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Delaware Basin Monitoring Annual Report

September 2016

United States Department of Energy
Waste Isolation Pilot Plant

Carlsbad Field Office
Carlsbad, New Mexico

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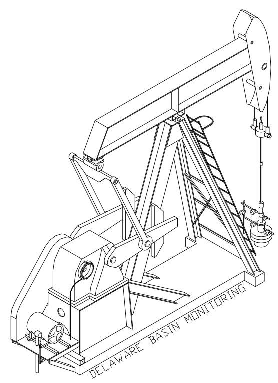

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United States Department of Energy
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Prepared for
the Department of Energy by
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Delaware Basin Drilling Surveillance Program

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1.0 Delaware Basin Drilling Surveillance Program

The Delaware Basin Drilling Surveillance Program (DBDSP) is designed to monitor drilling activities in the vicinity of the Waste Isolation Pilot Plant (WIPP) site. This program is based on Environmental Protection Agency (EPA) criteria in Title 40 Code of Federal Regulations (CFR) Part 194.33. The EPA Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes are codified in 40 CFR Part 191 (EPA 1993). Subpart B of 40 CFR Part 191 addresses the environmental standards for the disposal of radioactive waste. The standards require the Department of Energy (DOE) to demonstrate the expected long-term performance of the disposal system using a probabilistic risk assessment or performance assessment (PA). The results of the PA must show the expected long-term repository performance will not result in the release of radioactive material above EPA limits. The PA includes the consideration of inadvertent human intrusion into the repository.

In 40 CFR Part 194 (EPA 1996), the EPA defined the geographical area, for the evaluation of the historical rate of drilling for resources, as the Delaware Basin. This same area is used for monitoring mining, drilling, and drilling-related activities. The definition of the Delaware Basin in 40 CFR § 194.2 is:

> "Delaware Basin means those surface and subsurface features which lie inside the boundary formed to the north, east and west of the [WIPP] disposal system, by the innermost edge of the Capitan Reef, and formed, to the south, by a straight line drawn from the southeastern point of the Davis Mountains to the most southwestern point of the Glass Mountains."

The Delaware Basin, depicted in Figure 1, includes all or part of Brewster, Culberson, Jeff Davis, Loving, Pecos, Reeves, Ward, and Winkler counties in west Texas, and portions of Eddy and Lea counties in southeastern New Mexico.

The DOE continues to provide surveillance of mining and drilling activities in the Delaware Basin in accordance with the criteria established in 40 CFR Part 194. This will continue until the DOE and the EPA mutually agree no further benefit can be gained from continued surveillance. The results of the ongoing surveillance will be used to determine if a substantial and detrimental deviation has occurred that would affect the long-term performance of the disposal system.

The *Delaware Basin Drilling Surveillance Plan* (WP 02-PC.02; NWP 2014) places specific emphasis on the nine-township area surrounding the WIPP site, which includes townships 21 through 23 south and ranges 30 through 32 east in southeastern New Mexico. The DBDSP provides data to build on the information presented in the Compliance Certification Application (CCA), Appendix DEL (DOE 1996), the Compliance Recertification Application-2004 (CRA-2004), Appendix DATA (DOE 2004), the CRA-2009, Appendix DATA (DOE 2009), and the CRA-2014, Appendix DATA-2014 (DOE 2014).

2.0 2016 Updates

The 40 CFR §194.33 standards for a PA requires the consideration of disturbed case scenarios that include intrusions into the repository by inadvertent and intermittent drilling for resources. The DBDSP collects the drilling-related data to be used for future PA calculations. The probability of these intrusions is based on a future drilling rate, based on consideration of the record of drilling events in the Delaware Basin for the most recent 100-year period. The DOE models several types of human intrusion scenarios in the PA. These include both single borehole intrusion events and combinations of multiple borehole intrusions.

Two different types of boreholes are considered in the PA: (1) those that penetrate a pressurized brine reservoir in the underlying Castile Formation and (2) those that do not. While the presence of pressurized brine under the repository is speculative, it cannot be completely ruled out based on available information (DOE 1996). The primary consequence of contacting pressurized brine is the introduction of an additional source of brine beyond that which is assumed to be released into the repository from the Salado Formation. The human intrusion scenario models are based on extensive field data sets collected by the DOE. The data have been continuously collected from the time of the 1996 submittal of the CCA and include specific wells drilled during the last year in the New Mexico portion of the Delaware Basin, specifically the nine-township area immediately surrounding the WIPP site. Data provided in this report covers the period from September 1, 2015 to August 31, 2016. These data are summarized in the following sections.

2.1 Miscellaneous Drilling Information

The EPA provided criteria in 40 CFR §194.33(c) to address the consideration of drilling in the PA. These criteria led to the formulation of conceptual models that incorporate the effects of this activity. The conceptual models use parameter values as documented in CCA, Appendix DEL (DOE 1996), such as:

- drill collar diameter and length
- casing diameters
- drill pipe diameter
- speed of drill string rotation through the Salado Formation
- penetration rate through the Salado Formation
- instances of air drilling
- types of drilling fluids
- amounts of drilling fluids
- borehole depths
- borehole diameters
- borehole plugs
- fraction of each borehole that is plugged
- instances of encountering pressurized brine in the Castile Formation

The DBDSP data set includes the final borehole depth for wells drilled in the Delaware Basin. Borehole depths range from 19 feet to 25,201 feet. The 19-foot hole is an exhaust shaft monitoring well located on the WIPP site, and the 25,201-foot hole is a gas well located in the

Texas portion of the Delaware Basin. Borehole depths in the immediate vicinity of the WIPP site typically range from 7,750 feet to 9,000 feet for oil wells and 13,000 feet to 16,000 feet for gas wells.

The diameter of each well bore is more difficult to ascertain. The DBDSP data set includes the casing size and depth for each section of the hole drilled in the last year within the nine-township area (Table 1). Drill bit size is not a reportable element, although hole sizes are reported on Sundry notices (miscellaneous forms) maintained by the New Mexico Oil Conservation Division (NMOCD). The casing size or hole size is used to determine the diameter of the bit used to drill that particular section of the well. In previous years, the most common bit sizes were 17 1/2 inches for the surface section, 12 1/4 inches for the intermediate section, and 7 7/8 inches for the production section of the hole. During the reporting period (September 1 – August 31) the common pattern was observed for the surface and intermediate sections, however, 8 3/4, and 8 1/2 inches were observed for the production section. Table 2 shows the documented bit sizes used in drilling wells within the nine-township area during the last year. The typical hole and casing sizes, for a three-string well in the vicinity of the WIPP site, are shown in Figure 2.

2.1.1 Drilling Techniques

The drilling techniques reported since the CCA, Appendix DEL are still being implemented by area drillers. There were 102 hydrocarbon wells spudded, not necessarily completed, in the New Mexico portion of the Delaware Basin from September 1, 2015 through August 31, 2016. This number is derived from the Delaware Basin Well Tracking Application (DBWTA) maintained by the DBDSP. In reality, the number of new wells is higher; but paperwork on some of the wells has not yet been filed with the NMOCD or will be filed after this report is issued. Therefore, those wells are not included in the count listed above.

Rotary drilling rigs were used to drill the 102 wells. Some have been completed as oil wells, others as gas wells, still others as salt water disposal wells. The 102 wells were conventionally drilled utilizing mud as a medium for circulation. Six of these wells were in the nine-township area. The depths of the completed wells in the nine-township area range from 13,945 feet to 14,918 feet. Outside of the nine-township area the depths of the completed wells range from 3,259 feet to 20,131 feet.

A technique used by operators to increase production is to drill a well horizontally after a target depth for lateral kickoff point is reached, which allows for more of the wellbore area to be in the production zone. The CCA, Appendix DEL reported that this technique was not often used in this area because of the increased costs due to the additional drilling time needed; however this is no longer the case. The DBDSP monitors directional and horizontally drilled wells only in the nine-township area. All of the six new wells spudded during the last year in the nine-township area had horizontally drilled components.

2.1.2 Drilling Fluids

Employing a rotary rig for drilling involves the use of drilling fluids. Drilling fluid, commonly known as mud, is the liquid circulated through the wellbore during rotary drilling and workover operations. In addition to its function of bringing cuttings to the surface, drilling mud cools and lubricates the bit and drill stem, protects against blowouts by holding back subsurface pressures, and deposits a mud cake on the wall of the borehole to prevent loss of fluids into the formation.

Typically, a driller will use fresh water and additives to drill the surface section of the borehole, which ends at the top of the Salado Formation. A change in drilling practices would necessitate a change in the application of drilling fluids. Within the Known Potash Leasing Area (KPLA) of southeastern New Mexico, drillers are required under NMOCD Order R-111-P to use saturated brine to drill through the salt formation, which is usually called the intermediate section. The purpose of the requirement is to keep the salt from washing out and making the hole larger than necessary. Once this section has been drilled and cased, the driller again changes to fresh water and additives to finish drilling the hole to depth.

2.1.3 Air Drilling

A method of hydrocarbon drilling not emphasized in CCA, Appendix DEL is air drilling. As defined by the oil industry, air drilling is a method of rotary drilling using compressed air as the circulation medium. The conventional method of removing cuttings from the wellbore is to use a flow of water or drilling mud. In some cases, compressed air removes the cuttings with equal or greater efficiency. The rate of penetration is usually increased considerably when air drilling is used; however, a fundamental problem in air drilling is the penetration of formations containing water, since the entry of water into the system reduces the ability of the air to remove cuttings. Air drilling occurrences are tracked by the DBDSP in the New Mexico portion of the Delaware Basin only.

Stakeholders noted the air drilling scenario was not included by the DOE in the CCA and raised the following issues: (1) air drilling technology is currently successfully used in the Delaware Basin, (2) air drilling is thought to be a viable drilling technology under the hydrological and geological conditions at the WIPP site, and (3) air drilling could result in releases of radionuclides that are substantially greater than those considered by the DOE in the CCA. Considerable research on air drilling in the Delaware Basin has determined that, although air drilling is a common method of drilling wells, it is not practiced in the vicinity of the WIPP site because (1) it is against NMOCD Order R-111-P regulations to drill with anything but saturated brine through the salt formation in the KPLA; (2) it is not economical to drill with air when a driller has to use saturated brine for the intermediate section; and (3) if water is encountered prior to or after drilling the salt formation, the driller would have to convert to a conventional system of drilling.

DOE provided additional information to EPA Air Docket No. A-93-02, IV-G-7 (Kirkes 1998). In this information, the following was provided:

> "The well record search has continued and now includes information from the entire New Mexico portion of the Delaware Basin. Within the nine-townships surrounding the WIPP, the records showed no evidence of air drilling. One possible exception to this may be the Lincoln Federal #1. This well is said to have been air drilled due to a loss of circulation at a depth of 1290 feet, but this

has not been verified. The records associated with the Lincoln Federal #1 do not contain any evidence of air drilling. Rather, this information is based on verbal communications with the operating and drilling companies involved with the well. Nonetheless, the Lincoln Federal #1 may have been drilled with air, although it was not a systematic use of the technology. Air drilling at this well was used from 2984' to 4725' merely as a mitigative attempt to continue drilling to the next casing transition depth. After this casing transition, mud drilling was used for the remainder of the hole.

The area of the expanded search contains 3,756 boreholes. Of these, 407 well files were unavailable for viewing (in process); therefore, 3,349 well files constitute the database. Among these wells, 11 instances of air drilling were found in which any portion of the borehole was drilled with air. Only 7 of these were drilled through the Salado Formation at the depth of the repository. This results in a frequency of 7/3349, or 0.0021. This value is conservative in that it includes the Lincoln Federal #1, and four other wells which were proposed to be drilled with air, but no subsequent verification of actual drilling exists in the records."

In the CCA Final Rule (FR Vol. 63 No. 95) the EPA ruled air drilling did not have to be considered for PA; however, the DBDSP will continue to monitor for instances of air drilling (EPA 1998a).

During the summer of 1999, another search of these same records was conducted as a follow-up to the original research. This search of the records was used as a quality assurance check of the original search. The database consisted of 3,810 boreholes with only 12 records unavailable for viewing. This search added five more wells with indications of some portion of the borehole being drilled with air. None were located in the nine-township area or were air drilled through the Salado Formation. Of the five wells added to the count, one (the Sheep Draw "28" Federal #13) had the first 358 feet air drilled while the other four had the conductor casing drilled with air which consists of the first 40 feet of the borehole and is not usually reported in the drilling process. The conductor casing is typically drilled, set in place, and cemented prior to setting up the rotary drilling rig that will eventually drill the well.

The records on the new wells spudded during the last year (September 1, 2015 through August 31, 2016) are reviewed as they become available at the NMOCD Internet site for instances of air drilling. The records can be submitted to the NMOCD offices as late as two years after the well has been drilled. None of the records reviewed to date have indicated any additional instances of air drilling. Air drilling is not a common practice in the vicinity of the WIPP site. Table 3 shows the known indications of air drilling that have occurred in the New Mexico portion of the Delaware Basin.

2.2 Shallow Drilling Events

The criteria in 40 CFR Part 194.33 require that the CCA and subsequent CRAs adequately and accurately characterize the frequency of shallow drilling within the Delaware Basin, as well as, support the assumptions and determinations, particularly those that limit consideration of shallow drilling events based on the presence of resources of similar type and quantity found in the controlled area. The EPA defined shallow drilling as "drilling events in the Delaware Basin that do not reach a depth of 2,150 feet below the surface relative to where such drilling occurred." (EPA, 1996). The DOE concluded in CCA, Appendix SCR that shallow drilling could be removed from PA consideration based on low consequence. As a result, the DOE did not include shallow drilling in its PA drilling rate calculations and did not include any reduction in shallow drilling rates during the active and passive institutional control periods. In the CCA, Compliance Application Review Document (CARD) 33 (EPA 1998b), the EPA accepted the DOE's finding that shallow drilling would be of low consequence to repository performance and need not be included in PA.

Although the EPA has agreed, in CARD 33, shallow drilling is of low consequence and could be eliminated from PA, the DBDSP collects data on wells reported to be drilled within the boundaries of the Delaware Basin. Table 4 shows a breakdown of the various types and number of shallow wells located within the Delaware Basin.

2.3 Deep Drilling Events

In accordance with the criteria, the DOE used the historical rate of drilling for resources in the Delaware Basin to calculate a future drilling rate. In particular, in calculating the frequency of future deep drilling, the EPA provided the following criteria in 40 CFR §194.33(b)(3)(i) (EPA 1996) to the DOE:

> Identify deep drilling that has occurred for each resource in the Delaware Basin over the past 100 years prior to the time at which a compliance application is prepared.

The DOE used the historical record of deep drilling for resources below 2,150 feet that has occurred over the past 100 years in the Delaware Basin. This was chosen because it is the depth of the repository, and the repository could not be directly breached by boreholes less than this depth. In the past 100 years, deep drilling occurred for oil, gas, potash, and sulfur. These drilling events were used in calculating a rate for deep drilling for the PA as discussed in CCA, Appendix DEL. The period of calculation used was from January 1896 through June 1995. Historical drilling for purposes other than resource exploration and recovery (such as WIPP site investigation) were excluded from the calculation in accordance with criteria provided in 40 CFR §194.33.

In the Delaware Basin, deep drilling events are usually associated with oil and gas drilling. Information obtained from commercial databases and state regulatory agencies is used to identify these events. The DBDSP collects data on drilled wells within the Delaware Basin, making no distinction between resources. One combined Microsoft® SQL Server® based well tracking application is maintained on hydrocarbon wells for Texas and New Mexico. As information on wells is acquired, it is entered into this well tracking application. The Texas portion of the well tracking application contains information only on the current status of the well, when it was drilled, its location, the name of the operator, and the total depth of the well. For the purpose of reporting the Texas portion is used only for calculating the drilling rate. The New Mexico portion contains the same basic information as Texas, along with the required features, events, and processes for PA-related drilling events identified in the Delaware Basin Drilling Surveillance Plan (NWP 2014).

The DBDSP continues to monitor hydrocarbon drilling activity and any new potash, sulfur, water, or monitoring wells for deep-drilling events. Information from the drilling of these wells is added to the well tracking application maintained for these resources. During the last year, there were 1052 new wells added to the well tracking application. Most of the wells were drilled for hydrocarbon extraction and were deep-drilling events. Two of these new wells are in the nine-township area immediately surrounding the WIPP site. Table 5 shows the number and type of deep wells located in the Delaware Basin.

2.4 Past Drilling Rates

The EPA provided a formula for calculating the current drilling rate or intrusion rate when 40 CFR Part 194 was promulgated. The formula is as follows:

$$\text{Deep Drilling Rate} = \frac{(\text{\# of deep boreholes}) \times 10{,}000 \text{ years}}{23{,}102.1 \text{ square kilometers (km}^2\text{)}} \times \frac{1}{100 \text{ years}}$$

The DBDSP uses any deep drilling events (except WIPP Project-related boreholes) to calculate the drilling or intrusion rate.

The annual Fiscal Year (FY) (September 1 – August 31) drilling rates since the submittal of the CCA in 1996 are shown in Table 6. The large increase between 1996 and 1997 was the result of updating the databases with information from June 1995 through August 1997. Also, the 100-year period is considered a moving period; in which 100 years of data are used each time the calculation is performed. As each new year of data is added, the oldest year of data is dropped. For example, the drilling rate was calculated in 1999 by using the data from 1900 through 1999. In 2000, the data from 1901 through 2000 were used to calculate the drilling rate.

2.5 Current Drilling Rate

The calculated deep drilling rate for 2016 was derived from the information provided in Table 5. There were 20,425 boreholes deeper than 2,150 feet. Two wells were removed from the count because they were no longer within the 100-year interval. This brings the total deep well count to 20,423 boreholes for 2016. Applying the formula results in the following:

$$\text{Deep Drilling Rate} = \frac{(20{,}423 \text{ boreholes}) \times 10{,}000 \text{ years}}{23{,}102.1 \text{ km}^2} \times \frac{1}{100 \text{ years}}$$

This results in a deep drilling rate of 88.4 boreholes per km^2 over 10,000 years.

This is an increase from the 46.8 boreholes per km^2 reported in the CCA. The deep drilling rate is anticipated to rise for several more years before it begins to drop because the Delaware Basin is currently experiencing a period of increased drilling activity and because of the effect of the 100-year moving time frame used for drilling results. Currently a large number of wells are being added annually, while only a few are being removed due to the 100-year rolling time frame.

2.5.1 Nine-Township Area Drilling Activities

From September 1, 2015 to August 31, 2016, there were six new wells spudded in the nine-township area immediately surrounding the WIPP site. One well was drilled to the east, four to the southeast, and one to the southwest of the WIPP site. Figure 3 shows the status of known hydrocarbon wells drilled within one mile of the WIPP site boundary. Of the six new wells spudded in the nine-township area, one was drilled in Eddy County and five in Lea County.

2.5.2 Drilling Activities Outside the Nine-Township Area

In the New Mexico portion of the Delaware Basin outside of the nine-township area, there were 96 new wells spudded during the reporting period of September 1, 2015 through August 31, 2016. Of the 96 wells, 57 are located in Eddy County and 39 are in Lea County.

In the Texas portion of the Delaware Basin, 591 new wells were spudded during the reporting period. The DBDSP monitors drilling activities in portions of seven counties and all of one county (Loving). The majority of the wells were drilled in Loving, Reeves, Ward, and Culberson counties.

2.6 Castile Brine Encounters

The WIPP PA included the assumption that a borehole results in the establishment of a flow path between the repository and a pressurized brine pocket that might be located beneath the repository in the Castile Formation. DBDSP records indicated that 27 out of 620 wells encountered pressurized brine in the Castile Formation; of these, 25 wells were hydrocarbon wells scattered over a wide area in the vicinity of the WIPP site. The remaining wells, ERDA 6 and WIPP 12, were drilled in support of WIPP site characterization.

The search of the records performed in 1999 looked for instances of pressurized brine. Although the search of the records noted a number of instances of encounters with sulfur water and brine water, only the original 27 were found to have been pressurized brine encounters in the Castile Formation.

The DBDSP researches the well records of new wells drilled in the New Mexico portion of the Delaware Basin each year by looking for instances of encounters with pressurized brine. As of this report, none of the records indicated encounters with pressurized brine during the drilling of new wells spudded in the New Mexico portion of the Delaware Basin between September 1, 2015 and August 31, 2016.

Seven wells drilled since the CCA have encountered Castile Brine. Six were identified when WIPP site personnel performing field work talked to area drillers and the information was documented in the DBWTA. The other encounter was reported by an operator in the Annual Survey of area drillers. The new encounters have been in areas where, because of historical Castile Brine encounter data (Powers, Sigda, and Holt 1996), Castile Brine is expected to be encountered during the drilling process. Table 7 shows known Castile Brine encounters in the vicinity of the WIPP site.

In the CCA, the probability for encountering a Castile Brine reservoir was calculated at 8 percent with 27 Castile Brine encounters out of 345 boreholes. In the Performance Assessment Verification Test (PAVT), the EPA mandated a range of 1 percent to 60 percent. These higher values did not influence the predicted performance of the repository. The CRA-2004 continued to use the higher values and a probability for encountering a Castile Brine reservoir was not calculated. The CRA-2009 uses the values from the PAVT. However, due to the increased drilling in the area it was necessary to verify that the original value was still valid. The same parameters were used and the rate was calculated at 5 percent with 34 Castile Brine encounters out of 678 boreholes. For 2016, the same parameters were used and the rate was calculated at 4.1 percent with 34 Castile Brine encounters out of 836 boreholes.

2.7 Borehole Permeability Assessment - Plugging Practices

The hydrocarbon well plugging assumptions used for the borehole permeability assessment remain valid. The regulations in place since the submittal of the CCA have not changed. The assessment will not change unless the regulations change to allow a different method of plugging. Regulations require the well to be plugged in a manner that will permanently confine oil, gas, and water in the separate strata in which they were originally found. These regulations require a notice of intent to plug from the operator to the regulating agency. This notice includes a diagram of the well bore and the placement of the plugs. A 24-hour notice to the NMOCD or to the Bureau of Land Management (BLM) is required before plugging may commence.

Approximately 1,008 wells in the vicinity of the WIPP site are in the KPLA. Under NMOCD R-111-P regulations, the operator is required to provide a solid cement plug through the salt section and any water-bearing horizon in addition to installing a bridge plug above the perforations. The above requirement provides protection to mineralized potash areas and workings by requiring a continuous plug so there is virtually no chance of flooding nearby mines throughout their development and operation.

In the New Mexico portion of the Delaware Basin, the DBDSP retrieves a copy of the plugging report from the NMOCD Internet site when a well has been plugged and abandoned. This information is added to the records maintained by the DBDSP on each well drilled within the Delaware Basin. By maintaining records in such a fashion, should the regulations change and the plugging methods differ from what is now occurring, a trend would be noticed and the borehole permeability assessment revisited. Table 8 shows plugging information on the wells plugged and abandoned within the New Mexico portion of the Delaware Basin from September 1, 2015 to August 31, 2016.

The CCA, Appendix MASS, Attachment 16-1 describes the development of a conceptual model for long-term performance of plugged boreholes. The study did not attempt to predict the effectiveness of plugs, but to identify the location and physical characteristics of plugs, which might be important to PA. Guidance in 40 CFR Part 194.33 states; "Performance assessments should assume that the permeability of sealed boreholes will be affected by natural processes, and should assume that the fraction of boreholes that will be sealed by man equals the fraction of boreholes which are currently sealed in the Delaware Basin." The criteria also state that "...drilling practices will remain as those of today." Only wells plugged in the New Mexico portion of the Delaware Basin and drilled after 1988, when the current plugging regulation went into effect, were used for the study. The results of this study indicated the PA should assume a 100 percent plugging frequency (DOE 1996).

To determine the typical configuration and composition of a borehole plug, the study considered plugging practices to arrive at a model depicting six different types of plugging configurations (see Figure 4):

Type I — Plugs will be located at the transition between the surface and intermediate casings and the transition between the intermediate and production casings. This area is usually the top of the Salado Formation and the bottom of the Castile Formation, roughly 800 feet and 4,000 feet below the surface, respectively.

Type II — This plugging configuration has a portion of the production casing salvaged. Where the production casing was cut, a plug must be installed. If a plug occurs between 2,150 feet and 2,700 feet (above the hypothetical brine pocket) and the other plugs occur at the top of the Salado Formation and below the Castile Formation, it is considered a Type II configuration.

Type III — This configuration is the same as above except the removed production casing plug occurs above 2,150 feet.

Type IV — Extra plugs, in addition to those of Type II, have been emplaced above 2,150 feet.

Type V — The minimum regulatory requirements require a surface plug and a plug occurring at the bottom, provided no water-bearing zones were encountered. This type of plugging configuration is not common.

Type VI — This configuration has a solid cement plug through a significant portion of the salt section. This configuration, like the others, may have additional plugs above and below the salt-section plug.

There were 67 wells plugged during the reporting period. Twenty-five wells are in the nine-township area and 42 are outside the nine-township area. Thirteen of the 67 wells are in the KPLA. All 67 of the wells will be used in the permeability assessment update (see Table 9 and Table 10).

2.8 Seismic Activity in the Delaware Basin

Known seismic events occurring in southeast New Mexico and West Texas, specifically in the Delaware Basin, are recorded in a Microsoft® SQL server application. This information is obtained every quarter in a report from the New Mexico Institute of Mining and Technology (NMIMT), Socorro, New Mexico, utilizing data from an array of nine seismographs in the vicinity of the WIPP site (NMIMT 2015, NMIMT 2016a, NMIMT 2016b, NMIMT 2016c).

During the reporting period there were 70 seismic events recorded in the Delaware Basin. Twenty-four seismic events occurred in Reeves County with magnitudes between 0.73 and 3.2. Forty-four seismic events occurred in Pecos County magnitudes between 0.85 and 2.69. One seismic event occurred in Loving with a magnitude of 1.08 and one seismic event occurred in Eddy County with a magnitude of 0.49. Table 11 provides information on recorded seismic events, which have occurred in the Delaware Basin. The dramatic increase of reported seismic events in 2016 cannot necessarily be attributed to an increase in seismic activity. Rather, in 2016 NMIMT upgraded the WIPP seismic network equipment which increased network sensitivity, thereby allowing NMIMT the capability to report on previously undetectable seismic activity.

2.9 Secondary and Tertiary Recovery

Secondary recovery is defined by the oil industry as the first improved recovery method of any type applied to a reservoir to produce oil not recoverable by primary recovery methods. Waterflooding is one such method. This method involves pumping water through the existing perforations in a well. As the water is pumped into a formation, it stimulates production of oil or gas in other nearby wells. This is a proven method of recovering hydrocarbons. Waterflooding has been a popular form of secondary recovery for over 40 years. Waterflooding can be accomplished by one injection well or several injection wells in the immediate vicinity of other producing wells.

In the New Mexico portion of the Delaware Basin, there are three major waterflood projects and several injection well operations. One of the major waterflood projects in the area is the El Mar, located in T26S-R32E, on the Texas border. At one time, this project had 31 permitted injection wells. Currently, there are three injection wells actively injecting water. The remaining wells are shut-in, temporarily abandoned, or plugged and abandoned. The Paduca waterflood project, located in T25S-R32E, has three permitted injection wells but no wells are actively injecting water into the formation. The third major waterflood project in this area is the Indian Draw, located in T22S-R28E, has six permitted injection wells and is currently injecting into all of its permitted wells.

Tertiary recovery is defined by the oil industry as the use of any improved recovery method to remove additional oil after secondary recovery. At the time of this report, there are no known tertiary recovery projects being operated in the vicinity of the WIPP site, although several projects are being operated by oil companies in the Texas portion of the Delaware Basin using carbon dioxide (CO_2).

2.9.1 Nine-Township Injection Wells

Secondary recovery projects occurring in the nine-township area are on a small scale. There are seven injection wells located in the nine-township area surrounding the WIPP site. *ConocoPhillips Company* operates two injection wells northwest of the site in the Cabin Lake field. The other five injection wells are operated by *OXY USA INC* and are located south and east of the site. The six wells are injecting into the Brushy Canyon Formation of the Delaware Mountain Group at a depth of approximately 7,200 feet. Figure 5 shows a typical injection or salt water disposal well configuration. Table 12 provides information on the injection wells located in the nine-township area.

2.9.2 Nine-Township Salt Water Disposal Wells

The most common type of injection well is for the disposal of produced water coming from the producing formation in oil and gas wells. Figure 6 shows the location of active injection and salt water disposal wells in the nine-township area. Most active oil and gas wells produce brine water in addition to oil and gas. Salt Water Disposal (SWD) wells have become necessary as a result of the EPA's ruling that formation water may no longer be disposed of on the surface. The oil and gas producers now dispose of this water by injecting it into approved SWD wells.

There are currently 63 SWD wells located in the nine-township area surrounding the WIPP site. Three operators, *Devon Energy Production Company LP*, *OXY USA INC,* and *EOG Resources Inc.*, operate the majority of the SWD wells. Injection depths range from 3,400 feet to 18,000 feet. During the reporting period (September 1 – August 31), based on injection records, the three companies operated within their maximum permitted injection pressure. The volume of disposed brine water depends on the number of producing oil and gas wells maintained by the operator in the immediate vicinity of the SWD well. Table 12 provides information on SWD and injection wells in the nine-township area.

2.10 Mining

Resources found in the Delaware Basin that can be mined are potash, sulfur, caliche, gypsum, and halite (NMBMMR 1995).

2.10.1 Potash Mining

Potash mining in the immediate vicinity of the WIPP site continues as reported since the CCA, Appendix DEL. Figure 7 shows the location and the extent of the potash mines in the vicinity of the WIPP site. There have been several changes to the companies that operate in the area, most notably; only two potash companies are actively mining. No plans have been promulgated by either company to sink new shafts or develop new mines.

In August 1996, *Mississippi Potash* (a subsidiary of *Mississippi Chemical Corporation*) purchased the assets of *New Mexico Potash Corporation* and *Eddy Potash, Inc*. These plants were renamed Mississippi East and Mississippi North, respectively. In early 2004, *Mississippi Potash* sold its Carlsbad properties to *Intrepid Mining LLC*, a Denver based mining company.

Recently the company changed the name to *Intrepid Potash – New Mexico, LLC.* The former *Eddy Potash, Inc.* mine (Mississippi North) has been shut down. In July 2016 *Intrepid Potash – New Mexico, LLC* idled their west location and transitioned it into “maintenance mode. In addition, they have relinquished their mineral easements below the Eddy-Lea County Consortium.

The other potash producer in the area is *The Mosaic Company*, formerly known as *IMC Kalium Potash*, which was a wholly-owned subsidiary of *IMC Global*. *Western Ag-Minerals* was purchased by *IMC Global* in September 1997. This acquisition doubled the potash reserves for *IMC Kalium*. *IMC Global* merged with *Freeport-McMoRan*, a major world potash producer, in December 1997 with *IMC Global* as the surviving entity in the transaction. In 2004, *IMC Global* and *Cargill, Inc.* merged to form *The Mosaic Company.*

2.10.2 Sulfur Extraction

The only sulfur mining activity within the Delaware Basin was conducted by *Freeport-McMoRan Sulphur, Inc.*, formerly operated by *Pennzoil Sulphur Company*. The mine is located in Culberson County, Texas. The mine recovered sulfur utilizing the Frasch process, which consists of a hole drilled into the sulfur bearing formation and then cased. The next step involves the placement of three concentric pipes within the protective casing to facilitate pumping superheated water down the hole, melting the sulfur, then using compressed air to lift the molten sulfur to the surface. The mine was operated until it permanently ceased production on June 30, 1999. Abandonment and salvage operations continued until early summer of 2000.

2.10.3 Solution Mining

Solution mining is the process by which water is injected into a mineral formation, circulated to dissolve the mineral, with the solution then pumped back to the surface where the minerals are removed from the water, by evaporation. There are several brine mines or wells in the area, two in New Mexico and ten in Texas (see Figure 8), that use this process to provide a brine solution for area drilling operators to use in the drilling process. These are shallow wells using injected fresh water to dissolve salt into a brine solution.

Brine wells are classified as Class II injection wells. In the Delaware Basin, the process involves injecting fresh water into a salt formation to create a saturated brine solution, which is then extracted and used as a drilling agent when drilling a new well. These wells are tracked by the DBDSP.

Table 13 provides the status of brine wells in the Delaware Basin.

A moratorium on new brine wells was enacted by the NMOCD in mid-November 2008 due to the collapse of two brine wells in the vicinity of Loco Hills, New Mexico, neither of which is located in the Delaware Basin. One well was in an isolated area and was actively producing brine for sale. This well collapsed in July 2008. The second well that collapsed was located just outside of Loco Hills and was plugged and abandoned. This well collapsed in early November 2008.

One brine well, Eugenie #1, is closely being monitored by the NMOCD as it fits the geological profile of the two collapsed wells. This well is located within the Carlsbad city limits and is within the New Mexico portion of the Delaware Basin. It was voluntarily plugged and abandoned by the operator in October 2008.

In early 1997, *Mississippi Potash, Inc.* proposed to set up a pilot potash solution mining project at the former *Eddy Potash, Inc.* mine located north of the WIPP site and outside of the Delaware Basin In March 2002, *Mississippi Potash, Inc.* applied for a permit to operate a pilot in-situ potash solution mining project. In May 2002, the project was given approval to proceed by the BLM. *Intrepid Potash*, formerly *Mississippi Potash, Inc.*, has continued with the project by developing a required EIS, which was approved by the BLM on March 19, 2012. The in-situ solution mining project is currently extracting potash enriched brine from the former *Eddy Potash, Inc.* mine and evaporating the brine in surface ponds. After evaporation of potash enriched brine occurs, the ponds will be ready for potash production.

In the late 1960s, *Conoco Minerals* installed a pilot solution mining project on leases it held on the former *AMAX* property north of the Delaware Basin and the WIPP site. The project was designed to test solution mining of potassium minerals and consisted of one injection well and three withdrawal wells, but the potash ore zone was deemed too thin to make this method viable at this location.

2.11 New Drilling Technology

New drilling methods are researched by the DBDSP for impacts to the drilling methods currently used in the area. Anecdotal evidence suggests a new development technique called zipper fracking has recently been employed in the Delaware Basin. Zipper fracturing involves simultaneous stimulation of two parallel horizontal wells. The fractures are off-set such that that if one were to view a cross section of them they would appear like a zipper. The purpose of this technique is to create a more extensive fracture network (Gandossi, 2013).

2.12 Alternative Energy Activities

The DBDSP researches alternative energy activities that may have impact on PA. Alternative energy activities that may be conducted in the Delaware Basin include solar, wind, and geothermal power. Currently there are no known geothermal power projects being performed in the Delaware Basin. Solar power is currently being pursued in the Delaware Basin. *Sun Edison* completed construction of a photovoltaic solar power plant on the southern edge of the Carlsbad city limits, which is located within the Delaware Basin. Wind power is a proven technology and has been ongoing in the Delaware Basin since 1995. Two wind farms operated by *FPL Energy* are located in the western mountains of the Delaware Basin. One farm operates approximately 140 turbines and the second one has 40 turbines. Both are located adjacent to each other approximately 10 miles south of the Guadalupe Mountains National Park and 75 miles southwest of the WIPP site. The DBDSP continues to identify and document alternative energy activities.

3.0 Survey of Well Operators for Drilling Information

The DBDSP surveys local well operators annually to acquire information on drilling practices normally not available on the Sundry notices supplied to the local state and federal offices by the operator or through commercial sources maintained by the DBDSP. Participation in the survey is voluntary. This survey requests information on other items of interest to the WIPP Project such as hydrogen sulfide (H_2S) encounters, Castile Brine encounters, or whether any section of the well was drilled with air. The DBDSP personnel review the records on new wells drilled to look for the above data. The survey provides an additional source of information on drilling activities in the New Mexico portion of the Delaware Basin. The DBDSP submits the survey annually. The most recent responses the DBDSP has received were from 2016. No changes were made as a result of those responses.

4.0 Summary - 2016 Delaware Basin Drilling Surveillance Program

- No new instances of air drilling.
- No Castile Brine encounters reported.
- The drilling rate increased to 88.4 boreholes per square kilometer from 83.6 boreholes per square kilometer reported in the 2015 annual report (DOE 2015).
- Three new SWD wells were completed in the nine-township area compared to no SWD wells reported in the 2015 annual report (DOE 2015).
- Six wells were spudded in the nine-township area compared to 26 wells in the 2015 annual report (DOE 2015).
- Ninety-eight wells were spudded outside the nine-township area in New Mexico compared to 208 wells in the 2015 annual report (DOE 2015).
- Five hundred ninety-one wells were spudded in the Texas portion of the Delaware Basin compared to 801 wells in the 2015 annual report (DOE 2015).

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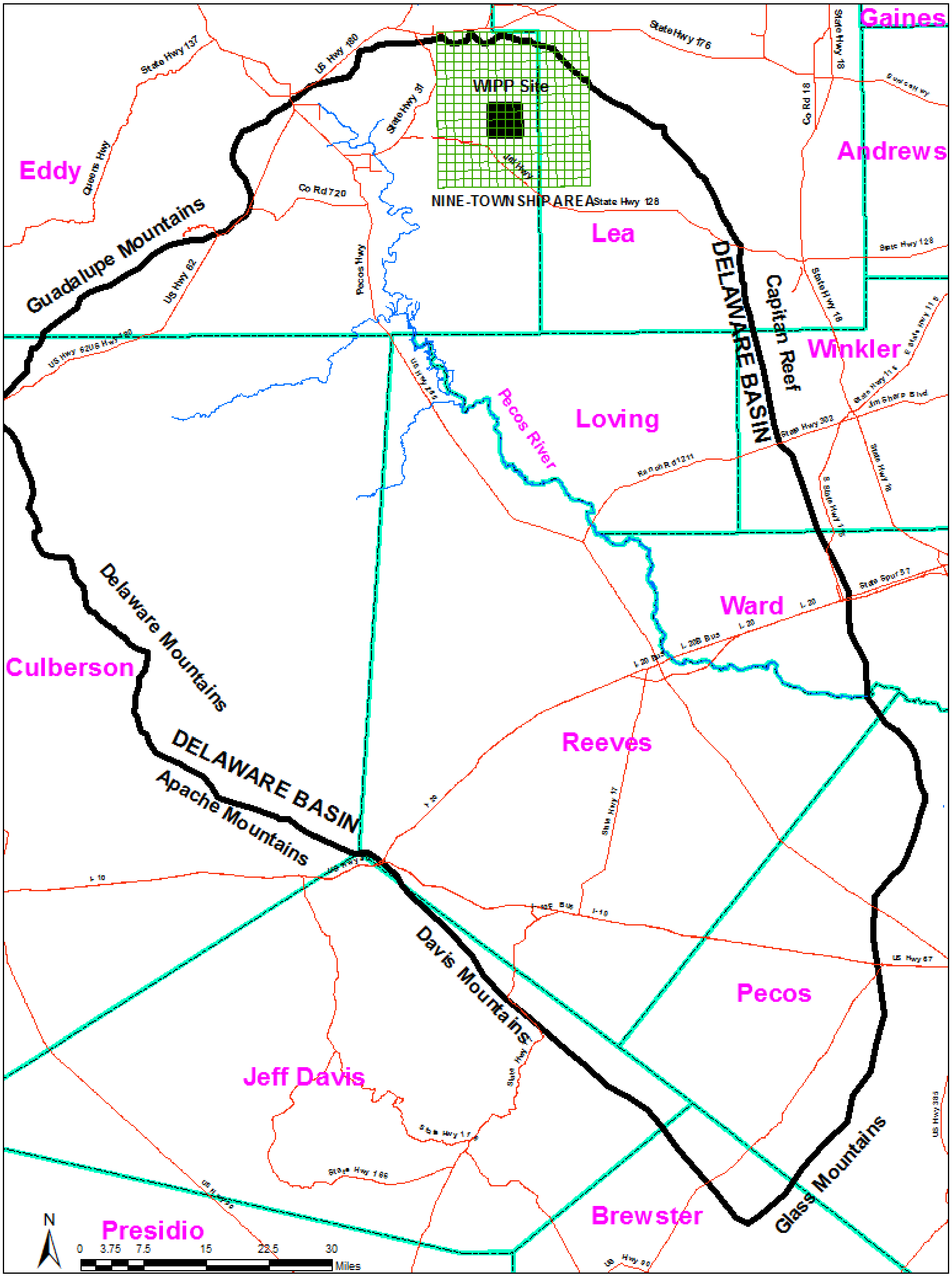

Figure 1: WIPP Site, Delaware Basin, and Surrounding Area

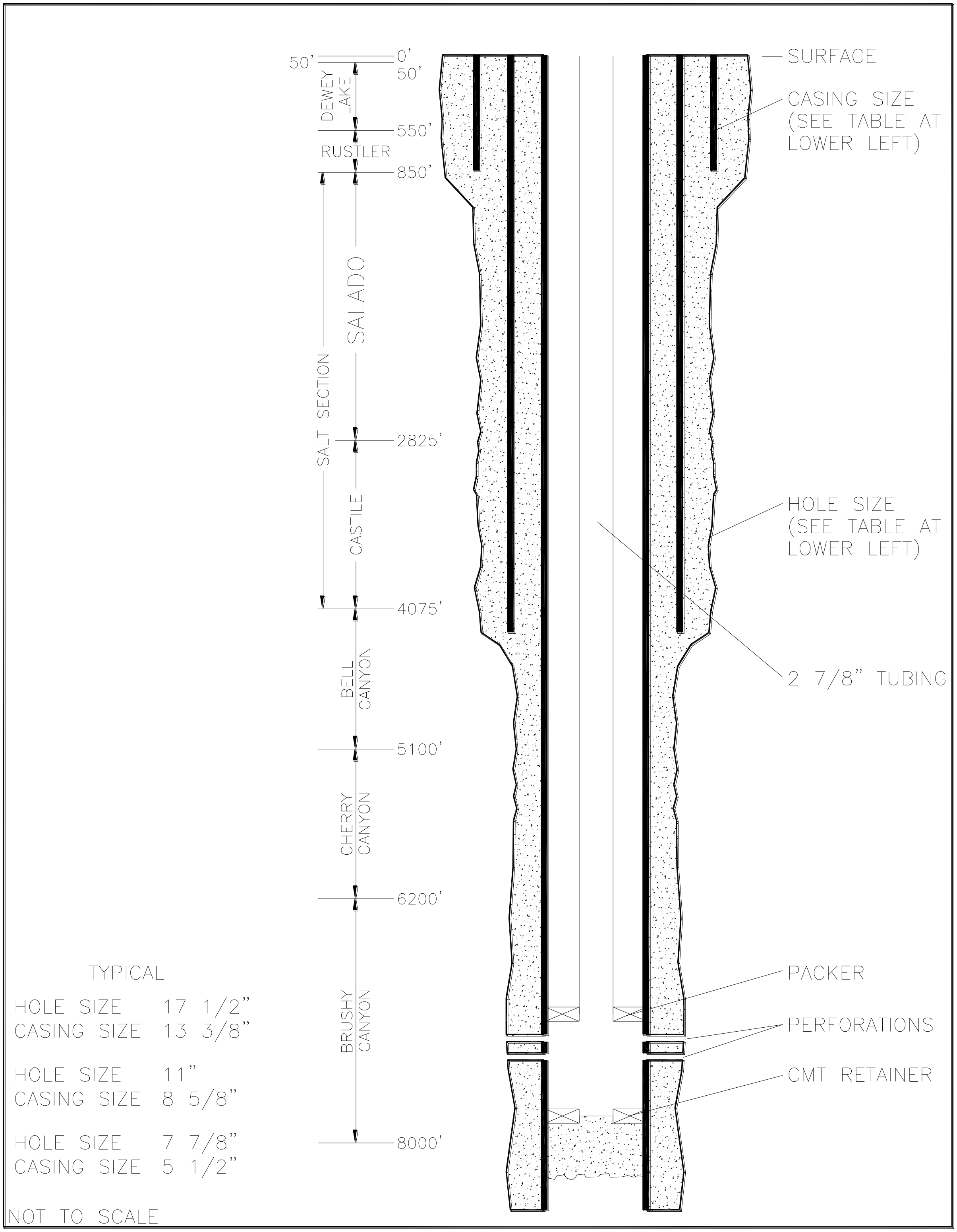

Figure 2: Typical Well Structure and General Stratigraphy Near the WIPP Site

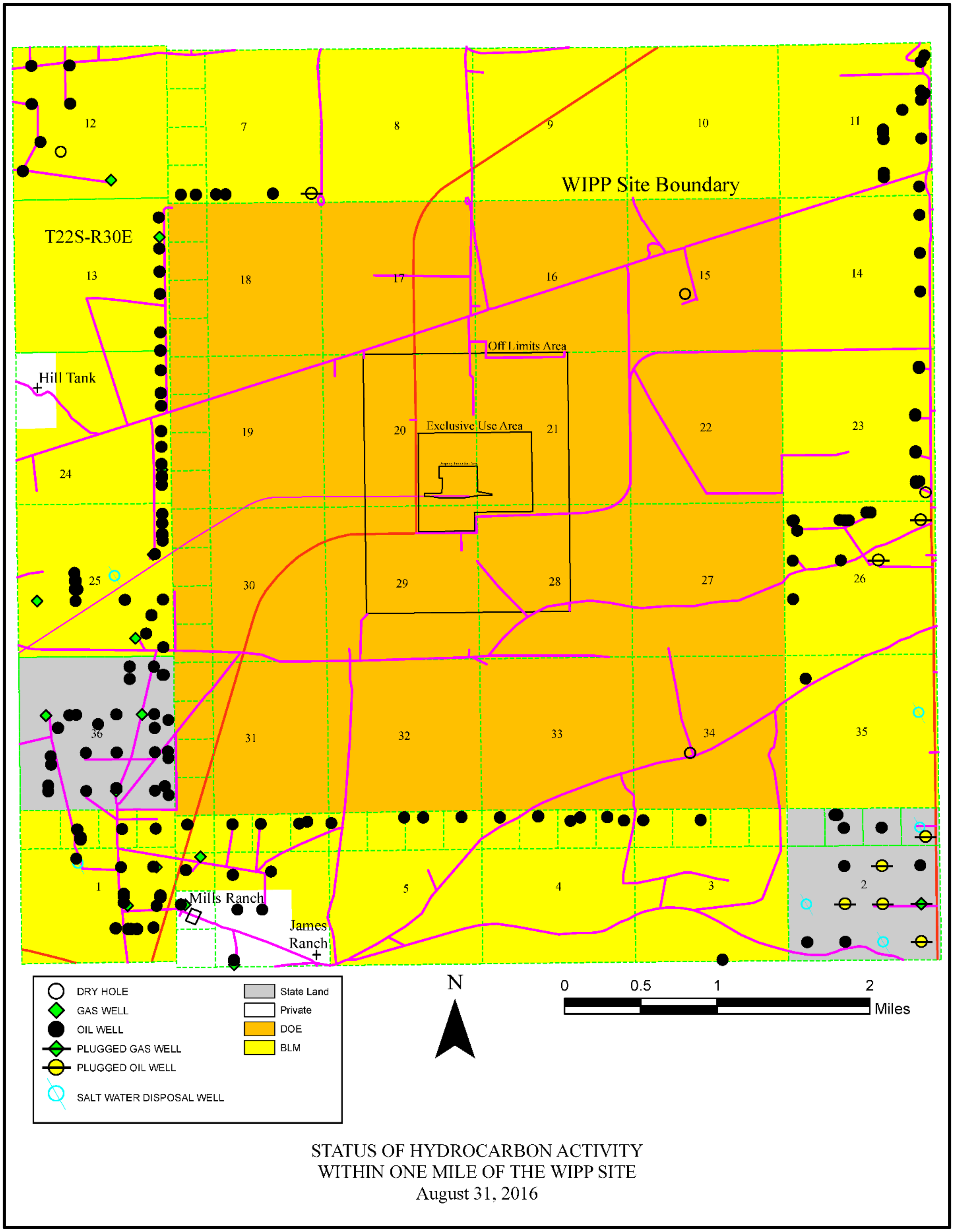

Figure 3: Oil and Gas Wells within One Mile of the WIPP Site

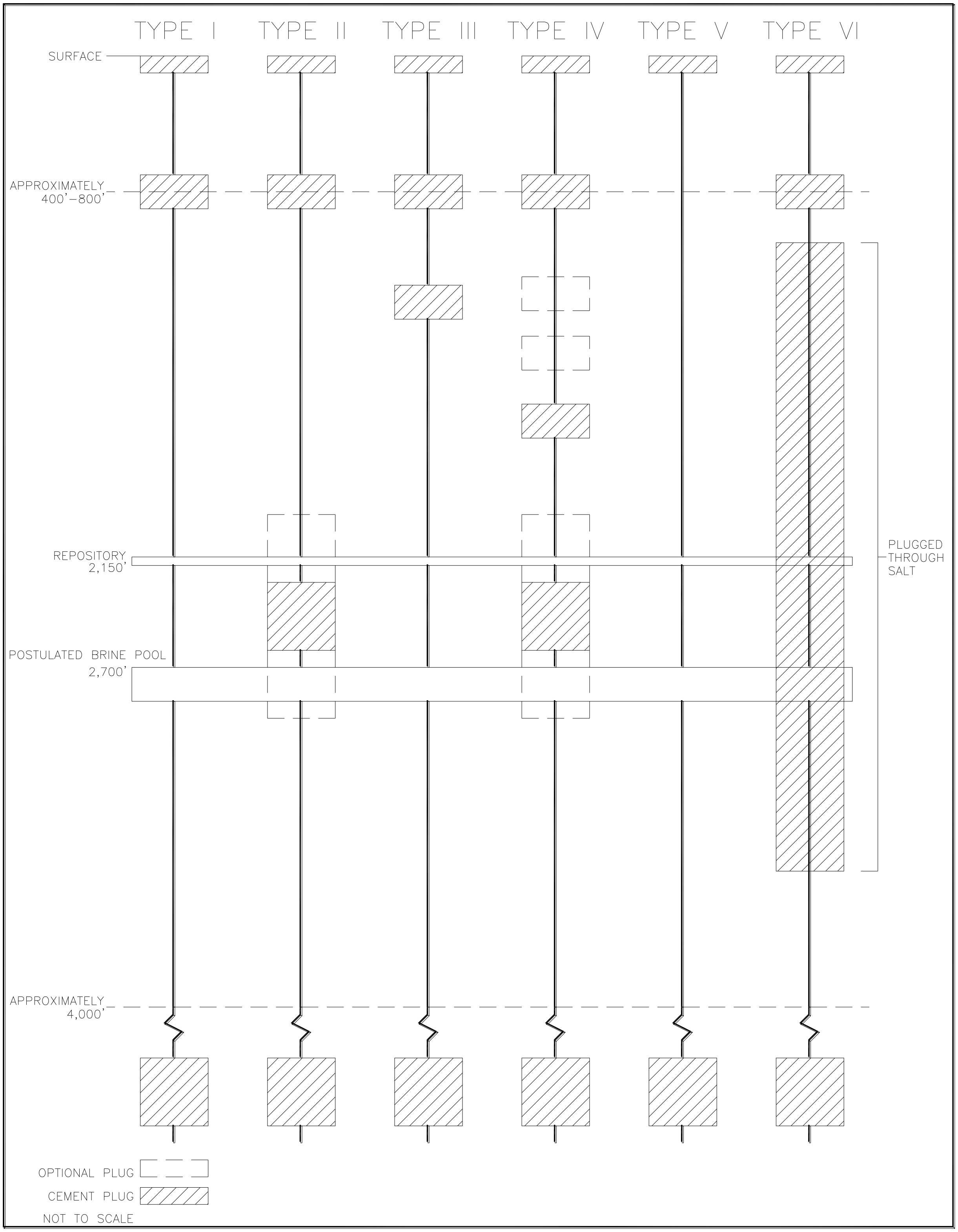

Figure 4: Typical Borehole Plug Configurations in the Delaware Basin

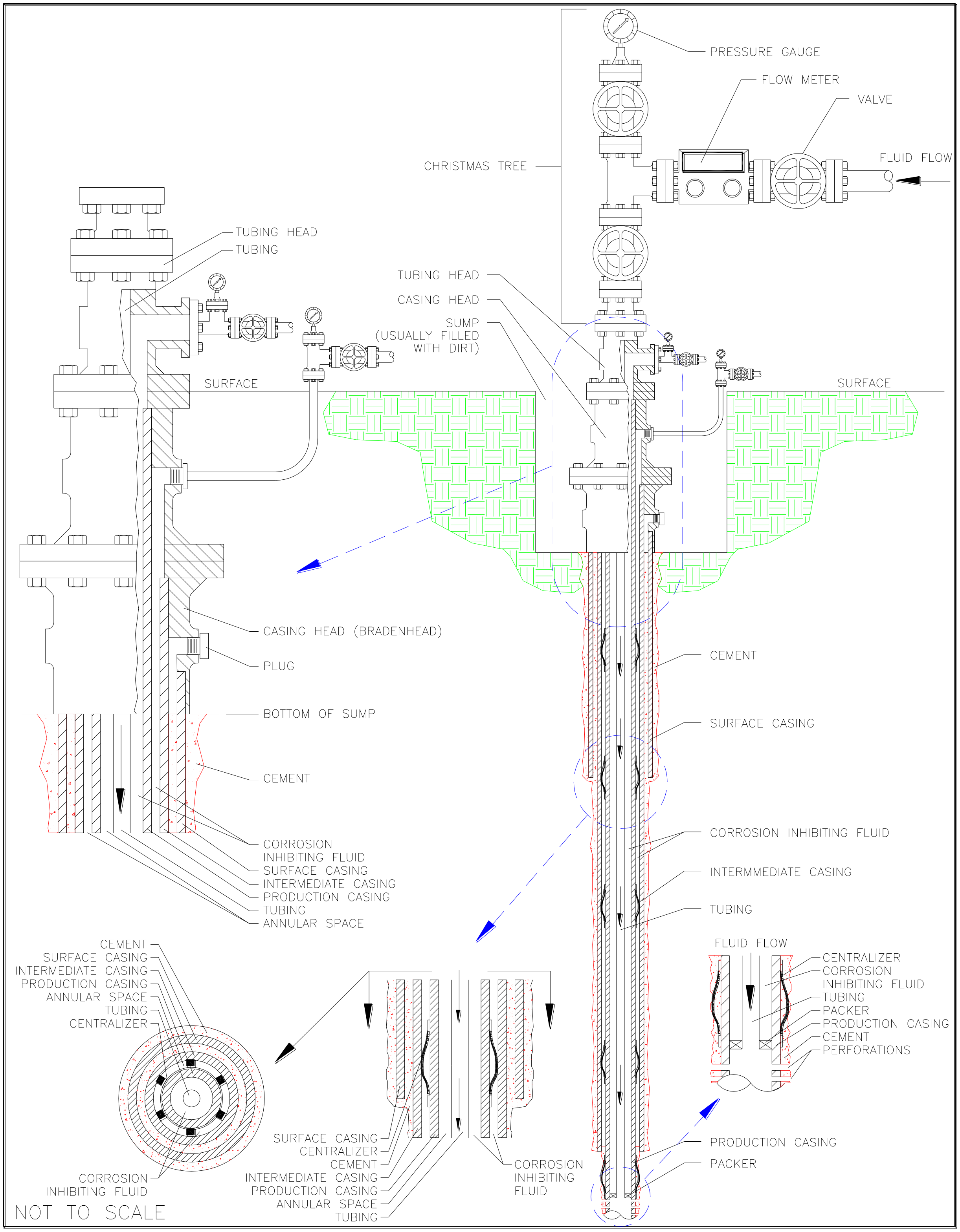

Figure 5: Typical Injection or SWD Well

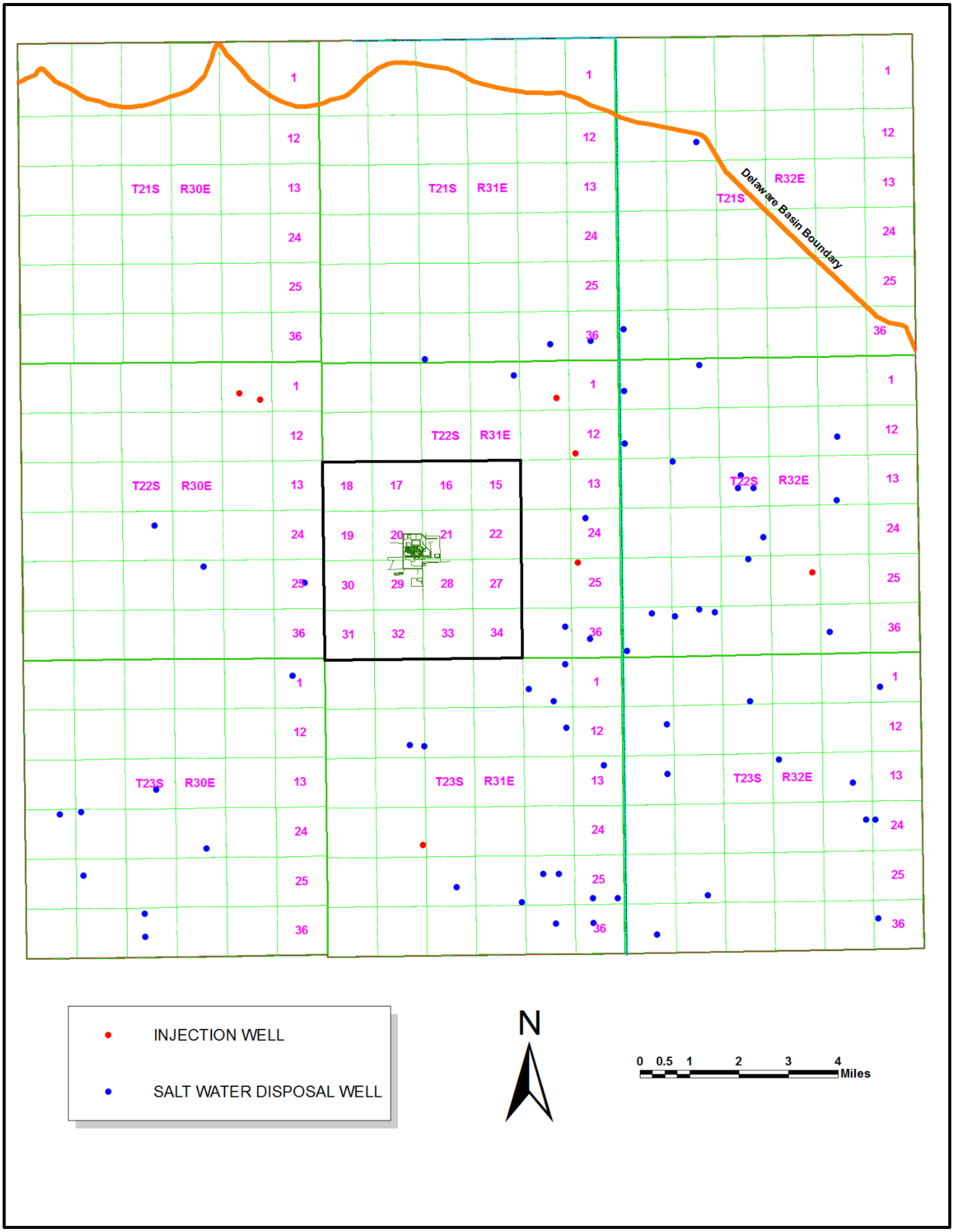

Figure 6: Active Injection and SWD Wells in the Nine-Township Area

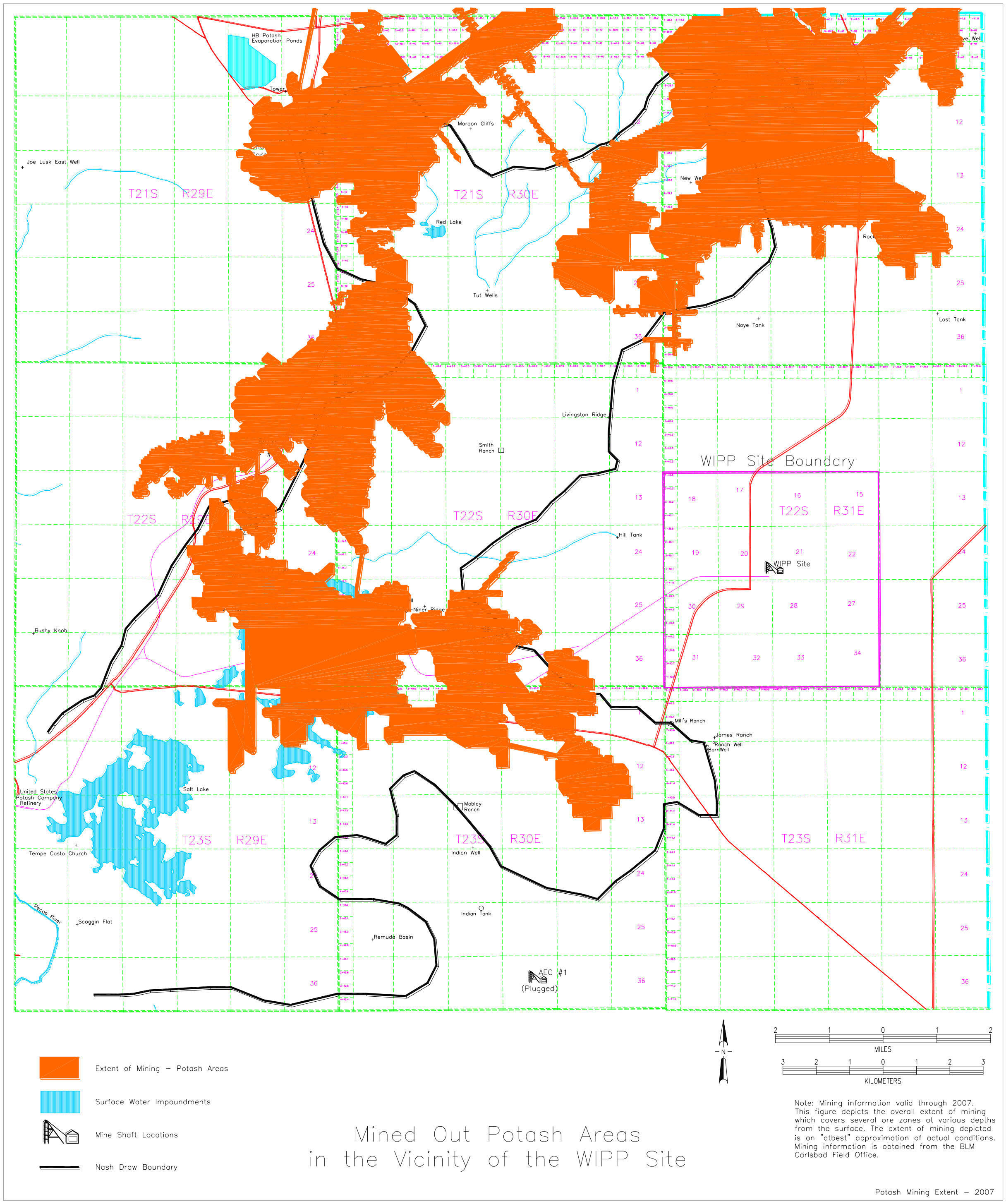

Figure 7: Potash Mining in the Vicinity of the WIPP Site

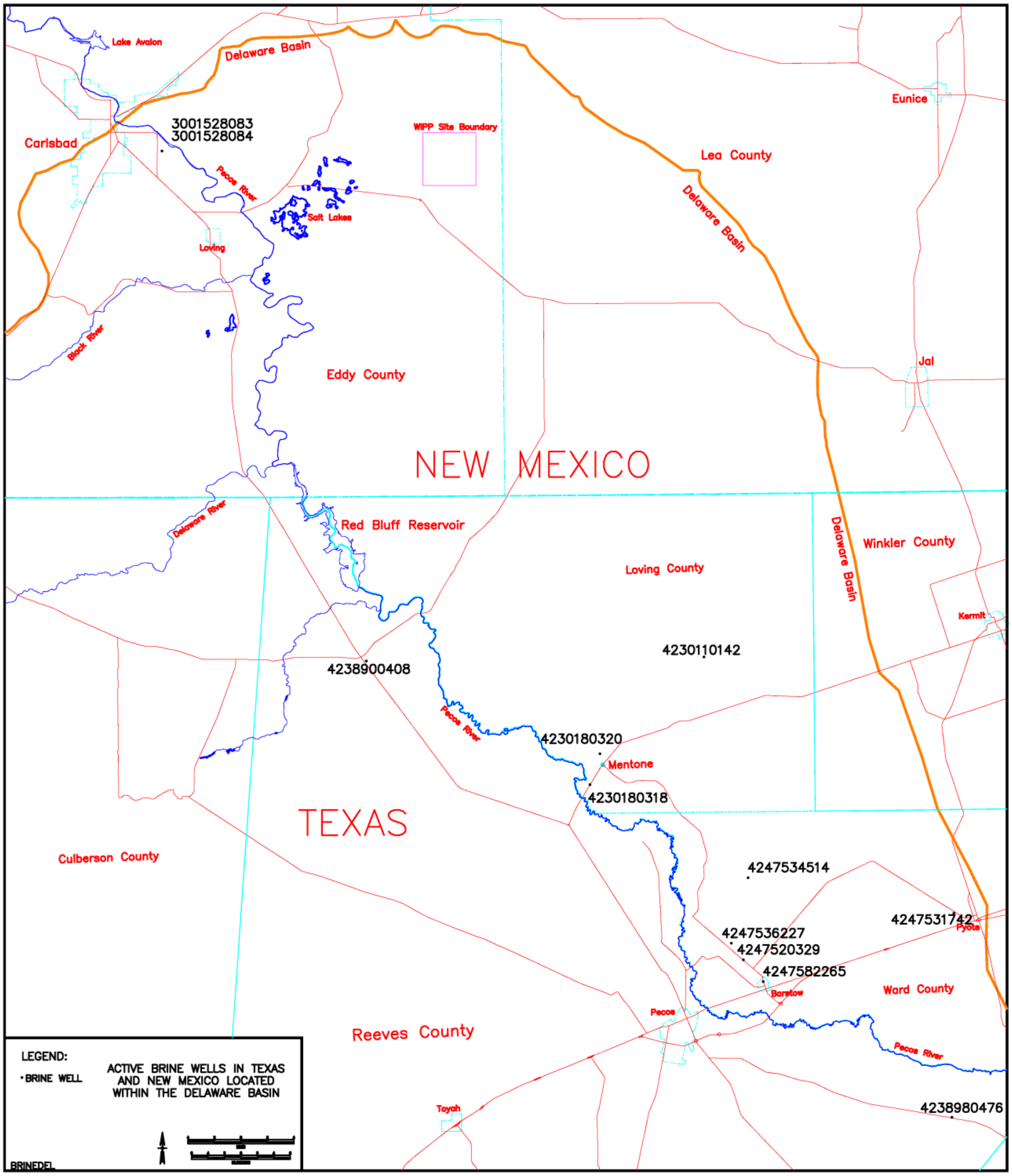

Figure 8: Active Brine Well Locations in the Delaware Basin

Table 1: Nine-Township Area Casing Sizes

Casing Size (Inches)	Surface Casing	Intermediate Casing	Production Casing
16	0	0	0
13 3/8	2	0	0
11 3/4	0	0	0
10 3/4	0	0	0
9 5/8	0	2	0
8 5/8	0	0	0
7 5/8	0	0	0
7	0	0	1
5 1/2	0	0	1

NOTE: There were 6 wells drilled in the nine-township area between September 1, 2015 and August 31, 2016. Two of the wells had complete records available on casing sizes.

Table 2: Nine-Township Area Bit Sizes

Bit Size (Inches)	Surface Hole	Intermediate Hole	Production Hole
20	0	0	0
17 1/2	2	0	0
16	0	0	0
14 3/4	0	0	0
12 3/4	0	0	0
12 1/4	0	2	0
11	0	0	0
10 5/8	0	0	0
9 7/8	0	0	0
8 3/4	0	0	1
8 1/2	0	0	1
7 7/8	0	0	0
7 3/4	0	0	0
7	0	0	0
6 1/8	0	0	0

NOTE: There were 6 wells drilled in the nine-township area between September 1, 2015 and August 31, 2016. Two of the wells had complete records available on bit sizes.

Table 3: Air-Drilled Wells in the New Mexico Portion of the Delaware Basin

#	Location	Well Name and No.	Spud Date	Status	Well Information
1	21S-28E-33	Richardson & Bass #1	7/27/1961	P&A	Air drilled through the salt. Between 2,545 ft. and 2,685 ft. encountered water and changed from air to mud-based drilling.
2	21S-32E-26	Lincoln Federal Unit #1	4/1/1991	P&A	Lost circulation at 1,290 ft. Hole was dry drilled to 1,792 ft. Supposedly, air drilled from 2,984 ft. to 4,725 ft.
3	23S-26E-17	Exxon "17" Federal #1	8/1/1989	Gas Well	Air drilled through the salt from 575 ft. to 2,707 ft.
4	23S-28E-11	CP Pardue #1	10/28/1958	P&A	Air drilled through the salt from 390 ft. to 2,620 ft.
5	23S-28E-11	Amoco Federal #1	8/4/1979	Oil Well	Air drilled from 475 ft. to 9,700 ft.
6	23S-28E-11	Amoco Federal #3	2/28/1980	Oil Well	Air drilled from 6,271 ft. to 9,692 ft.
7	23S-28E-23	South Culebra Bluff Unit #3	1/21/1979	Oil Well	Air drilled from 6,345 ft. to 8,000 ft.
8	23S-28E-23	South Culebra Bluff Unit #4	8/9/1979	Oil Well	Air drilled from 450 ft. to 9,802 ft.
9	24S-31E-03	Lilly "ALY" Federal #2	5/1/1994	Oil Well	Air drilled conductor hole to 40 ft.
10	24S-31E-03	Lilly "ALY" Federal #4	5/16/1994	Oil Well	Air drilled conductor hole to 40 ft.
11	24S-34E-04	Antelope Ridge Unit #2	9/13/1962	Gas Well	Attempted to drill with gas. Had to convert to water at 1,035 ft. Tried again several times at different depths.
12	24S-34E-09	Federal "9" Com #1	12/3/1963	Gas Well	Hit water while gas drilling at 4,865 ft.
13	24S-34E-13	Federal Johnson #1	6/23/1958	P&A	Proposed to drill with air, but no information in the records indicate air drilling.
14	26S-32E-20	Russell Federal #1	3/16/1966	Oil Well	Drilled with air to 1,330 ft.
15	26S-32E-36	North El Mar Unit #44	2/19/1959	Oil Well	Proposed to drill with air, but no information in the records indicate air drilling.
Wells Drilled after Supplemental Information Provided to the EPA Docket in 1997.					
16	22S-26E-28	Sheep Draw "28" Federal #13	7/1/1997	Oil Well	Air drilled the first 358 ft.

Table 4: Shallow Well Status in the Delaware Basin

Well Type	Texas	New Mexico	Totals
Core Hole	31	2	33
Dry Hole	354	160	514
Gas Well	1	0	1
Injection Well	1	0	1
Junked and Abandoned Well	63	31	94
Oil Well	79	9	88
Oil and Gas Well	2	0	2
Plugged Gas Well	1	5	6
Plugged Oil Well	23	27	50
Plugged Oil and Gas Well	2	3	5
Plugged Brine Well	1	0	1
Plugged Salt Water Disposal Well	0	5	5
Drilling or Waiting on Paperwork	510	2	512
Brine Well	1	2	3
Salt Water Disposal Well	3	4	7
Service Well	12	0	12
Stratigraphic Test Hole	1,170	0	1,170
Sulfur Core Hole	502	0	502
Potash Core Hole	0	1,791	1,791
Water Well	1,706	1,244	2,950
WIPP Well	0	211	211
Other (Mine Shafts, Gnome Project Wells)	0	31	31
TOTALS	4,462	3,527	7,989

NOTE: Only the known holes that occur in the Delaware Basin are listed in the above table. The 512 wells under the "Drilling or Waiting on Paperwork" category do not have an associated depth until one has been reported on paperwork. These are listed as shallow wells but may eventually be placed in the deep classification when a depth has been listed in the paperwork.

Table 5: Deep Well Status in the Delaware Basin

Well Type	Texas	New Mexico	Totals
Core Hole	5	0	5
Dry Hole	2,175	800	2,975
Gas Well	1,495	921	2,416
Injection Well	342	47	389
Junked and Abandoned Well	55	18	73
Oil Well	7,049	3,969	11,018
Oil and Gas Well	296	13	309
Plugged Gas Well	303	239	542
Plugged Injection Well	78	69	147
Plugged Oil Well	1,041	624	1,665
Plugged Oil and Gas Well	53	0	53
Plugged Brine Well	1	1	2
Plugged Salt Water Disposal Well	5	52	57
Plugged Service Well	6	1	7
Drilling or Waiting on Paperwork	22	2	24
Brine Well	9	0	9
Salt Water Disposal Well	192	228	420
Service Well	61	0	61
Stratigraphic Test Hole	44	2	46
Sulfur Core Hole	85	0	85
Potash Core Hole	0	111	111
WIPP Well	0	11	11
Other (Mine Shafts, Gnome Project Wells)	0	0	0
TOTALS	13,317	7,108	20,425

NOTE: The 24 wells under the "Drilling or Waiting on Paperwork" category have a depth associated with them which classifies them as deep wells, but the paperwork classifying these wells as oil, gas, or some other type of well have yet to be posted. When posted, the classification of these types of wells will be changed.

Table 6: Drilling Rates for the Delaware Basin

Fiscal Year September 1 – August 31	Number of Deep Boreholes	Drilling Rate Boreholes/km^2
FY1996	10,804 Boreholes Deeper Than 2,150 ft.	46.8
FY1997	11,444 Boreholes Deeper Than 2,150 ft.	49.5
FY1998	11,616 Boreholes Deeper Than 2,150 ft.	50.3
FY1999	11,684 Boreholes Deeper Than 2,150 ft.	50.6
FY2000	11,828 Boreholes Deeper Than 2,150 ft.	51.2
FY2001	12,056 Boreholes Deeper Than 2,150 ft.	52.2
FY2002[1]	12,139 Boreholes Deeper Than 2,150 ft.	52.5
FY2003	12,316 Boreholes Deeper Than 2,150 ft.	53.3
FY2004	12,531 Boreholes Deeper Than 2,150 ft.	54.2
FY2005	12,819 Boreholes Deeper Than 2,150 ft.	55.5
FY2006	13,171 Boreholes Deeper Than 2,150 ft.	57.0
FY2007	13,520 Boreholes Deeper Than 2,150 ft.	58.5
FY2008	13,824 Boreholes Deeper Than 2,150 ft.	59.8
FY2009	14,173 Boreholes Deeper Than 2,150 ft.	61.3
FY2010	14,403 Boreholes Deeper Than 2,150 ft.	62.3
FY2011	14,816 Boreholes Deeper Than 2,150 ft.	64.1
FY2012	15,558 Boreholes Deeper Than 2,150 ft.	67.3
FY2013	16,633 Boreholes Deeper Than 2,150 ft.	72.0
FY2014	17,937 Boreholes Deeper Than 2,150 ft.	77.6
FY2015	19,313 Boreholes Deeper Than 2,150 ft.	83.6
Current	20,423 Boreholes Deeper Than 2,150 ft.	88.4

NOTE: The notable increase in the drilling rate between 1996 and 1997 was not due to the drilling of wells, but to the fact that the Delaware Basin Drilling Surveillance Program did not begin until 1997 when a review of the records from July 1995 through 1997 was necessary to bring the databases up to date.

[1] In Rev. 3 of this report dated September 2002, the drilling rate for 2002 was shown as 52.9 with 12,219 deep holes. While reviewing the databases to develop reports for the Compliance Recertification Application, it was noticed that 80 shallow wells in Texas were listed as being deep. The classification of the 80 holes to shallow resulted in a reduction in the drilling rate from 52.9 to 52.5. This was reported in December 2002.

Table 7: Castile Brine Encounters in the Vicinity of the WIPP Site

#	Location	Well Name and No.	Spud Date	Status	Well Information
Original CCA-related Castile Brine Encounters - 1896 Through June 1995					
1	21S-31E-26	Federal #1	10/31/1979	P&A	Identified as encountering Castile Brine.
2	21S-31E-35	ERDA-6	6/13/1975	P&A	Identified as encountering Castile Brine.
3	21S-31E-35	Federal "FT" #1	9/25/1981	P&A	Identified as encountering Castile Brine.
4	21S-31E-36	Lost Tank "AIS" State #1	12/7/1991	Oil Well	Identified as encountering Castile Brine.
5	21S-31E-36	Lost Tank "AIS" State #4	11/19/1991	Oil Well	Identified as encountering Castile Brine.
6	21S-32E-31	Lost Tank SWD #1	11/12/1991	SWD	Identified as encountering Castile Brine.
7	22S-29E-09	Danford Permit #1	5/18/1937	P&A	Identified as encountering Castile Brine.
8	22S-31E-01	Unocal "AHU" Federal #1	4/2/1991	Oil Well	Identified as encountering Castile Brine.
9	22S-31E-01	Molly State #1	9/25/1991	Oil Well	Identified as encountering Castile Brine.
10	22S-31E-01	Molly State #3	10/20/1991	Oil Well	Identified as encountering Castile Brine.
11	22S-31E-02	State "2" #3	11/28/1991	Oil Well	Identified as encountering Castile Brine.
12	22S-31E-11	Martha "AIK" Federal #3	5/6/1991	Oil Well	Identified as encountering Castile Brine.
13	22S-31E-11	Martha "AIK" Federal #4	9/2/1991	Oil Well	Identified as encountering Castile Brine.
14	22S-31E-12	Federal "12" #8	3/28/1992	Oil Well	Identified as encountering Castile Brine.
15	22S-31E-13	Neff "13" Federal #5	2/4/1991	Oil Well	Identified as encountering Castile Brine.
16	22S-31E-17	WIPP-12	11/17/1978	Monitoring	Identified as encountering Castile Brine.
17	22S-32E-05	Bilbrey "5" Federal #1	11/26/1981	Oil Well	Identified as encountering Castile Brine.
18	22S-32E-15	Lechuza Federal #4	12/29/1992	Oil Well	Identified as encountering Castile Brine.
19	22S-32E-16	Kiwi "AKX" State #1	4/28/1992	Oil Well	Identified as encountering Castile Brine.
20	22S-32E-25	Covington "A" Federal #1	2/7/1975	Oil Well	Identified as encountering Castile Brine.
21	22S-32E-26	Culberson #1	12/15/1944	P&A	Identified as encountering Castile Brine.
22	22S-32E-34	Red Tank "34" Federal #1	9/23/1992	Oil Well	Identified as encountering Castile Brine.
23	22S-32E-36	Richardson State #1	7/20/1962	P&A	Identified as encountering Castile Brine.
24	22S-32E-36	Shell State #1	2/22/1964	Oil Well	Identified as encountering Castile Brine.
25	22S-33E-20	Cloyd Permit #1	9/7/1937	P&A	Identified as encountering Castile Brine.

#	Location	Well Name and No.	Spud Date	Status	Well Information
26	22S-33E-20	Cloyd Permit #2	6/22/1938	P&A	Identified as encountering Castile Brine.
27	23S-30E-01	Hudson Federal #1	2/25/1974	SWD	Identified as encountering Castile Brine.
Castile Brine Encounters Since July 1995					
1	21S-31E-35	Lost Tank "35" State #4	09/11/2000	Oil Well	Estimated several hundred barrels per hour. Continued drilling.
2	21S-31E-35	Lost Tank "35" State #16	2/6/2002	Oil Well	At 2,705 ft., encountered 1,000 barrels per hour. Shut-in to get room in reserve pit with pressure of 180 psi and water flow of 450 B/H. Two days later no water flow and full returns.
3	22S-31E-02	Graham "AKB" State #8	4/12/2002	Oil Well	Estimated 105 barrels per hour. Continued drilling
4	23S-30E-01	James Ranch Unit #63	12/23/1999	Oil Well	Sulfur water encountered at 2,900 ft. 35 ppm was reported but quickly dissipated to 3 ppm in a matter of minutes. Continued drilling.
5	23S-30E-01	Hudson "1" Federal #7	1/6/2001	Oil Well	Estimated initial flow at 400 to 500 barrels per hour with a total volume of 600 to 800 barrels. Continued drilling.
6	22S-30E-13	Apache "13" Federal "3	11/26/2003	Oil Well	Encountered strong water flow with blowing air at 2,850-3,315 ft. No impact on drilling process.
7	21S-31E-34	Jacque "AQJ" State #7	3/4/2005	Oil Well	Encountered water flow of 104 barrel per hour at 2,900 ft. No impact on drilling process.

Table 8: Plugged Well Information

#	Location	API#	Plug Date	R-111-P Area	Well Depth	Plug Depth	Plug Length
1	21S-28E-27	30-015-21946	2/3/2016	No	4800	CIBP 3240-2987 2650-2397 2186-2030 474-0	253 ft. 253 ft. 156 ft. 474 ft.
2	22S-27E-10	30-015-26314	2/1/2016	No	5358	CIBP 3085-3050 1880-1630 525-0	35 ft. 250 ft. 525 ft.
3	22S-27E-30	30-015-36231	4/28/2016	No	5340	CIBP 2800 1600-1500 430-280 60-3	35 ft. 100 ft. 150 ft. 57 ft.
4	22S-30E-2	30-015-26314	2/1/2016	Yes	7500	RBP 4650-4500 3600-3373 1500-1400 580-358 60-0	150 ft. 227 ft. 100 ft. 222 ft. 60 ft.
5	22S-32E-14	30-025-32764	4/12/2016	No	10059	8805-8605 CIBP 8390-8140 4660-4410 1465-1212 953-702 100-0	200 ft. 250 ft. 250 ft. 253 ft. 251 ft. 100 ft.
6	22S-32E-23	30-025-31906	6/1/2016	No	10050	CIBP 8330-8097 6479-4170 1080-788 200-0	233 ft. 2309 ft. 292 ft. 200 ft.
7	22S-32E-24	30-025-32878	5/19/2016	No	8975	CIBP 8450-8050 5500-5150 4925-3593 2490-2334 1150-815 200-0	400 ft. 350 ft. 1332 ft. 156 ft. 335 ft. 200 ft.
8	22S-34E-29	30-025-42778	10/2/2015	No	3798	3798-3115 2840-2578 2407-1204 2267-1643 74-0	683 ft. 262 ft. 1203 ft. 624 ft. 74 ft.
9	22S-34E-29	30-025-41978	9/8/2015	No	1688	1688-950 950-172 172-0	738 ft. 778 ft. 172 ft.
10	23S-26E-23	30-015-33349	2/15/206	No	12000	CIBP 2900-2344 1278-0	556 ft. 1278 ft.
11	23S-29E-17	30-015-22553	12/4/2015	No	13352	CIBP 6350-6000 3635-3435 450-0	350 ft. 200 ft. 450 ft.
12	23S-29E-20	30-015-22703	2/3/2016	No	13370	CIBP 6375-6175 2750-2550 450-0	200 ft. 200 ft. 450 ft.

#	Location	API#	Plug Date	R-111-P Area	Well Depth	Plug Depth	Plug Length
13	23S-30E-30	30-015-28922	2/15/2016	Yes	7224	CIBP 6488-6212 5805-5604 4250-4004 3035-2893 2895-2661 2345-0	276 ft. 201 ft. 246 ft. 142 ft. 234 ft. 2345 ft.
14	25S-31E-2	30-015-38432	12/17/2015	Yes	12739	CIBP 8400-8100 5100-4820 4450-4200 4125-975 818-718 100-0	300 ft. 280 ft. 250 ft. 3150 ft. 100 ft. 100 ft.
15	23S-31E-2	30-015-35678	11/25/2015	No	8455	CIBP 6860-6355 4483-4360 1106-0	505 ft. 123 ft. 1106 ft.
16	23S-31E-2	30-015-35676	11/19/2015	No	8468	6679-6580 4450-4055 950-0	99 ft. 395 ft. 950 ft.
17	23S-31E-2	30-015-25534	10/22/2015	No	15136	5400-5160 4575-4420 1950-1822 850-680 250-0	240 ft. 155 ft. 128 ft. 170 ft. 250 ft.
18	23S-31E-2	30-015-29590	9/23/2015	No	8470	4430-4300 2600-2450 760-600 200-0	130 ft. 150 ft. 160 ft. 200 ft.23
19	23S-31E-2	30-015-30809	9/16/2015	No	8482	CIBP 6100-5853 4525-4275 1975-1845 950-820 820-0	247 ft. 250 ft. 130 ft. 130 ft. 820 ft.
20	23S-31E-10	30-015-32692	1/14/2016	Yes	8325	8284-7690 CIBP 6450-6200 5270-4870 4411-3820 3800-791 115-0	594 ft. 250 ft. 400 ft. 591 ft. 3009 ft. 115 ft.
21	23S-31E-13	30-015-27859	11/24/2015	Yes	8650	CIBP 6100-5780 5400-5132 4500-1054 910-0	320 ft. 268 ft. 3446 ft. 910 ft.
22	23S-31E-15	30-015-33143	3/13/2016	No	8250	8150-8060 CIBP 6420-6170 5600-5350 4325-3926 1830-1309 950-688 120-0	90 ft. 250 ft. 250 ft. 399 ft. 521 ft. 262 ft. 120 ft.

#	Location	API#	Plug Date	R-111-P Area	Well Depth	Plug Depth	Plug Length
23	23S-31E-15	30-015-32733	3/12/2016	No	8375	8229-8065 CIBP 6650-6400 4400-2454 2400-1734 1714-672 115-0	164 ft. 250 ft. 1946 ft. 666 ft. 1042 ft. 115 ft.
24	23S-31E-15	30-015-32949	1/21/2016	Yes	8350	8142-7464 CIBP 6666-6430 4571-4043 3748-3700 3767-3142 1788-1116 626-0	678 ft. 236 ft. 528 ft. 48 ft. 625 ft. 672 ft. 626 ft.
25	23S-32E-21	30-025-35103	4/21/2016	No	8908	8650-8450 CIBP 7158-6908 4846-4460 1570-1111 115-0	200 ft. 250 ft. 386 ft. 459 ft. 115 ft.
26	23S-31E-22	30-015-32735	2/28/2016	Yes	8380	8357-8077 CIBP 7220-6990 4600-805 115-0	280 ft. 230 ft. 3795 ft. 115 ft.
27	23S-31E-22	30-015-32880	2/27/2016	Yes	8300	8255-8055 CIBP 6600-6350 4328-775 115-0	200 ft. 250 ft. 3553 ft. 115 ft.
28	23S-31E-22	30-015-32734	11/24/2015	Yes	8275	CIBP 8100-8065 CIBP 6820-6785 4600-4170 4050-1742 1700-0	35 ft. 35 ft. 430 ft. 2308 ft. 1700 ft.
29	23S-31E-23	30-015-31882	3/25/2016	Yes	8390	8330-7881 6904-6654 4480-1140 1140-0	449 ft. 250 ft. 3340 ft. 1140 ft.
30	23S-31E-24	30-015-27709	4/30/2016	No	8634	8431-8231 CIBP 7060-6830 5640-5326 4600-4174 1335-1047 940-796 100-0	200 ft. 230 ft. 314 ft. 426 ft. 288 ft. 144 ft. 100 ft.
31	23S-31E-24	30-015-27718	4/9/2016	No	8626	8433-8200 CIBP 7050-6800 5630-5380 4850-4700 115-0	233 ft. 250 ft. 250 ft. 150 ft. 115 ft.
32	23S-31E-24	30-015-27692	2/1/2016	Yes	8650	8503-7706 CIBP 6765-6515 5384-5086 4594-0	797 ft. 250 ft. 298 ft. 4594 ft.

#	Location	API#	Plug Date	R-111-P Area	Well Depth	Plug Depth	Plug Length
33	23S-31E-26	30-015-21431	12/8/2015	Yes	6103	CIBP 5980-5740 4420-3915 950-550 240-0	240 ft. 505 ft. 400 ft. 240 ft.
34	24S-25E-35	30-015-35613	1/12/2016	No	11865	CIBP 11150-10780 10355-10017 8339-7150 5189-4700 3130-3000 1644-1005 400-3	370 ft. 338 ft. 1189 ft. 489 ft. 130 ft. 639 ft. 397 ft.
35	24S-25E-36	30-015-37179	2/18/2016	No	8680	CIBP 4650-4550 1563-1010 483-157 100-3	100 ft. 553 ft. 326 ft. 97 ft.
36	24S-26E-10	30-015-32239	3/1/2016	No	11476	11290-11255 CIBP 11075-10710 8598-8379 7080-6810 5383-5072 3302-3109 1976-1772 850-696 495-3	35 ft. 365 ft. 219 ft. 270 ft. 311 ft. 193 ft. 204 ft. 154 ft. 492 ft.
37	24S-26E-11	30-015-32237	3/10/2016	No	11903	CIBP 11175-10965 10700-10260 8782-8602 7084-6914 5403-5253 3300-3170 2660-2540 1834-1714 850-750 63-3	210 ft. 440 ft. 180 ft. 170 ft. 150 ft. 130 ft. 120 ft. 120 ft. 100 ft. 60 ft.
38	24S-26E-26	30-015-34940	12/11/2015	No	11825	CIBP 11100-10813 10309-9997 8508-8328 7719-7549 5390-5240 3026-2896 1922-1812 1531-1421 480-380 63-3	287 ft. 312 ft. 180 ft. 170 ft. 150 ft. 130 ft. 110 ft. 110 ft. 100 ft. 60 ft.
39	24S-28E-6	30-015-32818	2/3/2016	No	12820	CIBP 5640-5372 2401-2089 640-401 60-0	268 ft. 312 ft. 239 ft. 60 ft.

#	Location	API#	Plug Date	R-111-P Area	Well Depth	Plug Depth	Plug Length
40	24S-28E-6	30-015-32640	9/22/2015	No	12820	CIBP 12270-11955 10493-10300 9050-8825 5915-5536 2551-2156 550-304 120-0	355 ft. 193 ft. 225 ft. 379 ft. 395 ft. 246 ft. 120 ft.
41	24S-29E-18	30-015-25237	4/4/2016	No	13058	650-0	650 ft.
42	24S-29E-28	30-015-29420	11/4/2015	No	5350	CIBP 5186-4939 4098-3847 2972-2600 1460-1257 575-0	247 ft. 251 ft. 372 ft. 203 ft. 575 ft.
43	24S-31E-2	30-015-32420	6/13/2016	No	8330	6273-6000 4485-3980 3000-2500 1200-700 700-0	273 ft. 505 ft. 500 ft. 500 ft. 700 ft.
44	24S-31E-9	30-015-27593	4/1/2016	Yes	8257	CIBP 6238-5852 5055-3969 2410-870 650-0	386 ft. 1086 ft. 1540 ft. 650 ft.
45	24S-33E-3	30-025-34562	10/8/2015	No	13850	CIBP 12850-12785 10818-10550 9127-8927 6292-6050 5042-4800 4150-3781 787-457 100-0	65 ft. 268 ft. 200 ft. 242 ft. 242 ft. 369 ft. 330 ft. 100 ft.
46	24S-33E-10	30-25-34724	12/4/2015	No	13532	13030-12931 12160-11902 11019-10781 9511-9273 6306-6059 5078-4417 3172-2975 1110-576 101-0	99 ft. 258 ft. 238 ft. 238 ft. 247 ft. 661 ft. 197 ft. 534 ft. 101 ft.
47	24S-33E-35	30-025-34719	9/23/2015	No	13850	CIBP 9250 6500-6300 5450-4752 3112-2793 1720-1587 728-425 100-0	35 ft. 200 ft. 698 ft. 319 ft. 133 ft. 303 ft. 100 ft.
48	25S-26E-1	30-015-36602	2/15/2016	No	4955	CIBP 2635-2485 1992-1486 1257-1050 500-0	150 ft. 506 ft. 207 ft. 500 ft.

#	Location	API#	Plug Date	R-111-P Area	Well Depth	Plug Depth	Plug Length
49	25S-26E-11	30-015-34193	2/10/2016	No	12275	CIBP 4530-4471	59 ft.
						CIBP 4470-4205	265 ft.
						2954-2722	232 ft.
						2017-1831	186 ft.
						450-3	447 ft.
50	25S-29E-31	30-015-36755	1/11/2016	No	11300	CIBP 6600-6481	119 ft.
						4780-4640	140 ft.
						2900-1800	1100 ft.
						1250-550	700 ft.
						550-3	547 ft.
51	25S-31E-12	30-015-20272	11/17/2015	No	16868	CIBP 13805-13675	130 ft.
						12895-12172	723 ft.
						10250-10050	200 ft.
						8400-8220	180 ft.
						7805-7593	212 ft.
						6300-6140	160 ft.
						4465-4189	276 ft.
						1200-633	567 ft.
						60-0	60 ft.
52	25S-31E-12	30-015-29850	4/9/2016	No	16499	14870-14278	592 ft.
						12500-11959	541 ft.
						8950-8790	160 ft.
						8300-7884	416 ft.
						4850-4700	150 ft.
						4400-4020	380 ft.
						1000-612	388 ft.
						100-0	100 ft.
53	25S-33E-3	30-025-34518	2/22/2016	No	13886	CIBP 12837-12802	35 ft.
						CIBP 10522-10102	420 ft.
						9403-9132	271 ft.
						6703-6432	271 ft.
						5210-4801	409 ft.
						1906-1486	420 ft.
						699-462	237 ft.
						120-0	120 ft.
54	25S-33E-13	30-025-32182	10/2/2015	No	15308	CIBP 11600	35 ft.
						9360-9160	200 ft.
						5232-4985	247 ft.
						2750-2534	216 ft.
						1575-1331	244 ft.
						700-520	180 ft.
						300-0	300 ft.
55	25S-34E-5	30-025-29729	6/13/2016	No	14100	CIBP 13480-12745	735 ft.
						12420-12050	370 ft.
						9257-8995	262 ft.
						6300-6047	253 ft.
						5800-5615	185 ft.
						5270-5110	160 ft.
						3000-2871	129 ft.
						1650-1485	165 ft.
						687-520	167 ft.
						60-0	60 ft.

#	Location	API#	Plug Date	R-111-P Area	Well Depth	Plug Depth	Plug Length
56	25S-34E-17	30-025-36237	2/5/2016	No	13849	CIBP 12000-11247	753 ft.
						10963-10744	219 ft.
						9359-9140	219 ft.
						7525-7306	219 ft.
						5207-5000	207 ft.
						3209-2946	263 ft.
						1211-491	720 ft.
						262-0	262 ft.
57	25S-34E-18	30-025-34659	6/13/2016	No	16235	11700-11308	392 ft.
						9360-9127	233 ft.
						7216-6983	233 ft.
						5238-4963	275 ft.
						4450-4302	148 ft.
						3850-2648	1202 ft.
						1575-1436	139 ft.
						709-599	110 ft.
						200-0	200 ft.
58	25S-34E-18	30-025-32651	1/8/2016	No	15363	CIBP 11640	35 ft.
						11623-11281	342 ft.
						9451-9207	244 ft.
						7505	
						5310-4837	473 ft.
						3205-2950	255 ft.
						1153-590	563 ft.
						328-0	328 ft.
59	26S-24E-4	30-015-20659	12/20/2015	No	7125	CIBP 6822-6771	51 ft.
						6310-5580	730 ft.
						5550-5205	345 ft.
						3659-3427	232 ft.
						1703-1430	273 ft.
						810-0	810 ft.
60	26S-27E-18	30-015-34749	2/1/2016	No	5900	4112-3764	348 ft.
						2911-1702	1209 ft.
						408-260	148 ft.
						100-0	100 ft.
61	26S-27E-18	30-015-35435	2/1/2016	No	3800	CIBP 2900-2780	120 ft.
						2000-1820	180 ft.
						1313-1213	100 ft.
						450-270	180 ft.
						100-0	100 ft.
62	26S-28E-17	30-015-37423	12/16/2015	No	10750	CIBP 6180-6000	180 ft.
						4140-4000	140 ft.
						2458-1957	501 ft.
						684-3	681 ft.
63	26S-29E-4	30-015-34795	3/8/2016	No	7022	4900-4650	250 ft.
						CIBP 3170-2456	714 ft.
						720-414	306 ft.
						100-0	100 ft.
64	26S-29E-12	30-015-25615	9/17/2015	No	3482	CIBP 3200-2618	582 ft.
						770-0	770 ft.
65	26S-33E-15	30-025-23992	6/20/2016	No	5150	CIBP 4900-4100	800 ft.
						1250-960	290 ft.
						456-0	456 ft.

#	Location	API#	Plug Date	R-111-P Area	Well Depth	Plug Depth	Plug Length
66	26S-33E-15	30-025-33308	6/15/2015	No	5300	CIBP 4930-4280 1250-1016 350-0	650 ft. 234 ft. 350 ft.
67	26S-33E-15	30-025-32749	6/9/2016	No	5221	CIBP 4920-4485 485-0	465 ft. 485 ft.

Table 9: Past Plugging Summary by Well Type

Type	CCA Well Count	CCA Frequency	CRA-2004 Well Count	CRA-2004 Frequency	CRA-2009 Well Count	CRA-2009 Frequency
I	61	32.5%	116	34.1%	131	30.5%
II	37	20%	60	17.7%	84	19.5%
III	64	34%	111	32.6%	142	33%
IV	19	10%	38	11.2%	52	12.1%
V	3	1.5%	10	2.9%	13	3%
VI	4	2%	5	1.5%	8	1.9%
TOTALS	188	100.0%	340	100.0%	430	100.0%

Type	CRA-2014 Well Count	CRA-2014 Frequency
I	147	26.9%
II	110	20.1%
III	163	29.9%
IV	90	16.5%
V	14	2.6%
VI	22	4.0%
TOTALS	546	100.0%

Table 10: Current Plugging Summary by Well Type for the CRA-2019

Type	CRA-2014	CRA-2014 Frequency	2013	2014	2015	2016	2017	Total	Current Frequency	Change
I	147	26.9%	3	3	1	9		154	23.0%	-3.9%
II	110	20.1%	2	9	11	20		132	21.5%	+1.4%
III	163	29.9%	2	6	5	9		176	26.1%	-3.8%
IV	90	16.5%	10	16	11	7		127	18.9%	+2.4%
V	14	2.6%	0	0	0	11		14	3.5%	+0.9%
VI	22	4.0%	0	3	13	11		38	6.9%	+2.9%
TOTALS	546	100.0%	17	37	41	67		708	100.0%	

NOTE: The 1996 Compliance Certification Application (CCA) used the 188 wells categorized into the above classifications to arrive at the percentage or frequency of each plugging event. The 2004 Compliance Recertification Application (CRA-2004) followed up on that study and 152 wells were added to the original value to update the frequency. For the CRA-2009, 90 wells were added to the CRA-2004 value to update the frequency. For the CRA-2014, 116 wells were added to the CRA-2009 value to update the frequency.

Table 11: Seismic Activity in the Delaware Basin

County	No. of Events	Earliest Event	Latest Event	Smallest Magnitude	Largest Magnitude
Culberson	16	10/27/1992	3/28/2015	1.1	2.4
Eddy	20	11/28/1975	3/24/2016	-1.3	3.7
Jeff Davis	1	3/28/2015	3/28/2015	0.65	0.65
Lea	1	6/23/1993	6/23/1993	2.1	2.1
Loving	4	2/4/1976	1/4/2016	1.1	1.6
Pecos	85	1/30/1975	6/26/2016	0.9	3.0
Reeves	78	2/19/1976	6/30/2016	0.6	3.2
Ward	50	9/3/1976	7/1/2009	0.3	2.8
Winkler	9	9/24/1971	10/19/2007	0.0	3.0
TOTAL	190				

KEY:

Magnitude

Less than 2	Very seldom ever felt
2.0 to 3.4	Barely felt
3.5 to 4.2	Felt as a rumble
4.3 to 4.9	Shakes furniture; can break dishes
5.0 to 5.9	Dislodges heavy objects; cracks walls
6.0 to 6.9	Considerable damage to buildings
7.0 to 7.3	Major damage to buildings; breaks underground pipes
7.4 to 7.9	Great damage; destroys masonry and frame buildings
Above 8.0	Complete destruction; ground moves in waves

NOTE: Four of the 20 seismic events in Eddy County can be directly attributed to mining activities.

Table 12: Nine-Township Injection and SWD Well Information

#	Location	API#	Status	Injection Zone	First Injection	Last Injection	Cumulative Bbl
1	21S-31E-33	30-015-29330	SWD	4,166-5,160	1998	July 2016	9,722,543
2	21S-31E-35	30-015-40890	SWD	4,355-6,320	2014	July 2016	1,457,900
3	21S-31E-36	30-015-43367	SWD	15,265-15,600	2016	N/A	N/A
4	21S-32E-08	30-025-31412	SWD	4,826-5,978	1991	July 2016	17,255,217
5	21S-32E-31	30-025-31443	SWD	4,618-6,012	1992	June 2016	5,890,763
6	22S-30E-02	30-015-25758	Injection	7,200-7,264	1993	June 2016	26,315,613
7	22S-30E-02	30-015-26761	Injection	5,600-7,400	1991	June 2016	26,742,081
8	22S-30E-21	30-015-41074	SWD	15,291-16,801	2014	July 2016	10,908,847
9	22S-30E-25	30-015-33439	SWD	5,678-5,930	2010	June 2016	2,982,085
10	22S-30E-27	30-015-04734	SWD	3,820-4,620	1981	Feb 2015	6,166,342
11	22S-31E-02	30-015-32440	Injection	6,989-7,020	2003	July 2016	3,780,817
12	22S-31E-03	30-015-38254	SWD	5,355-6,137	2012	July 2016	2,784,812
13	22S-31E-12	30-015-26742	Injection	4,574-4,963	2014	June 2016	715,978
14	22S-31E-24	30-015-26848	SWD	4,519-5,110	1991	July 2016	14,462,632
15	22S-31E-25	30-015-28281	Injection	5,634-5,987	1995	July 2016	13,535,929
16	22S-31E-35	30-015-26629	SWD	4,500-5,670	1991	July 2016	26,941,004
17	22S-31E-36	30-015-26171	SWD	4,500-5,700	1998	June 2016	10,507,287
18	22S-32E-05	30-025-27620	SWD	8,250-8,602	2004	July 2016	10,425,244
19	22S-32E-06	30-025-31227	SWD	4,626-5,730	2012	July 2016	3,991,731
20	22S-32E-07	30-025-31076	SWD	4,676-5,814	1991	July 2016	13,667,639
21	22S-32E-11	30-025-31716	SWD	5,220-8,706	1994	July 2016	3,993,312
22	22S-32E-14	30-025-08113	SWD	5,750-6,080	1994	June 2016	6,856,868
23	22S-32E-16	30-025-31644	SWD	5,582-6,380	2010	July 2016	1,721,071
24	22S-32E-16	30-025-31889	SWD	5,240-8,710	1995	July 2016	12,133,291
25	22S-32E-16	30-025-36006	SWD	5,850-6,450	2010	July 2016	2,364,254
26	22S-32E-17	30-025-31926	SWD	6,807-6,828	2007	July 2016	2,769,418
27	22S-32E-21	30-025-08109	SWD	4,755-5,110	1992	July 2016	4,355,682
28	22S-32E-27	30-025-32436	Injection	6,831-8,388	1998	July 2016	12,579,207
29	22S-32E-28	30-025-31754	SWD	4,674-5,672	1993	July 2016	6,980,821
30	22S-32E-31	30-025-20423	SWD	4,734-5,590	1993	July 2016	7,181,151
31	22S-32E-31	30-025-32093	SWD	4,590-5,626	2004	July 2016	1,008,547
32	22S-32E-32	30-025-36004	SWD	6,744-8,518	2010	July 2016	4,729,195
33	22S-32E-32	30-025-36135	SWD	5,850-6,450	2013	July 2016	2,043,700
34	22S-32E-32	30-025-37799	SWD	5,750-6,500	2010	July 2016	3,448,228
35	22S-32E-35	30-025-33149	SWD	4,950-6,252	1995	July 2016	11,010,661
36	23S-30E-01	30-015-21052	SWD	4,040-4,825	2001	Oct 2015	4,129,932
37	23S-30E-16	30-015-20899	SWD	4,433-5,952	2003	July 2016	5,688,042
38	23S-30E-19	30-015-28901	SWD	3,402-3,912	1997	July 2016	3,794,459
39	23S-30E-20	30-015-29549	SWD	4,124-4,774	2006	June 2016	3,356,222
40	23S-30E-22	30-015-33637	SWD	4,510-5,780	2012	July 2016	2,620,407
41	23S-30E-29	30-015-28808	SWD	5,370-6,380	1996	July 2016	5,731,000

#	Location	API#	Status	Injection Zone	First Injection	Last Injection	Cumulative Bbl
42	23S-30E-33	30-015-26084	SWD	4,470-7,558	2005	Oct 2015	6,819,690
43	23S-30E-33	30-015-31744	SWD	4,227-6,770	2002	Oct 2015	6,384,098
44	23S-31E-02	30-015-05840	SWD	4,500-5,700	1997	June 2016	10,277,542
45	23S-31E-02	30-015-29792	SWD	4,500-5,850	1998	June 2016	10,307,447
46	23S-31E-02	30-015-35749	SWD	4,600-5,880	2010	Apr 2016	4,297,845
47	23S-31E-08	30-015-32619	SWD	7,900-7,933	2004	June 2016	3,939,532
48	23S-31E-09	30-015-33368	SWD	7,744-7,952	2005	June 2016	5,467,613
49	23S-31E-11	30-015-25419	SWD	5,210-5,800	2005	Feb 2016	1,243,027
50	23S-31E-13	30-015-28904	SWD	5,760-5,862	2005	Feb 2016	1,016,523
51	23S-31E-20	30-015-30605	Injection	7,740-7,774	2001	July 2016	11,377,116
52	23S-31E-25	30-015-28817	SWD	5,776-5,920	2008	June 2016	1,986,838
53	23S-31E-25	30-015-28859	SWD	5,236-5,498	2008	June 2016	1,088,664
54	23S-31E-26	30-015-20277	SWD	4,460-5,134	1992	June 2016	5,308,714
55	23S-31E-26	30-015-20302	SWD	4,390-6,048	1971	June 2016	7,350,156
56	23S-31E-27	30-015-27106	SWD	4,750-5,720	1998	June 2016	6,142,990
57	23S-31E-28	30-015-26194	SWD	4,295-5,570	1993	July 2016	8,840,156
58	23S-31E-35	30-015-25640	SWD	4,484-5,780	1993	July 2016	10,307,786
59	23S-31E-36	30-015-20341	SWD	5,980-6,560	1994	June 2016	33,666,233
60	23S-32E-01	30-025-36192	SWD	5,468-6,092	2013	June 2016	2,271,064
61	23S-32E-04	30-025-31650	SWD	4,884-5,886	2003	July 2016	5,688,928
62	23S-32E-07	30-025-33398	SWD	4,660-6,270	2009	June 2016	2,398,389
63	23S-32E-14	30-025-26844	SWD	5,496-6,014	1991	July 2016	2,330,140
64	23S-32E-15	30-025-35524	SWD	5,786-5,942	2008	June 2016	840,433
65	23S-32E-18	30-025-25017	SWD	16,700-18,000	2016	N/A	N/A
66	23S-32E-23	30-025-33653	SWD	5,950-6,065	2000	June 2016	2,393,898
67	23S-32E-24	30-025-33521	SWD	5,925-6,042	2001	June 2016	2,038,651
68	23S-32E-29	30-025-31515	SWD	4,844-6,160	1992	July 2016	14,407,218
69	23S-32E-31	30-025-32868	SWD	5,150-5,700	1996	July 2016	4,763,020
70	23S-32E-36	30-025-31929	SWD	5,364-6,138	1995	June 2016	5,436,399

NOTE: Information collected from New Mexico Oil Conservation Division (OCD) offices in Artesia and Hobbs, New Mexico. Also, cumulative barrels information is collected from the Internet site maintained by the New Mexico Institute of Mining and Technology (NMIMT) on behalf of the New Mexico OCD.

Table 13: Brine Well Status in the Delaware Basin

County	Location	API#	Well Name and No.	Operator	Status
Eddy	22S-26E-36	30-015-21842	City Of Carlsbad #WS-1	Key Energy Services, LLC	Plugged Brine Well
Eddy	22S-27E-03	30-015-20331	Tracy #3	Ray Westall	Plugged Brine Well
Eddy	22S-27E-17	30-015-22574	Eugenie #WS-1	I & W Inc.	Plugged Brine Well
Eddy	22S-27E-17	30-015-23031	Eugenie #WS-2	I & W Inc.	Plugged Brine Well
Eddy	22S-27E-23	30-015-28083	Dunaway #1	Pyote Well Service, LLC	Active Brine Well
Eddy	22S-27E-23	30-015-28084	Dunaway #2	Pyote Well Service, LLC	Active Brine Well
Loving	Blk 29-03	42-301-10142	Lineberry Brine Station #1	Chance Properties Company	Active Brine Well
Loving	Blk 01-82	42-301-30680	Chapman Ford #BR1	Herricks & Son Co.	Plugged Brine Well
Loving	Blk 33-80	42-301-80318	Mentone Brine Station #1D	Basic Energy Services, LP	Active Brine Well
Loving	Blk 29-28	42-301-80319	East Mentone Brine Station #1	Permian Brine Sales, Inc.	Plugged Brine Well
Loving	Blk 01-83	42-301-80320	North Mentone Brine Station #1	Chance Properties Company	Active Brine Well
Reeves	Blk 56-30	42-389-00408	Orla Brine Station #1D	Mesquite SWD, Inc.	Active Brine Well
Reeves	Blk 04-08	42-389-20100	North Pecos Brine Station #WD-1	Chance Properties Company	Plugged Brine Well
Reeves	Blk 07-21	42-389-80476	Coyanosa Brine Station #1	Chance Properties Company	Active Brine Well
Ward	Blk 17-20	42-475-31742	Pyote Brine Station #WD-1	Chance Properties Company	Active Brine Well
Ward	Blk 01-13	42-475-34514	Quito West Unit #207	Seaboard Oil Co.	Active Brine Well
Ward	Blk 34-200	42-475-20329	Barstow Brine Station #1	Basic Energy Services, LP	Active Brine Well
Ward	Blk 34-174	42-475-82265	Barstow Brine Station #1	Energy Equity Company	Active Brine Well
Ward	Blk 34-214	42-475-36227	Brine #1	Mesquite SWD, Inc.	Active Brine Well