UIC - I - 8-1, 2 & 3

WDWs-1, 2 & 3 PERMITS, RENEWALS, & MODS (2 of 18)

2017

PERMIT APPLICATION FOR CLASS I NON-HAZARDOUS WASTE INJECTION WELLS WDW-1, WDW-2, AND WDW-3

HollyFrontier Navajo Refining LLC
Artesia, NM

WSP | PB Project No. 50904D

FEBRUARY 2017

Prepared By:

PB Energy Storage Services, Inc.
WSP | Parsons Brinckerhoff
16200 Park Row, Suite 200
Houston, Texas 77084

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INTRODUCTION

HollyFrontier Navajo Refining LLC (Navajo), located in Artesia, New Mexico, is applying to renew the discharge permits for Class I Non-hazardous Waste Disposal Well No. 1 (WDW-1), Waste Disposal Well No. 2 (WDW-2), and Waste Disposal Well No. 3 (WDW-3) which is located approximately ten (10) miles to the southeast of the refinery. WDW-1, WDW-2, and WDW-3 were initially permitted by the Oil Conservation Division (OCD) of the New Mexico Energy, Minerals and Natural Resources Department under the Water Quality Act in 1998 and have been operating under Permits UIC-CLI-008-1, UIC-CLI-008-2, and UIC-CLI-008-3.

The Navajo refinery is located at 501 East Main Street in Artesia, Eddy County, New Mexico. The three Class I nonhazardous waste injection wells operated by the refinery are designated WDW-1, WDW-2 and WDW-3. All three wells are permitted to inject nonhazardous waste water into a subsurface Injection Zone consisting of the lower portion of the Wolfcamp Formation and the underlying Cisco and Canyon Formations. The depth and thickness of the Injection Zone at the three Navajo refinery injection wells are as follows:

- WDW-1: 7,450 to 9,016 ft KB
- WDW-2: 7,270 to 8,894 ft KB
- WDW-3: 7,303 to 8,894 ft KB

Please note that the three Navajo injection wells were previously permitted separately coinciding with the life of the regulatory permit issued for each well. These Discharge Permits will expire on June 1, 2017. One technical report has been prepared along with three separate application forms for each of the wells.

Information concerning the locations of oil and gas wells and freshwater wells within the regulatory 1-mile radius area of review (AOR) surrounding the wells were obtained from OCD and New Mexico Water Rights Reporting System, respectively. No corrective action is needed for any of the artificial penetrations within the 1-mile radius AOR.

The regional and local geology have been evaluated, and no problems have been identified that will cause adverse effects as a result of the ongoing injection operations.

Reservoir characteristics of the Injection Zone indicate the reservoir has sufficient properties to accommodate the historical and planned future injection rate, volume and pressure from the three Navajo injection wells. Based on information gathered from the Navajo refinery injection well system, there are no adverse reactions identified with the waste stream and the well components of construction and the Injection Zone matrix and formation fluid.

WDW-1, WDW-2, and WDW-3 meet the construction and operating standards set forth in 20.6.2.5205 NMAC. A procedure to permanently plug and abandon the wells have been included per the requirements of 20.6.2.5209 NMAC.

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL
RESOURCES DEPARTMENT

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, New Mexico 87505

FORM C-108
Revised June 10, 2003

APPLICATION FOR AUTHORIZATION TO INJECT

I. PURPOSE: _____Secondary Recovery _____Pressure Maintenance ___X___Disposal _____Storage
Application qualifies for administrative approval? _____Yes _____No

II. OPERATOR: HollyFrontier Navajo Refining LLC

ADDRESS: 501 East Main, Artesia, NM 88210

CONTACT PARTY: Randy Dade PHONE: (575) 746-5281

III. WELL DATA: Complete the data required on the reverse side of this form for each well proposed for injection. Additional sheets may be attached if necessary.

IV. Is this an expansion of an existing project? _____Yes _____X____No
If yes, give the Division order number authorizing the project: _____

V. Attach a map that identifies all wells and leases within two miles of any proposed injection well with a one-half mile radius circle drawn around each proposed injection well. This circle identifies the well's area of review.

VI. Attach a tabulation of data on all wells of public record within the area of review which penetrate the proposed injection zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of completion, and a schematic of any plugged well illustrating all plugging detail.

VII. Attach data on the proposed operation, including:

1. Proposed average and maximum daily rate and volume of fluids to be injected;
2. Whether the system is open or closed;
3. Proposed average and maximum injection pressure;
4. Sources and an appropriate analysis of injection fluid and compatibility with the receiving formation if other than reinjected produced water; and,
5. If injection is for disposal purposes into a zone not productive of oil or gas at or within one mile of the proposed well, attach a chemical analysis of the disposal zone formation water (may be measured or inferred from existing literature, studies, nearby wells, etc.).

*VIII. Attach appropriate geologic data on the injection zone including appropriate lithologic detail, geologic name, thickness, and depth. Give the geologic name, and depth to bottom of all underground sources of drinking water (aquifers containing waters with total dissolved solids concentrations of 10,000 mg/l or less) overlying the proposed injection zone as well as any such sources known to be immediately underlying the injection interval.

IX. Describe the proposed stimulation program, if any.

*X. Attach appropriate logging and test data on the well. (If well logs have been filed with the Division, they need not be resubmitted).

*XI. Attach a chemical analysis of fresh water from two or more fresh water wells (if available and producing) within one mile of any injection or disposal well showing location of wells and dates samples were taken.

XII. Applicants for disposal wells must make an affirmative statement that they have examined available geologic and engineering data and find no evidence of open faults or any other hydrologic connection between the disposal zone and any underground sources of drinking water.

XIII. Applicants must complete the "Proof of Notice" section on the reverse side of this form.

XIV. Certification: I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

NAME: _____TITLE: _____

SIGNATURE: _____DATE: _____

E-MAIL ADDRESS: _____

* If the information required under Sections VI, VIII, X, and XI above has been previously submitted, it need not be resubmitted. Please show the date and circumstances of the earlier submittal: _____

DISTRIBUTION: Original and one copy to Santa Fe with one copy to the appropriate District Office

III. WELL DATA

A. The following well data must be submitted for each injection well covered by this application. The data must be both in tabular and schematic form and shall include:

(1) Lease name; Well No.; Location by Section, Township and Range; and footage location within the section.

(2) Each casing string used with its size, setting depth, sacks of cement used, hole size, top of cement, and how such top was determined.

(3) A description of the tubing to be used including its size, lining material, and setting depth.

(4) The name, model, and setting depth of the packer used or a description of any other seal system or assembly used.

Division District Offices have supplies of Well Data Sheets which may be used or which may be used as models for this purpose. Applicants for several identical wells may submit a "typical data sheet" rather than submitting the data for each well.

B. The following must be submitted for each injection well covered by this application. All items must be addressed for the initial well. Responses for additional wells need be shown only when different. Information shown on schematics need not be repeated.

(1) The name of the injection formation and, if applicable, the field or pool name.

(2) The injection interval and whether it is perforated or open-hole.

(3) State if the well was drilled for injection or, if not, the original purpose of the well.

(4) Give the depths of any other perforated intervals and detail on the sacks of cement or bridge plugs used to seal off such perforations.

(5) Give the depth to and the name of the next higher and next lower oil or gas zone in the area of the well, if any.

XIV. PROOF OF NOTICE

All applicants must furnish proof that a copy of the application has been furnished, by certified or registered mail, to the owner of the surface of the land on which the well is to be located and to each leasehold operator within one-half mile of the well location.

Where an application is subject to administrative approval, a proof of publication must be submitted. Such proof shall consist of a copy of the legal advertisement which was published in the county in which the well is located. The contents of such advertisement must include:

(1) The name, address, phone number, and contact party for the applicant;

(2) The intended purpose of the injection well; with the exact location of single wells or the Section, Township, and Range location of multiple wells;

(3) The formation name and depth with expected maximum injection rates and pressures; and,

(4) A notation that interested parties must file objections or requests for hearing with the Oil Conservation Division, 1220 South St. Francis Dr., Santa Fe, New Mexico 87505, within 15 days.

NO ACTION WILL BE TAKEN ON THE APPLICATION UNTIL PROPER PROOF OF NOTICE HAS BEEN SUBMITTED.

NOTICE: Surface owners or offset operators must file any objections or requests for hearing of administrative applications within 15 days from the date this application was mailed to them.

Side 1

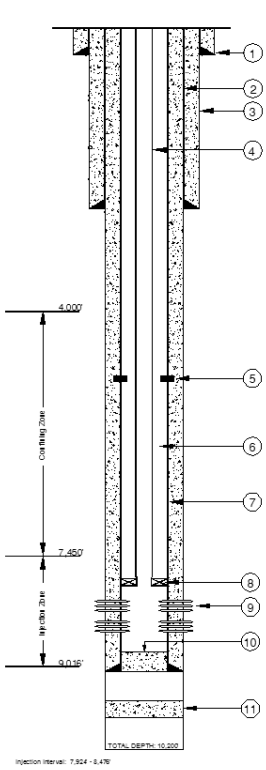
INJECTION WELL DATA SHEET

OPERATOR: **Facility**: HollyFrontier Navajo Refining LLC, 501 East Main, Artesia, New Mexico 88210;
Contact: Randy Dade, Environmental Specialist, (575) 746-5281, Lewis.Dade@HollyFrontier.com

WELL NAME & NUMBER: WDW-1

WELL LOCATION: 660 feet from the south line and 2,310 feet from the east line of SW/4, SE/4 | 31 | 17 South | 28 East
FOOTAGE LOCATION | UNIT LETTER | SECTION | TOWNSHIP | RANGE

WELLBORE SCHEMATIC



BELOW GROUND DETAILS

All depths are referenced to the Kelly bushing elevation of 12.5' above ground level. Ground level elevation is 3,678' above mean sea level.

1. Surface Casing: 13 ⅜", 48 lb/ft, J-55, ST&C set at 390' in a 17 ½" hole. Cemented with 150 sx Class C with 3% calcium chloride, 375 sx Class C Litewate w/3% calcium chloride and ¼ lb/sx flocele. Circulated 86 sx to surface.
2. Intermediate Casing: 9 ⅝", 36 lb/ft, J-55, ST&C set at 2,555' in a 12¼" hole. Cemented w/800 sx of Class C Lite w/¼ lb/sx flocele and 2 lb/sx Gilsonite and 12% salt. Followed by 200 sx of Class C w/2% calcium chloride. Circulated 133 sx to surface.
3. Base of the USDW at 493'.
4. Injection Tubing: 4 ½", 11.6 lb/ft, N-80, SMLS, R3, LT&C set at 7,879'.
5. DV Tool: at 5,496'.
6. Annulus Fluid: 8.7 lb/gal brine water mixed w/UniChem Techni-Hib 370 corrosion inhibitor.
7. Protection Casing: 7", 29 lb/ft, N-80, LT&C: 9094' to 7031', 7", 29 lb/ft, P-110, LT&C: 7031' to 5845', 7", 26 lb/ft, P-110, LT&C; 5,845' to surface. Casing set in 8 ¾" hole and cemented in two stages as follows:

   First Stage - 600 sx modified Class H w/0.4% CFR-3, 5 lb/sx Gilsonite, 0.5% Halad-344, and 1 lb/sx salt mixed at 13.0 ppg. Opened DV tool at 5,496' and circulated 142 sx to surface.

   Second Stage - Lead Slurry: 220 sx Interfill "C" (35:65:6) mixed at 11.7 ppg. Tail Slurry: 550 sx modified Class H w/0.4% CFR-3, 5 lb/sx, Gilsonite, 0.5% Halad-344, 0.1% HR-7, and 1 lb/sx mixed at 13.0 ppg. Circulated 75 sx to surface. Topped out w/20 sx premium plus 3% calcium chloride.
8. Packer: 7" x 3.5" EVI Oil Tools (Arrow), Model X-1 retrievable packer set at 7,879'. Minimum I.D. is 3.0". Wireline re-entry guide on bottom. To release: turn ¼ turn to the right and pick up.
9. Perforations: (2 SPF):

   Upper Zone - 7,924 - 7,942', 7,974 - 8,030', 8,050 - 8,056', 8,066 - 8,080', 8,118 - 8,127', 8,132 - 8,140', 8,160 - 8,164', 8,170 - 8,188'.

   Lower Zone - 8,220 - 8,254', 8,260 - 8,270', 8,280 - 8,302', 8,360 - 8,366', 8,370 - 8,378', 8,400 - 8,410', 8,419 - 8,423', 8,430 - 8,446', 8,460 - 8,464', 8,470 - 8,476'.
10. PBTD: 9,004'.
11. Cement Plug: 45 sx Class H from 9624' to 9734'.

WELL CONSTRUCTION DATA

Surface Casing

Hole Size: 17.5-inches | Casing Size: 13-3/8-inch

Cemented with: 525 sx. | ***or*** _____ ft^3

Top of Cement: surface | Method Determined: NMOCD

Intermediate Casing

Hole Size: 12.25-inches | Casing Size: 9-5/8-inch

Cemented with: 1,000 sx. | ***or*** _____ ft^3

Top of Cement: surface | Method Determined: NMOCD

Production Casing

Hole Size: 8.75-inches | Casing Size: 7-inch

Cemented with: 1,370 sx. | ***or*** _____ ft^3

Top of Cement: surface | Method Determined: NMOCD

Total Depth: 9,004 feet

Injection Interval

7,924 feet to 8,188 feet
8,220 feet to 8,476 feet
(Perforated)

Side 2

INJECTION WELL DATA SHEET

Tubing Size: 4 ½-inch_____Lining Material: steel construction_____

Type of Packer: Arrow X-1, 7-inch by 3 1/2-inch _____

Packer Setting Depth: 7,879-feet _____

Other Type of Tubing/Casing Seal (if applicable): _____

Additional Data

1. Is this a new well drilled for injection? _____Yes ___X__No

   If no, for what purpose was the well originally drilled? Originally for oil and gas production___

   _____

2. Name of the Injection Formation: __Lower Wolfcamp, Cisco, and Canyon Formations _____

3. Name of Field or Pool (if applicable): _____

4. Has the well ever been perforated in any other zone(s)? List all such perforated intervals and give plugging detail, i.e. sacks of cement or plug(s) used. The original oil and gas well was drilled to a total depth of 10,200 feet. When the well was converted to an injection well in 1999, a cement plug was set from 9,624 to 9,734 feet and 7-inch protection casing was set at 9,094 feet. A bottom plug was installed into the base of the 7-inch casing with the top of the plug tagged at 9,004 feet. The 7-inch protection casing was perforated with a 0.5-inch diameter hole at 2 shots per foot on a 60° phasing. The perforations are located between 7,924 feet and 8,188 feet and from 8,220 feet to 8,476 feet.

5. Give the name and depths of any oil or gas zones underlying or overlying the proposed injection zone in this area: The **Abo Formation** overlies the Wolfcamp and extends from 5,400 feet to 6,890 feet in WDW-1, from 5,506 feet to 6,728 feet in WDW-2, and from 5,380 feet to 6,745 feet in WDW-3. Although the Abo is well known as a major oil producer in the AOR, the producing intervals lie in the upper Abo, whose equivalents are above 6,100 feet in WDW-1 and above 6,200 feet in WDW-2. The deepest Abo test well in the area is located 6,000 feet east (downdip) of WDW-3 and was drilled to 6,412 feet.

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ADDRESS: 501 East Main, Artesia, NM 88210

CONTACT PARTY: Randy Dade PHONE: (575) 746-5281

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IV. Is this an expansion of an existing project? _____Yes _____X____No
If yes, give the Division order number authorizing the project: _____

V. Attach a map that identifies all wells and leases within two miles of any proposed injection well with a one-half mile radius circle drawn around each proposed injection well. This circle identifies the well's area of review.

VI. Attach a tabulation of data on all wells of public record within the area of review which penetrate the proposed injection zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of completion, and a schematic of any plugged well illustrating all plugging detail.

VII. Attach data on the proposed operation, including:

1. Proposed average and maximum daily rate and volume of fluids to be injected;
2. Whether the system is open or closed;
3. Proposed average and maximum injection pressure;
4. Sources and an appropriate analysis of injection fluid and compatibility with the receiving formation if other than reinjected produced water; and,
5. If injection is for disposal purposes into a zone not productive of oil or gas at or within one mile of the proposed well, attach a chemical analysis of the disposal zone formation water (may be measured or inferred from existing literature, studies, nearby wells, etc.).

*VIII. Attach appropriate geologic data on the injection zone including appropriate lithologic detail, geologic name, thickness, and depth. Give the geologic name, and depth to bottom of all underground sources of drinking water (aquifers containing waters with total dissolved solids concentrations of 10,000 mg/l or less) overlying the proposed injection zone as well as any such sources known to be immediately underlying the injection interval.

IX. Describe the proposed stimulation program, if any.

*X. Attach appropriate logging and test data on the well. (If well logs have been filed with the Division, they need not be resubmitted).

*XI. Attach a chemical analysis of fresh water from two or more fresh water wells (if available and producing) within one mile of any injection or disposal well showing location of wells and dates samples were taken.

XII. Applicants for disposal wells must make an affirmative statement that they have examined available geologic and engineering data and find no evidence of open faults or any other hydrologic connection between the disposal zone and any underground sources of drinking water.

XIII. Applicants must complete the "Proof of Notice" section on the reverse side of this form.

XIV. Certification: I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

NAME: _____TITLE: _____

SIGNATURE: _____DATE: _____

E-MAIL ADDRESS: _____

* If the information required under Sections VI, VIII, X, and XI above has been previously submitted, it need not be resubmitted. Please show the date and circumstances of the earlier submittal: _____

DISTRIBUTION: Original and one copy to Santa Fe with one copy to the appropriate District Office

III. WELL DATA

A. The following well data must be submitted for each injection well covered by this application. The data must be both in tabular and schematic form and shall include:

(1) Lease name; Well No.; Location by Section, Township and Range; and footage location within the section.

(2) Each casing string used with its size, setting depth, sacks of cement used, hole size, top of cement, and how such top was determined.

(3) A description of the tubing to be used including its size, lining material, and setting depth.

(4) The name, model, and setting depth of the packer used or a description of any other seal system or assembly used.

Division District Offices have supplies of Well Data Sheets which may be used or which may be used as models for this purpose. Applicants for several identical wells may submit a "typical data sheet" rather than submitting the data for each well.

B. The following must be submitted for each injection well covered by this application. All items must be addressed for the initial well. Responses for additional wells need be shown only when different. Information shown on schematics need not be repeated.

(1) The name of the injection formation and, if applicable, the field or pool name.

(2) The injection interval and whether it is perforated or open-hole.

(3) State if the well was drilled for injection or, if not, the original purpose of the well.

(4) Give the depths of any other perforated intervals and detail on the sacks of cement or bridge plugs used to seal off such perforations.

(5) Give the depth to and the name of the next higher and next lower oil or gas zone in the area of the well, if any.

XIV. PROOF OF NOTICE

All applicants must furnish proof that a copy of the application has been furnished, by certified or registered mail, to the owner of the surface of the land on which the well is to be located and to each leasehold operator within one-half mile of the well location.

Where an application is subject to administrative approval, a proof of publication must be submitted. Such proof shall consist of a copy of the legal advertisement which was published in the county in which the well is located. The contents of such advertisement must include:

(1) The name, address, phone number, and contact party for the applicant;

(2) The intended purpose of the injection well; with the exact location of single wells or the Section, Township, and Range location of multiple wells;

(3) The formation name and depth with expected maximum injection rates and pressures; and,

(4) A notation that interested parties must file objections or requests for hearing with the Oil Conservation Division, 1220 South St. Francis Dr., Santa Fe, New Mexico 87505, within 15 days.

NO ACTION WILL BE TAKEN ON THE APPLICATION UNTIL PROPER PROOF OF NOTICE HAS BEEN SUBMITTED.

NOTICE: Surface owners or offset operators must file any objections or requests for hearing of administrative applications within 15 days from the date this application was mailed to them.

Side 1

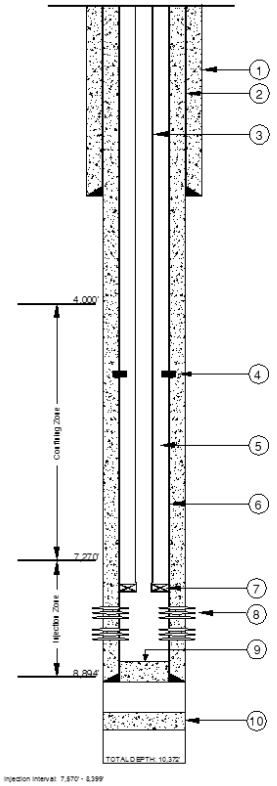
INJECTION WELL DATA SHEET

OPERATOR: **Facility**: HollyFrontier Navajo Refining LLC, 501 East Main, Artesia, New Mexico 88210;
Contact: Randy Dade, Environmental Specialist, (575) 746-5281, Lewis.Dade@HollyFrontier.com

WELL NAME & NUMBER: WDW-2

WELL LOCATION: 1,980 feet from the north line and 660 feet from the west line of SW/4, NW/4 12 18 South 27 East
FOOTAGE LOCATION UNIT LETTER SECTION TOWNSHIP RANGE

WELLBORE SCHEMATIC



BELOW GROUND DETAILS

All depths are referenced to the Kelly bushing elevation of 13' above ground level. Ground level elevation is 3610' above mean sea level.

1. Base of the USDW at 473'.
2. Surface Casing: 8 5/8", 32 lb/ft, set at 1995' in an 11" hole. Cemented to surface with 800 sacks of cement.
3. Injection Tubing: 3 1/2", 9.2 lb/ft, J-55, smls, NUE 10rd set at 7,528'.
4. DV Tool: at 5,785'.
5. Annulus Fluid: 8.7 lb/gal brine water mixed w/UniChem Techni-Hib 370 corrosion inhibitor.
6. Protection Casing: 5 1/2", 17 lb/ft, L-80, LT&C: 8,869' to the surface and set in a 7 7/8" hole. Casing cemented in two stages as follows:

   First Stage - 575 sacks of modified Class "H" with 0.4% CFR-3, 5 lb/sk Gilsonite, 0.5% Halad-344, and 3 lb/sk salt. Mixed at 13.0 ppg. DV tool opened at 5,785 and 20 sacks circulated to surface.

   Second Stage - Lead Slurry: 300 sacks of Interfill "C" (35:65:6) mixed at 11.7 ppg. Tail slurry: 695 sacks modified Class "H" with 0.4% CFR-3, 5 lb/sk Gilsonite, 0.5% Halad-344 and 3 lb/sk salt mixed at 13.0 ppg. Circulated 150 sacks to surface. Topped out with 10 yards of Redi-mix.
7. Packer: 5 1/2" x 2 7/8" Weatherford Completion Tools (Arrow) Model X-1 retrievable packer set at 7,528'. Minimum ID is 2.4375". Wireline re-entry guide is on bottom. To release: turn 1/4 turn to the right and pick up.
8. Perforations (2 SPF):

   Zone 1: 7,570-7,620'; 7,676-7,736'

   Zone 2: 7,826-7,834'; 7,858-7,880'; 7,886-7,904'; 7,916-7,936'; 7,944-7,964'; 7,990-8,042'; 8,096-8,116'; 8,191-8,201'; 8,304-8,319'; 8,395-8,399'.
9. PBTD: 8,770'
10. Cement Plug: 45 sacks from 9,675' to 9,775'.

WELL CONSTRUCTION DATA

Surface Casing

Hole Size: 11-inches Casing Size: 8-5/8-inch

Cemented with: 800 sx. ***or*** _____ ft^3

Top of Cement: surface Method Determined: NMOCD

Intermediate Casing

Hole Size: 7-7/8-inches Casing Size: 5-1/2-inch

Cemented with: 1,570 sx. ***or*** _____ ft^3

Top of Cement: surface Method Determined: NMOCD

Production Casing

Hole Size: _____ Casing Size: _____

Cemented with: _____ sx. ***or*** _____ ft^3

Top of Cement: _____ Method Determined: NMOCD

Total Depth: 8,770 feet

Injection Interval

7,570 feet _____ feet to 7,736 feet

7,826 feet _____ feet to 8,399 feet

(Perforated)

Side 2

INJECTION WELL DATA SHEET

Tubing Size: 3 ½-inch_____Lining Material: steel construction_____

Type of Packer: Arrow X-1, 5 1/2-inch by 2 7/8-inch _____

Packer Setting Depth: 7,528-feet _____

Other Type of Tubing/Casing Seal (if applicable): _____

Additional Data

1. Is this a new well drilled for injection? _____Yes ___X__No

   If no, for what purpose was the well originally drilled? Originally for oil and gas production___

   _____

2. Name of the Injection Formation: __Lower Wolfcamp, Cisco, and Canyon Formations _____

3. Name of Field or Pool (if applicable): _____

4. Has the well ever been perforated in any other zone(s)? List all such perforated intervals and give plugging detail, i.e. sacks of cement or plug(s) used. The original oil and gas well was drilled to a total depth of 10,200 feet. When the well was converted to an injection well in 1999, a cement plug was set from 9,624 to 9,734 feet and 7-inch protection casing was set at 9,094 feet. A bottom plug was installed into the base of the 7-inch casing with the top of the plug tagged at 9,004 feet. The 7-inch protection casing was perforated with a 0.5-inch diameter hole at 2 shots per foot on a 60° phasing. The perforations are located between 7,924 feet and 8,188 feet and from 8,220 feet to 8,476 feet.

5. Give the name and depths of any oil or gas zones underlying or overlying the proposed injection zone in this area: The **Abo Formation** overlies the Wolfcamp and extends from 5,400 feet to 6,890 feet in WDW-1, from 5,506 feet to 6,728 feet in WDW-2, and from 5,380 feet to 6,745 feet in WDW-3. Although the Abo is well known as a major oil producer in the AOR, the producing intervals lie in the upper Abo, whose equivalents are above 6,100 feet in WDW-1 and above 6,200 feet in WDW-2. The deepest Abo test well in the area is located 6,000 feet east (downdip) of WDW-3 and was drilled to 6,412 feet.

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V. Attach a map that identifies all wells and leases within two miles of any proposed injection well with a one-half mile radius circle drawn around each proposed injection well. This circle identifies the well's area of review.

VI. Attach a tabulation of data on all wells of public record within the area of review which penetrate the proposed injection zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of completion, and a schematic of any plugged well illustrating all plugging detail.

VII. Attach data on the proposed operation, including:

1. Proposed average and maximum daily rate and volume of fluids to be injected;
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3. Proposed average and maximum injection pressure;
4. Sources and an appropriate analysis of injection fluid and compatibility with the receiving formation if other than reinjected produced water; and,
5. If injection is for disposal purposes into a zone not productive of oil or gas at or within one mile of the proposed well, attach a chemical analysis of the disposal zone formation water (may be measured or inferred from existing literature, studies, nearby wells, etc.).

*VIII. Attach appropriate geologic data on the injection zone including appropriate lithologic detail, geologic name, thickness, and depth. Give the geologic name, and depth to bottom of all underground sources of drinking water (aquifers containing waters with total dissolved solids concentrations of 10,000 mg/l or less) overlying the proposed injection zone as well as any such sources known to be immediately underlying the injection interval.

IX. Describe the proposed stimulation program, if any.

*X. Attach appropriate logging and test data on the well. (If well logs have been filed with the Division, they need not be resubmitted).

*XI. Attach a chemical analysis of fresh water from two or more fresh water wells (if available and producing) within one mile of any injection or disposal well showing location of wells and dates samples were taken.

XII. Applicants for disposal wells must make an affirmative statement that they have examined available geologic and engineering data and find no evidence of open faults or any other hydrologic connection between the disposal zone and any underground sources of drinking water.

XIII. Applicants must complete the "Proof of Notice" section on the reverse side of this form.

XIV. Certification: I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief.

NAME: _____TITLE: _____

SIGNATURE: _____DATE: _____

E-MAIL ADDRESS: _____

* If the information required under Sections VI, VIII, X, and XI above has been previously submitted, it need not be resubmitted. Please show the date and circumstances of the earlier submittal: _____

DISTRIBUTION: Original and one copy to Santa Fe with one copy to the appropriate District Office

III. WELL DATA

A. The following well data must be submitted for each injection well covered by this application. The data must be both in tabular and schematic form and shall include:

(1) Lease name; Well No.; Location by Section, Township and Range; and footage location within the section.

(2) Each casing string used with its size, setting depth, sacks of cement used, hole size, top of cement, and how such top was determined.

(3) A description of the tubing to be used including its size, lining material, and setting depth.

(4) The name, model, and setting depth of the packer used or a description of any other seal system or assembly used.

Division District Offices have supplies of Well Data Sheets which may be used or which may be used as models for this purpose. Applicants for several identical wells may submit a "typical data sheet" rather than submitting the data for each well.

B. The following must be submitted for each injection well covered by this application. All items must be addressed for the initial well. Responses for additional wells need be shown only when different. Information shown on schematics need not be repeated.

(1) The name of the injection formation and, if applicable, the field or pool name.

(2) The injection interval and whether it is perforated or open-hole.

(3) State if the well was drilled for injection or, if not, the original purpose of the well.

(4) Give the depths of any other perforated intervals and detail on the sacks of cement or bridge plugs used to seal off such perforations.

(5) Give the depth to and the name of the next higher and next lower oil or gas zone in the area of the well, if any.

XIV. PROOF OF NOTICE

All applicants must furnish proof that a copy of the application has been furnished, by certified or registered mail, to the owner of the surface of the land on which the well is to be located and to each leasehold operator within one-half mile of the well location.

Where an application is subject to administrative approval, a proof of publication must be submitted. Such proof shall consist of a copy of the legal advertisement which was published in the county in which the well is located. The contents of such advertisement must include:

(1) The name, address, phone number, and contact party for the applicant;

(2) The intended purpose of the injection well; with the exact location of single wells or the Section, Township, and Range location of multiple wells;

(3) The formation name and depth with expected maximum injection rates and pressures; and,

(4) A notation that interested parties must file objections or requests for hearing with the Oil Conservation Division, 1220 South St. Francis Dr., Santa Fe, New Mexico 87505, within 15 days.

NO ACTION WILL BE TAKEN ON THE APPLICATION UNTIL PROPER PROOF OF NOTICE HAS BEEN SUBMITTED.

NOTICE: Surface owners or offset operators must file any objections or requests for hearing of administrative applications within 15 days from the date this application was mailed to them.

Side 1

INJECTION WELL DATA SHEET

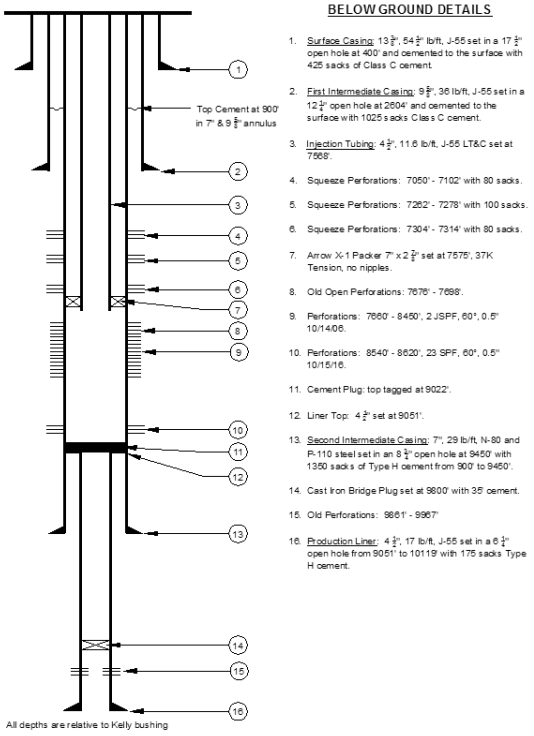
OPERATOR: **Facility**: HollyFrontier Navajo Refining LLC, 501 East Main, Artesia, New Mexico 88210;
Contact: Randy Dade, Environmental Specialist, (575) 746-5281, Lewis.Dade@HollyFrontier.com

WELL NAME & NUMBER: WDW-3

WELL LOCATION: _____ 1 18 South 27 East

FOOTAGE LOCATION	UNIT LETTER	SECTION	TOWNSHIP	RANGE

WELLBORE SCHEMATIC



BELOW GROUND DETAILS

1. Surface Casing: 13 3/8", 54.5# lb/ft, J-55 set in a 17 1/2" open hole at 400' and cemented to the surface with 425 sacks of Class C cement.
2. First Intermediate Casing: 9 5/8", 36 lb/ft, J-55 set in a 12 1/4" open hole at 2604' and cemented to the surface with 1025 sacks Class C cement.
3. Injection Tubing: 4 1/2", 11.6 lb/ft, J-55 LT&C set at 7568'.
4. Squeeze Perforations: 7050' - 7102' with 80 sacks.
5. Squeeze Perforations: 7262' - 7278' with 100 sacks.
6. Squeeze Perforations: 7304' - 7314' with 80 sacks.
7. Arrow X-1 Packer 7" x 2 7/8" set at 7575', 37K Tension, no nipples.
8. Old Open Perforations: 7676' - 7698'.
9. Perforations: 7660' - 8450', 2 JSPF, 60°, 0.5" 10/14/06.
10. Perforations: 8540' - 8620', 23 SPF, 60°, 0.5" 10/15/16.
11. Cement Plug: top tagged at 9022'.
12. Liner Top: 4 1/2" set at 9051'.
13. Second Intermediate Casing: 7", 29 lb/ft, N-80 and P-110 steel set in an 8 3/4" open hole at 9450' with 1350 sacks of Type H cement from 900' to 9450'.
14. Cast Iron Bridge Plug set at 9800' with 35' cement.
15. Old Perforations: 9661' - 9967'
16. Production Liner: 4 1/2", 17 lb/ft, J-55 set in a 6 1/4" open hole from 9051' to 10119' with 175 sacks Type H cement.

WELL CONSTRUCTION DATA

Surface Casing

Hole Size: 17.5-inches Casing Size: 13-3/8-inch

Cemented with: 425 sx. ***or*** _____ ft^3

Top of Cement: surface Method Determined: NMOCD

Intermediate Casing

Hole Size: 12.25-inches Casing Size: 9-5/8-inch

Cemented with: 1,025 sx. ***or*** _____ ft^3

Top of Cement: surface Method Determined: NMOCD

Production Casing

Hole Size: 8.75-inches Casing Size: 7-inch

Cemented with: 1,350 sx. ***or*** _____ ft^3

Top of Cement: surface Method Determined: NMOCD

Total Depth: 9,022 feet

Injection Interval

7,650 feet to 8,450 feet

8,540 feet to 8,620 feet

(Perforated)

Side 2

INJECTION WELL DATA SHEET

Tubing Size: 4 ½-inch_____Lining Material: steel construction_____

Type of Packer: Arrow X-1, 7-inch by 2-7/8-inch _____

Packer Setting Depth: 7,575-feet _____

Other Type of Tubing/Casing Seal (if applicable): _____

Additional Data

1. Is this a new well drilled for injection? _____Yes ___X__No

   If no, for what purpose was the well originally drilled? Originally for oil and gas production___

   _____

2. Name of the Injection Formation: __Lower Wolfcamp, Cisco, and Canyon Formations _____

3. Name of Field or Pool (if applicable): _____

4. Has the well ever been perforated in any other zone(s)? List all such perforated intervals and give plugging detail, i.e. sacks of cement or plug(s) used. The original oil and gas well was drilled to a total depth of 10,200 feet. When the well was converted to an injection well in 1999, a cement plug was set from 9,624 to 9,734 feet and 7-inch protection casing was set at 9,094 feet. A bottom plug was installed into the base of the 7-inch casing with the top of the plug tagged at 9,004 feet. The 7-inch protection casing was perforated with a 0.5-inch diameter hole at 2 shots per foot on a 60° phasing. The perforations are located between 7,924 feet and 8,188 feet and from 8,220 feet to 8,476 feet.

5. Give the name and depths of any oil or gas zones underlying or overlying the proposed injection zone in this area: The **Abo Formation** overlies the Wolfcamp and extends from 5,400 feet to 6,890 feet in WDW-1, from 5,506 feet to 6,728 feet in WDW-2, and from 5,380 feet to 6,745 feet in WDW-3. Although the Abo is well known as a major oil producer in the AOR, the producing intervals lie in the upper Abo, whose equivalents are above 6,100 feet in WDW-1 and above 6,200 feet in WDW-2. The deepest Abo test well in the area is located 6,000 feet east (downdip) of WDW-3 and was drilled to 6,412 feet.

1.0 Underground Injection Control Well Class

The Navajo refinery Waste Disposal Wells WDW-1, WDW-2, and WDW-3 are classified as Class I Non-Hazardous Waste Injection Wells.

2.0 Operator

The operator information for WDW-1, WDW-2, and WDW-3 is provided below:

Facility Address

HollyFrontier Navajo Refining LLC
501 East Main
Artesia, New Mexico 88210
(575) 748-3310

Contact Person

Randy Dade, Environmental Specialist
(575) 746-5281
Lewis.Dade@hollyfrontier.com

3.0 Location

WDW-1 (API No. 30-015-27592) is located 660 feet from the south line and 2,310 feet from the east line of SW/4, SE/4, Section 31, Township 17 South, Range 28 East, Latitude 32°47'6.77"N, Longitude 104°12'50.22"W, in Eddy County, New Mexico.

WDW-2 (API No. 30-015-20894) is located 1,980 feet from the north line and 660 feet from the west line of SW/4, NW/4, Section 12, Township 18 South, Range 27 East, Latitude 32°45'49.32"N, Longitude 104°14'18.59"W, in Eddy County, New Mexico.

WDW-3 is located 790 feet from the south line and 2,250 feet from the west line of SE/4, SW/4, Section 1, Township 18 South, Range 27 East, Latitude 32°46'16.51"N, Longitude 104°13'59.80"W, in Eddy County, New Mexico.

A topographic map showing the location of the Navajo refinery, WDW-1, WDW-2, and WDW-3 is provided as Figure 1. An enlarged version of the topographic map showing the locations of the wells is provided as Figure 2.

4.0 Landowner(s)

The parcel of land where WDW-1 is located is owned by the following:

HollyFrontier Navajo Refining LLC
501 E. Main Street
Artesia, New Mexico 88210
(575) 748-3311

The parcels of land where WDW-2 and WDW-3 are located are owned by the following:

U.S. Department of the Interior
Bureau of Land Management
620 Greene Street
Carlsbad, New Mexico 88220
(575) 887-6544

The parcels of land (Appendix A) where the wells are located are surrounded by state owned, privately owned, and Bureau of Land Management owned land.

5.0 Facility Description

The Class I non-hazardous injection wells WDW-1 and WDW-2 are located approximately 10 miles southeast of the Navajo refinery, and WDW-3 is located approximately 14 miles east of the Navajo refinery, the largest refinery in New Mexico. Drawing 1 presents an aerial photograph of the refinery's location with respect to the wellhead facilities, identifying pertinent features between the sites. The wellhead facilities are located within fenced areas that enclose the well, injection pumps, filters and piping, wellhead annulus monitoring systems (WAMS) on contained concrete pads, and power panels. The pumps and filters are located on a separate, contained concrete pad. No buildings or tanks, other than the 250 gallon glycol tank, are associated with the WAMS units.

6.0 Proposed Discharge Plan (see 20.6.2.3106C NMAC)

This permit renewal application is for three existing Class I Non-Hazardous waste injection wells. Those portions of 20.6.2.3106.C NMAC that are relevant to underground injection, especially 20.6.2.3103.C(8) NMAC, are addressed in Section 7.0 of this document.

- 6(a) is addressed in 7(f)
- 6(b) is addressed in 7(a)
- 6(c) is addressed in 7(d)
- 6(d) is addressed in 7(e)
- 6(e) measurement of flow is determined by a flow meter at each wellhead, with information transmitted electronically to the refinery control room
- 6(f) is addressed in 7(e)
- 6(g) is addressed in 7(e)

7.0 Information for Class I Non-Hazardous Waste Injection Wells and Class III Brine Wells (20.6.2.5210 NMAC)

The following sections present the information required in Subsection B of Section 20.6.2.5210 NMAC.

7 (a) Area of Review

The Area of Review (AOR) consists of a composite area within a 1-mile radius surrounding each well as shown on Drawing 2. Potential sources of information relevant to the locations of non-freshwater artificial penetrations of the injection zone and freshwater wells within the AOR were reviewed.

Non-Freshwater Artificial Penetrations in Area of Review

The locations of non-freshwater artificial penetrations (oil and gas wells, exploratory tests, disposal wells, etc.) within the composite 1-mile radius AOR surrounding WDW-1, WDW-2, and WDW-3 are identified in Drawing 2. A total of 294 non-freshwater artificial penetrations are present.

Each artificial penetration is identified by a Map ID number. Table 1A lists information about non-freshwater artificial penetrations in the AOR.

Of the 294 non-freshwater artificial penetrations identified within the composite AOR, a total of 17 wells were advanced to a depth to penetrate the top of the Injection Zone. Table 1B presents a listing of these wells. Appendix B contains NMOCD well records and constructions schematics for these non-freshwater artificial penetrations.

Freshwater Wells in Area of Review

Based upon information obtained from records maintained by the New Mexico Water Rights Reporting System, no freshwater wells exist within the AOR surrounding WDW-1, WDW-2, or WDW-3.

Drawing 3 presents a topographic map depicting the composite 1-mile radius AOR. The map illustrates surface bodies of water, mines (surface and subsurface), quarries, springs, and other surface features, including roads and residences. No subsurface faults in the AOR are known to have surface expression; therefore, no surface fault traces have been included on this map.

7 (b) Data Tabulation

Table 1A presents a tabulation of the non-freshwater artificial penetrations within the AOR. Table 1B presents a listing of wells that penetrate the Injection Zone. Appendix B contains well records and schematics for the non-freshwater artificial penetrations that penetrate the Injection Zone.

7 (c) Corrective Action

The available records for each of the artificial penetrations that penetrate the top of the Injection Zone within the AOR were evaluated to determine if corrective action would be required to prevent movement of fluids into or between Underground Sources of Drinking Water (USDW) that which could be caused by pressures in the Injection Zone. The USDWs are aquifers containing groundwater with total dissolved solids concentration of less than 10,000 milligrams per liter (mg/L). These records are contained in Appendix B.

No corrective actions are warranted because artificial penetration records reviewed for this permit indicate that the wells have been properly constructed, plugged and/or abandoned and they will prevent movement of fluids into or between USDWs, or they are still operating.

7 (d) Maps and Cross-Sections

Figure 3 presents a generalized hydrogeologic cross-section for the local area. Figure 4 presents a published map indicating the direction of shallow groundwater movement in the local area. The base of the USDW observed at each of the wells is shown in the table below.

	WDW-1 (KB = 3,693 ft MSL)		**WDW-2 (KB = 3,623 ft MSL)**		**WDW-3 (KB = 3,625 ft MSL)**	
	Depth KB (ft)	*Depth (ft MSL)*	*Depth KB (ft)*	*Depth (ft MSL)*	*Depth KB (ft)*	*Depth (ft MSL)*
Base of USDW	493	3,200	473	3,151	475	3,150

The top of the Injection Zone is separated from the base of the USDW by several thousand feet of low-permeability carbonates, siltstones, and shale as depicted on the geologic cross-sections presented on Drawings 5, 6 and 7. A map showing the locations of the cross-sections is presented as Drawing 4 (geologic cross-section index map).

7 (e) Geology

The Navajo refinery is located in Eddy County, New Mexico, on the Northwestern Shelf of the larger Permian Basin, as shown on Figure 5. Figure 6 is stratigraphic column presenting the geologic formations relevant to the underground injection operations at the injection well locations. The refinery is located on the southern flank of the Artesia-Vacuum anticline (also referred to as the Vacuum Arch), which trends east to west across the study area as shown Figure 7. Figure 8 is a published regional structural map of the San Andres Formation.

The hree geologic cross-sections presented on Drawings 5, 6, and 7, depict the subsurface geology in the area of the Navajo injection wells. Structural dip of all geologic formations is about 100 feet/mile to the southeast away from the Vacuum Arch depicted on Figure 7.

Injection Zone

The Injection Zone into which all three injection wells at the Navajo refinery are injecting is composed of the lower portion of the Wolfcamp Formation and the underlying Cisco and Canyon Formations. These formations occur in WDW-1, WDW-2, and WDW-3 at the depths shown in the table below.

Injection Zone Formations	WDW-1 (KB = 3,693 ft MSL)		WDW-2 (KB = 3,623 ft MSL)		WDW-3 (KB = 3,625 ft MSL)	
	Depth KB (ft)	*Depth (ft MSL)*	*Depth KB (ft)*	*Depth (ft MSL)*	*Depth KB (ft)*	*Depth (ft MSL)*
Lower Wolfcamp	7,450	3,757	7,270	3,647	7,303	3,678
Cisco	7,816	4,123	7,645	4,022	7,650	4,025
Canyon	8,475	4,782	8,390	4,767	8,390	4,765
Base of Injection Zone (base of Canyon)	9,016	5,323	8,894	5,271	8,894	5,269

The following are brief descriptions of the three geologic formations that form the Injection Zone.

Lower Portion of Wolfcamp Formation (Permian Age)

The lower portion of the Wolfcamp Formation is a light brown to tan, fine to medium grained, fossiliferous limestone with shale interbeds.

Cisco Formation (Pennsylvanian Age)

The Cisco Formation is a uniform, light-colored, chalky, fossiliferous limestone with shale interbeds.

Canyon Formation (Pennsylvanian Age)

The Canyon Formation is a white to tan to light brown fine grained, chalky, fossiliferous limestone with shale interbeds.

Drawing 8 presents a structure contour map of the Injection Zone and Drawing 9 presents an isopach map of the Injection Zone.

Confining Zone

The Confining Zone overlying the Injection Zone, in descending order, is composed of the Yeso Formation, Abo Formation, and the upper portion of the Wolfcamp Formation. The following are brief descriptions of the three geologic formations that form the Confining Zone.

Yeso Formation (Permian Age)

The Yeso Formation consists of orange shale, light gray to white dolostone, and bedded anhydrite.

Abo Formation (Permian Age)

The Abo Formation is a non-marine to marginal marine red shale and fine-grained sandstone interbedded sequence.

Upper Portion of Wolfcamp Formation (Permian Age)

The upper portion of the Wolfcamp Formation is a light brown to tan, fine to medium grained, fossiliferous limestone with shale interbeds.

Drawing 10 presents a structure contour map of the Confining Zone and Drawing 11 presents an isopach map of the Confining Zone.

Faulting

No evidence has been found of any subsurface faulting within or immediately surrounding the AOR that would provide hydraulic connection between the Injection Zone and the shallow USDW. The nearest documented subsurface fault is the “K-M” fault located approximately 17 miles to the northwest, well outside the geologic study area for the Navajo refinery injection wells.

Seismicity

The southeastern portion of New Mexico is historically an area of low seismicity with naturally occurring earthquakes being rare and of low magnitude. The Navajo refinery is located in one of the areas recognized as having the lowest level of seismic risk in the continental United States (Figure 9).

The potential for earthquakes to occur in the vicinity of the Navajo site are minimal. Appendix C presents a listing of all recorded seismic events within 200 miles of the Navajo refinery for the period from 1973 through 2012.

The injection operations at the Navajo refinery do not have the potential to cause any seismic activity which could alter the confining capability of the subsurface Injection Zone and overlying Confining Zone.

Surface Geology and Flooding Potential

The surface geology of the local area is shown on Figure 10. The Pecos River, located about three miles east of Artesia is the only surface water body in the area of the Navajo refinery. Local annual rainfall is approximately 13.5 inches. As indicated on the topographic map on Figure 1, the land surface elevation

at the refinery is higher than that near the river; therefore, the potential for flooding at the Navajo refinery is minimal.

7 (f) Proposed Operating Parameters

Source and Description of Injection Fluid

The fluid injected into the Navajo injection wells is comprised of exempt and nonexempt non-hazardous oilfield waste that is generated in the refining process. Waste waters from process units, cooling towers, boilers, streams from water purification units, desalting units, recovered and treated ground water, and general waste waters will be blended to form the fluid to be injected into the injection wells. Table 2 and Appendix D present data characterizing the injection fluid.

Average and Maximum Daily Flow Rate and Volume

The maximum permitted composite injection rate into all three Navajo injection wells is 800 gallons per minute (gpm). This rate of injection is equal to 1,152,000 gallons per day or 420,480,000 gallons per year or 2,102,400,000 gallons into the injection zone over the upcoming 5-year permit time frame per well. The historical daily volumes of fluid injected into the three injection wells are summarized in Appendix E-1.

Average and Maximum Surface Injection Pressure

The average wellhead injection pressure is approximately 817 pounds per square inch gauge (psig) and an estimated bottom-hole pressure of 4,167 pounds per square inch absolute (psia). Appendix E-1 includes a tabulation of historical injection rates and associated surface injection pressures.

Maximum Allowable Surface Injection Pressure (MASIP) Calculation

As required by the New Mexico Oil Conservation Division (NMOCD) Proposed Rule 21.B(7), dated October 6, 1997, the maximum operating injection wellhead pressure (MASIP) will not exceed:

- 1,585 psi or 0.2 psi per foot of depth to the top of the injection zone at 7,924 feet in WDW-1; MASIP =7,924 feet x 0.2 psi/ft = 1,585 psi
- 1,514 psi or 0.2 psi per foot of depth to the top of the Injection Zone at 7,570 feet in WDW-2; MASIP =7,570 feet x 0.2 psi/ft = 1,514 psi
- 1,460 psi or 0.2 psi per foot of depth to the top of the injection zone at 7,303 feet in WDW-3; MASIP = 7,303 feet x 0.2 psi/ft = 1,460 psi

7 (g) Formation Testing Program

Formation testing was conducted during the initial construction of the Navajo refinery injection wells to obtain site-specific data relating to the chemical, physical and radiological characteristics of the injection zone.

The analysis of formation fluids can be found in Appendix F-1. The three wells were converted oil and gas wells and no cores were cut from the confining zone or injection intervals. Correlations were made using data from offset wells.

7 (h) Fluids and Pressure

The following are descriptions of the changes in reservoir conditions that have been observed to-date and the predicted changes over the upcoming 5-year permit time frame for WDW-1, WDW-2, and WDW-3. This information is based on the known historical rates and volumes that have been injected into the wells and the future 5-year emplacement of the permitted maximum volume at the maximum permitted injection rate between the three wells of 800 gpm.

The interface between injected waste and the formation brine (the waste front) expands radially from the wellbores in each well. As fluid is injected, the injection zone will continue to pressurize due to the resistance of fluid movement and the compression of the fluid and rock matrix.

Current Cone of Influence and Waste Plume Front

The maximum lateral spread of the waste front and the predicted pressure rise during the operational life of WDW-1, WDW-2, and WDW-3 to-date were initially calculated and included in the original permit application.

Calculated Cone of Influence (Current)

The current cone of influence within the injection zone is presented on Drawing 12. The current cone of influence is based on the injection operations through December 31, 2016.

Calculated Plume Front Migration (Current)

The radius of the current dispersed plume for the wells are:

- WDW-1: 4,274 feet
- WDW-2: 3,707 feet (WDW-2 is approximately 7,850 feet from WDW-1)
- WDW-3: 2,911 feet (WDW-3 is approximately 7,900 feet from WDW-1)

Future Cone of Influence and Waste Plume Front

The maximum predicted pressure rise during the upcoming 5-year permit time frame for WDW-1, WDW-2, and WDW-3 were calculated using the software program PredictW. The equations used in the program are presented in Appendix E-3.

The plume fronts for each well were calculated using the equations from Warner and Lehr (1977)

Calculated Cone of Influence (5 Years)

The predicted cone of influence can be found on Drawings 13 through 16. The following four analyses were performed for the cone of influence calculations:

1. Injection into WDW-1 and WDW-2 with no injection into WDW-3 (Drawing 13).
2. Injection into WDW-1 and WDW-3 with no injection into WDW-2 (Drawing 14).
3. Injection into WDW-2 and WDW-3 with no injection into WDW-1 (Drawing 15).
4. Injection into WDW-1, WDW-2 and WDW-3 (Drawing 16).

The cone of influence is defined as the area with increased injection zone pressures caused by injection of wastes which would be sufficient to cause vertical fluid movement through any wellbore or other conduits into a USDW. This demonstration shows that the conservative worst-case cone of influence of the injection operations is smaller than the regulatory 1-mile composite radius AOR in which artificial penetrations were investigated.

In the worst case, an undocumented abandoned well is imagined to be open to both the injection zone and the base of the USDW. In addition, the well is filled to within 100 feet of the ground surface with formation brine from the injection zone and fresh water from the base of the USDW. The cone of influence can be calculated by comparing the hydraulic heads of the injection zone and the lowermost USDW. It is only where the injection zone head is above the USDW head that fluid movement from the injection zone into the USDW could occur. This worst-case model of the potential effect of injection on the USDW is conservative. No wells within the 1-mile composite radius AOR surrounding the wells are open to both the injection zone and the USDW and they are filled with brine.

On July 25, 1998, formation fluid was swabbed from the perforations of the deeper Cisco interval between 8,220 feet and 8,476 feet in WDW-1. The total dissolved solids (TDS) concentration of the sample was 33,000 milligrams per liter (mg/L), and the specific gravity of the sample at room temperature was 1.034. On July 29, 1998, formation fluid was swabbed from the perforations of the shallower Cisco interval between 7,924 feet and 8,188 feet in WDW-1. The analysis of a sample of this fluid indicated that the TDS concentration of the sample was 18,000 mg/L, and the specific gravity at room temperature was 1.018. The chemical analysis of the formation fluid samples is included as Appendix F-1. These values compare favorably with information from the analysis of fluid retrieved during drill-stem test (DST) No. 5, which was conducted on August 26, 1993 in WDW-1 (Appendix F-1). The salinity of the formation fluid retrieved during DST No. 5 was reported as having a chlorides concentration of 25,000 mg/L. The formation fluid is therefore assumed to have a sodium chloride concentration of 25,000 mg/L. The specific gravity of the formation brine was approximately 1.02.

The pre-injection pressure of the injection interval was measured on July 30, 1998 in WDW-1 to be 2,928 psia at 7,911 feet below ground level (BGL). Using the reservoir brine with the lightest specific gravity (1.018) will yield a high initial pressure, P_i, which is conservative. The pre-injection pressure, P_i, at the top of the injection zone in WDW-1 at 7,924 feet BGL is 2,934 psia, and is calculated as follows:

$$P_i(7{,}924 \text{ feet}) = P_i(7{,}911 \text{ feet}) + (7{,}924 \text{ feet} - 7{,}911 \text{ feet})\ (0.433 \text{ psi/ft})\ (1.018)$$
$$= 2{,}928 \text{ psia} + 6 \text{ psi}$$
$$= 2{,}934 \text{ psia}$$

The hydraulic head of the lowermost USDW is estimated to be 100 feet BGL. This estimate is reasonably conservative, as it is based on a static water level measurement of 81 feet.

The critical pressure, P_c at 7,924 feet BGL that would be necessary to raise the hydrostatic head of the injection interval to the head of the lowermost USDW at 100 feet BGL is 3,446 psia, and is calculated as follows:

P_c = (Top of Injection Zone - Base of USDW) (0.433 psi/ft)(1.018)
+ (Base of USDW - Head of USDW) (0.433 psi/ft)
= (7,924 feet - 493 feet) (0.433 psi/ft) (1.018)
+ (493 feet - 100 feet) (0.433 psi/ft)
= 3,446 psia

The critical increase in reservoir pressure, ΔP_c, above the native pressure that is necessary to raise the hydrostatic head of the injection zone to the head of the lowermost USDW is 512 psi, and is calculated as follows:

$\Delta P_c = P_c - P_i$
= 3,446 psia – 2,934 psia
= 512 psi

An increase in reservoir pressure greater than 512 psi would be sufficient to raise the head of the Injection zone above the head of the lowermost USDW. The cone of influence is the area around the injection wells within which the increase in reservoir pressure caused by injection is greater than 512 psi.

The gridded pressure increases created with PredictW were contoured using Surfer, a commercial contouring software package. Contour plots of the predicted pressure increase in the injection zone (Drawings 13 through 16) were generated using historical injection rates and volumes and the permitted maximum injection rate of 800 gpm over the upcoming 5-year permit time frame.

Conservative values for reservoir thickness and permeability were used to overestimate the predicted increase in reservoir pressure. The porosity was assumed to be 10 percent. The reservoir was assumed to have a thickness of 85 feet. The permeability of the reservoir was assumed to be 251 millidarcies (md). The modeled permeability-thickness, kh, of 21,335 millidarcy-ft (md-ft) (251 md x 85 feet), is approximately 18 percent of the kh, of 115,670 md-ft, that was determined from the pressure falloff test conducted in WDW-1 between September 21, 2012 and September 23, 2012 (Appendix G). Using a low kh yields a predicted pressure increase that is greater than expected and a cone of influence that is larger than expected.

The viscosity of the formation fluid with TDS concentration of 25,000 ppm at 130 °F is 0.53 cp (Appendix E-3). The compressibility of the pore volume of the formation is c_r, is 5.5×10^{-6} psi^{-1}. The compressibility

of the formation fluid is c_w, is 2.9 x 10^{-6} psi^{-1}. The total compressibility ($c_t = c_r + c_w$) is 8.4 x 10^{-6} psi^{-1} (Appendix E-4).

Historical injection data for WDW-1, WDW-2 and WDW-3 were used for the injection period from September 23, 1999 (initial injection at the site) through December 31, 2012. WDW-1, WDW-2 and WDW-3 were then modeled as injecting from January 1, 2013 through December 31, 2017 at a continuous rate of 800 gpm distributed among the three wells. The maximum modeled per-well injection rate for any one well is 400 gpm.

The 512-psi pressure-increase contour, which defines the outline of the worst-case cone of influence, is located less than one mile from WDW-1, WDW-2, and WDW-3, as shown on Drawing 16. An improperly abandoned wellbore or other conduit filled with formation fluid that is located farther than one mile from the proposed wells would not transmit sufficient pressure from the injection zone to move fluids into the USDW. Navajo researched public and private sources of information about wells within the 1-mile radius AOR. Information is presented in Section 7 (b) that demonstrates that each of the injection zone penetrations is properly constructed to prevent migration of fluids into the USDW. The output from PredictW is presented in Appendix E-5.

Modeled Plume Front Migration (to December 31, 2022)

The lithologic character of the injection zone, with the resulting hydrodynamic characteristics, is expected to be horizontally uniform. Given the anticipated homogeneity of the injection zone, plume geometry during the active injection phase is expected to be cylindrical.

More than 175 feet of formation is anticipated to exist in the injection zone at the locations of the three Navajo injection wells. Each well is completed in the same interval with 100 to 200 feet of perforations per well. For a conservative estimate of the injection plume size, the plume radius is calculated on the basis of all flow emplaced in an 85-foot thick interval. Based on historical injection data, the volume of fluid injected through January 1, 2017 are listed below. Assuming a continuous injection rate of 400 gpm over a 5-year injection period, the additional future volume which can be injected will be 1,051,200,000 gallons in any well. The following summarizes the plume radii for each well:

WDW-1

- Current plume radius (January 1, 2017): 4,274 feet
- Projected plume radius (January 1, 2022: 5,308 feet

WDW-2 (located approximately 7,850 feet from WDW-1)

- Current plume radius (January 1, 2017): 3,707 feet
- Projected plume radius (January 1, 2022: 4,886 feet

WDW-3 (located approximately 7,900 feet from WDW-1)

- Current plume radius (January 1, 2017): 2,911 feet
- Projected plume radius (January 1, 2022: 4,359 feet

Details of the plume radius calculations for WDW-1, WDW-2, and WDW-3 are presented in Appendix E-6.

7 (i) Stimulation Program

Historical Information

The only stimulation performed on the well has consisted of acid treatments of which the majority was performed through coil tubing pumped across the existing perforation. No fracturing of the injection interval has been performed.

Future Stimulation Programs and Procedures

Currently, no changes are planned in the way the wells are stimulated. Navajo reserves the right to fracture the injection interval with approval from NMOCD. Approximately once every two years an acid stimulation is performed on the wells. The stimulation procedure will consist of pumping 4,000 gallons to 8,000 gallons of 15 percent NEFE Hydrochloric acid through coil tubing at 1 bpm to 2 bpm across the perforations. The acid will be displaced into the formation down the tubing at the highest possible rate.

7 (j) Injection Procedure

Injection into all three Navajo injection wells is on a continuous basis. The injection fluid is routed from the refinery process areas via pipeline to each injection well. Figure 11a, 11b, and 11c present the pre-injection facilities for each well.

Historical Injection Rates and Volumes

The historical rates and volumes can be found in Appendix E-1.

Predicted Injection Rates and Volumes

The maximum permitted composite injection rate into all three Navajo injection wells is 800 gpm. This rate of injection is equal to 1,152,000 gallons per day or 420,480,000 gallons per year or 2,102,400,000 gallons into the injection zone over the upcoming 5-year permit time frame for WDW-1.

The maximum permitted composite injection rate into all three Navajo injection wells is 800 gpm. This rate of injection is equal to 1,152,000 gallons per day or 420,480,000 gallons per year or 2,102,400,000 gallons into the Injection Zone over the upcoming 5-year permit time frame for WDW-2.

The maximum permitted composite injection rate into all three Navajo injection wells is 800 gpm. This rate of injection is equal to 1,152,000 gallons per day or 420,480,000 gallons per year or 2,102,400,000 gallons into the Injection Zone over the upcoming 5-year permit time frame for WDW-3.

7 (k) Drawings

Figures 11a, 11b, and 11c present a schematic of the pre-injection surface facilities. Figures 12a, 12b, and 12c present as-built diagrams of the below-grade portions of the wells. Figure 13a, 13b, and 13c present as-built diagrams of the wellheads.

7 (l) Construction

WDW-1 was converted from the following oil and gas well originally drilled to a depth of 10,200 feet in 1993:

Mewbourne Oil Company
Chalk Bluff "31" State
Section 31, Township 17 South, Range 28 East
(API No. 30-015-27592)

The oil and gas well was re-entered in 1998 and converted to Injection Well WDW-1. Appendix H includes a copy of the report documenting the well conversion that provides relevant information about how the well was originally constructed and how it was converted to an injection well. Figure 12a presents an as-built diagram of the below-grade portions of WDW-1. Figure 13a presents an as-built diagram of the WDW-1 wellhead.

WDW-2 was converted from the following oil and gas well originally drilled to a depth of 10,200 feet in 1973:

The Eastland Oil Company
Chukka Federal No. 2
Section 12, Township 18 South, Range 27 East
(30-015-20894)

The oil and gas well was re-entered in 1999 and converted to Injection Well WDW-2. Appendix H includes excerpts from a report documenting the well conversion that provides relevant information about how the well was originally constructed and how it was converted to an injection well. Figure 12b presents an as-built diagram of the below-grade portions of WDW-2. Figure 13b presents an as-built diagram of the WDW-2 wellhead.

WDW-3 was converted from the following oil and gas well originally drilled to a depth of 9,450 feet in 1991:

Mewbourne Oil Company
Navajo Chalk Bluff Federal No. 1
Section 1, Township 18 South, Range 27 East
(API No. 30-015-26575)

The oil and gas well was converted to an injection well (WDW-3) in 2006. Appendix H includes excerpts from a report documenting the well conversion that provides relevant information about how the well was originally constructed and how it was converted to an injection well. Figure 12c presents an as-built diagram of the below-grade portions of WDW-3. Figure 13c presents an as-built diagram of the WDW-3 wellhead.

General Description of the WDW-1

Size, Type, and Depth of Injection Tubing: The information for the tubing string was obtained from NMOCD records on file with the state and geophysical logs.

- **Tubing**: 4 1/2-inch, 11.6 pound per foot, steel construction, API grade N-80, with long thread connections (LTC) set at 7,879.
- **Packer**: Arrow X-1, 7-inch by 3 1/2-inch set at 7,879 feet.

Size, Type, and Depth of Casing: There are three casing strings in the well. The information for these casing strings was obtained from NMOCD records on file with the state and geophysical logs.

- **13-3/8-inch**, 48.0 pound per foot, steel construction, API grade J-55, with short thread connections (STC), set at a depth of 390 feet back to surface. The casing was cemented to the surface with 525 sacks of cement. The casing was set in an open hole with a diameter of 17.5 inches. This information was obtained from NMOCD records.
- **9-5/8-inch**, 36.0 pound per foot, steel construction, API grade J-55, STC, set at a depth of 2,555 feet back to surface. The casing was cemented to the surface with 1,000 sacks of cement. The casing was set in an open hole with a diameter of 12.25 inches. This information was obtained from NMOCD records.
- **7-inch**, 29.0 pound per foot, steel construction, API grade N-80, with long thread connections (LTC), set at a depth of 9,094 feet to 7,031 feet; 29.0 pound per foot, steel construction, API grade P-110, LTC from 7,031 feet to 5,845 feet; and 26.0 pound per foot, P-110, LTC at 5,845 feet back to surface. The casing was cemented to the surface with 1,370 sacks of cement. The casing was set in an open hole with a diameter of 8.75 inches.

The original oil and gas well was drilled to a total depth of 10,200 feet. When the well was converted to an injection well in 1999, a cement plug was set from 9,624 to 9,734 feet and 7-inch protection casing was set at 9,094 feet. A bottom plug was installed into the base of the 7-inch casing with the top of the plug tagged at 9,004 feet. The 7-inch protection casing was perforated with a 0.5-inch diameter hole at 2 shots per foot on a 60° phasing. The perforations are located between 7,924 feet and 8,188 feet and from 8,220 feet to 8,476 feet as depicted on Figure 12a.

Current Loading on Pipe and Pipe Specifications for WDW-1

Pipe Size	Type	Weight	Depth Ref. to Kelly Bushing Level (12.5 ft above GL)		Hole Size	Cement Volume	Collapse	Yield
(in)		*(lb/ft)*	*Top*	*Bottom*	*(in)*	*(sks)*	*(psi)*	*(psi)*
13-3/8	Conductor Casing, J-55	48	Surface	390	17.5	525	1130	2730
9-5/8	Surface Casing	36	Surface	2555	12.25	1000	2020	3520
7	Protection, J-55 Casing, N-80, P-110	29 & 26	Surface	9094	8.75	1390	5410	7240
4-1/2	Injection Tubing, N-80	11.6	Surface	7879	6.184	N/A	4960	5350
7x 2-7/8	Arrow X-1 Packer	N/A	7871	7879	2.5	N/A	N/A	N/A

General Description of the WDW-2

Size, Type, and Depth of Injection Tubing: The information for the tubing string was obtained from NMOCD records on file with the state and geophysical logs.

- **Tubing**: 3 1/2-inch, 9.2 pound per foot, steel construction, API grade J-55, with long thread connections (LTC) set at 7,528.
- **Packer**: Arrow X-1, 5-1/2-inch by 2 7/8-inch set at 7,528 feet.

Size, Type, and Depth of Casing: There are three casing strings in the well. The information for these casing strings was obtained from NMOCD records on file with the state and geophysical logs.

- **8-5/8-inch**, 32.0 pound per foot, steel construction, API grade J-55, STC, set at a depth of 1,995 feet back to surface. The casing was cemented to the surface with 800 sacks of cement. The casing was set in an open hole with a diameter of 11.0 inches. This information was obtained from NMOCD records.
- **5-1/2-inch**, 17.0 pound per foot, steel construction, API grade L-80, with long thread connections (LTC), set at a depth of 8,869 feet. The casing was cemented to the surface in two stages using 1,570 sacks of cement. The casing was set in an open hole with a diameter of 7-7/8 inches.

The original oil and gas well was drilled to a total depth of 10,372 feet. When the well was converted to an injection well in 1999, a cement plug was set at 9,675 to 9,775 feet and 5-1/2-inch protection casing was

set at 8,869 feet. A bottom plug was installed into the base of the 5-1/2-inch casing with the top of the plug tagged at 8,770 feet. The 5-1/2-inch protection casing was perforated with a 0.5-inch diameter hole at 2 shots per foot on a 60° phasing. The perforations are located between 7,570 feet and 7,736 feet and from 7,826 feet to 8,399 feet as depicted on Figure 12b.

Current Loading on Pipe and Pipe Specifications for WDW-2

Pipe Size	Type	Weight	Depth Ref. to Kelly Bushing Level (12.5 ft above GL)		Hole Size	Cement Volume	Collapse	Yield
(in)		*(lb/ft)*	*Top*	*Bottom*	*(in)*	*(sks)*	*(psi)*	*(psi)*
8 5/8	Surface Casing, J-55	32	Surface	1,995	11.0	800	2,530	3,930
5½	Protection Casing, L-80	17	Surface	8,869	7.875	1,570	6,280	7,740
3½	Injection Tubing, J-55	9.2	Surface	7,528	4.892	N/A	N/A	N/A
5½ x2 7/8	Arrow X-1Packer	N/A	7,526	7,528	4.892	N/A	N/A	N/A

General Description of the WDW-3

Size, Type, and Depth of Injection Tubing: The information for the tubing string was obtained from NMOCD records on file with the state and geophysical logs.

- **Tubing**: 4-1/2-inch, 11.6 pound per foot, steel construction, API grade J-55, with long thread connections (LTC).
- **Packer**: Arrow X-1, 7-inch by 2-7/8-inch set in tension (37,000 pounds) at 7,575 feet.
- **Tubing Length**: 7,568 feet with a 0.54-foot, 4-1/2-inch by 2-7/8-inch crossover in the top of the packer. There are no profile nipples in the tubing or the packer as this was not a requirement of the permit.

Size, Type, and Depth of Casing: There are four casing strings in the well and one below the injection interval. The information for these casing strings was obtained from NMOCD records on file with the state and geophysical logs.

- **13-3/8-inch**, 54.5 pound per foot, steel construction, API grade J-55, with short thread connections (STC), set at a depth of 400 feet. The casing was cemented to the surface with 425 sacks of cement. The casing was set in an open hole with a diameter of 17.5 inches. This information was obtained from NMOCD records.
- **9-5/8-inch**, 36 pound per foot, steel construction, API grade J-55, STC, set at a depth of 2,604 feet. The casing was cemented to the surface with 1,025 sacks of cement. The casing was set in an open hole with a diameter of 12.25 inches. This information was obtained from NMOCD records.

- **7-inch**, 26 pound per foot steel construction, API grade N-80 and P-110, STC, set at a depth of 9,450 feet. The casing was cemented with 1,350 sacks of cement to 900 feet from the surface. The casing was set in an open hole with a diameter of 8.75 inches. The top of cement and weight of the pipe was verified with a CBL and caliper log run on October 13, 2006. The remainder of the information was obtained from NMOCD records.

Below the cement plug at 9,022 feet is the top of a 4-1/2-inch liner. The liner is a string of 4-1/2-inch casing installed to a depth of 10,119 feet. There is a cast iron bridge plug set in the liner at 9,800 feet, which is above the original perforations between 9,861 feet and 9,967 feet. The current injection interval is above the plug at 9,022 feet. The cement plug also isolates the lower section of the original wellbore. This information was obtained from NMOCD records.

The top of cement was determined from a CBL that was run in the 7-inch casing string on October 13, 2006. The top of cement in the 7-inch casing was found at 900 feet below the surface. The top of cement in the 9-5/8-inch and 13-3/8-inch casing strings was verified through NMOCD records and volume calculations.

The 7-inch casing was perforated on October 14 and 15, 2006. The casing was perforated with a 0.5-inch diameter hole at 2 shots per foot on a 60° phasing. The perforations are located between 7,660 feet and 8,450 feet and from 8,540 feet to 8,620 feet as depicted on Figure 12c.

The total depth of the well is 10,119 feet with the plug back depth at 9,022 feet. On August 30, 2009, fill was tagged at 8,986 feet.

Current Loading on Pipe and Pipe Specifications for WDW-3

Pipe Size	Type	Weight	Depth Ref. to Ground Level (ft)		Hole Size	Cement Volume	Collapse	Yield
(in)		*(lb/ft)*	*Top*	*Bottom*	*(in)*	*(sks)*	*(psi)*	*(psi)*
13-3/8	Conductor Casing, J-55	54-1/2	Surface	400	17.5	425	1130	2730
9-5/8	Surface Casing	36	Surface	2604	12.25	1025	2020	3520
7	Protection, J-55 Casing, N-80, P-110	26 & 29	Surface	9450	8.75	1350	5410	7240
4-1/2	Injection Tubing, J-55	11.6	Surface	7561	6.184	N/A	4960	5350
7x 2-7/8	Arrow X-1 Packer	N/A	7561	7569	2.5	N/A	N/A	N/A
4-1/2	Liner, N-80	11.6	9051	10119	6.5	175	6350	7780

Depth to Injection Zone

The WDW-1 Injection Zone is 7,450 to 9,016 feet (MD below KB), and the Injection Interval (perforated interval) is 7,924 to 8,476 feet (MD below KB) as depicted on Figure 12a.

The WDW-2 Injection Zone is 7,270 to 8,894 feet (MD below KB). And the Injection Interval (perforated interval) is 7,570 to 8,399 feet (MD below KB) as depicted on Figure 12b.

The WDW-3 Injection Zone is 7,303 to 8,894 feet (MD below KB), and the Injection Interval (perforated interval) is 7,660 to 8,620 feet (MD below KB) as depicted on Figure 12c.

Pressures and Other Stresses That May Cause Well Failure

There are no known pressures or stresses that may cause failure in any of the wells.

Hole Size

The borehole advanced for the original oil and gas well that was later converted to WDW-1 was 12.25 inches in diameter.

The borehole advanced for the original oil and gas well that was later converted to WDW-2 was 11.0 inches in diameter.

The borehole advanced for the original oil and gas well that was later converted to WDW-3 was 12.25 inches in diameter.

Well Casing Information

Figures 12a, 12b, and 12c and Appendix H include information about the well casing for each of the wells. The preceding tables ("Current Loading on Pipe and Pie Specifications") provide overviews of the casing information.

Cement Information

Figure 12a, 12b, and 12c and Appendix H include information about the cement in each well.

Rate, Temperature and Volume of Injected Fluid

Average and Maximum Daily Flow Rate and Volume

The average injection rate for all three Navajo injection wells is approximately 400 gpm and the maximum permitted injection rate between the three wells is 800 gpm.

Temperature

The temperature of the injected fluid is within average ambient temperature ranges.

Volume of Injected Fluid

The maximum annual volume of injected fluid, based on a maximum composite injection rate of 800 gpm between the three injection wells is 420,480,000 gallons.

Chemical and Physical Characteristics of Injected Fluid

The fluid injected into the wells is comprised of exempt and nonexempt non-hazardous oilfield waste that is generated in the refining process. Waste waters from process units, cooling towers and boilers, streams from water purification units and desalting units, recovered and treated groundwater, and general wash waters are blended to form the fluid injected. Table 2 and Appendix D present data characterizing the injection fluid.

Chemical and Physical Characteristics of Formation Fluid

Formation testing was conducted during the initial construction of the Navajo refinery injection wells to obtain site-specific data relating to the chemical, physical and radiological characteristics of the Injection Zone. The formation fluid contained in the Injection Zone is compatible with the well construction components and the injected fluid.

Formation fluid information pertinent to the reservoir calculations is included in Appendix E.

Chemical and Physical Characteristics of the Receiving Formation

The Injection Zone is porous carbonates of the lower portion of the Wolfcamp Formation, the Cisco Formation, and the Canyon Formation.

The lower portion of the Wolfcamp Formation (Lower Wolfcamp) is the shallowest porous unit in the proposed injection interval. The Wolfcamp Formation (Permian-Wolf campaign age) consists of light brown to tan, fine to medium-grained, fossiliferous limestones with variegated shale interbeds (Meyer, 1966, page 69). The top of the Wolfcamp Formation was correlated for this study to be below the base of the massive, dense dolomites of the overlying Abo Formation. The base of the Wolfcamp coincides with the top of the Cisco Formation. The thickness of log porosity greater than 5 percent in the entire Wolfcamp Formation ranges from 0 feet to 295 feet in a band three miles wide that trends northeast-southwest across the study area.

The Cisco Formation (Pennsylvanian-Virgilian age) of the Northwest Shelf is described by Meyer (1966, page 59) as consisting of uniform, light colored, chalky, fossiliferous limestones interbedded with variegated shales. Meyer (1966, page 59) also describes the Cisco at the edge of the Permian basin as consisting of biothermal (mound) reefs composed of thick, porous, coarse-grained dolomites. Locally, the Cisco consists of porous dolomite that is 659 feet thick in WDW-1, 745 feet in WDW-2, and 720 feet in WDW-3. The total thickness of intervals with log porosity greater than 5 percent is approximately 310 feet in WDW-1, 580 feet in WDW-2, and 572 feet in WDW-3. The total thickness with log porosity greater than 10 percent is approximately 100 feet in WDW-1, 32 feet in WDW-2, and 65 feet in WDW-3. The thickness of the porous intervals in the Cisco ranges from 0 feet in the northwestern part of the study area to nearly 700 feet in a band three miles wide that trends northeast-southwest.

The Canyon Formation (Pennsylvanian-Missourian age) consists of white to tan to light brown fine grained, chalky, fossiliferous limestone with gray and red shale interbeds (Meyer, 1966, page 53). Locally, the Canyon occurs between the base of the Cisco dolomites and the top of the Strawn Formation (Pennsylvanian-Desmoinesian age). The total thickness of intervals with log porosity greater than 5 percent is 34 feet in WDW-1, 30 feet in WDW-2, and 10 feet in WDW-3. No intervals appear to have log porosity greater than 10 percent in any of the three injection wells.

Permeability measurements that range from less than 100 md to 2,733 md are available for the Lower Wolfcamp-Cisco-Canyon injection zone. Permeability measurements from hydrocarbon-producing intervals in the Wolfcamp, Cisco, and Canyon from Meyer (1966, Table) are summarized in Appendix I. Meyer reported permeabilities in the Cisco of up to 114 millidarcies (md), up to 38 md in the Canyon, and up to 200 md in the Wolfcamp.

Permeability was estimated to be 597 md from DST No. 5 conducted in WDW-1 on August 26, 1993. DST No. 5 was conducted near the top of the Cisco Formation from 7,817 feet to 7,851 feet (Appendix I).

Historical falloff data obtained during the life of the wells shows that the permeability ranges from 500 md to 1,000 md throughout the injection interval.

Chemical and Physical Characteristics of the Confining Zone

The Confining Zone extends from 4,000 feet to 7,450 feet in WDW-1, from 4,120 feet to 7,270 feet in WDW-2, and from 4,030 feet to 7,303 feet in WDW-3. The Confining Zone includes massive low-porosity carbonate beds and layers of shale in the Upper Wolfcamp, Abo, and Yeso Formations that will confine the injected fluids to the permitted Injection Zone (Lower Wolfcamp, Cisco, and Canyon Formations). The formations that comprise the Confining Zone are described below.

The Injection Zone is directly overlain by the confining layers of the upper portion of the Wolfcamp Formation. Three (3) DSTs were conducted in the upper portion of the Wolfcamp in WDW-1, in the interval from 7,016 feet to 7,413 feet, that indicate that the interval has low permeability and can confine injected fluids to the injection zone. An average permeability of 0.36 md was calculated from the data from DST No. 3, as follows:

$$k = 162.6 \frac{q\ B\ \mu}{mh}$$

$$= 162.6 \frac{(20\ \text{bbl/}\ 89\ \text{min x}\ 1440\ \text{min/day})(1\ )(0.53\ \text{cp})}{(570.883\ \text{psi/cycle})\ (7382\ \text{feet} - 7230\ \text{feet})}$$

$$= 162.6 \frac{(323.6\ \text{bpd})(1)(0.\ 53\ \text{cp})}{(570.883\ \text{psi/cycle})\ (152\ \text{feet})}$$

$$= 0.36\ \text{md}$$

A permeability on the order of 0.1 md is at the low end of the permeability range for carbonates, and is at the high end of the permeability range for shales, according to Freeze and Cherry (1979, p. 29).

Therefore, the low-permeability carbonates of the upper Wolfcamp will provide the first level of confinement for the Injection Zone.

The Abo Formation overlies the Wolfcamp and extends from 5,400 feet to 6,890 feet in WDW-1, from 5,506 feet to 6,728 feet in WDW-2, and from 5,380 feet to 6,745 feet in WDW-3. Although the Abo is well known as a major oil producer in the AOR, the producing intervals lie in the upper Abo, whose equivalents are above 6,100 feet in WDW-1 and above 6,200 feet in WDW-2. The deepest Abo test well in the area is located 6,000 feet east (downdip) of WDW-3 and was drilled to 6,412 feet. No Abo production in the area has been established below 6,298 feet, the producing interval in Map ID No. 112, located 3,800 feet southeast (downdip) of WDW-1. The base of the producing interval within the Abo Formation in the AOR, therefore, is over 900 feet above the top of the injection zone. The lower 600 feet of the Abo Formation (below the deepest producing interval in the AOR), consisting primarily of dolomite with an average porosity less than 5 percent and interbedded shale, will serve as the secondary confining layer above the proposed injection zone.

The Yeso Formation, which will provide additional confining capabilities, directly overlies the Abo Formation. The top of the Yeso is not consistently identified in the AOR, according to well records submitted to the NMOCD and available scout tickets. However, the top of the Confining Zone can be considered to extend to the top of the low-porosity limestone interval below the higher-porosity dolomites below the Glorieta Member of the San Andres Formation (at 4,000 feet in WDW-1, 4,120 feet in WDW-2, and 4,030 feet in WDW-3). The Yeso consists of low-porosity carbonates and clastic beds. The Tubb shale, a shale interval that is up to 150 feet thick in some wells in the study area, also occurs in this interval. Although no faults are known to exist in the confining zone within the AOR, the Tubb shale will serve to prevent movement of fluids through a hypothetical unknown fault.

Depth, Thickness and Chemical Characteristics of Penetrated Formations Containing Ground Water

The base of the USDW, groundwater with total dissolved solids concentration with less than 10,000 milligrams per liter (mg/L), occurs at the base of the Tansill Formation. Figure 3 presents a hydrostratigraphic cross-section for the local area. Figure 4 presents a potentiometric surface map indicating the direction of groundwater movement in the freshwater aquifers.

The base of the USDW occurs at the following approximate depths in Navajo's three injection wells:

- WDW-1: approximately 493 feet KB (3,200 feet above mean sea level)
- WDW-2: approximately 473 feet KB (3,150 feet above mean sea level)
- WDW-3: approximately 420 feet KB (3,150 feet above mean sea level)

In the eastern part of the study area, at depth, the Tansill Formation is overlain by the Salado Formation (Permian - Ochoan age). The Salado consists of halite, polyhalite, anhydrite, and potassium salts, which are soluble. The Salado is overlain by the Rustler Formation (Permian - Ochoan age). In the AOR, which straddles the outcrop area of the Salado, and to the east, the Salado has been removed by solution by ground water flowing through the Rustler.

To the east, where the Rustler is present, the Rustler is the USDW. To the west, where the Rustler has been removed by erosion and the Salado has been removed by solution, the Tansill is the USDW. The Tansill Formation and the underlying Yates Formation comprise the Three Twins Member of the Chalk

Bluff Formation known in outcrops in the region (Hendrickson and Jones, 1952, page 20), and listed as a freshwater-producing interval.

The top of the Injection Zone (Lower Wolfcamp, Cisco, and Canyon Formations) is separated from the base of the USDW by several thousand feet of lower permeability carbonates, siltstones and shales as follows:

- WDW-1: 6957 feet (7,450 feet - 493 feet)
- WDW-2: 6,797 feet (7,270 feet - 473 feet).
- WDW-3: 6,883 feet (7,303 feet - 420 feet).

7 (m) Contingency Plans

The wells are equipped with a high-level shutoff switch to prevent operation of the injection pump at pressures greater than the designated MASIP. The wells are equipped with a low pressure shutoff switch that will deactivate the injection pump in the event of a surface leak. In addition, the wells are equipped with a high/low pressure shutdown switch with a pressure sensor on the tubing/casing annulus. This pressure switch is intended to stop the injection pump in the event of 1) a tubing leak, or 2) a casing, packer, or wellhead leak.

If an alarm or shutdown is triggered, the cause of the alarm or shutdown will be immediately investigated.

- Immediately cease injection operations;
- Take all necessary steps to determine the presence or absence of a leak; and
- Provide verbal notification to NMOCD within 24 hours.

If the alarm or shutdown is not related to mechanical integrity and the cause of the alarm or shutdown is corrected, injection operations will be resumed. If the mechanical integrity of the wells are in question, the well will remain out of service until the mechanical integrity of the well is restored to the satisfaction of NMOCD and the agency approves resumption of injection operations.

7 (n) MIT Monitoring Plans (20.6.2.5207 NMAC)

Navajo has an ongoing monitoring program that satisfies all applicable requirements of 20.6.2.5207.NMAC.

- The mechanical integrity of WDW-1, WDW-2, and WDW-3 are demonstrated on an annual basis.
- Continuous monitoring devices are used to provide a record of injection pressure, flow rate, flow volume, and annular pressure.

The results of these monitoring activities are reported to NMED as required by regulation.

7 (o) Additional Monitoring Plans for Class I Non-Hazardous Waste Injection Wells (20.6.2.5207B NMAC)

Appendix J includes an Injected Fluids Monitoring Plan that describes the procedures to be carried out on a quarterly basis to obtain a detailed chemical and physical analysis of a representative sample of the injected fluid, including the quality assurance procedures. The plan will be updated as necessary.

The plan includes the following elements:

- The parameters for which the injected fluid will be analyzed and the rationale for the selection of these parameters; The test methods that will be used to test for these parameters;
- The sampling method that will be used to obtain a representative sample of the injected fluid being analyzed;
- Field sampling documentation methodologies;
- The commercial laboratory who performs the analysis; and
- Method of reporting analytical results to NMOCD.

7 (p) Additional Monitoring Plans for Class III Wells (20.6.2.5207C NMAC)

This section is not applicable; WDW-1, WDW-2, and WDW-3 are not a Class III well.

7 (q) Financial Assurance

Appendix K includes a well closure plans for each well. The estimated plug and abandon cost per well is presented in the table below. This cost estimate has been prepared to reflect the estimated costs that would be incurred by Navajo to abandon the well in accordance with the procedures in Appendix K.

Description of Service	**Estimated Cost**
Wireline (BHP, RTS, PFOT, Perforate)	$20,000
Rental Tools	$5,000
Pumping Service	$10,000
Cementing Service	$20,000
Excavating and Welding	$2,500
Mud/Brine	$5,000
Frac Tanks	$2,500
Vacuum Trucks	$2,500
Miscellaneous	$2,500
SUBTOTAL	$70,000
Field Supervision, Project Management, Procurement	$25,000
Total Estimated Cost	**$95,000**

Appendix L includes a copy of the financial assurance instrument that Navajo has established to provide the appropriate monies for plugging and abandoning each well, any groundwater restoration that may be necessary, and any post-operational monitoring that may be required.

7 (r) Logging and Testing Data

Appendix M includes pertinent open-hole logs run on each of well:

- A copy of the original oil and gas well log that was drilled in 1993 and later converted to WDW-1.
- A copy of the original oil and gas well log that was drilled in 1973 and later converted to WDW-2.
- A copy of the original oil and gas well that was drilled in 1991 and later converted to WDW-3.

Appendix N includes copies of pertinent cased-hole logs that were run on each well:

- Logs run as WDW-1 was being converted to disposal services.
- Logs run as WDW-2 was being converted to disposal services.
- Logs run as WDW-3 was being converted to disposal services.

Copies of additional open-hole and cased-hole logs are contained in the following:

- WDW-1, report submitted to NMOCD in September 1998: *Reentry and Completion Report, Waste Disposal Well No. 1, Navajo Refining Company, Artesia, New Mexico* prepared by Envirocorp Well Services, Inc., Houston, Texas
- WDW-2, report submitted to NMOCD in July 1999: *Reentry and Completion Report, Waste Disposal Well No. 2*, Navajo Refining Company, Artesia, New Mexico prepared by Subsurface Technology, Inc., Houston, Texas

7 (s) Mechanical Integrity Data (20.6.2.5204 NMAC)

Mechanical Integrity Testing (MIT) is conducted on WDW-1, WDW-2, and WDW-3 in 2015 in accordance with NMOCD regulations. Appendix G includes the text portion of the 2015 MIT Report for WDW-1, WDW-2, and WDW-3. Copies of the full MIT report were submitted to NMOCD. Previous annual MIT reports are contained in NMOCD files. The MITs were successful for all three disposal wells.

In addition, Appendix G includes a copy of the text portion of the 2016 Annual Bottomhole Pressure Survey and Pressure Falloff Test for WDW-1.

7 (t) Maximum Pressure and Flow Rate

The maximum injection rate and the maximum surface injection pressure at each of the Class I non-hazardous injection wells (WDW-1, WDW-2, and WDW-3) are as follows:

- Maximum Injection Rate: 500 gpm
- Maximum Surface Injection Pressure: 1,585 psi

7 (u) Formation Testing Program Data

Appendix F-1 includes the results of formation testing that was performed on the well when it was originally drilled as an oil and gas exploratory well.

7 (v) Compatibility

Components of WDW-1, WDW-2, and WDW-3 that are in direct contact with the non-corrosive waste stream and formation fluids in the Injection Interval (e.g., wetted surfaces) are constructed of materials that are compatible with these fluids.

Compatibility tests for Navajo's waste stream were performed by analyzing the chemical reactions between different mixtures of the secondary reverse osmosis reject fluid and the waste water and flue gas scrubber mixture. All testing and analysis were performed by Intertek Group PLC (Intertek) who provide chemical testing and analyses to understand the composition of chemical substances and materials that are used in products, industrial processes and manufacturing (Appendix F-2).

7 (w) Area of Review Corrective Actions

No corrective action plan is required for any of the artificial penetrations identified in the AOR. Artificial penetration records reviewed show those identified within the AOR have been properly constructed, plugged and/or abandoned in order to prevent movement of fluids into or between USDWs which could be caused by pressures in the Injection Zone.

8.0 Modification(s)

A request was issued via correspondence to the NMOCD on September 25, 2013 to process the applications for WDW-1 and WDW-2 so that these permits would be issued with the same expiration date as the WDW-3 permit (June 1, 2017). The permits were processed and thusly issued with the same expiration date of June 1, 2017. Appendix O includes a copy of this correspondence.

There are no other modifications for the three wells or proposed modifications to existing discharge processes.

9.0 Inspection/Maintenance and Reporting

Navajo performs daily visual inspections of their three injection wells and the pipeline and performs required maintenance (PM) activities as scheduled to ensure safe operation of the wells.

Navajo performs routine reporting in accordance with the requirements of 20.6.2.5208.A NMAC for Class I Non-Hazardous waste injection wells.

10.0 Contingency Plans

Navajo Refinery has an Integrated Contingency Plan detailing responses to spills of all types, reporting spills/releases, mitigation and corrective actions, clean up and disposal as applicable. The remote wells (WDW-1, WDW-2, and WDW-3) are equipped with a high-pressure shutoff switch to prevent operation of the injection pump at pressures greater than the designated MASIP. The wells are equipped with a low pressure shutoff switch that will deactivate the injection pump in the event of a surface leak. In addition, the wells are equipped with a high/low pressure shutdown switch with a pressure sensor on the tubing/casing annulus. This pressure switch is intended to stop the injection pump in the event of 1) a tubing leak, or 2) a casing, packer, or wellhead leak.

If an alarm or shutdown is triggered at the wellhead, electronic signals are sent to the Control Room at the refinery notifying of the shutdown and the cause of the alarm or shutdown will be immediately investigated.

Operators will immediately cease injection operations at the wellhead and divert flow to another well; and notify Maintenance and Environmental to take all necessary steps to determine the presence or absence of a leak; and Environmental will provide verbal notification to NMOCD within 24 hours.

If the alarm or shutdown is not related to mechanical integrity and the cause of the alarm or shutdown is corrected, injection operations will be resumed. If the mechanical integrity of the well is in question, the well will remain out of service until the mechanical integrity of the well is restored to the satisfaction of NMOCD and the agency approves resumption of injection operations.

11.0 Other Information

No additional information is required to demonstrate that the discharge permit will not result in concentrations in excess of the standards of 20.6.2.3103 NMAC or the presence of any toxic pollutant at any place of withdrawal of water for present or reasonably foreseeable future use.

12.0 Filing Fee

A check in the amount of $300, made payable to Water Quality Management Fund, accompanies this permit renewal application document for Class I Injection wells WDW-1, WDW-2, and WDW-3.

13.0 Draft Public Notice

20.6.2.3108.C NMAC requires that Navajo provide notice in accordance with 20.6.2.3108.F NMAC within 30 days of NMOCD deeming the permit renewal application to be administratively complete. Appendix P

includes a draft copy of the public notice that will be published following receipt of written notification from NMOCD that this discharge permit renewal application has been deemed administratively complete.

Navajo understands the requirement to submit to NMOCD within 15 days of completion of public notice requirements of 20.6.2.3108.C NMAC proof of notice, including an affidavit of mailing(s) and the list of property owner(s), proof of publication, and an affidavit of posting, as appropriate.

14.0 Certification

The required certification language is included at the end of the completed NMOCD Discharge Permit Application Form in the front of this permit renewal application document. The appropriate Navajo Refinery authority has signed the form.

TABLES

TABLE 1A

NON-FRESHWATER (OIL AND GAS) ARTIFICIAL PENETRATIONS IN AREA OF REVIEW
WDW-1, WDW-2, AND WDW-3
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

ID NO	API	Sect	TWP	RNG	NS FTG	EW FTG	WELL NAME	WELL NUMBER	OPERATOR	TOTAL DEPTH (FT)	WELL TYPE	WELL STATUS	DRILLL DATE	PLUG DATE
1	30-015-01636	31	17S	28E	330	2310	Pre-Ongard Well #001		Pre-Ongard Well Operator	?	O	PA	1/1/1900	1/1/1900
2	30-015-01633	31	17S	28E	330	330	Aston & Fair A #001		George A Chase JV dba G&C Service	525	O	Active	12/28/1945	NA
3	30-015-01634	31	17S	28E	350	345	Pre-Ongard Well #001		Pre-Ongard Well Operator	?	O	PA	1/1/1900	1/1/1901
4	30-015-01645	31	17S	28E	990	990	Pre-Ongard Well #001		Pre-Ongard Well Operator	?	O	PA	1/1/1900	1/1/1900
5	30-015-32162	31	17S	28E	460	990	Enron State #4		LRE Operating, LLC	3460	O	Active	3/26/2003	NA
6	30-015-38512	31	17S	28E	990	940	Enron State #16		LRE Operating, LLC	3658	O	Active	8/11/2011	NA
7	30-015-33994	36	17S	27E	915	420	Red Lake 36 A State #002		Apache Corp	3650	O	Active	3/24/2005	NA
8	30-015-00646	36	17S	27E	990	330	Delhi #007		George A Chase JV dba G&C Service	540	O	Active	3/24/1950	NA
9	30-015-00689	36	17S	27E	1650	330	Gates State #001		George A Chase JV dba G&C Service	557	O	Active	7/22/1951	NA
10	30-015-36978	31	17S	28E	990	330	Enron State #015		LRE Operating, LLC	3700	O	Active	6/25/2009	11/1/2004
11	30-015-00647	36	17S	27E	1650	990	Gates State #002		Aspen Oil Inc.	9999	O	PA	10/3/1952	NA
12	30-015-31123	36	17S	27E	1980	760	No Bluff State Comm #002		LRE Operating, LLC	10050	G	Active	3/19/2001	NA
13	30-015-00669	36	17S	27E	2310	330	Homan #001		George A Chase JV dba G&C Service	1804	O	Active	5/21/1949	NA
14	30-015-31036	36	17S	27E	2310	990	Gates State #003		George A Chase JV dba G&C Service	614	O	Active	3/26/2000	NA
15	30-015-36116	36	17S	27E	2305	1650	South Red Lake 11 Unit #057		Legacy Reserves Operating LLC	2121	O	Active	4/14/2008	NA
16	30-015-00687	36	17S	27E	2310	990	Ramapo #002		Kersey & Co.	9999	G	PA	3/24/1948	6/14/1996
17	30-015-05934	36	17S	27E	1650	1650	Empire ABO Unit #019A		Apache Corp	5970	O	Active	NA	NA
18	30-015-39325	36	17S	27E	990	2210	Big Boy State #007		COG Operating LLC	5120	O	Active	1/6/2012	NA
19	30-015-00670	36	17S	27E	2970	330	Ramapo #003		Kersey & Co.	9999	O	PA	1/1/1990	6/17/1996
20	30-015-00688	36	17S	27E	2310	330	Ramapo #001		Kersey & Co.	590	O	PA	10/3/1941	6/18/1996
21	30-015-00685	36	17S	27E	1650	330	Pre-Ongard Well #020		Pre-Ongard Well Operator	?	O	PA	1/1/1900	1/1/1900
22	30-015-39401	36	17S	27E	1110	630	Empire ABO Unit #417		Apache Corp	6300	O	Active	1/9/2012	NA
23	30-015-39323	36	17S	27E	870	1560	Big Boy State #005		COG Operating LLC	4953	O	Active	4/21/2012	NA
24	30-015-01251	36	17S	27E	660	1980	Empire ABO Unit #019		BP America Production Co.	6200	O	Plugged, Site Released	1/1/1900	9/9/2009
25	30-015-39324	36	17S	27E	480	2210	Big Boy State #006		COG Operating LLC	5072	O	Active	12/18/2011	NA
26	30-015-39326	36	17S	27E	275	1560	Big Boy State #008		COG Operating LLC	NA	O	N	NA	NA
27	30-015-40410	36	17S	28E	615	10	Big Girl 31 State #011H		COG Operating LLC	NA	O	N	NA	NA
28	30-015-00677	36	17S	27E	330	990	Empire ABO Unit #020		BP America Production Co.	6013	O	PA	3/17/1960	9/9/2009
29	30-015-39021	6	18S	28E	40	145	Empire ABO Unit #411		Apache Corp	6312	O	T	10/31/2011	NA
30	30-015-32309	1	18S	27E	330	1690	AAO Federal #003		Apache Corp	4125	O	Active	3/13/2003	NA
31	30-015-00708	1	18S	27E	660	1980	Empire ABO Unit #019B		Apache Corp	6078	O	Plugged, Site Released	5/29/1959	5/22/2013
32	30-015-01215	1	18S	27E	667	666	Empire ABO Unit #020D		Apache Corp	6118	O	Active	9/23/1959	NA
33	30-015-32310	1	18S	27E	990	990	AAO Federal #004		Apache Corp	4110	O	Active	7/14/2003	NA
34	30-015-39898	1	18S	27E	1258	1005	Empire ABO Unit #412		Apache Corp	NA	O	Cancelled Apd	NA	NA
35	30-015-33784	1	18S	27E	1650	330	AAO Federal #008		Apache Corp	4310	O	Active	2/28/2005	NA
36	30-015-00711	1	18S	27E	1980	660	Empire ABO Unit #020C		Apache Corp	6218	O	Plugged, Site Released	9/1/1959	7/8/2013
37	30-015-22656	1	18S	27E	2400	700	Empire ABO Unit #203		Apache Corp	6225	O	Active	9/13/1978	NA
38	30-015-23116	6	18S	28E	2050	100	Empire ABO Unit #213		Apache Corp	6242	O	Active	3/1/1980	NA
39	30-015-22637	6	18S	28E	2450	400	Empire ABO Unit #212		Apache Corp	6267	O	Active	12/4/1978	NA
40	30-015-21553	1	18S	27E	2501	20	Empire ABO Unit #201		Apache Corp	6225	O	Active	6/28/1975	NA
41	30-015-02622	6	18S	28E	2219	660	Empire ABO Unit #21D		Apache Corp	6194	O	Active	12/27/1959	NA
42	30-015-02619	6	18S	28E	1990	660	Empire ABO Unit #021C		Apache Corp	6202	O	Active	10/8/1959	NA
43	30-015-02613	6	18S	28E	990	660	Empire ABO Unit #21B		Apache Corp	6119	O	Active	12/8/1959	NA
44	30-015-22012	6	18S	28E	1350	1572	Empire ABO Unit #222		Apache Corp	6303	O	Active	2/17/1977	NA
45	30-015-02626	6	18S	28E	1650	1650	Pre-Ongard Well #001		Pre-Ongard Well Operator	?	O	PA	1/1/1900	1/1/1900
46	30-015-10107	6	18S	28E	1874	1874	State FX #001		Pre-Ongard Well Operator	1985	O	Active	12/31/9999	NA
47	30-015-02620	6	18S	28E	1990	2082	Empire ABO Unit #22D		Alamo Permian Resources, LLC	6206	O	Active	12/31/9999	NA
48	30-015-02621	6	18S	28E	66	1980	Empire ABO Unit #22E		Apache Corp	6033	O	Active	12/31/9999	NA
49	30-015-02625	6	18S	28E	470	2170	Empire ABO Unit #23C		Apache Corp	6194	O	Active	12/31/9999	NA
50	30-015-02615	6	18S	28E	660	660	Empire ABO Unit #24B		Apache Corp	6241	O	Active	12/31/9999	NA
51	30-015-02614	6	18S	28E	1980	1980	Empire ABO Unit #23B		Apache Corp	6242	O	Active	12/31/9999	NA
52	30-015-02611	6	18S	28E	2310	2310	Pre-Ongard Well #001		Pre-Ongard Well Operator	?	O	PA	1/1/1900	1/1/1900
53	30-015-21395	6	18S	28E	2630	1300	Empire ABO Unit #211		Apache Corp	6200	O	Active	11/22/1974	NA
54	30-015-22527	6	18S	28E	2630	1930	Empire ABO Unit #223		Apache Corp	6250	O	Approved Temporary Abandonment	4/22/1978	NA
55	30-015-02623	6	18S	28E	2248	2075	Empire ABO Unit #022F		Apache Corp	6210	O	Active	1/28/1960	NA
56	30-015-23548	6	18S	28E	1950	1000	Empire ABO Unit #211A		Apache Corp	6311	O	Active	2/11/1981	NA
57	30-015-02628	6	18S	28E	2260	2270	Empire ABO Unit #023D		BP America Production Co.	6310	O	PA	4/3/1960	12/5/2008
58	30-015-02618	6	18S	28E	1647	2076	Pre-Ongard #001		Pre-Ongard Well Operator	?	G	PA	1/1/1900	1/1/1900
59	30-015-22491	6	18S	28E	1700	2350	Empire ABO Unit #231B		BP America Production Co.	6350	O	PA	12/31/9999	8/24/2009
60	30-015-02610	6	18S	28E	955	1750	Empire ABO Unit #022C		Apache Corp	6243	O	Active	7/20/1960	NA
61	30-015-02624	6	18S	28E	968	2270	Pre-Ongard #001		Pre-Ongard Well Operator	?	O	PA	1/1/1900	1/1/1900
62	30-015-02617	6	18S	28E	2310	990	Empire ABO Unit #024K		BP America Production Co.	6346	O	PA	12/31/9999	12/12/2002
63	30-015-22528	6	18S	28E	2300	1570	Empire ABO Unit #232A		BP America Production Co.	6350	O	PA	6/27/1978	10/9/2009
64	30-015-22490	6	18S	28E	2550	2050	Empire ABO Unit #233		BP America Production Co.	6300	O	PA	7/1/1978	10/9/2009
65	30-015-21746	6	18S	28E	2610	2713	Empire ABO Unit #221		Apache Corp	6305	O	Active	12/31/9999	NA
66	30-015-21737	6	18S	28E	2253	1576	Empire ABO Unit #232A		BP America Production Co.	6345	O	PA	12/31/9999	10/9/2009
67	30-015-23547	6	18S	28E	1950	660	Empire ABO Unit #241		BP America Production Co.	6386	O	PA	12/31/9999	12/23/2008
68	30-015-02616	6	18S	28E	1650	990	Empire ABO Unit #024C		Apache Corp	6253	O	Active	12/31/9999	NA
69	30-015-22913	6	18S	28E	1750	1600	Empire ABO Unit #235		Apache Corp	600	O	PA	12/31/9999	?
70	30-015-21542	6	18S	28E	1260	1580	Empire ABO Unit #231B		Apache Corp	6261	O	Active	12/31/9999	NA

TABLE 1A

NON-FRESHWATER (OIL AND GAS) ARTIFICIAL PENETRATIONS IN AREA OF REVIEW
WDW-1, WDW-2, AND WDW-3
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

ID NO	API	Sect	TWP	RNG	NS FTG	EW FTG	WELL NAME	WELL NUMBER	OPERATOR	TOTAL DEPTH (FT)	WELL TYPE	WELL STATUS	DRILLL DATE	PLUG DATE
71	30-015-21626	6	18S	28E	1361	2531	Empire ABO Unit #231A		Apache Corp	6390	O	Active	12/31/9999	NA
72	30-015-22593	6	18S	28E	1900	2441	Empire ABO Unit #234		BP America Production Co.	6260	O	PA	12/31/9999	12/25/2008
73	30-015-30785	6	18S	28E	430	330	NW State #015		LRE Operating, LLC	3225	O	Active	12/20/1999	NA
74	30-015-20019	6	18S	28E	330	330	NW Artesia Unit #016		LRE Operating, LLC	3273	O	Active	12/31/9999	NA
75	30-015-39008	6	18S	28E	160	1300	Empire ABO Unit #410		Apache Corp	?	O	N	12/31/9999	NA
76	30-015-25522	5	18S	28E	2240	400	Walter Solt State #001		Walter Solt LLC	8500	SWD	Active	12/31/9999	NA
77	30-015-10244	5	18S	28E	2310	330	State AG #001		Mack Energy Corp	6365	O	PA	12/31/9999	3/27/2001
78	30-015-24485	5	18S	28E	1980	990	Illinois Camp A Com #001		Conoco Phillips Co	10450	G	Active	5/28/1983	NA
79	30-015-31086	5	18S	28E	1650	990	LP State #001		Marbob Energy Corp	4503	O	PA	7/3/2000	3/11/2008
80	30-015-02602	5	18S	28E	1650	1650	Empire ABO Unit #026D		Apache Corp	6265	O	Active	11/28/1959	NA
81	30-015-22697	5	18S	28E	1080	1914	Empire ABO Unit #261A		BP America Production Co.	6350	O	PA	12/31/9999	6/15/2009
82	30-015-02607	5	18S	28E	660	660	Empire ABO Unit #25C		Apache Corp	6273	O	Plugged, Site Released	2/23/1960	6/25/2013
83	30-015-22750	5	18S	28E	660	150	Empire ABO Unit #251		Apache Corp	6250	O	Active	12/31/9999	NA
84	30-015-02605	5	18S	28E	330	2271	Empire ABO Unit #27E		BP America Production Co.	6261	O	PA	12/31/9999	6/16/2009
85	30-015-02606	5	18S	28E	330	1941	Empire ABO Unit #26E		Apache Corp	6254	O	Active	7/6/1960	NA
86	30-015-22009	32	17S	28E	330	2481	Empire ABO Unit #272		Apache Corp	6370	O	Active	2/8/1977	NA
87	30-015-21539	32	17S	28E	150	1400	Empire ABO Unit #261A		Apache Corp	6220	O	Active	12/31/9999	NA
88	30-015-39007	32	17S	28E	70	100	Empire ABO Unit #409		Apache Corp	6400	N	N	12/31/9999	NA
89	30-015-37058	32	17S	28E	330	330	NW State #32		LRE Operating, LLC	3425	O	Active	8/12/2009	NA
90	30-015-37057	32	17S	28E	330	1750	NW State #31		LRE Operating, LLC	3500	O	Active	7/21/2009	NA
91	30-015-01659	32	17S	28E	660	1980	Empire ABO Unit #26A		Apache Corp	6172	O	Active	12/31/9999	NA
92	30-015-01660	32	17S	28E	660	660	Empire ABO Unit #25		BP America Production Co.	6187	O	PA	12/31/9999	6/30/2009
93	30-015-30685	32	17S	28E	990	990	NW State #007		LRE Operating, LLC	3220	O	Active	8/30/1999	NA
94	30-015-10834	32	17S	28E	990	2030	NW Artesia Unit #13		SDX Resources, Inc.	2006	O	PA	12/31/9999	11/2/2006
95	30-015-30815	32	17S	28E	1090	2126	NW State #008		LRE Operating, LLC	3310	I	Active	11/18/1999	NA
96	30-015-20043	32	17S	28E	990	760	NW Artesia Unit #012		LRE Operating, LLC	1998	I	Active	12/31/9999	NA
97	30-015-01661	32	17S	28E	1650	2310	Empire ABO Unit #26B		Apache Corp	6083	O	Active	12/31/9999	NA
98	30-015-36989	32	17S	28E	1630	1710	NW State #30		LRE Operating, LLC	3405	O	Active	7/7/2009	NA
99	30-015-01662	32	17S	28E	1650	990	Empire ABO Unit #25A		Apache Corp	6123	O	Active	12/31/9999	NA
100	30-015-36554	32	17S	28E	1770	550	NW State #29		LRE Operating, LLC	3450	O	Active	1/21/2009	NA
101	30-015-39927	32	17S	28E	1750	1765	AA State #002		Apache Corp	5800	O	N	12/31/9999	NA
102	30-015-30781	32	17S	28E	1900	2146	NW State #005		LRE Operating, LLC	3190	I	Active	10/28/1999	NA
103	30-015-10818	32	17S	28E	2310	2105	NW Artesia #008		SDX Resources, Inc.	2003	O	PA	12/31/9999	11/6/2006
104	30-015-30777	32	17S	28E	2310	990	NW State #006		LRE Operating, LLC	3204	O	Active	10/19/1999	NA
105	30-015-10795	32	17S	28E	2310	66	NW Arteisa #009		Lime Rock Resources L.P.	1980	O	PA	12/31/9999	5/28/2008
106	30-015-01657	32	17S	28E	2280	1980	AA State #001		Apache Corp	6171	O	Active	7/30/1960	NA
107	30-015-01671	32	17S	28E	2280	978	Empire ABO Unit #25B		BP America Production Co.	6013	O	PA	12/31/9999	7/21/2008
108	30-015-31920	32	17S	28E	990	990	Enron State #002		LRE Operating, LLC	4030	O	Active	9/4/2001	NA
109	30-015-40339	32	17S	28E	99	330	Enron State #018		LRE Operating, LLC	4250	O	N	12/31/9999	NA
110	30-015-35050	32	17S	28E	330	500	Enron State #012		LRE Operating, LLC	3810	O	Active	11/20/2006	NA
111	30-015-01654	32	17S	28E	33	330	Pre-Ongard #001		Pre-Ongard Well Operator	651	O	PA	1/1/1900	1/1/1900
112	30-015-39638	30	17S	28E	412	679	Anthoney State #003		LRE Operating, LLC	5039	O	Active	2/21/2012	NA
113	30-015-38234	30	17S	28E	430	800	Anthoney State #002		LRE Operating, LLC	4823	O	Active	2/1/2011	NA
114	30-015-01616	30	17S	28E	330	990	Blake State #1		CFM Oil LLC	615	O	Active	12/31/9999	NA
115	30-015-36564	30	17S	28E	330	2210	Staley State #009		LRE Operating, LLC	4010	O	Active	12/15/2008	NA
116	30-015-40026	30	17S	28E	330	2410	Staley State #017		LRE Operating, LLC	5108	O	Active	3/15/2012	NA
117	30-015-37673	30	17S	28E	330	1650	Staley State #012		LRE Operating, LLC	4785	O	Active	5/24/2010	NA
118	30-015-38203	30	17S	28E	330	990	Maple State #008		COG Operating LLC	4750	O	N	12/31/9999	NA
119	30-015-21594	31	17S	28E	330	1650	Powco State #001		Finney Oil Co	650	O	Active	12/31/9999	NA
120	30-015-01638	31	17S	28E	330	990	Pre-Ongard #001		Pre-Ongard Well Operator	2003	O	PA	1/1/1990	1/1/1990
121	30-015-30784	31	17S	28E	330	480	NW State #002		LRE Operating, LLC	3300	O	Active	11/11/1999	NA
122	30-015-30893	31	17S	28E	973	959	NW State #028		LRE Operating, LLC	2808	O	Active	9/14/2000	NA
123	30-015-25621	31	17S	28E	980	1620	Powco State #002		Finney Oil Co	734	O	Active	12/31/9999	NA
124	30-015-30783	31	17S	28E	1650	330	NW State #11		LRE Operating, LLC	3205	O	Active	11/4/1999	NA
125	30-015-36343	31	17S	28E	1650	2310	Malco State #002		George A Chase JV dba G&C Service	633	O	Active	6/30/2008	NA
126	30-015-10537	31	17S	28E	2277	330	NW Artesia Unit #004		LRE Operating, LLC	6200	O	Active	3/3/1966	NA
127	30-015-01652	31	17S	28E	2288	1625	Boling #001		Kersey & Co.	1938	O	Active	12/14/1989	NA
128	30-015-37428	31	17S	28E	1980	1980	Malco State #003		George A Chase JV dba G&C Service	650	O	Active	12/20/2009	NA
129	30-015-01637	31	17S	28E	2310	2310	Malco State #001		George A Chase JV dba G&C Service	1852	O	Active	1/14/1953	NA
130	30-015-01635	31	17S	28E	2310	2310	Aiton & Fair #001Y		George A Chase JV dba G&C Service	1926	O	Active	12/31/9999	NA
131	30-015-01643	31	17S	28E	2310	2360	Empire ABO Unit #22		BP America Production Co.	5971	O	PA	12/31/9999	7/10/2009
132	30-015-24887	31	17S	28E	2310	990	Hudson Saikin State #002		Alamo Permian Resources, LLC	1950	O	Active	12/31/9999	NA
133	30-015-02666	31	17S	28E	2310	330	Hudson Saikin State #001		Alamo Permian Resources, LLC	1860	O	Active	12/31/9999	NA
134	30-015-30849	31	17S	28E	2310	270	NW State #009		LRE Operating, LLC	3195	O	Active	12/14/1999	NA
135	30-015-10833	31	17S	28E	1980	660	NW Artesia Unit #010		LRE Operating, LLC	2000	O	Active	12/31/9999	NA
136	30-015-01644	31	17S	28E	1650	330	Empire ABO Unit #24A		BP America Production Co.	6106	O	PA	12/31/9999	6/15/2009
137	30-015-40409	31	17S	28E	1920	330	Big Girl 31 State #009H		COG Operating LLC	8447	O	N	12/31/9999	NA
138	30-015-01650	31	17S	28E	1650	1958	Empire ABO Unit #23A		BP America Production Co.	6094	O	PA	12/31/9999	9/17/2003
139	30-015-01642	31	17S	28E	1650	2310	State FW #001		Alamo Permian Resources, LLC	1937	O	Active	12/31/9999	NA
140	30-015-01651	31	17S	28E	1650	2387	Empire ABO Unit #22B		BP America Production Co.	6046	O	PA	12/31/9999	2/10/2010

TABLE 1A

NON-FRESHWATER (OIL AND GAS) ARTIFICIAL PENETRATIONS IN AREA OF REVIEW
WDW-1, WDW-2, AND WDW-3
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

ID NO	API	Sect	TWP	RNG	NS FTG	EW FTG	WELL NAME	WELL NUMBER	OPERATOR	TOTAL DEPTH (FT)	WELL TYPE	WELL STATUS	DRILLL DATE	PLUG DATE
141	30-015-01648	31	17S	28E	1651	1089	Empire ABO Unit #21A		BP America Production Co.	5971	O	PA	4/15/1960	8/24/2002
142	30-015-01640	31	17S	28E	2310	330	Rampo #002		Alamo Permian Resources, LLC	1996	O	Active	12/31/9999	NA
143	30-015-39011	31	17S	28E	1190	1320	Empire ABO Unit #419		Apache Corp	6310	O	Active	10/11/2011	NA
144	30-015-20042	31	17S	28E	990	660	NW Artesia Unit #011		LRE Operating, LLC	2012	O	Active	12/31/9999	NA
145	30-015-01653	31	17S	28E	990	1650	Pre-Ongard #001		Pre-Ongard Well Operator	742	O	PA	1/1/1900	1/1/1900
146	30-015-01639	31	17S	28E	990	330	Ramp #001		Alamo Permian Resources, LLC	1975	O	Active	12/31/9999	NA
147	30-015-30760	31	17S	28E	735	330	NW State #010		LRE Operating, LLC	3210	O	Active	10/12/1999	NA
148	30-015-01641	31	17S	28E	660	660	Empire ABO Unit #24		Apache Corp	6122	O	Active	12/31/9999	NA
149	30-015-39004	31	17S	28E	150	1300	Empire ABO Unit #401		Apache Corp	6400	O	N	12/31/9999	NA
150	30-015-01649	31	17S	28E	660	1939	Empire ABO Unit #23		BP America Production Co.	6094	O	PA	12/31/9999	1/14/2010
151	30-015-27592	31	17S	28E	660	2310	WDW #1		Navajo Refining Co.	10200	I	Active	8/4/1993	NA
152	30-015-10118	31	17S	28E	766	2188	State FV #001		Alamo Permian Resources, LLC	1957	O	Active	12/31/9999	NA
153	30-015-01646	31	17S	28E	660	2082	Empire ABO Unit #22A		BP America Production Co.	6050	O	PA	12/31/9999	8/20/2009
154	30-015-01647	31	17S	28E	660	660	Empire ABO Unit #21		BP America Production Co.	9999	O	PA	12/31/9999	7/23/2005
155	30-015-39020	31	17S	28E	140	2560	Empire ABO Unit #408		Apache Corp	6318	O	T	10/18/2011	NA
156	30-015-33473	1	18S	27E	1750	1650	AAO Federal #007		Apache Corp	4100	O	Active	10/22/2004	NA
157	30-015-25270	12	18S	27E	2310	2310	CHUKKA FEDERAL #001	#001	BILL L MILLER	1600	Oil	Active	4/23/1985	NA
158	30-015-26017	12	18S	27E	990	1650	COMSTOCK FEDERAL #010	#010	EASTLAND OIL CO	2040	Oil	Plugged, Site Released	12/22/1989	1/23/2003
159	30-015-25100	12	18S	27E	330	1650	COMSTOCK FEDERAL	#001	HARLOW ENTERPRISES LLC	2400	Oil	Active	12/10/1984	NA
160	30-015-25201	12	18S	27E	1650	1770	COMSTOCK FEDERAL #002	#002	HARLOW ENTERPRISES LLC	1600	Oil	Active	3/20/1985	NA
161	30-015-25545	12	18S	27E	990	990	COMSTOCK FEDERAL #003	#003	HARLOW ENTERPRISES LLC	1530	Oil	Active	5/19/1986	NA
162	30-015-25202	12	18S	27E	330	2310	COMSTOCK FEDERAL	#005	HARLOW ENTERPRISES LLC	NR	Oil	Active	4/19/1985	NA
163	30-015-25099	12	18S	27E	1809	990	COMSTOCK FEDERAL #006	#006	HARLOW ENTERPRISES LLC	1652	Oil	Active	8/18/1985	NA
164	30-015-00874	12	18S	27E	2310	2355	COMSTOCK FEDERAL #007	#007	HARLOW ENTERPRISES LLC	3664	Oil	Active	7/28/1948	NA
165	30-015-25738	12	18S	27E	2310	2310	COMSTOCK FEDERAL #009	#009	HARLOW ENTERPRISES LLC	1586	Oil	Active	4/25/1987	NA
166	30-015-26404	12	18S	27E	660	990	FEDERAL T SWD	#001	LIME ROCK RESOURCES II-A, L.P.	10,141	Salt Water Disposal	Active	6/28/1990	NA
167	30-015-20894	12	18S	27E	1980	660	WDW #002	#002	NAVAJO REFINING CO. PIPELINE DIVISION	10,372	Injection	Active	5/5/1999	NA
168	30-015-00872	12	18S	27E	310	990	PRE-ONGARD WELL #001	#001	PRE-ONGARD WELL OPERATOR	594	Oil	Plugged, Site Released	1/1/1900	1/1/1900
169	30-015-20535	12	18S	27E	330	455	PRE-ONGARD WELL #001	#002	PRE-ONGARD WELL OPERATOR	6295	Oil	Plugged, Site Released	1/1/1900	1/1/1900
170	30-015-06171	12	18S	27E	1069	251	PRE-ONGARD WELL	#003	PRE-ONGARD WELL OPERATOR	2200	Oil	Plugged, Site Released	1/1/1900	1/1/1900
171	30-015-23115	12	18S	27E	330	380	PRE-ONGARD WELL	#003	PRE-ONGARD WELL OPERATOR	6248	Oil	Plugged, Site Released	1/1/1900	1/1/1900
172	30-015-00873	12	18S	27E	330	330	PRE-ONGARD WELL	#004	PRE-ONGARD WELL OPERATOR	2510	Oil	Cancelled Apd	NA	NA
173	30-015-00875	12	18S	27E	330	330	PRE-ONGARD WELL	#004	PRE-ONGARD WELL OPERATOR	2000	Oil	Plugged, Site Released	1/1/1900	1/1/1900
174	30-015-00876	12	18S	27E	100	500	PRE-ONGARD WELL	#005	PRE-ONGARD WELL OPERATOR	1994	Oil	Plugged, Site Released	1/1/1900	1/1/1900
175	30-015-25649	12	18S	27E	1650	990	PRE-ONGARD WELL	#008	PRE-ONGARD WELL OPERATOR	2000	Oil	Plugged, Site Released	1/1/1900	1/1/1900
176	30-015-00871	12	18S	27E	330	330	FEDERAL EA #001	#001	RHONDA OPERATING CO	6253	Oil	Plugged, Site Released	7/3/1975	4/12/1994
177	30-015-22833	11	18S	27E	450	1175	EMPIRE ABO UNIT	#133B	APACHE CORP	6225	Oil	Active	5/23/1979	NA
178	30-015-22834	11	18S	27E	225	2280	EMPIRE ABO UNIT #141B	#141B	APACHE CORP	6225	Oil	Active	5/21/1979	NA
179	30-015-31319	7	18S	27E	2310	330	LAUREL STATE #003	003	BILL L. MILLER	1630	Oil	Active	10/2/2000	NA
180	30-015-06137	13	18S	27E	250	990	PRE-ONGARD WELL	002	PRE-ONGARD WELL OPERATOR	2696	Oil	Plugged, Site Released	1/1/1900	1/1/1901
181	30-015-24881	13	18S	27E	1880	1830	ANADARKO 13 FEDERAL	001	DAVID G. HAMMOND	3020	Oil	Plugged, Site Released	12/31/9999	7/17/2011
182	30-015-00888	13	18S	27E	1980	1650	PRE-ONGARD WELL	001	PRE-ONGARD WELL OPERATOR	2000	Oil	Plugged, Site Released	1/1/1900	1/1/1901
183	30-015-00880	13	18S	27E	1650	990	PRE-ONGARD WELL	001	PRE-ONGARD WELL OPERATOR	2353	Oil	Plugged, Site Released	1/1/1900	1/1/1900
184	30-015-00884	13	18S	27E	1650	990	PRE-ONGARD WELL	003	PRE-ONGARD WELL OPERATOR	2047	Oil	Plugged, Site Released	1/1/1900	1/1/1900
185	30-015-25394	13	18S	27E	2310	330	ARTESIA STATE	002	BILL L. MILLER	1613	Oil	Active	12/31/9999	NA
186	30-015-25241	13	18S	27E	330	1650	ARTESIA STATE	001	BILL L. MILLER	2300	Oil	Active	12/31/9999	NA
187	30-015-25370	13	18S	27E	480	940	ARTESIA STATE	802	ALAMO PERMIAN RESOURCES, LLC	1608	Oil	Active	8/27/1985	NA
188	30-015-00883	13	18S	27E	990	990	ARTESIA STATE	801	ALAMO PERMIAN RESOURCES, LLC	1650	Oil	Active	12/31/9999	NA
189	30-015-00895	14	18S	27E	1650	330	ARTESIA STATE	301	ALAMO PERMIAN RESOURCES, LLC	1888	Oil	Active	2/8/1945	NA
190	30-015-00891	14	18S	27E	990	330	PRE-ONGARD WELL	001	PRE-ONGARD WELL OPERATOR	2060	Oil	Plugged, Site Released	1/1/1900	1/1/1900
191	30-015-40187	14	18S	27E	660	990	VIOLET BIV STATE COM	001	YATES PETROLEUM CORP	10500	Gas	Cancelled Apd	4/18/2012	NA
192	30-015-36939	14	18S	27E	661	991	VIOLET BIV STATE COM	001C	YATES PETROLEUM CORP	10,500	Gas	Cancelled Apd	2/20/2009	NA
193	30-015-00870	14	18S	27E	1980	1980	PRE-ONGARD WELL	001	PRE-ONGARD WELL OPERATOR	7270	Oil	Plugged, Site Released	1/1/1900	1/1/1900
194	30-015-00866	14	18S	27E	1980	660	PRE-ONGARD WELL	131	PRE-ONGARD WELL OPERATOR	6120	Oil	Plugged, Site Released	1/1/1900	1/1/1900
195	30-015-00865	14	18S	27E	1650	1980	PRE-ONGARD WELL	014	PRE-ONGARD WELL OPERATOR	6208	Oil	Plugged, Site Released	1/1/1900	1/1/1900
196	30-015-20510	14	18S	27E	1650	1653	PRE-ONGARD WELL	001	PRE-ONGARD WELL OPERATOR	10168	Oil	Plugged, Site Released	1/1/1900	1/1/1900
197	30-015-22556	14	18S	27E	1100	1200	PRE-ONGARD WELL	131	PRE-ONGARD WELL OPERATOR	6325	Oil	Plugged, Site Released	1/1/1900	1/1/1900
198	30-015-00864	14	18S	27E	660	1980	PRE-ONGARD WELL	014	PRE-ONGARD WELL OPERATOR	6315	Oil	Plugged, Site Released	1/1/1900	1/1/1900
199	30-015-22569	14	18S	27E	560	2588	EMPIRE ABO UNIT #152B	152B	BP AMERICA PROD. CO.	6300	Oil	Plugged, Site Released	11/1/1978	10/2/2008
200	30-015-00868	14	18S	27E	660	1980	EMPIRE ABO UNIT #015C	015C	BP AMERICA PROD. CO.	6260	Oil	Plugged, Site Released	4/6/1958	7/16/2004
201	30-015-22568	14	18S	27E	400	1450	EMPIRE ABO UNIT #151B	151B	BP AMERICA PROD. CO.	6310	Oil	Plugged, Site Released	3/1/1979	8/16/2006
202	30-015-22838	14	18S	27E	200	1925	EMPIRE ABO UNIT	153B	BP AMERICA PROD. CO.	6225	Oil	Plugged, Site Released	5/6/1979	12/22/2008
203	30-015-00869	14	18S	27E	330	653	EMPIRE ABO UNIT #016C	016C	BP AMERICA PROD. CO.	6225	Oil	Plugged, Site Released	6/30/1959	1/24/2007
204	30-015-21807	2	18S	27E	275	1243	EMPIRE ABO UNIT	132	BP AMERICA PROD. CO.	6200	Oil	Plugged, Site Released	12/31/9999	6/22/2009
205	30-015-22608	2	18S	27E	100	1950	EMPIRE ABO UNIT #142	142	BP AMERICA PROD. CO.	6200	Oil	Plugged, Site Released	4/1/1979	9/9/2009
206	30-015-22013	2	18S	27E	90	1456	EMPIRE ABO UNIT #153	153	BP AMERICA PROD. CO.	6303	Oil	Plugged, Site Released	6/1/1977	10/30/2008
207	30-015-21825	2	18S	27E	320	2602	EMPIRE ABO UNIT #152	152	APACHE CORP	6335	Oil	Plugged, Site Released	7/1/1976	12/27/2011
208	30-015-22808	2	18S	27E	600	1330	EMPIRE ABO UNIT #156	156	BP AMERICA PROD. CO.	6225	Oil	Plugged, Site Released	5/1/1979	10/7/2009
209	30-015-00722	2	18S	27E	660	660	EMPIRE ABO UNIT	016A	BP AMERICA PROD. CO.	6114	Oil	Plugged, Site Released	12/12/1958	2/23/2009
210	30-015-00731	2	18S	27E	660	1980	EMPIRE ABO UNIT	015A	BP AMERICA PROD. CO.	6135	Oil	Plugged, Site Released	10/9/1958	2/12/2009

TABLE 1A

NON-FRESHWATER (OIL AND GAS) ARTIFICIAL PENETRATIONS IN AREA OF REVIEW
WDW-1, WDW-2, AND WDW-3
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

ID NO	API	Sect	TWP	RNG	NS FTG	EW FTG	WELL NAME	WELL NUMBER	OPERATOR	TOTAL DEPTH (FT)	WELL TYPE	WELL STATUS	DRILLL DATE	PLUG DATE
211	30-015-00730	2	18S	27E	660	1980	EMPIRE ABO UNIT	014	APACHE CORP	6152	Oil	Active	9/22/1958	NA
212	30-015-22669	2	18S	27E	800	2500	EMPIRE ABO UNIT #154	154	BP AMERICA PROD. CO.	6200	Oil	Plugged, Site Released	1/1/1979	6/30/2009
213	30-015-22885	2	18S	27E	1040	2025	EMPIRE ABO UNIT #155	155	APACHE CORP	6202	Oil	Plugged, Site Released	6/1/1979	1/3/2012
214	30-015-21544	2	18S	27E	1100	1322	EMPIRE ABO UNIT #151	151	APACHE CORP	6285	Oil	Plugged, Site Released	5/19/1975	1/6/2012
215	30-015-22914	2	18S	27E	1310	590	EMPIRE ABO UNIT #161	161	APACHE CORP	6225	Oil	Active	6/21/1979	NA
216	30-015-22051	2	18S	27E	1370	2445	EMPIRE ABO UNIT #141A	141A	APACHE CORP	6203	Oil	Plugged, Site Released	6/1/1977	12/21/2011
217	30-015-22609	2	18S	27E	1200	1900	EMPIRE ABO UNIT #212	143	APACHE CORP	6093	Oil	Active		NA
218	30-015-22896	2	18S	27E	1820	2550	EMPIRE ABO UNIT #143A	143A	APACHE CORP	6108	Oil	Active	4/16/1979	NA
219	30-015-00716	2	18S	27E	1980	1830	EMPIRE ABO UNIT #015	015	APACHE CORP	6100	Oil	Active	2/11/1959	NA
220	30-015-32946	2	18S	27E	2210	1650	SCBP STATE #1	001	APACHE CORP	3880	Oil	Active	3/14/2005	NA
221	30-015-35814	2	18S	27E	2063	441	STATE H NO 2	002	MACK ENERGY CORP	7545	Oil	Active	10/31/2007	NA
222	30-015-00704	1	18S	27E	1980	660	PRE-ONGARD WELL #017	017	PRE-ONGARD WELL OPERATOR	5960	Oil	Plugged, Site Released	1/1/1900	1/1/1900
223	30-015-00706	1	18S	27E	2310	1980	EMPIRE ABO UNIT #018A	018A	APACHE CORP	6087	Oil	Active	4/24/1959	NA
224	30-015-34071	1	18S	27E	2169	1963	AAO FEDERAL #006	006	APACHE CORP	3977	Oil	Active	7/6/2005	NA
225	30-015-21552	1	18S	27E	2500	2500	EMPIRE ABO UNIT #191	191	APACHE CORP	6259	Oil	Active	7/23/2013	9/1/1975
226	30-015-22657	1	18S	27E	2490	2200	EMPIRE ABO UNIT #193	193	APACHE CORP	6225	Oil	Active	9/29/1978	NA
227	30-015-36281	1	18S	27E	2193	1520	SUN DEVILS FEDERAL	001	MACK ENERGY CORP	6016	Oil	Cancelled Apd	NA	NA
228	30-015-22560	1	18S	27E	220	1390	EMPIRE ABO UNIT #192	192	APACHE CORP	6250	Oil	Active	5/30/1978	NA
229	30-015-00696	1	18S	27E	1980	1980	EMPIRE ABO UNIT #019Q	19Q	APACHE CORP	6,180	Oil	Plugged, Site Released	7/24/1959	7/12/2013
230	30-015-27163	1	18S	27E	1980	990	CHALK BLUFF FEDERAL #003	COM 003	MEWBOURNE OIL CO.	10,150	Gas	Active	5/10/1981	NA
231	30-015-21873	1	18S	27E	1526	1470	EMPIRE ABO UNIT #191A	191A	APACHE CORP	6350	Oil	Approved Temporary Abandonment	8/27/1976	NA
232	30-015-00699	1	18S	27E	940	330	EMPIRE ABO UNIT #020B	020B	APACHE CORP	6250	Oil	Active	11/16/1961	NA
233	30-015-22658	1	18S	27E	1500	2130	EMPIRE ABO UNIT #194	194	APACHE CORP	6325	Oil	Active	10/18/1978	NA
234	30-015-00717	2	18S	27E	1980	660	EMPIRE ABO UNIT #016	016	APACHE CORP	6100	Oil	Active	3/30/1959	NA
235	30-015-34576	1	18S	27E	2060	2160	AAO FEDERAL #010	010	APACHE CORP	4000	Oil	Active	6/2/2006	NA
236	30-015-22559	1	18S	27E	2290	2445	EMPIRE ABO UNIT #184	184	APACHE CORP	6200	Oil	Plugged, Site Released	2/1/1979	7/18/2013
237	30-015-20394	1	18S	27E	953	2197	Russell USA #045	019	PRE-ONGARD WELL OPERATOR	870	Oil	Plugged, Site Released	1/1/1900	8/12/2013
238	30-015-00698	1	18S	27E	660	1980	EMPIRE ABO UNIT	191	ARCO PERMIAN	6365	SWD	Plugged, Site Released	10/7/1959	12/8/1989
239	30-015-26575	1	18S	27E	790	2250	WDW #003	003	NAVAJO REFINING	10,119	Injection	Active	12/22/1990	NA
240	30-015-34998	1	18S	27E	890	1650	AAO FEDERAL #012	012	APACHE CORP	4075	Oil	Active	8/13/2006	NA
241	30-015-00713	1	18S	27E	995	1644	EMPIRE ABO UNIT #018D	018D	BP AMERICA PROD. CO.	6174	Oil	Plugged, Site Released	10/28/1959	9/27/2003
242	30-015-21792	1	18S	27E	1533	2370	EMPIRE ABO UNIT #182	182	APACHE CORP	6369	Oil	Active	5/6/1976	NA
243	30-015-00707	1	18S	27E	1980	1980	EMPIRE ABO UNIT #018B	018B	APACHE CORP	6163	Oil	Active	4/23/1959	NA
244	30-015-22096	1	18S	27E	2370	1510	EMPIRE ABO UNIT #183	183	APACHE CORP	6210	Oil	Active	6/23/1977	NA
245	30-015-21554	1	18S	27E	1367	1440	EMPIRE ABO UNIT #181	181	BP AMERICA PROD. CO.	6137	Oil	Plugged, Site Released	11/1/1975	4/17/2003
246	30-015-00703	1	18S	27E	1980	660	EMPIRE ABO UNIT #017A	017A	BP AMERICA PROD. CO.	7705	Oil	Plugged, Site Released	2/16/1959	3/19/2009
247	30-015-34387	1	18S	27E	1980	630	AAO FEDERAL #009	009	APACHE CORP	3950	Oil	Active	11/7/2005	NA
248	30-015-00695	1	18S	27E	1650	330	PRE-ONGARD WELL	001	PRE-ONGARD WELL OPERATOR	1763	Oil	Plugged, Site Released	1/1/1900	1/1/1901
249	30-015-00705	1	18S	27E	990	660	EMPIRE ABO UNIT #017B	017B	BP AMERICA PROD. CO.	6150	Oil	Plugged, Site Released	3/24/1959	7/21/2004
250	30-015-34555	1	18S	27E	890	660	AAO FEDERAL #011	011	APACHE CORP	4100	Oil	Active	2/15/2006	NA
251	30-015-22815	1	18S	27E	670	330	EMPIRE ABO UNIT #171	171	APACHE CORP	6300	Oil	Active	5/22/1979	NA
252	30-015-00745	2	18S	27E	1980	660	STATE H #001	001	MACK ENERGY CORP	5962	Oil	Plugged, Site Released	12/22/1958	3/7/2008
253	30-015-27538	11	18S	27E	990	660	PRE-ONGARD WELL	001	PRE-ONGARD WELL OPERATOR	NR	Oil	Cancelled Apd	12/31/9999	NA
254	30-015-00662	36	17S	27E	330S	330W	STATE NO. 2		ACREY, B L & F D	600	O	P&A	10/15/1942	10/15/1942
255	30-015-00676	36	17S	27E	330N	990W	EMPIRE ABO UNIT #017		LIME ROCK RESOURCES A, L.P.	5797	O	Active	?	NA
256	30-015-00697	1	18S	27E	1980S	660E	EMPIRE ABO UNIT #020K		BP AMERICA PRODUCTION COMPANY	6185	O	P&A	1/5/2003	1/5/2003
257	30-015-00709	1	18S	27E	1980N	1980E	EMPIRE ABO UNIT #019C		ALAMO PERMIAN RESOURCES, LLC	6205	O	Active	8/2/1959	NA
258	30-015-00710	1	18S	27E	660N	1980W	AAO FEDERAL No. 013		ALAMO PERMIAN RESOURCES, LLC	6200	O	Active	7/21/2004	NA
259	30-015-00712	1	18S	27E	647N	667W	EMPIRE ABO UNIT I NO. 17		ARCO OIL & GAS	5902	O	P&A	1/24/1987	1/24/1987
260	30-015-00715	1	18S	27E	330N	330W	SOUTH RED LAKE GRAYBURG UNIT #037		LEGACY RESERVES OPERATING LP	1820	I	Active	?	NA
261	30-015-00718	2	18S	27E	330S	610W	PRE-ONGARD WELL #2		PRE-ONGARD WELL OPERATOR	512	O	P&A	?	NA
262	30-015-00720	2	18S	27E	990N	1650E	RIVERWOLF UNIT #004		BP AMERICA PRODUCTION COMPANY	5881	O	P&A	10/21/1959	12/12/2008
263	30-015-00721	2	18S	27E	330N	990E	SOUTH RED LAKE GRAYBURG UNIT #036		FAIRWAY RESOURCES OPERATING LLC	1705	O	P&A	11/6/1947	NA
264	30-015-00724	2	18S	27E	990N	330E	EMPIRE ABO UNIT #016B		LIME ROCK RESOURCES A, L.P.	5920	O	Active	?	NA
265	30-015-00737	2	18S	27E	905N	1601E	SOUTH RED LAKE GRAYBURG UNIT #038		FAIRWAY RESOURCES OPERATING LLC	1685	O	Active	5/23/1948	NA
266	30-015-00740	2	18S	27E	1650N	2197E	SOUTH RED LAKE GRAYBURG UNIT #040		MCQUADRANGLE, LC	5884	I	P&A	7/10/2002	7/10/2002
267	30-015-00741	2	18S	27E	2310N	1980E	EMPIRE ABO UNIT #015B		APACHE CORPORATION	5884	O	Active	6/6/1959	NA
268	30-015-00742	2	18S	27E	1650N	990E	SOUTH RED LAKE GRAYBURG UNIT 39 WIW		S&J OPERATING COMPANY	1741	O	P&A	2/8/1991	2/8/1991
269	30-015-00744	2	18S	27E	2310S	1640E	STATE 1		COMPTON-SMITH	5962	O	P&A	?	NA
270	30-015-01218	36	17S	27E	330S	2310W	EMPIRE ABO UNIT #018		BP AMERICA PRODUCTION COMPANY	6849	O	P&A	3/11/2009	3/11/2009
271	30-015-02627	6	18S	28E	949S	990W	STATE M-AI #002		RUTH OIL CO, LLC	6225	O	Active	10/21/1960	NA
272	30-015-10184	36	17S	27E	330S	920W	STATE #006		ASPEN OIL INC	1343	O	Active	?	NA
273	30-015-21623	36	17S	27E	360S	455W	STATE #007		GEORGE A CHASE JR & C SERVICE	1366	O	Active	?	NA
274	30-015-21783	1	18S	27E	2490N	1299E	EMPIRE ABO UNIT #202		ALAMO PERMIAN RESOURCES, LLC	6296	O	Active	5/13/1976	NA
275	30-015-22816	1	18S	27E	1120S	1440E	EMPIRE ABO UNIT L #192		ARCO OIL & GAS	6350	O	ABANDONED	6/28/1980	6/23/1980
276	30-015-25675	7	18S	28E	940N	1757W	LAUREL STATE #002		EASTLAND OIL CO	1690	O	Active	11/10/1988	NA
277	30-015-25997	7	18S	28E	940N	1757W	LAUREL STATE #001		EASTLAND OIL CO	1690	O	Active	2/23/1987	NA
278	30-015-26741	1	18S	27E	1650N	1350W	CHALK BLUFF FEDERAL COM #002		MEWBOURNE OIL CO	10140	G	Active	8/24/1991	NA
279	30-015-26943	6	18S	28E	990S	730W	CHALK BLUFF 6 STATE #001		MEWBOURNE OIL CO	10200	G	Active	4/16/1992	NA
280	30-015-27286	36	17S	27E	660S	990W	CHALK BLUFF 36 STATE #001		MEWBOURNE OIL CO	10060	O	Active	3/30/1993	NA

TABLE 1A

NON-FRESHWATER (OIL AND GAS) ARTIFICIAL PENETRATIONS IN AREA OF REVIEW
WDW-1, WDW-2, AND WDW-3
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

ID NO	API	Sect	TWP	RNG	NS FTG	EW FTG	WELL NAME	WELL NUMBER	OPERATOR	TOTAL DEPTH (FT)	WELL TYPE	WELL STATUS	DRILLL DATE	PLUG DATE
281	30-015-31087	6	18S	28E	990S	330W	LP STATE #003		MARBOB ENERGY CORP	446	O	P&A	7/15/2000	3/17/2008
282	30-015-31592	36	17S	27E	330S	2310E	RAMAPO #007		ROJO GRANDE COMPANY LLC	612	O	P&A	12/21/2001	12/21/2001
283	30-015-32307	1	18S	27E	330N	990W	AAO FEDERAL #001		APACHE CORPORATION	3851	O	Active	12/10/2002	NA
284	30-015-32308	1	18S	27E	430N	2310W	AAO FEDERAL #002		APACHE CORPORATION	4150	O	Active	9/19/2002	NA
285	30-015-40429	36	17S	27E	492	806W	Big Boy State #004	4	COG Operating LLC	5015	O	Active	8/28/2014	NA
286	30-015-32959	1	18S	27E	1650N	875W	AAO FEDERAL #005		APACHE CORPORATION	3900	O	Active	10/12/2004	NA
287	30-015-39899	1	18S	27E	1305N	2535W	EMPIRE ABO UNIT #016		APACHE CORPORATION	6300	O	Cancelled Apd	NA	NA
288	30-015-39900	1	18S	27E	1120N	1205W	EMPIRE ABO UNIT #016		APACHE CORPORATION	6300	O	Cancelled Apd	NA	NA
289	30-015-00701	1	18S	27E	330N	330W	SOUTH RED LAKE GRAYBURG UNIT 37 WIW		FAIRWAY RESOURCES OPERATING LLC	NA	O	Plugged, Site Released	NA	NA
290	30-015-02608	5	18S	28E	1660N	330W	State E AI #001	1	Conoco Phillips Co	6265	O	Plugged, Site Released	3/1/1960	1/13/2006
291	30-015-40428	36	17S	27E	200S	485W	Big Boy State #002	2	COG Operating LLC	4990	O	Active	4/27/2013	NA
292	30-015-37045	32	17S	28E	1563S	2207E	Jeffers 32 State #002	2	Vanguard Operating, LLC	5130	O	Active	7/29/2010	NA
293	30-015-32028	2	22S	31E	990S	330W	Flora AKF State #004	4	EOG Y Resources, Inc.	8350	O	Active	11/20/2002	NA
294	30-015-34028	6	18S	28E	2285N	1366E	Slider 6 State #001	1	BP America Production Co	10374	O	Plugged, Site Released	6/19/2005	12/23/2008

(ft) - Feet
? - Data Not Available
Map ID No. - Refer to Drawing 2
N/A - Not Applicable
Well Type - O=Oil, I=Injection, G=Gas

TABLE 1B

NON-FRESHWATER (OIL AND GAS) WELLS IN AREA OF REVIEW PENETRATING TOP OF INJECTION ZONE
WDW-1, WDW-2, AND WDW-3
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

ID NO	API	Sect	TWP	RNG	NS FTG	EW FTG	WELL NAME	WELL NUMBER	OPERATOR	TOTAL DEPTH (FT)	WELL TYPE	WELL STATUS	DRILLL DATE	PLUG DATE
12	30-015-31123	36	17S	27E	1980	760	No Bluff State Comm #002	2	LRE Operating, LLC	10,050	G	Active	3/19/2001	NA
76	30-015-25522	5	18S	28E	2240	400	Walter Solt State #001	1	WALTER SOLT LLC	8,500	SWD	Active	1/9/1986	NA
78	30-015-24485	5	18S	28E	1980	990	Illinois Camp A Com #001	1	Conoco Phillips Co	10,450	G	Active	5/28/1983	NA
151	**30-015-27592**	**31**	**17S**	**28E**	**660**	**2310**	**WDW-1**	**1**	**NAVAJO REFINING**	**10,200**	**I**	**Active**	**34185**	**NA**
166	30-015-26404	12	18S	27E	660	990	FEDERAL T SWD	#001	LIME ROCK RESOURCES II-A, L.P.	10,141	Salt Water Disposal	Active	6/28/1990	NA
167	**30-015-20894**	**12**	**18S**	**27E**	**1980**	**660**	**WDW-2**	**2**	**NAVAJO REFINING CO. PIPELINE DIV**	**10,372**	**Injection**	**Active**	**5/5/1999**	**NA**
191	30-015-40187	14	18S	27E	660	990	VIOLET BIV STATE COM	001	YATES PETROLEUM CORP	10,500	Gas	Cancelled Apd	4/18/2012	NA
192	30-015-36939	14	18S	27E	661	991	VIOLET BIV STATE COM	001C	YATES PETROLEUM CORP	10,500	Gas	Cancelled Apd	2/20/2009	NA
193	30-015-00870	14	18S	27E	1980	1980	PRE-ONGARD WELL	001	PRE-ONGARD WELL OPERATOR	7,270	Oil	Plugged, Site Released	1/1/1900	1/1/1900
196	30-015-20510	14	18S	27E	1650	1653	PRE-ONGARD WELL	001	PRE-ONGARD WELL OPERATOR	10,168	Oil	Plugged, Site Released	1/1/1900	1/1/1900
221	30-015-35814	2	18S	27E	2063	441	STATE H NO 2	002	MACK ENERGY CORP	7,545	Oil	Active	10/31/2007	NA
230	30-015-27163	1	18S	27E	1980	990	CHALK BLUFF FEDERAL #003	COM 003	MEWBOURNE OIL CO.	10,150	Gas	Active	5/10/1981	NA
239	**30-015-26575**	**1**	**18S**	**27E**	**790**	**2250**	**WDW-3**	**3**	**NAVAJO REFINING**	**10,119**	**Injection**	**Active**	**5/5/1999**	**NA**
246	30-015-00703	1	18S	27E	1980	660	EMPIRE ABO UNIT #017A	017A	BP AMERICA PROD. CO.	7,705	Oil	Plugged, Site Released	2/16/1959	3/19/2009
278	30-015-26741	1	18S	27E	1650N	1350W	CHALK BLUFF FEDERAL COM #002	COM 002	MEWBOURNE OIL CO	10,140	G	Active	8/24/1991	NA
279	30-015-26943	6	18S	28E	990S	730W	CHALK BLUFF 6 STATE #001	1	MEWBOURNE OIL CO	10,200	G	Active	4/16/1992	NA
280	30-015-27286	36	17S	27E	660S	990W	CHALK BLUFF 36 STATE #001	1	MEWBOURNE OIL CO	10,060	O	Active	3/30/1993	NA

Map ID No. - Refer to Drawing 2
Well Type - O=Oil, I=Injection, G=Gas
(ft) - Feet
N/A - Not Applicable
? - Data Not Available

TABLE 2
INJECTION FLUID CHARACTERIZATION DATA
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

	Feb 2011	May 2011	Aug 2011	Nov 2011	Feb 2012	May 2012	Sept 2012	Nov 2012	Mar 2013
Metals									
Aluminum	6.0	0.438	0.625	0.752	1.87	0.394	1.11	4.04	1.34
Arsenic	0.0557	0.0198	0.0207	0.0365	0.141	0.0791	0.0468	0.070	0.0404
Barium	0.0590	0.0541	0.0796	0.0182	0.0282	0.0202	0.0182	0.0599	0.0860
Boron	0.216	0.353	0.276	0.243	0.335	0.238	0.253	0.286	0.722
Cadmium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.004	<0.004
Chromium	0.00562	<0.005	<0.005	<0.005	0.00598	<0.005	<0.005	<0.010	<0.010
Copper	0.0265	0.00715	0.00709	<0.005	0.0117	<0.005	0.0108	0.018	<0.010
Lead	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.010	<0.010
Manganese	0.0940	0.0239	0.0559	0.0213	0.0555	0.0524	0.0329	0.0669	<0.832
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.002	<0.0002	<0.0002
Molybdenum	0.202	0.168	0.145	0.0443	0.0987	0.154	0.243	0.255	0.182
Nickel	0.0141	0.00605	0.00767	<0.005	0.106	0.0122	0.0112	0.0109	0.0153
Selenium	0.382	0.646	0.465	0.99	0.312	0.690	1.00	0.842	0.924
Silver	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.010	<0.010
Zinc	1.42	0.0884	0.0983	0.012	0.0746	0.0402	0.0560	0.0836	0.0737

All concentrations reported in milligrams per liter (mg/L).
< Less than.

TABLE 2
INJECTION FLUID CHARACTERIZATION DATA
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NM

	Feb 2011	May 2011	Aug 2011	Nov 2011	Feb 2012	May 2012	Sept 2012	Nov 2012	Mar 2013
Volatiles									
1,1,1-Trichloroethane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1,2,2-Tetrachloroethane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1,2-Trichloroethane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1-Dichloroethane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1-Dichloroethene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,2-Dichloroethane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2-Butanone	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	NA	<0.010	<0.010
2-Chloroethyl vinty ether	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	NA	<0.010	<0.010
2-Hexanone	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	NA	<0.010	<0.010
4-Methyl-2-pentanone	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	NA	<0.010	<0.010
Acetone	0.025	<0.010	<0.010	0.200	0.120	<0.010	NA	<0.055	0.016
Benzene	<0.005	<0.005	<0.005	0.200	<0.005	<0.005	<0.005	<0.005	<0.005
Bromodichloromethane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Bromoform	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Bromomethane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Carbon disulfide	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	NA	<0.010	<0.010
Carbon tetrachloride	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Chlorobenzene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Chloroethane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Chloroform	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chloromethane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
cis-1,3-Dichloropropene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Dibromochloromethane	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Ethylbenzene	<0.005	<0.005	<0.005	0.190	<0.005	<0.005	<0.005	<0.005	<0.005
m,p-Xylene	<0.010	<0.010	<0.010	0.360	<0.010	<0.010	NA	<0.010	<0.010
Methylene chloride	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.005	<0.010	<0.010
Styrene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Tetrachloroethene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Toluene	<0.005	<0.005	<0.005	0.510	<0.005	<0.005	<0.005	<0.005	<0.005
trans-1,3-Dichloropropene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Trichloroethene	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Vinyl acetate	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	NA	<0.010	<0.010
Vinyl chloride	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Xylenes, Total	<0.015	<0.015	<0.015	0.560	<0.015	<0.015	<0.015	<0.015	<0.015

All concentrations reported in milligrams per liter (mg/L).

< Less Than.

NA Not Analyzed.

TABLE 2
INJECTION FLUID CHARACTERIZATION DATA
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

	Feb 2011	May 2011	Aug 2011	Nov 2011	Feb 2012	May 2012	Sept 2012	Nov 2012	Mar 2013
Semivolatiles									
1,2,4-Trichlorobenzene	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
2,4,5-Trichlorophenol	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
2,4,6-Trichlorophenol	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
2,4-Dinitrotoluene	NA	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
2-Methylnaphthalene	<0.025	<0.005	<0.050	0.040	<0.005	<0.005	<0.0002	<0.005	<0.005
2-Methylphenol	<0.025	<0.005	<0.050	0.29	<0.005	<0.005	NA	<0.005	<0.005
2-Nitroaniline	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
3&4-Methylphenol	<0.025	<0.005	<0.050	0.52	<0.005	<0.005	NA	<0.005	<0.005
3-Nitroaniline	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
4-Nitroaniline	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
4-Nitrophenol	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Acenaphthene	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Acenaphthylene	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Aniline	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Anthracene	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Benz(a)anthracene	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	<0.0002	<0.005	<0.005
Benzidine	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Hexachlororthane	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Indeno(1,2,3-cd)pyrene	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Isophorone	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Naphthalene	<0.025	<0.005	<0.050	0.038	<0.005	<0.005	<0.0002	<0.005	<0.005
Nitrobenzene	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
N-Nitrosodimethylylamine	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
N-Nitosodi-n-propylamine	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
N-Nitrosodiphenylamine	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Pentachlorophenol	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Phenanthrene	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Phenol	<0.025	<0.005	<0.050	0.99	<0.005	<0.005	NA	0.013	0.013
Pyrene	<0.025	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005
Pyridine	NA	<0.005	<0.050	<0.005	<0.005	<0.005	NA	<0.005	<0.005

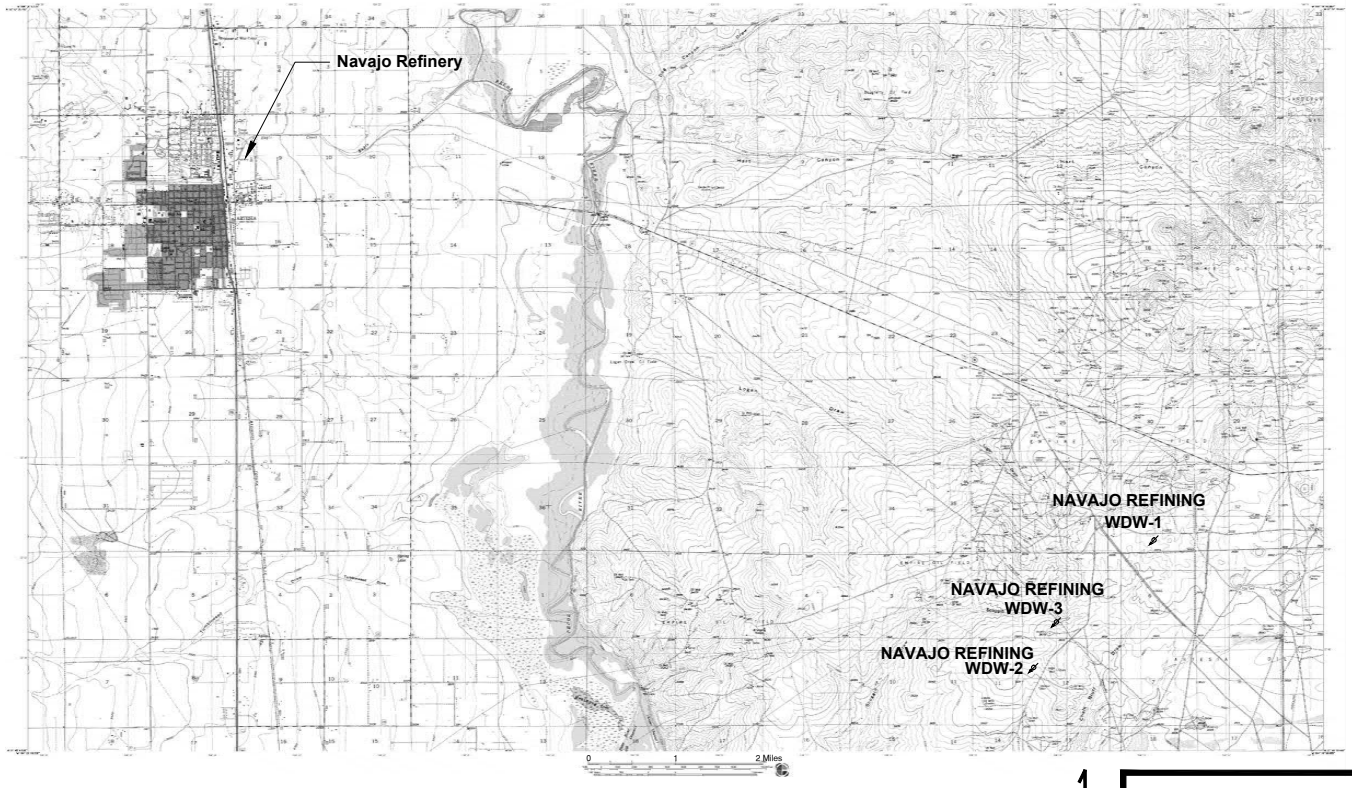
All concentrations reported in milligrams per liter.
< Less Than.
NA Not Analyzed.

TABLE 2
INJECTION FLUID CHARACTERIZATION DATA
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

	Feb 2011	May 2011	Aug 2011	Nov 2011	Feb 2012	May 2012	Sept 2012	Nov 2012	Mar 2013
Miscellaneous									
Reactive Cyanide (mg/Kg)	<40.0	<40.0	<40.0	<40.0	<40.0	<40.0	<40.0	<40.0	<40.0
Reactive Sulfide (mg/Kg)	<40.0	<40.0	<40.0	<40.0	<40.0	<40.0	<40.0	<40.0	<40.0
Chloride (mg/L)	410	213	404	332	519	646	458	401	647
Sulfate (mg/L)	1,510	2,240	2,290	2,350	1,870	2,220	3,460	2,580	2,630
Alkalinity (Total) (mg/L)	441	243	302	217	466	175	284	239	366
Sp. Cond. (umhos/cm)	6,270	4,680	7,380	5,430	5,990	6,650	8,370	6,680	8,110
Ignitability (°F)	>212	>212	>212	>212	>212	>212	>212	>212	>212
pH (S.U.)	7.40	7.85	8.11	7.52	7.30	6.76	7.33	7.63	7.98
TDS (mg/L)	3,310	3,400	4,320	4,840	3,890	3,100[(1)]	6,140	4,780	5,500

mg/Kg	Milligrams per kilogram.
mg/L	Milligrams per liter.
umhos/cm	Micromhos per centimeter.
°F	Degrees Fahrenheit.
S.U.	Standard Units.
>	Greater than.
<	Less than.
(1)	TDS Sample collected in July 2012.

FIGURES



Maps compiled from USGS Quads: Artesia, NM; Spring Lake, NM; Red Lake, NM; Illinois Camp, NM; Dayton, NM; Lake Mcmillan N, NM

WSP | PARSONS BRINCKERHOFF

FIGURE 1

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

SITE LOCATION MAP

DATE: 01/19/17	CHECKED BY:	JOB NO: 50904D
DRAWN BY: WDD	APPROVED BY:	DWG. NO:

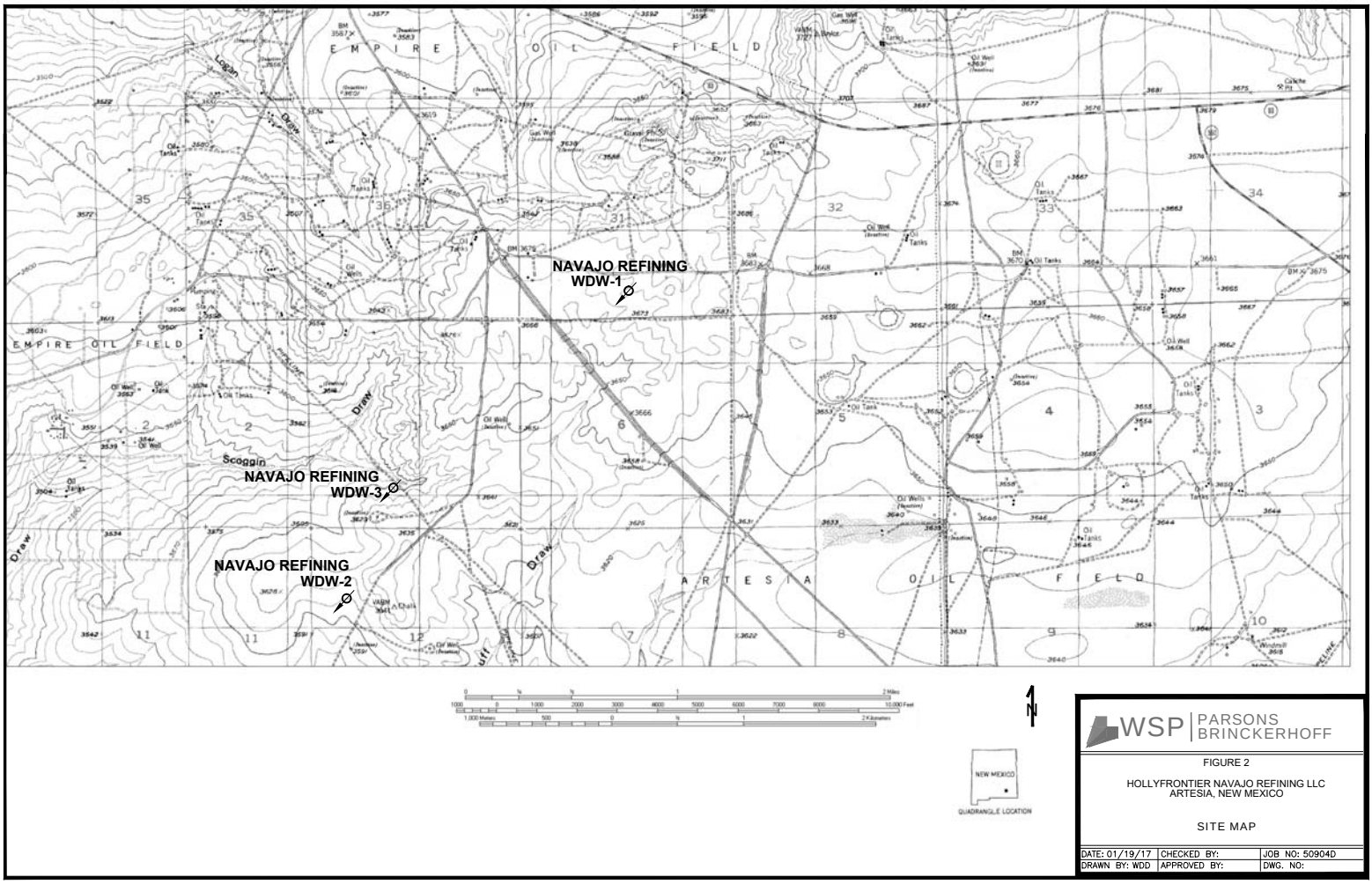


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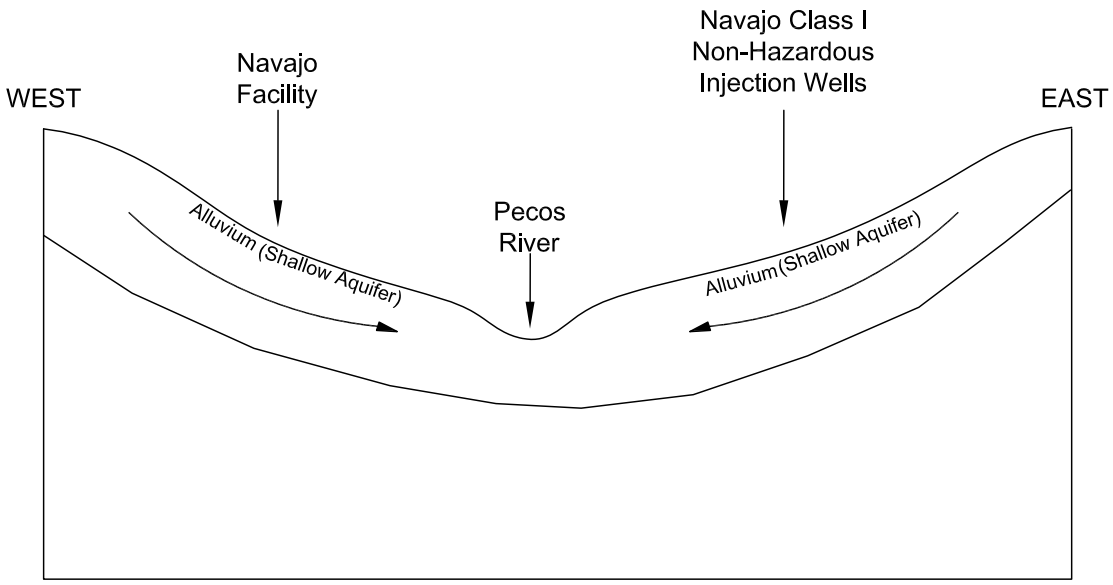
FIGURE 2

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

SITE MAP

DATE: 01/19/17	CHECKED BY:	JOB NO: 50904D
DRAWN BY: WDD	APPROVED BY:	DWG. NO:



NOT TO SCALE

EXPLANATION

Direction of Groundwater Movement

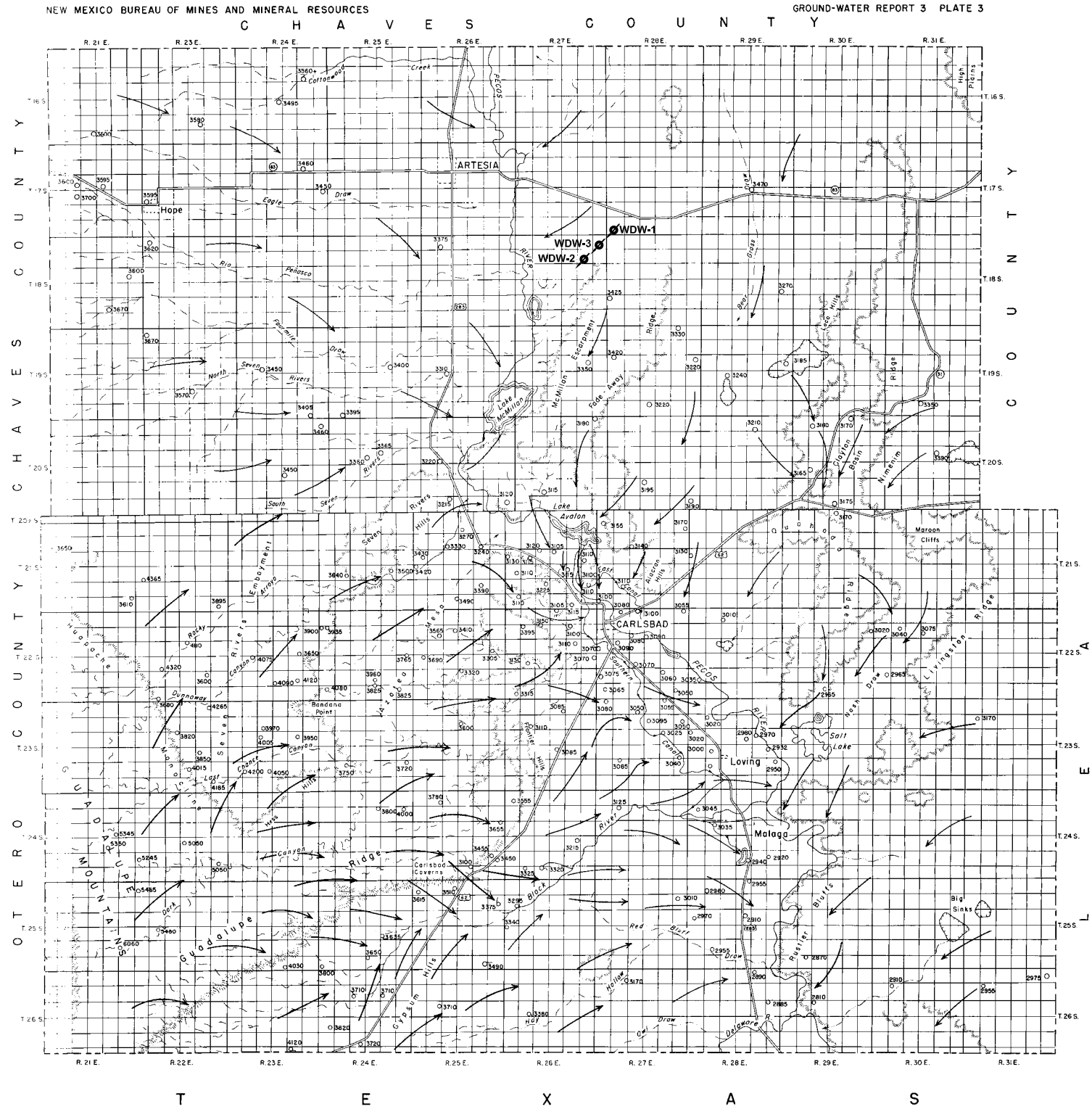
WSP | PARSONS BRINCKERHOFF

FIGURE 3

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

GENERALIZED HYDROGEOLOGIC CROSS-SECTION

DATE: 01/26/17	CHECKED BY:	JOB NO: 60D6945
DRAWN BY: WDD	APPROVED BY:	DWG. NO:



GENERAL DIRECTION OF MOVEMENT OF GROUND WATER

IN EDDY COUNTY, NEW MEXICO

SCALE

5 0 5 10 MILES

EXPLANATION

○ Well ○ Spring

Direction of ground water movements

3380 Altitudes (feet above sea level) of ground water levels

FIGURE 4

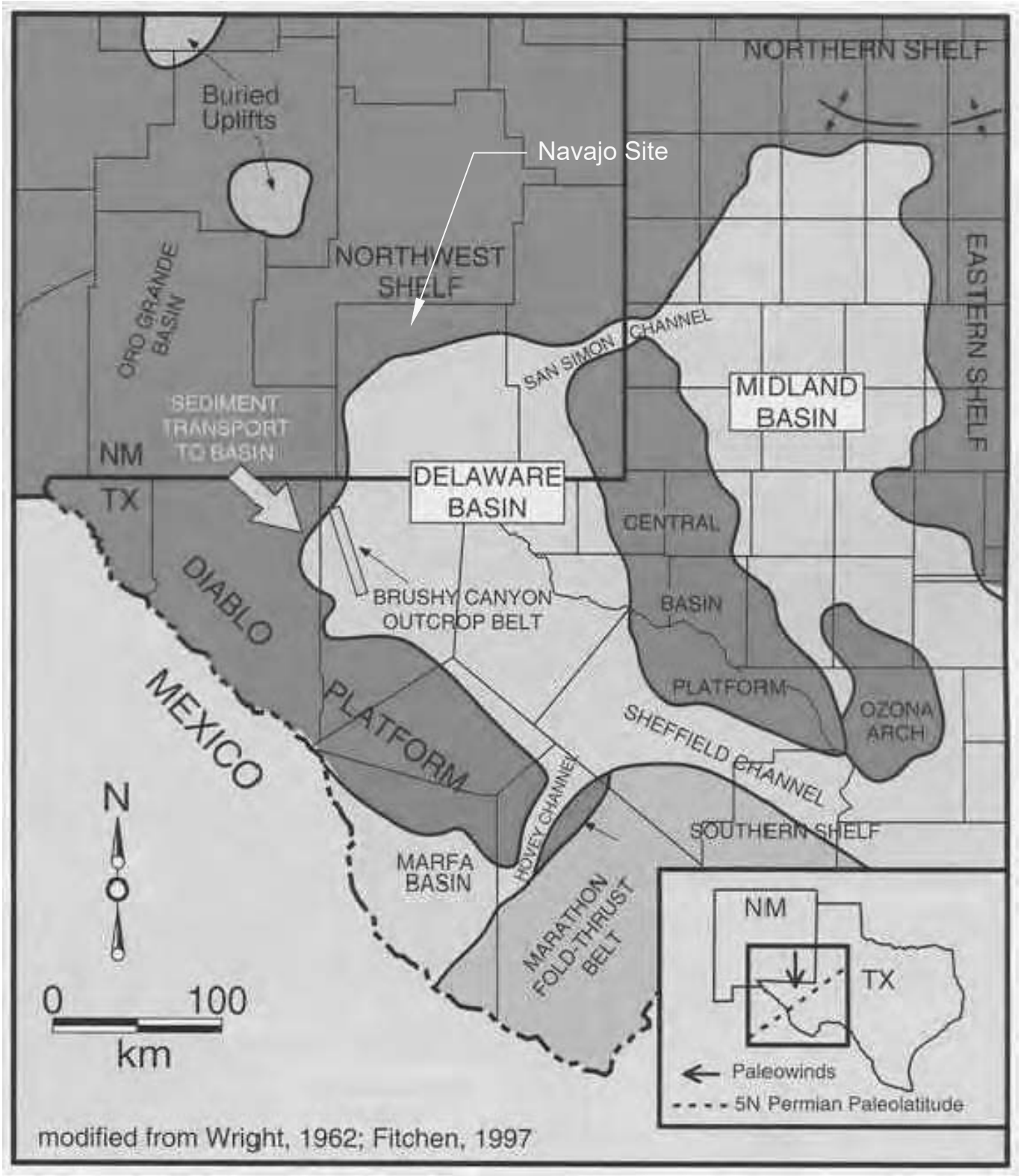


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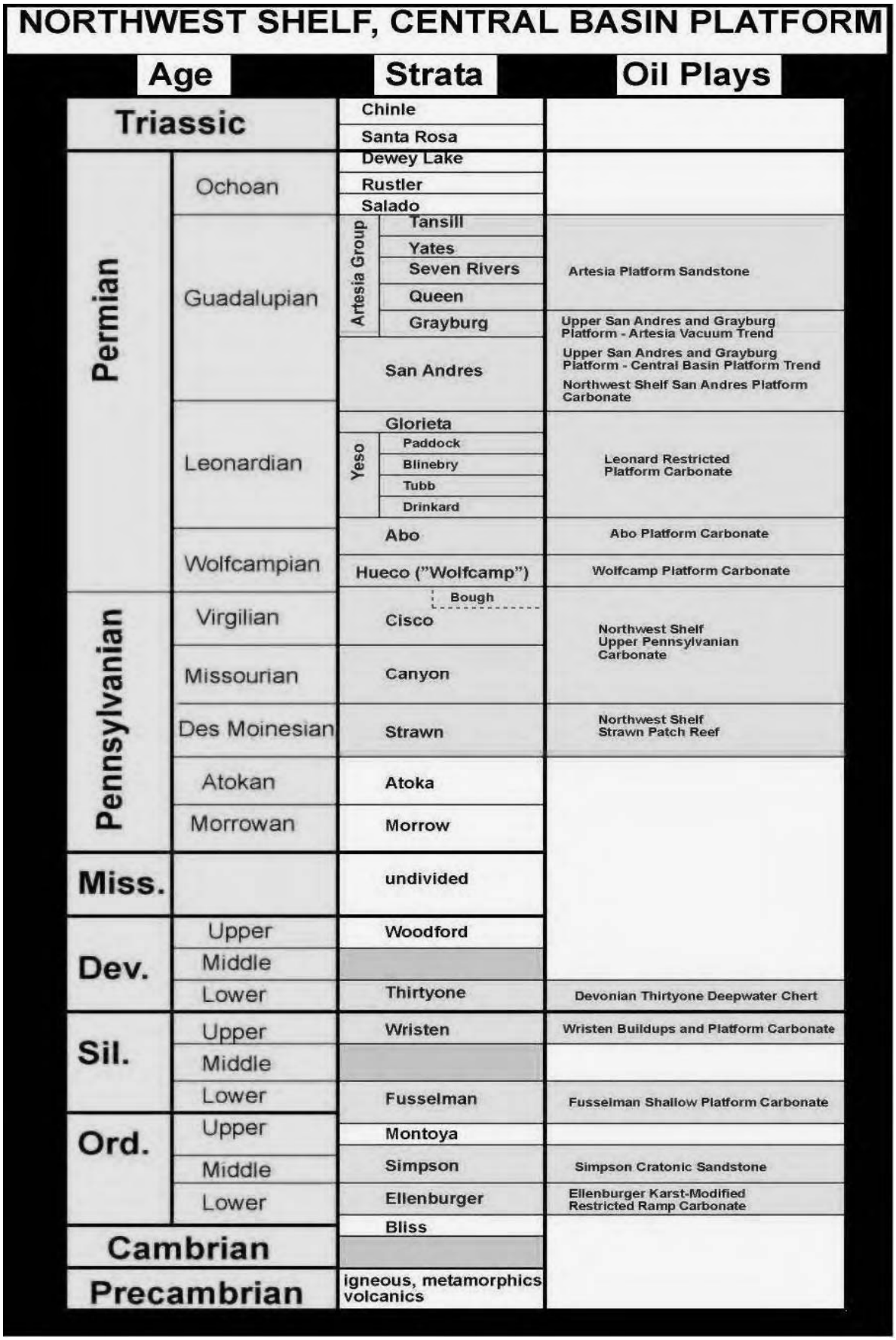
FIGURE 5

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

PERMIAN BASIN MAP

DATE: 01/19/20	CHECKED BY:	JOB NO: 60D6945
DRAWN BY: WDD	APPROVED BY:	DWG. NO:



STRATIGRAPHIC COLUMN

Source: Broadhead, et al., 2004. ***Play Analysis of Major Oil Reservoirs in the New Mexico Part of the Permian Basin: Enhanced Production Through Advanced Technologies.*** **New Mexico Bureau of Geology and Mineral Resources. Open File Report 479.**

FIGURE 6

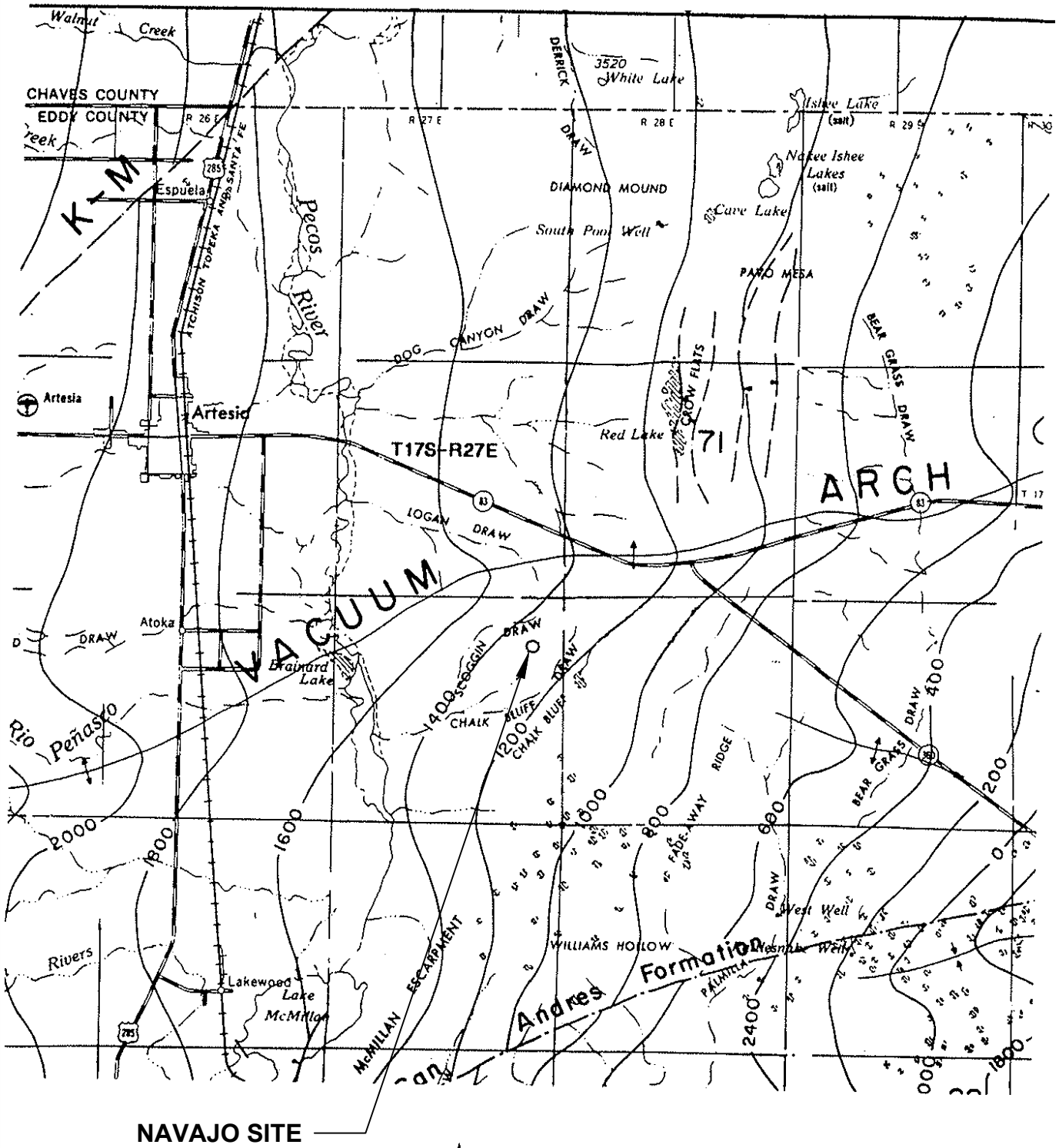


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FIGURE 7

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

REGIONAL GEOLOGIC FEATURES

DATE: 01/19/17	CHECKED BY:	JOB NO: 60D6945
DRAWN BY: WDD	APPROVED BY:	DWG. NO:

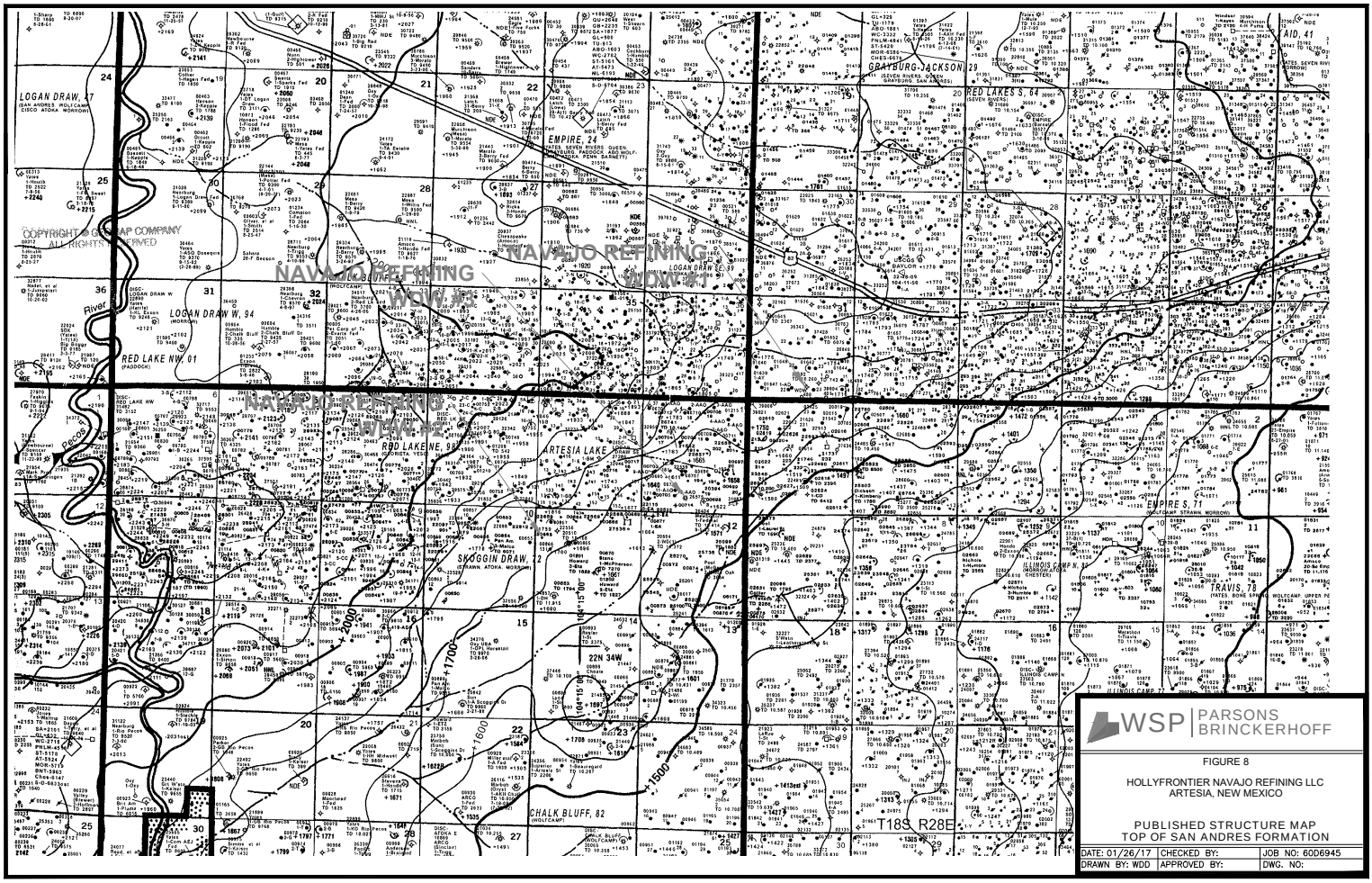

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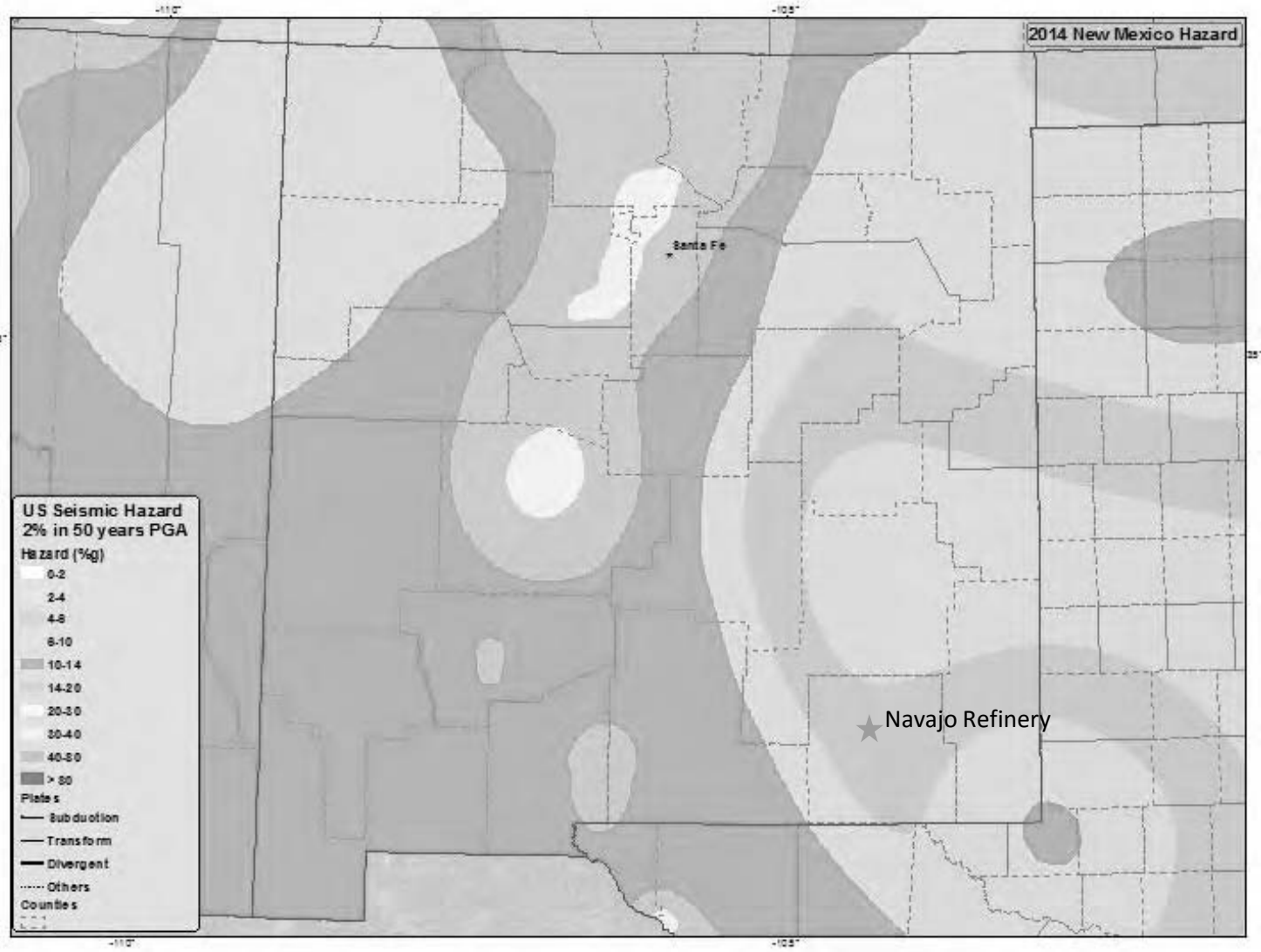
FIGURE 8

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

PUBLISHED STRUCTURE MAP
TOP OF SAN ANDRES FORMATION

DATE: 01/26/17	CHECKED BY:	JOB NO: 60D6945
DRAWN BY: WDD	APPROVED BY:	DWG. NO:



Source: USGS, 2017. *Information by Region – New Mexico; 2014 Seismic Hazard Map.* Earthquake Hazards Program. https://earthquake.usgs.gov/earthquakes/byregion/newmexico-haz.php

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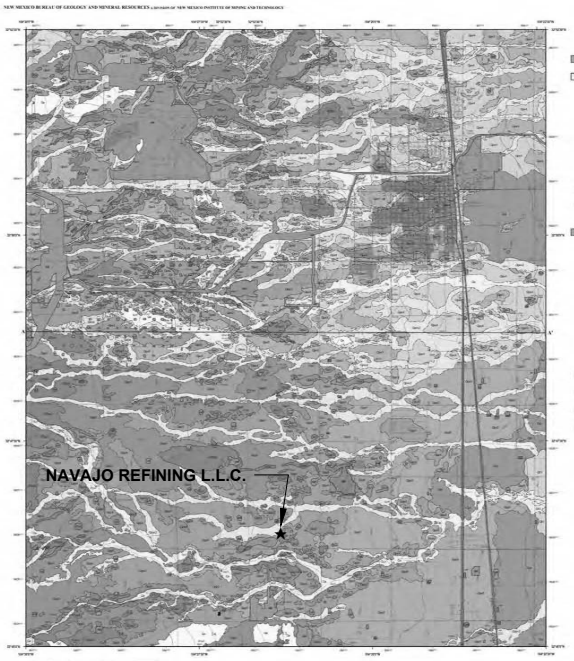
FIGURE 9
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

SEISMIC RISK MAP

DATED: 1/16/2017	**APPROVED BY:**	**JOB NO. 50904D**
DRAWN BY: GEM	**CHECKED BY:**	**SCALE: N/A**



Geologic map of the Artesia quadrangle, Eddy County, New Mexico.

May 2011

by

David J. McCraw and Shannon Williams

New Mexico Bureau of Geology and Mineral Resources, 801 Leroy Place, Socorro, NM 87801

DESCRIPTION OF MAP UNITS

CORRELATION OF MAP UNITS

REFERENCES

GEOLOGIC CROSS SECTION

COMMENTS TO MAP USERS

EXPLANATION OF MAP SYMBOLS

QUADRANGLE LOCATION

FIGURE 10

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

SURFACE GEOLOGIC MAP

DATE: 01/19/20	CHECKED BY:	JOB NO: 60D6945
DRAWN BY: WDD	APPROVED BY:	DWG. NO:

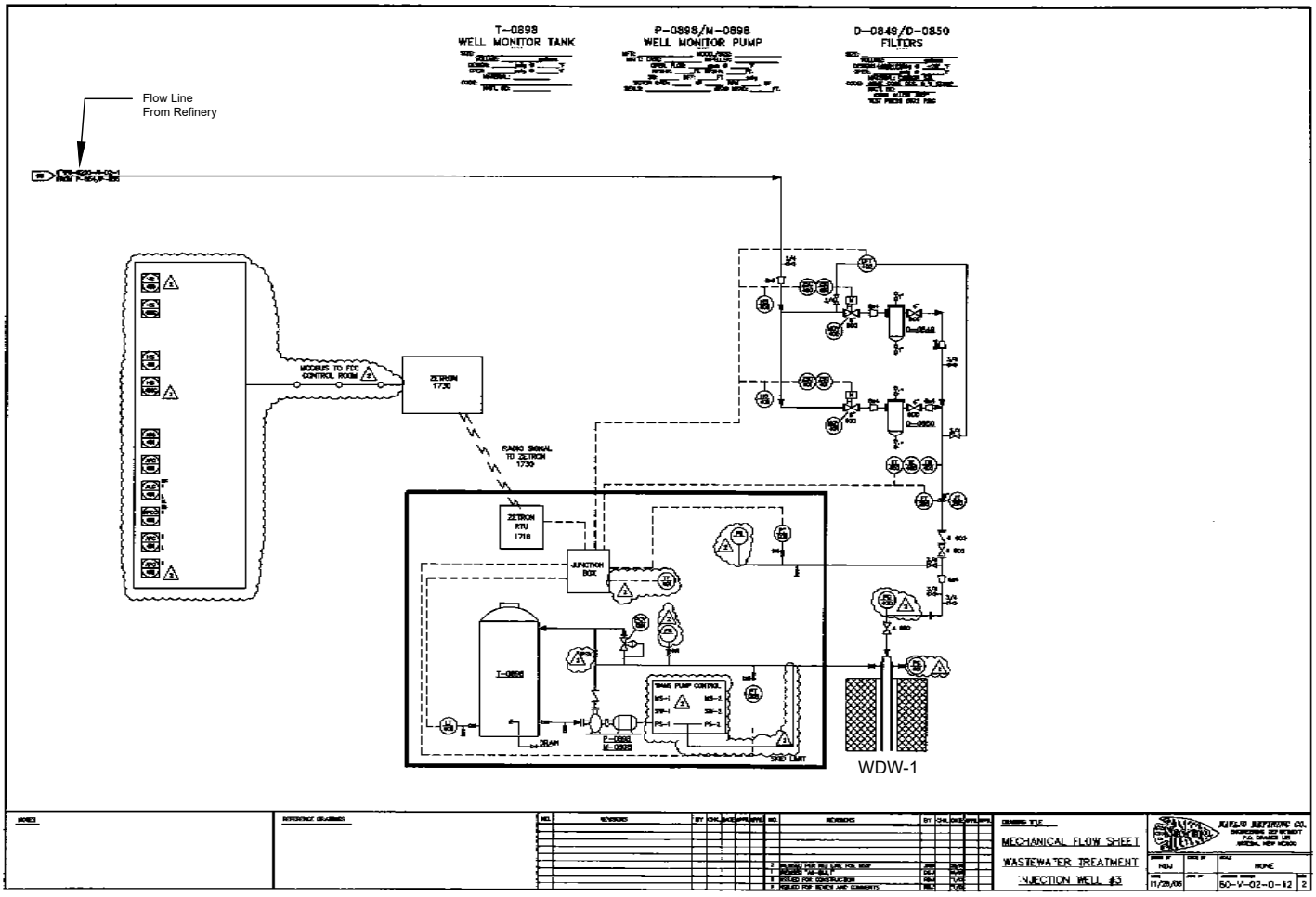


FIGURE 11a
PRE-INJECTION SURFACE FACILITIES
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

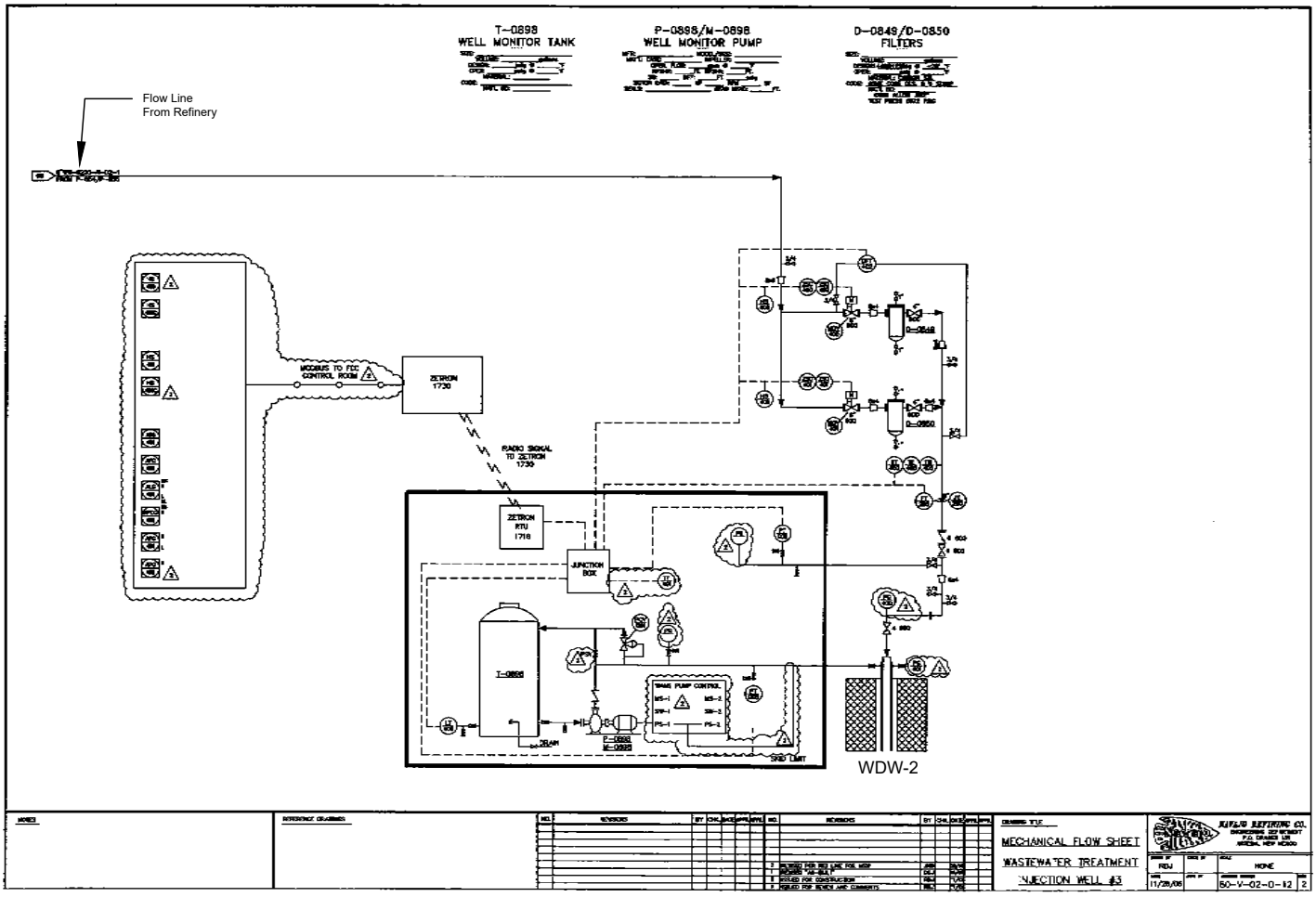


FIGURE 11b
PRE-INJECTION SURFACE FACILITIES
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

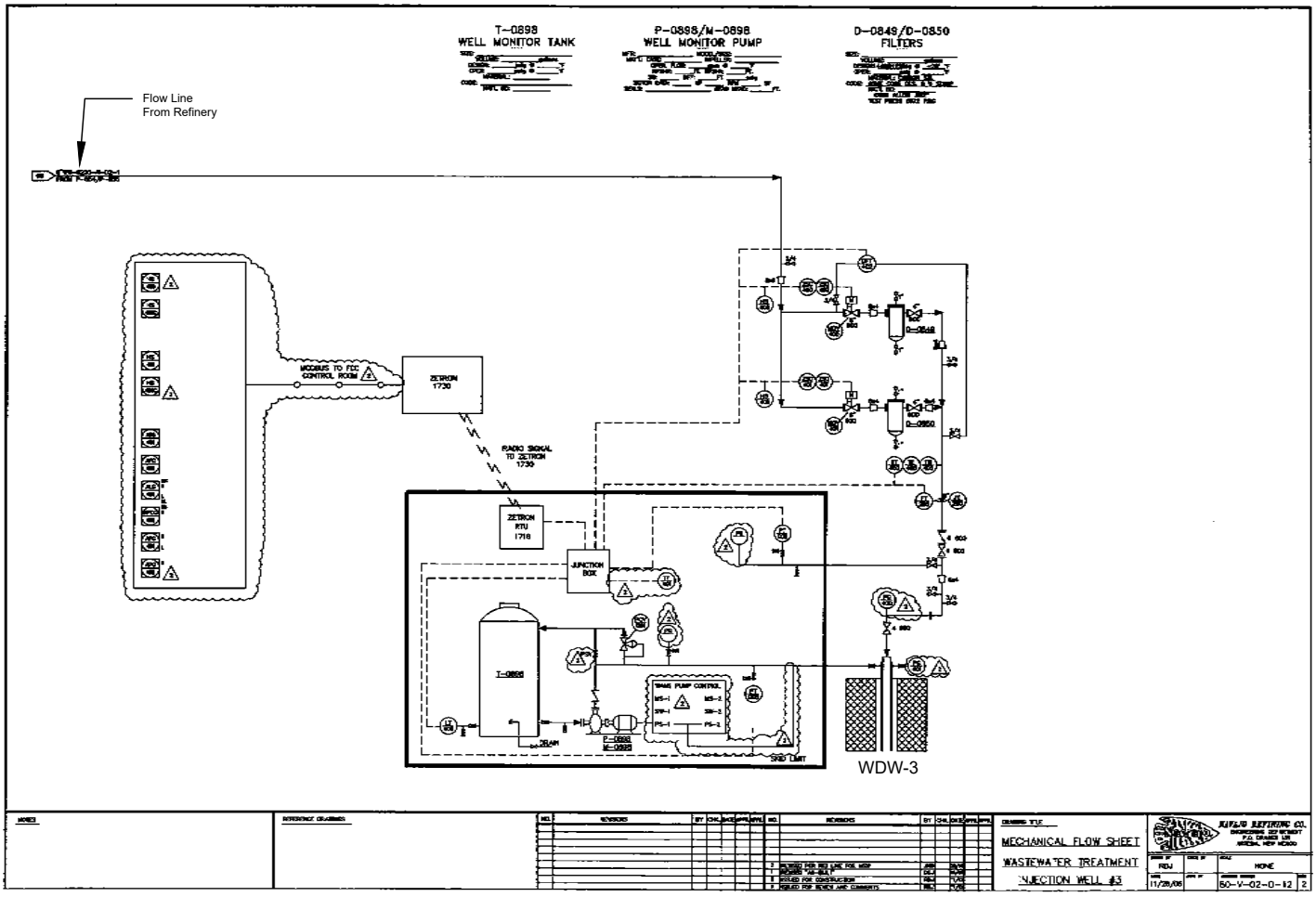
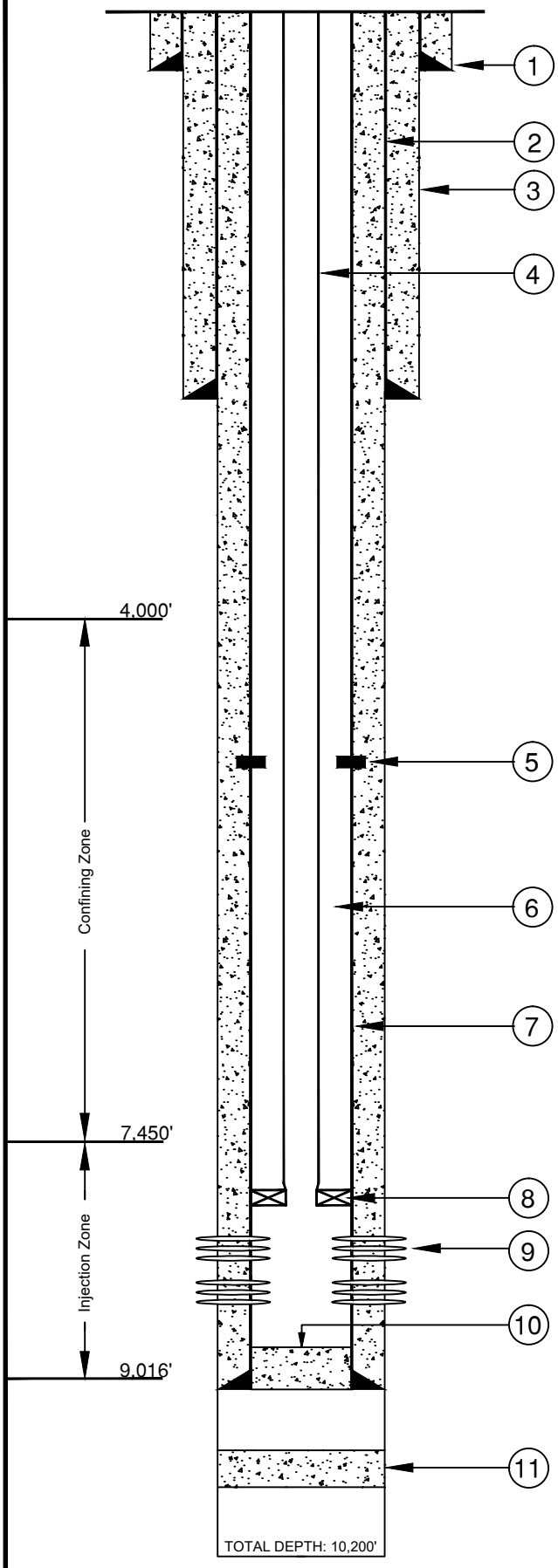


FIGURE 11c
PRE-INJECTION SURFACE FACILITIES
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO



Injection Interval: 7,924' - 8,476'

BELOW GROUND DETAILS

All depths are referenced to the Kelly bushing elevation of 12.5' above ground level. Ground level elevation is 3,678' above mean sea level.

1. Surface Casing: 13 ⅜", 48 lb/ft, J-55, ST&C set at 390' in a 17 ½" hole. Cemented with 150 sx Class C with 3% calcium chloride, 375 sx Class C Litewate w/3% calcium chloride and ½ lb/sx flocele. Circulated 86 sx to surface.

2. Intermediate Casing: 9 ⅝", 36 lb/ft, J-55, ST&C set at 2,555' in a 12 ¼ " hole. Cemented w/800 sx of Class C Lite w/ ½ lb/sx flocele and 2 lb/sx Gilsonite and 12% salt. Followed by 200 sx of Class C w/2% calcium chloride. Circulated 133 sx to surface.

3. Base of the USDW at 493'.

4. Injection Tubing: 4 ½", 11.6 lb/ft, N-80, SMLS, R3, LT&C set at 7,879'.

5. DV Tool: at 5,498'.

6. Annulus Fluid: 8.7 lb/gal brine water mixed w/UniChem Techni-Hib 370 corrosion inhibitor.

7. Protection Casing: 7", 29 lb/ft, N-80, LT&C: 9094' to 7031'. 7", 29 lb/ft, P-110, LT&C: 7031' to 5845'. 7", 26 lb/ft, P-110, LT&C; 5,845' to surface. Casing set in 8 ¾" hole and cemented in two stages as follows:

   First Stage - 600 sx modified Class H w/0.4% CFR-3, 5 lb/sx Gilsonite, 0.5% Halad-344, and 1 lb/sx salt mixed at 13.0 ppg. Opened DV tool at 5,498' and circulated 142 sx to surface.

   Second Stage - Lead Slurry: 220 sx Interfill "C" (35:65:6) mixed at 11.7 ppg. Tail Slurry: 550 sx modified Class H w/0.4% CFR-3, 5 lb/sx, Gilsonite, 0.5% Halad-344, 0.1% HR-7, and 1 lb/sx mixed at 13.0 ppg. Circulated 75 sx to surface. Topped out w/20 sx premium plus 3% calcium chloride.

8. Packer: 7" x 3.5" EVI Oil Tools (Arrow), Model X-1 retrievable packer set at 7,879'. Minimum I.D. is 3.0". Wireline re-entry guide on bottom. To release: turn ¼ turn to the right and pick up.

9. Perforations (2 SPF):

   Upper Zone - 7,924 - 7,942', 7,974 - 8,030', 8,050 - 8,056', 8,066 - 8,080', 8,118 - 8,127', 8,132 - 8,140', 8,160 - 8,164', 8,170 - 8,188'.

   Lower Zone - 8,220 - 8,254', 8,260 - 8,270', 8,280 - 8,302', 8,360 - 8,366', 8,370 - 8,378', 8,400 - 8,410', 8,419 - 8,423', 8,430 - 8,446', 8,460 - 8,464', 8,470 - 8,476'.

10. PBTD: 9,004'.

11. Cement Plug: 45 sx Class H from 9624' to 9734'.

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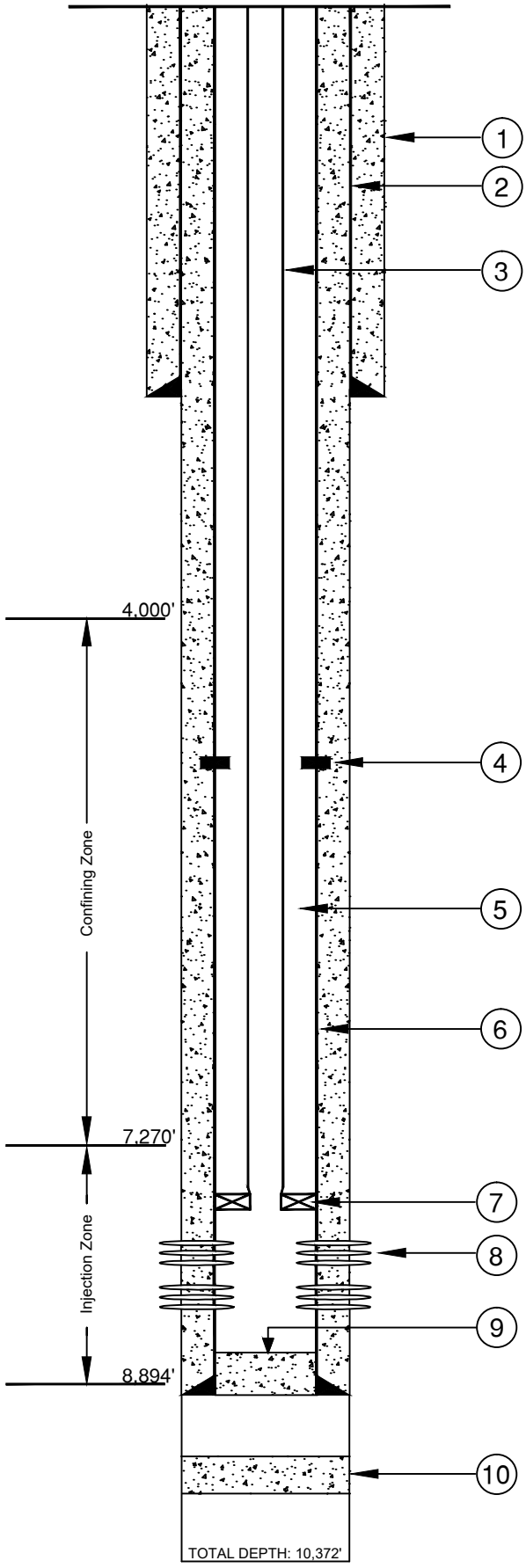
FIGURE 12a

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

BELOW GROUND WELL SCHEMATIC
WASTE DISPOSAL WELL NO. 1

DATE: 01/19/17	CHECKED BY:	JOB NO: 50904D
DRAWN BY: WDD	APPROVED BY:	DWG. NO:



Injection Interval: 7,570' - 8,399'

BELOW GROUND DETAILS

All depths are referenced to the Kelly bushing elevation of 13' above ground level. Ground level elevation is 3610' above mean sea level.

1. Base of the USDW at 473'.
2. Surface Casing: 8 5/8", 32 lb/ft, set at 1995' in an 11" hole. Cemented to surface with 800 sacks of cement.
3. Injection Tubing: 3 1/2", 9.2 lb/ft, J-55, smls, NUE 10rd set at 7,528'.
4. DV Tool: at 5,785'.
5. Annulus Fluid: 8.7 lb/gal brine water mixed w/UniChem Techni-Hib 370 corrosion inhibitor.
6. Protection Casing: 5 1/2", 17 lb/ft, L-80, LT&C: 8,869' to the surface and set in a 7 7/8" hole. Casing cemented in two stages as follows:

   First Stage - 575 sacks of modified Class "H" with 0.4% CFR-3, 5 lb/sk Gilsonite, 0.5% Halad-344, and 3 lb/sk salt. Mixed at 13.0 ppg. DV tool opened at 5,785 and 20 sacks circulated to surface.

   Second Stage - Lead Slurry: 300 sacks of Interfill "C" (35:65:6) mixed at 11.7 ppg. Tail slurry: 695 sacks modified Class "H" with 0.4% CFR-3, 5 lb/sk Gilsonite, 0.5% Halad-344 and 3 lb/sk salt mixed at 13.0 ppg. Circulated 150 sacks to surface. Topped out with 10 yards of Redi-mix.
7. Packer: 5 1/2" x 2 7/8" Weatherford Completion Tools (Arrow) Model X-1 retrievable packer set at 7,528'. Minimum ID is 2.4375". Wireline re-entry guide is on bottom. To release: turn 1/4 turn to the right and pick up.
8. Perforations (2 SPF):

   Zone 1: 7,570-7,620'; 7,676-7,736'

   Zone 2: 7,826-7,834'; 7,858-7,880'; 7,886-7,904'; 7,916-7,936'; 7,944-7,964'; 7,990-8,042'; 8,096-8,116'; 8,191-8,201'; 8,304-8,319'; 8,395-8,399'.
9. PBTD: 8,770'
10. Cement Plug: 45 sacks from 9,675' to 9,775'.

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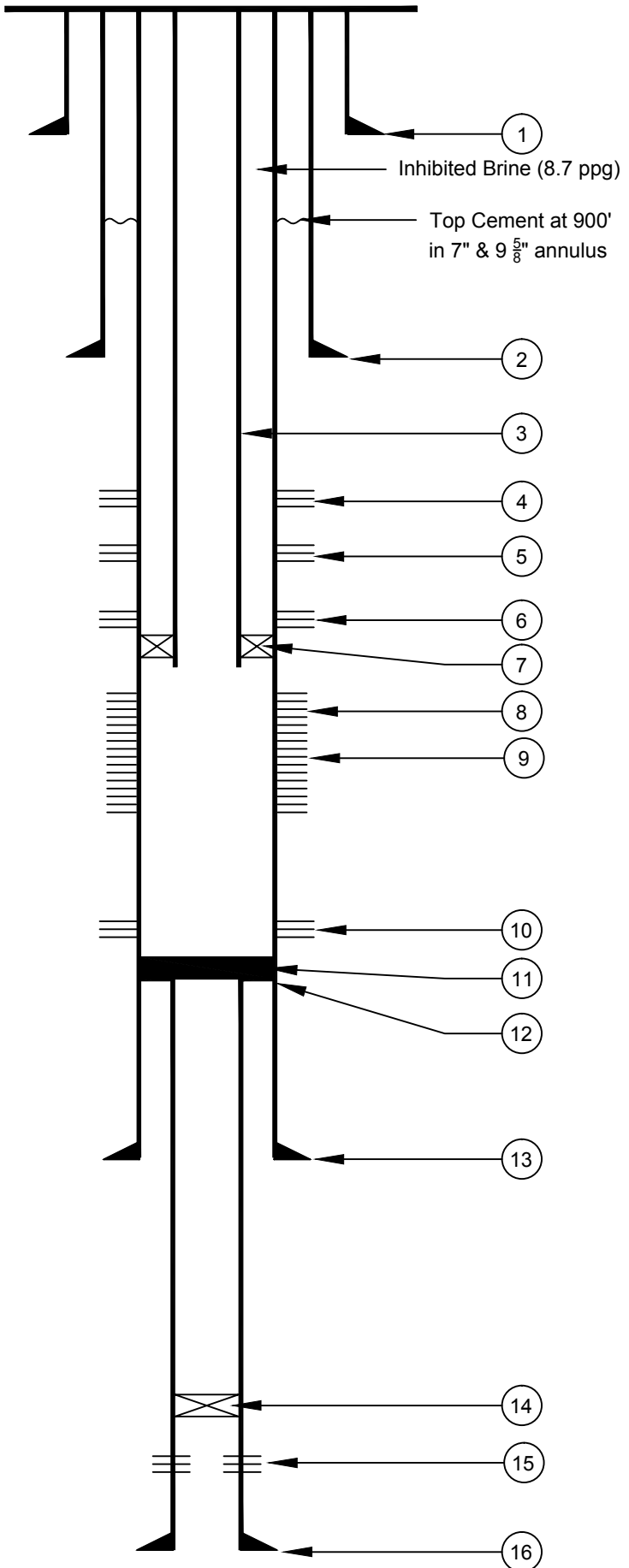
FIGURE 12b

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

BELOW GROUND WELL SCHEMATIC
WASTE DISPOSAL WELL NO. 2

DATE: 01/19/17	CHECKED BY:	JOB NO: 50904D
DRAWN BY: WDD	APPROVED BY:	DWG. NO:



All depths are relative to Kelly bushing

BELOW GROUND DETAILS

1. Surface Casing: 13 $\frac{3}{8}$", 54 $\frac{1}{2}$" lb/ft, J-55 set in a 17 $\frac{1}{2}$" open hole at 400' and cemented to the surface with 425 sacks of Class C cement.
2. First Intermediate Casing: 9 $\frac{5}{8}$", 36 lb/ft, J-55 set in a 12 $\frac{1}{4}$" open hole at 2604' and cemented to the surface with 1025 sacks Class C cement.
3. Injection Tubing: 4 $\frac{1}{2}$", 11.6 lb/ft, J-55 LT&C set at 7568'.
4. Squeeze Perforations: 7050' - 7102' with 80 sacks.
5. Squeeze Perforations: 7262' - 7278' with 100 sacks.
6. Squeeze Perforations: 7304' - 7314' with 80 sacks.
7. Arrow X-1 Packer 7" x 2 $\frac{7}{8}$" set at 7575', 37K Tension, no nipples.
8. Old Open Perforations: 7676' - 7698'.
9. Perforations: 7660' - 8450', 2 JSPF, 60°, 0.5" 10/14/06.
10. Perforations: 8540' - 8620', 23 SPF, 60°, 0.5" 10/15/16.
11. Cement Plug: top tagged at 9022'.
12. Liner Top: 4 $\frac{1}{2}$" set at 9051'.
13. Second Intermediate Casing: 7", 29 lb/ft, N-80 and P-110 steel set in an 8 $\frac{3}{4}$" open hole at 9450' with 1350 sacks of Type H cement from 900' to 9450'.
14. Cast Iron Bridge Plug set at 9800' with 35' cement.
15. Old Perforations: 9861' - 9967'
16. Production Liner: 4 $\frac{1}{2}$", 17 lb/ft, J-55 set in a 6 $\frac{1}{4}$" open hole from 9051' to 10119' with 175 sacks Type H cement.

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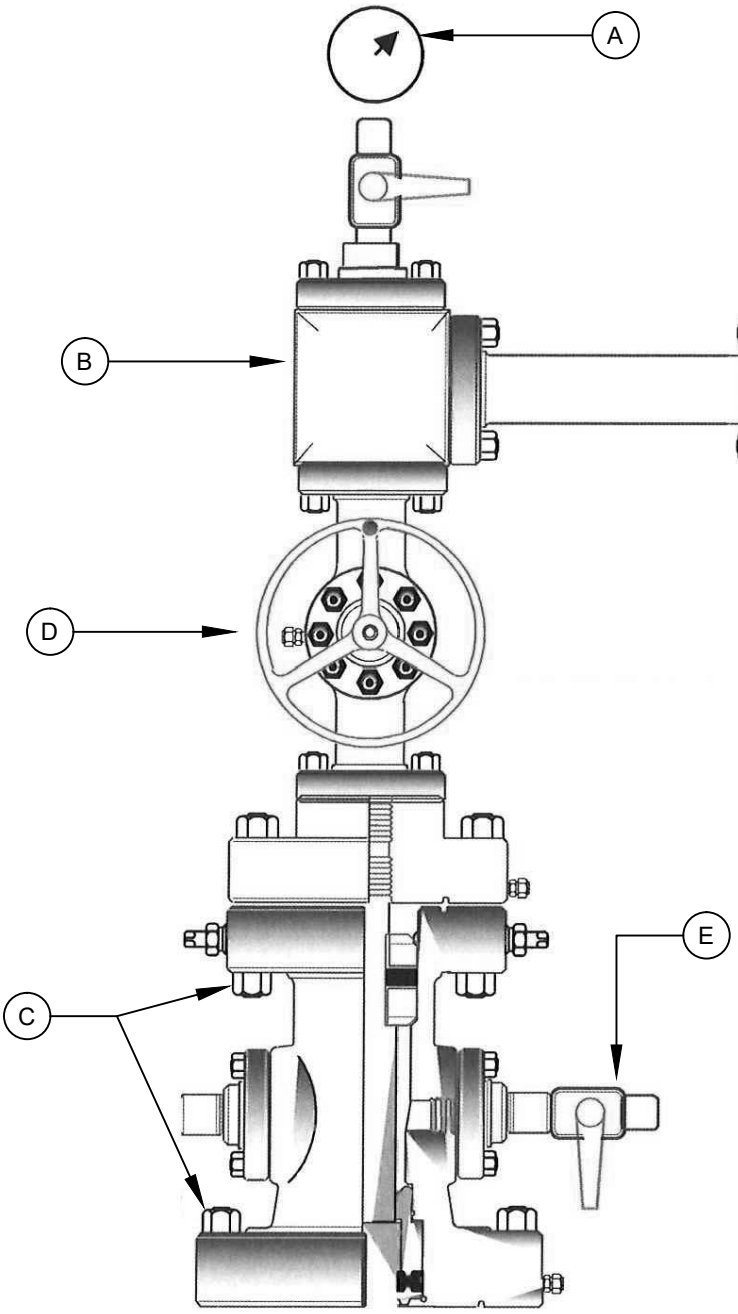
FIGURE 12c

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

BELOW GROUND WELL SCHEMATIC
WASTE DISPOSAL WELL NO. 3

DATE: 01/19/17	CHECKED BY:	JOB NO: 50904D
DRAWN BY: WDD	APPROVED BY:	DWG. NO:



WELLHEAD DETAILS

A. Top Connection: 2 $\frac{3}{8}$" 8rd x 4 $\frac{1}{16}$" 3K 2" x 2 $\frac{3}{8}$" Ball Valve 2 $\frac{3}{8}$" Bull Plug $\frac{1}{2}$" NPT 5000 LB Pressure Gauge.

B. Upper Tree Assembly: A5PP, 4 $\frac{1}{2}$" 3K X 4 $\frac{1}{16}$" 3K

C. Flange: 7 $\frac{1}{16}$", 3 $\frac{1}{2}$" 3K X 4 $\frac{1}{16}$" UPTBG 3K

D. Tree Gate Valve: 4 $\frac{1}{16}$" 3K

E. Annulus Valve: 2" 3K Ball Valve

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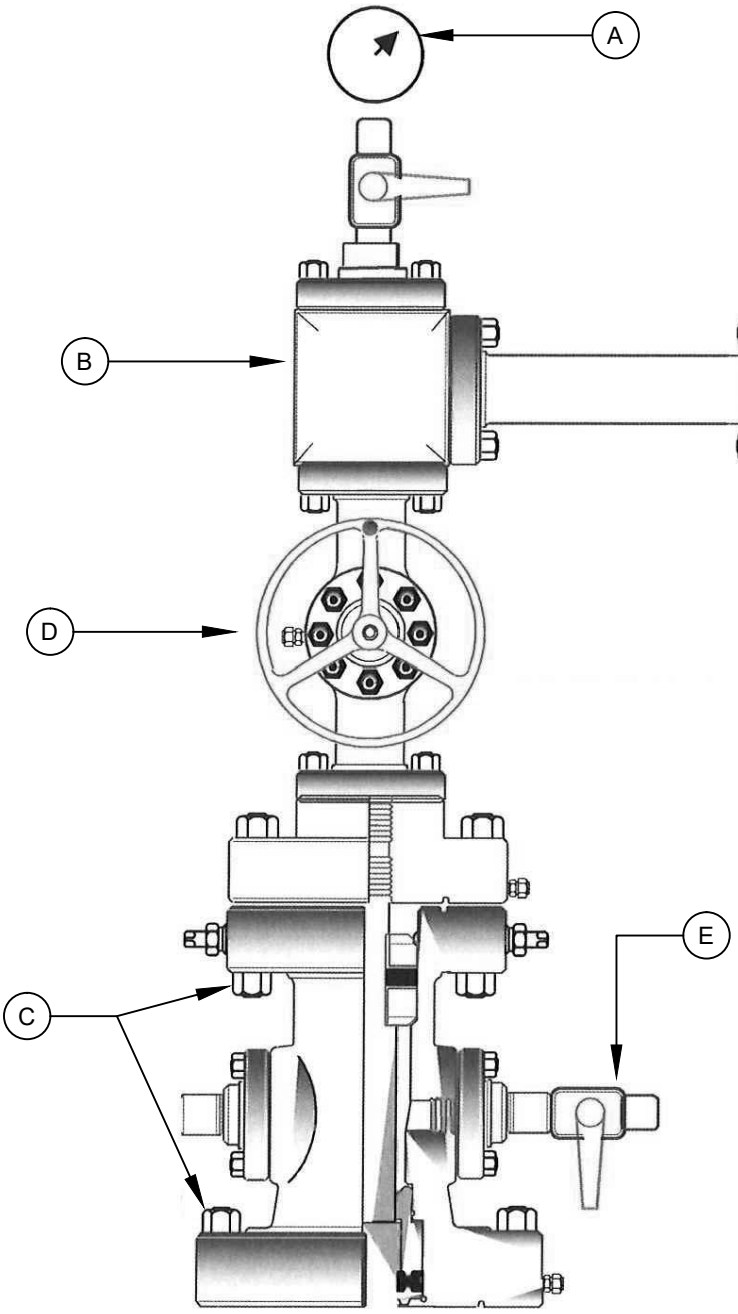
FIGURE 13a

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

WELLHEAD SCHEMATIC
WASTE DISPOSAL WELL NO. 1

DATE: 01/26/17	CHECKED BY:	JOB NO: 50904D
DRAWN BY: WDD	APPROVED BY:	DWG. NO:



WELLHEAD DETAILS

A. Top Connection: 2 $\frac{3}{8}$" 8rd x 4 $\frac{1}{16}$" 3K, 2" x 2 $\frac{3}{8}$" Ball Valve, 2 $\frac{3}{8}$" Bull Plug $\frac{1}{2}$" NPT 5000 LB Pressure Gauge.

B. Upper Tree Assembly: A5PP, 4 $\frac{1}{2}$" 3K X 4 $\frac{1}{16}$" 3K

C. Flange: 7 $\frac{1}{16}$", 3 $\frac{1}{2}$" 3K X 4 $\frac{1}{16}$" UPTBG 3K

D. Tree Gate Valve: 4 $\frac{1}{16}$" 3K

E. Annulus Valve: 2" 3K Ball Valve

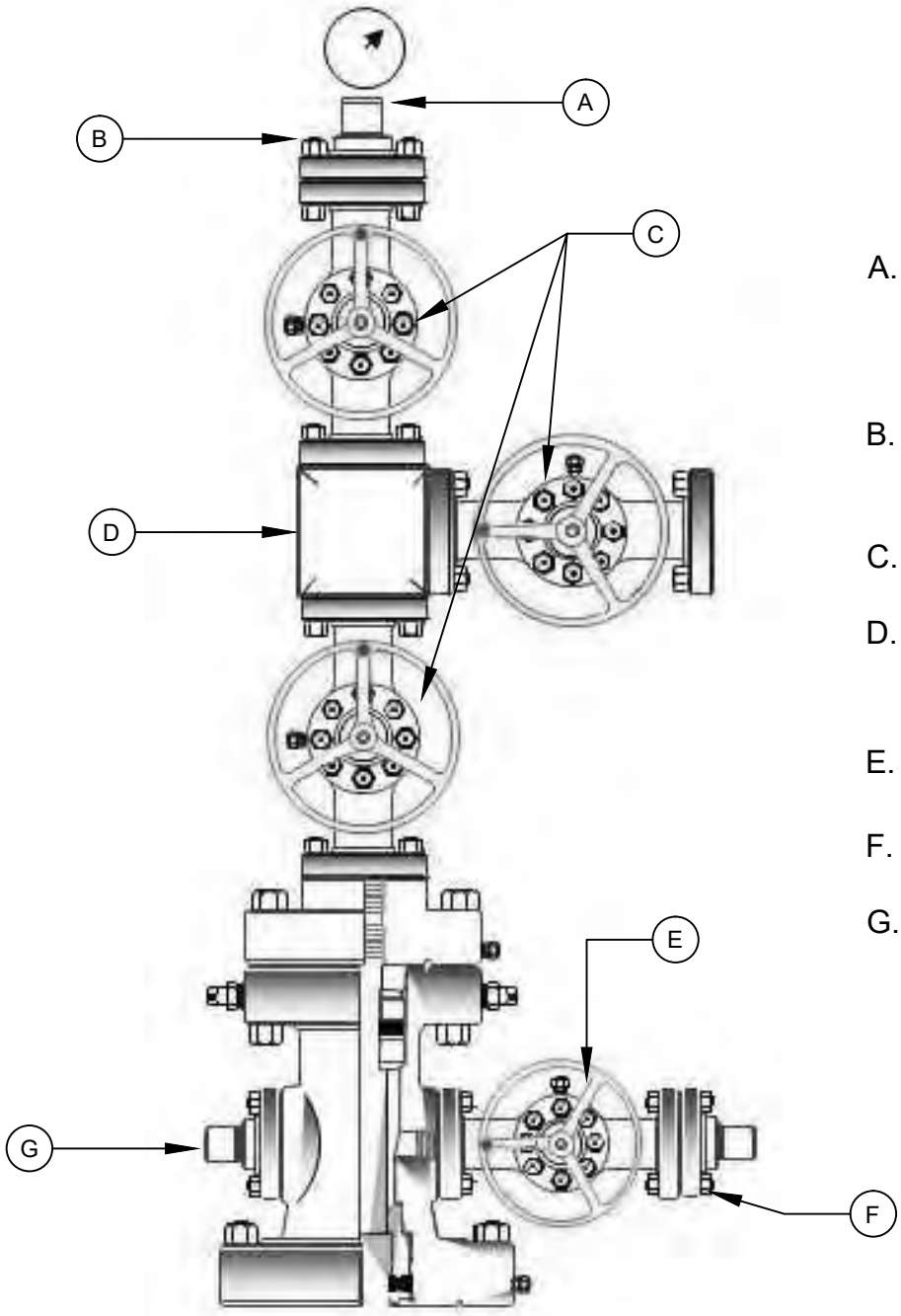
WSP | PARSONS BRINCKERHOFF

FIGURE 13b

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

WELLHEAD SCHEMATIC
WASTE DISPOSAL WELL NO. 2

DATE: 01/26/17	CHECKED BY:	JOB NO: 50904D
DRAWN BY: WDD	APPROVED BY:	DWG. NO:



WELLHEAD DETAILS

A. Top Connection: 4 $\frac{1}{2}$" EUE, 2 $\frac{7}{8}$" 8rd, 2 $\frac{7}{8}$" bull plug, $\frac{1}{2}$" NPT 5000 lb gauge.

B. Flange: 4 $\frac{1}{16}$" 3K x 4 $\frac{1}{2}$" UPTBG 3K

C. Tree Gate Valves: 4 $\frac{1}{16}$" 3K

D. Upper Tree Assembly: A5PP, 4 $\frac{1}{2}$", 7 $\frac{1}{16}$" 3K x 4 $\frac{1}{16}$" 3K

E. Annulus Valve: 2 $\frac{1}{16}$" 5K

F. Flange: 2 $\frac{1}{16}$" 5K x 2" LP 5K

G. Annulus Valve: 2" ball valve 3K

WSP | PARSONS BRINCKERHOFF

FIGURE 13c

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

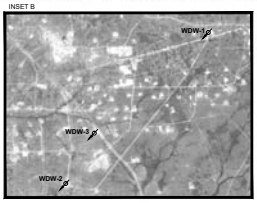
WELLHEAD SCHEMATIC
WASTE DISPOSAL WELL NO. 3

DATE: 01/19/17	CHECKED BY:	JOB NO: 50904D
DRAWN BY: WDD	APPROVED BY:	DWG. NO:

DRAWINGS

INSET A

INSET B



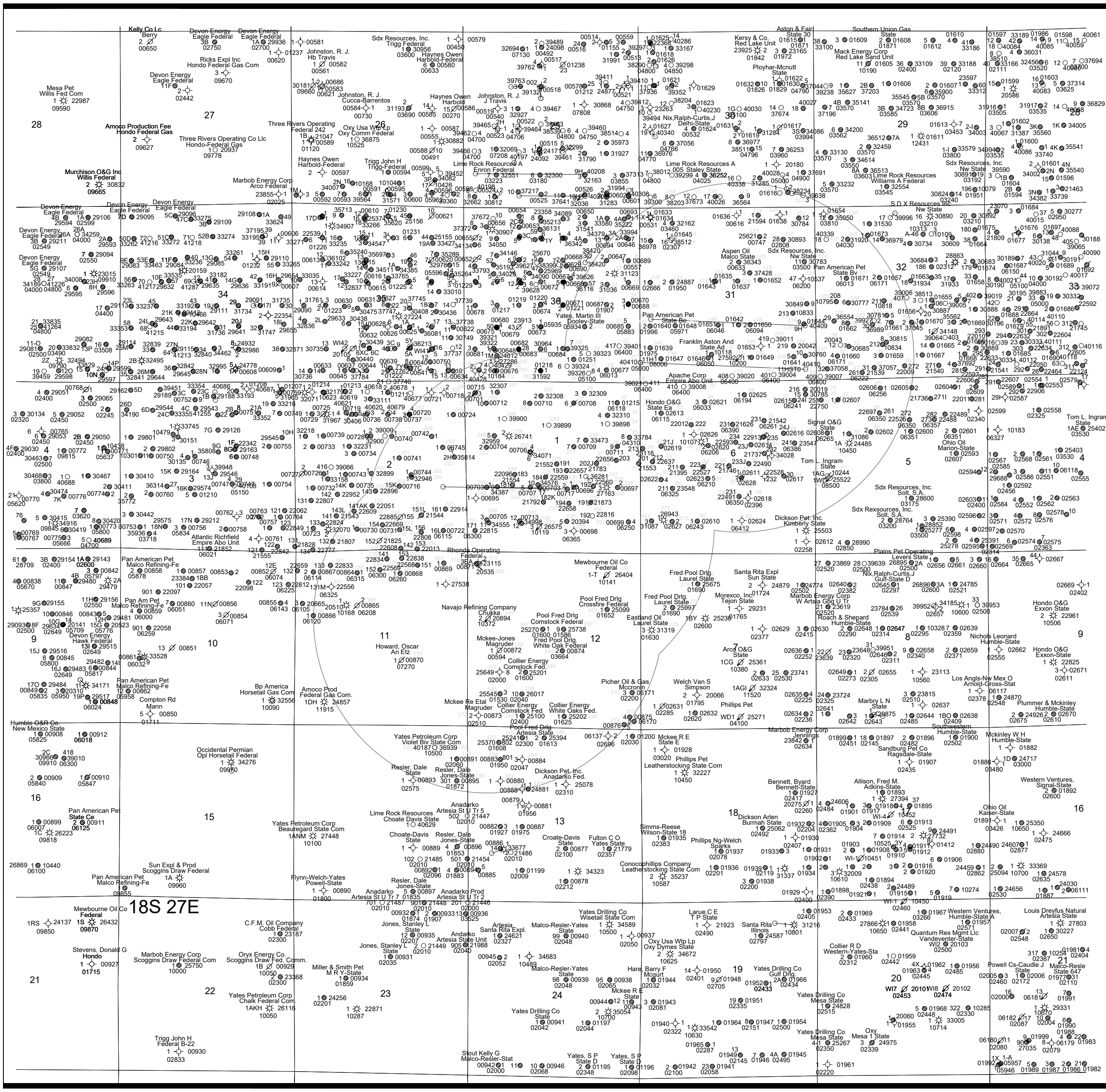
WSP | PARSONS BRINCKERHOFF

DRAWING 1

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

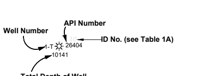
FACILITY MAP

DATE: 01/19/17	CHECKED BY:	JOB NO: 509040
DRAWN BY: WDD	APPROVED BY:	DWG. NO:



LEGEND

- PERMITTED WELL
- DRY HOLE
- PLUGGED AND ABANDONED WELL
- GAS WELL
- OIL WELL
- OIL & GAS WELL
- ABANDONED GAS WELL
- ABANDONED OIL WELL
- ABANDONED OIL & GAS WELL
- INJECTION WELL
- PLUGGED & ABANDONED INJECTION WELL
- SALTWATER DISPOSAL WELL
- PLUGGED SALTWATER DISPOSAL WELL
- 1-MILE COMPOSITE AREA OF REVIEW



SCALE
(IN FEET)
0 1000 2000

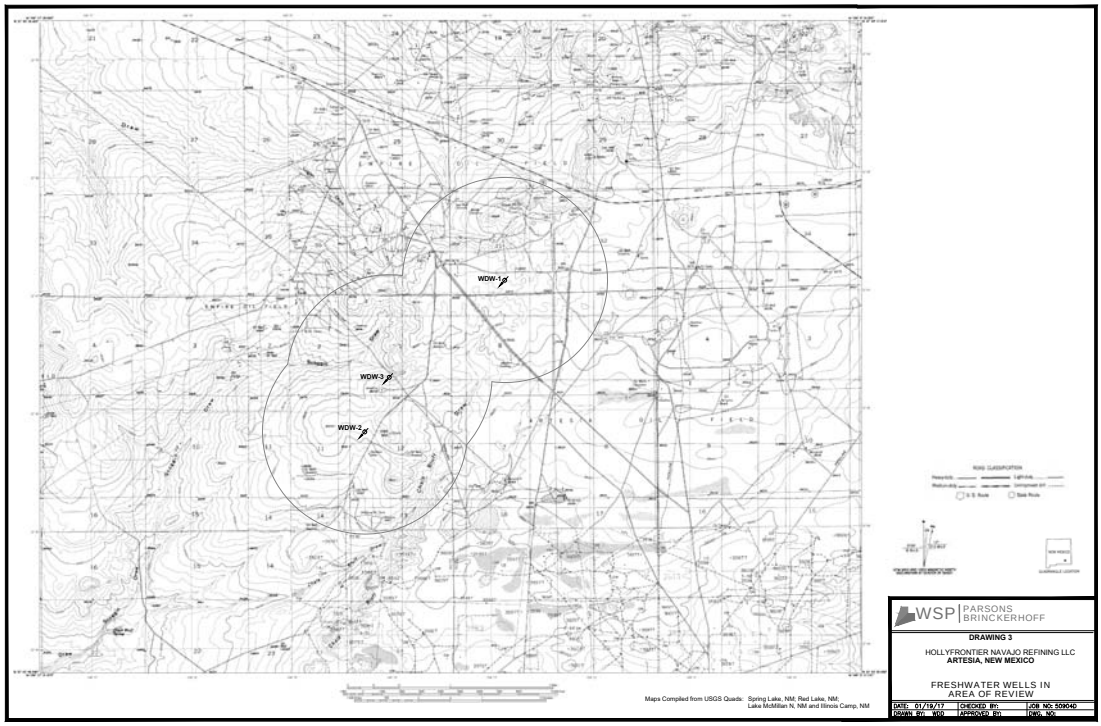
WSP | PARSONS BRINCKERHOFF

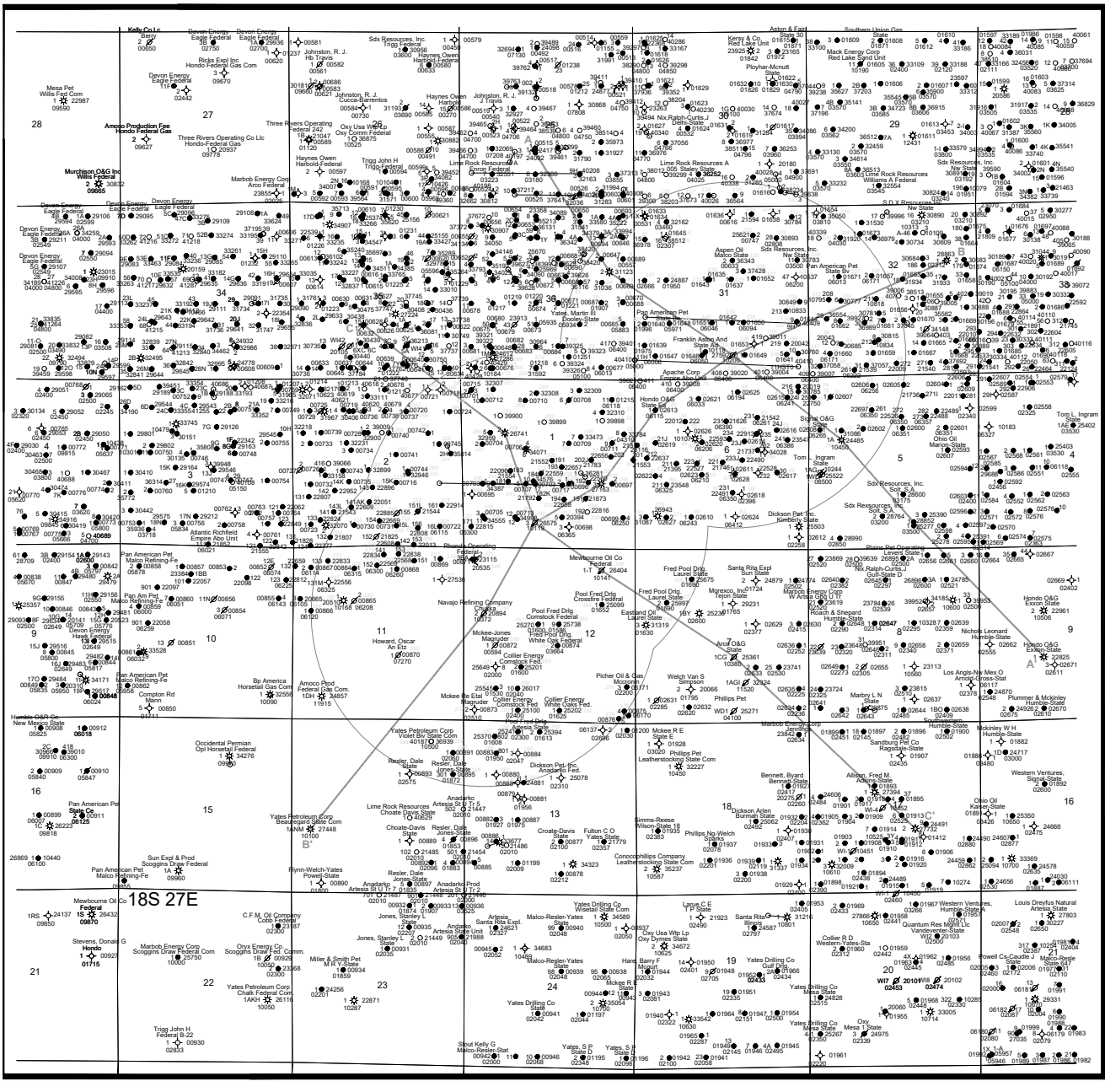
DRAWING 2

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

AREA OF REVIEW MAP

DATE: 01/19/17	CHECKED BY:	JOB NO: 50904D
DRAWN BY: WDD	APPROVED BY:	DWG NO:


WDW-1
WDW-3
WDW-2
Maps Compiled from USGS Quads: Spring Lake, NM; Red Lake, NM; Lake McMillan N, NM and Illinois Camp, NM
WSP | PARSONS BRINCKERHOFF
DRAWING 3
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO
FRESHWATER WELLS IN AREA OF REVIEW
DATE: 01/19/17
CHECKED BY:
JOB NO: 509040
DRAWN BY: WDD
APPROVED BY:
DWG. NO:



LEGEND

- PERMITTED WELL
- DRY HOLE
- PLUGGED AND ABANDONED WELL
- GAS WELL
- OIL WELL
- OIL & GAS WELL
- ABANDONED GAS WELL
- ABANDONED OIL WELL
- ABANDONED OIL & GAS WELL
- INJECTION WELL
- PLUGGED & ABANDONED INJECTION WELL
- SALTWATER DISPOSAL WELL
- PLUGGED SALTWATER DISPOSAL WELL
- 1-MILE COMPOSITE AREA OF REVIEW
- GEOLOGIC CROSS-SECTION LINES

Well Number — API Number — ID No. (see Table 1A) — Total Depth of Well

SCALE (IN FEET)

0 1000 2000

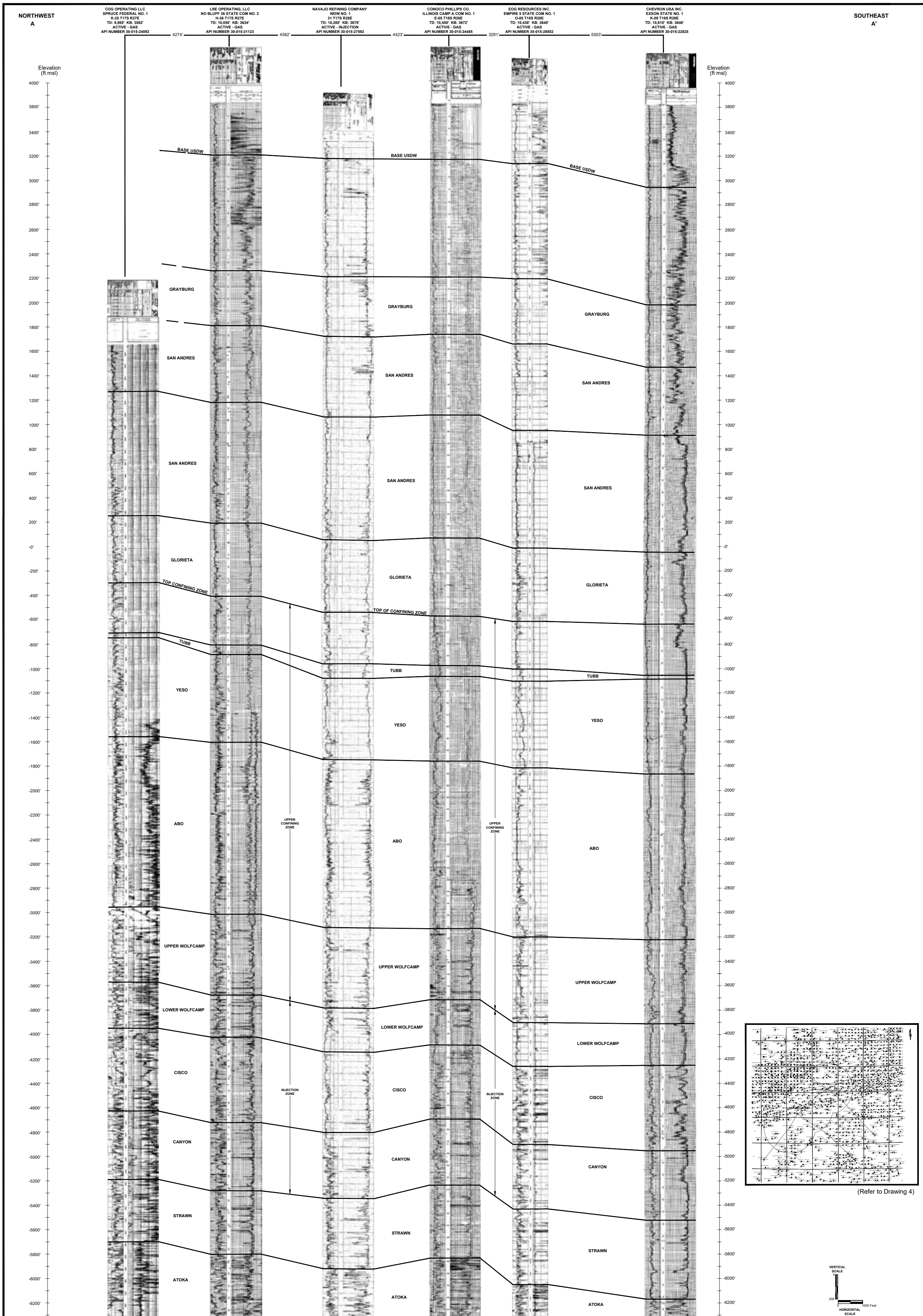
WSP | PARSONS BRINCKERHOFF

DRAWING 4

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

GEOLOGIC CROSS-SECTION INDEX MAP

DATE: 01/19/17	CHECKED BY:	JOB NO. 590040
DRAWN BY: WDD	APPROVED BY:	DWG NO.



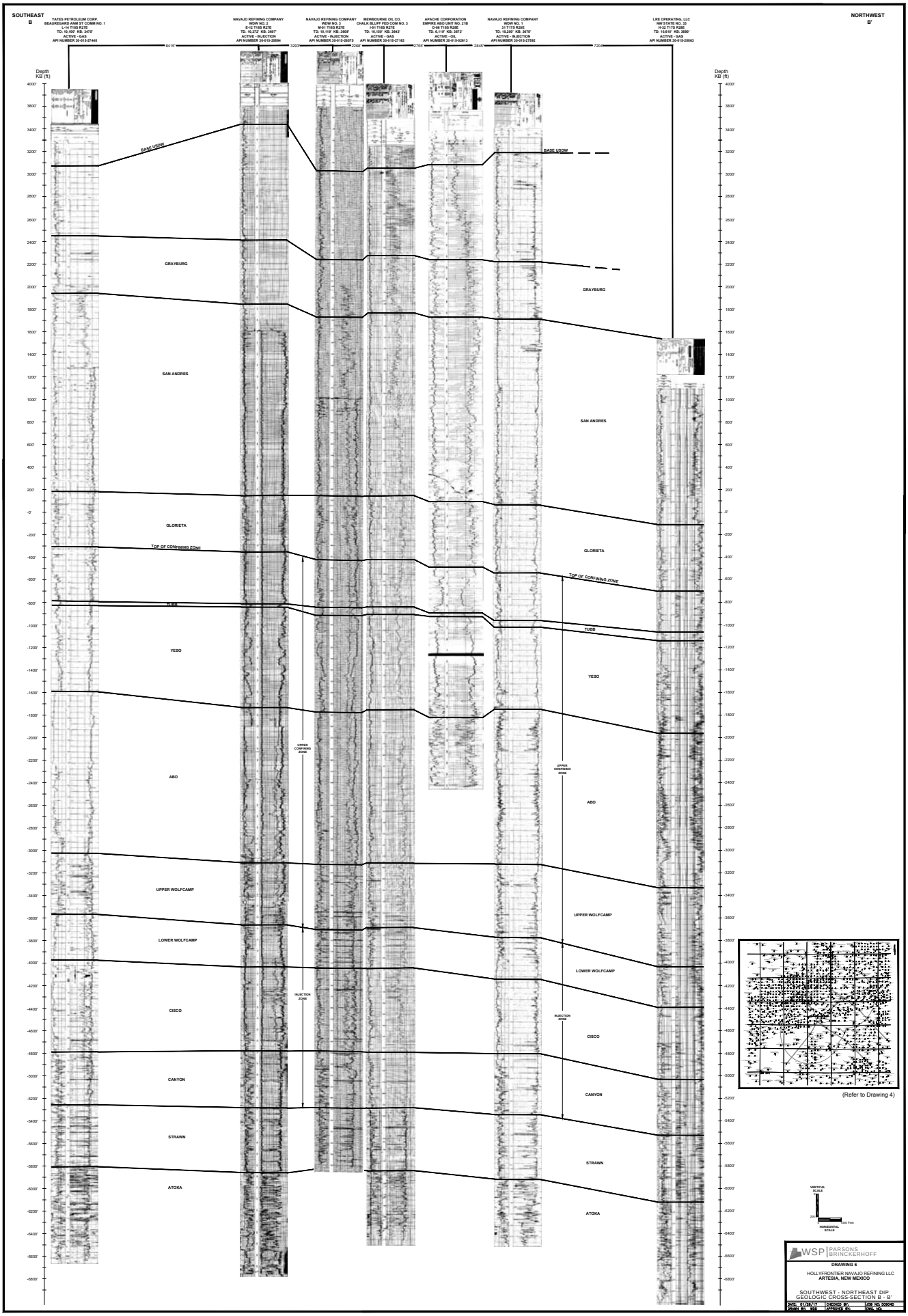
WSP | PARSONS BRINCKERHOFF

DRAWING 5

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

NORTHWEST - SOUTHEAST DIP
GEOLOGIC CROSS-SECTION A - A'

DATE: 01/26/17	CHECKED BY:	JOB NO: 50904D
DRAWN BY: WDD	APPROVED BY:	DWG. NO:



(Refer to Drawing 4)

VERTICAL SCALE
200
HORIZONTAL SCALE
1000 Feet

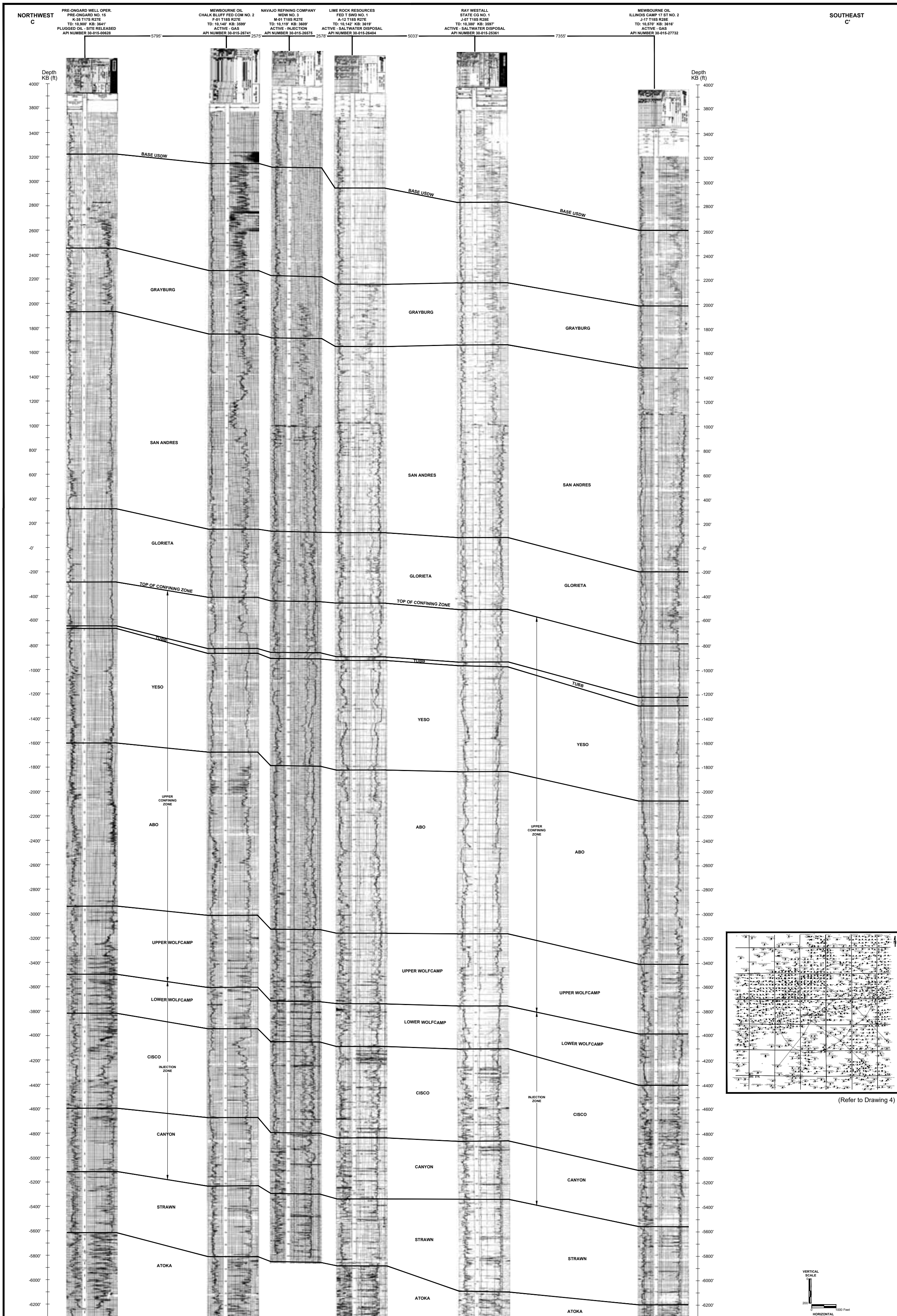
WSP | PARSONS BRINCKERHOFF

DRAWING 6

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

SOUTHWEST - NORTHEAST DIP
GEOLOGIC CROSS-SECTION B - B'

DATE: 07/26/17	CHECKED BY:	JOB NO. 530340	
DRAWN BY: MD	APPROVED BY:	DWG. NO.	



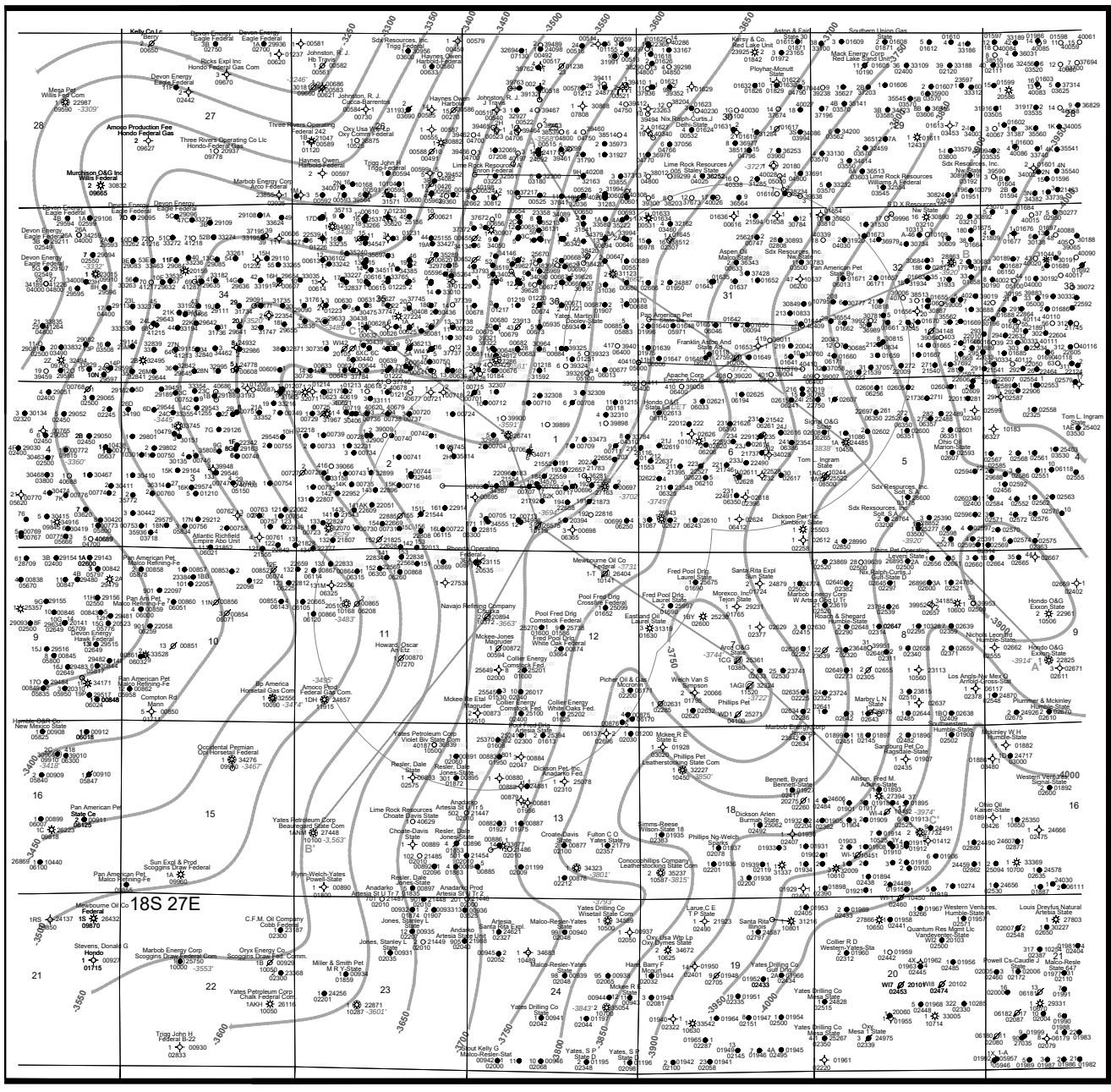
WSP | PARSONS BRINCKERHOFF

DRAWING 7

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

NORTHWEST - SOUTHEAST DIP
GEOLOGIC CROSS-SECTION C - C'

DATE: 01/26/17	CHECKED BY:	JOB NO: 50904D
DRAWN BY: WDD	APPROVED BY:	DWG. NO:



LEGEND

- PERMITTED WELL
- DRY HOLE
- PLUGGED AND ABANDONED WELL
- GAS WELL
- OIL WELL
- OIL & GAS WELL
- ABANDONED GAS WELL
- ABANDONED OIL WELL
- ABANDONED OIL & GAS WELL
- INJECTION WELL
- PLUGGED & ABANDONED INJECTION WELL
- SALTWATER DISPOSAL WELL
- PLUGGED SALTWATER DISPOSAL WELL
- 1-MILE COMPOSITE AREA OF REVIEW
- -3700- STRUCTURE CONTOUR OF TOP OF INJECTION ZONE

Well Number — API Number — ID No. (see Table 1A) — Elevation Top of Injection Zone (ft msl) — Total Depth of Well

SCALE (IN FEET)

0 1000 2000

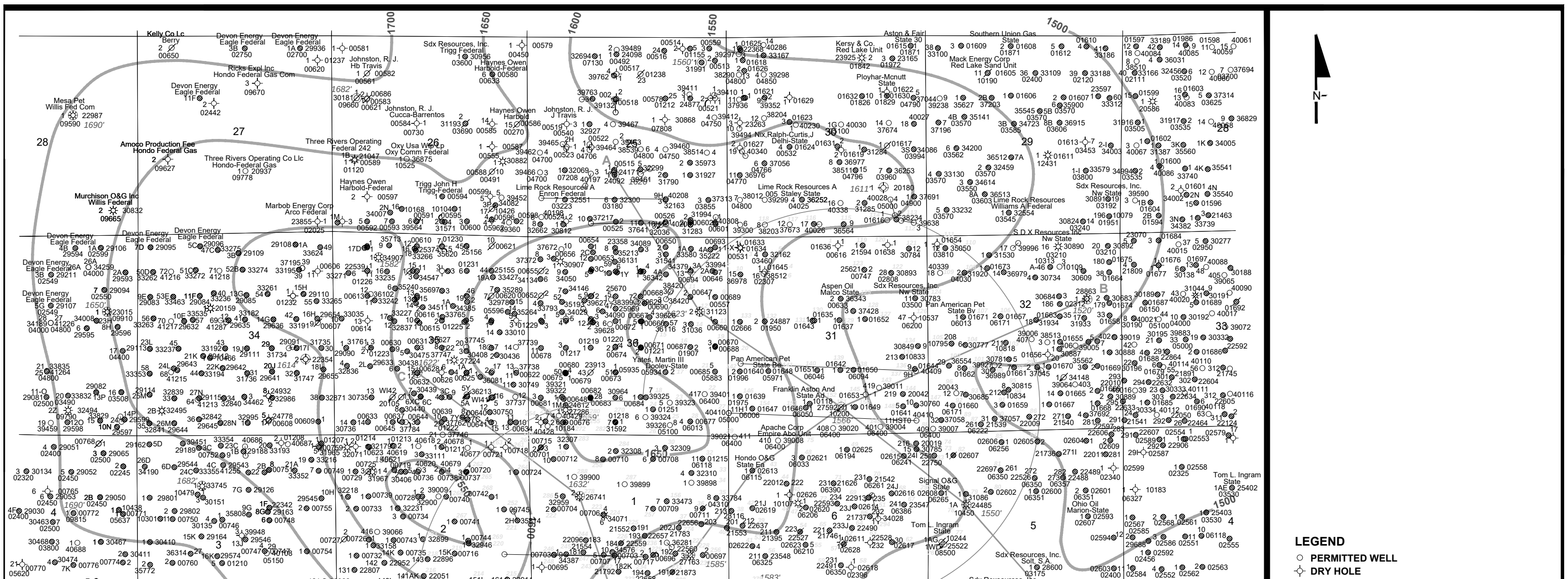
WSP | PARSONS BRINCKERHOFF

DRAWING 8

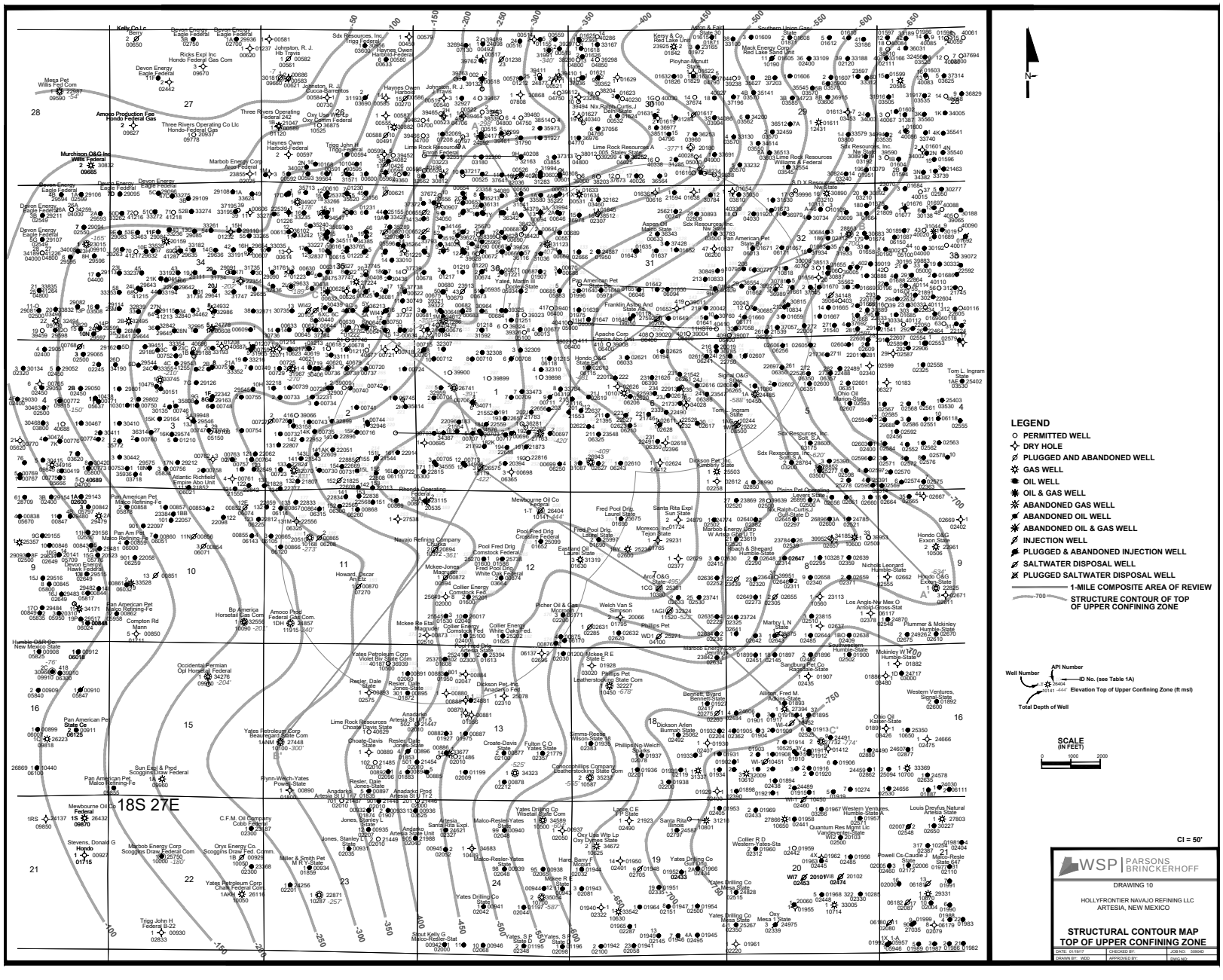
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

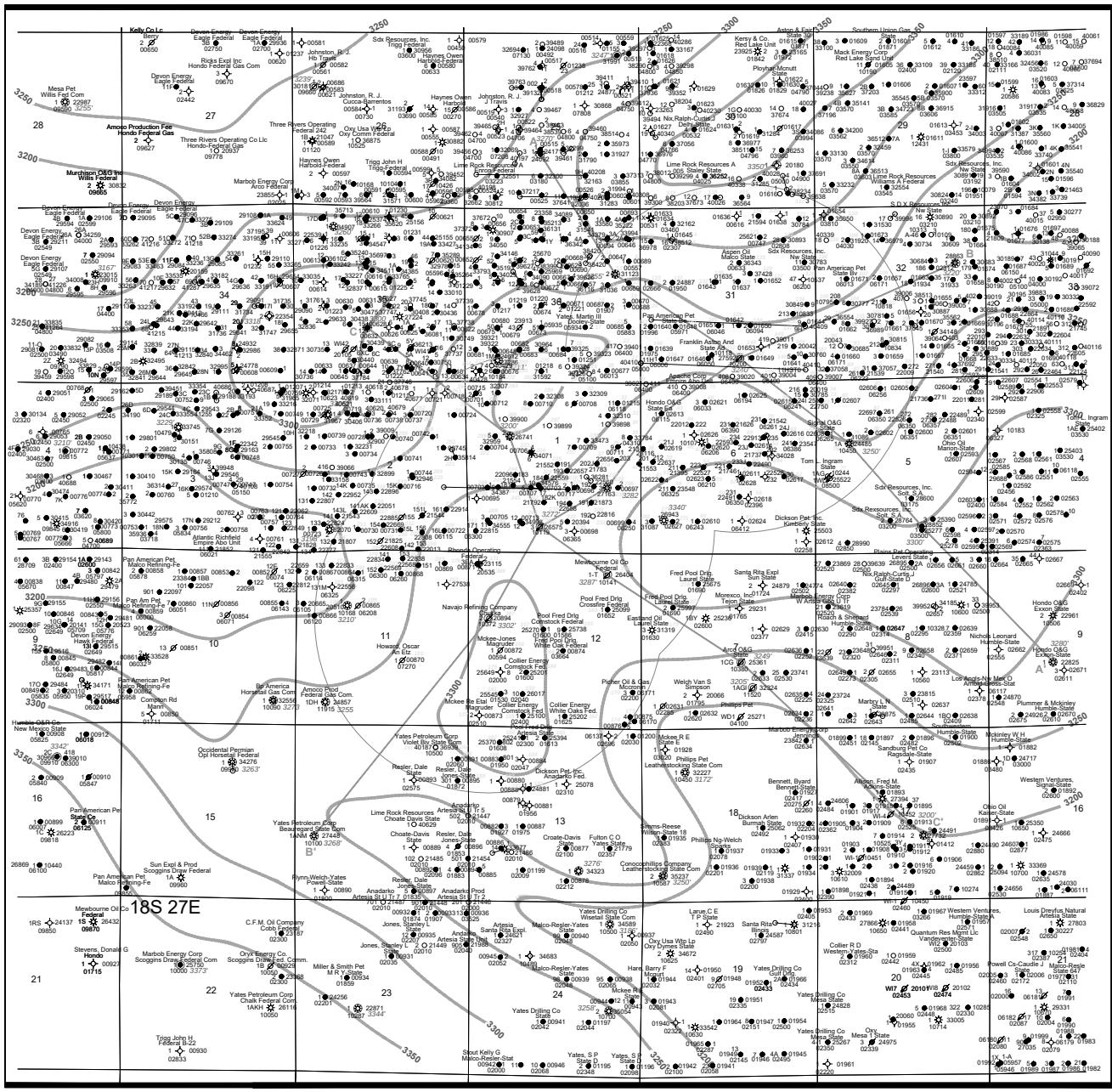
STRUCTURAL CONTOUR MAP TOP OF INJECTION ZONE

DATE: 01/19/17	CHECKED BY:	JOB NO. 50904D
DRAWN BY: WDD	APPROVED BY:	DWG NO.



LEGEND
PERMITTED WELL
DRY HOLE
PLUGGED AND ABANDONED WELL
GAS WELL
OIL WELL
OIL & GAS WELL
ABANDONED GAS WELL
ABANDONED OIL WELL
ABANDONED OIL & GAS WELL
INJECTION WELL
PLUGGED & ABANDONED INJECTION WELL
SALTWATER DISPOSAL WELL
PLUGGED SALTWATER DISPOSAL WELL
1-MILE COMPOSITE AREA OF REVIEW
ISOPACH CONTOUR OF THE INJECTION ZONE
Well Number
API Number
ID No. (see Table 1A)
Thickness of the Injection Zone (ft)
Total Depth of Well
SCALE (IN FEET)
0 1000 2000
CI = 50'
18S 27E
WSP | PARSONS BRINCKERHOFF
DRAWING 9
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO
ISOPACH CONTOUR MAP OF THE INJECTION ZONE
DATE: 01/19/17
DRAWN BY: WDD
CHECKED BY:
APPROVED BY:
JOB NO: 50904D
DWG NO:


18S 27E
LEGEND
PERMITTED WELL
DRY HOLE
PLUGGED AND ABANDONED WELL
GAS WELL
OIL WELL
OIL & GAS WELL
ABANDONED GAS WELL
ABANDONED OIL WELL
ABANDONED OIL & GAS WELL
INJECTION WELL
PLUGGED & ABANDONED INJECTION WELL
SALTWATER DISPOSAL WELL
PLUGGED SALTWATER DISPOSAL WELL
1-MILE COMPOSITE AREA OF REVIEW
STRUCTURE CONTOUR OF TOP OF UPPER CONFINING ZONE
Well Number
API Number
ID No. (see Table 1A)
Elevation Top of Upper Confining Zone (ft msl)
Total Depth of Well
SCALE (IN FEET)
CI = 50'
WSP | PARSONS BRINCKERHOFF
DRAWING 10
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO
STRUCTURAL CONTOUR MAP
TOP OF UPPER CONFINING ZONE
DATE: 01/18/17
CHECKED BY:
JOB NO.: 5989HD
DRAWN BY: WDD
APPROVED BY:
DWG NO.:



LEGEND

- PERMITTED WELL
- DRY HOLE
- PLUGGED AND ABANDONED WELL
- GAS WELL
- OIL WELL
- OIL & GAS WELL
- ABANDONED GAS WELL
- ABANDONED OIL WELL
- ABANDONED OIL & GAS WELL
- INJECTION WELL
- PLUGGED & ABANDONED INJECTION WELL
- SALTWATER DISPOSAL WELL
- PLUGGED SALTWATER DISPOSAL WELL
- 1-MILE COMPOSITE AREA OF REVIEW
- 3300 ISOPACH CONTOUR OF THE UPPER CONFINING ZONE

Well Number — API Number — ID No. (see Table 1A) — Thickness of the Upper Confining Zone (ft) — Total Depth of Well

SCALE (IN FEET)

0 1000 2000

CI = 50'

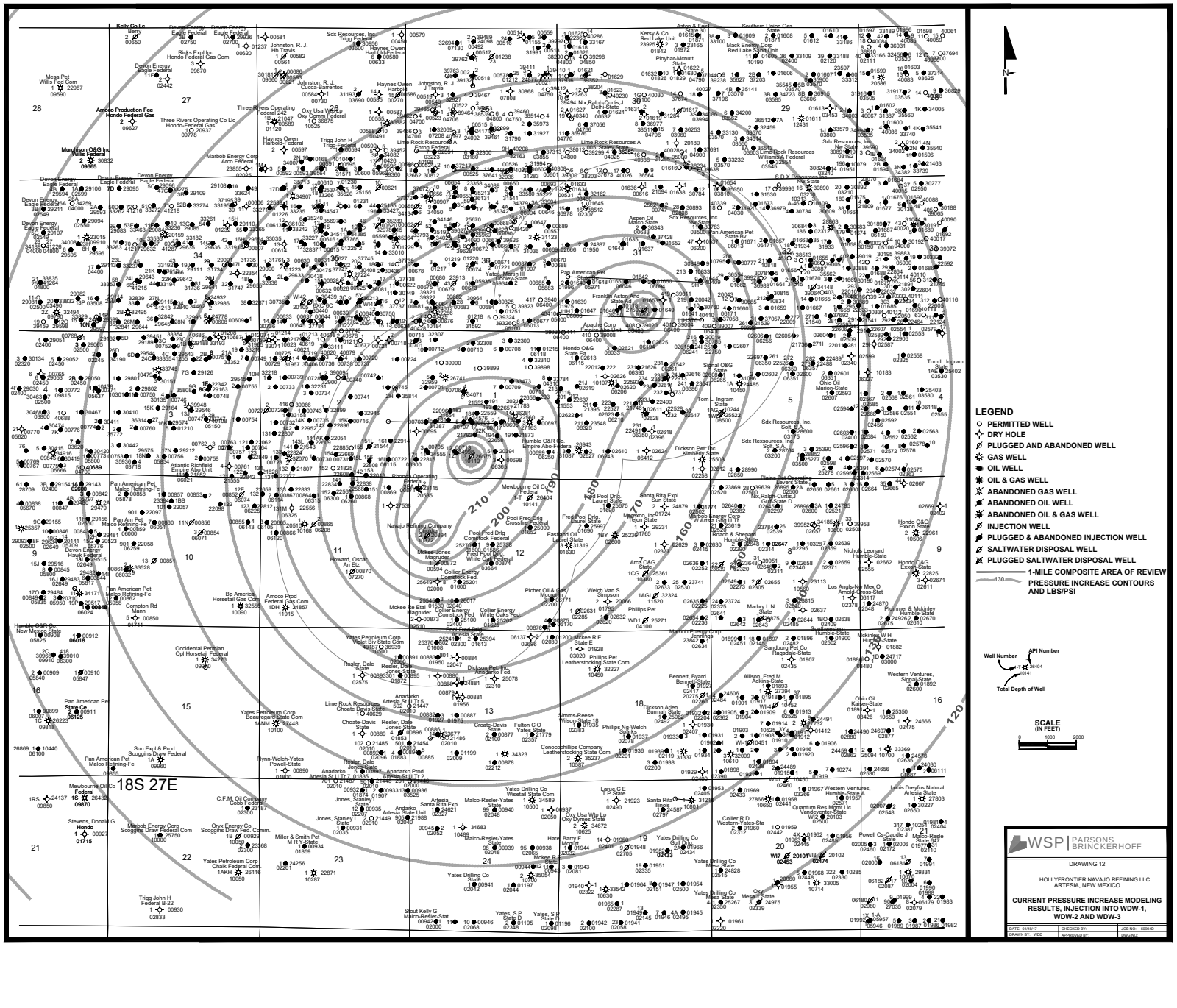
WSP | PARSONS BRINCKERHOFF

DRAWING 11

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

ISOPACH MAP OF UPPER CONFINING ZONE

DATE: 8/1/2017	CHECKED BY:	JOB NO: 558040
DRAWN BY: WDD	APPROVED BY:	DWG NO:



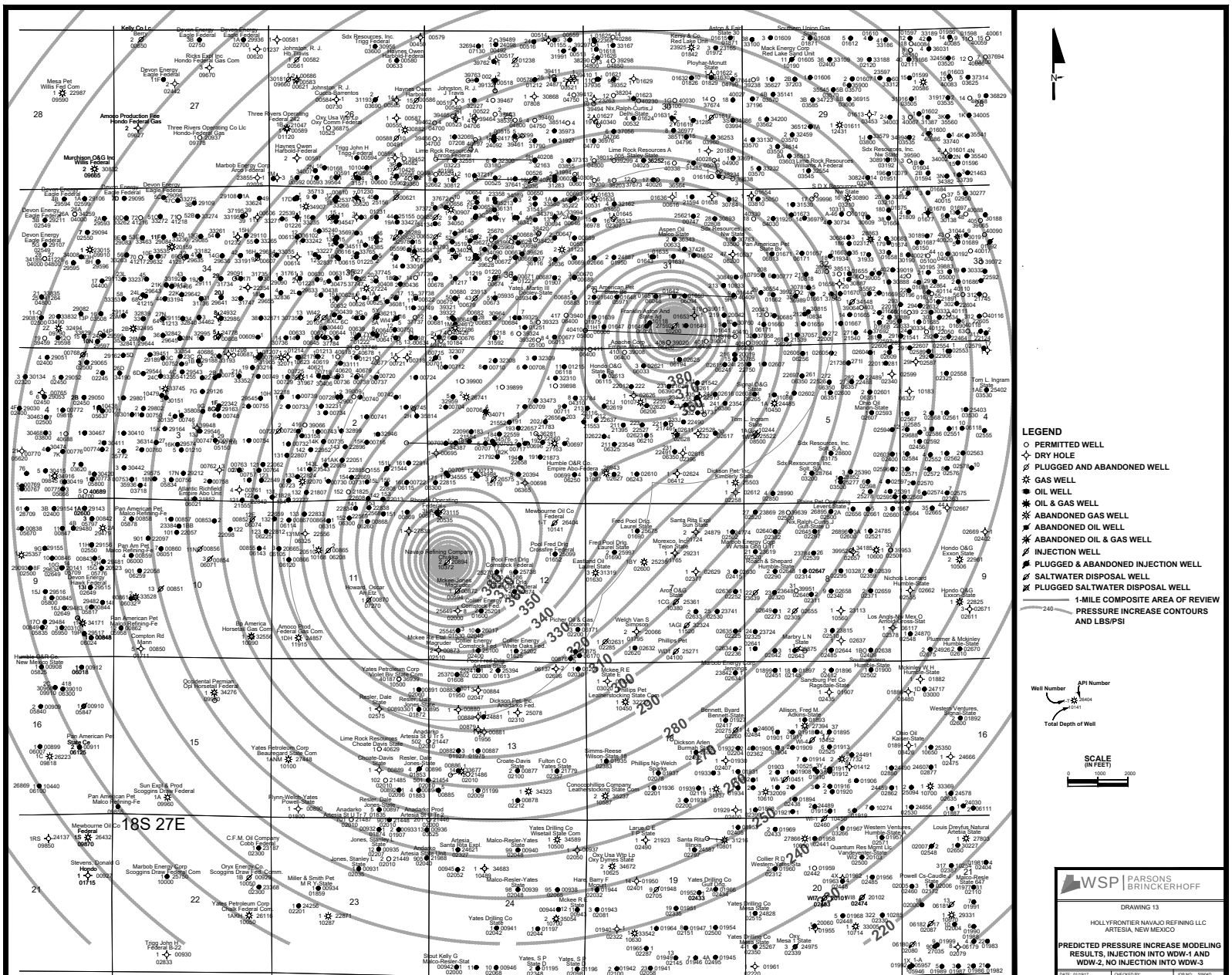
WSP | PARSONS BRINCKERHOFF

DRAWING 12

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

CURRENT PRESSURE INCREASE MODELING RESULTS, INJECTION INTO WDW-1, WDW-2 AND WDW-3

DATE: 01/18/17	CHECKED BY:	JOB NO: 30904D
DRAWN BY: WDD	APPROVED BY:	DWG NO:



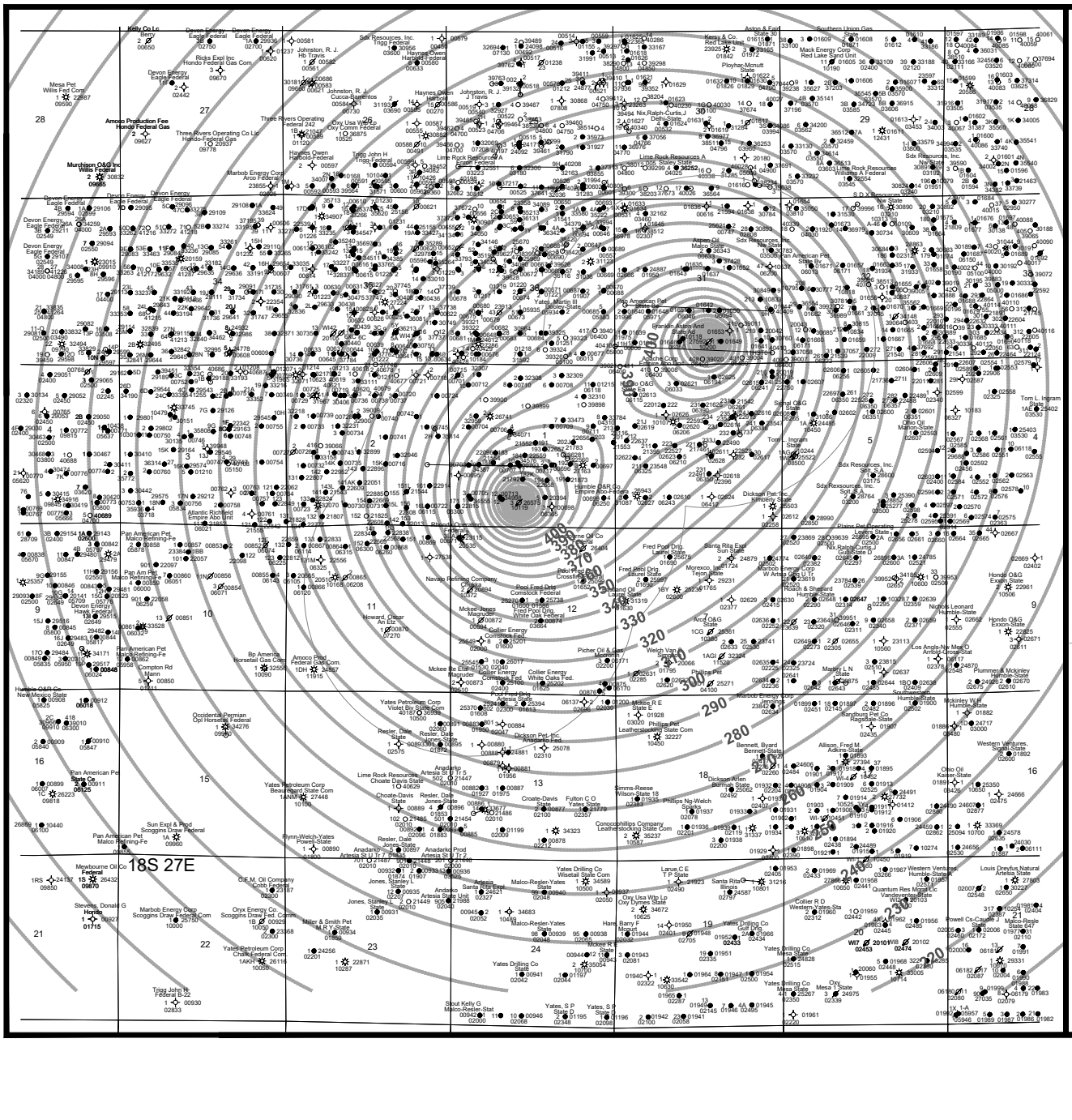
WSP | PARSONS BRINCKERHOFF

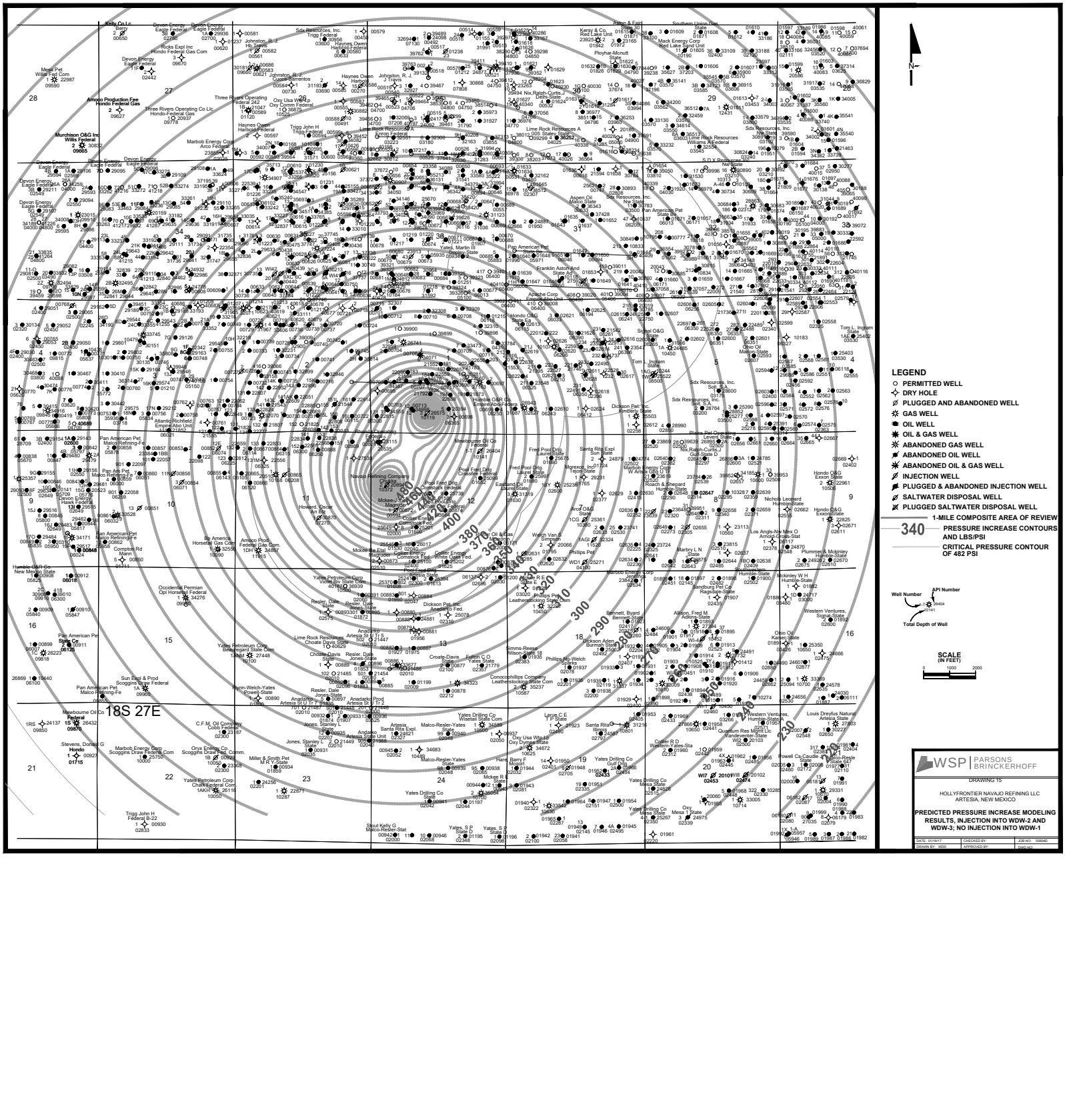
DRAWING 13

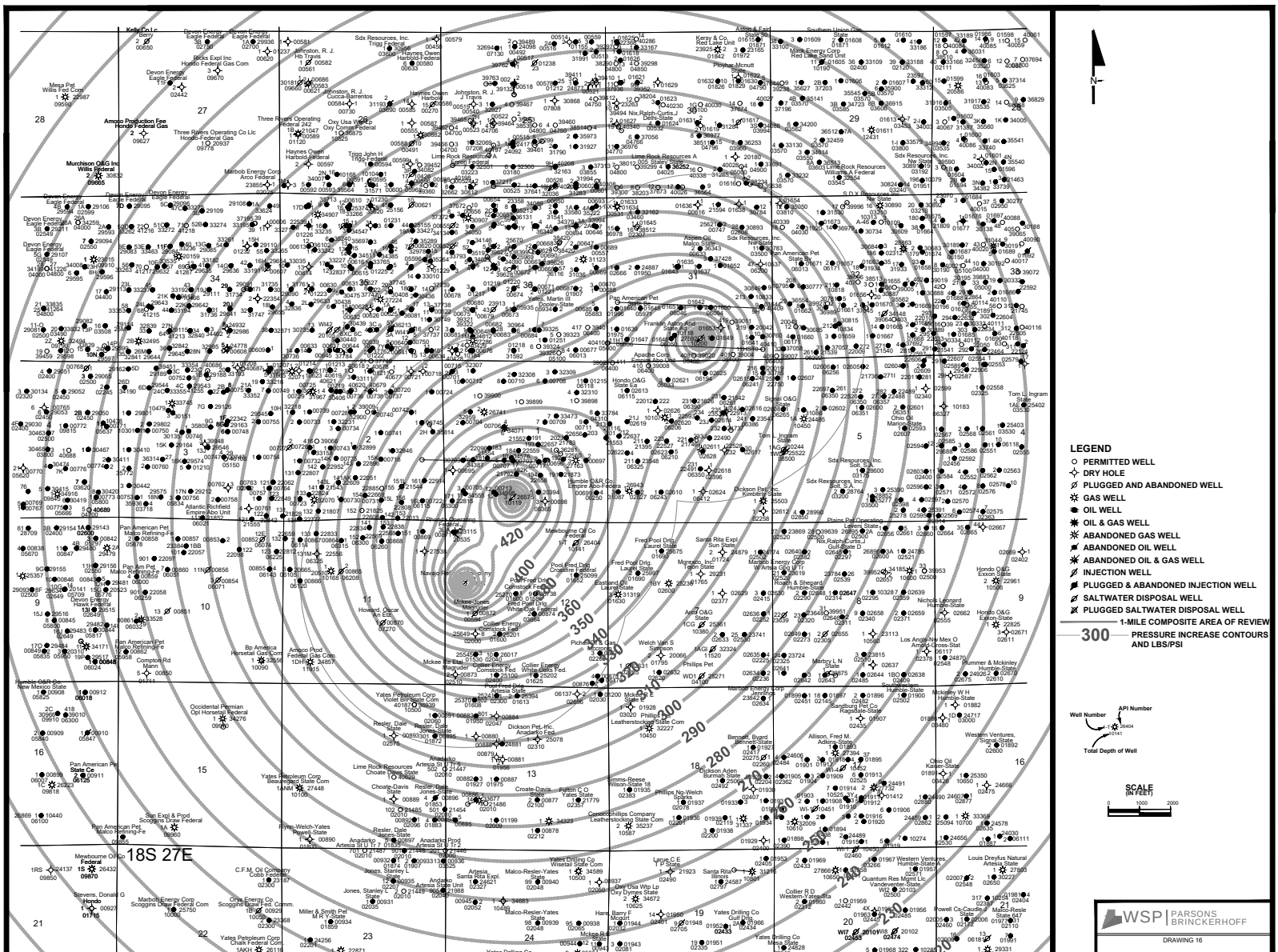
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

PREDICTED PRESSURE INCREASE MODELING RESULTS, INJECTION INTO WDW-1 AND WDW-2, NO INJECTION INTO WDW-3

DATE: 01/19/17	CHECKED BY:	JOB NO.: 5990HD
DRAWN BY: WDD	APPROVED BY:	DWG NO.:


18S 27E
LEGEND
PERMITTED WELL
DRY HOLE
PLUGGED AND ABANDONED WELL
GAS WELL
OIL WELL
OIL & GAS WELL
ABANDONED GAS WELL
ABANDONED OIL WELL
ABANDONED OIL & GAS WELL
INJECTION WELL
PLUGGED & ABANDONED INJECTION WELL
SALTWATER DISPOSAL WELL
PLUGGED SALTWATER DISPOSAL WELL
1-MILE COMPOSITE AREA OF REVIEW
340 PRESSURE INCREASE CONTOURS AND LBS/PSI
Well Number
API Number
Total Depth of Well
SCALE (IN FEET)
0 1000 2000
WSP | PARSONS BRINCKERHOFF
DRAWING 14
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO
PREDICTED PRESSURE INCREASE MODELING RESULTS, INJECTION INTO WDW-1 AND WDW-3, NO INJECTION INTO WDW-2
DATE: 08/13/13
CHECKED BY:
JOB NO: 60D0845
DRAWN BY: WDD
APPROVED BY:
DWG NO:


18S 27E
LEGEND
PERMITTED WELL
DRY HOLE
PLUGGED AND ABANDONED WELL
GAS WELL
OIL WELL
OIL & GAS WELL
ABANDONED GAS WELL
ABANDONED OIL WELL
ABANDONED OIL & GAS WELL
INJECTION WELL
PLUGGED & ABANDONED INJECTION WELL
SALTWATER DISPOSAL WELL
PLUGGED SALTWATER DISPOSAL WELL
1-MILE COMPOSITE AREA OF REVIEW
340 PRESSURE INCREASE CONTOURS AND LBS/PSI
CRITICAL PRESSURE CONTOUR OF 482 PSI
Well Number
API Number
Total Depth of Well
SCALE (IN FEET)
0 1000 2000
WSP | PARSONS BRINCKERHOFF
DRAWING 15
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO
PREDICTED PRESSURE INCREASE MODELING RESULTS, INJECTION INTO WDW-2 AND WDW-3; NO INJECTION INTO WDW-1
DATE: 01/19/17
CHECKED BY:
JOB NO: 536040
DRAWN BY: WDD
APPROVED BY:
DWG NO:



LEGEND

- PERMITTED WELL
- DRY HOLE
- PLUGGED AND ABANDONED WELL
- GAS WELL
- OIL WELL
- OIL & GAS WELL
- ABANDONED GAS WELL
- ABANDONED OIL WELL
- ABANDONED OIL & GAS WELL
- INJECTION WELL
- PLUGGED & ABANDONED INJECTION WELL
- SALTWATER DISPOSAL WELL
- PLUGGED SALTWATER DISPOSAL WELL
- 1-MILE COMPOSITE AREA OF REVIEW
- 300 PRESSURE INCREASE CONTOURS AND LBS/PSI

Well Number — API Number

Total Depth of Well

SCALE (IN FEET)

0 1000 2000

WSP | PARSONS BRINCKERHOFF

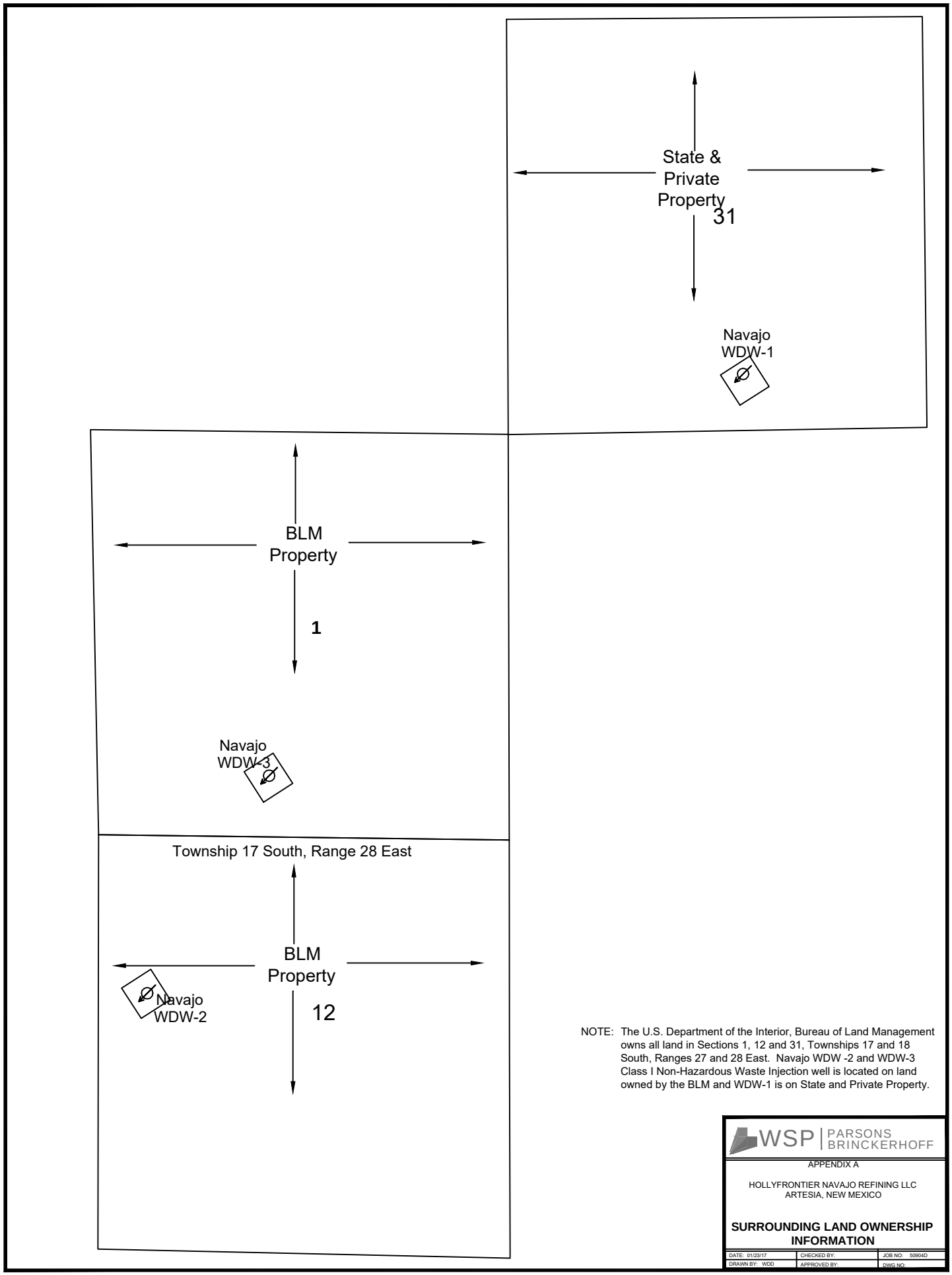
DRAWING 16

HOLLYFRONTIER NAVAJO REFINING LLC
ARETESIA, NEW MEXICO

PREDICTED PRESSURE INCREASE MODELING RESULTS, INJECTION INTO WDW-1, WDW-2 AND WDW-3

DATE: 08/13/13	CHECKED BY:	JOB NO: 60006945
DRAWN BY: WDD	APPROVED BY:	PWLNO:

APPENDICES



NOTE: The U.S. Department of the Interior, Bureau of Land Management owns all land in Sections 1, 12 and 31, Townships 17 and 18 South, Ranges 27 and 28 East. Navajo WDW -2 and WDW-3 Class I Non-Hazardous Waste Injection well is located on land owned by the BLM and WDW-1 is on State and Private Property.

WSP | PARSONS BRINCKERHOFF

APPENDIX A

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA, NEW MEXICO

SURROUNDING LAND OWNERSHIP INFORMATION

DATE: 01/23/17	CHECKED BY:	JOB NO: 50904D
DRAWN BY: WDD	APPROVED BY:	DWG NO:

Surrounding Property Owners to WDW-1, WDW-2, and WDW-3 Locations

January 28, 2017

1:72,224

0 0.5 1 2 mi

0 1 2 4 km

Administrative Unit Boundary

Counties

Townships

Sections

Bureau of Land Management, Network Operations Center (NOC)
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO,

U.S. Bureau of Land Management

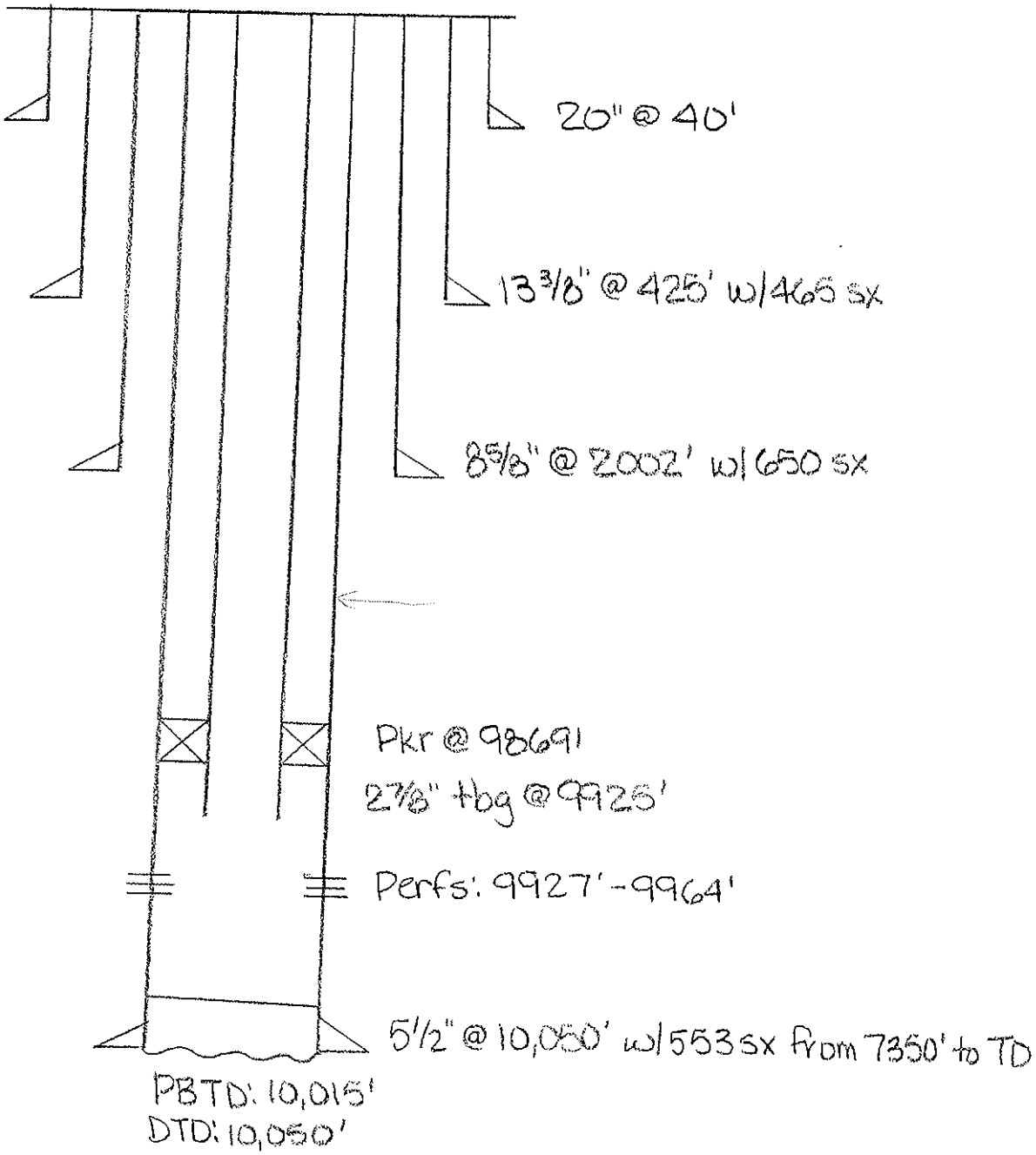
SUBSURFACE

NAVAJO REFINING COMPANY, L.L.C.
Map ID No. 12
Artificial Penetration Review

OPERATOR LRE Operating, LLC
LEASE No Bluff 36 State Com
WELL NUMBER 2
DRILLED 3/19/01
PLUGGED NA

STATUS Active Gas
LOCATION Sec. 36-T 17S-R 27E
MUD FILLED BOREHOLE NA
INJECTION ZONE 7296'
API NO. 30-015-31123

REMARKS:



30-015-31123

Ogrid - 148111
Prop - 25858
Pool - 78890

Geol. Tops per /BCA

Bowers	845	Abo	5018
Queen	1040	Wolfcamp	6735
Grayburg	1372	Cisco	8237
San Andres	1733	Canyon	8360
Glorieta	3197	Strawn	8881
Tubb	4057	Atoka	9464
		Morrow	9650

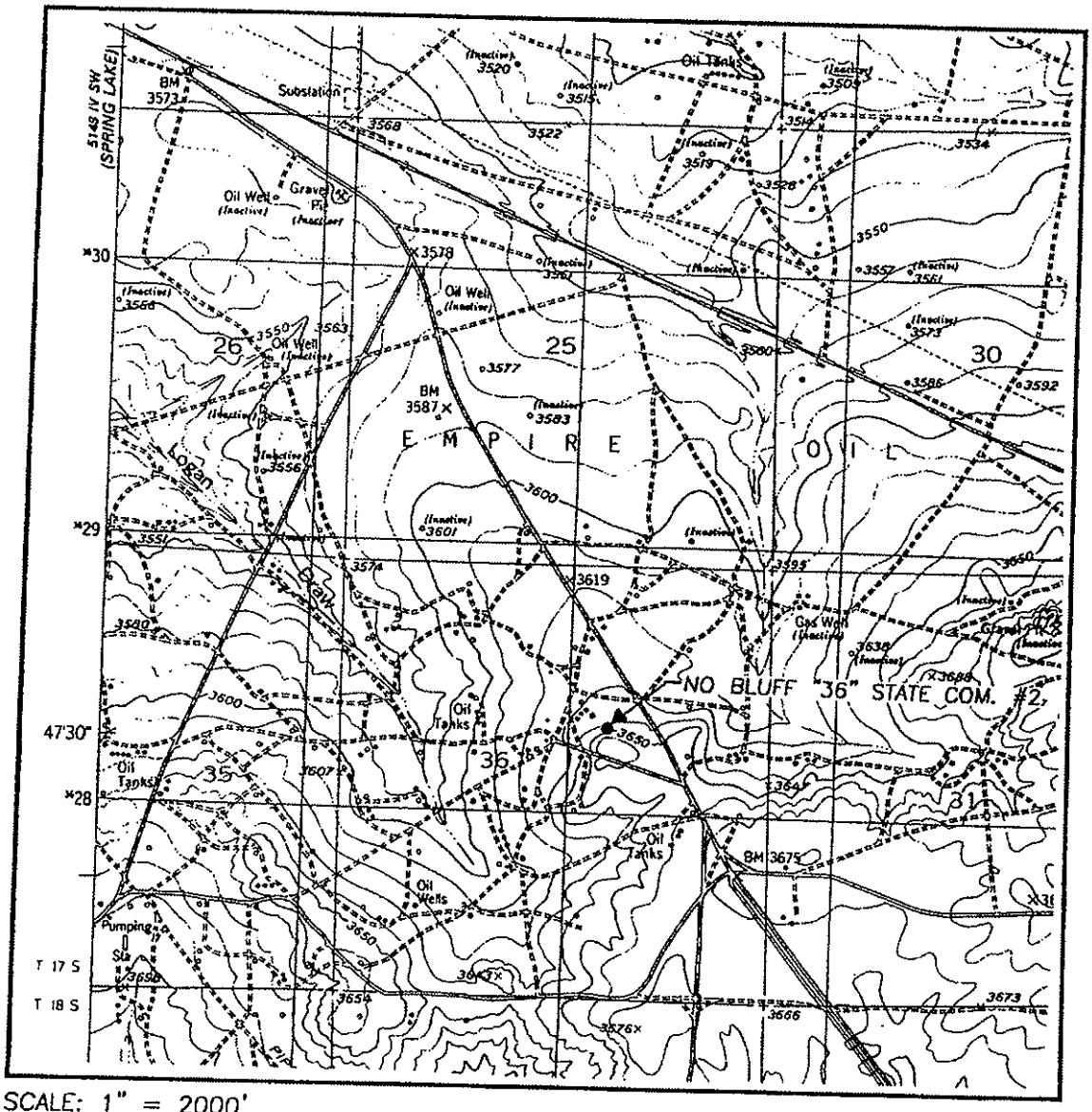
Comp Orig

Confidential 8-23-01

5-23-01
DLL/GR
4995 - 10003
Comp Z-DL/Comp Neut/GR
Surf - 9984
[illegible] /Recomputed Comp & Sh

GR
1990 - 10013

LOCATION VERFICATION MAP



SCALE: 1" = 2000'

CONTOUR INTERVAL:
RED LAKE, N.M. – 10'

SEC. 36 TWP. 17-S RGE. 27-E

SURVEY N.M.P.M.

COUNTY EDDY

DESCRIPTION 1980' FNL & 1980' FEL

ELEVATION 3639

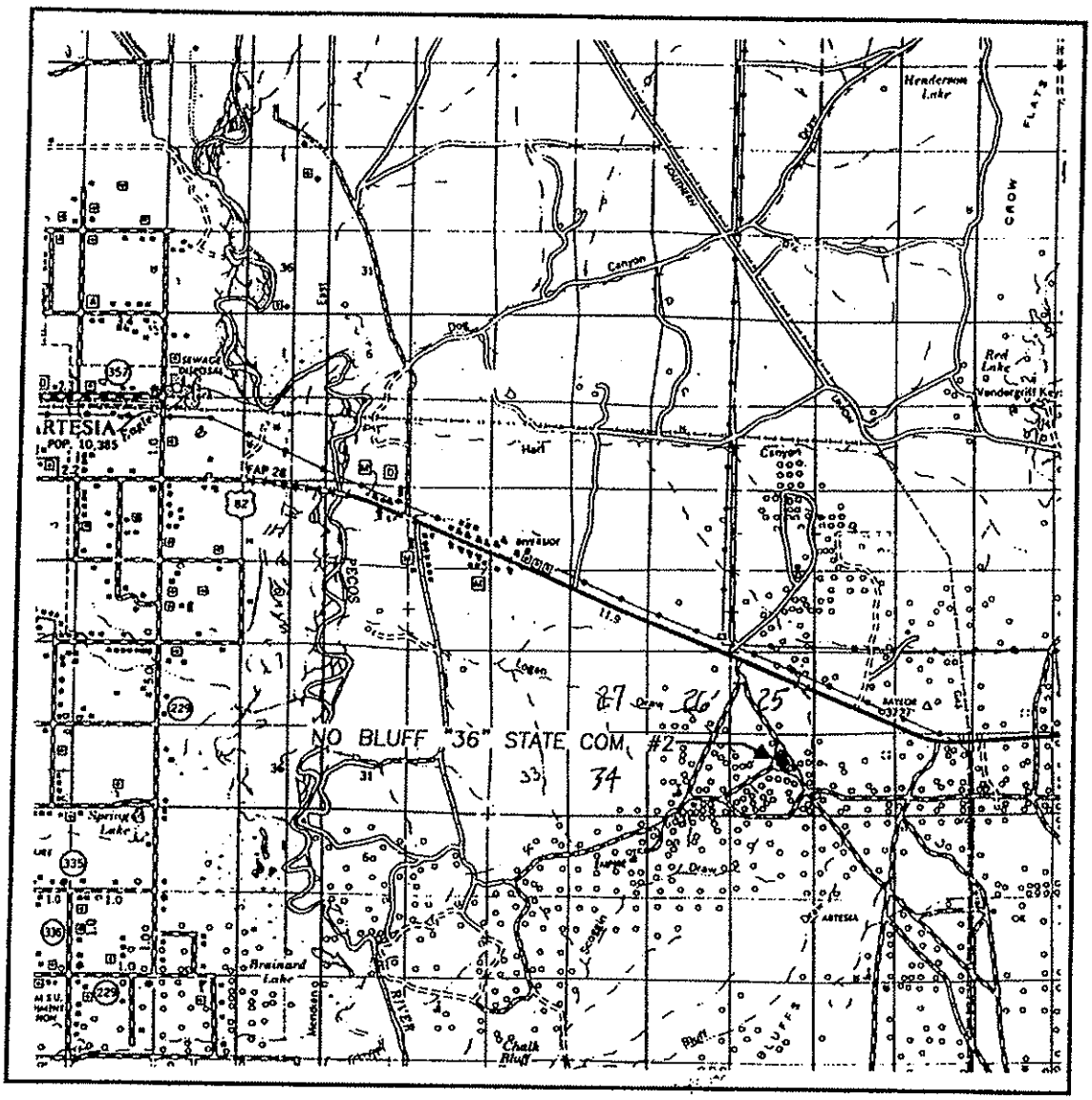
OPERATOR SOUTHWESTERN ENERGY PRODUCTION CO.

LEASE NO BLUFF "36" STATE COM.

U.S.G.S. TOPOGRAPHIC MAP
RED LAKE, N.M.

JOHN WEST SURVEYING
HOBBS, NEW MEXICO
(505) 393-3117

VICINITY MAP



SCALE: 1" = 2 MILES

SEC. 36 TWP. 17-S RGE. 27-E

SURVEY N.M.P.M.

COUNTY EDDY

DESCRIPTION 1980' FNL & 1980' FEL

ELEVATION 3639

OPERATOR SOUTHWESTERN ENERGY PRODUCTION CO.

LEASE NO BLUFF "36" STATE COM.

JOHN WEST SURVEYING
HOBBS, NEW MEXICO
(505) 393-3117

2000'-10,100'	13-5/8" 5000# double ram type preventers, 5000# annular preventer and rotating head body. Test all rams choke manifold, kill line upper and lower kelly valves to 3000 psi. A choke manifold and 120 gallon accumulator with floor and remote operating stations and auxiliary power system.

Any equipment failing to test satisfactorily, will be repaired or replaced. Results of the BOP test will be recorded in the Driller's Log.

The BOP's will be maintained ready for use until drilling operations are completed. BOP drills will be conducted as necessary to assure that equipment is operational and each crew is properly trained to carry out emergency duties.

Accumulator shall maintain a pressure capacity reserve at all times to provide for the close-open-close sequence of the blind and pipe rams of the hydraulic preventers.

GENERAL DRILLING PROGRAM- Attachment to Form C-101

Southwestern Energy Production Company- No Bluff "36" State Com. #2
1980' FNL 1980' FEL Section 36-T17S-R27E
Eddy County, New Mexico

Elevation: 3639' GR Proposed Total Depth: 10,100'

Estimated Formation Tops

San Andres	1851'
Glorietta	3355'
Wolfcamp	6670'
Strawn	9030'
Morrow Clastics	9770'
Missippian	10,000'

Casing/Cement Program

Hole Size	Casing Size/Weight/Grade	Setting Depth	Cement	Est. TOC
	20" Conductor pipe	40'	ready mix	surface
17-1/2"	13-3/8" 61# J-55 ST&C	425'	1500 sx 15:85 Poz: Class C + 0.25 pps D29+2% S1+2% D20	surface
12-1/4"	8-5/8" 32# J-55 ST&C	2000'	Lead: 1260 sx 35:65 Poz: Class C + 6% D20+ 0.25 pps D29 Tail: 235 sx Class C+ 2% S1 +0.25 pps D29	surface
7-7/8"	5-1/2" 17# N-80 LT&C	10,100'	860 sx 50:50 Poz: Class H + 6% D44 +2% D20+0.4% D59	8000'

Drilling Fluids Program

Depth	Mud Weight	Viscosity	Fluid Loss	Comments
0-425'	8.4-8.6	32-34	NC	spud mud
425'-2000'	9.0-9.2	28-29	NC	cut brine water,paper,caustic
2000'-9300'	8.4-9.3	28-29	NC	cut brine,caustic,paper
9300'-10,100'	9.3-9.6	34-38	<15 cc	xantham gum, starch

Blowout Prevention Program- Attachment to Form C-101

0'-425' None

425'-2000' 20" 2000# annular preventer system.

DISTRICT I
P.O. Box 1980, Hobbs, NM 88241-1980

DISTRICT II
P.O. Drawer DD, Artesia, NM 88211-0719

DISTRICT III
1000 Rio Brazos Rd., Aztec, NM 87410

DISTRICT IV
P.O. BOX 2088, SANTA FE, N.M. 87504-2088

State of New Mexico
Energy, Minerals and Natural Resources Department

Form C-102
Revised February 10, 1994
Submit to Appropriate District Office
State Lease - 4 Copies
Fee Lease - 3 Copies

MAY 2000
RECEIVED
OCD - ARTESIA

OIL CONSERVATION DIVISION

P.O. Box 2088
Santa Fe, New Mexico 87504-2088

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

API Number	Pool Code	Pool Name

Property Code	Property Name	Well Number
	NO BLUFF "36" STATE COM.	2
OGRID No.	Operator Name	Elevation
	SOUTHWESTERN ENERGY PRODUCTION CO.	3639

Surface Location

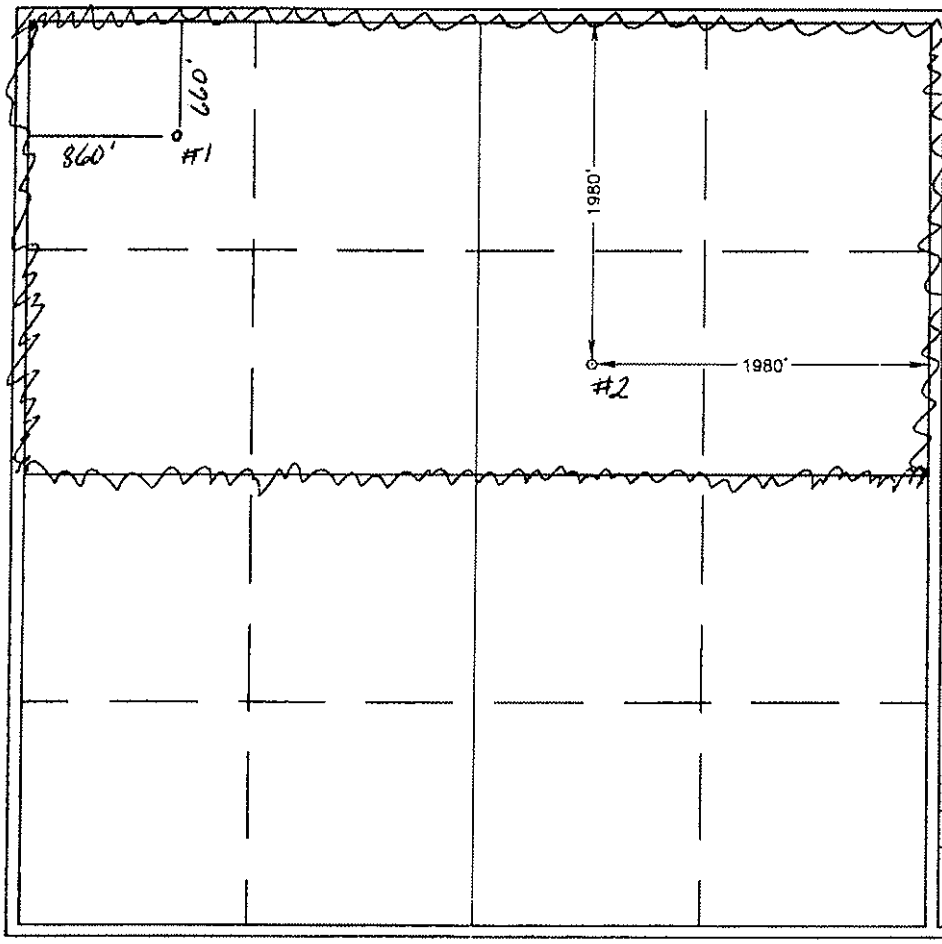
UL or lot No.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
G	36	17 S	27 E		1980	NORTH	1980	EAST	EDDY

Bottom Hole Location If Different From Surface

UL or lot No.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County

Dedicated Acres	Joint or Infill	Consolidation Code	Order No.
320			

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION



OPERATOR CERTIFICATION

I hereby certify the the information contained herein is true and complete to the best of my knowledge and belief.

Signature

Cathy Rowan
Printed Name

Drilling Technician
Title

May 4, 2000
Date

SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervison, and that the same is true and correct to the best of my belief.

APRIL 19, 2000
Date Surveyed LMP

Signature & Seal of Professional Surveyor

Ronald J. Eidson 4/24/2000

00-11-0509

Certificate No. RONALD J. EIDSON 3239
GARY EIDSON 12641
MACON McDONALD 12185

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 South First, Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
2040 South Pacheco
Santa Fe, NM 87505

MAY 2000
RECEIVED
OCD - ARTESIA

Form C-101
Revised March 17, 1999

Submit to Appropriate District Office
State Lease - 6 Copies
Fee Lease - 5 Copies

☐ AMENDED REPORT

APPLICATION FOR PERMIT TO DRILL, RE-ENTER, DEEPEN, PLUGBACK, OR ADD A ZONE

[1] Operator Name and Address	[2] OGRID Number
Southwestern Energy Production Company **2350 North Sam Houston Parkway East, Suite 300** **Houston, TX 77032**	**148111**
	[3] API Number 30-015-31123

[3] Property Code	[5] Property Name	[6] Well No.
25858	**No Bluff "36" State Com.**	**2**

[7] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
G	36	17S	27E		1980	North	1980	East	Eddy

[8] Proposed Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County

[9] Proposed Pool 1	[10] Proposed Pool 2
Wildcat (Mississippian)	

[11] Work Type Code	[12] Well Type Code	[13] Cable/Rotary	[14] Lease Type Code	[15] Ground Level Elevation
N	G	R	S	3639
[16] Multiple	[17] Proposed Depth	[18] Formation	[19] Contractor	[20] Spud Date
N	10,100'	Mississippian	Patterson	5/25/00 (est.)

[21] Proposed Casing and Cement Program

Hole Size	Casing Size	Casing weight/foot	Setting Depth	Sacks of Cement	Estimated TOC
26"	20"	Minimum WOC time 18hrs	40'	Ready Mix	Surface
17 – ½"	13 – 3/8"	61#	425'	1500	Surface
12 – ¼"	8 5/8"	32#	2,000'	1,495	Surface
7 7/8"	5 ½"	17#	10,100'	860	~~8,000~~ *

* Oper to cover all oil, gas & water bearing zones

22 Describe the proposed program. If this application is to DEEPEN or PLUG BACK, give the data on the present productive zone and proposed new productive zone. Describe the blowout prevention program, if any. Use additional sheets if necessary.

SEE ATTACHMENT

Notify OCD at SPUD & TIME to witness cementing the 13 3/8" casing.

[23] I hereby certify that the information given above is true and complete to the best of my knowledge and belief.

Signature: Cathy Rowan

Printed name: Cathy Rowan

Title: Drilling Technician

Date: May 2, 2000 Phone: 281-618-4733

OIL CONSERVATION DIVISION

Approved by: ORIGINAL SIGNED BY TIM W. GUM DISTRICT II SUPERVISOR

Approval Date: MAY 03 2000 Expiration Date: MAY 03 2001

Conditions of Approval:

Attached ☐

DISTRICT I
1625 N. French Dr., Hobbs, NM 88240

DISTRICT II
P.O. Drawer DD, Artesia, NM 88211-0719

DISTRICT III
1000 Rio Brazos Rd., Aztec, NM 87410

DISTRICT IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy, Minerals & Natural Resources Department

OIL CONSERVATION DIVISION
2040 South Pacheco
Santa Fe, NM 87505

Form C-102
Revised August 15, 2000
Submit to Appropriate District Office
State Lease - 4 Copies
Fee Lease - 3 Copies

XX AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

API Number	Pool Code	Pool Name
30-015-31123		Wildcat (Mississippian)

Property Code	Property Name	Well Number
25858	NO BLUFF "36" STATE COM	2

OGRID No.	Operator Name	Elevation
148111	SOUTHWESTERN ENERGY PRODUCTION CO.	3634

Surface Location

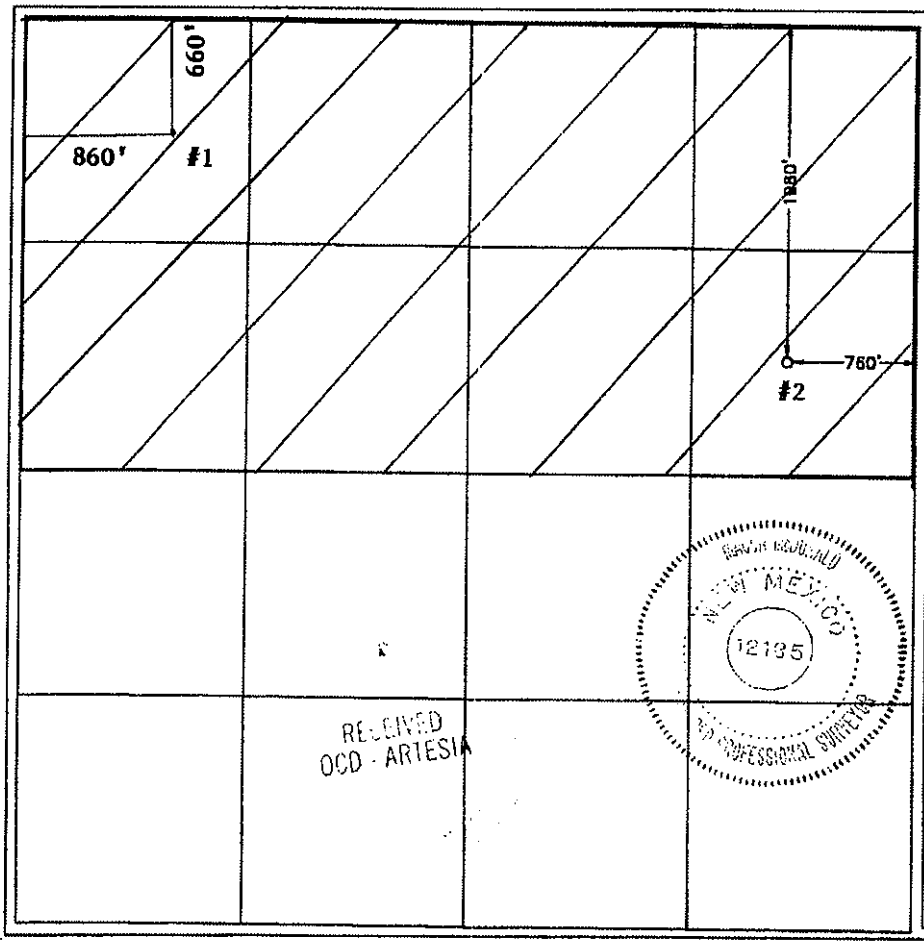
UL or Lot No.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
H	36	17 S	27 E		1980	NORTH	760	EAST	EDDY

Bottom Hole Location If Different From Surface

UL or Lot No.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County

Dedicated Acres	Joint or Infill	Consolidation Code	Order No.
320			

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION



OPERATOR CERTIFICATION

I hereby certify the the information contained herein is true and complete to the best of my knowledge and belief.

Signature

Cathy Rowan

Printed Name

Sr. Engineering Tech.

Title

March 1, 2001

Date

SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

February 28, 2001

Date Surveyed

M2

Signature & Seal of Professional Surveyor

W.O. Num. 2001-0151-S

Certificate No. MACON McDONALD 12185

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 South First, Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
2040 South Pacheco, Santa Fe, NM 87505

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State of New Mexico
Energy Minerals and Natural Resources

Oil Conservation Division
2040 South Pacheco
Santa Fe, NM 87505

C15F

Form C-101
Revised March 17, 1999

Submit to appropriate District Office
State Lease - 6 Copies
Fee Lease - 5 Copies

X AMENDED REPORT

APPLICATION FOR PERMIT TO DRILL, RE-ENTER, DEEPEN, PLUGBACK, OR ADD A ZONE

[1] Operator Name and Address	[2] OGRID Number
Southwestern Energy Production Company **2350 North Sam Houston Parkway East, Suite 300** **Houston, TX 77032**	**148111**
	[3] API Number 30 - 015 - 31123

[3] Property Code	[5] Property Name	[6] Well No.
25858	**No Bluff "36" State Com.**	**2**

[7] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
H	36	17S	27E		1980	North	760	East	Eddy

[8] Proposed Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County

[9] Proposed Pool 1	[10] Proposed Pool 2
Wildcat (Mississippian)	

[11] Work Type Code	[12] Well Type Code	[13] Cable/Rotary	[14] Lease Type Code	[15] Ground Level Elevation
N	G	R	S	3634
[16] Multiple	**[17] Proposed Depth**	**[18] Formation**	**[19] Contractor**	**[20] Spud Date**
N	10,050'	Mississippian	UTI	04/01/01 (est.)

[21] Proposed Casing and Cement Program

Hole Size	Casing Size	Casing weight/foot	Setting Depth	Sacks of Cement	Estimated TOC
26"	20"		40'	Ready Mix	Surface
17 – ½"	13 – 3/8"	61#	425'	1500	Surface
12 – ¼"	8 5/8"	32#	2,000'	1,495	Surface
7 7/8"	5 ½"	17#	10,100'	860	8,000'

22 Describe the proposed program. If this application is to DEEPEN or PLUG BACK, give the data on the present productive zone and proposed new productive zone. Describe the blowout prevention program, if any. Use additional sheets if necessary.

SEE ATTACHMENT

NOTE: SL changed from 1980' FNL, 660' FEL to 1980' FNL, 760' FEL

[23] I hereby certify that the information given above is true and complete to the best of my knowledge and belief.

Signature: Cathy Rowan

Printed name: Cathy Rowan

Title: Sr. Engineering Technician

Date: March 1, 2001 | Phone: 281-618-4733

OIL CONSERVATION DIVISION

Approved by: ORIGINAL SIGNED BY TIM W. GUM
DISTRICT II SUPERVISOR

Approval Date: MAR – 8 2001 | Expiration Date: MAR – 8 2002

Conditions of Approval:

Attached ☐

GENERAL DRILLING PROGRAM- Attachment to Form C-101

Southwestern Energy Production Company- No Bluff "36" State Com. #2
1980' FNL 760' FEL Section 36-T17S-R27E
Eddy County, New Mexico

Elevation: 3630' GR Proposed Total Depth: 10,100'

Estimated Formation Tops

Yates	320'
7 Rivers	460'
Queen	1000'
Grayburg	1300'
San Andres 'D'	1784'
Glorieta	3160'
Wolfcamp	6470'
Strawn	8870'
Atoka	9430'
Morrow Lime	9544'
Morrow Clastics	9724'
Missippian	10,040'

Casing/Cement Program

Hole Size	Casing Size/Weight/Grade	Setting Depth	Cement	Est. TOC
	20" Conductor pipe	40'	ready mix	surface
17-1/2"	13-3/8" 61# J-55 ST&C	425'	550 sx 15:85 Poz: Class C + 0.25 pps D29+2% S1+2% D20	surface
12-1/4"	8-5/8" 32# J-55 ST&C	1900'	Lead:700 sx 35:65 Poz: Class C + 6% D20+ 0.25 pps D29 Tail: 235 sx Class C+ 2% S1 +0.25 pps D29	surface
7-7/8"	5-1/2" 17# N-80 LT&C	10,050'	860 sx 50:50 Poz: Class H + 6% D44 +2% D20+0.4% D59	8000'

Drilling Fluids Program

Depth	Mud Weight	Viscosity	Fluid Loss	Comments
0-425'	8.4-8.6	32-34	NC	spud mud
425'-1900'	9.0-9.2	28-29	NC	cut brine water,paper,caustic
1900'-9300'	8.4-9.3	28-29	NC	cut brine,caustic,paper
9300'-10.050'	9.3-9.6	34-38	<15 cc	xantham gum, starch

Blowout Prevention Program- Attachment to Form C-101

Submit 3 Copies To Appropriate District Office
District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 South First, Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
2040 South Pacheco
Santa Fe, NM 87505

015

Form C-103
Revised March 25, 1999

WELL API NO. 30-015-31123

5. Indicate Type of Lease STATE [X] FEE [ ]

6. State Oil & Gas Lease No.

SUNDRY NOTICES AND REPORTS ON WELLS

(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT" (FORM C-101) FOR SUCH PROPOSALS.)

1. Type of Well: Oil Well [X] Gas Well [ ] Other

7. Lease Name or Unit Agreement Name: No Bluff "36" State Com

2. Name of Operator: Southwestern Energy Production Company

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OCD - ARTESIA

8. Well No. 2

3. Address of Operator: 2350 N. Sam Houston Parkway East, Suite 300 - Houston, TX 77032

9. Pool name or Wildcat: Wildcat (Mississippian)

4. Well Location

Unit Letter H : 1980 feet from the N line and 760 feet from the E line

Section 36 Township 17S Range 27E NMPM Eddy County

10. Elevation *(Show whether DR, RKB, RT, GR, etc.)* 3634' GR

11. Check Appropriate Box to Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:				SUBSEQUENT REPORT OF:			
PERFORM REMEDIAL WORK	[ ]	PLUG AND ABANDON	[ ]	REMEDIAL WORK	[ ]	ALTERING CASING	[ ]
TEMPORARILY ABANDON	[ ]	CHANGE PLANS	[ ]	COMMENCE DRILLING OPNS.	[X]	PLUG AND ABANDONMENT	[ ]
PULL OR ALTER CASING	[ ]	MULTIPLE COMPLETION	[ ]	CASING TEST AND CEMENT JOB	[X]		
OTHER:	[ ]			OTHER:			[ ]

12. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 1103. For Multiple Completions: Attach wellbore diagram of proposed completion or recompletion.

03/19/01 thru 03/20/01

Set 20" conductor to 40'. Cmt to surf w/ready mix. Spud @ 9:00 CST on 03/19/01. Drl to 425'. Run 10 jts -13-3/8" 48#, H-40 csg to 425'. Cmt w/465 sx Class C + 2% S1 + 0.25 pps D29. Circ to surf. WOC 18 hrs. Tst csg. OK.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNATURE Vonnie J. Cermin TITLE Drilling Technician DATE 03/21/01

Type or print name Vonnie J. Cermin Telephone No. 281-618-4739

(This space for State use)

APPROVED BY ORIGINAL SIGNED BY TIM W. GUM DISTRICT II SUPERVISOR TITLE DATE APR 25 2001

Conditions of approval, if any:

Submit 3 Copies To Appropriate District Office
District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 South First, Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
2040 South Pacheco
Santa Fe, NM 87505

c151 02

Form C-103
Revised March 25, 1999

WELL API NO.
30-015-31123

5. Indicate Type of Lease
STATE [X] FEE [ ]

6. State Oil & Gas Lease No.

SUNDRY NOTICES AND REPORTS ON WELLS

(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT" (FORM C-101) FOR SUCH PROPOSALS.)

7. Lease Name or Unit Agreement Name:
No Bluff "36" State Com

1. Type of Well:
Oil Well [X] Gas Well [ ] Other

2. Name of Operator
Southwestern Energy Production Company

8. Well No. 2

3. Address of Operator
2350 N. Sam Houston Parkway East, Suite 300 – Houston, TX 77032

8. Pool name or Wildcat
Wildcat (Mississippian)

4. Well Location

Unit Letter H : 1980 feet from the N line and 760 feet from the E line

Section 36 Township 17S Range 27E NMPM Eddy County

10. Elevation *(Show whether DR, RKB, RT, GR, etc.)*
3634' GR

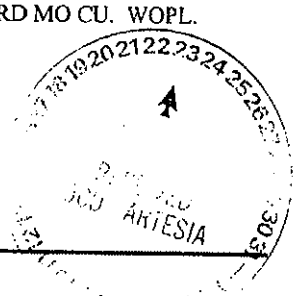
11. Check Appropriate Box to Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:				SUBSEQUENT REPORT OF:			
PERFORM REMEDIAL WORK	[ ]	PLUG AND ABANDON	[ ]	REMEDIAL WORK	[ ]	ALTERING CASING	[ ]
TEMPORARILY ABANDON	[ ]	CHANGE PLANS	[ ]	COMMENCE DRILLING OPNS.	[ ]	PLUG AND ABANDONMENT	[ ]
PULL OR ALTER CASING	[ ]	MULTIPLE COMPLETION	[ ]	CASING TEST AND CEMENT JOB	[ ]		
OTHER:	[ ]			OTHER: Completion	[X]		

12. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 1103. For Multiple Completions: Attach wellbore diagram of proposed completion or recompletion.

04/19/01 thru 04/28/01.

MI RU CU. Drl cmt. Tag TD. Corrected TD – 10,015'. Perf. L. Morrow from 9,927' – 9.964'. Swab. RD MO CU. WOPL.



I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNATURE Cathy Rowan TITLE Sr. Engineering Technician DATE 05/21/01

Type or print name Cathy Rowan Telephone No. 281-618-4733

(This space for State use)

ORIGINAL SIGNED BY TIM W. GUM
DISTRICT II SUPERVISOR

APPPROVED BY _____ TITLE _____ DATE JUL 05 2001

Conditions of approval, if any:

Submit 3 Copies To Appropriate District Office
District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 South First, Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
2040 South Pacheco
Santa Fe, NM 87505

C-103P

Form C-103
Revised March 25, 1999

WELL API NO. 30-015-31123

5. Indicate Type of Lease STATE [X] FEE [ ]

6. State Oil & Gas Lease No.

SUNDRY NOTICES AND REPORTS ON WELLS

(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT" (FORM C-101) FOR SUCH PROPOSALS.)

7. Lease Name or Unit Agreement Name: No Bluff "36" State Com

1. Type of Well: Oil Well [X] Gas Well [ ] Other

2. Name of Operator: Southwestern Energy Production Company

8. Well No. 2

3. Address of Operator: 2350 N. Sam Houston Parkway East, Suite 300 – Houston, TX 77032

RECEIVED OCD - ARTESIA

8. Pool name or Wildcat: Wildcat (Mississippian)

4. Well Location

Unit Letter H : 1980 feet from the N line and 760 feet from the E line

Section 36 Township 17S Range 27E NMPM Eddy County

10. Elevation *(Show whether DR, RKB, RT, GR, etc.)* 3634' GR

11. Check Appropriate Box to Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:				SUBSEQUENT REPORT OF:			
PERFORM REMEDIAL WORK	[ ]	PLUG AND ABANDON	[ ]	REMEDIAL WORK	[ ]	ALTERING CASING	[ ]
TEMPORARILY ABANDON	[ ]	CHANGE PLANS	[ ]	COMMENCE DRILLING OPNS.	[ ]	PLUG AND ABANDONMENT	[ ]
PULL OR ALTER CASING	[ ]	MULTIPLE COMPLETION	[ ]	CASING TEST AND CEMENT JOB	[X]		
OTHER:	[ ]			OTHER:			[ ]

12. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 1103. For Multiple Completions: Attach wellbore diagram of proposed completion or recompletion.

03/21/01 thru 03/23/01

Drl to 2002'. Run 45 jts –8-5/8" 32#, J-55 csg to 2002'. Cmt lead w/500 sx 35/65 Poz "C" + 5% D44 BWOW + 6% D20 + 0.25 PPS D29. Cmt tail w/150 sx Class "C" + 2% S1 + 0.25 pps D29. Circ to surf. WOC 18 hrs. Tst csg. OK.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNATURE Vonnie J. Cermin TITLE Drilling Technician DATE 03/27/01

Type or print name Vonnie J. Cermin Telephone No. 281-618-4739

(This space for State use)

APPPROVED BY ORIGINAL SIGNED BY TIM W. GUM DISTRICT II SUPERVISOR TITLE DATE APR 25 2001

Conditions of approval, if any:

Submit 3 Copies To Appropriate District Office
District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 South First, Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
2040 South Pacheco
Santa Fe, NM 87505

Form C-103
Revised March 25, 1999

WELL API NO.
30-015-31123

5. Indicate Type of Lease
STATE [X] FEE [ ]

6. State Oil & Gas Lease No.

SUNDRY NOTICES AND REPORTS ON WELLS

(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT" (FORM C-101) FOR SUCH PROPOSALS.)

7. Lease Name or Unit Agreement Name:
No Bluff "36" State Com

1. Type of Well:
Oil Well [X] Gas Well [ ] Other

2. Name of Operator
Southwestern Energy Production Company

8. Well No. 2

3. Address of Operator
2350 N. Sam Houston Parkway East, Suite 300 -- Houston, TX 77032

8. Pool name or Wildcat
Wildcat (Mississippian)

4. Well Location

Unit Letter H : 1980 feet from the N line and 760 feet from the E line

Section 36 Township 17S Range 27E NMPM Eddy County

10. Elevation *(Show whether DR, RKB, RT, GR, etc.)*
3634' GR

11. Check Appropriate Box to Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:				SUBSEQUENT REPORT OF:			
PERFORM REMEDIAL WORK	[ ]	PLUG AND ABANDON	[ ]	REMEDIAL WORK	[ ]	ALTERING CASING	[ ]
TEMPORARILY ABANDON	[ ]	CHANGE PLANS	[ ]	COMMENCE DRILLING OPNS.	[ ]	PLUG AND ABANDONMENT	[ ]
PULL OR ALTER CASING	[ ]	MULTIPLE COMPLETION	[ ]	CASING TEST AND CEMENT JOB	[X]		
OTHER:	[ ]			OTHER:			[ ]

12. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 1103. For Multiple Completions: Attach wellbore diagram of proposed completion or recompletion.

03/23/01 thru 04/16/01

Drl to 10,050'. Log. Run SW Cores. Run 232 jts –5 1/2" 17#, N-80 csg to 10,050'. Cmt w/553 sx 35/65 Poz "C" + 5% D44 BWOW + 6% D20 + .1 PPS D130. Calc. TOC @ 7,350'. Release rig @ 2100 CST on 4/16/01. WOCU.

RECEIVED
OCD - ARTESIA

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNATURE Cathy Rowan TITLE Sr. Engineering Technician DATE 05/21/01

Type or print name Cathy Rowan Telephone No. 281-618-4733

(This space for State use)

APPPROVED BY ORIGINAL SIGNED BY TIM W. GUM DISTRICT II SUPERVISOR TITLE DATE JUL 05 2001

Conditions of approval, if any:

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 South First, Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy, Minerals & Natural Resources

OIL CONSERVATION DIVISION
2040 South Pacheco
Santa Fe. NM 87505

15F
CT
DP

Form C-104
Revised March 25, 1999

Submit to Appropriate District Office
5 Copies

☐ AMENDED REPORT

I. REQUEST FOR ALLOWABLE AND AUTHORIZATION TO TRANSPORT

[1] Operator name and Address	[2] OGRID Number
Southwestern Energy Production Company 2350 N. Sam Houston Parkway East, Suite 300 – Houston, TX 77032	14811
	[3] Reason for Filing Code: NW

[4] API Number	[5] Pool Name	[6] Pool Code
30 – 015-31123	Illinois Camp [redacted]; Morrow, N	78890
[7] Property Code: 25858	[8] Property Name: No Bluff State Com.	[9] Well Number: 2

II. [10] Surface Location

Ul or lot no.	Section	Township	Range	Lot.Idn	Feet from the	North/South Line	Feet from the	East/West line	County
H	36	17S	27E		1980	North	760	East	Eddy

[11] Bottom Hole Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County

[12] Lse Code	[13] Producing Method Code	[14] Gas Connection Date	[15] C-129 Permit Number	[16] C-129 Effective Date	[17] C-129 Expiration Date
S	Flowing	5/17/01			

III. Oil and Gas Transporters

[18] Transporter OGRID	[19] Transporter Name and Address	[20] POD	[21] O/G	[22] POD ULSTR Location and Description
36785 [redacted]	Duke Energy Field Services	2829026 [redacted]	G	
[redacted]		[redacted]		
[redacted]		[redacted]		
[redacted]		[redacted]		

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IV. Produced Water

[23] POD	[24] POD ULSTR Location and Description

V. Well Completion Data

[25] Spud Date	[26] Ready Date	[27] TD	[28] PBTD	[29] Perforations	[30] DHC, MC
3/19/01	4/28/01	10,050'	10,015'	9,927' – 9,964'	

[31] Hole Size	[32] Casing & Tubing Size	[33] Depth Set	[34] Sacks Cement
17 ½"	13 3/8", 61#	425'	465
12 ¼"	8 5/8", 32#	2,002'	650
7 7/8"	5 ½", 17#	10,050'	553
	2 7/8" TBG	9,925'	

VI. Well Test Data

[35] Date New Oil	[36] Gas Delivery Date	[37] Test Date	[38] Test Length	[39] Tbg. Pressure	[40] Csg. Pressure
n/a	5/17/01	5/19/01	24 HRS	4	0
[41] Choke Size	[42] Oil	[43] Water	[44] Gas	[45] AOF	[46] Test Method
open	0	0	250 MCF		F

[47] I hereby certify that the rules of the Oil Conservation Division have been complied with and that the information given above is true and complete to the best of my knowledge and belief.

Signature: Cathy Rowan

Printed name: Cathy Rowan

Title: Sr. Engineering Technician

Date: 05/21/01 Phone: (281) 618-4733

OIL CONSERVATION DIVISION

Approved by: ORIGINAL SIGNED BY TIM W. GUM
DISTRICT II SUPERVISOR

Title:

Approval Date: JUL 05 2001

[48] If this is a change of operator fill in the OGRID number and name of the previous operator

Arrant, Bryan

From: Arrant, Bryan
Sent: Monday, July 15, 2002 1:37 PM
To: Jones, William V
Cc: Gum, Tim
Subject: RE: No Bluff "36" State Com Well No. 2 API: 30-015-31123

Will,
I briefly looked into the area surrounding the Bluff 36 State Com. #2 well and I see that there is Abo production immediately to the south of this well.
The operator should had brought cement to cover the Abo. As you indicated with operators permitting Glorieta-Yeso wells in this area, possibly cement up though these formations also. Once you issue an order, we will take steps and have SW Energy perf and squeeze their production casing to meet OCD requirements. If you have other plans or concerns, please advice.
Bryan

-----Original Message-----
From: Jones, William V
Sent: Thursday, July 11, 2002 8:50 AM
To: Gum, Tim
Cc: Arrant, Bryan; Catanach, David
Subject: No Bluff "36" State Com Well No. 2 API: 30-015-31123

Hello Tim:
I thought I would send an email with all the facts as I have found them:

This well was drilled and 5.5 inch set to 10050' (to the Mississippian) on 4/16/01. They only used 553 sx of cement and calc cement top at 7,350'. Many operators in this area to this depth have used 2 stage tools and cemented 2000 sacks total in 3 stages. I see OCD instructions in the file 5/3/2000 for the operator (Southwestern Energy Production Company) to "cover all oil, gas, and water bearing zones".

I think there are other productive zones. For instance, the Jeffers 36 St #003 (api: 30-015-31541) and other wells have been permitted to 4000' in this area with the Glorieta or SA as the objective. There is also some 500' shallow Yates production that is played out already.

The reason I found this:
I am looking at an SWD application from Mack Energy. They have drilled a new well and want to complete the Beech Federal #003 for SWD in the Abo at 5000'. The No Bluff 36 State Com #2 is in the Area of Review with cement top below the Abo.

Please let me know what action you will take on this - so I can determine how to proceed with Mack's application.

Regards,

Will Jones

Submit To Appropriate District Office
State Lease - 6 copies
Fee Lease - 5 copies
District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 South First, Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
2040 South Pacheco, Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
2040 South Pacheco
Santa Fe, NM 87505

5

Form C-105
Revised March 25, 1999

WELL API NO. 30-015-31123

5. Indicate Type of Lease STATE [X] FEE [ ]

State Oil & Gas Lease No.

WELL COMPLETION OR RECOMPLETION REPORT AND LOG

1a. Type of Well: OIL WELL [ ] GAS WELL [X] DRY [ ] OTHER

b. Type of Completion: NEW WELL [X] WORK OVER [ ] DEEPEN [ ] PLUG BACK [ ] DIFF. RESVR. [ ] OTHER

7. Lease Name or Unit Agreement Name: No Bluff State Com.

2. Name of Operator: Southwestern Energy Production Company

8. Well No. 2

3. Address of Operator: 2350 N. Sam Houston Parkway East, Suite 300 – Houston, TX 77032

9. Pool name or Wildcat ~~Wildcat;Mississippian~~ N ILLINOIS Camp Morrow

4. Well Location

Unit Letter H : 1980 Feet From The N Line and 760 Feet From The E Line

Section 36 Township 17S Range 27E NMPM Eddy County

10. Date Spudded	11. Date T.D. Reached	12. Date Compl. (Ready to Prod.)	13. Elevations (DF& RKB, RT, GR, etc.)	14. Elev. Casinghead
03/19/01	04/14/01	04/28/01	3,634' GR	

15. Total Depth	16. Plug Back T.D.	17. If Multiple Compl. How Many Zones?	18. Intervals Drilled By	Rotary Tools	Cable Tools
10,050'	10,015'			0 – 10,050'	

19. Producing Interval(s), of this completion - Top, Bottom, Name
9,927' – 9,964' L Morrow

20. Was Directional Survey Made: Yes

21. Type Electric and Other Logs Run
Combo

21. Was Well Cored: Yes

23. CASING RECORD (Report all strings set in well)

CASING SIZE	WEIGHT LB./FT.	DEPTH SET	HOLE SIZE	CEMENTING RECORD	AMOUNT PULLED
13 3/8"	61#	425'	17 ½"	465 sx	
8 5/8"	32#	2,002'	12 ¼"	650 sx	
5 ½"	17#	10,050'	7 7/8"	553 sx	

24. LINER RECORD

SIZE	TOP	BOTTOM	SACKS CEMENT	SCREEN

25. TUBING RECORD

SIZE	DEPTH SET	PACKER SET
2 7/8"	9,925'	9,869'

26. Perforation record (interval, size, and number)
9,927' – 9,964' 6 SPF, 37', 222 shots

27. ACID, SHOT, FRACTURE, CEMENT, SQUEEZE, ETC.

DEPTH INTERVAL	AMOUNT AND KIND MATERIAL USED

28 PRODUCTION

Date First Production	Production Method (Flowing, gas lift, pumping - Size and type pump)	Well Status (Prod. or Shut-in)
05/17/01	Flowing	Prod.

Date of Test	Hours Tested	Choke Size	Prod'n For Test Period	Oil - Bbl	Gas - MCF	Water - Bbl.	Gas - Oil Ratio
05/19/01	24	open		0	250	0	

Flow Tubing Press.	Casing Pressure	Calculated 24-Hour Rate	Oil - Bbl.	Gas - MCF	Water - Bbl.	Oil Gravity - API - (Corr.)
4	0		0	250	0	

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MAY 2001
OCD - ARTESIA

29. Disposition of Gas (Sold, used for fuel, vented, etc.)
Sold

Test Witnessed By

30. List Attachments
logs, inclinational survey

31. I hereby certify that the information shown on both sides of this form as true and complete to the best of my knowledge and belief

Signature Cathy Rowan Printed Name Cathy Rowan Title Sr. Engineering Technician Date 05/21/01

INSTRUCTIONS

This form is to be filed with the appropriate District Office of the Division not later than 20 days after the completion of any newly-drilled or deepened well. It shall be accompanied by one copy of all electrical and radio-activity logs run on the well and a summary of all special tests conducted, including drill stem tests. All depths reported shall be measured depths. In the case of directionally drilled wells, true vertical depths shall also be reported. For multiple completions, items 25 through 29 shall be reported for each zone. The form is to be filed in quintuplicate except on state land, where six copies are required. See Rule 1105.

INDICATE FORMATION TOPS IN CONFORMANCE WITH GEOGRAPHICAL SECTION OF STATE

Southeastern New Mexico		Northwestern New Mexico	
T. Anhy	T. Canyon 8350	T. Ojo Alamo	T. Penn. "B"
T. Salt	T. Strawn 8881	T. Kirtland-Fruitland	T. Penn. "C"
B. Salt	T. Atoka 9464	T. Pictured Cliffs	T. Penn. "D"
T. Yates	T. Miss	T. Cliff House	T. Leadville
T. 7 Rivers	T. Devonian	T. Menefee	T. Madison
T. Queen	T. Silurian	T. Point Lookout	T. Elbert
T. Grayburg	T. Montoya	T. Mancos	T. McCracken
T. San Andres	T. Simpson	T. Gallup	T. Ignacio Otzte
T. Glorieta 3199	T. McKee	Base Greenhorn	T. Granite
T. Paddock	T. Ellenburger	T. Dakota	T
T. Blinebry	T. Gr. Wash	T. Morrison	T.
T.Tubb 4059	T. Delaware Sand	T.Todilto	T
T. Drinkard	T. Bone Springs	T. Entrada	T.
T. Abo 5018	T.	T. Wingate	T.
T. Wolfcamp 6740	T.	T. Chinle	T.
T. Penn	T.	T. Permian	T.
T. Cisco (Bough C) 8242	T.	T. Penn "A"	T.

OIL OR GAS SANDS OR ZONES

No. 1, from.....to..... No. 3, from.....to.....

No. 2, from.....to..... No. 4, from.....to.....

IMPORTANT WATER SANDS

Include data on rate of water inflow and elevation to which water rose in hole.

No. 1, from.....to.....feet.....

No. 2, from.....to.....feet.....

No. 3, from.....to.....feet.....

LITHOLOGY RECORD (Attach additional sheet if necessary)

From	To	Thickness In Feet	Lithology
5000	5290	290	Dolomite
5290	5310	20	No sample
5310	5500	190	Dolomite w/tr of shale
5500	5520	20	No sample
5520	6730	1210	Dolomite w/tr of shale
6730	7480	750	Dolomite w/tr of ls & shale
7480	9140	1660	Dolomite w/ls, chert, & shale
9140	10040	910	Dolomite w/tr of ss, sh ls

From	To	Thickness In Feet	Lithology

Deviation surveys taken on Southwestern Energy Production Company's No Bluff "36" State Com #2 well in Eddy County, New Mexico:

Depth	Degree
190	1.00
302	.75
395	1.00
492	.75
765	.50
1042	.75
1319	.75
1645	.75
1845	.75
1950	1.00
2166	2.00
2256	1.50
2412	1.75
2597	1.75
2784	2.00
3084	2.00
3372	2.00
3591	2.00
3839	2.00
4119	2.00
4210	2.25
4303	2.75
4365	2.50
4521	3.00
4614	2.75
4707	2.50
4798	2.75
4891	3.00
4983	3.00
5133	2.75
5227	3.00
5414	3.00
5662	2.75
5822	3.00
6063	3.00
6249	3.00
6374	2.50
6469	2.75
6807	1.50
7240	2.00
7450	2.25
7741	2.25
7986	2.75
8140	2.00
8450	1.00
8849	1.50

9098	1.00
9501	.50
9870	1.75

I hereby certify that I have personal knowledge of the facts placed on this sheet and that such information given above is true and complete.

Patterson-UTI Drilling Co., LP, LLLP

Before me, the undersigned authority, on this day personally appeared John W. Norton, known to me to be the person whose name is subscribed hereto, who, after being duly sworn, on oath states that he is the drilling contractor of the well identified in this instrument and that such well was not intentionally deviated from the vertical whatsoever.

John W. Norton

SWORN AND SUBSCRIBED TO before me this 21st day of May 2001.

PAT FARRELL
Notary Public, State of Texas
My Commission Expires 04-09-2004

Notary Public in and for
Lubbock County, Texas.

District I
1625 N. French Dr., Hobbs, NM 88240
Phone:(505) 393-6161 Fax:(505) 393-0720
District II
1301 W. Grand Ave., Artesia, NM 88210
Phone:(505) 748-1283 Fax:(505) 748-9720

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

Form C-145
Permit 76583

Change of Operator

Previous Operator Information		New Operator Information	
		Effective Date:	8/15/2008
OGRID:	148111	OGRID:	255333
Name:	SOUTHWESTERN ENERGY PRODUCTION COMPANY	Name:	LIME ROCK RESOURCES A, L.P.
Address:	2350 N. SAM HOUSTON PKWY E	Address:	1111 BAGBY STREET
Address:	SUITE 300	Address:	SUITE 4600
City, State, Zip:	HOUSTON , TX 77032	City, State, Zip:	HOUSTON , TX 77002

I hereby certify that the rules of the Oil Conservation Division have been complied with and that the information on this form and the certified list of wells is true to the best of my knowledge and belief.

Previous Operator		New Operator	
Signature:		Signature:	
Printed Name:	Jim Dewbre	Printed Name:	C. Tim Miller
Title:	VP. LAND	Title:	Vice President - Operations
Date:	10/29/08 Phone: 281.618.4711	Date:	10/29/08 Phone: 713.292.9514

NMOCD Approval
Electronic Signature: Paul Kautz, District 1
Electronic Signature: Jane Prouty, District 2
Date: October 29, 2008

ChangeOp Comments

OGRID: [148111] SOUTHWESTERN ENERGY PRODUCTION COMPANY
Permit Number: 76583
Permit Type: ChangeOp

Created By	Comment	Comment Date
DPHILLIPS	I show a bond in your Financial Assurance report that requires bonding - 30-015-31552. I cannot approve the change of operator until bonding for this well is received. Questions? Call me 476-3461.	10/9/2008
DMULL	The form C-145 that is attached is the wrong one. The Permit number that is required to be signed and attached should be 76583, and not 80182. Please send the correct, signed permit number 76583 and then resubmit. If you have questions on this matter, please call Donna Mull (575) 393-6161 ext 115.	10/23/2008

District I
1625 N. French Dr., Hobbs, NM 88240
Phone:(575) 393-6161 Fax:(575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone:(575) 748-1283 Fax:(575) 748-9720
District III
1000 Rio Brazos Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

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

Form C-145
August 1, 2011

Permit 140504

Change of Operator

Previous Operator Information		New Operator Information	
		Effective Date:	Effective on the date of approval by the OCD
OGRID:	255333	OGRID:	281994
Name:	LIME ROCK RESOURCES A, L.P.	Name:	LRE OPERATING, LLC
Address:	1111 Bagby Street	Address:	1111 Bagby
	Suite 4600		Suite 4600
City, State, Zip:	Houston, TX 77002	City, State, Zip:	Houston, TX 77002

I hereby certify that the rules of the Oil Conservation Division have been complied with and that the information on this form and the certified list of wells is true to the best of my knowledge and belief.

Additionally, by signing below, LRE OPERATING, LLC certifies that it has read and understands the following synopsis of applicable rules.

PREVIOUS OPERATOR certifies that all below-grade tanks constructed and installed prior to June 16, 2008 associated with the selected wells being transferred are either (1) in compliance with 19.15.17 NMAC, (2) have been closed pursuant to 19.15.17.13 NMAC or (3) have been retrofitted to comply with Paragraphs 1 through 4 of 19.15.17.11(I) NMAC.

LRE OPERATING, LLC understands that the OCD's approval of this operator change:

1. constitutes approval of the transfer of the permit for any permitted pit, below-grade tank or closed-loop system associated with the selected wells; and
2. constitutes approval of the transfer of any below-grade tanks constructed and installed prior to June 16, 2008 associated with the selected wells, regardless of whether the transferor has disclosed the existence of those below-grade tanks to the transferee or to the OCD, and regardless of whether the below-grade tanks are in compliance with 19.15.17 NMAC.

As the operator of record of wells in New Mexico, LRE OPERATING, LLC agrees to the following statements:

1. I am responsible for ensuring that the wells and related facilities comply with applicable statutes and rules, and am responsible for all regulatory filings with the OCD. I am responsible for knowing all applicable statutes and rules, not just the rules referenced in this list. I understand that the OCD's rules are available on the OCD website under "Rules," and that the Water Quality Control Commission rules are available on the OCD website on the "Publications" page.
2. I understand that if I acquire wells from another operator, the OCD must approve the operator change before I begin operating those wells. See 19.15.9.9.B NMAC. I understand that if I acquire wells or facilities subject to a compliance order addressing inactive wells or environmental cleanup, before the OCD will approve the operator change it may require me to enter into an enforceable agreement to return those wells to compliance. See 19.15.9.9.C(2) NMAC.
3. I must file a monthly C-115 report showing production for each non-plugged well completion for which the OCD has approved an allowable and authorization to transport, and injection for each injection well. See 19.15.7.24 NMAC. I understand that the OCD may cancel my authority to transport from or inject into all the wells I operate if I fail to file C-115 reports. See 19.15.7.24.C NMAC.
4. I understand that New Mexico requires wells that have been inactive for certain time periods to be plugged or placed on approved temporary abandonment. See 19.15.25.8 NMAC. I understand the requirements for plugging and approved temporary abandonment in 19.15.25 NMAC. I understand that I can check my compliance with the basic requirements of 19.15.25.8 NMAC by using the "Inactive Well List" on OCD's website.
5. I must keep current with financial assurances for well plugging. I understand that New Mexico requires each state or fee well that has been inactive for more than two years and has not been plugged and released to be covered by a single-well financial assurance, even if the well is also covered by a blanket financial assurance and even if the well is on approved temporary abandonment status. See 19.15.8.9.C NMAC. I understand that I can check my compliance with the single-well financial assurance requirement by using the "Inactive Well Additional Financial Assurance Report" on the OCD's website.
6. I am responsible for reporting releases as defined by 19.15.29 NMAC. I understand the OCD will look to me as the operator of record to take corrective action for releases at my wells and related facilities, including releases that occurred before I became operator of record.
7. I have read 19.15.5.9 NMAC, commonly known as "Part 5.9," and understand that to be in compliance with its requirements I must have the appropriate financial assurances in place, comply with orders requiring corrective action, pay penalties assessed by the courts or agreed to by me in a settlement agreement, and not have too many wells out of compliance with the inactive well rule (19.15.25.8 NMAC). If I am in violation of Part 5.9, I may not be allowed to drill, acquire or produce any additional wells, and will not be able to obtain any new injection permits. See 19.15.16.19 NMAC, 19.15.26.8 NMAC, 19.15.9.9 NMAC and 19.15.14.10 NMAC. If I am in violation of Part 5.9 the OCD may, after notice and hearing, revoke my existing injection permits. See 19.15.26.8 NMAC.
8. For injection wells, I understand that I must report injection on my monthly C-115 report and must operate my wells in compliance with 19.15.26 NMAC and the terms of my injection permit. I understand that I must conduct mechanical integrity tests on my injection wells at least once every five years. See 19.15.26.11 NMAC. I understand that when there is a continuous one-year period of non-injection into all wells in an injection or storage project or into a saltwater disposal well or special purpose injection well, authority for that injection automatically terminates. See 19.15.26.12 NMAC. I understand that if I transfer operation of an injection well to another operator, the OCD must approve the transfer of authority to inject, and the OCD may require me to demonstrate the well's mechanical integrity prior to approving that transfer. See 19.15.26.15 NMAC.

[redacted]