



**Application for Approval to  
Alter the Condition of a Well  
Paramount Berkley  
SW Arrowhead O-15**

**April 2022**

## Introduction

**Paramount Berkley SW Arrowhead O-15** was drilled in 1999 by Paramount Resources to a depth of 33301m. The openhole section was plugged back to 2780mKB, leaving 244mm intermediate casing shoe @ 2805mKB. In addition, a permanent bridge plug was set at 2306mKB and capped with 8 meters of cement. The well was never perforated.

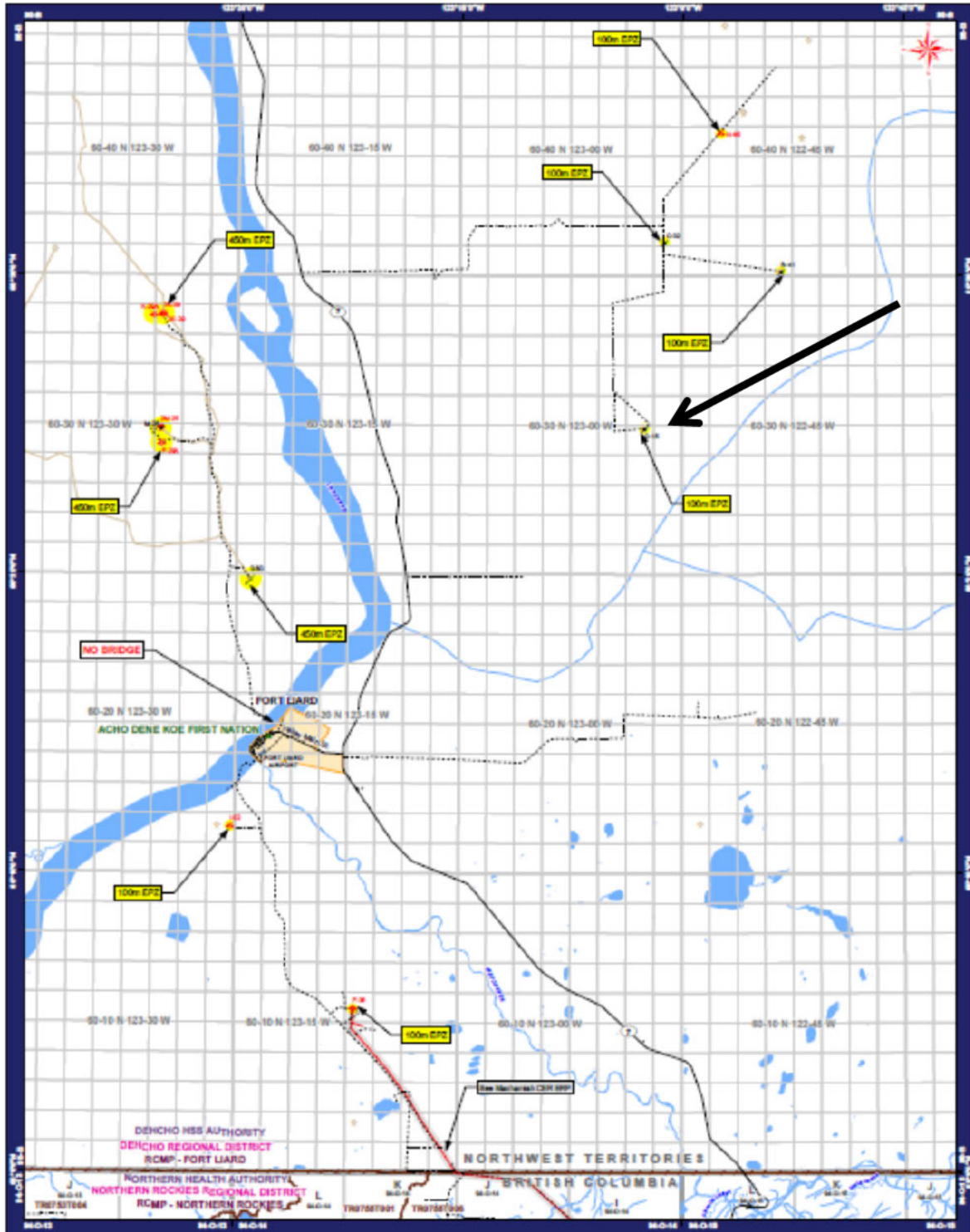
Paramount intends to abandon the O-15 well in compliance with the requirements of OROGO. Current plans are to abandon this well in conjunction with three others in the region in the winter season of 2023. Paramount has received Operations Authorization OA-2020-001-PAR for the abandonment of these wells. Circumstances and/or permitting issues may mean that it is more desirable to change the order and/or timing of the abandonments.

To improve operational efficiency and minimize environmental impact, Paramount intends to abandon these wells in conjunction with similar operations by CNRL in the same area, using the same access roads and infrastructure. Paramount intends to diligently pursue abandonment operations of these (and other) wells in OROGO jurisdiction, but to allow unexpected events to and minimize administrative overhead, PRL requests that the Well Approval be valid until April 30, 2025.

For ease of review and completeness, this application will follow the format of the OROGO “Roadmap for applications”.

## Area of Application

The well is located northeast of the hamlet of Fort Liard and east of NWT highway 7.



# **General Requirements for a Well Approval**

## **Engagement - Consultation with Existing/Asserted Aboriginal Rights Holders Constitution Act 1982 - 35**

Paramount has ongoing consultation and engagement requirements under its approvals from the Mackenzie Valley Land and Water Board and OROGO and are summarized in the Liard East Project Engagement Plan.

No concerns for OROGO activities were raised by any of the parties involved.

The area of operations is separated from the community of Fort Liard by approximately 40 km and accessible only by purpose-built winter road.

The Engagement Plans and Engagement Records were provided as part of the supporting information for the application for Operations Authorization for this project.

Paramount has ongoing consultation and engagement requirements under its approvals from the Mackenzie Valley Land and Water Board, these are summarized in the Liard East Project Engagement Plan, the most current version can be found on the public registry. Table 5 specifically notes engagement related to OROGO authorized activities.

## **Well Approval Application Form (AACW)**

The original of this form is attached to the covering letter and a copy included as Appendix 1

# Requirements of the Oil and Gas Drilling and Production Regulations (OGDPR)

## Requirement for a Well Approval – OGDPR S.10

The operations contemplated under this program (well abandonment) require a Well Approval. This document is provided in support of Paramount's application for a Well Approval for the abandonment of Paramount et al SW Arrowhead O-15.

## Application to Drill - OGDPR S.11

This application does not include any new drilling and thus this section of the OGDPR does not apply.

## Application to Abandon a Well - OGDPR S.12

The following is a summary of the abandonment program for SW Arrowhead O-15.

An additional cap of a minimum of 15 meters of cement will be circulated on top of the existing bridge plug and cement cap. The fluid in the casing (believed to be fresh water) will be tested with a refractometer to confirm that it meets the OROGO requirements of 4000mg/l TDS or less. If it does not meet this standard, the fluid will be replaced with fresh (non-saline water).

No cement bond log is available for this well, but records indicate that the surface casing was cemented to surface and 5 m<sup>3</sup> of cement were reported to surface. A gas migration test in 2020 showed no CH<sub>4</sub> levels more than 1 ppm above background. Due to damage to the surface casing vent, it was not possible to perform a SCVF check in 2020 and results in 2018 were inconclusive. An additional inspection and repair of the surface casing vent will be performed in the summer of 2022. A cement bond log will be run as part of the abandonment program. The results of the above will be evaluated to determine the need for and probability of success Vs casing damage resulting from a perforation and squeeze attempt.

Finally, the casing will be cut below surface and closed with a non-sealing cap. The full program is provided in the appendices, along with current and proposed abandonment diagrams.

Current plans are to start construction of a winter road in December 2022 (subject to weather conditions). Downhole abandonment operations are planned to start late January 2023 and are estimated to take about 4 days. As there are a total of four wells to be abandoned in the area, the exact order of operations and wells may vary but it is planned to abandon all four wells by the end of March 2023.

Operations are subject to weather and site conditions, and to the availability of equipment and suitable personnel. For this reason, the timing, duration, and even order of the operations may change from those below.

### **Conditions for Abandonment- OGDPR S.56**

The abandonment of this well, as described above and in the program in Appendix 2 will comply with the requirements of OGDPR section 56.

### **Monitoring of Suspended Well - OGDPR S.57**

A gas migration test was conducted during the inspection in 2020 and were no signs of gas migration of methane over 1ppm above background levels. Intermittent bubbles were noted in the water filled cellar during the 2020 inspection but the source of these has not been determined. As previously noted, this will be examined further during the 2022 summer inspection (and at the time of abandonment) to determine any necessary corrective action. If any indication of gas migration or surface casing vent flow is observed, operations will be suspended, the program will be modified to address the issue, and OROGO will be notified.

Once the well has been cut and capped and reported as permanently abandoned no further monitoring is anticipated.

### **Offshore Well- OGDPR S.58**

As this is not an offshore well, this section of the OGDPR does not apply.

## **Other Requirements**

### **The Well Suspension and Abandonment Guidelines and Interpretation Notes**

The abandonment of this well, as described above and in the program in Appendix 2 will comply with the *Well Suspension and Abandonment Guidelines and Interpretation Notes* provided by OROGO.

### **Information Disclosure Consent**

This form for the SW Arrowhead O-15 operations is included as Appendix 3. The form for the information associated with the Operations Authorization was included with that application.

## **Appendices**

**Appendix 1 Well Approval Application Form (AACW)**

**Appendix 2 Abandonment Program – O-15  
Current Downhole Diagram  
Proposed Downhole Abandonment Configuration**

**Appendix 3 Information Disclosure Consent Letter**



**Appendix 1 Well Approval Application Form (AACW)**

## APPROVAL TO ALTER THE CONDITION OF A WELL

This form is an application for a Well Approval under Section 10 of the *Oil and Gas Drilling and Production Regulations*.

### INSTRUCTIONS:

1. Complete both pages.
2. Send one electronic copy of this form and supporting technical documentation by email to [orogo@gov.nt.ca](mailto:orogo@gov.nt.ca). If you wish to communicate with OROGO in hard copy, please do so using the courier address found at [www.orogo.gov.nt.ca](http://www.orogo.gov.nt.ca).

### WELL INFORMATION

Well Name	PARAMOUNT BERKLEY SW SW ARROWHEAD O-15	Operator	Paramount Resources Ltd.
Well Type	Exploratory Well (if Other, specify )	Contractor	TBD

### RELATED LICENCES, PERMITS, AND AUTHORIZATIONS

Operating Licence No.	NWT-OL-2014-014	Operations Authorization	OA-2020-001-PAR
PRA Licence No.	Exploration Licence <input type="checkbox"/>	Station Keeping	Not Applicable
		Land Structure	Conventional Land
Land Use Permit No.	MV2020A0010	Issued by:	Mackenzie Valley Land and Water Board
Water Licence No.	MV2020L1-0007	Issued by:	Mackenzie Valley Land and Water Board

### ACTIVITY INFORMATION

Current Well Status	Suspended	Anticipated Well Status	Abandoned
Well Path	Vertical	Elevation KB/RT	6.5 m
Approximate Start Date	January 2023	Ground Level / Seafloor	380 m
Est. Days on Location	7 days	Anticipated Total Depth	3349 m KB

### WELL OPERATION PROGRAM

Activity Type	Top to Bottom Interval (m KB)	Comments
Select	2298-0	Evaluate SCVF and run Cement Bond Log
Select	2298-2273	Circulate additional cement on existing BP & cement cap
Select	2273-50	Confirm non-saline water in wellbore - replace if needed
Select	TBD-	Perforate and squeeze if needed due to SCVF

Additional Information      Cut & install vented cap

**"I certify that the information provided on this form is true and correct"**

Name	<u>John Hawkins</u>	Phone	<u>(403) 817-5074 Ext</u>
Title	<u>Director Asset Management</u>	E-Mail	<u>john.hawkins@paramountres.com</u>
Operator	<u>Paramount Resources Ltd.</u>		
Signature	 <u>Responsible Officer of Company</u>	Date	<u>April 27, 2022</u>

**Appendix 2 Abandonment Program – O-15**

**Current Downhole Diagram**

**Proposed Downhole Abandonment Configuration**



**ABANDONMENT PROGRAM**  
**OROGO Compliant Suspended Well**  
**OROGO LEVEL II WELLBORE**  
**PARAMOUNT BERKLEY SW ARROWHEAD O-15**  
**WID # 1834**  
**POTENTIAL H<sub>2</sub>S: 0.0%**

**PROCEDURE APPROVAL & DISTRIBUTION**

**DATE:** April 25, 2022  
**WELL NAME:** PARAMOUNT BERKLEY ARROWHEAD O-15  
**COORDINATES** **60° 24' 53.694" N** **123° 02' 31.174" W**  
**UWID:** 300/O-15-6030-12300/1  
**OPERATIONS AREA:** Liard East **PROVINCE:** NWT  
**OBJECTIVE:** Abandon wellbore in accordance with OROGO guidelines and approved ACW.

**AFE NUMBER:** **POU WI (%): 50%**

**POU Supplier Coding:** **PR210-9231-xxx (Abandonment program)**

**REGULATORY APPROVALS:**

**REQUIRED: YES**

**TYPE: OROGO Operations Authorization and ACW.**

**AUTHORIZATION RECEIVED by:** **DATE:**

**PROCEDURE COMPLIES WITH CONDITIONS OF AUTHORIZATION:** YES  NO

**TYPE OF WORK:** Abandonment

**PROCEDURE COMPLIES WITH PARAMOUNT RESOURCES LTD. POLICIES ON:**

- 1) Paramount Well Control Manual
- 2) AER Servicing **BOP Class III** well

**DISTRIBUTION:** **FIELD:** **CALGARY:** Richard Bean/Corey Thomson/Well Files

**PREPARED BY:** Richard Heenan, P.Eng. - Consultant **DATE:** April 25, 2022

**REVIEWED AND**

**APPROVED BY:**

**APPROVED BY:** Corey Thomson – Completions Engineer **DATE:** April 27, 2022

Tim Wood, Manager ARO & Workover **DATE:** April 27, 2022



John Hawkins, Director Asset Management

DATE: April 28, 2022

## ABANDONMENT PROGRAM

### OBJECTIVE

Abandon well to OROGO requirements in same time frame as CNRL project to achieve cost efficiencies.  
Cut and cap well.

### REPORTING

- All rig calls and Daily Reports are to be directed to Corey Thomson (Engineer ARO)
  - Office: 403-261-1250
  - Cell: 403-835-4447
  - E-mail: [Corey.Thomson@paramountres.com](mailto:Corey.Thomson@paramountres.com)

### PROGRAM SUMMARY

- Read & record SIP(s), Confirm status of SCVF/GM (SCVF inconclusive)
- MIRU Service Rig, P-tank, snubbing unit and associated equipment.
- Perform cement bond log (CBL) from PBSD to surface and evaluate for possible cement squeeze
- RIH with 73.0mm tubing and circulate cement plug on top of existing cement and bridge plug
- Confirm well full of fresh water – replace if needed
- Perforate and squeeze will be evaluated considering SCVF tests, bond log, and cementation history. If these are to be performed it will be done at this point. (Details to be supplied after CBL)
- Lower fluid level in wellbore to prevent freezing due to permafrost
- Cut and cap the casing strings with vented cap & install well sign

### WELL HISTORY

The well was drilled on Exploration License No.383

Precision Drilling Rig #622E was moved onto the location starting on January 17, 1999. The diverter was nipped-up and function tested with the HCR. The well spudded on January 18, 1999, at 08:00 hours. The 444.5 mm surface hole was drilled to 499.9 mKB by first drilling 311 mm then opening up to 444.5 mm. There were no losses to the formation during the drilling of the surface hole. Surface casing of 339.7 mm, 81.1 kg/m, K-55 LT&C casing was run and set at 499.9 mKB. The surface casing was cemented with 31 tonnes 0:1:0 'G' cement plus 1% CaCl<sub>2</sub> and 27 tonnes of expand-mix with good cement returns throughout the job and 5m<sup>3</sup> cement to surface.

The first intermediate hole was then drilled with foam and air hammer to 867m at which point the well watered out. Cutter 'D' was used to 1560mKB with a 311mm bit. Deviation was recorded at 7° but directional surveys were observed to have walked out to 15° and the well was then plugged back to a depth of 1195mKB using 16 tonnes of 0:1:0 'G' and 244.5mm x 64.74kg/m L-80 casing was then run to a depth of 1186mKB and cemented in place with 21 tonnes of LW14 and 29 tonnes of 0:1:0 'G', 5m<sup>3</sup> of cement returns were recorded at surface.

The second intermediate hole was drilled to 1455mKB utilizing a 216mm bit using a mud motor to combat deviation. Due to time constraints associated with spring break-up the well was plugged back with Plug #1 1255-



1455mKB using 4 tonnes Thermal 40 cement and Plug #2 996-1196mKB using 3.5 tonnes Thermal 40 cement, a drillable plug was set at 903mKB. Drilling would re-commence the following winter to complete the well. PD Rig 622E was released March 24<sup>th</sup>, 1998.

On January 19<sup>th</sup>, 1999 Precision Rig #507 was rigged in and the well was re-spudded to complete the drill from the previous winter. An additional intermediate hole was drilled using 216mm drill bit from previous plug back to a depth of 2805mKB and 177.8mm x 38.69kg/m L-80 casing was landed and run to surface, cemented in place with 24.6 tonnes 1:1:2 fill cement and tailed in with 17 tonnes Thermal 40 cement. No cement returns were observed to surface but traces of diesel were noted in returns placing cement top **approximately 645m from surface** based on annular calculation.

A main hole was drilled using a 156mm bit to a depth of 3301mKB. At this point the well was logged and three DST's were run. Following this the main hole was plugged back to 2780mKB with two cement plugs; Plug #1 3301-3191mKB utilizing 3.9m<sup>3</sup> of Thermal 40 cement, Plug #2 from 3005-2820mKB using 3.49m<sup>3</sup> of Thermal 40 cement – confirmation run found cement top at 2780mKB. Pipe got stuck pulling out of hole and free point tool identified it to be stuck at 2733mKB, string shots were used to back off pipe at the next free connection. 30 joints of 89mm Grade 'E' pipe were left in hole. A permanent bridge plug was set with wireline at 2306mKB and capped with 8m of cement.

The drilling rig was released March 6, 1999 at 2359hrs.

#### **WELL COMPLETION:**

**No Completion on file. Well remains in the above listed state.**

#### **September 29, 2020 Shut-in Well Inspection.**

SICP = 0 kPa. SITP = 0 kPa (in communication)

SCVF was not conducted as SVC piping was not present and assumed to have fallen into the water filled cellar.

One bubble every 8 seconds was noted in the cellar, but the source could not be confirmed.

Gas migration test indicated no CH<sub>4</sub> above background (1ppm sensitivity).

Previous inspection (2018) showed a buildup of 0.27kPa (1" water column)

The well remains shut in and secured.



## **SAFETY**

A safety meeting is to be held with all service company personnel prior to each job. Wellsite supervisor must notify Contractors of known hazards of which Contractor(s) may be unaware. Wellsite supervisor must ensure that workers are aware of their responsibilities and duties under OH&S regulations and that workers comply with regulations. All service companies supplying materials will review Material Safety Data Sheets at this meeting for all products supplied and maintain these Material Safety Data Sheets available for worker's examination on location in compliance with WHIMIS regulations. All safety meetings will be recorded on the Paramount daily report and on the daily tour sheet.

Whenever possible, plan and conduct all workover procedures in a manner which will avoid the mixing of air & hydrocarbons in the well bore and connected surface piping. If mixing does occur, purge prior to pressurizing or exposing mixture to any other possible source of ignition.

Rig anchor locations if required will be approved by Paramount Wellsite Supervisor prior to installation.

## **REGULATIONS**

All applicable regulations, including, but not limited to the specific approved OROGO ACW approval, OROGO Well Suspension and Abandonment Guidelines, Oil and Gas Occupational Safety and Health Regulations (NWT) and Occupational Health and Safety (OHS) Regulations (NWT) are to be strictly adhered to. Written instructions must be posted in doghouse or other conspicuous area prior to the wellsite supervisor leaving the lease. Wellsite supervisor must designate, in writing (see attached Form), a competent person to carry out principal contractor's responsibilities. All verbal notifications and approvals from government regulatory agencies will be recorded on Paramount's daily report sheet. The name of the individual contacted, and the subject matter of approval or notification should be recorded on same.

Paramount shall provide all staff and contractors for this program with the OROGO 24-hour incident reporting phone number (867-445-8551) prior to commencing any work or activity.

Paramount shall submit to OROGO an updated operator contact list for this program prior to any work or activity by email at [orogo@gov.nt.ca](mailto:orogo@gov.nt.ca).

Paramount shall submit to OROGO certificates and inspection documents for any service rig, well control and associated equipment (including boilers) at least 10 days prior to the rig commencing work by e mail at [orogo@gov.nt.ca](mailto:orogo@gov.nt.ca).

Paramount shall submit all reports required under the Oil and Gas Drilling and Production Regulations in a timely manner to OROGO by email at [orogo@gov.nt.ca](mailto:orogo@gov.nt.ca). Daily abandonment reports are to be submitted by 1 pm the following day.

Paramount shall submit to OROGO, completed Change of Well Status form 30 days after the service rig release date or when the abandonment operation has been finished.

## **WORK ORDERS/FIELD TICKETS**

Delivery and field tickets for all work, services performed, or materials purchased must be signed by a Company wellsite supervisor. Record the AFE number and well location on all purchase and work tickets.

## **MATERIAL TRANSFERS**

All materials shipped to this location that are not used must be transferred to an appropriate warehouse point.





Transfers of any tubular materials must include complete tally. Company wellsite supervisor will complete such transfers and forward both copies to Calgary office for approval and further handling.



# PARAMOUNT BERKLEY ARROWHEAD O-15 ABANDONMENT

## WELL DATA AND WELLBORE CONFIGURATION

### WELL DATA:

Surface Location:	LAT: 60.41498, LONG: 123.04351 (NAD 83)
UWI:	300/0-15-6030-12300/1
Profile:	Slight Deviation
WID#:	1834
OPERATING LICENCE#	NWT-OL-2014-014
LAND USE PERMIT#	LUP MV2020A0010
WATER LICENCE #	MV2020L1-0007
OROGO OA#	OA-2020-001-PAR
OROGO ACW#	TBD
Spud Date:	February 15, 1998
Rig Release Date:	March 6, 1999
KB:	387.0m
GL:	380.5m
KB-GL:	6.5m
PBTD Original:	2780.0m KB
TVD:	3301.0m KB
TMD:	3349.17m KB

**CONDUCTOR:**                   **Hole size 610mm to 10m.**  
508mm heavy wall conductor pipe set at 10m and cemented in place with 40 sacks of construction cement.

**SURFACE:**                   **Hole size 444.5mm to 500m**  
36 Jts. 339.7mm 81.1kg/m J-55 Range 3, ST&C landed at 499m KB.  
Cemented with 21 Tonnes (34m<sup>3</sup>) TLW14 + 29 Tonnes (22m<sup>3</sup>) 0:1:0 G cement plus 1% CFLH. 5m<sup>3</sup> of cement returns.

**INTERMEDIATE#1:**       **Hole size 311mm 1186.6m.**  
57 Jts. 244.5mm 64.74kg/m L-80 Range 2, LTC landed at 1186.6m KB.  
Cemented with 42 Tonnes 0:1:0 G cement plus 0.4% FL-77. 1.0m<sup>3</sup> of cement returns.

**INTERMEDIATE#2:**       **Hole Size 216mm to 2805m**  
177.8mm 38.69kg/m + 34.20kg/m<sup>3</sup> L-80, LT&C landed at 2805.0m KB.  
Cemented with 24.6 Tonnes (26.6m<sup>3</sup>) 1:1:2 'G' + 17 Tonnes (12.75m<sup>3</sup>) Thermal 40. Calculated cement top at 645m KB based on observed trace diesel returns  
Note: pre-flush included 3.0m<sup>3</sup> diesel then 3.0m<sup>3</sup> of Nowflush and 3.0m<sup>3</sup> of scavenger cement.

**MAIN HOLE:**               **Hole size 156mm to 3301m**  
Open hole plugged back with cement plugs  
Plug #1 3301-3191mKB utilizing 3.9m<sup>3</sup> of Thermal 40 cement,  
Plug #2 from 3005-2820mKB using 3.49m<sup>3</sup> of Thermal 40 cement – confirmation run found cement top at 2780mKB



Bridge plug subsequently set at 2306mKB and capped with 8m cement

**PERFORATIONS:** Nil

**Formation Tops**  
**geoSCOUT Ref Elev(m):** +387.0

Formation	TVD (m)	Elev (m)
Kscatter	276.1	110.9
Kgarbutt	344.5	42.5
Krad_zn	428.2	-41.2
Kchinkeh	449	-62
Mflett	464.8	-77.8
Mbanff	985.1	-598.1
Mexshaw	1550.6	-1163.6
Dkotcho	1578.9	-1191.9
Dtrout_rv	2018	-1631
Dkakisa	2103.3	-1716.3
Dft smpsn	2152.2	-1765.2
Dmuskwa	2771.9	-2384.9
Dslave_pt	2796.6	-2409.6
Dwatt_mtn	2900.7	-2513.7
Dsulp_pt	2911.2	-2524.2
Dpine_pt	3139.8	-2752.8

**Capacities:**

Capacity of 177.8 mm 38.69 kg/m casing: 45.96m<sup>3</sup> (2298m PBTD)

**Tubing/Casing Data:**

	Surface Casing	Int. Casing #1	Int. Casing #2	Liner	Work String
Size O.D. (mm)	339.7	244.5	177.8		73
Weight (kg/m)	81.10	64.74	38.69/34.2		9.67
Grade	K-55	L-80	L-80		J-55
Connection	LT&C	LT&C	LT&C		EUE
Drift I.D. (mm)	316.46	218.4	156.24		59.61
I.D. (mm)	320.42	222.38	159.41		62.0
Capacity (m <sup>3</sup> /m)	0.080637	0.038840	0.020535		0.003019
Collapse (MPa)	7.8	26.3	26		53.0
Burst (MPa)	18.8	43.6	41		49.6
Tension (daN)	228 600	361 600	193 000		44 300
Annular Volume (m <sup>3</sup> /m)					
Depth (mKB)	499	1185	2805		2306m (To reach PBTD).



## Reservoir Data:

Formation	Madson (at PBDT)	
Perforations		
Reservoir Pressure	18,900 Kpa**	
Reservoir Temperature	76 °C	
H <sub>2</sub> S	0ppm	

\*\*From Drilling Program

Note: All formations isolated with cement - mud weight = 10.5kPa/m

## ABANDONMENT PROGRAM

1. Submit certificates and inspection documents for any service rig, well control and associated equipment (including boilers) at least 10 days prior to the rig commencing work by e mail at [orogo@gov.nt.ca](mailto:orogo@gov.nt.ca).
2. Ensure application to alter well has been submitted and approved prior to commencing work. Ensure a copy of the approved application to alter is on site and available.
3. The Wellsite Supervisor is responsible to notify (or verify notification has been completed) the OROGO, a minimum of 24 hrs prior to any well servicing abandonment operation.
4. Flaring: No flaring is anticipated.  
NOTE: Per the Operations Authorization the volume and composition of any gas flared or vented must be reported on the daily report and submitted to OROGO.  
**Any release of gas (vented) over 1m<sup>3</sup> per day or flared over 0.040 E3m<sup>3</sup>/day (40m<sup>3</sup>) or a duration of over 4 hours must be reported to OROGO as an incident under section 75 of the NWT OGDPR.**
5. Paramount shall provide all staff and contractors for this program with the OROGO 24-hour incident reporting phone number (867-445-8551) prior to commencing any work or activity.
6. Complete lease inspection. Note the condition of the lease, record any clean-up operations required and record any other noteworthy findings on the first morning report. Coordinate the transportation arrangements for the tanks and fluid with respect to other activity in the surrounding field.
7. Prepare location for Service Rig. P-Tank and flare stack & support equipment. Source 900m of 73mm, 9.67 kg/m J-55 EUE tubing for abandonment operations.
8. Ensure surface casing vent piping is exposed to determine if it is open and intact.  
Perform SCVF bubble-test – note history of SCVF is inconclusive – report results to office for determination of potential perforate and squeeze.  
Record SITP and SICP.  
Check and monitor LEL and H<sub>2</sub>S levels at wellhead.  
Investigate for evidence of gas migration (GM)at surface.  
Record SICP, SICP, SVCF and GM results on daily report.  
Contact Calgary Office for program modification if SCVF or H<sub>2</sub>S is detected.  
  
Note: There are no flowlines present on location.
9. MIRU service rig complete with a 280mm 35 MPa (11" 5000#) Class III BOP stack. 73 mm rams, kill spool, rig pump, clean tank, and related auxiliary equipment to OROGO, OH&S and PRL regulations and guidelines. Ensure Corporate Policies and Procedures are followed prior to commencing operations (see attached). Space out equipment in accordance with OROGO and OH&S requirements.



- Ensure all necessary safety equipment is strategically positioned, on site and tested to ensure proper operating condition prior to commencing with the workover operations.
  - All personnel must be familiar with the operation of all emergency equipment. Safety and BOP drills are to be conducted on a regular basis and recorded on the “Daily Completion / Workover Report”
  - Conduct a complete inspection of the service rig per requirements of AER Directive 37 and PRL guideline policy. Identify and remediate any deficiencies prior to initiating completion operations
  - Conduct an operational and safety meeting prior to installing BOPs onto the wellhead and pressure testing.
10. Haul in tubing work string, 2400 meters of 73mm, 9.67kg/m J-55 EUE tubing string. Ensure scrapers, and pressure test packer for 178mm 38.7 kg/m casing is available. Haul in sufficient water for pressure testing and cement mixing. Approximately 46m<sup>3</sup> of fresh water will be needed to displace well if current fluid contains over 4000 mg/l TDS and a similar amount of fluid will have to be disposed of – due to cost do not haul in water until need is confirmed.
11. Conduct daily pre-job safety meeting and equipment inspection.
12. Install the working spool and BOPs onto the BOP test stump. If required warm up the BOP stack with steam. Function test the blind rams and pipe rams on the test stump. Close the blind rams and pressure test the working spool, the blind rams and BOP flange to **1.4MPa** and **21MPa** for **10 minutes** each. Install a ported tubing pup and stabbing valve through the BOPs on the BOP test stump. Pressure test the pipe rams and stabbing valve to **1.4MPa** and **21MPa** for **10 minutes** each. Pressure test the annular preventers to low of **1400 kPa** and a high of **7,000 kPa**. Record results in daily report and tour book.
13. Conduct an accumulator function test. Recharge the accumulator, shut off the pump and record the accumulator pressure. Close each ram and record the start and end pressures and the time to close each ram. Close annular on a tubing joint. Rams must close in 30 seconds and annular in 60 seconds. Final accumulator pressure must be 8400 kPa or greater. Record results in daily report and tour book
- Recharge the accumulator and record the time for the accumulator to recharge to the original pressure. Accumulator must recharge in 5 minutes. Record results in daily report and tour book
- Ensure that hand wheels are available and are the correct type and size for all the BOP rams. Record the number of turns to close each ram manually in tour book and on daily report.
14. Ensure the well is dead. (All zones have been previously abandoned and there is a permanent bridge plug and cement at 2298mKB.) Remove wellhead top section and nipple up the rig BOPs. **Note: BOPs will be nipped up on 11” 5000# flange.**
15. Pressure test the pump lines and connections to **1400 kPa** and **21 MPa** high. Fill casing with fresh water (if required) and pressure test the casing and BOP connection to **7 MPa** for **ten minutes**. Record results in Daily Report and in Tour Book. Bleed off the wellbore to the rig tank.
16. Rig up wireline and run cement bond log from PBDT (approximately 2298mKB) to surface. Re-run with 7MPa pressure pass if bond is questionable.



Perform field evaluation of bond and possible perforation/squeeze zone(s)

Forward log to Calgary office for formal evaluation.

Continue to proceed with testing wellbore fluid and topping off existing plug while the practicality of a squeeze is evaluated (due to 5m<sup>3</sup> cement returns a squeeze may not be possible).

17. Pick up 73mm EUE tubing RIH to PBD (approximately 2298mKB).
18. Circulate down tubing with fresh water (+/- 2m<sup>3</sup>) and catch sample of returns to confirm annular fluid is non-saline (fresh) water.  
Test sample with handheld refractometer. OROGO standard is 4,000 mg/l Total Dissolved Solids (TDS) or less = 0.4% NaCl on a refractometer.  
Record results in Daily Report and in Tour Book.
19. If value is 0.4% TDS (or less) move to next step.  
If more than 0.4%, displace entire hole volume to fresh water (68 m<sup>3</sup>).

Returns must be disposed of at an approved location in BC or Alberta (E.G. Secure Energy Mile 103).

Record TDS reading and "Displaced entire wellbore to non-saline (fresh) water" (if applicable) on daily report and on tour sheet - Use this exact wording.

20. Spot a 1m<sup>3</sup> Class G cement plug at PBD (on top of bridge plug) using balanced plug technique.  
This will give a +/- 50m cement cap.  
(This step may be performed prior to displacing to fresh water if logistically more convenient.)  
Pull up 50m and back wash (reverse circulate) two tubing volumes.
21. Once surface samples have set, pressure test cement plug and casing to 7MPa for 10 minutes.  
Record results in Daily Report and in Tour Book.  
Tag and record cement plug top (18kDan minimum set down).  
Minimum required cement top is 15m above top of bridge plug.

**Previous surface casing vent testing was inconclusive due to damage to SCV. Primary cement job on surface casing have 5m<sup>3</sup> returns making SCV unlikely and making a cement squeeze unlikely to be successful.**

**Based on results for SCV test in the summer of 2022 and prior to the start of abandonment operations and the results of the bond log the necessity and practicality of a perforations and squeeze operation will be evaluated. If required, the perforation and squeeze (and potential acid squeeze) will be inserted at this point. An addendum to the program will be provided at that time if needed.**

22. Pull tubing from hole.  
Install a water-tight cap on the end of tubing (e.g., a short piece of tubing with a steel plate welded on it).
23. RIH with tubing to 250m.  
This will displace 1m<sup>3</sup> of water to lower final fluid level to 50m to prevent freezing due to permafrost.  
POOH.  
Do not fill hole.
24. Remove BOPs and rig out.  
Cover exposed flange securely if well is not to be immediately cut and capped.
25. Prepare "as built" downhole abandonment diagram – using attached proposed diagram as a guide.

#### **Surface Abandonment:**

Cut and cap the casing strings at least 1 m below ground level with vented cap as per the procedure below or with Hydro jet vented cap system.



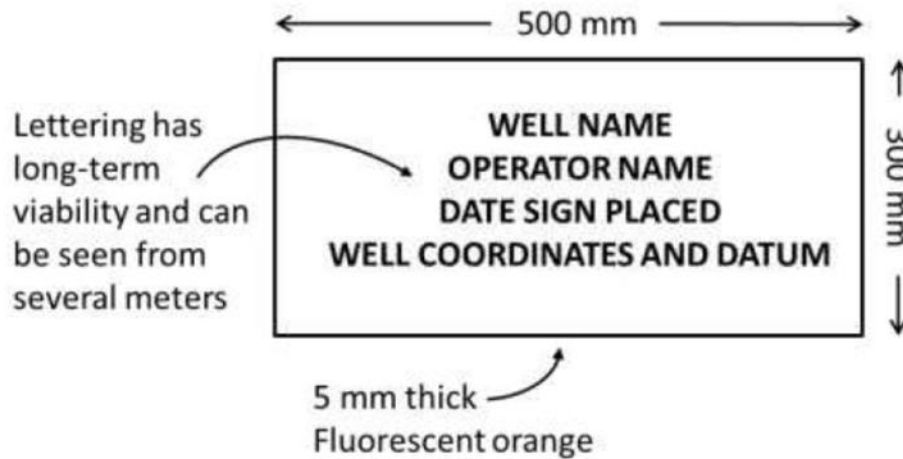
- 26. Confirm LEL and H2S are zero. Reconfirm no indications of gas migration.
- 27. Excavate a 2.5m deep bell hole around the wellhead ensuring that walls of the bell hole are sloped at a maximum of 45 degrees for safe entry and egress and to prevent sloughing in.
- 28. Confirm surface casing vent is open.  
Cut a small hole 30 cm below the surface casing bowl and investigate for trapped gas and fluids. Check and monitor LEL and H2S levels.  
Attach wellhead to lifting unit (rig, backhoe, picker, etc.). Pull slight tension  
Weld cut three (3) windows in the surface casing to access the innermost casing string ensuring that 50% of the circumferential metal remains to prevent possible collapse of the surface casing from the weight of the wellhead. While exercising caution, weld cut the innermost string.

**NOTE:**

Innermost string can be expected to suddenly drop once completely cut.  
Do not place pry bars, hands or fingers in the windows.

- 29. Complete weld cut of the surface casing, lift and remove wellhead from bell hole.
- 30. Stitch weld (non-sealing) steel plate “surface casing and production casing.  
Weld inscribe the LSD on top of the steel plate and document with a digital photograph.
- 31. Install abandoned well sign as below.  
Verify well coordinates (decimal format to 4 decimal places) in header with handheld GPS field measurement – use NAD 83 Datum  
Record well coordinates on daily report.  
A buried 5 gallon pail filled with cement may be helpful in supporting the well sign (as below)  
**DO NOT WELD SIGNPOST TO CASING.**

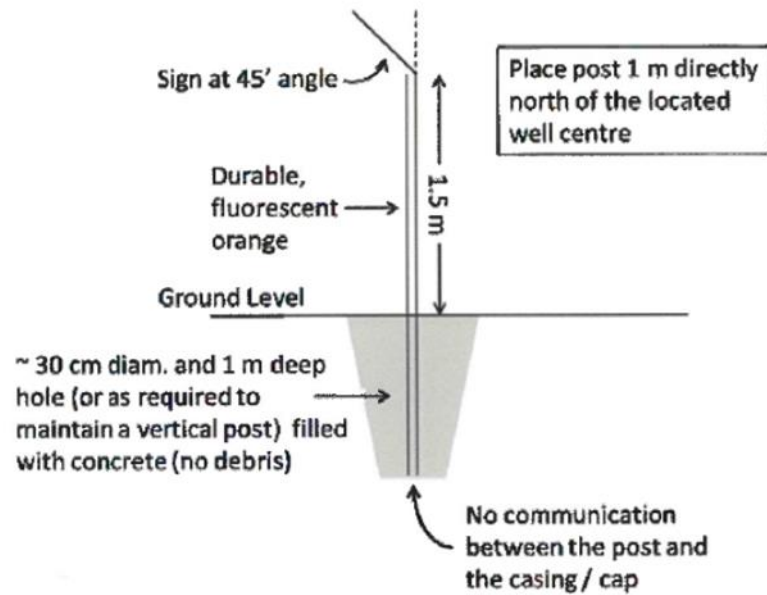
**Sign Requirements**





## Well Suspension and Abandonment Guidelines and Interpretation Notes

### Post Requirements



32. Prepare field sketch of lease indicating well location, signpost (1 meter north of well) and any relevant features. Submit with daily report.
33. Backfill and compact the excavation, clean up lease and rig out and release all services.





## CORPORATE CONTACTS

Paramount Resources Ltd.  
2800, 421 - 7<sup>th</sup> Avenue, SW  
Calgary, AB  
T2P 4KP

### ARO (Calgary):

	<u>Business</u>	<u>Cellular</u>	<u>Fax</u>
Corey Thomson Abandonment Engineer E-mail: <a href="mailto:corey.thomson@paramountres.com">corey.thomson@paramountres.com</a>	(403) 261-1250	(403) 835-4447	(403) 261-1349
Richard Bean Abandonment Supt-Staff E-mail: <a href="mailto:richard.bean@paramountres.com">richard.bean@paramountres.com</a>	(403) 303-1929	(403) 793-4586	(403) 261-1349

---

### MORNING REPORTS (Calgary):

	<u>Business</u>	<u>Cellular</u>	<u>Fax</u>
Corey Thomson Abandonment Engineer E-mail: <a href="mailto:corey.thomson@paramountres.com">corey.thomson@paramountres.com</a>	(403) 261-1250	(403) 835-4447	(403) 261-1349
Richard Bean Abandonment Supt E-mail: <a href="mailto:richard.bean@paramountres.com">richard.bean@paramountres.com</a>	(403) 303-1929	(403) 793-4586	(403) 261-1349
Tim Wood Abandonment Manager E-mail: <a href="mailto:tim.wood@paramountres.com">tim.wood@paramountres.com</a>	(403) 290-2919	(403) 809-8410	(403) 261-1349



## CORPORATE POLICY & PROCEDURES

- All operations carried out on behalf of the Operator shall be conducted in a safe and efficient manner in compliance with the Operator's safety regulations and all applicable acts and regulations.
- The Operator expects that all operations conducted will be designed to protect and maintain the quality and integrity of the environment and comply with all environmental acts and regulations.
- All contractors on location must have as a minimum a valid H<sub>2</sub>S ticket (if necessary), WHMIS, and be fully covered by the NWT Worker's Compensation Board (WCB) where applicable, carry a minimum of \$5,000,000 liability insurance.
- Before commencing operations, the Wellsite Supervisor will complete a list of nearest available emergency services. This list along with a detailed and accurate description of directions to the location is to be posted in a conspicuous and accessible location known to all personnel.
- Any excavation or installation of anchors (if required) on location shall follow Paramount's Ground Disturbance Requirements:
  - a. Contact 1<sup>st</sup> Call (Review Paramount's Grey book)
  - b. Prior to excavation – obtain Ground Disturbance Permit
    - i. If pipeline in area, arrange for Hydrovac and hand expose lines within 5 meters of excavation.
- Prior to commencing operations, the Wellsite Supervisor shall:
  - Read and record SIP(s). Examine surface casing vent for blow or suction, record and report findings. Check and monitor LEL and H<sub>2</sub>S levels at wellhead and investigate for evidence of gas migration at surface.
- Before commencing operations, the Wellsite Supervisor in conjunction with the Rig Manager will conduct an initial rig inspection using a CAODC or equivalent inspection form. A detailed rig inspection is to be completed weekly thereafter. Confirmation of these inspections is to be recorded on both the morning report and tour report.
- Have on-site access to the AER Drilling/ Servicing Regulations - Directive 36, Workplace Health and Safety Regulations, NWT Oil and Gas Operations Act, NWT Drilling and Production Regulations, OROGO Well Suspension and Abandonment Guidelines.
- The Wellsite Supervisor and Rig Manager will conduct daily walk-around inspections and complete a daily rig inspection report in an effort to identify deficiencies regarding well control and safety related items.
- The Wellsite Supervisor must ensure that all pertinent data (tubulars, logs, tests etc.) are properly recorded on the tour sheets and that samples, where required are collected as required by well licence. Also, the Wellsite Supervisor must ensure that trip sheets are properly completed and maintained.
- During cold weather operations, the Wellsite Supervisor must ensure that Precautions are taken to prevent freezing of the bleed-off and kill lines
- The Wellsite Supervisor must ensure that all personnel are advised and instructed not to trespass off the demised property.
- Safety meetings are to be held every day with wellsite personnel and recorded on both the morning reports and tour reports. Pre-job safety/orientation meetings are to be held prior to commencing new or non-routine work at which time the Wellsite Supervisor shall advise all personnel of known hazards, special precautions and procedures. Hazard assessments must be conducted in accordance to Workplace Health and Safety Regulations and documented accordingly.
- BOP equipment will be function tested at least once daily and any equipment found defective should be made serviceable before operations are resumed. Blowout prevention drills are to be performed weekly and are to be recorded on both the



morning reports and tour reports. **All appropriate Certifications for equipment used will be on-site and available for review.** Communicate this information with the contracted services.

- The Wellsite Supervisor will ensure that service companies supplying products and/or materials that require Material Safety Data Sheets review and advise wellsite personnel with the potential hazards associated and the appropriate emergency response to be undertaken when handling the same. As well, in compliance with WHMIS regulations, all MSDS are to be posted in a conspicuous and accessible place known to all personnel for their information and emergency reference. Site Specific Orientation to all personnel on-site must be given for all chemicals and materials used.
- The Wellsite Supervisor will ensure that dangerous goods shipped or received are classified, packaged, marked, labeled and documented in compliance with the Transportation of Dangerous Goods Regulations. If required, placards must be attached to vehicles transporting dangerous goods. All shipping documents must be forwarded to the Calgary office for filing.
- The Operator expects full compliance with all conditions detailed on the Land Use Permit and Water Permit, OA and ACW.
- During the absence of the Wellsite Supervisor, a qualified and competent alternate shall be designated, in writing, to carry out the principal Contractor's responsibilities. Written instructions must be posted in a conspicuous and accessible location known to all personnel prior to the Wellsite Supervisor leaving the location.
- All verbal notifications and approvals received on location from any regulatory agency must be documented and recorded on both morning reports and tour reports and should include a contact name from the agency, phone number and details of the subject matter.

Daily reports shall be prepared by the Wellsite Supervisor and e-mailed (faxed) to the Operator's Calgary office by 07:00Hrs. every morning.

- All field tickets and other supporting documentation submitted for materials purchased and/or services rendered require a correct AFE# and accurate identification of the well location along with the Wellsite Supervisor's signature indicating acceptance to the same.
- All rental equipment must be accounted for and returned promptly upon conclusion of operations. Rental Sheets must be utilized.
- All surplus material and/or equipment must be accounted for and either returned for credit or material transferred to the appropriate warehouse point accordingly. Disposition of scrap material must be documented.
- All Accidents or Incidents shall be reported immediately to the Calgary Office - Attention: Corey Thomson or Richard Bean. Complete the Paramount Safe Incident Report and conduct the necessary Investigations immediately. Fax copy to Calgary within 6 hours of incident.
- Ensure that all garbage and debris has been removed from the location. and that any environmental concern has been addressed. Contact the Construction foreman with any concerns.
- Prepare a final wellbore diagram with all pertinent information recorded.
- Forward all paperwork including field logs and computer data files to the Calgary office including copies of all field logs. A paper and digital copy of all Paramount operation reports should be provided. All field tickets, Material Transfers, Incident Reports, well test reports, rig inspection reports and service reports shall be included with the operation report package.



## Alternate Cut and Cap Operation

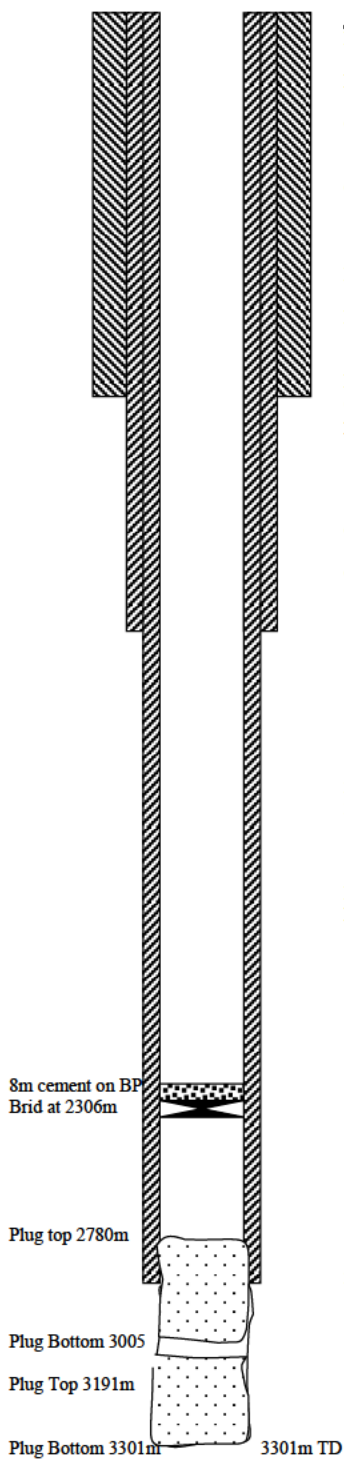
If available, a proprietary Hydrojet cut and cap system may be used to cut the casing(s) a minimum of 1 m below ground level and install a vented (non-sealing) cap on the casing stub below ground level once all downhole operations have been completed and tested as per the program.

In summary the steps are:

- Remove wellhead from the top of the well (down to surface casing bowl flange)
- Place the hydraulic pipe cutter inside the innermost casing
- Apply high-pressure water and abrasive to the cutting tip (typically 1-2m below grade).
- Rotate the cutting tip to sever the casing from the inside out.  
(Typically it takes 20 minutes to an hour to complete the cut)
- Remove tool and pull the casing stub out of the ground.
- Compression fit vented cap to the below-ground casing strings.  
(Welded options are available for jurisdictions where this is required)
- Backfill the hole (typically about the diameter of the surface casing drill bit)
- Install independent well signpost as per OROGO requirements (detailed above).



**Well Schematic**  
**Paramount Berkley Arrowhead O15**  
**As Drilled March 06, 1999**



**Surface Hole:** (surface – 500 )

Hole Size: 444 mm  
 Surveys: ¾ @ 463  
 Mud Type: Air to 442, gel/chem to 500

Casing: 339 7 mm, 81 1 kg/m, K55  
 Landed at 499 9 m KB

Cement: Lead: 31 T 0:1:0 Class "G" + 1% CaCl<sub>2</sub>  
 Tail: 27 T Expandomix + 2% CaCl<sub>2</sub>  
 8 m3 returns

**Intermediate Hole:** (500 – 1455 m)

Hole Size: 311 mm  
 Surveys: This section originally kicked out to 15° so was plugged back and re-drilled  
 To keep vertical

**First Leg:** 500 – 1560 m KB  
 (partial plug back)  
 Drilled with foam and air hammer to 867 m, well watered out Drill with  
 Cutter D to 1560 m MD  
 Problems: Totco surveys indicated 7°, directional survey read 15°,  
 Decision was made to plug back and redrill  
 Plug #1: 1195 – 1350 m w/ 16 T 0:1:0 High Density G + 1% CFR + 1% LTR

Casing: 244 5 mm, 64 74 kg/m, L80 landed at 1196 m

Cement: Lead: 21 T LW14 + 2% CaCl<sub>2</sub> + 2% LWA + 2% SMS  
 Tail: 29 T 0:1:0 G + 0 4% CFL3 + 1% CFLH + 2% SPC 2  
 5 m3 returns

1196m

**2<sup>nd</sup> Intermediate Re-Entry** (spud January 19, 1999)

**2<sup>nd</sup> Intermediate hole :** drill 216 mm 1196 m to 2805 m KB  
 Casing: 177 8 mm, 38 69 kg/m IL-80 - 0 - 2805 m KB  
 Cement: 24 6 Tonnes 1:1:2 G fill plus 17 Tonnes Thermal 40 tail

Hole Size: 216 mm  
 Mud Type: Invert

8m cement on BP  
 Brid at 2306m

Plug top 2780m

2805m

Plug Bottom 3005

**Main hole:** drill 156 mm hole 2805 - 3301 m KB  
 Mud: Invert  
 Open Hole

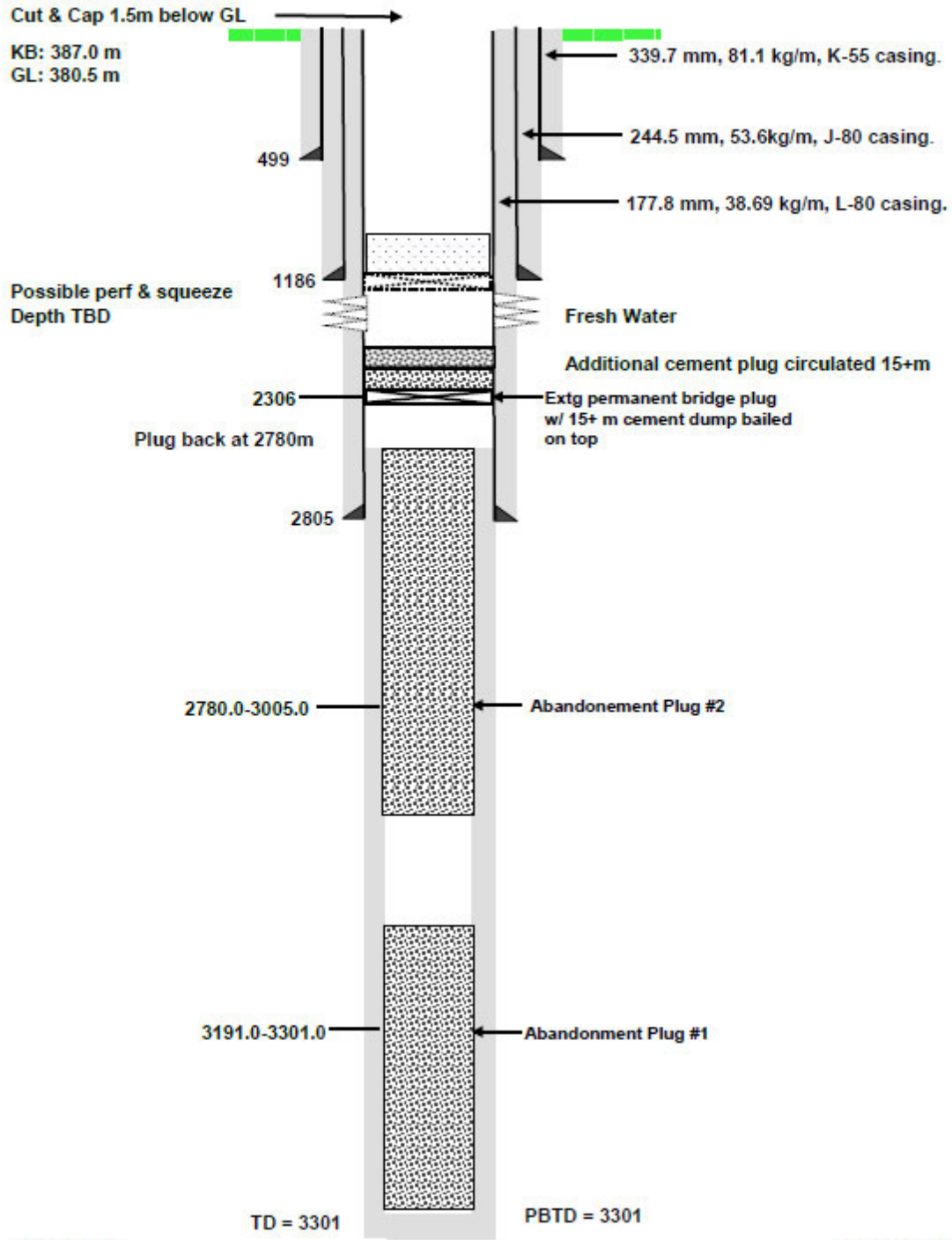
Plug Top 3191m

Plug Bottom 3301m 3301m TD



# PARAMOUNT BERKLEY SW ARROWHEAD 0-15

## Proposed Wellbore Configuration





**Wellhead Photo – No Schematic Available  
(No tubing in well – tubing hanger unknown)**



**Appendix 3 Information Disclosure Consent Letter**



## INFORMATION DISCLOSURE CONSENT FORM

Pursuant to subsection 91(3) of the *Petroleum Resources Act* (PRA)

Subject to its obligations under section 91 of the PRA and the objectives expressed by the Government of the Northwest Territories Oil and Gas Regulator (Regulator) in its *Information Disclosure Guidelines*, issued under section 18 of the *Oil and Gas Operations Act* (OGOA) on May 10, 2016, the Regulator wishes to facilitate public access to information about the regulation of oil and gas works and activities under OGOA, while protecting an applicant's right to maintain privilege over certain information.

Paramount Resources Ltd (the Applicant), requires authorizations, approvals, orders, or other consents from the Regulator in respect of the following works or activities: South Liard Well Abandonment - Arrowhead wells B-41, C-02, N-65 & O-15

The Applicant (please mark box or boxes):

- Does not consent to the public disclosure of any information with respect to the above-noted works or activities, other than information or documentation that the Regulator is already permitted to disclose under section 91 of the PRA, and has provided a rationale for non-disclosure in the space provided on the reverse of this form.

or

**Consents** to the public disclosure of all the information indicated by the Applicant below with respect to the above-noted works or activities, with the exception of any information noted in the space provided on the reverse of this form where accompanied by a rationale for non-disclosure:

- This completed *Information Disclosure Consent* form
- A brief project description (approximately 1-5 pages) that includes the name of the applicant, the scope, purpose, location, timing and nature of the proposed work or activity. This project description may be used for the purposes of a preliminary screening under Part V of the *Mackenzie Valley Resource Management Act*.
- The contents of an application for an Authorization under section 10(1)(b) of OGOA, including but not limited to:
- The completed application for the Authorization;
  - All required documentation supporting the application, including the safety plan and environmental protection plan where applicable;
  - Correspondence and Information Requests between the Regulator and the Applicant;

- The approved Authorization, including any conditions imposed by the Regulator;
- The completed application for any associated approvals (such as well approvals);
- Any associated approvals issued, including any conditions imposed by the Regulator;
- Subsequent amendments to any authorizations or approvals issued by the Regulator; and
- Any requests to vary or seek exemption from a regulatory requirement under section 54 of OGOA.

Classes of information or documentation obtained by the Regulator as a result of carrying on a work or activity that is authorized under OGOA, as described in subsection 91(8) of PRA, remain privileged for the periods of time described in that subsection.

By providing its consent to the disclosure of the above information, the Applicant hereby releases OROGO, its officers, agents or employees from any claims, demands, losses or liability arising out of or related to the disclosure of the information.


This consent remains in effect until it is revoked or amended by written notice to OROGO, in which case the amended consent would apply to information provided to the Regulator after the date of the written notice.

The Applicant hereby affirms that it has read and fully understands this Information Disclosure Consent Form and release of liability.

Paramount Resources Ltd

Name of Applicant Company

April 25, 2022  
Date

  
Signature of Officer, on behalf of Applicant

John Hawkins, Director Asset Management

Name of Officer (print)

**Information the Applicant Does Not Consent to Disclose:**

**Rationale for Non-Disclosure (use additional paper if necessary):**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_