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Sea Riser Modelling of combination Glass Reinforced Epoxy and Steel tubing for Offshore Drilling in Antarctica.

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Distribution

The following notes and modeling report by Stress Engineering Services (SES) is made available to third parties via the Paleoclimate Records of the Antarctic Margin and Southern Ocean (PRAMSO:SCAR) website. The modeling as a commercial contract was commissioned by Victoria University of Wellington (VUW) and funded from ANDRILL Science Steering Committee (ASC) subscriptions that where held at the University of Nebraska at Lincoln (UNL). These community funds are now held by SCAR-PRAMSO and this report is open to be used by the international science drilling community. VUW, UNL and SES take no responsibility how third parties interpret or use this modeling study.

Background

The New Zealand Antarctic programme has initiated a new programme of research on the Ross Ice Shelf and associated oceanography, marine glaciology and sedimentology. An intermediate depth capable hot water drill based on the British Antarctic Survey (BAS) modular designs has been built by Victoria University of Wellington and this will support the Ross Ice Shelf research projects. Access of the sea floor glaciological record to any significant depth (10's-100's of metres) is still technically problematic and the subject of the following notes and SES report.

The Cape Roberts Project, ANDRILL project MIS, SMS and prospective Coulman High sites all required a sea riser (casing) to enable the slim hole diamond coring technologies that were used to recover high quality rock cores from the sea floor. SES undertook sea riser modeling studies for these drilling operations.

Our past experience indicates that a riser casing is required to enable the use of similar drilling technologies through the Ross Ice Shelf and water column to access the sea floor sedimentary sequences. To integrate sea floor drilling technologies with the modular HWD operations and make it practical to deploy by traverse to remote locations, we require drilling technologies that are as small and light as possible. Our previous sea risers have been constructed from threaded steel tubing which for a nominal 1000 m depth capability (ice shelf and water column thickness) would make this too heavy for the capacity of the "small" drill rig we propose to integrate with the HWD operations. For this reason we commissioned SES to model a riser comprising a combination of lighter Glass Reinforced Epoxy (GRE) tubing and steel slim hole drill rods. To achieve our desired scale of "light" drilling equipment we should consider that the proposed drilling operation is "exploratory in nature" with nominal limits on the ice/water depth of 1000 m and possible penetration into the sea floor of 100-200 m.

Sea Riser Concept

The purpose of the modeling is to determine the general viability of a small diameter riser comprising a mix of Steel and Glass Reinforced Epoxy tubulars deployed from a floating ice platform for coring into the sea floor.

SES have modeled a riser of nominally 3.5 inch GRE tubing and an H size steel slim hole diamond coring drill rod. The GRE tubing is derived from the oil industry and the steel tubing from the minerals industry. Each industry uses different dimensioned tubulars and thread systems so careful consideration is required for a combination riser enable N size diamond drilling to be practical. The GRE tubular is externally upset at the threaded coupling whereas the steel casing is externally flush coupled.

A fundamental requirement of the riser configurations that have been modeled has been that the stronger and more rigid steel tubing has been used in zones that have higher curvature. This improves the overall strength of the riser configuration and should reduce clearance problems with the internal slim hole drill string, barrel and coring inner tubes through the curved zones. In addition by deploying steel casing in the lower part of the ice shelf hole improved ice melting (by conduction through the steel tube) with hot water should enable unfreezing of the riser for recovery after coring. Limiting the GRE casing in the straight sections of the riser should also reduce the internal wear rate of this tubular caused by the rotation of the internal drill string.

Riser Modelling Results

The modeling results show that in multiple generalised situations a combination of steel and GRE tubular will provide a satisfactory “light riser”. The maximum combined weight of the riser and drill string was limited to 9.99 mT which is the working load of the type of small compact drill rig we are considering. Changes to the riser and drill strings could increase the total load of the system requiring a different drill rig capability. Ice platform offset and current velocities are variables that are modeled to help access the viability of a drilling site. It should be noted that a range of nominal site conditions are considered, however to assess the riser performance for a specific site operation it is **strongly recommended that specific site environment data be collected** in addition to ice and water depths and should include ice platform moment rates, tidal range and cycle, water column currents profiles, to determine how the modeling results can be applied. Further modeling using the site specific data may be required to help constrain the riser design and drilling operations including curvature in the near floor steel sections that would affect the passage of the drill string coring tools. As noted by SES the detailed design and performance of the sea floor telescopic joint/stress joint may also require specific modelling as this may influence the configuration of the stinger, the weight required to set it in the soil, and the loads that the "sea floor" may be required to bear.

Sincerely
Alex R. Pyne

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STRESS ENGINEERING SERVICES INC.

an employee-owned company

Riser Analysis for Drilling Offshore Antarctica

Final Report

Prepared for:

Antarctic Research Centre – Victoria Univ. of Wellington

Wellington, New Zealand

12 March 2019

SES Document No.: 1103701-RR-RP-01 (Rev 0)

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Antarctic Research Centre – Victoria Univ. of Wellington

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Executive Summary

Stress Engineering Services, Inc. (SES) was contracted by Antarctic Research Centre – Victoria Univ. of Wellington to perform riser analysis for a lightweight riser system to be used for scientific drilling offshore Antarctica. The system would be run from a mobile drilling rig that is proposed to be operated on floating ice at various locations close to Antarctica.

The riser serves as a conduit to guide a drill string to the borehole. For practical reasons, a light-weight system is desired, thus it has been proposed to configure sections of the riser using glass-reinforced epoxy (GRE) pipe as needed, particularly for sites in relatively deep water.

This analysis focuses on determining displacements, loads, and stresses on the riser system to determine the amount of ice movement that the riser system can accommodate. The analysis accounts for many combinations of water depth, ice thickness, current speed and direction, bottom weight, and the presence of the drill string.

This report discusses four configurations of the system that are meant to accommodate various combinations of water depth and ice thickness. For those circumstances that may benefit from use of the GRE pipe, the configurations place steel pipe in the sections where the highest bending moments are expected and locates GRE pipe at least 50 meters away from those locations. This is to operate the GRE pipe within limits on curvature that are recommended by the pipe manufacturer.

This report discusses the performance of this system in a wide variety of circumstances with emphasis on determining the amount of ice movement that the system can accommodate before it reaches the first of several limits on stress, curvature, and stroke. The analysis shows that stresses caused by bending tend to be concentrated near the mudline and where the riser emerges from the bottom of the ice layer. The high bending stresses predicted near the mudline arise from an assumed fixed boundary condition there. If the foundation does indeed behave that way, the telescopic joint may benefit from a more robust section (larger OD and or thicker wall).

On the other hand, the foundation may be more compliant than this analysis has assumed. In that case, the limitation on offset may actually be the integrity of the foundation. Although the foundation was not the focus of this analysis, this report also discusses load and shear force at the mudline assuming that the foundation is firm enough to bear the loads that would be imposed on it in these conditions. This may influence the composition and installation process of the foundation. Consequently, it may be beneficial to establish bounding assumptions about the near-surface soil properties and perform additional analysis that includes the stinger and soil to identify and mitigate any limitations on the system's ability to accommodate ice movement that might arise from that.

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1. Introduction

Stress Engineering Services, Inc. (SES) was contracted by Antarctic Research Centre – Victoria Univ. of Wellington to perform riser analysis for a lightweight riser system to be used for scientific drilling offshore Antarctica. The system would be run from a mobile drilling rig that is proposed to be operated on floating ice at various locations close to Antarctica.

The riser serves as a conduit to guide a drill string to the borehole. For practical reasons, a light-weight system is desired, thus it has been proposed to configure sections of the riser using glass-reinforced epoxy (GRE) pipe as needed, particularly for sites in relatively deep water.

This analysis focuses on determining displacements and the resulting loads and stresses borne by the riser system to determine the amount of ice movement that the riser system can accommodate. The analysis accounts for many combinations of water depth, ice thickness, current speed and direction, bottom weight, and the presence of the drill string.

This report discusses four configurations of the system that are meant to accommodate various combinations of water depth and ice thickness. For those circumstances that may benefit from use of the GRE pipe, the configurations place steel pipe in the sections where the highest bending moments are expected and locates GRE pipe at least 50 meters away from those locations. This is to operate the GRE pipe within limits on curvature that are recommended by the pipe manufacturer.

2. Riser Configurations

This analysis assumes that the riser will be configured for each site according to one of four generic configuration types, which are illustrated in Figure 1.

Type 1 applies to deep sites where both the ice thickness and the interval of water below the ice are large enough to accommodate GRE in both in the ice layer and below it. The bottom section of Type 1 includes the foundation and the telescopic joint as well as a length of steel pipe above the outer barrel. Next is the lower GRE section. This is followed by an upper steel section. The upper steel section is located so that the middle of this section is at the bottom of the ice, thereby placing the burden of any bending moments that are generated there on steel pipe rather than GRE pipe. The upper GRE section is located entirely within the ice, with the intent of making any curvature that is developed there negligible.

Type 2 eliminates the upper GRE section from Type 1. This is applicable when the ice thickness is small.

Type 3 eliminates both the upper GRE and upper steel section from Type 1. (Alternatively, this could be thought of as eliminating the upper steel section and the lower GRE section.) In this case, the remaining GRE section would be entirely within the ice, again placing the burden of any bending created near the

foundation or the bottom of the ice on steel pipe. This is applicable for sites where the ice is thick enough to accommodate a GRE section but the water column below the ice is too short to accommodate a section of GRE.

Type 4 is all steel, so it could be thought of as eliminating all but the bottom section from Type 1. This is most applicable to sites that are shallow enough that GRE sections are not needed. In those cases, removing the GRE eliminates the limitation that it imposes on curvature.

The transitions between steel and GRE are located 50 meters away from locations where high bending moments are anticipated. This is intended to limit curvature in the GRE section to acceptable amounts. The transition from the lower steel section to GRE section, if applicable, is always at least 50 meters above the top of the outer barrel and 55 meters above the mudline. The transition from the lower GRE section to the upper steel section (where applicable) is always 50 meters below the bottom of the ice. The transition from the upper steel section to the upper GRE section (where applicable) is always 50 meters above the bottom of the ice. This approach produces long sections of GRE, where practical, while minimizing the amount of bending that either GRE section will experience. The length of each buffer was assumed to be 50 meters based on hand calculations using the bending rigidity of the steel pipe and the expected range of effective tensions. It is possible that the length of each buffer could be adjusted to optimize weight and performance. This has not been investigated in this analysis.

For each combination of depth and ice thickness, the analysis included cases with and without the drill string present. With the drill string present, the analysis accounted for the case where the drill string was at the mudline and hanging under its own weight, this the weight on bit is assumed to be nearly zero which we understand to be representative of this type of coring operation.

The model has a fixed boundary condition at the mudline, meaning that the bottom node, which is located at the mudline, is unable to rotate or displace in any direction. The air gap between the drilling rig and the water line has been assumed to be 10% of the ice thickness in all cases. The riser was assumed to be filled with sea water from the mudline to the drilling rig.

In each case, the model was assumed to be purely vertical before any current or ice movement is applied, so the borehole is assumed to be located directly below the initial position of the drilling rig and the foundation is assumed to be vertical.

The telescopic joint is assumed to be 5 meters in overall length. The inner barrel has the same OD and wall thickness as the steel sections above the telescopic joint (3.500 inch OD x 0.155 inch wall). The outer barrel is assumed to have 4.500 inch OD and 0.250 wall and a seal between the outer barrel and inner barrel has been assumed to act on a 3.500 inch diameter. The seal diameter may be important if it is foreseeable that pressure inside the telescopic joint could be higher than outside. In that case, a large seal diameter can lead to “effective compression” in the telescopic joint that may require weight to offset it (to prevent the telescopic joint from extending and to prevent large bending in the riser).

For cases that include the drill string, the OD of the drill string has 2.750 inches OD with a 0.155 inch wall.

Table 1 summarizes each configuration. The table shows top tension with and without the drill string present. This table also assumes that the weight added to the outer barrel is 1.5 mT (dry weight). Each configuration was also evaluated with less weight on the outer barrel (0.5 and 1.0 mT).

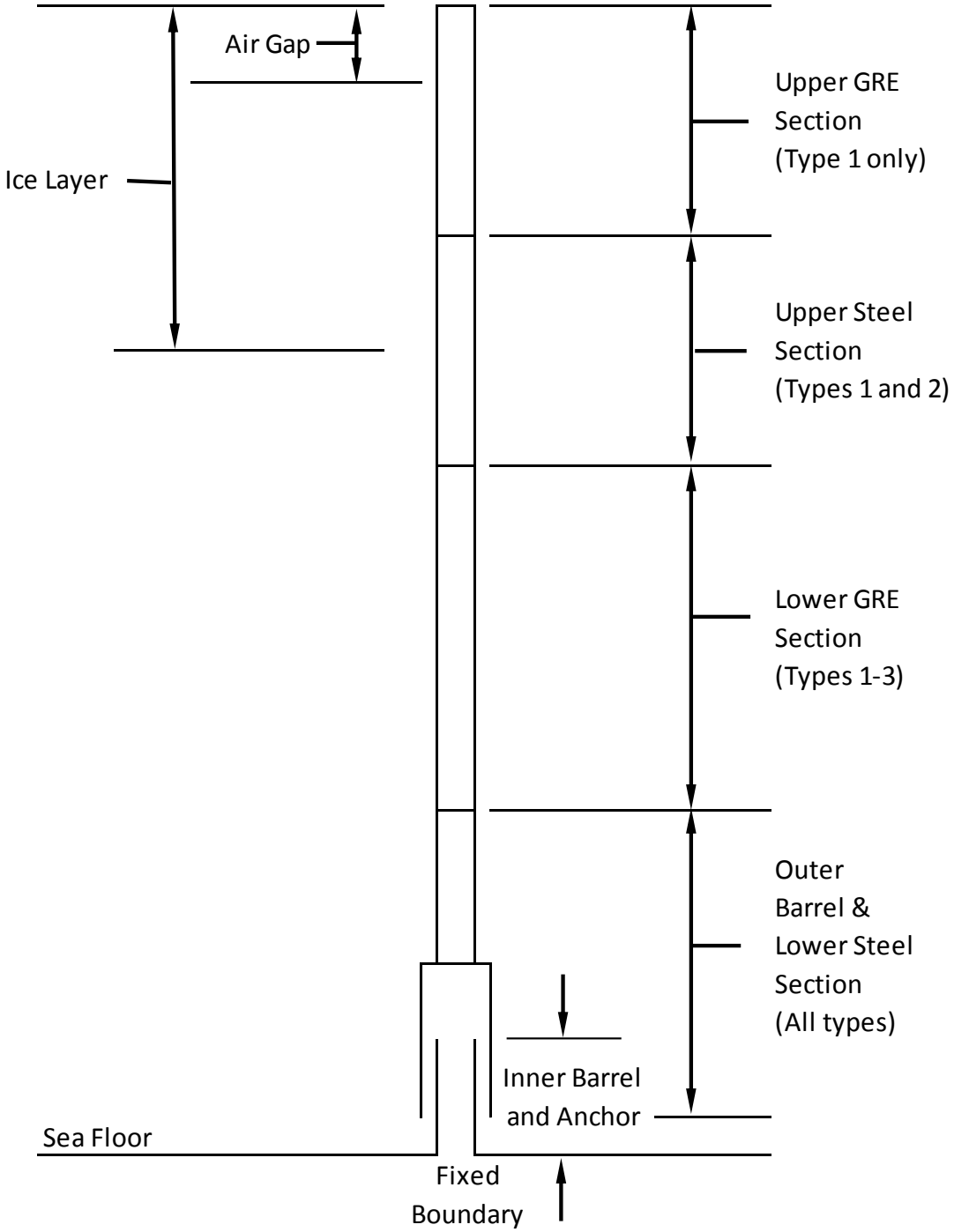


Figure 1: Riser Configuration Types

Table 1: Riser Configurations and Top Tensions

					Type 1				Type 2			Type 3		Type 4	Top Tension (mT)		
OB Weight (mT)	Ice (m)	Water Below Ice (m)	Total Riser Length (m)	Air Gap (m)	Upper GRE Section Length (m)	Upper Steel Section Length (m)	GRE Section Length (m)	Lower Steel Section Length (m)	Upper Steel Section Length (m)	GRE Section Length (m)	Lower Steel Section Length (m)	GRE Section Length (m)	Steel Section Length (m)	Steel Length (m)	Riser (mT)	Drill String (when incl.) (mT)	Total (mT)
1.5	0	100	100	0										95	2.09	0.57	2.66
		200	200	0					50	95	50				2.30	1.15	3.46
		400	400	0					50	295	50				2.68	2.32	5.00
		700	700	0					50	595	50				3.25	4.06	7.31
		1000	1000	0					50	895	50				3.82	5.81	9.63
	300	10	310	30								250	55		2.25	1.82	4.07
		25	325	30								250	70		2.36	1.91	4.27
		50	350	30								250	95		2.56	2.05	4.61
		100	400	30								250	145		2.95	2.34	5.29
		200	500	30	250	100	95	50							3.17	2.93	6.09
		400	700	30	250	100	295	50							3.54	4.09	7.63
		700	1000	30	250	100	595	50							4.11	5.84	9.95
	500	10	510	50								450	55		2.63	3.00	5.63
		25	525	50								450	70		2.74	3.09	5.83
		50	550	50								450	95		2.94	3.23	6.17
		100	600	50								450	145		3.32	3.53	6.85
		200	700	50	450	100	95	50							3.54	4.11	7.65
		400	900	50	450	100	295	50							3.92	5.27	9.19
		500	1000	50	450	100	395	50							4.11	5.86	9.96
	800	10	810	80								750	55		3.19	4.77	7.97
		25	825	80								750	70		3.31	4.86	8.17
		50	850	80								750	95		3.50	5.01	8.51
		100	900	80								750	145		3.89	5.30	9.19
		200	1000	80	750	100	95	50							4.11	5.88	9.99

3. Riser Analysis

This riser analysis accounts for 1296 load cases, as follows:

- (24) configurations shown in Table 1
- (3) bottom weights (0.5, 1.0, and 1.5 mT)
- (9) current speeds (0, ±0.25, …, ±1.0 m/s)
- with and without drill pipe in the riser.

The analysis is “static”, meaning that no wave loading has been applied. Each load case was evaluated at various levels of ice movement (“offset”) from directly over the borehole to 20% of the distance from the bottom of the ice to the mudline in increments of 1%. For each case, the results were queried to determine:

- maximum nominal stress in each steel cross-section (4.500 inch OD x 0.250 inch wall in the outer barrel and 3.500 inch OD x 0.155 inch wall in the inner barrel and all other steel components)
- minimum radius of curvature in the lower GRE section (when applicable)

- stroke in the telescopic joint.

For each load case, the analysis determined an amount of offset at which a limit on one of these criteria would be reached. For the steel sections, the allowable limit on stress was assumed to be 326 MPa (47 ksi). This is 2/3 of the tensile stress formed by the "maximum pullback" tension and the nominal OD and ID of the HRQ V-Wall pipe shown in Appendix A. Appendix A also indicates a minimum bend radius of 53 m for the GRE pipe. Applying the same rationale to GRE pipe that was applied to the steel pipe, we assumed a bend radius limit of 79.5 m, i.e. 53 m multiplied by 3/2. The assumed stroke limit was 2 m.

Each table in Appendix B show results for the following load cases:

- one depth
- one ice thickness
- one air gap
- multiple outer barrel weights
- multiple current speeds
- with and without the drill string present.

Each table shows the offset at which the first limit would be reached as well as the maximum value that occurs for each of the other criteria between 0 meters and the limiting offset. If a response is larger at some smaller offset than at the limiting offset, the tables in Appendix B will show the larger value. Each row also shows moment and shear force at the foundation. The values of moment and shear force are for reference, as no allowable was specified for these values.

Table 2 shows results for one load configuration, with 500 meters of ice and 500 meters of water below the ice. This has a total length of 1000 meters and assumes a water depth of 950 meters. This example has a current speed is 0.25 m/s (applied from bottom of the ice layer to the mudline) in the direction of ice movement, 1 mT added to the outer barrel, and no drill string in the riser. Figure 2 shows plots of these results. The highlighted values indicate that the governing criterion for this case is stress in the inner barrel and that this limit is reached after offset reaches 15.01 m and before 20.05 m.

With no ice movement (0 meters offset), this example show the influence of current-induced load. As offset increases, all of the responses increase. Inner barrel stress is the first response to exceed its allowable limit. Table B.19 (Row 24) shows an offset limit of 18.71 m and corresponding responses, all of which have been interpolated from the responses that are shown in Table 2. At this offset, the predicted increase in telescopic joint stroke is 0.81 m. Stress in the inner barrel reaches its allowable (326 MPa) at this offset. Stresses in the other areas of interest are below their allowable values. Minimum bend radius in the lower GRE section is 299 m.

Table 3 shows results for the corresponding case with current flowing in the opposite direction. In this case, all of the responses in the lower part of the riser decrease initially and then increase. In this example, stroke is the first allowable to be reached. Row 22 of Table B.19 shows that this occurs at 44.22 m. (Note that the 459 m bend radius reported in Table B19 for this case occurs at zero offset and

the minimum bend radii that occur through 44.22 m are larger for this case.) Figure 3 shows plots of these results.

Table 2: Example with Current Flowing in the Direction of Ice Movement

Offset (m)	Stroke (m)	Max Stress in Inner Barrel / Casing (MPa)	Max Stress in Outer Barrel Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress in Upper Steel Section (MPa)	Bending Moment (mT-m)	Shear (mT)
0.00	0.27	183.4	42.7	69.3	459.5	116.8	0.4109	0.0531
5.04	0.34	221.6	51.6	83.3	401.4	101.5	0.4979	0.0639
9.98	0.46	259.8	60.6	97.2	356.3	86.2	0.5850	0.0748
15.01	0.64	**297.9**	69.6	111.2	320.4	71.0	0.6721	0.0856
20.05	0.87	**336.1**	78.6	125.2	291.0	55.7	0.7591	0.0965
24.99	1.15	374.3	87.6	139.2	266.6	40.5	0.8462	0.1074
30.02	1.48	412.4	96.6	153.2	245.9	25.4	0.9333	0.1182
34.96	1.87	450.6	105.6	167.2	228.2	30.2	1.0204	0.1291
40.00	2.32	488.8	114.7	181.2	212.9	45.4	1.1074	0.1399
45.03	2.82	527.0	123.7	195.2	199.5	60.6	1.1945	0.1508
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
100.04	11.82	946.9	222.8	349.3	118.0	228.7	2.1523	0.2701

Table 3: Example with Current Flowing Opposite the Direction of Ice Movement

Offset (m)	Stroke (m)	Max Stress in Inner Barrel / Casing (MPa)	Max Stress in Outer Barrel Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress in Upper Steel Section (MPa)	Bending Moment (mT-m)	Shear (mT)
0.00	0.27	183.4	42.7	69.3	459.5	116.8	0.4109	0.0531
5.04	0.26	145.3	33.7	55.3	537.3	132.1	0.3238	0.0422
9.98	0.30	107.1	24.8	41.4	646.7	147.4	0.2367	0.0314
15.01	0.39	69.0	15.9	27.5	812.3	162.7	0.1496	0.0205
20.05	0.53	31.1	7.5	13.9	1091.6	178.0	0.0626	0.0097
24.99	0.73	14.8	5.7	12.8	1663.8	193.3	0.0245	0.0012
30.02	0.99	52.4	13.4	26.3	1870.6	208.6	0.1116	0.0120
34.96	1.29	90.5	22.2	40.2	1580.9	223.9	0.1986	0.0229
40.00	**1.66**	128.6	31.1	54.1	1369.0	239.2	0.2857	0.0337
45.03	**2.07**	166.7	40.0	68.1	1207.1	254.5	0.3728	0.0446
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
100.04	10.16	586.6	139.1	222.0	242.4	422.7	1.3306	0.1639

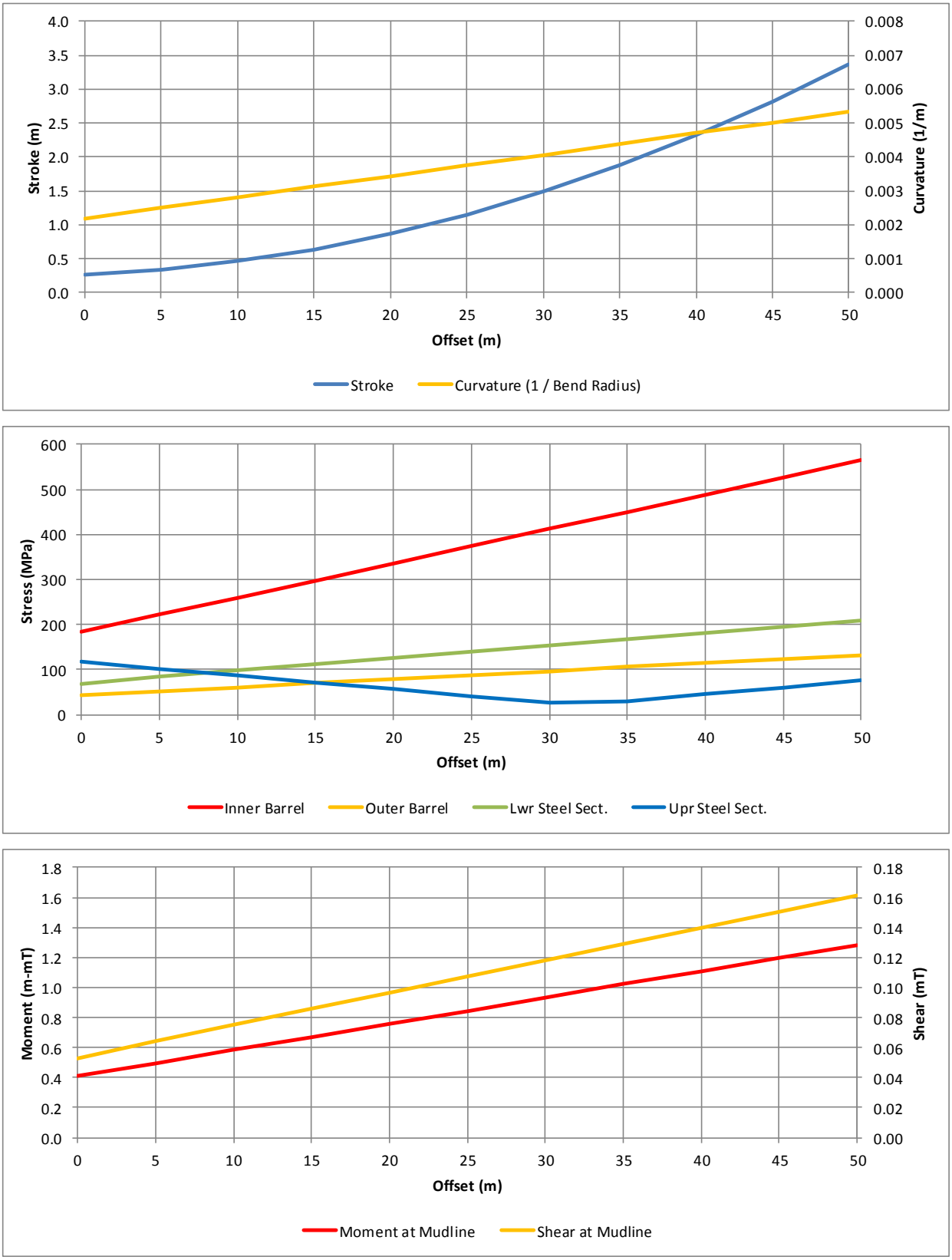


Figure 2: Example with Current Flowing in the Direction of Ice Movement

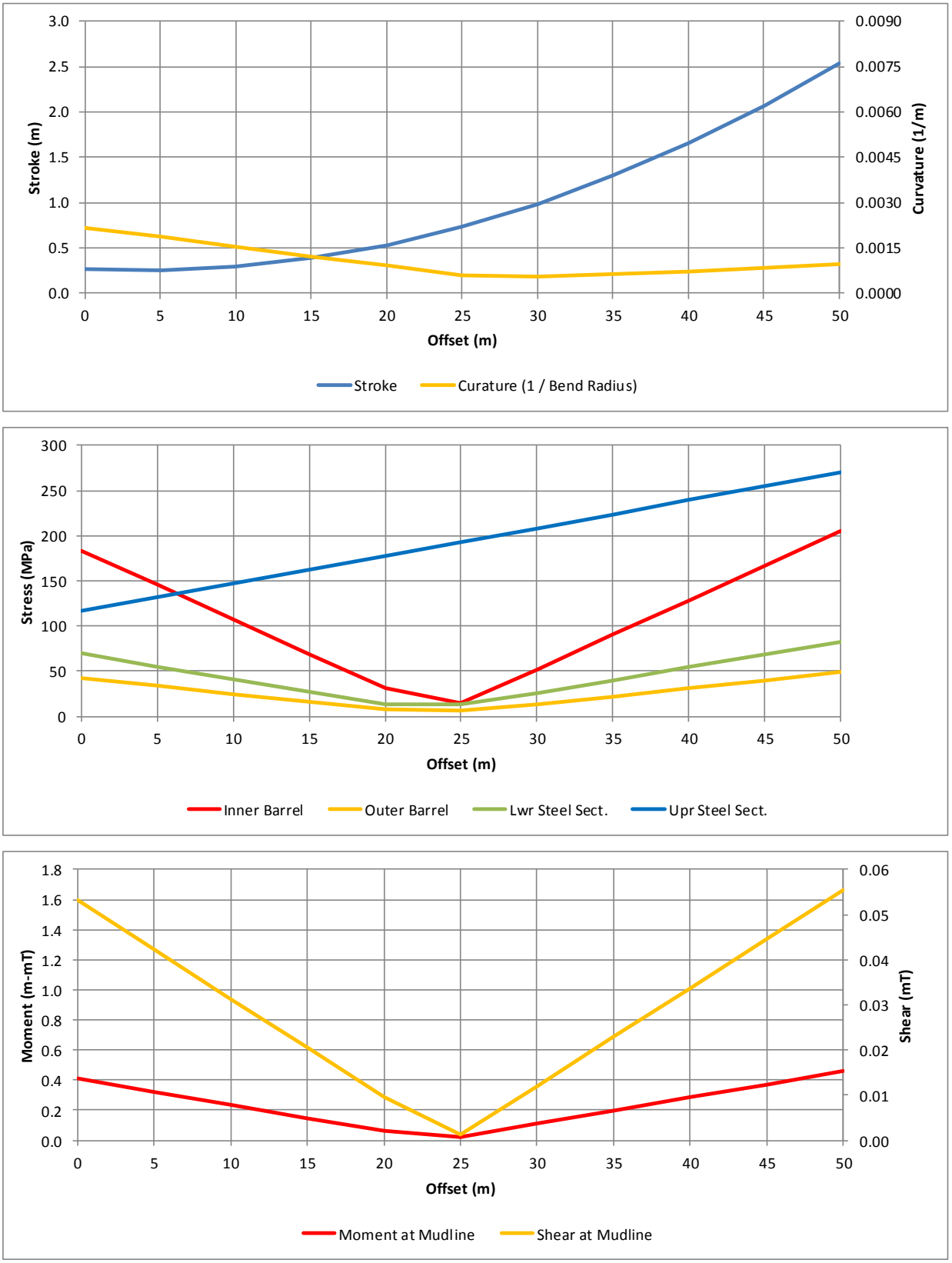


Figure 3: Example with Current Flowing Opposite the Direction of Ice Movement

Tables 4 and 5 show results for a 1000 meter case with minimal ice, 1 mT in the outer barrel, no current, with and without the drill string. Figures 6 through 9 show plots of displacement, effective tension, and moment for these two cases, each at 50 m offset.

The presence of the drill string in the riser increases the effective weight of the system (as shown in Figure 6) as well as its bending rigidity. This tends to produce more sag in the riser, as shown in Figure 7. It also tends to produce larger moments on the bottom of the riser. Figure 8 shows a bulge in the moment distribution that extends to roughly 55 meters above the mudline. This coincides with a transition from steel pipe to GRE at 55 m above the mudline. Figure 9 shows corresponding results at the top 20 meters of the riser.

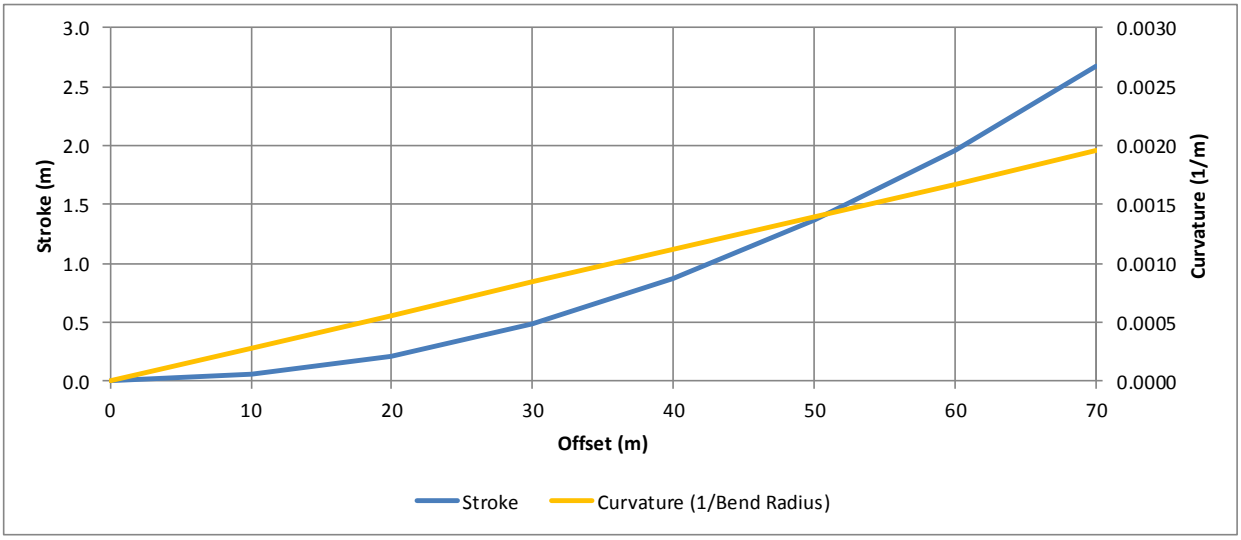
Table 4 shows that, without the drill string in the riser, offset is limited by stroke. Table 5 shows that, when the drill string is present, stroke decreases but pipe stresses tend to increase and loads on the foundation also increase.

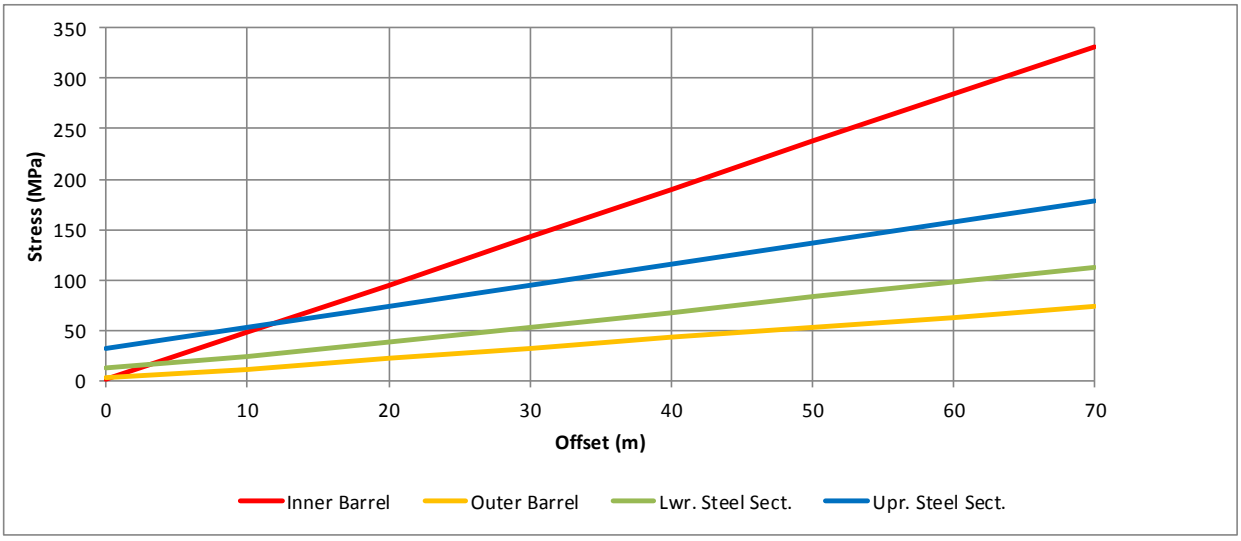
Table 4: 1000 m Case, Minimal Ice, No Drill String

Offset (m)	Stroke (m)	Max Stress in Inner Barrel / Casing (MPa)	Max Stress in Outer Barrel Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress in Upper Steel Section (MPa)	Bending Moment (mT-m)	Shear (mT)
0.00	0.00	0.3	3.0	12.0	INF	31.6	0.0000	0.0000
10.00	0.05	47.7	11.2	23.2	3581.3	52.5	0.1081	0.0175
20.00	0.22	95.1	21.5	38.1	1790.6	73.4	0.2163	0.0350
30.00	0.49	142.5	31.8	52.9	1193.8	94.3	0.3244	0.0524
40.00	0.87	189.9	42.2	67.8	895.3	115.2	0.4325	0.0699
50.00	1.36	237.3	52.5	82.6	716.3	136.1	0.5406	0.0874
60.00	**1.96**	284.7	62.8	97.4	596.9	157.0	0.6488	0.1049
70.00	**2.67**	332.1	73.2	112.3	511.6	177.9	0.7569	0.1223
80.00	3.49	379.5	83.5	127.1	447.7	198.8	0.8650	0.1398
90.00	4.41	426.9	93.8	141.9	397.9	219.7	0.9732	0.1573
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
200.01	21.79	948.4	207.5	305.1	179.1	449.5	2.1626	0.3496

Table 5: 1000 m case, Minimal Ice, with Drill String

Offset (m)	Stroke (m)	Max Stress in Inner Barrel / Casing (MPa)	Max Stress in Outer Barrel Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress in Upper Steel Section (MPa)	Bending Moment (mT-m)	Shear (mT)
0.00	0.00	0.3	3.0	12.0	INF	31.6	0.0000	0.0000
10.00	0.07	72.2	22.8	35.4	3167.9	51.4	0.2406	0.0339
20.00	0.28	144.0	44.8	62.5	1583.9	71.2	0.4812	0.0678
30.00	0.64	215.9	66.7	89.5	1056.0	91.0	0.7218	0.1017
40.00	1.14	**287.8**	88.7	116.5	792.0	110.8	0.9624	0.1356
50.00	1.77	**359.7**	110.7	143.5	633.6	130.6	1.2031	0.1695
60.00	2.56	431.6	132.7	170.6	528.0	150.4	1.4437	0.2034
70.00	3.48	503.4	154.6	197.6	452.6	170.2	1.6843	0.2373
80.00	4.54	575.3	176.6	224.6	396.0	190.0	1.9249	0.2712
90.00	5.75	647.2	198.6	251.6	352.0	209.8	2.1655	0.3051
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
200.01	28.40	1437.9	440.3	548.9	158.4	427.6	4.8122	0.6780





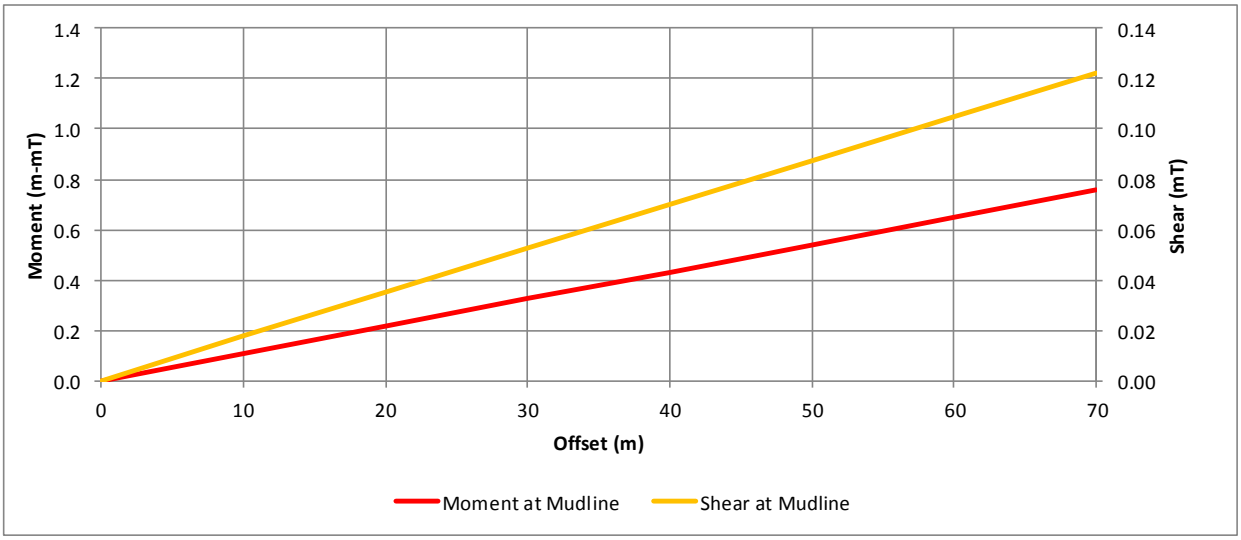
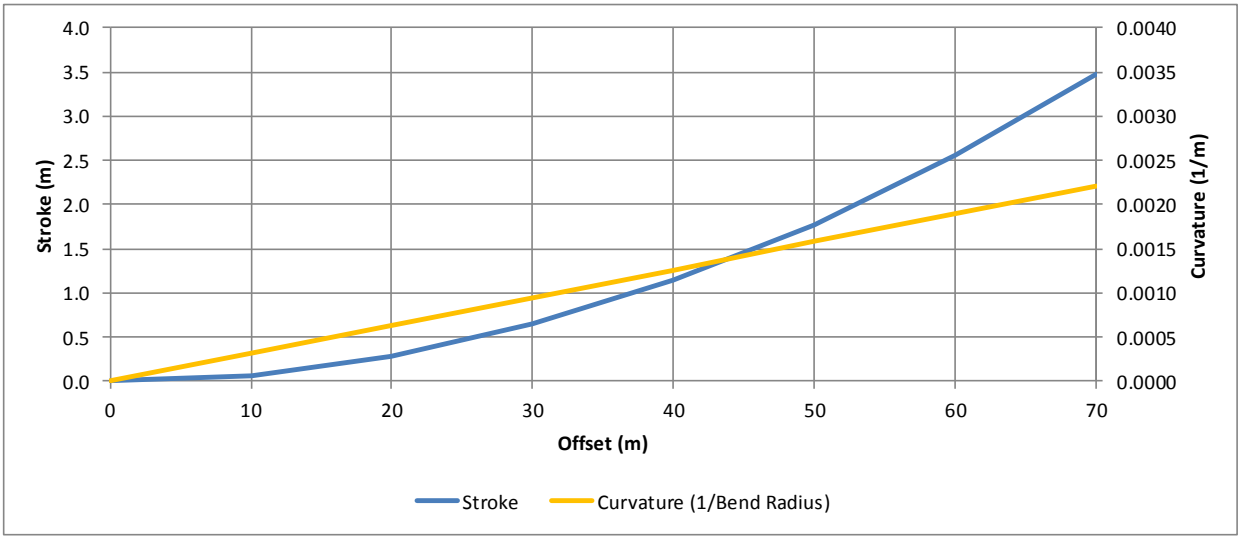
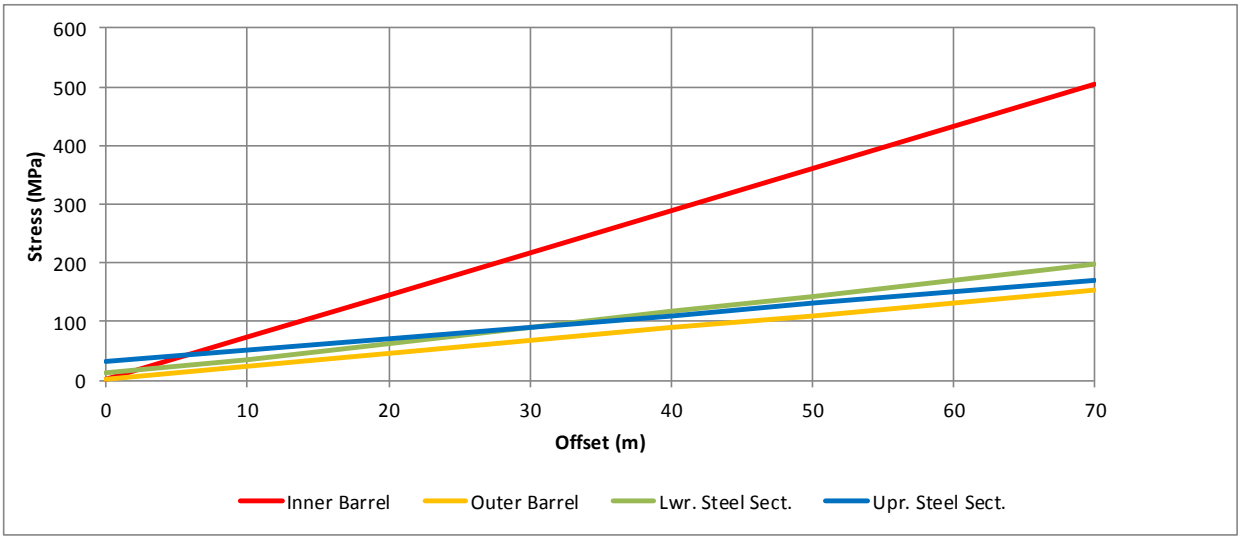


Figure 4: 1000 m Case, Minimal Ice, No Drill String





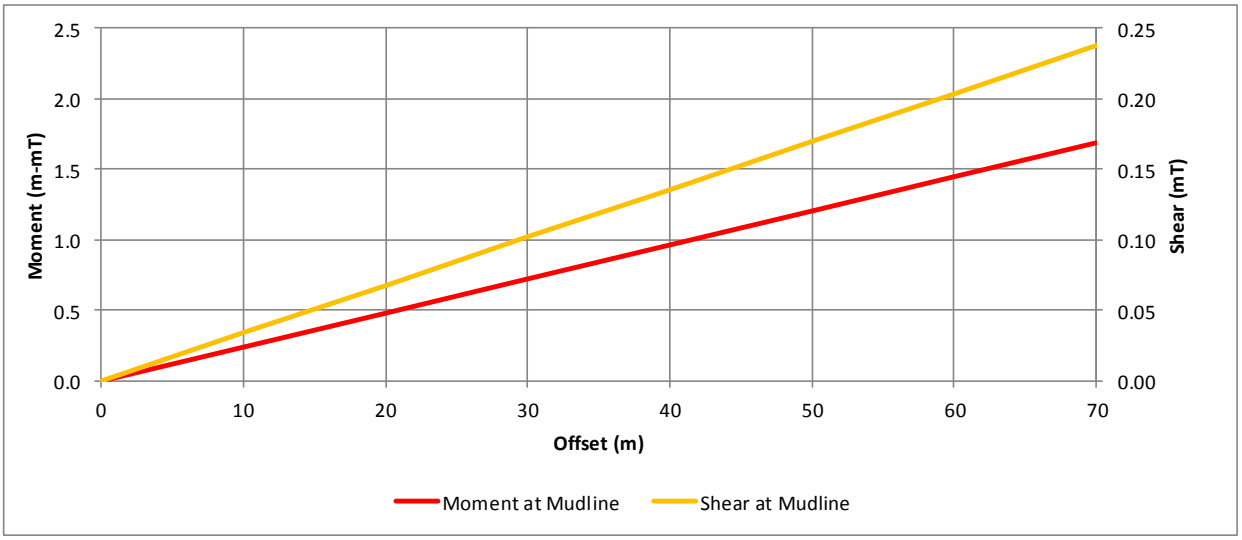


Figure 5: 1000 m case, Minimal Ice, with Drill String

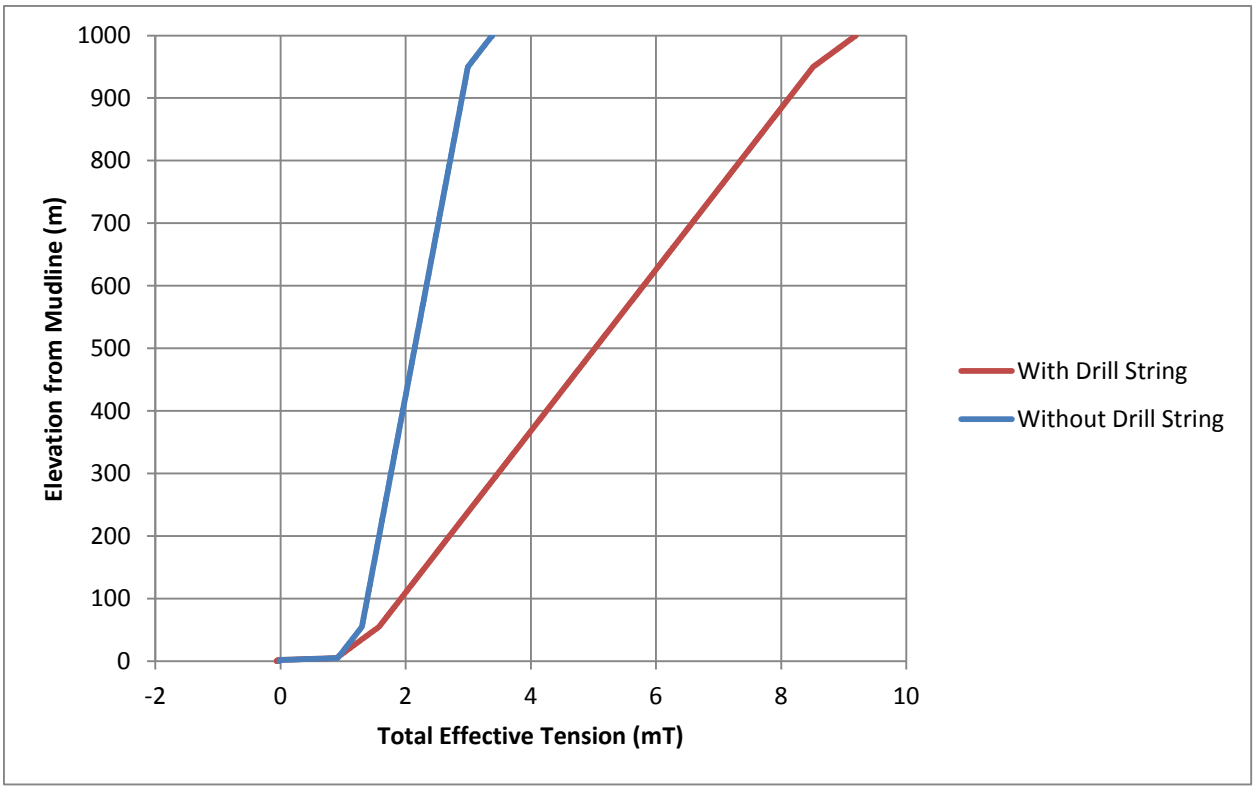


Figure 6: Effective Tension Distribution for 1000 m Cases at 50 m Offset

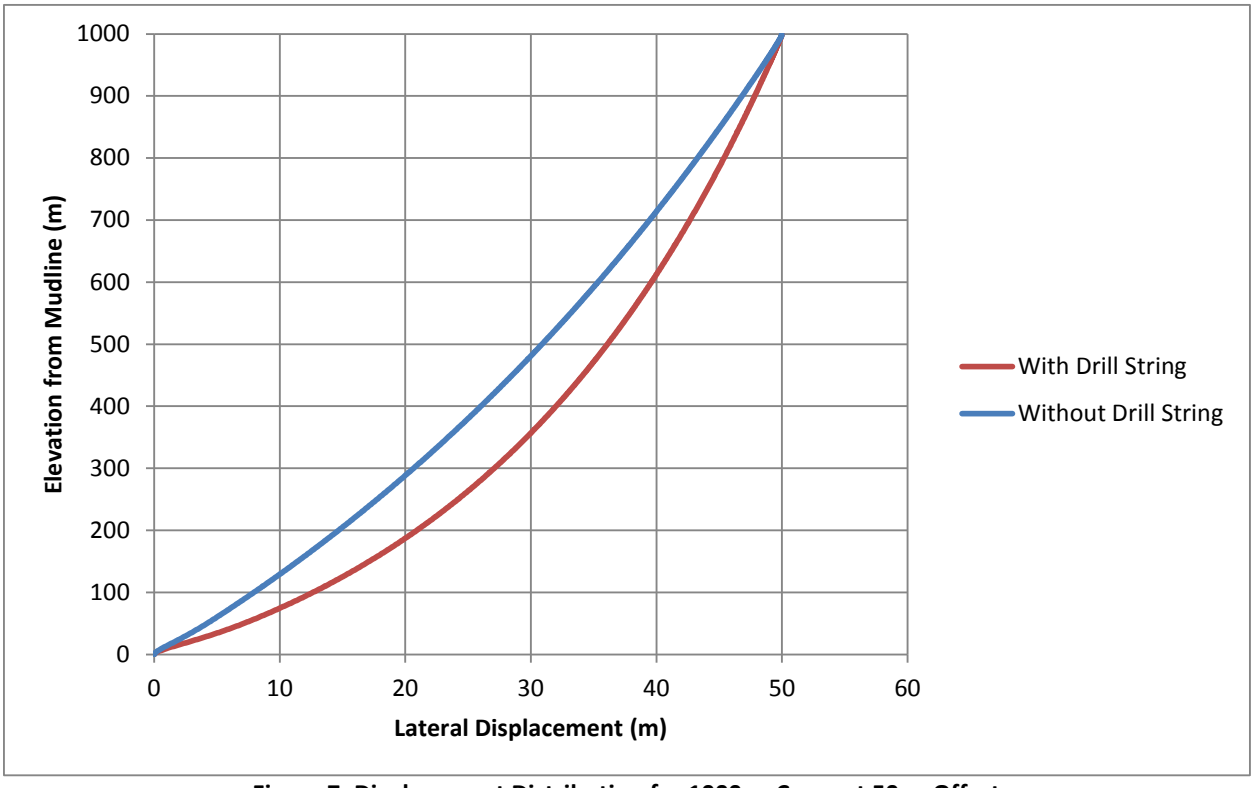


Figure 7: Displacement Distribution for 1000 m Cases at 50 m Offset

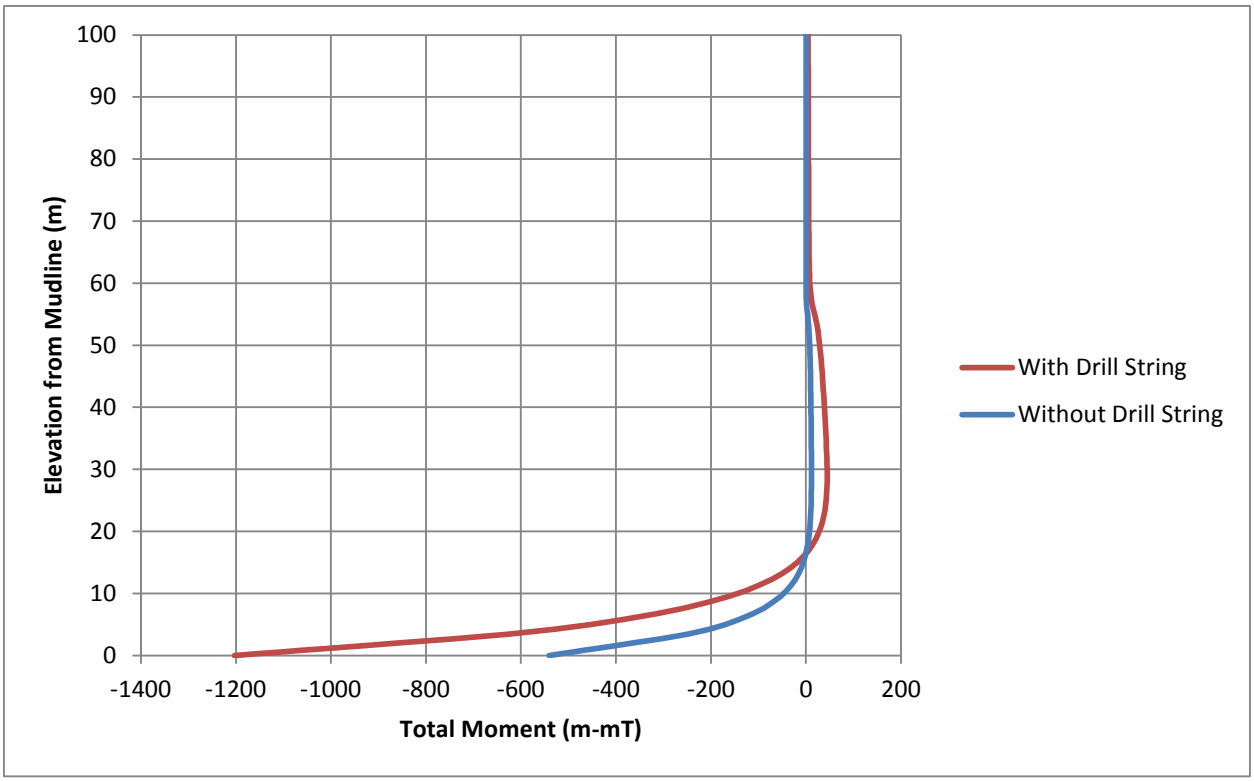


Figure 8: Moment Distribution at Bottom for 1000 m Cases at 50 m Offset

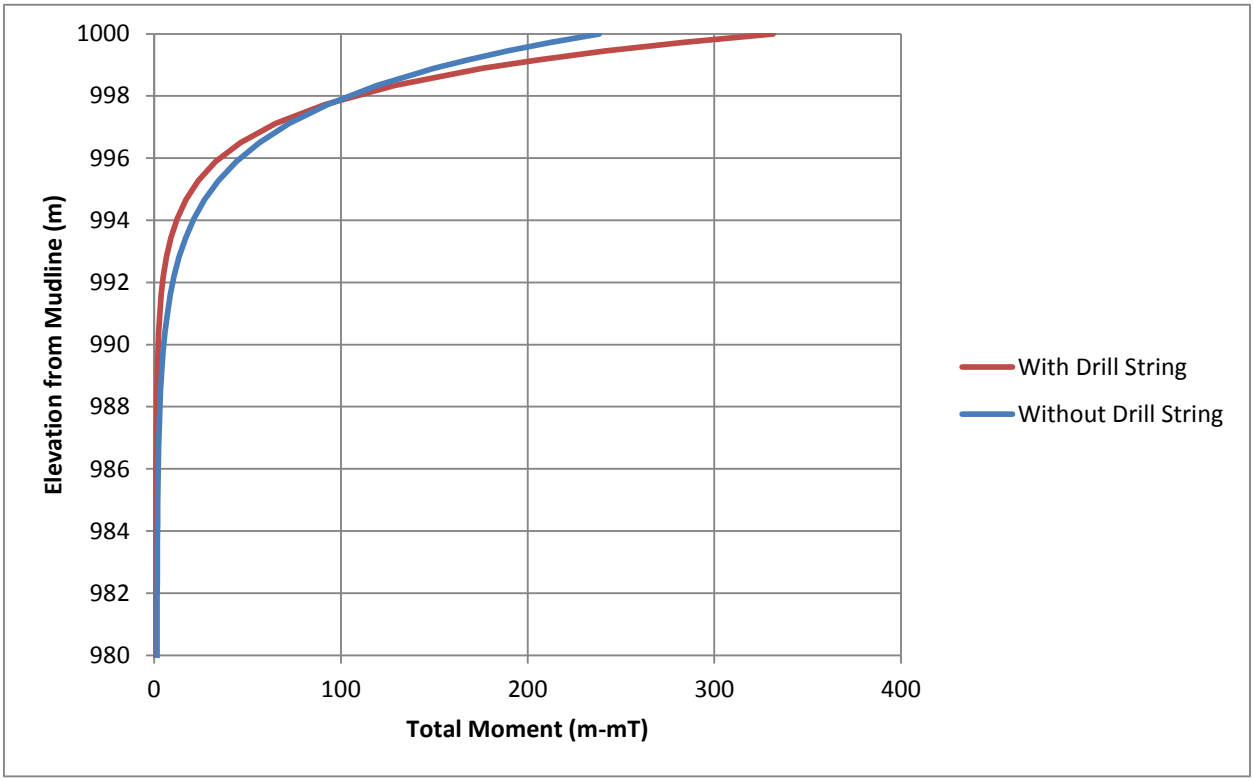


Figure 9: Moment Distribution at Top for 1000 m Cases at 50 m Offset

4. Conclusions

The results show that the riser and the seawater in the riser (from the outer barrel to the surface) may weigh as much as 4.1 mT. The drill string as modeled (with the bit at the mudline) may weigh as much as 5.9 mT.

The GRE bend radius did not govern in any case.

Outer barrel stress was not limiting in any cases either. This is a consequence of its larger cross-section (compared to the inner barrel).

In most cases, the first limit that was reached was the stress on the inner barrel. This occurred at the foundation, which was assumed to be fixed. Stroke limited some cases. Stress in the steel section at the bottom of the ice (shown as “lower steel section” or “upper steel section” in the tables, depending on the configuration type) limited some of cases.

Bending moment at the mudline reached slightly over 1 m-Mt and shear reach 0.25 mT in many cases. This provides an estimate of loads that could be put into the foundation if the soil is firm enough to bear these loads. If not, the loads on the inner barrel may decrease but the foundation itself may deflect in response to ice movement. This depends on the size and depth of the stinger, the properties of the soil, and the method used to install the stinger. This was not a focus of this analysis but it may warrant additional investigation.

The distance from the mudline to the bottom of the ice influences the results in two important ways. If this distance is very short, the limiting offsets are smaller than in other cases. This is simply because relatively small offsets cause significant increases in angle, bending moments, and stresses. At the other extreme, cases with the largest distances from the mudline to the bottom of the ice (i.e. Table B.5, 1000 m with no ice) are most strongly influenced by current.

The presence or absence of the drill string is generally more influential when the distance from the mudline to the bottom of the ice is relative large. In some cases, the drill string causes the limiting offsets to increase while, in others, the affect is the opposite. When the ice bottom is relatively close to the mudline, the drill string has less influence on the response.

Adding weight to the outer barrel had the most significant effect for the cases with the largest distance from the bottom of the ice to the mudline. In these cases, additional weight tended to make the system somewhat less susceptible to current.

Possible areas of further study:

- ARC may find it appropriate to review the assumptions and the results in the context of the operational and logistical considerations to determine if any changes are appropriate. For example, ARC might determine that the assumed limits of 326 MPa for the steel pipe and 79.5

bend radius for the GRE pipe put excessive constraints on the system. If so, ARC might find that these constraints could be relaxed.

- This study could be extended to modify the model to account for dimensional or design changes. In particular, the telescopic joint dimensions were assumed, because the actual telescopic joint has not been designed.

- This analysis could be expanded to add the stinger and soil springs to the model and evaluate various combinations of stinger configurations and soil conditions. For example, firm soil may be difficult to penetrate, thus it may require a short stinger. On the other hand, soft soil may require a deeper stinger to stay reasonably upright as the ice moves the rig off location.

- Noting that stresses tend to be highest in the inner barrel and at the ice bottom and substantially lower elsewhere, it may be desirable to investigate the use of a thinner wall pipe for the lower steel section (i.e. the steel pipe located directly above the outer barrel). This could reduce weight, reduce stresses on the inner barrel, and reduce soil loading. It might be beneficial to taper the telescopic joint as well.

- If significant current is anticipated, it is possible that vortex-shedding would cause drag forces to be higher (roughly 50 to 100% higher) than this analysis has assumed. Since drag is proportional to velocity-squared, this would have the same effect as a roughly 20-40% increase in current speed. This might be important for sites where significant current is anticipated.

Appendix A: GRE, Casing, and Coring Rod Specifications

Table A.1: GRE Casing Specifications

FUTURE PIPE INDUSTRIES

Technical Data Sheet
(Single Product Format)
Turn Down Box
3-1/2" RED BOX 2000- 8Rd
FIBREGLASS CASING AND TUBING
AROMATIC AMINE CURED EPOXY RESIN

V17.25 (Oct-04-2017)

DIMENSIONAL SPECIFICATIONS

Nom. Size (in.)	Class	Nom. I.D. (in.)	Nom. I.D. (mm)	Nom. O.D. (in.)	Nom. O.D. (mm)	Nom Box O.D. (TC) (in.)	Nom Box O.D. (TC) (mm)	Drift Diameter (in.)	Drift Diameter (mm)
3-1/2	2000	3.00	76.1	3.51	89.1	4.48	113.8	2.90	73.7
TPI	Suffix	Ends							
8RD		TC							

THREAD DETAILS

Nom. Size (in.)	Thread	Joint Short Code	Connection Type	FPi Connection Code	Ends
3-1/2	3-1/2	BH	3-1/2" 8Rd EUE Long TC	0312-EUE-LONG-A8	TC

Nom. Size (in.)		Pitch (E1) (in.)	Pitch (E1) (mm)	L4 (in.)	L4 (mm)	D4 (in.)	D4 (mm)	Pin Upset O.D. (in.)	Pin Upset O.D. (mm)
3-1/2		3.664	93.1	3.125	79.4	3.750	95.3	3.850	97.8

Tolerance on Nom. Box O.D. is +/- 0.10" up to 9-5/8"; +/- 0.15" above 9-5/8"

Thread lengths may exceed API L4.

Rd = Round thread per inch, EUE = External-Upset Ends, Csg = Casing, IJ = Integral Joint, TC = Threaded & Coupled

PERFORMANCE AND RATINGS -60F (-50c) to +150F (65c)

Nom. Size (in.)		Design Pressure (psi)	Design Pressure (bar)	Factory Hydrotest Pressure (psi)	Factory Hydrotest Pressure (bar)	Max. Field Test Pressure (psi)	Max. Field Test Pressure (bar)	Collapse Rating (psi)	Collapse Rating (bar)
3-1/2		2000	137.9	2600	179.3	2000	137.9	2300	158.6

Factory and field test pressure may be reduced for certain casing applications and for some turndown box products.

Nom. Size (in.)		Min. Bend Radius (ft)	Min. Bend Radius (m)	Axial Tensile Rating (uniaxial) (lbs)	Axial Tensile Rating (uniaxial) (kN)	Axial Tensile Rating (biaxial) (lbs)	Axial Tensile Rating (biaxial) (kN)	Nom. Wgt (lb/ft)	Nom. Wgt (kg/m)
3-1/2		175	53	30,500	135.7	30,500	135.7	2.4	3.6

Standard de-rating factors for pressure: 203F (95c), 0.88; 212F (100c), 0.81; 230F (110c), 0.66; 250F (121c), 0.50

MECHANICAL AND PHYSICAL PROPERTIES

Pipe Body Properties	<= 10-3/4	>= 11-3/4		<= 10-3/4	>= 11-3/4	
Tensile Strength, Hoop	31,300	40,000	psi	216	276	MPa
Tensile Strength, Axial (biaxial loading)	30,000	20,000	psi	207	138	MPa
Tensile Strength, Axial (uniaxial loading)	30,000	9,400	psi	207	65	MPa
Axial Modulus	2.5	1.5	10^6 psi	17.2	10	GPa
Specific Gravity	1.94	1.94	---	1.94	1.94	---
Density	0.07	0.07	lb/in3	1.94	1.94	g/cm3
Thermal Conductivity	2.4	2.4	Btu-in./(hr-ft2-F)	0.0035	0.0035	W-cm/(cm2-C)
Thermal Expansion Coefficient (Linear)	0.000011	0.000012	in./in./F	0.000020	0.000022	cm/cm/C
Flow Factor (Hazen Williams)	150	150	---	150	150	---

Copy of RedBox-V17.xlsm

Table A.2: Steel Casing Specifications

HRQ™ V-WALL™ TECHNICAL INFORMATION

PERFORMANCE RATING	METRIC SYSTEM	IMPERIAL
Rated Drilling Depth by Joint Strength	3050 m	10000 ft
Rated Maximum Pullback	510 Nm	115,000 ft lb
Rated Maximum Torque (Operating or Make-Up)	3 500 Nm	2,600 ft lb
Recommended Minimum Make-Up Torque for Deep Holes over 2000m	2 750 Nm	2,000 ft lb
Recommended Minimum Make-Up Torque for Deep Holes over 1000m	2 000 Nm	1,500 ft lb
Recommended Minimum Make-Up Torque	1 000 Nm	750 ft lb
API Theoretical Burst Pressure at Box Shoulder (per API bulletin 5C3)	44 500 kPa	6,458 psi
API Theoretical Burst Pressure at Midbody (per API bulletin 5C3)	50 200 kPa	7,280 psi
API Theoretical Collapse Pressure at Midbody (per API bulletin 5C3)	29 000 kPa	4,206 psi

RATING CRITERIA	METRIC SYSTEM	IMPERIAL
Rod Midbody Outer Diameter	88.90 mm	3.50 in
Rod Midbody Inner Diameter	81.00 mm	3.19 in
Rod Joint Inner Diameter	77.80 mm	3.06 in
Rod Resistance to Deviation (Moment of Inertia)	24592 mm^4	38.1 in^4
Rod Weight per Unit Length	27.23 kg/3 m	60.0 lb/10 ft
Rod Content Weight (Water) per Unit Length	5.14 l/m	0.40 gal/ft
Rod Displacement (Water) per Unit Length	1.1 l/m	0.09 gal/ft

All ratings and recommendations are based on tension load testing by an independent party.
- These ratings apply to new, unused rods of Boart Longyear manufacture, in a straight vertical down hole, assuming compliance to Boart Longyear Care and Handling or Product Literature and standard core drilling practices.
- Actual performance may vary depending on operating conditions and drilling practices.
- Depth and load capacities decrease with wear. For example, de-rate by at least 50% for box shoulder thickness worn to 50% of original.
- Increase make-up torque to match operating torque as depth increases. Operating torque should not exceed make-up torque.

Table A.3: Drill Rod Specifications

NRQ™ V-WALL™ TECHNICAL INFORMATION

PERFORMANCE RATING	METRIC SYSTEM	IMPERIAL
Rated Drilling Depth by Joint Strength	3360 m	11023 ft
Rated Maximum Pullback	330.0 kN	74255 lbf
Rated Maximum Torque (Operating or Make-Up)	2400 Nm	1750 ft lbf
Recommended Minimum Make-Up Torque for Deep Holes over 2000m	1400 Nm	1000 ft lbf
Recommended Minimum Make-Up Torque for Deep Holes over 1000m	1000 Nm	750 ft lbf
Recommended Minimum Make-Up Torque	600 Nm	452 ft lbf
API Theoretical Burst Pressure at Box Shoulder (per API bulletin 5C3)	49 700 kPa	7,215 psi
API Theoretical Burst Pressure at Midbody (per API bulletin 5C3)	63 387 kPa	9,193 psi
API Theoretical Collapse Pressure at Midbody (per API bulletin 5C3)	52 421 kPa	7,603 psi

RATING CRITERIA	METRIC SYSTEM	IMPERIAL
Rod Midbody Outer Diameter	69.90 mm	2.75 in
Rod Midbody Inner Diameter	62.00 mm	2.44 in
Rod Joint Inner Diameter	60.30 mm	2.38 in
Rod Resistance to Deviation (Moment of Inertia)	11408 mm^4	17.7 in^4
Rod Weight per Unit Length	20.42 kg/3 m	45.0 lb/10 ft
Rod Content Weight (Water) per Unit Length	2.97 kg/m	0.24 gal/ft
Rod Displacement (Water) per Unit Length	0.80 kg/m	0.07 gal/ft

Appendix B: Detailed Riser Analysis Results

Table B.1

Water Depth (m):	100	Ice Thickness (m):	0	Air Gap (m):	0

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	Values at Allowable Offset for Each Criterion						(mT-m)	(mT)
0.5	no	-1.00	0.00	0.85	559	134	435	N/A	N/A	1.27	0.20
		-0.75	4.87	0.33	314	75	**326**	N/A	N/A	0.72	0.11
		-0.50	13.29	0.93	227	62	**326**	N/A	N/A	0.52	0.06
		-0.25	13.08	0.91	**326**	85	243	N/A	N/A	0.74	0.09
		0.00	11.82	0.76	**326**	85	197	N/A	N/A	0.74	0.10
		0.25	10.55	0.63	**326**	84	151	N/A	N/A	0.74	0.10
		0.50	6.75	0.34	**326**	82	133	N/A	N/A	0.74	0.10
		0.75	0.43	0.28	**326**	78	250	N/A	N/A	0.74	0.11
		1.00	0.00	0.85	559	134	435	N/A	N/A	1.27	0.20
	yes	-1.00	0.00	0.48	400	129	311	N/A	N/A	1.34	0.19
		-0.75	10.50	0.62	225	73	**326**	N/A	N/A	0.75	0.11
		-0.50	15.58	1.30	**326**	116	303	N/A	N/A	1.09	0.12
		-0.25	12.83	0.91	**326**	114	209	N/A	N/A	1.09	0.12
		0.00	11.92	0.80	**326**	114	177	N/A	N/A	1.09	0.13
		0.25	11.00	0.70	**326**	113	155	N/A	N/A	1.09	0.13
		0.50	8.26	0.47	**326**	111	149	N/A	N/A	1.09	0.14
		0.75	3.68	0.28	**326**	108	180	N/A	N/A	1.09	0.15
		1.00	0.00	0.48	400	129	311	N/A	N/A	1.34	0.19
1	no	-1.00	0.00	0.39	459	96	370	N/A	N/A	1.05	0.20
		-0.75	5.46	0.25	258	54	**326**	N/A	N/A	0.59	0.11
		-0.50	10.90	0.62	235	56	**326**	N/A	N/A	0.54	0.08
		-0.25	11.06	0.64	**326**	75	263	N/A	N/A	0.74	0.12
		0.00	10.16	0.55	**326**	74	223	N/A	N/A	0.74	0.12
		0.25	9.27	0.46	**326**	74	182	N/A	N/A	0.74	0.12
		0.50	6.59	0.27	**326**	72	104	N/A	N/A	0.74	0.13
		0.75	2.11	0.16	**326**	70	215	N/A	N/A	0.74	0.13
		1.00	0.00	0.39	459	96	370	N/A	N/A	1.05	0.20
	yes	-1.00	0.00	0.26	340	99	276	N/A	N/A	1.14	0.19
		-0.75	9.36	0.48	191	56	**326**	N/A	N/A	0.64	0.11
		-0.50	13.58	0.97	**326**	105	319	N/A	N/A	1.09	0.15
		-0.25	11.47	0.70	**326**	103	233	N/A	N/A	1.09	0.16
		0.00	10.77	0.63	**326**	103	204	N/A	N/A	1.09	0.16
		0.25	10.07	0.56	**326**	102	176	N/A	N/A	1.09	0.16
		0.50	7.96	0.39	**326**	101	124	N/A	N/A	1.09	0.16
		0.75	4.45	0.23	**326**	98	162	N/A	N/A	1.09	0.17
		1.00	0.00	0.26	340	99	276	N/A	N/A	1.14	0.19
1.5	no	-1.00	0.00	0.23	401	75	331	N/A	N/A	0.91	0.19
		-0.75	5.44	0.21	226	43	**326**	N/A	N/A	0.51	0.11
		-0.50	9.48	0.47	242	52	**326**	N/A	N/A	0.55	0.10
		-0.25	9.72	0.49	**326**	67	273	N/A	N/A	0.74	0.14
		0.00	9.03	0.42	**326**	67	237	N/A	N/A	0.74	0.14
		0.25	8.33	0.37	**326**	66	201	N/A	N/A	0.74	0.14
		0.50	6.25	0.23	**326**	65	97	N/A	N/A	0.74	0.14
		0.75	2.78	0.12	**326**	63	195	N/A	N/A	0.74	0.15
		1.00	0.00	0.23	401	75	331	N/A	N/A	0.91	0.19
	yes	-1.00	3.53	0.20	302	80	**326**	N/A	N/A	1.01	0.19
		-0.75	8.52	0.39	170	46	**326**	N/A	N/A	0.57	0.11
		-0.50	12.08	0.76	324	96	**326**	N/A	N/A	1.08	0.17
		-0.25	10.43	0.57	**326**	95	248	N/A	N/A	1.09	0.18
		0.00	9.86	0.52	**326**	94	222	N/A	N/A	1.09	0.18
		0.25	9.28	0.46	**326**	94	196	N/A	N/A	1.09	0.18
		0.50	7.57	0.33	**326**	93	116	N/A	N/A	1.09	0.19
		0.75	4.71	0.20	**326**	90	151	N/A	N/A	1.09	0.19
		1.00	0.71	0.18	**326**	87	253	N/A	N/A	1.09	0.21

Table B.2

Water Depth (m):	200	Ice Thickness (m):	0	Air Gap (m):	0

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	2	326	326	326	79.5	326	(mT-m)	(mT)
				Values at Allowable Offset for Each Criterion							
0.5	no	-1.00	0.00	7.44	1198	301	473	42	830	2.73	0.38
		-0.75	0.00	2.36	674	169	268	75	472	1.54	0.22
		-0.50	14.06	0.79	300	75	122	168	**326**	0.68	0.10
		-0.25	26.92	1.87	**326**	86	147	398	272	0.74	0.09
		0.00	21.89	1.28	**326**	85	144	307	182	0.74	0.10
		0.25	16.86	0.85	**326**	84	141	251	93	0.74	0.10
		0.50	1.78	0.50	**326**	82	133	161	217	0.74	0.10
		0.75	0.00	2.36	674	169	268	75	472	1.54	0.22
		1.00	0.00	7.44	1198	301	473	42	830	2.73	0.38
	yes	-1.00	0.00	3.42	817	275	354	113	555	2.74	0.35
		-0.75	0.00	1.08	460	155	201	200	318	1.54	0.20
		-0.50	25.43	1.66	222	81	118	451	**326**	0.74	0.09
		-0.25	22.48	1.39	**326**	115	160	535	204	1.09	0.12
		0.00	19.44	1.10	**326**	114	158	478	149	1.09	0.13
		0.25	16.39	0.86	**326**	114	156	431	94	1.09	0.13
		0.50	7.25	0.49	**326**	111	149	333	149	1.09	0.14
		0.75	0.00	1.08	460	155	201	200	318	1.54	0.20
		1.00	0.00	3.42	817	275	354	113	555	2.74	0.35
1	no	-1.00	0.00	3.41	968	213	282	67	709	2.21	0.38
		-0.75	0.00	1.08	544	120	162	119	407	1.24	0.22
		-0.50	13.62	0.61	242	54	77	267	**326**	0.55	0.10
		-0.25	23.01	1.35	**326**	75	113	761	290	0.74	0.12
		0.00	19.41	0.98	**326**	75	111	527	211	0.74	0.12
		0.25	15.81	0.69	**326**	74	109	403	132	0.74	0.12
		0.50	5.00	0.31	**326**	73	103	236	190	0.74	0.13
		0.75	0.00	1.08	544	120	162	119	407	1.24	0.22
		1.00	0.00	3.41	968	213	282	67	709	2.21	0.38
	yes	-1.00	0.00	1.90	691	210	241	163	498	2.31	0.36
		-0.75	0.00	0.60	389	118	139	290	288	1.30	0.20
		-0.50	21.73	1.21	211	69	94	652	**326**	0.71	0.09
		-0.25	20.91	1.16	**326**	104	132	843	229	1.09	0.16
		0.00	18.46	0.94	**326**	103	130	721	178	1.09	0.16
		0.25	16.01	0.75	**326**	103	128	629	126	1.09	0.16
		0.50	8.67	0.41	**326**	101	124	458	138	1.09	0.16
		0.75	0.00	0.60	389	118	139	290	288	1.30	0.20
		1.00	0.00	1.90	691	210	241	163	498	2.31	0.36
1.5	no	-1.00	0.00	1.98	839	165	188	91	634	1.91	0.38
		-0.75	0.00	0.62	472	93	111	161	366	1.08	0.21
		-0.50	12.83	0.50	210	42	56	363	**326**	0.48	0.10
		-0.25	20.29	1.05	**326**	68	92	1227	299	0.74	0.14
		0.00	17.48	0.79	**326**	67	90	773	228	0.74	0.14
		0.25	14.67	0.58	**326**	67	89	564	156	0.74	0.14
		0.50	6.23	0.25	**326**	66	84	311	175	0.74	0.15
		0.75	0.00	0.62	472	93	111	161	366	1.08	0.21
		1.00	0.00	1.98	839	165	188	91	634	1.91	0.38
	yes	-1.00	0.00	1.22	614	171	178	214	460	2.05	0.37
		-0.75	0.00	0.39	345	97	106	380	268	1.16	0.21
		-0.50	19.30	0.95	208	63	81	856	**326**	0.70	0.11
		-0.25	19.46	0.99	**326**	95	113	1206	245	1.09	0.18
		0.00	17.41	0.81	**326**	95	111	996	197	1.09	0.18
		0.25	15.36	0.66	**326**	95	110	849	149	1.09	0.18
		0.50	9.21	0.36	**326**	93	106	589	131	1.09	0.19
		0.75	0.00	0.39	345	97	106	380	268	1.16	0.21
		1.00	0.00	1.22	614	171	178	214	460	2.05	0.37

Table B.3

Water Depth (m):	400	Ice Thickness (m):	0	Air Gap (m):	0

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	2	326	326	326	79.5	326	(mT-m)	(mT)
				Values at Allowable Offset for Each Criterion							
0.5	no	-1.00	0.00	49.17	2392	567	978	28	1523	5.46	0.73
		-0.75	0.00	15.56	1346	319	552	49	864	3.07	0.41
		-0.50	0.00	3.07	598	142	248	111	393	1.36	0.18
		-0.25	39.67	**2.00**	188	47	87	444	268	0.43	0.05
		0.00	38.37	1.99	**326**	79	143	304	168	0.74	0.09
		0.25	20.77	0.94	**326**	79	140	248	111	0.74	0.10
		0.50	0.00	3.07	598	142	248	111	393	1.36	0.18
		0.75	0.00	15.56	1346	319	552	49	864	3.07	0.41
		1.00	0.00	49.17	2392	567	978	28	1523	5.46	0.73
	yes	-1.00	0.00	17.41	1550	497	697	73	935	5.19	0.63
		-0.75	0.00	5.51	872	280	394	129	533	2.92	0.36
		-0.50	0.00	1.09	388	125	178	290	246	1.30	0.16
		-0.25	37.52	1.98	**326**	108	160	527	213	1.09	0.12
		0.00	28.92	1.35	**326**	108	157	470	124	1.09	0.13
		0.25	20.32	0.93	**326**	107	155	424	74	1.09	0.13
		0.50	0.00	1.09	388	125	178	290	246	1.30	0.16
		0.75	0.00	5.51	872	280	394	129	533	2.92	0.36
		1.00	0.00	17.41	1550	497	697	73	935	5.19	0.63
1	no	-1.00	0.00	23.87	1920	386	573	48	1323	4.38	0.73
		-0.75	0.00	7.55	1080	218	326	86	754	2.46	0.41
		-0.50	0.00	1.49	480	97	150	193	347	1.09	0.18
		-0.25	39.77	**2.00**	244	52	86	772	302	0.56	0.09
		0.00	35.64	1.65	**326**	68	110	517	200	0.74	0.12
		0.25	22.51	0.84	**326**	67	108	398	102	0.74	0.12
		0.50	0.00	1.49	480	97	150	193	347	1.09	0.18
		0.75	0.00	7.55	1080	218	326	86	754	2.46	0.41
		1.00	0.00	23.87	1920	386	573	48	1323	4.38	0.73
	yes	-1.00	0.00	10.29	1312	371	469	112	856	4.39	0.65
		-0.75	0.00	3.26	738	209	268	200	491	2.47	0.37
		-0.50	0.00	0.64	328	94	124	450	230	1.10	0.16
		-0.25	36.36	1.77	**326**	96	131	825	236	1.09	0.15
		0.00	29.05	1.24	**326**	96	129	709	151	1.09	0.16
		0.25	21.74	0.86	**326**	95	128	622	73	1.09	0.16
		0.50	0.00	0.64	328	94	124	450	230	1.10	0.16
		0.75	0.00	3.26	738	209	268	200	491	2.47	0.37
		1.00	0.00	10.29	1312	371	469	112	856	4.39	0.65
1.5	no	-1.00	0.00	14.27	1660	290	374	69	1193	3.78	0.72
		-0.75	0.00	4.51	934	164	216	123	682	2.13	0.41
		-0.50	0.00	0.89	415	74	103	277	317	0.95	0.18
		-0.25	38.66	1.89	279	52	79	1110	**326**	0.64	0.12
		0.00	32.93	1.40	**326**	60	88	758	219	0.74	0.14
		0.25	22.45	0.76	**326**	59	87	556	98	0.74	0.14
		0.50	0.00	0.89	415	74	103	277	317	0.95	0.18
		0.75	0.00	4.51	934	164	216	123	682	2.13	0.41
		1.00	0.00	14.27	1660	290	374	69	1193	3.78	0.72
	yes	-1.00	0.00	6.97	1168	297	342	155	800	3.91	0.66
		-0.75	0.00	2.20	657	168	198	275	461	2.20	0.37
		-0.50	20.77	0.72	292	76	95	619	**326**	0.98	0.17
		-0.25	34.83	1.59	**326**	87	112	1183	253	1.09	0.18
		0.00	28.46	1.13	**326**	86	110	978	172	1.09	0.18
		0.25	22.09	0.80	**326**	86	109	837	91	1.09	0.18
		0.50	2.96	0.50	**326**	84	105	582	219	1.09	0.18
		0.75	0.00	2.20	657	168	198	275	461	2.20	0.37
		1.00	0.00	6.97	1168	297	342	155	800	3.91	0.66

Table B.4

Water Depth (m):	700	Ice Thickness (m):	0	Air Gap (m):	0

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	2	326	326	326	79.5	326	(mT-m)	(mT)
				Values at Allowable Offset for Each Criterion							
0.5	no	-1.00	0.00	192.03	4062	981	1690	19	2413	9.27	1.22
		-0.75	0.00	60.76	2285	552	953	34	1367	5.21	0.68
		-0.50	0.00	12.00	1016	246	426	76	620	2.32	0.30
		-0.25	50.31	**2.00**	254	62	110	303	289	0.58	0.08
		0.00	50.00	**2.00**	291	71	128	341	139	0.66	0.08
		0.25	12.38	1.07	**326**	79	140	249	172	0.74	0.10
		0.50	0.00	12.00	1016	246	426	76	620	2.32	0.30
		0.75	0.00	60.76	2285	552	953	34	1367	5.21	0.68
		1.00	0.00	192.03	4062	981	1690	19	2413	9.27	1.22
	yes	-1.00	0.00	56.27	2543	833	1170	49	1378	8.51	1.00
		-0.75	0.00	17.80	1430	469	660	87	785	4.79	0.56
		-0.50	0.00	3.52	636	209	296	196	361	2.13	0.25
		-0.25	49.93	**2.00**	279	94	138	622	220	0.93	0.10
		0.00	37.16	1.47	**326**	109	158	467	106	1.09	0.12
		0.25	19.03	0.94	**326**	108	156	422	107	1.09	0.13
		0.50	0.00	3.52	636	209	296	196	361	2.13	0.25
		0.75	0.00	17.80	1430	469	660	87	785	4.79	0.56
		1.00	0.00	56.27	2543	833	1170	49	1378	8.51	1.00
1	no	-1.00	0.00	100.23	3282	676	998	35	2135	7.48	1.23
		-0.75	0.00	31.71	1846	381	565	62	1212	4.21	0.69
		-0.50	0.00	6.26	821	170	256	139	553	1.87	0.31
		-0.25	51.49	**2.00**	205	43	70	556	309	0.47	0.08
		0.00	51.27	**2.00**	308	65	104	551	176	0.70	0.11
		0.25	20.12	0.86	**326**	68	108	398	158	0.74	0.12
		0.50	0.00	6.26	821	170	256	139	553	1.87	0.31
		0.75	0.00	31.71	1846	381	565	62	1212	4.21	0.69
		1.00	0.00	100.23	3282	676	998	35	2135	7.48	1.23
	yes	-1.00	0.00	34.89	2157	626	787	79	1281	7.22	1.05
		-0.75	0.00	11.04	1214	352	446	141	732	4.06	0.59
		-0.50	0.00	2.18	540	157	203	316	340	1.81	0.26
		-0.25	50.88	**2.00**	292	87	119	938	242	0.98	0.14
		0.00	38.83	1.41	**326**	97	130	708	131	1.09	0.15
		0.25	22.76	0.87	**326**	96	128	618	105	1.09	0.16
		0.50	0.00	2.18	540	157	203	316	340	1.81	0.26
		0.75	0.00	11.04	1214	352	446	141	732	4.06	0.59
		1.00	0.00	34.89	2157	626	787	79	1281	7.22	1.05
1.5	no	-1.00	0.00	62.68	2850	511	654	52	1945	6.50	1.23
		-0.75	0.00	19.83	1603	288	373	92	1107	3.66	0.69
		-0.50	0.00	3.92	713	129	173	208	509	1.63	0.31
		-0.25	51.57	1.97	178	34	53	832	**326**	0.41	0.08
		0.00	51.47	1.97	**326**	61	89	761	206	0.74	0.14
		0.25	23.33	0.77	**326**	60	87	557	150	0.74	0.14
		0.50	0.00	3.92	713	129	173	208	509	1.63	0.31
		0.75	0.00	19.83	1603	288	373	92	1107	3.66	0.69
		1.00	0.00	62.68	2850	511	654	52	1945	6.50	1.23
	yes	-1.00	0.00	24.62	1929	503	573	112	1211	6.46	1.08
		-0.75	0.00	7.79	1085	284	328	200	694	3.63	0.60
		-0.50	0.00	1.54	482	127	153	450	326	1.61	0.27
		-0.25	51.40	**2.00**	307	83	106	1269	262	1.03	0.17
		0.00	39.14	1.33	**326**	88	111	979	151	1.09	0.18
		0.25	24.66	0.82	**326**	87	109	835	104	1.09	0.18
		0.50	0.00	1.54	482	127	153	450	326	1.61	0.27
		0.75	0.00	7.79	1085	284	328	200	694	3.63	0.60
		1.00	0.00	24.62	1929	503	573	112	1211	6.46	1.08

Table B.5

Water Depth (m):	1000	Ice Thickness (m):	0	Air Gap (m):	0

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	2	326	326	326	79.5	326	(mT-m)	(mT)
				Values at Allowable Offset for Each Criterion							
0.5	no	-1.00	0.00	431.07	5633	1410	2367	15	3185	12.85	1.68
		-0.75	0.00	136.39	3169	793	1333	26	1804	7.23	0.94
		-0.50	0.00	26.94	1408	353	595	58	817	3.21	0.42
		-0.25	0.00	1.68	352	88	152	234	225	0.80	0.10
		0.00	58.49	**2.00**	276	70	122	362	127	0.63	0.08
		0.25	0.00	1.68	352	88	152	234	225	0.80	0.10
		0.50	0.00	26.94	1408	353	595	58	817	3.21	0.42
		0.75	0.00	136.39	3169	793	1333	26	1804	7.23	0.94
		1.00	0.00	431.07	5633	1410	2367	15	3185	12.85	1.68
	yes	-1.00	0.00	114.44	3473	1178	1622	37	1741	11.62	1.35
		-0.75	0.00	36.21	1953	663	914	66	991	6.54	0.76
		-0.50	0.00	7.15	868	295	409	149	456	2.91	0.34
		-0.25	60.15	**2.00**	245	85	123	597	235	0.82	0.09
		0.00	42.42	1.51	**326**	112	159	464	99	1.09	0.12
		0.25	14.16	0.98	**326**	111	157	421	135	1.09	0.13
		0.50	0.00	7.15	868	295	409	149	456	2.91	0.34
		0.75	0.00	36.21	1953	663	914	66	991	6.54	0.76
		1.00	0.00	114.44	3473	1178	1622	37	1741	11.62	1.35
1	no	-1.00	0.00	236.24	4581	991	1411	28	2853	10.45	1.71
		-0.75	0.00	74.75	2577	558	797	49	1619	5.88	0.96
		-0.50	0.00	14.76	1145	248	359	110	737	2.61	0.43
		-0.25	56.50	1.96	287	63	96	441	**326**	0.65	0.11
		0.00	60.57	**2.00**	287	63	98	592	158	0.65	0.11
		0.25	8.32	1.07	**326**	71	108	401	208	0.74	0.12
		0.50	0.00	14.76	1145	248	359	110	737	2.61	0.43
		0.75	0.00	74.75	2577	558	797	49	1619	5.88	0.96
		1.00	0.00	236.24	4581	991	1411	28	2853	10.45	1.71
	yes	-1.00	0.00	72.67	2948	893	1091	62	1634	9.87	1.42
		-0.75	0.00	22.99	1659	503	617	110	933	5.55	0.80
		-0.50	0.00	4.54	737	224	279	247	432	2.47	0.35
		-0.25	61.08	**2.00**	255	79	106	990	253	0.85	0.12
		0.00	45.32	1.48	**326**	100	131	708	121	1.09	0.15
		0.25	19.68	0.86	**326**	100	129	614	132	1.09	0.16
		0.50	0.00	4.54	737	224	279	247	432	2.47	0.35
		0.75	0.00	22.99	1659	503	617	110	933	5.55	0.80
		1.00	0.00	72.67	2948	893	1091	62	1634	9.87	1.42
1.5	no	-1.00	0.00	152.66	4000	763	932	42	2621	9.12	1.73
		-0.75	0.00	48.30	2250	430	530	75	1490	5.13	0.97
		-0.50	0.00	9.54	1000	192	242	168	682	2.28	0.43
		-0.25	53.12	1.67	250	49	70	674	**326**	0.57	0.11
		0.00	61.38	**2.00**	302	59	84	827	184	0.69	0.13
		0.25	15.40	0.86	**326**	63	88	561	197	0.74	0.14
		0.50	0.00	9.54	1000	192	242	168	682	2.28	0.43
		0.75	0.00	48.30	2250	430	530	75	1490	5.13	0.97
		1.00	0.00	152.66	4000	763	932	42	2621	9.12	1.73
	yes	-1.00	0.00	52.42	2643	726	796	90	1555	8.85	1.46
		-0.75	0.00	16.58	1487	409	453	159	890	4.98	0.82
		-0.50	0.00	3.28	661	183	208	358	415	2.21	0.37
		-0.25	61.58	**2.00**	267	76	95	1432	268	0.89	0.14
		0.00	46.42	1.42	**326**	92	112	981	139	1.09	0.18
		0.25	22.88	0.81	**326**	91	110	834	131	1.09	0.18
		0.50	0.00	3.28	661	183	208	358	415	2.21	0.37
		0.75	0.00	16.58	1487	409	453	159	890	4.98	0.82
		1.00	0.00	52.42	2643	726	796	90	1555	8.85	1.46

Table B.6

Water Depth (m):	280	Ice Thickness (m):	300	Air Gap (m):	30

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
				Allowable for Each Criterion						Bending	
Bottom Weight	Drill String Present	Current Speed		2	326	326	326	79.5	326	Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	Values at Allowable Offset for Each Criterion						(mT-m)	(mT)
0.5	no	-1.00	0.61	0.02	326	68	288	N/A	N/A	0.74	0.12
		-0.75	0.60	0.02	326	66	276	N/A	N/A	0.74	0.13
		-0.50	0.59	0.02	326	64	266	N/A	N/A	0.74	0.13
		-0.25	0.58	0.02	326	63	261	N/A	N/A	0.74	0.13
		0.00	0.58	0.02	326	63	259	N/A	N/A	0.74	0.14
		0.25	0.58	0.02	326	62	257	N/A	N/A	0.74	0.14
		0.50	0.57	0.02	326	62	252	N/A	N/A	0.74	0.14
		0.75	0.56	0.02	326	60	243	N/A	N/A	0.74	0.15
		1.00	0.55	0.02	326	58	230	N/A	N/A	0.74	0.15
	yes	-1.00	0.62	0.02	326	85	285	N/A	N/A	1.08	0.19
		-0.75	0.60	0.02	326	83	276	N/A	N/A	1.08	0.20
		-0.50	0.60	0.02	326	81	269	N/A	N/A	1.08	0.21
		-0.25	0.59	0.02	326	81	266	N/A	N/A	1.08	0.21
		0.00	0.59	0.02	326	80	264	N/A	N/A	1.08	0.21
		0.25	0.59	0.02	326	80	263	N/A	N/A	1.08	0.21
		0.50	0.59	0.02	326	79	259	N/A	N/A	1.08	0.22
		0.75	0.58	0.02	326	78	253	N/A	N/A	1.08	0.22
		1.00	0.57	0.02	326	76	244	N/A	N/A	1.08	0.23
1	no	-1.00	0.59	0.02	326	63	285	N/A	N/A	0.74	0.13
		-0.75	0.58	0.02	326	60	273	N/A	N/A	0.74	0.14
		-0.50	0.57	0.02	326	59	264	N/A	N/A	0.74	0.14
		-0.25	0.57	0.02	326	58	259	N/A	N/A	0.74	0.15
		0.00	0.56	0.02	326	58	257	N/A	N/A	0.74	0.15
		0.25	0.56	0.02	326	57	255	N/A	N/A	0.74	0.15
		0.50	0.56	0.02	326	56	250	N/A	N/A	0.74	0.15
		0.75	0.55	0.02	326	55	241	N/A	N/A	0.74	0.16
		1.00	0.54	0.02	326	53	229	N/A	N/A	0.74	0.16
	yes	-1.00	0.60	0.02	326	80	283	N/A	N/A	1.08	0.21
		-0.75	0.59	0.02	326	78	275	N/A	N/A	1.08	0.21
		-0.50	0.58	0.02	326	77	269	N/A	N/A	1.08	0.22
		-0.25	0.58	0.02	326	76	265	N/A	N/A	1.08	0.22
		0.00	0.58	0.02	326	76	264	N/A	N/A	1.08	0.22
		0.25	0.58	0.02	326	75	263	N/A	N/A	1.08	0.22
		0.50	0.57	0.02	326	75	259	N/A	N/A	1.08	0.23
		0.75	0.57	0.02	326	73	253	N/A	N/A	1.08	0.23
		1.00	0.56	0.02	326	71	244	N/A	N/A	1.08	0.24
1.5	no	-1.00	0.57	0.02	326	58	283	N/A	N/A	0.74	0.14
		-0.75	0.56	0.02	326	56	271	N/A	N/A	0.74	0.15
		-0.50	0.56	0.02	326	55	263	N/A	N/A	0.74	0.15
		-0.25	0.55	0.02	326	54	258	N/A	N/A	0.74	0.16
		0.00	0.55	0.02	326	53	256	N/A	N/A	0.74	0.16
		0.25	0.55	0.02	326	53	254	N/A	N/A	0.74	0.16
		0.50	0.54	0.02	326	52	249	N/A	N/A	0.74	0.16
		0.75	0.54	0.02	326	51	241	N/A	N/A	0.74	0.17
		1.00	0.53	0.02	326	49	229	N/A	N/A	0.74	0.17
	yes	-1.00	0.58	0.02	326	76	283	N/A	N/A	1.08	0.22
		-0.75	0.58	0.02	326	74	274	N/A	N/A	1.08	0.22
		-0.50	0.57	0.02	326	73	268	N/A	N/A	1.08	0.23
		-0.25	0.57	0.02	326	72	265	N/A	N/A	1.08	0.23
		0.00	0.57	0.02	326	72	264	N/A	N/A	1.08	0.23
		0.25	0.57	0.02	326	72	262	N/A	N/A	1.08	0.23
		0.50	0.56	0.02	326	71	259	N/A	N/A	1.08	0.24
		0.75	0.56	0.02	326	69	253	N/A	N/A	1.08	0.24
		1.00	0.55	0.02	326	68	244	N/A	N/A	1.08	0.25

Table B.7

Water Depth (m):	295	Ice Thickness (m):	300	Air Gap (m):	30

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	2	326	326	326	79.5	326	(mT-m)	(mT)
				Values at Allowable Offset for Each Criterion							
0.5	no	-1.00	2.69	0.17	216	69	**326**	N/A	N/A	0.49	0.06
		-0.75	3.10	0.22	309	89	**326**	N/A	N/A	0.70	0.06
		-0.50	2.97	0.20	**326**	90	288	N/A	N/A	0.74	0.07
		-0.25	2.79	0.18	**326**	88	258	N/A	N/A	0.74	0.08
		0.00	2.74	0.17	**326**	87	248	N/A	N/A	0.74	0.08
		0.25	2.68	0.17	**326**	86	238	N/A	N/A	0.74	0.08
		0.50	2.53	0.15	**326**	84	208	N/A	N/A	0.74	0.09
		0.75	2.24	0.12	**326**	81	158	N/A	N/A	0.74	0.10
		1.00	1.85	0.08	**326**	76	104	N/A	N/A	0.74	0.11
	yes	-1.00	3.00	0.21	284	106	**326**	N/A	N/A	0.94	0.08
		-0.75	3.10	0.22	**326**	116	312	N/A	N/A	1.08	0.11
		-0.50	2.91	0.20	**326**	113	279	N/A	N/A	1.08	0.12
		-0.25	2.80	0.18	**326**	111	259	N/A	N/A	1.08	0.13
		0.00	2.76	0.18	**326**	110	252	N/A	N/A	1.08	0.13
		0.25	2.72	0.17	**326**	110	245	N/A	N/A	1.08	0.13
		0.50	2.62	0.16	**326**	108	226	N/A	N/A	1.08	0.14
		0.75	2.44	0.14	**326**	105	193	N/A	N/A	1.08	0.15
		1.00	2.18	0.11	**326**	101	146	N/A	N/A	1.08	0.16
1	no	-1.00	2.49	0.14	250	67	**326**	N/A	N/A	0.56	0.06
		-0.75	2.74	0.17	**326**	81	322	N/A	N/A	0.74	0.09
		-0.50	2.54	0.14	**326**	78	279	N/A	N/A	0.74	0.10
		-0.25	2.41	0.13	**326**	76	254	N/A	N/A	0.74	0.10
		0.00	2.37	0.13	**326**	76	245	N/A	N/A	0.74	0.11
		0.25	2.32	0.12	**326**	75	236	N/A	N/A	0.74	0.11
		0.50	2.20	0.11	**326**	73	211	N/A	N/A	0.74	0.11
		0.75	2.00	0.09	**326**	71	168	N/A	N/A	0.74	0.12
		1.00	1.69	0.07	**326**	67	108	N/A	N/A	0.74	0.13
	yes	-1.00	2.77	0.18	299	100	**326**	N/A	N/A	0.99	0.12
		-0.75	2.76	0.17	**326**	105	304	N/A	N/A	1.08	0.14
		-0.50	2.62	0.15	**326**	102	275	N/A	N/A	1.08	0.15
		-0.25	2.53	0.14	**326**	101	257	N/A	N/A	1.08	0.16
		0.00	2.51	0.14	**326**	100	251	N/A	N/A	1.08	0.16
		0.25	2.47	0.14	**326**	100	245	N/A	N/A	1.08	0.16
		0.50	2.38	0.13	**326**	98	227	N/A	N/A	1.08	0.17
		0.75	2.22	0.11	**326**	96	197	N/A	N/A	1.08	0.17
		1.00	2.02	0.09	**326**	92	156	N/A	N/A	1.08	0.19
1.5	no	-1.00	2.30	0.12	272	63	**326**	N/A	N/A	0.62	0.08
		-0.75	2.42	0.13	**326**	71	312	N/A	N/A	0.74	0.11
		-0.50	2.24	0.11	**326**	69	274	N/A	N/A	0.74	0.12
		-0.25	2.15	0.10	**326**	68	251	N/A	N/A	0.74	0.12
		0.00	2.12	0.10	**326**	67	244	N/A	N/A	0.74	0.13
		0.25	2.09	0.10	**326**	67	236	N/A	N/A	0.74	0.13
		0.50	1.99	0.09	**326**	65	213	N/A	N/A	0.74	0.13
		0.75	1.81	0.07	**326**	63	176	N/A	N/A	0.74	0.14
		1.00	1.58	0.06	**326**	60	123	N/A	N/A	0.74	0.15
	yes	-1.00	2.60	0.15	310	94	**326**	N/A	N/A	1.03	0.15
		-0.75	2.53	0.14	**326**	96	300	N/A	N/A	1.08	0.17
		-0.50	2.40	0.13	**326**	94	272	N/A	N/A	1.08	0.17
		-0.25	2.32	0.12	**326**	92	256	N/A	N/A	1.08	0.18
		0.00	2.29	0.12	**326**	92	251	N/A	N/A	1.08	0.18
		0.25	2.26	0.11	**326**	92	245	N/A	N/A	1.08	0.18
		0.50	2.19	0.11	**326**	90	229	N/A	N/A	1.08	0.19
		0.75	2.07	0.09	**326**	88	202	N/A	N/A	1.08	0.19
		1.00	1.88	0.08	**326**	85	164	N/A	N/A	1.08	0.21

Table B.8

Water Depth (m):	320	Ice Thickness (m):	300	Air Gap (m):	30

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	2	326	326	326	79.5	326	(mT-m)	(mT)
				Values at Allowable Offset for Each Criterion							
0.5	no	-1.00	3.41	0.24	301	70	**326**	N/A	N/A	0.68	0.11
		-0.75	6.76	0.53	170	49	**326**	N/A	N/A	0.38	0.06
		-0.50	8.55	0.81	**326**	93	308	N/A	N/A	0.74	0.07
		-0.25	7.33	0.60	**326**	91	232	N/A	N/A	0.74	0.07
		0.00	6.94	0.54	**326**	90	207	N/A	N/A	0.74	0.07
		0.25	6.53	0.48	**326**	89	181	N/A	N/A	0.74	0.08
		0.50	5.34	0.33	**326**	86	146	N/A	N/A	0.74	0.08
		0.75	3.33	0.18	**326**	82	130	N/A	N/A	0.74	0.10
		1.00	0.54	0.13	**326**	76	227	N/A	N/A	0.74	0.11
	yes	-1.00	6.00	0.42	190	55	**326**	N/A	N/A	0.63	0.11
		-0.75	8.05	0.72	283	104	**326**	N/A	N/A	0.94	0.09
		-0.50	7.71	0.66	**326**	116	272	N/A	N/A	1.08	0.12
		-0.25	6.99	0.54	**326**	114	224	N/A	N/A	1.08	0.12
		0.00	6.74	0.51	**326**	113	207	N/A	N/A	1.08	0.13
		0.25	6.49	0.47	**326**	113	191	N/A	N/A	1.08	0.13
		0.50	5.77	0.38	**326**	111	146	N/A	N/A	1.08	0.14
		0.75	4.54	0.26	**326**	107	135	N/A	N/A	1.08	0.15
		1.00	2.82	0.15	**326**	103	147	N/A	N/A	1.08	0.16
1	no	-1.00	3.78	0.20	239	47	**326**	N/A	N/A	0.54	0.10
		-0.75	5.80	0.37	204	53	**326**	N/A	N/A	0.46	0.06
		-0.50	6.62	0.47	**326**	79	303	N/A	N/A	0.74	0.10
		-0.25	5.86	0.37	**326**	78	242	N/A	N/A	0.74	0.10
		0.00	5.60	0.34	**326**	77	221	N/A	N/A	0.74	0.10
		0.25	5.34	0.31	**326**	76	201	N/A	N/A	0.74	0.11
		0.50	4.58	0.23	**326**	75	139	N/A	N/A	0.74	0.11
		0.75	3.29	0.14	**326**	72	107	N/A	N/A	0.74	0.12
		1.00	1.50	0.08	**326**	68	183	N/A	N/A	0.74	0.13
	yes	-1.00	5.47	0.34	164	53	**326**	N/A	N/A	0.54	0.11
		-0.75	6.93	0.52	294	97	**326**	N/A	N/A	0.98	0.12
		-0.50	6.58	0.47	**326**	104	276	N/A	N/A	1.08	0.15
		-0.25	6.05	0.40	**326**	102	234	N/A	N/A	1.08	0.15
		0.00	5.87	0.37	**326**	102	220	N/A	N/A	1.08	0.16
		0.25	5.68	0.35	**326**	101	206	N/A	N/A	1.08	0.16
		0.50	5.12	0.29	**326**	100	164	N/A	N/A	1.08	0.16
		0.75	4.22	0.21	**326**	97	113	N/A	N/A	1.08	0.17
		1.00	2.94	0.13	**326**	93	130	N/A	N/A	1.08	0.19
1.5	no	-1.00	3.73	0.17	206	36	**326**	N/A	N/A	0.47	0.10
		-0.75	5.17	0.29	236	53	**326**	N/A	N/A	0.53	0.08
		-0.50	5.58	0.33	**326**	70	298	N/A	N/A	0.74	0.12
		-0.25	5.00	0.27	**326**	69	245	N/A	N/A	0.74	0.12
		0.00	4.82	0.25	**326**	68	228	N/A	N/A	0.74	0.13
		0.25	4.63	0.23	**326**	68	210	N/A	N/A	0.74	0.13
		0.50	4.06	0.18	**326**	66	157	N/A	N/A	0.74	0.13
		0.75	3.11	0.11	**326**	64	96	N/A	N/A	0.74	0.14
		1.00	1.80	0.07	**326**	61	160	N/A	N/A	0.74	0.15
	yes	-1.00	5.05	0.28	170	56	**326**	N/A	N/A	0.56	0.11
		-0.75	6.20	0.41	304	91	**326**	N/A	N/A	1.01	0.15
		-0.50	5.83	0.36	**326**	95	278	N/A	N/A	1.08	0.17
		-0.25	5.39	0.31	**326**	94	240	N/A	N/A	1.08	0.18
		0.00	5.24	0.30	**326**	93	228	N/A	N/A	1.08	0.18
		0.25	5.09	0.28	**326**	93	215	N/A	N/A	1.08	0.18
		0.50	4.66	0.24	**326**	92	177	N/A	N/A	1.08	0.19
		0.75	3.92	0.17	**326**	89	115	N/A	N/A	1.08	0.19
		1.00	2.91	0.11	**326**	86	120	N/A	N/A	1.08	0.20

Table B.9

Water Depth (m):	370	Ice Thickness (m):	300	Air Gap (m):	30

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	Values at Allowable Offset for Each Criterion						(mT-m)	(mT)
0.5	no	-1.00	0.00	1.38	644	152	444	N/A	N/A	1.46	0.18
		-0.75	0.00	0.44	363	85	254	N/A	N/A	0.82	0.10
		-0.50	17.26	1.57	285	77	**326**	N/A	N/A	0.64	0.05
		-0.25	14.16	1.09	**326**	85	207	N/A	N/A	0.74	0.07
		0.00	12.60	0.89	**326**	84	161	N/A	N/A	0.74	0.07
		0.25	11.04	0.72	**326**	83	155	N/A	N/A	0.74	0.08
		0.50	6.36	0.38	**326**	80	145	N/A	N/A	0.74	0.08
		0.75	0.00	0.44	363	85	254	N/A	N/A	0.82	0.10
		1.00	0.00	1.38	644	152	444	N/A	N/A	1.46	0.18
	yes	-1.00	0.00	0.49	399	118	282	N/A	N/A	1.33	0.19
		-0.75	12.90	0.90	226	67	**326**	N/A	N/A	0.75	0.11
		-0.50	15.65	1.30	**326**	109	276	N/A	N/A	1.08	0.12
		-0.25	12.90	0.91	**326**	107	190	N/A	N/A	1.08	0.12
		0.00	11.98	0.81	**326**	106	161	N/A	N/A	1.08	0.13
		0.25	11.06	0.71	**326**	106	152	N/A	N/A	1.08	0.13
		0.50	8.30	0.47	**326**	103	146	N/A	N/A	1.08	0.13
		0.75	3.71	0.29	**326**	100	163	N/A	N/A	1.08	0.15
		1.00	0.00	0.49	399	118	282	N/A	N/A	1.33	0.19
1	no	-1.00	0.00	0.54	500	98	358	N/A	N/A	1.14	0.19
		-0.75	7.10	0.37	282	55	**326**	N/A	N/A	0.64	0.10
		-0.50	13.53	0.96	287	64	**326**	N/A	N/A	0.65	0.08
		-0.25	11.75	0.73	**326**	71	232	N/A	N/A	0.74	0.10
		0.00	10.72	0.61	**326**	70	193	N/A	N/A	0.74	0.10
		0.25	9.69	0.51	**326**	70	154	N/A	N/A	0.74	0.10
		0.50	6.60	0.29	**326**	68	108	N/A	N/A	0.74	0.11
		0.75	1.46	0.20	**326**	65	207	N/A	N/A	0.74	0.12
		1.00	0.00	0.54	500	98	358	N/A	N/A	1.14	0.19
	yes	-1.00	0.00	0.27	339	88	247	N/A	N/A	1.13	0.19
		-0.75	11.45	0.70	192	50	**326**	N/A	N/A	0.63	0.11
		-0.50	13.67	0.98	**326**	96	288	N/A	N/A	1.08	0.15
		-0.25	11.55	0.71	**326**	95	211	N/A	N/A	1.08	0.15
		0.00	10.85	0.64	**326**	94	185	N/A	N/A	1.08	0.16
		0.25	10.14	0.57	**326**	93	159	N/A	N/A	1.08	0.16
		0.50	8.03	0.39	**326**	92	120	N/A	N/A	1.08	0.16
		0.75	4.50	0.23	**326**	89	145	N/A	N/A	1.08	0.17
		1.00	0.00	0.27	339	88	247	N/A	N/A	1.13	0.19
1.5	no	-1.00	0.00	0.29	426	71	311	N/A	N/A	0.97	0.18
		-0.75	7.11	0.32	240	41	**326**	N/A	N/A	0.54	0.10
		-0.50	11.66	0.70	296	58	**326**	N/A	N/A	0.67	0.11
		-0.25	10.22	0.54	**326**	62	242	N/A	N/A	0.74	0.12
		0.00	9.45	0.47	**326**	61	208	N/A	N/A	0.74	0.12
		0.25	8.68	0.40	**326**	61	174	N/A	N/A	0.74	0.12
		0.50	6.36	0.25	**326**	59	91	N/A	N/A	0.74	0.13
		0.75	2.50	0.14	**326**	57	183	N/A	N/A	0.74	0.14
		1.00	0.00	0.29	426	71	311	N/A	N/A	0.97	0.18
	yes	-1.00	5.47	0.28	301	71	**326**	N/A	N/A	1.00	0.19
		-0.75	10.45	0.58	174	50	**326**	N/A	N/A	0.58	0.11
		-0.50	12.24	0.78	**326**	87	294	N/A	N/A	1.08	0.17
		-0.25	10.52	0.58	**326**	85	223	N/A	N/A	1.08	0.18
		0.00	9.94	0.53	**326**	85	200	N/A	N/A	1.08	0.18
		0.25	9.37	0.47	**326**	84	176	N/A	N/A	1.08	0.18
		0.50	7.65	0.34	**326**	83	107	N/A	N/A	1.08	0.18
		0.75	4.78	0.20	**326**	81	135	N/A	N/A	1.08	0.19
		1.00	0.77	0.18	**326**	77	226	N/A	N/A	1.08	0.20

Table B.10

Water Depth (m):	470	Ice Thickness (m):	300	Air Gap (m):	30

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
				Allowable for Each Criterion						Bending Moment	Shear
Bottom Weight	Drill String Present	Current Speed		2	326	326	326	79.5	326		
(mT)	(yes/no)	(m/s)	(m)	Values at Allowable Offset for Each Criterion						(mT-m)	(mT)
0.5	no	-1.00	0.00	12.26	1410	368	628	31	836	3.21	0.36
		-0.75	0.00	3.88	794	207	354	55	475	1.81	0.20
		-0.50	0.00	0.77	354	92	159	124	218	0.80	0.09
		-0.25	27.75	**2.00**	313	86	157	294	228	0.71	0.07
		0.00	22.51	1.39	**326**	88	159	228	145	0.74	0.07
		0.25	16.38	0.88	**326**	87	156	192	63	0.74	0.08
		0.50	0.00	0.77	354	92	159	124	218	0.80	0.09
		0.75	0.00	3.88	794	207	354	55	475	1.81	0.20
		1.00	0.00	12.26	1410	368	628	31	836	3.21	0.36
	yes	-1.00	0.00	3.44	818	269	351	112	495	2.73	0.35
		-0.75	0.00	1.09	461	152	199	200	283	1.54	0.20
		-0.50	27.95	**2.00**	265	93	135	450	306	0.88	0.09
		-0.25	22.45	1.38	**326**	112	157	537	182	1.08	0.12
		0.00	19.38	1.09	**326**	112	155	479	132	1.08	0.13
		0.25	16.33	0.86	**326**	111	153	432	83	1.08	0.13
		0.50	7.19	0.49	**326**	109	146	334	132	1.08	0.13
		0.75	0.00	1.09	461	152	199	200	283	1.54	0.20
		1.00	0.00	3.44	818	269	351	112	495	2.73	0.35
1	no	-1.00	0.00	4.65	1068	237	338	56	681	2.43	0.37
		-0.75	0.00	1.47	602	133	193	100	390	1.37	0.21
		-0.50	17.70	0.95	269	59	89	224	**326**	0.61	0.09
		-0.25	24.18	1.49	**326**	76	120	603	254	0.74	0.10
		0.00	20.02	1.05	**326**	75	118	434	179	0.74	0.10
		0.25	15.90	0.72	**326**	74	116	340	104	0.74	0.11
		0.50	3.56	0.36	**326**	73	109	205	182	0.74	0.11
		0.75	0.00	1.47	602	133	193	100	390	1.37	0.21
		1.00	0.00	4.65	1068	237	338	56	681	2.43	0.37
	yes	-1.00	0.00	1.91	692	204	238	163	441	2.31	0.36
		-0.75	0.00	0.60	390	115	137	289	255	1.30	0.20
		-0.50	26.58	1.80	297	93	123	651	**326**	0.99	0.13
		-0.25	20.87	1.15	**326**	100	129	845	203	1.08	0.15
		0.00	18.43	0.93	**326**	100	127	722	157	1.08	0.16
		0.25	15.96	0.75	**326**	99	126	630	112	1.08	0.16
		0.50	8.62	0.41	**326**	98	121	458	122	1.08	0.16
		0.75	0.00	0.60	390	115	137	289	255	1.30	0.20
		1.00	0.00	1.91	692	204	238	163	441	2.31	0.36
1.5	no	-1.00	0.00	2.48	902	176	214	80	592	2.05	0.37
		-0.75	0.00	0.78	508	99	125	143	342	1.15	0.21
		-0.50	16.63	0.79	227	44	62	321	**326**	0.51	0.09
		-0.25	21.08	1.13	**326**	67	95	1039	262	0.74	0.12
		0.00	17.98	0.83	**326**	66	94	671	196	0.74	0.12
		0.25	14.85	0.60	**326**	66	92	498	129	0.74	0.13
		0.50	5.51	0.26	**326**	64	87	280	163	0.74	0.13
		0.75	0.00	0.78	508	99	125	143	342	1.15	0.21
		1.00	0.00	2.48	902	176	214	80	592	2.05	0.37
	yes	-1.00	0.00	1.23	614	164	175	214	404	2.05	0.36
		-0.75	0.00	0.39	346	93	103	380	236	1.15	0.20
		-0.50	23.72	1.43	291	83	103	855	**326**	0.97	0.15
		-0.25	19.43	0.98	**326**	92	110	1208	216	1.08	0.18
		0.00	17.39	0.81	**326**	91	109	998	174	1.08	0.18
		0.25	15.33	0.66	**326**	91	107	850	132	1.08	0.18
		0.50	9.18	0.36	**326**	89	104	589	116	1.08	0.19
		0.75	0.00	0.39	346	93	103	380	236	1.15	0.20
		1.00	0.00	1.23	614	164	175	214	404	2.05	0.36

Table B.11

Water Depth (m):	670	Ice Thickness (m):	300	Air Gap (m):	30

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
				Allowable for Each Criterion						Bending Moment	Shear
Bottom Weight	Drill String Present	Current Speed		2	326	326	326	79.5	326		
(mT)	(yes/no)	(m/s)	(m)	Values at Allowable Offset for Each Criterion						(mT-m)	(mT)
0.5	no	-1.00	0.00	77.47	2846	729	1317	19	1496	6.49	0.68
		-0.75	0.00	24.51	1602	410	742	34	848	3.65	0.39
		-0.50	0.00	4.84	713	182	331	77	385	1.62	0.17
		-0.25	39.61	**2.00**	180	46	85	308	229	0.41	0.04
		0.00	37.77	**2.00**	325	85	158	227	130	0.74	0.07
		0.25	17.09	0.93	**326**	84	155	191	108	0.74	0.08
		0.50	0.00	4.84	713	182	331	77	385	1.62	0.17
		0.75	0.00	24.51	1602	410	742	34	848	3.65	0.39
		1.00	0.00	77.47	2846	729	1317	19	1496	6.49	0.68
	yes	-1.00	0.00	17.44	1555	503	698	73	812	5.20	0.63
		-0.75	0.00	5.52	876	283	394	129	463	2.92	0.36
		-0.50	0.00	1.09	390	126	176	290	214	1.30	0.16
		-0.25	37.32	1.95	**326**	108	157	531	184	1.08	0.12
		0.00	28.74	1.33	**326**	108	155	473	107	1.08	0.12
		0.25	20.09	0.92	**326**	107	153	426	65	1.08	0.13
		0.50	0.00	1.09	390	126	176	290	214	1.30	0.16
		0.75	0.00	5.52	876	283	394	129	463	2.92	0.36
		1.00	0.00	17.44	1555	503	698	73	812	5.20	0.63
1	no	-1.00	0.00	31.76	2135	457	699	39	1249	4.87	0.71
		-0.75	0.00	10.05	1202	257	396	70	711	2.74	0.40
		-0.50	0.00	1.98	535	114	180	156	327	1.22	0.18
		-0.25	39.74	**2.00**	227	50	86	626	258	0.51	0.07
		0.00	35.93	1.70	**326**	71	117	430	166	0.74	0.10
		0.25	21.13	0.82	**326**	71	115	338	96	0.74	0.10
		0.50	0.00	1.98	535	114	180	156	327	1.22	0.18
		0.75	0.00	10.05	1202	257	396	70	711	2.74	0.40
		1.00	0.00	31.76	2135	457	699	39	1249	4.87	0.71
	yes	-1.00	0.00	10.31	1317	376	469	112	738	4.40	0.65
		-0.75	0.00	3.26	742	212	267	200	424	2.48	0.37
		-0.50	0.00	0.64	331	94	122	449	199	1.10	0.16
		-0.25	36.15	1.75	**326**	96	129	830	204	1.08	0.15
		0.00	28.86	1.22	**326**	95	127	714	131	1.08	0.15
		0.25	21.51	0.85	**326**	95	125	625	64	1.08	0.16
		0.50	0.00	0.64	331	94	122	449	199	1.10	0.16
		0.75	0.00	3.26	742	212	267	200	424	2.48	0.37
		1.00	0.00	10.31	1317	376	469	112	738	4.40	0.65
1.5	no	-1.00	0.00	17.64	1796	332	437	60	1099	4.09	0.71
		-0.75	0.00	5.58	1011	187	251	107	629	2.30	0.40
		-0.50	0.00	1.10	451	84	117	240	292	1.02	0.18
		-0.25	39.81	**2.00**	278	53	82	960	284	0.63	0.10
		0.00	33.28	1.43	**326**	62	93	666	185	0.74	0.12
		0.25	21.73	0.74	**326**	62	91	495	91	0.74	0.12
		0.50	0.00	1.10	451	84	117	240	292	1.02	0.18
		0.75	0.00	5.58	1011	187	251	107	629	2.30	0.40
		1.00	0.00	17.64	1796	332	437	60	1099	4.09	0.71
	yes	-1.00	0.00	6.98	1173	302	342	155	686	3.92	0.67
		-0.75	0.00	2.21	660	170	197	275	396	2.20	0.37
		-0.50	31.04	1.30	295	76	94	619	**326**	0.98	0.17
		-0.25	34.63	1.57	**326**	87	109	1194	218	1.08	0.18
		0.00	28.27	1.12	**326**	86	108	984	148	1.08	0.18
		0.25	21.85	0.78	**326**	86	107	842	79	1.08	0.18
		0.50	2.75	0.49	**326**	84	103	584	189	1.08	0.18
		0.75	0.00	2.21	660	170	197	275	396	2.20	0.37
		1.00	0.00	6.98	1173	302	342	155	686	3.92	0.67

Table B.12

Water Depth (m):	970	Ice Thickness (m):	300	Air Gap (m):	30

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	2	326	326	326	79.5	326	(mT-m)	(mT)
				Values at Allowable Offset for Each Criterion							
0.5	no	-1.00	0.00	287.92	4835	1284	2282	13	2304	11.02	1.14
		-0.75	0.00	91.10	2720	723	1285	23	1305	6.20	0.64
		-0.50	0.00	18.00	1210	321	573	51	591	2.76	0.29
		-0.25	48.99	**2.00**	304	81	145	203	252	0.69	0.07
		0.00	48.75	**2.00**	297	80	145	249	109	0.67	0.07
		0.25	3.61	1.23	**326**	87	156	192	163	0.74	0.08
		0.50	0.00	18.00	1210	321	573	51	591	2.76	0.29
		0.75	0.00	91.10	2720	723	1285	23	1305	6.20	0.64
		1.00	0.00	287.92	4835	1284	2282	13	2304	11.02	1.14
	yes	-1.00	0.00	56.33	2556	862	1177	49	1156	8.55	1.01
		-0.75	0.00	17.82	1439	485	663	87	659	4.81	0.57
		-0.50	0.00	3.52	641	216	296	195	304	2.14	0.25
		-0.25	49.92	**2.00**	282	97	137	621	186	0.94	0.10
		0.00	36.81	1.44	**326**	111	156	471	90	1.08	0.12
		0.25	18.62	0.92	**326**	110	154	426	91	1.08	0.13
		0.50	0.00	3.52	641	216	296	195	304	2.14	0.25
		0.75	0.00	17.82	1439	485	663	87	659	4.81	0.57
		1.00	0.00	56.33	2556	862	1177	49	1156	8.55	1.01
1	no	-1.00	0.00	129.60	3652	824	1224	28	1973	8.33	1.19
		-0.75	0.00	41.00	2055	463	691	49	1120	4.68	0.67
		-0.50	0.00	8.10	915	206	311	110	511	2.08	0.30
		-0.25	51.10	**2.00**	230	52	83	441	267	0.52	0.07
		0.00	50.82	**2.00**	309	70	112	459	144	0.70	0.10
		0.25	15.84	0.87	**326**	73	116	339	146	0.74	0.11
		0.50	0.00	8.10	915	206	311	110	511	2.08	0.30
		0.75	0.00	41.00	2055	463	691	49	1120	4.68	0.67
		1.00	0.00	129.60	3652	824	1224	28	1973	8.33	1.19
	yes	-1.00	0.00	34.92	2171	653	793	79	1070	7.26	1.06
		-0.75	0.00	11.05	1222	367	449	140	612	4.08	0.60
		-0.50	0.00	2.18	544	163	203	316	286	1.82	0.26
		-0.25	50.85	**2.00**	295	90	118	938	205	0.98	0.14
		0.00	38.43	1.38	**326**	99	128	715	111	1.08	0.15
		0.25	22.31	0.84	**326**	98	126	623	90	1.08	0.16
		0.50	0.00	2.18	544	163	203	316	286	1.82	0.26
		0.75	0.00	11.05	1222	367	449	140	612	4.08	0.60
		1.00	0.00	34.92	2171	653	793	79	1070	7.26	1.06
1.5	no	-1.00	0.00	76.03	3092	610	772	44	1761	7.05	1.21
		-0.75	0.00	24.06	1740	344	439	79	1003	3.97	0.68
		-0.50	0.00	4.75	775	153	201	177	462	1.76	0.30
		-0.25	51.76	**2.00**	195	39	58	709	281	0.44	0.08
		0.00	51.17	1.97	**326**	65	93	672	171	0.74	0.12
		0.25	20.62	0.74	**326**	65	92	497	137	0.74	0.13
		0.50	0.00	4.75	775	153	201	177	462	1.76	0.30
		0.75	0.00	24.06	1740	344	439	79	1003	3.97	0.68
		1.00	0.00	76.03	3092	610	772	44	1761	7.05	1.21
	yes	-1.00	0.00	24.64	1943	530	579	112	1006	6.50	1.09
		-0.75	0.00	7.80	1094	298	330	200	579	3.65	0.61
		-0.50	0.00	1.54	487	133	153	449	273	1.62	0.27
		-0.25	51.36	**2.00**	311	86	106	1269	221	1.03	0.17
		0.00	38.70	1.30	**326**	90	109	990	127	1.08	0.18
		0.25	24.19	0.79	**326**	90	108	843	90	1.08	0.18
		0.50	0.00	1.54	487	133	153	449	273	1.62	0.27
		0.75	0.00	7.80	1094	298	330	200	579	3.65	0.61
		1.00	0.00	24.64	1943	530	579	112	1006	6.50	1.09

Table B.13

Water Depth (m):	460	Ice Thickness (m):	500	Air Gap (m):	50

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	Values at Allowable Offset for Each Criterion						(mT-m)	(mT)
0.5	no	-1.00	0.62	0.02	326	69	286	N/A	N/A	0.74	0.11
		-0.75	0.61	0.02	326	67	273	N/A	N/A	0.74	0.12
		-0.50	0.60	0.02	326	65	264	N/A	N/A	0.74	0.12
		-0.25	0.59	0.02	326	64	259	N/A	N/A	0.74	0.13
		0.00	0.59	0.02	326	64	257	N/A	N/A	0.74	0.13
		0.25	0.59	0.02	326	63	255	N/A	N/A	0.74	0.13
		0.50	0.58	0.02	326	62	249	N/A	N/A	0.74	0.13
		0.75	0.57	0.02	326	61	240	N/A	N/A	0.74	0.14
		1.00	0.56	0.02	326	58	227	N/A	N/A	0.74	0.15
	yes	-1.00	0.62	0.02	326	85	283	N/A	N/A	1.08	0.19
		-0.75	0.61	0.02	326	83	274	N/A	N/A	1.08	0.20
		-0.50	0.60	0.02	326	81	267	N/A	N/A	1.08	0.21
		-0.25	0.60	0.02	326	80	264	N/A	N/A	1.08	0.21
		0.00	0.60	0.02	326	80	262	N/A	N/A	1.08	0.21
		0.25	0.60	0.02	326	80	261	N/A	N/A	1.08	0.21
		0.50	0.59	0.02	326	79	257	N/A	N/A	1.08	0.22
		0.75	0.59	0.02	326	78	251	N/A	N/A	1.08	0.22
		1.00	0.58	0.02	326	76	242	N/A	N/A	1.08	0.23
1	no	-1.00	0.60	0.02	326	64	283	N/A	N/A	0.74	0.12
		-0.75	0.59	0.02	326	61	271	N/A	N/A	0.74	0.13
		-0.50	0.58	0.02	326	60	262	N/A	N/A	0.74	0.13
		-0.25	0.58	0.02	326	59	257	N/A	N/A	0.74	0.14
		0.00	0.57	0.02	326	59	255	N/A	N/A	0.74	0.14
		0.25	0.57	0.02	326	58	253	N/A	N/A	0.74	0.14
		0.50	0.57	0.02	326	57	248	N/A	N/A	0.74	0.14
		0.75	0.56	0.02	326	56	239	N/A	N/A	0.74	0.15
		1.00	0.55	0.02	326	54	227	N/A	N/A	0.74	0.16
	yes	-1.00	0.61	0.02	326	80	281	N/A	N/A	1.08	0.20
		-0.75	0.60	0.02	326	78	273	N/A	N/A	1.08	0.21
		-0.50	0.59	0.02	326	77	267	N/A	N/A	1.08	0.22
		-0.25	0.59	0.02	326	76	263	N/A	N/A	1.08	0.22
		0.00	0.59	0.02	326	75	262	N/A	N/A	1.08	0.22
		0.25	0.58	0.02	326	75	261	N/A	N/A	1.08	0.22
		0.50	0.58	0.02	326	74	257	N/A	N/A	1.08	0.23
		0.75	0.57	0.02	326	73	251	N/A	N/A	1.08	0.23
		1.00	0.57	0.02	326	71	242	N/A	N/A	1.08	0.24
1.5	no	-1.00	0.59	0.02	326	58	281	N/A	N/A	0.74	0.13
		-0.75	0.57	0.02	326	56	269	N/A	N/A	0.74	0.14
		-0.50	0.56	0.02	326	55	260	N/A	N/A	0.74	0.14
		-0.25	0.56	0.02	326	54	255	N/A	N/A	0.74	0.15
		0.00	0.56	0.02	326	54	254	N/A	N/A	0.74	0.15
		0.25	0.56	0.02	326	53	252	N/A	N/A	0.74	0.15
		0.50	0.55	0.02	326	53	247	N/A	N/A	0.74	0.15
		0.75	0.54	0.02	326	51	238	N/A	N/A	0.74	0.16
		1.00	0.53	0.02	326	49	226	N/A	N/A	0.74	0.17
	yes	-1.00	0.59	0.02	326	75	281	N/A	N/A	1.08	0.22
		-0.75	0.58	0.02	326	73	272	N/A	N/A	1.08	0.22
		-0.50	0.58	0.02	326	72	266	N/A	N/A	1.08	0.23
		-0.25	0.57	0.02	326	71	263	N/A	N/A	1.08	0.23
		0.00	0.57	0.02	326	71	262	N/A	N/A	1.08	0.23
		0.25	0.57	0.02	326	71	260	N/A	N/A	1.08	0.23
		0.50	0.57	0.02	326	70	257	N/A	N/A	1.08	0.24
		0.75	0.56	0.02	326	69	251	N/A	N/A	1.08	0.24
		1.00	0.55	0.02	326	67	243	N/A	N/A	1.08	0.25

Table B.14

Water Depth (m):	475	Ice Thickness (m):	500	Air Gap (m):	50

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	2	326	326	326	79.5	326	(mT-m)	(mT)
				Values at Allowable Offset for Each Criterion							
0.5	no	-1.00	2.78	0.18	208	71	**326**	N/A	N/A	0.47	0.06
		-0.75	3.20	0.24	307	92	**326**	N/A	N/A	0.69	0.04
		-0.50	3.08	0.22	**326**	94	288	N/A	N/A	0.74	0.06
		-0.25	2.90	0.20	**326**	92	256	N/A	N/A	0.74	0.06
		0.00	2.84	0.19	**326**	91	245	N/A	N/A	0.74	0.07
		0.25	2.79	0.18	**326**	90	235	N/A	N/A	0.74	0.07
		0.50	2.61	0.16	**326**	88	203	N/A	N/A	0.74	0.07
		0.75	2.28	0.12	**326**	84	150	N/A	N/A	0.74	0.09
		1.00	1.87	0.09	**326**	78	108	N/A	N/A	0.74	0.10
	yes	-1.00	3.00	0.21	287	107	**326**	N/A	N/A	0.95	0.08
		-0.75	3.07	0.22	**326**	116	310	N/A	N/A	1.08	0.11
		-0.50	2.90	0.19	**326**	113	276	N/A	N/A	1.08	0.12
		-0.25	2.79	0.18	**326**	111	257	N/A	N/A	1.08	0.13
		0.00	2.76	0.17	**326**	111	250	N/A	N/A	1.08	0.13
		0.25	2.72	0.17	**326**	110	243	N/A	N/A	1.08	0.13
		0.50	2.62	0.16	**326**	108	223	N/A	N/A	1.08	0.14
		0.75	2.43	0.14	**326**	105	190	N/A	N/A	1.08	0.15
		1.00	2.16	0.11	**326**	101	144	N/A	N/A	1.08	0.16
1	no	-1.00	2.56	0.15	246	69	**326**	N/A	N/A	0.55	0.06
		-0.75	2.83	0.18	**326**	84	322	N/A	N/A	0.74	0.08
		-0.50	2.62	0.15	**326**	81	277	N/A	N/A	0.74	0.09
		-0.25	2.49	0.14	**326**	79	251	N/A	N/A	0.74	0.09
		0.00	2.43	0.13	**326**	78	242	N/A	N/A	0.74	0.09
		0.25	2.38	0.13	**326**	78	233	N/A	N/A	0.74	0.10
		0.50	2.23	0.12	**326**	76	206	N/A	N/A	0.74	0.10
		0.75	2.02	0.09	**326**	73	161	N/A	N/A	0.74	0.11
		1.00	1.72	0.07	**326**	69	99	N/A	N/A	0.74	0.12
	yes	-1.00	2.79	0.18	302	101	**326**	N/A	N/A	1.00	0.12
		-0.75	2.76	0.17	**326**	105	302	N/A	N/A	1.08	0.14
		-0.50	2.62	0.15	**326**	103	273	N/A	N/A	1.08	0.15
		-0.25	2.53	0.14	**326**	101	255	N/A	N/A	1.08	0.16
		0.00	2.50	0.14	**326**	101	249	N/A	N/A	1.08	0.16
		0.25	2.47	0.14	**326**	100	243	N/A	N/A	1.08	0.16
		0.50	2.37	0.13	**326**	99	225	N/A	N/A	1.08	0.17
		0.75	2.20	0.11	**326**	96	195	N/A	N/A	1.08	0.17
		1.00	2.00	0.09	**326**	93	154	N/A	N/A	1.08	0.19
1.5	no	-1.00	2.35	0.12	271	65	**326**	N/A	N/A	0.61	0.07
		-0.75	2.49	0.14	**326**	73	311	N/A	N/A	0.74	0.10
		-0.50	2.29	0.12	**326**	71	271	N/A	N/A	0.74	0.11
		-0.25	2.18	0.11	**326**	70	248	N/A	N/A	0.74	0.11
		0.00	2.14	0.10	**326**	69	240	N/A	N/A	0.74	0.12
		0.25	2.11	0.10	**326**	69	232	N/A	N/A	0.74	0.12
		0.50	2.01	0.09	**326**	67	209	N/A	N/A	0.74	0.12
		0.75	1.84	0.08	**326**	65	170	N/A	N/A	0.74	0.13
		1.00	1.60	0.06	**326**	61	115	N/A	N/A	0.74	0.14
	yes	-1.00	2.62	0.15	313	95	**326**	N/A	N/A	1.04	0.15
		-0.75	2.53	0.14	**326**	96	297	N/A	N/A	1.08	0.17
		-0.50	2.39	0.13	**326**	94	270	N/A	N/A	1.08	0.17
		-0.25	2.30	0.12	**326**	92	254	N/A	N/A	1.08	0.18
		0.00	2.27	0.12	**326**	92	248	N/A	N/A	1.08	0.18
		0.25	2.24	0.11	**326**	92	243	N/A	N/A	1.08	0.18
		0.50	2.17	0.11	**326**	90	227	N/A	N/A	1.08	0.19
		0.75	2.05	0.09	**326**	88	200	N/A	N/A	1.08	0.19
		1.00	1.88	0.08	**326**	85	162	N/A	N/A	1.08	0.20

Table B.15

Water Depth (m):	500	Ice Thickness (m):	500	Air Gap (m):	50

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
				Allowable for Each Criterion						Bending Moment	Shear
Bottom Weight	Drill String Present	Current Speed		2	326	326	326	79.5	326		
(mT)	(yes/no)	(m/s)	(m)	Values at Allowable Offset for Each Criterion						(mT-m)	(mT)
0.5	no	-1.00	0.00	0.18	339	83	250	N/A	N/A	0.77	0.10
		-0.75	7.19	0.61	192	47	**326**	N/A	N/A	0.43	0.06
		-0.50	9.34	0.99	**326**	99	304	N/A	N/A	0.74	0.05
		-0.25	7.89	0.71	**326**	96	221	N/A	N/A	0.74	0.06
		0.00	7.41	0.63	**326**	95	194	N/A	N/A	0.74	0.06
		0.25	6.93	0.55	**326**	94	169	N/A	N/A	0.74	0.06
		0.50	5.48	0.36	**326**	91	157	N/A	N/A	0.74	0.07
		0.75	3.07	0.18	**326**	86	143	N/A	N/A	0.74	0.08
		1.00	0.00	0.18	339	83	250	N/A	N/A	0.77	0.10
	yes	-1.00	6.02	0.43	192	57	**326**	N/A	N/A	0.63	0.11
		-0.75	8.09	0.73	286	106	**326**	N/A	N/A	0.95	0.09
		-0.50	7.69	0.65	**326**	117	270	N/A	N/A	1.08	0.12
		-0.25	6.95	0.54	**326**	115	221	N/A	N/A	1.08	0.12
		0.00	6.71	0.50	**326**	114	205	N/A	N/A	1.08	0.13
		0.25	6.46	0.47	**326**	114	189	N/A	N/A	1.08	0.13
		0.50	5.73	0.38	**326**	112	144	N/A	N/A	1.08	0.13
		0.75	4.50	0.25	**326**	108	134	N/A	N/A	1.08	0.15
		1.00	2.79	0.15	**326**	104	146	N/A	N/A	1.08	0.16
1	no	-1.00	3.76	0.21	258	54	**326**	N/A	N/A	0.58	0.10
		-0.75	6.03	0.41	195	54	**326**	N/A	N/A	0.44	0.06
		-0.50	6.95	0.53	**326**	83	301	N/A	N/A	0.74	0.09
		-0.25	6.09	0.41	**326**	81	236	N/A	N/A	0.74	0.09
		0.00	5.80	0.37	**326**	81	215	N/A	N/A	0.74	0.09
		0.25	5.52	0.33	**326**	80	193	N/A	N/A	0.74	0.09
		0.50	4.66	0.25	**326**	78	128	N/A	N/A	0.74	0.10
		0.75	3.23	0.14	**326**	75	112	N/A	N/A	0.74	0.11
		1.00	1.22	0.09	**326**	71	193	N/A	N/A	0.74	0.12
	yes	-1.00	5.50	0.34	165	55	**326**	N/A	N/A	0.54	0.11
		-0.75	6.95	0.53	298	99	**326**	N/A	N/A	0.99	0.13
		-0.50	6.55	0.47	**326**	105	274	N/A	N/A	1.08	0.15
		-0.25	6.01	0.39	**326**	104	232	N/A	N/A	1.08	0.15
		0.00	5.82	0.37	**326**	103	218	N/A	N/A	1.08	0.16
		0.25	5.64	0.35	**326**	103	204	N/A	N/A	1.08	0.16
		0.50	5.09	0.29	**326**	101	162	N/A	N/A	1.08	0.16
		0.75	4.18	0.21	**326**	98	112	N/A	N/A	1.08	0.17
		1.00	2.90	0.13	**326**	95	129	N/A	N/A	1.08	0.18
1.5	no	-1.00	3.76	0.18	218	40	**326**	N/A	N/A	0.49	0.10
		-0.75	5.34	0.31	232	55	**326**	N/A	N/A	0.52	0.07
		-0.50	5.75	0.35	**326**	73	296	N/A	N/A	0.74	0.11
		-0.25	5.13	0.28	**326**	72	241	N/A	N/A	0.74	0.11
		0.00	4.93	0.26	**326**	71	222	N/A	N/A	0.74	0.12
		0.25	4.72	0.24	**326**	71	204	N/A	N/A	0.74	0.12
		0.50	4.11	0.18	**326**	69	149	N/A	N/A	0.74	0.12
		0.75	3.08	0.12	**326**	67	99	N/A	N/A	0.74	0.13
		1.00	1.65	0.07	**326**	63	166	N/A	N/A	0.74	0.14
	yes	-1.00	5.09	0.29	174	57	**326**	N/A	N/A	0.57	0.11
		-0.75	6.22	0.42	307	93	**326**	N/A	N/A	1.02	0.15
		-0.50	5.80	0.36	**326**	96	276	N/A	N/A	1.08	0.17
		-0.25	5.36	0.31	**326**	95	238	N/A	N/A	1.08	0.18
		0.00	5.21	0.29	**326**	94	225	N/A	N/A	1.08	0.18
		0.25	5.07	0.28	**326**	94	213	N/A	N/A	1.08	0.18
		0.50	4.63	0.23	**326**	93	175	N/A	N/A	1.08	0.19
		0.75	3.90	0.17	**326**	90	112	N/A	N/A	1.08	0.19
		1.00	2.88	0.11	**326**	87	119	N/A	N/A	1.08	0.20

Table B.16

Water Depth (m):	550	Ice Thickness (m):	500	Air Gap (m):	50

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	Values at Allowable Offset for Each Criterion						(mT-m)	(mT)
0.5	no	-1.00	0.00	2.08	741	199	488	N/A	N/A	1.68	0.18
		-0.75	0.00	0.66	418	112	278	N/A	N/A	0.95	0.10
		-0.50	19.34	2.00	302	91	**326**	N/A	N/A	0.68	0.04
		-0.25	14.78	1.21	**326**	95	189	N/A	N/A	0.74	0.06
		0.00	12.89	0.96	**326**	94	174	N/A	N/A	0.74	0.06
		0.25	11.07	0.76	**326**	93	169	N/A	N/A	0.74	0.06
		0.50	5.53	0.39	**326**	90	157	N/A	N/A	0.74	0.07
		0.75	0.00	0.66	418	112	278	N/A	N/A	0.95	0.10
		1.00	0.00	2.08	741	199	488	N/A	N/A	1.68	0.18
	yes	-1.00	0.00	0.49	405	131	280	N/A	N/A	1.35	0.19
		-0.75	12.98	0.91	229	74	**326**	N/A	N/A	0.76	0.11
		-0.50	15.51	1.28	**326**	117	273	N/A	N/A	1.08	0.12
		-0.25	12.73	0.89	**326**	115	187	N/A	N/A	1.08	0.12
		0.00	11.82	0.78	**326**	114	158	N/A	N/A	1.08	0.13
		0.25	10.91	0.69	**326**	113	151	N/A	N/A	1.08	0.13
		0.50	8.13	0.46	**326**	111	145	N/A	N/A	1.08	0.13
		0.75	3.56	0.28	**326**	108	161	N/A	N/A	1.08	0.15
		1.00	0.00	0.49	405	131	280	N/A	N/A	1.35	0.19
1	no	-1.00	0.00	0.68	547	124	377	N/A	N/A	1.24	0.19
		-0.75	6.97	0.40	309	70	**326**	N/A	N/A	0.70	0.10
		-0.50	14.35	1.07	293	75	**326**	N/A	N/A	0.66	0.08
		-0.25	12.00	0.76	**326**	81	222	N/A	N/A	0.74	0.09
		0.00	10.86	0.63	**326**	80	181	N/A	N/A	0.74	0.09
		0.25	9.73	0.52	**326**	79	140	N/A	N/A	0.74	0.09
		0.50	6.28	0.29	**326**	78	115	N/A	N/A	0.74	0.10
		0.75	0.56	0.23	**326**	74	218	N/A	N/A	0.74	0.11
		1.00	0.00	0.68	547	124	377	N/A	N/A	1.24	0.19
	yes	-1.00	0.00	0.27	345	100	246	N/A	N/A	1.14	0.19
		-0.75	11.52	0.71	195	57	**326**	N/A	N/A	0.64	0.11
		-0.50	13.51	0.95	**326**	105	284	N/A	N/A	1.08	0.15
		-0.25	11.39	0.69	**326**	103	207	N/A	N/A	1.08	0.15
		0.00	10.69	0.62	**326**	103	181	N/A	N/A	1.08	0.16
		0.25	9.99	0.55	**326**	102	155	N/A	N/A	1.08	0.16
		0.50	7.84	0.38	**326**	100	120	N/A	N/A	1.08	0.16
		0.75	4.34	0.22	**326**	98	144	N/A	N/A	1.08	0.17
		1.00	0.00	0.27	345	100	246	N/A	N/A	1.14	0.19
1.5	no	-1.00	0.00	0.34	458	91	323	N/A	N/A	1.04	0.19
		-0.75	7.13	0.33	259	51	**326**	N/A	N/A	0.58	0.11
		-0.50	12.11	0.76	303	67	**326**	N/A	N/A	0.68	0.10
		-0.25	10.31	0.55	**326**	71	234	N/A	N/A	0.74	0.11
		0.00	9.49	0.47	**326**	70	198	N/A	N/A	0.74	0.12
		0.25	8.64	0.40	**326**	70	163	N/A	N/A	0.74	0.12
		0.50	6.13	0.24	**326**	68	93	N/A	N/A	0.74	0.12
		0.75	1.94	0.14	**326**	66	189	N/A	N/A	0.74	0.13
		1.00	0.00	0.34	458	91	323	N/A	N/A	1.04	0.19
	yes	-1.00	5.54	0.28	307	81	**326**	N/A	N/A	1.02	0.19
		-0.75	10.52	0.59	180	56	**326**	N/A	N/A	0.59	0.11
		-0.50	12.07	0.75	**326**	95	289	N/A	N/A	1.08	0.17
		-0.25	10.36	0.56	**326**	94	219	N/A	N/A	1.08	0.18
		0.00	9.79	0.51	**326**	94	195	N/A	N/A	1.08	0.18
		0.25	9.22	0.45	**326**	93	172	N/A	N/A	1.08	0.18
		0.50	7.46	0.32	**326**	92	104	N/A	N/A	1.08	0.19
		0.75	4.62	0.19	**326**	90	134	N/A	N/A	1.08	0.19
		1.00	0.58	0.18	**326**	87	225	N/A	N/A	1.08	0.20

Table B.17

Water Depth (m):	650	Ice Thickness (m):	500	Air Gap (m):	50

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
				Allowable for Each Criterion						Bending Moment	Shear
Bottom Weight	Drill String Present	Current Speed		2	326	326	326	79.5	326		
(mT)	(yes/no)	(m/s)	(m)	Values at Allowable Offset for Each Criterion						(mT-m)	(mT)
0.5	no	-1.00	0.00	18.89	1627	430	795	24	911	3.70	0.33
		-0.75	0.00	5.98	917	242	448	42	517	2.08	0.19
		-0.50	0.00	1.18	409	108	200	95	236	0.93	0.08
		-0.25	27.62	**2.00**	294	82	160	237	208	0.66	0.05
		0.00	22.68	1.47	**326**	90	173	177	126	0.74	0.06
		0.25	15.55	0.91	**326**	89	168	153	67	0.74	0.06
		0.50	0.00	1.18	409	108	200	95	236	0.93	0.08
		0.75	0.00	5.98	917	242	448	42	517	2.08	0.19
		1.00	0.00	18.89	1627	430	795	24	911	3.70	0.33
	yes	-1.00	0.00	3.45	815	258	347	112	494	2.72	0.35
		-0.75	0.00	1.09	460	145	196	200	282	1.53	0.20
		-0.50	27.96	**2.00**	264	90	133	450	305	0.87	0.09
		-0.25	22.46	1.39	**326**	108	155	536	181	1.08	0.12
		0.00	19.45	1.10	**326**	108	153	478	131	1.08	0.12
		0.25	16.37	0.86	**326**	107	151	431	82	1.08	0.13
		0.50	7.20	0.49	**326**	105	144	334	131	1.08	0.13
		0.75	0.00	1.09	460	145	196	200	282	1.53	0.20
		1.00	0.00	3.45	815	258	347	112	494	2.72	0.35
1	no	-1.00	0.00	5.90	1147	249	384	49	717	2.61	0.35
		-0.75	0.00	1.87	647	140	218	87	410	1.47	0.20
		-0.50	17.98	1.02	289	63	100	195	**326**	0.65	0.09
		-0.25	25.12	1.62	**326**	74	126	505	248	0.74	0.09
		0.00	20.58	1.12	**326**	74	123	374	170	0.74	0.09
		0.25	16.00	0.74	**326**	73	121	297	92	0.74	0.09
		0.50	2.36	0.41	**326**	71	114	184	190	0.74	0.10
		0.75	0.00	1.87	647	140	218	87	410	1.47	0.20
		1.00	0.00	5.90	1147	249	384	49	717	2.61	0.35
	yes	-1.00	0.00	1.91	688	192	234	163	440	2.29	0.36
		-0.75	0.00	0.60	389	108	134	289	254	1.29	0.20
		-0.50	26.76	1.82	299	89	121	651	**326**	0.99	0.13
		-0.25	20.95	1.16	**326**	96	127	841	202	1.08	0.15
		0.00	18.50	0.94	**326**	95	125	720	156	1.08	0.15
		0.25	16.03	0.75	**326**	94	124	628	111	1.08	0.16
		0.50	8.68	0.41	**326**	93	119	457	121	1.08	0.16
		0.75	0.00	0.60	389	108	134	289	254	1.29	0.20
		1.00	0.00	1.91	688	192	234	163	440	2.29	0.36
1.5	no	-1.00	0.00	2.93	944	175	232	73	615	2.15	0.35
		-0.75	0.00	0.93	533	99	135	130	354	1.21	0.20
		-0.50	16.96	0.83	239	44	65	293	**326**	0.54	0.09
		-0.25	21.77	1.21	**326**	64	98	904	259	0.74	0.11
		0.00	18.44	0.88	**326**	63	96	604	191	0.74	0.11
		0.25	15.05	0.62	**326**	63	94	453	122	0.74	0.11
		0.50	5.00	0.28	**326**	61	89	259	168	0.74	0.12
		0.75	0.00	0.93	533	99	135	130	354	1.21	0.20
		1.00	0.00	2.93	944	175	232	73	615	2.15	0.35
	yes	-1.00	0.00	1.23	611	153	171	214	403	2.03	0.36
		-0.75	0.00	0.39	345	86	101	380	235	1.14	0.20
		-0.50	23.84	1.45	292	78	101	855	**326**	0.97	0.15
		-0.25	19.54	0.99	**326**	86	108	1201	216	1.08	0.18
		0.00	17.47	0.81	**326**	85	106	993	173	1.08	0.18
		0.25	15.40	0.66	**326**	85	105	847	131	1.08	0.18
		0.50	9.25	0.36	**326**	83	101	587	115	1.08	0.18
		0.75	0.00	0.39	345	86	101	380	235	1.14	0.20
		1.00	0.00	1.23	611	153	171	214	403	2.03	0.36

Table B.18

Water Depth (m):	850	Ice Thickness (m):	500	Air Gap (m):	50

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	2	326	326	326	79.5	326	(mT-m)	(mT)
				Values at Allowable Offset for Each Criterion							
0.5	no	-1.00	0.00	114.67	3351	952	1719	14	1609	7.64	0.65
		-0.75	0.00	36.28	1887	536	967	25	911	4.30	0.37
		-0.50	0.00	7.17	840	239	431	55	413	1.91	0.16
		-0.25	39.55	**2.00**	213	61	109	222	219	0.48	0.04
		0.00	36.47	1.95	**326**	94	174	178	111	0.74	0.06
		0.25	12.79	0.93	**326**	93	169	154	114	0.74	0.06
		0.50	0.00	7.17	840	239	431	55	413	1.91	0.16
		0.75	0.00	36.28	1887	536	967	25	911	4.30	0.37
		1.00	0.00	114.67	3351	952	1719	14	1609	7.64	0.65
	yes	-1.00	0.00	17.43	1569	539	706	72	810	5.24	0.64
		-0.75	0.00	5.51	884	303	398	129	462	2.95	0.36
		-0.50	0.00	1.09	395	136	178	290	213	1.31	0.16
		-0.25	37.04	1.91	**326**	115	156	537	182	1.08	0.12
		0.00	28.36	1.30	**326**	114	154	477	105	1.08	0.12
		0.25	19.76	0.89	**326**	114	152	431	64	1.08	0.13
		0.50	0.00	1.09	395	136	178	290	213	1.31	0.16
		0.75	0.00	5.51	884	303	398	129	462	2.95	0.36
		1.00	0.00	17.43	1569	539	706	72	810	5.24	0.64
1	no	-1.00	0.00	39.45	2342	565	829	33	1308	5.34	0.70
		-0.75	0.00	12.48	1319	318	468	59	743	3.00	0.39
		-0.50	0.00	2.47	588	142	211	132	340	1.33	0.18
		-0.25	39.75	**2.00**	216	54	87	530	250	0.49	0.06
		0.00	35.70	1.69	**326**	80	125	378	154	0.74	0.09
		0.25	19.49	0.78	**326**	79	122	300	99	0.74	0.09
		0.50	0.00	2.47	588	142	211	132	340	1.33	0.18
		0.75	0.00	12.48	1319	318	468	59	743	3.00	0.39
		1.00	0.00	39.45	2342	565	829	33	1308	5.34	0.70
	yes	-1.00	0.00	10.30	1331	412	477	112	737	4.45	0.67
		-0.75	0.00	3.26	750	232	271	200	422	2.50	0.37
		-0.50	0.00	0.64	335	104	123	449	198	1.11	0.17
		-0.25	35.81	1.71	**326**	103	128	844	201	1.08	0.15
		0.00	28.42	1.19	**326**	103	126	722	128	1.08	0.15
		0.25	21.11	0.82	**326**	102	125	632	63	1.08	0.16
		0.50	0.00	0.64	335	104	123	449	198	1.11	0.17
		0.75	0.00	3.26	750	232	271	200	422	2.50	0.37
		1.00	0.00	10.30	1331	412	477	112	737	4.45	0.67
1.5	no	-1.00	0.00	20.56	1929	409	504	54	1137	4.39	0.71
		-0.75	0.00	6.51	1086	230	288	96	649	2.47	0.40
		-0.50	0.00	1.29	485	103	133	215	301	1.10	0.18
		-0.25	39.85	**2.00**	272	59	84	861	277	0.61	0.09
		0.00	33.01	1.42	**326**	70	97	613	176	0.74	0.12
		0.25	20.68	0.71	**326**	70	96	458	92	0.74	0.12
		0.50	0.00	1.29	485	103	133	215	301	1.10	0.18
		0.75	0.00	6.51	1086	230	288	96	649	2.47	0.40
		1.00	0.00	20.56	1929	409	504	54	1137	4.39	0.71
	yes	-1.00	0.00	6.97	1188	336	349	155	684	3.96	0.68
		-0.75	0.00	2.21	669	189	201	275	395	2.23	0.38
		-0.50	31.25	1.32	299	84	95	619	**326**	0.99	0.17
		-0.25	34.22	1.53	**326**	94	109	1216	215	1.08	0.18
		0.00	27.80	1.08	**326**	94	108	998	145	1.08	0.18
		0.25	21.42	0.76	**326**	93	106	853	76	1.08	0.18
		0.50	2.30	0.48	**326**	92	103	590	188	1.08	0.18
		0.75	0.00	2.21	669	189	201	275	395	2.23	0.38
		1.00	0.00	6.97	1188	336	349	155	684	3.96	0.68

Table B.19

Water Depth (m):	950	Ice Thickness (m):	500	Air Gap (m):	50

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
				Allowable for Each Criterion						Bending Moment	Shear
Bottom Weight	Drill String Present	Current Speed		2	326	326	326	79.5	326		
(mT)	(yes/no)	(m/s)	(m)	Values at Allowable Offset for Each Criterion						(mT-m)	(mT)
0.5	no	-1.00	0.00	193.73	4137	1150	2133	12	1912	9.43	0.79
		-0.75	0.00	61.30	2328	647	1200	21	1082	5.30	0.44
		-0.50	0.00	12.11	1037	288	534	46	490	2.36	0.20
		-0.25	43.54	**2.00**	262	73	135	186	229	0.59	0.05
		0.00	40.79	**2.00**	318	90	169	182	105	0.72	0.06
		0.25	8.35	1.05	**326**	91	169	154	134	0.74	0.06
		0.50	0.00	12.11	1037	288	534	46	490	2.36	0.20
		0.75	0.00	61.30	2328	647	1200	21	1082	5.30	0.44
		1.00	0.00	193.73	4137	1150	2133	12	1912	9.43	0.79
	yes	-1.00	0.00	28.15	1906	639	865	62	938	6.37	0.77
		-0.75	0.00	8.91	1074	360	487	110	534	3.58	0.43
		-0.50	0.00	1.76	479	161	217	248	246	1.59	0.19
		-0.25	42.15	**2.00**	313	108	150	559	183	1.04	0.12
		0.00	31.70	1.37	**326**	111	154	475	98	1.08	0.12
		0.25	20.06	0.90	**326**	110	152	427	73	1.08	0.13
		0.50	0.00	1.76	479	161	217	248	246	1.59	0.19
		0.75	0.00	8.91	1074	360	487	110	534	3.58	0.43
		1.00	0.00	28.15	1906	639	865	62	938	6.37	0.77
1	no	-1.00	0.00	69.59	2885	671	1024	29	1572	6.57	0.85
		-0.75	0.00	22.02	1624	377	578	51	893	3.70	0.48
		-0.50	0.00	4.35	724	168	260	115	408	1.64	0.21
		-0.25	44.22	**2.00**	183	43	69	459	252	0.41	0.05
		0.00	42.28	1.92	**326**	77	124	377	149	0.74	0.09
		0.25	18.71	0.81	**326**	76	122	299	117	0.74	0.09
		0.50	0.00	4.35	724	168	260	115	408	1.64	0.21
		0.75	0.00	22.02	1624	377	578	51	893	3.70	0.48
		1.00	0.00	69.59	2885	671	1024	29	1572	6.57	0.85
	yes	-1.00	0.00	16.97	1618	484	583	98	859	5.40	0.80
		-0.75	0.00	5.37	911	272	330	174	492	3.04	0.45
		-0.50	0.00	1.06	407	121	150	392	230	1.35	0.20
		-0.25	42.45	1.94	**326**	100	128	842	204	1.08	0.15
		0.00	32.32	1.27	**326**	99	126	720	121	1.08	0.15
		0.25	22.24	0.84	**326**	98	124	629	72	1.08	0.16
		0.50	0.00	1.06	407	121	150	392	230	1.35	0.20
		0.75	0.00	5.37	911	272	330	174	492	3.04	0.45
		1.00	0.00	16.97	1618	484	583	98	859	5.40	0.80
1.5	no	-1.00	0.00	37.15	2376	479	620	48	1376	5.41	0.87
		-0.75	0.00	11.75	1338	270	353	85	784	3.04	0.49
		-0.50	0.00	2.32	597	120	162	191	362	1.35	0.22
		-0.25	44.41	**2.00**	215	44	69	764	274	0.48	0.07
		0.00	39.74	1.64	**326**	67	97	607	172	0.74	0.11
		0.25	21.51	0.72	**326**	66	95	455	108	0.74	0.12
		0.50	0.00	2.32	597	120	162	191	362	1.35	0.22
		0.75	0.00	11.75	1338	270	353	85	784	3.04	0.49
		1.00	0.00	37.15	2376	479	620	48	1376	5.41	0.87
	yes	-1.00	0.00	11.69	1444	391	425	137	802	4.82	0.82
		-0.75	0.00	3.70	814	220	243	243	461	2.71	0.46
		-0.50	0.00	0.73	364	98	114	548	218	1.21	0.20
		-0.25	40.95	1.76	**326**	90	109	1202	218	1.08	0.18
		0.00	32.01	1.18	**326**	89	107	995	137	1.08	0.18
		0.25	23.09	0.78	**326**	89	106	848	73	1.08	0.18
		0.50	0.00	0.73	364	98	114	548	218	1.21	0.20
		0.75	0.00	3.70	814	220	243	243	461	2.71	0.46
		1.00	0.00	11.69	1444	391	425	137	802	4.82	0.82

Table B.20

Water Depth (m):	730	Ice Thickness (m):	800	Air Gap (m):	80

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	2	326	326	326	79.5	326	(mT-m)	(mT)
				Values at Allowable Offset for Each Criterion							
0.5	no	-1.00	0.63	0.02	326	70	284	N/A	N/A	0.73	0.10
		-0.75	0.61	0.02	326	67	271	N/A	N/A	0.73	0.10
		-0.50	0.59	0.02	326	65	262	N/A	N/A	0.73	0.11
		-0.25	0.58	0.02	326	64	256	N/A	N/A	0.73	0.11
		0.00	0.58	0.02	326	64	254	N/A	N/A	0.73	0.12
		0.25	0.58	0.02	326	64	252	N/A	N/A	0.73	0.12
		0.50	0.57	0.02	326	63	247	N/A	N/A	0.73	0.12
		0.75	0.57	0.02	326	61	237	N/A	N/A	0.73	0.13
		1.00	0.56	0.02	326	59	224	N/A	N/A	0.73	0.13
	yes	-1.00	0.61	0.02	326	83	280	N/A	N/A	1.07	0.19
		-0.75	0.60	0.02	326	81	271	N/A	N/A	1.07	0.20
		-0.50	0.59	0.02	326	80	265	N/A	N/A	1.07	0.21
		-0.25	0.58	0.02	326	79	261	N/A	N/A	1.07	0.21
		0.00	0.58	0.02	326	78	260	N/A	N/A	1.07	0.21
		0.25	0.58	0.02	326	78	259	N/A	N/A	1.07	0.21
		0.50	0.58	0.02	326	77	255	N/A	N/A	1.07	0.21
		0.75	0.57	0.02	326	76	249	N/A	N/A	1.07	0.22
		1.00	0.56	0.02	326	74	240	N/A	N/A	1.07	0.23
1	no	-1.00	0.60	0.02	326	64	281	N/A	N/A	0.73	0.11
		-0.75	0.58	0.02	326	62	268	N/A	N/A	0.73	0.12
		-0.50	0.57	0.02	326	60	259	N/A	N/A	0.73	0.12
		-0.25	0.57	0.02	326	59	254	N/A	N/A	0.73	0.13
		0.00	0.57	0.02	326	59	252	N/A	N/A	0.73	0.13
		0.25	0.57	0.02	326	58	250	N/A	N/A	0.73	0.13
		0.50	0.56	0.02	326	57	245	N/A	N/A	0.73	0.13
		0.75	0.55	0.02	326	56	236	N/A	N/A	0.73	0.14
		1.00	0.54	0.02	326	54	223	N/A	N/A	0.73	0.15
	yes	-1.00	0.59	0.02	326	78	279	N/A	N/A	1.07	0.20
		-0.75	0.58	0.02	326	76	270	N/A	N/A	1.07	0.21
		-0.50	0.58	0.02	326	75	264	N/A	N/A	1.07	0.22
		-0.25	0.57	0.02	326	74	261	N/A	N/A	1.07	0.22
		0.00	0.57	0.02	326	74	259	N/A	N/A	1.07	0.22
		0.25	0.57	0.02	326	73	258	N/A	N/A	1.07	0.22
		0.50	0.57	0.02	326	73	255	N/A	N/A	1.07	0.23
		0.75	0.56	0.02	326	71	249	N/A	N/A	1.07	0.23
		1.00	0.56	0.02	326	69	240	N/A	N/A	1.07	0.24
1.5	no	-1.00	0.58	0.02	326	59	278	N/A	N/A	0.73	0.12
		-0.75	0.57	0.02	326	56	266	N/A	N/A	0.73	0.13
		-0.50	0.56	0.02	326	55	258	N/A	N/A	0.73	0.13
		-0.25	0.56	0.02	326	54	253	N/A	N/A	0.73	0.14
		0.00	0.55	0.02	326	54	251	N/A	N/A	0.73	0.14
		0.25	0.55	0.02	326	53	249	N/A	N/A	0.73	0.14
		0.50	0.55	0.02	326	52	244	N/A	N/A	0.73	0.14
		0.75	0.54	0.02	326	51	235	N/A	N/A	0.73	0.15
		1.00	0.53	0.02	326	49	223	N/A	N/A	0.73	0.16
	yes	-1.00	0.58	0.02	326	73	278	N/A	N/A	1.07	0.21
		-0.75	0.57	0.02	326	72	270	N/A	N/A	1.07	0.22
		-0.50	0.57	0.02	326	70	264	N/A	N/A	1.07	0.23
		-0.25	0.56	0.02	326	70	260	N/A	N/A	1.07	0.23
		0.00	0.56	0.02	326	69	259	N/A	N/A	1.07	0.23
		0.25	0.56	0.02	326	69	258	N/A	N/A	1.07	0.23
		0.50	0.56	0.02	326	68	254	N/A	N/A	1.07	0.24
		0.75	0.55	0.02	326	67	249	N/A	N/A	1.07	0.24
		1.00	0.55	0.02	326	65	240	N/A	N/A	1.07	0.25

Table B.21

Water Depth (m):	745	Ice Thickness (m):	800	Air Gap (m):	80

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
				Allowable for Each Criterion						Bending	
Bottom Weight	Drill String Present	Current Speed		2	326	326	326	79.5	326	Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	Values at Allowable Offset for Each Criterion						(mT-m)	(mT)
0.5	no	-1.00	2.90	0.21	195	72	**326**	N/A	N/A	0.42	0.06
		-0.75	3.44	0.28	300	97	**326**	N/A	N/A	0.67	0.03
		-0.50	3.34	0.26	**326**	100	287	N/A	N/A	0.73	0.03
		-0.25	3.11	0.23	**326**	97	252	N/A	N/A	0.73	0.04
		0.00	3.02	0.22	**326**	96	241	N/A	N/A	0.73	0.04
		0.25	2.95	0.21	**326**	95	229	N/A	N/A	0.73	0.05
		0.50	2.75	0.18	**326**	92	194	N/A	N/A	0.73	0.05
		0.75	2.40	0.14	**326**	87	141	N/A	N/A	0.73	0.07
		1.00	1.90	0.09	**326**	81	115	N/A	N/A	0.73	0.08
	yes	-1.00	3.00	0.21	291	108	**326**	N/A	N/A	0.96	0.09
		-0.75	3.06	0.22	**326**	115	307	N/A	N/A	1.07	0.11
		-0.50	2.88	0.19	**326**	112	274	N/A	N/A	1.07	0.12
		-0.25	2.78	0.18	**326**	110	254	N/A	N/A	1.07	0.13
		0.00	2.75	0.17	**326**	110	247	N/A	N/A	1.07	0.13
		0.25	2.71	0.17	**326**	109	241	N/A	N/A	1.07	0.13
		0.50	2.62	0.15	**326**	107	221	N/A	N/A	1.07	0.14
		0.75	2.43	0.13	**326**	104	188	N/A	N/A	1.07	0.15
		1.00	2.15	0.11	**326**	100	142	N/A	N/A	1.07	0.16
1	no	-1.00	2.67	0.16	238	70	**326**	N/A	N/A	0.53	0.06
		-0.75	2.97	0.21	**326**	87	323	N/A	N/A	0.73	0.06
		-0.50	2.74	0.17	**326**	84	275	N/A	N/A	0.73	0.07
		-0.25	2.61	0.15	**326**	82	246	N/A	N/A	0.73	0.07
		0.00	2.56	0.15	**326**	81	237	N/A	N/A	0.73	0.08
		0.25	2.51	0.14	**326**	80	227	N/A	N/A	0.73	0.08
		0.50	2.33	0.12	**326**	78	199	N/A	N/A	0.73	0.08
		0.75	2.08	0.10	**326**	75	151	N/A	N/A	0.73	0.09
		1.00	1.76	0.07	**326**	70	88	N/A	N/A	0.73	0.11
	yes	-1.00	2.80	0.18	306	101	**326**	N/A	N/A	1.01	0.12
		-0.75	2.75	0.17	**326**	104	300	N/A	N/A	1.07	0.14
		-0.50	2.62	0.15	**326**	101	270	N/A	N/A	1.07	0.15
		-0.25	2.54	0.14	**326**	100	252	N/A	N/A	1.07	0.16
		0.00	2.50	0.14	**326**	99	246	N/A	N/A	1.07	0.16
		0.25	2.47	0.14	**326**	98	240	N/A	N/A	1.07	0.16
		0.50	2.36	0.13	**326**	97	222	N/A	N/A	1.07	0.16
		0.75	2.20	0.11	**326**	94	193	N/A	N/A	1.07	0.17
		1.00	2.01	0.09	**326**	91	151	N/A	N/A	1.07	0.18
1.5	no	-1.00	2.46	0.14	267	66	**326**	N/A	N/A	0.60	0.06
		-0.75	2.60	0.15	**326**	75	310	N/A	N/A	0.73	0.09
		-0.50	2.39	0.13	**326**	73	269	N/A	N/A	0.73	0.09
		-0.25	2.25	0.11	**326**	71	244	N/A	N/A	0.73	0.10
		0.00	2.21	0.11	**326**	71	236	N/A	N/A	0.73	0.10
		0.25	2.17	0.11	**326**	70	228	N/A	N/A	0.73	0.10
		0.50	2.07	0.10	**326**	68	203	N/A	N/A	0.73	0.11
		0.75	1.90	0.08	**326**	66	162	N/A	N/A	0.73	0.11
		1.00	1.60	0.06	**326**	62	104	N/A	N/A	0.73	0.13
	yes	-1.00	2.64	0.15	317	95	**326**	N/A	N/A	1.04	0.15
		-0.75	2.54	0.14	**326**	94	295	N/A	N/A	1.07	0.17
		-0.50	2.39	0.13	**326**	92	268	N/A	N/A	1.07	0.17
		-0.25	2.30	0.12	**326**	91	251	N/A	N/A	1.07	0.18
		0.00	2.27	0.12	**326**	90	246	N/A	N/A	1.07	0.18
		0.25	2.24	0.11	**326**	90	241	N/A	N/A	1.07	0.18
		0.50	2.17	0.11	**326**	88	224	N/A	N/A	1.07	0.19
		0.75	2.05	0.10	**326**	86	197	N/A	N/A	1.07	0.19
		1.00	1.89	0.08	**326**	83	159	N/A	N/A	1.07	0.20

Table B.22

Water Depth (m):	770	Ice Thickness (m):	800	Air Gap (m):	80

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	2	326	326	326	79.5	326	(mT-m)	(mT)
				Values at Allowable Offset for Each Criterion							
0.5	no	-1.00	0.00	0.36	427	111	307	N/A	N/A	0.96	0.10
		-0.75	8.05	0.81	243	63	**326**	N/A	N/A	0.54	0.06
		-0.50	10.01	1.16	281	94	268	0	N/A	0.63	0.02
		-0.25	9.11	0.98	**326**	103	210	N/A	N/A	0.73	0.03
		0.00	8.39	0.84	**326**	102	204	N/A	N/A	0.73	0.03
		0.25	7.71	0.72	**326**	101	198	N/A	N/A	0.73	0.03
		0.50	5.63	0.42	**326**	96	179	N/A	N/A	0.73	0.04
		0.75	2.17	0.19	**326**	89	174	N/A	N/A	0.73	0.06
		1.00	0.00	0.36	427	111	307	N/A	N/A	0.96	0.10
	yes	-1.00	6.09	0.44	193	56	**326**	N/A	N/A	0.63	0.11
		-0.75	8.15	0.74	290	107	**326**	N/A	N/A	0.95	0.09
		-0.50	7.66	0.65	**326**	115	267	N/A	N/A	1.07	0.12
		-0.25	6.94	0.54	**326**	113	219	N/A	N/A	1.07	0.12
		0.00	6.68	0.50	**326**	113	203	N/A	N/A	1.07	0.13
		0.25	6.42	0.47	**326**	112	187	N/A	N/A	1.07	0.13
		0.50	5.70	0.37	**326**	110	142	N/A	N/A	1.07	0.13
		0.75	4.45	0.25	**326**	106	132	N/A	N/A	1.07	0.14
		1.00	2.75	0.15	**326**	102	144	N/A	N/A	1.07	0.16
1	no	-1.00	3.58	0.23	291	63	**326**	N/A	N/A	0.65	0.10
		-0.75	6.44	0.48	177	52	**326**	N/A	N/A	0.39	0.06
		-0.50	7.61	0.64	**326**	86	298	N/A	N/A	0.73	0.06
		-0.25	6.56	0.48	**326**	84	227	N/A	N/A	0.73	0.07
		0.00	6.23	0.43	**326**	83	203	N/A	N/A	0.73	0.07
		0.25	5.89	0.39	**326**	83	180	N/A	N/A	0.73	0.08
		0.50	4.84	0.27	**326**	80	124	N/A	N/A	0.73	0.08
		0.75	3.10	0.15	**326**	77	123	N/A	N/A	0.73	0.09
		1.00	0.65	0.11	**326**	71	212	N/A	N/A	0.73	0.11
	yes	-1.00	5.52	0.35	166	55	**326**	N/A	N/A	0.54	0.11
		-0.75	7.02	0.54	301	98	**326**	N/A	N/A	0.99	0.13
		-0.50	6.52	0.46	**326**	103	272	N/A	N/A	1.07	0.15
		-0.25	6.00	0.39	**326**	102	230	N/A	N/A	1.07	0.15
		0.00	5.81	0.37	**326**	101	216	N/A	N/A	1.07	0.15
		0.25	5.61	0.35	**326**	100	202	N/A	N/A	1.07	0.16
		0.50	5.08	0.29	**326**	99	160	N/A	N/A	1.07	0.16
		0.75	4.16	0.20	**326**	96	109	N/A	N/A	1.07	0.17
		1.00	2.89	0.13	**326**	92	127	N/A	N/A	1.07	0.18
1.5	no	-1.00	3.78	0.19	238	44	**326**	N/A	N/A	0.53	0.10
		-0.75	5.60	0.35	223	54	**326**	N/A	N/A	0.50	0.06
		-0.50	6.11	0.40	**326**	74	294	N/A	N/A	0.73	0.09
		-0.25	5.38	0.31	**326**	73	235	N/A	N/A	0.73	0.10
		0.00	5.16	0.29	**326**	72	215	N/A	N/A	0.73	0.10
		0.25	4.94	0.26	**326**	71	196	N/A	N/A	0.73	0.10
		0.50	4.22	0.20	**326**	70	137	N/A	N/A	0.73	0.11
		0.75	3.06	0.12	**326**	67	104	N/A	N/A	0.73	0.11
		1.00	1.39	0.07	**326**	63	176	N/A	N/A	0.73	0.13
	yes	-1.00	5.13	0.29	178	57	**326**	N/A	N/A	0.58	0.10
		-0.75	6.26	0.42	311	92	**326**	N/A	N/A	1.02	0.16
		-0.50	5.78	0.36	**326**	94	273	N/A	N/A	1.07	0.17
		-0.25	5.33	0.31	**326**	92	236	N/A	N/A	1.07	0.18
		0.00	5.20	0.29	**326**	92	223	N/A	N/A	1.07	0.18
		0.25	5.06	0.28	**326**	91	211	N/A	N/A	1.07	0.18
		0.50	4.60	0.23	**326**	90	173	N/A	N/A	1.07	0.18
		0.75	3.89	0.17	**326**	88	110	N/A	N/A	1.07	0.19
		1.00	2.86	0.11	**326**	85	117	N/A	N/A	1.07	0.20

Table B.23

Water Depth (m):	820	Ice Thickness (m):	800	Air Gap (m):	80

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
Bottom Weight	Drill String Present	Current Speed		Allowable for Each Criterion						Bending Moment	Shear
(mT)	(yes/no)	(m/s)	(m)	2	326	326	326	79.5	326	(mT-m)	(mT)
				Values at Allowable Offset for Each Criterion							
0.5	no	-1.00	0.00	4.97	985	287	593	N/A	N/A	2.24	0.15
		-0.75	0.00	1.57	556	163	337	N/A	N/A	1.26	0.09
		-0.50	19.16	**2.00**	250	76	279	N/A	N/A	0.56	0.04
		-0.25	15.89	1.52	**326**	105	212	N/A	N/A	0.73	0.03
		0.00	13.39	1.16	**326**	103	205	N/A	N/A	0.73	0.03
		0.25	10.80	0.88	**326**	102	199	N/A	N/A	0.73	0.03
		0.50	3.19	0.49	**326**	97	179	N/A	N/A	0.73	0.05
		0.75	0.00	1.57	556	163	337	N/A	N/A	1.26	0.09
		1.00	0.00	4.97	985	287	593	N/A	N/A	2.24	0.15
	yes	-1.00	0.00	0.49	407	132	279	N/A	N/A	1.35	0.19
		-0.75	13.17	0.93	231	75	**326**	N/A	N/A	0.76	0.11
		-0.50	15.43	1.27	**326**	117	270	N/A	N/A	1.07	0.12
		-0.25	12.69	0.88	**326**	115	184	N/A	N/A	1.07	0.12
		0.00	11.73	0.78	**326**	114	156	N/A	N/A	1.07	0.12
		0.25	10.82	0.68	**326**	114	149	N/A	N/A	1.07	0.13
		0.50	8.11	0.45	**326**	112	143	N/A	N/A	1.07	0.13
		0.75	3.50	0.28	**326**	108	160	N/A	N/A	1.07	0.14
		1.00	0.00	0.49	407	132	279	N/A	N/A	1.35	0.19
1	no	-1.00	0.00	1.03	625	150	415	N/A	N/A	1.41	0.18
		-0.75	0.00	0.33	354	85	238	N/A	N/A	0.80	0.10
		-0.50	15.91	1.33	300	81	**326**	N/A	N/A	0.67	0.06
		-0.25	12.75	0.87	**326**	86	207	N/A	N/A	0.73	0.07
		0.00	11.34	0.71	**326**	85	164	N/A	N/A	0.73	0.07
		0.25	9.99	0.57	**326**	84	133	N/A	N/A	0.73	0.08
		0.50	5.86	0.30	**326**	82	124	N/A	N/A	0.73	0.08
		0.75	0.00	0.33	354	85	238	N/A	N/A	0.80	0.10
		1.00	0.00	1.03	625	150	415	N/A	N/A	1.41	0.18
	yes	-1.00	0.00	0.27	347	101	245	N/A	N/A	1.14	0.19
		-0.75	11.62	0.72	197	58	**326**	N/A	N/A	0.64	0.11
		-0.50	13.48	0.95	**326**	105	281	N/A	N/A	1.07	0.15
		-0.25	11.31	0.68	**326**	104	204	N/A	N/A	1.07	0.15
		0.00	10.61	0.61	**326**	103	178	N/A	N/A	1.07	0.15
		0.25	9.92	0.54	**326**	102	153	N/A	N/A	1.07	0.16
		0.50	7.82	0.37	**326**	101	117	N/A	N/A	1.07	0.16
		0.75	4.28	0.22	**326**	98	142	N/A	N/A	1.07	0.17
		1.00	0.00	0.27	347	101	245	N/A	N/A	1.14	0.19
1.5	no	-1.00	0.00	0.45	502	105	343	N/A	N/A	1.13	0.18
		-0.75	7.12	0.36	285	60	**326**	N/A	N/A	0.64	0.10
		-0.50	12.99	0.87	306	72	**326**	N/A	N/A	0.69	0.09
		-0.25	10.72	0.60	**326**	74	225	N/A	N/A	0.73	0.10
		0.00	9.78	0.50	**326**	74	188	N/A	N/A	0.73	0.10
		0.25	8.85	0.42	**326**	73	150	N/A	N/A	0.73	0.10
		0.50	5.98	0.24	**326**	72	97	N/A	N/A	0.73	0.11
		0.75	1.24	0.16	**326**	69	200	N/A	N/A	0.73	0.11
		1.00	0.00	0.45	502	105	343	N/A	N/A	1.13	0.18
	yes	-1.00	5.63	0.29	309	82	**326**	N/A	N/A	1.02	0.19
		-0.75	10.61	0.60	185	58	**326**	N/A	N/A	0.60	0.11
		-0.50	11.99	0.75	**326**	96	287	N/A	N/A	1.07	0.17
		-0.25	10.29	0.56	**326**	95	216	N/A	N/A	1.07	0.18
		0.00	9.73	0.50	**326**	94	193	N/A	N/A	1.07	0.18
		0.25	9.16	0.45	**326**	94	169	N/A	N/A	1.07	0.18
		0.50	7.42	0.32	**326**	92	102	N/A	N/A	1.07	0.18
		0.75	4.56	0.19	**326**	90	132	N/A	N/A	1.07	0.19
		1.00	0.52	0.18	**326**	87	223	N/A	N/A	1.07	0.20

Table B.24

Water Depth (m):	920	Ice Thickness (m):	800	Air Gap (m):	80

Load Case			Allowable Offset	Limiting Criteria						Reaction at Mudline	
				Stroke (m)	Max Stress in Inner Barrel (MPa)	Max Stress in Outer Barrel (MPa)	Max Stress Lwr Steel Section (MPa)	Min GRE Bend Radius (m)	Max Stress Upr Steel Section (MPa)		
				Allowable for Each Criterion						Bending Moment	Shear
Bottom Weight	Drill String Present	Current Speed		2	326	326	326	79.5	326		
(mT)	(yes/no)	(m/s)	(m)	Values at Allowable Offset for Each Criterion						(mT-m)	(mT)
0.5	no	-1.00	0.00	49.48	2320	693	1369	13	1094	5.28	0.27
		-0.75	0.00	15.65	1307	391	770	23	619	2.97	0.15
		-0.50	0.00	3.09	584	175	343	51	280	1.32	0.07
		-0.25	27.09	**2.00**	272	86	177	147	171	0.61	0.02
		0.00	21.12	1.50	**326**	101	205	109	83	0.73	0.03
		0.25	11.59	0.92	**326**	100	198	101	77	0.73	0.03
		0.50	0.00	3.09	584	175	343	51	280	1.32	0.07
		0.75	0.00	15.65	1307	391	770	23	619	2.97	0.15
		1.00	0.00	49.48	2320	693	1369	13	1094	5.28	0.27
	yes	-1.00	0.00	3.45	821	268	349	112	492	2.73	0.35
		-0.75	0.00	1.09	464	152	197	200	281	1.54	0.20
		-0.50	27.91	**2.00**	267	94	132	449	303	0.88	0.09
		-0.25	22.28	1.36	**326**	112	154	540	178	1.07	0.12
		0.00	19.23	1.08	**326**	111	151	482	128	1.07	0.12
		0.25	16.19	0.84	**326**	111	149	434	79	1.07	0.13
		0.50	7.01	0.48	**326**	108	143	336	130	1.07	0.13
		0.75	0.00	1.09	464	152	197	200	281	1.54	0.20
		1.00	0.00	3.45	821	268	349	112	492	2.73	0.35
1	no	-1.00	0.00	9.02	1334	321	502	38	785	3.03	0.34
		-0.75	0.00	2.86	753	181	284	67	447	1.71	0.19
		-0.50	0.00	0.56	337	82	128	151	206	0.76	0.08
		-0.25	26.36	1.79	**326**	83	139	377	235	0.73	0.07
		0.00	20.89	1.18	**326**	82	136	292	151	0.73	0.07
		0.25	15.50	0.75	**326**	81	133	238	67	0.73	0.07
		0.50	0.00	0.56	337	82	128	151	206	0.76	0.08
		0.75	0.00	2.86	753	181	284	67	447	1.71	0.19
		1.00	0.00	9.02	1334	321	502	38	785	3.03	0.34
	yes	-1.00	0.00	1.91	694	202	234	163	438	2.31	0.36
		-0.75	0.00	0.60	393	114	134	289	252	1.30	0.20
		-0.50	26.98	1.86	306	95	122	650	**326**	1.01	0.14
		-0.25	20.72	1.14	**326**	100	125	851	198	1.07	0.15
		0.00	18.31	0.92	**326**	99	123	726	153	1.07	0.15
		0.25	15.84	0.73	**326**	99	122	634	108	1.07	0.16
		0.50	8.48	0.40	**326**	97	117	460	119	1.07	0.16
		0.75	0.00	0.60	393	114	134	289	252	1.30	0.20
		1.00	0.00	1.91	694	202	234	163	438	2.31	0.36
1.5	no	-1.00	0.00	3.87	1047	216	282	63	654	2.38	0.35
		-0.75	0.00	1.23	591	122	162	111	375	1.34	0.20
		-0.50	17.45	0.90	266	55	77	250	**326**	0.59	0.09
		-0.25	22.50	1.29	**326**	71	104	750	250	0.73	0.10
		0.00	18.72	0.91	**326**	70	102	516	178	0.73	0.10
		0.25	14.91	0.62	**326**	70	100	393	105	0.73	0.10
		0.50	3.50	0.30	**326**	68	94	229	176	0.73	0.11
		0.75	0.00	1.23	591	122	162	111	375	1.34	0.20
		1.00	0.00	3.87	1047	216	282	63	654	2.38	0.35
	yes	-1.00	0.00	1.23	616	162	172	214	401	2.05	0.36
		-0.75	0.00	0.39	349	92	100	380	233	1.15	0.20
		-0.50	24.06	1.47	299	84	102	854	**326**	0.98	0.16
		-0.25	19.30	0.97	**326**	90	106	1218	212	1.07	0.18
		0.00	17.28	0.80	**326**	90	105	1005	170	1.07	0.18
		0.25	15.20	0.65	**326**	89	104	855	128	1.07	0.18
		0.50	9.06	0.35	**326**	88	100	591	113	1.07	0.18
		0.75	0.00	0.39	349	92	100	380	233	1.15	0.20
		1.00	0.00	1.23	616	162	172	214	401	2.05	0.36