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OIL AND GAS WELL HYDRO SLOTTING PERFORATION PROFESSIONAL SERVICE

Maximize well production

MAXXWELL PRODUCTION

CONTINUOUS MOVING JET SLOTTING PERFORATION TECHNOLOGY FOR VERTICAL AND HORIZONTAL WELLS

Data: July 6, 2015 # TX-011

SLOT PERFORATION PROGRAM

Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

MAXXWELL PRODUCTION

Oil and gas well slotting perforation professional service

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/Oil and gas well slotting perforation professional service engineer/

Maxxwell Production appreciates the opportunity to present this proposal and looks forward to being of service to you.

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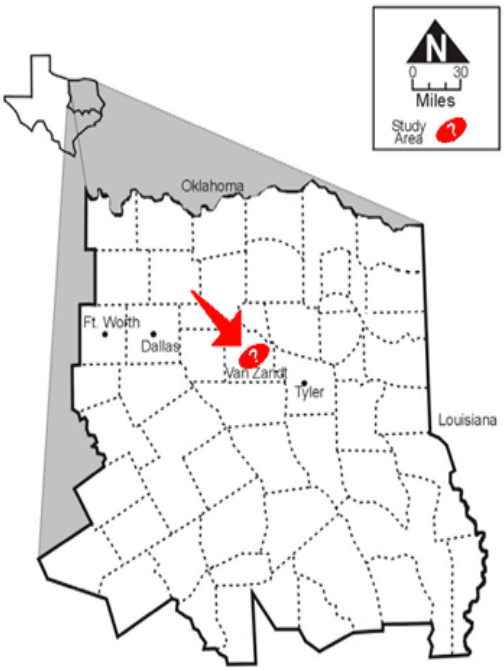
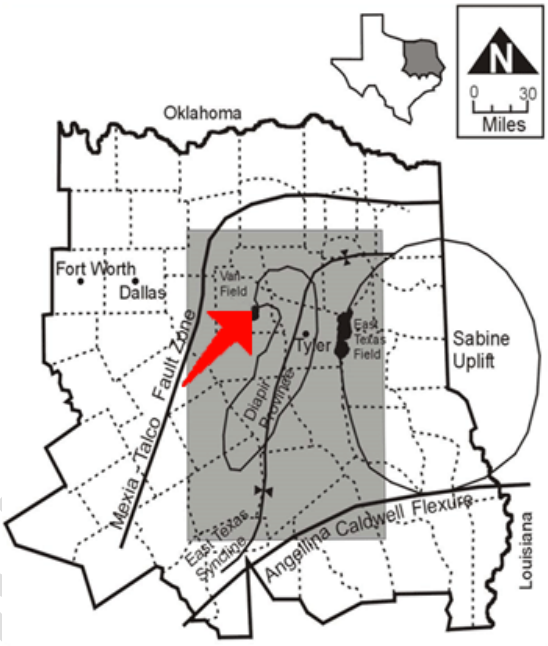
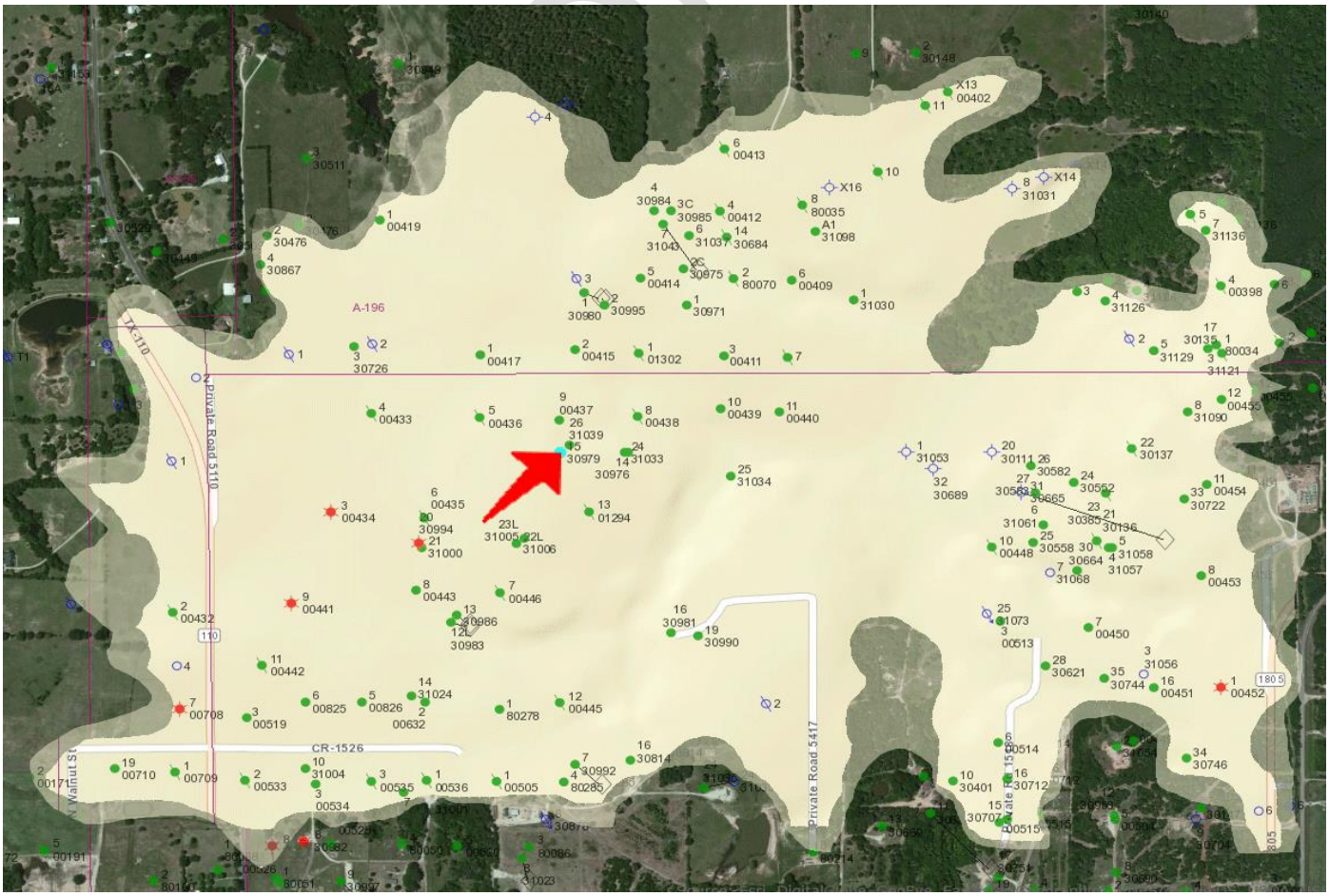
LOCATION







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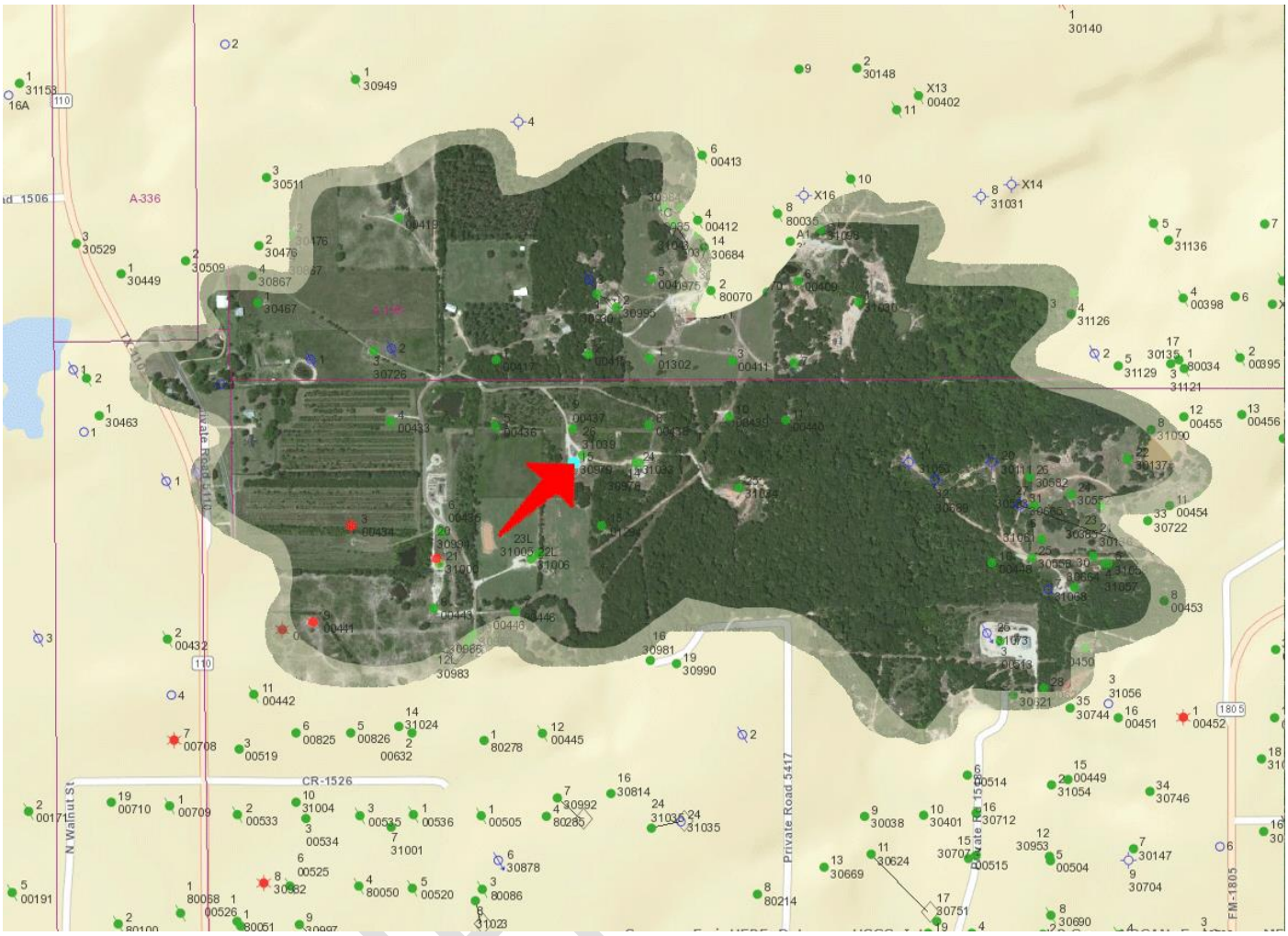
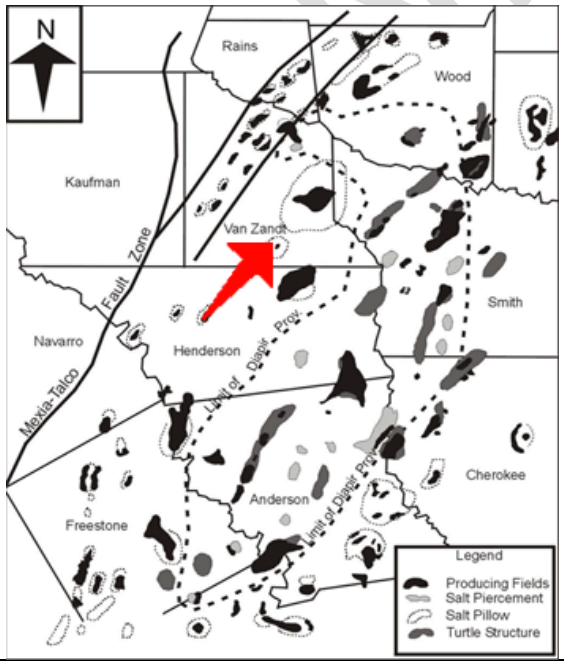


Major producing fields



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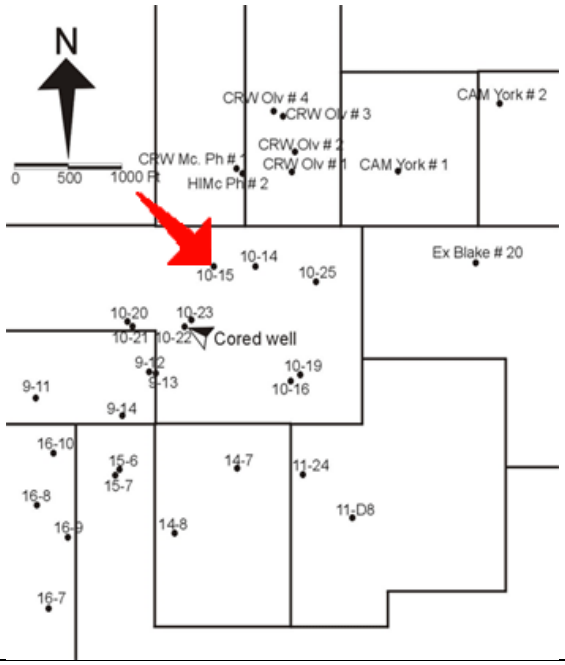
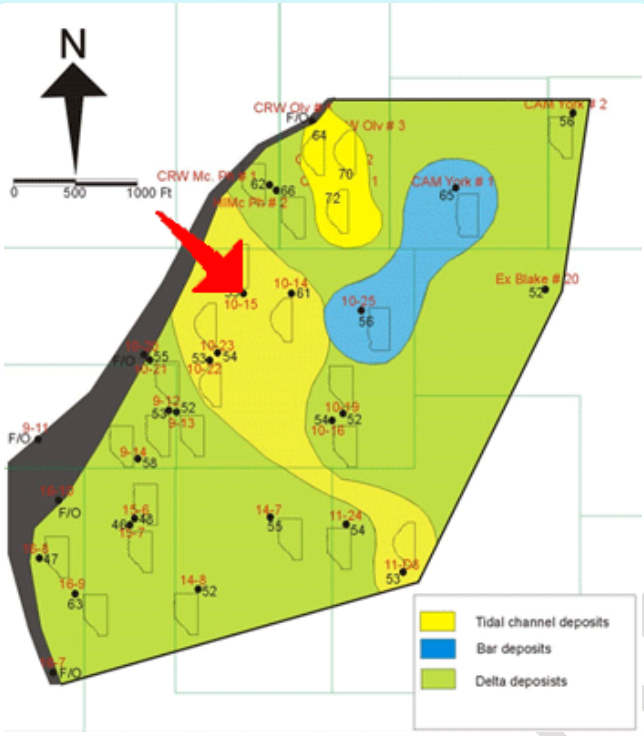


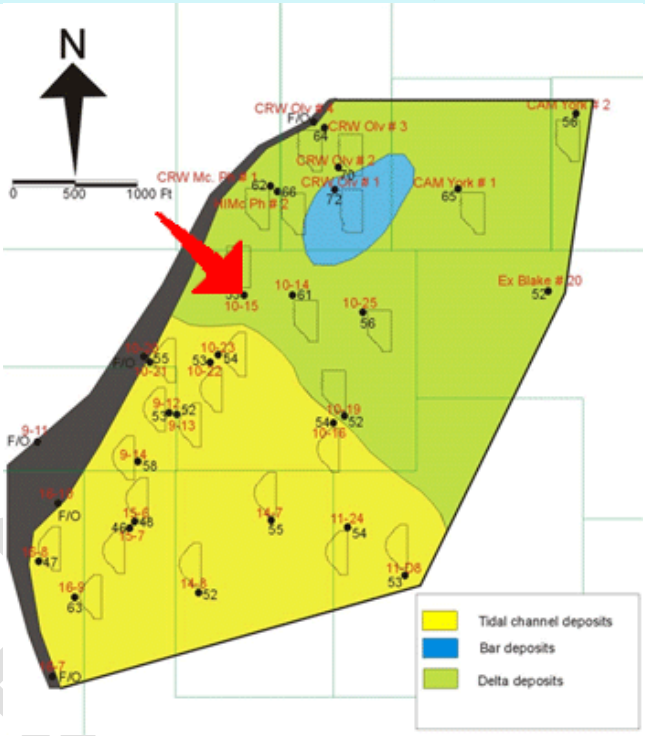
Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

GEOLOGICAL AND GEOPHYSICAL STRUCTURE

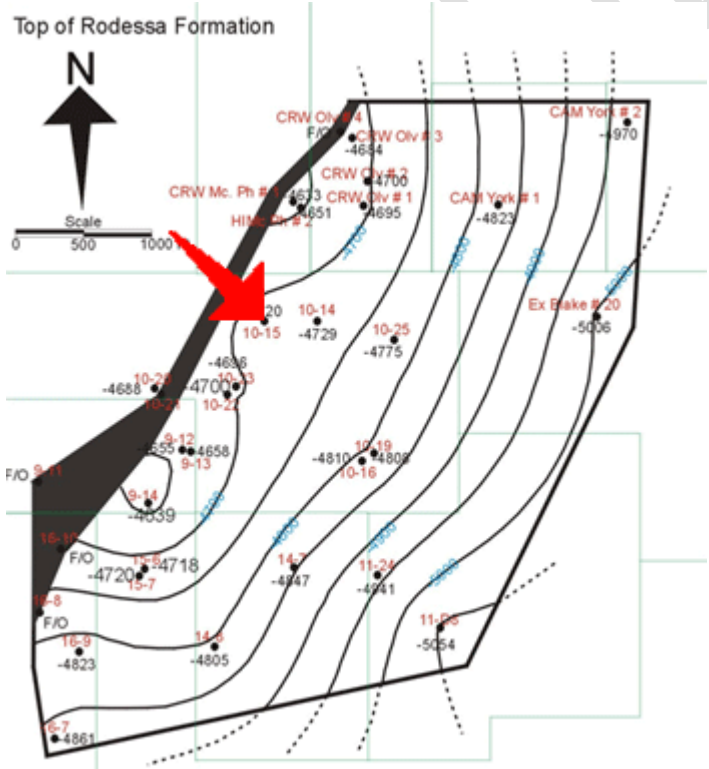
Upper Carlisle sandy



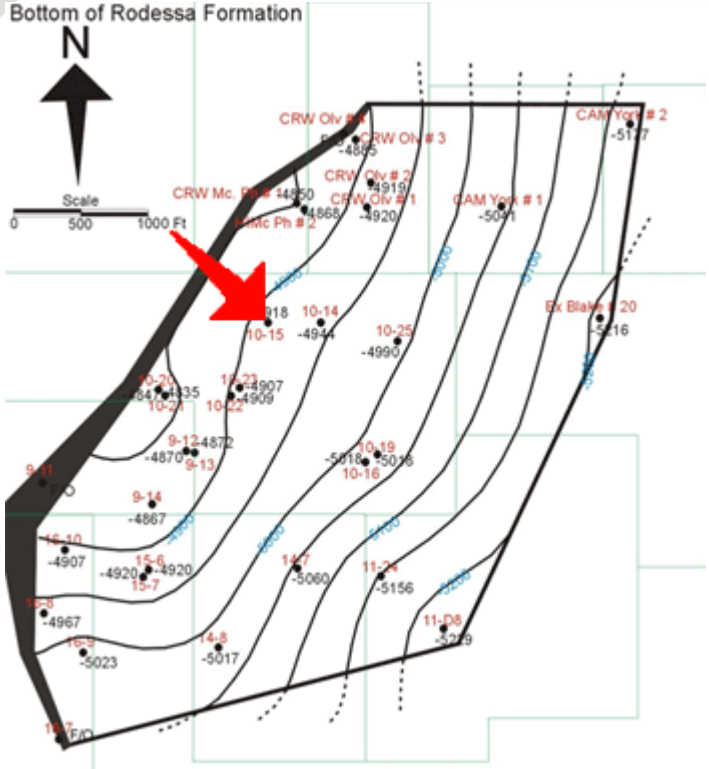
Lower Carlisle sandy



Rodessa Formation (Top)



Rodessa Formation (Bottom)



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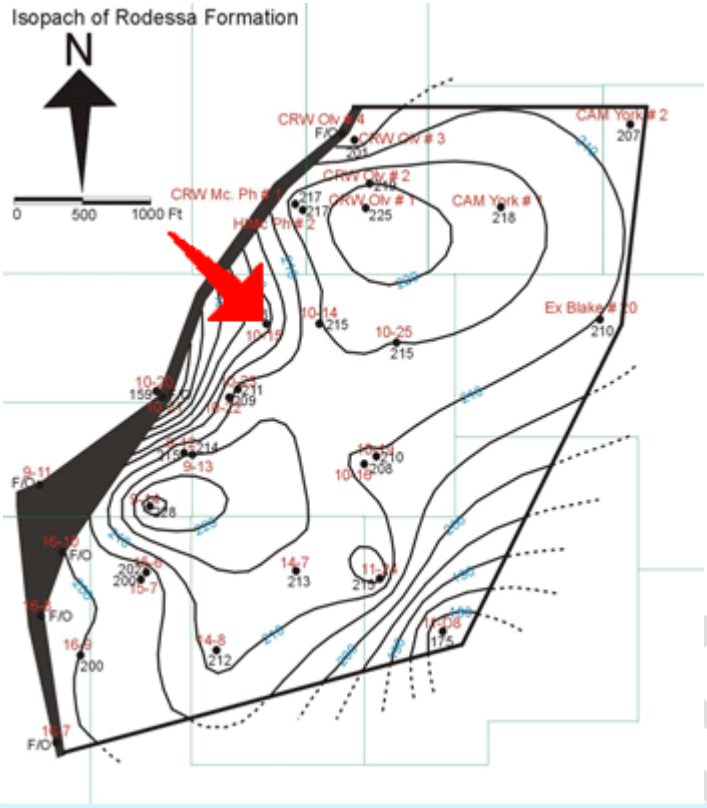
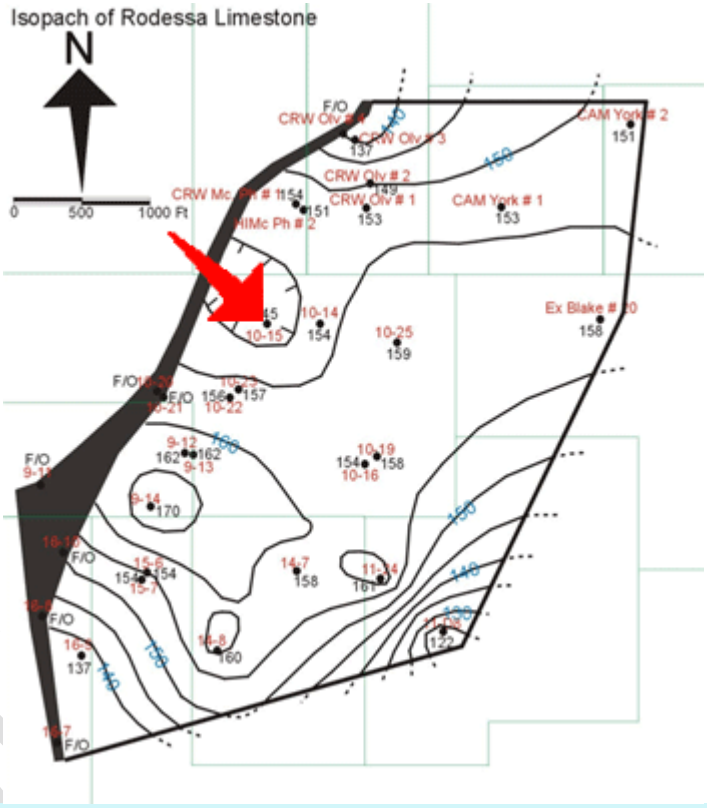
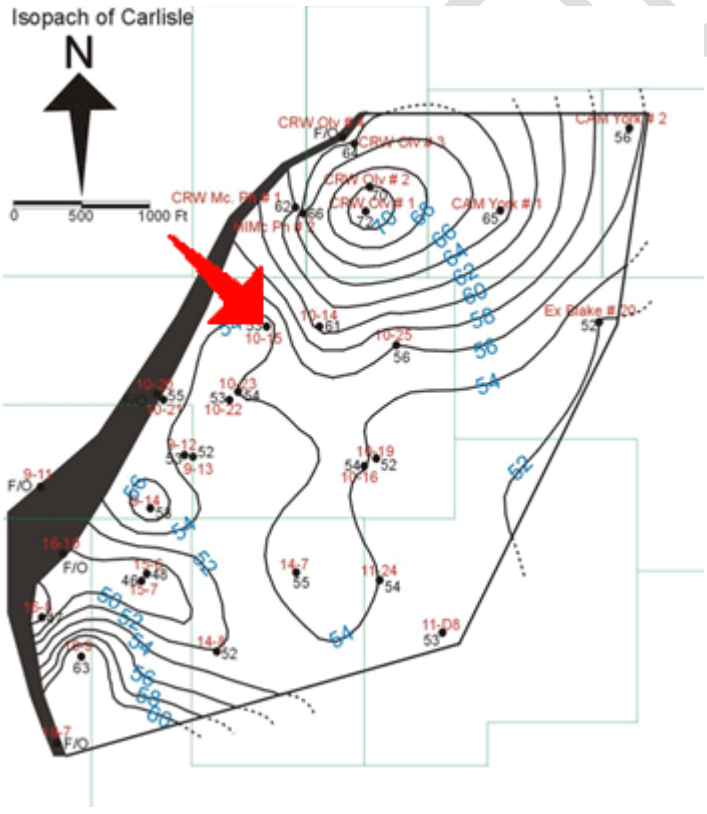
Isopach Rodessa Formation



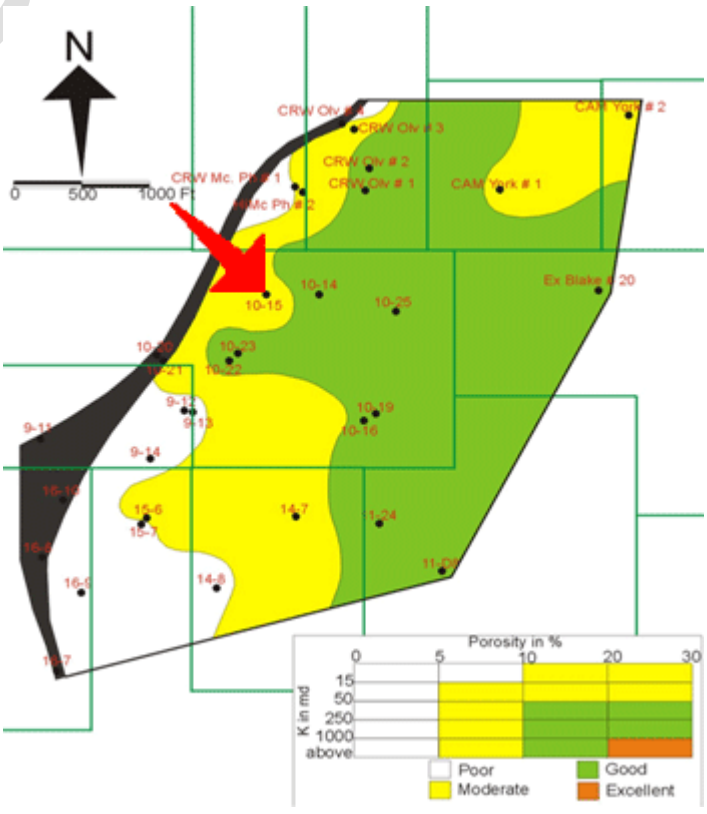
Isopach Rodessa Limestone



Isopach Carlisle Sandstone



Porosity: 10-20’ Carlisle Sandstone (Top)

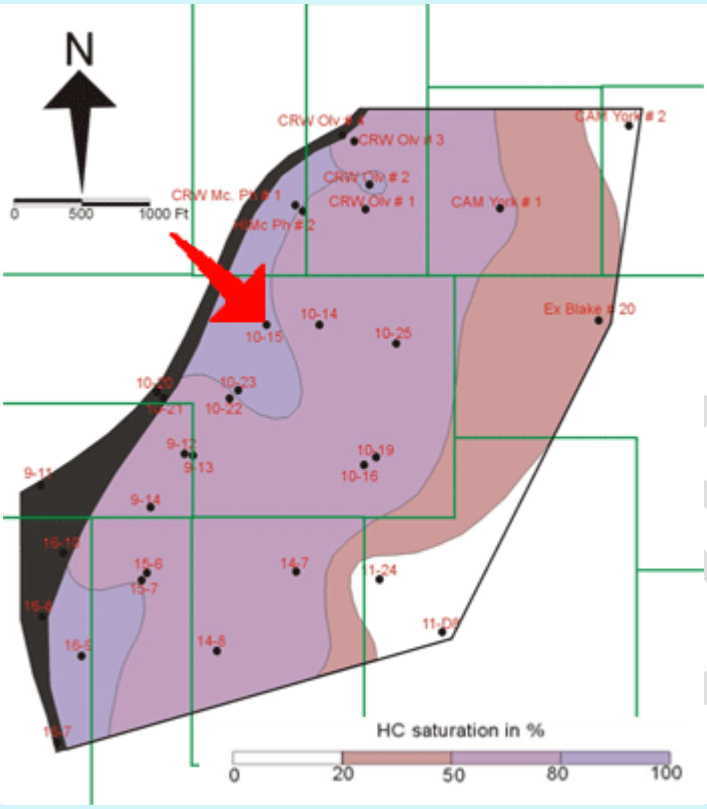


Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

Porosity range (%)	Qualitative description
5 or less	Poor
10	Fair
15	Good
> 20	Excellent

Permeability range (md)	Qualitative description
<1.0 - 15	Poor to fair
15 - 50	Moderate
50 - 250	Good
250 - 1000	Very good
> 1000	Excellent

HC saturation: 10-20' Carlisle Sandstone



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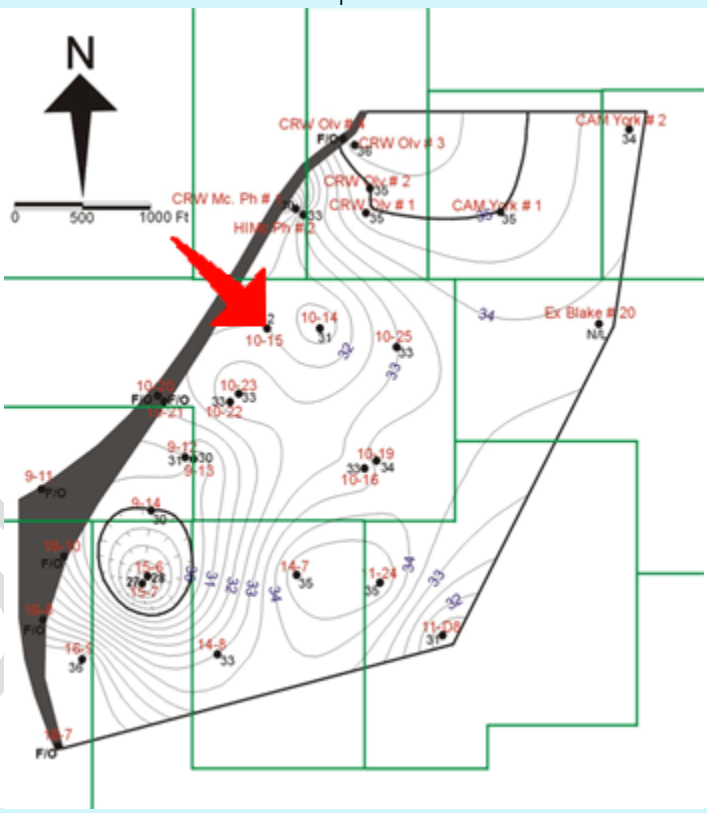
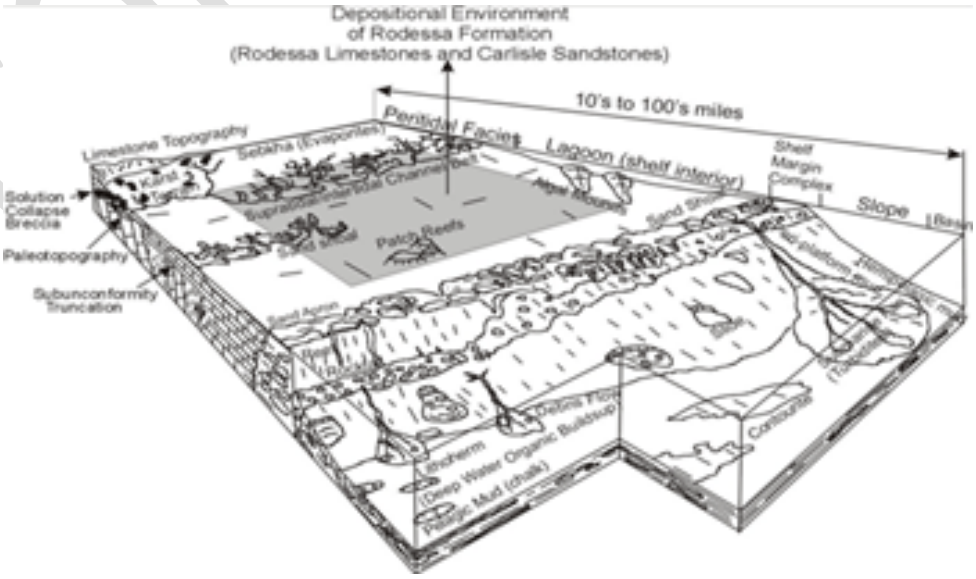
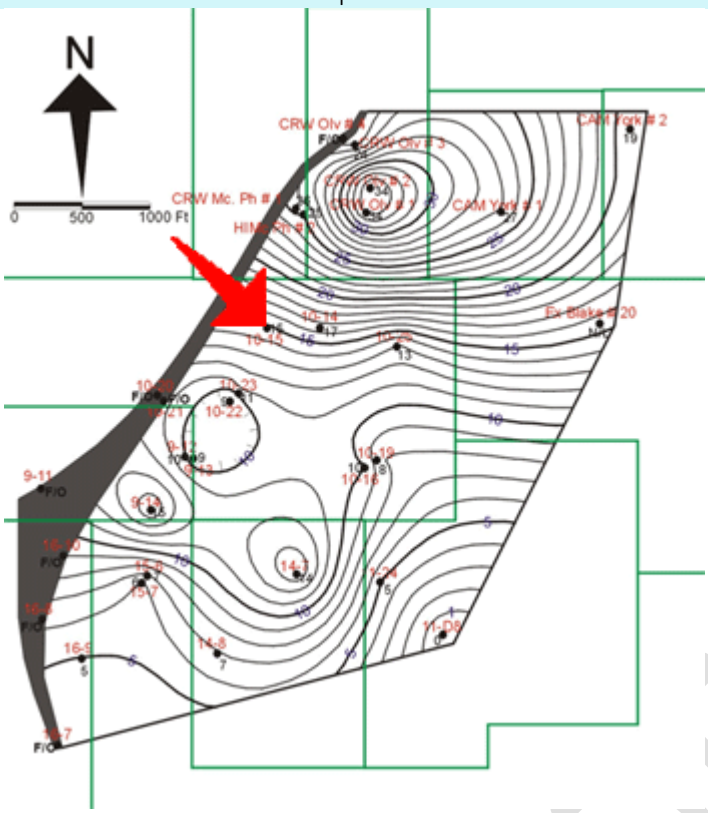


Depositional model Rodessa Formation



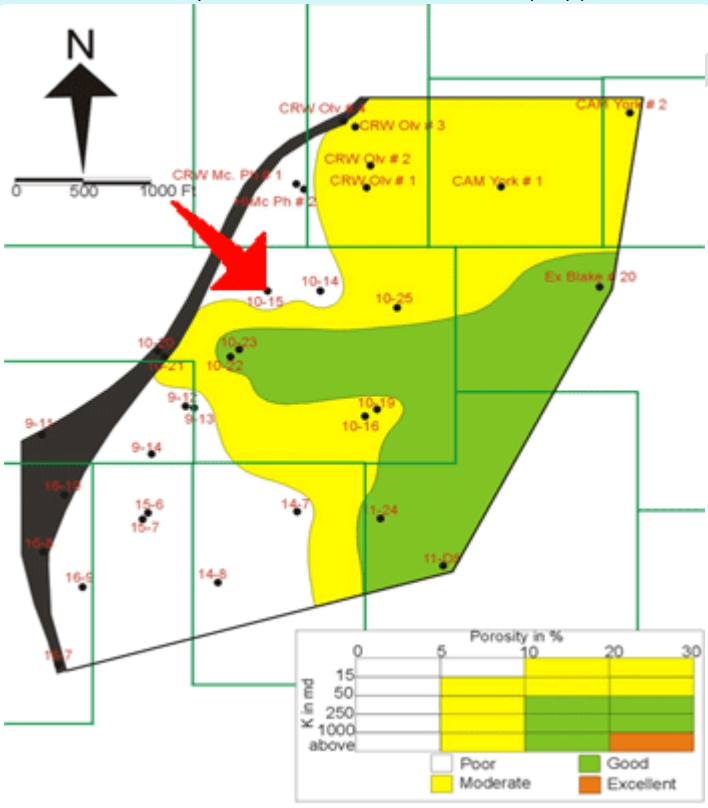
Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

Isopach

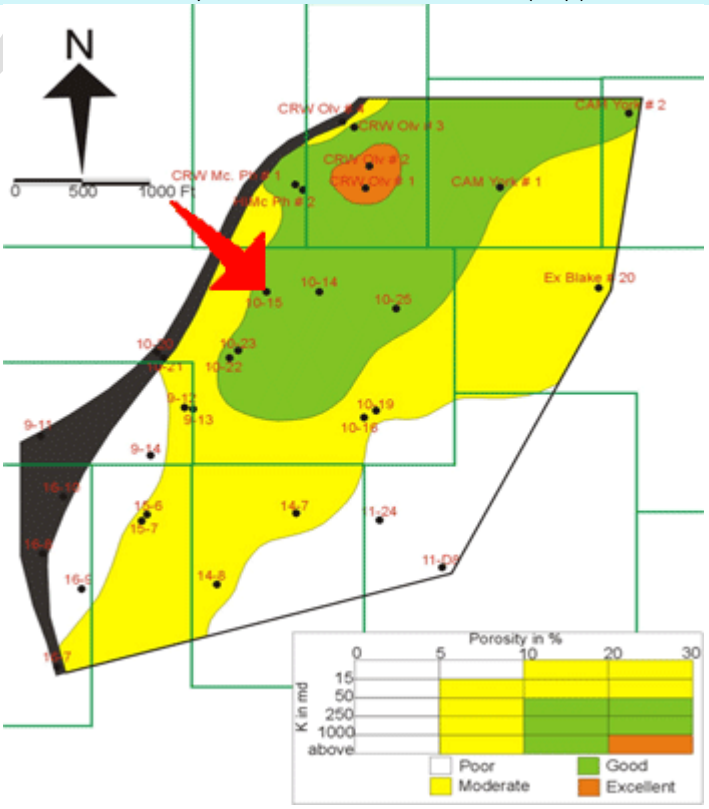


Porosity: 10-20’ Carlisle Sandstone (Top)

Porosity: 20-30’ Carlisle Sandstone (Top)



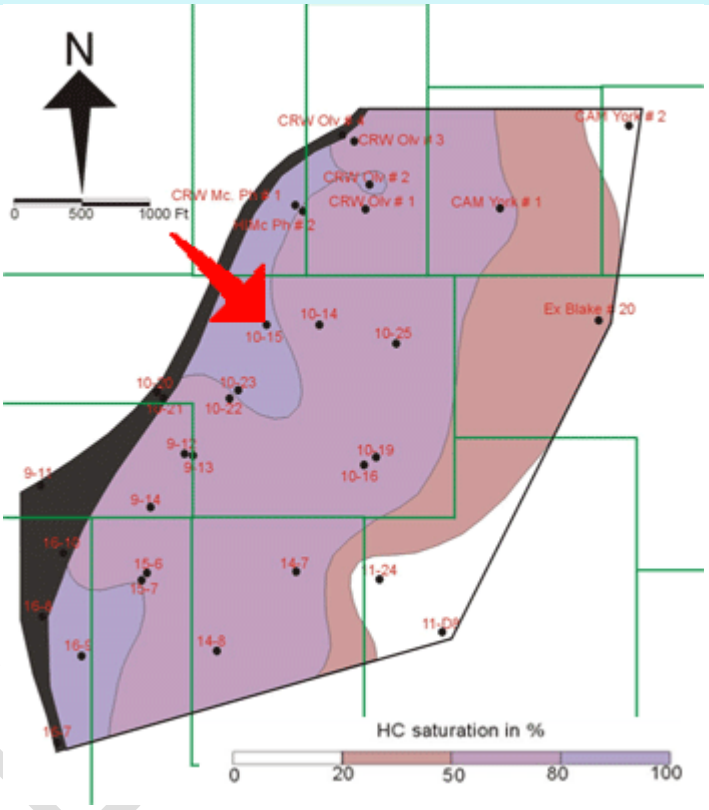
Porosity: 40-50’ Carlisle Sandstone (Top)



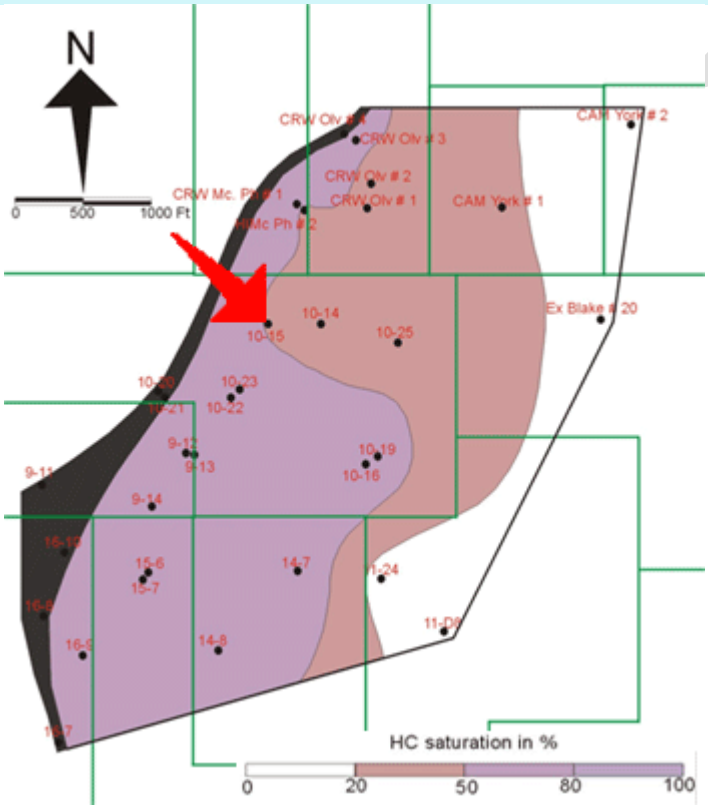
Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

Porosity: 50-60’ Carlisle Sandstone (Top)

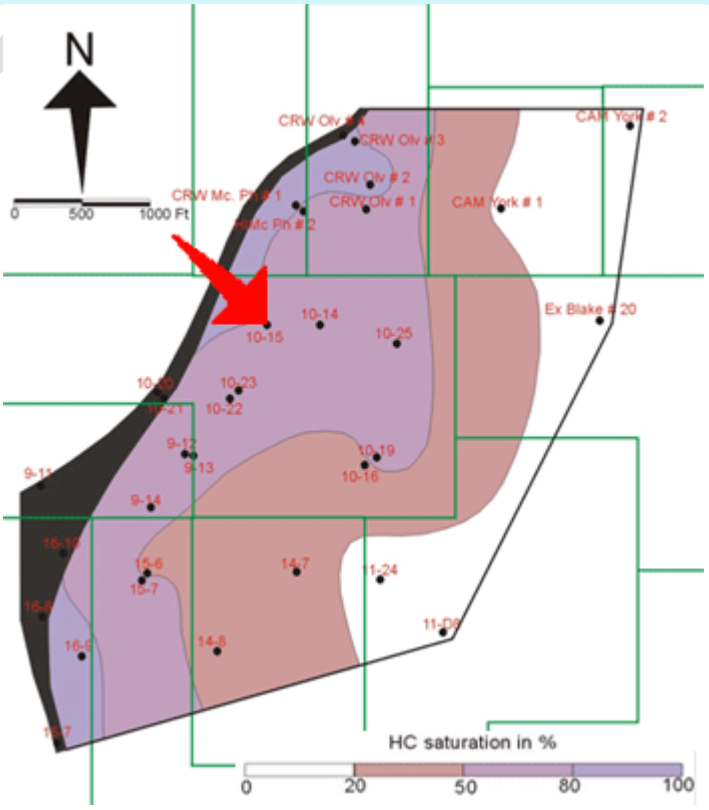
HC saturation: 10-20’ Carlisle Sandstone



HC saturation: 20-30’ Carlisle Sandstone

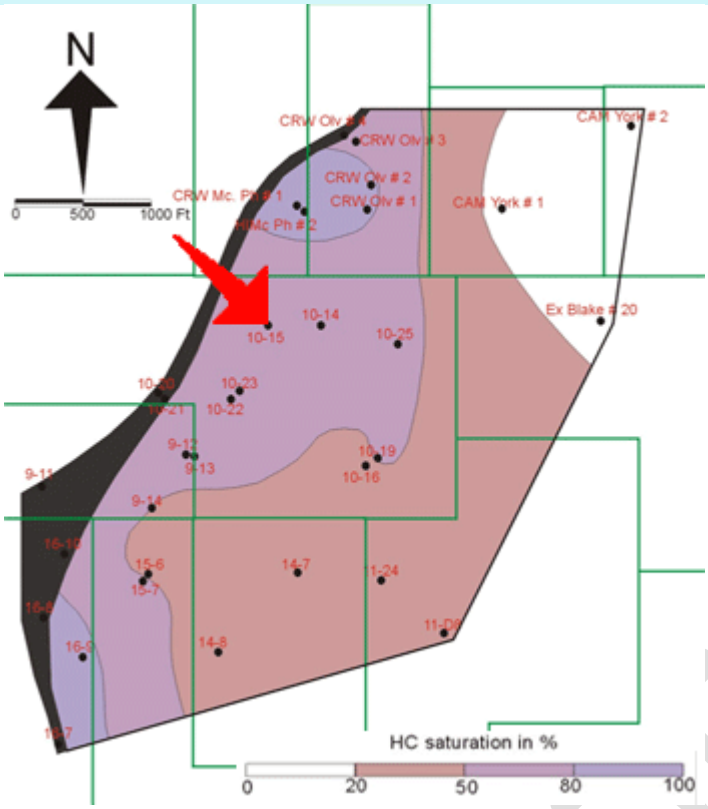


HC saturation: 40-50’ Carlisle Sandstone

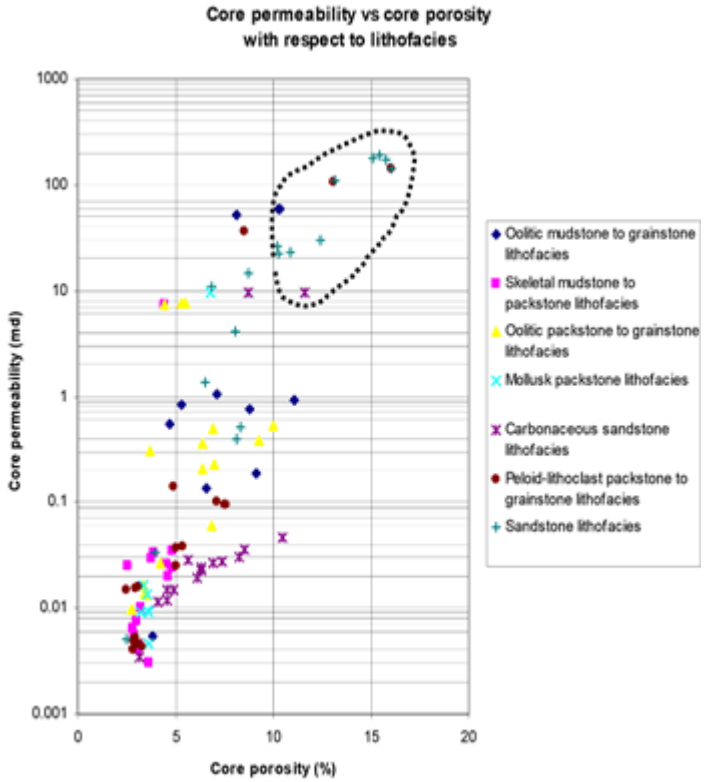


Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

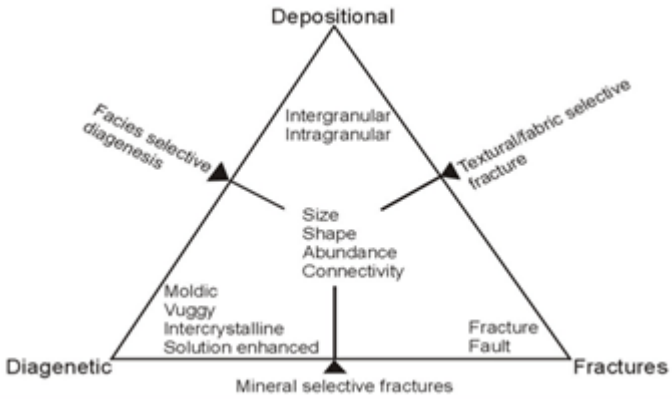
HC saturation: 50-60’ Carlisle Sandstone



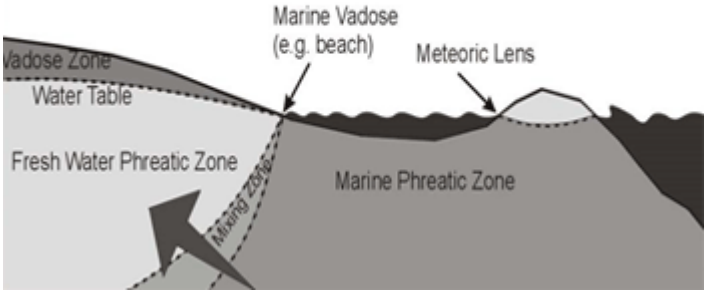
Permeability and porosity (Rodessa Formation)



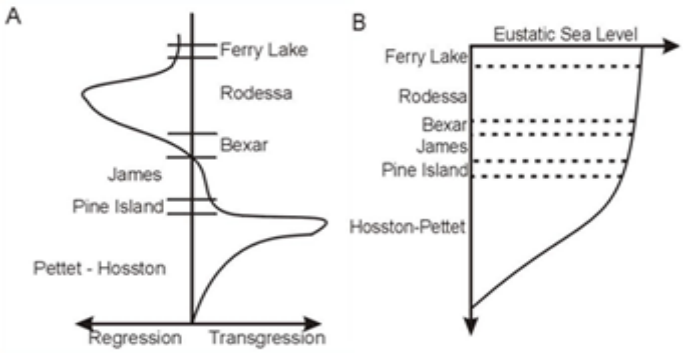
Porosity classifications (Carbonate reservoir)



Diagenetic environments (Rodessa Formation)

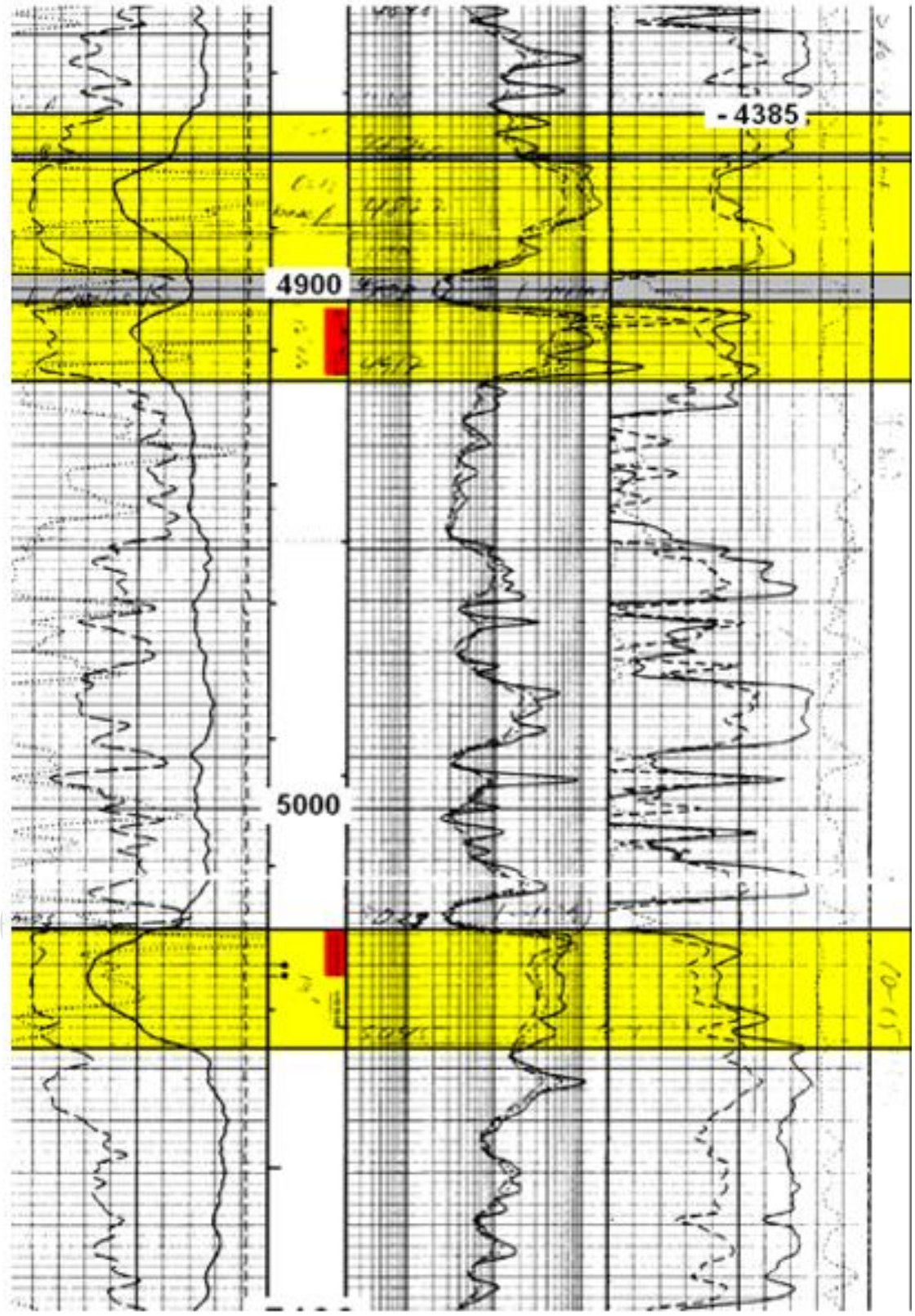


Sea level diagram

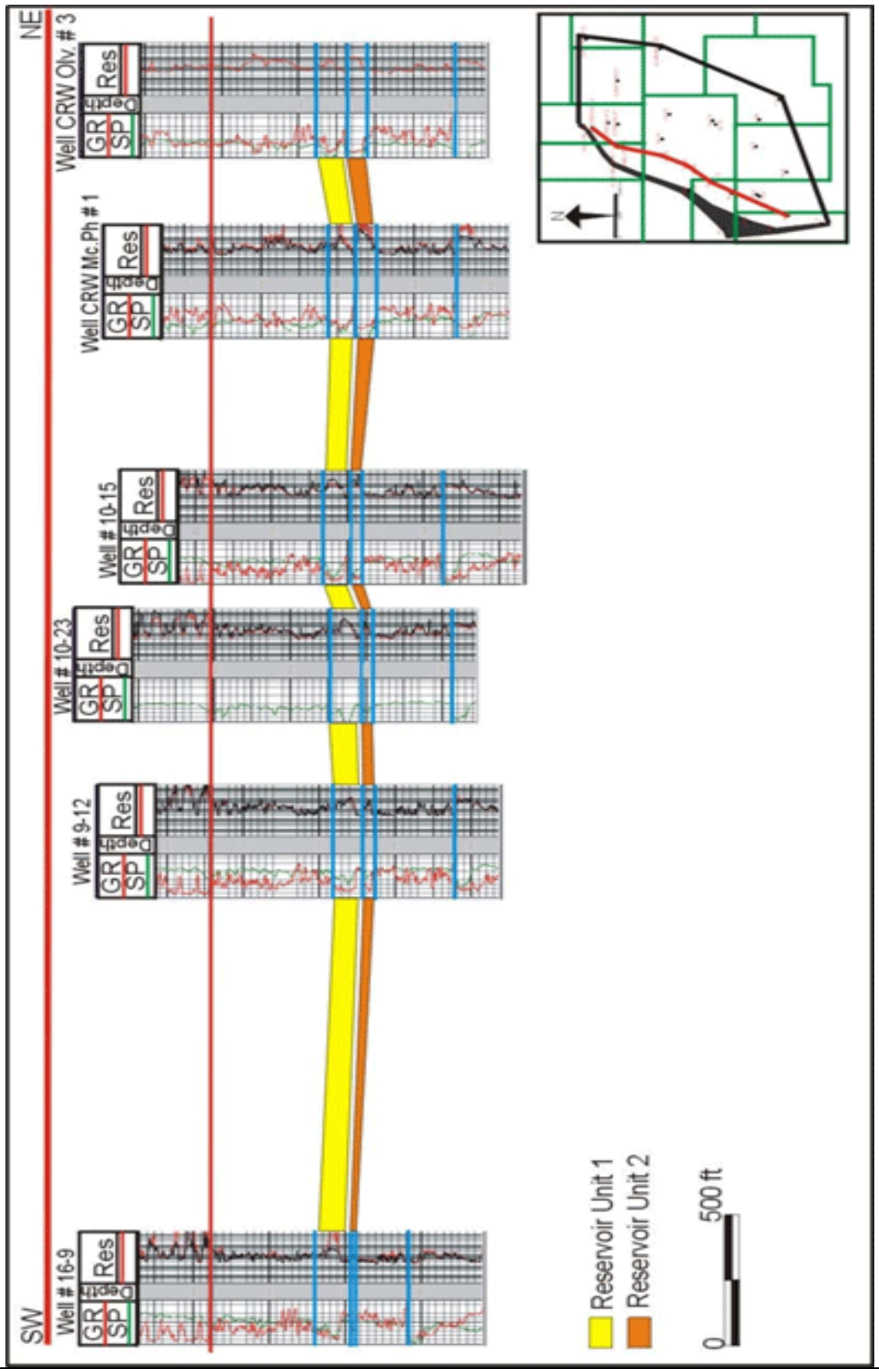


Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

DESIGN AND LOGGING

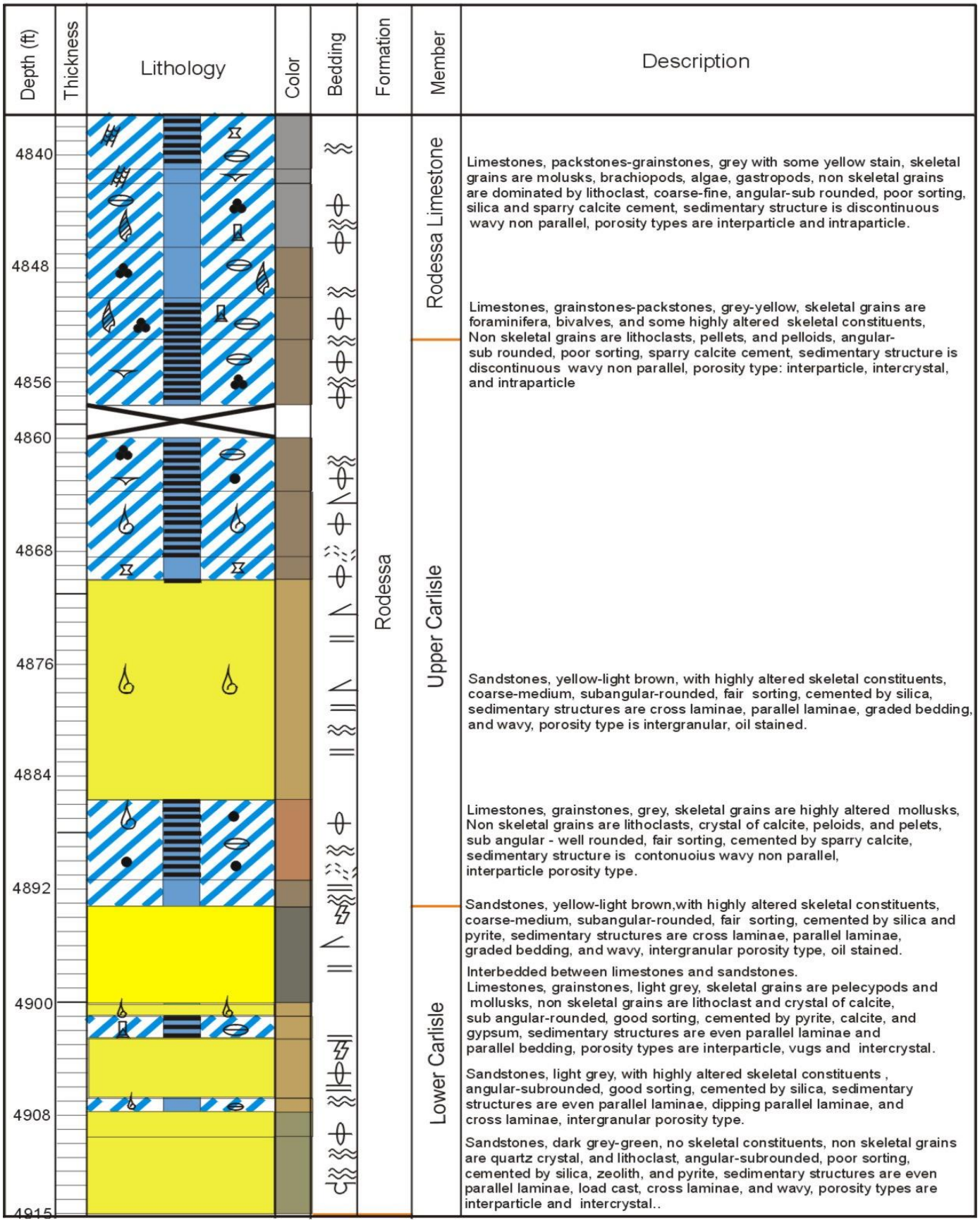


Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

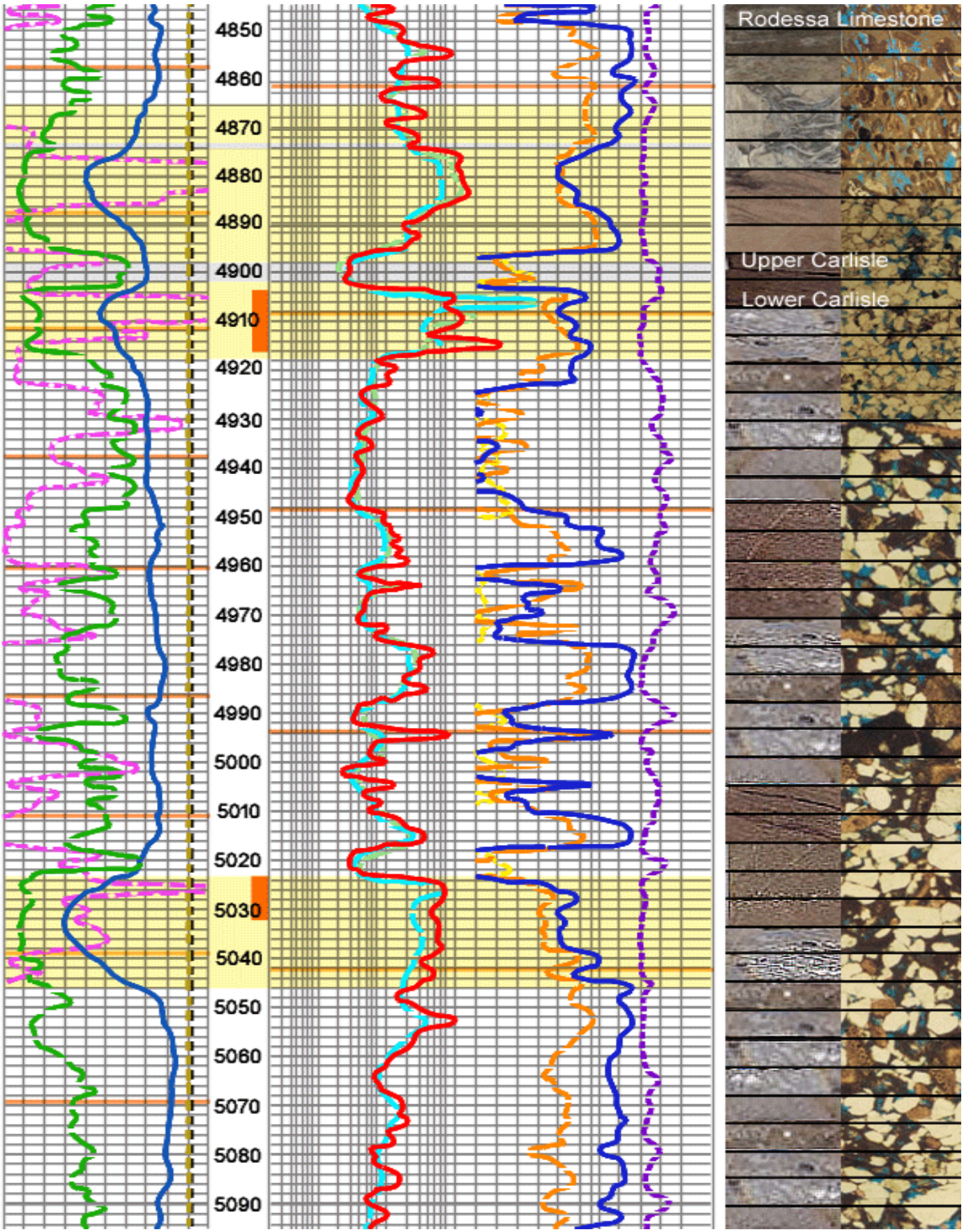


Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

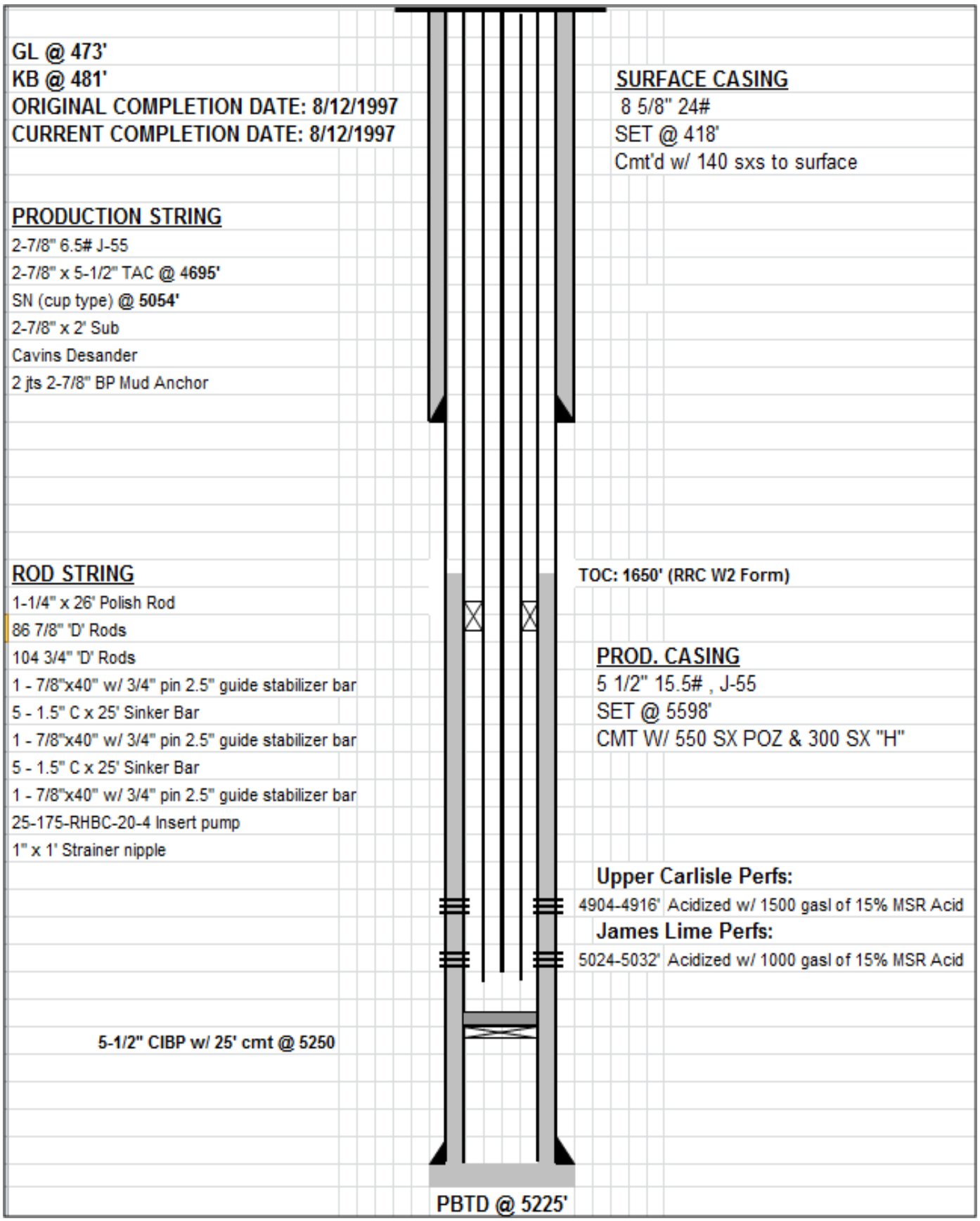
Interval 4837' - 4915'



Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX



Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX



Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

SUMMARY ANALYSIS OF GEOLOGICAL AND GEOPHYSICAL DATA (WELL BRAWNER 10-15)

Background:

Initial data:

- logging the well Brawner 10-15
- reservoir performance Rodessa on the basis of core analysis
- well design

Results:

- On the basis of the submissions of GIS (GR, SP, ILD, ILM, SFLU, NPHI, DPHI) and coring studies explored deposits are porous medium to coarse-grained sandstones with interlayers of clay and carbonate rocks.
- Roof bounces producing formation at a depth of 4865 feet
- In the context of GIS data layers identified six reservoirs (Table 1, Appendix 1). Table 1 shows the results of the interpretation of GIS.
- The porosity of the reservoir layers 2,4,5,6 GIS varies from 10 to 18%, the resistance of more than 50 collectors Homme, the data collector oil saturation.
- Permeability is calculated based on the constructed according to a study of the core. (Figure 1)
- The layers 1 and 3 have the worst reservoir properties.
- The porosity of less than 10% and a resistance of 30 Ohm. Reduced resistance due to the presence of the clay material in the collectors and do not exclude their oil saturation.
- Based on the above information, for slotted perforations in the well Brawner 10-15 intervals recommended 4875'-4890', 5024'-5032', 5032'-5045'.
- The intervals 4865-4875 and 4890-4896 are optional due to low reservoir properties.
- Previously layers 4 and 5 are perforated.
- For a more accurate assessment of reservoir saturation are required test data and data of the well.

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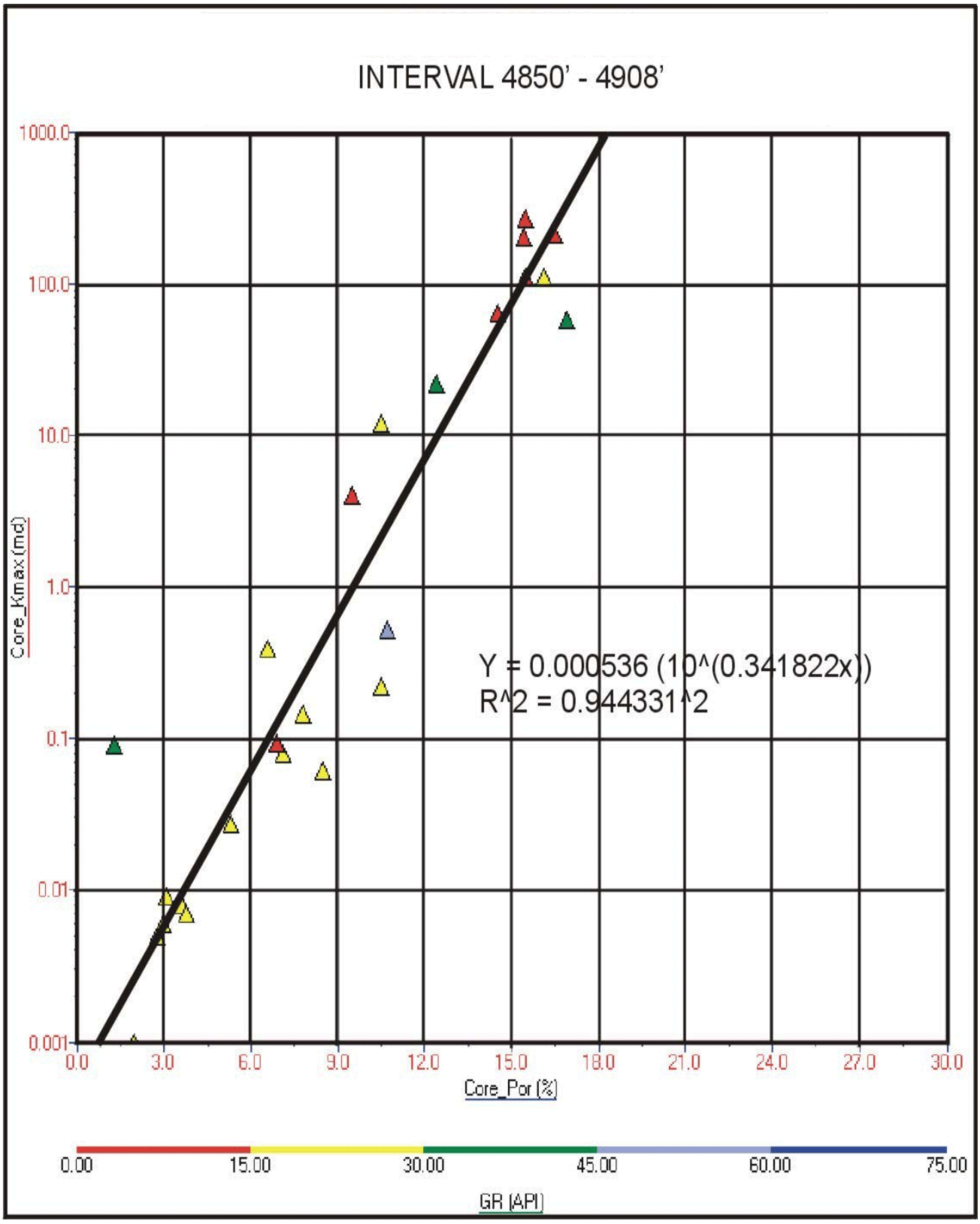
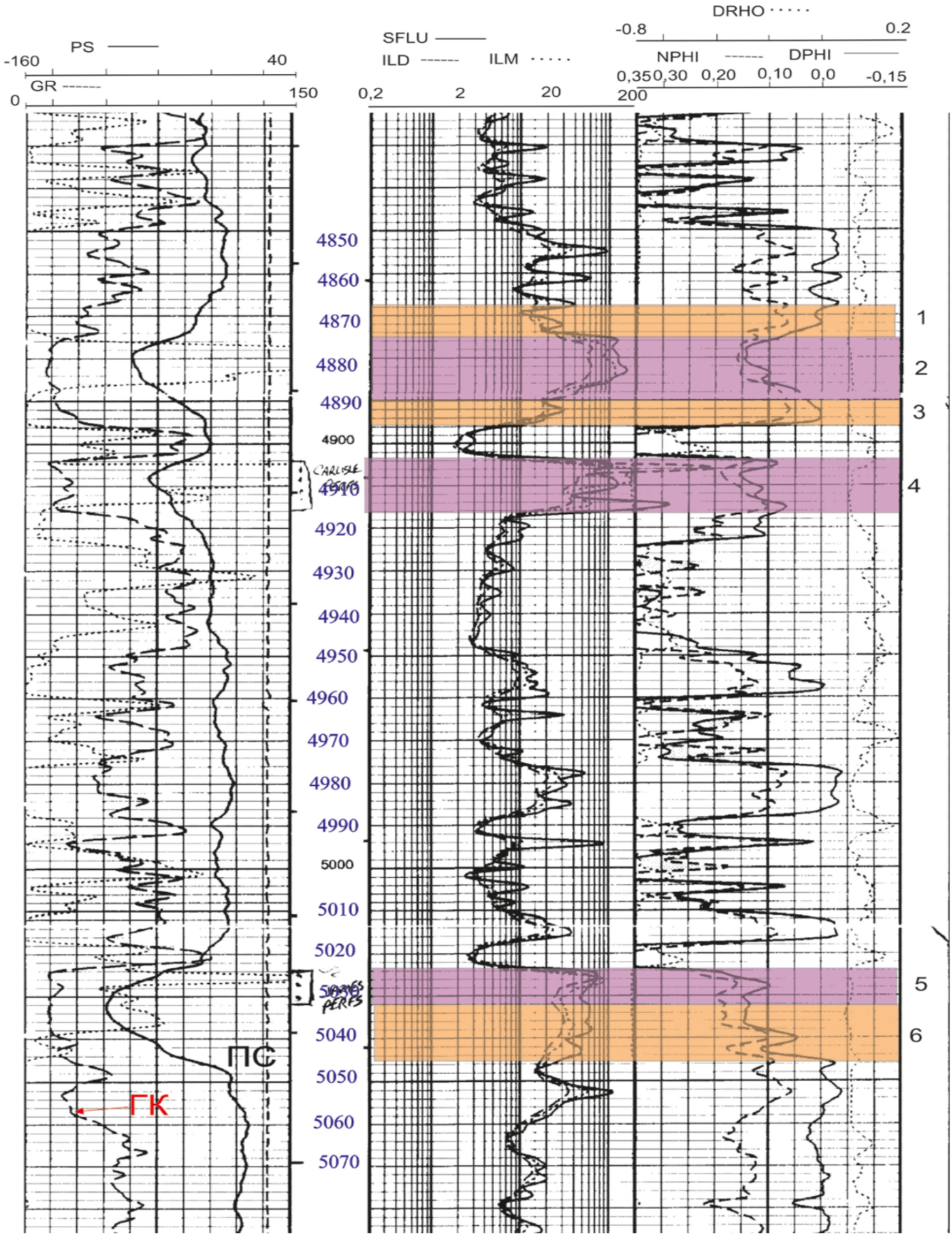
Figure 1



Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX



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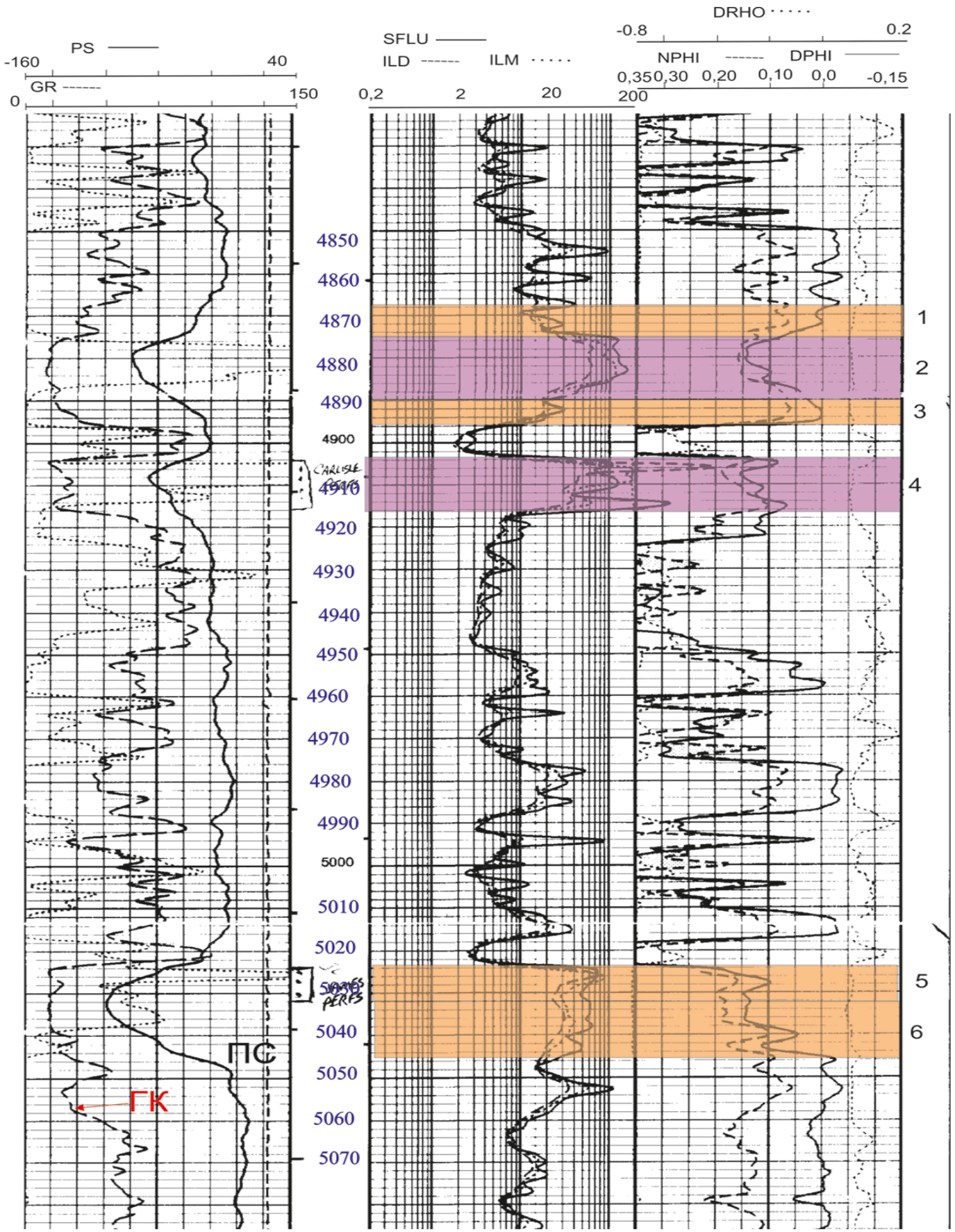

The interpretation results of GIS

Table 1

№	Top (ft.)	Bottom (ft.)	Top (m)	Bottom (m)	Thickness (ft.)	Thickness (m)	Porosity (%)	Resistivity (Ohm)	Permeability (mD)	Saturation	Reservoir type
1	4865	4875	1482.852	1485.29	10	2.43	8.5	30	0.431	Oil	Possible collector
2	4875	4890	1485.595	1490.472	15	4.88	15	80	71.861	Oil	Collector
3	4890	4896	1490.472	1492.606	6	2.113	8.5	30	0.431	Oil	Possible collector
4	4904	4916	1494.739	1498.397	12	3.66	10-18	80-200	1.4-762	Oil	Collector
5	5024	5032	1531.315	1533.754	8	2.43	15	60	71.861	Oil	Collector
6	5032	5045	1533.754	1537.716	13	3.96	12	50	6.777	Oil	Collector
Summary thickness of collectors					48	14.93					
Summary thickness					16	4.5					

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Table 2

Recommended intervals for hydro-slotting perforation

Layer number	Top (ft.)	Bottom (ft.)	Thickness (ft.)	Top (m)	Bottom (m)	Interval (m)	Interval (ft.)
2	4875.00	4876.64	1.64	1485.90	1486.40	0.50	1.64
2	4877.30	4878.94	1.64	1486.60	1487.10	0.50	1.64
2	4879.59	4881.23	1.64	1487.30	1487.80	0.50	1.64
2	4881.89	4883.53	1.64	1488.00	1488.50	0.50	1.64
2	4884.19	4885.83	1.64	1488.70	1489.20	0.50	1.64
2	4886.48	4888.12	1.64	1489.40	1489.90	0.50	1.64
2	4888.78	4890.00	1.22	1490.10	1490.47	0.37	1.22
Summary			11.06			3.37	11.06
4	4904.00	4905.64	1.64	1494.74	1495.24	0.50	1.64
4	4906.30	4907.94	1.64	1495.44	1495.94	0.50	1.64
4	4908.59	4910.23	1.64	1496.14	1496.64	0.50	1.64
4	4910.89	4912.20	1.31	1496.84	1497.24	0.40	1.31
4	4912.86	4914.17	1.31	1497.44	1497.84	0.40	1.31
4	4914.83	4916.14	1.31	1498.04	1498.44	0.40	1.31
Summary			8.86			2.70	8.86
Total			19.92			6.07	19.92

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ALL POSSIBLE PERSPECTIVE INTERVALS

1	4865.00	4866.64	1.64	1482.85	1483.35	0.50
	4867.30	4868.94	1.64	1483.55	1484.05	0.50
	4869.59	4871.23	1.64	1484.25	1484.75	0.50
	4871.89	4873.00	1.11	1484.95	1485.29	0.34
			6.03			1.84
2	4875.00	4876.64	1.64	1485.90	1486.40	0.50
	4877.30	4878.94	1.64	1486.60	1487.10	0.50
	4879.59	4881.23	1.64	1487.30	1487.80	0.50
	4881.89	4883.53	1.64	1488.00	1488.50	0.50
	4884.19	4885.83	1.64	1488.70	1489.20	0.50
	4886.48	4888.12	1.64	1489.40	1489.90	0.50
	4888.78	4890.00	1.22	1490.10	1490.47	0.37
			11.06			3.37
3	4890.00	4891.64	1.64	1490.47	1490.97	0.50
	4892.30	4893.94	1.64	1491.17	1491.67	0.50
	4894.59	4896.23	1.64	1491.87	1492.37	0.50
			4.92			1.50
4	4904.00	4905.64	1.64	1494.74	1495.24	0.50
	4906.30	4907.94	1.64	1495.44	1495.94	0.50
	4908.59	4910.23	1.64	1496.14	1496.64	0.50
	4910.89	4912.20	1.31	1496.84	1497.24	0.40
	4912.86	4914.17	1.31	1497.44	1497.84	0.40
	4914.83	4916.14	1.31	1498.04	1498.44	0.40
			8.86			2.70
5	5024.00	5025.64	1.64	1531.32	1531.82	0.50
	5026.30	5027.94	1.64	1532.02	1532.52	0.50
	5028.59	5030.23	1.64	1532.72	1533.22	0.50
	5030.89	5032.53	1.64	1533.42	1533.92	0.50
	5033.19	5034.83	1.64	1534.12	1534.62	0.50
			8.20			2.50
6	5035.48	5037.12	1.64	1534.82	1535.32	0.50
	5037.78	5039.42	1.64	1535.52	1536.02	0.50
	5040.08	5041.39	1.31	1536.22	1536.62	0.40
	5042.04	5043.36	1.31	1536.82	1537.22	0.40
	5044.01	5045.00	0.99	1537.42	1537.72	0.30
			6.89			2.10

Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

RECOMMENDED INTERVALS (13)

1	4914.83'-4916.14' (1.31')	Lift up to 1.97' (~2.0')
2	4912.86'-4914.17' (1.31')	Lift up to 1.97' (~2.0')
3	4910.89'-4912.20' (1.31')	Lift up to 2.30' (~2.5')
4	4908.59'-4910.23' (1.64')	Lift up to 2.30' (~2.5')
5	4906.30'-4907.94' (1.64')	Lift up to 2.30' (~2.5')
6	4904.00'-4905.64' (1.64')	Lift up to 15.22' (~15.5')
7	4888.78'-4890.00' (1.22')	Lift up to 2.30' (~2.5')
8	4886.48'-4888.12' (1.64')	Lift up to 2.30' (~2.5')
9	4884.19'-4885.83' (1.64')	Lift up to 1.64' (~1.5')
10	4881.89'-4883.53' (1.64')	Lift up to 1.64' (~1.5')
11	4879.59'-4881.23' (1.64')	Lift up to 2.30' (~2.5')
12	4877.30'-4878.94' (1.64')	Lift up to 2.30' (~2.5')
13	4875.00'-4876.64' (1.64')	Finish

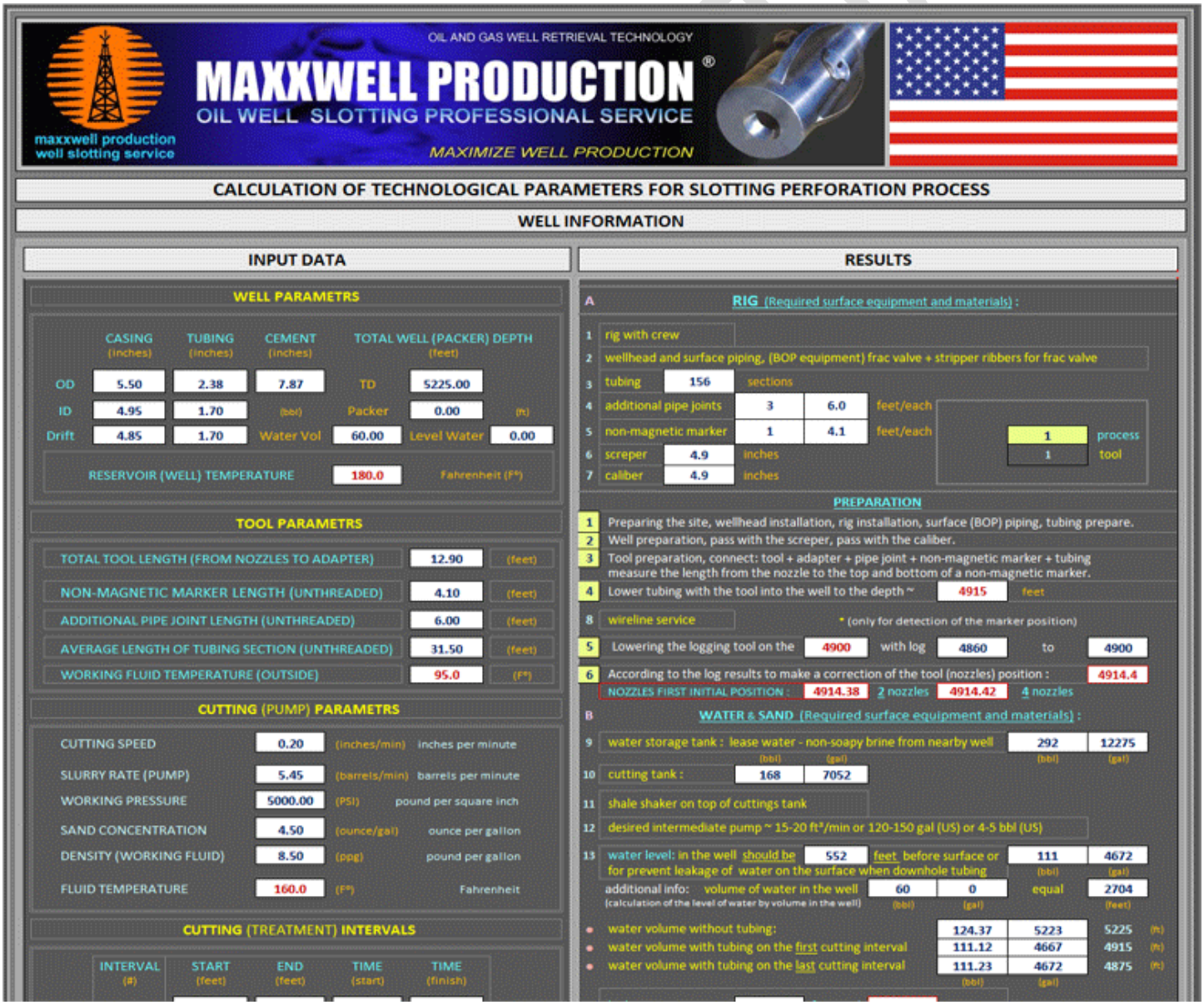
* The intervals must be adjusted to bypass couplings of casing after correlation logging

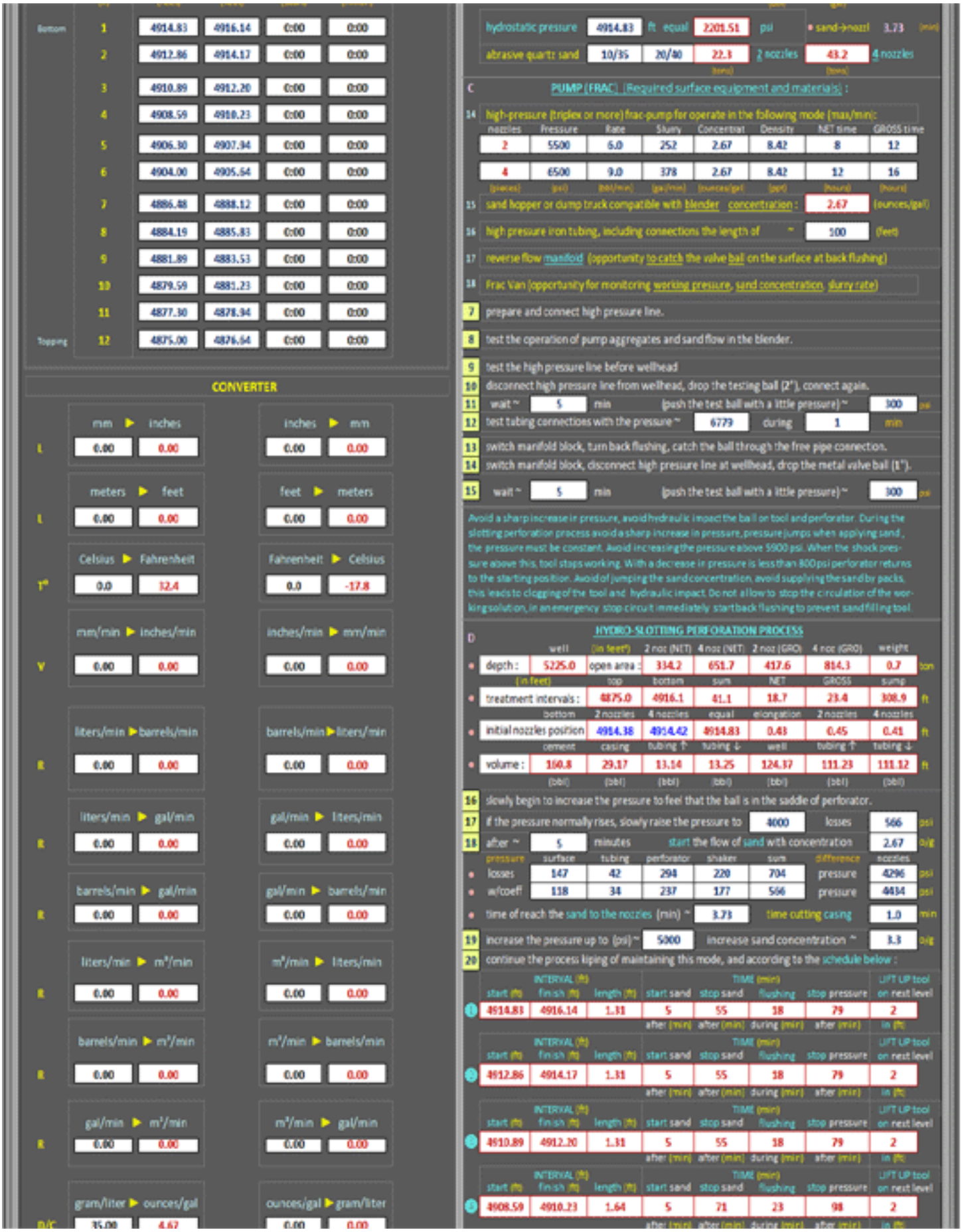
INITIAL DATA

#	Casing Size (Inches)	Downhole temp	Expected Interval
2	5-1/2"	180F	4900'~5035'

PBTD	5225'
Total Well Depth	5225'
Formation-1	Upper Carlisle
Formation-2	James Lime
Treatment interval	~ 4916.14'-4875.00' (19.92')
Gross interval	~ 4916.14'-4875.00' (41.14')
OD Casing	5.5"
Casing weight (lb. /ft.)	15.5
Brand	J-55
ID Casing	4.95"
Drift Casing	4.85"
FT^3 per LIN FT	0.1336
LIN FT per FT^3	7.4830
BBL per LIN FT	0.0238

LIN FT per BBL	42.0138
OD Tubing-1	2.375”
ID Tubing-1	1.7”
Drift Tubing-1	1.7”
OD Tubing-2	2.875”
ID Tubing-2	2.0”
Drift Tubing-2	2.0”
OD Drill Bit	7.87”
Open hole used	7.87”
Cement weight	1400 pound/ft.
Cement used	SpectraCem NP + 0.9% FL-5 + 0.8% LCB-1000
Mud weight used	-
Bottom hole temp	180°F / 82°C
Estimated working fluid temperature	160°F / 70°C
Fluid salinity	46000 ppm
Casing Collars	-





Bottom	1	4914.83	4916.14	0:00	0:00
	2	4912.86	4914.17	0:00	0:00
	3	4910.89	4912.20	0:00	0:00
	4	4908.59	4910.23	0:00	0:00
	5	4906.30	4907.94	0:00	0:00
	6	4904.00	4905.64	0:00	0:00
	7	4886.48	4888.12	0:00	0:00
	8	4884.19	4885.83	0:00	0:00
	9	4881.89	4883.53	0:00	0:00
	10	4879.59	4881.23	0:00	0:00
	11	4877.30	4878.94	0:00	0:00
Topping	12	4875.00	4876.64	0:00	0:00

CONVERTER

	mm ▶ inches		inches ▶ mm	
L	0.00	0.00	0.00	0.00
	meters ▶ feet		feet ▶ meters	
L	0.00	0.00	0.00	0.00
	Celsius ▶ Fahrenheit		Fahrenheit ▶ Celsius	
T°	0.0	32.4	0.0	-17.8
	mm/min ▶ inches/min		inches/min ▶ mm/min	
V	0.00	0.00	0.00	0.00
	liters/min ▶ barrels/min		barrels/min ▶ liters/min	
R	0.00	0.00	0.00	0.00
	liters/min ▶ gal/min		gal/min ▶ liters/min	
R	0.00	0.00	0.00	0.00
	barrels/min ▶ gal/min		gal/min ▶ barrels/min	
R	0.00	0.00	0.00	0.00
	liters/min ▶ m³/min		m³/min ▶ liters/min	
R	0.00	0.00	0.00	0.00
	barrels/min ▶ m³/min		m³/min ▶ barrels/min	
R	0.00	0.00	0.00	0.00
	gal/min ▶ m³/min		m³/min ▶ gal/min	
R	0.00	0.00	0.00	0.00
	gram/liter ▶ ounces/gal		ounces/gal ▶ gram/liter	
D/C	35.00	4.67	0.00	0.00

hydrostatic pressure 4914.83 ft equal 2201.51 psi • sand→nozzl 3.73 (min)

abrasive quartz sand 10/35 20/40 22.1 (tons) 2 nozzles 43.2 (tons) 4 nozzles

C PUMP (FRAC) (Required surface equipment and materials) :

14 high-pressure (triplex or more) frac-pump for operate in the following mode (max/min):

nozzles	fressure	Rate	Slurry	Concentrat	Density	NET time	GROSS time
2	5500	6.0	252	2.67	8.42	8	12
4	6500	9.0	378	2.67	8.42	12	16
(pieces)	(psi)	(bbl/min)	(ga/min)	(ounces/gal)	(ppt)	(hours)	(hours)

15 sand hopper or dump truck compatible with blender concentration : 2.67 (ounces/gal)

16 high pressure iron tubing, including connections the length of ~ 100 (feet)

17 reverse flow manifold (opportunity to catch the valve ball on the surface at back flushing)

18 Frac Van (opportunity for monitoring working pressure, sand concentration, slurry rate)

7 prepare and connect high pressure line.

8 test the operation of pump aggregates and sand flow in the blender.

9 test the high pressure line before wellhead

10 disconnect high pressure line from wellhead, drop the testing ball (2"), connect again.

11 wait ~ 5 min (push the test ball with a little pressure) ~ 300 psi

12 test tubing connections with the pressure ~ 6779 during 1 min

13 switch manifold block, turn back flushing, catch the ball through the free pipe connection.

14 switch manifold block, disconnect high pressure line at wellhead, drop the metal valve ball (1").

15 wait ~ 5 min (push the test ball with a little pressure) ~ 300 psi

Avoid a sharp increase ir pressure, avoid hydraulic impact the ball on tool and perforator. During the slotting perforation process avoid a sharp increase in pressure, pressure jumps when applying sand , the pressure must be constant. Avoid increasing the pressure above 5900 psi. When the shock pressure above this, tool stops working. With a decrease ir pressure is less than 800 psi perforator returns to the starting position. Avoid of jumping the sand concertration, avoid supplying the sand by packs, this leads to clogging of the tool and hydraulic impact. Do not allow to stop the circulation of the working solution, in an emergency stop circuit immediately start back flushing to prevent sand filling tool.

D HYDRO-SLOTTING PERFORATION PROCESS

	well	(in feet')	2 noz (NET)	4 noz (NET)	2 noz (GRO)	4 noz (GRO)	weight	
• depth :	5225.0	open area :	334.2	651.7	417.6	814.3	0.7	ton
	(in feet)		top	bottom	sum	NET	GROSS	sump
• treatment intervals :	4875.0		4916.1	41.1	18.7	23.4	308.9	ft
	bottom		2 nozzles	4 nozzles	equal	elongation	2 nozzles	4 nozzles
• initial nozzles position	4914.38		4914.42	4914.83	0.43	0.45	0.41	ft
	cement		casing	tubing ↑	tubing ↓	well	tubing ↑	tubing ↓
• volume :	160.8	29.17	13.14	13.25	124.37	111.23	111.12	ft
	(bbl)	(bbl)	(bbl)	(bbl)	(bbl)	(bbl)	(bbl)	

16 slowly begin to increase the pressure to feel that the ball is in the saddle of perforator.

17 if the pressure normally rises, slowly raise the pressure to 4000 losses 566 psi

18 after ~ 5 minutes start the flow of sand with concentration 2.67 oz/g

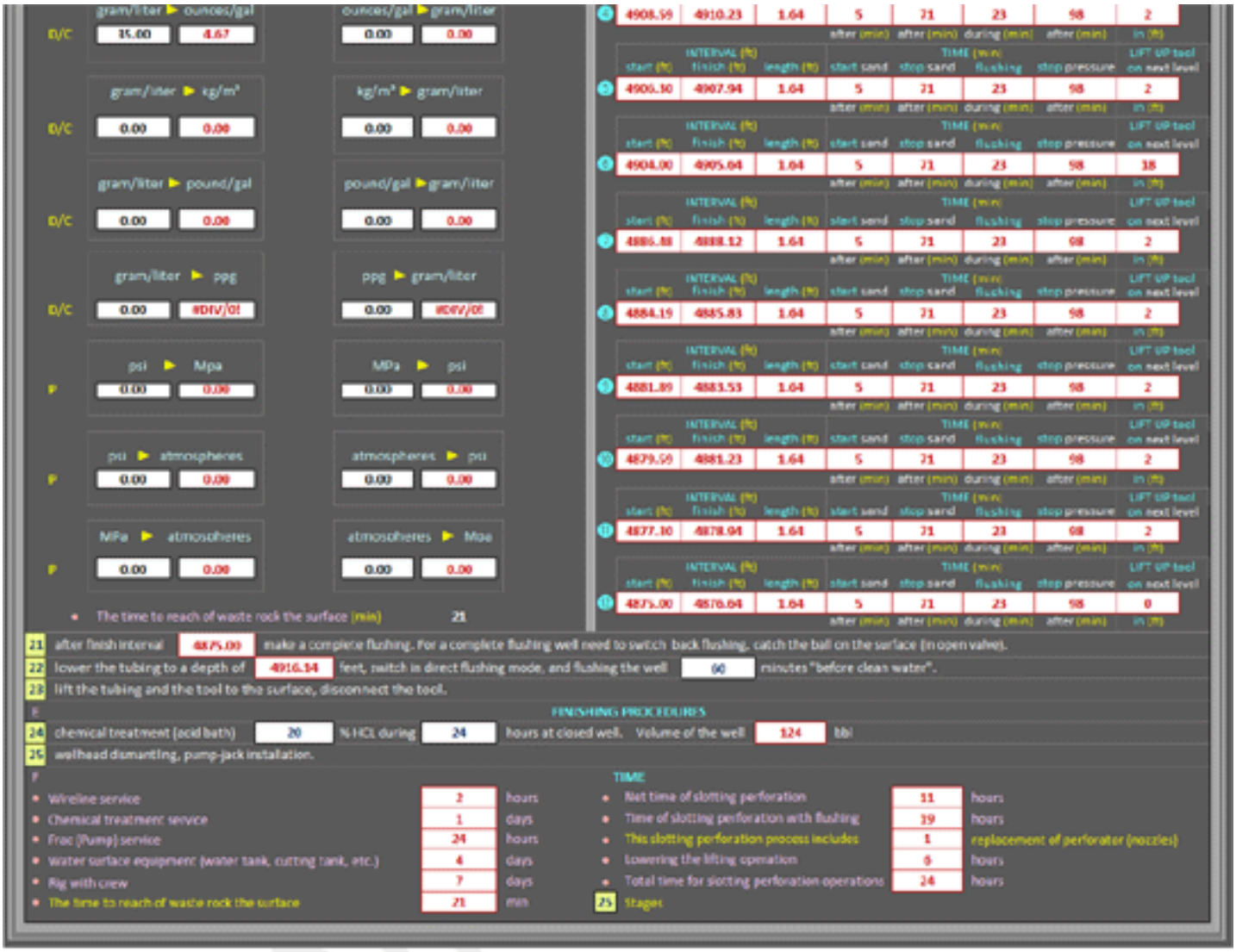
	pressure surface	tubing	perforator	shaker	sum	Difference	nozzles	
• losses	147	42	294	220	704	pressure	4296	psi
• w/coeff	118	34	237	177	566	pressure	4434	psi

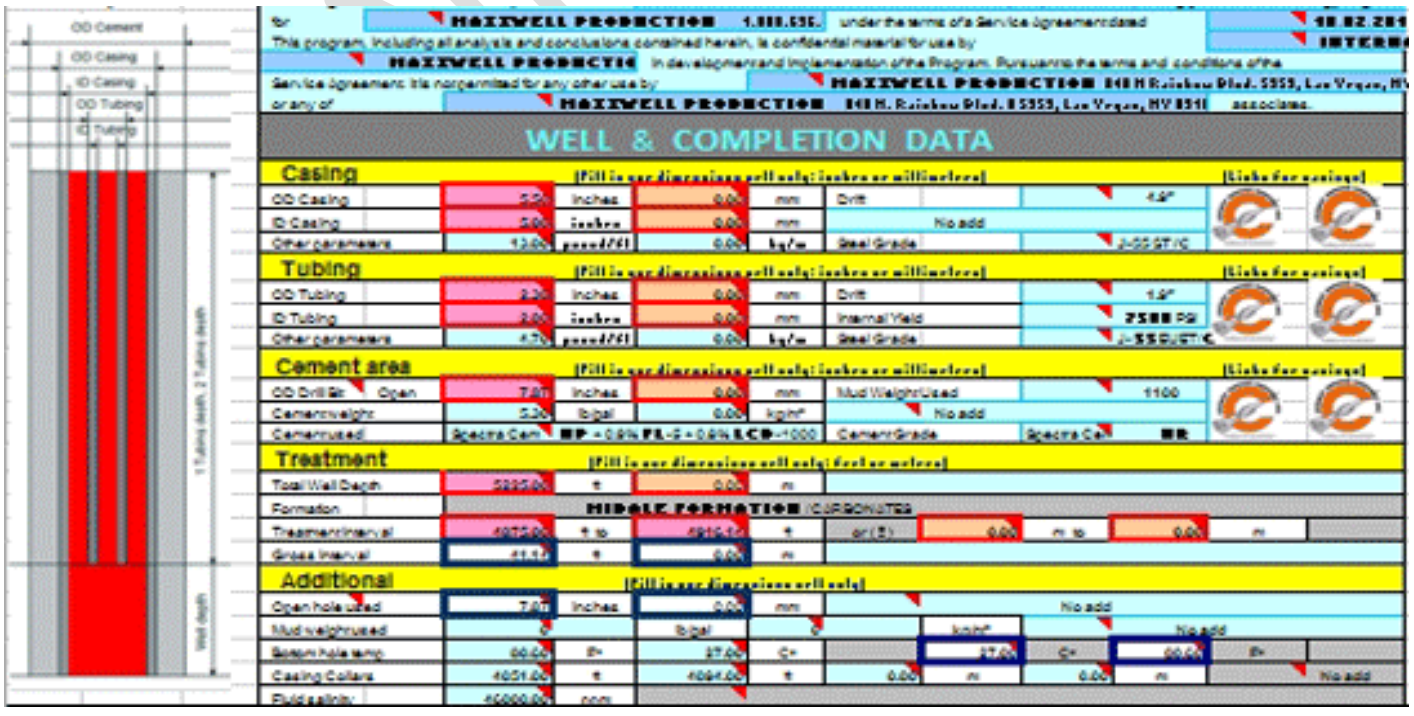
• time of reach the sand to the nozzles (min) ~ 3.73 time cutting casing 1.0 min

19 increase the pressure up to (psi) ~ 5000 increase sand concentration ~ 3.3 oz/g

20 continue the process kiping of maintaining this mode, and according to the schedule below :

	INTERVAL (ft) start (ft)	finish (ft)	length (ft)	TIME (min) start sand	stop sand	flushing	stop pressure	LIFT UP tool on next level
1	4914.83	4916.14	1.31	5	55	18	79	2
				after (min)	after (min)	during (min)	after (min)	in (ft)
2	4912.86	4914.17	1.31	5	55	18	79	2
				after (min)	after (min)	during (min)	after (min)	in (ft)
3	4910.89	4912.20	1.31	5	55	18	79	2
				after (min)	after (min)	during (min)	after (min)	in (ft)
4	4908.59	4910.23	1.64	5	71	23	98	2
				after (min)	after (min)	during (min)	after (min)	in (ft)


gram/liter ► ounces/gal
ounces/gal ► gram/liter
D/C
35.00
4.67
0.00
0.00
gram/liter ► kg/m³
kg/m³ ► gram/liter
gram/liter ► pound/gal
pound/gal ► gram/liter
gram/liter ► ppg
ppg ► gram/liter
#DIV/0!
psi ► Mpa
MPa ► psi
P
psi ► atmospheres
atmospheres ► psi
MPa ► atmospheres
atmospheres ► Mpa
The time to reach of waste rock the surface (min) 21
INTERVAL (ft)
TIME (min)
start (ft)
finish (ft)
length (ft)
start sand
stop sand
flushing
stop pressure
LIFT UP tool on next level
4908.59 4910.23 1.64 5 71 23 98 2
4906.10 4907.94 1.64 5 71 23 98 2
4904.00 4905.04 1.64 5 71 23 98 18
4886.88 4888.12 1.64 5 71 23 98 2
4884.19 4885.83 1.64 5 71 23 98 2
4881.89 4883.53 1.64 5 71 23 98 2
4879.59 4881.23 1.64 5 71 23 98 2
4877.30 4878.94 1.64 5 71 23 98 2
4875.00 4876.64 1.64 5 71 23 98 0
21 after finish interval 4875.00 make a complete flushing. For a complete flushing well need to switch back flushing, catch the ball on the surface (in open valve).
22 lower the tubing to a depth of 4916.14 feet, switch in direct flushing mode, and flushing the well 60 minutes "before clean water".
23 lift the tubing and the tool to the surface, disconnect the tool.
FINISHING PROCEDURES
24 chemical treatment (acid bath) 20 % HCL during 24 hours at closed well. Volume of the well 124 bbl
25 wellhead dismantling, pump-jack installation.
Wireline service 2 hours
Chemical treatment service 1 days
Frac (Pump) service 24 hours
Water surface equipment (water tank, cutting tank, etc.) 4 days
Rig with crew 7 days
The time to reach of waste rock the surface 21 min
TIME
Net time of slotting perforation 11 hours
Time of slotting perforation with flushing 19 hours
This slotting perforation process includes 1 replacement of perforator (nozzles)
Lowering the lifting operation 6 hours
Total time for slotting perforation operations 24 hours
25 Stages


OD Cement
OD Casing
ID Casing
OD Tubing
ID Tubing
MAXIWELL PRODUCTION
WELL & COMPLETION DATA
Casing
Tubing
Cement area
Treatment
Additional
MIDDLE FORMATION (CARBONATES)
No add

Casing area volume (inside)	5000.00	ft / or	1000.00	m	000.00	00.00	00000	0000.1	0000	1000.0	1000.0	0000.7
Tubing area volume on	4878.00	ft / or	1000.00	m	1000.0	0.00	0000	0000.7	000.0	000.0	000.1	000.1
Tubing area volume on	4878.16	ft / or	1000.00	m	1000.00	0.00	0000	0000.0	000.1	000.0	000.0	000.0
Tubing area volume (inside)	4878.00	ft / or	1000.00	m	1000.00	0.00	0000	0000.0	000.0	000.0	000.0	000.0
Tubing area volume (inside)	4878.16	ft / or	1000.00	m	1000.00	0.00	0000	0000.0	000.0	000.0	000.0	000.0
Fluid Volume (Wall) for	4878.00	ft / or	1000.00	m	1000.00	0.00	0000	0000.0	000.0	000.0	000.0	000.0
Fluid Volume (Wall) for	4878.16	ft / or	1000.00	m	1000.00	0.00	0000	0000.0	000.0	000.0	000.0	000.0
Average Volume (Wall)	4878.08	ft / or	1000.00	m	1000.00	0.00	0000	0000.0	000.0	000.0	000.0	000.0
Volume of working fluid in the surface system and tank volume (min)					1000	00	00000	00000	000	000	000	00000

SURFACE EQUIPMENT

RIG

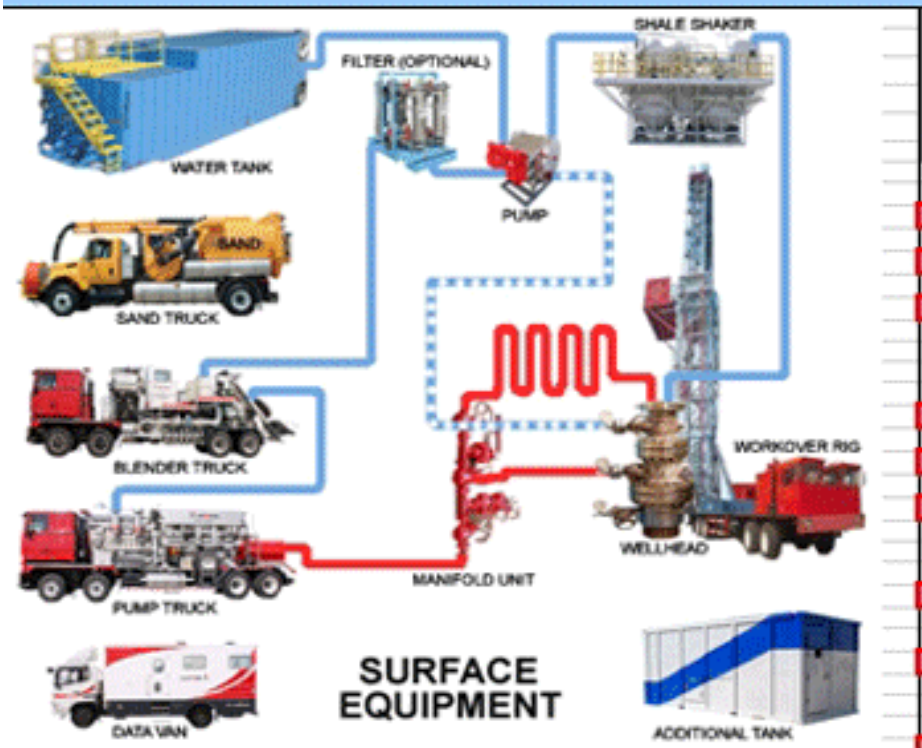
		(ft)	(mm)	(Bars)	gal (us)	bbl (us)	bbl (oil)	bbl (us)	gal (us)
a	Rig, plus tubing trailer with tubing, to be spotted opposite rig								
b	Water storage tank volume approximately (minimum)	1000	00	00000	10000	000	000	000	10000
c	Cuttings tank volume approximately (minimum)	000	00	00000	7000	000	000	000	0000
d	Shale shaker (on top of cuttings tank): 1 pump (500-600 L/min or 17.5-21.2 ft³/min or 130-159 gal (us) or 4.0-5.0 bbl (us).								
e	Fhoreshaker; then 1 filter (0.125 particle size); 2 pumps (combined 1 m³/min) or 35.3 ft³/min or 264 (gal (US)/min or 6.4 bbl (US)/min								
g	30 m (98.4 ft) of low pressure tubing plus connections								
f	Standard BOP equipment – frac valve + 6 stripper rubbers for frac valve								

FRAC SERVICE

a	1 high-pressure (triplex) pump (minimum 35 MPa (5000 psi) & 1 m³/min) or 35.3 ft³/min or 264 (gal (US)/min or 6.4 bbl (US)/min
b	1 blender (25-50 kg/m3)
g	30 m (98.4 ft) of high pressure iron tubing, including connections & reverse flow manifold
d	Frac van

CONSUMABLES

a	30 m³/min (30 liters/min or 7925.3 ft³ or 5283 gal (us) or 189 bbl (us) lease water – non-saucy brine from nearby well (look in the "Rig" table)
b	Friction reducer additive for 30 m³ (65.6 ft³) or 3 water
g	10-15 tonnes abrasive grit* Program must be finalized to determine quantity: (See the next Table)
d	1 sand hopper or dump truck compatible with blender



CALCULATION THE ELONGATION OF THE TUBING UNDER THE WORKING FLUID PRESSURE, FIRST INTERVAL AND SECTIONS

A - landing length before nozzles: 0.00 ft | cm | 0.00

B - collar with seat length: 0.00 ft | cm | 0.00

C - additional pup joins section length: 0.00 ft | cm | 0.00

D - full length before tubing: 0.00 ft | cm | 0.00

E - marker length: 0.00 ft | cm | 0.00

F - one section of tubing length: 31.20 ft | cm | 0.00

Pump performance (bbl/min)

bbl/min	gal/min	l/min
0.0	0.0	0.0

Wellhead pressure (psi)

psi	kPa	atm
1000.0	0.0	0.0

Elongation of the tubing under the working fluid pressure :

ft/in	in	
2874	3473	cm
9.7	9.7	ft
116.1	97.4	inch

Installation of the first interval :

ft	m
4018.89	1224.10

Number of sections (unlisting):

Depth In	Top Interval	Difference
4840.09	4005.20	-816.36
1139.20	1734.73	-340.03
Sections:	139	155
Pup joins : 0.6m (2ft)		-23
Pup joins : 1.2m (4ft)		-23

1	Cut1	from	4827.00	to	4061	ft		0	m	
2	Cut2	from	4078.00	to	4061.00	ft			m	
3	Cut3	from	4088.00	to	4088.00	ft			m	
4	Cut4	from	4100.00	to	4100.00	ft			m	
5	Cut5	from	4138.00	to	4138.00	ft			m	
6	Cut6	from	0.00	to	0.00	ft			m	
7	Cut7	from	0.00	to	0.00	ft			m	
8	Cut8	from	0.00	to	0.00	ft			m	
9	Cut9	from	0	to	0.00	ft	0		m	
		from	for each	to	for each					
Time for sand :		4.00	4816.74	ft	4.00	4872.00	ft	Average		
0		min	1468.44	m	min	1485.80	m	Engine	0.0	

HYDRO-SLOTTED PROCESS

Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

RESULTS OF CALCULATION OF TECHNOLOGICAL PARAMETERS FOR HSP

Casing area volume (inside) PBTD = 5225.00’	6760 gal / 214 bbl
Tubing area volume on the lowest position = 4916.14’	1137 gal / 36 bbl
Tubing area volume on the highest position = 4875.00’	1128 gal / 35 bbl
Tubing area volume (inside) on 4916.14’	803 gal / 36 bbl
Tubing area volume (inside) on 4875.00’	796 gal / 25 bbl
Fluid Volume (Well) for 4916.14’	6120 gal / 194.1 bbl
Fluid Volume (Well) for 4875.00’	6122 gal / 194.2 bbl
Average Volume (Well) 2644.57’	6121 gal / 194.2 bbl
All Volume (Surface + Well)	12242 gal / 388 bbl
Pump performers (Start)	5.45 bbl./min
Pump performers (Finish)	10.0 bbl./min
Water tank (surface)	7416 gal / 235 bbl
Working pressure	~ 5000 psi
Cutting (slotting) speed	0.16 / 0.18 / 0.20 in / min (corrected during the operation)
Full length of the equipment (before tubing)	11.2’
Marker length	4.1’
One section of tubing length	31.5’
Installation of the first (initial) cutting interval (Tubing A)	4914’ (4913.85’) (Elongation 10-12 inches)
Installation of the first (initial) cutting interval (Tubing B)	4914’ (4914.43’) (Elongation 5-6 inches)
Shale shaker (on top of cuttings tank)	1
Low pressure tubing plus connections	98.4 ft
Standard BOP equipment	Frac valve + 8 stripper rubbers for frac valve
1 high-pressure (triplex) pump	1
1 blender	1
High pressure iron tubing & reverse flow manifold	98.4 ft including connections
Frac van	1
Non-soapy brine from nearby well	
Friction reducer additive for	65.6 ft or 3 water
Abrasive quartz sand (abrasive grit*) 10/35 or 20/40	22-26 tons (2 nozzles), 43-50 tons (4 nozzles)
The distance between cuts (slots)	-
Time to reach the sand to the nozzles	~ 4 min
Time to reach the sand to the surface	~ 20-25 min
Pressure loss in tubing	~ 42 / 34 psi
Pressure drop across the nozzles	~ 4296 / 4434 psi
Friction coefficient	~ 1.5
Pup joints	2’ + 5’

#	Cutting interval	Action

* Initial position for the first cutting interval with taking into account the tubing’s elongation is 4914’

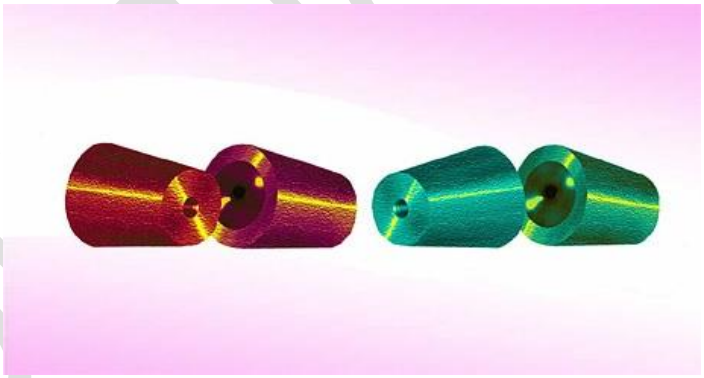
1	4914.83’-4916.14’ (1.31’)	Lift up to 1.97’ (~2.0’)
2	4912.86’-4914.17’ (1.31’)	Lift up to 1.97’ (~2.0’)
3	4910.89’-4912.20’ (1.31’)	Lift up to 2.30’ (~2.5’)
4	4908.59’-4910.23’ (1.64’)	Lift up to 2.30’ (~2.5’)

5	4906.30'-4907.94' (1.64')	Lift up to 2.30' (~2.5')
6	4904.00'-4905.64' (1.64')	Lift up to 15.22' (~15.5')
7	4888.78'-4890.00' (1.22')	Lift up to 2.30' (~2.5')
8	4886.48'-4888.12' (1.64')	Lift up to 2.30' (~2.5')
9	4884.19'-4885.83' (1.64')	Lift up to 1.64' (~1.5')
10	4881.89'-4883.53' (1.64')	Lift up to 1.64' (~1.5')
11	4879.59'-4881.23' (1.64')	Lift up to 2.30' (~2.5')
12	4877.30'-4878.94' (1.64')	Lift up to 2.30' (~2.5')
13	4875.00'-4876.64' (1.64')	Finish

* The intervals must be adjusted to bypass couplings of casing after correlation logging

Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

TECHNICAL PARAMETERS



APPROXIMATE NOZZLES DIAMETERS (INITIAL AND FINAL)

	Initial diameter		Final diameter	
Number of nozzles	1 nozzle	all nozzles	1 nozzle	all nozzles
2	5.1 mm (0.2 inches)	10.2 mm (0.4 inches)	8.9 mm (0.35 inches)	17.8 mm (0.7 inches)
4	5.1 mm (0.2 inches)	20.4 mm (0.8 inches)	8.9 mm (0.35 inches)	35.6 mm (1.4 inches)

APPROXIMATE EROSION OF NOZZLES BY CUTTING INTERVALS

2 NOZZLES

Start	End of 1 interval	End of 2 interval	End of 3 interval	End of 4 interval	End of 5 interval
10.2 mm	11.8 mm	13.2 mm	14.8 mm	16.2 mm	17.8 mm
0.4 inches	0.46 inches	0.52 inches	0.58 inches	0.64 inches	0.7 inches

4 NOZZLES

Start	End of 1 interval	End of 2 interval	End of 3 interval	End of 4 interval	End of 5 interval
20.4 mm	23.6 mm	26.4 mm	29.6 mm	32.4 mm	35.6 mm
0.8 inches	0.93 inches	0.26 inches	1.04 inches	1.28 inches	1.4 inches

Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

APPROXIMATE PUMP RATE BY CUTTING INTERVALS

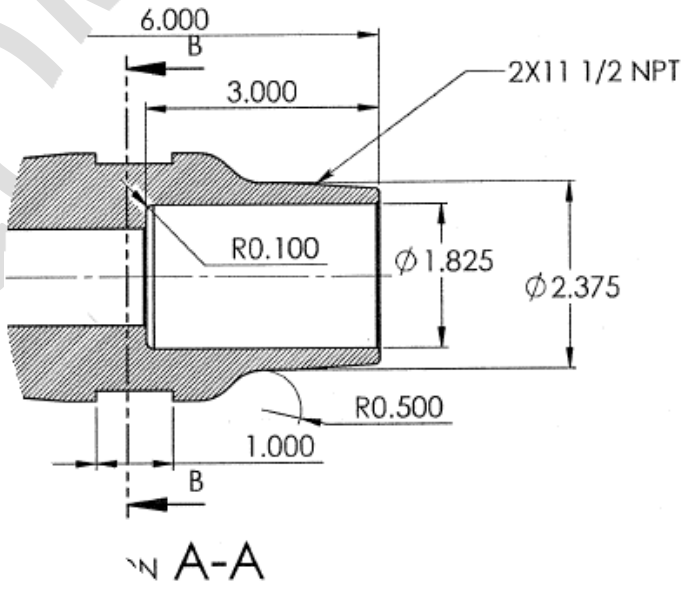
2 NOZZLES

Start	End of 1 interval	End of 2 interval	End of 3 interval	End of 4 interval	End of 5 interval
0.38 m³/min	0.45 m³/min	0.54 m³/min	0.63 m³/min	0.72 m³/min	0.81 m³/min
3.25 bbl./min	3.85 bbl./min	4.45 bbl./min	5.05 bbl./min	5.65 bbl./min	6.25 bbl./min

4 NOZZLES

Start	End of 1 interval	End of 2 interval	End of 3 interval	End of 4 interval	End of 5 interval
0.65 m³/min	0.76 m³/min	0.87 m³/min	0.97 m³/min	1.08 m³/min	1.19 m³/min
5.45 bbl./min	6.35 bbl./min	7.33 bbl./min	8.17 bbl./min	9.09 bbl./min	10.0 bbl./min

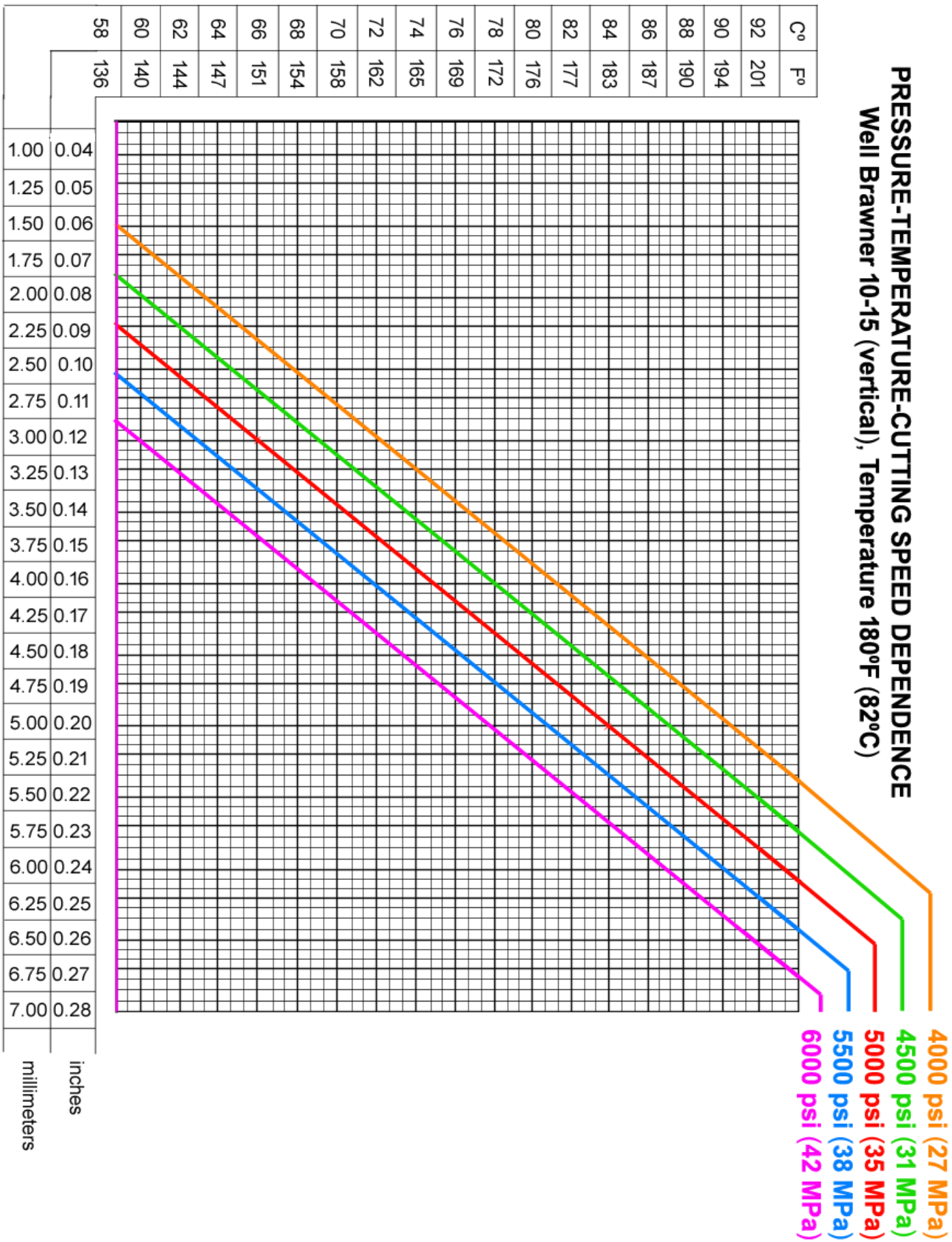
CONNECTION TOOL/EQUIPMENT'S ADAPTER WITH TUBING



Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

FLOW CONTROL VALVE

	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125
1.0																						
1.5																						
2.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2.5																						
3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3.5																						
4.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
4.5																						
5.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
5.5																						
6.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
6.5																						
7.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
7.5																						
8.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
8.5																						
9.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
9.5																						
10.0	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
10.5																						
11.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
11.5																						
12.0	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
12.5																						
13.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
13.5																						
14.0	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
14.5																						
15.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
15.5																						
16.0	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
16.5																						
17.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
17.5																						
18.0	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
18.5																						
19.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
19.5																						
20.0	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5

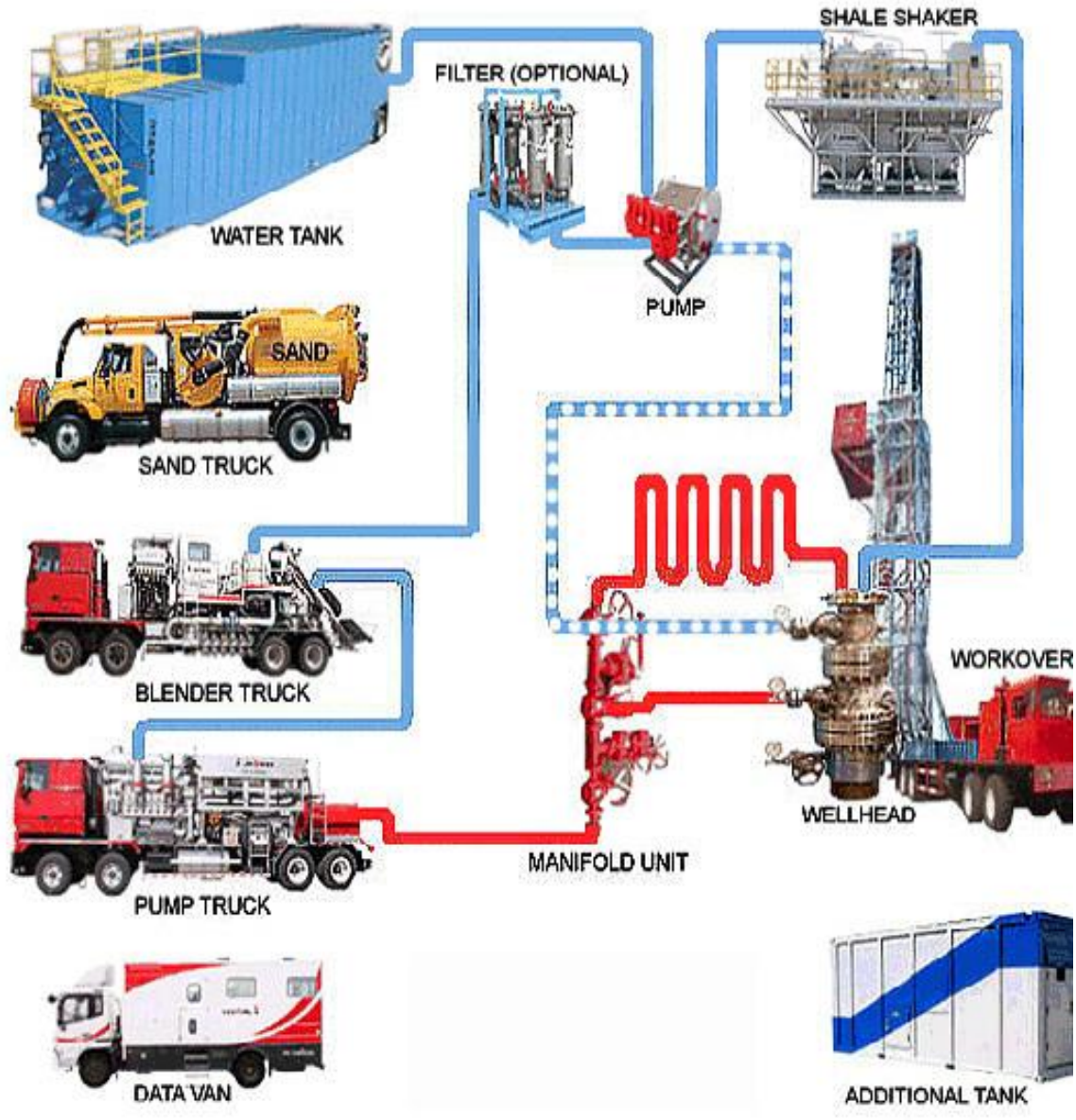

PRESSURE-TEMPERATURE-CUTTING SPEED DEPENDENCE
Well Brawner 10-15 (vertical), Temperature 180°F (82°C)
4000 psi (27 MPa)
4500 psi (31 MPa)
5000 psi (35 MPa)
5500 psi (38 MPa)
6000 psi (42 MPa)
C° F°
92 201
90 194
88 190
86 187
84 183
82 177
80 176
78 172
76 169
74 165
72 162
70 158
68 154
66 151
64 147
62 144
60 140
58 136
1.00 0.04
1.25 0.05
1.50 0.06
1.75 0.07
2.00 0.08
2.25 0.09
2.50 0.10
2.75 0.11
3.00 0.12
3.25 0.13
3.50 0.14
3.75 0.15
4.00 0.16
4.25 0.17
4.50 0.18
4.75 0.19
5.00 0.20
5.25 0.21
5.50 0.22
5.75 0.23
6.00 0.24
6.25 0.25
6.50 0.26
6.75 0.27
7.00 0.28
millimeters
inches

Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

EXAMPLE OF CUTTING AT THE SAME SPEED AT DIFFERENT TEMPERATURES

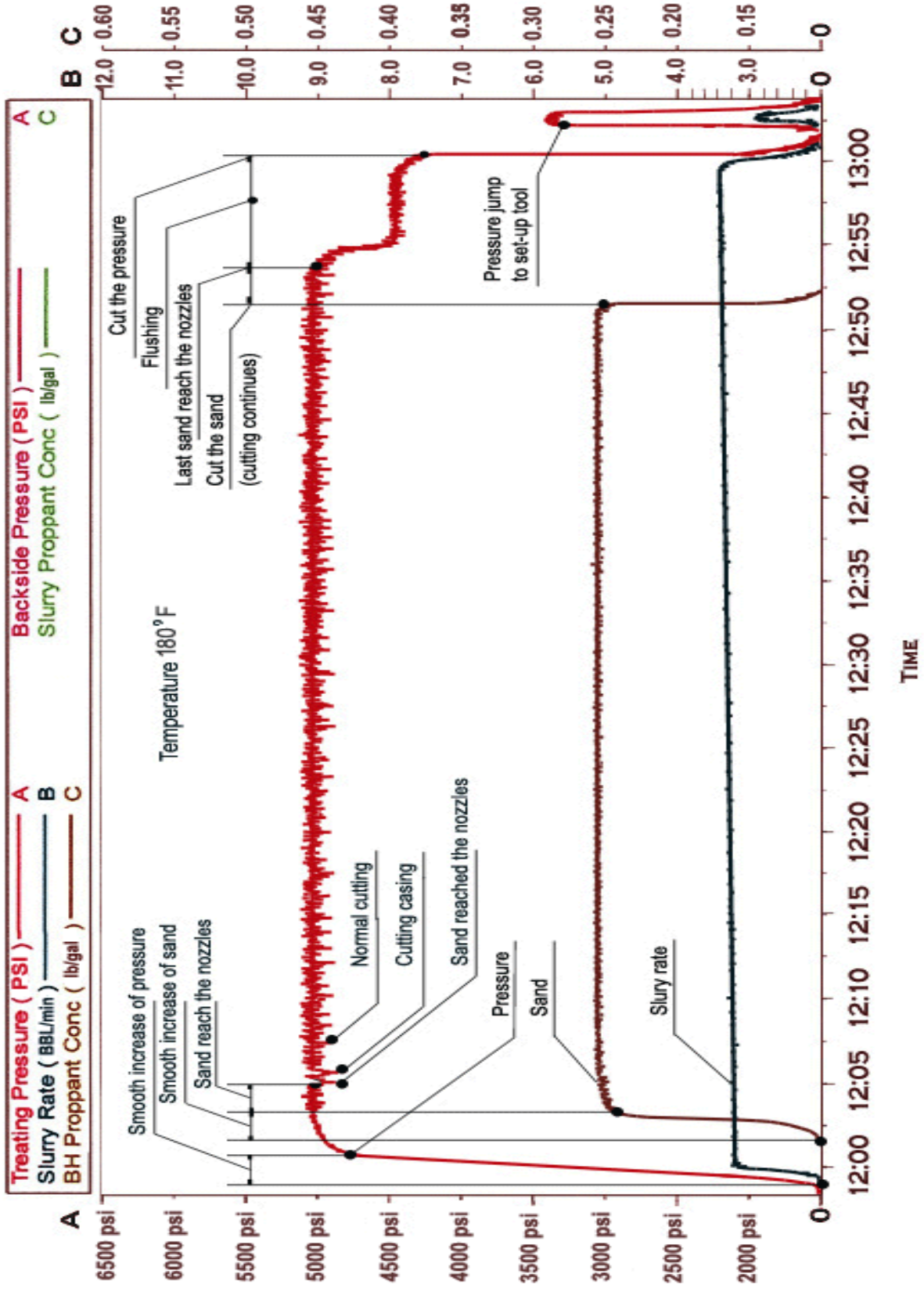
Speed=0.18 inches/min (4.5 mm/min)	
Temperature (F^o)	Pressure (psi)
160°F	6500 psi
165°F	6000 psi
170°F	5500 psi
175°F	5000 psi
180°F	4500 psi
185°F	4000 psi
190°F	3500 psi
195°F	3000 psi

SURFACE EQUIPMENT LOCATION SCHEME



Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

SLOTTING PERFORATION PROCESS EXAMPLE



Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

GENERAL SLOTTING PROGRAM DETAILS

1. Have site cleaned up and prepared for operations. Notify Operator at least 24 hours before starting operations.

2. Notify the SIR and the land owner at least 24 hours before commencing well site operations. When notifying these contacts, inform them of the intended operations, the start and the expected duration of time. Record the names and the times of the notifications on the first day's report. Ensure all residents within a 1 mile radius of the well receive the notification letter & note this on the first daily report. Spot water tank. Before moving be sure to open tank and take pictures of the amount of sand in the tank.
3. Move-in and rig-up mobile service rig, specifications complete with pump, clean rig tank, and BOP system. Conduct detailed CAODC Service Rig Inspection and report any equipment/safety deficiencies, inoperable service rig components or negative pressure test results before proceeding. Install and pull test rig anchors to service rig manufacturers specifications (if required). Perform a surface casing vent flow test and report the vent status.

4. Hold a safety and procedural meeting with all onsite personnel.

5. Remove the wellhead top section and install and pressure test the BOP to 200 psi and 2000 psi for 10 minutes each.

6. Set up surface flow lines to be able to reverse flow casing and tubing (manifold for casing/tubing reverse flow). Have tanker truck bring water into the storage tank. Record well pressure before taking off gauge. Bleed off any pressure (< 100 psi). ND tree & NU Frac Valve (if necessary). Pressure test Frac Valve. Kill well.

7. Pressure test tubing with pump in the hole. If tubing does not pressure test call magnascope to scan tubing.

8. If needed, pump hot formation water down backside of the tubing and establish circulation down the backside and up the tubing and up over the rods. Unseat the pump and pull pump and rods to surface. Inspect the rods on the site to see if any need replacing. If the pump needs to be replaced or refurbished, hot shot for service.

9. Confirm is an anchor downhole, if so unseat anchor and pull tubing. Inspect tubing on lease to identify any pieces that need replacing.

10. Pressure test the blind rams, HCR and manifold to a low test and a high test for duration of 15 minutes and record in tour sheet.

11. Pressure test the pipe rams and annular preventer to a low test and a high test for a duration of 15 minutes each. Test kelly cock, stabbing valve and motor kills. Ensure that all BOP control equipment tests positive prior to drill out and all motor kills are working properly.

12. Have directional company ready to install directional motor to the end of the drill pipe with a 0.5° knuckle so that the well can be drilled deeper. Also install an MWD tool to track the bit. If a depth of 1196 m tvd is reached before the target, stop drilling and consult Admiralty representative.

13. Have rentals delivered: Power Swivel, Drill Pipe, Drill Pipe Elevator, Cross-over to tubing and tuning pieces, Centrifuge, Command Center, 3 x Light Plant, Reamer, 2 x open tanks, Trash Pump, Genset and Shale Shaker.

14. Have Geological Services on-site to collect cuttings.

15. Run in hole with directional equipment.

Well Brawner 10-15 (vertical)	API # 42467309790000 (309790)	Van Field, Van Zandt County, TX

16. Take and record a survey.

17. Pressure test the Maxxwell slotting tool on surface so that it is ready to be installed. While is being tested, the mixing skid, twin pumper and nitrogen unit should arrive and be setting up high pressure iron and sand mixer with ~ 50 T of 20/40 abrasive quartz sand. Once the tool is positioned, hook-up all iron and pressure test. The slotting intervals and ideal cutting parameters can be seen below.

18. Run the Maxxwell slotting tool down to the first (deepest, further away) slot (be sure to account for elongation).

19. The Formation water on-site.

20. A filtration and settling area will be set-up on site so that all of the cuttings can be separated once each slot has been cut, the cuttings will be collected in a pail and the slot interval will be marked. Then the volume excavated from each slot can be calculated to determine the dimensions of each slot interval. While we are slotting the sand, cutting fluid, excavated reservoir pieces and nitrogen will be flowing up the back side of the tubing. The fluid will flow over the Shale Shaker first to remove the large pieces of material and then into a settling tank where the nitrogen bubbles can settle out and the larger pieces of material will settle out. The fluid will then be sucked out of the settling tank with a Trash Pump and into the Centrifuge to take out the smaller material from the slotting fluid. From there the fluid will go into the rig tank and water tank to be treated with KCl and Biotide (swelling clays and micro-organisms) before being pulled into the mixer and pushed back downhole with sand.

PREPARATIONS FOR SLOT PERFORATION PROCESS

Stage	Description	Time
1	Prepare site. Inspection driveways, territory clean-up, coating gravel (if necessary)	
2	Equip site with safety requirements, electricity and lighting, toilet, sitting area	
3	Organization site, garbage collection and disposal, reservoir for rock and sand	
4	Spot rig and installation	
5	Pump-Jack disassembly. Lift service tubing and downhole equipment	
6	Headwell with BOP installation	
	* wellhead and surface piping, (BOP equipment) frac valve + stripper robbers for frac valve	
7	Spot operation tubing (tubing trailer)	
8	Spot cutting tank (with shaker for reset the waste abrasive quartz sand)	
9	Spot water storage tank (fill brine water storage tank). Well should be filled with water.	
10	Surface piping. Set up surface flow lines to be able to reverse flow csg/tbg	
11	Well inspection / preparation. Pass with scraper / caliber ID=4.9”	
12	Slot perforation tool/equipment assembly	
13		
14	HSP tool/equipment + additional pipe joints + non-magnetic marker + tubing connection	
	* additional pipe joints (~ 3 x 6”) are selected depending on the maximum allowable lift the high pressure line when changing sections tubing during the cutting process	
	* non-magnetic marker (~ 4 - 5”’) it must be visible during logging	
15	Measure the length of the tool/equipment assembly to the nozzles	
16	Pull down the tool/equipment on the tubing into the well to the desired depth	

17	Wireline service. Correlation log (backsight logging)	
18	Correction the downhole tool/equipment based on the obtained log	
19	Stop. Leave it in this position until the HSP process, not to move the tubing	

20	Spot frac service (pump service) with frac-van (monitoring centre)	
21	Install high pressure line and Manifold block (to be able to reverse flow csg/tbg)	
	* (optional) desired intermediate pump (to be able in emergency situation to reverse flow csg/tbg	
22	Abrasive quartz sand in the special track	
23	Blender/mixer for controlled and uniform supply of sand	
24	Spot additional nitrogen/chemical treatment service	

25	Safety meeting (s)	

26	Pump pressure and high pressure line test (before wellhead)	
27	(optional) Tubing pressure test:	
	disconnect high pressure line from wellhead	
	drop downhole cermet 1.5” ball	
	connect high pressure line with wellhead	
	supply pressure ~ 7000 psi for 1 min. If tubing keeps the pressure, cut the pressure	
	switch Manifold block on the reverse flushing	
	by reverse flushing wash out the cermet 1.5” ball on the surface	
28	Disconnect high pressure line from wellhead and drop downhole valve metal 1.0” ball	
	(optional) Procedures 27, 28 may skip if the tubing is new, all connections are good tight, and all pipes are clean. In this case the valve metal 1.0” ball can be put into the HSP tool/equipment before pull down into the well to the desired depth (paragraph 16)	

SLOT PERFORATION PROCESS

Stage	Description	Time

- Lower and lift the tool with caution to prevent possible jamming (especially in the horizontal section).
- Installation of the first (initial) cutting interval taking into account the elongation of tubing.
- The system and tubing must be absolutely clean (without residual of proppant which is used in hydraulic fracturing), otherwise such foreign bodies will get stuck in the nozzles.
- The speed of movement of the cutting nozzles along the wellbore depends on the temperature and pressure (graph is attached). The actual temperature is determined in the process of slotting perforation. Depending on the temperature optimal cutting modes are chosen (pressure and sand concentration). Initial pressure parameters - 4500 psi, sand concentration - 0.21 lb/gal.
- The initial pressure supply should be smooth (approximately during a minute). Hydraulic impacts (caused by the rapid increase in pressure, initial overpressure, jumps pressure) on the tool not allowed. When the pressure is established, it is possible to supply the abrasive sand.
- Pressure drop below 800 psi leads to set up the tool (perforator is set to the starting position). Set up time is 4 sec. The maximum pressure on the tool may not exceed 6200 psi.
- The initial abrasive sand supply should be smooth (approximately during a minute). Feed sand with packs, irregular supply of abrasive sand, over sand, jumping concentration of abrasive sand unacceptable and leads to failure of the nozzles.
- Incorrect supply of pressure and abrasive sand reduces working time of nozzles to one or two cutting intervals.

- If it is impossible to establish normal operation (conditions) for slotting perforation process - stop the process.
- (Graph of slotting perforation process is attached). Immediately after the filling of abrasive sand the cutting does not occur. Time to reach the abrasive sand to nozzles is approximately 4-5 min (depending on slurry rate). During the slotting perforation process the pressure and concentration curves (on the monitor) must be sufficiently straight, without jumps. Pressure curve should be a "small teeth of saw". The process should not be interrupted during cutting through the whole interval.
- Emergency stop pressure must immediately provide additional circulation of the working fluid to prevent the filling tool with the sand and rock, because it could lead to the loss of the well.
- Time of working process is determined according to the speed-temperature graph (temperature graph is attached). It is required take into account the time for flushing.
- Full stroke of working stock in the tool is 1.64 inches including the time to reach the sand to nozzles and flushing after slotting perforation process.
- Under the normal operating conditions (supply the pressure and sand concentration) the slurry rate and erosion of nozzles (at 4 nozzles) should have approximately the following parameters:

Start	End of 1 interval	End of 2 interval	End of 3 interval	End of 4 interval	End of 5 interval
0.65 m^3/min	0.76 m^3/min	0.87 m^3/min	0.97 m^3/min	1.08 m^3/min	1.19 m^3/min
5.45 bbl./min	6.35 bbl./min	7.33 bbl./min	8.17 bbl./min	9.09 bbl./min	10.0 bbl./min

Start	End of 1 interval	End of 2 interval	End of 3 interval	End of 4 interval	End of 5 interval
20.4 mm	23.6 mm	26.4 mm	29.6 mm	32.4 mm	35.6 mm
0.8 inches	0.93 inches	0.26 inches	1.04 inches	1.28 inches	1.4 inches

Stage	Description	Time
•	An excessively high or over limit slurry rate at high pressure should serve as grounds for lifting the tool on the surface for replace the nozzles.	
•	At the termination supply of abrasive sand, the cutting process continues until the last batch of sand will reach the nozzles (approximately 4-5 min, depending on slurry rate).	
•	At the end of the operation there needs to be done flushing during 10-15 min. Sand and rock reaches the surface during approximately 20-25 min. During flushing the pressure may be reduced up to 4000-4500 psi).	
•	(Optional) After cut the pressure it is recommended make the jump of pressure (as shown on the slotting graph) up to 3500 psi for greater certainty that perforator took the starting position and is ready for cutting of the next interval.	

Stage	Description	Time
START		
1	Slowly raise the pressure up to 4500 psi (without hydraulic shocks).	
2	After two or three minutes of normal operation (rate 5.45 bbl./min) begin to gradually apply the sand. The concentration not more than 0.21 lb/gal.	
3	After 4 minutes, the sand reaches the nozzles. Follow the graph, the pressure and the concentration of sand. Working conditions: Pressure ~ 5000 psi, Concentration ~ 0.25-0.28 lb/gal.	
•	Measure the temperature in the cutting tank. Compare with the speed graph. Specifies the time for cutting the interval.	
•	After 20-25-30 minutes, in the cutting (shaker) tank should be a rock.	
4	At the end of the cutting interval stop the flow of sand, but cutting continues for 4 minutes more.	

•	(Optional) After passing through the nozzles pure water waiting 5 minutes with the same pressure, then make the leap by the pressure 5000 psi→900 psi→5000 psi (to nozzle were in the middle of the interval) and flushing for 15 minutes.	
•	(Optional) For ensure that the perforator with nozzles got to the starting position can again raise pressure up to 3000 psi and stop.	
5	After cut pressure and pull the tool in the next interval.	

POSSIBLE VIOLATIONS OF HSP TECHNOLOGICAL PROCESS

- The presence in the pumping system, manifold block or in the high pressure line a residual of proppant (fracturing sand).
- The presence in the tubing, drilling pipes or in the coiled tubing a residual of rock, mud, clay, foreign particles, etc.
- Inability to gradually raise the pressure pump, inability of pump to keep the pressure on the same position, pressure jumps, stop the pump, the inability to create a back flushing.
- Inability to continuously supply of abrasive quartz sand, sand feed by batches, inability to supply the sand concentration at the same position, excess concentrations of sand, concentration jumps.

SLOT PERFORATION SCHEDULE

#	Interval	Slots	Skip	Process	Time
* Initial position for the first cutting interval with taking into account the tubing's elongation is 4914'					
1	4914.83'-4916.14'	<1.31'>		Cutting 1 interval	1 hour 15 min
				Flushing	15 min
				Lift up to 1.97' (~2.0')	10 min
			>3.28'<		
2	4912.86'-4914.17'	<1.31'>		Cutting 2 interval	1 hour 15 min
				Flushing	15 min
				Lift up to1.97' (~2.0')	10 min
			>3.28'<		
3	4910.89'-4912.20'	<1.31'>		Cutting 3 interval	1 hour 15 min
				Flushing	15 min
				Lift up to 2.30' (~2.5')	10 min
			>3.61'<		
4	4908.59'-4910.23'	<1.64'>		Cutting 4 interval	1 hour 35 min
				Flushing	15 min
				Lift up to 2.30' (~2.5')	10 min
			>3.93'<		
5	4906.30'-4907.94'	<1.64'>		Cutting 5 interval	1 hour 35 min
				Flushing	15 min
				Lift up to 2.30' (~2.5')	10 min
			>3.93'<		
6	4904.00'-4905.64'	<1.64'>		Cutting 6 interval	1 hour 35 min

				Flushing	15 min
				Lift up to 15.22’ (~15.5’)	15 min
			>16.86’<		

7	4888.78’-4890.00’	<1.22’>		Cutting 7 interval	1 hour 10 min
				Flushing	15 min
				Lower down to 4915’ (26’)	15 min

	4915’			Reverse flushing	20 min
				Catch the ball on the surface	-
				Direct Flushing	30 min

Total Time:	12 hours 10 min

* Lifting tool for the replacement of nozzles

* Lower tool downhole for the depth 4884.19’ (4883.39’ with elongation)

8	4886.48’-4888.12’	<1.64’>		Cutting 8 interval	1 hour 35 min
					15 min
				Lift up to 2.30’ (~2.5’)	10 min
			>3.52’<		

9	4884.19’-4885.83’	<1.64’>		Cutting 9 interval	1 hour 35 min
				Flushing	15 min
				Lift up to 2.30’ (~2.5’)	10 min
			>3.94’<		

10	4881.89’-4883.53’	<1.64’>		Cutting 10 interval	1 hour 35 min
				Flushing	15 min
				Lift up to 2.30’ (~2.5’)	10 min
			>3.94’<		

11	4879.59’-4880.90’	<1.31’>		Cutting 11 interval	1 hour 15 min
				Flushing	15 min
				Lift up to 2.30’ (~2.5’)	10 min
			>3.60’<		

12	4877.30’-4878.61’	<1.31’>		Cutting 12 interval	1 hour 15 min
				Flushing	15 min
				Lift up to 2.30’ (~2.5’)	10 min
			>3.61’<		

13	4875.00’-4876.64’	<1.64’>		Cutting 13 interval	1 hour 35 min
				Flushing	15 min
				Lower down to 4915’ (40’)	20 min

	4915’			Reverse flushing	15 min
				Catch the ball on the surface	-
				Direct Flushing	45 min

Total Time:	12 hours 10 min

* Lifting tool to the surface

SAFETY AND OPERATIONAL REQUIREMENTS

It is expected the field operations representatives will use their judgment and knowledge in executing the program and supervising the operations to ensure that all work is conducted in a safe manner that results in the greatest degree of protection possible for the on-site personnel, the public and the environment. The program is a guide and cannot replace good judgment on the wellsite.

Safety and Operational requirements are encourages and stresses the importance of safety in all aspects of its operations and therefore expects contractors and wellsite supervisors to adhere to recommended safe industry practices and Occupational Health and Safety regulations. All work must be conducted in compliance with the following:

- SIR Regulations
- Occupational Health and Safety Regulations
- Applicable ARP's
- Safety Specifications
- Safety Meetings

- Regular safety meetings are to be held and documented by the wellsite supervisor responsible for coordinating the activities of contractors. These meetings are held at the beginning of each day, prior to each high-pressure operation or stimulation and more frequently as conditions warrant.

- Meetings will be held with all involved personnel to ensure that each individual is familiar with the overall objectives, their specific duties, pressure limitations, and emergency and safety procedures.

- These meetings are to be documented on the Daily Tour Sheets.

Notifications

- Provide 24 hour notification of flaring operations and any pending operations if applicable to the SER area office. Record SIR contact, dates, and times on the Daily Morning Report. When notifying via the Digital Data Submission system note the electronic confirmation number on the morning report.

- Notify appropriate PFRA office in areas that fall under their direction.

- Venting and flaring notifications must be done 24 hours prior to commencement of flaring. Residents within 1.5 km radius (sweet) or 3 km radius (sour) of the well must be notified if the flaring or cleanup operation is to exceed 4 hours duration and/or the 24 hour flare volume is to exceed 30E3m^3 (1 mile for H2S<1% & 2 miles for H2S>1%. Refer to SIR Guidelines, to ensure that all flaring notification requirements have been met.

- The SIR has adopted a policy that places responsibilities of resident notification with the operating oil company (contract field supervisor) and failure to comply with this policy could result in a total shutdown of operations. It is therefore extremely important for the wellsite supervisor to establish communications with any residents in the vicinity of the well who may be affected by the following operations and keep them informed of any activity that is deemed to be disruptive to their daily routine - e.g. Acidizing, Fracturing, testing, perforating, etc.

- Ensure the operators field superintendent is contacted prior to moving on equipment.

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- Rig Inspection and BOP Drills
- Rig inspections are to be done on the first well for a new contractor and every two weeks after. BOP drills are to be done on every well and at least once every seven calendar days and recorded in the Daily Tour Sheet.
- BOP drills should be done more often to bring crew training up to an acceptable level if required.
- The BOP drill form is to be filled out and noted on the Daily Tour Sheet.
- A Walk around Rig Inspection is to be conducted at the beginning of each day and recorded in the Daily Tour Sheet.

Emergency Response Plan - Schedule A

- The supervisor and rig manager should be familiar with the Emergency Response Plan.
- Ensure that on all wells with site specific Emergency Response Plans (ERP), crew members are briefed and trained about their respective duties when an ERP goes into effect.
- Ensure that the Emergency Response Plan Contact list is filled out and posted.

Ground Disturbance

- All ground disturbance must follow all applicable regulations.
- Rig anchors should never be installed without a line locate pull test to 20000 lbs.
- All ground disturbance greater than 1 foot, within 16 feet of ANY underground facility, anode bed, pipeline/riser or electrical cable must be exposed via Hydrovac or Hand exposing. This is critical before cutting and capping well bores.
- The use of mechanical equipment (backhoe) within 2 feet of exposed or buried pipelines or electrical cables is not allowed.
- All operations are to remain on operators right of way (see survey plan). If in doubt check concerning re-staking the lease and road.

Pressure Testing

- Prior to the installation of BOP's, unless the well has not been completed, conduct a stump test of the BOP equipment, safety valve, pump manifold and lines to a low of 200 psi and a high of either; 2000 psi, the pressure rating of the production casing flange or the formation pressure, whichever is the greater.
- Upon installation of the BOP's ensure that the ring groove connection is pressure tested as above and that all BOP components are function tested as per regulations. Prior to starting other operations, such as Fracture, acidizing, wireline operations, etc., ensure that all equipment that has potential to be exposed to well pressure or that is used to control well pressure is pressure tested as above and/or in accordance with the contractor's specifications.
- All pressure tests are to be recorded in the Daily Tour Sheet as per regulations.

Vent Flow Test

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- Conduct a bubble test on the surface casing vent to check for flow. Fill out a Surface Casing Vent Flow / Gas Migration sheet and e-mail with the first morning report.

EMERGENCY RESPONSE PLAN

The Emergency Response Plan must contains telephone numbers of provincial regulatory agencies, emergency response agencies, company personnel, and on-site personnel who may need to be contacted in the event of an emergency. It also contains the legal site description and simple directions for the most efficient way.

Following are the procedures to be followed in the event of an emergency. It is the responsibility of every worker on site to familiarize themselves with these procedures and know their role within each one. It is the responsibility of the site consultant/operator to delegate these roles, and ensure that workers have an opportunity to practice them.

The goal is a safe and healthy worksite from start to finish. Should an emergency arise, a quick, well prepared response will give us our best chance for a positive outcome. Emergencies that could arise at this site are:

- Incidents which result in or could result in serious injury or loss of life; (Medical Emergency)
- Well blow-out or other emergencies related to drilling & field operations;
- H2S release;
- Major fire;
- Spill of a product or chemical which may be hazardous to health and/or property/environment;
- Acts of God such as a blizzard; and
- Bomb Threat.

EMERGENCY MEDICAL RESPONSE PROCEDURE

1. Assess the situation – is it safe to approach the victim? Note the time of incident.
2. First person on the scene contact or direct someone to contact site supervisor and emergency medical services.
   - Provide information about location of incident
   - Provide information on nature of injuries
   - Stay on the line with emergency services until they decide to end the call
3. Perform critical interventions (i.e. CPR/control massive hemorrhage)
4. Treat injuries to the best that training and available equipment allows
5. Do not leave the patient until another person with more advanced training arrives to take over.
6. Stand-by and be prepared to assist as necessary.
7. If patient can be moved (no suspected neck or spine injury) begin moving to more advanced medical aid only if necessary. Transport to hospital requires driver and attendant. Stay in contact with ambulance and transport patient until transfer can be made with ambulance.
8. If suspected neck or spine injury, move only if leaving patient would put them in greater danger (fire, chemical spill, etc.). Make every attempt to keep the head and neck as stable as possible.
9. If patient cannot be moved, wait for ambulance to arrive, keeping patient as comfortable as possible.
10. Monitor and record vital signs (including the time when the vital signs are taken) every five to ten minutes;

The on-site supervisor or a designate is responsible for all notifications. Under no circumstances should anyone notify or talk to either next-of-kin or the media in the event of an injury or accident.

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FIRE EMERGENCY PROCEDURE

1. Immediately shut off power, engines, and any fuel sources if safe to do so.
2. Move fuel sources away from fire if safe to do so
3. Have all non-essential personnel evacuate to muster point and assign someone to do a head count.
4. If the fire is controllable, use extinguisher to fight fire - if not call fire department and clear the area. Ensure the proper extinguisher is used depending on the fire.
5. Make notifications as per notification flow chart.

The on-site supervisor or a designate is responsible for all notifications. Under no circumstances should anyone notify or talk to either next-of-kin or the media in the event of an accident or injury.

SPILL OR RELEASE PROCEDURE

1. Identify product.
2. Clear area and make any local notifications if necessary to protect public health.
3. Make sure to get proper PPE. Check MSDS.
4. Control product flow.
5. Attempt to contain product. Divert from water courses if possible.
6. Lay out absorbent material.
7. Make notifications according to flow chart.

The on-site supervisor or a designate is responsible for all notifications. Under no circumstances should anyone notify or talk to either next-of-kin or the media in the event of an accident or injury.

H2S EMERGENCY PROCEDURE

In the event of an H2S release, it is imperative that the following seven step response strategy is followed in order. Remember, Hydrogen Sulphide can render you unconscious with one breath. The first step is always to get yourself to safety.

Seven Step Response Strategy:

1. Evacuate - Immediately move upwind (check on-site wind sock) if release is downwind of you or move crosswind if release is upwind of you. If possible, move to higher ground as H2S is heavier than air.
2. Assess - Do a head count and look for other hazards.
3. Alarm - Call for help by whatever means available ex. horn, radio, whistle, etc. Call or have someone call fire dept.
4. Protect - Must use an SCBA if a rescue is to be attempted. If no SCBA is available, do not attempt rescue - wait for fire dept.
5. Rescue - If SCBA is available, put on and retrieve victim. Move to a safe area.
6. Revive - Apply CPR if necessary.
7. Medical Aid - Arrange for transport of victim to nearest medical facility.

The on-site supervisor or a designate is responsible for all notifications. Under no circumstances should anyone notify or talk to either next-of-kin or the media.

EMERGENCY RESPONSE FOR STORM

1. During working hours the site supervisor is to monitor weather both visually and by radio or highway hotline.
2. If a weather warning is issued, the site supervisor must determine if the threat is imminent and decide on a course of action which may include: shutting down the site, securing equipment and structures that may be affected, or sending workers home in advance of storm if safe to do so.

3 If weather conditions do not permit travel, workers should go to wait out the storm. The site supervisor should gather any emergency equipment that may be needed.

4 Site supervisor or designate conduct a visual inspection of site to confirm all people have evacuated to safe area. Once all people are gathered, perform a head count and verify with signing sheet.

5 Site supervisor to advise Management of the situation, giving details of location, number of workers kept on site, and readiness for the storm. If possible, supervisor should periodically re-establish contact to keep management informed of conditions.

6 Once storm has passed, supervisor must assess site for any damage and determine the next course of action.

7 Workers are not to leave the site until the supervisor authorizes that it is safe to do so, based on most current weather broadcast. If possible recommend that workers travel in groups of at least 2 vehicles. If their vehicles do not have survival gear, they should be supplied with whatever is available from the site (to be returned later). They should also have a cell phone with them.

8 If stranded in vehicle, Do Not Leave The Vehicle. Stay in vehicle and wait for someone to come to you. Conserve fuel by only starting vehicle periodically.

RESPONSE TO A BOMB THREAT

1	Threat received by telephone:
	Respond as follows:
	A. Do not put caller on hold. Listen to them and do not interrupt.
	B. Remain as calm as you can.
	C. Note the time and write it down.
	D. Notify the supervisor/consultant if possible while you are on the phone.
	E. Stall any way you can. Ask questions such as:
	- Where is the bomb?
	- When will it go off?
	- What kind of bomb is it?
	- How do you know so much about the bomb?
	- Why are you doing this?
	- Did you put it there?
	- What is your name?
	F. As you are talking make written notes on such things as:
	- Male of female?
	- Accent? Mannerisms?
	- Approx. age?
	- Background noise, if any o Etc.
2	When you hang up, if you haven't yet notified the supervisor/consultant do so now.
3	Supervisor/consultant is to call R.C.M.P. Person who took the call should remain close as R.C.M.P. may want to talk to them.
4	Supervisor/consultant to decide whether or not to evacuate the site.

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MEDICAL INFORMATION FORM

Name:	Age:
Known Allergies:	
Known Medical Conditions:	
Relevant Medical History:	
Currently on the Following Medications:	
Emergency Contact:	

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EMERGENCY DRILL EVALUATION FORM

Was the drill treated as a real life incident	☐	Yes	☐	No
Were necessary notifications made?	☐	Yes	☐	No
IF NOT—What happened?				
Problems observed during the drill:				
Were the goals of the drill met?	☐	Yes	☐	No
IF NOT—Why were goals not met?				
Is a re-drill necessary at this time?	☐	Yes	☐	No

Date/Time of Drill: Location

Drill Scenario Summary:

Corrective Actions and Recommendations	Assigned to:	Date Completed:

EMERGENCY DRILL PLANNING FORM

Location of proposed practice drill:

Type of drill (circle all that apply):	Medical	Site Evacuation	Fire
	Natural Disaster	Haz Mat	Confined Space
	Rescue	Blow-Out	Other (specify)

Details of drill scenario:

Safety or Environmental Concerns about this scenario?

How have concerns been addressed?

Who are the intended victims of this drill (if any)?

What equipment will be needed?

What are the goals of the drill?

What Emergency Response Agencies will be involved?

Have Emergency Response Agencies, adjacent facilities and surrounding community been notified of drill in advance?

Media involved/notified?

Manager Comments:

Date/Time of proposed practice drill