categories and severity of consequence where reviewed by the project team and the environmental consequences determined are site specific for the MC-20 release.

	Category				
	Rank	**HEALTH AND SAFETY**	**OPERATIONS (TIME, SCHEDULE, COST)**	**ENVIRONMENT**	**Public Confidence**
Consequence	1	HSE: Potential for Slight Injury (including first aid cases) – not affecting work performance or causing disability.	Potential failure that cannot result in lost revenue or downtime. Equipment: Slight Damage and/or No disruption to operations (costs <$50,000)	Minor oil spill/spill (less than 5 bbl. / day) contained within facility boundaries. Harm to marine life within facility boundaries.	Slight Impact – Public awareness may exist, but there is no public concern or loss of public confidence.
	2	HSE: Minor injury or health effects. Medical treatment cases, and restricted duty injuries, limited health effects that are reversible, e.g., food poisoning, skin irritation.	Potential failure may cause downtime, rework utilization loss < 5 days. Impacts ability to meet project schedule or budget. Equipment: Minor Damage and/or Brief disruption to operations (cost $50,000 ≤ x > $150,000)	Small oil spill (5 to 20 bbl. / day). No impact on sensitive environmental resources. Single exceedance in water discharge limits.	Limited Impact – Some public concern. Some local media and/or political attention, with potentially adverse impact on reputation or public confidence.
	3	HSE: Days away from work injuries. Affecting work performance in the longer term, such as prolonged absence from work. Irreversible, health damage without loss of life, e.g., noise induced hearing loss, chronic back injuries.	Potential utilization loss (between 5 to 10 days) Equipment: Local Damage and/or Partial shutdown (can be restarted but costs $150,000 ≤ x > $1,000,000) Potential to be removed from bidder's list. Lack of process that could result in loss of certification impacting business.	Moderate oil spill (20 bbl./d to 30 bbl./d) Minor/localized impact on sensitive environmental resources. Repeated exceedance of discharge limits (Few times per year but not continuous)	Considerable Impact – Regional client and public concern. Extensive adverse attention in local media. Slight national media and/or local/regional political attention. Adverse opinion of stance of government agencies.
	4	HSE: Single fatality or permanent total disability from an incident or occupational illness.	Potential Major Damage and/or Partial operation loss (2 weeks shutdown utilization loss and costs $1,000,000 ≤ x ≥ $10,000,000) Potential for not meeting client requirements	Large oil spill (30 bbl. / day to 100 bbl. / day) Regional impact on sensitive environmental resources. Extended exceedance of	National Impact – National public concern. Extensive adverse attention in national media. Regional/national policies with potentially restrictive measures and/or impact on future operations / industry.

				discharge limits. (Continuous leak or spill up to 1 Year or greater)	Mobilization of action groups.
	5	HSE: Multiple fatalities.	Potential for extensive damage and/or Substantial or total loss of operation (> $10,000,000) Potential for not meeting regulatory requirements	Massive oil spill (More than 100 bbl. / day) Widespread impact of sensitive environmental resources.	International Impact – International public attention. Extensive adverse attention in international media. National/international policies with potentially severe impact on industry, access to new operational areas and loss of confidence in governmental agencies.

3.2.3 Risk Probability

The parameters used to assess probability of occurrence for each of the risks and the definitions of each frequency increment are shown below.

Improbable	Unlikely	Occasional	Probable	Frequent
Very unlikely to occur in lifetime of Project. No records or experience indicate previous occurrences of similar projects or similar industries	Could occur once in a lifetime of Project. Records show occurrence has happened at some time in similar industry	Has occurred more than once. Records show occurrences have happened in a similar industry.	Probability of occurrence in this or similar industries. Records show similar incidents at intermittent intervals throughout the project period.	Records indicate occurrences at regular intervals in this of similar industries. These occurrences are probable to occur annually.

3.2.4 Risk Assessment Ranking

Risk assessment is conducted by multiplying Consequence (C) and Probability (P) generating a risk score. The risk score allows the risk to be appropriately placed in the Risk Assessment Matrix.

Risk	Score	Action
Critical	**≥15**	Highly hazardous and highly likely event. In all cases, the potential severity is too high to allow the operation to continue. Operations in this risk band must be eliminated, avoided or totally re-planned. A safe system of work must be documented and approved by relevant Manager prior to work commencing
Serious	**10-14**	Within this band, severity and probability are high and the work cannot be carried out until risk is reduced to an acceptable level. Mitigating the hazard can be via the provision of written procedures or work instructions, supervising the work, isolation or limiting exposure. The Risk Assessment for work in this band may be approved by the relevant Manager

Moderate	**4-9**	Use proven safeguards to reduce the risk to As Low as Reasonably Practicable. Long Term Action Plan should be considered.
Acceptable	**≤3**	Normally accepted controls should be in place for the work (i.e.- JSEA, PPE, warning signs, barriers, announcements, etc.) Typically, no immediate additional action is required.

Although all of the categories were considered during the course of the risk assessment, it is an accepted practice to record "by exception" and only record the discussions where:

- The consequences of a risk are significant, and the existing controls are noted to ensure recognition of the causes and the controls inherent in the process;
- The existing controls are found to be inadequate and recommendations are made for additional / changes to these controls or for further study of the issue; or
- The stakeholders wish to record that the issue was discussed and that the existing controls are considered acceptable

The benefit of this approach over the "full recording" approach is a considerable reduction in the duration of the workshop and the quantity of risks generated.

4 Findings Options Ranking

The pairwise analysis weighted each category to best determine priorities of the Project Team. The following point system was used for the pairwise ranking to determine applicability of category against identified options.

Relative Importance Points		
A Little more	=	1
Reasonably more	=	2
Much more	=	3

4.1 Weighting of Criteria

The Project Team reached consensus by applying the point system by analyzing pairs of criteria, by first determining the criteria of most importance and subsequently the degree of importance. The pairwise analysis generated the following weighting of each criteria.

Ranking Criteria

	B	C	D	E	F			Score	%
A	A3	A2	A3	E2	F1	A	Long Term Source Control	8	25.8%
	B	B2	B2	E2	F2	B	Oil & Gas Expression in the Environment	4	12.9%
		C	C1	E2	F2	C	Cost	1	3.2%
			D	E3	F3	D	Schedule	0	0.0%
				E	E1	E	Safety	10	32.3%
						F	Operational Feasibility	8	25.8%
								31	100%

4.2 Applicability of Criteria to Options (Grid Analysis)

To complete the option ranking, the applicability of each criteria was assessed based on material presented to the Project Team by Firms with Industry Specific Technical Expertise. Applicability scores were assigned through consensus using the best-known data and information at the time. The applicability of each criteria was applied to each option using the parameters outlined in 3.1.3 Applicability of Criteria to Options (Grid Analysis). Each option was scored as follows.

Long Term Source Control	Oil & Gas Expression in the Environment	Cost	Schedule	Safety	Operational Feasibility	#	Option
2	2	2	1	2	2	1	Intercept wells - WWC
2	2	2	1	2	2		Intercept wells - Cudd
1	2	1	1	1	2	2	Depletion with recovery - Couvillion
2	1	1	1	1	1	3	Accelerated Depletion
						4	Excavation for Access - Excavation - M&H
							Excavation for Access - Reconnection - Oceaneering
							Excavation for Access - Wireline - Oceaneering
3	2	3	2	2	2		Excavation for Access - Aggregate w/Wireline
						4	Excavation for Access - Excavation - M&H
							Excavation for Access - Reconnection - Oceaneering
							Excavation for Access - Coiled Tubing - Cudd
3	2	3	2	2	2		Excavation for Access - Aggregate w/Coil tubing

For Option #4, Excavation for Access, several operations needed to be applied to create a complete solution. As a result, multiple Firms with Industry Specific Technical Expertise provided data for their specific area of operational expertise. The results were aggregated to create a combined criteria applicability score for the option. The combined score for each criteria and option was then applied in a similar manner to the other options.

Long Term Source Control	Oil & Gas Expression in the Environment	Cost ($ MM)	Schedule (Months)	Safety	Operational Feasibility	#	Option
-	2	97.9	20		2	4	Excavation - M&H
	2	40	8.5	2	3		Reconnection - Oceaneering
3	3	70	11.5	2	2		Wireline - Oceaneering
		207.9	**40**				**Aggregate w/Wireline**
3	**2**	**3**	**2**	**2**	**2**		**Score**

-	2	97.9	20		2	4	Excavation - M&H
	2	40	8.5	2	3		Reconnection - Oceaneering
3	3	75.75	12.5	2	2		Coiled Tubing - Cudd
		213.65	**41**				**Aggregate w/Coil tubing**
3	**2**	**3**	**2**	**2**	**2**		**Score**

determine option ranking produced a several potential areas for further study / investigation. The full risk identification is shown in Appendix A at the end of this report. A total of 138 items were considered / recorded during the workshop, resulting in the identification of 8 recommendations / additional controls for consideration.

4.3 Option Ranking Results

To rank and prioritize the options, the weighted criteria was multiplied with the applicability score. The result and score for each option is shown as follows.

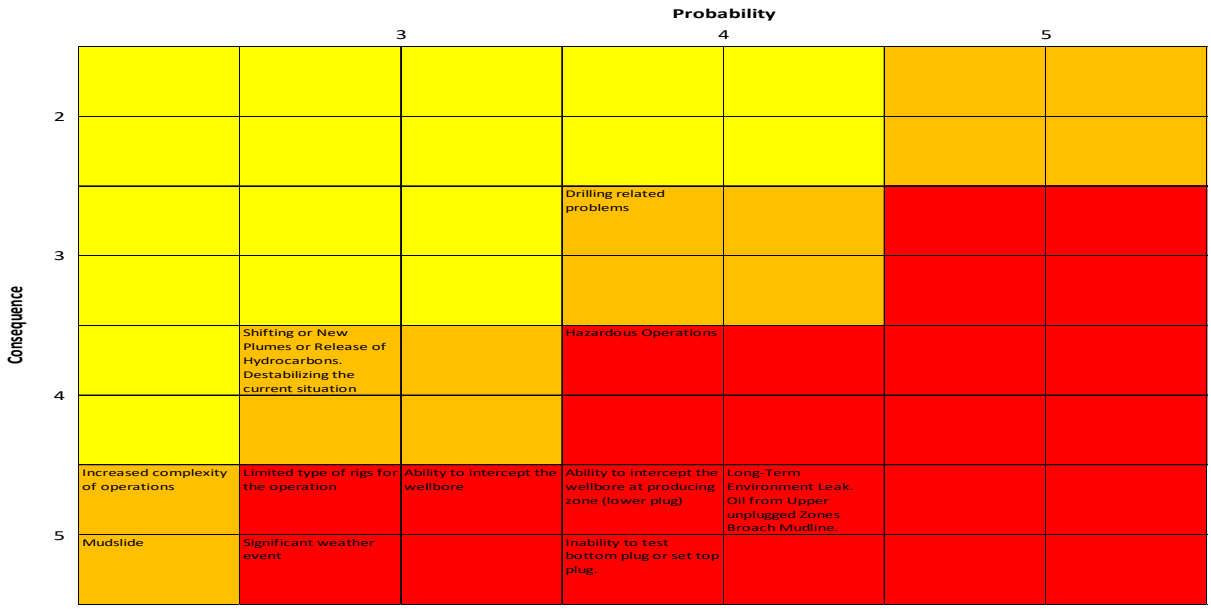
#	Option	Long Term Source Control	Oil & Gas Expression in the Environment	Cost	Schedule	Safety	Operational Feasibility	Value
		0.26	*0.13*	*0.03*	*0.00*	*0.32*	*0.26*	
1	Intercept wells - WWC	0.52	0.26	0.06	0.00	0.65	0.52	**2.00**
	Intercept wells - Cudd	0.52	0.26	0.06	0.00	0.65	0.52	**2.00**
2	Depletion with recovery - Couvillion	0.26	0.26	0.03	0.00	0.32	0.52	**1.39**
3	Accelerated Depletion	0.52	0.13	0.03	0.00	0.32	0.26	**1.26**
4	Excavation for Access - Excavation - M&H							
	Excavation for Access - Reconnection - Oceaneering							
	Excavation for Access - Wireline - Oceaneering							
	Excavation for Access - Aggregate w/Wireline	0.77	0.26	0.10	0.00	0.65	0.52	**2.29**
4	Excavation for Access - Excavation - M&H							
	Excavation for Access - Reconnection - Oceaneering							
	Excavation for Access - Coiled Tubing - Cudd							
	Excavation for Access - Aggregate w/Coil tubing	0.77	0.26	0.10	0.00	0.65	0.52	**2.29**

5 Findings - Risk

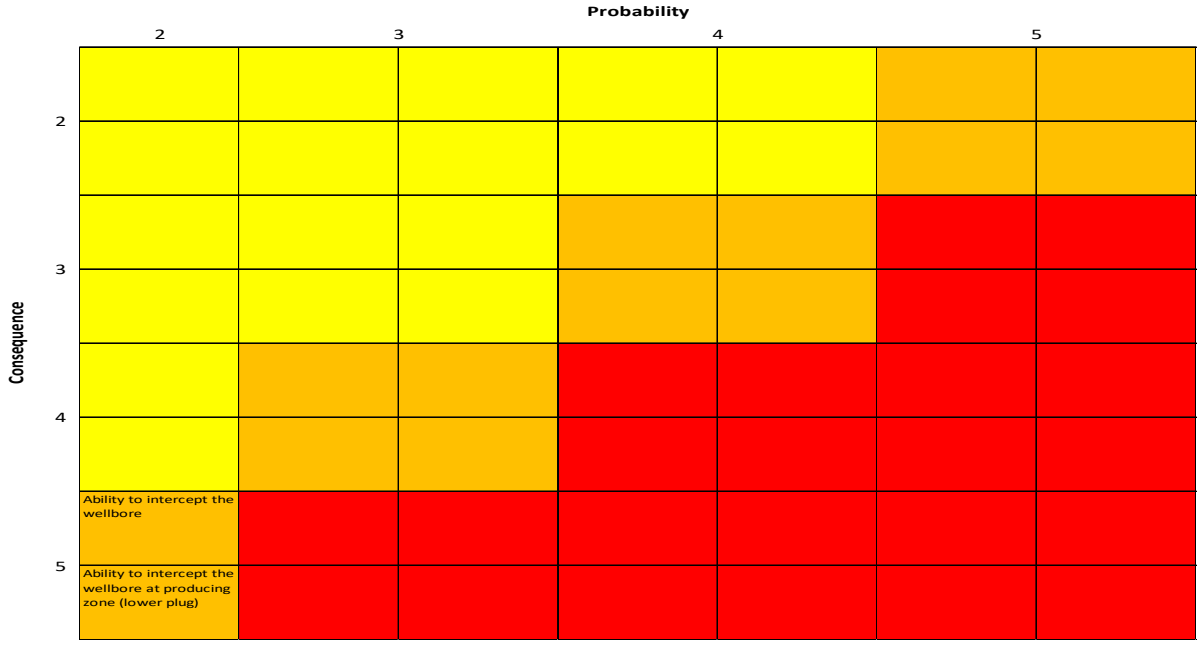
The risk assessment identified several potential areas for further study / investigation. Moderate and Acceptable risks are not shown in the below matrix; however, the full risk identification is shown in Appendix A at the end of this report. A total of 138 items were considered / recorded during the workshop, resulting in the identification of 8 recommendations / additional controls for consideration.

5.1 Risk - Intercept Wells

Pre-Mitigation: Matrix risk assessment of the 32 hazards resulted in 13 Critical Risks, 7 Serious risks, 10 Moderate risks and 2 Acceptable risks.

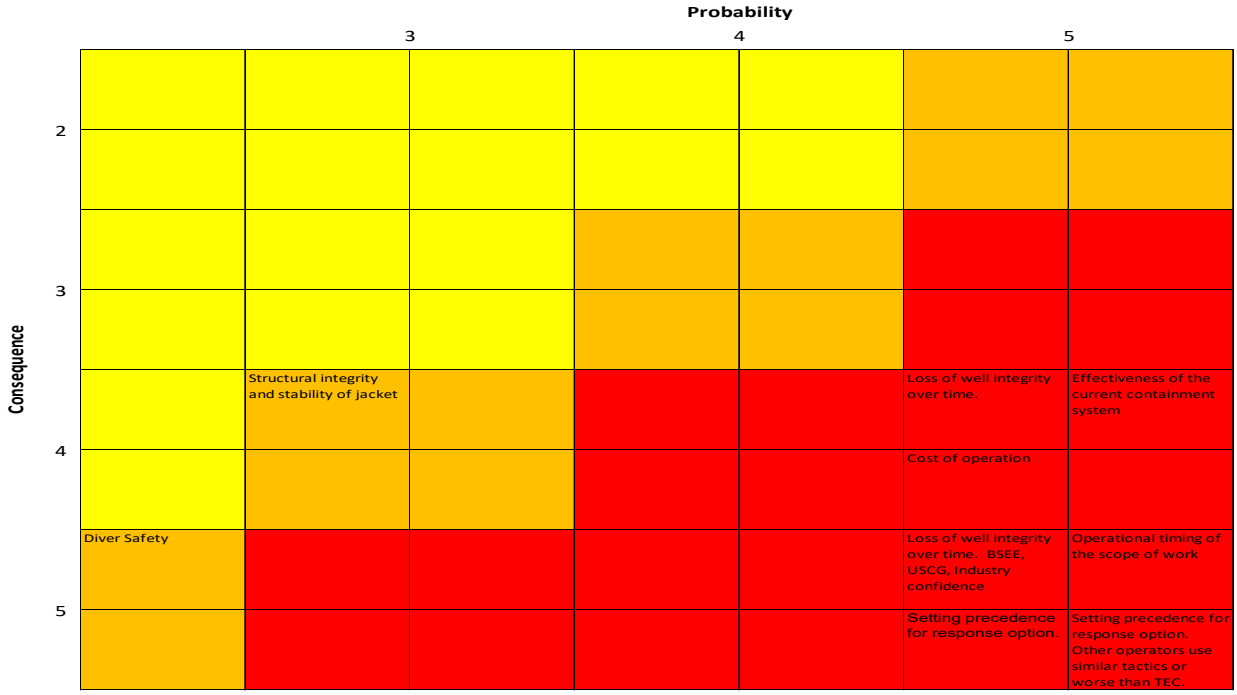


Post Mitigation: Matrix risk assessment of the 30 hazards resulted in 0 Critical Risks, 2 Serious risks, 16 Moderate risks and 14 Acceptable risks.

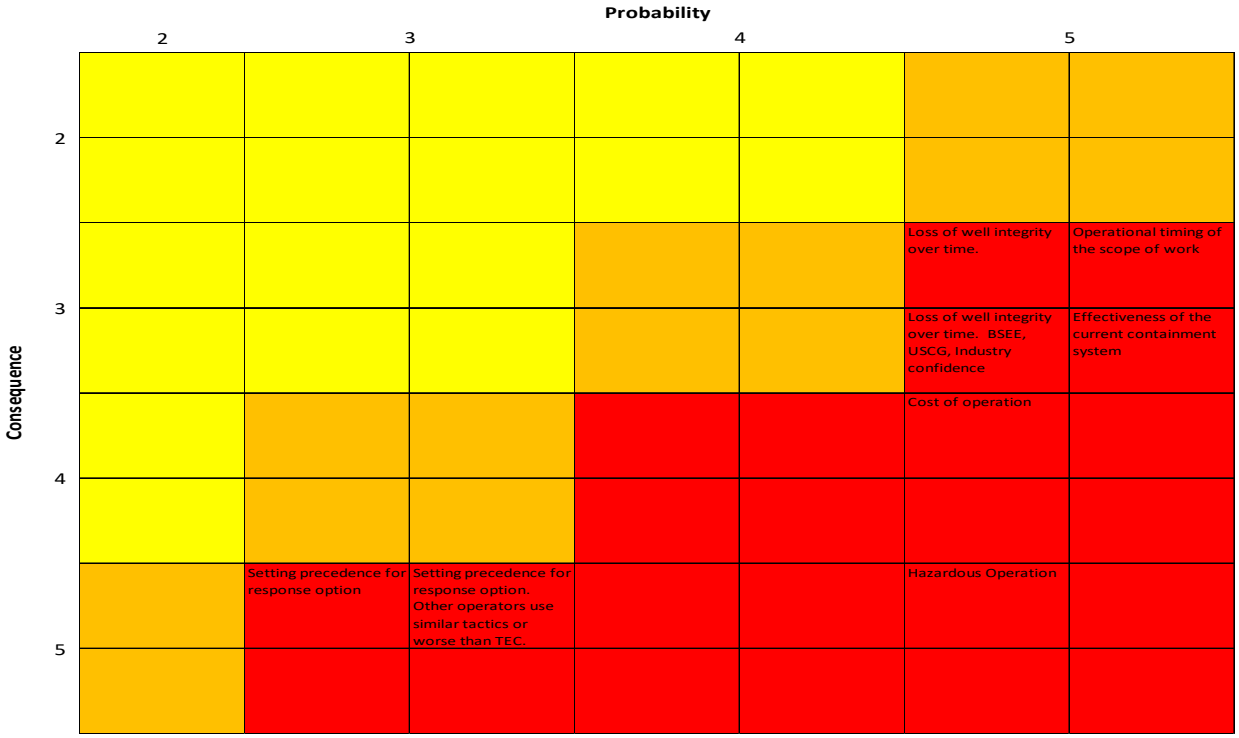


5.2 Risk - Depletion with Recovery

Pre-Mitigation: Matrix risk assessment of the 14 hazards resulted in 9 Critical Risks, 2 Serious risks, 2 Moderate risks and 1 Acceptable risk.



Post Mitigation: Matrix risk assessment of the 14 hazards resulted in 9 Critical Risks, 0 Serious risks, 4 Moderate risks and 1 Acceptable risk.


Probability
2
3
4
5
Consequence
2
3
4
5
Loss of well integrity over time.
Operational timing of the scope of work
Loss of well integrity over time. BSEE, USCG, Industry confidence
Effectiveness of the current containment system
Cost of operation
Setting precedence for response option
Setting precedence for response option. Other operators use similar tactics or worse than TEC.
Hazardous Operation

5.3 Risk - Accelerated Depletion

Pre-Mitigation: Matrix risk assessment of the 64 hazards resulted in 31 Critical Risks, 13 Serious risks, 19 Moderate risks and 1 Acceptable risk.

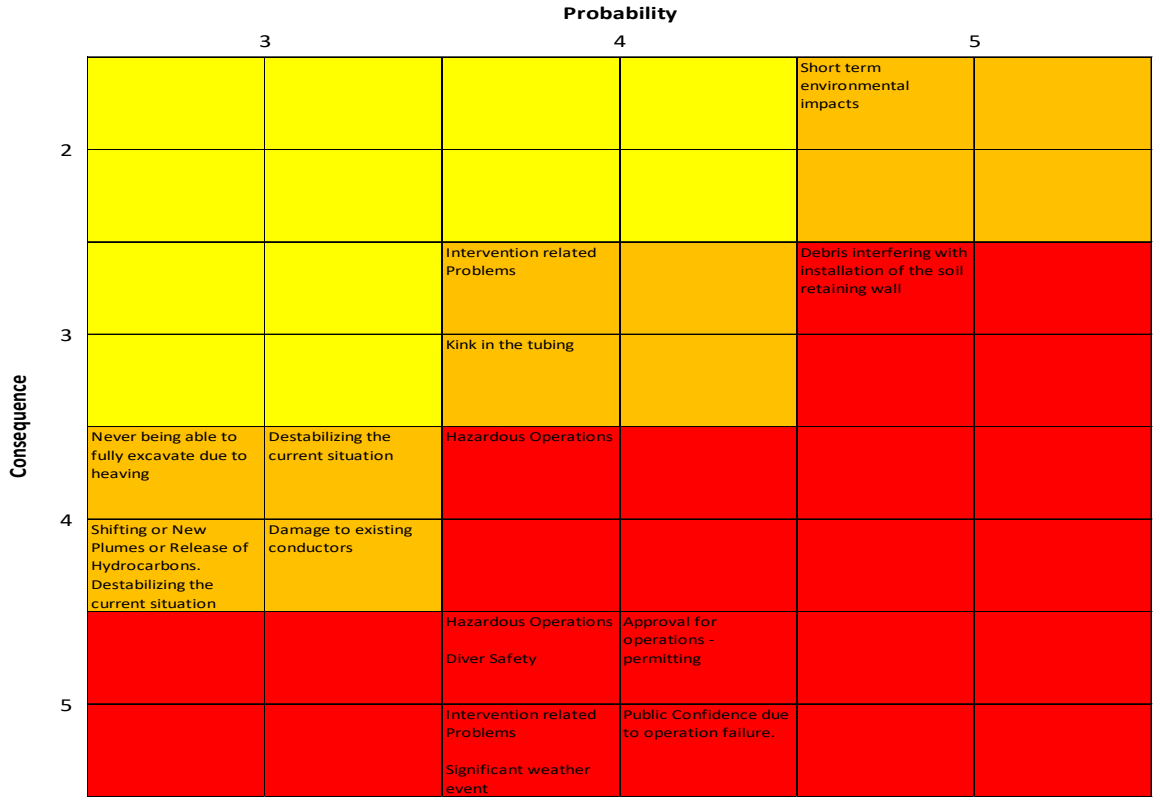
Consequence \ Probability	3	4	5
2			
3		Kink in the tubing Destabilizing the current situation	Damage to existing conductors Intervention related Problems
4	Structural integrity and stability of jacket Shifting or New Plumes or Release of Hydrocarbons. Destabilizing the current situation	Never being able to fully excavate due to heaving Intervention related Problems	Loss of well integrity over time. Hazardous Operations Cost of operation Loss of well integrity over time. BSEE, USCG, Industry confidence
5	Increased complexity of operations Mudslide Mud slide or similar condition causes facility damage. Limited type of rigs for the operation	Debris interfering with installation of the soil retaining wall Significant weather event Intervention related Problems Ability to intercept the wellbore at producing zone (lower plug)	Inability to test bottom plug or set top plug. Long-Term Environment Leak. Oil from Upper unplugged Zones Broach Mudline. Operational timing of the scope of work	Effectiveness of the current containment system Setting precedence for response option. Ability to get funding for option.

Post Mitigation: Matrix risk assessment of the 64 hazards resulted in 13 Critical Risks, 2 Serious risks, 28 Moderate risks and 21 Acceptable risks.

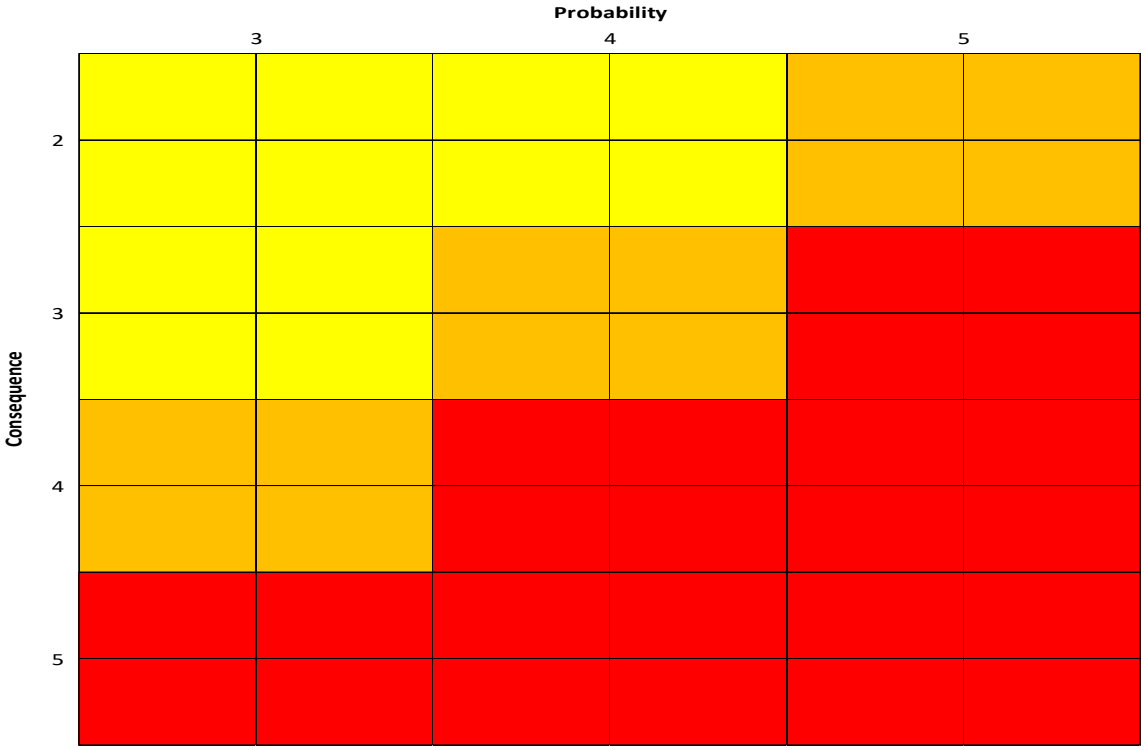
Consequence \ Probability	2	3	4	5
2				
3				Loss of well integrity over time Operational timing of the scope of work	Loss of well integrity over time. BSEE, USCG, Industry confidence Effectiveness of the current containment system
4		Hazardous Operations	Cost of operation	
5	Ability to intercept the wellbore Ability to intercept the wellbore at producing zone (lower plug)	Setting precedence for response option. Mud slide or similar condition causes facility damage.	Intervention related Problems	Ability to get funding for option.

5.4 Risk - Excavation for Access

Pre-Mitigation: Matrix risk assessment of the 28 hazards resulted in 8 Critical Risks, 9 Serious risks, 11 Moderate risks and 0 Acceptable risks.



Post Mitigation: Matrix risk assessment of the 28 hazards resulted in 0 Critical Risks, 0 Serious risks, 14 Moderate risks and 14 Acceptable risks.



6 Recommendations

The recommendations / additional controls are shown in the table below. Responsibilities should be assigned to each of these items and a sign-off should take place to ensure that they are actioned appropriately.

Item #	Recommendations / Additional Controls	Benefit / Output
1	Continue with the next steps in the project – FEED work to develop next level of engineering design and project assurance. A delay here will cause in loss of momentum, potentially allow for additional release into the environment and likely allow for project to stall at a critical phase.	Continued momentum
2	Pangeo AC Corer Sub-bottom Imaging Field Wide Survey	Full field Scan and interpretation.
3	Excavation Design Development and Refinement (based on field wide survey) - While initial conceptual study was done, excavation will be most affected by results of AC Corer Full Field Scans.	Engineering Excavation Design with Drawings, Equipment Specifications, Material Budgets, etc...
4	Subsea Coil Tubing Concept Design Development - Development of the Horizontal Subsea Coil Tubing Based on MC 20 Conditions. Takes this option past the conceptual phase.	Engineering drawings, tool specification, Engineering Design of System.
5	Study on how best to reconnect Wellheads (based on field wide survey) - Initial study was completed, this should be a refinement based upon new information from AC Corer results.	Refinement of Plan.
6	Subsea Riserless Wire Line Intervention (based on field wide survey) - Initial study was completed, this should be a refinement based upon new information from AC Corer results.	Refinement of Plan
7	Intercept Wells - No initial study was commissioned for this option. Will need an engineering review of all wells to include TEC 9 parallel intercept wells.	Well by well intercept plans and approach.
8	Mobile Containment System (Suction Pile) Design	Reduce Risk

7 Conclusions

The risk identification workshop and subsequent review by SME's achieved its aim of identifying the nature and scale of hazards that might occur during the operation of the proposed options. The risk identification team comprised of a core group of knowledgeable personnel, well versed in the proposed technology and mode of operation. A total of 138 items were considered / recorded during the workshop, resulting in the identification of 8 recommendations / additional controls for consideration. None of the hazards were assessed as being extreme risks, with 6 high risks, 18 medium risks and 19 low risks. None of the identified risks were considered to have the potential for significant offsite effects. Thus, they would have no impact on the surrounding population and would not present a risk offsite. As a result, no further modelling is considered necessary for these operations.

The risk identification workshop was conducted at a preliminary stage of the MC20 Project. As a result, there was some information that was not available for inclusion / consideration in the study. Noteworthy examples of this are:

- Details of the design and operation of the proposed intervention systems, including safety systems, detection and minimization, and emergency shutdown systems and procedures were not available. The workshop assumed that the operation would meet all relevant Regulatory Standards and meet current best practice for similar operations around the world.

The construction phase of the project was not considered in the risk identification workshop, as no detailed information regarding the construction methods / requirements was available. A separate construction risk identification should be conducted when a construction contractor has been engaged to consider the specific hazards related to the construction phase of the project.

If any major changes are made to the project design or options, the findings of this risk assessment study may be affected. As a result, any such changes should also be subjected to a risk assessment style review.

It is important to note that the risk assessment is the start of the process, not the end. A successful outcome depends on methodical close out of the recommendations / additional controls identified in the workshop.

Appendix A - Risk Register

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Appendix A.1. – Intercept Wells

Risk Assessment Template											
Scope of Work (Job Category)	Consequence Type	Risk Name	Event Description / Impact	Uncontrolled Assessment (Cons x Prob = Risk)			Mitigation / Action	Owner	By Date	Post Mitigation Assessment (Cons x Prob = Risk)		
				Cons.	Prob.	Risk				Cons.	Prob.	Risk
Drilling	Environmental	Loss of well control to the surface	Collision with another wellbore. Ellipses of uncertainty and depth of well. Release more oil affecting marine life Potential uncontrolled release of oil results in regional impact on sensitive environmental resources.	4	2	**8**	Prepare with Heavy Mud (enough barite to add 1ppg above reservoir pressure) * Adequate planning * Real-time monitoring of MWD magnetic interference * No approach until after intermediate casing * Torque/vibration monitoring in BHA * Stop drilling, run ranging tool for confirmation Heighten monitoring protocols, multiple ranging runs Have Back up Containment System ready at dock.			3	1	**3**
Drilling	Operations	Limited type of rigs for the operation	Schedule, availability and cost. Would BSEE approve? There are currently two maybe three rigs available. Potential damage to containment system from moored rig or jack-up rig.	5	3	**15**	Use Combo Rig - Quick release moored with DP capability. Engage contractor early to have right rig on contract. Have back up containment system ready at beach to deploy.			5	1	**5**

Drilling	Operations	Increased complexity of operations	Conditions forces subsea stack, riser system, subsea containment system etc.	5	2	**10**	* Review conductor design - enhance (bigger, thicker, deeper) * Adequate riser margin in case BOP/Wellhead lost Identified in Approach of Operation and planned for in Option Weighting (Cost and Schedule)			1	1	**1**
Drilling	Environmental	Mudslide	Significant weather event and sediment buildup causes to sheer riser below stack. Potential uncontrolled release of oil results in regional impact on sensitive environmental resources.	5	2	**10**	* Review conductor design - enhance (bigger, thicker, deeper) * Adequate riser margin in case BOP/Wellhead lost Use of Combo Rig with quick release moored system and DP capability. Have back up containment system at dock ready.			3	1	**3**
Drilling	Operations	Significant weather event	Impact to schedule, damage to rig	5	3	**15**	Use Combo Rig - Quick release moored with DP capability Identified in Approach of Operation and planned for in Option Weighting (Cost and Schedule)			3	1	**3**
Drilling	Operations	Ability to intercept the wellbore	Failure to stop the flow. Ellipses of uncertainty for 28+9 wells Cannot get bottom plug.	5	3	**15**	Directional Control & pre-planning. Have good data. Potential to use current or other to identify 9 wells drilled by Taylor. Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made)	Intercept well provider - will need more detailed study.		5	2	**10**

Drilling	Operations	Ability to intercept the wellbore at producing zone (lower plug)	The 9 IA wells drilled previously by TEC will cause interference issues with the 9 target wells. Ranging techniques will not be able to discern which well is which. Cannot intercept these wells to set bottom plug. Cannot get access target well to effectively set bottom plug. Note - the bottom plug will need to be set across producing zone or slightly above across tubing, and annuli to assure leak paths are plugged. Cost go up and schedule increases drastically in continued attempts or cannot meet the Intercept Well operational objective (2 plugs)	5	4	**20**	Intercept at a higher point which avoids the interference issue. Directional Control & pre-planning. Have good data. * Re-enter previous intervention wells - side track at point where wells are sufficiently separated ** This applies to all risks involving interference from previous TEC intervention wells Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made)	Intercept well provider - will need more detailed study.		5	2	**10**

Drilling	Environmental	Ability to intercept the wellbore at producing zone (lower plug)	The 9 IA wells drilled previously by TEC will cause interference issues with the 9 target wells. Ranging techniques will not be able to discern which well is which. Cannot intercept these wells to set bottom plug. Cannot get access target well to effectively set bottom plug. Note - the bottom plug will need to be set across producing zone or slightly above across tubing, and annuli to assure leak paths are plugged. Do not solve the long-term environmental objectives. Leak continues.	4	4	**16**	Intercept at a higher point which avoids the interference issue. Directional Control & pre-planning. Have good data. Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made) Have back up containment system at the dock.			3	2	**6**

Drilling	Reputation/ Public Confidence	Ability to intercept the wellbore at producing zone (lower plug)	The 9 IA wells drilled previously by TEC will cause interference issues with the 9 target wells. Ranging techniques will not be able to discern which well is which. Cannot intercept these wells to set bottom plug. Cannot get access target well to effectively set bottom plug. Note - the bottom plug will need to be set across producing zone or slightly above across tubing, and annuli to assure leak paths are plugged. Problem persists, spend inordinate amount of time, money and still do not solve problem. Industry and Regulators are viewed in very bad light. Can affect the access to existing and new area and/or current and	5	4	**20**	Intercept at a higher point which avoids the interference issue. Directional Control & pre-planning. Have good data. Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made)	Intercept well provider - will need more detailed study.		4	2	**8**

			prospective entrants.									
Planning	Operations	Approval for operations - permitting	Unable to perform operations	4	1	**4**	Use of a combo rig should allow for permitting concerns.			4	1	**4**
Plug & Abandonment	Operations	Inability to test bottom plug or set top plug.	Cannot get access target well higher to test the bottom plug, no verification of plug. Note - the top plug will need to be set across tubing, and annuli to assure leak paths are plugged. Cost go up and schedule increases drastically in continued attempts or cannot meet the Intercept Well operational objective (2 plugs)	5	4	**20**	Test from intercept wellbore. This would be a limited test to FIT. Intercept at a higher point which avoids the interference issue. Directional Control & pre-planning. Have good data. * Re-enter previous intervention wells - side track at point where wells are sufficiently separated ** This applies to all risks involving interference from previous TEC intervention wells Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made)	Intercept well provider - will need more detailed study.		3	3	**9**

Plug & Abandonment	Environmental	Inability to test bottom plug or set top plug.	Cannot get access target well higher to test the bottom plug, no verification of plug. Note - the top plug will need to be set across tubing, and annuli to assure leak paths are plugged. Do not solve the long-term environmental objectives. Leak continues.	4	5	**20**	Intercept at a higher point which avoids the interference issue. Directional Control & pre-planning. Have good data. Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made) Have back up containment system at the dock.			3	2	**6**
Excavation (Access to Conductors)	Operations (Cost and Schedule)	New Expression of Oil due to damage to RSS or shift in plume	New Expression of Oil due to damage to RSS or shift in plume	2	2	**4**	Have back up containment system ready at beach to deploy.			4	1	**4**
Excavation (Access to Conductors)	Environmental	New Expression of Oil due to damage to RSS or shift in plume	New Expression of Oil due to damage to RSS or shift in plume	2	3	**6**	Have back up containment system ready at beach to deploy.			4	1	**4**

Plug & Abandonment	Reputation/ Public Confidence	Inability to test bottom plug or set top plug.	Cannot get access target well higher to test the bottom plug, no verification of plug. Note - the top plug will need to be set across tubing, and annuli to assure leak paths are plugged. Problem persists, spend inordinate amount of time, money and still do not solve problem. Industry and Regulators are viewed in very bad light. Can affect the access to existing and new area and/or current and prospective entrants.	4	4	**16**	Test from intercept wellbore. This would be a limited test to FIT. Intercept at a higher point which avoids the interference issue. Directional Control & pre-planning. Have good data. * Re-enter previous intervention wells - side track at point where wells are sufficiently separated ** This applies to all risks involving interference from previous TEC intervention wells Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made)	Intercept well provider - will need more detailed study.		3	3	**9**
Post-Operations	Environmental	Long-Term Environment Leak. Oil from Upper unplugged Zones Broach Mudline.	Do not abandoned top zones. release of more oil (Gas or Produced Water) due to shallow zone broaching of hydrocarbons to surface. Harm to marine life. Causing additional leak patterns.	5	4	**20**	Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made)	BSEE, USCG & NOAA		4	1	**4**

Post-Operations	Reputation/ Public Confidence	Long-Term Environment Leak. Oil from Upper unplugged Zones Broach Mudline.	Do not abandoned top zones. release of more oil (Gas or Produced Water) due to shallow zone broaching of hydrocarbons to surface. Harm to marine life. Causing additional leak patterns.	5	4	**20**	Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made)	BSEE, USCG & NOAA		4	1	**4**
Abandonment Operations	Environmental	Loss of well integrity in target well	Release of hydrocarbons through alternative leak paths impacting marine life. Flow from one zone to another zone. Potential uncontrolled release of oil results in regional impact on sensitive environmental resources.	4	2	**8**	Use of heavy kill mud. Good directional control. Have back up containment system ready at beach to deploy.			3	1	**3**
	Environmental	Shifting or New Plumes or Release of Hydrocarbons. Destabilizing the current situation	Intercept work causes plume location to shift or new plume location to occur that the dome cannot capture	4	3	**12**	Have back up containment system ready at beach to deploy. Conduct full field sub-bottom imaging prior to intercept wells.			3	2	**6**
Drilling	**Environmental**	Operational timing of the scope of work	Will take 3 to 5 years to complete. If too long it can impact the current containment system.	4	2	**8**	Have back up containment system ready at beach to deploy. Inspect system during pump off operations. Adhere to maintenance plan.			3	1	**3**

Drilling	**Health and Safety**	Hazardous Operations	Serious injury from high hazard operations during campaign: - Working at Heights. - Energy Isolation - Dropped Objects - Confined Space - Lifting - Proper Utilization of Permit to Work, PPE, JSEA, MOC - Competency of People	4	4	**16**	Hire contractors with good safety records, safety management systems. Assure competent workforce Training program. Proper on-site leadership / oversight. Use of JSEA, Permit to Work, PPE, MOC			4	2	**8**
Drilling	**Operations**	Drilling related problems	Schedule delay (NPT). Typically up to 30% of time is lost to: - New Rig / Competency of Crew, Invisible Lost Time (ILT) - DH Losses - Stuck Pipe / Depleted Zones - Hole Cleaning - Directional Control - Equipment (Top Drive, BOP's, Mud Pumps, etc.…) - Fishing	3	4	**12**	* Typical rig acceptance inspections * Proper planning / Pre-spud / DWOP with all parties * Supervision / oversight * Select best service contractors			3	3	**9**
Drilling	**Operations**	Drilling related problems	Intercept and affect Leaking Packer	2	3	**6**	Intercept above the packer			2	1	**2**
Drilling	**Environmental**	Drilling related problems	Intercept and affect Leaking Packer	2	2	**4**	Pump Heavy Mud			1	2	**2**

Drilling	**Environmental**	Drilling related problems	Intercept above packer and intersect tubing. Tubing flows into A annulus.	2	3	**6**	Pump Heavy Mud			1	3	**3**
Drilling	**Environmental**	Drilling related problems	Pumping into the well creates a release to the environment	4	3	**12**	Have enough KWF and LCM to kill well - check max reservoir pressure Have back up containment system ready at dock.			3	1	**3**
Drilling	**Operations**	Drilling related problems	Hit another well up higher accidently	2	1	**2**	Kill that interest well.			1	1	**1**
Drilling	**Operations**	Drilling related problems	During initial penetration get stuck as loose fluid.	3	2	**6**	* The typical risk around getting stuck at the intercept point involves high differential between relief well and flowing (blowout) well. If we maintain our mud weight to a minimum and have a good LCM plan in place I don't see this being more than a 2 probability and a 2 consequence since we'll have a short open hole section at the time with jars in the BHA that are up inside casing.			3	1	**3**
Drilling	**Operations**	Drilling related problems	Losses	3	4	**12**	LCM Plan in Place			2	3	**6**
Drilling	**Operations**	Drilling related problems	Lengthy open hole when intercept creates hole problems or stuck pipe.	3	4	**12**	Control Open Hole length prior to intercept point, set liner or casing and pull mill back up to avoid stuck If stuck can sever DP and intercept higher.			3	2	**6**

Drilling	**Operations**	Drilling related problems	Inadvertently intercept wrong well	2	1	**2**	Target lower in the wells. Stay away from intermediate section. Kill and set plug in wrong well. Directional Control & pre-planning. Have good data.			1	1	**1**

Appendix A.2. – Depletion with Recovery

Risk Assessment Template											
Scope of Work (Job Category)	**Consequence Type**	**Risk Name**	**Event Description / Impact**	**Uncontrolled Assessment (Cons x Prob = Risk)**			**Mitigation / Action**	**Owner**	**By Date**	**Post Mitigation Assessment (Cons x Prob = Risk)**		
				Cons.	**Prob.**	**Risk**				**Cons.**	**Prob.**	**Risk**
Depletion	Environmental	Mudslide	Significant weather event and sediment buildup causes damage to containment system. Uncontrolled release of oil results in regional impact on sensitive environmental resources.	4	2	**8**	Have back up containment system ready at beach to deploy.			3	2	**6**
Depletion	Environmental	Loss of well integrity over time.	Delay or doing nothing: The condition will only get worse – Reservoir will continue to re-pressurize due to aquifer support. Tubulars will continue to erode due to existing integrity issues compounded by time, flowing fluids (produced water, oil & gas), re-pressurization. It is not a matter of if, rather when new or increased plumes	4	5	**20**	Have multiple back up containment system ready at beach to deploy.			3	5	**15**

			will occur. Release of hydrocarbons through alternative leak paths impacting marine life. Flow from one zone to another zone. Potential uncontrolled release of oil results in regional impact on sensitive environmental resources.										
Depletion	Reputation/ Public Confidence	Loss of well integrity over time. BSEE, USCG, Industry confidence	Delay or doing nothing: The condition will only get worse – Reservoir will continue to re-pressurize due to aquifer support. Tubulars will continue to erode due to existing integrity issues compounded by time, flowing fluids (produced water, oil & gas), re-pressurization. It is not a matter of if, rather when new or increased plumes will occur. Perception of Industry and Regulatory Bodies	5	5	**25**	Have multiple back up containment system ready at beach to deploy.			3	5	**15**

			failing to address or solve the issue will lead to public lack of confidence. Potential effects - Increased regulations, affect access to existing and new areas, affect access to existing or new industry entrants.										
Depletion	Operational	Operational timing of the scope of work	Will take 50-100 years to complete. If too long it can impact the current containment system.	5	5	**25**	Have multiple back up containment system ready at beach to deploy.			3	5	**15**
Depletion	Environmental	Operational timing of the scope of work	Continued release of oil from the containment system during 50-100 years before operation is complete results in localized impact on sensitive environmental resources. - OR- Potential degradation and collapse of structure during 50-100 years before operation is complete results in uncontrolled release of oil and regional impact on sensitive environmental resources.	4	5	**20**	Have multiple back up containment system ready at beach to deploy.			3	5	**15**
Depletion	Cost	Cost of operation	Cost over a long period of time to operate the current	4	5	**20**				4	5	**20**

			containment system. 1.6BN over the next 100 years (excluding inflation)									
Depletion	Environmental	Effectiveness of the current containment system	Overtime temp containment system no longer effective either because of size or change in plume location. Potential discharge exceeds temporary capture system capacity. New plumes not covered by current system. Uncontrolled release of oil results in regional impact on sensitive environmental resources.	4	5	**20**	Have multiple back up containment system ready at beach to deploy.			3	5	**15**
Depletion	Environmental	Structural integrity and stability of jacket	Jacket at risk of exceeding lifespan and collapse. Leak no longer contained	4	3	**12**	Have multiple back up containment system ready at beach to deploy.			3	3	**9**
Depletion	Environmental	Setting precedence for response option.	Delayed action on other spills. Using temporary solutions as a long-term band-aid. Expecting more of the government than taking responsibility for event. Note - instances of this are already occurring.	5	5	**25**	Action needs to be taken to ward off other bad players. It is noted that instances of bad behavior are already being experienced from other operators.	BSEE, USCG, NOAA		5	3	**15**

Depletion	Reputation/ Public Confidence	Setting precedence for response option. Other operators use similar tactics or worse than TEC. BSEE, USCG, Industry confidence	Delayed action on other spills. Using temporary solutions as a long-term band-aid. Expecting more of the government than taking responsibility for event. Note - instances of this are already occurring.	5	5	**25**	Action needs to be taken to ward off other bad players.			5	3	**15**
Pump Off, Maintenance or Replacement Operations	Safety		Serious injury from high hazard operations during campaign: - Working at Heights. - Energy Isolation - Dropped Objects - Slips, trips and Falls - Confined Space - Lifting - Proper Utilization of Permit to Work, PPE, JSEA, MOC - Competency of People Injury due to last of Work Rest due to continuous operations Injury due to Equipment failure	5	5	**25**	Hire contractors with good safety records, safety management systems. Assure competent workforce Training program. Proper on-site leadership / oversight. Use of JSEA, Permit to Work, PPE, MOC As this project is set to run 50 to 100 years - it is deemed good probability of a Serious or Critical Accident.			5	5	**25**

Pump Off, Maintenance or Replacement Operations	Safety	Diver Safety	Injury to divers during repair or replacement operation	5	2	**10**	Hire contractors with good safety records, safety management systems. Assure competent workforce Training program. Proper on-site leadership / oversight. Use of JSEA, Permit to Work, PPE, MOC Develop ROV interface system, i.e. no divers. Same comment as above with respect to duration of project.			5	1	**5**
Pump Off, Maintenance or Replacement Operations	Safety	Heat/Cold stress	Injury due to Heat/Cold stress	3	1	**3**				3	1	**3**
Pump Off, Maintenance or Replacement Operations	Safety	Overboard/Drowning	Overboard/Drowning	5	1	**5**	Conduct overboard drills Proper PPE during deck operations			5	1	**5**

Appendix A.3. – Accelerated Depletion

Risk Assessment Template											
Scope of Work (Job Category)	**Consequence Type**	**Risk Name**	**Event Description / Impact**	**Uncontrolled Assessment (Cons x Prob = Risk)**			**Mitigation / Action**	**Owner**	**By Date**	**Post Mitigation Assessment (Cons x Prob = Risk)**		
				Cons.	**Prob.**	**Risk**				**Cons.**	**Prob.**	**Risk**
Depletion	Environmental	Mudslide	Significant weather event and sediment buildup causes damage to containment system. Uncontrolled release of oil results in regional impact on sensitive environmental resources.	4	2	**8**	Have back up containment system ready at beach to deploy.			3	2	**6**
Depletion	Environmental	Loss of well integrity over time.	Delay or doing nothing: The condition will only get worse – Reservoir will continue to re-pressurize due to aquifer support. Tubulars will continue to erode due to existing integrity issues compounded by time, flowing fluids (produced water, oil & gas), re-pressurization. It is not a matter of if, rather when new or increased plumes	4	5	**20**	Have multiple back up containment system ready at beach to deploy.			3	5	**15**

			will occur. Release of hydrocarbons through alternative leak paths impacting marine life. Flow from one zone to another zone. Potential uncontrolled release of oil results in regional impact on sensitive environmental resources.										
Depletion	Reputation/ Public Confidence	Loss of well integrity over time. BSEE, USCG, Industry confidence	Delay or doing nothing: The condition will only get worse – Reservoir will continue to re-pressurize due to aquifer support. Tubulars will continue to erode due to existing integrity issues compounded by time, flowing fluids (produced water, oil & gas), re-pressurization. It is not a matter of if, rather when new or increased plumes will occur. Perception of Industry and Regulatory Bodies	5	5	**25**	Have multiple back up containment system ready at beach to deploy.			3	5	**15**

			failing to address or solve the issue will lead to public lack of confidence. Potential effects - Increased regulations, affect access to existing and new areas, affect access to existing or new industry entrants.										
Depletion	Operational	Operational timing of the scope of work	Will take 50-100 years to complete. If too long it can impact the current containment system.	5	5	**25**	Have multiple back up containment system ready at beach to deploy.			3	5	**15**
Depletion	Environmental	Operational timing of the scope of work	Continued release of oil from the containment system during 50-100 years before operation is complete results in localized impact on sensitive environmental resources. - OR- Potential degradation and collapse of structure during 50-100 years before operation is complete results in uncontrolled release of oil and regional impact on sensitive environmental resources.	4	5	**20**	Have multiple back up containment system ready at beach to deploy.			3	5	**15**

Depletion	Cost	Cost of operation	Cost over a long period of time to operate the current containment system. 1.6BN over the next 100 years (excluding inflation)	4	5	**20**				4	5	**20**
Depletion	Environmental	Effectiveness of the current containment system	Overtime temp containment system no longer effective either because of size or change in plume location. Potential discharge exceeds temporary capture system capacity. New plumes not covered by current system. Uncontrolled release of oil results in regional impact on sensitive environmental resources.	4	5	**20**	Have multiple back up containment system ready at beach to deploy.			3	5	**15**
Depletion	Environmental	Structural integrity and stability of jacket	Jacket at risk of exceeding lifespan and collapse. Leak no longer contained	4	3	**12**	Have multiple back up containment system ready at beach to deploy.			3	3	**9**
Depletion	Environmental	Setting precedence for response option.	Delayed action on other spills. Using temporary solutions as a long-term band-aid. Expecting more of the government than taking responsibility for event.	5	5	**25**	Action needs to be taken to ward off other bad players. It is noted that instances of bad behavior are already being experienced from other operators.	BSEE, USCG, NOAA		5	3	**15**

			Note - instances of this are already occurring.										
Depletion	Reputation/ Public Confidence	Setting precedence for response option. Other operators use similar tactics or worse than TEC. BSEE, USCG, Industry confidence	Delayed action on other spills. Using temporary solutions as a long-term band-aid. Expecting more of the government than taking responsibility for event. Note - instances of this are already occurring.	5	5	**25**	Action needs to be taken to ward off other bad players.			5	3	**15**
Fabrication, installation and maintenance of new structure for accelerated production.	Operations	Intervention related Problems	Schedule delay (NPT). Typically up to 30% of time is lost to: - New Rig / Competency of Crew, Invisible Lost Time (ILT) - DH Losses - Stuck Pipe / Depleted Zones - Hole Cleaning - Directional Control - Equipment (Top Drive, BOP's, Mud Pumps, etc....) - Fishing	5	4	**20**	Hire Contractor with track record in this type of operations Note - These are massive operations from top-sides to installation to operating over multi year period. Many man-hours. Ensure competency of personnel Adequate preplanning - Job on paper work shop			5	3	**15**

Fabrication, installation, operation and maintenance of new structure for accelerated production.	Safety	Hazardous Operations	Serious injury from high hazard operations during campaign: - Working at Heights. - Energy Isolation - Dropped Objects - Confined Space - Lifting - Proper Utilization of Permit to Work, PPE, JSEA, MOC - Competency of People	4	5	**20**	Hire Contractor with track record in this type of operations Note - These are massive operations from top-sides to installation to operating over multi year period. Ensure competency of personnel Adequate preplanning - Job on paper work shop			4	4	**16**
Fabrication, installation, operation and maintenance of new structure for accelerated production.	Environmental	Mud slide or similar condition causes facility damage.	New mud slide or similar condition causes the facility damage and have ensuing environmental damage.	5	3	**15**	Have multiple back-up containment system ready at dock.			3	3	**9**
Fabrication, installation, operation and maintenance of new structure for accelerated production.	Operations	Mud slide or similar condition causes facility damage.	New mud slide or similar condition causes the facility damage and have ensuing cost/schedule issue.	5	3	**15**				5	3	**15**
Fabrication, installation, operation and maintenance of new structure for accelerated production.	Public Confidence	Mud slide or similar condition causes facility damage.	New mud slide or similar condition causes the facility damage and public confidence of govt entities shattered, a 2nd time… in a known high mud slide area.	5	3	**15**	Have multiple back-up containment system ready at dock.			5	3	**15**

Fabrication, installation, operation and maintenance of new structure for accelerated production.	Public Confidence / Operations	Ability to get funding for option.	The ability to pay for such a project is projected to be above a billion dollars. The only known funding for this type of investment is the Oil Spill Liability Trust Fund. It would be difficult if not impossible to get funding for this option. Additionally, it is not clear what entity would perform such an endeavor or take the responsibility for this plan.	5	5	**25**				5	5	**25**
Drilling of Accelerated Production Wells	Operations	Intervention related Problems	Schedule delay (NPT). Typically up to 30% of time is lost to: - New Rig / Competency of Crew, Invisible Lost Time (ILT) - DH Losses - Stuck Pipe / Depleted Zones - Hole Cleaning - Directional Control - Equipment (Top Drive, BOP's, Mud Pumps, etc....) - Fishing	4	4	**16**	Hire Contractor with track record in this type of operations Note - Drilling of multiple wells (minimum of 18 in this case) typically get better over time with good learning curve. This would be a multi-year campaign. Ensure competency of personnel Adequate preplanning - Job on paper work shop			4	2	**8**

Drilling of Accelerated Production Wells	Safety	Hazardous Operations	Serious injury from high hazard operations during campaign: - Working at Heights. - Energy Isolation - Dropped Objects - Confined Space - Lifting - Proper Utilization of Permit to Work, PPE, JSEA, MOC - Competency of People	4	4	**16**	Hire Contractor with track record in this type of operations Note - Drilling of multiple wells (minimum of 18 in this case) typically get better over time with good learning curve. This would be a multi-year campaign. Ensure competency of personnel Adequate preplanning - Job on paper work shop			4	2	**8**
Pump Off, Maintenance or Replacement Operations	Safety	Heat/Cold stress	Injury due to Heat/Cold stress	3	1	**3**				3	1	**3**
Pump Off, Maintenance or Replacement Operations	Safety	Overboard/Drowning	Overboard/Drowning	5	1	**5**	Conduct overboard drills Proper PPE during deck operations			5	1	**5**
Excavation (Access to Conductors)	Operations (Cost and Schedule)	Mudslide	Mudslide collapses the excavation site.	4	1	**4**	Have back up containment system ready at beach to deploy.			3	1	**3**
Excavation (Access to Conductors)	Environmental	Mudslide or other	Damage to containment system leads to plume resurfacing	4	2	**8**	Have back up containment system ready at beach to deploy.			3	1	**3**

Excavation (Access to Conductors)	Environmental	Short term environmental impacts	Excavation causes: - Movement of soils (release of entrained hydrocarbons) - Movement of soils (Disturbs local animals - Shrimp, Worms, Fish) - Movement of soils (Soils displaced to other location could contain hydrocarbon)	2	5	**10**	Use of cutter boxes. Perform environmental analysis prior to operation and enact needed mitigations.			1	4	**4**
Excavation (Access to Conductors)	Operations (Cost and Schedule)	Excavation too close to the jacket	Jacket shifting, damage to existing containment system Need to replace containment System.	4	1	**4**	Have back up containment system ready at beach to deploy.			4	1	**4**
Excavation (Access to Conductors)	Environmental	Excavation too close to the jacket	Jacket shifting, damage to existing containment system Plumes return to surface.	4	1	**4**	Have back up containment system ready at beach to deploy.			3	1	**3**
Excavation (Access to Conductors)	Operations (Cost and Schedule)	Dredging induced Slope failure	Collapse of the excavation site damaging containment system.	4	2	**8**	Engineering designed to withstand failure - Frame concept. Adequate slope based on soils testing, strength and engineering.			4	1	**4**
Excavation (Access to Conductors)	Operations (Cost and Schedule)	Never being able to fully excavate due to heaving	Failure to access conductors	4	3	**12**	Engineering designed to withstand failure - Frame concept. Adequate slope based on soils testing, strength and engineering.			4	1	**4**

Excavation (Access to Conductors)	Operations (Cost and Schedule)	Debris interfering with installation of the soil retaining wall	Debris being in the way of the required soil retaining wall not being able to install structure	3	5	**15**	Image Field to identify debris and develop plan prior to excavateDesign supporting structure and excavation plan to account for debris field			3	1	**3**
Excavation (Access to Conductors)	Health and Safety	Hazardous Operations	Serious injury from high hazard operations during campaign: - Working at Heights. - Energy Isolation - Dropped Objects - Confined Space - Lifting - Proper Utilization of Permit to Work, PPE, JSEA, MOC - Diving Operations - Competency of People	4	4	**16**	Hire contractors with good safety records, safety management systems. Assure competent workforce Training program. Proper on-site leadership / oversight. Inspection to assure proper equipment. Use of JSEA, Permit to Work, PPE, MOC, DROPS program, LOTO, Lift Plans, Toolbox Talks.			4	1	**4**
Excavation (Access to Conductors)	Operations	Lack of geotechnical data	Insufficient data to support operations and excavation	2	2	**4**	Good soils data and pre-engineering solution (get soils boring to confirm soil data) Use of caissons or frame Image Field to identify debris and develop plan prior to excavate			2	1	**2**
Excavation (Access to Conductors)	Operations	Uncertainty in permitting	Unable to perform operations. Approval for operations - permitting	4	2	**8**	Project pre-planning and Work Scope HAZID. Options analysis and risk assessment - keep regulatory body informed and included in planning.			4	1	**4**

Excavation (Access to Conductors)	Operations (Cost and Schedule)	Location of conductors and tubing	Lack of good data will not reduce the uncertainty of the area to be excavated	4	1	**4**	Good soils data and pre-engineering solution (get soils boring to confirm soil data) Use of caissons or frame Image Field to identify debris and develop plan prior to excavate			4	1	**4**
Excavation (Access to Conductors)	Environmental	Shifting or New Plumes or Release of Hydrocarbons. Destabilizing the current situation	Intervention work causes plume location to shift or new plume location to occur that the dome cannot capture	4	3	**12**	Have back up containment system ready at beach to deploy. Conduct full field sub-bottom imaging prior to excavation / intervention work.			3	1	**3**
Phase I - TA with WH	Operations	Pressurized gas	Uncontrolled release of pressurized gas releasing additional hydrocarbons, in case of pulling conductors.	2	2	**4**	Normal Pressured Reservoir. Use of proper kill fluid Hot Tap, kill any pressure and TA prior to moving any conductor / tubular. Wells to be pressure monitored for TA verification.			2	1	**2**
Phase I - TA with WH	Environmental	Shifting or New Plumes or Release of Hydrocarbons. Destabilizing the current situation	Intervention work causes plume location to shift or new plume location to occur that the dome cannot capture	4	3	**12**	Have back up containment system ready at beach to deploy. Conduct full field sub-bottom imaging prior to excavation / intervention work.			3	1	**3**

Phase I - TA with WH	Operations	Intervention related Problems	Schedule delay (NPT). Typically up to 30% of time is lost to: - New vessel / Competency of Crew, Invisible Lost Time (ILT) - DH Losses - Stuck Pipe / Depleted Zones - Hole Cleaning - Directional Control - Equipment (Top Drive, BOP's, Mud Pumps, etc....) - Fishing	3	4	**12**	Hire Contractor with track record in this type of operations Note - these operations are very specialized and there exist some very qualified and experienced personnel to perform. Ensure competency of personnel Adequate preplanning - Job on paper work shop			3	1	**3**
Phase II - WL Source Control / Abandonment Operations	Operations	Intervention related Problems	Schedule delay (NPT). Typically up to 30% of time is lost to: - New Rig / Competency of Crew, Invisible Lost Time (ILT) - DH Losses - Stuck Pipe / Depleted Zones - Hole Cleaning - Directional Control - Equipment (Top Drive, BOP's, Mud Pumps, etc....) - Fishing	3	4	**12**	Hire Contractor with track record in this type of operations Note - these operations are very specialized and there exist some very qualified and experienced personnel to perform. Ensure competency of personnel Adequate preplanning - Job on paper work shop			3	1	**3**

Phase I - TA with WH	Safety	Hazardous Operations	Serious injury from high hazard operations during campaign: - Working at Heights. - Energy Isolation - Dropped Objects - Confined Space - Lifting - Proper Utilization of Permit to Work, PPE, JSEA, MOC - Competency of People	4	4	**16**	Hire Contractor with track record in this type of operations Note - these operations are very specialized and there exist some very qualified and experienced personnel to perform. Ensure competency of personnel Adequate preplanning - Job on paper work shop			4	2	**8**
Phase I - TA with WH	Environmental	Mudslide or other	Damage to containment system leads to new plume or plume resurfacing	4	2	**8**	Have back up containment system ready at beach to deploy.			3	1	**3**
Phase II - WL Source Control / Abandonment Operations	Environmental	Mudslide or other	Damage to containment system leads to new plume or plume resurfacing	4	2	**8**	Have back up containment system ready at beach to deploy.			3	1	**3**
Phase II - WL Source Control / Abandonment Operations	Safety	Hazardous Operations	Serious injury from high hazard operations during campaign: - Working at Heights. - Energy Isolation - Dropped Objects - Confined Space - Lifting - Proper Utilization of Permit to Work, PPE, JSEA, MOC - Competency of People	5	4	**20**	Hire Contractor with track record in this type of operations Note - these operations are very specialized and there exist some very qualified and experienced personnel to perform. Ensure competency of personnel Adequate preplanning - Job on paper work shop			4	1	**4**

Phase II - WL Source Control / Abandonment Operations	Environmental	Destabilizing the current situation	Intervention work causes plume location to shift or new plume location to occur that the dome cannot capture	4	3	**12**	Hot Tap, kill any pressure and TA prior to moving any conductor / tubular. Have back up containment system ready at dock.			3	1	**3**
Phase II - WL Source Control / Abandonment Operations	Environmental	Damage to existing conductors	Releasing of additional hydrocarbons, if conductors are pulled.	4	3	**12**	Hot Tap, kill any pressure and TA prior to moving any conductor / tubular. Have back up containment system ready at dock.			3	1	**3**
Phase II - WL Source Control / Abandonment Operations	Operations	Kink in the tubing	Kink in the tubing makes it difficult to plug lower zone	3	4	**12**	Ability to cut tubing / fish tubing Perform full field scan prior to operations, determine if any curative of radius or potential kink. Put / design mitigations, e.g. cutting / pulling devise to remove any potential kink. Plan to set top plug (Bullhead / squeeze) if cannot get by.	Scans - BSEE Design - TA to WH Vendor.		3	2	**6**

Drilling	Environmental	Loss of well control to the surface	Collision with another wellbore. Ellipses of uncertainty and depth of well. Release more oil affecting marine life Potential uncontrolled release of oil results in regional impact on sensitive environmental resources.	4	2	**8**	Prepare with Heavy Mud (enough barite to add 1ppg above reservoir pressure) * Adequate planning * Real-time monitoring of MWD magnetic interference * No approach until after intermediate casing * Torque/vibration monitoring in BHA * Stop drilling, run ranging tool for confirmation Heighten monitoring protocols, multiple ranging runs Have Back up Containment System ready at dock.			3	1	**3**
Drilling	Operations	Limited type of rigs for the operation	Schedule, availability and cost. Would BSEE approve? There are currently two maybe three rigs available. Potential damage to containment system from moored rig or jack-up rig.	5	3	**15**	Use Combo Rig - Quick release moored with DP capability. Engage contractor early to have right rig on contract. Have back up containment system ready at beach to deploy.			5	1	**5**
Drilling	Operations	Increased complexity of operations	Conditions forces subsea stack, riser system, subsea containment system etc.	5	2	**10**	* Review conductor design - enhance (bigger, thicker, deeper) * Adequate riser margin in case BOP/Wellhead lost Identified in Approach of Operation and planned for in Option			1	1	**1**

							Weighting (Cost and Schedule)					
Drilling	Environmental	Mudslide	Significant weather event and sediment buildup causes to sheer riser below stack. Potential uncontrolled release of oil results in regional impact on sensitive environmental resources.	5	2	**10**	* Review conductor design - enhance (bigger, thicker, deeper) * Adequate riser margin in case BOP/Wellhead lost Use of Combo Rig with quick release moored system and DP capability. Have back up containment system at dock ready.			3	1	**3**
Drilling	Operations	Significant weather event	Impact to schedule, damage to rig	5	3	**15**	Use Combo Rig - Quick release moored with DP capabilityIdentified in Approach of Operation and planned for in Option Weighting (Cost and Schedule)			3	1	**3**
Drilling	Operations	Ability to intercept the wellbore	Failure to stop the flow. Ellipses of uncertainty for 28+9 wells Cannot get bottom plug.	5	3	**15**	Directional Control & pre-planning. Have good data. Potential to use current or other to identify 9 wells drilled by Taylor. Combine this option with Excavation for access option should reduce probability to a 1 (However this	Intercept well provider - will need more detailed study.		5	2	**10**

							decision needs to be made)						
Drilling	Operations	Ability to intercept the wellbore at producing zone (lower plug)	The 9 IA wells drilled previously by TEC will cause interference issues with the 9 target wells. Ranging techniques will not be able to discern which well is which. Cannot intercept these wells to set bottom plug. Cannot get access target well to effectively set bottom plug. Note - the bottom plug will need to be set across producing zone or slightly above across tubing, and annuli to assure leak paths are plugged. Cost go up and schedule increases drastically in continued attempts or cannot meet the Intercept Well	5	4	**20**	Intercept at a higher point which avoids the interference issue. Directional Control & pre-planning. Have good data. * Re-enter previous intervention wells - side track at point where wells are sufficiently separated ** This applies to all risks involving interference from previous TEC intervention wells Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made)	Intercept well provider - will need more detailed study.		5	2	**10**

			operational objective (2 plugs)										
Drilling	Environmental	Ability to intercept the wellbore at producing zone (lower plug)	The 9 IA wells drilled previously by TEC will cause interference issues with the 9 target wells. Ranging techniques will not be able to discern which well is which. Cannot intercept these wells to set bottom plug. Cannot get access target well to effectively set bottom plug. Note - the bottom plug will need to be set across producing zone or slightly	4	4	**16**	Intercept at a higher point which avoids the interference issue. Directional Control & pre-planning. Have good data. Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made) Have back up containment system at the dock.			3	2	**6**

			above across tubing, and annuli to assure leak paths are plugged. Do not solve the long-term environmental objectives. Leak continues.									
Drilling	Reputation/ Public Confidence	Ability to intercept the wellbore at producing zone (lower plug)	The 9 IA wells drilled previously by TEC will cause interference issues with the 9 target wells. Ranging techniques will not be able to discern which well is which. Cannot intercept these wells to set bottom plug. Cannot get access target well to effectively set bottom plug. Note - the bottom plug will need to be set across producing zone or slightly above across tubing, and annuli to assure leak paths are plugged. Problem persists, spend inordinate amount of time, money and still do not solve problem.	5	4	**20**	Intercept at a higher point which avoids the interference issue. Directional Control & pre-planning. Have good data. Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made)	Intercept well provider - will need more detailed study.		4	2	**8**

			Industry and Regulators are viewed in very bad light. Can affect the access to existing and new area and/or current and prospective entrants.									
Planning	Operations	Approval for operations - permitting	Unable to perform operations	4	1	**4**	Use of a combo rig should allow for permitting concerns.			4	1	**4**
Plug & Abandonment	Operations	Inability to test bottom plug or set top plug.	Cannot get access target well higher to test the bottom plug, no verification of plug. Note - the top plug will need to be set across tubing, and annuli to assure leak paths are plugged. Cost go up and schedule increases drastically in continued attempts or cannot meet the Intercept Well operational objective (2 plugs)	5	4	**20**	Test from intercept wellbore. This would be a limited test to FIT. Intercept at a higher point which avoids the interference issue. Directional Control & pre-planning. Have good data. * Re-enter previous intervention wells - side track at point where wells are sufficiently separated ** This applies to all risks involving interference from previous TEC intervention wells Combine this option with Excavation for access option should reduce probability to a	Intercept well provider - will need more detailed study.		3	3	**9**

							1 (However this decision needs to be made)					
Plug & Abandonment	Environmental	Inability to test bottom plug or set top plug.	Cannot get access target well higher to test the bottom plug, no verification of plug. Note - the top plug will need to be set across tubing, and annuli to assure leak paths are plugged. Do not solve the long-term environmental objectives. Leak continues.	4	5	**20**	Intercept at a higher point which avoids the interference issue. Directional Control & pre-planning. Have good data. Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made) Have back up containment system at the dock.			3	2	**6**
Excavation (Access to Conductors)	Operations (Cost and Schedule)	New Expression of Oil due to damage to RSS or shift in plume	New Expression of Oil due to damage to RSS or shift in plume	2	2	**4**	Have back up containment system ready at beach to deploy.			4	1	**4**
Excavation (Access to Conductors)	Environmental	New Expression of Oil due to damage to RSS or shift in plume	New Expression of Oil due to damage to RSS or shift in plume	2	3	**6**	Have back up containment system ready at beach to deploy.			4	1	**4**

Plug & Abandonment	Reputation/ Public Confidence	Inability to test bottom plug or set top plug.	Cannot get access target well higher to test the bottom plug, no verification of plug. Note - the top plug will need to be set across tubing, and annuli to assure leak paths are plugged. Problem persists, spend inordinate amount of time, money and still do not solve problem. Industry and Regulators are viewed in very bad light. Can affect the access to existing and new area and/or current and prospective entrants.	4	4	**16**	Test from intercept wellbore. This would be a limited test to FIT. Intercept at a higher point which avoids the interference issue. Directional Control & pre-planning. Have good data. * Re-enter previous intervention wells - side track at point where wells are sufficiently separated ** This applies to all risks involving interference from previous TEC intervention wells Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made)	Intercept well provider - will need more detailed study.		3	3	**9**
Post-Operations	Environmental	Long-Term Environment Leak. Oil from Upper unplugged Zones Broach Mudline.	Do not abandoned top zones. release of more oil (Gas or Produced Water) due to shallow zone broaching of hydrocarbons to surface. Harm to marine life. Causing additional leak patterns.	5	4	**20**	Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made)	BSEE, USCG & NOAA		4	1	**4**

Post-Operations	Reputation/ Public Confidence	Long-Term Environment Leak. Oil from Upper unplugged Zones Broach Mudline.	Do not abandoned top zones. release of more oil (Gas or Produced Water) due to shallow zone broaching of hydrocarbons to surface. Harm to marine life. Causing additional leak patterns.	5	4	**20**	Combine this option with Excavation for access option should reduce probability to a 1 (However this decision needs to be made)	BSEE, USCG & NOAA		4	1	**4**
Abandonment Operations	Environmental	Loss of well integrity in target well	Release of hydrocarbons through alternative leak paths impacting marine life. Flow from one zone to another zone. Potential uncontrolled release of oil results in regional impact on sensitive environmental resources.	4	2	**8**	Use of heavy kill mud. Good directional control. Have back up containment system ready at beach to deploy.			3	1	**3**
Abandonment Operations	Environmental	Shifting or New Plumes or Release of Hydrocarbons. Destabilizing the current situation	Intercept work causes plume location to shift or new plume location to occur that the dome cannot capture	4	3	**12**	Have back up containment system ready at beach to deploy. Conduct full field sub-bottom imaging prior to intercept wells.			3	2	**6**
Drilling	**Environmental**	Operational timing of the scope of work	Will take 3 to 5 years to complete. If too long it can impact the current containment system.	4	2	**8**	Have back up containment system ready at beach to deploy. Inspect system during			3	1	**3**

							pump off operations. Adhere to maintenance plan.						

Appendix A.4. – Excavation for Access

Risk Assessment Template - Excavation for Access and Intervention Option												
Scope of Work (Job Category)	**Consequence Type**	**Risk Name**	**Event Description / Impact**	**Uncontrolled Assessment (Cons x Prob = Risk)**			**Mitigation / Action**	**Owner**	**By Date**	**Post Mitigation Assessment (Cons x Prob = Risk)**		
				Cons.	**Prob.**	**Risk**				**Cons.**	**Prob.**	**Risk**
Excavation (Access to Conductors)	Operations (Cost and Schedule)	Mudslide	Mudslide collapses the excavation site.	4	1	**4**	Have back up containment system ready at beach to deploy.			3	1	**3**
Excavation (Access to Conductors)	Environmental	Mudslide or other	Damage to containment system leads to plume resurfacing	4	2	**8**	Have back up containment system ready at beach to deploy.			3	1	**3**
Excavation (Access to Conductors)	Environmental	Short term environmental impacts	Excavation causes: - Movement of soils (release of entrained hydrocarbons) - Movement of soils (Disturbs local animals - Shrimp, Worms, Fish) - Movement of soils (Soils displaced to other location could contain hydrocarbon)	2	5	**10**	Use of cutter boxes. Perform environmental analysis prior to operation and enact needed mitigations.			1	4	**4**
Excavation (Access to Conductors)	Operations (Cost and Schedule)	Excavation too close to the jacket	Jacket shifting, damage to existing containment system Need to replace	4	1	**4**	Have back up containment system ready at beach to deploy.			4	1	**4**

			containment System.									
Excavation (Access to Conductors)	Environmental	Excavation too close to the jacket	Jacket shifting, damage to existing containment system Plumes return to surface.	4	1	**4**	Have back up containment system ready at beach to deploy.			3	1	**3**
Excavation (Access to Conductors)	Operations (Cost and Schedule)	Dredging induced Slope failure	Collapse of the excavation site damaging containment system.	4	2	**8**	Engineering designed to withstand failure - Frame concept. Adequate slope based on soils testing, strength and engineering.			4	1	**4**
Excavation (Access to Conductors)	Operations (Cost and Schedule)	Never being able to fully excavate due to heaving	Failure to access conductors	4	3	**12**	Engineering designed to withstand failure - Frame concept. Adequate slope based on soils testing, strength and engineering.			4	1	**4**
Excavation (Access to Conductors)	Operations (Cost and Schedule)	Debris interfering with installation of the soil retaining wall	Debris being in the way of the required soil retaining wall not being able to install structure	3	5	**15**	Image Field to identify debris and develop plan prior to excavate Design supporting structure and excavation plan to account for debris field			3	1	**3**

Excavation (Access to Conductors)	Health and Safety	Hazardous Operations	Serious injury from high hazard operations during campaign: - Working at Heights. - Energy Isolation - Dropped Objects - Confined Space - Lifting - Proper Utilization of Permit to Work, PPE, JSEA, MOC - Diving Operations - Competency of People	4	4	**16**	Hire contractors with good safety records, safety management systems. Assure competent workforce Training program. Proper on-site leadership / oversight. Inspection to assure proper equipment. Use of JSEA, Permit to Work, PPE, MOC, DROPS program, LOTO, Lift Plans, Toolbox Talks.			4	1	**4**
Excavation (Access to Conductors)	Operations	Lack of geotechnical data	Insufficient data to support operations and excavation	2	2	**4**	Good soils data and pre-engineering solution (get soils boring to confirm soil data) Use of caissons or frame Image Field to identify debris and develop plan prior to excavate			2	1	**2**
Excavation (Access to Conductors)	Operations	Uncertainty in permitting	Unable to perform operations. Approval for operations - permitting	4	2	**8**	Project pre-planning and Work Scope HAZID. Options analysis and risk assessment - keep regulatory body informed and included in planning.			4	1	**4**
Excavation (Access to Conductors)	Operations (Cost and Schedule)	Location of conductors and tubing	Lack of good data will not reduce the uncertainty of the area to be excavated	4	1	**4**	Good soils data and pre-engineering solution (get soils boring to confirm soil data) Use of caissons or frame Image Field to identify			4	1	**4**

							debris and develop plan prior to excavate					
Excavation (Access to Conductors)	Environmental	Shifting or New Plumes or Release of Hydrocarbons. Destabilizing the current situation	Intervention work causes plume location to shift or new plume location to occur that the dome cannot capture	4	3	**12**	Have back up containment system ready at beach to deploy. Conduct full field sub-bottom imaging prior to excavation / intervention work.			3	1	**3**
Phase I - TA with WH	Operations	Pressurized gas	Uncontrolled release of pressurized gas releasing additional hydrocarbons, in case of pulling conductors.	2	2	**4**	Normal Pressured Reservoir. Use of proper kill fluid Hot Tap, kill any pressure and TA prior to moving any conductor / tubular. Wells to be pressure monitored for TA verification.			2	1	**2**
Phase I - TA with WH	Environmental	Shifting or New Plumes or Release of Hydrocarbons. Destabilizing the current situation	Intervention work causes plume location to shift or new plume location to occur that the dome cannot capture	4	3	**12**	Have back up containment system ready at beach to deploy. Conduct full field sub-bottom imaging prior to excavation / intervention work.			3	1	**3**
Phase I - TA with WH	Operations	Intervention related Problems	Schedule delay (NPT). Typically up to 30% of time is lost to: - New vessel / Competency of Crew, Invisible Lost Time (ILT) - DH Losses - Stuck Pipe / Depleted Zones - Hole Cleaning - Directional Control	3	4	**12**	Hire Contractor with track record in this type of operations Note - these operations are very specialized and there exist some very qualified and experienced personnel to perform. Ensure competency of personnel Adequate preplanning - Job on paper work shop			3	1	**3**

			- Equipment (Top Drive, BOP's, Mud Pumps, etc.…) - Fishing									
Phase II - WL Source Control / Abandonment Operations	Operations	Intervention related Problems	Schedule delay (NPT). Typically up to 30% of time is lost to: - New Rig / Competency of Crew, Invisible Lost Time (ILT) - DH Losses - Stuck Pipe / Depleted Zones - Hole Cleaning - Directional Control - Equipment (Top Drive, BOP's, Mud Pumps, etc.…) - Fishing	3	4	**12**	Hire Contractor with track record in this type of operations Note - these operations are very specialized and there exist some very qualified and experienced personnel to perform. Ensure competency of personnel Adequate preplanning - Job on paper work shop			3	1	**3**
Phase I - TA with WH	Safety	Hazardous Operations	Serious injury from high hazard operations during campaign: - Working at Heights. - Energy Isolation - Dropped Objects - Confined Space - Lifting - Proper Utilization of Permit to Work, PPE, JSEA, MOC - Competency of People	4	4	**16**	Hire Contractor with track record in this type of operations Note - these operations are very specialized and there exist some very qualified and experienced personnel to perform. Ensure competency of personnel Adequate preplanning - Job on paper work shop			4	2	**8**

Phase I - TA with WH	Environmental	Mudslide or other	Damage to containment system leads to new plume or plume resurfacing	4	2	**8**	Have back up containment system ready at beach to deploy.			3	1	**3**
Phase II - WL Source Control / Abandonment Operations	Environmental	Mudslide or other	Damage to containment system leads to new plume or plume resurfacing	4	2	**8**	Have back up containment system ready at beach to deploy.			3	1	**3**
Phase II - WL Source Control / Abandonment Operations	Safety	Hazardous Operations	Serious injury from high hazard operations during campaign: - Working at Heights. - Energy Isolation - Dropped Objects - Confined Space - Lifting - Proper Utilization of Permit to Work, PPE, JSEA, MOC - Competency of People	5	4	**20**	Hire Contractor with track record in this type of operations Note - these operations are very specialized and there exist some very qualified and experienced personnel to perform. Ensure competency of personnel Adequate preplanning - Job on paper work shop			4	1	**4**
Phase II - WL Source Control / Abandonment Operations	Environmental	Destabilizing the current situation	Intervention work causes plume location to shift or new plume location to occur that the dome cannot capture	4	3	**12**	Hot Tap, kill any pressure and TA prior to moving any conductor / tubular. Have back up containment system ready at dock.			3	1	**3**
Phase II - WL Source Control / Abandonment Operations	Environmental	Damage to existing conductors	Releasing of additional hydrocarbons, if conductors are pulled.	4	3	**12**	Hot Tap, kill any pressure and TA prior to moving any conductor / tubular. Have back up containment system ready at dock.			3	1	**3**

Phase II - WL Source Control / Abandonment Operations	Operations	Kink in the tubing	Kink in the tubing makes it difficult to plug lower zone	3	4	**12**	Ability to cut tubing / fish tubing Perform full field scan prior to operations, determine if any curative of radius or potential kink. Put / design mitigations, e.g. cutting / pulling devise to remove any potential kink. Plan to set top plug (Bullhead / squeeze) if cannot get by.	Scans - BSEE Design - TA to WH Vendor.		3	2	**6**
Excavation (Access to Conductors)	Operations	Significant weather event	Impact to schedule, damage to excavation(re-sloughing)	5	3	**15**	Use engineered designed system to assure withstand re-sloughing.			4	2	**8**
Planning	Operations	Approval for operations - permitting	Unable to perform operations due to environmental assessment	5	3	**15**	Aligned goals of Federal Agencies and inclusion in plans. Note - in option ranking source control and abandonment ranked higher than short term environmental (expressions) criteria. Also, per NOAA work and initial results of suction pile operations it appears that oil concentrations may be only near dome area. Additional mitigations include: - Mobile containment system - Potential knockout box.			3	2	**6**

Excavation (Access to Conductors) + TA with WH	Safety	Diver Safety	Injury to divers during excavation operation, Hot tapping, or wellhead installation	5	3	**15**	Hire contractors with good safety records, safety management systems. Assure competent workforce Training program. Proper on-site leadership / oversight. Use of JSEA, Permit to Work, PPE, MOC. Develop ROV interface system, i.e. no divers. Use of soil movement detection devise to give advance warning of any movement or sloughing. Use of engineered designed system (frame and truss with piles of pile system for cofferdam. Same comment as above with respect to duration of project.			3	2	**6**
Excavation (Access to Conductors) + TA with WH	Public Confidence	Public Confidence due to operation failure.	Operation does not work and public losses confidence in BSEE, USCG, Industry	5	3	**15**	Have multiple back up containment system ready at beach to deploy. Combine with other options to get best chance of success. Follow through the process with FISTE, Risks and Option Ranking. Trust the process. Combine with other safe and viable options to get best outcome. Issue the order and hold			3	2	**6**

							TEC feet to the fire or federalize and initiate response.					