Additional Information

Received 06/20/2023

From: Fuge, Dylan, EMNRD
To: Goetze, Phillip, EMNRD
Cc: Wrinkle, Justin, EMNRD; Powell, Brandon, EMNRD
Subject: Fwd: [EXTERNAL] Enduring POD1 Materials
Date: Wednesday, June 21, 2023 3:17:15 PM
Attachments: image001.png
Enduring NOI Attachment A 5-22-2018.pdf
Noticing.pdf
Enduring SJ-4301 depletions without POD1 POD3 6-2023.pdf

This was buried in my "other" inbox.

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From: Brian Egolf <Brian@egolflaw.com>
Sent: Tuesday, June 20, 2023 3:52 PM
To: Fuge, Dylan, EMNRD <Dylan.Fuge@emnrd.nm.gov>
Subject: [EXTERNAL] Enduring POD1 Materials

CAUTION: This email originated outside of our organization. Exercise caution prior to clicking on links or opening attachments.

Dear Dylan,

Thank you for the recent meeting on Enduring's POD1 application.

I am attaching to this email:

- A technical memorandum from John Shomaker & Associates, Inc. dated May 22, 2018 that concludes the effect on surface streamflow from the pumping of all of Enduring's wells over a forty year period "would be essentially zero." (Page 9)
- A technical memorandum dated June 12, 2023 the updates information to reflect that two of the original wells approved for pumping will not be injection wells (if OCD approved POD1). The report concludes that there will be no effect on surface stream flow from injections into the Entrada Formation at POD1.
- Proof of the notice that was given for POD1.

Would you kindly confirm your receipt of this email?

Thanks,
Brian

JSAI

TECHNICAL MEMORANDUM

To: Alex Campbell, Enduring Resources

From: John Shomaker

Date: June 12, 2023

Subject: 100-year depletion of Rio Gallina due to pumping 942 ac-ft/yr from each of Wells SJ-4301 POD2, POD4 and POD 5 for 20 years.

Enduring has State Engineer approval to divert and consume a total 4,710 ac-ft/yr from five Entrada Sandstone wells under File No. SJ-4301 for 20 years, each well limited to 942 ac-ft/yr. Enduring has converted Well SJ-4301 POD3 to a salt-water disposal well (API No. 30-045-38292) and it will no longer be used to divert groundwater. The disposal-well permit was approved by the U.S. Bureau of Land Management on February 7, 2023. Enduring is also planning to convert Well SJ-4301 POD1 to a salt-water disposal well.

The Office of the State Engineer used a groundwater model prepared by Eric Keyes (Keyes, 2018) to estimate the rate of depletion of Rio Gallina flows attributable to the SJ-4301 pumping. For the purpose of this memorandum, the same model was used to estimate the depletion that would be attributable to pumping from the remaining three wells.

The five wells had been in service for about four years. For the first 14 years of pumping from all five wells, the model predicts a Rio Gallina depletion rate of 0.0 ac-ft/yr. For the case of pumping from three wells for 20 years (Figure 1), the model predicts depletion of 0.2 ac-ft/yr at the end of 20 years, 2.9 ac-ft/yr at the end of 40 years, and 12.1 ac-ft/yr at the end of 100 years.

The model is likely to over-predict Rio Gallina depletion, for several reasons. The Keyes model represents the aquifer as a single layer, without leakage from above or below, but the beds above and below are not completely impermeable and other modeling studies show that significant contributions of water from those beds can be expected, so that drawdowns at

the location of the Rio Gallina would not be as great as predicted. The Entrada Sandstone is cut by significant faulting between the SJ-4301 wells and the Rio Gallina, so that the aquifer is offset against lower-permeability beds, and effects on the side of the fault zone opposite the wells would be less than as predicted by the model, which represents no faulting. Enduring has injected important quantities of water into the same aquifer as part of its oil and gas operations, which would serve to offset part of the drawdown created by pumping from the SJ-4301 wells, and expects to inject still more water into the aquifer through the disposal wells that formerly were SJ-4301 POD1 and POD3.

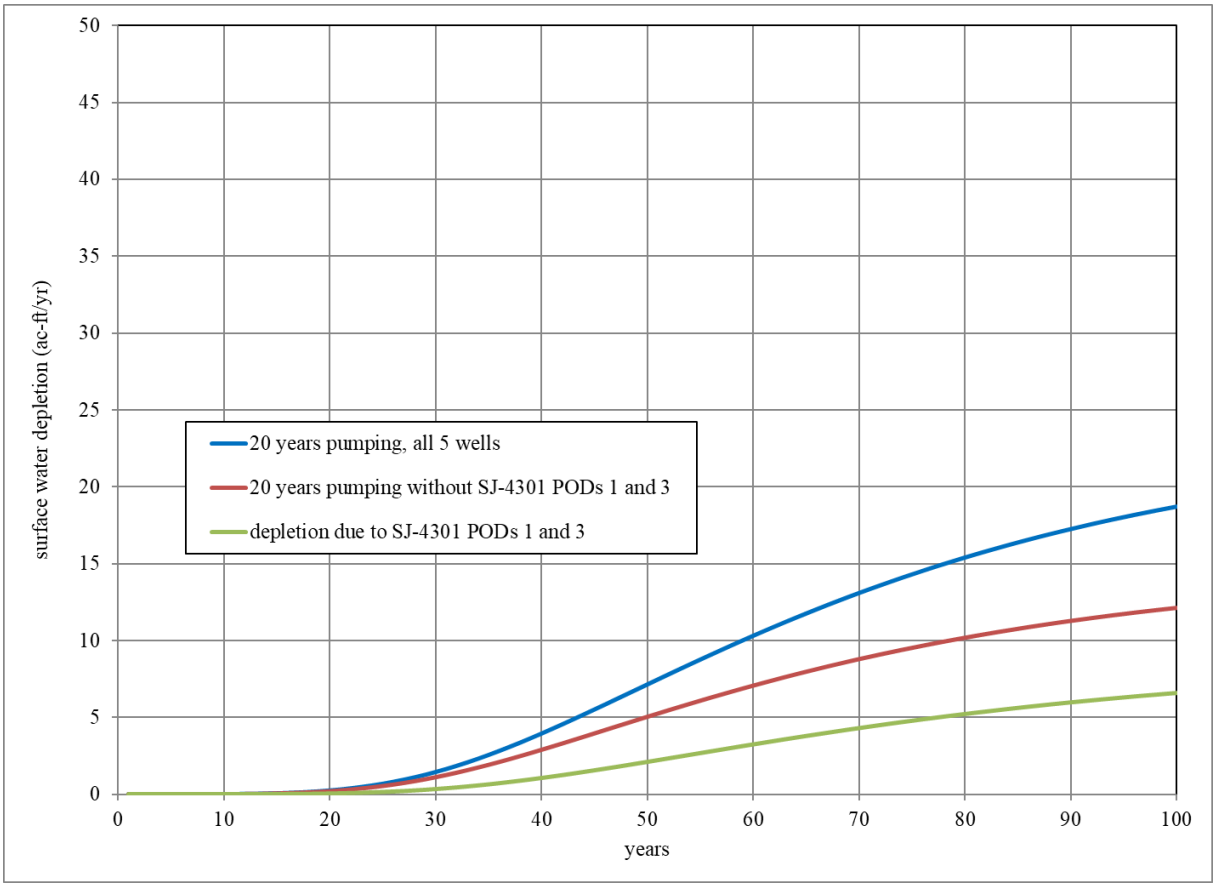

Figure 1. Graph showing rate of streamflow depletion of Rio Gallina due to pumping 942 ac-ft/yr from each of Wells SJ-4301 POD2, POD4, and POD 5 for 20 years (red curve).

REFERENCE CITED

Keyes, E., 2018, SJ-4301 *et al*, evaluation of surface water impacts from Enduring Resources deep pumping of 4710 AFY: N.M. Office of the State Engineer, Technical Memorandum addressed to John Romero, Director, WRAP, dated November 28, 2018, 9 p.

Ms. Khem Sullivan, Regulatory Manager at Enduring Resources, LLC. 200 Energy Court, Farmington, New Mexico 87401 (303-350-5721), wishes to provide notification for the submittal of an Application for Authorization to Inject to the New Mexico Oil Conservation Division (NMOCD). The application requests the use of existing water supply well N Escavada Unit 2207-16B, permitted with the New Mexico Office of the State Engineer, for the use as a Class II injection well. The well is located in Sandoval County, New Mexico at latitude 36.14407256°N longitude -107.5762770°W. This well will be used to inject fluids produced from the enhanced recovery of oil and/or natural gas in the San Juan Basin. Fluids will be injected into the Entrada Formation at depths between 6,925 feet and 7,114 feet below ground surface. Maximum injection rates and pressures are anticipated to be 20,000 barrels of water per day and 1,385 pounds per square inch, respectively. Interested parties may contact the Oil Conservation Division, 1220 South Saint Francis Drive, Santa Fe, New Mexico 87505, within 15 days.

Observer: October 27, 2022

AFFIDAVIT OF PUBLICATION

STATE OF NEW MEXICO

County of Sandoval SS

David Montoya, the undersigned, authorized Representative of Rio Rancho Observer, on oath states that this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Section 3, Chapter 167, Session Laws of 1937; that payment therefore has been made of assessed as court cost; and that the notice, copy of which is hereto attached, was published in said paper in the regular edition, for 1 time(s) on the following date(s):

10/27/2022

David Montoya

CHRISTINA MARIE WHITE
Notary Public - State of New Mexico
Commission # 1122050
My Comm. Expires Jul 26, 2026

Sworn and subscribed before me, a Notary Public, in and for the County of Sandoval and State of New Mexico this 27 day of October of 2022

PRICE $51.72

Statement to come at the end of month.

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ENDURING RESOURCES, LLC

6300 S Syracuse Way, Suite 525 Centennial, CO 80111
Farmington Field Office: 505.636.9720 | Main Office: 303.573.1222

October 28, 2022

Via Certified Mail (Article 7020 2450 0001 1930 9993)

Hicks Oil & Gas, Inc.
PO Box 3307
Farmington, NM 87499-3307

Re: North Escavada Unit 2207-16B WSW
NMOSE Permit No. SJ-4301 POD 1
Sandoval County, NM

To Whom it May Concern:

Enduring Resources, LLC (Enduring) is applying (C-108 Application enclosed) to convert its North Escavada U 2207-16B WSW well into a Salt Water Disposal Well. The subject well was initially drilled in 2018 by Enduring to target the Entrada Formation as a water sypply well for oil and gas development.

Pursuant to Section 19.15.26 of the New Mexico Administrative Code, this letter serves as formal notice of the SWD conversion. No action is needed unless you have any questions or objections.

- Well Name: North Escavada Unit 2207-16B WSW
- NMOSE Permit: SJ-4301 POD 1
- Location: B-16, T22N-R07W
- Injection Interval: 6,925' to 7,114'
- Proposed Disposal Zone: Entrada Pool (Pool Code: 964360)
- Applicant Name: Enduring Resources, LLC
- Applicant Address: 6300 S Syracuse Way, Suite 525, Centennial, CO 80111

If you have any questions or concerns, please contact the undersigned using the information provided below.

Sincerely,

Khem Suthiwan
Regulatory Manager
Enduring Resources, LLC
303.350.5721 – Office
720.662.5218 – Cell

ENDURING RESOURCES, LLC

6300 S Syracuse Way, Suite 525 Centennial, CO 80111
Farmington Field Office: 505.636.9720 | Main Office: 303.573.1222

October 28, 2022

Via Certified Mail (Article 7020 2450 0001 1930 9986)

NM State Land Office
PO Box 1148
Santa Fe, NM 87504

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NMOSE Permit No. SJ-4301 POD 1
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Sincerely,

Khem Suthiwan
Regulatory Manager
Enduring Resources, LLC
303.350.5721 – Office
720.662.5218 – Cell

JSAI

ATTACHMENT A

NOTICE OF INTENTION
pursuant to NMSA §§72-12-26 and 27 for
five proposed wells in the San Juan Basin

TECHNICAL MEMORANDUM

To: John Conley, Enduring Resources IV, LLC

From: John Shomaker, PhD, Principal Hydrogeologist

Date: May 22, 2018

Subject: Description of target aquifer and overlying confining strata

INTRODUCTION

Enduring Resources IV, LLC, proposes to drill five water-supply wells as listed in Table 1 and shown on Figure 1. All will be completed in the Entrada Sandstone at depths (to the top of the aquifer) greater than 6,000 ft below ground level, under the provisions of §72-12-25 et seq., NMSA. Total depths of the wells are approximately 6,600 to 9,000 ft. The maximum anticipated production from each well is 20,000 BWPD (barrels of water per day), equivalent to 942 acre-feet per year (ac-ft/yr).

Table 1. Location, estimated depth to top of Todilto Limestone (the confining unit above the Entrada Sandstone aquifer), and total depth, for five proposed wells to be drilled under the provisions of §72-12-25 et seq., NMSA. Depth to the top of the Entrada is up to 140 ft greater than depth to top of the Todilto. Depths are referred to ground-level datum.

proposed well	location (approximate; see NOI for final location)	estimated depth to top of Todilto Limestone, ft	estimated total depth, ft
Escavada WSW 1	NW/4 NE/4 Sec. 16, T. 22 N., R. 7 W.	5,986	6,736
Escavada WSW 2	SW/4 SE/4 Sec. 20, T. 22 N., R. 6 W.	7,000	7,500
West Lybrook WSW	SE/4 SW/4 Sec. 24, T. 23 N., R. 9 W.	6,250	6,750
Kimbeto WSW	NE/4 SW/4 Sec. 19, T. 23 N., R. 9 W.	6,100	6,600
Rincon WSW	SW/4 NW/4 Sec. 32, T. 27 N., R. 6 W.	8,500	9,000

NOI - Notice of Intention

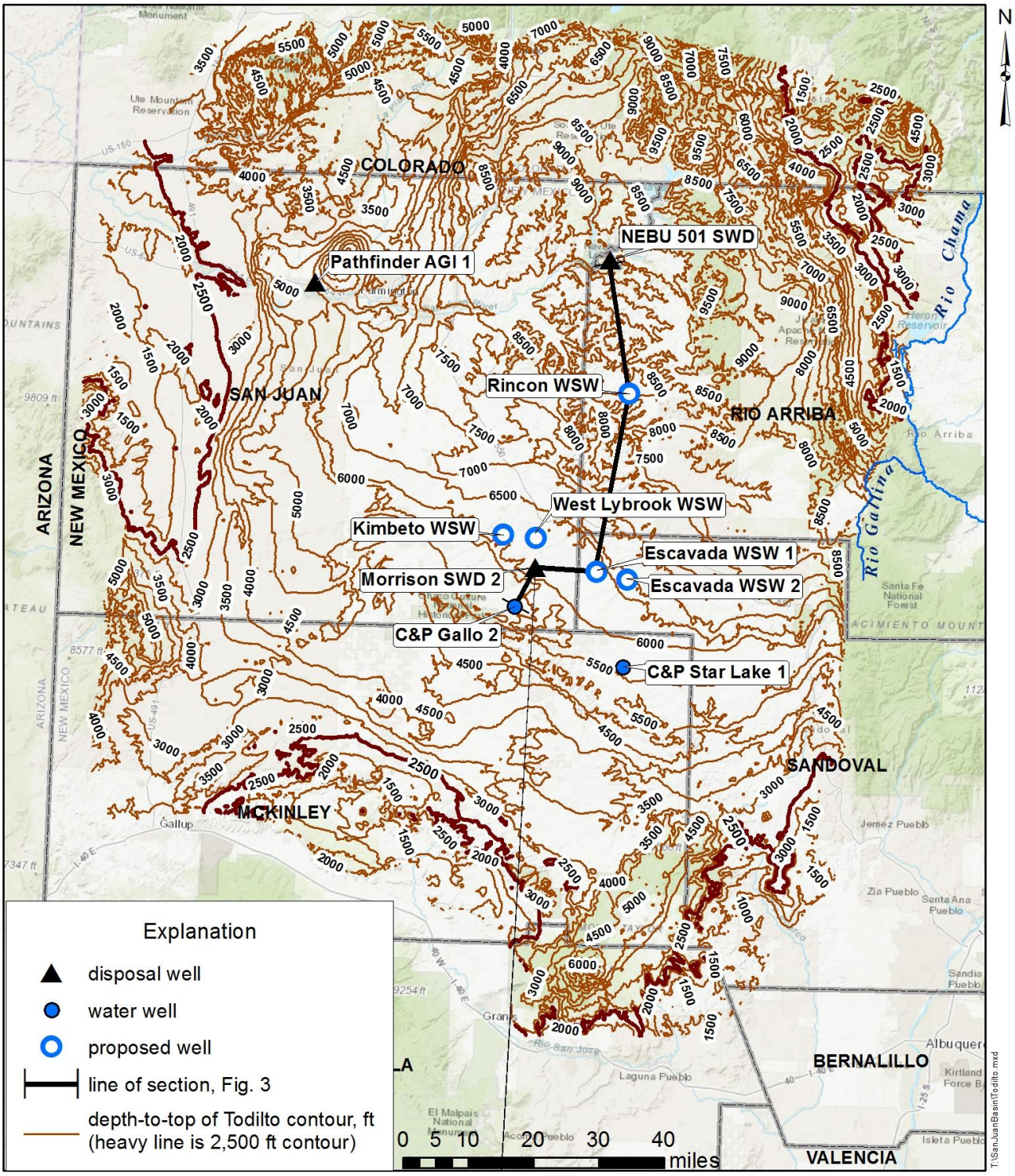

Figure 1. Map showing depth-to-top contours (in feet) for Todilto Limestone in San Juan Basin, locations of wells mentioned in text, Rio Gallina, and line of section (Fig. 3). See text for derivation of contours. Top of Entrada Sandstone would be up to 140 ft deeper.

This Technical Memorandum is Attachment A to the Notice of Intention (NOI), as required by State Engineer regulations, to describe the target aquifer and the overlying confining strata, and to provide the information demonstrating conformance with the provisions of §72-12-25 et seq., NMSA. Attachment A is to contain "a description of the target aquifer and overlying confining strata, geologic cross sections of the target aquifer and overlying confining strata. Also include any other studies that form the basis for the contention that the target aquifer meets the criteria of 72-12-25 NMSA, addressing total dissolved solids content of the target aquifer groundwater, and hydraulic separation of target aquifer from shallower aquifer systems and surface water."[1]

DESCRIPTION OF TARGET AQUIFER AND OVERLYING CONFINING STRATA

Target Aquifer: Entrada Sandstone

The Entrada is a widespread dune-sand deposit of Jurassic age. Its distribution in the San Juan Basin is indicated by the area of the contours shown on Figure 1, and its stratigraphic position is shown in the cross-section of Figure 2. The Entrada is described by Craigg (2001, p. 19) as follows (references omitted).

> The Entrada Sandstone is present throughout the San Juan Basin and adjacent Colorado Plateau. Throughout most of the basin, the Entrada unconformably overlies the Chinle Formation (and equivalent rocks of the Dolores Formation in Colorado) except in the northwest, where it unconformably overlies the Wingate Sandstone.
>
> The Entrada Sandstone generally consists of reddish-orange, mottled red and white to light-brown silty sandstone and very fine to medium-grained well-sorted quartz sandstone interbedded with thinner reddish-brown siltstone. High-angle, large-scale crossbedding is a characteristic feature, indicating deposition in an eolian environment, whereas the siltstone represents deposition in interdune and sabkha environments.

Kernodle (1996, citing others) gives a thickness range of 60 to 350 ft for the Entrada in general, and a typical thickness of 130 ft in the southeastern San Juan Basin. It is 132 ft thick in the Morrison SWD 2 Well, 150 ft thick in the C&P Gallo No. 1 Well, and about 212 ft thick in the NEBU 501 Well (see Figs. 1 and 3).

Lateral Extent and Depth: The lateral extent, and the minimum depth to the top of the Entrada can be inferred from the lateral extent and depth to the top of the overlying Todilto Limestone Member of the Wanakah Formation, shown by Figure 1, as explained below.

[1] From Section 2, OSE Form wr-30, version of January 12, 2010.

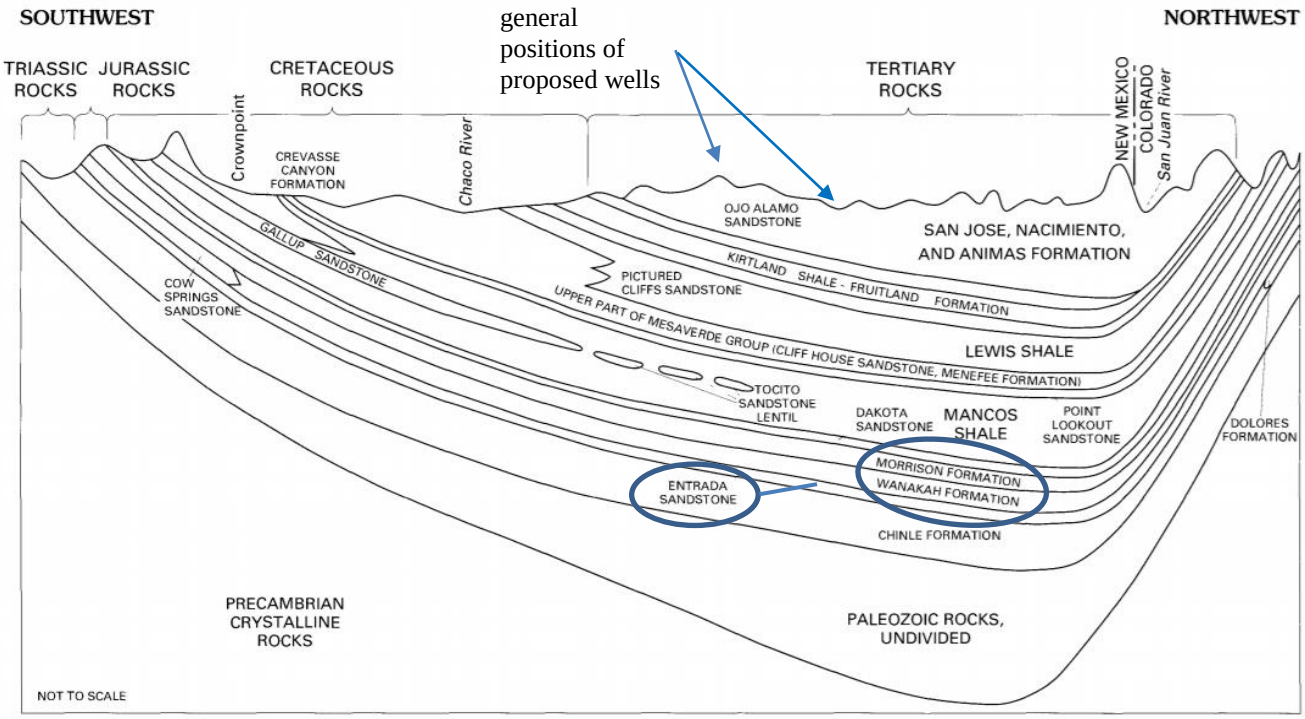

Figure 2. Diagrammatic stratigraphic section across central San Juan Basin showing relationships of Entrada Sandstone, Wanakah Formation (Todilto Limestone at base), Morrison Formation (including Westwater Canyon Member aquifer), and other geologic units. Modified from Craigg, 2001, fig. 6.

Overlying Confining Strata: Todilto Limestone Member of Wanakah Formation and Other Units

The Todilto Limestone Member, which directly overlies the Entrada Sandstone, is described by Craigg (2001, p. 20) as follows (references omitted).

> The Todilto Limestone Member in New Mexico and equivalent Pony Express Limestone Member in Colorado are arbitrarily separated by the State line. These members contain two major lithofacies, a lower gray limestone unit and an upper gypsum and anhydrite unit and some siltstone and sandstone. The limestone facies is present throughout the study area except in the Gallup Sag and in the extreme northwest. It conformably overlies the Entrada Sandstone and typically forms an erosion-resistant caprock. The maximum thickness of the limestone facies is about 40 feet. The massive light-gray to white gypsum and anhydrite facies is present only in the eastern one-half of the study area. Its thickness ranges from zero to a maximum of about 100 feet. The Todilto Limestone and Pony Express Limestone Members were deposited either in a fresh to saline inland lake or in a restricted marine basin.

Ridgley and Hatch (2013, fig. 6) suggest that the total thickness of the Todilto reaches 140 ft, but the local thickness may be greater. The predicted depths to the tops of the Todilto in the proposed Escavada WSW 1 and Rincon WSW Wells, and the relationship to three Entrada Sandstone completions, are shown in the geophysical-log cross-section of Figure 3.

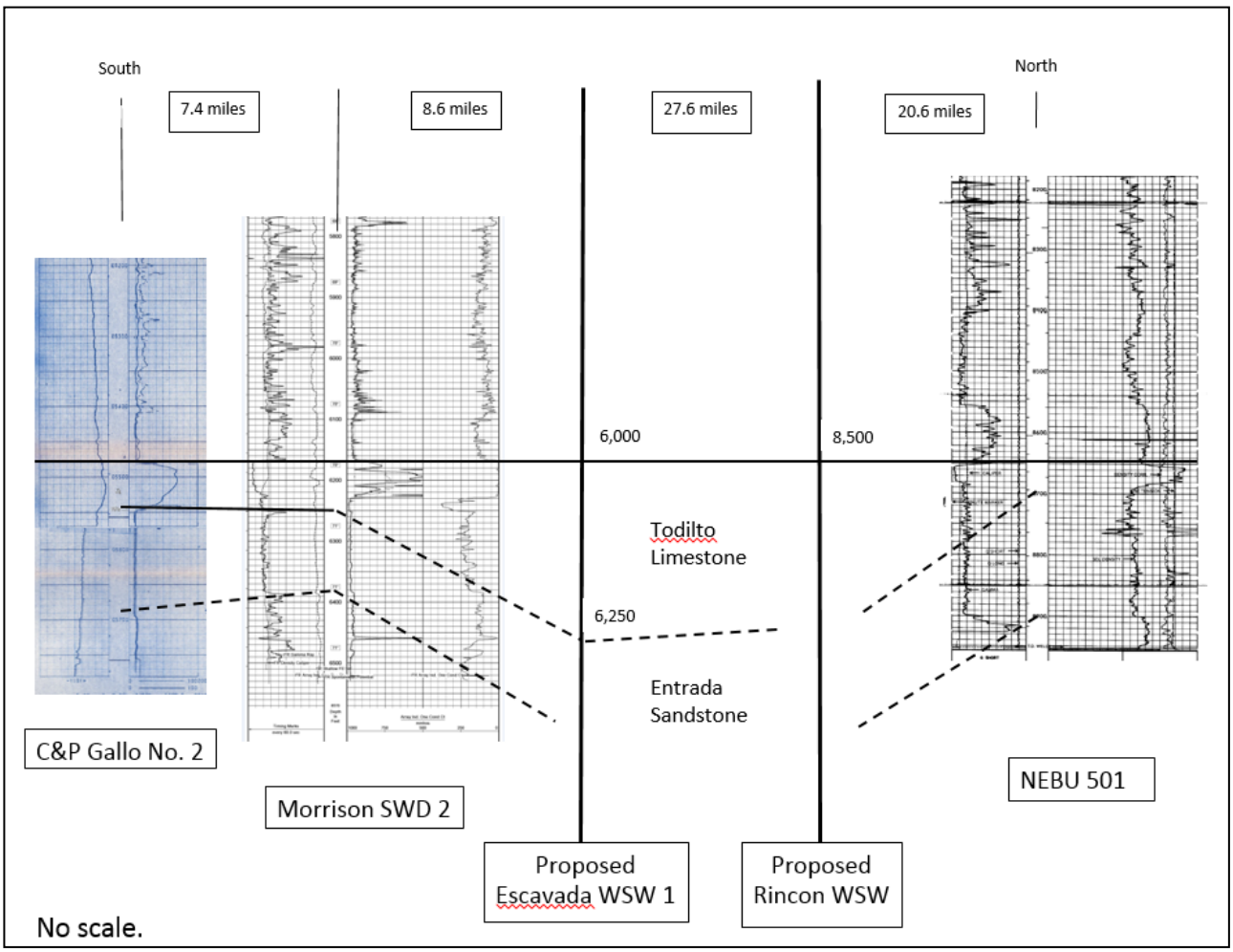

Figure 3. Geophysical-log cross-section showing predicted depths to the tops of the Todilto and the Entrada in the proposed Escavada WSW 1 and Rincon WSW Wells, and the relationship to Entrada Sandstone completions in the Morrison SWD 2 (API No. 30-045-33684) in Sec. 13, T. 22 N., R. 9 W., Cherokee & Pittsburg Gallo Wash No. 2 water well (C&P Gallo No. 2, OSE File No. SJ-549-Explor-1), in Sec. 16, T. 21 N., R. 9 W., and the NEBU 501 disposal well (API 30-039-24236) in Sec. 10, T. 30 N., R. 7 W. The line of cross-section is shown on Figure 1.

Lateral Extent and Depth: The Entrada is continuous in the subsurface over the entire area represented by the top-of-Todilto contours of Figure 1. The thickness of the Entrada is variable over short distances because of its origin as preserved sand dunes. The thickness of the combined Entrada and Todilto is somewhat more regular, in that Todilto limestone and anhydrite filled the lower inter-dune areas, and in any case, of course, the top of the Entrada is everywhere deeper than the top of the Todilto, and would encompass a slightly larger area. The lateral extent and depth to the top of the Todilto are shown as Figure 1, which was constructed by digitally subtracting the elevation of the top of the Todilto as given by the structure contours of Ridgley and Hatch (2013, fig. 5) from the ground-level elevation as taken from the USGS Digital Elevation Model (DEM). The 2,500-ft depth contour is labeled and marked by a heavier line-weight.

CONFORMANCE WITH CRITERIA OF §72-12-25 et seq., NMSA

Total Dissolved Solids Content

The nearest Entrada well for which a water analysis is available is probably the Cherokee & Pittsburg Gallo Wash No. 2 water well (C&P Gallo 2), OSE File No. SJ-549-Explor-1, in Sec. 16, T. 21 N., R. 9 W. (Fig. 1). Total dissolved solids (TDS) concentration was 10,630 mg/L. The major-ion analysis is shown below in Table 2. Total dissolved solids concentration increases northward toward the core of the San Juan Basin, as confirmed by the analysis of water from the Northeast Blanco Unit No. 501 salt-water disposal well (NEBU 501 SWD) in Sec. 10, T. 30 N., R. 7 W., API No. 30-03-924236, also shown in Table 2. A TDS concentration significantly in excess of 1,000 mg/L can be confidently expected in Entrada Sandstone water from each of the proposed wells.

Table 2. Summary of analyses of water from Entrada Sandstone in the vicinity of the proposed wells. Concentrations in mg/L.

	C&P Gallo 2	NEBU 501 SWD		C&P Gallo 2	NEBU 501 SWD
location	Sec. 16, T.21N., R.9W.	Sec. 10, T.30N., R.7W.		Sec. 16, T.21N., R.9W.	Sec. 10, T.30N., R.7W.
date	July 14, 1978	Aug. 2, 1988			
sodium	3,520	4,237	**chloride**	544	8,165
potassium	27.5		**carbonate**	0	0
calcium	172	1,162	**bicarbonate**	242	102
magnesium	13	267	**sulfate**	6,380	1,600
iron, total	2.1	500+?			
			TDS	10,630	15,500
reference	Shomaker, 1981, p. 67	NMOCD, API No. 30-03-924236			

mg/L - milligrams per liter
TDS - total dissolved solids

Hydraulic Separation from Shallower Aquifers and Surface Water: Confining Zone

The next-shallower aquifer above the Entrada Sandstone is the Westwater Canyon Member of the Morrison Formation. The top of the Morrison is expected to be about 750 ft above the top of the Entrada, and the top of the Westwater Canyon would be somewhat deeper. The Entrada is separated from the Westwater Canyon by very-low-conductivity beds of the Todilto Limestone Member of the Wanakah Formation, and also the siltstones of the Beclabito Member of the Wanakah and the Recapture Shale Member of the Morrison Formation. The hydraulic separation is demonstrated by several lines of evidence.

Vertical Hydraulic Conductivity of Todilto Limestone Member: The relationship between the Entrada and the Todilto is described by Ridgley and Hatch (2013, p. 1) in these terms: "[p]reservation of individual sand dunes [the Entrada] overlain by a carbonate unit that serves as both source rock and seal make the Todilto a locally sourced TPS [Total Petroleum System]."

The hydraulic conductivity across bedding planes is not known to have been measured, but the Todilto is recognized as an effective barrier to flow. Wu et al. (2011, Sec. 22.3.2.2), referring to the proposed Pathfinder AGI No. 1 well in Sec. 1, T. 29 N., R. 15 W. (Fig. 1), say "[t]he Entrada is effectively sealed on top by the overlying Todilto Limestone and Beclabito siltstones of the Jurassic Wanakah Formation and below by the underlying shales and mudstones of the Triassic Chinle Formation." The New Mexico Oil Conservation Division (NMOCD, 2009, p. 2) found, in an order relating to the same well, that "the Entrada formation is sealed on top by the Todilto Limestone and Beclabito siltstones [the upper member of the Wanakah]. The Caprock (Wanakah) is a low porosity siltstone and recrystallized limestone which is an effective barrier above the injection zone."

The results of the pumping test of the C&P Gallo Wash No. 2 well (Shomaker, 1981) are consistent with the response of a Theissian aquifer, that is, an aquifer that has no hydraulic connection above or below. Figure 4 is the plot of recovery measurements after the test, and there is no change in the later part of the slope that would signal the presence of either leakage or a boundary condition; the blue line, added to the plot and defined by the recovery data, would pass through the original water level at 23 ft at infinite time (t/t' = 1).

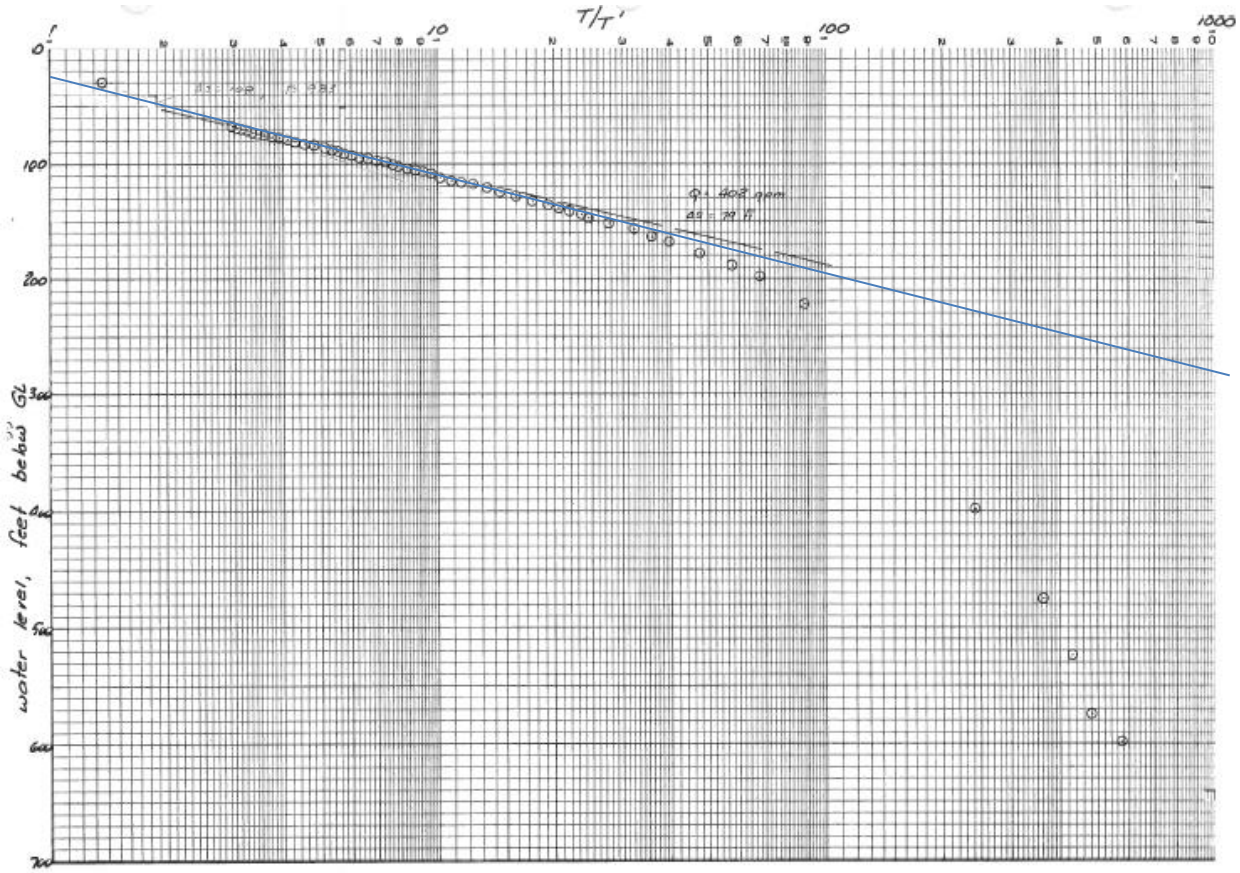

Figure 4. Plot of recovery data after the pumping test of the C&P Gallo No. 2 well (Shomaker, 1981, fig. 11). The blue line was added to the illustration.

Groundwater Head Difference Between Entrada and Next Overlying Aquifer: The hydraulic separation between the Entrada and the Westwater Canyon is consistent with the significant difference in groundwater head as between two water wells near each other in T. 21 N., R. 9 W., one completed in the Entrada and the other in the Westwater Canyon, as shown in Table 3. The head in the Entrada was 114 ft lower than that in the Westwater in a well about 3,000 ft distant.

Table 3. Comparison of characteristics of Entrada Sandstone and next-shallower aquifer, the Westwater Canyon Member of the Morrison Formation, in two wells in Sec. 16, T. 21 N., R. 9 W., in the vicinity of the proposed wells (data from Shomaker, 1981)

	C&P Gallo No. 1	C&P Gallo No. 2
location in Sec. 16, T. 21 N., R. 9 W.	C SW/4 NE/4	NE/4 SE/4 SE/4
OSE File No.	SJ-118	SJ-549-Explor-1
aquifer	Westwater Canyon	Entrada
GL elevation, ft	6,380	6,418
depth to top of Morrison Formation, GL, ft	4,580	4,603
depth to top of Entrada Sandstone, GL, ft	5,508 (after deepening)	5,532
depth to water, ft (+ means above GL)	+129	23
water-level elevation, ft	6,509	6,395
total dissolved solids, mg/L	3,648	10,630

OSE - New Mexico Office of the State Engineer mg/L - milligrams per liter

Water Quality in Entrada Sandstone and Overlying Aquifers: As shown in Table 3, the quality of water in the Entrada is significantly different, with a TDS of 10,630 mg/L, from water in the Westwater Canyon at 3,648 mg/L.

Effects of Pumping from Proposed Well on Surface Water Supplies

The nearest point at which the Entrada Sandstone might be in connection with a stream (and the overlying Todilto beds are absent), may in T. 23 N., R. 1 E., where the Entrada subcrop is beneath alluvium in the valley of Rio Gallina, about 36 miles east of the nearest proposed well, Escavada WSW 2 (Fig. 1). Although this appears to be the closest point at which a stream crosses the Entrada outcrop or subcrop, the unit may be may be separated from the main body of the aquifer there by a regional-scale fault.

A Theis-equation estimate of the drawdown at that distance after 40 years, based on the aquifer transmissivity of 40 ft^2/day representing the Entrada in the Kernodle (1996) groundwater flow model of the San Juan Basin, and assuming a storage coefficient[2] of 0.00026 based on a typical thickness of 130 ft, and a constant pumping rate of 20,000 BWPD (942 ac-ft/yr) from the nearest proposed well, would be about 0.85 ft. The 40-year calculated drawdown in the Entrada at the Rio Gallina due to the combined pumping of 942 ac-ft/yr each from the five wells would be 1.3 ft.

[2] The storage coefficient was assumed to be 2 x 10^{-6} times thickness in feet.

Actual drawdown at the Rio Gallina can be expected to be much less than the Theis-equation estimate because of contribution from the underlying Chinle Formation aquitard over the very large area influenced by the head differential between the Entrada and the underlying beds. In regional groundwater systems that include widespread confined aquifers and confining beds, much of the water produced from the aquifers is actually released from storage in the confining beds (see, e.g., Bredehoeft, 1983; Shomaker, 1995), although in the case of the proposed wells, this probably applies only to the underlying Chinle beds. The effect on streamflow would be essentially zero.

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CONDITIONS

Action 255693

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