PROPOSED SOUTH PIERSON UNIT NO. 4

Application for Enhanced Oil Recovery Waterflood Project

Lower Amaranth/Mission Canyon

Pierson, Manitoba

August 10, 2018
Tundra Oil and Gas

INTRODUCTION

The Pierson field is located in Townships 1-3 Ranges 27-29 west of the prime meridian (Figure 1). The main production target in this area is the Lower Amaranth (Spearfish) formation, although some Mission Canyon (Alida) production exists throughout the field. In 1993 Home Oil, as operator of the area, unitized a portion of the field and implemented a 40 acre waterflood. The unit was named South Pierson Unit No. 1 (SPU1). Canadian Natural Resources Limited (CNRL) acquired the lands in 2002 and received approval to downspace the unit to a 20 acre waterflood. In November 2010, CNRL received approval for South Pierson Unit No. 2 (SPU2) and in January 2013 received approval for South Pierson Unit No. 3 (SPU3).

In the South Pierson field, potential exists for incremental production and reserves from a Waterflood EOR project in the Lower Amaranth (Spearfish) and/or the Mission Canyon (Alida) formations. Attached is an application by Tundra Oil and Gas (Tundra) to establish South Pierson Unit No. 4 (N/2 Section 14-002-29W1) and implement a Secondary Waterflood EOR scheme within the Spearfish/Alida formations as outlined on Figure 2.

The proposed project area falls within the existing designated 07-35A Lower Amaranth Pool-Mission Canyon 3B pool of the Pierson Oilfield (Figure 3).

SUMMARY

1. The proposed South Pierson Unit No. 4 will include 2 abandoned vertical wells and 11 horizontal wells that are completed in the Lower Amaranth (Spearfish) and/or Mission Canyon (Alida) formations, within 8 Legal Sub Divisions (LSD). The project is located northeast of SPU3 (Figure 2).

2. The original oil in place (OOIP) in the project area has been calculated to be 1,186 e^3m^3 (7,461 Mbbl) for an average of 148.25 net e^3m^3 (932.5 Mbbl) OOIP per 40 acre LSD.

3. Cumulative production current to May 31, 2018 from the proposed South Pierson Unit No. 4 project area was 67.2 e^3m^3 oil (423 Mbbl) and 77.7 e^3m^3 water (489 Mbbl), representing a **5.7%** recovery factor (RF) of the total OOIP within the proposed boundary.

4. Figure 4 shows the production from the proposed area peaked in November 2012 at 185.9 m^3/d oil (1170 bbl/d) from 10 wells. As of May 31, 2018, production was 4.26 m^3/d oil (26.8 bbl/d), 19.33 m^3/d of water (121.7 bbl/d) from 9 wells and 81.9% watercut.

5. In November 2012, production averaged 18.6 m^3/d oil (23.5 bbl/d) per well. As of May 2018, average per well production has declined to 0.47 m^3/d oil (2.9 bbl/d). Decline analysis of the group primary production data forecasts total oil to continue declining at an annual rate of approximately 25% in the project area.

6. Estimated Ultimate Recovery (EUR) of Primary Proved Producing oil reserves in the proposed South Pierson Unit No. 4 project area has been calculated to be 75.9 e^3m^3 (477 Mbbl), with 8.7 e^3m^3 (54.8 Mbbl) remaining as of May 31, 2018.

7. Ultimate oil recovery of the proposed South Pierson Unit No. 4 OOIP, under the current Primary Production method, is forecasted to be **6.4%**.

8. Estimated Ultimate Recovery (EUR) of oil reserves under Secondary WF EOR for the proposed South Pierson Unit No. 4 is estimated to be 108.7 e^3m^3 (684 Mbbl), with 41.5 e^3m^3 (261 Mbbl) remaining. An incremental 32.8 e^3m^3 (206 Mbbl) of oil reserves are forecasted to be recovered under the proposed Unitization and Secondary EOR production vs the existing Primary Production method.

9. Total RF under Secondary WF in the proposed South Pierson Unit No. 4 is estimated to be **9.2%**.

10. Analog waterfloods (SPU1, SPU2, SPU3) indicate that a pattern waterflood would be successful in Pierson.

11. Existing horizontal wells, with multi-stage hydraulic fractures, will be converted to injection wells (Figure 5) within the proposed South Pierson Unit No. 4, to complete waterflood patterns with effective 20 acre spacing.

DISCUSSION

The proposed South Pierson Unit No. 4 project area is located within Township 2, Range 29 W1 of the Pierson oil field. The proposed Pierson Unit currently consists of 1 abandoned vertical well, 1 suspended horizontal well and 10 producing horizontal wells within an area covering 8 LSDs in the north half of Section 14-002-29W1 (Figure 2). A project area well list complete with recent production statistics is attached as Table 3.

Geology

Lower Amaranth

Stratigraphy:

The Triassic aged Lower Amaranth formation is the oil producing reservoir that is the subject of this unit application. The stratigraphy of the reservoir section for the proposed unit is shown on the structural cross-section attached as Appendix 1. The section runs SW to NE approximately through the mid-point of the proposed unit. The Lower Amaranth is bounded on top by the Amaranth Evaporite and by the Mississippian Unconformity at the base.

The producing sequence in descending order consists of the Lower Amaranth "A" Unit, Lower Amaranth Green Sand, Lower Amaranth Blue Sand, Lower Amaranth Purple Sand, Lower Amaranth Brown Sand, Lower Amaranth Red Sand, and the Lower Amaranth Lower Sand. The reservoir units are primarily represented by the Green, Blue, Purple, Brown, and Red Sands. The Upper portion of the Lower Amaranth A unit is considered tight, and represents the top seal for the reservoir.

Sedimentology:

The Lower Amaranth reservoir units (top of Green through to base of Red Sand) comprise interlaminated shale, siltstone, and fine grained sandstone. The laminations tend to range from > 1 cm up to 20 cm in thickness, often show signs of scouring at the base of each laminae and tend to fine upwards. There are anhydrite beds capping each sub unit within the producing sequence; these anhydrite layers are generally correlatable over the entire Pierson/Waskada/Goodlands area. These anhydrite layers are the basis for the stratigraphic framework that is being used to describe the reservoir within the proposed unit.

The units within the producing sequence have very similar characteristics. Color tends to vary with grain size in that the finer grained material tends to be brick red, while the coarser grained material generally tends to be grey to light brown. All of the sub-units have a varying component of anhydrite cement, which will appear as millimeter sized nodules in heavily cemented areas. Finally, well rounded, floating, course, frosted quartz grains are common throughout the entire productive interval.

Lower Amaranth reservoir is interpreted as having been deposited in an arid tidal flat (Sabkha) setting. The stratigraphic divisions (Green, Blue, Purple, Brown, Red, and Lower Sands) are interpreted as representing individual evaporitic cycles, each exhibiting relatively higher depositional energy at the base, grading into very low energy towards the top.

Since each cycle is bound by an erosive surface on the top and bottom, there can be lateral variability in sediment preservation within each cycle. Occasional preservation of high angled cross stratification suggests periods of very high energy during deposition which are interpreted as channel deposits, which help support a tidal flat setting depositional model.

The Upper portion of the Upper Amaranth "A" unit is made up of brick red shale that is generally not bedded and does not tend to exhibit any sedimentary structures. It is a low permeability zone that represents the top seal to the Lower Amaranth reservoir.

The Lower Sand portion of the Lower Amaranth (immediately beneath the Red Sand), has a lot of the same characteristics as the productive interval, but tends to have much less effective porosity due to abundant anhydrite cement.

Structure:

Structure contour maps are provided for the top and base of the reservoir interval (Appendices 2 and 3). The reservoir units dip to the southwest, which is consistent with regional dip. Structural mapping based on well control does not indicate the presence of large scale structural features that would indicate an increased risk of faulting within the proposed unit boundary.

Reservoir Continuity:

There are limited barriers to reservoir continuity that are apparent from the data available. Available data from well logs do not show any apparent lateral facies changes within the proposed unit that would result in significant lateral permeability barriers. An Isopach map of the reservoir interval (Appendix 4) shows that the gross reservoir thickness averages about 13.0 meters.

Also, as mentioned above, there are no indications of any structural features that could set up any lateral permeability barriers within the proposed unit. The lack of lateral permeability barriers suggests this pool is well suited for secondary oil recovery.

Reservoir Quality:

Net pay determination within the proposed unit was done by using a sonic porosity cut off of 10%, where:

- Average Sonic porosity was calculated for wells in which digital sonic data was available (Appendix 5) using the following formula:

$$Sonic\ Porosity = \frac{Dt - Dtmatrix}{Dtwater - Dtmatrix}$$

Where

Dt = Sonic travel time (ms/m)
Dt_{matrix} = Sonic travel time of the rock matrix (198 ms/m)
Dt_{water} = Sonic travel time of the formation water (681 ms/m)

- Appendix 6 illustrates average porosity in the net pay interval over the proposed unit. Using IHS Petra software, average density porosity for the proposed Unit area has been calculated to be 14.3%.

OOIP Estimates

OOIP values were calculated using the following volumetric equation:

$$OOIP = \frac{Area * Net\ Pay * \ Porosity * (1 - Water\ Saturation)}{Initial\ Formation\ Volume\ Factor\ of\ Oil}$$

or

$$OOIP(m3) = \frac{A * h * \emptyset * (1 - Sw)}{Bo} * \frac{10{,}000m2}{ha}$$

or

$$OOIP(Mbbl) = \frac{A * h * \emptyset * (1 - Sw)}{Bo} * 3.28084\frac{ft}{m} * 7{,}758.367\frac{bbl}{acre * ft} * \frac{1Mbbl}{1{,}000bbl}$$

where

OOIP	= Original Oil in Place by LSD (Mbbl, or m3)
A	= Area (40acres, or 16.187 hectares, per LSD)
h * Ø	= Net Pay * Porosity, or Phi * h (ft, or m)
Bo	= Formation Volume Factor of Oil (stb/rb, or sm3/rm3)
Sw	= Water Saturation (decimal)

For the purposes of this unit application, porosity, Bo and Sw were held constant at 14.3%, 1.17 and 40% respectively. As described above, porosity value was calculated by averaging the offsetting sonic porosity logs. The initial oil formation volume factor was derived from a PVT taken from the 8-26-1-26W1, which is representative of the fluid characteristics in the reservoir. Sw determination was set at 40% which is consistent with historic unit applications in the Waskada area.

The phi * h portion of the calculation has been broken out, and included in Appendix 7 for reference.

Total volumetric OOIP for the Lower Amaranth within the proposed unit has been calculated to be **1,020 e^{3}m^3** (6,416 Mbbls).

Tabulated parameters for each LSD from the calculations can be found in Table 1.

Mission Canyon

Stratigraphy:

The Mississippian aged MC-3 member of the Mission Canyon formation is a secondary reservoir included in this unit application. The stratigraphy of the MC-3 is shown on the structural cross section

attached as Appendix 8. The section runs S to N through the proposed unit. The MC-3 is bounded on top by the Lower Amaranth and is bounded at the base by the MC-2 member. The MC-3 is subdivided into a lower MC-3A and an upper MC-3B. Separating the two is the MC-3 Marker, which is equivalent to the Dando Evaporite found further east in the Waskada area.

The producing zone within the proposed unit is the MC-3B. In the greater Pierson area, the MC-3B can be further subdivided into individual cycles referred to as the Lower, Middle and Upper. In the area of this unit application, the reservoir unit is the MC-3B Lower.

Sedimentology:

The MC-3B is comprised of cycles of mudstone to wackestone, packstone, & grainstone. The mudstone lithology is generally comprised of dolomite to dolomitic limestone. The coarser grained rocks are dominated by limestone, and contain variable combinations of ooids, pisoids, oncolites, and peloids. The producing zone is related to the wacke/pack/grainstone facies, with the mudstone facies acting as a seal at the base of each cycle.

The MC-3B is interpreted as being deposited in an extensively shallow low gradient marine setting. Each cycle present represents a relative rise and fall of sea level. The reservoir itself, is interpreted to be from shoal to back shoal deposits.

Structure:

A structure contour map is provided for the MC-3B Lower Reservoir (Appendix 9). Regional structure dips toward the southwest. The majority of pools in this area are related to structural highs. The area around section 14-002-29W1 is on a small structural high.

Reservoir Continuity:

Over the proposed unit, the reservoir should be relatively consistent. There should not be any drastic facies changes within the reservoir zone, however there may be slight permeability differences due to differences in porosity development and varying amounts of anhydrite, calcite, and dolomite cementing. There are only a handful of wells in the area that have core and core analysis over the MC-3B, with none of them occurring within the proposed unit. Over the larger area, permeabilities range from 12-22mD.

Reservoir Quality:

Net pay determination within the proposed unit was done by using a neutron density porosity cut off of 6%. Work in other areas of Pierson and Gainsborough suggest that a cutoff higher than 6% would be pessimistic in terms of recoverable oil (Appendix 10).

OOIP Estimates

For the purposes of this unit application, Bo, Sw, and porosity were held constant at 1.22, 46%, and 9%. PVT analysis is scarce in the immediate area for the MC-3, therefore, the initial oil formation volume factor was derived from a fluid analysis taken from the 03-21-003-28W1. The Sw is assumed to be similar to wells in the North Pierson Unit 1 unit application. The average neutron density porosity of 9% was used for the proposed Unit area.

Total volumetric OOIP for the Mission Canyon within the proposed unit has been calculated to be **166.0 e^3m^3** (1,044 Mbbl) oil.

Tabulated parameters for each LSD from the calculations can be found in Table 4.

Historical Production

A historical group production history plot for the proposed South Pierson Unit No. 4 is shown as Figure 4. Oil production commenced from the proposed Unit area in October 1993. Production peaked in November 2012 at 185.9 m^3/d oil from 10 wells. As of May 31, 2018, production was 4.26 m^3/d oil, 19.33 m^3/d of water from 9 wells and 81.9% watercut.

From peak production in November 2012, oil production is declining at an annual rate of approximately 25% under the current Primary Production method.

The field's production rate indicates the need for pressure restoration and maintenance, and waterflooding is deemed to be the most efficient means of secondary recovery to introduce energy back into the system and provide areal sweep between wells.

UNITIZATION

The basis for unitization is to develop the lands in an effective way that will be conducive to waterflooding. Unitizing will enable the reservoir to have the greatest recovery possible by allowing horizontal wells to be optimally spaced and for water injection to be implemented to maintain reservoir pressure and increase oil production. Unitization and implementation of a Waterflood EOR project is forecasted to increase overall recovery of OOIP from the proposed project area by 2%.

Unit Name

Tundra Oil and Gas (Tundra) proposes that the official name of the new Unit shall be South Pierson Unit No. 4.

Unit Operator

Tundra will be the Operator of record for South Pierson Unit No. 4.

Unitized Zone

The unitized zones to be waterflooded in South Pierson Unit No. 4 will be the Lower Amaranth (Spearfish) and Mission Canyon (Alida).

Unit Wells

The 11 horizontal wells and 1 vertical well to be included in the proposed South Pierson Unit No. 4 are outlined in Table 3 with their current status.

Unit Lands

South Pierson Unit No. 4 will consist of a half section as follows:

LSDs 9-16 of Section 14 of Township 2, Range 29, W1M

The lands included in the 40 acre tracts are outlined in Table 1.

Tract Factors

The proposed South Pierson Unit No. 4 will consist of 8 tracts, based on the 40 acre LSD's containing the 1 vertical well and 11 horizontal wells.

The Tract Factor contribution for each of the LSD's within the proposed South Pierson Unit No. 4 was calculated as follows:

- Gross OOIP by LSD, minus cumulative production to date for the LSD as distributed by the LSD specific Production Allocation (PA) % in the applicable producing horizontal or vertical well (to yield Remaining Gross OOIP)

- Tract Factor by LSD = the product of Remaining Gross OOIP by LSD as a % of total proposed Unit Remaining Gross OOIP

Tract Factor calculations for all individual LSDs based on the above methodology are outlined within Table 2.

Working Interest Owners

Table 1 outlines the working interest (WI) for each recommended tract within the proposed South Pierson Unit No. 4. Tundra Oil and Gas holds a 100% WI ownership in all the proposed Tracts.

Tundra Oil and Gas will have a 100% WI in the proposed South Pierson Unit No. 4.

WATERFLOOD EOR DEVELOPMENT

Technical Studies

The waterflood performance predictions for the proposed South Pierson Unit No. 4, are based on recent geological and engineering analysis. Internal reviews included analysis of available open-hole logs; core data; petrophysics; seismic; drilling information; completion information; and production information. These were used to develop a suite of geological maps and establish reservoir parameters to support the calculation of the proposed South Pierson Unit No. 4 OOIP (Table 4).

Reserves Recovery Profiles and Production Forecasts

The primary waterflood performance predictions for the proposed South Pierson Unit No. 4 are based on oil production decline curve analysis, and the secondary predictions are based on internal engineering analysis performed by the Tundra reservoir engineering group using South Pierson Units 1, 2 and 3 as an analog. Given the reservoir and injection pattern design similarities of horizontal producers and injectors on 20 acre spacing, these units were considered an appropriate analog for the work that Tundra intends to undertake.

Primary Production Forecast

Cumulative production current to May 31, 2018 within the proposed unit boundary is **67.2** e^3m^3 oil and **77.7** e^3m^3 water, representing a **5.7**% recovery factor (RF) of the total OOIP within the proposed boundary. The most recent calendar daily production rate from May 2018 was 4.26 m^3/d oil and 19.33 m^3/d water.

Ultimate Primary Proved Producing oil reserves recovery for South Pierson Unit No. 4 with no further development has been estimated to be **75.9** e^3m^3, or a **6.4**% Recovery Factor (RF) of OOIP. Remaining Producing Primary Reserves has been estimated to be **8.7** e^3m^3 to end of May 2018.

The expected production decline and forecasted cumulative oil recovery under continued Primary Production is shown in Figures 7 & 8.

Pre-Production Schedule/Timing for Conversion of Horizontal Wells to Water Injection

Tundra will plan an injection conversion schedule to allow for the most expeditious development of the waterflood within the proposed South Pierson Unit No. 20, while maximizing reservoir knowledge. Tundra currently plans to convert 2-3 wells to injection in late 2018 or early 2019.

Criteria for Conversion to Water Injection Well

Four (4) water injection wells (3 Lower Amaranth completions/1 Alida completion) are required for this proposed unit as shown in Figure 5.

Tundra will monitor the following parameters to assess the best timing for each individual horizontal well to be converted from primary production to water injection service.

- Measured reservoir pressures at start of and/or through primary production
- Fluid production rates and any changes in decline rate
- Any observed production interference effects with adjacent vertical and horizontal wells
- Pattern mass balance and/or oil recovery factor estimates
- Reservoir pressure relative to bubble point pressure

The above allows for the proposed South Pierson Unit No. 4 project to be developed equitably and efficiently. It also provides the Unit Operator flexibility to manage the reservoir conditions and response to help ensure maximum ultimate recovery of OOIP.

Secondary EOR Production Forecast

The proposed project oil production profile under Secondary Waterflood has been developed based on the response observed to date in the South Pierson Units 1,2 and 3 (Figure 6).

Secondary Waterflood plots of the expected oil production forecast over time and the expected oil production vs. cumulative oil are plotted in Figures 7 & 8, respectively. Total Secondary EUR for the proposed South Pierson Unit No. 4 is estimated to be **108.7** e^3m^3 with **41.5** e^3m^3 remaining, representing a total secondary recovery factor of **9.2%** for the proposed Unit area. An incremental **32.8** e^3m^3 of oil, or a **2.8%** recovery factor, are forecasted to be recovered under the proposed Unitization and Secondary EOR production scheme vs. the existing Primary Production method.

Estimated Fracture Pressure

Completion data from the existing producing wells within the project area indicate an actual fracture pressure gradient range of 18.0 to 22.0 kPa/m true vertical depth (TVD).

WATERFLOOD OPERATING STRATEGY

Water Source

Injection water for the proposed South Pierson Unit No. 4 will be supplied from the Mannville formation at the 100/16-14-002-29W1/2 (100/16-14) well. In May 2018, Tundra received approval to re-complete the 100/16-14 well in the Mannville formation. Mannville water will be pumped to surface via a submersible pump in the 100/16-14 source well. The discharge pressure from the source well pump will feed water into the injection wellhead where polishing filters will be used for final filtration prior to injection. A diagram of the Pierson water injection system and new pipeline connection to the project area injection wells is shown as Figure 10.

Injection Wells

The water injection wells for the proposed South Pierson Unit No. 4 will be current producing wells configured downhole for injection as shown in Figures 9a and 9b. The horizontal injection wells will have been stimulated by multiple hydraulic fracture treatments to obtain suitable injection. Tundra has extensive experience with horizontal fracturing in the area, and all jobs are rigorously programmed and monitored during execution. This helps ensure optimum placement of each fracture stage to prevent, or

minimize, the potential for out-of-zone fracture growth and thereby limit the potential for future out-of-zone injection.

New water injection wells will be placed on injection once approval to inject has been received. Wellhead injection pressures will be maintained below the least value of either:

- the area specific known and calculated fracture gradient, or
- the licensed surface injection Maximum Allowable Pressure (MOP)

Tundra has a thorough understanding of area fracture gradients. A management program will be utilized to set and routinely review injection target rates and pressures vs. surface MOP and the known area formation fracture pressures.

All new water injection wells will be surface equipped with injection volume metering and rate/pressure controls. An operating procedure for monitoring water injection volumes and meter balancing will also be utilized to monitor the entire system measurement and integrity on a daily basis.

The proposed South Pierson Unit No. 4 horizontal water injection well rates are forecasted to average **10 - 30** m^3 WPD, based on expected reservoir conditions and fill-up volumes.

Reservoir Pressure

No representative initial pressure surveys are available for the proposed South Pierson Unit No. 4 project area. Tundra assumed operatorship of these properties in late 2015 and has been unable to recover any pressure surveys from the original operators.

Reservoir Pressure Management during Waterflood

Tundra expects it will take 2-4 years to re-pressurize the reservoir due to cumulative primary production voidage and pressure depletion. Initial monthly Voidage Replacement Ratio (VRR) is expected to be approximately 1.25 to 2.00 within the patterns during the fill up period. As the cumulative VRR approaches 1, target reservoir operating pressure for waterflood operations will be 75-90% of original reservoir pressure.

Waterflood Surveillance and Optimization

South Pierson Unit No. 4 EOR response and waterflood surveillance will consist of the following:

- Regular production well rate and WCT testing
- Daily water injection rate and pressure monitoring vs target
- Water injection rate/pressure/time vs. cumulative injection plot
- Reservoir pressure surveys as required to establish pressure trends
- Pattern VRR
- Potential use of chemical tracers to track water injector/producer responses
- Use of some or all of: Water Oil Ratio (WOR) trends, Log WOR vs Cum Oil, Hydrocarbon Pore Volumes Injected, Conformance Plots

The above surveillance methods will provide an ever increasing understanding of reservoir performance, and provide data to continually control and optimize the South Pierson Unit No. 4 waterflood operation. Controlling the waterflood operation will significantly reduce or eliminate the potential for out-of-zone injection, undesired channeling or water breakthrough, or out-of-Unit migration. The monitoring and surveillance will also provide early indicators of any such issues so that waterflood operations may be altered to maximize ultimate secondary reserves recovery from the proposed South Pierson Unit No. 4.

On Going Reservoir Pressure Surveys

Any pressures taken during the operation of the proposed unit will be reported within the Annual Progress Reports for South Pierson Unit No. 4 as per Section 73 of the Drilling and Production Regulation.

Economic Limits

Under the current Primary recovery method, existing wells within the proposed South Pierson Unit No. 4 will be deemed uneconomic when the net oil rate and net oil price revenue stream becomes less than the current producing operating costs. With any positive oil production response under the proposed Secondary recovery method, the economic limit will be significantly pushed out into the future. The actual economic cut off point will then again be a function of net oil price, the magnitude and duration of production rate response to the waterflood, and then current operating costs. Waterflood projects generally become uneconomic to operate when Water Oil Ratios (WOR's) exceed 100.

WATER INJECTION FACILITIES

The South Pierson Unit No. 4 waterflood operation will utilize the Tundra operated water source well 100/16-14-002-29W1/2. This well will be equipped with a submersible pump which has the dual role of pumping Mannville water from 100/16-14 and acting as an injection supply pump for the injection wells in the area.

A complete description of all planned system design and operational practices to prevent corrosion related failures is shown in Figure 11. All surface facilities and wellheads will have cathodic protection to prevent corrosion. All injection flowlines will be made of fiberglass so corrosion will not be an issue.

NOTIFICATION OF MINERAL AND SURFACE RIGHTS OWNERS

Tundra is in the process of notifying all mineral rights and surface rights owners of this proposed EOR project and formation of South Pierson Unit No. 4. Copies of the Notices, and proof of service, to all surface rights owners will be forwarded to the Petroleum Branch, when available, to complete the South Pierson Unit No. 4 Application.

South Pierson Unit No. 4 Unitization, and execution of the formal South Pierson Unit No. 4 Agreement by affected Mineral Owners, is expected before the end of Q3 2018. Copies of same will be forwarded to the Petroleum Branch, when available, to complete the South Pierson Unit No. 4 Application.

Should the Petroleum Branch have further questions or require more information, please contact Yeirys Gerder at 403.767.1393 or by email at Yeirys.Gerder@tundraoilandgas.com.

TUNDRA OIL & GAS

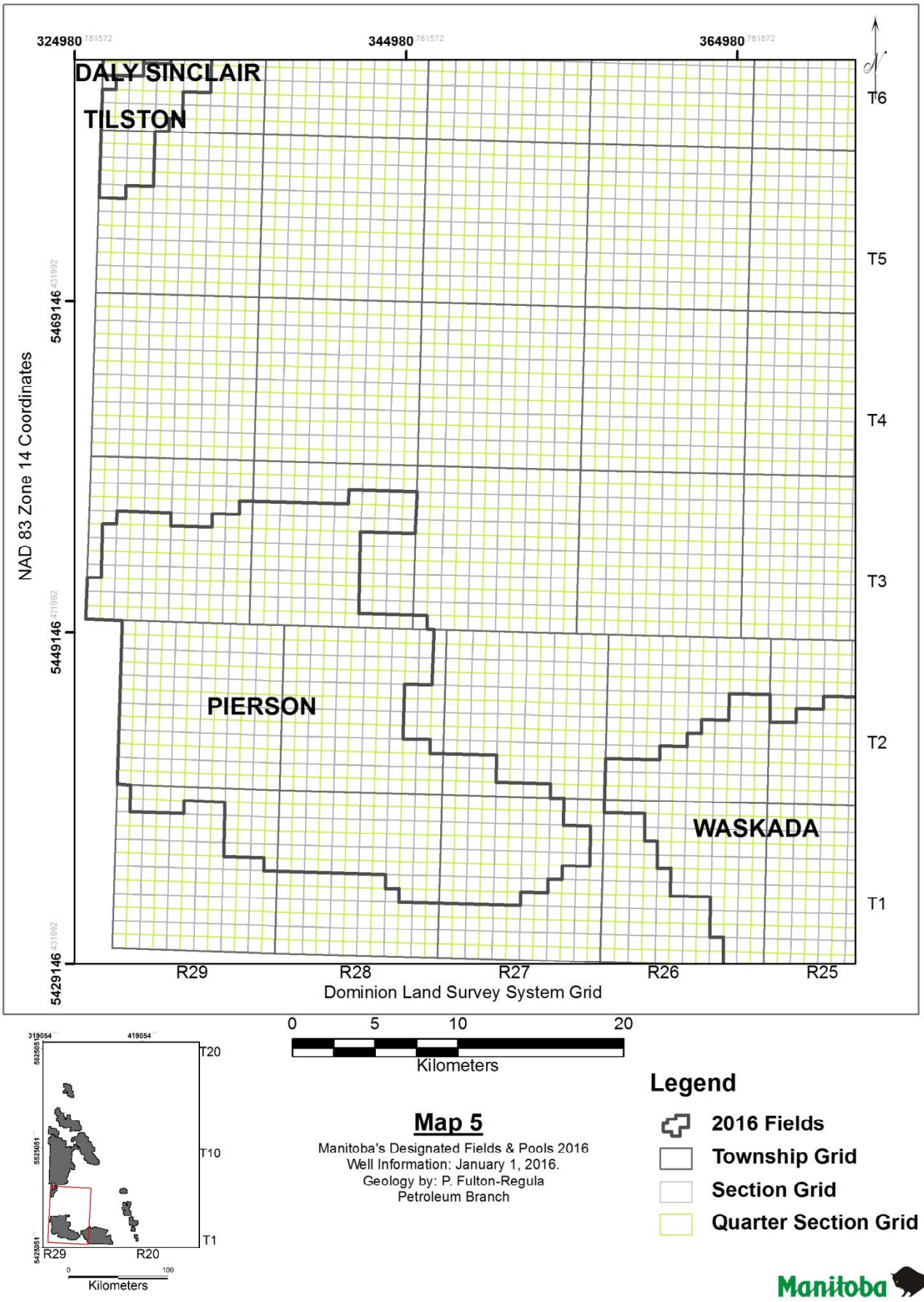
Original Signed by Yeirys Gerder, August 10, 2018

Proposed South Pierson Unit No. 4

Application for Enhanced Oil Recovery Waterflood Project

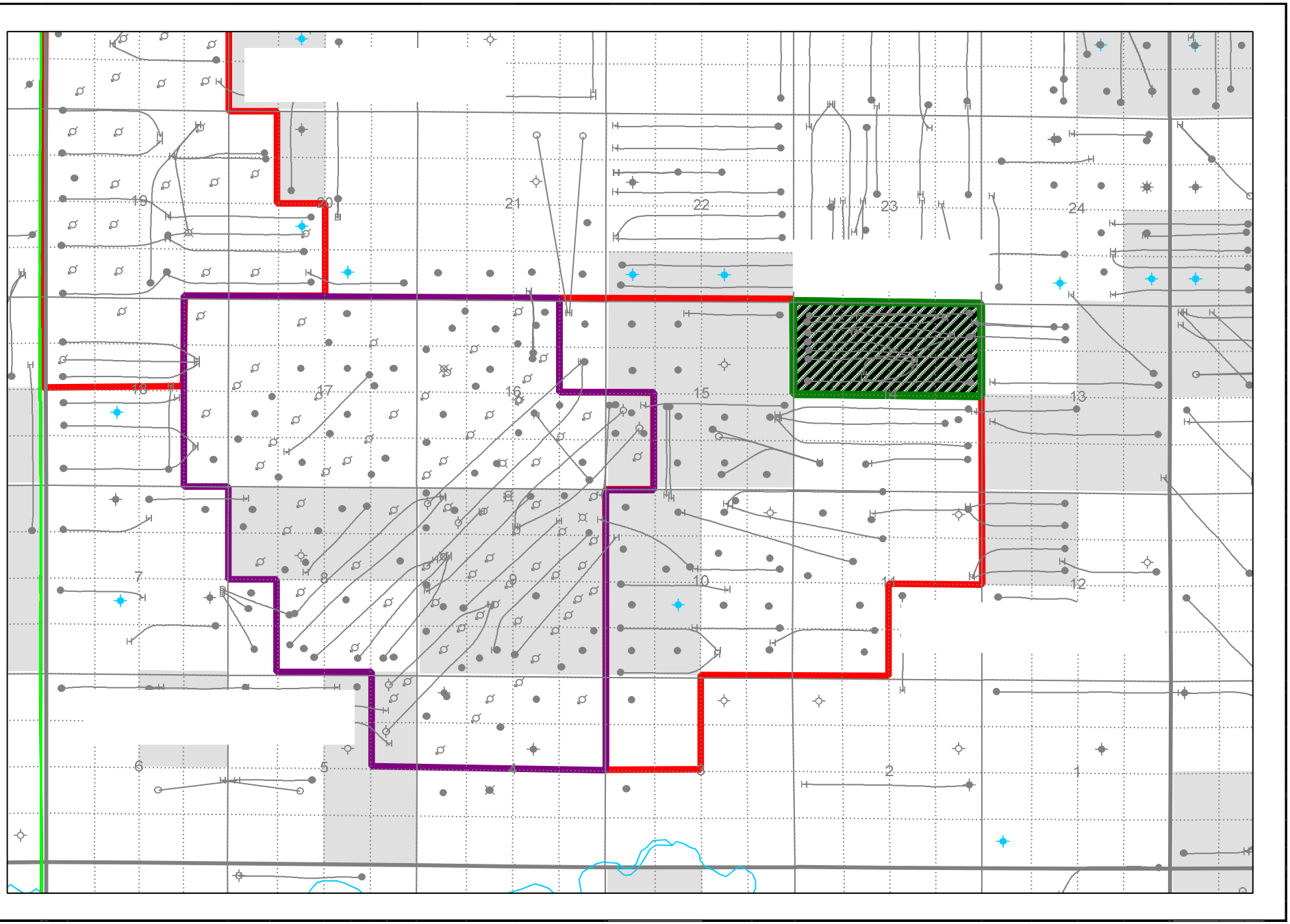
List of Figures

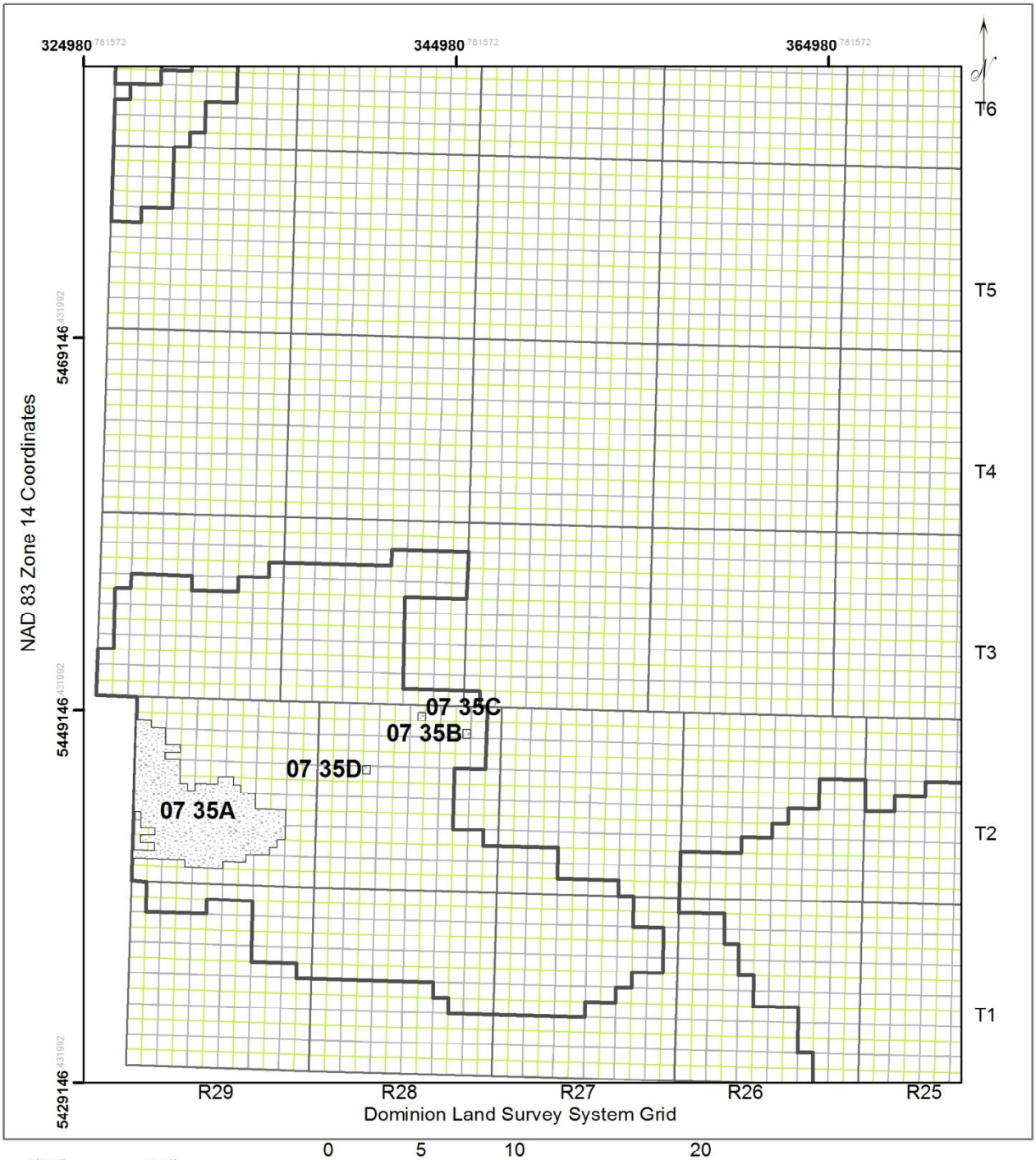
Figure 1

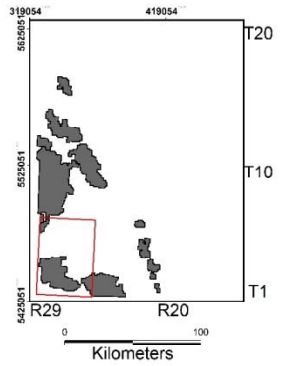


Tilston, Pierson & Waskada Fields

Figure 2







0 5 10 20
Kilometers

Map 5

Manitoba's Designated Fields & Pools 2016
Well Information: January 1, 2016.
Geology by: P. Fulton-Regula
Petroleum Branch

Legend

- 2016 Fields
- Oil Pools
- Township Grid
- Section Grid
- Quarter Section Grid

Manitoba

Lower Amaranth-Mission Canyon 3b Pools (35)

Figure 4

Production Graph

Group:	spu4 lam-mc well list.lwell	**On Prod:**	1993-10 to 2018-05	**Cum Oil:**	67165.9 m3
# of Wells:	13	**Prod Form:**	AMRNTHL; MISSNCYN	**Cum Gas:**	74.4 E3m3
Fluid:	Oil	**Field:**	PIERSON (MB7)	**Cum Wtr:**	77687.3 m3
Mode:	Abandoned; Producing; Suspended	**Pool Code:**	MB000729B; MB000742L	**Cum Inj Oil:**	0.0 m3
		Unit Code:		**Cum Inj Gas:**	0.0 E3m3
				Cum Inj Wtr:	0.0 m3

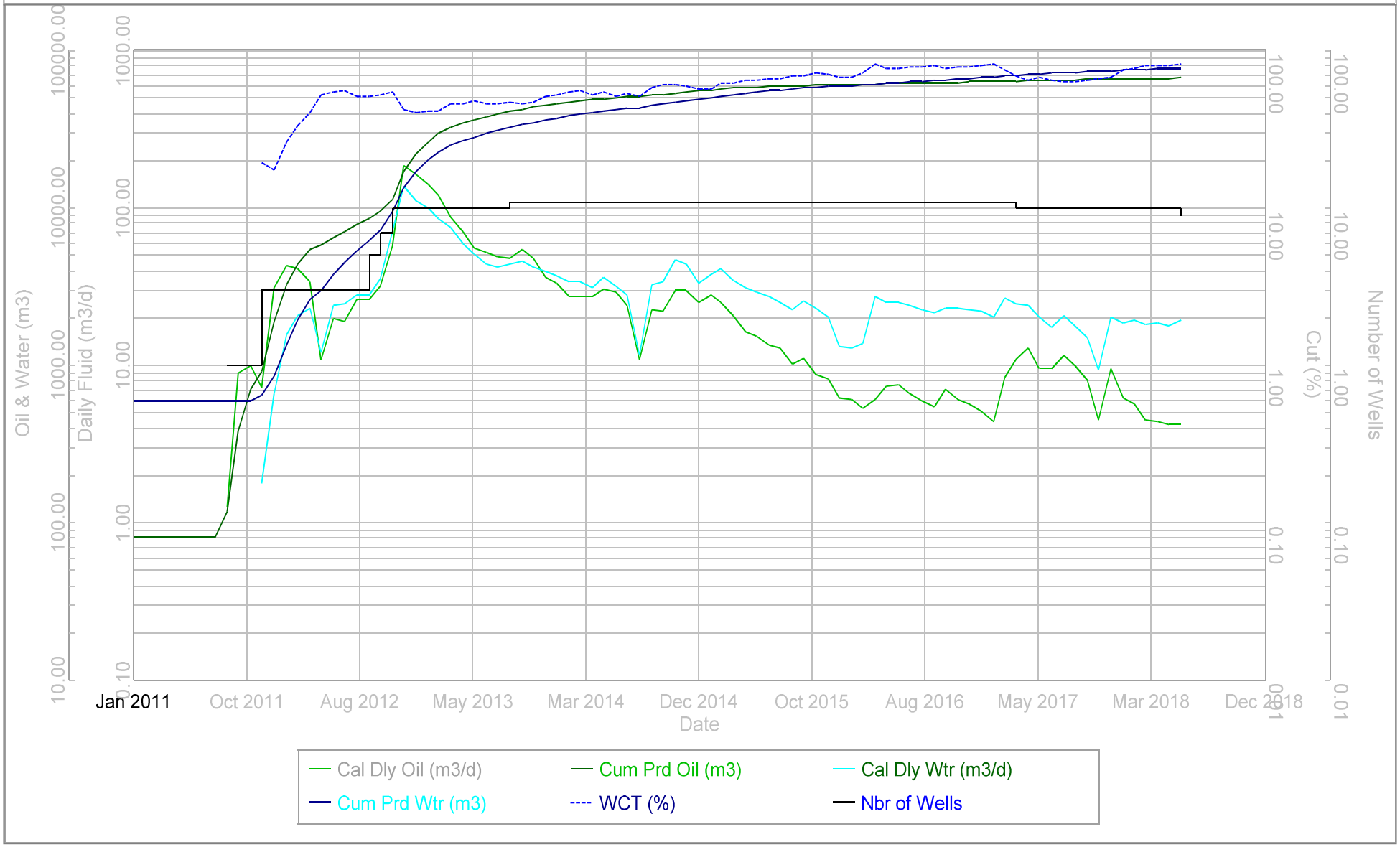


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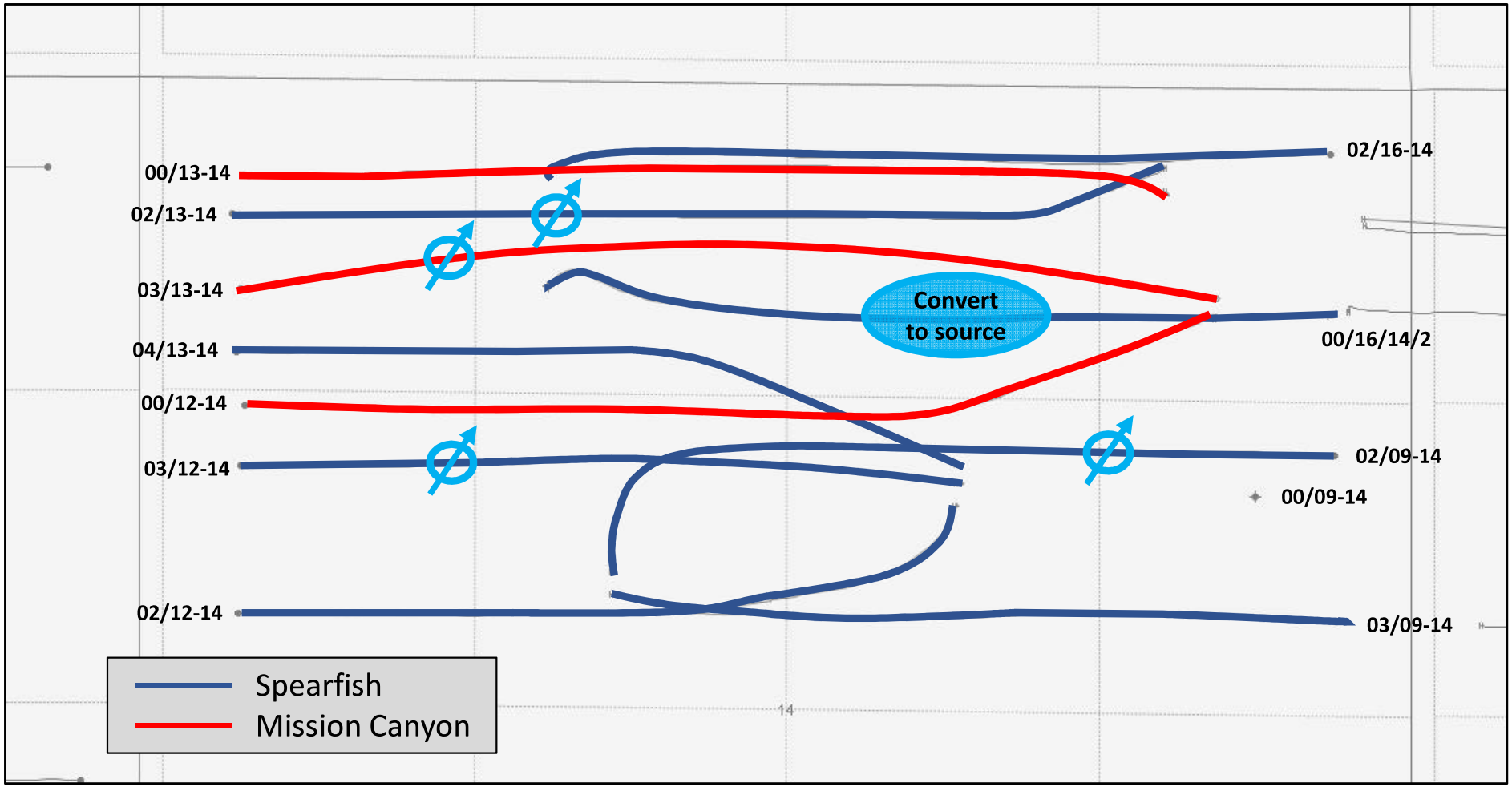
Figure 5

Section 14-002-29 – Proposed Development Plan

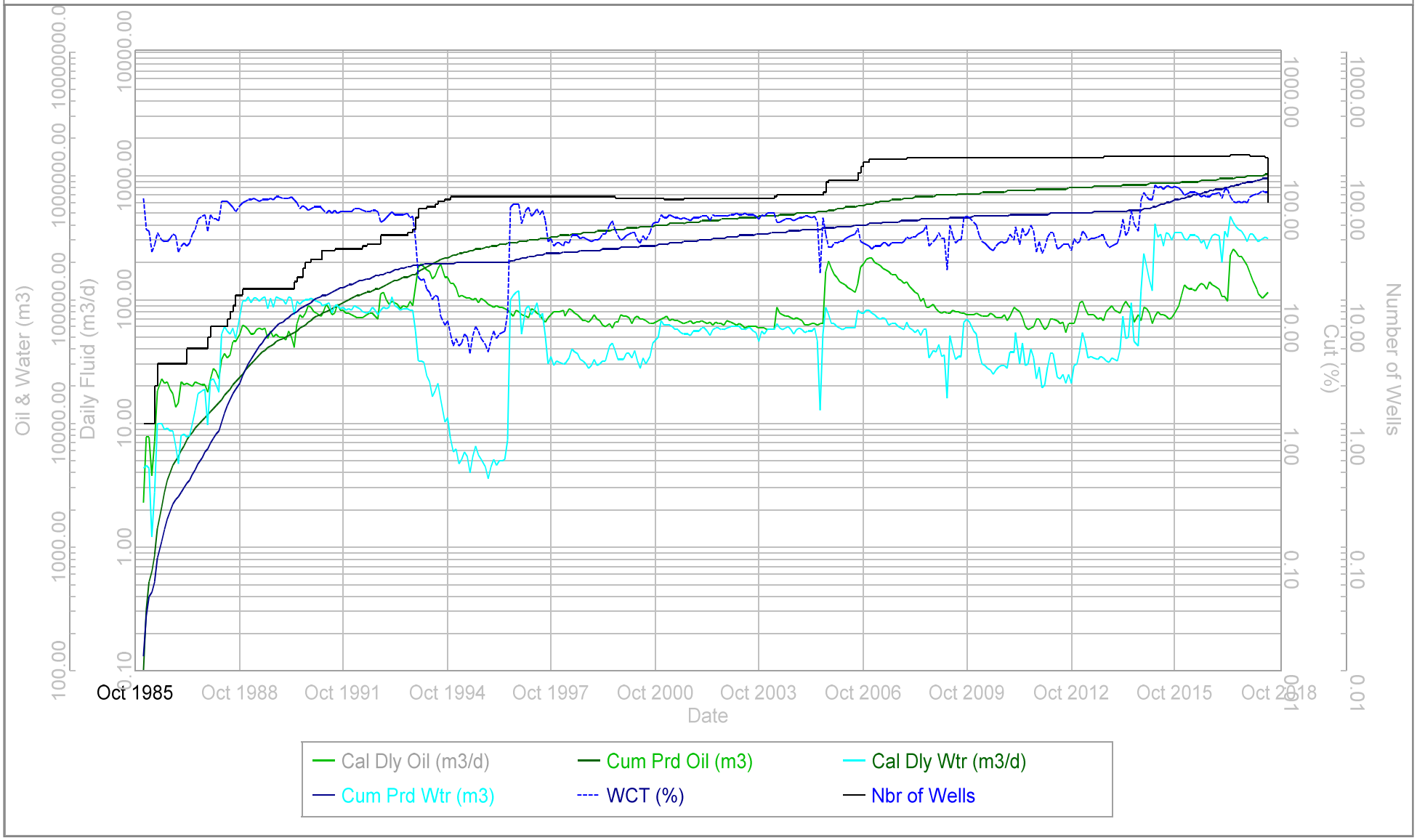


Unit SOUTH PIERSON UNIT NO. 1 Information as of 7/23/2018

Figure 6

Production Graph

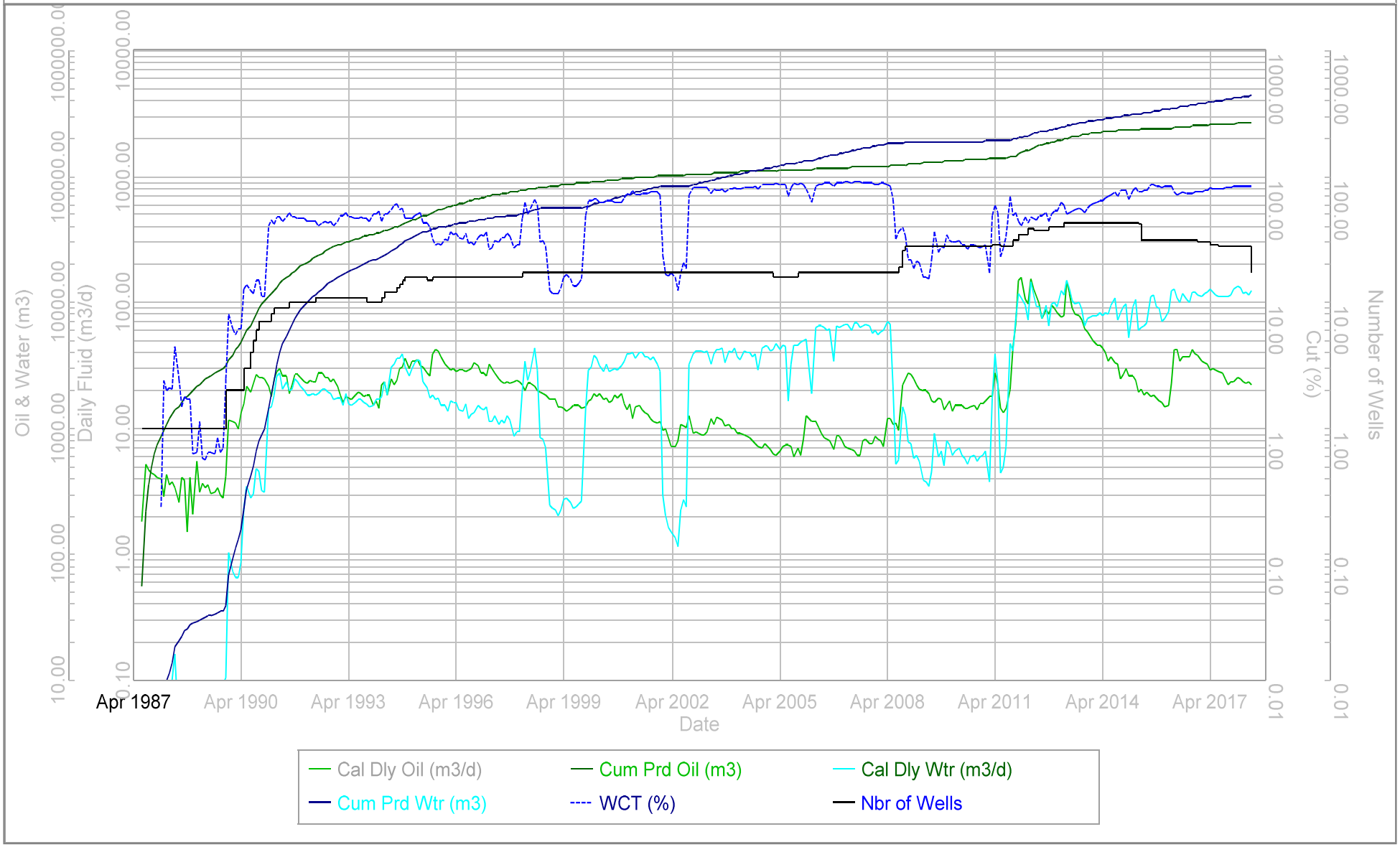
Group:	SOUTH PIERSON UNIT NO. 1	**On Prod:**	1985-12 to 2018-05	**Cum Oil:**	1018493.1 m3
# of Wells:	156	**Prod Form:**	AMRNTHL; ALIDABD; MISSNCYN; TILSTNBD	**Cum Gas:**	44398.6 E3m3
Fluid:	Oil; Water Injection; Water	**Field:**	PIERSON (MB7)	**Cum Wtr:**	952512.6 m3
Mode:	Abandoned; Producing; Injection; Source	**Pool Code:**	MB000735A; MB000744	**Cum Inj Oil:**	0.0 m3
		Unit Code:	735A1	**Cum Inj Gas:**	0.0 E3m3
				Cum Inj Wtr:	2959131.3 m3



Unit SOUTH PIERSON UNIT NO. 2 Information as of 7/23/2018

Production Graph

Group:	SOUTH PIERSON UNIT NO. 2	**On Prod:**	1987-06 to 2018-05	**Cum Oil:**	268195.3 m3
# of Wells:	49	**Prod Form:**	AMRNTHL; MISSNCYN	**Cum Gas:**	11600.3 E3m3
Fluid:	Oil; Water Injection	**Field:**	PIERSON (MB7)	**Cum Wtr:**	442092.8 m3
Mode:	Producing; Injection; Pumping; Abandoned	**Pool Code:**	MB000735A	**Cum Inj Oil:**	0.0 m3
		Unit Code:	735A2	**Cum Inj Gas:**	0.0 E3m3
				Cum Inj Wtr:	192614.7 m3



Printed on 8/8/2018 2:26:20 PM

Unit SOUTH PIERSON UNIT NO. 3 Information as of 7/23/2018

Production Graph

Group:	SOUTH PIERSON UNIT NO. 3	**On Prod:**	1987-12 to 2018-05	**Cum Oil:**	386830.9 m3
# of Wells:	56	**Prod Form:**	AMRNTHL; ALIDABD; MISSNCYN; TILSTNBD; AMRNTH	**Cum Gas:**	22429.9 E3m3
Fluid:	Oil	**Field:**	PIERSON (MB7)	**Cum Wtr:**	825885.4 m3
Mode:	Producing; Abandoned Zone; Pumping	**Pool Code:**	MB000735A	**Cum Inj Oil:**	0.0 m3
		Unit Code:	735A3	**Cum Inj Gas:**	0.0 E3m3
				Cum Inj Wtr:	0.0 m3

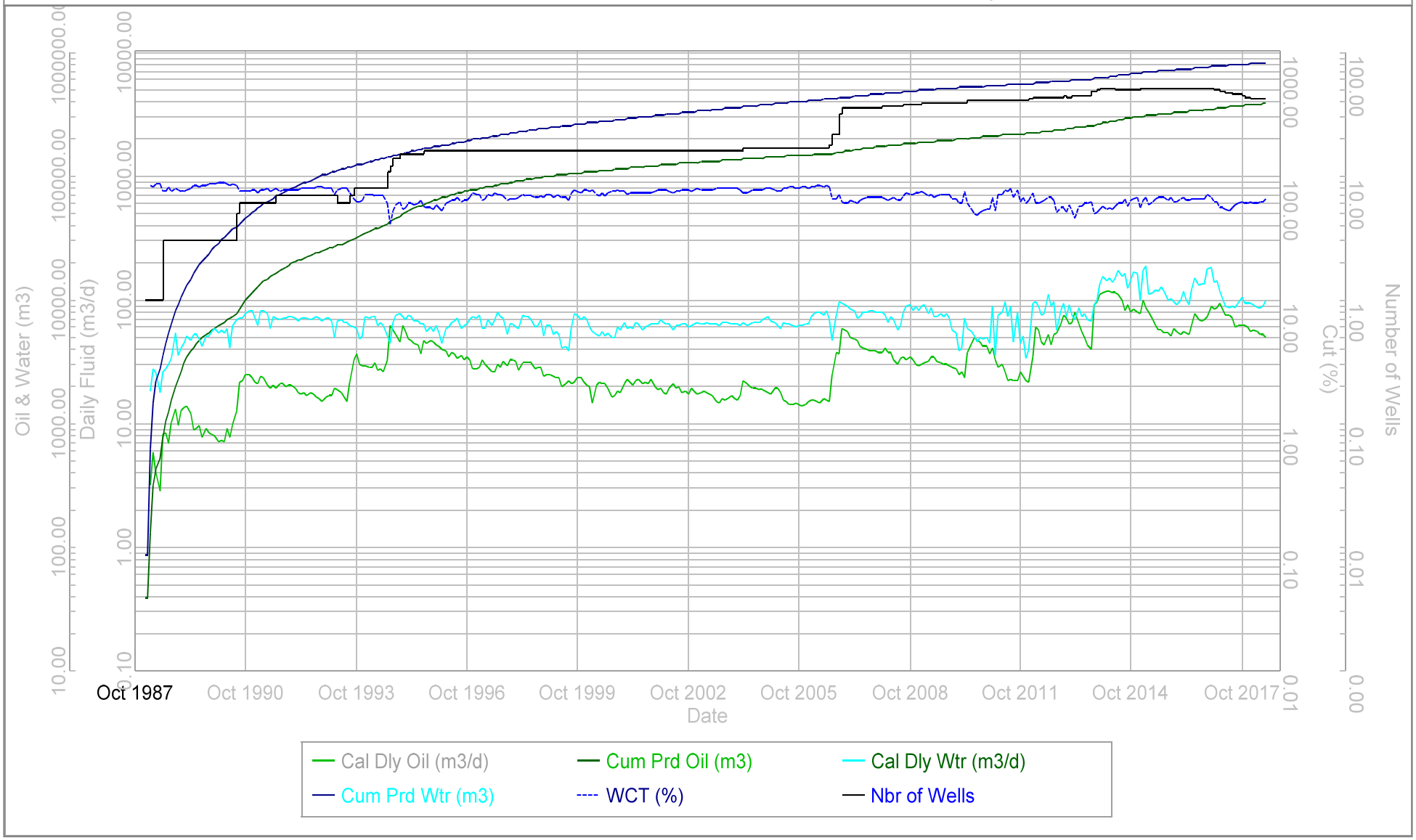


Figure 7

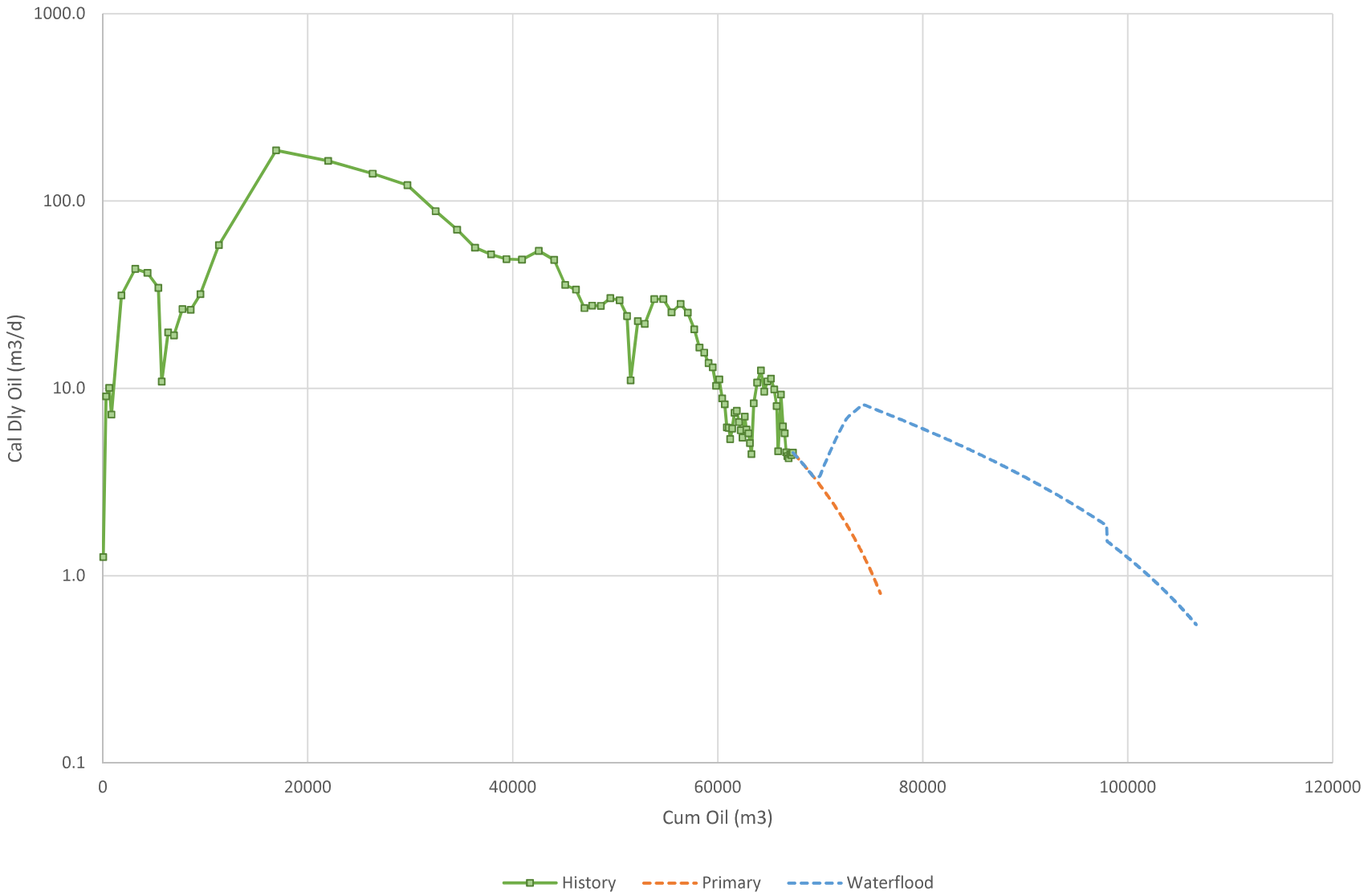
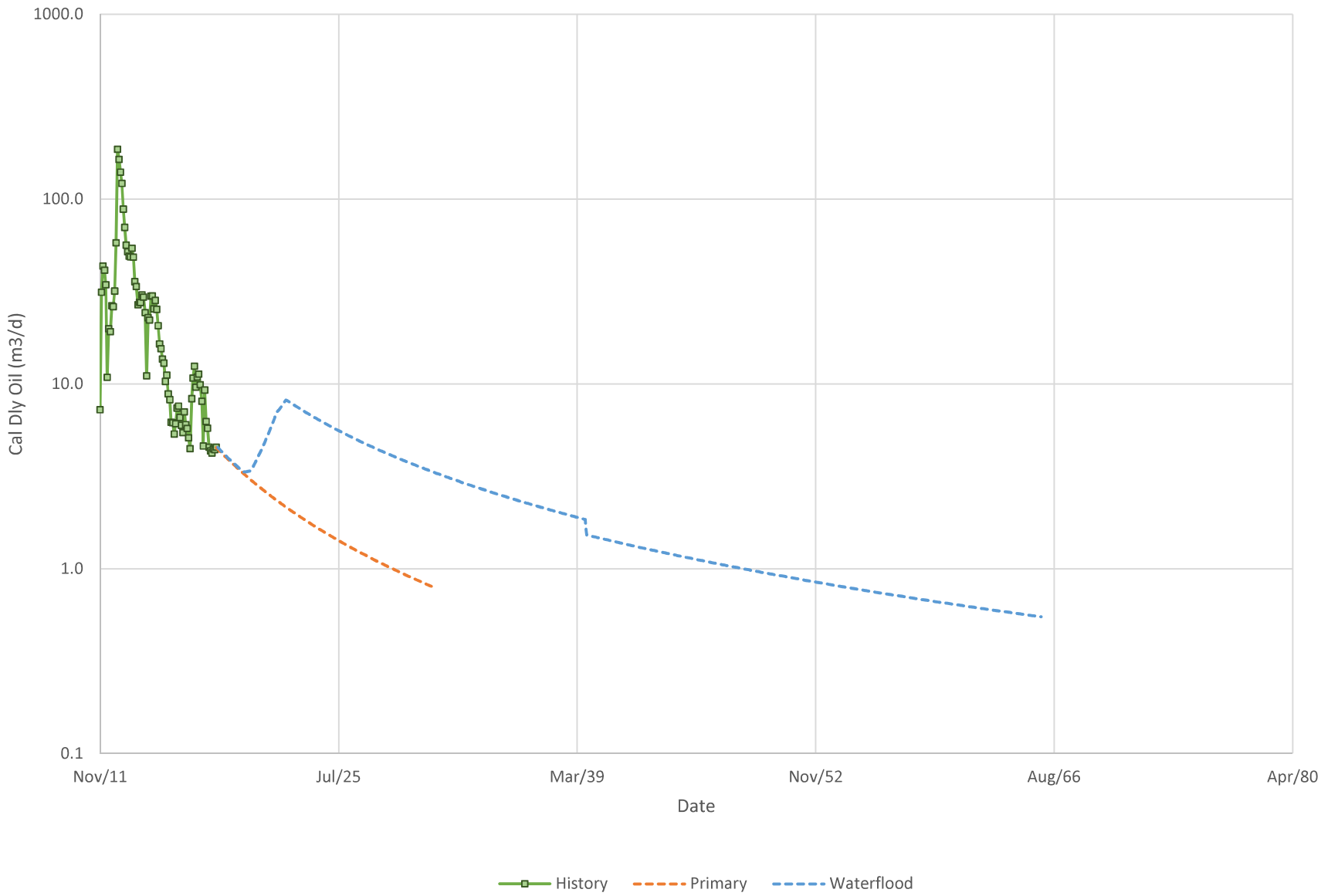

Pierson WF pilot
1000.0
100.0
10.0
1.0
0.1
Cal Dly Oil (m3/d)
0
20000
40000
60000
80000
100000
120000
Cum Oil (m3)
History
Primary
Waterflood

Figure 8


Pierson WF pilot
1000.0
100.0
10.0
1.0
0.1
Cal Dly Oil (m3/d)
Nov/11
Jul/25
Mar/39
Nov/52
Aug/66
Apr/80
Date
History
Primary
Waterflood

Tundra Oil And Gas

FIGURE 9 - TYPICAL CEMENTED LINER WATER INJECTION WELL (WIW) DOWNHOLE DIAGRAM

WELL NAME:	South Pierson Unit 4 HZNTL Cemented Liner WIW			**WELL LICENCE:**		
Prepared by	WRJ	(average depths)		Date:	2012	
Elevations :						
KB [m]		KB to THF [m]			TD [m]	2400.0
GL [m]		CF (m)			PBTD [m]	
Current Perfs:	**Cemented Casing / Liner**			950.0	to	2400.0
Current Perfs:					to	
KOP:	700 m MD		Total Interval		to	
Tubulars	Size [mm]	Wt - Kg/m	Grade	Landing Depth [mKB]		
Surface Casing	244.5	48.06	H-40 - ST&C	Surface	to	140.0
Intermed Csg (if run)	177.8	34.23 & 29.76	J-55 - LT&C	Surface	to	950.0
Production Liner	114.3	17.26	L-80	Surf or from Intermed Csg to		2400.0
Tubing	60.3 or 73.0 - TK-99	6.99 or 9.67	J-55	Surface	to	940.0

Date of Tubing Installation:

Item	Description	Length	Top @ m KB
	KB to Ground	0.00	
	Corrosion Protected ENC Coated Packer (set inside 114.3 mm Casing / Liner)		
	60.3 mm or 73 mm TK-99 Internally Coated Tubing		
	TK-99 Internally Coated Tubing Pup Jt		
	Coated Split Dognut		
	Annular space above injection packer filled with inhibited fresh water		
	Bottom of Tubing mKB		

Rod String :

Date of Rod Installation:

Bottomhole Pump:

Directions:

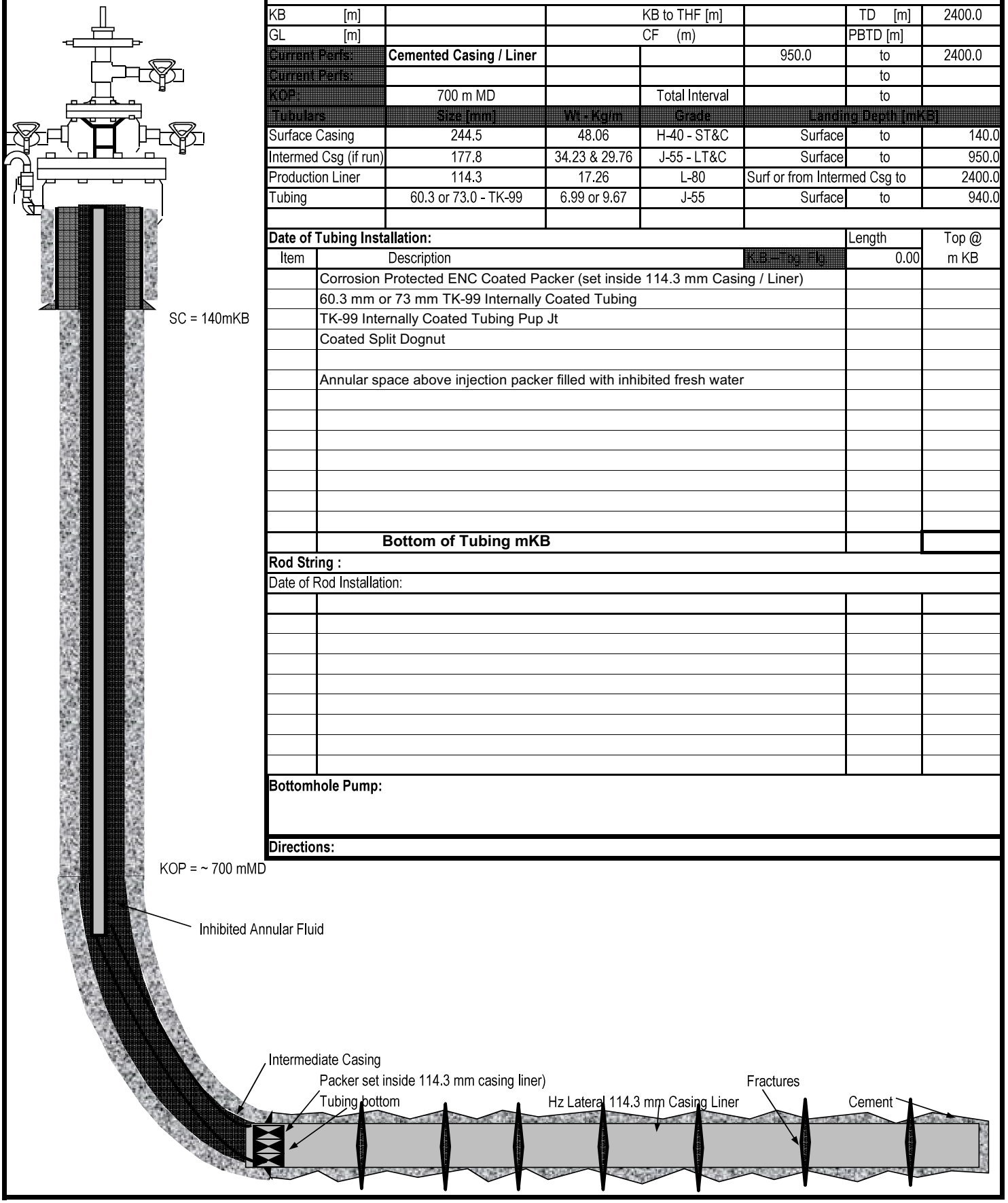
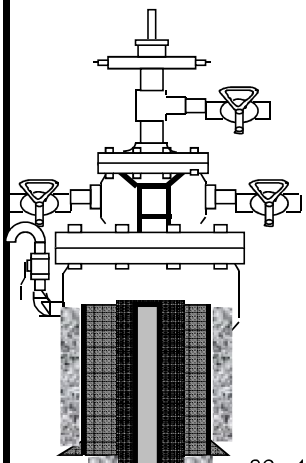


FIGURE 9 - TYPICAL OPEN HOLE WATER INJECTION WELL (WIW) DOWNHOLE DIAGRAM



SC = 140mKB

KOP = ~ 800 mMD

Inhibited Annular Fluid

Injection Packer set within 15 m of Intermediate Casing Shoe

Intermediate Casing Shoe

WELL NAME:	South Pierson Unit 4 HZNTL Open Hole WIW				**WELL LICENCE:**	
Prepared by	JWR	(average depths)		Date:	2013	
Elevations :						
KB [m]		KB to THF [m]			TD [m]	2400.0
GL [m]		CF (m)			PBTD [m]	
Current Perfs:	**Open Hole**			1050.0	to	2400.0
Current Perfs:					to	
KOP:	800 m MD		Total Interval		to	
Tubulars	Size [mm]	Wt - Kg/m	Grade	Landing Depth [mKB]		
Surface Casing	244.5	48.06	H-40 - ST&C	Surface	to	140.0
Intermed Csg (if run)	177.8	34.23 & 29.76	J-55 - LT&C	Surface	to	1050.0
Open Hole Latera	none	none	none	1050.0	to	2400.0
Tubing	60.3 or 73.0 - TK-99	6.99 or 9.67	J-55	Surface	to	940.0

Date of Tubing Installation:			Length	Top @
Item	Description	Kg - Ka - lb	0.00	m KB
	Corrosion Protected ENC Coated Packer (set within 15 m of Intermed Csg shoe)			
	60.3 mm or 73 mm TK-99 Internally Coated Tubing			
	TK-99 Internally Coated Tubing Pup Jt			
	Coated Split Dognut			
	Annular space above injection packer filled with inhibited fresh water			
	Bottom of Tubing mKB			

Rod String :			
Date of Rod Installation:			

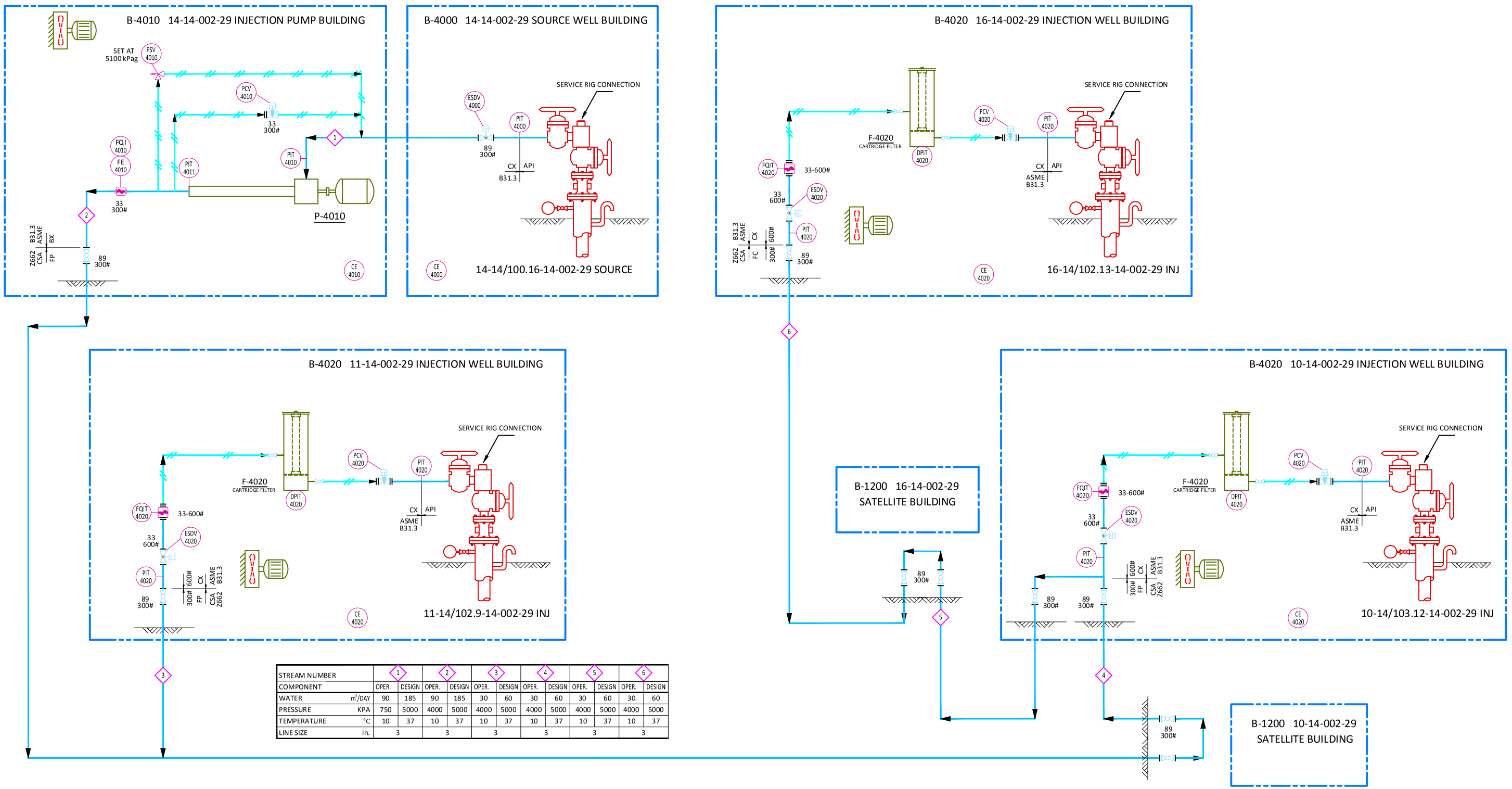
Bottomhole Pump:

Directions:

P-4010
WATER INJECTION PUMP
MAKE: SUMMIT ESP
MODEL: SF850 AR
30HP 575V,3PH,60HZ, 3600RPM, TEFC MOTOR

F-4020
FILTER
Twister 1 micron

DPIT-4020
DP FLOW TRANSMITTER
ROSEMOUNT 2051C
MODEL: 2051CD5A22A1AB4K6M5



STREAM NUMBER		1		2		3		4		5		6	
COMPONENT		OPER.	DESIGN	OPER.	DESIGN	OPER.	DESIGN	OPER.	DESIGN	OPER.	DESIGN	OPER.	DESIGN
WATER	m^3/DAY	90	185	90	185	30	60	30	60	30	60	30	60
PRESSURE	KPA	750	5000	4000	5000	4000	5000	4000	5000	4000	5000	4000	5000
TEMPERATURE	°C	10	37	10	37	10	37	10	37	10	37	10	37
LINE SIZE	in.	3		3		3		3		3		3	

REV	DESCRIPTION	BY	DATE	CHK	APP
0	ISSUE FOR REVIEW	YQ	30JUL2018	JC	
A	ISSUED FOR REVIEW	JC	16JULY2018	BE	YQ

REFERENCE DRAWING

Figure 10

TUNDRA OIL & GAS LIMITIED

PIERSON SEC 14 PILOT WATERFLOOD
14-002-29 W1M

SOURCE AND INJECTION WELLS
PROCESS FLOW DIAGRAM

DRAWN BY:	SCALE:	AFE:	DRAWING NUMBER:	REV NO:
JC	NTS	TBA	14-002-29W1M-PFD-1000	0

Figure 11 – Corrosion Control

Injection Wells

- Corrosion inhibitor in the annulus between tubing and casing.
- Surface freeze protection of annular fluids near surface.
- Corrosion-resistant valves on wellhead and flowline.
- Corrosion-resistant flowline equipment.
- Installation of cathodic protection to protect casing.
- Scale inhibitor protection as needed.
- Bacteria control chemical treatments when needed.
- Water injector packer will be coated for corrosion resistance.

Producing Wells

- Downhole corrosion inhibitor, either batch or daily injection, as needed.
- Scale inhibitor treatment daily injection as required for horizontal wells.
- Paraffin treatment daily injection if needed.
- Casing cathodic protection where required.

Pipelines

- Injection lines to have Flexpipe 1000# pipe.
- Producing lines existing as per original flowline licenses.

Facilities

14-14-2-29 Injection Facility

- Plant piping –all stainless steel.
- Filtration – stainless steel filter at each wellhead.
- Pumps – multi-stage centrifugal with stainless head and base.

Proposed South Pierson Unit No. 4

Application for Enhanced Oil Recovery Waterflood Project

List of Tables

TABLE NO. 2: TRACT FACTOR CALCULATIONS FOR SOUTH PIERSON UNIT NO. 4 - LAM-MC APPLICATION

TRACT FACTORS BASED ON OIL-IN-PLACE (OOIP) - CUMULATIVE PRODUCTION TO MAY 2018

LSD-SEC	Tract	OOIP (m3)	HZ Wells Alloc Cum Prodn (m3)	Vert Wells Cum Prodn (m3)	Sum Hz + Vert Alloc Cum Prodn	OOIP - Cum	OOIP Tract Factor (%)	Tract
09-14	09-14-002-29W1M	131,135	4,861.3	79.8	4,941.1	126,194	11.277376101%	09-14-002-29W1M
10-14	10-14-002-29W1M	154,137	7,308.2	0.0	7,308.2	146,829	13.121460567%	10-14-002-29W1M
11-14	11-14-002-29W1M	154,867	12,774.9	0.0	12,774.9	142,092	12.698143160%	11-14-002-29W1M
12-14	12-14-002-29W1M	141,518	11,476.5	0.0	11,476.5	130,041	11.621202794%	12-14-002-29W1M
13-14	13-14-002-29W1M	136,117	7,617.0	0.0	7,617.0	128,500	11.483520642%	13-14-002-29W1M
14-14	14-14-002-29W1M	161,640	9,723.9	0.0	9,723.9	151,916	13.576046723%	14-14-002-29W1M
15-14	15-14-002-29W1M	164,596	9,474.6	0.0	9,474.6	155,122	13.862544292%	15-14-002-29W1M
16-14	16-14-002-29W1M	142,155	3,849.9	0.0	3,849.9	138,305	12.359705721%	16-14-002-29W1M
		1,186,164	**67,086.1**	**79.8**	**67,165.9**	**1,118,998**	**100.000000000%**	

Table No. 3 - Well List and Status

UWI	*License Number*	*Type*	*Pool Name*	*Producing Zone*	*Mode*	*On Production Date*	*Prod Date*	*Cal Dly Oil (m3/d)*	*Monthly Oil (m3)*	*Cum Prd Oil (m3)*	*Cal Dly Water (m3/d)*	*Monthly Water (m3)*	*Cum Prd Water (m3)*	*WCT (%)*
100/09-14-002-29W1/0	004367	Vertical	LOWER AMARANTH B	AMRNTHL	Abandoned	10/30/1993	Jul-1996	0.32	10.00	79.80	0.00	0.00	596.80	0.00
102/09-14-002-29W1/0	008703	Horizontal	LOWER AMARANTH B	AMRNTHL	Producing	10/28/2012	May-2018	0.20	6.30	5241.40	0.25	7.80	5354.20	55.32
103/09-14-002-29W1/0	008704	Horizontal	LOWER AMARANTH B	AMRNTHL	Producing	10/27/2012	May-2018	0.28	8.70	6271.30	0.26	8.20	4657.40	48.52
100/12-14-002-29W1/0	008705	Horizontal	MISSION CANYON 3B L	MISSNCYN	Producing	8/31/2012	May-2018	0.43	13.20	1900.20	4.25	131.90	8401.80	90.90
102/12-14-002-29W1/0	008706	Horizontal	LOWER AMARANTH B	AMRNTHL	Producing	9/30/2012	May-2018	2.05	63.50	13881.90	0.80	24.80	4750.50	28.09
103/12-14-002-29W1/0	008707	Horizontal	LOWER AMARANTH B	AMRNTHL	Producing	9/28/2012	May-2018	0.24	7.50	9431.10	0.10	3.20	4528.00	29.91
100/13-14-002-29W1/0	008069	Horizontal	MISSION CANYON 3B L	MISSNCYN	Producing	11/30/2011	May-2018	0.54	16.60	6823.80	4.39	136.20	15902.70	89.14
102/13-14-002-29W1/0	008314	Horizontal	LOWER AMARANTH B	AMRNTHL	Producing	11/30/2011	May-2018	0.03	0.90	6291.40	0.07	2.20	3180.90	70.97
103/13-14-002-29W1/0	008708	Horizontal	MISSION CANYON 3B L	MISSNCYN	Producing	8/31/2012	May-2018	0.36	11.30	2177.90	9.05	280.70	19316.50	96.13
104/13-14-002-29W1/0	008709	Horizontal	LOWER AMARANTH B	AMRNTHL	Producing	10/25/2012	Apr-2018	0.01	0.20	6504.90	0.01	0.40	3080.00	66.67
100/14-14-002-29W1/0	007696	Horizontal			Abandoned	N/A								
100/16-14-002-29W1/2	007696	Horizontal	LOWER AMARANTH B	AMRNTHL	Suspended	8/31/2011	Feb-2017	0.01	0.20	4007.80	0.16	4.50	5773.90	95.74
102/16-14-002-29W1/0	009378	Horizontal	LOWER AMARANTH B	AMRNTHL	Producing	8/24/2013	May-2018	0.13	4.10	4554.40	0.14	4.30	2144.60	51.19
										67165.90			**77687.30**	

Table No. 4 : OOIP Calculation

Polygon Name	LAM OOIP (m3)	LAM OOIP (bbls)	MC OOIP (m3)	MC OOIP (bbls)	TOTAL OOIP
9-14-002-29W1	127,359	801,063	3,776	23,749	131,135
10-14-002-29W1	129,116	812,115	25,021	157,378	154,137
11-14-002-29W1	127,164	799,839	27,703	174,244	154,867
12-14-002-29W1	127,582	802,470	13,935	87,649	141,518
13-14-002-29W1	125,325	788,272	10,792	67,881	136,117
14-14-002-29W1	125,606	790,037	36,034	226,645	161,640
15-14-002-29W1	130,152	818,634	34,444	216,645	164,596
16-14-002-29W1	127,815	803,931	14,340	90,196	142,155
	1,020,120		**166,044**		**1,186,164**

Proposed South Pierson Unit No. 4

Application for Enhanced Oil Recovery Waterflood Project

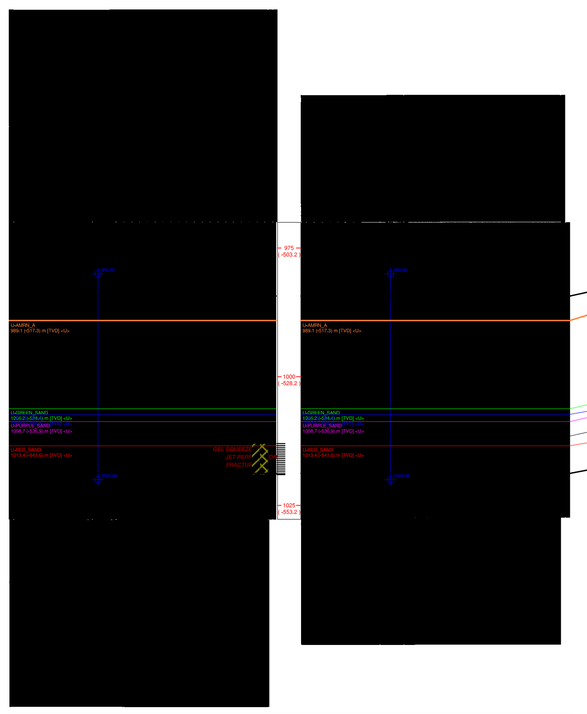
LIST OF APPENDICES

00/02-15-002-29W1/0

KB: 471.8 m
TD: 1026.0 m [TVD]
Mode: Prod
CNRL PIERSON 2-15-2-29(WPM)

RR: 2006-09-27
FormTD: AMINTHL
Fluid: Oil

398.9m to next well >



DST Information

Prod	Oil (m3)	Gas (E3m3)	Water (m3)
Cum	5080.2	236.1	244.4
Daily	1.3	0.1	0.1

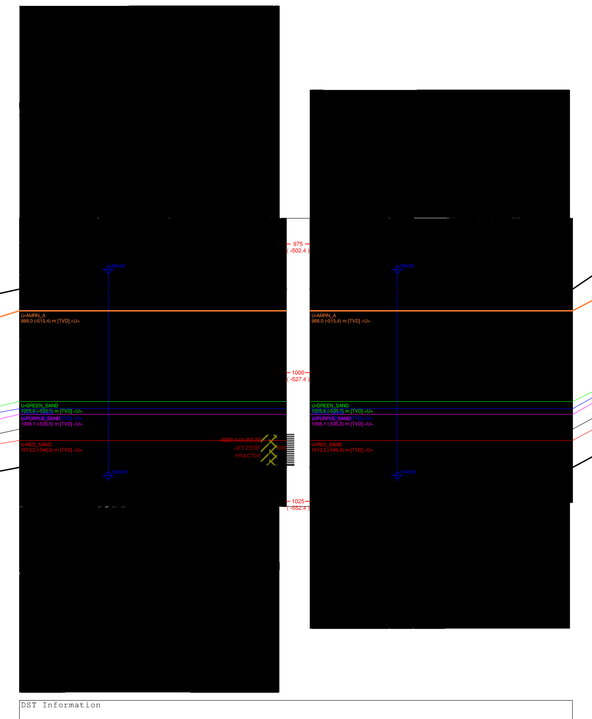
02/07-15-002-29W1/0

KB: 472.6 m
TD: 1023.0 m [TVD]
Mode: Prod
CNRL PIERSON 7-15-2-29(WPM)

RR: 2006-09-30
FormTD: AMINTHL
Fluid: Oil

< 398.9m to previous well

400.0m to next well >



DST Information

Prod	Oil (m3)	Gas (E3m3)	Water (m3)
Cum	1443.9	124.9	345.8
Daily	0.6	0.1	0.2

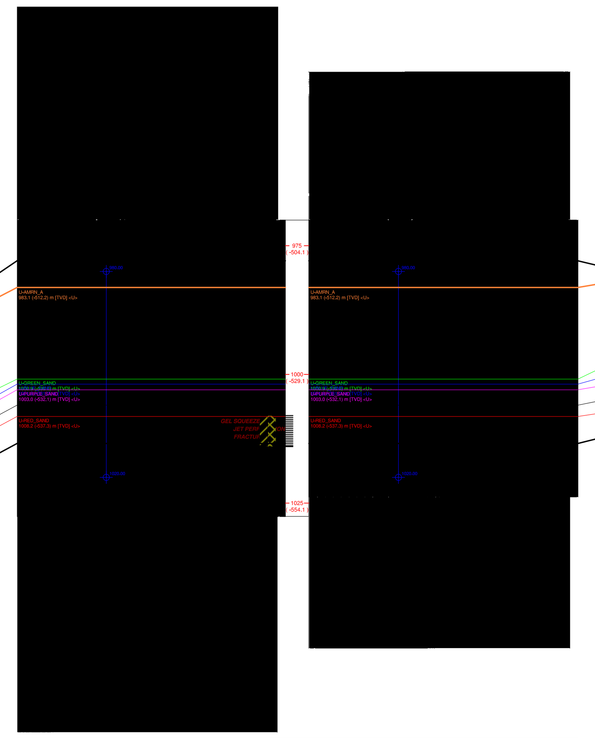
00/08-15-002-29W1/0

KB: 470.9 m
TD: 1021.0 m [TVD]
Mode: Prod
CNRL PIERSON 8-15-2-29(WPM)

RR: 2006-08-25
FormTD: AMINTHL
Fluid: Oil

< 400.0m to previous well

1041.7m to next well >



DST Information

Prod	Oil (m3)	Gas (E3m3)	Water (m3)
Cum	2460.1	547.8	390.8
Daily	0.6	0.1	0.3

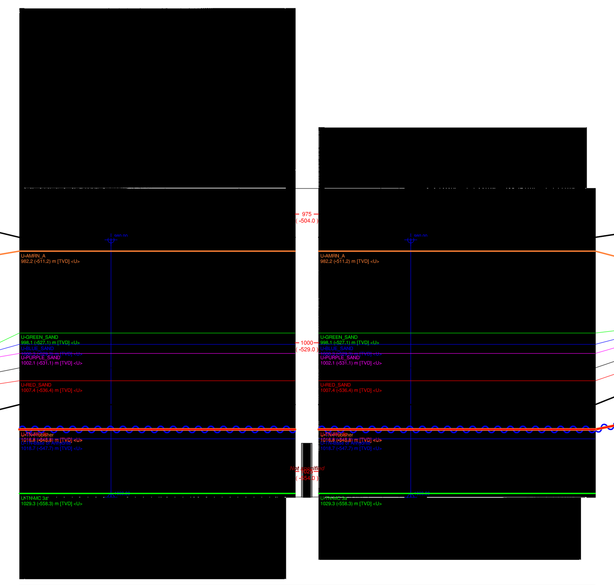
00/14-14-002-29W1/0

KB: 471.0 m
TD: 1065.0 m [TVD]
Mode: Abnd
RED BESS PIERSON HZNTL 16-14-2-29 (WPM)

RR: 2010-12-10
FormTD: MISSRCYN
Fluid: N/A

< 1041.7m to previous well

951.6m to next well >



DST Information

Prod	Oil (m3)	Gas (E3m3)	Water (m3)
Cum	0.0	0.0	0.0
Daily	0.0	0.0	0.0

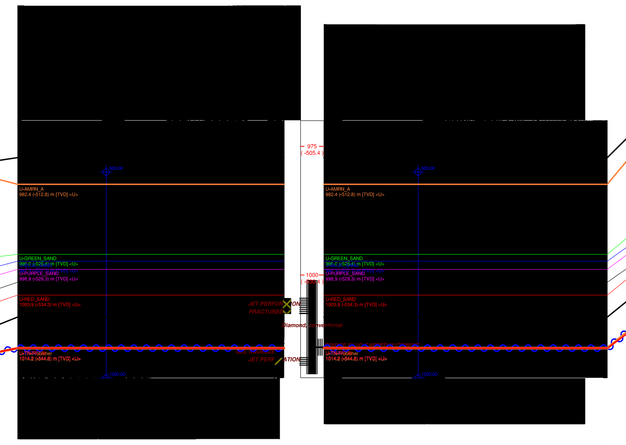
00/09-14-002-29W1/0

KB: 469.6 m
TD: 1035.0 m [TVD]
Mode: Abnd
CYN-TECH PIERSON 9-14-2-29

RR: 1993-09-06
FormTD: ALIDABD
Fluid: Oil

< 951.6m to previous well

1125.7m to next well >



DST Information

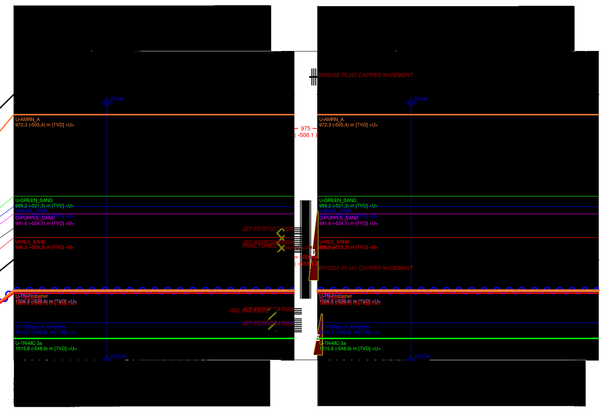
Prod	Oil (m3)	Gas (E3m3)	Water (m3)
Cum	79.8	0.0	596.4
Daily	2.3	0.0	17.4

00/03-24-002-29W1/0

KB: 466.9 m
TD: 1023.0 m [TVD]
Mode: Abnd
TDL PIERSON 3-24-2-29

RR: 1988-02-16
FormTD: ALIDABD
Fluid: Oil

< 1125.7m to previous well



DST Information

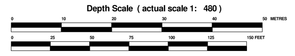
1. 993.0[TVD]-1004.5[TVD] (AMINTHL)
  Misrun
  Type: UNDEFINED
  VO: 10.0/60.0 ZI: 90.0/120.0 min
  FP: 0.0/852.0 kPa
  SIP: 10267.0/8823.0 kPa
  HP: 12134.0/12074.0 kPa
  BLOW DESCRIPTION: VERY WEAK BLOW, DEAD IN 1 MINUTE. RECOVERY: 18M (59FT) OIL CUT MUD RECOVERY: 25M (82FT) MUD
2. 1011.0[TVD]-1019.0[TVD] (ALIDARD)
  Misrun
  Type: UNDEFINED
  VO: 10.0/60.0 ZI: 60.0/120.0 min
  FP: 9276.0/9894.0 kPa
  SIP: 9276.0/9894.0 kPa
  HP: 11261.0/11261.0 kPa
  BLOW DESCRIPTION: FAINT TO WEAK BLOW IN 10 MINUTES ON PREFLOW. FAINT TO WEAK BLOW IN 5 MINUTES ON FINAL FLOW, STEADY THROUGHOUT. RECOVERY: 26M (85FT) OIL CUT MUD

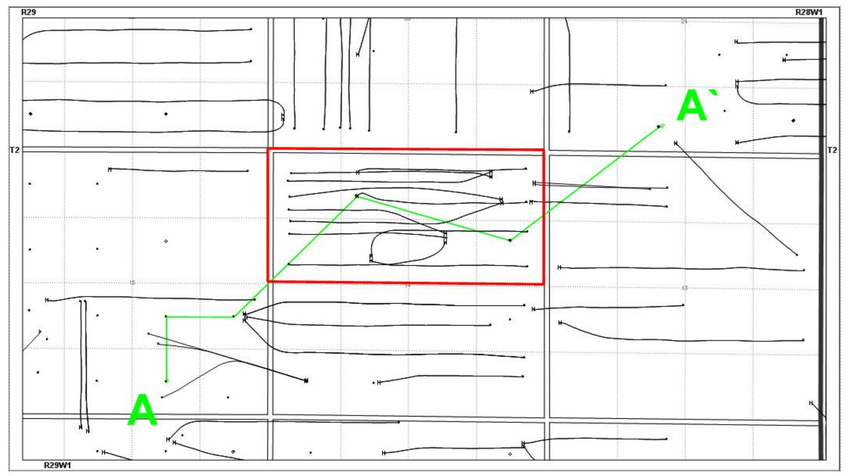
Prod	Oil (m3)	Gas (E3m3)	Water (m3)
Cum	365.2	0.0	3304.8
Daily	0.2	0.0	1.3

Legend

- Oil
- Dry & Abandoned
- Abandoned Oil
- Contact Type - Conformity
- Contact Type - Unconformity
- Contact Type - Time Equivalence
- Contact Type - Left Fault
- Contact Type - Right Fault
- Light Blue

Depth Scale (actual scale 1: 400)





Appendix 1

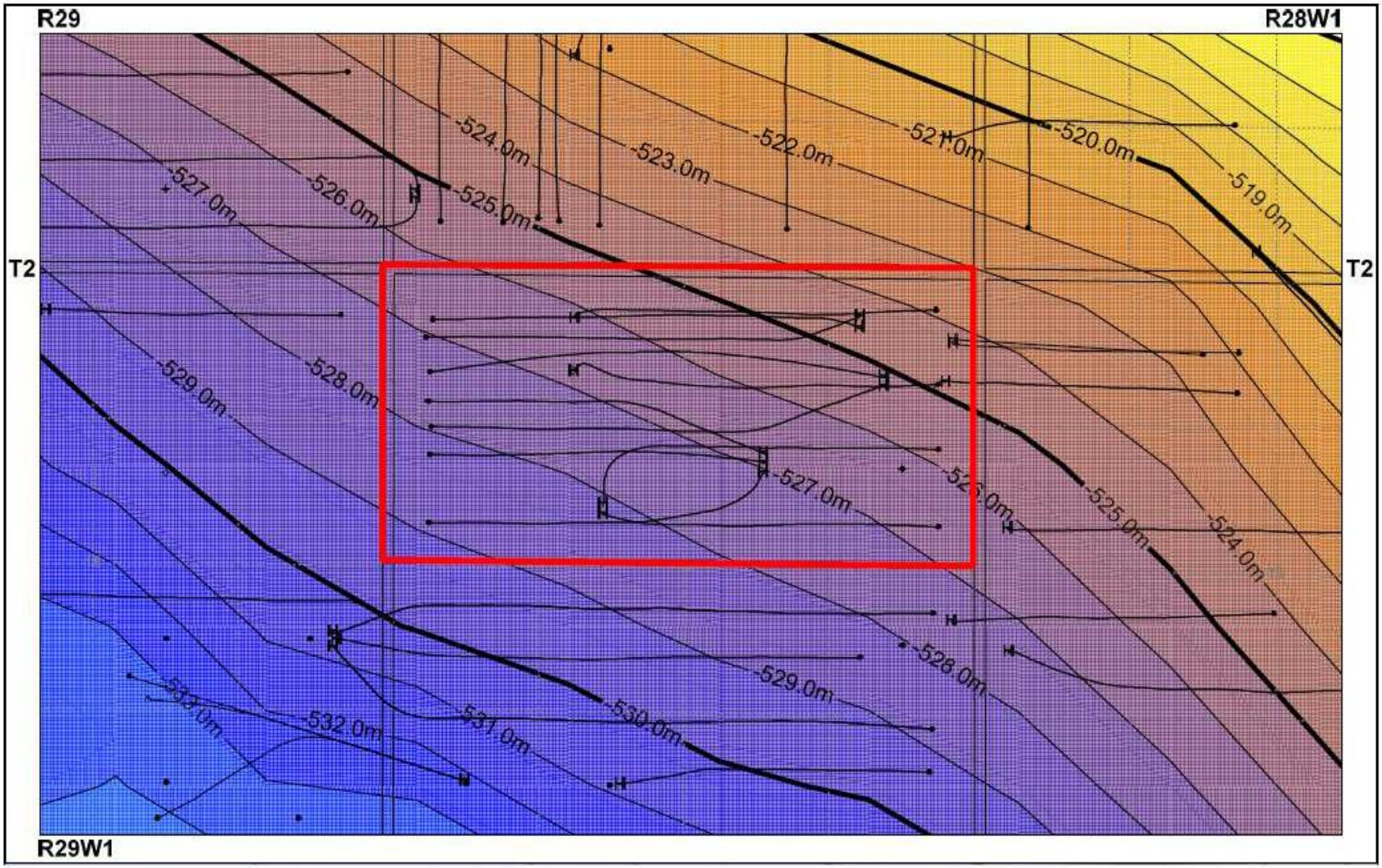
Tundra Oil and Gas

South Pierson Unit 4

Produced by:
AccuLogs
Version 9.2.2.229535
Datum: NAD27

Copyright 2017, IHS

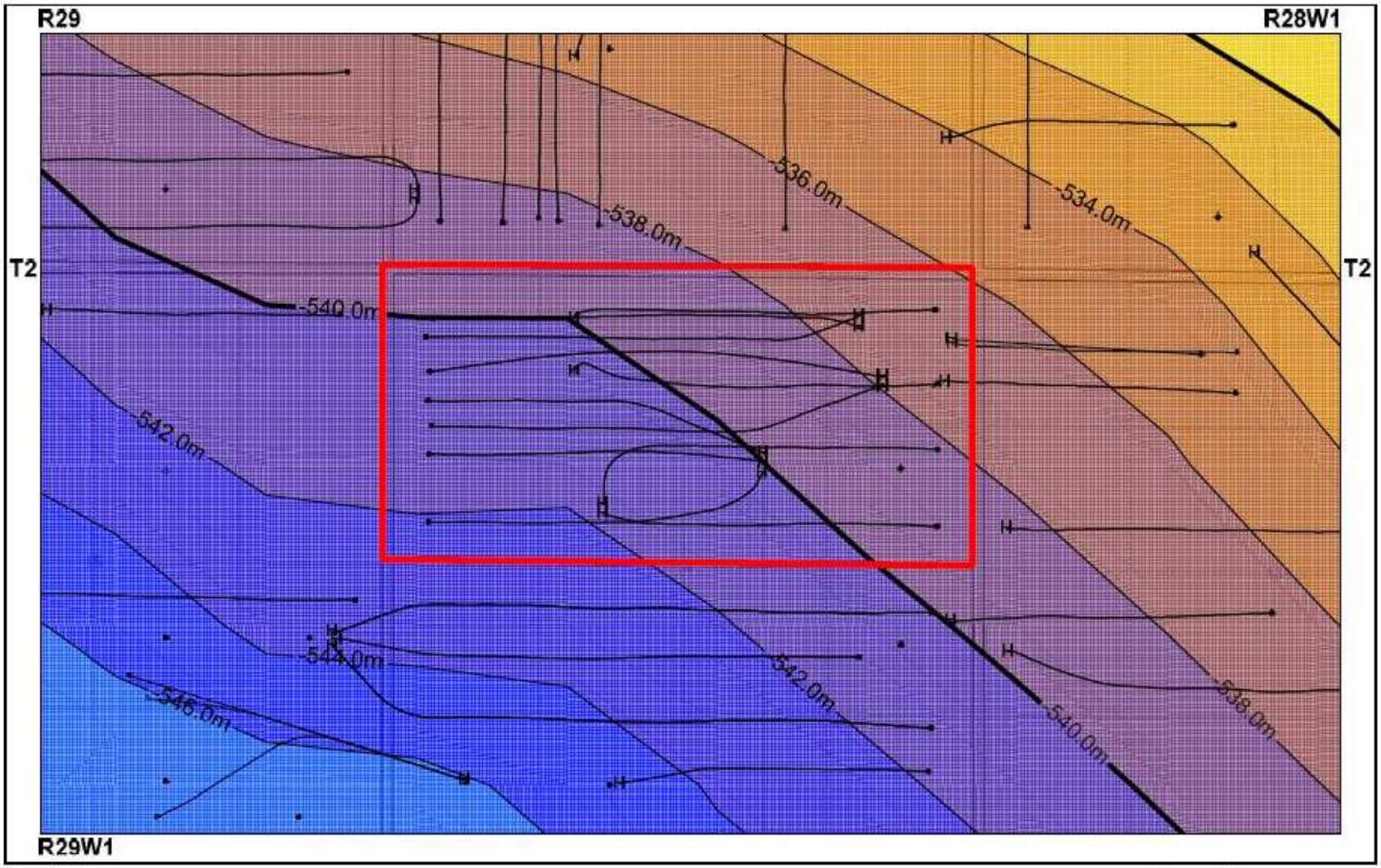
Author:
Modified On: Thursday, July 19, 2018 12:37PM
Printed On: Thursday, July 19, 2018 12:37PM
Start Formation: Sm, above AMINTHL
End Formation: Sm, below U/MSSP
Cross Section Name: PIERSONE.XSC



Pierson Unit Application

Appendix 2

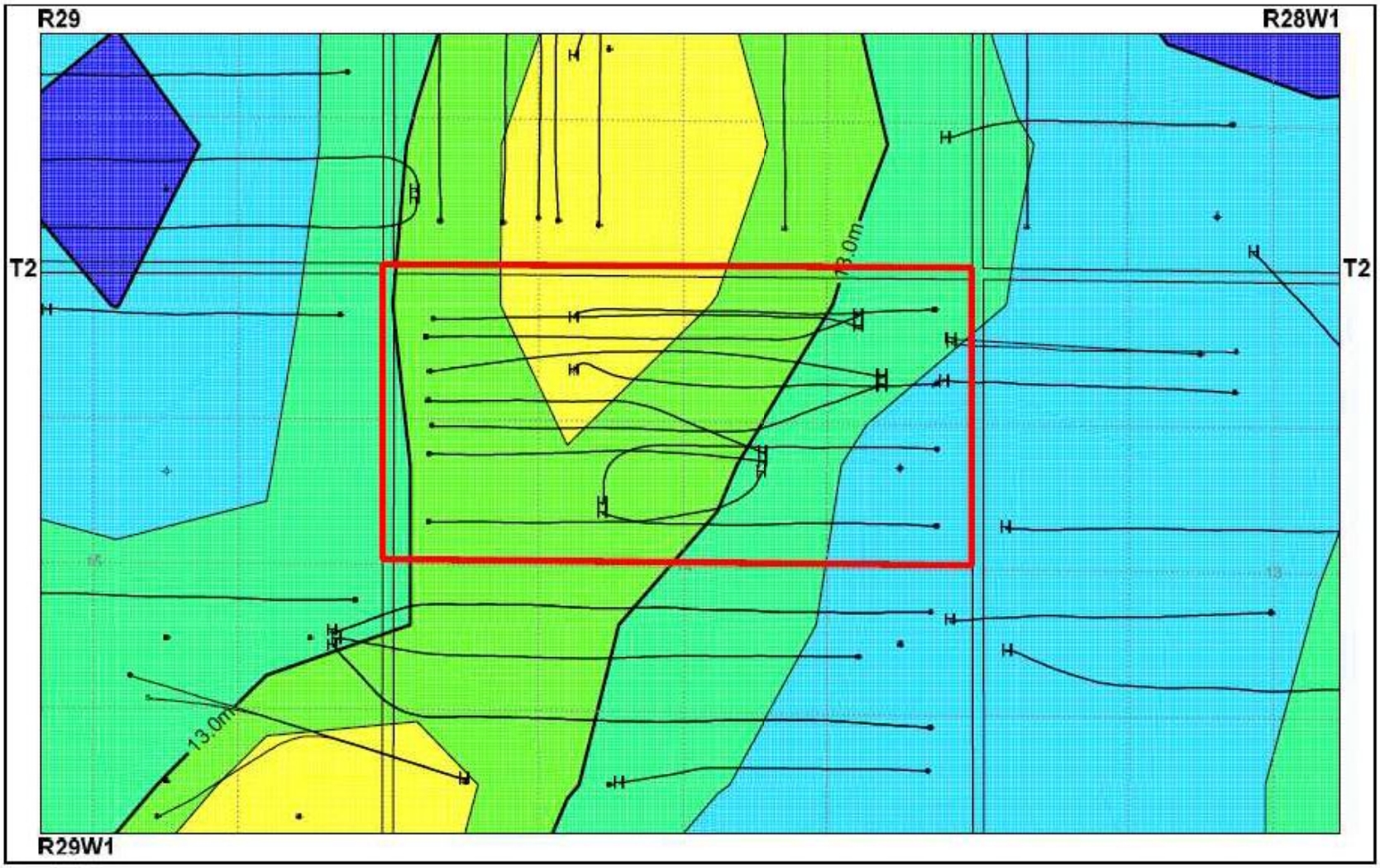
Pierson Unit Application
Green Sand Structure (Top of Reservoir)
July 12, 2018



Pierson Unit Application

Appendix 3

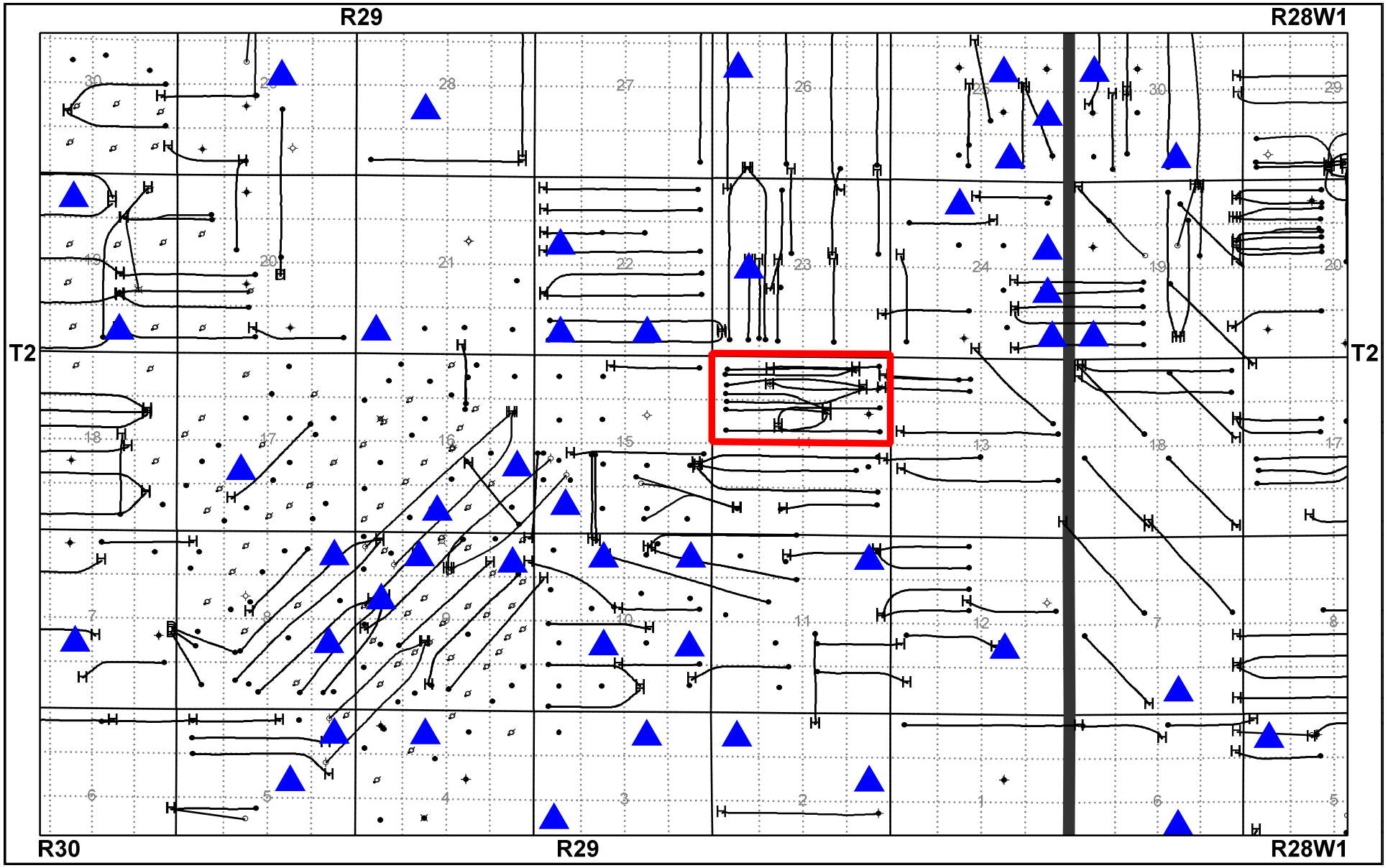
Pierson Unit Application
Lower Sand Structure (Base of Reservoir)
July 12, 2018



Pierson Unit Application

Appendix 4

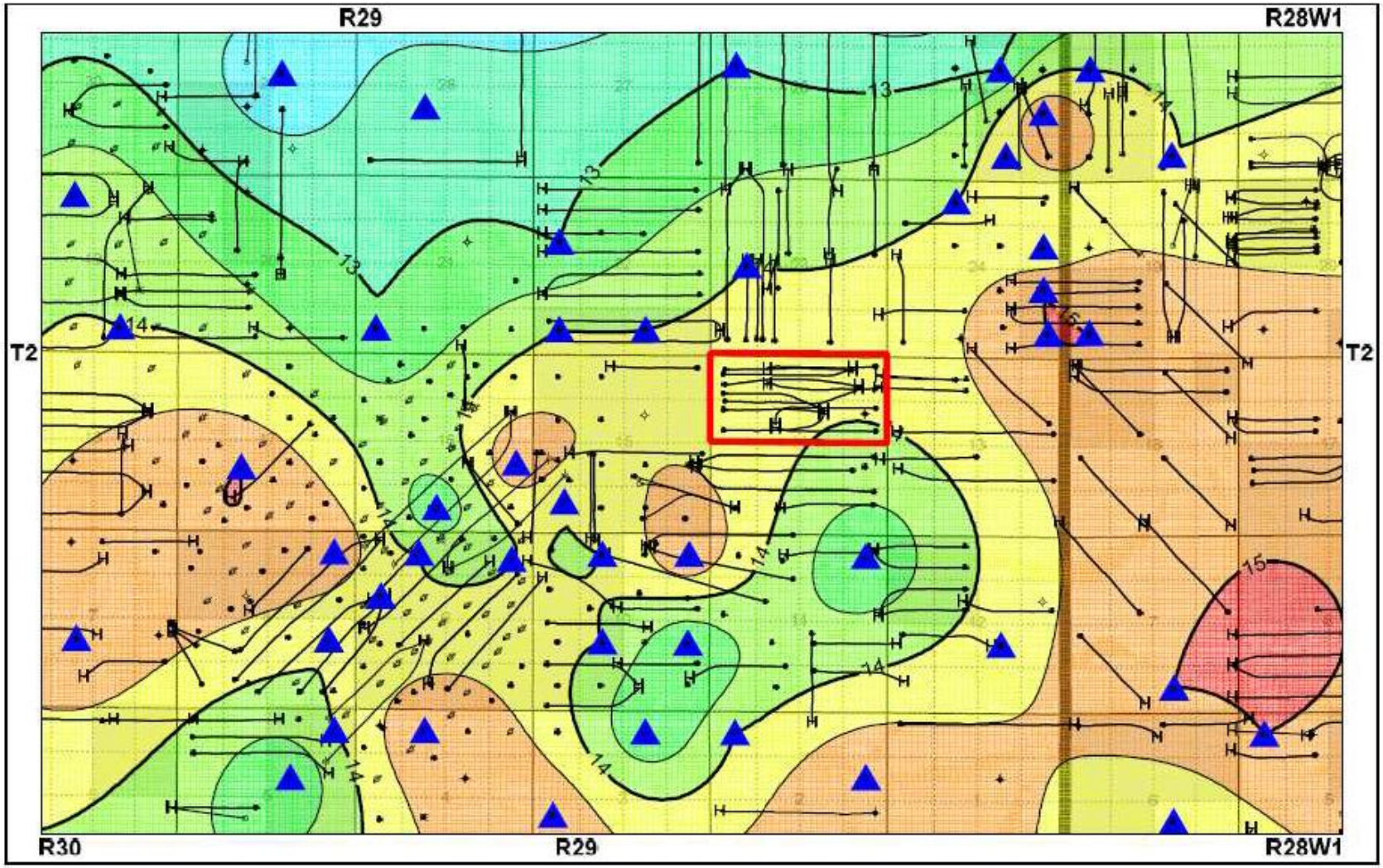
Pierson Unit Application
Reservoir Isopach (Top Green to Base Red Sand)
July 12, 2018



Pierson Unit Application

Appendix 5

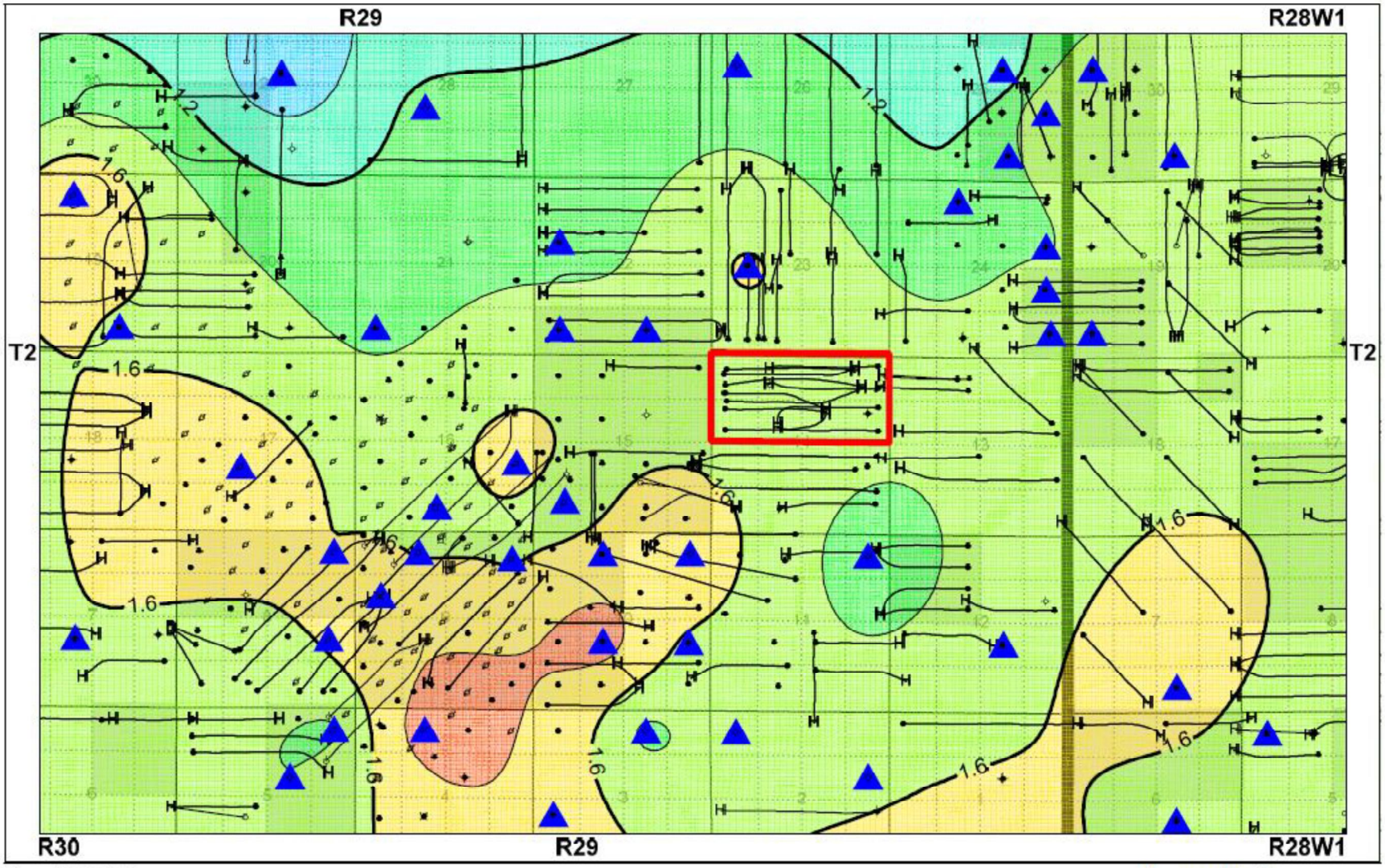
Wells with Digital Sonic Logs



Pierson Unit Application

Appendix 6

Pierson Unit Application
Mean Sonic Porosity
July 20, 2018

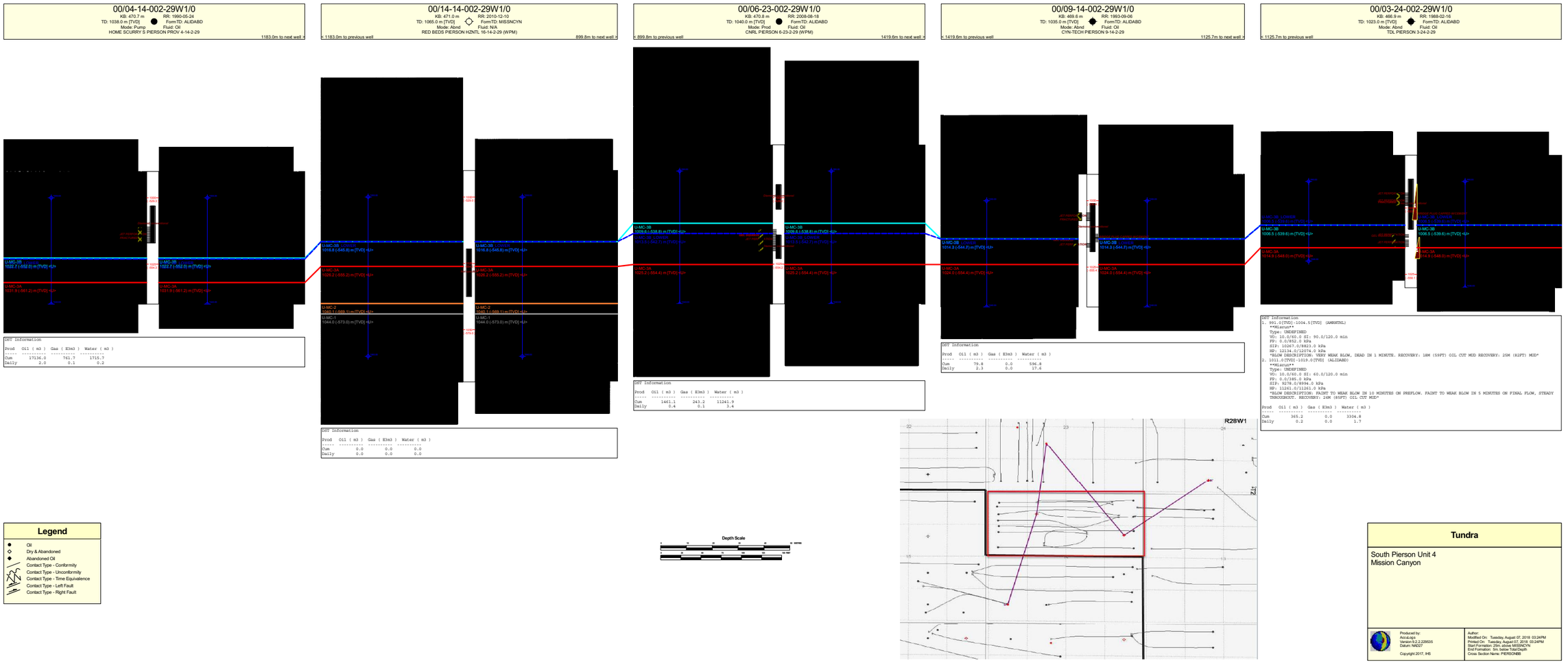


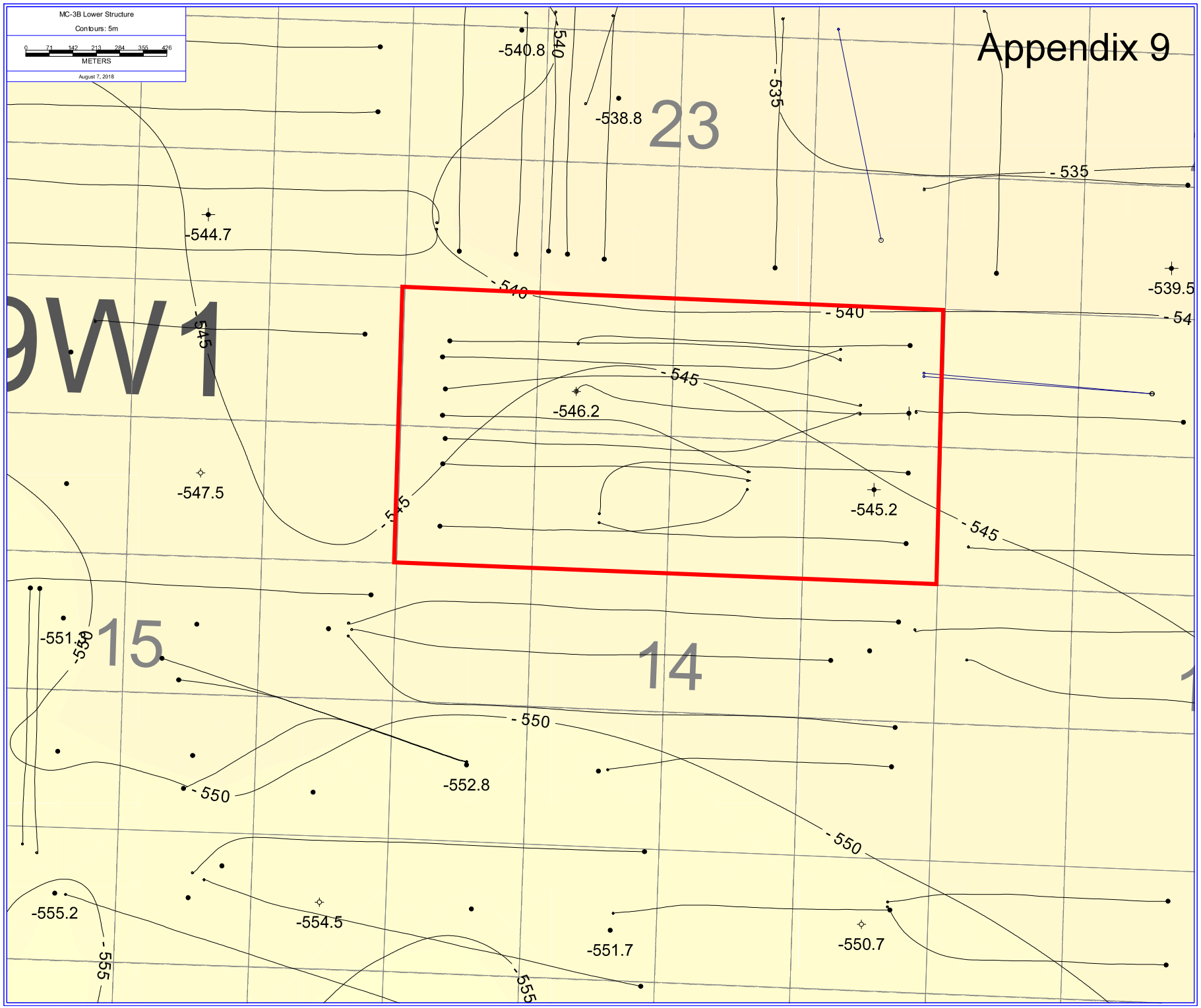
Pierson Unit Application

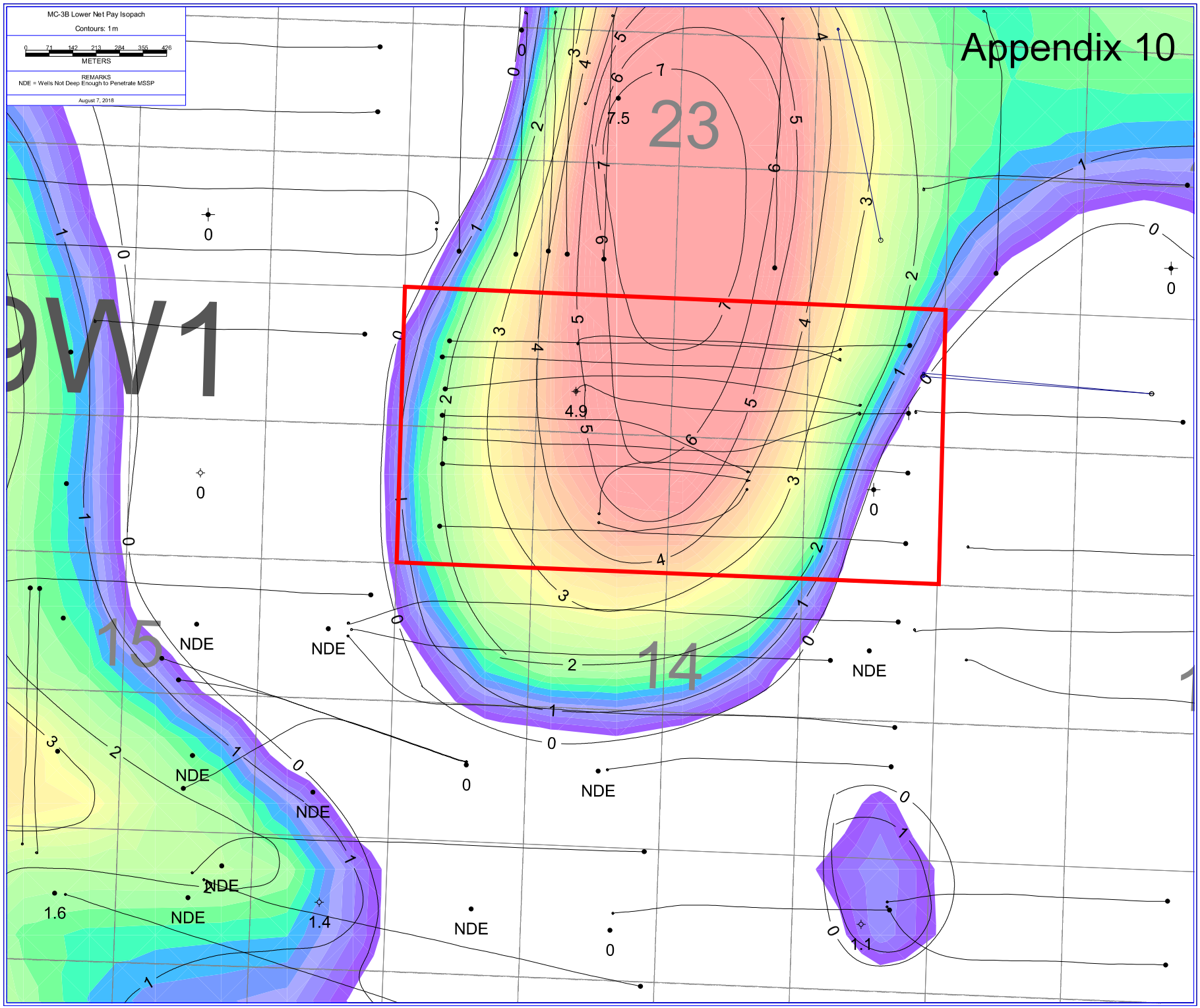
Appendix 7

Pierson Unit Application
Phi*h
July 20, 2018

Appendix 8


00/04-14-002-29W1/0
KB: 470.7 m
RR: 1990-05-24
TD: 1038.0 m [TVD]
Form TD: ALIDABD
Mode: Pump
Fluid: Oil
HOME SCURRY S PIERSON PROV 4-14-2-29
1183.0m to next well
00/14-14-002-29W1/0
KB: 471.0 m
RR: 2010-12-10
TD: 1065.0 m [TVD]
Form TD: MISSNCYN
Mode: Abnd
Fluid: N/A
RED BEDS PIERSON HZNTL 16-14-2-29 (WPM)
< 1183.0m to previous well
899.8m to next well >
00/06-23-002-29W1/0
KB: 470.8 m
RR: 2008-08-18
TD: 1040.0 m [TVD]
Form TD: ALIDABD
Mode: Prod
Fluid: Oil
CNRL PIERSON 6-23-2-29 (WPM)
< 899.8m to previous well
1419.6m to next well >
00/09-14-002-29W1/0
KB: 469.6 m
RR: 1993-09-06
TD: 1035.0 m [TVD]
Form TD: ALIDABD
Mode: Abnd
Fluid: Oil
CYN-TECH PIERSON 9-14-2-29
< 1419.6m to previous well
1125.7m to next well >
00/03-24-002-29W1/0
KB: 466.9 m
RR: 1988-02-16
TD: 1023.0 m [TVD]
Form TD: ALIDABD
Mode: Abnd
Fluid: Oil
TDL PIERSON 3-24-2-29
< 1125.7m to previous well
DST Information
Prod Oil (m3) Gas (E3m3) Water (m3)
Cum 17134.0 761.7 1715.7
Daily 2.0 0.1 0.2
DST Information
Prod Oil (m3) Gas (E3m3) Water (m3)
Cum 0.0 0.0 0.0
Daily 0.0 0.0 0.0
DST Information
Prod Oil (m3) Gas (E3m3) Water (m3)
Cum 1461.1 243.2 11241.9
Daily 0.4 0.1 3.4
DST Information
Prod Oil (m3) Gas (E3m3) Water (m3)
Cum 79.8 0.0 596.8
Daily 2.3 0.0 17.6
DST Information
1. 991.0[TVD]-1004.5[TVD] (AMBIENTAL)
Analysis
Type: UNDEFINED
VO: 10.0/60.0 SI: 90.0/120.0 min
FP: 0.0/852.0 kPa
SIP: 10267.0/8823.0 kPa
HP: 12134.0/12074.0 kPa
BLOW DESCRIPTION: VERY WEAK BLOW, DEAD IN 1 MINUTE. RECOVERY: 18M (59FT) OIL CUT MUD RECOVERY: 25M (82FT) MUD
2. 1011.0[TVD]-1019.0[TVD] (ALIDABD)
Analysis
Type: UNDEFINED
VO: 10.0/60.0 SI: 60.0/120.0 min
FP: 0.0/385.0 kPa
SIP: 9278.0/8994.0 kPa
HP: 11261.0/11261.0 kPa
BLOW DESCRIPTION: FAINT TO WEAK BLOW IN 10 MINUTES ON PREFLOW. FAINT TO WEAK BLOW IN 5 MINUTES ON FINAL FLOW, STEADY THROUGHOUT. RECOVERY: 26M (85FT) OIL CUT MUD
DST Information
Prod Oil (m3) Gas (E3m3) Water (m3)
Cum 365.2 0.0 3304.8
Daily 0.2 0.0 1.7
R28W1
Legend
Oil
Dry & Abandoned
Abandoned Oil
Contact Type - Conformity
Contact Type - Unconformity
Contact Type - Time Equivalence
Contact Type - Left Fault
Contact Type - Right Fault
Depth Scale
Tundra
South Pierson Unit 4
Mission Canyon
Produced by:
AccuLogs
Version 9.2.2.229535
Datum NAD27
Copyright 2017, IHS
Author:
Modified On: Tuesday August 07, 2018 03:24PM
Printed On: Tuesday August 07, 2018 03:24PM
Cross Section Name: PIERSONBB
End Formation: Sh. below TidalDepth
Cross Section Name: PIERSONBB


MC-3B Lower Structure
Contours: 5m
0 71 142 213 284 355 426
METERS
August 7, 2018
Appendix 9
-540.8
-538.8
23
- 535
-544.7
-539.5
- 540
- 545
-546.2
-547.5
-545.2
T2
-551.
15
14
- 550
-552.8
-555.2
-554.5
-551.7
-550.7
- 555
R29


MC-3B Lower Net Pay Isopach
Contours: 1 m
0 71 142 213 284 355 426
METERS
REMARKS
NDE = Wells Not Deep Enough to Penetrate MSSP
August 7, 2018
Appendix 10
23
14
15
NDE
4.9
7.5
1.6
1.4
1.1
T2
R29