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Groundwater Well Inventory and Assessment in the Area of the Proposed Normally Pressured Lance Natural Gas Development Project, Green River Basin, Wyoming, 2012

Data Series 770

U.S. Department of the Interior
U.S. Geological Survey

Front cover. Windmill on stock well, Sublette County, Wyoming, June 2012. Photograph by Michelle L. Taylor.

Back cover. Stock well with solar-powered pump, Sublette County, Wyoming, June 2012. Photograph by Audrey Plenty Hoops.

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SALLY JEWELL, Secretary

U.S. Geological Survey
Suzette M. Kimball, Acting Director

U.S. Geological Survey, Reston, Virginia: 2013

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Inch/Pound to SI

Multiply	By	To obtain
	Length	
mile (mi)	1.609	kilometer (km)
foot (ft)	0.3048	meter (m)
	Area	
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
acre	0.4047	square hectometer (hm^2)
acre	0.004047	square kilometer (km^2)
section (640 acres or 1 square mile)	259.0	square hectometer (hm^2)
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Abbreviations

BLM	Bureau of Land Management
EnCana	EnCana Oil & Gas (USA) Inc.
GPS	global-positioning system
GWSI	Groundwater Site Inventory (U.S. Geological Survey database)
JIDP	Jonah Infill Development Project
N	North
NPL	Normally Pressured Lance
PAPA	Pinedale Anticline Project Area
PFO	Bureau of Land Management Pinedale Field Office
PHC	petroleum hydrocarbons
QC	quality control
R	Range
RSFO	Bureau of Land Management Rock Springs Field Office
T	Township
USGS	U.S. Geological Survey
W	West
WDEQ	Wyoming Department of Environmental Quality
WSEO	Wyoming State Engineers Office

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Abstract

During May through September 2012, the U.S. Geological Survey, in cooperation with the Bureau of Land Management, inventoried and assessed existing water wells in southwestern Wyoming for inclusion in a possible groundwater-monitor network. Records were located for 3,282 wells in the upper Green River Basin, which includes the U.S. Geological Survey study area and the proposed Normally Pressured Lance natural gas development project area. Records for 2,713 upper Green River Basin wells were determined to be unique (not duplicated) and to have a Wyoming State Engineers Office permit. Further, 376 of these wells were within the U.S. Geological Survey Normally Pressured Lance study area. Of the 376 wells in the U.S. Geological Survey Normally Pressured Lance study area, 141 well records had sufficient documentation, such as well depth, open interval, geologic log, and depth to water, to meet many, but not always all, established monitor well criteria. Efforts were made to locate each of the 141 wells and to document their current condition. Field crews were able to locate 121 of the wells, and the remaining 20 wells either were not located as described, or had been abandoned and the site reclaimed. Of the 121 wells located, 92 were found to meet established monitor well criteria. Results of the field efforts during May through September 2012, and specific physical characteristics of the 92 wells, are presented in this report.

Introduction

Groundwater is the primary source of water supply for rural livestock, domestic, and industrial uses in the Green River Basin in southwestern Wyoming (Clarey and others, 2010). In April 2011, EnCana Oil & Gas (USA) Inc. (EnCana) filed a scoping notice [EnCana Oil & Gas (USA) Inc., 2011] with the Bureau of Land Management (BLM) for development of the Normally Pressured Lance (NPL) natural gas development project area, hereafter referred to as the NPL project area. The BLM then filed a notice of intent to prepare an environmental impact statement for the NPL natural gas development project in Sublette County, Wyoming (Bureau of Land Management, 2011). The notice of intent outlines a gas development project consisting of 3,500 wells installed within an area of 141,080 acres, with production from the Late Cretaceous-age Lance Formation at a depth from 6,500 to 13,500 feet (ft) below land surface, where gas is under normal formation pressure conditions.

As part of the public-involvement process, the BLM and the Wyoming Department of Environmental Quality (WDEQ) asked the U.S. Geological Survey (USGS) to inventory groundwater information for the NPL project area. During May through September 2012, in cooperation with the BLM, the USGS inventoried, verified, and assessed well records for the upper Green River Basin, an area that includes the NPL project area (fig. 1), for inclusion in a possible groundwater-monitor network. Field verification of well conditions and water levels was completed for a subset of wells in the vicinity of NPL project area.

Description of Study Area

The NPL project area (fig. 1) is located about 68 miles (mi) northwest of Rock Springs, Wyoming, and about 25 mi south of Pinedale, Wyoming, and covers approximately 141,080 acres administered by the BLM Pinedale Field Office (PFO) and the BLM Rock Springs Field Office (RSFO). The NPL project area consists of all or parts of 233 sections in Township (T) 27 North (N) Range (R) 107 West (W) through R109W, T28N R107W through R110W, and T29N R108W through R110W. The NPL project area is adjacent to the Jonah Infill Development Project (JIDP) in Sublette County, which also is an EnCana gas development project on BLM lands. No incorporated, permanently inhabited areas are within the NPL project area, although EnCana has a workforce facility adjacent to the JIDP that can house 296 people. This facility includes dedicated water supply and wastewater treatment facilities.

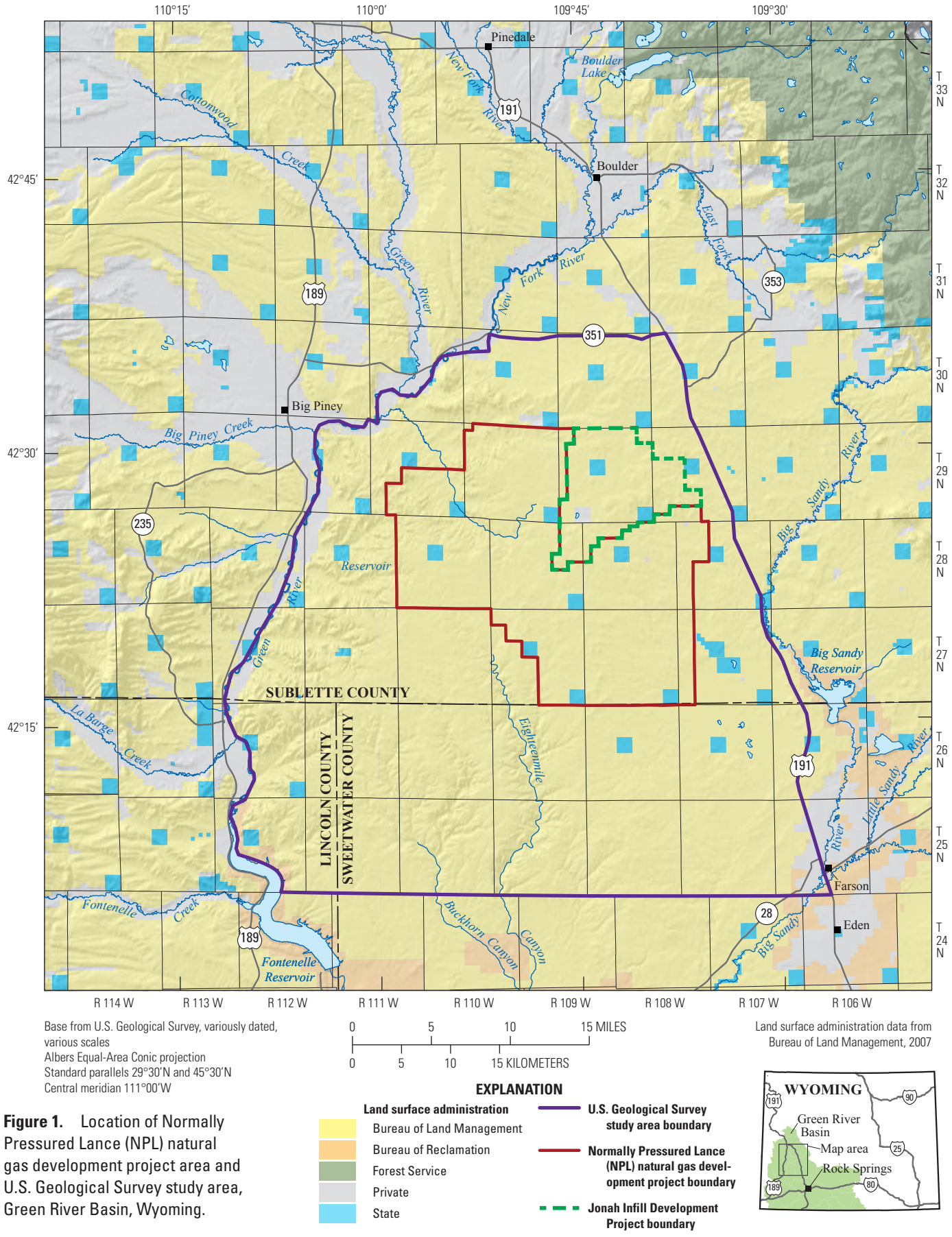

Figure 1. Location of Normally Pressured Lance (NPL) natural gas development project area and U.S. Geological Survey study area, Green River Basin, Wyoming.

To account for groundwater movement through the NPL project area, a study area was established between the Green River, the Big Sandy River, and U.S. Highway 191, and between State Highway 351 and an east-west line 12 mi south of the Sublette and Sweetwater County line, between the Green and Big Sandy Rivers. This area forms the USGS study area and covers approximately 702,000 acres.

The study area consists of sage brush steppe, and as such includes critical habitat (Duke and others, 2011) for the Greater Sage-Grouse (*Centrocercus urophasianus*), elk (*Cervus elaphus*), pronghorn (*Antilocapra americana)*, mule deer (*Odocoileus hemionus*), and feral horses (*Equus caballus*). Many other plant and animal species also are present in the area. Most of the land surface is federally owned and is administered by the BLM; as such, one of the primary land uses within the study area is livestock grazing. Most water wells in the study area provide water for livestock.

Purpose and Scope

The purpose of this report is to present an inventory and assessment of existing wells in the study area that was made during May through September 2012. These wells may be suitable for inclusion in a groundwater-monitor network in the NPL project area and the USGS study area.

The scope of the report includes a description of credible and suitable well criteria, and data objectives for different monitoring purposes, including depth of the well, depth to top of open interval, length of open or screened interval, and geologic formation or unit in which the well is completed.

Methods

The methods used include physical and electronic records searches, screening of wells based on published criteria required by BLM for establishment of a monitor well, and field reconnaissance to physically verify well location, access, depth, and measurement of depth to water. Screened intervals were determined from well completion records on file with the Wyoming State Engineers Office (WSEO). This information was assessed to determine suitability of each well for use in a monitor network.

Well Screening

Physical and digital groundwater well records were accessed from files and databases maintained by the WSEO, BLM field offices, Pinedale Anticline Project Area (PAPA) producers, and the USGS Groundwater Site Inventory (GWSI) database (U.S. Geological Survey, 2004). Records of groundwater wells from BLM, PAPA producers, and USGS sources included 3,282 wells in the upper Green River Basin. These records were compared against the WSEO well-permit database, and only those wells with WSEO permits (2,713 unique records) that were within the USGS study area (376 wells) were selected for assessment for inclusion in a possible groundwater-monitor network.

Records for the 376 wells were then screened according to the credible/suitable well screening matrix presented in AMEC Geomatrix (2009) and to the USGS Office of Groundwater site establishment specifications published in Cunningham and Schalk (2011), and were used to identify wells that would be suitable for use in a monitor network.

Credible/suitable well screening information developed by AMEC Geomatrix (2009) for the PAPA producers is listed in table 1. USGS minimum data elements required to establish a groundwater site are listed in table 2 (Cunningham and Schalk, 2011). In general, critical information is available for many existing wells that is common to all data objectives described in the credible/suitable well screening matrix (table 1) and that meets the minimum set of data elements required to establish a groundwater site (table 2); however, existing wells are unlikely to meet all of the credible/suitable criteria set forth for every data objective because some of the information needed to meet the criteria is not routinely reported by drillers upon well completion (*amec*, 2012).

Within the USGS study area, 376 wells with WSEO permits were identified. The records for each of these wells were then assessed using the criteria established by AMEC Geomatrix (2009) and the USGS (Cunningham and Schalk, 2011). A total of 141 existing well records were found that contained sufficient information to meet the AMEC Geomatrix (2009) criteria common to all data objectives and the specific criteria necessary to (1) characterize horizontal flow in the aquifer in which they were completed (data objective 1; table 1), (2) monitor groundwater levels and characterize vertical flow between hydrostratigraphic units (data objective 2; table 1), and (3) monitor water-quality impacts (data objectives 5 and 6; table 1) from oil and gas activities.

Specifically, information about these wells generally included information about the original depth of the well, the open or screened interval(s) of the well, the type of surface seal, and depth to water at the time of completion of the well. This information is sufficient to describe general groundwater conditions in an area such as the potentiometric surface, and to allow for the collection of groundwater-quality samples representative of the aquifer(s) in which the well(s) is completed. With the collection of additional data, this information is sufficient to allow for the description of changes to this surface with time, and to describe local effects from activities such as pumping,

Once the subset of 141 candidate wells was identified, USGS staff then developed a strategy to locate and document each of these wells. A local project folder was created for each well. The folder contained a copy of the well permit; drilling completion report(s), including driller's log(s); and any previously collected data from the well, such as depth to water, physical properties of water measured in the field, water-quality sample results, aquifer test results, and well production

Table 1. Credible/suitable well screening requirements to establish a groundwater site developed by AMEC Geomatrix (2009) for the Pinedale Anticline Project Area producers.

[BLM, Bureau of Land Management; <, less than; HSU, hydrostratigraphic unit; ft, foot; PHC, petroleum hydrocarbons; ≤, less than or equal to; USGS, U.S. Geological Survey; PAPA, Pinedale Anticline Producers Association]

Data objective	Well selection criteria
Critical information common to all data objectives	Existing monitoring data collected in accordance with BLM requirements.
	Well completion report available.
	Lithology recorded on drillers log.
	Geographic location known.
	Casing reference elevation known or can be obtained.
	Total depth known.
	Casing sealed and depth of seal known.
	Position of perforated interval known.
1. Characterize horizontal flow within an HSU	Well accessible for water-level measurements.
	Well perforated/screened in single hydrostratigraphic unit (HSU).
	Well adequately sealed from adjacent HSU(s).
	Perforated/screened interval <50 ft.
2. Characterize flow between HSUs (vertical gradients)	Well accessible for water-level measurements.
	Well located <200 ft from companion well completed in different HSU.[1]
	Well perforated/screened in single hydrostratigraphic unit (HSU) and adequately sealed.
	Discrete perforated/screened inverval (<50 feet).
3. Characterize flow between groundwater and surface water	Well accessible for water-level measurements.
	Well near river/stream.[2]
	Well perforated/screened in single HSU.
	Well located near an existing/planned streamgage.[3]
	All criteria for objective 2 are met.[1]
4. Collect credible aquifer test data[4]	Well accessible for water-level measurements.
	Perforated/screened interval in appropriate lithologic interval of target HSU.
	Perforated intervals isolated from nontarget lithologies.
5. Monitor water-quality impacts from oil and gas activities—surface release	Well accessible for sampling.
	Well is secure and access is controlled (for example, locking cap).[5]
	No non-oil and gas PHC sources located in immediate vicinity.
	Perforated/screened interval in uppermost HSU and brackets water table.
	Perforated/screened interval ≤50 ft.
	No prior PHC detections.[6]
6. Monitor water-quality impacts from oil and gas activities—excursion from drilling/operating gas wells	Well accessible for sampling.
	Well located in Pinedale Field or immediately downgradient of field.[7]
	Well is secure and access is controlled (for example, locking cap).[5]
	No prior PHC detections.[6]

[1] Currently (2012) no well clusters exist that meet this criterion.

[2] Not all wells will meet this criterion; however, there are some wells on the margins of the study area that do.

[3] Currently (2012) no wells meet this criterion; however, in 2013, shallow wells are planned to be installed at USGS streamgages that are along the margins of the USGS study area.

[4] Aquifer tests are not routinely performed on livestock supply wells; wells selected for a monitor network could be slug tested to determine some aquifer properties.

[5] Wells in the USGS study area are not dedicated monitor wells and therefore generally do not have locking caps. Most have pumps in them and are used intermittently for water supply for livestock and wildlife. Dedicated project monitor wells would have to be installed to be able to secure them.

[6] In general, few water-quality analyses are available for the selected wells. This criterion would need to be established at the time of baseline sampling to determine if any wells meet this criterion.

[7] This PAPA criterion will be modified to state that the well must be located in either the Normally Pressured Lance (NPL) natural gas development project area or the USGS study area (Janet Bellis, Bureau of Land Management, oral commun., 2012).

values. A map was created using the location information provided for each well. Well records were then sorted by the aquifer or geologic formation in which they seemed to be completed, determined from well completion reports, driller's logs, and water-level records.

Field Reconnaissance

Field crews consisted of experienced USGS hydrologists assisted by student interns. The field crews were trained by a senior hydrologist in the specifics of locating and documenting groundwater wells based on procedures described in Cunningham and Schalk (2011). After field work was complete, a supervisory hydrologist checked all field records to verify well inventories were complete. Follow-up visits are planned in 2013 to further document wells for which water levels were not measured in 2012 because of well access issues.

Before attempting to locate and visit each well, ownership information was used to contact the owner of each well for permission to access the site and the well. In most cases (135), the BLM was the owner of the well. If the BLM well was considered part of a grazing lease, the current (2012) lessee was contacted and informed of the USGS's need to access the site and the well. For privately owned wells (6), the owners were contacted by phone and permission was requested to access the site and the well. Site and well access was granted for all 141 well sites.

Using the project folder for each well, field crews attempted to physically locate each of the 141 candidate wells. Because the study area is in a remote part of the State that has sparse human habitation, many of the wells are located in areas that do not have maintained roads. For this reason, USGS obtained road and trail information from EnCana for use with global-positioning system (GPS) devices. Each morning, the field crew would identify target wells to locate

Table 2. U.S. Geological Survey minimum set of data elements to establish a groundwater site.

[Minimum set of data elements based on Cunningham and Schalk (2011). GPS, global-positioning system; GWSI, Groundwater Site Inventory]

Data accuracy and limitations
1. Altitudes determined from topographic maps are accurate to within one-half the map contour interval; latitudes and longitudes are accurate to about 0.5 second.
2. Accuracy of latitude, longitude, and altitudes determined by use of GPS are dependent on each instrument's capabilities.
3. The accuracy of the measuring point, land-surface datum, measuring point correction, and reference marks depends on the measurement method used.
4. A graduated steel or electric tape commonly is accurate to 0.01 foot.
Assumptions
1. The groundwater site is established by a field visit. At times, a site is established without a field visit. In that instance, less information may be available to establish the site in GWSI.
2. A groundwater site is a single point, not a geographic area or property.
3. All information available for a site will be compiled and entered in GWSI. This includes data and information that are not mandatory for GWSI (U.S. Geological Survey, 2004).
4. A GPS unit, aerial photographs, remotely-sensed images, paper maps, or some combination of these resources, will be used to complete the location-based information needed for Form 9-1904-A (fig. 3). A U.S. Geological Survey (USGS) computer application is available for this task, which automates some of the steps in the procedure. Use of that application is encouraged, but it is not yet available for field use.
5. The hydrographer has gathered all of the information available about the well, including a well-construction log, geologic log, and owner information, and has permission to access the well.
Instructions
1. Locate the well as described in Cunningham and Schalk (2011).
2. Establish a permanent measuring point, land-surface datum, and nearby reference marks as described in Cunningham and Schalk (2011).
3. Measure the total depth of the well as described in Cunningham and Schalk (2011).
4. Measure the water level in the well by using a steel tape or electric tape, as described in Cunningham and Schalk (2011).
5. Use the information collected before the field visit and the measurements collected during the field visit to complete every GWSI component (Form 9-1904-A, see fig. 3) for which you have information.
Data recording
Data are recorded in the field on the GWSI Groundwater Site Schedule (Form 9-1904-A, see fig. 3). Water levels also are recorded on the appropriate water-level measurement field form.

for that day, and would determine the best route to each well using the GPS, paper maps, aerial photography, and remotely-sensed images. In many cases, the most precise location information available was a quarter-quarter section (40 acres or 0.06 square mile). To overcome this limitation, a conversion from quarter-quarter section to latitude-longitude coordinates for the centroid of the quarter-quarter section was used to assist with navigation. This reduced the area of uncertainty for a well to 10 acres or 0.015 square mile in most cases.

From June through August of 2012, field visits were attempted at each of the 141 candidate wells that met initial criteria. Upon arriving at the reported well location, an attempt was made to locate and identify each well. Field crews were able to locate 121 of the wells (table 3) because the well was readily visible (examples are shown in figs. 2*A*, 2*B*) and the location information was correct. Upon arrival at each well, the field crew would assess the site for any safety considerations and would then begin to document the well by completing a detailed field form (fig. 3, at the back of the report). Photographs were taken of the well from each cardinal direction. Additional photographs were taken as needed to document the site, such as close-ups of any infrastructure and additional identifying information (fig. 2*C*).

The height of the well casing above land surface was measured and documented, and the well was then accessed to make a water-level measurement and to sound the well for total depth. In most cases water levels were measured with an electric tape (Cunningham and Schalk, 2011, p. 33–38) or a graduated steel tape (Cunningham and Schalk, 2011, p. 95–104). Access to measure water levels typically was through a small port provided in the well cap for this purpose (fig. 2*D*). In some cases, wells were not capped and access was directly into open casing. In other cases, typically those wells having windmills, a metal plate was over the well. Many of these metal plates did not have access ports, so they were lifted off the well casing using a jack or wedge, and the water-level measuring tape was inserted between the metal plate and the top of the well casing. For measurements made this way, the water-level measurement is slightly less accurate (approximately 0.01–0.03 foot) because the tape is not held vertically at the measuring point, and there is a slight curvature to the tape. Multiple water-level measurements were made until two successive measurements fell within the guidelines for accurate measurements (Cunningham and Schalk, 2011, p. 5–8 and 33–38). Water levels were recorded on the site-specific field form (fig. 3).

Table 3. Number of wells visited, preliminary aquifer assignment, and results of field visit.

[Shaded cells indicate candidate credible/suitable wells: blue, free flowing well; tan, candidate well that could not be accessed to measure water level; min, minimum; max, maximum; ft, feet; SS, sandstone; WL, water level]

	Geohydrologic unit (min-max depth of wells in feet)							
				Wasatch-Fort Union aquifer				
	Alluvium (not reported–1,042 ft)	Laney Member of Green River Formation (26–385 ft)	Farson SS Member of Green River Formation/ Alkali Creek Tongue of Wasatch Formation (8–1,365 ft)	Wasatch Formation (155–1,573 ft)	Cathedral Bluffs Tongue of Wasatch Formation (150 ft)	New Fork Tongue of Wasatch Formation (55–500 ft)	Unknown (not reported)	Total
Water-level measurement	1	10	42[1]	6[1]	0	0	0	**59**
Pumping WL	1	3	6	1	1	0	0	**12**
Flowing	2	1	1	4	0	0	0	**8**
No access; WL might be possible	0	1	6	2	0	2	2	**13**
Dry (to total depth or obstruction)	0	1	4	2	0	0	2	**9**
Plugged or sealed; abandoned	1	4	5	2	0	0	8	**20**
Could not locate	0	1	6	3	0	0	10	**20**
Total	5	21	70	20	1	2	22	**141**

[1] Two wells are completed in both the Farson SS Member of the Green River Formation/Alkali Creek Tongue of Wasatch Formation and the Wasatch Formation of the Wasatch-Fort Union aquifer, but are only counted in the Farson SS Member of the Green River Formation/Alkali Creek Tongue of Wasatch Formation.

Upon completing water-level measurements, the well was sounded to ascertain the total depth of the well. Each member of the field crew checked the depth, and the well depth was recorded on the site-specific field form (fig. 3). Measured well depths were checked against both permitted and report completion depths, and discrepancies noted.

Upon completion of in-hole measurements, the well was returned to the condition in which it was found and the field crew completed the remaining entries on the field form, including a site sketch, date and time of visit and water-level measurement, latitude and longitude measured on site with a field-grade GPS, and any other information the field crew felt was pertinent. Well elevations were assigned based on the well location plotted on a USGS 1:24,000-scale topographic map. Both EnCana and surface lessees asked USGS field crews to document any sightings of wildlife, including elk, horses, and raptors, and these observations were included in the field notes for any well location where sightings were made.

Photograph by Katharine Foster, U.S. Geological Survey.

Photograph by Mike Sweat, U.S. Geological Survey.

Photograph by Michelle Taylor, U.S. Geological Survey.

Photograph by Katharine Foster, U.S. Geological Survey.

Figure 2. Photographs illustrating: *A*, an easily located well; *B*, a well with existing pump and storage tank; *C*, additional identifying information found at some wells; and *D*, typical access for water-level measurement.

Results

Through an inventory of physical and digital well records, the USGS found 3,282 groundwater-well records for the upper Green River Basin. A total of 141 existing well records were found that contained sufficient information to meet the AMEC Geomatrix (2009) criteria common to all data objectives (table 1) and the specific criteria necessary to (1) characterize horizontal flow in the aquifer in which they were completed (data objective 1; table 1), (2) monitor groundwater levels and characterize vertical flow between hydrostratigraphic units (data objective 2; table 1), and (3) monitor water-quality impacts from oil and gas activities (data objectives 5 and 6; table 1). The USGS attempted to visit each of the 141 wells to verify the wells existence and condition, and to measure the water level. This section describes the wells that met credible/suitable criteria and the results of well field visits.

During the well-records search, information for each well was tabulated in a worksheet. Well records were screened on the basis of whether data required to meet credible/suitable criteria were available for each well. For many wells, some of the required information was not reported; however, using best professional judgment, USGS hydrologists determined these wells might meet criteria for some of the data objectives listed in table 1 and the wells were included in the study. The information that most commonly was missing from the records was depth to open interval(s) and depth to bottom of seal. Additionally, the perforated or screened intervals in most of the wells do not straddle (bracket) the water table (data objective 5; table 1), and the perforated or screened interval in many wells is not in a single hydrostratigraphic unit (data objectives 1, 2, 3, and 5; table 1), because these wells were designed to produce water. Given these limitations, USGS determined that wells listed in table 4 (at the back of the report) might be credible/suitable monitor wells for data objectives 1, 2, 5, and 6 (table 1).

For data objective 1 (table 1), wells in table 4 generally meet all well selection criteria, although many wells have perforated or screened (open) intervals greater than 50 ft. Many of these wells have multiple perforated or screened intervals, in which case packers could be used to isolate sections of aquifer less than or equal to 50 ft for measuring water levels from different hydrostratigraphic units.

For data objective 2 (table 1), wells in table 4 generally meet the first and third criteria; however, only two sites have multiple wells located within 200 ft of each other and completed in different hydrostratigraphic units. Without the installation of additional, dedicated monitor wells at other locations, this data objective is unlikely to be met as stated; however, the use of packers in wells with multiple perforated or screened intervals would allow for water levels to be measured at discrete vertical intervals within a well, which would provide data similar to multiple wells completed at different depths.

For data objectives 5 and 6, best professional judgment was used to include these wells. Because most of these wells are used for stock or other purposes, they have dedicated pumps installed, and generally are not locked or secured due to the remoteness of the area. Additionally, many have not been previously sampled for petroleum hydrocarbons (PHC), so it is not known if any of them might have detectable levels of PHC; however, given the information that is known about the wells, their location, and their current (2012) use(s), USGS believes that these wells could provide reliable data about water quality if they were to be sampled. For data objective 5, an arbitrary maximum depth of 200 ft for the top of the open interval (table 4) was selected for this report as a cut off beyond which surface spills are unlikely to be detected. Consultation with cooperators and additional site characterization would be needed to determine the suitability of any given well to meet data objective 5.

During field reconnaissance, 20 of the 141 wells the USGS attempted to visit could not be located (table 3). These 20 wells could not be located due to either incorrect location information in the well records, or because the well had been abandoned or destroyed and no surface indication of the well could be found at the site. The 121 wells that were visited were found in many different conditions.

Static water levels were measured at 59 wells, and pumping water levels were measured at 12 wells. Eight of the located wells were free flowing (no pump) (tables 3 and 4; fig. 4). Field crews noted the height and diameter of the discharge point; however, they did not have pressure gages or other tools with which to accurately measure water level. Flowing wells are planned to be revisited in 2013, and a pressure gage will be used to determine the actual height above the land surface to which water would rise. It is important to include flowing wells in the network because they offer valuable information about the rate and direction of vertical flow both in and between aquifers. No water-level measurement was attempted at 13 wells due to site conditions, but these are planned to be revisited in 2013 and water-level measurements will be attempted. Of the remaining 29 wells (table 3), 9 were located and found to be dry or obstructed, and 20 were located and found to be plugged or sealed, and abandoned.

A total of 92 wells (fig. 5) were determined to either meet some credible/suitable criteria (79 wells) or to be candidate wells that might meet credible/suitable criteria (13 wells). The latter wells were located, but due to site conditions, a water-level measurement was not made or attempted during the initial field visit. These wells are planned to be revisited in 2013 by a senior hydrologist who will attempt to measure both the depth to water and the total depth of the well. Access to measure water level would likely make these wells candidates for inclusion in a monitor well network.

Of the 79 wells found to meet credible/suitable criteria for determining potentiometric surface and water-quality (table 3), 4 were completed in alluvium, 14 were completed

Figure 4. A flowing well. Photograph by Michelle L. Taylor, U.S. Geological Survey.

in the Laney Member of the Green River Formation, 49 were completed in the geohydrologic unit composed of the Farson Sandstone Member of the Green River Formation and the Alkali Creek Tongue of the Wasatch Formation, and 12 were completed in 3 different units of the Wasatch-Fort Union aquifer. Two wells completed in the geohydrologic unit composed of the Farson Sandstone Member of the Green River Formation and the Alkali Creek Tongue of the Wasatch Formation also have open intervals in the Wasatch Formation (table 3), and are reported as only for the Farson Sandstone Member of the Green River Formation/Alkali Creek Tongue of the Wasatch Formation.

Results of the field reconnaissance were entered into the USGS GWSI database and are presented in table 4 for those wells that met many, but not necessarily all, of the credible/suitable criteria. Additional data for the wells are available from the USGS National Water Site Inventory Web page at *http://nwis.waterdata.usgs.gov/wy/nwis/inventory* by using the site numbers in table 4.

Quality Control

Collection of quality-control (QC) measurements is critical for evaluating the procedures and protocols used during field reconnaissance, as well as for providing confirmation of results. QC procedures for the well inventory and assessment consisted of having two people on each field crew, the use of a consistent, defined field form by all personnel (fig. 3), and following published protocols (Cunningham and Schalk, 2011).

During water-level measurements, one person made the primary water-level determination and the second person made a confirmatory measurement. When determining GPS coordinates, one person read the GPS coordinates out loud to the second person who was taking the field notes; the note taker then read the coordinates back to the person with the GPS, who acknowledged or corrected the information. Protocols and QC procedures for the measurement of water levels that are described by Cunningham and Schalk (2011) were followed for this study. For wells that could not be located on the initial attempt, a second attempt was made by a different field crew.

Summary

During May through September 2012, the U.S. Geological Survey, in cooperation with the Bureau of Land Management, inventoried and assessed existing water wells in southwestern Wyoming for inclusion in a possible groundwater-monitor network. An inventory was made of water-well records for the upper Green River Basin, an area that encompasses the Normally Pressured Lance natural gas development project area. Records for 3,282 water wells were located in industry, local, State, and Federal databases. These records were matched against the Wyoming State Engineers Office well-permit database, and 2,713 unique (not duplicated) records were isolated. Of these unique records, 376 were located in the U.S. Geological Survey study area. Completion reports, well logs, and other ancillary data, as available, were reviewed for each of these 376 wells to determine wells that would meet selected data objectives for inclusion in a possible groundwater-monitor network.

A total of 141 existing well records were found that seemed to meet the criteria common to all data objectives, and also met the specific criteria necessary to (1) characterize horizontal flow in the aquifer in which they were completed, (2) monitor groundwater levels and characterize vertical flow between hydrostratigraphic units, and (3) monitor water-quality impacts from oil and gas activities.

In 2012, field crews attempted to physically locate each of the 141 candidate wells. If the well was located, the well then was documented and an effort was made to measure the depth to water in the well and the total depth of the well. A total of 121 of the 141 candidate wells were located. Twenty

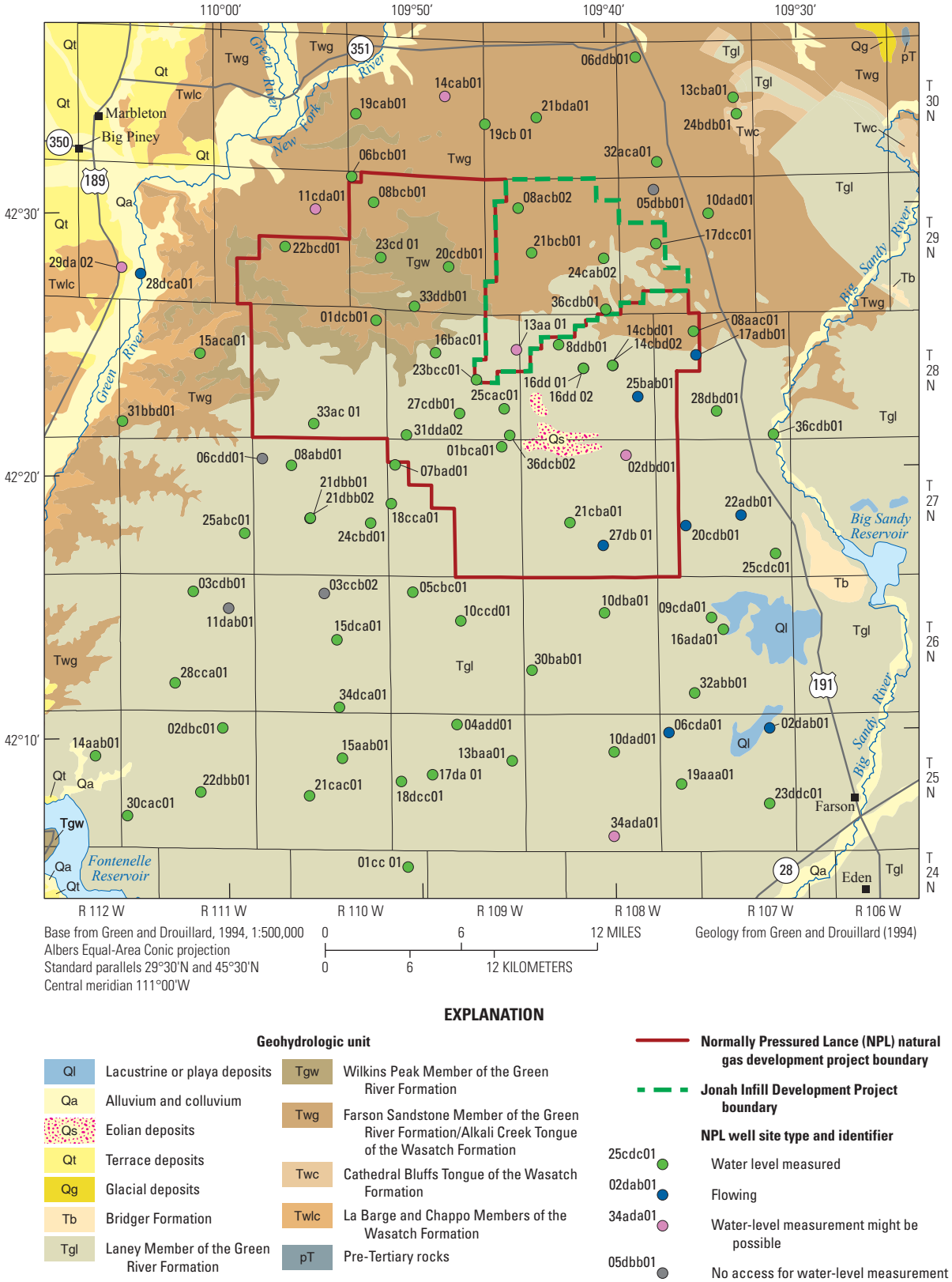

Figure 5. Location of credible/suitable wells (79 wells) and candidate credible/suitable wells (13 wells) located within the U.S. Geological Survey study area.

wells were not able to be located, either because of incorrect location information, or because the well had been abandoned and the site reclaimed. For each of these 20 wells, at least 2 attempts were made to locate them, and in each case there was no surface evidence of the well. Of the wells located, 20 were plugged or sealed and abandoned, and 9 of these wells were dry.

Of the remaining wells located, a total of 92 wells were determined to either meet some credible/suitable criteria (79 wells) or to be candidate wells that might meet credible/suitable criteria (13 wells). At the latter wells, site conditions prevented measuring water levels at the time of the initial visit. These wells were documented and are planned to be revisited in 2013. Eight of the wells located were free flowing and are planned to be revisited in 2013 to measure the pressure of the well to determine a water level.

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FORM NO. 9-1904-A
Revised Sept 2009, NWIS 4.9

File Code _____
Date _____

Coded by _____
Checked by _____
Entered by _____

U.S DEPT. OF THE INTERIOR
GEOLOGICAL SURVEY

GROUNDWATER SITE SCHEDULE
General Site Data

AGENCY CODE (C4) USGS | SITE ID (C1) | PROJECT (C5)

STATION NAME (C12/900)

1 SITE TYPE (C802) ___ - ___ (Primary - Secondary) | DISTRICT (C6) | COUNTRY (C41) | STATE (C7) | County code

COUNTY or TOWN (C8) _____

LATITUDE (C9) . | LONGITUDE (C10) . | LAT/LONG ACCURACY (C11): H (Hndrth sec.) 1 (tenth sec.) 5 (half sec.) S (sec.) R (3 sec.) F (5 sec.) T (10 sec.) M (min.) U (Unknown)

LAT/LONG METHOD (C35): C (land net) D (DGPS) G (GPS) L (LORAN) M (map) N (interpolated digital map) R (reported) S (survey) U (unknown)

LAT/LONG DATUM (C36): NAD27 (North American Datum of 1927) NAD83 (North American Datum of 1983)

ALTITUDE (C16) .

ALTITUDE ACCURACY (C18)

ALTITUDE METHOD (C17): A (altimeter) D (DGPS) G (GPS) I (IfSAR) J (LiDAR) L (Level) M (map) N (DEM) R (reported) U (unknown)

ALTITUDE DATUM (C22): NGVD29 (National Geodetic Vertical Datum of 1929) NAVD88 (North American Vertical Datum of 1988)

LAND NET (C13) ___ ___ ___ S ___ T ___ ___ (1/4 1/4 1/4 section township range merid)

TOPOGRAPHIC SETTING (C19): A (alluvial fan) B (playa) C (stream channel) D (depression) E (dunes) F (flat) G (flood-plain) H (hill-top) K (sink-hole) L (lake or swamp) M (mangrove swamp) O (off-shore) P (pedi-ment) S (hill-side) T (ter-race) U (undu-lating) V (valley flat) W (upland draw)

HYDROLOGIC UNIT CODE (C20) | DRAINAGE BASIN CODE (C801) | STANDARD TIME ZONE (C813) | DAYLIGHT SAVINGS TIME FLAG (C814) Y OR N

MAP NAME (C14) | MAP SCALE (C15)

AGENCY USE (C803): A (active no/na) D (discontinued) I (inactive site) L (active written) M (active oral) O (inventory site) R (remediated)

2 NATIONAL WATER-USE (C39)

DATA TYPE (C804)
Place an 'A' (active), an 'I' (inactive), or an 'O' (inventory) in the appropriate box

WL cont | WL int | QW cont | QW int | PR cont | PR int | EV cont | EV int | wind vel. | tide cont | tide int | sed. con | sed. ps | peak flow | low flow | state water use

INSTRUMENTS (C805)
(Place a "Y" in the appropriate box):

digital recorder | graphic recorder | telemetry land line | telemetry radio | telemetry satellite | AHDAS | crest-stage gage | tide gage | deflection meter | bubble gage | stilling well | CR type recorder | weighing rain gage | tipping bucket rain gage | acoustic velocity meter | electromagnetic flowmeter | pressure transducer

DATE INVENTORIED (C711) ___ (month) – ___ (day) – ___ (year)

RECORD READY FOR WEB (C32): Y (ready to display) C (conditional) P (proprietary) L (local use only)

REMARKS (C806)

FOOTNOTES

1 SITE TYPE (C802)

GL	Glacier	OC	Ocean
WE	Wetland	OC-CO	Coastal
AT	Atmosphere	LK	Lake, Reservoir, Impoundment
ES	Estuary	SP	Spring
LA	Land	ST	Stream
LA-EX	Excavation	ST-CA	Canal
LA-OU	Outcrop	ST-DCH	Ditch
LA-SNK	Sinkhole	ST-TS	Tidal strea m
LA-SH	Soil hole	FA-WIW	Waste-Injection well
LA-SR	Shore		

GW	Well	SB	Subsurface
GW-CR	Collector or Ranney type well	SB-CV	Cave
GW-EX	Extensometer well	SB-GWD	Groundwater drain
GW-HZ	Hyporheic -zone well	SB-TSM	Tunnel, shaft, or mine
GW-IW	Interconnected wells	SB-UZ	Unsaturated zone
GW-TH	Test hole not completed as a well		
GW-MW	Multiple wells		

2 WS (water supply) DO (domestic) CO (commercial) IN (industrial) IR (irrigation) MI (mining) LV (livestock) PH (power hydroelectric) ST (waste water treatment) RM (remediation) TE (thermoelectric power) AQ (aquaculture)

C22 Other (see manual for codes)
C36 Other (see manual for codes)
C39 is mandatory for all sites having data in SWUDS.

Figure 3. Example field form (Form 9-1904-A) used to document the assessment of and information about each well.

GENERAL SITE DATA

DATA RELIABILITY (C3) C L M U
(C: field checked; L: poor location; M: minimal data; U: unchecked)

DATE OF FIRST CONSTRUCTION (C21) ___ – ___ – ____ (month – day – year)

USE OF SITE (C23) A C D E G H M O P R S T U V W X Z
(A: anode; C: standby emer. supply; D: drain; E: geothermal; G: seismic; H: heat reservoir; M: mine; O: observation; P: oil or gas; R: recharge; S: repressurize; T: test; U: unused; V: withdrawal/return; W: withdrawal; X: waste; Z: destroyed)

SECONDARY USE OF SITE (C301) (See use of site) ☐ TERTIARY USE OF SITE (C302) (See use of site) ☐

USE OF WATER (C24) A B C D E F H I J K M N P Q R S T U Y Z
(A: air cond.; B: bottling; C: commercial; D: dewater; E: power; F: fire; H: domestic; I: irrigation; J: industrial (cooling); K: mining; M: medicinal; N: industrial; P: public supply; Q: aquaculture; R: recreations; S: stock; T: institutional; U: unused; Y: desalination; Z: other)

SECONDARY USE OF WATER (C25) (see use of water) ☐ TERTIARY USE OF WATER (C26) (see use of water) ☐

AQUIFER TYPE (C713) U N C M X
(U: unconfined single; N: unconfined multiple; C: confined single; M: confined multiple; X: mixed)

PRIMARY AQUIFER (C714) ____

NATIONAL AQUIFER (C715) ____

HOLE DEPTH (C27) ____.__

WELL DEPTH (C28) ____.__

SOURCE OF DEPTH DATA (C29) A D G L M O R S Z
(A: other gov't; D: driller; G: geologist; L: logs; M: memory; O: owner; R: other reported; S: reporting agency; Z: other)

WATER-LEVEL DATA

DATE WATER-LEVEL MEASURED (C235) ___ – ___ – ____ (month – day – year)

TIME (C709) ____

WATER-LEVEL TYPE CODE (C243) L M S
(L: land surface; M: meas. pt.; S: vertical datum)

WATER LEVEL (C237/241/242) ____.__

MP SEQUENCE NO. (C248) (Mandatory if WL type=M) ____

WATER-LEVEL DATUM (C245) (Mandatory if WL type=S) NGVD29 (National Geodetic Vertical Datum 0f 1929) NAVD88 (North American Vertical Datum 0f 1988) ____ (Other (See manual for codes))

SITE STATUS FOR WATER LEVEL (C238) A B C D E F G H I J M N O P R S T V W X Z
(A: atmos. pressure; B: tide stage; C: ice; D: dry; E: recently flowing; F: flowing; G: nearby flowing; H: nearby recently flowing; I: injector site; J: injector site monitor; M: plugged; N: measurement discontinued; O: obstruction; P: pumping; R: recently pumped; S: nearby pumping; T: nearby recently pumped; V: foreign substance; W: well destroyed; X: affected by surface water; Z: other)

METHOD OF WATER-LEVEL MEASUREMENT(C239) A B C D E F G H L M N O P R S T V Z
(A: airline; B: analog; C: calibrated airline; D: differential GPS; E: estimated; F: transducer; G: pressure gage; H: calibrated press. gage; L: geophysical logs; M: manometer; N: non-rec. gage; O: observed; P: acoustic pulse; R: reported; S: steel tape; T: electric tape; V: calibrated elec. tape; Z: other)

WATER-LEVEL ACCURACY (C276) 0 1 2 9
(0: foot; 1: tenth; 2: hundredth; 9: not to nearest foot)

SOURCE OF WATER-LEVEL DATA (C244) A D G L M O R S Z
(A: other gov't; D: driller's log; G: geologist; L: geophysical logs; M: memory; O: owner; R: other reported; S: reporting agency; Z: other)

PERSON MAKING MEASUREMENT (C246) (WATER LEVEL PARTY) ____

MEASURING AGENCY (C247) (SOURCE) ____

EQUIP ID (C249) (20 char) _____

REMARKS (C267) (256 char) _____

RECORD READY FOR WEB (C858) Y C P L
(Y: ready to display; C: conditional; P: proprietary; L: local use only)

CONSTRUCTION DATA

RECORD TYPE (C754) C O N S

RECORD SEQUENCE NO. (C723) ____

DATE OF COMPLETED CONSTRUCTION (C60) ___ – ___ – ____ (month – day – year)

NAME OF CONTRACTOR (C63) ____

SOURCE OF DATA (C64) A D G L M O R S Z
(A: other gov't; D: driller; G: geologist; L: logs; M: memory; O: owner; R: other reported; S: reporting agency; Z: other)

METHOD OF CONSTRUCTION (C65) A B C D H J P R S T V W Z
(A: air-rotary; B: bored or augered; C: cable tool; D: dug; H: hydraulic rotary; J: jetted; P: air percussion; R: reverse rotary; S: sonic; T: trenching; V: driven; W: drive wash; Z: other)

TYPE OF FINISH (C66) C F G H O P S T W X Z
(C: porous concrete; F: gravel w/perf.; G: gravel screen; H: horiz. gallery; O: open end; P: perf or slotted; S: screen; T: sand point; W: walled; X: open hole; Z: other)

TYPE OF SEAL (C67) B C G N Z
(B: bentonite; C: clay; G: cement grout; N: none; Z: other)

BOTTOM OF SEAL (C68) ____

METHOD OF DEVELOPMENT (C69) A B C J N P S Z
(A: air-lift pump; B: bailed; C: compressed air; J: jetted; N: none; P: pumped; S: surged; Z: other)

HOURS OF DEVELOPMENT (C70) ____

SPECIAL TREATMENT (C71) C D E F H M Z
(C: chemicals; D: dry ice; E: explosives; F: defloculent; H: hydro-fracturing; M: mechanical; Z: other)

CONSTRUCTION HOLE DATA (3 sets shown)

RECORD TYPE (C756) H O L E RECORD SEQUENCE NO. (C724) SEQUENCE NO. OF PARENT RECORD (C59)

DEPTH TO TOP OF INTERVAL (C73) . DEPTH TO BOTTOM OF INTERVAL (C74) . DIAMETER OF INTERVAL (C75) .

RECORD SEQUENCE NO. (C724)

DEPTH TO TOP OF INTERVAL (C73) . DEPTH TO BOTTOM OF INTERVAL (C74) . DIAMETER OF INTERVAL (C75) .

RECORD SEQUENCE NO. (C724)

DEPTH TO TOP OF INTERVAL (C73) . DEPTH TO BOTTOM OF INTERVAL (C74) . DIAMETER OF INTERVAL (C75) .

CONSTRUCTION CASING DATA (4 sets shown)

RECORD TYPE (C758) C S N G RECORD SEQUENCE NO. (C725) SEQUENCE NO. OF PARENT RECORD (C59)

DEPTH TO TOP OF CASING (C77) . DEPTH TO BOTTOM OF CASING (C78) . DIAMETER OF CASING (C79) .

4 CASING MATERIAL (C80) CASING THICKNESS (C81) .

RECORD SEQUENCE NO. (C725) SEQUENCE NO. OF PARENT RECORD (C59)

DEPTH TO TOP OF CASING (C77) . DEPTH TO BOTTOM OF CASING (C78) . DIAMETER OF CASING (C79) .

4 CASING MATERIAL (C80) CASING THICKNESS (C81) .

RECORD SEQUENCE NO. (C725) SEQUENCE NO. OF PARENT RECORD (C59)

DEPTH TO TOP OF CASING (C77) . DEPTH TO BOTTOM OF CASING (C78) . DIAMETER OF CASING (C79) .

4 CASING MATERIAL (C80) CASING THICKNESS (C81) .

RECORD SEQUENCE NO. (C725) SEQUENCE NO. OF PARENT RECORD (C59)

DEPTH TO TOP OF CASING (C77) . DEPTH TO BOTTOM OF CASING (C78) . DIAMETER OF CASING (C79) .

4 CASING MATERIAL (C80) CASING THICKNESS (C81) .

FOOTNOTE:

4 CASING MATERIAL CODES

A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S	T	U	V	W	X	Y	Z	4	6
abs	brick	concrete	copper	PTFE	Fiber-glass	galv. iron	Fiber-glass plastic	wrought iron	Fiber-glass epoxy	PVC thread-ed	glass	other metal	PVC glued	PVC or plastic	FEP	rock or stone	steel	tile	coated steel	stain-less steel	wood	steel carbon	steel galva-nized	other mat.	stain-less 304	stain-less 316

CONSTRUCTION OPENINGS DATA (3 sets shown)

RECORD TYPE (C760) O P E N

RECORD SEQUENCE NO. (C726)

SEQUENCE NO. OF PARENT RECORD (C59)

DEPTH TO TOP OF INTERVAL (C83) .

DEPTH TO BOTTOM OF INTERVAL (C84) .

DIAMETER OF INTERVAL (C87) .

[5] MATERIAL TYPE (C86)

[6] TYPE OF OPENING (C85)

LENGTH OF OPENING (C89) .

WIDTH OF OPENING (C88) .

RECORD SEQUENCE NO. (C726)

DEPTH TO TOP OF INTERVAL (C83) .

DEPTH TO BOTTOM OF INTERVAL (C84) .

DIAMETER OF INTERVAL (C87) .

[5] MATERIAL TYPE (C86)

[6] TYPE OF OPENING (C85)

LENGTH OF OPENING (C89) .

WIDTH OF OPENING (C88) .

RECORD SEQUENCE NO. (C726)

DEPTH TO TOP OF INTERVAL (C83) .

DEPTH TO BOTTOM OF INTERVAL (C84) .

DIAMETER OF INTERVAL (C87) .

[5] MATERIAL TYPE (C86)

[6] TYPE OF OPENING (C85)

LENGTH OF OPENING (C89) .

WIDTH OF OPENING (C88) .

FOOTNOTES:

[5] TYPE OF MATERIAL CODES FOR OPEN SECTIONS

A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S	T	V	W	X	Y	Z	4	6
ABS	brass or bronze	concrete	ceramic	PTFE	fiber-glass	galv. iron	fiber-glass plastic	wrought iron	fiber-glass epoxy	PVC thread-ed	glass	other metal	PVC glued	PVC	FEP	stain-less steel	steel	tile	brick	mem-brane	steel carbon	steel galva-nized	other	stain-less 304	stain-less 316

[6] TYPE OF OPENINGS CODES

F	L	M	P	R	S	T	W	X	Z
fractured rock	louvered or shutter-type	mesh screen	perforated, porous or slotted	wire-wound screen	screen (unk.)	sand point screen	walled or shored	open hole	other

CONSTRUCTION MEASURING POINT DATA

RECORD TYPE (C766) M P N T

RECORD SEQUENCE NO. (C728)

BEGINNING DATE (C321) month – day – year

ENDING DATE (C322) – –

M.P. HEIGHT (C323) .

ALTITUDE OF MEASURING POINT (C325)

ALTITUDE METHOD (C326)

ALTITUDE ACCURACY (C327)

ALTITUDE DATUM (C328)

M.P. REMARKS (C324)

RECORD READY FOR WEB (C857)

Y	C	P	L
ready to display	condi-tional	proprie-tary	local use only

CONSTRUCTION LIFT DATA

RECORD TYPE (C752): L I F T

RECORD SEQUENCE NO. (C254):

TYPE OF LIFT (C43): A air; B bucket; C centrifugal; J jet; P piston; R rotary; S submersible; T turbine; U unknown; X no lift; Z other

DATE RECORDED (C38): month – day – year

PUMP INTAKE DEPTH (C44):

TYPE OF POWER (C45): D diesel; E electric; G gasoline; H hand; L LP gas; N natural gas; S solar; W windmill; Z other

HORSEPOWER RATING (C46): .

MANUFACTURER (C48):

SERIAL NO. (C49):

POWER COMPANY (C50):

POWER COMPANY ACCOUNT NUMBER (C51):

POWER METER NUMBER (C52):

PUMP RATING (C53) (million gallons/units of fuel): .

ADDITIONAL LIFT (C255):

PERSON OR COMPANY MAINTAINING PUMP (C54):

RATED PUMP CAPACITY (gpm) (C268):

STANDBY POWER (C56) (see TYPE OF POWER):

HORSEPOWER OF STANDBY POWER SOURCE (C57): .

MISCELLANEOUS OWNER DATA

RECORD TYPE (C768): O W N R

RECORD SEQUENCE NO. (C718):

DATE OF OWNERSHIP (C159): – –

WU OWNER TYPE (C350): CP Corporation; GV Government; IN Individual; MI Military; OT Other; TG Tribal; WS Water Supplier

END DATE OF OWNERSHIP (C374): – –

OWNER'S NAME (C161):

EXAMPLES: JONES, RALPH A.
JONES CONSTRUCTION COMPANY

OWNER'S PHONE NUMBER (C351):

ACCESS TO OWNER'S NAME (C352): 0 Public Access; 1 Cooperator; 2 USGS Only; 3 District Only; 4 Proprietary

OWNER'S ADDRESS (LINE 1) (C353):

OWNER'S ADDRESS (LINE 2) (C354):

OWNER'S CITY NAME (C355):

STATE (C356):

OWNER'S ZIP CODE (C357): –

OWNER'S COUNTRY NAME (C358):

ACCESS TO OWNER'S PHONE/ADDRESS (C359): 0 Public Access; 1 Cooperator; 2 USGS Only; 3 District Only; 4 Proprietary

MISCELLANEOUS VISIT DATA

RECORD TYPE (C774): V I S T

RECORD SEQUENCE NO. (C737):

DATE OF VISIT (C187): month – day – year

NAME OF PERSON (C188):

MISCELLANEOUS OTHER ID DATA (2 sets shown)

RECORD TYPE (C770) O T I D

RECORD SEQUENCE NO. (C736)

OTHER ID (C190)

ASSIGNER (C191)

RECORD SEQUENCE NO. (C736)

OTHER ID (C190)

ASSIGNER (C191)

MISCELLANEOUS OTHER DATA

RECORD TYPE (C772) O T D T

RECORD SEQUENCE NO. (C312)

OTHER DATA TYPE (C181)

OTHER DATA LOCATION (C182): C Cooperator's Office, D District Office, R Reporting Agency, Z other

DATA FORMAT (C261): F files, M machine readable, P published, Z other

MISCELLANEOUS LOGS DATA (3 sets shown)

RECORD TYPE (C778) L O G S

RECORD SEQUENCE NO. (C739)

TYPE OF LOG (C199)

BEGINNING DEPTH (C200) .

ENDING DEPTH (C201) .

SOURCE OF DATA (C202): A other gov't, D driller, G geol-ogist, L logs, M memory, O owner, R other reported, S reporting agency, Z other

DATA FORMAT (C225): F files, M machine readable, P published, Z other

OTHER DATA LOCATION (C226)

RECORD TYPE (C778) L O G S

RECORD SEQUENCE NO. (C739)

TYPE OF LOG (C199)

BEGINNING DEPTH (C200) .

ENDING DEPTH (C201) .

SOURCE OF DATA (C202): A other gov't, D driller, G geol-ogist, L logs, M memory, O owner, R other reported, S reporting agency, Z other

DATA FORMAT (C225): F files, M machine readable, P published, Z other

OTHER DATA LOCATION (C226)

RECORD TYPE (C778) L O G S

RECORD SEQUENCE NO. (C739)

TYPE OF LOG (C199)

BEGINNING DEPTH (C200) .

ENDING DEPTH (C201) .

SOURCE OF DATA (C202): A other gov't, D driller, G geol-ogist, L logs, M memory, O owner, R other reported, S reporting agency, Z other

DATA FORMAT (C225): F files, M machine readable, P published, Z other

OTHER DATA LOCATION (C226)

ACOUSTIC LOG:
AS Sonic
AV Acoustic velocity
AW Acoustic waveform
AT Acoustic televiewer

CALIPER LOG:
CP Caliper
CS Caliper, single arm
CT Caliper, three arm
CM Caliper, multi arm
CA Caliper, acoustic

DRILLING LOG:
DT Drilling time
DR Drillers
DG Geologists
DC Core

ELECTRIC LOG:
EE Electric
ER Single-point resistance
EP Spontaneous potential
EL Long-normal resistivity
ES Short-normal resistivity
EF Focused resistivity
ET Lateral resistivity
EN Microresistivity
EC Microresistivity, forused
EO Microresistivity, lateral
ED Dipmeter

ELECTROMAGNETIC LOG:
MM Magnetic log
MS Magnetic susceptibiity log
MI Electromagnetic induction log
MD Electromagnetic dual induction log
MR Radar reflection image log
MV Radar direct-wave velocity log
MA Radar direct-wave amplitude log

FLUID LOG:
FC Fluid conductivity
FR Fluid resistivity
FT Fluid temperature
FF Fluid differential temperature
FV Fluid velocity
FS Spinner flowmeter
FH Heat-pulse flowmeter
FE Electromagnetic flowmeter
FD Doppler flowmeter
FA Radioactive tracer
FY Dye tracer
FB Brine tracer

NUCLEAR LOG:
NG Gamma
NS Spectral gamma
NA Gamma-gamma
NN Neutron
NT Neutron activitation
NM Neuclear magnetic resonance

OPTICAL LOG:
OV Video
OF Fisheye video
OS Sidewall video
OT Optical televiewer

COMBINATION LOG:
ZF Gamma, fluid resistivity, temperature
ZI Gamma, electromagnetic induction
ZR Long/short normal resistivity
ZT Fluid resistivity, temperature
ZM Electromagnetic flowmeter, fluid resistivity, temperature
ZN Long/short normal resistivity, spontaneous potential
ZP Single-point resistance, spontaneous potential
ZE Gamma, long/short normal resistivity, spontaneous potential, single-point resistance, fluid resitivity, temperature

WELL CONSTRUCTION LOG:
WC Casing collar
WD Borehole deviation

OTHER LOG:
OR Other

6 - Groundwater Site Schedule

MISCELLANEOUS NETWORK DATA (3 types shown)

RECORD TYPE (C780): NETW | RECORD SEQUENCE NO. (C730): | TYPE OF NETWORK (C706): QW (water quality) | BEGINNING YEAR (C115): | ENDING YEAR (C116):

TYPE OF ANALYSIS (C120):

A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Z
physical properties	common ions	trace elements	pesticides	nutrients	sanitary analysis	codes D&B	codes B&E	codes B&C	codes B&F	codes D&E	codes C,D&E	all or most	codes B&C& radioactive	codes B,C&A	other

SOURCE AGENCY (C117): | [7] FREQUENCY OF COLLECTION (C118): | ANALYZING AGENCY (C307): | [8] PRIMARY NETWORK SITE (C257): | [8] SECONDARY NETWORK SITE (C708):

RECORD TYPE (C780): NETW | RECORD SEQUENCE NO. (C730): | TYPE OF NETWORK (C706): WL (water level) | BEGINNING YEAR (C115): | ENDING YEAR (C116):

SOURCE AGENCY (C117): | [7] FREQUENCY OF COLLECTION (C118): | [8] PRIMARY NETWORK SITE (C257): | [8] SECONDARY NETWORK SITE (C708):

RECORD TYPE (C780): NETW | RECORD SEQUENCE NO. (C730): | TYPE OF NETWORK (C706): WD (pumpage or withdrawals) | BEGINNING YEAR (C115): | ENDING YEAR (C116):

SOURCE AGENCY (C117): | [7] FREQUENCY OF COLLECTION (C118): | METHOD OF COLLECTION (C133):

C	E	M	U	Z
calculated	estimated	metered	unknown	other

[8] PRIMARY NETWORK SITE (C257): | [8] SECONDARY NETWORK SITE (C708):

FOOTNOTES:

[7] FREQUENCY OF COLLECTION CODES

A	B	C	D	F	I	M	O	Q	S	W	Z	2	3	4	5	X
annually	bi monthly	continuously	daily	semi-monthly	intermittent	monthly	one-time only	quarterly	semi-annually	weekly	other	bi-annually	every 3 years	every 4 years	every 5 years	every 10 years

[8] NETWORK SITE CODES

1	2	3	4
national,	district,	project,	cooperator,

MISCELLANEOUS REMARKS DATA (4 types shown)

RECORD TYPE (C788): RMKS | RECORD SEQUENCE NO. (C311): | DATE OF REMARK (C184): ___ (month) – ___ (day) – ____ (year)

REMARKS (C185)

Subsequent entries may be used to continue the remark. Miscellaneous remarks field is limited to 256 characters.

RECORD TYPE (C788): RMKS | RECORD SEQUENCE NO. (C311): | DATE OF REMARK (C184): ___ (month) – ___ (day) – ____ (year)

REMARKS (C185)

Subsequent entries may be used to continue the remark. Miscellaneous remarks field is limited to 256 characters.

DISCHARGE DATA

RECORD SEQUENCE NO. (C147)

DATE DISCHARGE MEASURED (C148) month – day – year

TYPE OF DISCHARGE (C703): P pumped, F flow

DISCHARGE (gpm) (C150)

ACCURACY OF DISCHARGE MEASUREMENT (C310): E excellent (LT 2%), G good (2%-5%), F fair (5%-8%), P poor (GT 8%)

SOURCE OF DATA (C151): A other gov't, D driller, G geologist, L logs, M memory, O owner, R other reported, S reporting agency, Z other

METHOD OF DISCHARGE MEASUREMENT (C152): A acoustic meter, B bailer, C current meter, D Doppler meter, E estimated, F flume, M totaling meter, O orifice, P pitot-tube, R reported, T trajectory, U venturi meter, V volumetric meas, W weir, X unknown, Z other

PRODUCTION WATER LEVEL (C153)

STATIC WATER LEVEL (C154)

SOURCE OF DATA (C155): A other gov't, D driller, G geologist, L logs, M memory, O owner, R other reported, S reporting agency, Z other

METHOD OF WATER-LEVEL MEASUREMENT (C156): A airline, B recorder, C calibrated airline, D differential GP, E estimated, F transducer, G pressure gage, H calibrated press. gage, L geophysical logs, M manometer, N non-rec. gage, O observed, P acoustic pulse, R reported, S steel tape, T electric tape, V calibrated elec. tape, Z other

PUMPING PERIOD (C157)

SPECIFIC CAPACITY (C272)

DRAWDOWN (C309)

GEOHYDROLOGIC DATA

RECORD TYPE (C748): GEOH

RECORD SEQUENCE N0. (C721)

DEPTH TO TOP OF UNIT (C91)

DEPTH TO BOTTOM OF UNIT (C92)

UNIT IDENTIFIER (C93)

LITHOLOGY (C96)

CONTRIBUTING UNIT (C304): P principal aquifer, Q aggregate of lithologic units, S secondary aquifer, N no contribution, U unknown

LITHOLOGIC MODIFIER (C97)

GEOHYDROLOGIC AQUIFER DATA

RECORD TYPE (C750): AQFR

RECORD SEQUENCE NO. (C742)

SEQUENCE NO. OF PARENT RECORD (C256)

DATE (C95) month – day – year

STATIC WATER LEVEL (C126)

CONTRIBUTION (C132)

SITE LOCATION SKETCH AND DIRECTIONS

Township _____ Range _____

Section # _____

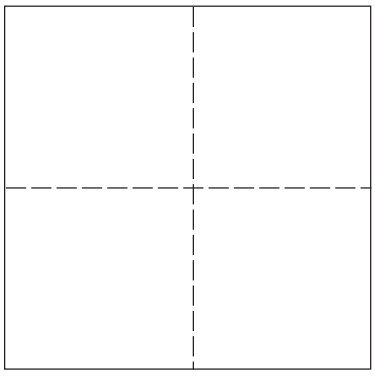

Table 4. Summary of candidate credible/suitable wells visited in the study area, 2012.

[LSD, Land surface datum; ft, foot; bls, below land surface; Type of surface seal: G, cement grout; --, not reported; B, bentonite; Z, other; Primary aquifer: LNEY, Laney Member of Green River Formation; FNNL, Farson Sandstone Member of the Green River Formation/Alkali Creek Tongue of the Wasatch Formation; EOCN, Eocene; WSTC, Wasatch Formation; NFRK, New Fork Tongue of Wasatch Formation; --, not assigned; CDBF, Cathedral Bluffs Tongue of Wasatch Formation; Water level status: P, pumping; F, flowing; R, recently pumped; Z, other; O, obstructed; Water level method: T, electric tape; --, water level not measured; S, steel tape; O, observed; Credible/suitable data objective met: C, critical common; 1, horizontal flow; 2 vertical gradient; 5, water-quality surface release; 6 water-quality excursion; Remarks: ft, foot; SE, southeast; shaded cells: tan, candidate well that could not be accessed to measure water level; blue, free flowing well]

Local well number	Site number	Measurement date	Well depth, feet below LSD	Depth to top of open interval, ft bls	Depth to bottom of open interval, ft bls	Length of open interval, ft bls	Type of surface seal	Depth to bottom of surface seal, ft bls
01cc 01	420513109504701	20120803	71.79	57	72	15	G	--
34ada01	420610109402201	20120801	853	758	853	95	G	0
30cac01	420703110051501	20120802	705	646	705	59	G	--
23ddc01	420710109315601	20120730	1365	687	720	33	G	63
				1,012	1,044	32		
				1,173	1,206	33		
				1,324	1,334	10		
21cac01	420757109555601	20120801	189.69	43	59	16	G	0
				100	190	90		
19aaa01	420759109363201	20120730	228.37	204	225	21	G	--
18dcc01	420814109510201	20120803	825	662	822	160	G	666
22dbb01	420822110013201	20120802	774.84	615	760	145	G	0
13baa01	420901109460001	20120801	482.84	--	--		G	0
15aab01	420905109540901	20120801	500.00	211	500	289	G	211
10dad01	420915109403901	20120731	882	756	882	126	G	756
14aab01	420919110065301	20120802	685	625	685	60	G	--
06cda01	420957109370901	20120730	--	--	--		--	--
02da 01	421005109315901	20120730	200	150	190	40	--	0
04add01	421025109481901	20120801	190.0	102	205	103	G	102
02dbc01	421045110002001	20120802	480	--	--		G	0
34dca01	421051109543001	20120620	280.45	--	--		G	0
32abb01	421127109354601	20120625	190.97	160	200	40	G	20
28cda01	421208110025801	20120802	710	570	710	140	G	20
30bab01	421219109433801	20120621	618	170	190	20	G	0
				480	618	138		
15dca01	421308109541901	20120801	316	190	220	30	G	0
				280	316	36		
17da 01	421321109493502	20120801	193	--	--		G	0
16ada01	421351109341501	20120730	79.67	60	80	20	B	55
09cda01	421418109345001	20120629	174.03	130	180	50	G	20
10ccd01	421421109475001	20120614	312	60	80	20	G	0
				280	310	30		
10dba01	421433109402301	20120621	490	469	490	21	G	--
05cbc01	421515109501801	20120614	207.47	49	210	161	G	49

Table 4. Summary of candidate credible/suitable wells visited in the study area, 2012.—Continued

[LSD, Land surface datum; ft, foot; bls, below land surface; Type of surface seal: G, cement grout; --, not reported; B, bentonite; Z, other; Primary aquifer: LNEY, Laney Member of Green River Formation; FNNL, Farson Sandstone Member of the Green River Formation/Alkali Creek Tongue of the Wasatch Formation; EOCN, Eocene; WSTC, Wasatch Formation; NFRK, New Fork Tongue of Wasatch Formation; --, not assigned; CDBF, Cathedral Bluffs Tongue of Wasatch Formation; Water level status: P, pumping; F, flowing; R, recently pumped; Z, other; O, obstructed; Water level method: T, electric tape; --, water level not measured; S, steel tape; O, observed; Credible/suitable data objective met: C, critical common; 1, horizontal flow; 2 vertical gradient; 5, water-quality surface release; 6 water-quality excursion; Remarks: ft, foot; SE, southeast; shaded cells: tan, candidate well that could not be accessed to measure water level; blue, free flowing well]

Local well number	Primary aquifer	Water level, feet below LSD	Water level status	Water level method	Credible/ suitable data objective met[1]	Site included in Trihydro network[2]	Remarks
01cc 01	LNEY	26.69		T	C, 1, 2, 5, 6	No	Not pumping; trough dry.
34ada01	FNNL			--	C, 1, 2, 6	No	Cap needs to be drilled for water level access. Well inside large metal culvert with steel lid.
30cac01	FNNL	282.49		T	C, 1, 2, 6	No	Not pumping; trough dry.
23ddc01	FNNL	67.50	P	T	C, 1, 2, 6	No	--
21cac01	LNEY	38.64		S	C, 1, 2, 5, 6	No	Not pumping; trough dry.
19aaa01	LNEY	5.89	P	T	C, 1, 2, 6	No	
18dcc01	FNNL	281.42		T	C, 1, 2, 6	No	Not pumping; trough dry.
22dbb01	FNNL	203.45		T	C, 1, 2, 6	No	Not pumping; trough dry.
13baa01	FNNL	128.71		T	C, 6	No	Not pumping; trough dry.
15aab01	FNNL	80.10		T	C, 1, 2, 6	No	Not pumping; trough dry.
10dad01	FNNL	92.24		T	C, 1, 2, 6	No	Not pumping; trough dry.
14aab01	FNNL	399.47		T	C, 1, 2, 6	No	Not pumping; trough dry.
06cda01	EOCN		F	O	C, 1,2, 6	No	Flowing.
02da 01	LNEY		F	O	C, 1, 2, 5, 6	No	Flowing.
04add01	LNEY	12.92		T	C, 1, 2, 5, 6	No	Not pumping; trough dry.
02dbc01	FNNL	120.96		T	C, 6	No	Not pumping; trough dry.
34dca01	FNNL	60.45		S	C, 6	No	Not pumping; trough dry.
32abb01	LNEY	131.69	P	T	C, 1, 2, 5, 6	No	--
28cda01	FNNL	466.20		T	C, 1, 2, 6	No	Not pumping; trough dry.
30bab01	FNNL	151.40		S	C, 1, 2, 6	No	Not pumping; trough dry.
15dca01	EOCN	86.57		S	C, 1, 2, 5, 6	No	Not pumping; trough dry.
17da 01	LNEY	56.69		T	C, 6	No	Not pumping; trough dry.
16ada01	LNEY	17.52		T	C, 1, 2, 5, 6	No	Not pumping; trough dry.
09cda01	LNEY	17.76		T	C, 1, 2, 5, 6	No	Not pumping; trough dry.
10ccd01	FNNL	57.53		T	C, 1, 2, 5, 6	No	Not pumping; trough dry.
10dba01	FNNL	59.13		S	C, 1, 2, 6	No	Not pumping; trough dry.
05cbc01	LNEY	34.72		S	C, 1, 2, 5, 6	No	Not pumping; trough dry.

Table 4. Summary of candidate credible/suitable wells visited in the study area, 2012.—Continued

[LSD, Land surface datum; ft, foot; bls, below land surface; Type of surface seal: G, cement grout; --, not reported; B, bentonite; Z, other; Primary aquifer: LNEY, Laney Member of Green River Formation; FNNL, Farson Sandstone Member of the Green River Formation/Alkali Creek Tongue of the Wasatch Formation; EOCN, Eocene; WSTC, Wasatch Formation; NFRK, New Fork Tongue of Wasatch Formation; --, not assigned; CDBF, Cathedral Bluffs Tongue of Wasatch Formation; Water level status: P, pumping; F, flowing; R, recently pumped; Z, other; O, obstructed; Water level method: T, electric tape; --, water level not measured; S, steel tape; O, observed; Credible/suitable data objective met: C, critical common; 1, horizontal flow; 2 vertical gradient; 5, water-quality surface release; 6 water-quality excursion; Remarks: ft, foot; SE, southeast; shaded cells: tan, candidate well that could not be accessed to measure water level; blue, free flowing well]

Local well number	Site number	Measurement date	Well depth, feet below LSD	Depth to top of open interval, ft bls	Depth to bottom of open interval, ft bls	Length of open interval, ft bls	Type of surface seal	Depth to bottom of surface seal, ft bls
03ccb02	421524109545601	20120620	140	--	--		G	--
03cdb01	421532110014301	20120718	825	785	825	40	--	--
25cdc01	421633109310701	20120612	92.12	--	--		G	0
27db 01	421706109402501	20120622	730	520	720	200	--	20
20cdb01	421749109360601	20120622	390	270	390	120	G	--
25abc01	421749109585701	20120717	732	490	732	242	G	20
21cba01	421800109420701	20120626	700	320	400	80	--	--
24cbd01	421804109522801	20120720	702.64	480	500	20	G	20
				520	540	20		
				560	580	20		
				600	620	20		
				640	660	20		
22adb01	421811109331401	20120615	1100	--	--		G	60
21dbb02	421817109553601	20120718	395.69	--	--		G	--
18cca01	421847109512101	20120614	349	260	349	89	B	250
07bad01	422016109511001	20120614	483	--	--		G	20
08abd01	422017109563301	20120717	900	520	580	60	G	16
				740	860	120		
06cdd01	422034109580301	20120620	725	480	720	240	G	20
01bca01	422054109453601	20120614	630	435	455	20	G	20
				500	520	20		
				545	585	40		
36cdb01	422115109312801	20120612	77	160	170	10	B	30
31dda02	422125109503401	20120614	447.6	--	--		--	--
33acd01	422202109553801	20120717	420	--	--		G	--
31bbd01	422203110051801	20120718	457.39	--	--		--	--
28dbd01	422210109342501	20120626	743	630	750	120	G	--
27cdb01	422212109474701	20120620	510	290	490	200	--	--
25cac01	422221109452701	20120613	339.61	290	340	50	G	--
30dc 01	422221109575101	20120718	500	371	390	19	G	--
				475	500	25	G	

Table 4. Summary of candidate credible/suitable wells visited in the study area, 2012.—Continued

[LSD, Land surface datum; ft, foot; bls, below land surface; Type of surface seal: G, cement grout; --, not reported; B, bentonite; Z, other; Primary aquifer: LNEY, Laney Member of Green River Formation; FNNL, Farson Sandstone Member of the Green River Formation/Alkali Creek Tongue of the Wasatch Formation; EOCN, Eocene; WSTC, Wasatch Formation; NFRK, New Fork Tongue of Wasatch Formation; --, not assigned; CDBF, Cathedral Bluffs Tongue of Wasatch Formation; Water level status: P, pumping; F, flowing; R, recently pumped; Z, other; O, obstructed; Water level method: T, electric tape; --, water level not measured; S, steel tape; O, observed; Credible/suitable data objective met: C, critical common; 1, horizontal flow; 2 vertical gradient; 5, water-quality surface release; 6 water-quality excursion; Remarks: ft, foot; SE, southeast; shaded cells: tan, candidate well that could not be accessed to measure water level; blue, free flowing well]

Local well number	Primary aquifer	Water level, feet below LSD	Water level status	Water level method	Credible/ suitable data objective met[1]	Site included in Trihydro network[2]	Remarks
03ccb02	LNEY			--	C, 6	No	No access for water level. Well located behind generator shed, next to large storage tank, near water troughs. Generator connected to a timer. Lots of wiring around well. Original well 50 ft southeast of this well.
03cdb01	WSTC	484.66	R	S	C, 1, 2, 6	No	Not pumping but troughs are full.
25cdc01	LNEY	19.45		T	C, 6	No	Not pumping; trough dry.
27db 01	FNNL		F	O	C, 1, 2, 6	No	Flowing.
20cdb01	FNNL				C, 1, 2, 6	No	Currently no pump, no access to measure water level.
25abc01	FNNL	482.82	R	S	C, 1, 2, 6	No	Not pumping but troughs are full.
21cba01	FNNL	123.19		T	C, 1, 2, 6	No	Not pumping; trough dry.
24cbd01	FNNL	244.72		T	C, 1, 2, 6	No	Unused.
22adb01	WSTC		F	O	C, 1, 2, 6	No	Flowing.
21dbb02	FNNL	120.66	R	S	C, 6	No	Not pumping but troughs are full.
18cca01	FNNL	159.33		S	C, 1, 2, 6	No	Not pumping; trough dry.
07bad01	FNNL	174.60		T	C, 6	No	No pump in well.
08abd01	WSTC, FNNL	382.56	R	S	C, 1, 2, 6	No	Not pumping but troughs are full; revisit, check measurement.
06cdd01	FNNL			--	C, 1, 2, 6	Yes	Unable to access well, no ports and shelter allows no room to jack up. Very thick steel plate, would be difficult to drill through.
01bca01	FNNL	245.48	R	S	C, 1, 2, 6	No	Not pumping.
36cdb01	LNEY	77.31	P	S	C, 1, 2, 5, 6	No	
31dda02	FNNL	219.44	R	S	C, 6	Yes	Not pumping but troughs are full.
33acd01	FNNL	316.24	R	T	C, 6	Yes	Windmill disconnected.
31bbd01	WSTC	223.38		T	C, 6	No	Open hole.
28dbd01	WSTC	130.62	P	T	C, 1, 2, 6	No	--
27cdb01	FNNL	131.53		T	C, 1, 2, 6	No	Not pumping.
25cac01	FNNL	115.12		T	C, 1, 2, 6	No	Not pumping; trough dry.
30dc 01	NFRK		Z	--	C, 1, 2, 6	No	Well is sealed; may be able to drill.

Table 4. Summary of candidate credible/suitable wells visited in the study area, 2012.—Continued

[LSD, Land surface datum; ft, foot; bls, below land surface; Type of surface seal: G, cement grout; --, not reported; B, bentonite; Z, other; Primary aquifer: LNEY, Laney Member of Green River Formation; FNNL, Farson Sandstone Member of the Green River Formation/Alkali Creek Tongue of the Wasatch Formation; EOCN, Eocene; WSTC, Wasatch Formation; NFRK, New Fork Tongue of Wasatch Formation; --, not assigned; CDBF, Cathedral Bluffs Tongue of Wasatch Formation; Water level status: P, pumping; F, flowing; R, recently pumped; Z, other; O, obstructed; Water level method: T, electric tape; --, water level not measured; S, steel tape; O, observed; Credible/suitable data objective met: C, critical common; 1, horizontal flow; 2 vertical gradient; 5, water-quality surface release; 6 water-quality excursion; Remarks: ft, foot; SE, southeast; shaded cells: tan, candidate well that could not be accessed to measure water level; blue, free flowing well]

Local well number	Site number	Measurement date	Well depth, feet below LSD	Depth to top of open interval, ft bls	Depth to bottom of open interval, ft bls	Length of open interval, ft bls	Type of surface seal	Depth to bottom of surface seal, ft bls
25bab01	422245109383001	20120626	1042	--	--		G	--
23bcc01	422330109465201	20120620	218	190	--		--	--
16dd 01	422351109411901	20120717	299.13	--	--		G	--
16dd 02	422351109411902	20120627	363	270	290	20	--	--
				310	330	20		
14cbd02	422357109394801	20120613	128.5	--	--		--	--
17adb01	422408109350001	20120613	900	--	--		--	0
16bac01	422431109490001	20120620	75	--	--		G	--
13aa 01	422436109444601	20120621	575	230	270	40	G	20
				415	435	20	G	
08ddb01	422446109423501	20120717	600	--	--		G	--
15aca01	422452110013101	20120802	209.83	100	110	10	--	0
				165	215	50		
08aac01	422513109353401	20120613	534.98	210	587	377	G	--
01dcb01	422600109523501	20120619	180	--	--		--	0
36cdb01	422615109395001	20120731	79.15	--	--		G	--
33ddb01	422618109500401	20120620	252.87	--	--		--	--
33cca01	422651109044801	20120621	155	121	155	34	G	0
35aab01	422722110014401	20120718	105	82	95	13	--	--
28dca01	422740110041701	20120621	336	280	336	56	G	--
23cd 01	422747109481601	20120619	359.59	--	--		G	--
24cab02	422801109401001	20120731	423.7	325	345	20	--	--
20cdb01	422811109514701	20120717	359.55	--	--		G	--
21bcb01	422812109435001	20120731	370.84	283	295	12	G	1
				350	365	15		
22bcd01	422838109564501	20120621	749.69	404	698	294	G	20
17dcc01	422840109372101	20120628	66.05	--	--		G	0
10dad01	422951109344501	20120628	102	55	102	47	G	0
08acb01	422954109444201	20120731		19	278	259	G	0
08acb02	422959109443601	20120731	349.85	--	--		G	--
11cda01	423000109551501	20120621		55	90	35	--	0
08bcb01	423016109520801	20120618	214.87	140	160	20	--	--
				180	220	40		
05dbb01	423033109371901	20120628	200	146	200	54	G	--
06bcb01	423055109530501	20120802	174	145	170	25	G	0

Table 4. Summary of candidate credible/suitable wells visited in the study area, 2012.—Continued

[LSD, Land surface datum; ft, foot; bls, below land surface; Type of surface seal: G, cement grout; --, not reported; B, bentonite; Z, other; Primary aquifer: LNEY, Laney Member of Green River Formation; FNNL, Farson Sandstone Member of the Green River Formation/Alkali Creek Tongue of the Wasatch Formation; EOCN, Eocene; WSTC, Wasatch Formation; NFRK, New Fork Tongue of Wasatch Formation; --, not assigned; CDBF, Cathedral Bluffs Tongue of Wasatch Formation; Water level status: P, pumping; F, flowing; R, recently pumped; Z, other; O, obstructed; Water level method: T, electric tape; --, water level not measured; S, steel tape; O, observed; Credible/suitable data objective met: C, critical common; 1, horizontal flow; 2 vertical gradient; 5, water-quality surface release; 6 water-quality excursion; Remarks: ft, foot; SE, southeast; shaded cells: tan, candidate well that could not be accessed to measure water level; blue, free flowing well]

Local well number	Primary aquifer	Water level, feet below LSD	Water level status	Water level method	Credible/ suitable data objective met[1]	Site included in Trihydro network[2]	Remarks
25bab01	EOCN		F	O	C, 1, 2, 6	No	Flowing.
23bcc01	FNNL	67.50		S	C, 1, 2, 5, 6	No	Not pumping; trough dry.
16dd 01	FNNL	149.11		T	C, 6	No	Old well; abandoned.
16dd 02	FNNL	56.69		T	C, 1, 2, 6	No	Not pumping; trough dry.
14cbd02	LNEY	97.76	Z	S	C, 6	No	Not pumping; trough dry.
17adb01	WSTC		F	O	C, 1, 2, 6	Yes	Flowing.
16bac01	LNEY	27.18		S	C, 6	Yes	Not pumping; trough dry.
13aa 01	FNNL		O	S	C, 1, 2, 6	No	Could not measure water level.
08ddb01	EOCN	339.09	P	T	C, 6	No	--
15aca01	FNNL	96.85		T	C, 1, 2, 5, 6	No	Not pumping; trough dry.
08aac01	FNNL	113.46		S	C, 1, 2, 6	No	Not pumping.
01dcb01	FNNL	44.52	P	S	C, 6	No	--
36cdb01	FNNL	37.90		T	C, 6	No	Not pumping; trough dry.
33ddb01	FNNL	152.67	P	S	C, 6	Yes	Pumping upon arrival for site visit.
33cca01	WSTC		F	--	C, 1, 2, 6	Yes	Flowing, fields flooded until August, no access to well until that time.
35aab01	WSTC		Z	--	C, 1, 2, 5, 6	No	Well shot up; may be able to access.
28dca01	WSTC		F	O	C, 1, 2, 6	Yes	Flowing.
23cd 01	FNNL	12.59	P	S	C, 6	No	Pumping upon arrival for site visit.
24cab02	FNNL	297.99		S	C, 1, 2, 6	No	Not pumping; trough dry.
20cdb01	FNNL	281.49		S	C, 6	No	Not pumping; trough dry.
21bcb01	FNNL	272.62		S	C, 1, 2, 6	No	Not pumping; trough dry.
22bcd01	WSTC	242.54		T	C, 1, 2, 6	No	Open hole.
17dcc01	FNNL	34.35		T	C, 6	No	Not pumping; trough dry.
10dad01	FNNL	25.10	P	T	C, 1, 2, 5, 6	No	--
08acb01	--		Z	--	C, 1, 2, 5, 6	No	No access for water level; needs to be drilled.
08acb02	FNNL	103.68	P	T	C, 6	Yes	--
11cda01	--		P	S	C, 1, 2, 5, 6	Yes	Not able to measure water level because of pumping.
08bcb01	FNNL	125.34		S	C, 1, 2, 5, 6	Yes	Not pumping; trough dry.
05dbb01	FNNL		O	--	C, 1, 2, 5, 6	No	Cannot access to get water level.
06bcb01	FNNL	114.64		T	C, 1, 2, 5, 6	No	Not pumping; trough dry.

Table 4. Summary of candidate credible/suitable wells visited in the study area, 2012.—Continued

[LSD, Land surface datum; ft, foot; bls, below land surface; Type of surface seal: G, cement grout; --, not reported; B, bentonite; Z, other; Primary aquifer: LNEY, Laney Member of Green River Formation; FNNL, Farson Sandstone Member of the Green River Formation/Alkali Creek Tongue of the Wasatch Formation; EOCN, Eocene; WSTC, Wasatch Formation; NFRK, New Fork Tongue of Wasatch Formation; --, not assigned; CDBF, Cathedral Bluffs Tongue of Wasatch Formation; Water level status: P, pumping; F, flowing; R, recently pumped; Z, other; O, obstructed; Water level method: T, electric tape; --, water level not measured; S, steel tape; O, observed; Credible/suitable data objective met: C, critical common; 1, horizontal flow; 2 vertical gradient; 5, water-quality surface release; 6 water-quality excursion; Remarks: ft, foot; SE, southeast; shaded cells: tan, candidate well that could not be accessed to measure water level; blue, free flowing well]

Local well number	Site number	Measurement date	Well depth, feet below LSD	Depth to top of open interval, ft bls	Depth to bottom of open interval, ft bls	Length of open interval, ft bls	Type of surface seal	Depth to bottom of surface seal, ft bls
32aca01	423140109370301	20120628	222.5	199	228	29	G	--
19cab01	423320109525701	20120628	555	325	330	5	G	1
				530	550	20		
19cb 01	423312109461701	20120627	338.63	--	--		G	--
23acd01	423320109405601	20120627	375	--	--		G	--
21bda01	423325109433501	20120627	503.9	--	--		--	--
24bdb01	423328109330901	20120627	150	80	100	20	G	64
13cba01	423408109331501	20120627	250	168	188	20	G	0
				188	260	72		
14cab01	423416109482101	20120718	810	420	450	30	G	200
				550	570	20		
				660	690	30		
				760	780	20		
06ddb01	423539109382201	20120627	146.61	80	90	10	G	--
				140	153	13		
05aca01	423630109512501	20120627	55	40	52	12	Z	25

[1] See table 1 for full definition of each credible/suitable data objective.

[2] Trihydro Corporation (2011 and 2012).

Table 4. Summary of candidate credible/suitable wells visited in the study area, 2012.—Continued

[LSD, Land surface datum; ft, foot; bls, below land surface; Type of surface seal: G, cement grout; --, not reported; B, bentonite; Z, other; Primary aquifer: LNEY, Laney Member of Green River Formation; FNNL, Farson Sandstone Member of the Green River Formation/Alkali Creek Tongue of the Wasatch Formation; EOCN, Eocene; WSTC, Wasatch Formation; NFRK, New Fork Tongue of Wasatch Formation; --, not assigned; CDBF, Cathedral Bluffs Tongue of Wasatch Formation; Water level status: P, pumping; F, flowing; R, recently pumped; Z, other; O, obstructed; Water level method: T, electric tape; --, water level not measured; S, steel tape; O, observed; Credible/suitable data objective met: C, critical common; 1, horizontal flow; 2 vertical gradient; 5, water-quality surface release; 6 water-quality excursion; Remarks: ft, foot; SE, southeast; shaded cells: tan, candidate well that could not be accessed to measure water level; blue, free flowing well]

Local well number	Primary aquifer	Water level, feet below LSD	Water level status	Water level method	Credible/ suitable data objective met[1]	Site included in Trihydro network[2]	Remarks
32aca01	FNNL	135.92		T	C, 1, 2, 5, 6	No	Not pumping; trough dry.
19cab01	WSTC	314.42		S	C, 1, 2, 6	No	Not pumping; trough dry.
19cb 01	FNNL	171.20		T	C, 6	No	Not pumping; trough dry.
23acd01	FNNL		Z	--	C, 6	No	Well capped but could be measured if drilled access.
21bda01	WSTC or FNNL	67.95		T	C, 6	No	Not pumping; trough dry.
24bdb01	CDBF	48.11		T	C, 1, 2, 5, 6	No	Pumping upon arrival for site visit.
13cba01	FNNL	67.28		T	C, 1, 2, 5, 6	No	Open hole.
14cab01	WSTC		Z	--	C, 1, 2, 6	No	Well capped.
06ddb01	FNNL	67.26		T	C, 1, 2, 5, 6	No	Not pumping; trough dry.
05aca01	NFRK		Z	--	C, 1, 2, 5, 6	No	Well capped.

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