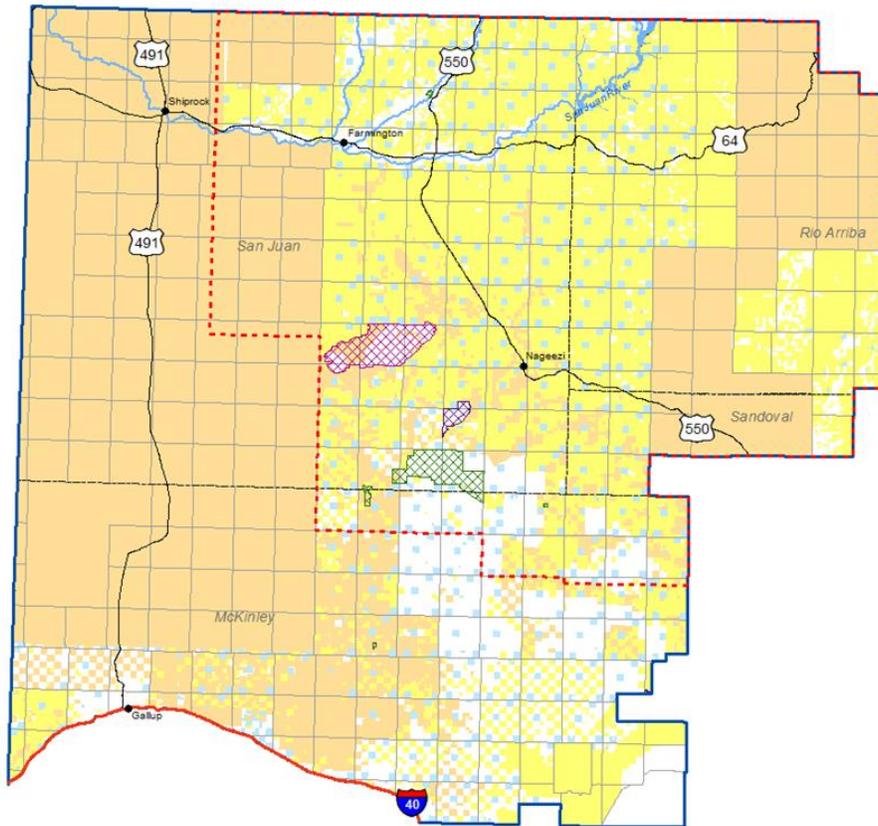


Reasonable Foreseeable Development Scenario for Oil and Gas Activities

Mancos-Gallup RMPA Planning Area, Farmington Field Office,
northwestern New Mexico



Farmington Field Office, northwestern New Mexico. Mancos-Gallup RMPA Planning Area marked by red dashed outline.

**Kelsey Crocker
and
James F. Glover**

**United States Department of the Interior
Bureau of Land Management**

Final Report

February 2018

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Introduction

The purpose of this reasonable foreseeable development (RFD) scenario is to analyze the known and potential oil and gas resources within a portion of the Farmington Field Office in northwestern New Mexico, and to project the potential future oil and gas development activity for the next 20 years (2018-2037) based on logical and technical assumptions. Historic and current activity, occurrence potential, projected development potential (including projections for vertical and horizontal wells drilled during the life of the plan), estimated future surface disturbance, estimated water use for hydraulic fracturing, and estimated oil and gas production volumes are presented. This RFD scenario has been prepared in support of the Farmington Field Office's Mancos-Gallup Resource Management Plan Amendment (RMPA). Previous RFD scenarios for portions of the field office were completed in 2001, 2014, and 2015.

The RMPA Planning Area is encompassed by the Farmington Field Office administrative boundary, and contains approximately 4.2 million total acres of all mineral ownership types in portions of San Juan, Rio Arriba, Sandoval, and McKinley Counties. Federal oil and gas minerals in the area cover 2.1 million acres (51%). Of the Federal minerals, 1.8 million acres (85%) are leased and 300,000 acres (15%) are currently unleased. Indian-owned oil and gas minerals (allotted and tribal) cover 1.4 million acres (34% of the Planning Area). Portions of oil and gas minerals are State-owned or owned privately and are not subject to the RMPA. Specially-designated areas that are unavailable for leasing are shown in hatched shading on **Figure 1**.

Under the RMPA, the Federal oil and gas minerals managed by the BLM that could potentially be available for leasing total 2 million acres—approximately 47% of the planning area and 92% of Federal fluid minerals within the planning area. All BLM-managed oil and gas minerals within the RMPA Planning Area boundary are covered by decisions made in the BLM Farmington Field Office Mancos-Gallup RMPA. All acreages presented herein are based on geographic information systems (GIS) calculations and should be considered approximate.

Guidance and Data Sources

The BLM derives guidance for RFD scenarios from the “Interagency Reference Guide: Reasonable Foreseeable Development Scenarios and Cumulative Effects Analysis, 2004” developed by the Rocky Mountain Leadership Forum, a consortium of Federal natural resource management agencies. This document defines the RFD scenario as a reasonable projection of the most likely anticipated oil and gas activity supported by a clearly stated set of assumptions. This projection establishes a baseline scenario that is unconstrained by management imposed conditions and is based on historical and geological parameters. This baseline RFD scenario can then be used to compare the resource management plan with its alternatives and to analyze the

long-term effects that could result from oil and gas activities. It must be emphasized that the RFD scenario is not a decision document and does not establish limitations on development.

Information presented in this report was compiled from various sources. Historical and current well data (including production volumes) were provided by IHS Energy. Land and mineral ownership data as well as most other GIS data were provided by the BLM New Mexico State Office and the Farmington Field Office. Geological data were sourced from New Mexico Bureau of Geology and Mineral Resources reports, U.S. Geological Survey Oil and Gas Assessments, and various professional publications. Hydraulic fracturing fluid volumes were sourced from reports published by the New Mexico Bureau of Geology and Mineral Resources and by the U.S. Environmental Protection Agency. Information regarding price trends was taken from the Energy Information Administration. All data sources are cited appropriately throughout the text.

Assumptions and Findings

For this RFD scenario, we assume that, unless significant new oil and gas discoveries are made in the area, future activity will be primarily horizontal drilling for oil in the Mancos-Gallup play, with minor development targeted at natural gas production. We also assume that oil and natural gas prices will follow Energy Information Administration projections (Annual Energy Outlook, 2017).

Within the RMPA Planning Area, the RFD baseline scenario projects 3,200 new oil and gas wells (2,300 horizontal and 900 vertical or directional) for period 2018-2037. As of 2017, existing wells in the planning area were associated with 56,500 acres of surface disturbance. Over the life of the plan, the maximum potential disturbance (including existing and projected disturbance) is 75,000 acres. Accounting for reclamation, we expect for 43,000 acres of surface disturbance to remain at the end of the plan in 2037. Hydraulic fracturing of the projected wells will require an estimated 60 million barrels (2.5 billion gallons) of water. Over the life of the plan, the existing and projected wells will produce an estimated 279,561,000 barrels of oil, 5,083,680,000 thousand cubic feet (Mcf) of gas, and 187,223,000 barrels of water.

Historical Activity

A total of 37,307 wells have been drilled within the RMPA Planning Area through August 2017 (IHS Energy Group, 2017). The total figure includes 24,825 gas wells (67%), 2,249 oil wells (6%), 208 injection wells (0.5%), and 9,638 abandoned wells (26%). The remaining 387 wells (1%) consist of 3 carbon dioxide wells, 51 salt water disposal wells, 63 wells in pre-productive statuses (start, at total depth, and treated), and 270 wells in non-productive statuses (pilot, service, observation, suspended, and temporarily abandoned).

Annual drilling activity in the planning area is shown in **Figure 2**. Historically, the San Juan Basin has been dominated by vertical drilling for natural gas. Drilling for coalbed gas in the central basin took off in the late 1980s; the sharp spike in drilling in 1990, in which 1,248 wells were drilled, is from coalbed development. Horizontal drilling in the planning area has occurred sporadically since 1980, but began to increase sharply as a share of overall drilling in the mid-2000s. **Figure 3** shows the locations of all horizontal wells drilled within the Farmington Field Office.

Recent Drilling Activity

Figure 4 shows the locations of oil and gas wells drilled in the past ten years (2008-2017) within the Farmington Field Office. A total of 2,336 wells were drilled within the RMPA Planning Area boundary. The total figure includes 1,799 gas wells (77%), 293 oil wells (13%), 3 injection wells (0.1%), and 93 abandoned wells (4%). The remaining 148 wells (6%) consist of 2 carbon dioxide wells, 13 salt water disposal wells, 63 wells in pre-productive statuses (start, at total depth, and treated), and 70 wells in non-productive statuses (pilot, service, observation, suspended, and temporarily abandoned).

Horizontal drilling first accounted for greater than 10% of total drilling in the planning area in 2010. In 2014, drilling for oil (118 wells) surpassed drilling for gas (43 wells) for the first time. Horizontal drilling peaked in 2014, with 120 horizontal wells drilled (of which 102 were for oil). In 2017, horizontal drilling made up 77% of total development.

Oil and Gas Production

Supplemental Table A shows historical oil, natural gas, and water production for the RMPA Planning Area since 1973 (IHS Energy Group, 2018). Gas production increased sharply from 1991 to 1999, peaking at 1.1 billion Mcf in 1999. Gas production remained high through approximately 2007 and has declined through year-end 2017. Oil production gradually declined from 7,817,998 barrels in 1986 to 2,195,314 barrels in 2012 before rising sharply from 2012 to 2015, peaking at 8,457,418 barrels in 2015. Data are shown through year-end 2017.

Oil and Gas Prices

Historical and projected annual natural gas and oil prices are shown in **Figure 5**. Natural gas prices peaked at \$8.86/Mcf in 2008 and oil prices peaked at \$99.67/barrel in 2008. Drilling activity in the planning area (**Figure 2**) does not appear to correlate with the rise and fall of market prices. It is reasonable to assume that areas left undeveloped during the period of elevated prices (2000-2010) are unlikely to be developed unless either market prices meet or exceed those levels in the future, or technological advances result in significantly lower drilling and completion costs. For purposes of this RFD scenario, we assume natural gas and oil prices during the 2018-2037 planning period will align with the Energy Information Administration 2017 projections.

Pipelines and Facilities

Figure 6 shows the existing pipelines and facilities by owner within the Farmington Field Office administrative boundary (IHS Energy Group, 2017). The U.S. Energy Information Administration defines intrastate pipelines as pipelines that operate totally within state borders and link producers to local markets or to the interstate pipeline network. Conversely, interstate pipelines cross one or more state borders, connecting regional networks.

San Juan, McKinley, and Sandoval Counties have both intrastate and interstate oil pipelines. Intrastate and interstate gas pipelines exist in San Juan, McKinley, Sandoval, and Rio Arriba Counties. In San Juan County, the Bloomfield Terminal acts as a storage and shipping location for crude oil and petroleum products (New Mexico Oil Conservation Division, 2017). Western Refining operates an oil refinery in Gallup, New Mexico. The company also owns a natural gas liquids fractionation plant in Wingate, New Mexico, but the plant has been idle since 2014. Natural gas liquids pipelines connect the Gallup and Wingate plants in McKinley County, and also exist in San Juan, Rio Arriba, and Sandoval Counties. In producing gas fields, gas compressors are a necessary part of the infrastructure to move natural gas to market. The BLM anticipates no additional gas compressors in producing fields since the current infrastructure is expected to handle present and future gas demand. Unless the gas market performs significantly better than projected, no new major gas pipelines or facilities are expected to be needed in the planning area. Additional intrastate or interstate oil pipelines may be needed to move the projected oil volumes.

Occurrence Potential

Producing Formations

Oil and gas occur in numerous formations within the RMPA Planning Area, ranging in time from the Middle Jurassic to the Eocene. A chronostratigraphic chart for the San Juan Basin showing producing formations is presented in **Figure 7**. The chart is modified from the U.S. Geological Survey's assessment of the San Juan Basin from 2013. Formations that are predominantly oil-producing are shown in green, predominantly gas-producing in red, and formations that have produced both oil and gas are shown in purple (IHS Energy Group, 2017). Oil-producing intervals include the Jurassic San Rafael Group, including the Entrada Sandstone; and the Cretaceous Gallup Sandstone and Tociito Sandstone "lentils" within the Mancos Shale. Gas is found in the Jurassic Burro Canyon Formation; the Cretaceous Mesaverde Group, Lewis Shale, Pictured Cliffs Sandstone, and Fruitland Formation; and the Tertiary Ojo Alamo Sandstone, Nacimiento Formation, Animas Formation, and San Jose Formation. Formations that are known to produce both oil and gas include the Jurassic Morrison Formation, including the Brushy Basin Member; the Cretaceous Dakota Sandstone, and members of the Mancos Shale including the Graneros, Greenhorn Limestone, Juana Lopez, and El Vado Sandstone.

For more detail on the hydrocarbon potential and geological setting of the San Juan Basin, please refer to the geological discussions in Molenaar, 1987; USGS, 2013; and Broadhead, 2015. For a comprehensive geologic history of the region, we suggest *Geology of the American Southwest* (Baldrige, 2004).

Occurrence Potential—General

For the purposes of this document, “occurrence potential” is defined as “the geologic likelihood for oil and gas accumulations to exist in a given area,” and does not account for economic factors or historical development trends. (See the “Projections of Future Activity” section of this document for analysis that incorporates these factors.)

We consider the RMPA Planning Area to have very high potential for the occurrence of oil and gas overall (**Figure 8**) and medium to very high potential for oil and gas that is likely to be developed by horizontal drilling (**Figure 9**). The USGS has defined multiple assessment units with oil and gas potential that encompass the planning area (San Juan Basin Assessment, 2013).

The BLM has established criteria for rating the oil and gas occurrence potential of lands studied for planning area documents. This rating system is based on guidance outlined in the Bureau of Land Management Handbook H-1624-1. The USGS assessment units within the Planning Area were classified using a number of geologic characteristics that qualify them as having high occurrence potential:

- presence of hydrocarbon source rocks
- presence of reservoir rocks with adequate porosity/permeability
- potential for structural/stratigraphic traps to exist
- opportunity for migration from source to trap, and
- favorable temperature, depth of burial, and subsurface pressure conditions.

Table 2. Rating system for hydrocarbon occurrence potential.

Occurrence Potential	Explanation
Very High	Within two or more overlapping USGS Assessment Units
High	Within one USGS Assessment Unit
Medium	Outside of USGS Assessment Units, but conditions for hydrocarbon accumulation may exist
None	Intrusive igneous rocks outcrop at surface. Conditions for hydrocarbon accumulation do not exist

Occurrence Potential—For Horizontally-Developed Plays

As discussed in the “Historical Activity” section of this document, horizontal drilling has increased as a fraction of total drilling since the mid-2000s, and we project the trend to continue over the life of the plan. As such, we have generated a map (**Figure 9**) that focuses on oil and

gas plays that are likely to be developed horizontally based on past drilling activity. Please note that the criteria used to generate this map (described in **Table 3**, below) are different from the criteria used to generate the general occurrence potential map (**Table 2** for criteria, **Figure 8** for map).

USGS plays were identified as having major or moderate existing horizontal development using the “Play Name” attribute in well data from IHS (IHS Energy, 2017). The plays with major existing horizontal development (more than 50 wells) were the Mancos, the Fruitland, and the Pictured Cliffs. The plays with moderate existing horizontal development (five to twenty wells) were the Dakota, the Lewis, the Mesaverde, and Point Lookout. Plays with fewer than five existing horizontal wells were not considered likely candidates for future horizontal development.

Table 3. Rating system for occurrence potential for horizontally-developed plays.

Occurrence Potential for Horizontal Development	Explanation
Very High	Within two or more major horizontal plays
High	Within one major horizontal play
Medium	Within no major horizontal plays, but within one or more moderate horizontal plays
Low	Outside of major and moderate horizontal plays
None	Intrusive igneous rocks outcrop at surface. Conditions for hydrocarbon accumulation do not exist

Projections of Future Activity

Development Potential

Figure 10 shows the development potential (location and intensity of projected development) for the RMPA Planning Area. This information is also summarized in **Table 4**, below.

Table 4. Development potential summary for the RMPA Planning Area.

Development Potential	Acres in Planning Area	Wells per Township	Type of Development
Negligible	249,400	< 1	Likely vertical
Low	1,810,000	4-8	Likely vertical
Medium	1,635,000	6-9	Likely horizontal
High	273,000	10+	Likely horizontal

Historic drilling trends, geologic assessments, and recent indications of interest from industry were incorporated to determine where future development activities would likely occur. Indications of interest from industry include locations for applications for permit to drill (APDs), expressions of interest for leasing (EOIs), and proposed and recently-approved unitization agreements.

Development projections were only made for those lands within the Mancos-Gallup RMPA Planning Area that could potentially be available for leasing. This baseline scenario assumes all potentially productive areas within the planning area can be open under standard lease terms and conditions, except those areas designated as closed to leasing by law, regulation, or executive order.

Future Drilling

For the baseline development scenario, we estimate that during the 2018-2037 planning period, 2,300 horizontal wells and 900 vertical wells may be drilled in the RMPA Planning Area. The majority of horizontal drilling is expected to occur in the area of high development potential near Nageezi and is expected to target the Mancos-Gallup play. Development in the area of medium development potential to the south and west of the high potential area is also expected to target the Mancos-Gallup. The medium development potential area in the north central part of the planning area is anticipated to have more varied target formations; recent horizontal development has targeted the Fruitland, Mancos, and Pictured Cliffs, while recent vertical development has targeted the Dakota, Fruitland, Mancos, Morrison, Pictured Cliffs, and Point Lookout. The low development potential area has had fewer than 50 wells spudded per year since 2009 (compared to over 250 wells per year from 1979 to 1981), and recent development has been largely vertical drilling targeting the Dakota, Fruitland, Mancos, and Mesaverde. In the negligible development potential area, a total of four wells (all vertical) have been drilled since 2008. For the low and minimal development potential areas, we anticipate the trends of low overall levels of development to continue throughout the planning period.

Estimated Future Oil and Gas Production

Supplemental Table B represents our baseline estimates for cumulative annual production volumes for oil and gas within the RMPA Planning Area for period 2018-2037. We estimated the future yearly oil and gas production values by generating decline curves for vertical and horizontal wells from historical production data in the planning area and then convolving those production curves with the forecasted well counts. These estimates include both production from existing wells and production from predicted wells. Over the 20-year period, we predict a total of 279,561,000 barrels of oil; 5,083,680,000 thousand cubic feet of gas; and 187,223,000 barrels of water to be produced.

Estimated Surface Disturbance

Table 5 (next page) presents our estimates of surface disturbance associated with the baseline projections for the period 2018-2037. In 2017, there were approximately 56,500 acres of existing disturbance associated with oil and gas development. For period 2018-2037, we estimate an additional 18,500 acres of disturbance, which includes both new wells and new disturbance on existing well pads, for a maximum potential disturbance of 75,000 acres.

Accounting for interim and final reclamation, we expect 43,000 acres of surface disturbance to remain at the end of the plan.

Table 5. Summary of estimated surface disturbance, 2018-2037.

Surface Disturbance Category	Acres
Existing Disturbance, 2017	56,500
New Disturbance, 2018 to 2037	18,500
Maximum Potential Disturbance (New + Existing)	75,000
Interim and Final Reclamation, 2018 to 2037	32,000
Disturbance Remaining at End of Plan (Maximum - Reclamation)	43,000

For more details on estimating existing and additional surface disturbance, please refer to **Supplemental Table C** and **Supplemental Table D**. Acreage estimates for roads, flow lines, and well pads come from Farmington Field Office staff (Sarah Scott, personal communication, 2018).

Estimated Water Use for Hydraulic Fracturing

Within the RMPA Planning Area, we estimate that hydraulically fracturing the wells projected for period 2018-2037 will require 2.5 billion gallons (7,683 acre-feet) of water over the 20-year period.

These estimates assume that 100% of wells will be hydraulically fractured, and do not account for re-use or recycling of hydraulic fracturing fluid. Fracturing fewer wells and/or re-using or recycling hydraulic fracturing fluid would reduce these volumes.

Statistics for water volumes used for hydraulic fracturing in the San Juan Basin come from the New Mexico Bureau of Geology and Mineral Resources’ hydrologic assessment of oil and gas development in the San Juan Basin (Kelley, 2014) and from the U.S. Environmental Protection Agency’s assessment of impacts from hydraulic fracturing on drinking water resources (U.S. Environmental Protection Agency, 2016). Mean water volumes for vertical and directional wells in the San Juan Basin vary by formation and range from 105,000 gallons per well (Dakota formation; Kelley, 2014) to 207,000 gallons per well (Gallup formation; Kelley, 2014). EPA data and other formations discussed in the Kelley assessment fall within this range. The mean water volume for fracturing horizontal wells in the San Juan Basin was 1,020,000 gallons per well (not differentiated by formation; Kelley, 2014). This figure does not control for the length of the fractured interval and could increase as longer laterals are drilled.

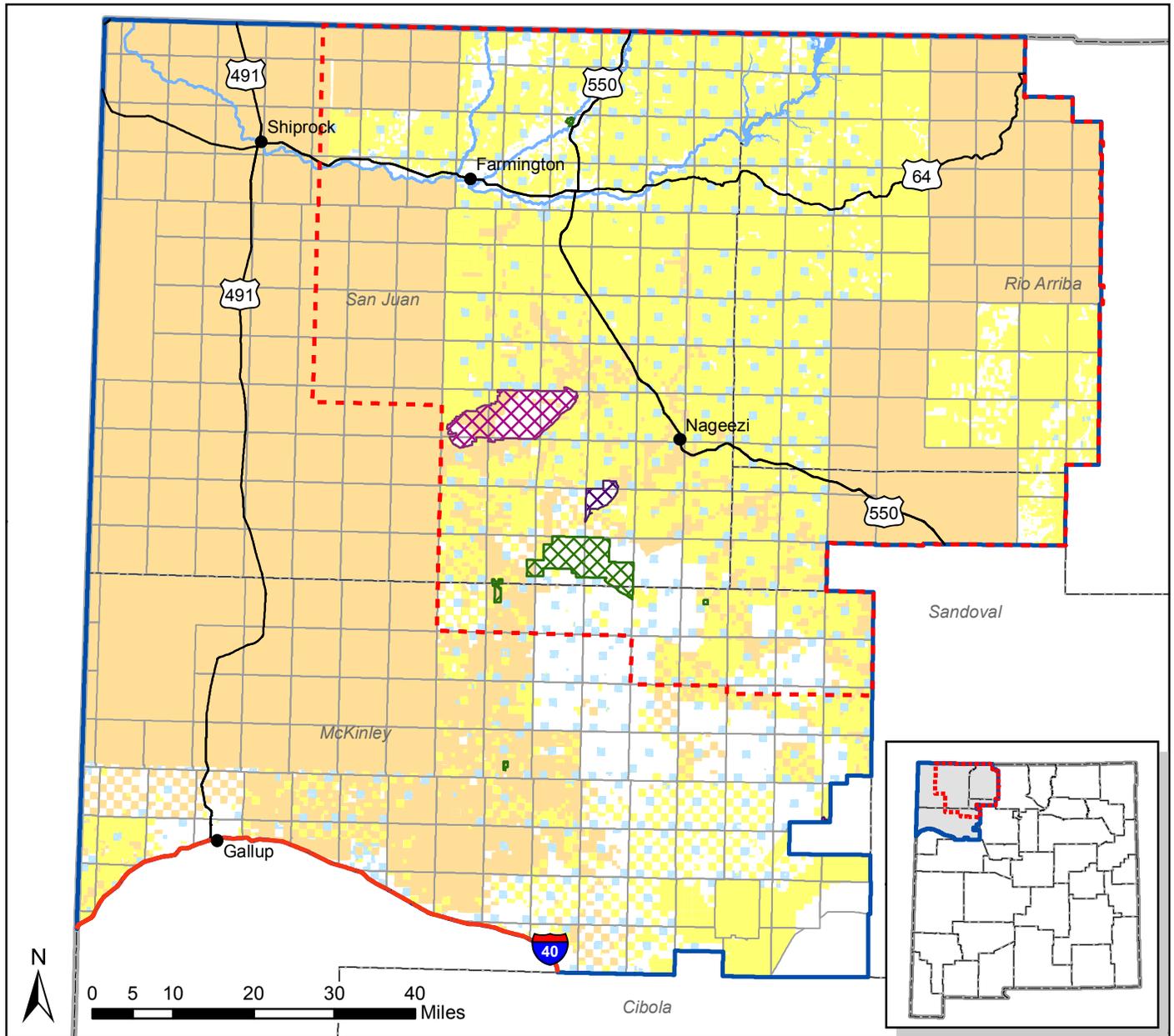
Summary

We examined the available information on the Mancos-Gallup Resource Management Plan Amendment Planning Area within the Farmington Field Office administrative boundary (geologic reports, recent drilling data, indications of industry interest, and professional knowledge of the area) and used that data to prepare a map that indicates areas of potential oil and gas development for 2018-2037 (**Figure 10**). We also estimated the number of wells that could be drilled during this period, as well as the disturbance associated with projected and existing wells over the life of the plan. We estimated that 3,200 wells (2,300 horizontal and 900 vertical) may be reasonably assumed to be drilled. Within the planning area, the maximum potential surface disturbance over the life of the plan is 75,000 acres, and we project 43,000 acres of disturbance to remain by 2037.

Figure 1. Oil and Gas Minerals within the Farmington Field Office Administrative Boundary

Kelsey Crocker, GIS Specialist
 James Glover, Geologist
 Farmington Field Office RMPA
 February 2018

Oil and gas mineral ownership and status (available or unavailable for leasing).



Explanation

- RMPA Planning Area
- FFO Administrative Boundary
- BLM-Managed Oil and Gas Minerals Potentially Open to Leasing
- Indian Minerals (Allotted and Tribal)
- State Minerals

Unavailable for Fluid Leasing

- National Park Service Boundaries
- Wilderness Areas
- Wilderness Study Areas

NAD 1983 Albers
 False Easting: 0.0
 False Northing: 0.0
 Central Meridian: -106.0
 Standard Parallel 1: 33.0
 Standard Parallel 2: 36.0
 Latitude of Origin: 34.5
 Linear Unit: Meter

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. This information was developed through digital means and may be updated without notice.



RFD Scenario for Oil and Gas Activities—Farmington Field Office RMPA, New Mexico

Figure 2. Wells drilled within the RMPA Planning Area, 1973-2017 (IHS Energy Group, 2017).

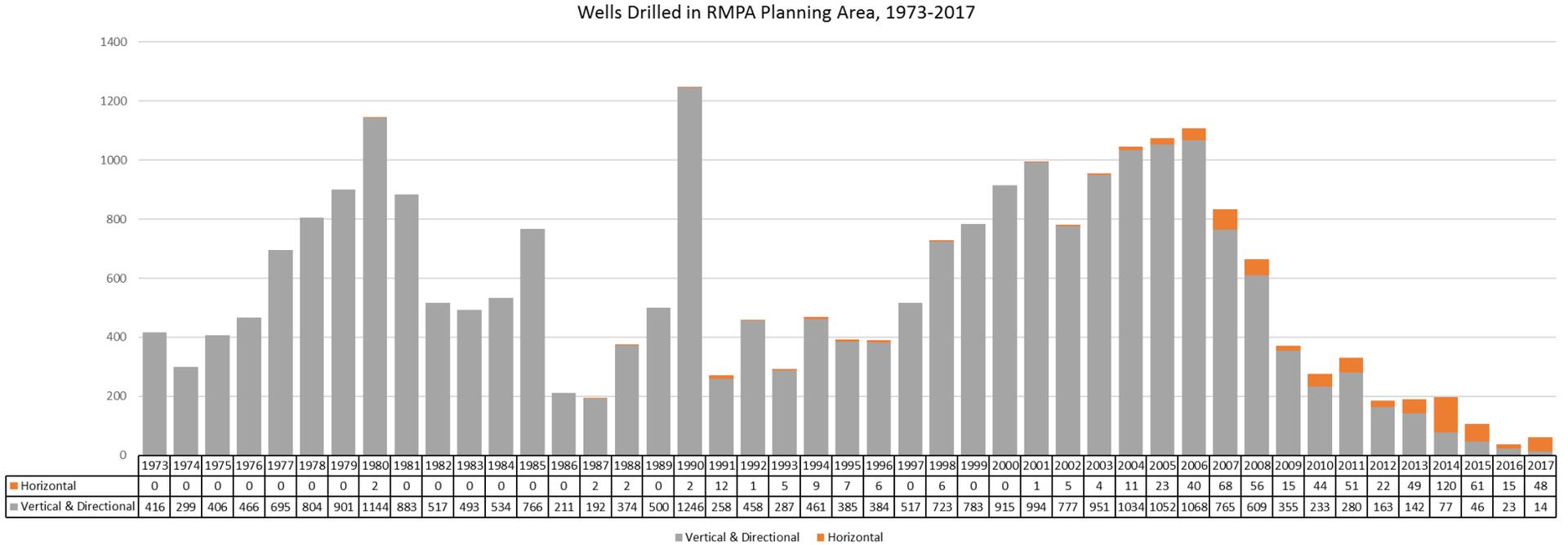
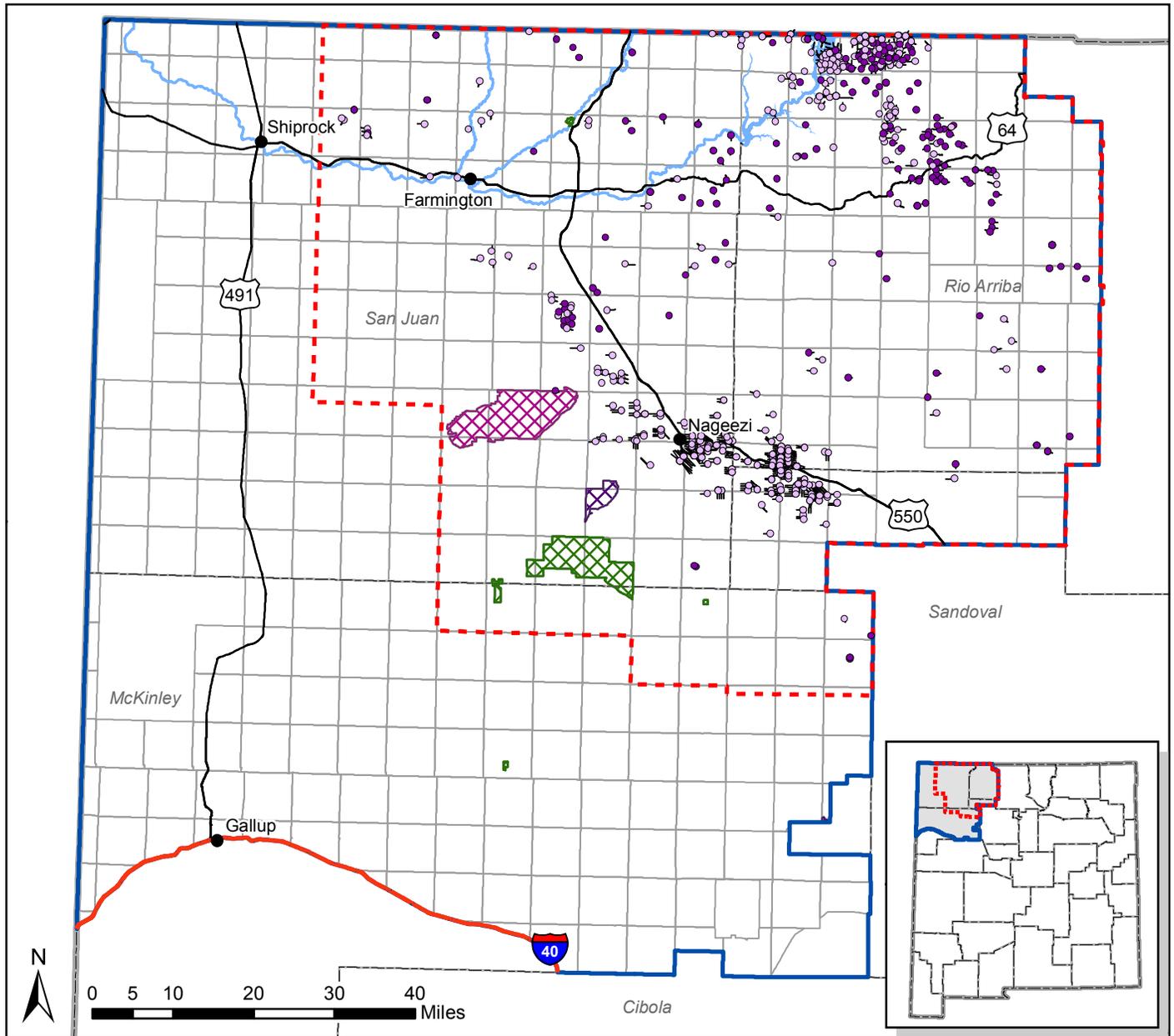


Figure 3. All Horizontal Wells within the Farmington Field Office Administrative Boundary

Kelsey Crocker, GIS Specialist
 James Glover, Geologist
 Farmington Field Office RMPA
 February 2018

All horizontal wells (first horizontal well drilled in 1980)



Horizontal Wells 1980 - 2017

- Wells Drilled 1980 - 2007
- Wells Drilled 2008 - 2017
- Well Bores

- RMPA Planning Area
- FFO Administrative Boundary
- National Park Service Boundaries
- Wilderness Areas
- Wilderness Study Areas

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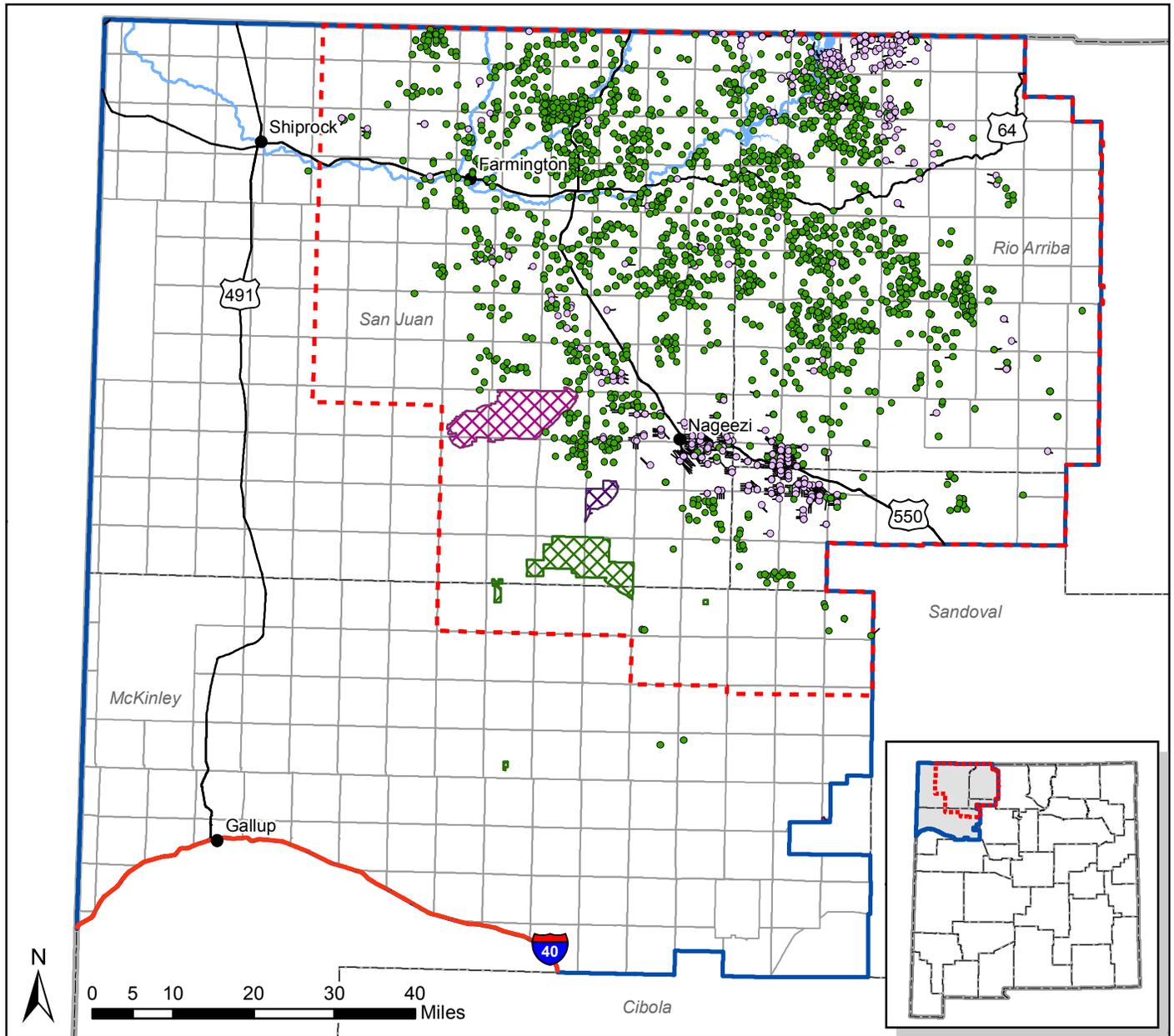
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Figure 4. Recent Oil and Gas Wells within the Farmington Field Office Administrative Boundary

Kelsey Crocker, GIS Specialist
 James Glover, Geologist
 Farmington Field Office RMPA
 February 2018

All wells drilled between 2008 and 2017



Wells Drilled Since 2008

- Vertical and Directional Wells
- Horizontal Wells
- Well Bores

- ⋮ RMPA Planning Area
- FFO Administrative Boundary
- ▨ National Park Service Boundaries
- ▨ Wilderness Areas
- ▨ Wilderness Study Areas

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Figure 5. Historical and projected U.S. natural gas and oil prices, 1970-2040 (Energy Information Administration, 2017).

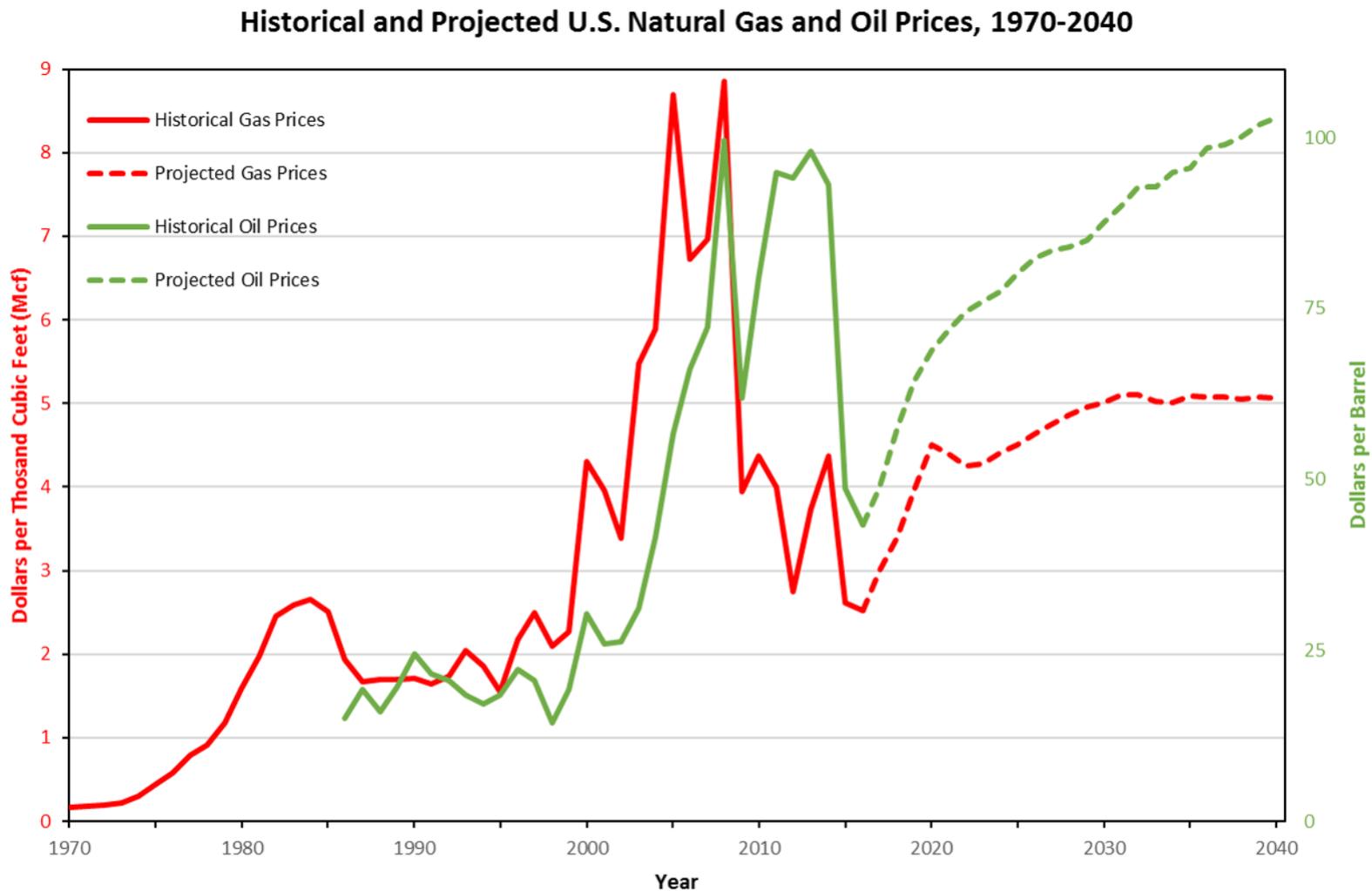
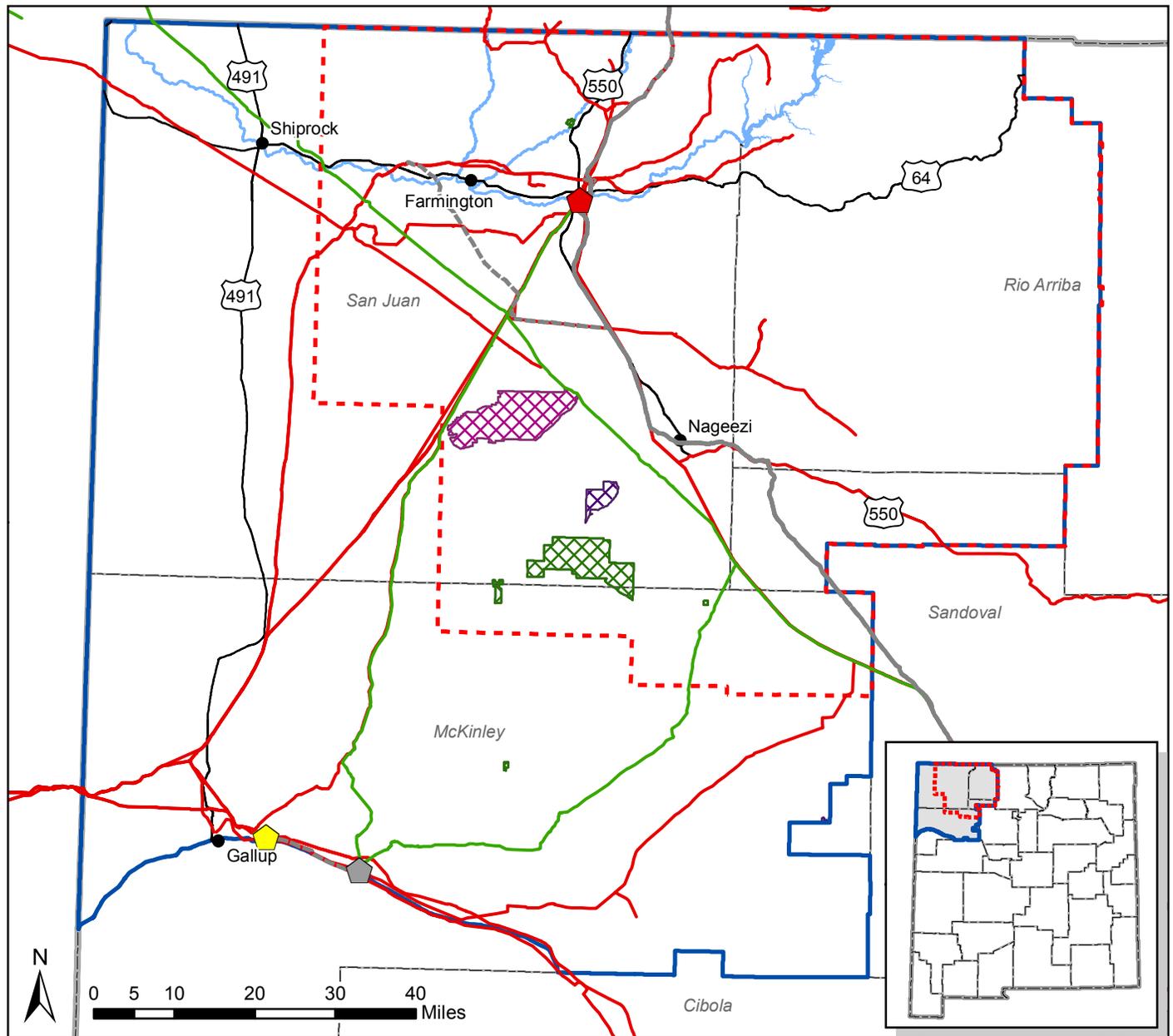


Figure 6. Pipelines and Facilities within the Farmington Field Office Administrative Boundary

Kelsey Crocker, GIS Specialist
 James Glover, Geologist
 Farmington Field Office RMPA
 February 2018



Pipelines and Facilities

- Oil Pipelines
- Gas Pipelines
- Natural Gas Liquids Pipelines
- ◆ Bloomfield Terminal
- ◆ Gallup Refinery
- ◆ Wingate Fractionation Plant (idled 2014)

- RMPA Planning Area
- FFO Administrative Boundary
- National Park Service Boundaries
- Wilderness Areas
- Wilderness Study Areas

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RFD Scenario for Oil and Gas Activities—Farmington Field Office RMPA, New Mexico

Figure 7. Chart showing regional chronostratigraphic correlations in the San Juan Basin with formations that are predominantly oil-producing, gas-producing, or mixed oil/gas-producing formations. This chart is modified from the U.S. Geological Survey’s assessment of the San Juan Basin (U.S. Geological Survey San Juan Basin Assessment Team, 2013). Vertical lines are unconformities. Production information is from IHS Energy Group, 2017.

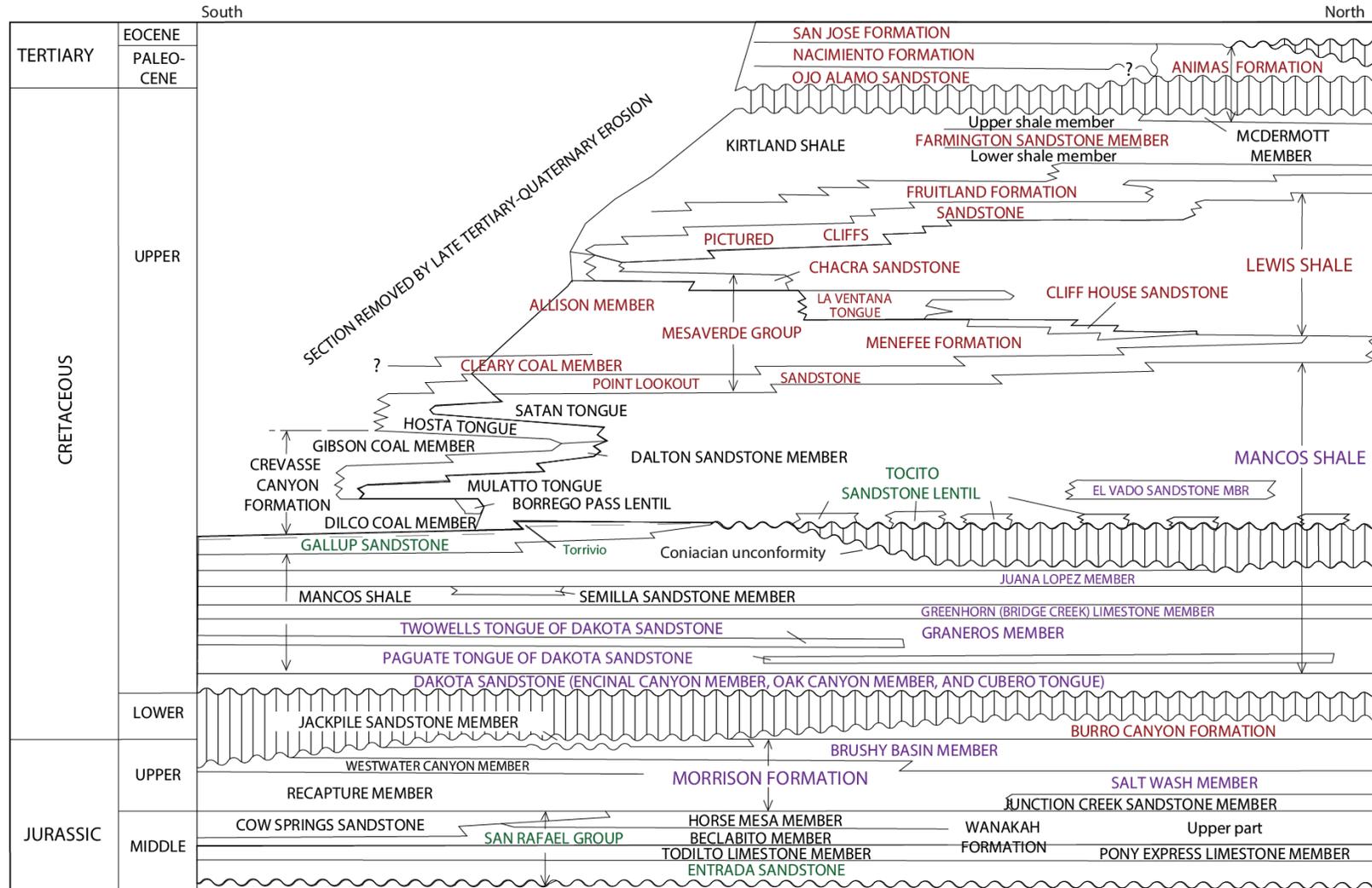
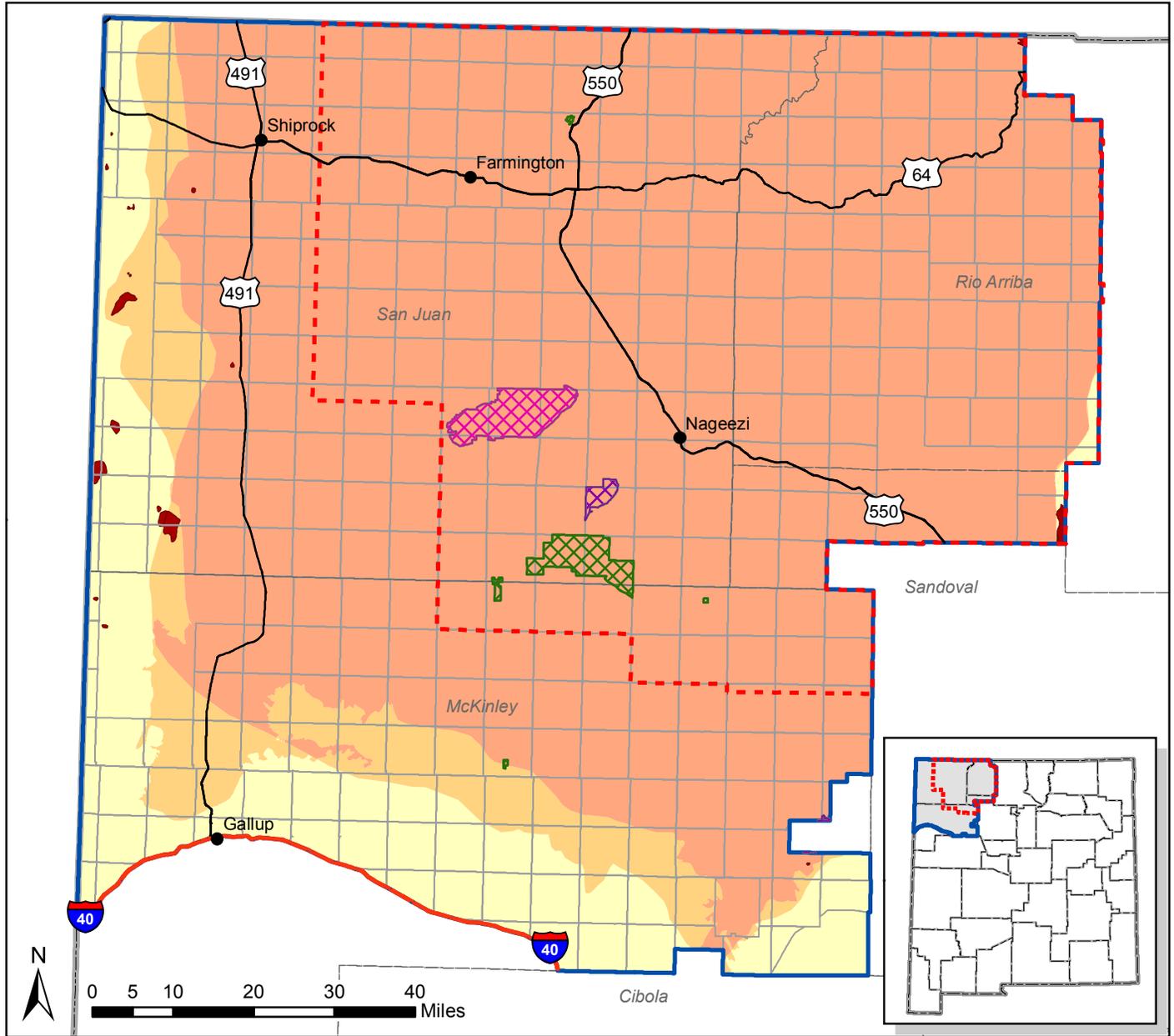


Figure 8. Oil and Gas Occurrence Potential within the Farmington Field Office Administrative Boundary

Kelsey Crocker, GIS Specialist
 James Glover, Geologist
 Farmington Field Office RMPA
 February 2018

All plays combined



Occurrence Potential

- None - crystalline rock
- Medium
- High
- Very High

- RMPA Planning Area
- FFO Administrative Boundary
- National Park Service Boundaries
- Wilderness Areas
- Wilderness Study Areas

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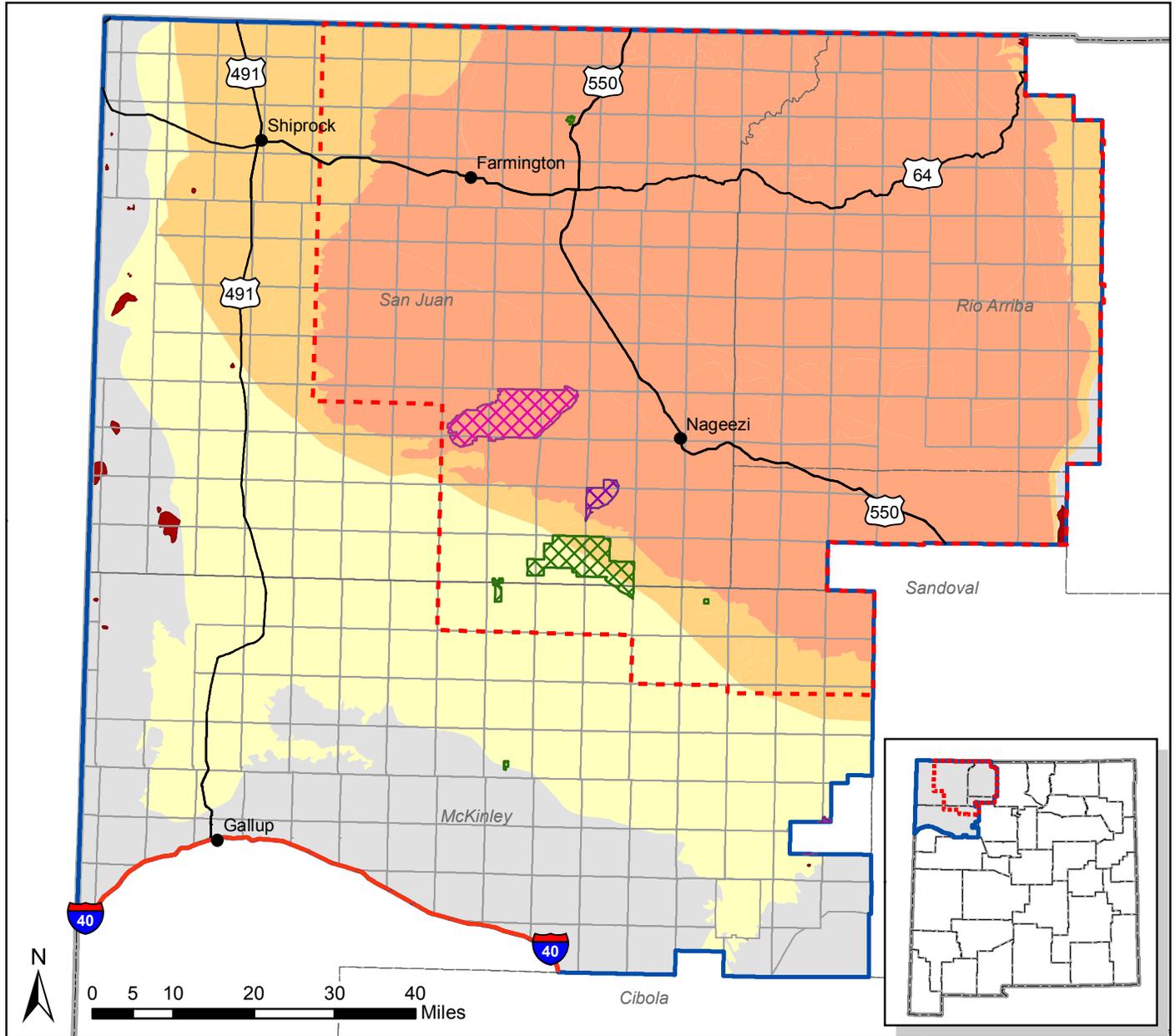
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. This information was developed through digital means and may be updated without notice.



Figure 9. Oil and Gas Occurrence Potential within the Farmington Field Office Administrative Boundary

Kelsey Crocker, GIS Specialist
 James Glover, Geologist
 Farmington Field Office RMPA
 February 2018

For horizontally-developed plays



Occurrence Potential for Horizontal Development

- None - crystalline rock
- Low
- Medium
- High
- Very High

- RMPA Planning Area
- FFO Administrative Boundary
- National Park Service Boundaries
- Wilderness Areas
- Wilderness Study Areas

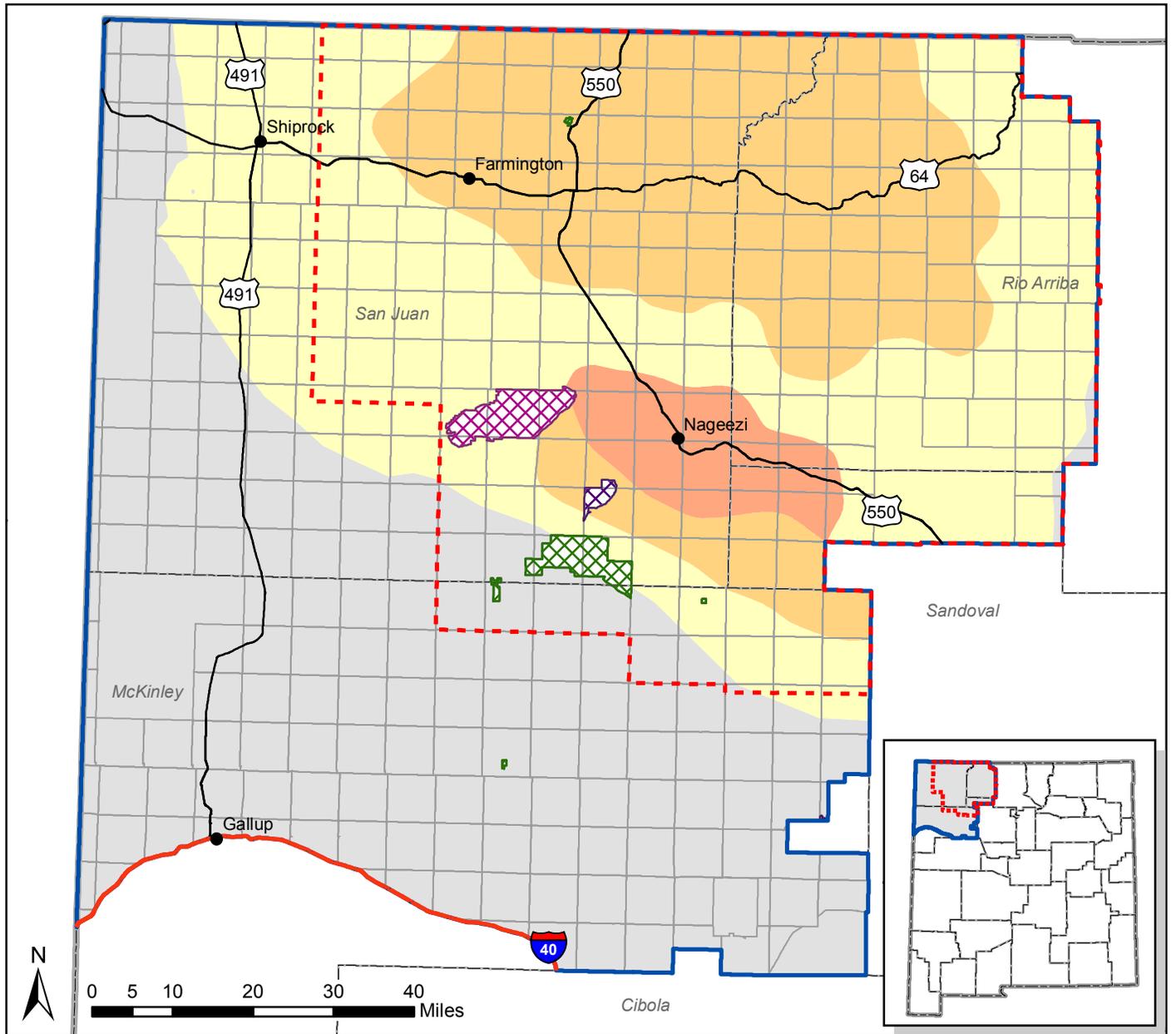
NAD 1983 Albers
 False Easting: 0.0
 False Northing: 0.0
 Central Meridian: -106.0
 Standard Parallel 1: 33.0
 Standard Parallel 2: 36.0
 Latitude of Origin: 34.5
 Linear Unit: Meter

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. This information was developed through digital means and may be updated without notice.



Figure 10. Oil and Gas Development Potential within the Farmington Field Office Administrative Boundary, 2018-2037

Kelsey Crocker, GIS Specialist
 James Glover, Geologist
 Farmington Field Office RMPA
 February 2018



Development Potential

- Negligible (<1 well per township, likely vertical)
- Low (4-8 wells per township, likely vertical)
- Medium (6-9 wells per township, likely horizontal)
- High (10+ wells per township, likely horizontal)

- RMPA Planning Area
- FFO Admin. Boundary
- National Park Service Boundaries
- Wilderness Areas
- Wilderness Study Areas

NAD 1983 Albers
 False Easting: 0.0
 False Northing: 0.0
 Central Meridian: -106.0
 Standard Parallel 1: 33.0
 Standard Parallel 2: 36.0
 Latitude of Origin: 34.5
 Linear Unit: Meter

Areas closed to leasing by statute are not analyzed for development potential.

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data was compiled from various sources. This information was developed through digital means and may be updated without notice.



Supplemental Tables

Supplemental Table A. Historical oil, gas, and water production from the Mancos-Gallup RMPA Planning Area, 1973-2017. Cumulative volumes are from 1973 forward.

Year	Oil (bbl)		Gas (Mcf)		Water (bbl)	
	ANNUAL	CUM	ANNUAL	CUM	ANNUAL	CUM
1973	5,716,800	5,716,800	531,287,668	531,287,668	10,324,391	10,324,391
1974	5,236,789	10,953,589	525,904,604	1,057,192,272	14,769,943	25,094,334
1975	4,495,723	15,449,312	497,517,602	1,554,709,874	13,721,771	38,816,105
1976	4,582,245	20,031,557	509,967,363	2,064,677,237	15,896,985	54,713,090
1977	4,787,130	24,818,687	516,087,877	2,580,765,114	19,962,508	74,675,598
1978	5,073,495	29,892,182	526,237,398	3,107,002,512	27,213,876	101,889,474
1979	5,349,084	35,241,266	550,930,908	3,657,933,420	31,253,586	133,143,060
1980	5,374,917	40,616,183	553,419,713	4,211,353,133	33,303,987	166,447,047
1981	6,213,383	46,829,566	544,379,563	4,755,732,696	37,299,198	203,746,245
1982	5,771,394	52,600,960	450,286,390	5,206,019,086	36,995,593	240,741,838
1983	5,885,364	58,486,324	384,564,540	5,590,583,626	35,651,214	276,393,052
1984	6,836,401	65,322,725	424,727,288	6,015,310,914	35,575,650	311,968,702
1985	7,420,594	72,743,319	419,577,756	6,434,888,670	46,674,111	358,642,813
1986	7,817,998	80,561,317	303,053,821	6,737,942,491	27,666,349	386,309,162
1987	7,357,362	87,918,679	381,101,246	7,119,043,737	26,210,387	412,519,549
1988	6,524,802	94,443,481	359,787,979	7,478,831,716	25,476,580	437,996,129
1989	6,239,870	100,683,351	413,222,483	7,892,054,199	29,826,262	467,822,391
1990	5,221,494	105,904,845	498,102,640	8,390,156,839	41,334,768	509,157,159
1991	4,468,025	110,372,870	543,249,967	8,933,406,806	39,788,923	548,946,082
1992	4,758,817	115,131,687	747,970,801	9,681,377,607	32,959,423	581,905,505
1993	4,480,318	119,612,005	897,879,103	10,579,256,710	31,528,469	613,433,974
1994	4,149,299	123,761,304	950,964,342	11,530,221,052	22,790,154	636,224,128
1995	3,863,079	127,624,383	991,282,475	12,521,503,527	27,406,814	663,630,942
1996	3,737,614	131,361,997	1,032,946,096	13,554,449,623	29,106,512	692,737,454
1997	3,527,475	134,889,472	1,048,412,673	14,602,862,296	30,500,370	723,237,824
1998	3,123,784	138,013,256	1,073,319,014	15,676,181,310	27,238,632	750,476,456
1999	3,020,326	141,033,582	1,107,058,650	16,783,239,960	20,817,132	771,293,588
2000	2,990,259	144,023,841	1,080,591,791	17,863,831,751	22,184,310	793,477,898
2001	2,811,017	146,834,858	1,023,338,343	18,887,170,094	22,624,225	816,102,123
2002	2,676,747	149,511,605	968,929,539	19,856,099,633	21,470,799	837,572,922
2003	2,561,962	152,073,567	946,806,293	20,802,905,926	24,019,135	861,592,057
2004	2,409,369	154,482,936	964,134,462	21,767,040,388	25,020,444	886,612,501
2005	2,378,542	156,861,478	958,487,109	22,725,527,497	25,861,523	912,474,024
2006	2,363,695	159,225,173	963,917,906	23,689,445,403	28,167,260	940,641,284

(continued on next page)

RFD Scenario for Oil and Gas Activities—Farmington Field Office RMPA, New Mexico

Supplemental Table A, continued. Historical oil, gas, and water production from the Mancos-Gallup RMPA Planning Area, 1973-2017 (IHS Energy Group, 2018). Cumulative volumes are from 1973 forward.

Year	Oil (bbl)		Gas (Mcf)		Water (bbl)	
	ANNUAL	CUM	ANNUAL	CUM	ANNUAL	CUM
2007	2,266,600	161,491,773	935,226,410	24,624,671,813	34,468,372	975,109,656
2008	2,284,345	163,776,118	896,186,332	25,520,858,145	35,425,669	1,010,535,325
2009	2,230,399	166,006,517	864,801,616	26,385,659,761	37,435,679	1,047,971,004
2010	2,015,139	168,021,656	804,541,980	27,190,201,741	39,083,011	1,087,054,015
2011	2,103,028	170,124,684	775,975,741	27,966,177,482	39,607,511	1,126,661,526
2012	2,195,314	172,319,998	741,575,511	28,707,752,993	39,920,867	1,166,582,393
2013	2,912,460	175,232,458	687,349,503	29,395,102,496	37,704,475	1,204,286,868
2014	5,754,767	180,987,225	664,211,261	30,059,313,757	42,362,511	1,246,649,379
2015	8,457,418	189,444,643	642,442,712	30,701,756,469	39,180,438	1,285,829,817
2016	6,888,791	196,333,434	596,747,304	31,298,503,773	33,757,377	1,319,587,194
2017	5,979,536	202,312,970	464,709,385	31,763,213,158	17,068,297	1,336,655,491

RFD Scenario for Oil and Gas Activities—Farmington Field Office RMPA, New Mexico

Supplemental Table B. Projected oil, natural gas, and water production from the Mancos-Gallup RMPA Planning Area, 2018-2037.

Year	Projected wells	Oil (bbl)		Gas (Mcf)		Water (bbl)	
		ANNUAL	CUM	ANNUAL	CUM	ANNUAL	CUM
2018	67	7,728,000	7,728,000	378,604,000	378,604,000	9,405,000	9,405,000
2019	76	8,405,000	16,133,000	313,271,000	691,875,000	5,744,000	15,149,000
2020	86	8,954,000	25,087,000	265,002,000	956,877,000	4,453,000	19,602,000
2021	96	9,528,000	34,615,000	231,152,000	1,188,029,000	4,164,000	23,766,000
2022	106	10,063,000	44,678,000	208,659,000	1,396,688,000	4,340,000	28,106,000
2023	116	10,583,000	55,261,000	197,789,000	1,594,477,000	4,919,000	33,025,000
2024	126	11,145,000	66,406,000	191,704,000	1,786,181,000	5,564,000	38,589,000
2025	136	11,762,000	78,168,000	189,422,000	1,975,603,000	6,281,000	44,870,000
2026	146	12,429,000	90,597,000	191,739,000	2,167,342,000	7,052,000	51,922,000
2027	156	13,140,000	103,737,000	197,594,000	2,364,936,000	7,888,000	59,810,000
2028	166	13,932,000	117,669,000	206,544,000	2,571,480,000	8,687,000	68,497,000
2029	176	14,739,000	132,408,000	217,656,000	2,789,136,000	9,518,000	78,015,000
2030	180	14,499,000	146,907,000	229,086,000	3,018,222,000	10,328,000	88,343,000
2031	194	16,006,000	162,913,000	244,381,000	3,262,603,000	11,294,000	99,637,000
2032	204	17,024,000	179,937,000	260,365,000	3,522,968,000	12,108,000	111,745,000
2033	214	17,974,000	197,911,000	276,518,000	3,799,486,000	13,120,000	124,865,000
2034	224	18,965,000	216,876,000	293,654,000	4,093,140,000	14,116,000	138,981,000
2035	234	19,942,000	236,818,000	310,443,000	4,403,583,000	15,077,000	154,058,000
2036	244	20,897,000	257,715,000	330,313,000	4,733,896,000	16,094,000	170,152,000
2037	253	21,846,000	279,561,000	349,784,000	5,083,680,000	17,071,000	187,223,000

RFD Scenario for Oil and Gas Activities—Farmington Field Office RMPA, New Mexico

Supplemental Table C. Estimated surface disturbance in 2017 from existing wells.

	Well Count	Pad Count	Roads & Flow Lines per pad (ac.)	Well Pad after interim rec. (ac.)	Total acres
Existing horizontal wells (avg. 2 wells/pad)	557	279	0.6	2.5	865
Existing vertical wells	26,517	26,517	0.6	1.5	55,685
Totals	27,074	26,796	--	--	56,550

Supplemental Table D. New surface disturbance over the life of the plan (2018-2037).

	Well Count	Pad Count	Roads & Flow Lines per pad (ac.)	Well Pad (ac.)	Total acres
Projected horizontal wells (avg. 2 wells/pad)	2,300	1,150	0.6	6.25	7,878
Projected vertical wells	900	900	0.6	3.75	3,195
Existing horizontal wells (avg. 2 wells/pad)	557	279	0	0.25	70
Existing vertical wells	26,517	26,517	0	0.25	6,629
Totals	30,274	28,846	--	--	18,492

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