Leking, Geoffrey R, EMNRD

30-025-40451

From: Randall Hicks <r@rthicksconsult.com>
Sent: Thursday, January 24, 2013 3:29 PM
To: Leking, Geoffrey R, EMNRD
Cc: 'Richard Wright'; rickmassey11@aol.com; 'Dale Littlejohn'; 'Kristin Pope'; Warnell, Terry G.
Subject: Caza - Lennox 32 State 2H

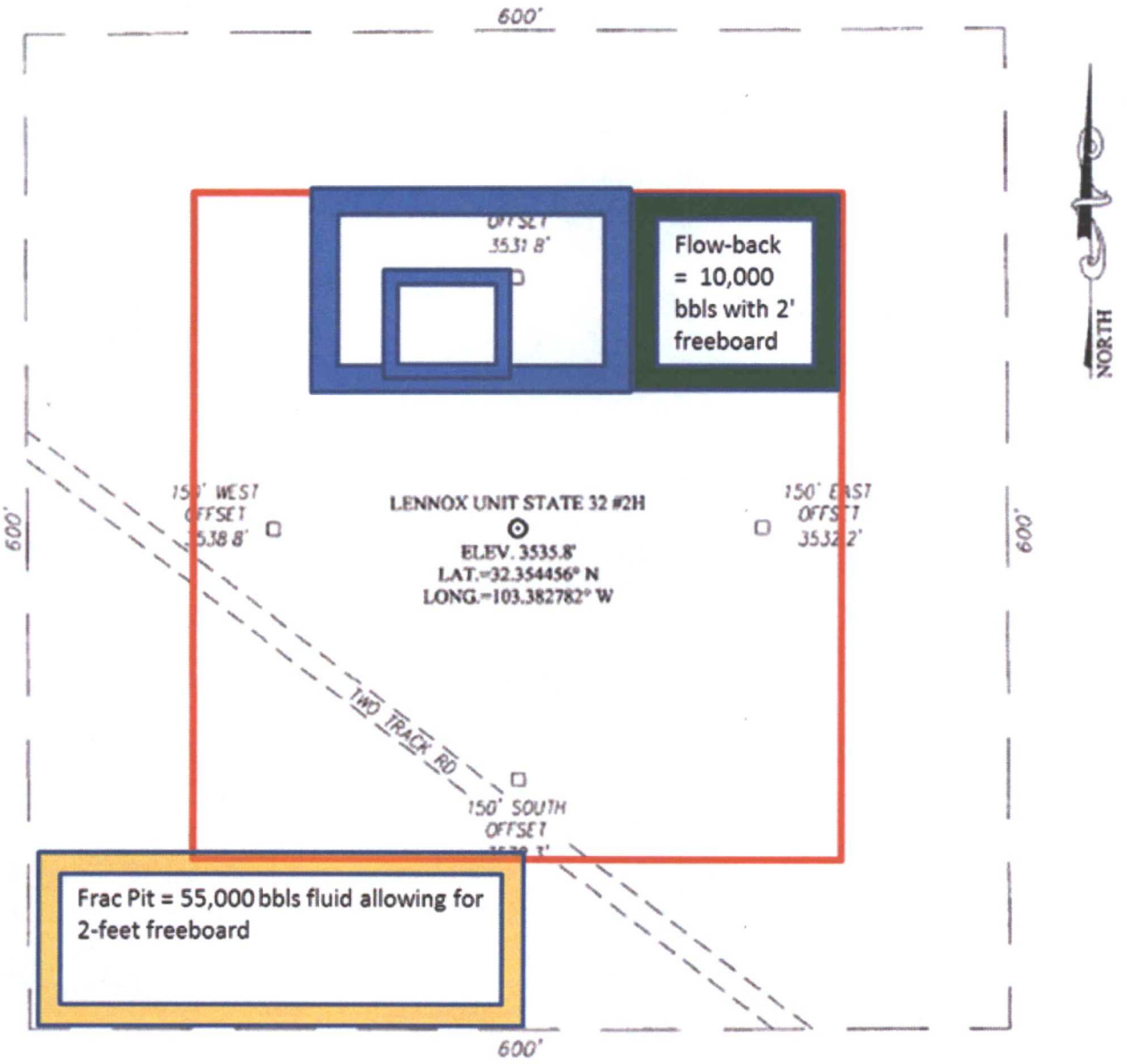
Geoff

We constructed the pit according to the permit. The footprint and depth are about the same as we planned. There are two changes

1. The temporary pits are on the north side of the location, not the east side and
2. A frac pit to hole only fresh water is located within the State Lease as shown.

While we do not need a permit from OCD, SLO or the OSE for the frac pit, we thought it a good idea to notify everyone that it does exist. The OSE granted a permit for a water well, which will be located northeast of the flow-back cell of the temporary pit.

So far, all is working as designed at the site.



IRECTIONS TO LOCATION

100 0 100 200 Feet

Randall Hicks
RT Hicks Consultants
Office: 505-266-5004
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CAZA LENNOX C-144
SUPPORTING INFO

Leking, Geoffrey R, EMNRD

From: Dale Littlejohn <dale@rthicksconsult.com>
Sent: Monday, October 01, 2012 3:03 PM
To: Leking, Geoffrey R, EMNRD
Cc: Randall Hicks (r@rthicksconsult.com); VonGonten, Glenn, EMNRD; Gonzales, Elidio L, EMNRD; Jones, Brad A., EMNRD
Subject: Re: Distance to ground water at the Lennox 32 State No. 2H
Attachments: Lennon 32 #2H OFR 95 Maps.pdf

HOBBS OCD

OCT 01 2012

RECEIVED

Geoffrey,

We want to thank you for the opportunity to provide some additional explanation of our interpretation of the hydrogeology with respect to the prediction of groundwater depth at the temporary pit.

The shallow (Ogallala) hydrogeology in this area is not simple because it is not a thick, regionally extensive, relatively homogeneous layer, as it is found to the north. That is why the Nicholson and Clebsch map presented in Figure 2 does not include Ogallala contours in the area of the proposed temporary pit site, but instead depicts the Triassic groundwater contours. In this area, Nicholson and Clebsch suggest that the Ogallala may not be consistently saturated (a regional aquifer).

The point we were trying to make in our explanation is that the shallow aquifers across the area are located in small, localized basins (hydrogeologic systems) that are isolated from one another. Each basin contains porous rocks (alluvium or Ogallala) resting on an erosional surface of low porosity red-beds that behave as lower confining layer. Where the paleo-topography of the red-beds form a ridge that lies at a higher elevation than the water table, no shallow aquifer is present. In these areas, supply wells must be drilled to the deeper Triassic aquifer.

In your response, you indicated that the wells to the northwest, which are farther away, are a better analog to our site than the nearby wells because they have a similar topographic elevation. We contend that among that group of wells there is more than one isolated basin (created by the paleo-topography of the red-bed surface) as the water table elevations range from 3,490 to 3,572 feet in a very short distance. We believe the critical issue is not the topographic elevation or average depth to groundwater of the analogs, but whether or not the underlying red-beds at our site are above or below the elevation of the shallow groundwater.

Fortunately, we have site-specific data in the form of a boring drilled at the location to install the conductor pipe. Caza Operating frequently uses a small, slow drilling cable tool rig to begin their oil wells in order to satisfy the mineral lease "start-time" requirements while waiting on a proper drilling rig to become available. As described on page 3 of our C-144 application, the cable tool rig operated by Rick Baccus (432/556-3816) had drilled a dry hole to a depth of 104 feet (3,432). They encountered red-beds at 81 feet (3,455), which is approximately 15 to 16 feet above the anticipated elevation of the water table, based on the nearest wells.

Perhaps we failed to make this point clear enough in our application, but we believe that the data from cable tool rig demonstrates beyond question that the location of the proposed temporary pit (and most likely the entire topographic ridge upon which it sits) overlies non-porous red-beds that are present at an elevation higher than the shallow aquifer. There is no water-table aquifer present beneath the proposed pit site; groundwater occurs only in the lower saturated zones of the Dockum Group red-beds.

On Friday September 28th after we received your email we contacted Mr. Baccus to verify the information provided in the application. He indicated that the boring has now been drilled to a depth of 122 feet (3,414 elevation) and the conductor pipe has been installed. He reiterated that no groundwater has been encountered at any time during the operation.

We cannot speak to the accuracy of the trend map you mentioned in your email. We are sure it is a very useful tool in areas where the aquifer is regionally consistent. Regional groundwater maps, especially depth to water maps that do not take into account the surface elevation, can be misleading in areas such as this, where the remnant aquifer hydrogeologic systems are localized and inconsistent. We have confidence in the published Nicholson and Clebsch map in this area only because they clearly indicate the limits of their data reliability.

As an example of how depth to groundwater maps can be misleading, Figures 1 and 2 on the attached document are water level elevation and depth to groundwater maps of the area of the proposed pit that are in Open File Report OF-95 (see ftp://geoinfo.nmt.edu/Open-file_Reports/OFR014-99/76-99/95). Section 32 is outlined by the red box in Figures 1 and 2. Note that the depth to water map suggests a distance of less than 100 feet between ground surface and groundwater. However, the groundwater elevation map suggests that the elevation of groundwater is 3,400. The survey presented in the C-144 shows the surface elevation of the site is 3,535. Thus one map shows a groundwater depth of less than 100 feet while the same authors of OF-95 predict a depth to groundwater of about 135 feet using the potentiometric surface. Which map is correct? The depth to groundwater map obviously does not consider the local topography. The potentiometric surface map is a representation of the elevation of groundwater, which allows professionals to determine the depth to groundwater at a place of known surface elevation.

We have abandoned the use of depth to water maps for this reason – they are generally flawed in areas that are not flat. Instead, we rely upon field measurements by Hicks Consultants, the USGS or certain other sources that allow a professional to create a potentiometric surface map then use simple arithmetic to determine the distance between the proposed pit and groundwater. As discussed on page 3 of the permit application, at the Lennox State 32 2H, we predicted that the water table elevation near the proposed pit was less than 3,429. The elevation of the red-bed surface of 3,455 feet asl, above the nearby water table aquifer. Therefore, it is not a surprise to us that the conductor hole was dry to a depth of 122 feet. We stand by our conclusion that groundwater beneath the proposed pit lies in the lower permeable units of the Dockum Group red-beds at a depth of about 400 feet.

We hope this information clarifies that the depth to groundwater at the location is greater than 122 feet. Please contact me if R.T. Hicks Consultants can be further service in this matter.

Dale Littlejohn
RT Hicks Consultants LTD
(432) 528-3878

On Sep 28, 2012, at 3:02 PM, Leking, Geoffrey R, EMNRD wrote:

Dale

It appears the ground water table mimics the topography. If you look at your wells at higher ground elevation, they still exhibit shallow ground water as do those at lower ground elevations. Therefore, your reasoning of extrapolating the ground water tables from the closer wells at lower ground elevation to the higher elevation of where the pit will be located is flawed. You are mixing apples and oranges. Our trend map indeed displays shallow ground water (less than 50 feet and then less than 25') at the higher elevations to the northwest. The pit location is approximately at the same ground elevation of the area to the northwest. The pit location on our trend map sits southeast of the nose of the shallow ground water and in the plane between a 75 feet to ground water contour as that contour wraps around. Since the nose of the shallow ground water area is in between this looping 75' contour also, I extrapolate downward instead of upward and split the difference between 75' and 50'; calling it 62'. At best you could call it 75' across the plane. In any case, the ground water elevation beneath the pit will be at a depth of less than 100' below ground surface (bgs). Please reply. Thank you.

Geoffrey Leking
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Figure 1: Open File Report No. 95 – Groundwater Elevation Map

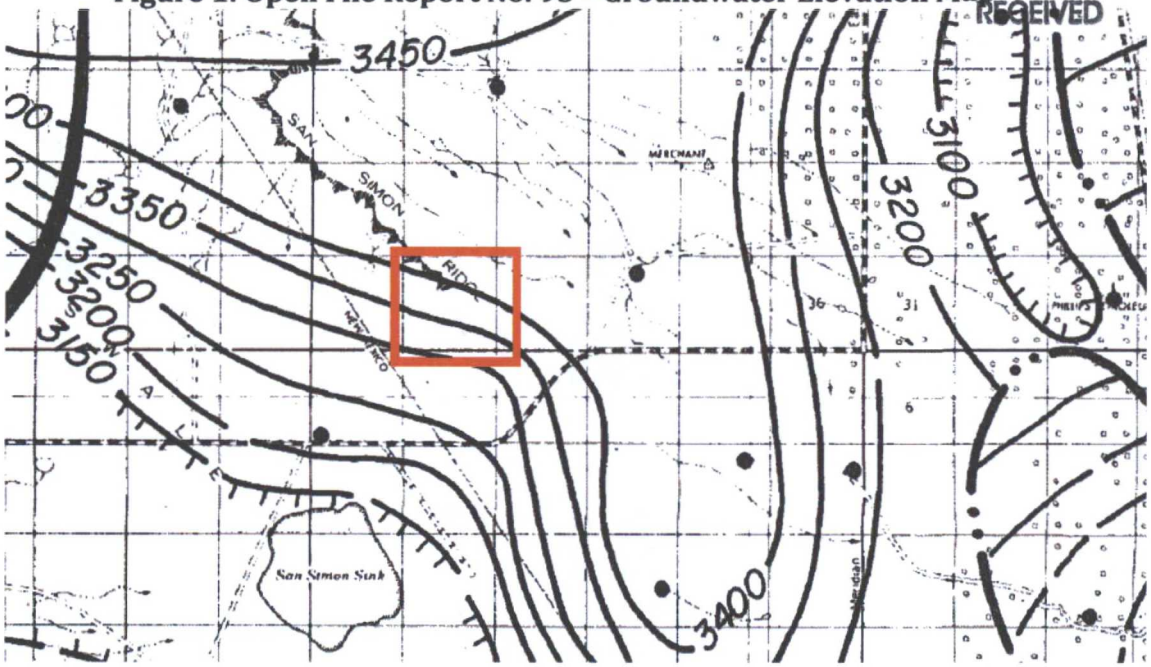

Figure 2: Open File Report No. 95 – Depth to Groundwater Map