UIC-1001

OCD UIC PROGRAM

Exempted Aquifer Documents

Materials Supporting Water Salinity in the West Bisti SWD #1 is Greater Than 10,000 PPM TDS

Dugan Production Corporation; In Support of Application for Disposal in Entrada Sandstone

dugan production corp.

Mr. William F. Carr
Holland and Hart LLP
110 North Guadalupe Street
Santa Fe, New Mexico 87501

January 12, 2009

RE: Materials supporting water salinity in the West Bisti SWD #1 is greater than 10,000 ppm TDS.

Dear Mr. Carr,

Dugan Production Corp. respectfully submits the following materials to support Entrada, formation water salinity in the West Bisti SWD #1 is greater than 10,000 ppm TDS. It is Dugan's belief that the water salinity is between 13,500 and 15,000 ppm TDS.

Entrada Sandstone – San Juan Basin Background

In the San Juan Basin of northwest New Mexico, the Entrada Sandstone is the best interval for salt water disposal available. Currently there are fifty-six Entrada salt water disposal wells in the San Juan Basin (Exhibit 1). Dugan Production Corp. is the operator of eight Entrada salt water disposal wells. Oil and gas operators, private land owners, grazing permitees, municipalities and the governing regulatory agencies prefer the Entrada as a salt water disposal zone over all other intervals in the basin for the following reasons:

1) Depth: the Entrada is deep. In the oil and gas productive part of the basin the interval ranges from 5,000 feet to over 8,000 feet in depth and underlies much shallower sandstone intervals in the Cliff House, Menefee, Point Lookout and Dakota that may have fresh water (Cliff House and Menefee) or natural gas and oil production.

2) Lithology: the Entrada is a thick (150-250 feet) windblown deposit of clean, well sorted sandstone with very good porosity (17-20 %), transmissivity (50 – 350 ft^2/d) (Stone, 1983), permeability (293 – 665 millidarcies) (Fassett and others 1978 and 1983) and no interstitial clay or cement matrix. The interval lacks shale, is very homogenous across large areas of the basin and is capable of storing large volumes of water. The Todilto limestone / anhydrite interval acts as an effective seal on top of the interval and prevents vertical migration of injected fluids.

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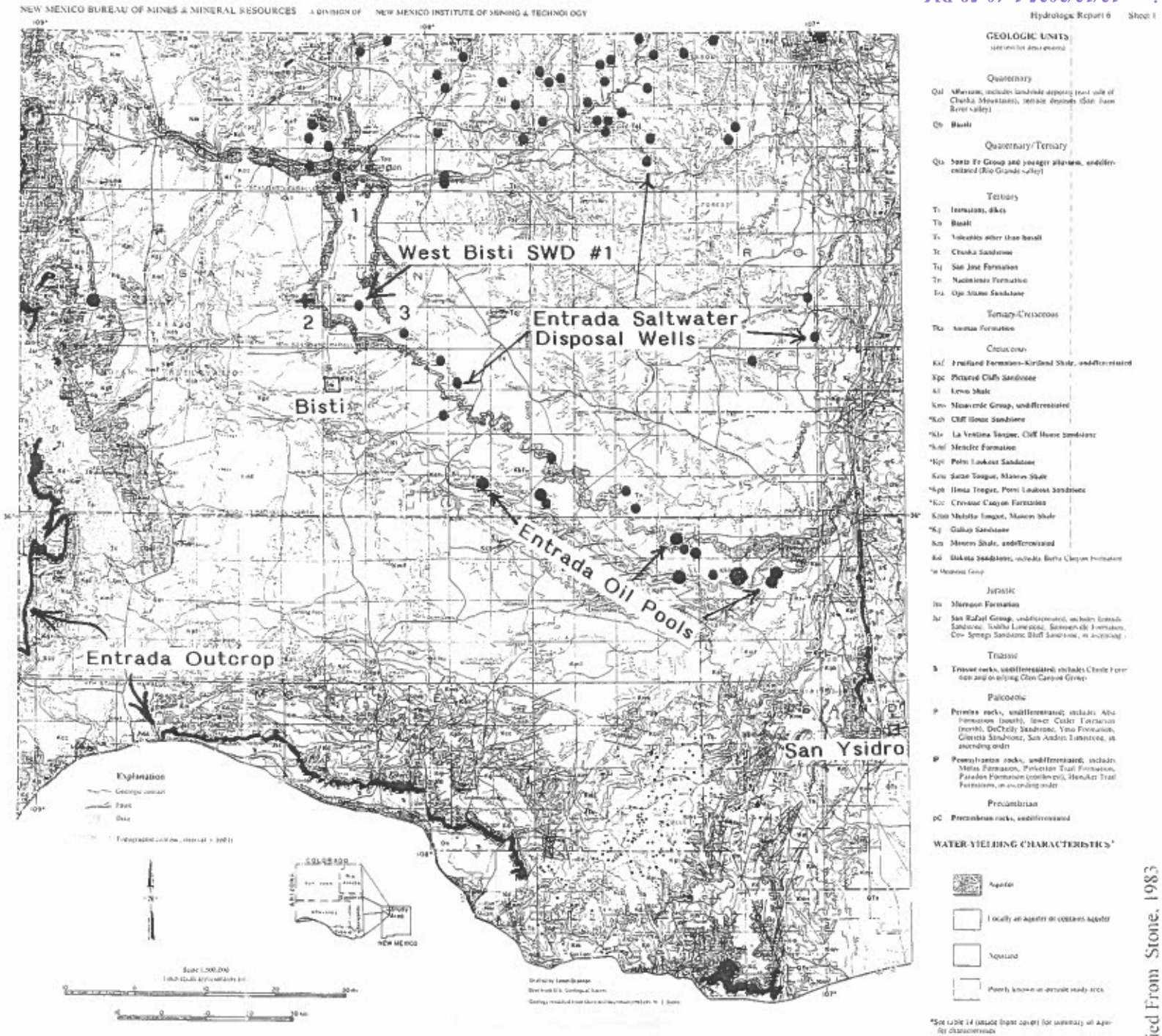
EXHIBIT 1.



Hydrogeologic map of the San Juan Basin, New Mexico

Modified From Stone, 1983

● Entrada Salt Water Disposal Wells (NMOCD Well File Database).

● Entrada Oil and Gas Pools (Fassett and others, 1978 and 1983).

1-3 Open-hole Electric Logs Used in M.Mullen's Water Analysis Study.

3) Water quality: at depths greater than 5,000-feet the specific conductance of the Entrada is greater than 10,000 µmhos. In an elongated area between Bisti (very close to the West Bisti SWD #1) and San Ysidro. there are several oil fields that produce large quantities of water with oil from the Entrada interval (Vincelette and Chittum, 1981). Following separation and recovery of the oil, the water is disposed of by re-injecting back into the Entrada. The produced water has a specific conductance of between 10,000 and 20,000 µmhos (Stone and others, 1983). Drill stem tests, mud-log shows and water analysis reports show the Entrada water is contaminated with oil basin-wide (Vincelette and Chittum. 1981. Stone and others. 1983. Fassett and others 1978 and 1983 and operator's files). Also, there are significant amounts of oil produced with water at the outcrop on the west edge of the basin and near the recharge area (Navajo Oil Co., Raymond #1).

4) Lack of beneficial use: the Entrada water is not used for domestic, live-stock, agricultural or industrial purposes and has no beneficial use in the San Juan Basin of northwest, New Mexico.

Dugan Production Corp. – Entrada Sandstone Background

Dugan Production Corp. operates eight Entrada salt water disposal wells in the San Juan Basin. Seven have been drilled and completed (including the West Bisti SWD #1) and one is pending. The Dugan wells are located 60-miles apart and trend from the southeast near Counselors, New Mexico along the Chaco Slope to Kirtland, New Mexico on the northwest margin of the San Juan Basin.

In the Dugan wells, the Entrada Sandstone is a thick, unconsolidated sand interval with very good porosity and permeability capable of producing large amounts of water, oil and gas and susceptible to invasion while drilling by large volumes of drilling mud. Well-bore stability can be a problem because the formation is deep (6,400-7,500 feet) and over-pressured / artesian, the sands are unconsolidated and the overlying shale's are water sensitive (susceptible to sloughing). Also, the overlying Todilto anhydrite ($Ca SO_4$) is soluble, goes into solution and can collapse (destroying the seal on top of the injection interval) behind the pipe and / or precipitate scale, plugging the perforations and tubing.

The most effective means to minimize the problems cited above are to monitor the well-bore continuously with an onsite mud-logging unit and follow a strict mud program designed to handle all formation problems encountered while drilling (with 24-hour supervision). During completion operations it is important to minimize the flow back of water. The longer the well is allowed to flow back, the more sand flow back, well-bore collapse and scale build up can occur.

To maintain safe working conditions and maintain well-bore stability, the following drilling precautions are used:

1) Detailed mud-logging while drilling – used to identify formation tops, lithology and possible productive zones and provide advance warning of zones with poor hole stability, lost circulation and blow out potential. The Entrada is productive of oil and gas in the areas drilled. Minor hydrocarbon shows were recorded in four of the Dugan wells and one well produced a show of oil on the drilling reserve pit. The detailed mud log is used in place of open-hole logs, when well-bore stability problems are apparent.

2) Fresh water-based, gelled mud drilling program – required to maintain well-bore stability and prevent an uncontrolled blow-out. Program design (Exhibit 2) is to keep chlorides between 7,000 and 7,500 ppm (high enough to stabilize water sensitive shale and low enough to maintain high viscosity with gel), viscosity 50-60 cp (to ensure proper cleaning of cuttings from the well-bore), mud weight 9.5#/gal. (or greater as needed to control water flows and gas kicks from the Entrada and shallower formations), water loss 12.0 cc/30-min. (to prevent swelling of shale) and pre-treat mud with lost circulation material before drilling into permeable zones (minimize invasion of drilling mud into formation). A higher chloride level might be more effective at stabilizing the overlying anhydrite layers but makes it more difficult to elevate the viscosity to the adequate level necessary to ensure proper cleaning of cuttings from the well-bore.

WesVan Mud & Chemical Co.

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08-20-08

EXHIBIT 2.

COMPANY: DUGAN PRODUCTION CORP.

ATTENTION: KURT FAGRELIUS

WELL: WEST BISTI UNIT #1 SWD

LOCATION: 36, 26 N - 13 W
SAN JUAN CO., NM

PREPARED BY: ARNOLD VAN NOY

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08-20-08

EXHIBIT 2 Continued.

DUGAN PRODUCTION CORP.

West Bisti Unit #1 SWD

DRILLING FLUIDS RECAP

11-23-08	Move in.
11-24-08	Finish moving in - drill surface at 100' - vis 60, wt 8.4, chlorides 10,000 ppm. Use production water from storage tanks next to location. Chloride 10,000 ppm, Calcium 240 ppm.
11-25-08	Set 9 5/8 @ 478' - W.O.C.
11-26-08	Nipple up - test - drill cement with water to reserve pit. Mud up while drilling.
11-27-08	Drill ok 1260' - Vis 35, Wt 8.8, WL 12.0, PH 11.0, chloride 10,000 ppm. Use production water in reserve pit for mud. Lost @ 50 barrels mud seeping away while drilling @ 1100'.
11-28-08	Drill ok 1950' - Vis 43, Wt 8.9, WL 11.2, PH 10.0, chloride 10,000ppm.
11-29-08	Drill ok 3170' - Vis 40, Wt 9.2, WL 12.8, PH 9.0, chloride 8200 ppm. Use some water from rig tank - water from Hilltop store - chlorides 400 ppm.
11-30-08	Drill 4132' - Vis 41, Wt 9.2, WL 12.0, PH 9.0, chlorides 8000 ppm.
12-01-08	Drill 4915' -Vis 45, Wt 9.5, WL 12.0, PH 9.0, chlorides 7800 ppm.
12-02-08	Drill 5590' - Vis 48, Wt 9.4, WL 11.8, PH 9.0, chlorides 7600 ppm.
12-03-08	Drill ok 6070' - Vis 43, wt 9.4, WL 12.0, PH 9.5, chlorides 7400 ppm.
12-04-08	Drill ok 6490' - Vis 51,Wt 9.4, WL 12.0, PH 9.5, chlorides 7400 ppm
12-05-08	Drill ok 7220' - Vis 61, Wt 9.5, WL 12.0, PH 10.5, chlorides 7200 ppm.
12-06-08	Circulate @ T.D. 7250' - Vis 100, Wt 9.5, WL 12.6, Ph 10.0, chlorides 7000 ppm. Trip to casing - circulate to run casing - no logs.
12-07-08	Lay down drill pipe - run 5½" casing ok - cement 1st stage ok. Circulate - mud ok.
12-08-08	Cement 2nd and 3rd stages - ok. Move to Aztec yard.

WesVan Mud & Chemical Co

Ronald VanDyke

av/ve

During completion operations the well bore is difficult to maintain because the wells flow back water, large amounts of unconsolidated formation sand and thick scale builds up across casing perforations and on the internal walls of production tubing. If left uncontrolled, flow-back of formation sand and scale build up could cause irreversible damage and possible loss of the injection interval. To maintain safe working conditions and maintain well-bore stability, the following completion precautions are used:

1) Cement casing in three stages to insure adequate bonding between casing and formation and proper isolation of different zones.
2) Install properly designed pressure control equipment that is in good working condition.
3) Drill out stage tools with fresh water.
4) Clean out excess debris and cement from bottom of well-bore by circulating with fresh water.
5) Run cased-hole GR-CCL-CNL and CBL logs; evaluate quality of cement bonding between casing and isolation of different zones. Evaluate and perforate the Entrada injection interval.
6) Flow well back for the least possible amount of time needed to recover uncontaminated formation water for analysis. The amount of time available for flow back is minimized due to concerns with flow back of formation sand, and scale buildup. Depending on the volume and depth of invasion of fresh water mud during drilling and cementing operations, it may not be physically possible to flow the well back for a long enough period of time to get a sample of uncontaminated formation water for analysis.

Although Dugan takes every precaution to insure safe working conditions and maintain well-bore stability, the following problems were encountered while drilling and completing seven Entrada salt water disposal wells:

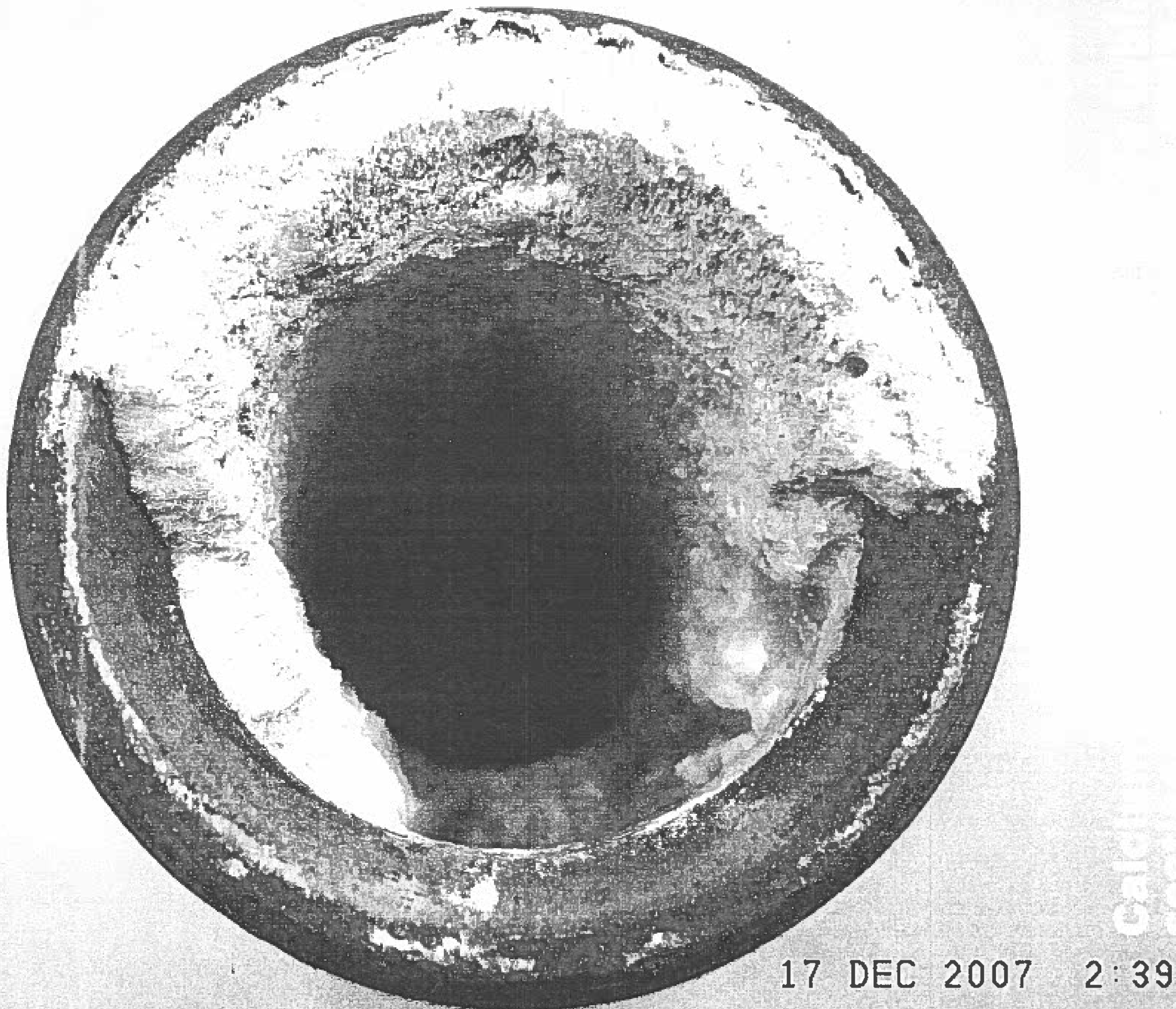
1) Four were artesian and had initial flow rates of 40-80 Bls/hour (that dropped to 20-40 Bls/hour after approximately 8-10 hours of flow back time) the other 3-wells maintained fluid levels between 100-300 feet below the surface. All water that flows back has to be trucked because the existing reserve pits are normally full to capacity at this time in the drilling and completion program.

2) Three flowed unconsolidated sand into the wellbore. The worst took three days to clean up (+200-feet of sand) before the well-bore stabilized. The sand has to be cleaned out of the well-bore and the formation behind the casing has to be stabilized to prevent continual flow of sand into the well-bore and collapse of the overlying shale and anhydrite into the injection interval and close to the well-bore.

3) Four wells developed a thick scale of $CaSO_4$ (1/4 – ½ inches thick) across the perforated interval and on the seating nipple. packer and inside of the tubing. On two wells. the scale coated (3/8 inches thick) the inside of the tubing for 900-1,000 feet from the bottom up. The anhydrite goes into solution when exposed to water that is fresher than formation water and then transported in solution and precipitated as a thick scale as the pressure drops across the perforations, seating nipple, packer and inside the tubing (Exhibit 3 and 4).

Sulfate precipitate inside tubing /
nipple, Sponge Bob SWD #1.

EXHIBIT 4.



Dugan Production Corp. – West Bisti SWD #1 Background

The West Bisti SWD #1 is located on split estate lands (Navajo Trust surface / Federal minerals) in Block 9 of the Navajo Indian Irrigation Project.

The Application for Permit to Drill the Dugan Production Corp. West Bisti SWD #1 was approved by the Navajo Nation, Bureau of Indian Affairs and Bureau of Land Management on 8-15-2007. The State of New Mexico application for produced water disposal was approved by the New Mexico Energy, Minerals and Natural Resources Department (SWD-1072) on 2-21-2007. The Authorization to Operate and Inject (UIC Permit NN 17) was approved by the Navajo Nation Environmental Protection Agency on 9-25-2007. Authorization to Operate and Inject in the West Bisti SWD #1 was approved by the U.S. Environmental Protection Agency, Region IX (NN207000003) on 11-2-2007.

The location of the West Bisti SWD #1 disposal well posed several drilling problems that were addressed in meetings with Dugan personnel, drilling contractors, mud engineers and mud loggers prior to spudding. The following issues were addressed:

1) Well is located within Basin Fruitland Coal pool, there are numerous producing wells in the immediate vicinity of the West Bisti SWD #1. There were concerns about losing mud into the fractured coals and damaging the formation while drilling the interval at 1180-1220 feet.

2) The Cliff House and parts of the Menefee interval from 1962 – 2700 feet are considered fresh water zones and needed to be protected from drilling and disposal fluids. There are water supply wells that provide water for the Bisti Gallup water flood in the immediate vicinity. Large volumes of water have been produced from the Cliff House / Menefee interval in the area, it is under pressured and susceptible to invasion by drilling mud and injection fluids.

3) The well is located within the Bisti Gallup Oil pool, there are many Gallup oil producing and water disposal wells in the immediate vicinity. There were concerns about encountering a strong oil and water flow from the Tocito sands in the Gallup Formation while drilling through the interval at 4900 – 4950. The interval has produced oil since the mid 1950's. It was converted to water flood in October of 1960 and has 1,000 psi of surface pressure on it. To prevent a blow out situation, the over pressured interval would have to be contained while drilling through it and carefully monitored for containment while drilling the rest of the well-bore.

4) Lost circulation of drilling mud into the Fruitland Coal (1180-feet), Dakota (5691-feet), Morrison (5924-feet), Bluff (6494-feet) and the Entrada Sandstone (6878-7064 feet) would have to be closely monitored in order to prevent a fluid drop in the well-bore which could result in a blow out from the Tocito, Entrada or other over pressured interval.

Following approval of all required permits, the Dugan Production Corp. West Bisti SWD #1 was spud on November 24, 2007. The well was drilled to total depth 7,250-feet on December 7, 2007. The well-bore was circulated with fresh water, 5-1/2" casing was set at 7,208' and cemented in 3-stages using 1654 cu ft of cement. Fresh water and mud flush were pumped ahead of each cement stage and each stage was displaced with fresh water and mud. Based on Dugan's past experience and specific concerns it had with the Entrada in this area, completion activities were conducted as follows:

1-17-2008 - Completion rig was moved in to drill out the stage tools and the well-bore was cleaned out to 7,116-feet.

1-23-2008 - GR-CCL-CNL and CBL cased-hole logs were run and the Entrada Sandstone was perforated from 6,878 to 7,064 feet below the surface. A total of 186-feet was perforated with 191-holes using 5-gun runs over a period of 4-1/2 hours. Three hours into the job, the well began to flow water at the surface. The 2" flow was diverted to a steel, open top tank and filled it (85-Bls) in one hour. The flow was then diverted to the drilling reserve pit for the remaining 1-1/2 hours of the perforating. The rate dropped to a 1" flow by the end of the job (estimated to be about 40-Bls per hour) (total water recovered to date 156-Bls). First water sample (6,065 ppm TDS) was taken at this time, before shutting the well in.

1-24-2008 - Tubing and a packer were run in the well-bore. The well was open for 5-1/2 hours and flowed a 1" stream of water at the start decreasing to a ¾" stream at the end (total water recovered 193-Bls, cumulative to date 349-Bls). Second water sample (9,210 ppm TDS) was taken at this time, before shutting the well in.

1-25-2008 - Well was acidized with 48-Bls 15% HCL, 80-Bls water and 200-ball sealers. Well flowed back 2-hours and died, then made 15-swab runs (total fluid injected 128-Bls, total fluid recovered 100-Bls, cumulative to date 321-Bls)

1-28-2008 - Made 5-swab runs and well started flowing. Tripped out of well-bore with work string of tubing. The seating nipple, packer and bottom 30-joints had heavy scale ($CaSO_4$) build up (approximately 3/8" – ½" thick) on the inside of tubing (total fluid recovered 200-Bls, cumulative to date 521-Bls). Third water sample (14,700 ppm TDS) was taken at this time, before shutting the well in.

1-30-2008 - Internally, plastic coated injection tubing and packer were run and set (packer set at 6809', end of tubing at 6815' and top perforation at 6878-feet.

2-1-2008 - Performed mechanical integrity test, passed (witnessed by NMOCD).

2-13-2008 - Performed mechanical integrity test, passed (witnessed by USEPA).

2-21-2008 - Injection commenced.

4- 4-2008 - Ran pressure falloff test.

4-7-2008 - Re-run cement bond log (witnessed by USEPA).

4-8-2008 - Re-run tubing and packer and run mechanical integrity test, passed (witnessed by NEPA and NMOCD). Returned well to injection at end of test.

9-18-2008 – Operator shut well in and has not returned to injection as of this time.

Dugan Production Corp. – Water Analysis of the West Bisti SWD #1

Three water analyses were taken on the West Bisti SWD #1 and are as follows:

1) 6,000 ppm TDS – Taken 2-1/2 hours after initial flow started (2" flow of 85-Bls / hour decreased to 1" flow of 40-Bls / hour after 2-1/2 hours. average 62.5-Bls / hour, times 2.5 hours equals 156-Bls total fluid recovered) (Exhibit 5).

2) 9,210 ppm TDS – Taken 5-1/2 hours after well was opened the following day (1" flow of 40-Bls / hour decreased to ¾" flow of 30-Bls / hour, average 35-Bls / hour, times 5.5 hours equals 193 Bls fluid, 349-Bls total fluid recovered to date) (Exhibit 6).

3) 14,700 ppm TDS – Taken following acid treatment and after the well had been swabbed and flowed back (128-Bls acid and water injected, 300-Bls of fluid recovered, 521-Bls total fluid recovered to date) (Exhibit 7).

Sample # / ppm TDS	Bls Fluid Recovered	X	Conversion Factor	=	Cubic Feet	/	Interval Thickness	X	Porosity	=	Square Feet	=	π	r^2 ft	Then r = x feet
1 6,000	156 bls	X	5.6146	=	876	/	188	X	0.2	=	23.3	=	3.1416	7.42	2.7
2 9,210	156 + 193 = 349 bls	X	5.6146	=	1959.5	/	188	X	0.2	=	52.1	=	3.1416	16.6	4.1
3 14,700	156 + 193 - 128 + 300 = 521 bls	X	5.6146	=	2925.2	/	188	X	0.2	=	77.8	=	3.1416	24.8	5.0

The three water samples are not representative of Entrada formation water at the West Bisti SWD #1 location. The Entrada is a homogenous, thick (188-ft.), porous (17-20 %) interval with excellent permeability (293-665 millidarcies) that is highly susceptible to invasion by fresh drilling fluids. The samples tested were influenced by fresh water that invaded the near well-bore area during drilling and cementing operations. The relatively small volumes of water recovered prior to each sample being taken came from a very small drainage radius around the well-bore (see the chart above). Sample 1 was taken after only 156-Bls of total fluid had been recovered from the injection interval (drainage radius 2.7-feet). Sample 2 was taken after only 349-Bls of total fluid had been recovered from the injection interval (drainage radius 4.1-feet). Sample 3 was taken after only 521-Bls of total fluid had been recovered from the injection interval (drainage radius 5.0-feet). The pH on the third sample was 3.25, indicating the well had not flowed back long enough to clean the residual acid out of the formation. The volumes of water recovered when the well was flowing back and during swabbing operations are reported in the operator's internal daily reports and are available for review upon request.

Dugan Production was aware that the samples were contaminated with fresh water. The analysis were not representative of true formation water and did not meet the > 10,000 ppm TDS requirement of the USEPA, NEPA and NMOCD. However, Dugan was having well-bore stability problems. Along with the flow of water and formation sand into the well-bore, thick accumulations of $CaSO_4$ scale (3/8 – ½ inches thick) had built up

West Bisti SWD #1

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CATION / ANION ANALYSIS

EXHIBIT 5

Client:	Dugan Prod. Corp	Project #:	06094-003
Sample ID:	SWD #1	Date Reported:	01-28-08
Laboratory Number:	44113	Date Sampled:	01-23-08
Chain of Custody:	3016	Date Received:	01-24-08
Sample Matrix:	Water	Date Extracted:	N/A
Preservative:	Cool	Date Analyzed:	01-25-08
Condition:	Intact		

Parameter	Analytical Result	Units		
pH	11.56	s.u.		
Conductivity @ 25° C	11,200	umhos/cm		
Total Dissolved Solids @ 180C	6,000	mg/L		
Total Dissolved Solids (Calc)	6,065	mg/L		
SAR	58.0	ratio		
Total Alkalinity as CaCO3	439	mg/L		
Total Hardness as CaCO3	290	mg/L		
Bicarbonate as HCO3	<0.1	mg/L	0.00	meq/L
Carbonate as CO3	439	mg/L	14.63	meq/L
Hydroxide as OH	<0.1	mg/L	0.00	meq/L
Nitrate Nitrogen	<0.1	mg/L	0.00	meq/L
Nitrite Nitrogen	0.012	mg/L	0.00	meq/L
Chloride	3,000	mg/L	84.63	meq/L
Fluoride	0.53	mg/L	0.03	meq/L
Phosphate	0.2	mg/L	0.01	meq/L
Sulfate	340	mg/L	7.08	meq/L
Iron	0.297	mg/L	0.01	meq/L
Calcium	116	mg/L	5.79	meq/L
Magnesium	<0.1	mg/L	0.00	meq/L
Potassium	70.5	mg/L	1.80	meq/L
Sodium	2,270	mg/L	98.75	meq/L
Cations			106.34	meq/L
Anions			106.38	meq/L
Cation/Anion Difference			0.04%	

Reference: U.S.E.P.A., 600/4-79-020, "Methods for Chemical Analysis of Water and Wastes", 1983.
Standard Methods For The Examination of Water And Waste Water", 18th ed., 1992.

Comments: West Bisti SWD #1.

Analyst

Review

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ENVIROTECH LABS

PRACTICAL SOLUTIONS FOR A BETTER TOMORROW

CATION / ANION ANALYSIS

EXHIBIT 6.

Client:	Dugan Prod.	Project #:	06094-003
Sample ID:	Before Frac	Date Reported:	01-31-08
Laboratory Number:	44149	Date Sampled:	01-25-08
Chain of Custody:	3849	Date Received:	01-30-08
Sample Matrix:	Water	Date Extracted:	N/A
Preservative:	Cool	Date Analyzed:	01-30-08
Condition:	Intact		

Parameter	Analytical Result	Units		
pH	7.85	s.u.		
Conductivity @ 25° C	17,500	umhos/cm		
Total Dissolved Solids @ 180C	9,210	mg/L		
Total Dissolved Solids (Calc)	9,149	mg/L		
SAR	49.2	ratio		
Total Alkalinity as CaCO3	164	mg/L		
Total Hardness as CaCO3	600	mg/L		
Bicarbonate as HCO3	164	mg/L	2.69	meq/L
Carbonate as CO3	<0.1	mg/L	0.00	meq/L
Hydroxide as OH	<0.1	mg/L	0.00	meq/L
Nitrate Nitrogen	<0.1	mg/L	0.00	meq/L
Nitrite Nitrogen	0.002	mg/L	0.00	meq/L
Chloride	660	mg/L	18.62	meq/L
Fluoride	7.70	mg/L	0.41	meq/L
Phosphate	0.5	mg/L	0.02	meq/L
Sulfate	5,350	mg/L	111.39	meq/L
Iron	1.003	mg/L	0.04	meq/L
Calcium	240.0	mg/L	11.98	meq/L
Magnesium	<0.1	mg/L	0.00	meq/L
Potassium	19.9	mg/L	0.51	meq/L
Sodium	2,770	mg/L	120.50	meq/L
Cations			132.98	meq/L
Anions			133.11	meq/L
Cation/Anion Difference			0.10%	

Reference: U.S.E.P.A., 600/4-79-020, "Methods for Chemical Analysis of Water and Wastes", 1983.
Standard Methods For The Examination of Water And Waste Water", 18th ed., 1992.

Comments: **Bisti SWD #1.**

Analyst

Review

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ENVIROTECH LABS

PRACTICAL SOLUTIONS FOR A BETTER TOMORROW

CATION / ANION ANALYSIS

EXHIBIT 7.

Client:	Dugan Prod.	Project #:	06094-003
Sample ID:	After Frac	Date Reported:	01-31-08
Laboratory Number:	44150	Date Sampled:	01-28-08
Chain of Custody:	3849	Date Received:	01-30-08
Sample Matrix:	Water	Date Extracted:	N/A
Preservative:	Cool	Date Analyzed:	01-30-08
Condition:	Intact		

Parameter	Analytical Result	Units
pH	3.25	s.u.
Conductivity @ 25° C	29,000	umhos/cm
Total Dissolved Solids @ 180C	14,700	mg/L
Total Dissolved Solids (Calc)	14,623	mg/L
SAR	14.8	ratio
Total Alkalinity as CaCO3	<0.1	mg/L
Total Hardness as CaCO3	6,560	mg/L

Bicarbonate as HCO3	<0.1	mg/L	0.00	meq/L
Carbonate as CO3	<0.1	mg/L	0.00	meq/L
Hydroxide as OH	<0.1	mg/L	0.00	meq/L
Nitrate Nitrogen	0.1	mg/L	0.00	meq/L
Nitrite Nitrogen	0.092	mg/L	0.00	meq/L
Chloride	7,100	mg/L	200.29	meq/L
Fluoride	1.35	mg/L	0.07	meq/L
Phosphate	27.6	mg/L	0.87	meq/L
Sulfate	2,450	mg/L	51.01	meq/L
Iron	494	mg/L	17.69	meq/L
Calcium	1,670	mg/L	83.33	meq/L
Magnesium	581	mg/L	47.81	meq/L
Potassium	31.4	mg/L	0.80	meq/L
Sodium	2,760	mg/L	120.06	meq/L

Cations	252.01	meq/L
Anions	252.25	meq/L
Cation/Anion Difference	0.10%	

Reference: U.S.E.P.A., 600/4-79-020, "Methods for Chemical Analysis of Water and Wastes", 1983.
Standard Methods For The Examination of Water And Waste Water", 18th ed., 1992.

Comments: Bisti SWD #1.

Analyst

Review

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across the perforated interval and inside the tubing. If the dissolution and precipitation of $CaSO_4$ were allowed to continue, the integrity of the overlying seal (12-feet of Todilto anhydrite) would have been compromised. The seal could collapse which would allow injection fluids to migrate vertically above and out of the permitted injection interval. Continued precipitation of $CaSO_4$ across the perforated interval and inside tubing could have caused irreversible damage to the well. In order to insure safe working conditions and maintain well-bore stability, the decision was made to discontinue flowing back water from the West Bisti SWD #1.

Dugan has two water samples that tested between 9,210 and 14.710 ppm TDS (one compromised by contamination with fresh drilling mud and the other compromised by contamination with spent acid) that indicate true formation water is > 10,000 ppm TDS in the well. Water data from other operator's well files, regulatory agencies data-base sets, published literature and a detailed water analysis performed by Mr. Mike Mullen (well known and respected, well-log analyst) (Exhibit 8) further support this conclusion.

Mr. Mullen conducted a detailed water analysis from electric open-hole logs on three wells that are very close to the West Bisti SWD #1 (Exhibit 9). Two of the wells are active, Entrada salt water disposal wells (Carson WDW #242, located 6-miles to the east and the Central Basin SWD #1, located 15-miles north) and the third (Navajo "O" #1, located 6-miles west) is an old, plugged and abandoned, oil and gas test well drilled through the Entrada to the "basement".

Mr. Mullen used three different methods (SP, RWA and Picket Plot) to determine water resistivity which was then converted to equivalent salinity in PPM of NaCl. Traditionally, the RWA and Picket Plot are the preferred methods because they are not affected by the invasion of fresh drilling fluid like the SP method is. When using the SP method, the invasion of fresh drilling fluid (a common occurrence in the thick, porous and permeable Entrada Sandstone) gives an invalid indication of lower water salinity. Using both the RWA and Picket Plot methods, Mr. Mullen has shown that the water salinity in the Entrada ranges from 13,500 to 15,000 ppm TDS and that there is very little variation in salinity between the wells.

The West Bisti SWD #1 is located in close proximity and between two of the wells in the study. Water salinity is greater than 10,000 ppm TDS in both wells and there is very little variation in salinity between the wells (13,500 – 15,000 ppm TDS). It is reasonable to conclude that the water salinity in the West Bisti SWD #1 is greater than 10,000 ppm TDS and that it falls somewhere between 13,500 and 15,000 ppm TDS.

Very Sincerely,

Kurt Fagrelius

Kurt Fagrelius
Vice President, Exploration
Dugan Production Corp.

Michael J. Mullen – Biographical Information

Contact Information:
7356 S. Ogden Way
Centennial, CO 80122
mnmullen@comcast.net
Home Phone: 303-347-8552

Education:
BS in Electrical Engineering, 1976 – University of Missouri-Rolla

Registered Professional Engineer:
New Mexico Number 10699
Colorado Number 39264

Personal History

Mike Mullen is a Principle Technical Professional specializing in the integration of petrophysics, reservoir simulation and economic stimulation design with Halliburton Energy Services in Denver, CO. He graduated from the University of Missouri - Rolla in 1976 with a BS degree in Electrical Engineering. Mike began his career as a logging field engineer in Hobbs, NM in 1976 and has held positions in technical support, sales and formation evaluation over the past 31 years. He has work experience throughout the Rocky Mountains, Southeast New Mexico, Oklahoma, Australia and the CIS. He has authored several papers concerning Economic Stimulation Design, Coalbed Methane, Unconventional Reservoir Formation Analysis and Production Log analysis.

Mike is a member of SPE and SPWLA.

Current Technical Position

Mike is currently working for Halliburton Energy Services as a Technical Professional Manager. He oversees a team that integrates well log analysis, stimulation and production for various basins in the Rocky Mountains to identify the optimum stimulation treatments for a given area as a continuous process. He is also the author of the StimLOG Petrophysical model which is used to evaluate well logs for the hydrocarbon potential from the conventional reservoir, coal, and organic rich shale. He also initiated the SwiftSIGMA model which utilizes the calibrated well log analysis data to generate consistent hydraulic stimulation designs and decline curve forecasting to reliably monitor the effectiveness of changes in the stimulation treatment design in the quest for the most economic and effective stimulation treatments.

Mike is one of the original members of Halliburton's North America Shale Team. As part of this team he developed Halliburton's Petrophysical model for organic rich shale, ShaleLOG, and consulted on numerous shale projects throughout the world. He has also given numerous presentations at industry conferences and forums on the subject of the analysis and classification of unconventional resource plays throughout the country.

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EXHIBIT 9.

Kurt Fagreulas
Dugan Production
Farmington, NM

The determination of water salinity in the Entrada formation in the Carson WDW 242, Navajo "O" #1 and the Central Basin SWD #1 wells using wireline log data .

Kurt,

Attached please find our report on the determination of water salinity using wireline log data for three wells in Rio Arriba County

Sincerely,

Mike J Mullen, P.E

Mike Mullen
Technical Professional Manager - Denver Solution Team
Registered PE in NM and CO
Halliburton Energy Services
Denver, CO
303-899-4762

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Denver, CO 80202

The determination of water salinity in the Entrada formation in the Carson WDW 242, Navajo "O" #1 and the Central Basin SWD #1 wells using wireline log data

Objective: To determine the water salinity in the Entrada formation in three wells in the San Juan Basin

Methodology: Three methods using wireline logs were used to determine the the water resistivity which was converted to equivilant salinity in PPM of NaCl.

1. SP method – to use this method the magnitude of the spontaneous potential (SP) from the shale baseline and the resistivity of the mud filtrate (Rmf) was obtained from the log header. The Rmf is then adjusted for temperature effects using Chart Gen 5. Chart SP-4 is used to determine the resistivity of the formation water using Rmf and SP deflection from the log.
2. RWA method – the Rwa method is derived from the standard Archie water saturation equation

   Water Saturation = (aRW/POROSITY^2 *RT)^.5
   If we assume zone is totally water saturated, the POROSITY^2 * RT is equal to aRW. For most reservoirs, a = 1, therefore an approximate value of RW is determined as the product of POROSITY^2 * RT

3. Pickett Plot Method – The Pickett Plot is a graphical solution to the Archie water waturation equation.

Termanology – Log analysis often uses unfamiliar abbreviations from the rest of the petroleum industry. Please refer to Chart Gen 5 for a listing of these abbreviations and their meaning.

Data Available

The data available for this project consisted of digital LAS file for the logs on the Carson WDW #242 and TIFF images of the raw logs for the Navajo "O" #1 and the Central Basin SWD #1.

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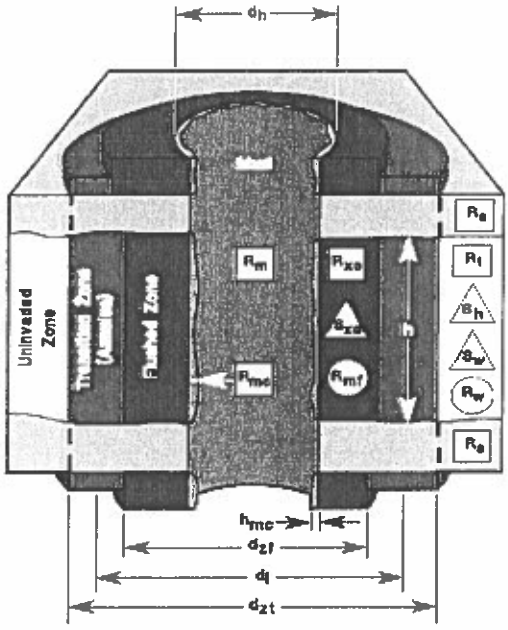
Borehole Diagram with Interpretation Symbols

Open Hole



h : Bed Thickness	S_h : Hydrocarbon Saturation	R_m : Mud Resistivity
h_{mc} : Mudcake Thickness	S_w : Water Saturation	R_{mc} : Mudcake Resistivity
d_i : Diameter of Invasion (step profile)	S_{xo} : Flushed Zone Water Saturation	R_{mf} : Mud Filtrate Resistivity
d_h : Borehole Diameter	S_{hr} : Residual Hydrocarbon Saturation	R_a : Adjacent Bed Resistivity
d_{zf} : Diameter of Flushed Zone		R_t : True Resistivity
d_{zt} : Diameter of Transition Zone		R_{xo} : Flushed Zone Resistivity
		R_w : Formation Water Resistivity

GEN-1a

Figure 1 Chart GEN 1A, Halliburton Log Analysis Charts, 1994

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Data Table of Results

		Central Basin SWD #1 Sec 9-28N-13W Unit Letter "N"	Navajo "O" #1 Sec 34-26N-14W Unit Letter "N"	Carson WDW #242 Sec 24-25N-12W Unit Letter "C"
Entrada Depth	From	7415	6890	6900
	To	7586	7020	7070
RT Average	Ohm	4	4	3.3
Porosity Average	PCT	20%	20%	26%
SP Deflection	mV	-18 mV	-15 mV	-29 mV
Rmf	Ohm	0.64	1.9	3.18
Rmf Temp	Deg F	100	64	65
Formation Temp	Deg F	165	152	151
Rmf at FT	Ohm	0.39	0.80	1.37
Rwa SP	Ohm	0.19	0.44	0.58
Rwa Archie	Ohm	0.16	0.16	0.22
Rwa Pickett	Ohm	0.22	0.22	0.25
Salinity by SP	ppm NaCl	13,500	5,800	5,000
Salinity by Arichie	ppm NaCl	17,500	18,000	14,000
Salinity by Pickett	ppm NaCl	14,500	15,000	13,500
Most Likely Salinity	ppm NaCl	14,500	15,000	13,500
Upper Range of Salinity	ppm NaCl	17,500	18,000	14,000

Discussion of Results

The determination of Rw from wireline logs have traditionally been performed using the Rwa Archie or Rwa Pickett methods. The SP method is often effected by low permeability and most likely in this case, by invasion of the fresh drilling fluid due to the high permeability in the Entrada. The invasion effect gives an indication of lower formation water salinity. Therefore, I think the most probable case for salinity in this interval is within the range of salinity highlighted above. The salinity of the formation waters in these three wells are very similar in their equivilent NaCl ppm.

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Supporting Analysis Plots

The following plots are the base data for the table on page 4

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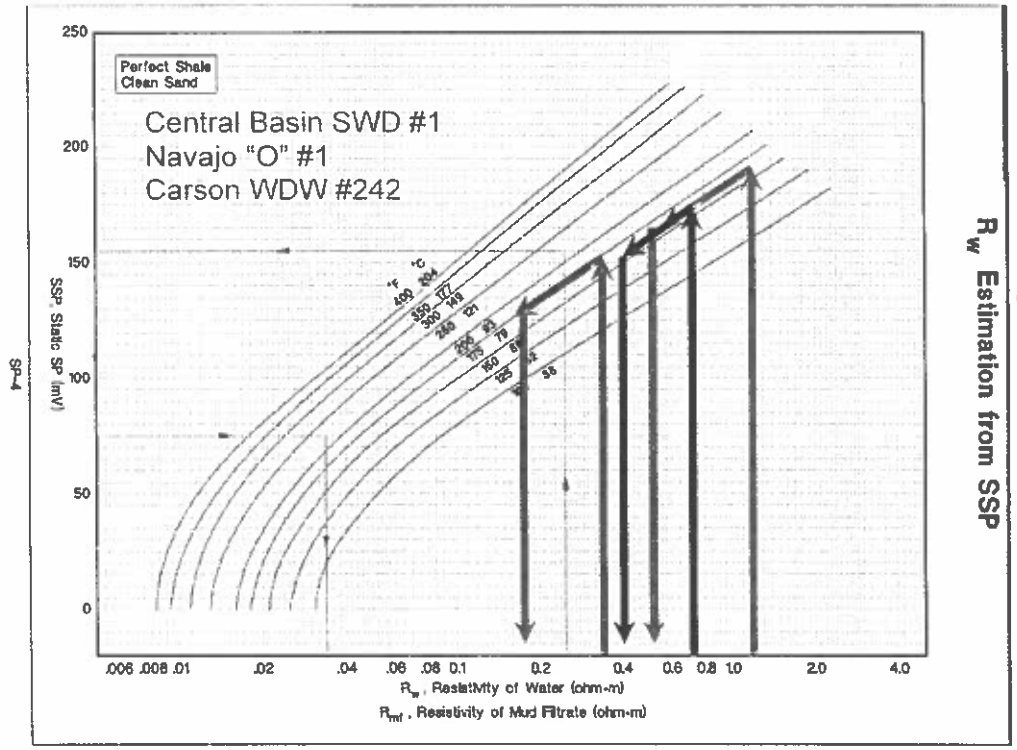

Figure 2 Chart SP-4, Halliburton Log Analysis Charts, 1994

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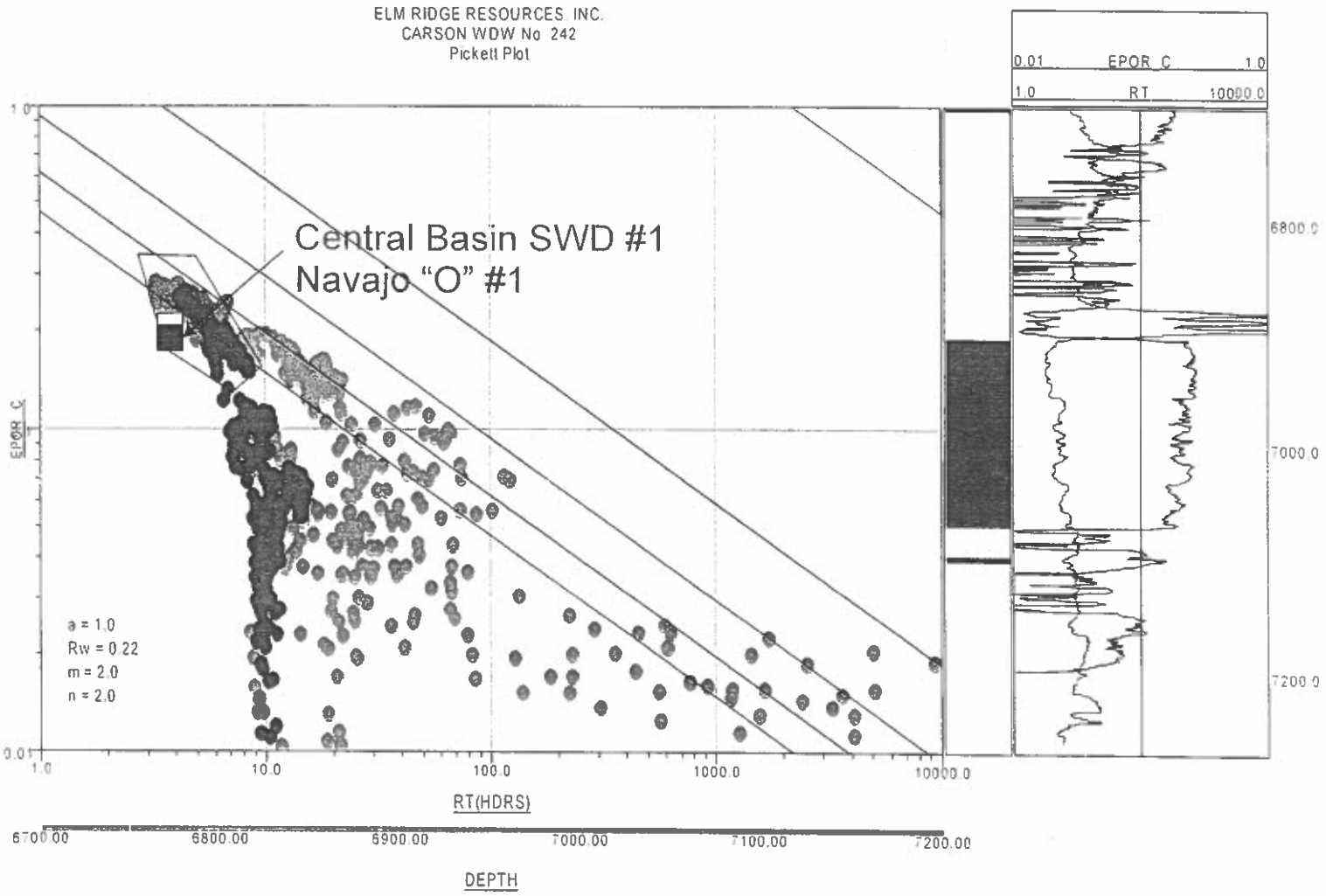

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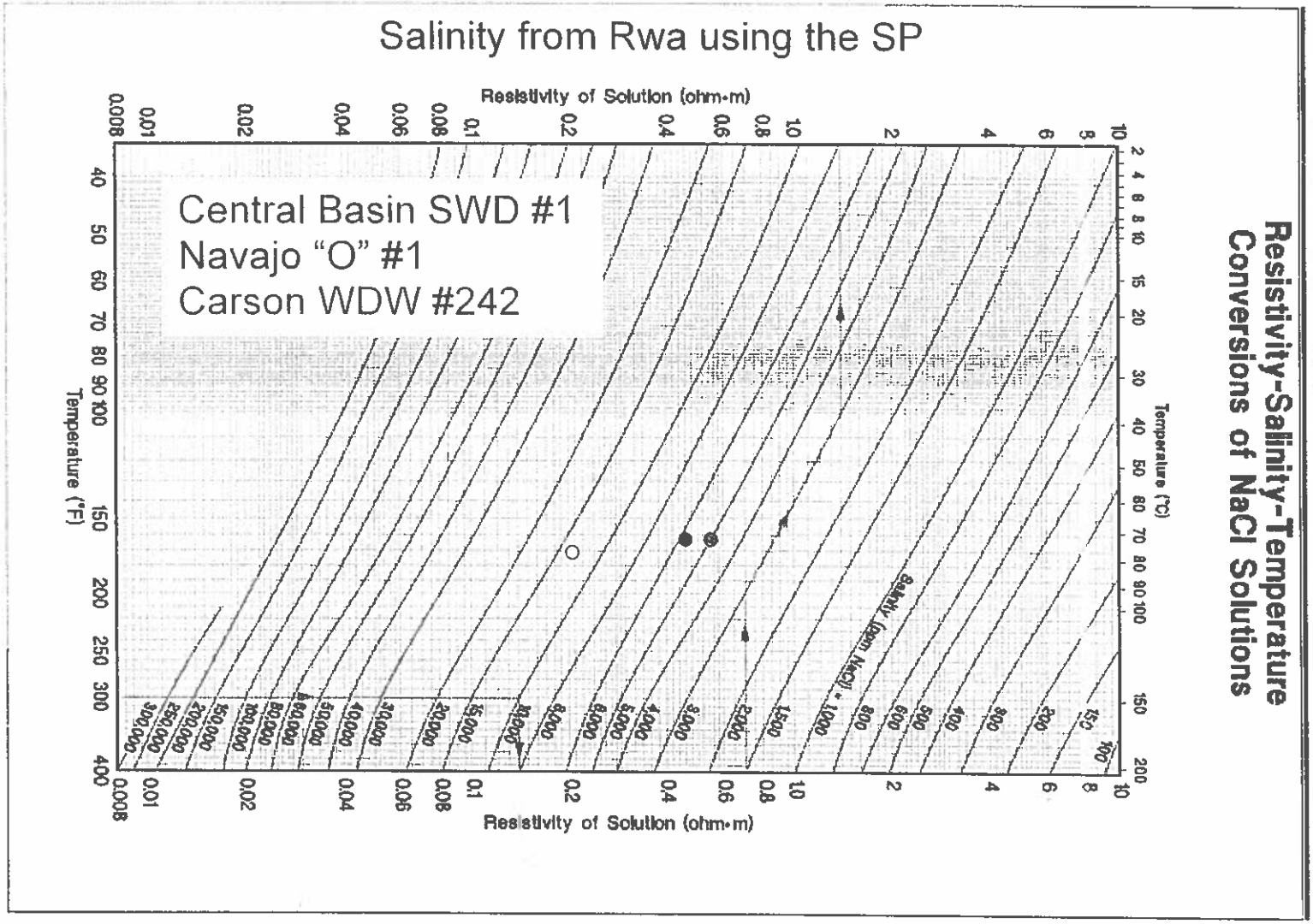

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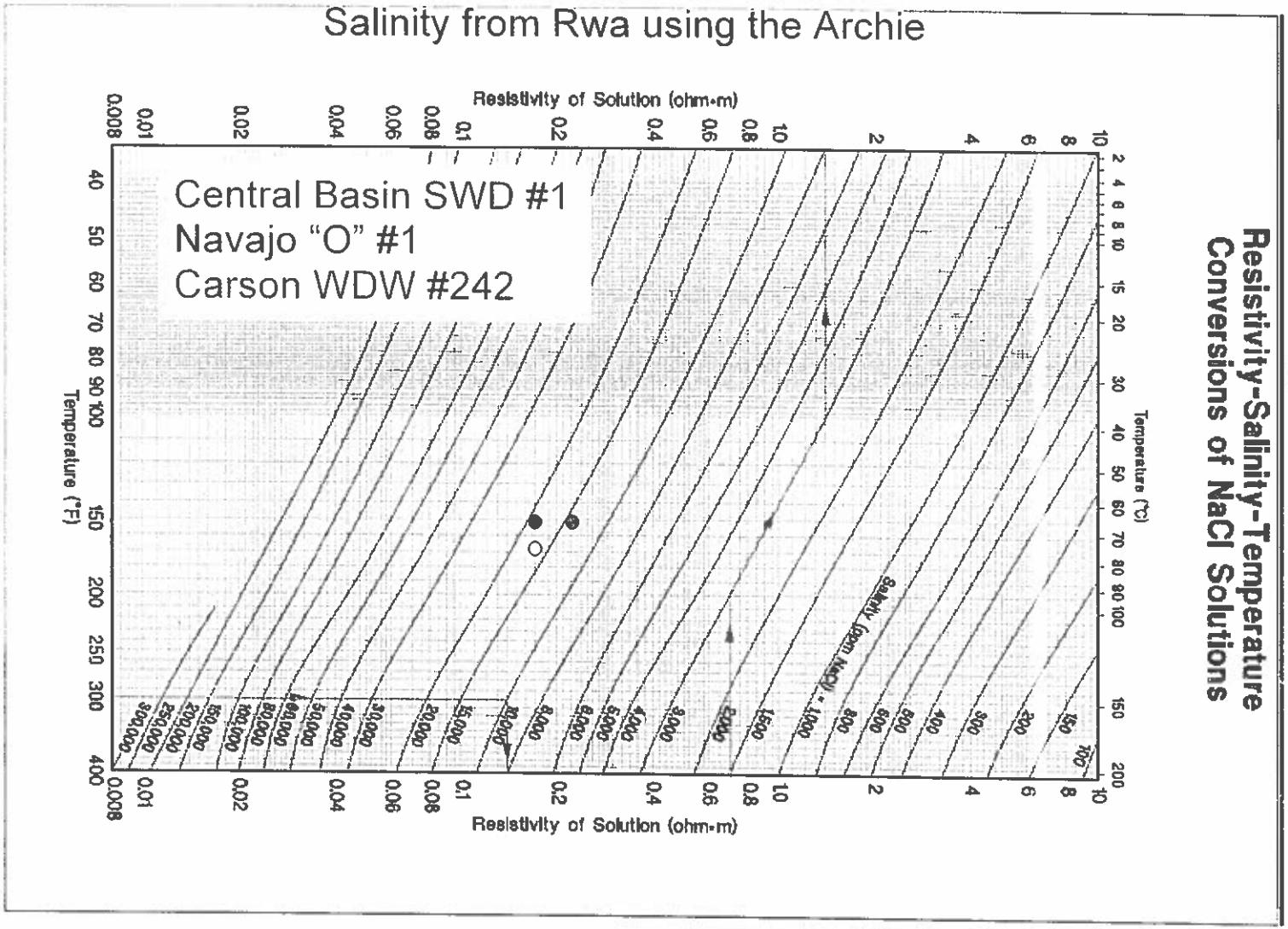

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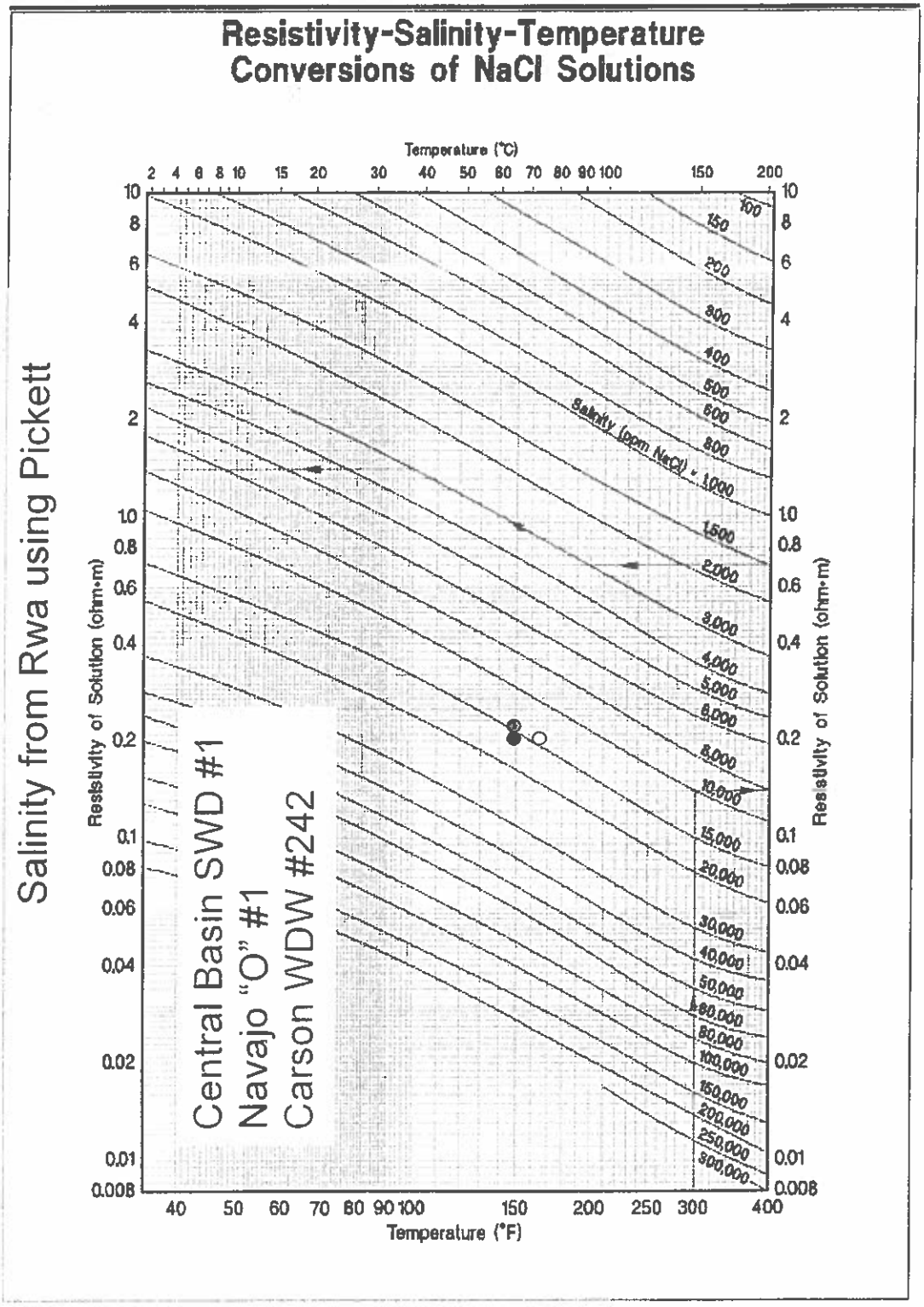
Resistivity-Salinity-Temperature Conversions of NaCl Solutions



GEN-5

10 of 15

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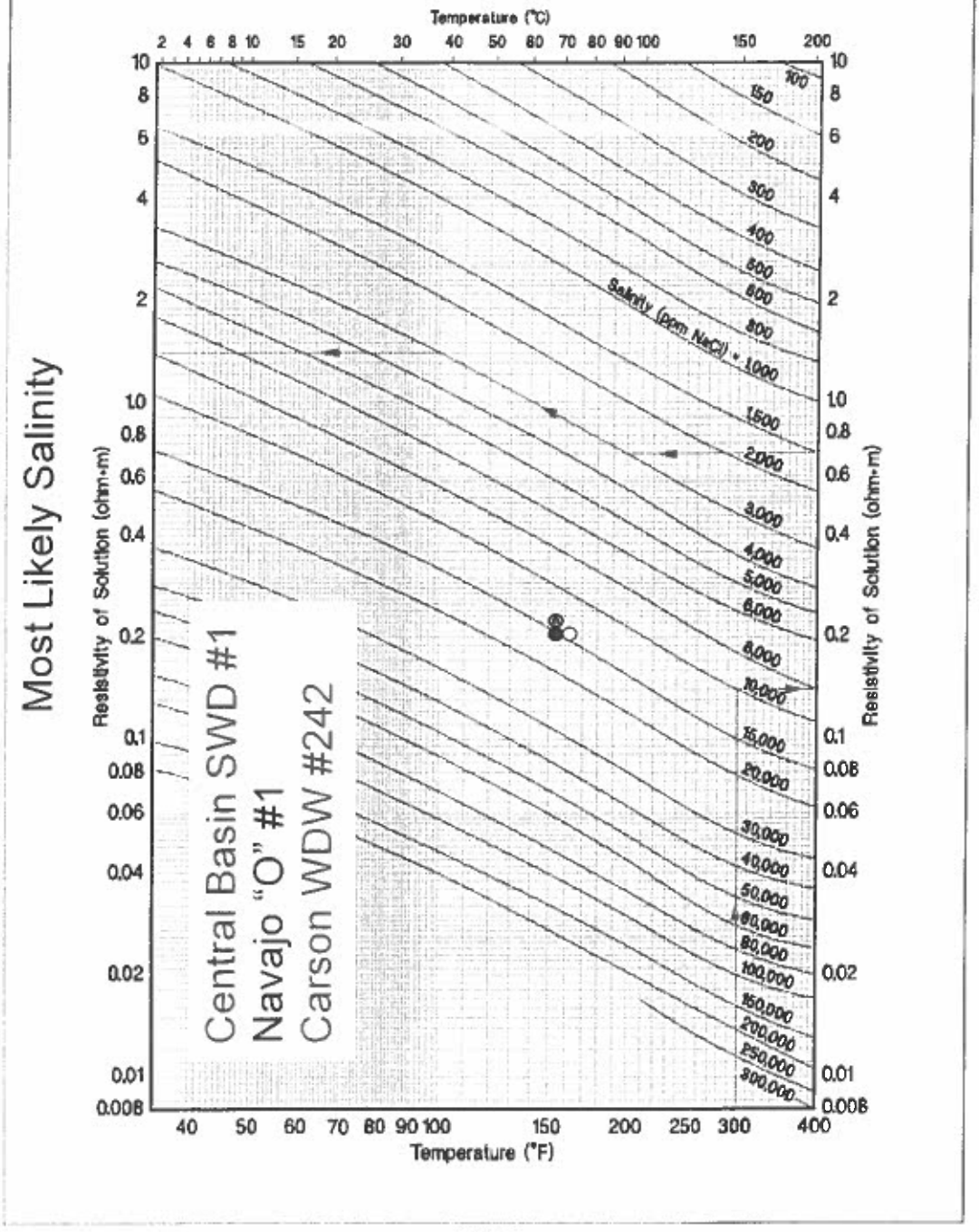
Resistivity-Salinity-Temperature Conversions of NaCl Solutions



GEN-5

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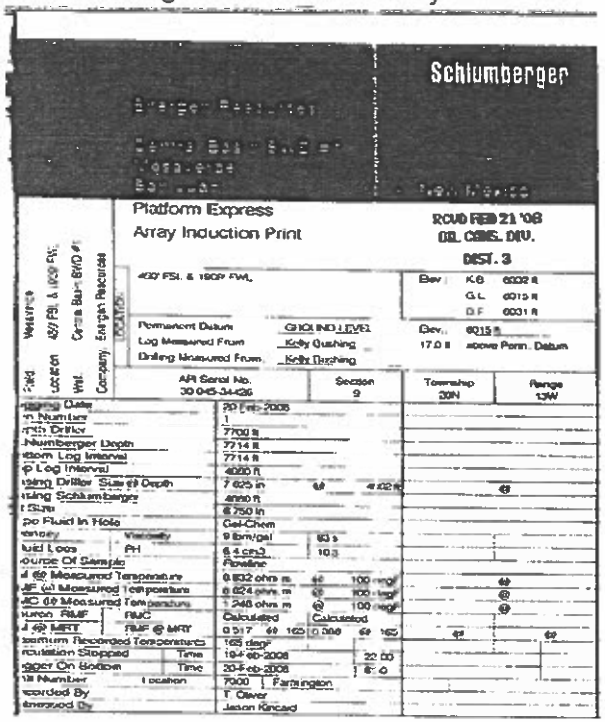
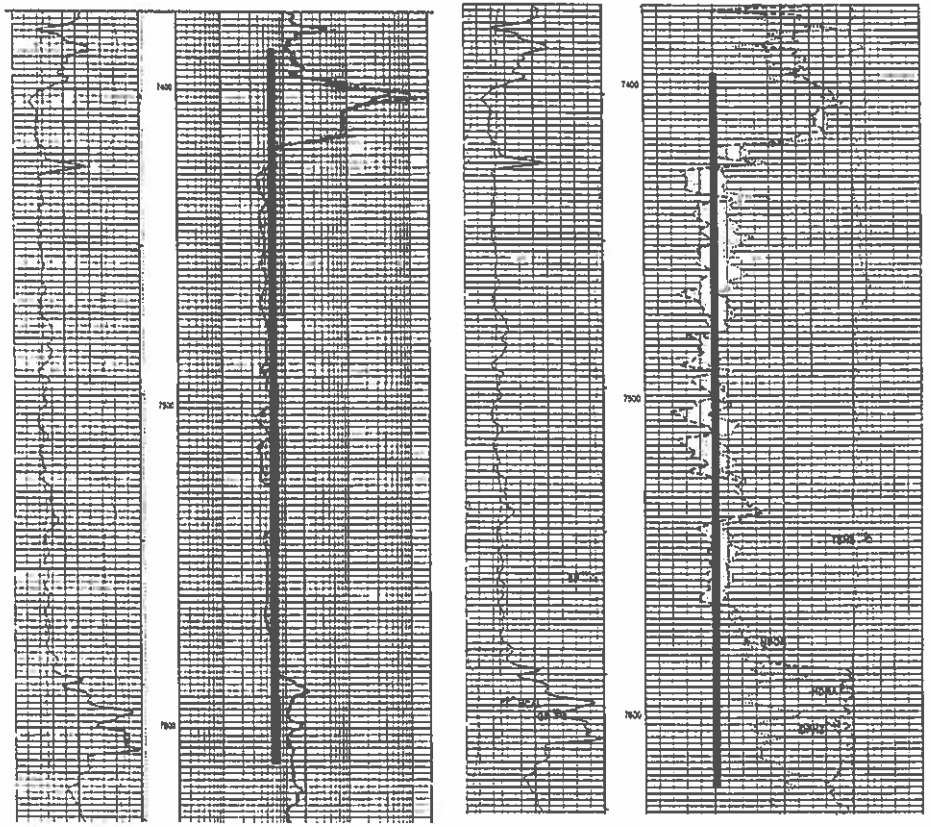
Wireline Logs used in the Study





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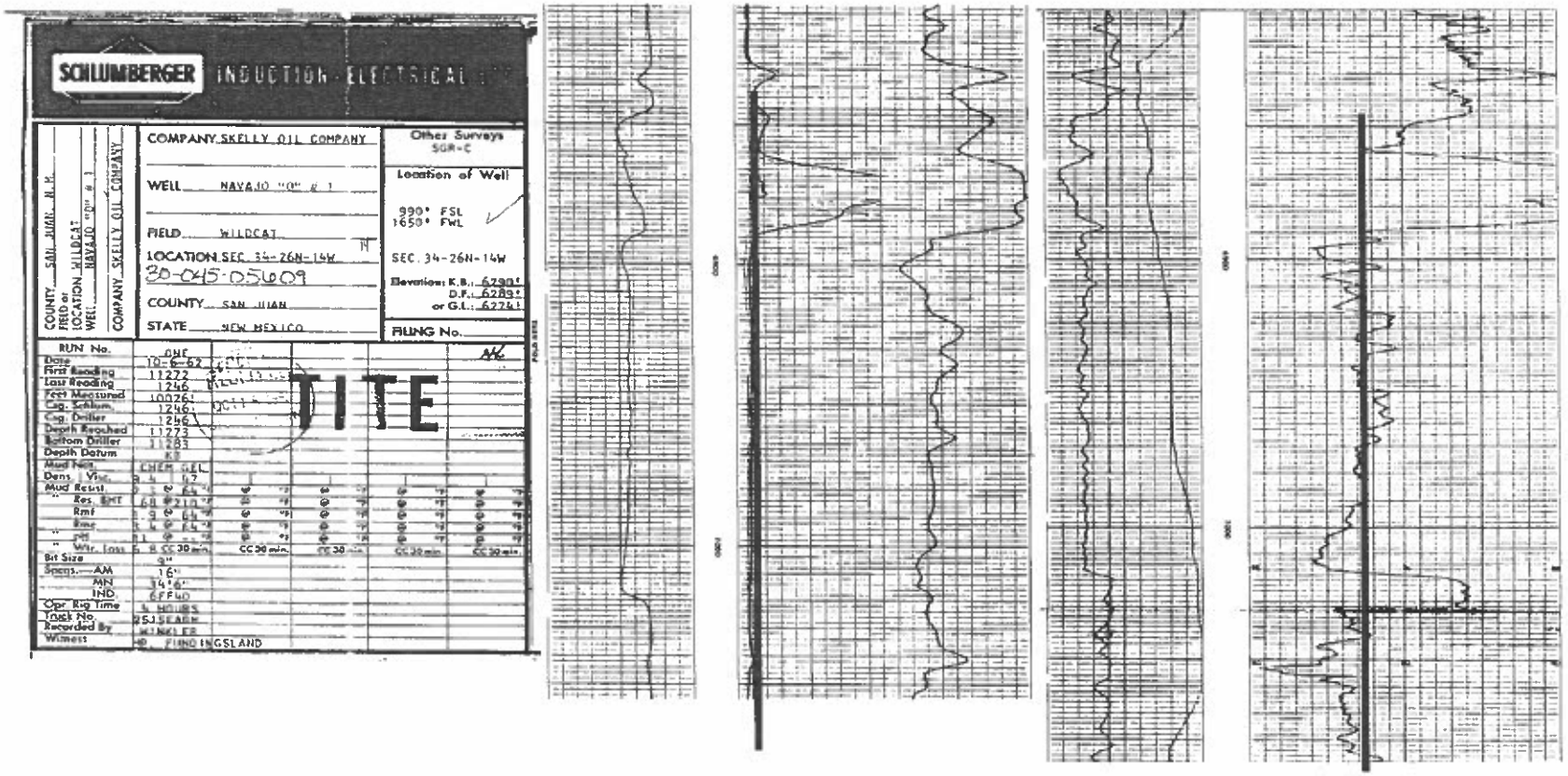

SCHLUMBERGER INDUCTION-ELECTRICAL

COMPANY SKELLY OIL COMPANY
WELL NAVAJO "O" # 1
FIELD WILDCAT
LOCATION SEC. 34-26N-14W
30-045-05609
COUNTY SAN JUAN
STATE NEW MEXICO

Other Surveys: SGR-C

Location of Well: 990' FSL 1650' FWL
SEC. 34-26N-14W
Elevation: K.B. 6290' D.F. 6289' or G.L. 6274'

FILING No.

COUNTY SAN JUAN FIELD or LOCATION WILDCAT WELL NAVAJO "O" # 1 COMPANY SKELLY OIL COMPANY

RUN No.	ONE
Date	10-6-62
First Reading	11272
Last Reading	1246
Feet Measured	10026
Csg. Schlum.	1246
Csg. Driller	1246
Depth Reached	11273
Bottom Driller	11283
Depth Datum	KB
Mud Type	CHEM GEL
Dens. Visc.	9.4 47
Mud Resist.	1.3 @ 64°
Res. BHT	68 @ 210°
Rmf	1.3 @ 64°
Rmc	1.4 @ 64°
Rm	2.1 @ 64°
Wtr. Loss	6.4 CC 30 min.
Bit Size	9"
Spacing AM	16"
MN	14'6"
IND	OFFSET
Opr. Rig Time	4 HOURS
Truck No.	251 SEARS
Recorded By	WINKLER
Witness	MR. FINDLINGSLAND

TITE

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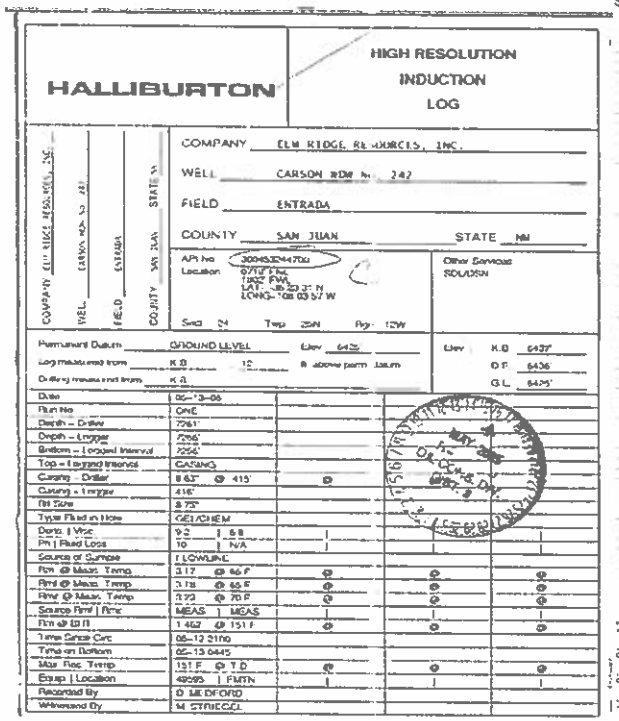
Well	CARSON WDW No. 242
Well ID	30045324470000
Field	ENTRADA
County	SAN JUAN
State/Prov	NM
Country	
Location	
Status	



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HIGH RESOLUTION INDUCTION LOG

COMPANY ELM RIDGE RESOURCES, INC.

WELL CARSON WDW No. 242

FIELD ENTRADA

COUNTY SAN JUAN STATE NM

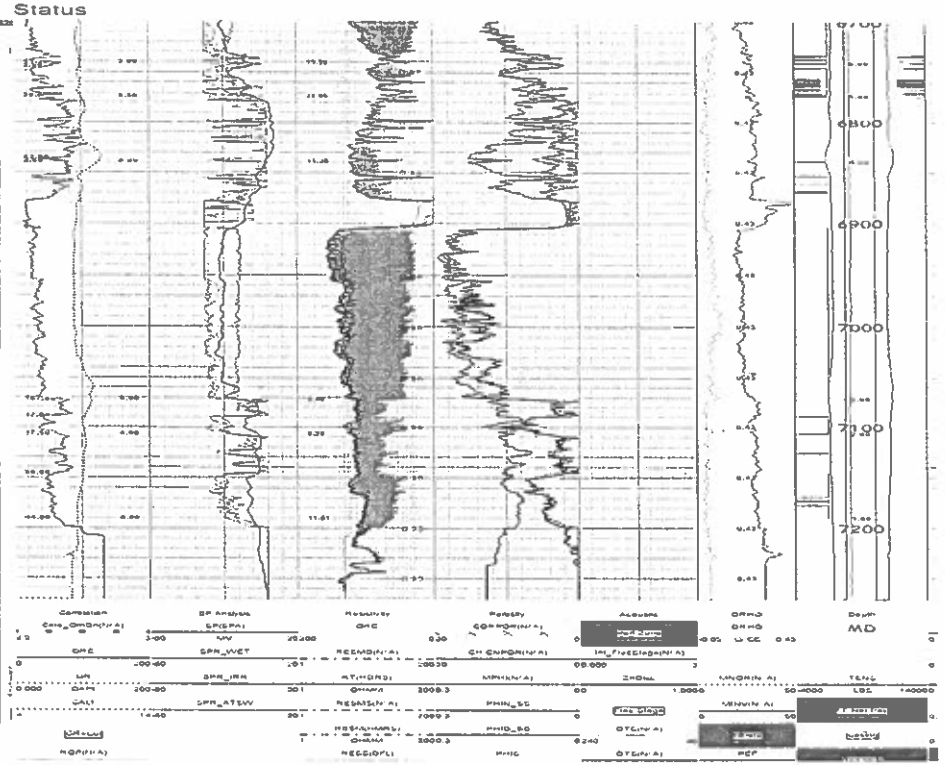
API No 30045324470000
Location 0715' FNL 1800' FWL
LAT= 36 53 3" N
LONG= 108 03 57 W
Sec 24 Twp 29N Rge 15W

Other Services
SOLAR/SN

Permanent Datum GROUND LEVEL Elev 6425
Log measured from KB 12 ft above perm. datum
Drilling measured from KB

Elev KB 6437
DF 6436
GL 6425

Date	05-13-06			
Run No	ONE			
Depth – Driller	7261'			
Depth – Logger	7266'			
Bottom – Logged Interval	7264'			
Top – Logged Interval	CASING			
Casing – Driller	8 63" @ 415'	@		
Casing – Logger	416'			
Bit Size	7.75"			
Type Fluid in Hole	GEL/CHEM			
Dens. / Visc	9.2 / 58			
Ph / Fluid Loss	10 / N/A			
Source of Sample	FLOWLINE			
Rm @ Meas. Temp	3.17 @ 66 F	@	@	@
Rmf @ Meas. Temp	2.78 @ 65 F	@	@	@
Rmc @ Meas. Temp	3.73 @ 70 F	@	@	@
Source Rmf / Rmc	MEAS / MEAS			
Rm @ BHT	1.462 @ 151 F	@	@	@
Time Since Circ	05-12 2100			
Time on Bottom	05-13 0445			
Max Rec. Temp	151 F @ TD	@	@	@
Equip. / Location	49593 / FMTN			
Recorded By	D MEDFORD			
Witnessed By	M STRIEGEL			



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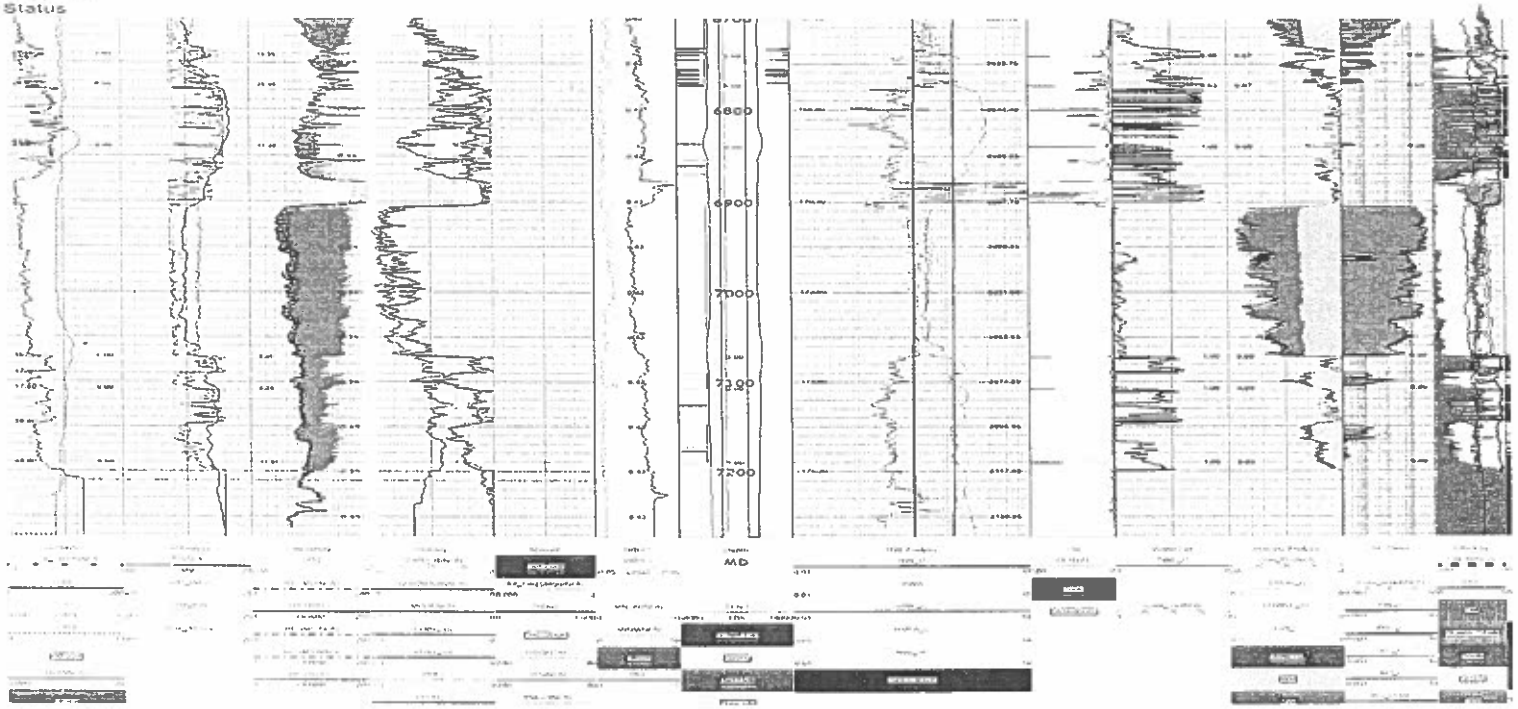
StimLOG Analysis of the Carson WDW #242

Well	CARSON WDW No. 242
Well ID	30045324470000
Field	ENTRADA
County	SAN JUAN
State/Prov	NM
Country	
Location	
Status	



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Fassett, J.E., Hamilton, W., Martin, G.W. and Middleman, A.A., 1983, Oil and Gas Fields of the Four Corners Area: Four Corners Geol. Soc., V. 3, pages 975-977.

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Rocky Mountain Formation Water Resistivities, 1985: Compiled and edited by the Denver Well Logging Society, a Chapter of the Society of Professional Well Log Analysts, Petroleum Information Corp. pages 88-99.

Operator's well file information used in preparing this report is stored in Dugan Production Corp.'s internal well files and is available for review upon request. Additional information was located in ConocoPhillips, Merrion Oil and Gas and XTO Energy, Inc.'s well files and may also be available for review upon request.

New Mexico Oil Conservation Division well file database.

Sante Fe Main Office
Phone: (505) 476-3441

General Information
Phone: (505) 629-6116

Online Phone Directory
https://www.emnrd.nm.gov/ocd/contact-us

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

CONDITIONS

Action 534545

CONDITIONS

Operator: NEW MEXICO ENERGY MINERALS & NATURAL RESOURCE 1220 S St Francis Dr Santa Fe , NM 87504	OGRID: 264235
	Action Number: 534545
	Action Type: [IM-SD] Admin Order Support Doc (ENG) (IM-AAO)

CONDITIONS

Created By	Condition	Condition Date
pgoetze	None	12/12/2025