Well Field Design Report
Grassy Mountain Project

Prepared for

Calico Resources USA Corp
665 Anderson Street
Winnemucca, Nevada 89445

Prepared by

SPF Water Engineering, LLC
300 East Mallard, Suite 350
Boise, Idaho 83706
(208) 383-4140

July 9, 2019

SPF WATER ENGINEERING

Table of Contents

List of Figures

Appendices

1. INTRODUCTION

This report presents a well field design for Calico Resources USA Corp's (Calico's) Grassy Mountain Project (Project). This report summarizes Project water demands, summarizes available construction and testing information from existing production wells, and provides potential yield and construction details for new water supply wells.

The source of water for the Project will be groundwater wells:

- Three wells, one existing and two proposed, are currently anticipated to be needed to fill the raw water tank. If the two new wells are not adequate to meet Project water demands, then additional wells will be needed.

- Two other existing wells can be used for local water supply for uses such as dust suppression.

The Project is located in Malheur County, Oregon, approximately 22 miles south-southwest of Vale (Figure 1) and consists of two areas: the Mine and Process Area and the Access Road Area (Figure 2).

The Mine and Process Area is located on three patented lode mining claims and unpatented lode mining claims that cover an estimated 886 acres. These patented and unpatented lode mining claims are part of a larger land position that includes 419 unpatented lode mining claims and nine mill site claims on lands administered by the Bureau of Land Management (BLM) (Figure 2). All proposed mining would occur on the patented claims, with some mine facilities on unpatented claims. The Mine and Process Area is in all or portions of Sections 5 through 8, Township 22 South, Range 44 East (T22S, R44E) (Willamette Meridian).

The Access Road Area is located on public land administered by the BLM, and private land controlled by others (Figure 2). A portion of the Access Road Area is a Malheur County Road named Twin Springs Road. The Access Road Area extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area is in portions of Section 5, T22S, R44E, Sections 3, 10, 11, 14, 15, 21 through 23, 28, 29, and 32, T21S, R44E, Sections 1, 12 through 14, 23, 26, 27, and 34, T20S, R44E, Sections 6 and 7, T20S, R45E, and Sections 22, 23, 26, 35, and 36, T19S, R44E (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline) to accommodate possible minor widening or re-routing, and a potential powerline adjacent to the access road. There are several areas shown that are significantly wider than 300 feet on the Permit Area Map (Figure 2), which are areas where the final alignment has not yet been determined. The final engineering of the road will be consistent throughout, and within the Permit Area. The Access Road Area also includes a buffer on either side of the proposed road width for the collection of environmental baseline data. The road corridor will be 30 feet wide, which includes a 20-foot wide road travel width (10 feet on either side of the road

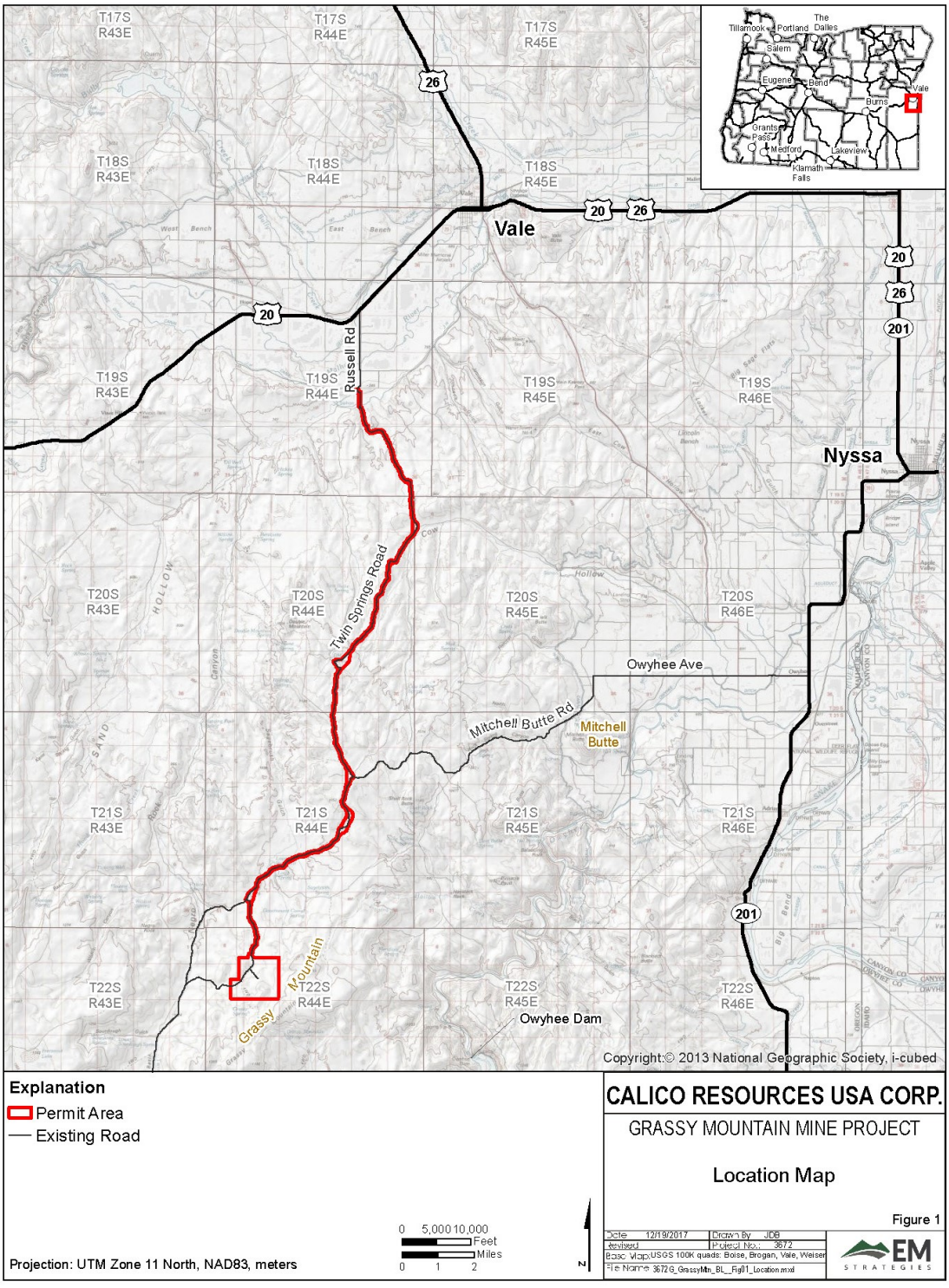


Figure 1. Location map

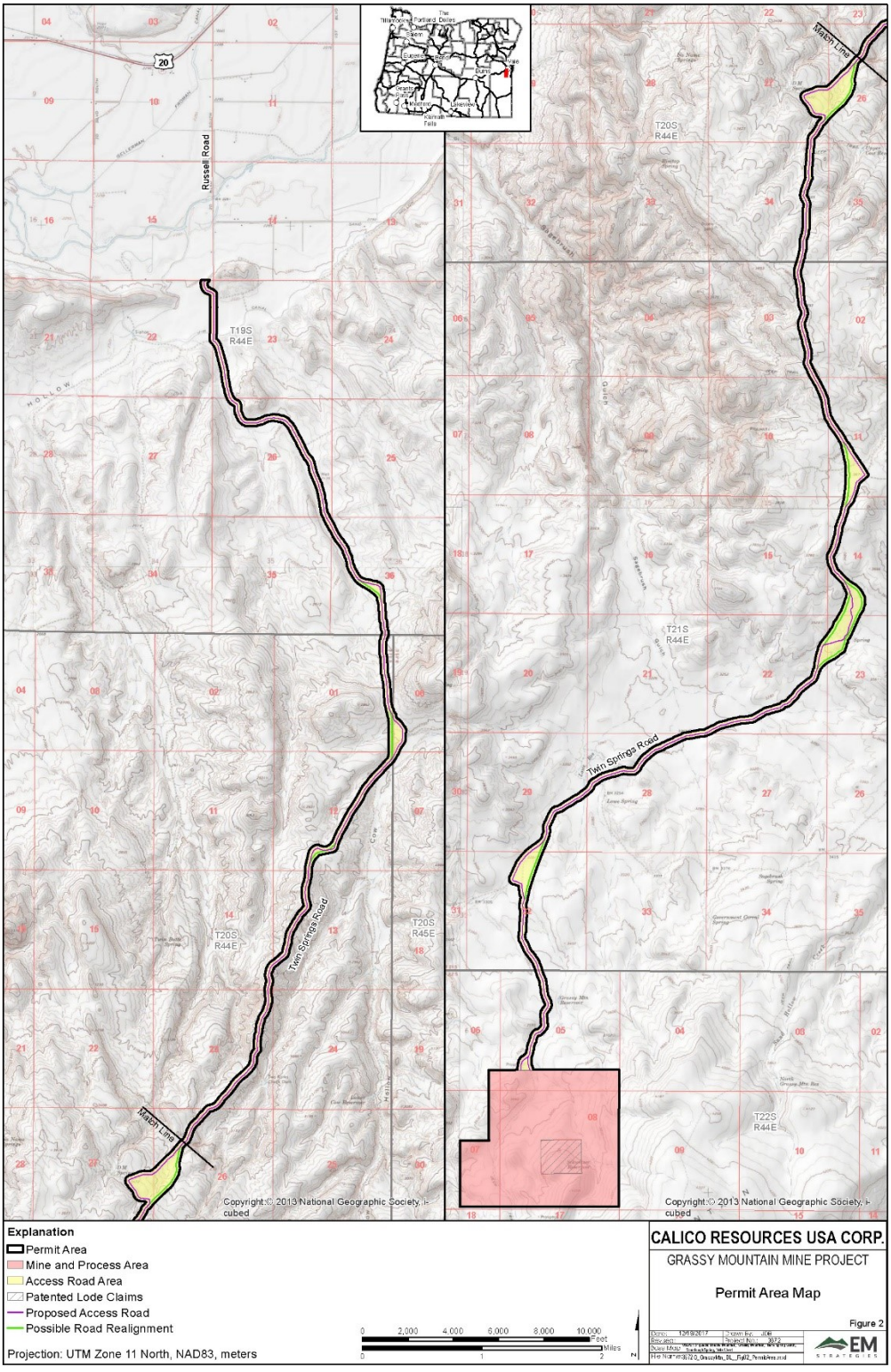


Figure 2. Permit area map

centerline), two-foot wide shoulders on each side of the road, minimum one-foot wide ditches on each side of the road, and appropriate cut and fill. The Access Road Area totals approximately 876 acres.

2. WATER DEMANDS

Water is required for the Project for mining, ore processing, fire protection, potable uses, dust suppression, and various other uses. Raw water will be pumped from the groundwater wells to a raw water storage tank, and then piped for use at the Project. It is anticipated that dust suppression uses can be supplied directly from existing wells.

The anticipated total peak raw water supply requirement is 400 gpm, which is expected to be required during the summer months when water cannot be reclaimed from the tailings storage facility. This supply requirement assumes a daily raw makeup water demand of 350 gpm for 12 hours, a daily process water demand of 230 gpm for 22 hours, a daily potable demand of 10 gpm for 24 hours, and other minor water demands. It is also assumed that storage will be provided for peaking and fire flow.

During the rest of the year, the wells will only need to supply 100 gpm of raw makeup water with 250 gpm coming from the tailings storage facility. The anticipated total peak raw water supply requirement during the non-summer months is estimated to be 270 gpm. The annual average daily demand is projected to be about 320 gpm (0.71 cfs, 516 acre-feet per year).

A nominal 237,000-gallon storage tank (total volume) will be installed to address peak water demands and provide 78,000 gallons of water for fire suppression. The tank is proposed to be installed at an elevation of approximately 3,880 feet, with an overflow elevation of about 3,915 feet.

3. GROUNDWATER CHARACTERIZATION

Groundwater in the general vicinity of the proposed mine site is found primarily within unconsolidated and semi-consolidated sandstone and conglomerate units of the Grassy Mountain Formation. The Grassy Mountain Formation generally strikes from east to west and dips towards the north. Discontinuous lenses of higher permeability sandstone and conglomerate form localized and compartmentalized water-bearing units that are interbedded with thick layers of low-permeability clay and clayey siltstone that impede groundwater flow. These sedimentary rocks are locally capped by basalt, alluvium and colluvium. The Grassy Mountain Formation is underlain by fine-grained lithic tuff, the Tuff of Kern Basin. The Grassy Mountain Formation is the host unit for the Grassy Mountain gold and silver deposit. A more detailed description of principal hydrogeological units can be found in the Grassy Mountain Gold Project Groundwater Characterization Report (SPF 2019b).

The aquifer system in the near vicinity of the proposed mine is typically found in silicified sediments or clay with very low hydraulic conductivity and high hydraulic gradients. Production and monitoring wells near the deposit completed in unconsolidated sediments and fractured basalt typically have short-term yields of less than 50 gpm. Long-term aquifer sustainability appears to be limited by negative hydraulic boundaries such as water-bearing zones of limited spatial extent, faulting, and/or silicification. Wells near the deposit completed in clay or silicified sediments have very low yields, generally less than 5 gpm.

The aquifer system to the north and downgradient of the proposed mine occurs in localized sandstone and conglomerate units of the Grassy Mountain Formation. These units are interbedded with thick layers of low-permeability clay and clayey siltstone, which appear to result in a confined aquifer. The Grassy Mountain Formation is underlain by fine-grained lithic tuff.

The aquifer hydraulic conductivity increases downgradient of the proposed mine where the sediments are not silicified. However, aquifer sustainability appears to be still affected by faulting and lithologic variability, with limited data suggesting that the Grassy Mountain Formation thins out moving north from the deposit. The Grassy Mountain fault zone also extends north of the deposit (RQV, 2015). This fault zone acts as a barrier to groundwater flow based on testing of nearby wells; the most productive wells in the area are presumably located on the east side of the Grassy Mountain fault zone.

4. EXISTING PRODUCTION WELLS

4.1. Introduction

There are three existing production wells for the Project: Prod-1, PW-1, and PW-4. These are referred to as Wells 1, 2, and 3 in this report and on Calico's original water right permit #G-10994. A map showing the well locations relative to the proposed mine is included as Figure 3. The existing production wells are described in more detail below.

4.2. Well 1 (Prod-1)

4.2.1. **Well Construction**

Well 1, also referred to as Prod-1, was drilled in 1989 for Atlas Precious Metals. The Oregon Water Resources Department (OWRD) well tag is L-107457 and the OWRD well name is MALH 227. The well driller's report lists a total depth of 425 feet below ground surface (bgs). Well 1 is constructed with 10-inch steel casing (0.250-inch wall thickness) from approximately 2 feet above ground surface to a total depth of 99 feet bgs, and 6-inch Schedule 80 PVC casing from approximately 2 feet above ground surface to a total depth of 245 feet bgs. The well is screened with 6-inch Schedule 80 PVC screen from 145 to 255 feet bgs and from 325 to 355 feet bgs in sandstone with

interbedded blue clay, and from 380 to 420 feet bgs in sandstone. The well driller's report is included in Appendix A.

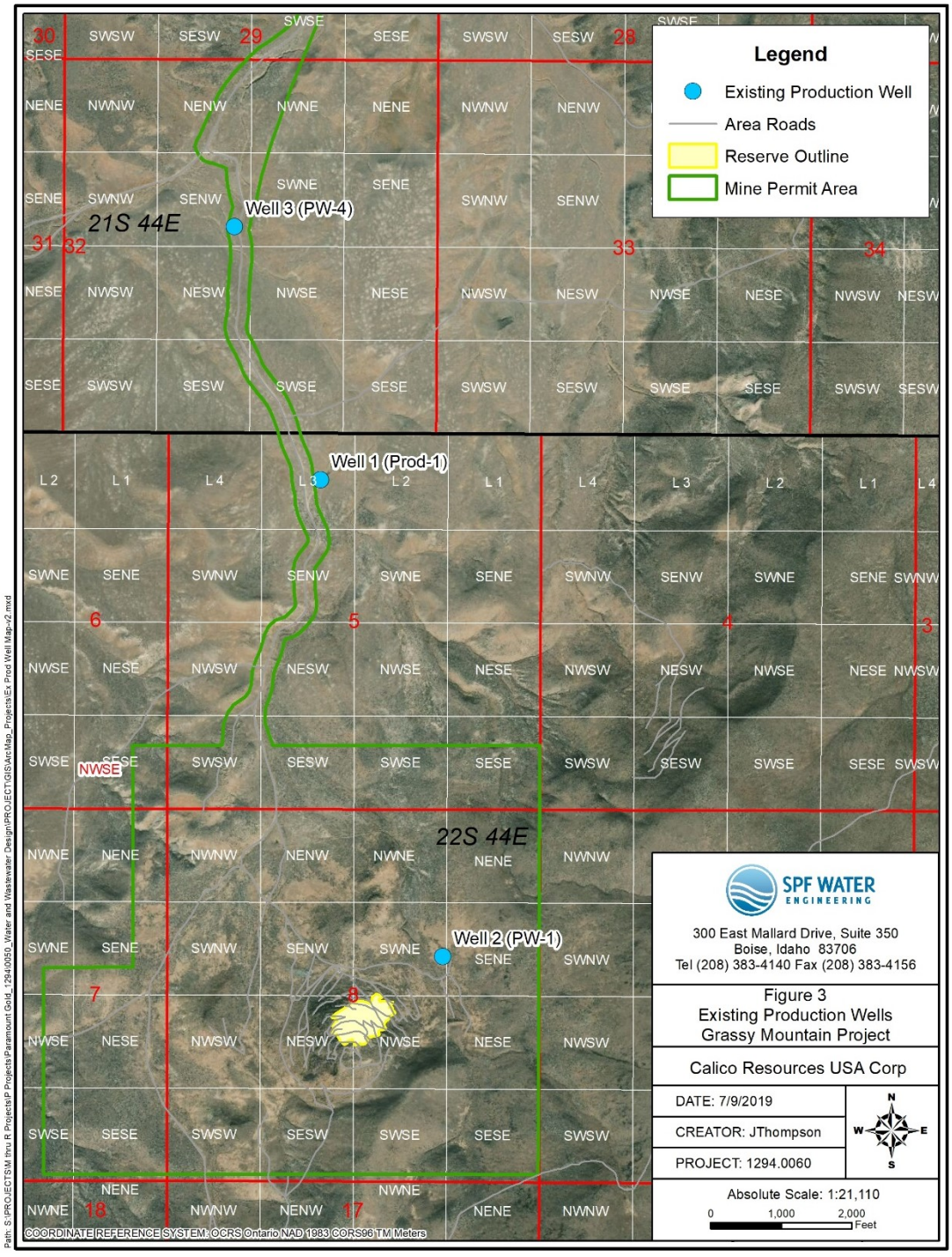


Figure 3. Map of existing production wells

4.2.2. **Well Location**

Well 1 is located in the NE ¼ of the NW ¼ (Lot 3) of Section 5, T22S R44E, refer to Figure 3. The latitude and longitude coordinates of the well are 43°41'29.83" N and 117°21'39.74" W. Well 1 is located about 1.45 miles north of the proposed mine, at an elevation of approximately 3,435 feet.

4.2.3. **Geologic Setting**

The Grassy Mountain Geology and Soils Baseline Report (Abrams 2018) describes the surficial geology in the vicinity of the Project. Figure 4, which includes the Mine and Process Area Geology map from the baseline report, shows that Well 1 is underlain by geologic unit *Tis*, identified as Upper Miocene interbedded conglomerate and siltstone. The geologic unit is reportedly underlain by undifferentiated arkose, siltstone, and conglomerate of the Grassy Mountain Formation (unit *Tgs*). Figure 4 shows concealed faults on either side of Well 1, part of the Grassy Mountain Fault Zone extending north from the deposit.

The Geology and Soils Baseline Report describes the *Tis* unit: *Chert pebble conglomerate and interbedded diatomaceous siltstone. Mainly tuffaceous and arkosic sandstone and siltstone with interbedded conglomerate. Locally becomes finer grained upward into pale, white and yellow claystones and interbedded diatomaceous siltstones. Presumed base of Tis near Grassy Mountain Reservoir contains black chert-pebble and granite-clast conglomerate. Erosional contact with underlying unit Tgs marked by rounded boulders of olivine basalt unit Tgb. Unit is approximately 400 feet thick in mapped area.*

The Geology and Soils Baseline Report describes the *Tgs* unit: *Arkosic sandstones and channel-fill granite clast conglomerates. Mainly white to tan arkosic sandstones. Includes Tgsc, channel fill conglomerates with abundant granite and rhyolite clasts in the upper part of the unit. Uppermost conglomerates locally contain rounded obsidian clasts and rare black chert clasts. Unit Tgs generally becomes finer grained upward and includes white bentonitic clays near the top of the section which, where overlain by unit Tgb often generated large landslide masses. Hot spring activity contemporaneous with the deposition of the arkoses is indicated by sinter beds Tgsn, and sinter boulders containing silicified reeds and wood near the Grassy mountain gold deposit. Unit Tgs is the host for both the Grassy Mountain and Crabgrass gold deposits*

The well driller's report for Well 1 describes brown clay to a depth of 140 feet, underlain by interbedded layers of sandstone and blue clay to the completion depth of 425 feet.

4.2.4. **Water Rights**

Well 1 is listed as an authorized point of diversion on Calico's original water right permit #G-10994. The permit authorizes a total diversion of 2.0 cfs. Calico submitted a Permit Amendment to OWRD on March 27, 2019, which proposes modification to the Points of Appropriation and Place of Use for the authorized 2.0 cfs.

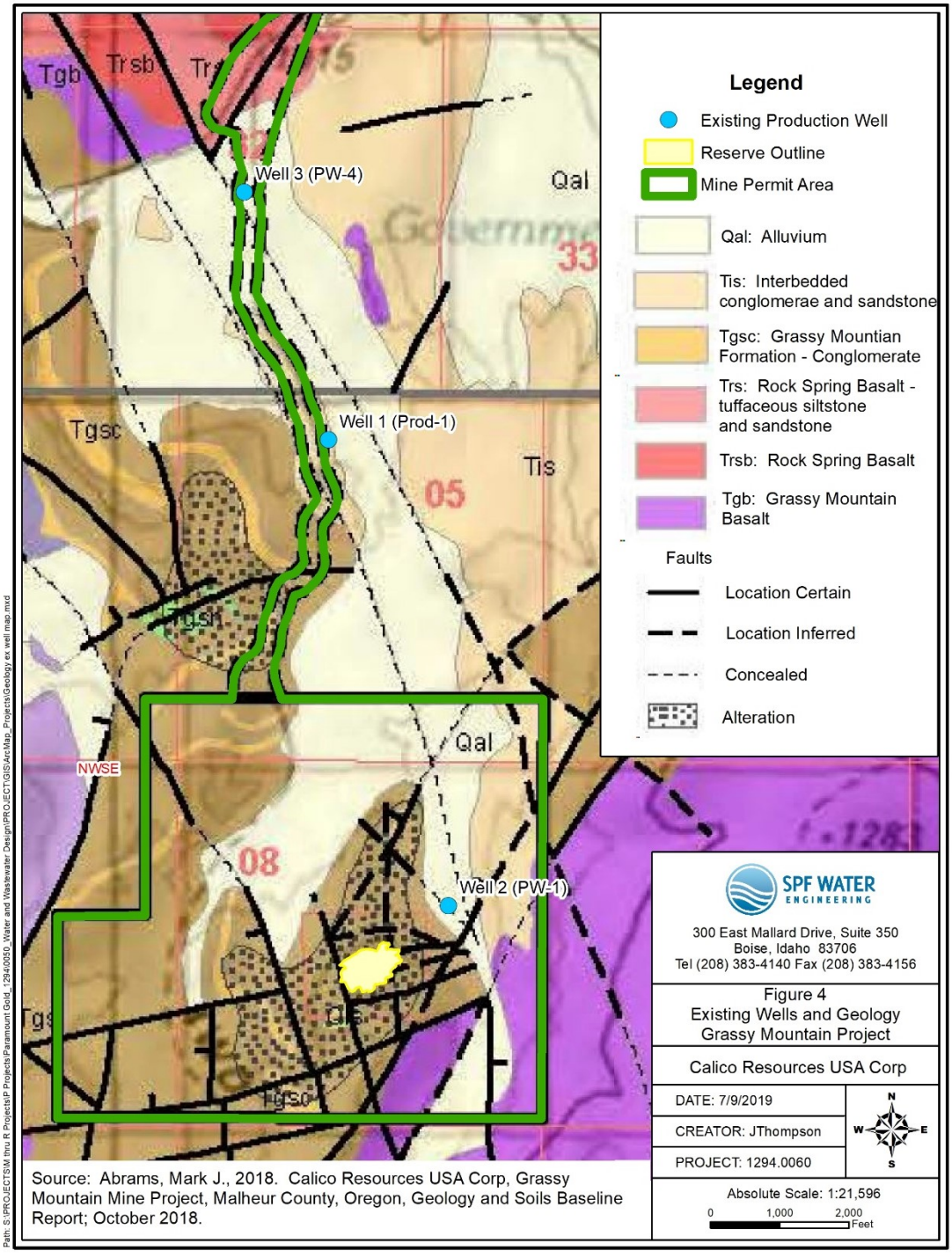


Figure 4. Map of existing wells and surficial geology

4.2.5. **Static Water Level**

Well 1 is normally a flowing artesian well. The flow from this well has been measured quarterly starting in 2013 (SPF 2019a). A plot of the flow data between the 1st Quarter of 2013 and the 4th Quarter of 2018 is presented as Figure 5. Flow has ranged from 1.40 gpm in the 1st Quarter of 2013 (March 17, 2013) to no flow between the 4th Quarter of 2016 (December 21, 2016) and the 3rd Quarter of 2017 (September 26, 2017). The loss of artesian pressure is a result of pumping the well for drill water in November and December 2016 and between March and May 2017.

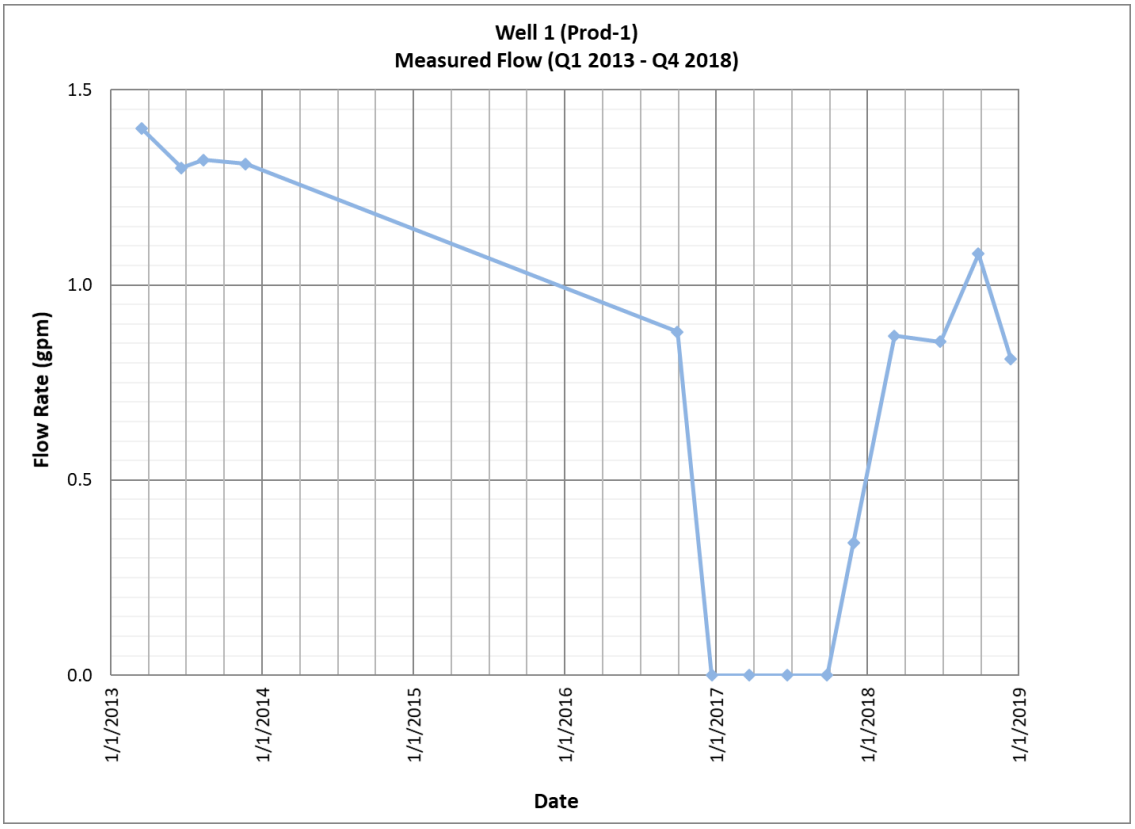


Figure 5. Artesian flows measured at Well 1 (Prod-1)

4.2.6. **Well Testing**

Well 1 was test pumped for 45 hours at 100 gpm between January 14 and 16, 1991, by James M. Montgomery Consulting Engineers, Inc (JMM) as described in JMM 1991. Prior to testing, an artesian pressure of 9 feet was measured above ground surface. At the end of the test, the pumping water level was measured to be 157 feet below the measurement point (bmp, approximately 3 feet above ground surface). Water level recovery was measured for nearly 13 days, with a final water level of 4.65 feet, equal to about 10.65 feet below the pre-test static water level. Testing indicates a well short-

term specific capacity of approximately 0.6 gpm per foot of drawdown. Plots of water levels during pumping and recovery are presented in Appendix B.

Aquifer transmissivity in the immediate area of the well was calculated to be approximately 1,500 gpd/ft. After 1,000 minutes of pumping, the transmissivity declined to approximately 200 gpd/ft. Recovery measurements following pumping indicated a near well bore transmissivity of approximately 1,500 gpd/ft; the transmissivity declined to approximately 220 gpd/ft after nearly a day of recovery. This decline in transmissivity indicates the presence of a negative hydraulic boundary due to thinning of the aquifer, faulting, or a decline in aquifer permeability. The Geology and Soils Baseline Report and Figure 4 identify concealed faults on either side of Well 1. The presence of these faults may be related to the observed decline in aquifer transmissivity during testing of Well 1.

During testing, water levels were monitored in all of the monitoring and production wells within the project area and discharge was measured from six springs in the area. No response was observed at any of the wells or springs.

4.2.7. **Well Capacity**

The long-term yield of Well 1 is estimated to be approximately 30 gpm based off the testing performed in 1991. The long-term pumping water level at 30 gpm is predicted to be about 134 feet bmp, above the top screen section. This pumping water level assumes no interference from nearby pumping wells. If pumping for an extended period of time, the pumping water level should remain above the top of the upper screen to avoid cascading water, air entrainment, and potential pump cavitation. The well should be able to pump for about a month at 50 gpm with the pumping water level dropping about 10 feet into the upper screen section. The short-term yield of Well 1 is estimated to be 100 gpm, with a pumping water level of about 133 feet bmp after one day of pumping. These conclusions are in general agreement with previous investigations (JMM 1991).

4.2.8. **Proposed Use and Recommendations**

It is recommended that Well 1 be used as a local source of water for dust suppression and other water needs. Due to the well's low long-term yield and casing diameter, it is not recommended and may not be possible to equip the well with a pump capable of filling the raw water storage tank.

A 4-inch pump is the largest pump that can fit in the well's 6-inch Schedule 80 PVC casing (inside diameter of 5.761 inches). The well could be equipped with a pump capable of producing 50 gpm at a total dynamic head (TDH) of 160 feet (pumping water level of 150 feet and 10 feet of head for headloss and lift to water truck). This same pump could also produce 80 gpm on a short-term basis at a TDH of 60 feet. An example pump curve is included in Appendix C. Alternatively, the existing pump in the well can continue to be used. The capacity of this existing pump is not known, but it was used to fill water trucks during exploration drilling and appears to be suitable for the use. It is

recommended that the well and discharge piping be housed in a heated enclosure to prevent freezing in the winter.

4.3. Well 2 (PW-1)

4.3.1. **Well Construction**

Well 2, also referred to as PW-1, was drilled in 1989 for Atlas Precious Metals. The OWRD well tag is L-109353 and the OWRD name is MALH 2276. The well driller's report lists a total depth of 555 feet bgs. Well 2 is constructed with 6-inch steel casing (0.250-inch wall thickness) from approximately 3.4 feet above ground surface to a depth of 320 feet bgs and from 340 feet to 400 feet bgs. The well is screened with 6-inch low carbon steel wire-wound screen (30 slot) from 320 feet to 340 feet bgs in brown clay and sand and from 400 feet to 420 feet bgs in coarse sandstone. The well driller's report is included in Appendix A.

4.3.2. **Well Location**

Well 2 is located in the SW ¼ of the NE ¼ of Section 5, T22S R44E. The latitude and longitude coordinates of the well are 43°40'23.24" N and 117°21'15.73" W. Well 2 is located about 1,500 feet northeast of the proposed mine, at an elevation of approximately 3,706 feet. A map showing the well is included as Figure 3.

4.3.3. **Geologic Setting**

The Mine and Process Area Geology map from the Grassy Mountain Geology and Soils Baseline Report, as depicted on Figure 4, shows that Well 2 is underlain by geologic unit *Qal*, identified as Pleistocene and Holocene alluvium. The geologic unit is reportedly underlain by Grassy Mountain Basalt (unit *Tgb*), Upper Miocene interbedded conglomerate and siltstone (unit *Tis*), and undifferentiated Grassy Mountain Formation (unit *Tgs*). Figure 4 shows concealed faults in close proximity and on either side of Well 2.

The Geology and Soils Baseline Report describes the *Qal* unit: *Unconsolidated and generally poorly sorted deposits or gravel, sand and silt accumulated along modern streams, drainages and floodplains.*

The well driller's report for Well 2 describes the surface alluvium to a depth of 190 feet, then basalt to a depth of 315 feet, then sediments to the completion depth of 555 feet.

4.3.4. **Water Rights**

Well 2 is listed as an authorized point of diversion on Calico's original water right permit #G-10994. However, the location of the well on the permit is incorrect. An Application for Permit Amendment was submitted on March 27, 2019, to OWRD that corrects the location of Well 2.

4.3.5. **Static Water Level**

The static water level in Well 2 has been measured quarterly starting in 2013 (SPF 2019a). A plot of the static water level measured in feet bmp between the 1st Quarter of 2013 and the 4th Quarter of 2018 is presented as Figure 6. The static water level in Well 2 varied between approximately 56 and 57 feet bmp (3.38 above ground surface) between the 1st Quarter of 2013 (March 26, 2013) and the 3rd Quarter of 2016 (September 29, 2016). Between the 3rd Quarter of 2016 measurement and the 4th Quarter of 2016 (December 21, 2016) measurement, the water level in the well declined by almost 7 feet. This decline was due to pumping the well for exploration drilling. By the 1st Quarter of 2018 (March 7, 2018), the static water level in the well had returned to above pre-pumping levels. The water level stabilized at a depth of around 54.5 feet bmp through the 4th Quarter of 2018.

Figure 6 also shows static water level measured in GW-1, a monitoring well located about 100 feet east of Well 2. GW-1 is screened from a depth of 135.5 feet to 155.5 feet bgs in a layer of gravel. The static water level in GW-1 follows a similar pattern as Well 2, with a decline of nearly 4 feet between the 3rd Quarter of 2016 and the 4th Quarter of 2016. This response suggests a hydraulic connection between the two wells, despite the difference in completion depths. Well 2 may not be adequately sealed through the upper sediment even though the driller's report notes a volclay bentonite seal from ground surface to a depth of 300 feet bgs. It is also possible that the shallow and deeper alluvial aquifers are interconnected, with leakage from the shallow to deeper aquifer zones.

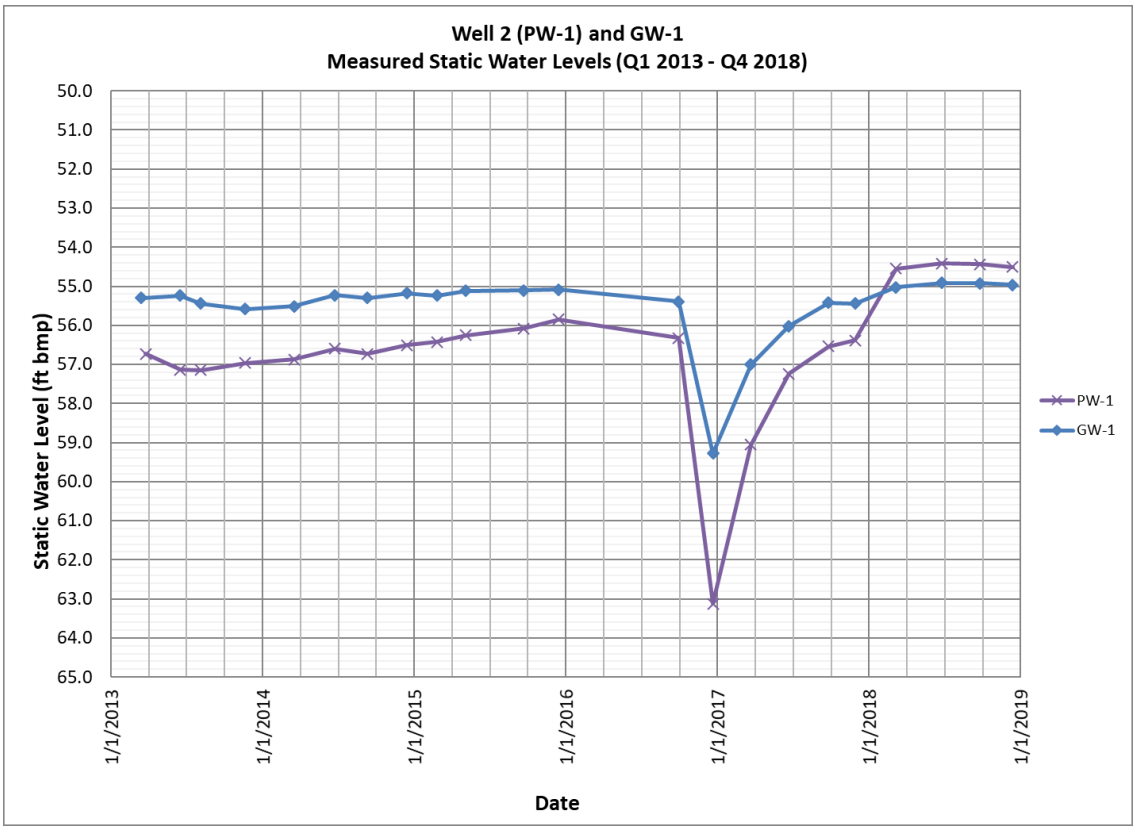


Figure 6. Well 2 (PW-1) and GW-1 static water levels

4.3.6. **Well Testing**

Well 2 was test pumped for 7 days at 30 gpm between January 29, 1991, and February 5, 1991, by JMM as described in JMM 1991. Prior to testing, the static water level was 53.81 feet bmp (top of casing, approximately 3.7 feet above ground surface). The pumping water level after seven days was 282.5 feet, equal to a drawdown of 228.7 feet. The test indicates a well specific capacity of 0.13 gpm/ft. Water level recovery was measured for 5.5 hours, with a final water level measurement of 97.81 feet, equal to 44 feet below the original static water level before testing began. Plots of water levels during pumping and recovery are presented in Appendix B.

The drawdown and recovery response of Well 2 suggests an aquifer transmissivity ranging from 100 to 250 gpd/ft. A negative hydraulic boundary is evident during the recovery of the well, with transmissivity declining from 250 gpd/ft to 100 gpd/ft after approximately 2 hours of recovery. This decline in transmissivity indicates the presence of a negative hydraulic boundary such as pinching of the aquifer, faulting, or a decline in aquifer permeability. Faults have been mapped in close proximity to Well 2 (Figure 4) that may serve as a hydraulic boundary to groundwater flow.

During the Well 2 test, water levels were measured in nearby monitoring well GW-1. The water level in GW-1 dropped nearly 6 feet during test pumping of PW-1 suggesting hydraulic connectivity between the two wells. A plot of the water levels in both wells is included in Appendix B. As noted in Section 4.3.5, a water level response was also observed in GW-1 when PW-1 was used to supply water for exploration drilling. GW-1 is screened about 165 feet higher than PW-1, so this response suggests leakage between the shallower and deeper aquifer zones or inadequate sealing of PW-1.

4.3.7. **Well Capacity**

Test pumping of Well 2 indicates a long-term yield of approximately 25 gpm. The long-term pumping water level at 25 gpm is predicted to be about 284 feet bmp, above the top screen section. This pumping water level assumes no interference from nearby pumping wells. The short-term yield of Well 2 is estimated to be 40 gpm, with a pumping water level of about 315 feet bmp after one day of pumping. These conclusions are in general agreement with previous findings (JMM 1991).

4.3.8. **Proposed Use and Recommendations**

The recommended use of Well 2 is as a local, stand-alone source of water for dust suppression and other water needs. The well's low long-term yield does not make it a good candidate for equipping with a pump and pipeline to fill the raw water storage tank.

Well 2 could be equipped with a pump capable of producing 25 gpm at a total dynamic head (TDH) of 300 feet (pumping water level of 284 feet and 16 feet of head for headloss and lift to water truck). The same pump could also be used to pump 40 gpm at a TDH of 200 feet, which the well should be able to support for about an hour. An example pump curve is included in Appendix C. Well 2 is currently equipped with a pump and has been used for water supply in the past. This pump appears to be suitable for filling water trucks. It is recommended that the well and discharge piping be housed in a heated enclosure to prevent freezing in the winter.

4.4. Well 3 (PW-4)

4.4.1. **Well Construction**

Well 3, also referred to as PW-4, was drilled in 1989 for Atlas Precious Metals. The OWRD well tag is L-109351 and the OWRD name is MALH 2206. The well driller's report lists a total depth of 375 feet bgs. Well 3 is constructed with 6-inch steel casing (0.250-inch wall thickness) from approximately 3.2 feet above ground surface to a depth of 280 feet bgs and from 300 feet to 340 feet bgs. The well is screened with 6-inch low carbon steel wire-wound screen (30 slot) from 280 feet to 300 feet bgs in sandstone and from 340 feet to 360 feet bgs in sandstone and conglomerate. The well driller's report is included in Appendix A.

4.4.2. **Well Location**

Well 3 is located in the SE ¼ of the NW ¼ of Section 32, T21S R44E. The latitude and longitude coordinates of the well are 43°42'5.28" N and 117°21'56.54" W. Well 3 is located about 2.1 miles north of the proposed mine, at an elevation of approximately 3,338 feet. A map showing the well is included as Figure 3.

4.4.3. **Geologic Setting**

Well 3 is underlain by geologic unit *Qal*, identified as Pleistocene and Holocene alluvium, as shown on Figure 4. The geologic unit is reportedly underlain by interbedded conglomerate and siltstone (unit *Tis*), and undifferentiated Grassy Mountain Formation (unit *Tgs*). Figure 4 shows a concealed fault just to the west of Well 3.

The well driller's report for Well 3 describes alluvium to a depth of 175 feet, then interbedded sandstone and clay to the completion depth of 375 feet. Conglomerate is noted with sandstone between a depth of 325 and 365 feet.

Exploration drill hole 26-057 was drilled near Well 3 between 1988 and 1989. This hole encountered conglomerate to 55 feet, clay to 165 feet, layers of siltstone and conglomerate to 445 feet, and then tuff to a depth of 740 feet. The driller noted about 15 gpm of water at a depth of 35 feet, 50 gpm from 150 feet after 30 minutes, and 100 gpm at a depth of 300 feet.

4.4.4. **Water Rights**

Well 3 was not listed as an authorized point of diversion on Calico's original water right permit #G-10994. However, Well 3 was added as a point of diversion on the Application for Permit Amendment submitted to OWRD on March 27, 2019.

4.4.5. **Static Water Level**

The static water level in Well 3 has been measured quarterly since 2013 (SPF 2019a). A plot of the static water level measured in feet bmp between the 1st Quarter of 2013 and the 4th Quarter of 2018 is presented as Figure 7. The static water level in Well 3 typically ranged from 80 to 80.5 feet bmp (3.16 feet above ground surface). The static water level in GW-4, located about 140 southeast of Well 3, typically ranged from 82 to 83 feet bmp (2.32 feet above ground surface).

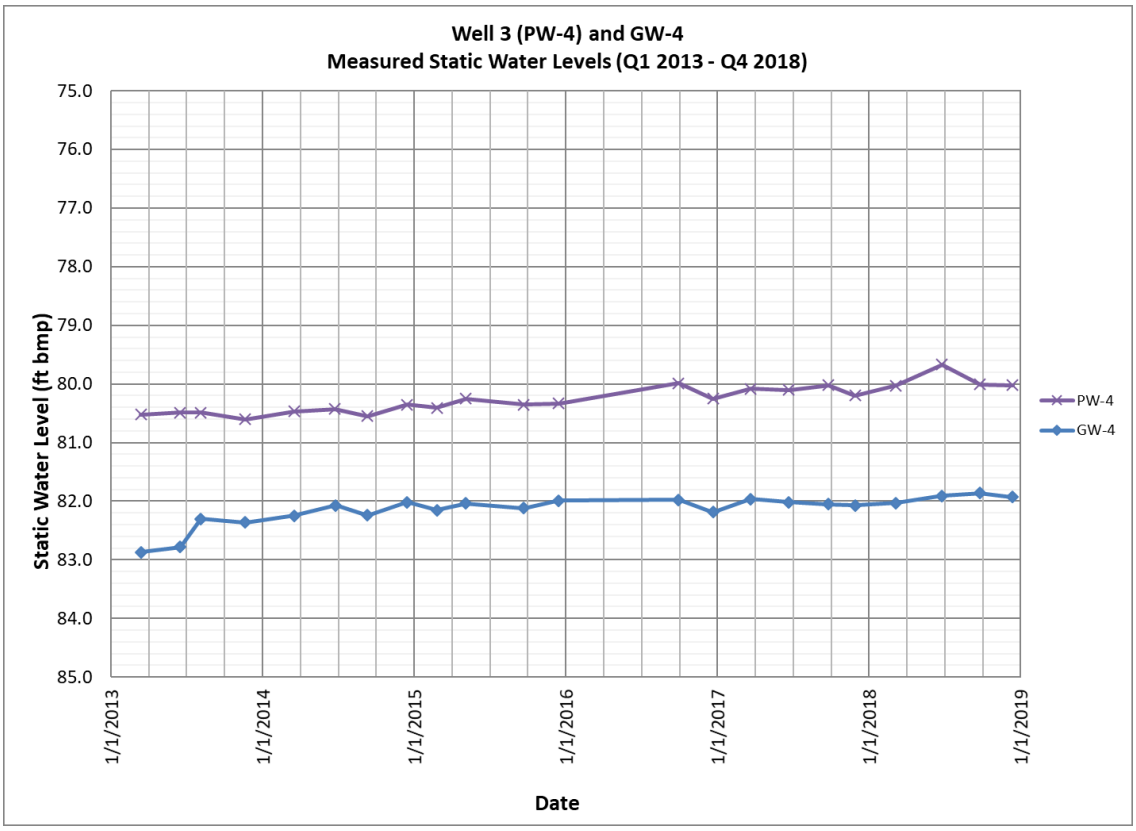


Figure 7. Well 3 (PW-4) and GW-4 static water levels

4.4.6. **Well Testing**

Well 3 was test pumped for a little over 3 days at an average pumping rate of 145 gpm between November 28 and December 1, 1989, by Steffen Robertson and Kirsten Consulting Engineers and Scientists (SRK) as described in SRK 1989. Prior to testing, the static water level was 82.25 feet bmp. The pumping water level after 3 days was 164.76 feet, equal to a drawdown of 82.51 feet. The test indicates a well specific capacity of about 1.8 gpm/ft. Recovery was measured for nearly 4 days, with a final water level about 5 feet below the pre-test static water level. Plots of water levels during pumping and recovery are presented in Appendix B.

During testing of Well 3, water levels were also measured in the nearby monitoring well GW-4. GW-4 is constructed similarly to PW-4, with screen placed from a depth of 280 to 350 feet. The water level in GW-4 dropped over 43 feet during test pumping of PW-4 suggesting hydraulic connectivity between the two wells. A plot of the water levels in both wells is included in Appendix B.

The drawdown and recovery response of Well 3 and GW-4 suggest a near well bore aquifer transmissivity of approximately 3,800 gpd/ft. The transmissivity declined to about 1,700 gpd/ft after approximately 1,000 minutes of pumping, after encountering a

negative hydraulic boundary. Faults have been mapped near Well 2 (Figure 4) that could be restricting groundwater flow to the well.

An aquifer storativity ranging from 7×10^{-5} to 2×10^{-3} was calculated from the test, with the range a product of using pre-boundary conditions or post-boundary conditions. The storativity values suggest that that PW-4 draws water from a confined aquifer.

4.4.7. **Well Capacity**

Test pumping of Well 3 indicates a long-term yield of approximately 200 gpm, with a projected pumping water level after one year of about 260 feet bmp, above the top of the upper screen. This pumping water level assumes no interference from nearby pumping wells. The short-term yield of Well 3 is estimated to be around 250 gpm. The well may be able to produce more but extrapolating higher yields from the test data is subject to errors. These conclusions are in general agreement with previous findings (JMM 1991), but are based on limited data (i.e., a 3-day pumping test in 1989).

While Well 3 is estimated to have a long-term capacity of 200 gpm, actual capacity of the well is limited by casing diameter and pump motor size. The actual capacity of the well is estimated to be 150 gpm, see Section 4.4.10.

4.4.8. **Pumping Interference**

Pumping interference is expected between water supply wells based on the response of monitoring well GW-4 to testing of Well 3. For Well 3, interference from the other supply wells needs to be accounted for. Well 3 is located about 650 feet from proposed Well 4, about 1,400 feet from proposed Well 5, and approximately 980 feet from proposed Well 7.

To estimate drawdown from pumping, a Theis (1935) analysis was performed. Assumptions inherent to the Theis solution are that the aquifer is homogeneous and isotropic, uniform in thickness and areal extent, the aquifer receives no recharge, the pumping well penetrates the full aquifer thickness, water removed by discharge is removed instantaneously, the pumping well is 100 percent efficient, laminar flow exists throughout the aquifer, and that the water table or potentiometric surface has no slope. These assumptions are not applicable to the complex aquifer system in the Project area. However, this method is useful for providing an estimate of interference effects. During the test pumping of the supply wells, water levels in nearby wells will be measured to determine actual drawdown in non-pumping wells.

For the Theis analysis, estimates of aquifer transmissivity and storativity are required along with a pumping rate and duration of pumping. When a negative hydraulic boundary is evident in the test data, aquifer coefficients must be calculated from the early test data before boundary effects are realized (Driscoll 1986). For this analysis, an early-time transmissivity of 3,800 gpd/ft and a storativity of 7×10^{-5} are used based on test pumping data from Well 3.

This analysis assumes Wells 4 and 5 are the primary supply wells. Well 3 should only be needed for a short duration in the event that one of these wells is not operational. If Well 3 is pumped at 150 gpm and Well 4 is the other supply well and is pumped at 250 gpm for a short duration (one week), then the pumping interference in Well 3 is predicted to be about 42 feet. The resultant pumping water level in Well 3 would be the non-interference pumping water level of 175 feet bgs plus 42 feet or 217 feet bgs.

4.4.9. **Water Quality**

Baseline water quality samples were collected from Well 3 on a quarterly basis between the 1st Quarter of 2013 and the 3rd Quarter of 2014 (SPF 2019a). Sampling results show that the groundwater produced from Well 3 exceeds the primary drinking water standard for arsenic of 0.010 mg/L. Arsenic concentrations in samples ranged from 0.0148 to 0.0221 mg/L). If used for potable water supply, treatment will be required to remove arsenic from the water.

Well 3 also produces water that exceeds the secondary drinking water standards for aluminum (0.05 mg/L), iron (0.3 mg/L), manganese (0.05 mg/L), and total dissolved solids (500 mg/L). There is evidence that Well 3 may not be adequately developed. When purge pumped for water quality sampling, the water produced from the well was a black color with a minor amount of sand. Eventually the water would clear up after about 30 minutes of pumping. Incomplete development may be contributing to high concentrations of these constituents. Analysis of the dissolved samples showed much lower concentrations. It is likely that with additional development the water will have much lower concentrations of these analytes, potentially below secondary standards.

4.4.10. **Proposed Use and Recommendations**

Well 3 is recommended to be used as a backup water supply for mining, ore processing, fire protection, potable uses, and various other uses at the mine. This would require equipping the pump with enough head to fill the raw water storage tank. There is an elevation difference of approximately 577 feet between the well ground surface and the tank overflow elevation.

Well 3 is constructed with 6-inch steel casing (inside diameter of 6.125 inches). Therefore, the largest submersible motor that can fit in the well is a nominal 6-inch diameter (5.5-inch outside diameter). Given a 460-volt, 3-phase power supply, a 60-hp, 3,600-rpm motor should be able to fit in the well casing. Therefore, while Well 3 is estimated to have a long-term capacity of 200 gpm, actual capacity of the well is limited by casing diameter and pump motor size. The actual capacity of the well is estimated to be 150 gpm.

It is recommended that Well 3 be equipped with a 5-inch submersible pump and motor capable of producing 150 gpm at a TDH of 900 feet. The TDH assumes a long-term pumping water level of 230 feet, 650 feet of lift and headloss (281 psi wellhead discharge pressure), and 20 feet of safety factor. The assumed pumping water level accounts for short-duration pumping interference. An example pump curve is included

in Appendix C. At a maximum allowable pumping water level of 270 feet, this pump would produce about 145 gpm. The pump can be set on 3-inch column pipe to a depth of 273 feet, above the top of the screen at a depth of 280 feet.

The TDH estimate for the proposed pump is based on an estimate of long-term pumping water level based on a relatively short-duration test conducted 30 years ago. Well 3 has likely not been pumped at a high capacity since the 1989 testing. Given the age of the well and length of time since the well has been pumped at a high capacity, the following actions are recommended:

1. Remove the existing pump (estimated capacity of 30 gpm).
2. Perform a video survey on the well to assess its condition.
3. Clean the well mechanically and/or chemically if the video survey indicates that it is needed. If the casing has excessive mineralization on the casing, it could be difficult to install or remove the pump with 6-inch motor.
4. If the well screens appear plugged, re-develop the well using air-lifting, jetting, swabbing, or surging with a pump.
5. Test pump the well at the target yield of 150 gpm for at least 7 days to confirm long-term pumping water level and better evaluate the effects of negative boundaries. Once the well is test pumped, the permanent pump can be selected.

Well 3 should be equipped with soft start, check valve, pressure relief / surge anticipator valve, flow meter, pressure gauge, isolation valve, and air valve. Given the column pipe and well casing diameter, there is not enough space to install a 1-inch sounding tube that could hold a water level pressure transducer. Therefore, a ½-inch PVC sounding tube and a 3/8-inch PEX air-line tube is recommended to allow for manual water level measurements. Well 3 and associated equipment should be located in a heated metal building. Treatment will be required to remove arsenic from the water if Well 3 is used for potable water supply.

5. PROPOSED PRODUCTION WELLS

5.1. Introduction

The total anticipated raw water demand for the Project is 400 gpm and includes water for mining, ore processing, and potable uses. This total does not include water for dust suppression, which is assumed to be supplied from the existing Wells 1 and 2. Peak water demands and water for fire protection will be provided from storage. Raw water will be suppled from wells, which will be pumped to a raw water storage tank and then distributed for use by gravity.

Current long-term production well capacity is estimated to be about 200 gpm, with 150 gpm derived from Well 3 (PW-4), and the remainder from Well 1 (Prod-1) and Well 2 (PW-1). It is recommended that Well 3 be equipped with a pump for use as a raw water

supply while Wells 1 and 2 are better suited for use as local sources of water (dust suppression, etc).

There is currently a 250-gpm deficit in raw water groundwater supply. A minimum of two, and likely three, new supply wells (Wells 4, 5, and 7) are proposed to serve as primary supply wells, with Well 3 serving as a backup supply. Each of the new wells will be sized to produce 100 to 200 gpm for the life of the mine to meet the total peak raw water supply requirement of 400 gpm.

5.2. Proposed Well Locations

The proposed locations of the new supply wells are shown on Figure 8. Several factors were considered when choosing the locations of new wells, including: hydrogeological conditions, existing production wells, proximity to mine facilities, and the approved Project Permit Area. Each of these factors are described in more detail below.

5.2.1. **Hydrogeological Conditions**

Well 3 is completed in water-bearing layers of sandstone and conglomerate between a depth of 280 and 360 feet bgs. The nearby well GW-4 encountered similar lithology. Exploration drill hole 26-057 was also drilled near PW-4, but not completed as a permanent well. The driller's notes identify layers of siltstone and conglomerate from 165 to 445 feet, and then tuff to a depth of 740 feet. Drilling of PW-4, GW-4 and 26-057 indicate the presence of a relatively productive sandstone and conglomerate aquifer from a depth of approximately 300 to 450 feet.

Well 3 is completed in an aquifer with an estimated near well bore transmissivity of 3,800 gpd/ft. This is higher than the near well bore transmissivities noted for Well 1 (1,500 gpd/ft) and Well 2 (250 gpd/ft). Transmissivity and hydraulic conductivity appear to increase in the area moving away from the silicified deposit.

Testing of Well 3 indicates the presence of a negative hydraulic boundary near the well, causing a decline in effective transmissivity to an estimated 1,700 gpd/ft. However, the impact of the boundary condition was much less than that observed at Well 1 (decline to 200 gpd/ft) and Well 2 (decline to 100 gpd/ft). The cause of the transmissivity decline is not known with certainty, it could be a result of limitations in the size and extent of favorable higher permeable aquifer strata. It could be due to faulting; all of these wells are located near the Grassy Mountain fault zone, which may be acting as a barrier to groundwater flow. In the case of Well 2, sediment silicification in and near the deposit probably contributes to restricted groundwater recharge. While the cause of the transmissivity decline is not known with certainty, it is apparent that the negative impact is lessened farther from the deposit. Hydrogeological conditions appear to favor well locations farther from the deposit based on available evidence.

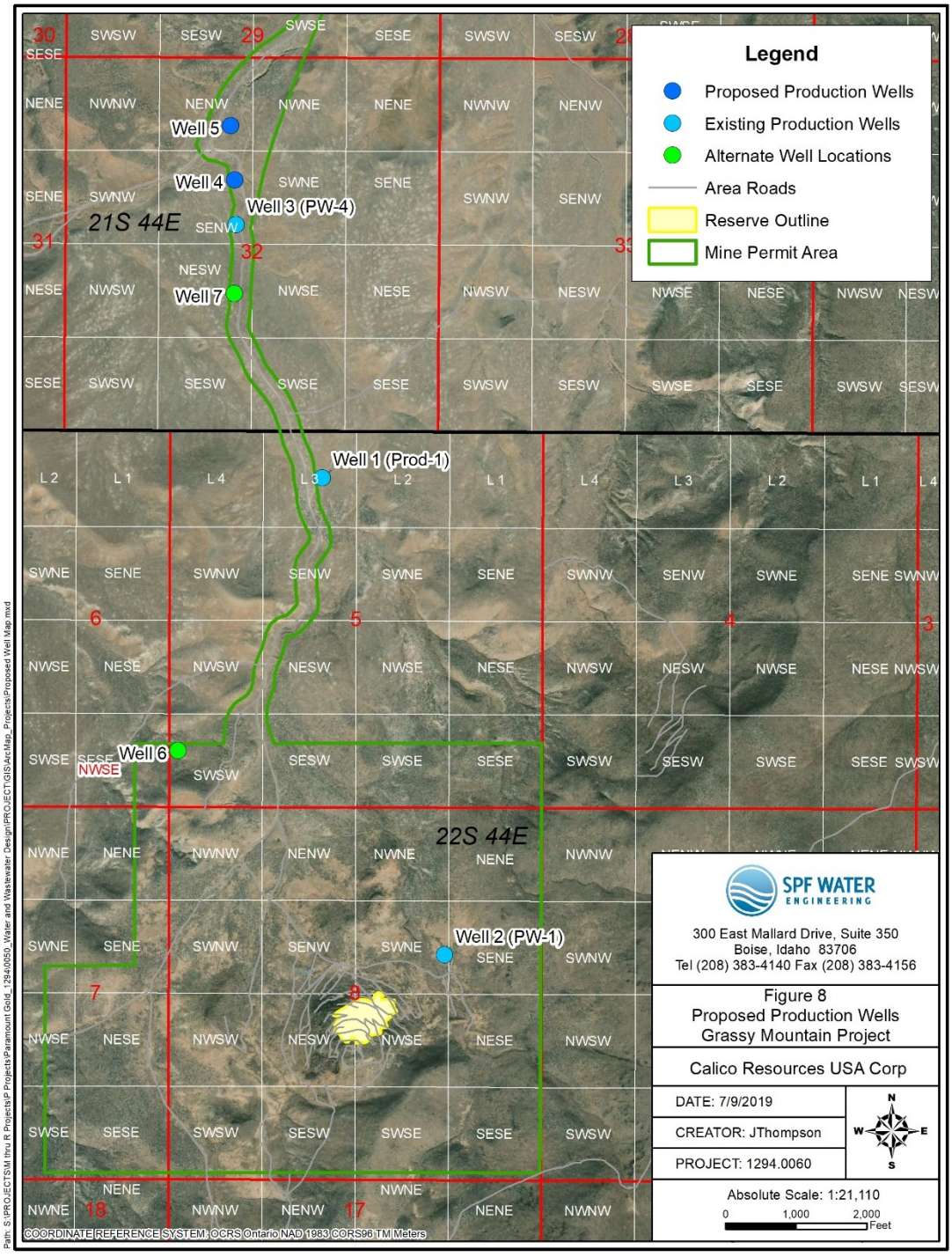


Figure 8. Map of existing and proposed production wells

5.2.2. **Existing Well Capacity**

Well capacity is directly related to aquifer transmissivity. Therefore, it is no surprise that the most productive existing supply well is Well 3 with an estimated long-term yield of approximately 200 gpm. The long-term capacity of the other existing production wells, including Wells 1 and 2, is much lower (30 gpm for Well 1, 25 gpm for Well 2). These results indicate that the area around Well 3 is more likely to support a higher well yield than areas around Wells 1 and 2.

5.2.3. **Proximity to Mine Facilities**

Well 3 is the farthest existing well from the proposed mine, being located about 2.1 miles away. Wells 1 and 2 are closer to the proposed mine, being located about 1.45 miles and 0.3 miles away, respectively. Groundwater development in the area around Well 2 is advantageous from purely a cost and logistical perspective. However, as described above, it is unlikely that a reliable groundwater supply can be developed in the near proximity to the mine that can meet Project water needs.

While Well 3 is located over 2 miles from the proposed mine, this area is believed to provide the best opportunity for developing a reliable and long-term groundwater supply for the proposed mine.

5.2.4. **Permitting Considerations**

The Project Permit Area is defined in the *Third Notice of Intent Pre-Application Phase of a Proposed Mining Operation: Calico Resources USA Corp. Grassy Mountain Gold Project (February 2017)* (EM Strategies, Inc., 2017). The Permit Area includes two parcels, a Mine and Process Area, and an Access Road Area. These are shown on Figure 2 and Figure 3 in the vicinity of the proposed mine.

The Mine and Process Area parcel is located on three patented lode mining claims and unpatented lode mining claims that cover an estimated 886 acres (EM Strategies, Inc., 2017). The Access Road Area parcel follows an unnamed dirt road and Twin Springs Road in the vicinity of the proposed mine as shown on Figure 3. The width of the Access Road Area is generally 300 feet (150 feet on either side of the access road centerline) to accommodate road improvements and a power line. The Access Road Area is wider in spots to allow for flexibility in the final road alignment.

All Project facilities and associated disturbances are planned to be located within the Permit Area. Therefore, any new water supply wells would also need to be located within the Permit Area. There may be opportunities for groundwater development outside the Permit Area, along Negro Rock Canyon west of the proposed mine and near Poison Spring northwest of the proposed mine (JMM 1991). These locations are not currently planned for water supply exploration or development due to being outside the Permit Area and to distance from the proposed mine.

5.3. Well 4

5.3.1. **Anticipated Well Construction**

Well 4 will be constructed to target water-bearing sandstone and conglomerate layers expected to occur between a depth of approximately 250 and 500 feet bgs. The anticipated maximum depth of the well is 500 feet. It is anticipated that the well will be drilled using the air-rotary method; temporary casing is expected to be needed to a depth of 30 feet through the surface alluvium. Once the surface casing is set, a small diameter pilot hole is planned to 500 feet to confirm total depth, identify location and thickness of water-bearing zones, and to develop a well screen design. The pilot hole is only planned to 500 feet because Well 5, discussed in Section 5.4, will be drilled first and a pilot hole to 1,000 feet is planned.

Well construction will comply with OWRD Well Construction Standards (Oregon Administrative Rules Chapter 690 Division 200). The final borehole size will be a minimum of 14 inches to meet OWRD well construction requirements.

The target yield of Well 4 is 200 gpm; actual yield will be determined after drilling, construction, and long-term test pumping. The well will be constructed with nominal 10-inch mild steel casing to accommodate a nominal 6-inch submersible pump and nominal 8-inch motor that can produce the target yield with enough head to deliver water to the raw water storage tank.

The conceptual design of Well 4 includes 10-inch diameter stainless steel wire-wrap well screen installed through the water-bearing strata. The placement and slot size will be determined after drilling. If Well 3 is used as a reference, 30-slot screen will be required. Once the well casing and screen are set as a single-string with centralizers, silica sand filter pack will be placed opposite the screened interval, with 20 feet of excess to allow for settling. The size of the filter pack will be determined after drilling the pilot hole and inspection of the drill cuttings; Well 3 was constructed with No. 10-20 silica sand. After placement of the filter pack, the annular space between the well casing and bore wall will be sealed with neat cement pumped from the bottom up using a tremie pipe in accordance with OAR 690-210-0140 and OAR 690-210-0170. A very fine sand or bentonite chips will be used as a filter pack seal to prevent grout intrusion into the pack.

Well construction specifications and a conceptual well design for Well 4 are included in Appendix D.

5.3.2. **Well Development and Testing**

Following construction, Well 4 will be developed until the water produced from the well is clear and free from sand or sediment. The well will be test pumped for an extended duration, expected to be 7 to 14 days, to determine long-term well capacity, assess aquifer sustainability and hydraulic characteristics, and evaluate the effects of any

negative boundaries encountered. All nearby wells and springs will be monitored during the test to evaluate the effects of pumping on groundwater levels in the vicinity.

5.3.3. **Well Location**

Well 4 is proposed in the SE ¼ of the NW ¼ of Section 32, T21S R44E. The latitude and longitude coordinates of the proposed well site are 43°42'11.99" N and 117°21'57.01" W. Well 4 would be located about 2.3 miles north of the proposed mine and about 650 feet north of Well 3, at an elevation of approximately 3,330 feet. The proposed well is shown on Figure 8.

Well 4 is located within the Project Permit Area, with Bureau of Land Management property surrounding the Project Permit Area. There are no sanitary hazards, as defined in Oregon Administrative Rules (OAR) 333-061-0050(2) within 100 feet of the proposed well. There are no gravity sewer lines or septic tanks within 50 feet of the proposed well. The proposed well site is not located in an area susceptible to flooding.

5.3.4. **Geologic Setting**

Well 4 is underlain by geologic unit *Qal*, identified as Pleistocene and Holocene alluvium, as shown on Figure 9. The geologic unit is reportedly underlain by interbedded conglomerate and siltstone (unit *Tis*), and undifferentiated Grassy Mountain Formation (unit *Tgs*). Faults are mapped to the north and west of Well 4, as depicted on Figure 9.

5.3.5. **Water Rights**

Well 4 is listed as a point of diversion on the Application for Permit Amendment filed on Calico's original water right permit #G-10994. The Application for Permit Amendment was submitted to OWRD on March 27, 2019.

5.3.6. **Anticipated Well Capacity**

It is assumed that Well 4 will have a long-term specific capacity at least equal to Well 3, about 1 gpm/ft. There is the potential of drilling a well with a higher specific capacity if additional water-bearing zones are encountered, the well is constructed more efficiently (i.e. screen and filter pack sized and placed appropriately), and the well is adequately developed. Conservatively assuming a long-term specific capacity of 1 gpm/ft, a pumping rate of 200 gpm, and a static water level of 70 feet bgs, the long-term pumping water level in the well is expected to be about 270 feet bgs, not accounting for pumping interference. The top of the well screen in Well 3 is at a depth of 280 feet bgs. If Well 4 encounters similar lithology, the projected pumping water level would still be above the top of the screen. If necessary, the well pump could be set in a blank section of 10-inch diameter casing between screen sections.

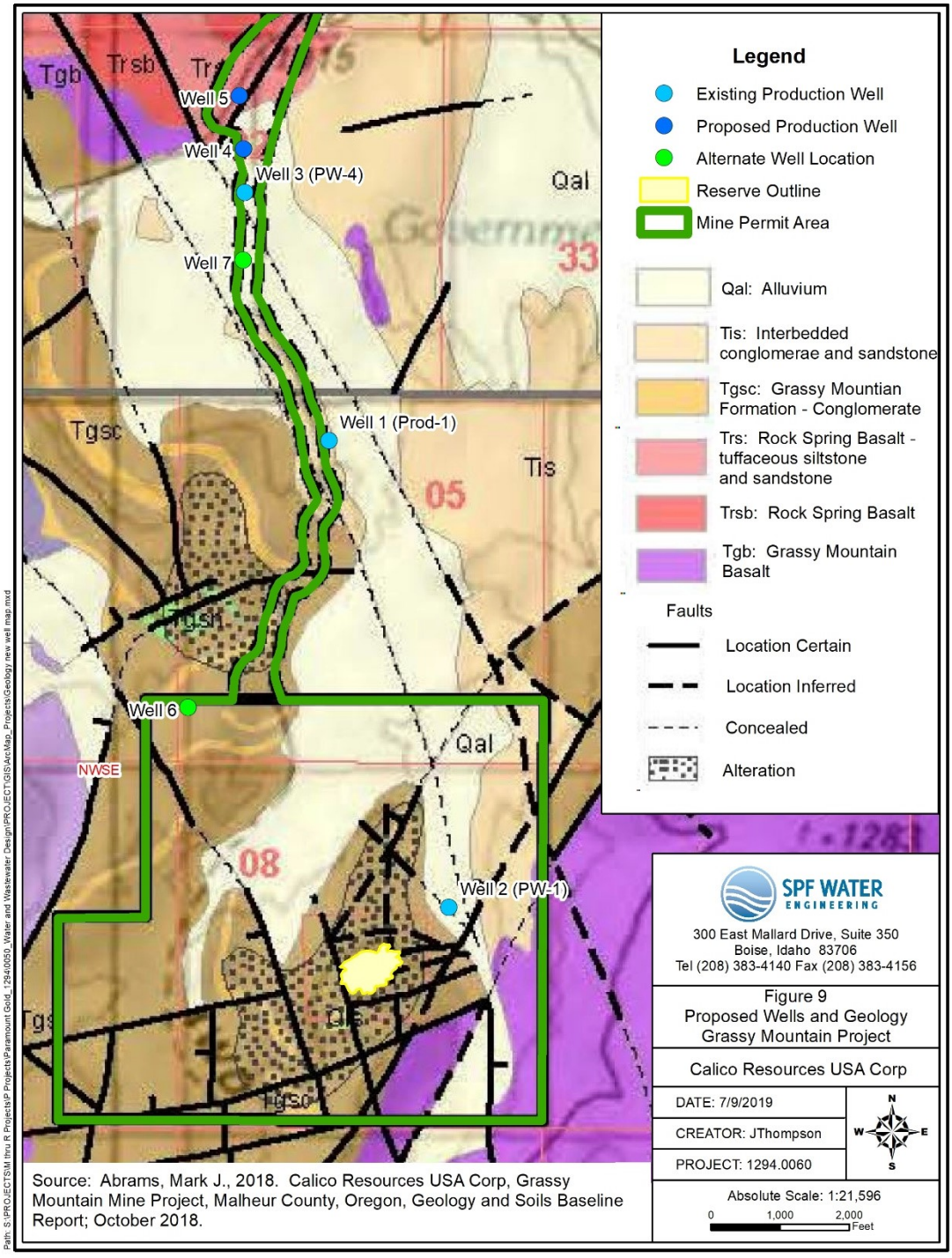


Figure 9. Map of proposed wells and surficial geology

5.3.7. **Pumping Interference**

For Well 4, pumping interference from the other main supply Well 5 needs to be accounted for. Well 5 is proposed to be located about 775 feet north of Well 4. Well 3 is expected to be a backup well, only needed if Wells 4 or 5 are not operational. Therefore, no interference effects are assumed from pumping Well 3.

To estimate drawdown from pumping, a Theis (1935) analysis was performed. For this analysis, an early-time transmissivity of 3,800 gpd/ft and a storativity of $7x10^{-5}$ are used based on test pumping data from Well 3. For the pumping rate, this analysis assumes Well 5 is the primary well, pumping at 200 gpm. The pumping interference in Well 4 is predicted to be about 55 feet after one year of pumping Well 5. If Well 5 is pumped annually at 200 gpm, the required annual pumping rate in Well 4 is estimated to be 120 gpm (the annual average daily water demand is projected to be about 320 gpm). The pumping water level in Well 4 is predicted to be 190 feet bgs after one year of pumping at 120 gpm. Accounting for pumping water level and interference effects, the water level in Well 4 is projected to be 245 feet bgs after one year of pumping. This water level is above the anticipated top of the well screen.

The maximum peak raw water supply demand is estimated to be 400 gpm during the summer months. If both Wells 4 and 5 are pumped at 200 gpm for 5 months, the pumping water level in Well 4 is projected to be 250 feet bgs plus 50 feet of interference drawdown for a total pumping water level of 300 feet bgs. This pumping water level falls below the anticipated top of the upper screen. The anticipated worst-case scenario is pumping Well 4 at 200 gpm for a year, with Well 5 pumped at 200 gpm for 5 months. The pumping water level in Well 5 is estimated to be 320 feet (270 feet plus 50 feet of interference).

If testing of the wells after construction also shows an unacceptable level of drawdown, it is possible to pump less from Wells 4 and 5 and utilize Well 3. For example, if Wells 4 and 5 were each pumped at 150 gpm and Well 3 was pumped at 100 gpm for 5 months, the pumping water level in Well 4 is predicted to be 205 feet bgs plus 37 feet of interference from Well 5 and 26 feet of interference from Well 3, for a total pumping water level of 268 feet, above the anticipated top of the upper screen.

This evaluation of pumping interference relies on assuming a specific capacity for Well 4 and running a Theis analysis that relies on assumptions not entirely applicable to the aquifer in question. However, this evaluation does demonstrate that having three supply wells should provide enough flexibility to meet Project water demands even if specific capacity of the new wells is not improved over Well 3. If after construction and testing it is determined that three wells are not enough, a fourth well (Well 7) could be constructed to provide additional capacity.

5.3.8. **Anticipated Water Quality**

The groundwater produced from Well 4 is anticipated to have similar water quality as the nearby Well 3, given the proximity of the wells and similar target aquifer. The well

is expected to produce water with an arsenic concentration greater exceeding the primary drinking water standard. The well might produce water exceeding secondary drinking water standards for aluminum, iron, manganese, and/or total dissolved solids based on water quality results from Well 3. However, with adequate well development it is likely the concentrations of these constituents will be lower than those observed in Well 3, potentially below the secondary drinking water standard.

5.3.9. **Proposed Use and Recommendations**

Well 4 is recommended to be used as a primary water supply for the proposed mine, and be equipped with a pump with enough head to fill the raw water storage tank. There is an elevation difference of approximately 585 feet between the well ground surface and the tank overflow elevation.

It is recommended that Well 4 be equipped with a 6-inch submersible pump and motor capable of producing 200 gpm at a TDH of 980 feet. The TDH assumes a long-term pumping water level of 270 feet, 640 feet of static lift and headloss (277 psi discharge pressure), 20 feet of safety factor, and 50 feet of pumping interference. A 75-hp pump and motor are anticipated based on these design conditions.

The TDH estimate for preliminary pump selection is considered conservative and is based on an estimate of pumping water level and interference effects. Final pump selection will occur after Well 4 is constructed and test pumped. An example pump curve is included in Appendix C. The pump will be set on 4-inch column pipe.

Well 4 should be equipped with soft start, check valve, pressure relief / surge anticipator valve, flow meter, pressure gauge, isolation valve, and air valve. A nominal 1-inch Schedule 40 flush-thread PVC sounding tube should be installed in the well to the top of the pump to house a water-level pressure transducer. Well 4 and associated equipment should be located in a heated metal building. Treatment will be required to remove arsenic from the water if Well 4 is used for potable water supply.

5.4. Well 5

5.4.1. **Anticipated Well Construction**

Well 5 will be constructed to target water-bearing sandstone and conglomerate layers expected to occur between a depth of approximately 250 and 500 feet bgs. The anticipated maximum depth of the well is 500 feet. Temporary surface casing is anticipated to be required to a depth of 30 feet through the surface alluvium. A small diameter exploratory pilot hole is planned to 1,000 feet to determine if there is a deeper water-bearing zone below 500 feet. Drilling results from exploratory drill hole 26-057, located about 1,500 feet to the south, suggests that there is not a deeper aquifer. This hole encountered tuff between a depth of 445 and 740 feet. However, drilling of the pilot hole is still recommended due to the spatial variability of the aquifer system. Final well design will be based on the results of the pilot hole drilling.

The target yield of Well 5 is 200 gpm; actual yield will be determined after drilling, construction, and long-term test pumping. Well 5 will be constructed similarly as Well 4, with nominal 10-inch mild steel casing and stainless steel wire-wrap well screen. Filter pack will be placed opposite the screened interval. Screen and filter pack selection will be finalized after drilling. Well 5 will be sealed from the top of the filter pack to ground surface with neat cement.

Well construction will comply with OWRD Well Construction Standards (Oregon Administrative Rules Chapter 690 Division 200). Well construction specifications and a conceptual well design for Well 5 are included in Appendix E.

5.4.2. **Well Development and Testing**

Following construction, Well 5 will be developed until the water produced from the well is clear and free from sand or sediment. Following development, the well will be test pumped for an estimated 7 to 14 days. All nearby wells and springs will be monitored during the test to evaluate the effects of pumping on groundwater levels in the vicinity.

5.4.3. **Well Location**

Well 5 is proposed in the NE ¼ of the NW ¼ of Section 32, T21S R44E. The latitude and longitude coordinates of the proposed well site are 43°42'19.02" N and 117°21'57.62" W. Well 5 would be located about 2.4 miles north of the proposed mine and about 775 feet north of Well 4, at an elevation of approximately 3,330 feet. The proposed well is shown on Figure 8.

Well 5 is located within the Project Permit Area. There are no sanitary hazards, as defined in Oregon Administrative Rules (OAR) 333-061-0050(2) within 100 feet of the proposed well. There are no gravity sewer lines or septic tanks within 50 feet of the proposed well. The proposed well site is not located in an area susceptible to flooding.

5.4.4. **Geologic Setting**

Well 5 is underlain by geologic unit *Trs*, identified as Rock Spring Basalt with interbedded tuffaceous siltstone and sandstone (Figure 9). The basalt is reportedly underlain by interbedded conglomerate and siltstone (unit *Tis*) and undifferentiated Grassy Mountain Formation (unit *Tgs*). Faults are mapped to the southeast and west of Well 5 (Figure 9).

5.4.5. **Water Rights**

Well 5 is listed as a point of diversion on the Application for Permit Amendment filed on Calico's original water right permit #G-10994.

5.4.6. **Anticipated Well Capacity**

Well 5 is expected to have a long-term specific capacity of at least 1 gpm/ft based on test pumping of the nearby Well 3. The long-term pumping water level in the well is

conservatively estimated to be about 270 feet bgs, assuming a long-term specific capacity of 1 gpm/ft, a pumping rate of 200 gpm, and a static water level of 70 feet bgs. This pumping water level does not include pumping interference from Well 4.

5.4.7. **Pumping Interference**

Pumping interference between the primary supply wells 4 and 5 is expected. Using the same analysis as described in Section 5.3.7, the pumping interference in Well 5 is predicted to be about 55 feet after one year of pumping Well 4 at 200 gpm. If Well 4 is pumped annually at 200 gpm, the annual pumping rate from Well 5 would need to be 120 gpm with a resultant pumping water level of 190 feet bgs. Accounting for pumping water level and interference effects, the water level in Well 5 is projected to be 245 feet bgs after one year of pumping.

If both Wells 4 and 5 are pumped at 200 gpm for 5 months to meet the peak summer raw water supply demand, the pumping water level in Well 5 is projected to be 250 feet bgs plus 50 feet of interference drawdown for a total pumping water level of 300 feet bgs. The anticipated worst-case scenario is pumping Well 5 at 200 gpm for a year, with Well 4 pumped at 200 gpm for 5 months. The pumping water level in Well 5 is estimated to be 320 feet (270 feet plus 50 feet of interference).

5.4.8. **Anticipated Water Quality**

The groundwater produced from Well 5 is anticipated to produce water with elevated arsenic greater than the primary drinking water standard and might also exceed secondary drinking water standards for aluminum, iron, manganese, and/or total dissolved solids. The water quality from Well 5 is expected to be similar to Well 3, although the concentrations of secondary constituents may be lower with adequate well development.

5.4.9. **Proposed Use and Recommendations**

Well 5 is recommended to be used as a primary water supply for the proposed mine, and be equipped with a pump with enough head to fill the raw water storage tank. There is an elevation difference of approximately 585 feet between the well ground surface and the tank overflow elevation.

It is recommended that Well 5 be equipped with a 6-inch submersible pump and motor capable of producing 200 gpm at a TDH of 980 feet. The TDH assumes a long-term pumping water level of 270 feet, 640 feet of static lift and headloss (277 psi wellhead discharge pressure), 20 feet of safety factor, and 50 feet of pumping interference. A 75-hp pump and motor are anticipated based on these design conditions. This pump selection is preliminary; final pump selection will occur after Well 5 is constructed and test pumped. An example pump curve is included in Appendix C. The pump will be set on 4-inch column pipe.

Well 5 should be equipped with soft start, check valve, pressure relief / surge anticipator valve, flow meter, pressure gauge, isolation valve, air valve, and 1-inch sounding tube with a water-level pressure transducer. Well 5 and associated equipment should be located in a heated metal building. Treatment will be required to remove arsenic from the water if Well 5 is used for potable water supply.

5.5. Well 7

Well 7 will be constructed if the long-term sustainable yield from Wells 4 and 5 are determined to be less than 400 gpm after construction and testing.

5.5.1. **Anticipated Well Construction**

Well 7 will be constructed to target water-bearing sandstone and conglomerate layers expected to occur between a depth of approximately 250 and 500 feet bgs. The anticipated maximum depth of the well is 500 feet. Temporary surface casing is anticipated to be required to a depth of 30 feet through the surface alluvium.

The anticipated yield of Well 7 is 100 gpm based on deeper static water level and bounded aquifer conditions similar to Well 1; actual yield will be determined after drilling, construction, and long-term test pumping. Well 7 will be constructed similarly as Wells 4 and 5, with nominal 10-inch mild steel casing and stainless steel wire-wrap well screen. Filter pack will be placed opposite the screened interval. Screen and filter pack selection will be finalized after drilling. Well 7 will be sealed from the top of the filter pack to ground surface with neat cement.

Well construction will comply with OWRD Well Construction Standards (Oregon Administrative Rules Chapter 690 Division 200).

5.5.2. **Well Development and Testing**

Following construction, Well 7 will be developed until the water produced from the well is clear and free from sand or sediment. Following development, the well will be test pumped for an estimated 7 to 14 days. All nearby wells and springs will be monitored during the test to evaluate the effects of pumping on groundwater levels in the vicinity.

5.5.3. **Well Location**

Well 7 is proposed in the NE ¼ of the SW ¼ of Section 32, T21S R44E. The latitude and longitude coordinates of the proposed well site are 43°41’55.59” N and 117°21’56.85” W. Well 7 would be located about 2.0 miles north of the proposed mine and about 975 feet south of Well 3, at an elevation of approximately 3,375 feet. The proposed well is shown on Figure 8.

Well 7 is located within the Project Permit Area. There are no sanitary hazards, as defined in Oregon Administrative Rules (OAR) 333-061-0050(2) within 100 feet of the proposed well. There are no gravity sewer lines or septic tanks within 50 feet of the proposed well. The proposed well site is not located in an area susceptible to flooding.

5.5.4. **Geologic Setting**

Well 7 is underlain by geologic unit *Qal*, identified as Pleistocene and Holocene alluvium, as shown on Figure 9. The geologic unit is reportedly underlain by interbedded conglomerate and siltstone (unit *Tis*), and undifferentiated Grassy Mountain Formation (unit *Tgs*). Well 7 appears to be bounded by faults to the northeast and southwest (Figure 9).

5.5.5. **Water Rights**

Well 7 is listed as a point of diversion on the Application for Permit Amendment filed on Calico's original water right permit #G-10994.

5.5.6. **Anticipated Well Capacity**

Well 7 is expected to have a long-term specific capacity of at least 0.6 gpm/ft based on test pumping of Wells 1 and 3. The long-term pumping water level in the well is conservatively estimated to be about 290 feet bgs, assuming a long-term specific capacity of 0.6 gpm/ft, a pumping rate of 100 gpm, and a static water level of 120 feet bgs. This pumping water level does not include pumping interference from Wells 3, 4, and 5.

5.5.7. **Pumping Interference**

Well 7 would be expected to be affected by pumping of Wells 4 and 5 (Well 3 would serve as a backup well). Well 7 would be about 1,600 feet from Well 4 and about 2,400 feet from Well 5.

If Wells 4 and 5 are each pumped at 150 gpm and Well 7 is pumped at 100 gpm for 5 months, the resultant pumping water level in Well 7 is estimated to be about 310 feet using the same analysis as described in Section 5.3.7. This value includes a non-interference pumping water level of 253 feet based on a 5-month specific capacity of 0.75 gpm/ft plus 31 feet of interference from Well 4 and 27 feet of interference from Well 5.

For annual pumping impacts (annual average daily demand of 320 gpm), it is assumed that Wells 4 and 5 are each pumped at 135 gpm and Well 4 is pumped at 50 gpm. Under this scenario the long-term pumping water level in Well 7 is predicted to be 260 feet bgs (pumping water level of 200 feet plus 60 feet of combined interference).

The anticipated worst-case scenario is pumping Well 7 at 100 gpm for a year, with Wells 4 and 5 pumped at 150 gpm each for 5 months. The pumping water level in Well 7 is estimated to be 350 feet (290 feet plus 60 feet of interference).

5.5.8. **Anticipated Water Quality**

The groundwater produced from Well 7 is anticipated to produce water with elevated arsenic greater than the primary drinking water standard and might also exceed

secondary drinking water standards for aluminum, iron, manganese, and/or total dissolved solids.

5.5.9. **Proposed Use and Recommendations**

Well 7, if needed, is recommended to be used as a primary water supply for the proposed mine, and be equipped with a pump with enough head to fill the raw water storage tank. There is an elevation difference of approximately 540 feet between the well ground surface and the tank overflow elevation.

It is recommended that Well 7 be equipped with a 7-inch submersible pump and 6-inch motor capable of producing 100 gpm at a TDH of 955 feet. The TDH assumes a long-term pumping water level of 290 feet, 585 feet of lift and headloss (253 psi wellhead discharge pressure), 20 feet of safety factor, and 60 feet of pumping interference. A 50-hp pump and motor are anticipated based on these design conditions. This pump selection is preliminary; final pump selection will occur after Well 7 is constructed and test pumped. An example pump curve is included in Appendix C. The pump will be set on 4-inch column pipe.

Well 7 should be equipped with soft start, check valve, pressure relief / surge anticipator valve, flow meter, pressure gauge, isolation valve, air valve, and 1-inch sounding tube with a water-level pressure transducer. Well 7 and associated equipment should be located in a heated metal building. Treatment will be required to remove arsenic from the water if Well 7 is used for potable water supply.

5.6. Alternate Well Locations

There is one additional water supply well location identified as a point of diversion on the Application for Permit Amendment filed on Calico's original water right permit #G-10994. This location is identified as Well 6 on Figure 8. If Wells 4, 5, and 7, with redundant supply from Well 3, cannot produce enough water to meet the Project long-term peak raw water supply demands, then Well 6 should be considered for groundwater development.

If additional supply is needed in excess of Wells 1 through 7, then potential areas to explore for additional water include along the access road north of Well 5 and in the vicinity of Schweizer Reservoir east of the deposit. In the event productive aquifers are encountered at these or other locations, permit #G-10994 will need to be amended to show additional points of diversions.

6. LIST OF PREPARERS

Jason Thompson, P.E.
SPF Water Engineering
300 E. Mallard Drive, Suite 350
Boise, Idaho 83706
208-383-4140
jthompson@spfwater.com

Terry Scanlan, P.E., P.G.
SPF Water Engineering
300 E. Mallard Drive, Suite 350
Boise, Idaho 83706
208-383-4140
tscanlan@spfwater.com

7. REFERENCES

Abrams, Mark J., 2018. Calico Resources USA Corp, Grassy Mountain Mine Project, Malheur County, Oregon, Geology and Soils Baseline Report. October 2018.

Driscoll, F.G., 1986. Groundwater and Wells. Johnson Division, St. Paul, MN.

EM Strategies, Inc., 2017. Environmental Baseline Study Work Plans. Grassy Mountain Project. Prepared for Calico Resources USA Corp. Prepared by EM Strategies, Inc., Reno, Nevada. September 22, 2017.

J.M. Montgomery Consulting Engineers, Inc. (JMM), 1991. Phase I Hydrogeologic Report on the Grassy Mountain Mine Project, Malheur County, OR. August 1991.

Red Quill Ventures, LLC (RQV), 2015. Calico Resources USA Corp, Grassy Mountain Project, Geology and Soils Baseline Study; February 2015.

SPF Water Engineering (SPF), 2019a. Grassy Mountain Gold Project Groundwater Resources Baseline Data Report. Prepared by SPF, Boise, Idaho. February 19, 2019.

SPF Water Engineering (SPF), 2019b. Draft Grassy Mountain Gold Project Groundwater Characterization Report. Prepared by SPF, Boise, Idaho.

Steffen Robertson and Kirsten Consulting Engineers and Scientists (SRK), 1989. Pumping Test Production Well PW-4-Procedures and Analyses. Letter to Atlas Precious Metals dated December 29, 1989.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of a well using ground-water storage. Transactions, American Geophysical Union, 16: 519-524.

Attachment A
Well Driller's Reports

Well 1 (PROD-1)

STATE OF OREGON

WATER WELL REPORT

(as required by ORS 537.765)

RECEIVED MAY 1989 WATER RESOURCES DEPT. SALEM, OREGON

MAH 2511

22S/44E/5ab

(START CARD) # 9256

(1) OWNER:

Well Number: SALEM, OREGON

Name Atlas Precious Metals

Address 743 Horizin Ct. Suite 202

City Grand Junction State Co Zip 81506

(2) TYPE OF WORK:

☒ New Well ☐ Deepen ☒ Recondition ☐ Abandon

(3) DRILL METHOD

☒ Rotary Air ☐ Rotary Mud ☐ Cable

☒ Other Auger

(4) PROPOSED USE:

☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval ☐ Yes ☐ No Depth of Completed Well ____ ft.

Explosives used ☐ Yes ☒ No Type ____ Amount ____

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
12"	0	18				
10	18	425				
			Cement grout	0	26	19

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E

☐ Other

Backfill placed from ____ ft. to ____ ft. Material Ft. 's Cement Grout

Gravel placed from 100 ft. to 245 ft. Size of gravel No. 8

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	10"	+2	99	.250	☒	☐	☒	☐
	6"	+2	245	Sch 80	☐	☒	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

☐ Perforations Method

☒ Screens Type Aardvark Material PVC Sch 80

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
380	420	.020		6"		☐	☐
145	255	325-355				☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour

☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
100	40'	300	1 hr.

Temperature of water ____ Depth Artesian Flow Found ____

Was a water analysis done? ☐ Yes By whom ____

Did any strata contain water not suitable for intended use? ☐ Too little

☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other ____

Depth of strata: ____

(9) LOCATION OF WELL by legal description:

County Malheur Latitude ____ Longitude ____

Township 22S N or S, Range 44E E or W, WM.

Section 5 NW ¼ NE ¼

Tax Lot ____ Lot ____ Block ____ Subdivision ____

Street Address of Well (or nearest address) ____

(10) STATIC WATER LEVEL:

40' ft. below land surface. Date 12-8-88

Artesian pressure ____ lb. per square inch. Date ____

(11) WATER BEARING ZONES:

Depth at which water was first found 40'

From	To	Estimated Flow Rate	SWL
140-[illegible]	255	30 gpm	
320	355	50 gpm	
380	415	150 gpm	

(12) WELL LOG:

Ground elevation ____

Material	From	To	SWL
Overburden w/ boulders	0	17	0
Clay brown	17	140	0
Sandstone w/ blue clay	140	255	40
blue clay	255	320	40
Sandstone w/ blue clay	320	355	40
Blue clay	355	380	40
Fruited hard sandstone	380	415	40
Blue clay	415	425	40
=			
12-5-88 - 12-10-88			
+=			
Redone surface seal to 26 feet using method 2 referring to letter sent January 9, 1989			
Drilled around 10" casing to the depth of 26' using method C pumped 19 sacks of cement down hole			
3-30-89 - 3-31-89			
=			
Incorporated to singel log per state request			

Date started 12-5-88 Completed 3-31-89

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

Signed Bob Doty WWC Number 1202

Date 4-10-89

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief. WWC Number 325[illegible]

Signed Bob Doty for Bill Doty Date 4/15/89

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 3/88

Well 2 (PW-1)

JAN 02 1990

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

WATER RESOURCES DEPT
SALEM, OREGON

Malh 2276

22s/44E/8ad

(START CARD) # W-14816

(1) OWNER:

Well Number:

Name Atlas Precious Metals Inc

Address 318 A St.

City Vale State OR Zip 97818

(2) TYPE OF WORK:

☑ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD

☑ Rotary Air ☐ Rotary Mud ☐ Cable

☐ Other

(4) PROPOSED USE:

☐ Domestic ☐ Community ☑ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval Yes ☐ No ☑ Depth of Completed Well 420 ft.

Explosives used Yes ☐ No ☑ Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
14 3/4	0	28	PT CEMENT	0	28	19
			VOLCLAY	300	SURFACE	40 Sacks
			BENT PELLETS	295	300	3 BUCKETS

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E

☐ Other TREMIE

Backfill placed from ft. to ft. Material

Gravel placed from 555 ft. to 295 ft. Size of gravel .030

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	6"	+2	320	.250	☑	☐	☑	☐
	6"	340	400	"	☑	☐	☑	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:

☐ Perforations Method

☑ Screens Type WIRE WOUND Material LOW CARBON

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
320	340	.030			6"	☐	☑
400	420	.030			6"	☐	☑
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour

☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
35		294	1 hr.

Temperature of water 64° F Depth Artesian Flow Found

Was a water analysis done? ☐ Yes By whom

Did any strata contain water not suitable for intended use? ☐ Too little

☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other

Depth of strata:

(9) LOCATION OF WELL by legal description:

County Malheur Latitude ' " Longitude ' "

Township 22S N or S, Range 44E E or W, WM.

Section 8 SE ¼ NE ¼

Tax Lot Lot Block Subdivision

Street Address of Well (or nearest address)

(10) STATIC WATER LEVEL:

52 ft. below land surface. Date 12-6-89

Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:

Depth at which water was first found

From	To	Estimated Flow Rate	SWL
320	340	20	
400	420	20	
		40	

(12) WELL LOG:

Ground elevation

Material	From	To	SWL
SOIL	0	2	
CLAY	2	10	
BASALT	10	28	
BROWN CLAY	28	55	
SILTSTONE	55	130	
CLAY & GRAVEL	130	173	
CLAY & SAND	173	190	
BASALT	190	315	
BROWN CLAY	315	323	
BROWN CLAY & SAND	323	360	
BROWN SANDSTONE	360	395	
BLACK & RED SAND	395	408	
SANDSTONE COARSE	408	441	
CLAY & GRAVEL	441	447	
CLAY & SAND	447	555	

Date started 11/27/89 Completed 12-1-89

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

WWC Number

Signed Date

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

WWC Number 544

Signed Larry Burd Date 12/1/89

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 3/88

Well 3 (PW-4)

JAN 02 1990

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

WATER RESOURCES DEPT.
SALEM, OREGON

Mail 2206

21S/44E/32bd
W-14815

(START CARD) # W-14811

(1) OWNER: Well Number: PW-4
Name ATLAS PRECIOUS METALS
Address 313 A STREET WEST
City VALE State OR Zip 97918

(2) TYPE OF WORK:
☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD
☒ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Other

(4) PROPOSED USE:
☐ Domestic ☐ Community ☒ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval Yes ☒ No ☐ Depth of Completed Well 375 ft.
Explosives used Yes ☐ No ☒ Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
14 3/4	0	40	PORTLAND CEMENT	0	40	19
9 7/8	40	375	VOLCLAY	5	275	40
			CEMENT	0	5	

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☐ Other
Backfill placed from 375 ft. to 370 ft. Material 10-20 MESH
Gravel placed from 370 ft. to 275 ft. Size of gravel 10-20 MESH

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	10"	0	40	.250	☒	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	6 5/8"	0	280	.250	☐	☐	☐	☐
	6 5/8"	300	340	.250	☒	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☐ Perforations Method
☒ Screens Type WIRE WOUND Material Low Carbon Steel

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
280	300	.030		6"		☐	☒
340	360	.030		6"		☐	☒
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
100		350	1 hr.

Temperature of water 62°F Depth Artesian Flow Found —
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☒ Odor ☐ Colored ☐ Other
Depth of strata: 280 STILL USABLE

(9) LOCATION OF WELL by legal description:
County MALHEUR Latitude ° ' " Longitude ° ' "
Township 21S N or S, Range 44E E or W, WM.
Section 32 SE ¼ NW ¼
Tax Lot Lot Block Subdivision
Street Address of Well (or nearest address)

(10) STATIC WATER LEVEL:
81 ft. below land surface. Date 11/17/89
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 280'

From	To	Estimated Flow Rate	SWL
280	360	100 gpm	81

(12) WELL LOG: Ground elevation ≅ 3350

Material	From	To	SWL
Alluvium	0	25'	
Clay	25	150'	
Sandy clay	150	175	
Sandstone	175	215	
Clay	215	275	
Sandstone	275	305	
Clay	305	325	
Sandstone and Conglomerate	325	365	
Clay.	365	375	

Date started 11/16/89 Completed 11/20/89

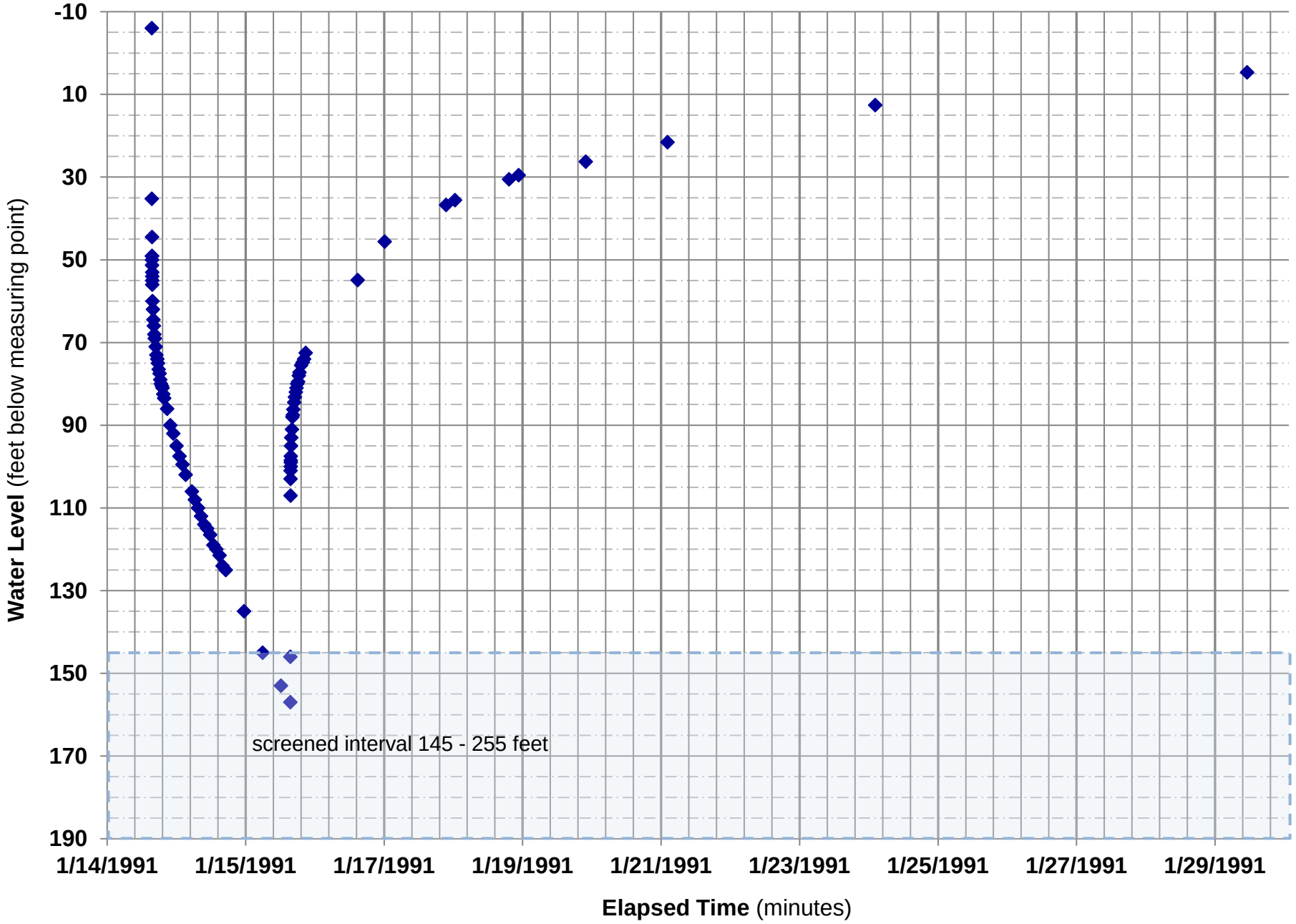
(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.
Signed [signature] WWC Number
Date 11/20/89

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
Signed Larry Burd WWC Number 544
Date 11-20-89

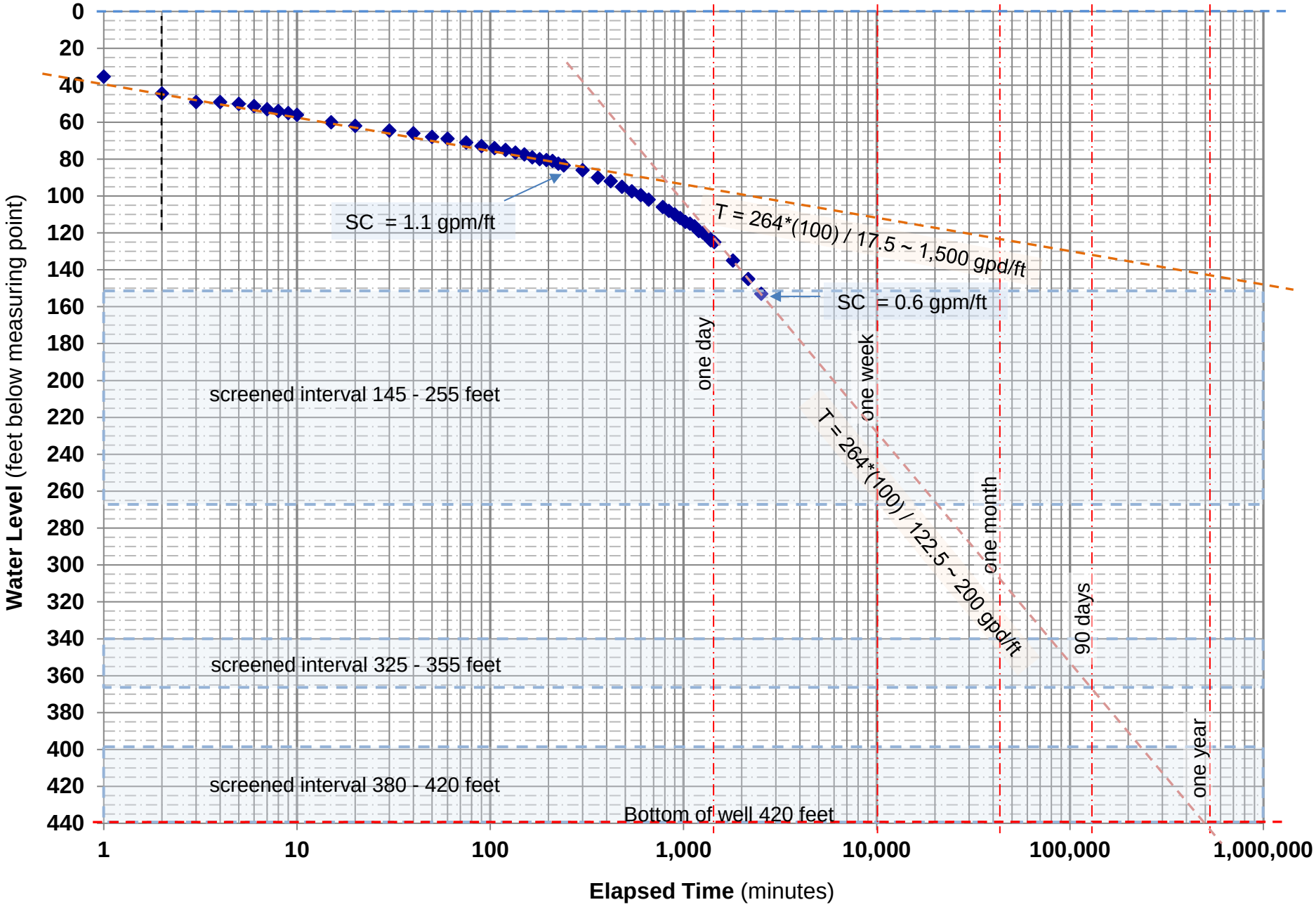
ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 3/85

Attachment B
Test Pumping Plots

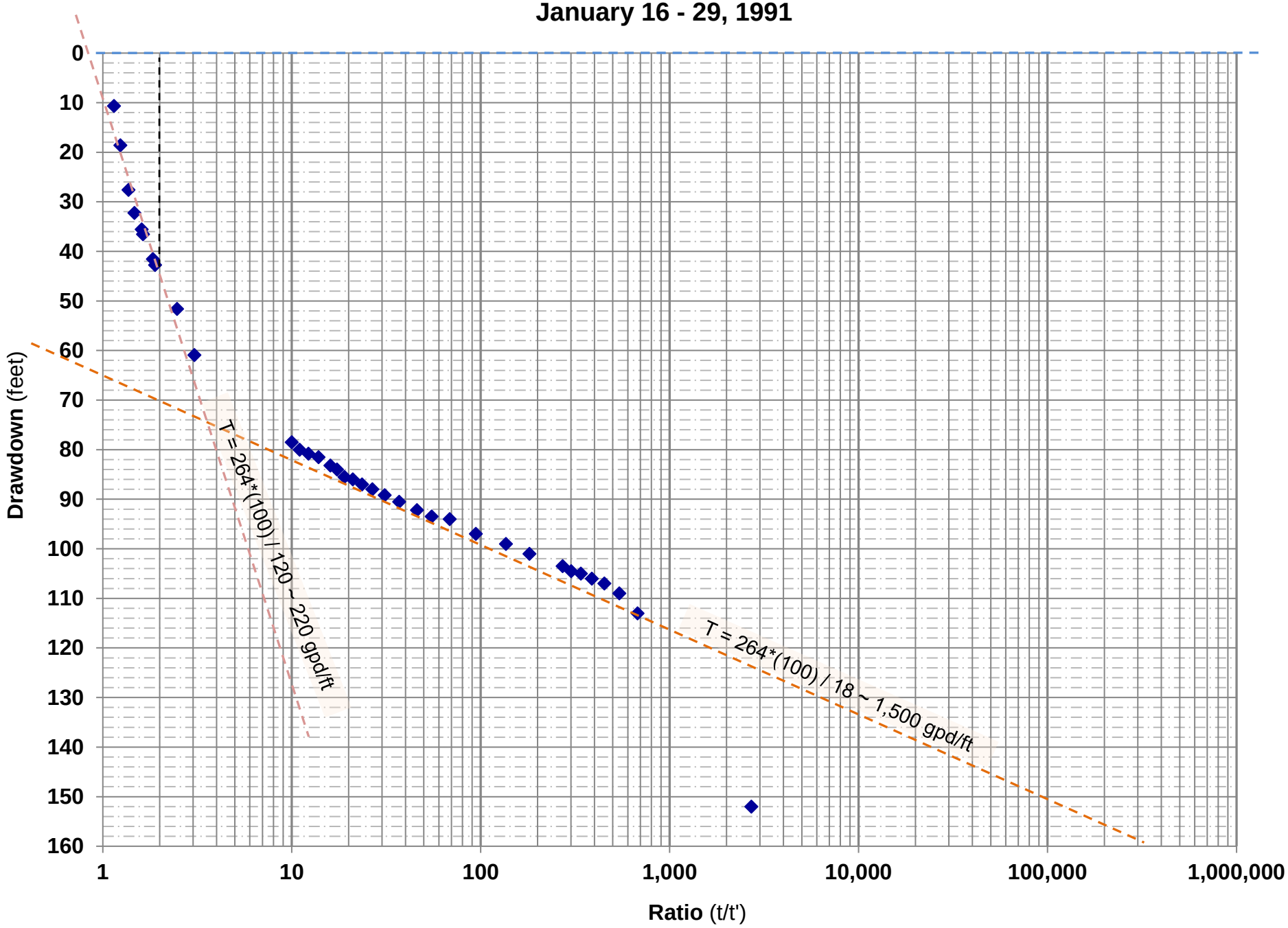
Prod-1 Constant-Rate Discharge Test
Depth to Water Plot, Q~100 gpm
January 14 - 29, 1991



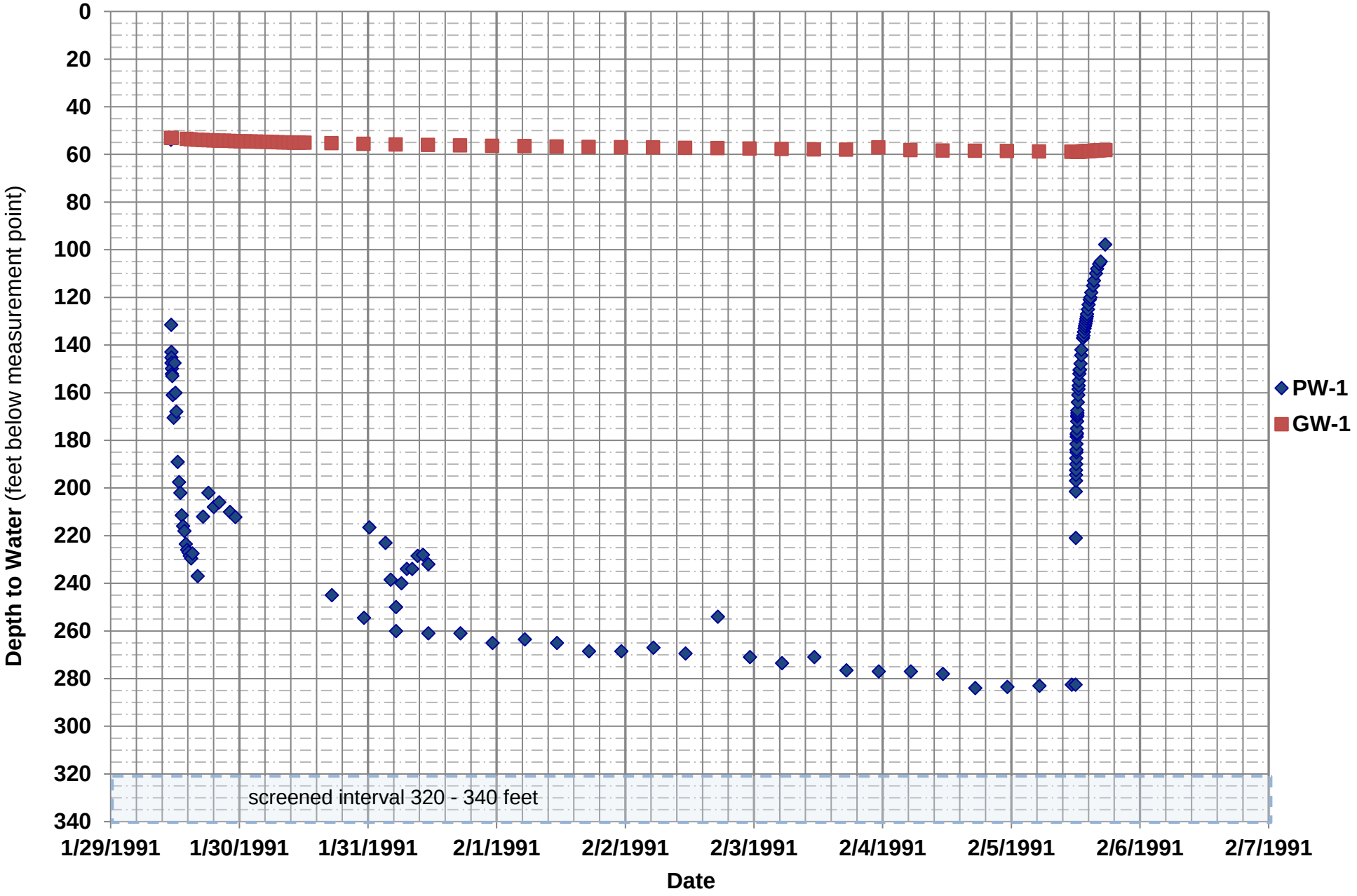
Prod-1 Constant-Rate Discharge Test
Semi-Log Water Level Plot, Q~100 gpm
January 14 - 16, 1991



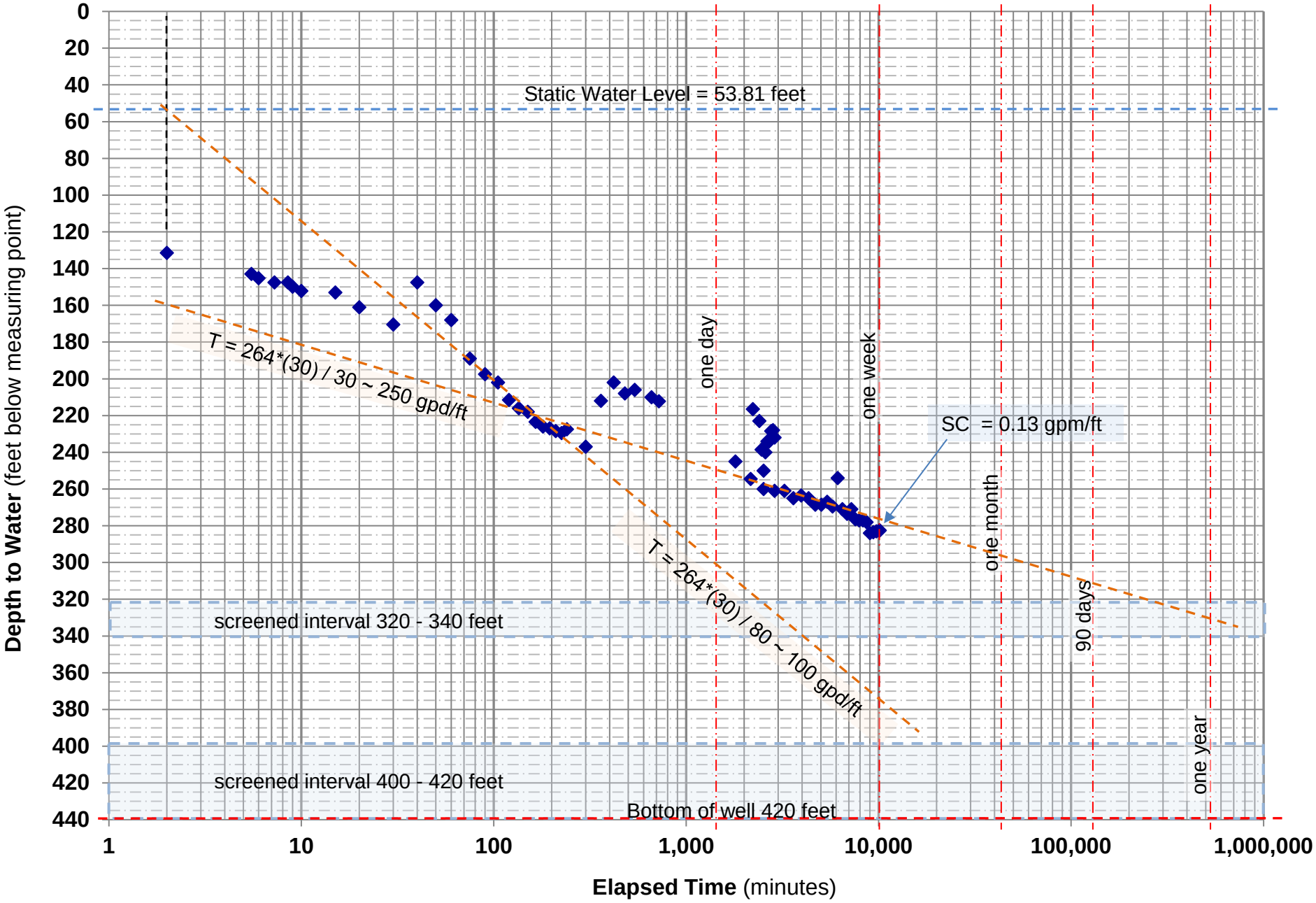
Prod-1 Constant-Rate Discharge Test
Semi-Log Recovery Plot, Q~100 gpm
January 16 - 29, 1991



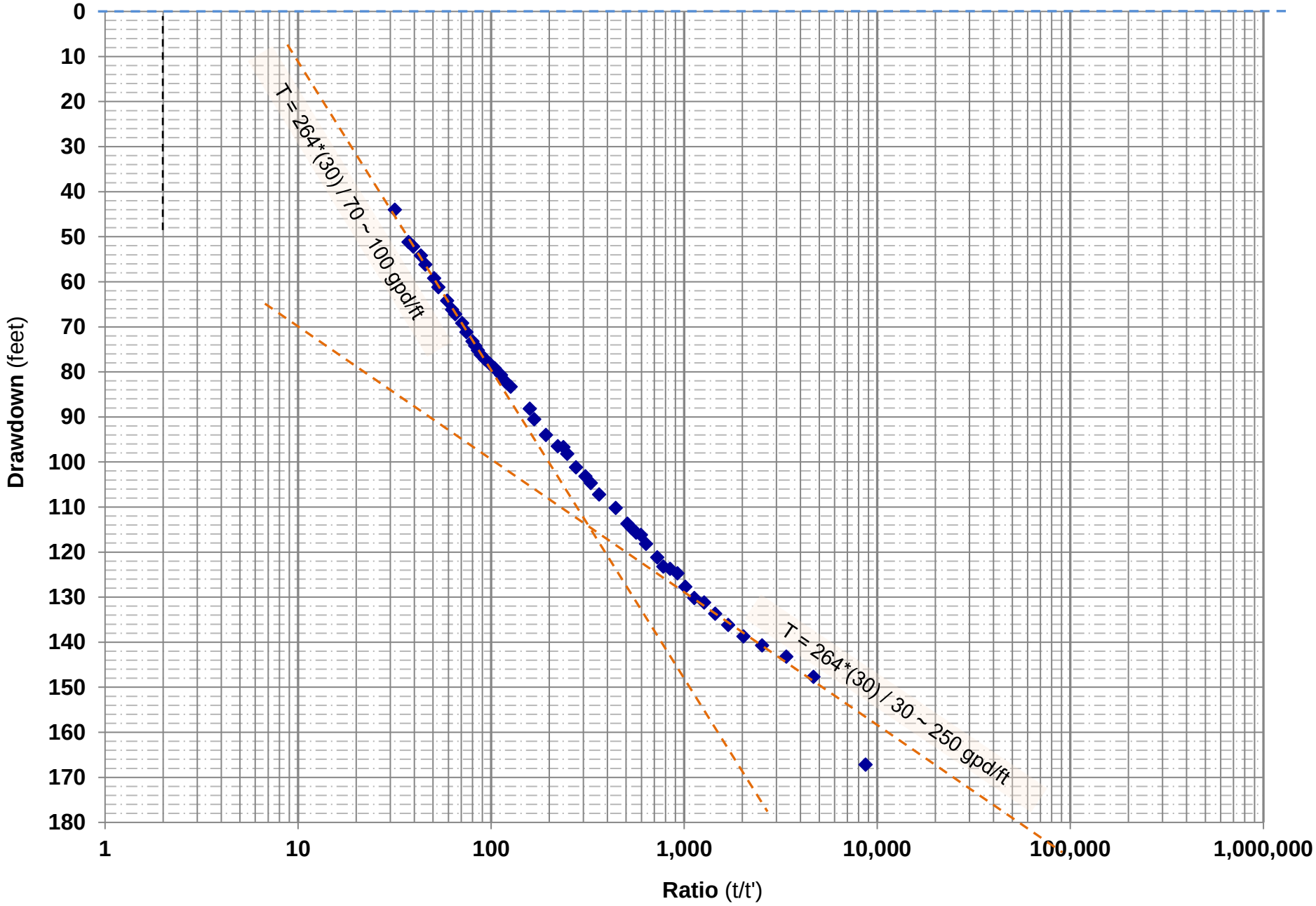
PW-1 Constant-Rate Discharge Test
Depth to Water Plot, Q~30 gpm
January 29 - February 5, 1991



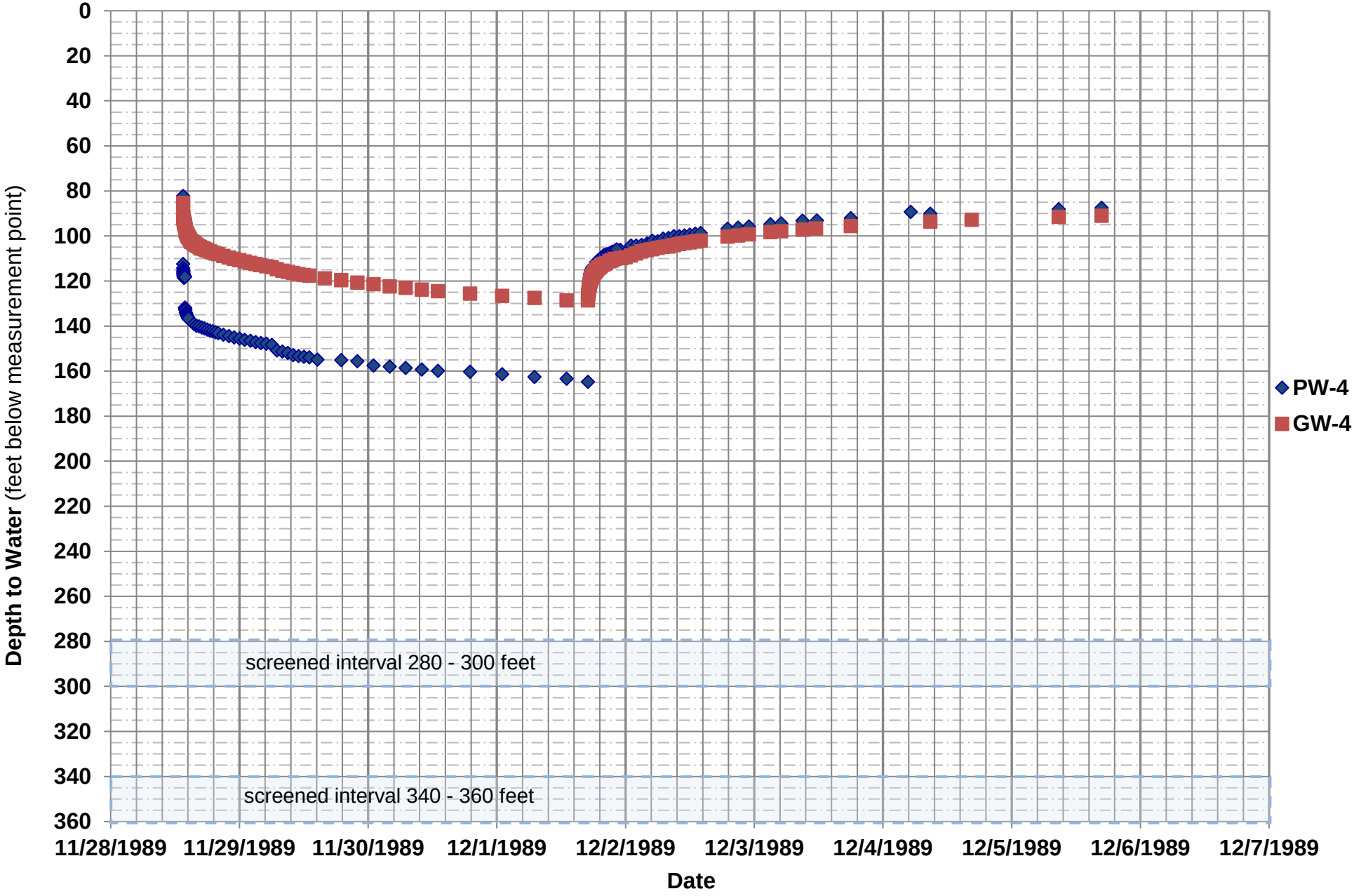
PW-1 Constant-Rate Discharge Test
Semi-Log Water Level Plot, Q~30 gpm
January 29 - February 5, 1991



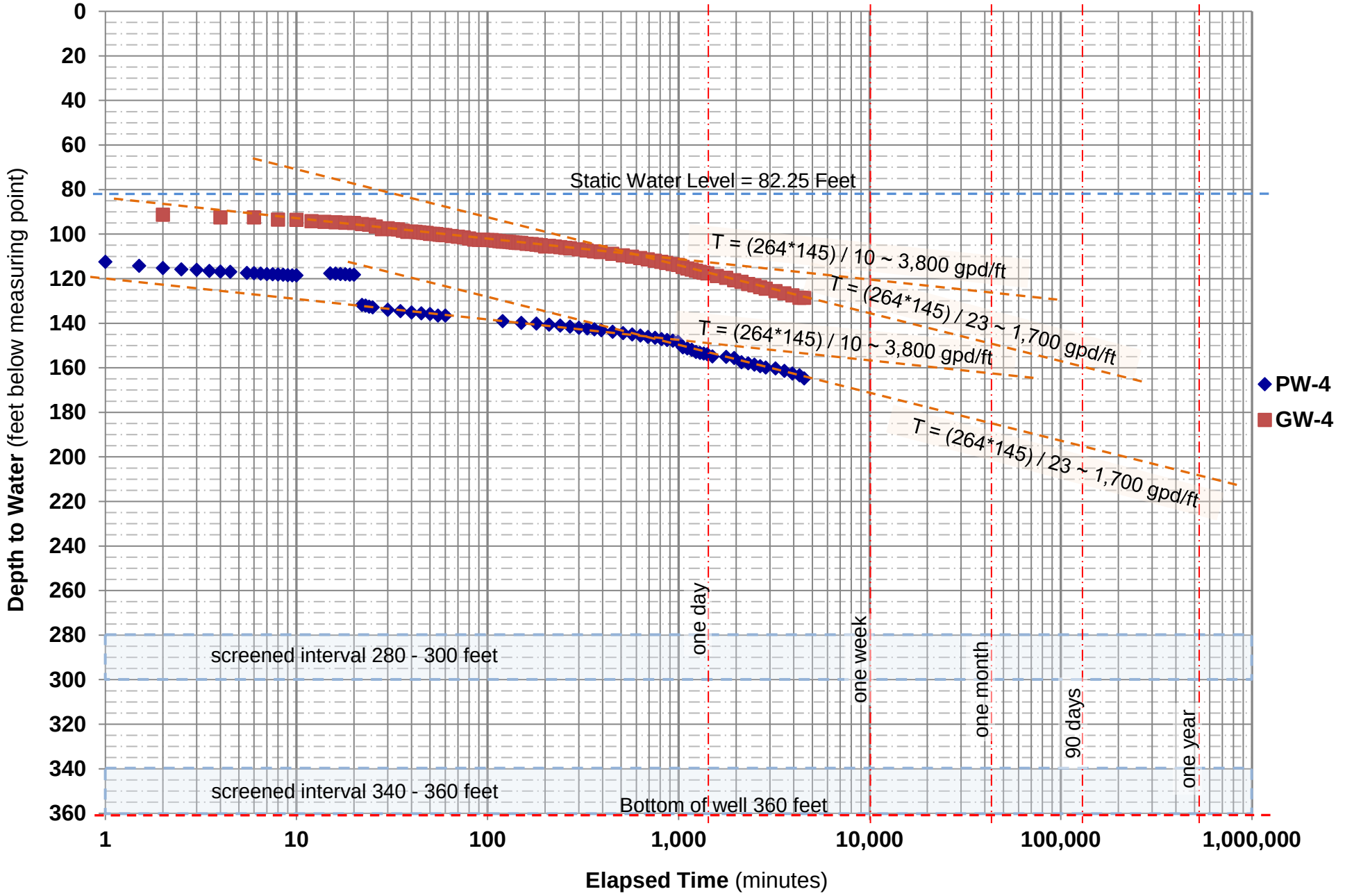
PW-1 Constant-Rate Discharge Test
Semi-Log Recovery Plot, Q~30 gpm
February 5, 1991

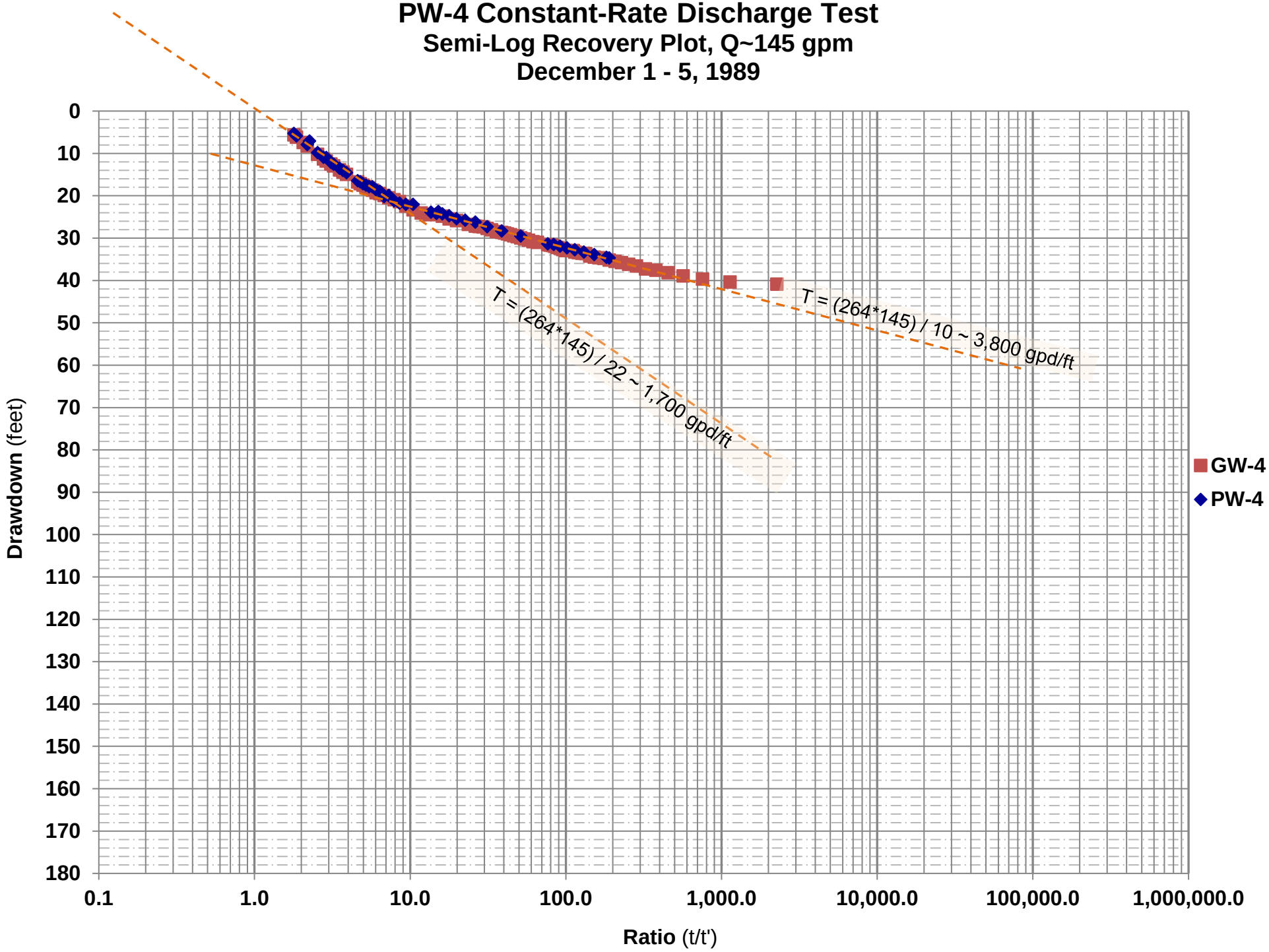


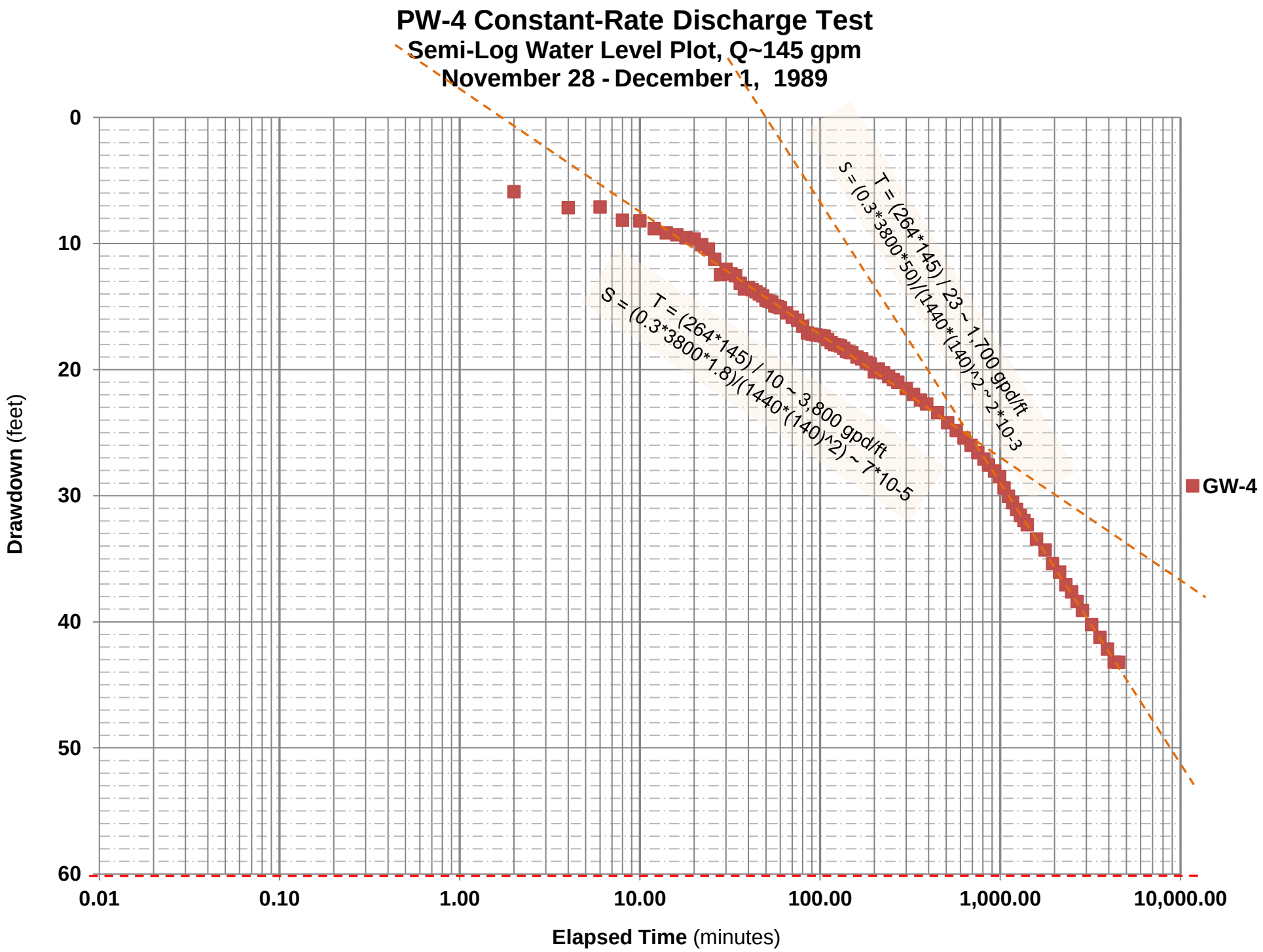
PW-4 Constant-Rate Discharge Test
Depth to Water Plot, Q~145 gpm
November 28 - December 5, 1989



PW-4 Constant-Rate Discharge Test
Semi-Log Water Level Plot, Q~145 gpm
November 28 - December 1, 1989



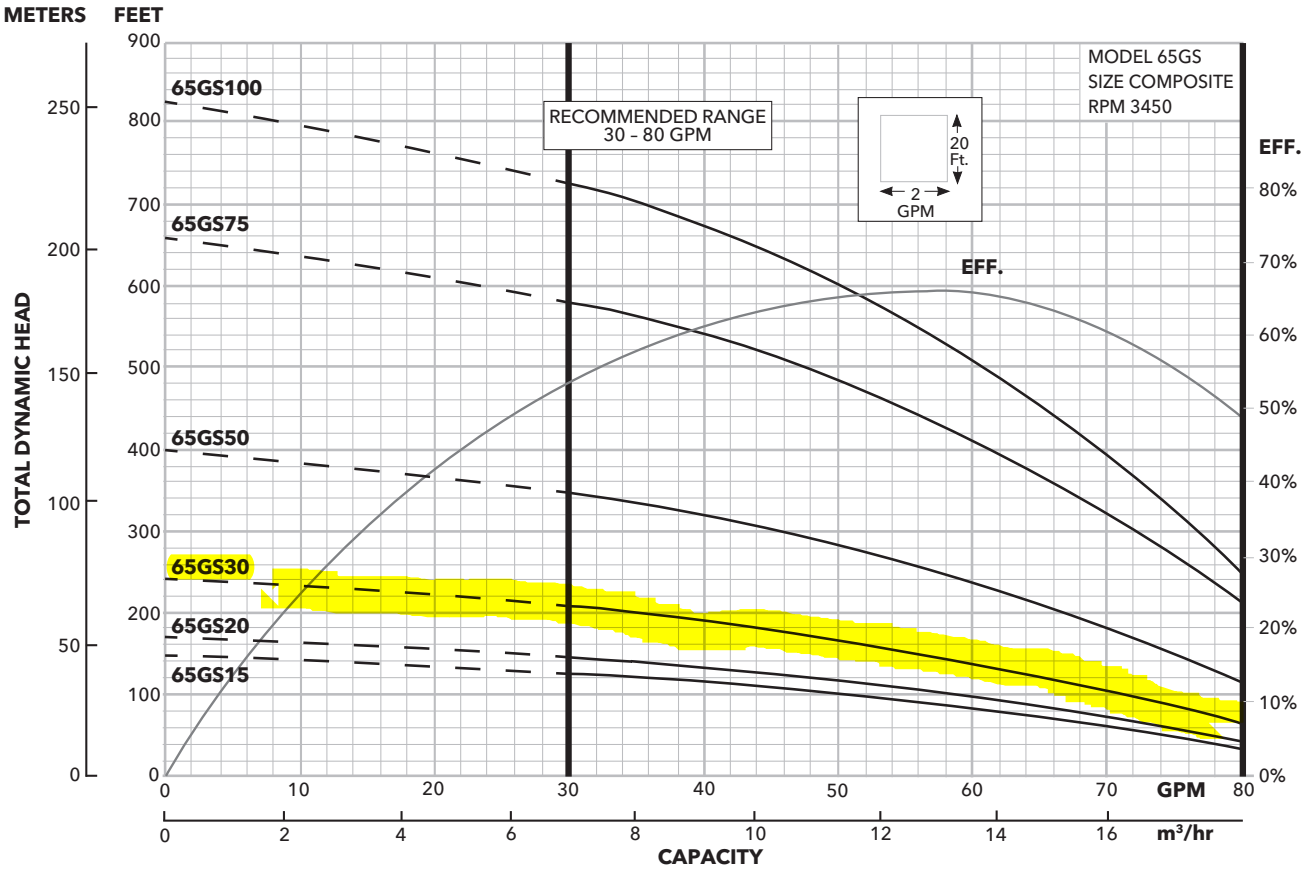

PW-4 Constant-Rate Discharge Test
Semi-Log Recovery Plot, Q~145 gpm
December 1 - 5, 1989
Drawdown (feet)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
0.1
1.0
10.0
100.0
1,000.0
10,000.0
100,000.0
1,000,000.0
Ratio (t/t')
T = (264*145) / 22 ~ 1,700 gpd/ft
T = (264*145) / 10 ~ 3,800 gpd/ft
GW-4
PW-4


PW-4 Constant-Rate Discharge Test
Semi-Log Water Level Plot, Q~145 gpm
November 28 - December 1, 1989
T = (264*145) / 23 ~ 1,700 gpd/ft
S = (0.3*3800*50)/(1440*(140)^2 ~ 2*10-3
T = (264*145) / 10 ~ 3,800 gpd/ft
S = (0.3*3800*1.8)/(1440*(140)^2) ~ 7*10-5
GW-4
Drawdown (feet)
0
10
20
30
40
50
60
0.01
0.10
1.00
10.00
100.00
1,000.00
10,000.00
Elapsed Time (minutes)

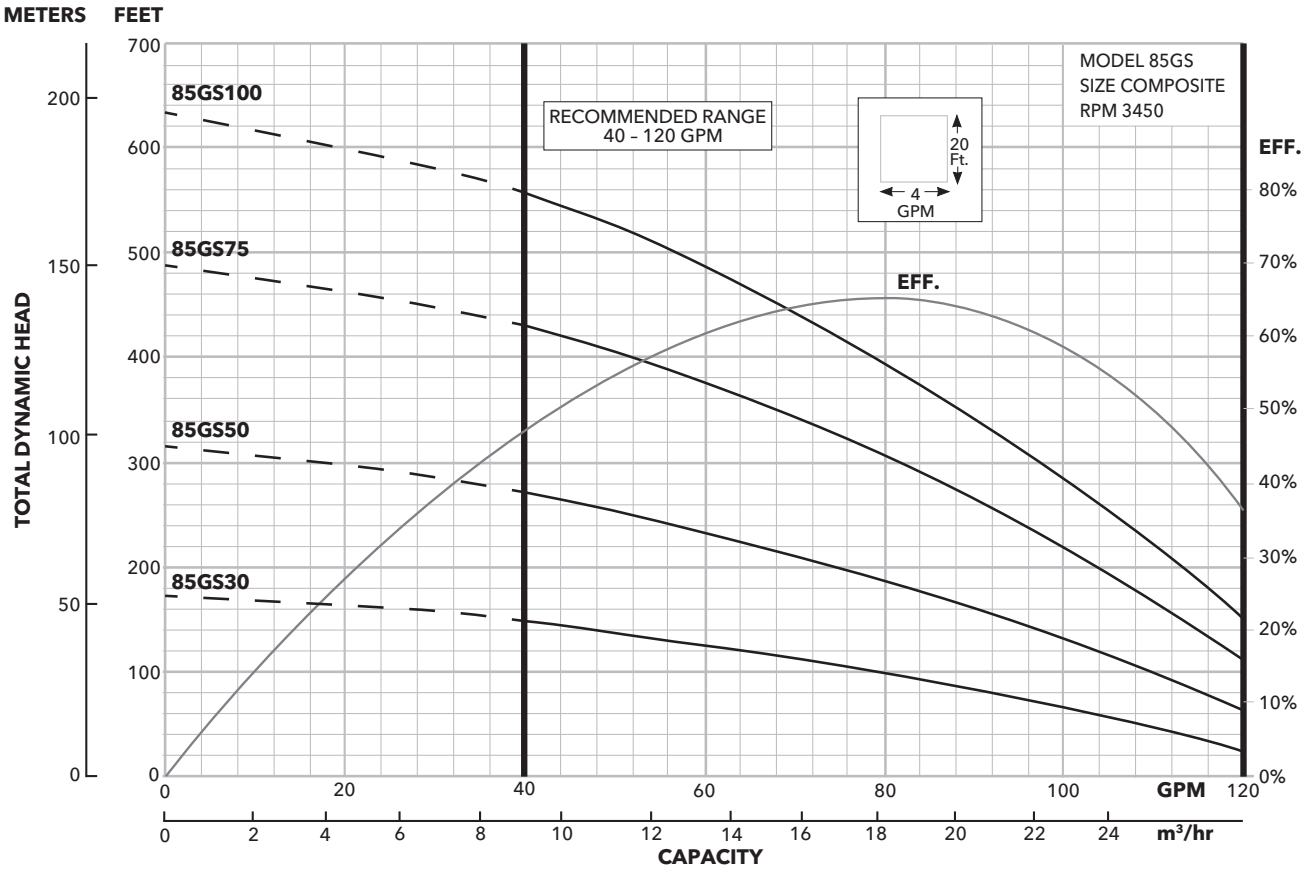
Attachment C
Example Pump Curves

Model 65GS

Example Pump for Well 1 (Prod-1)

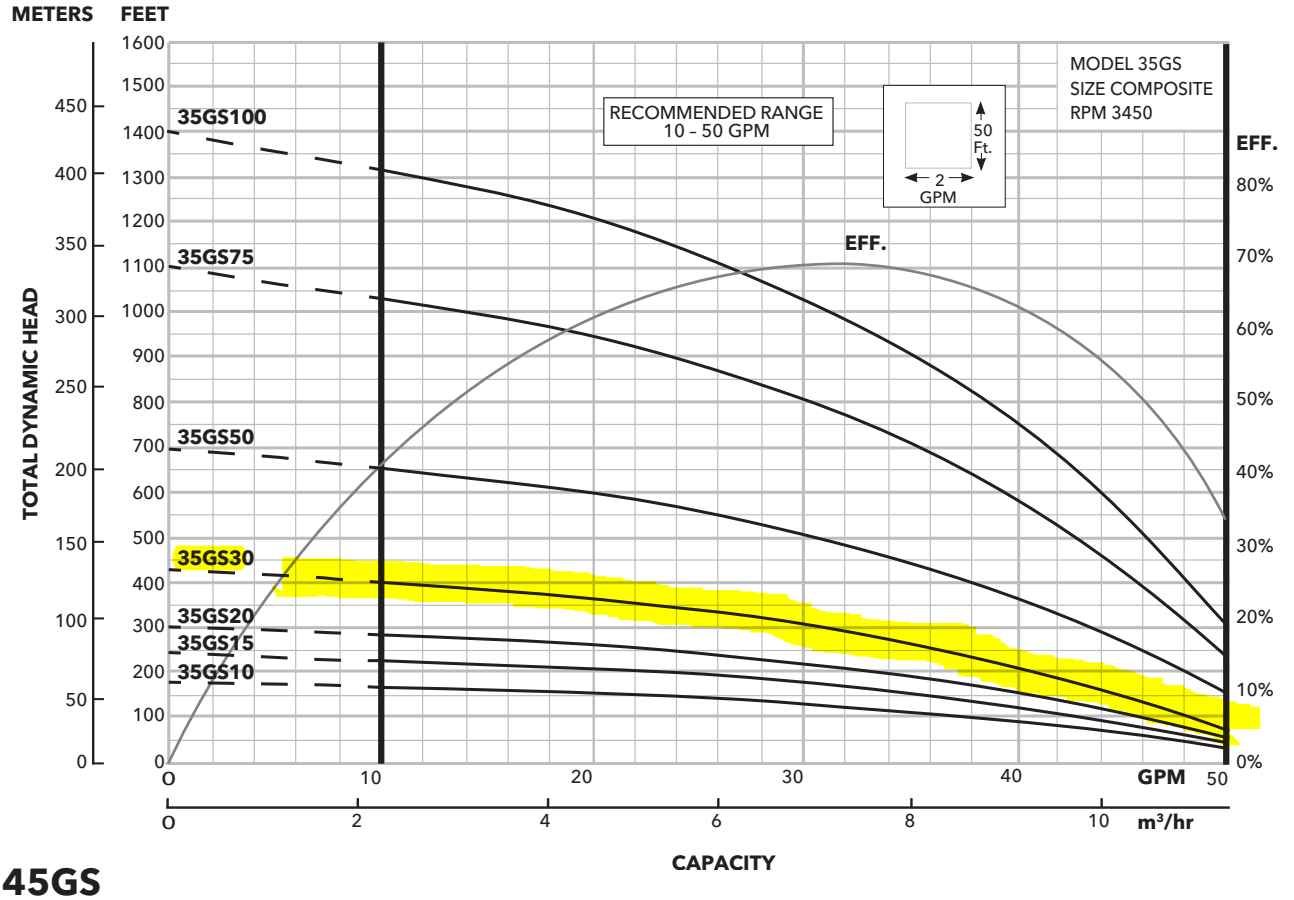


Model 85GS

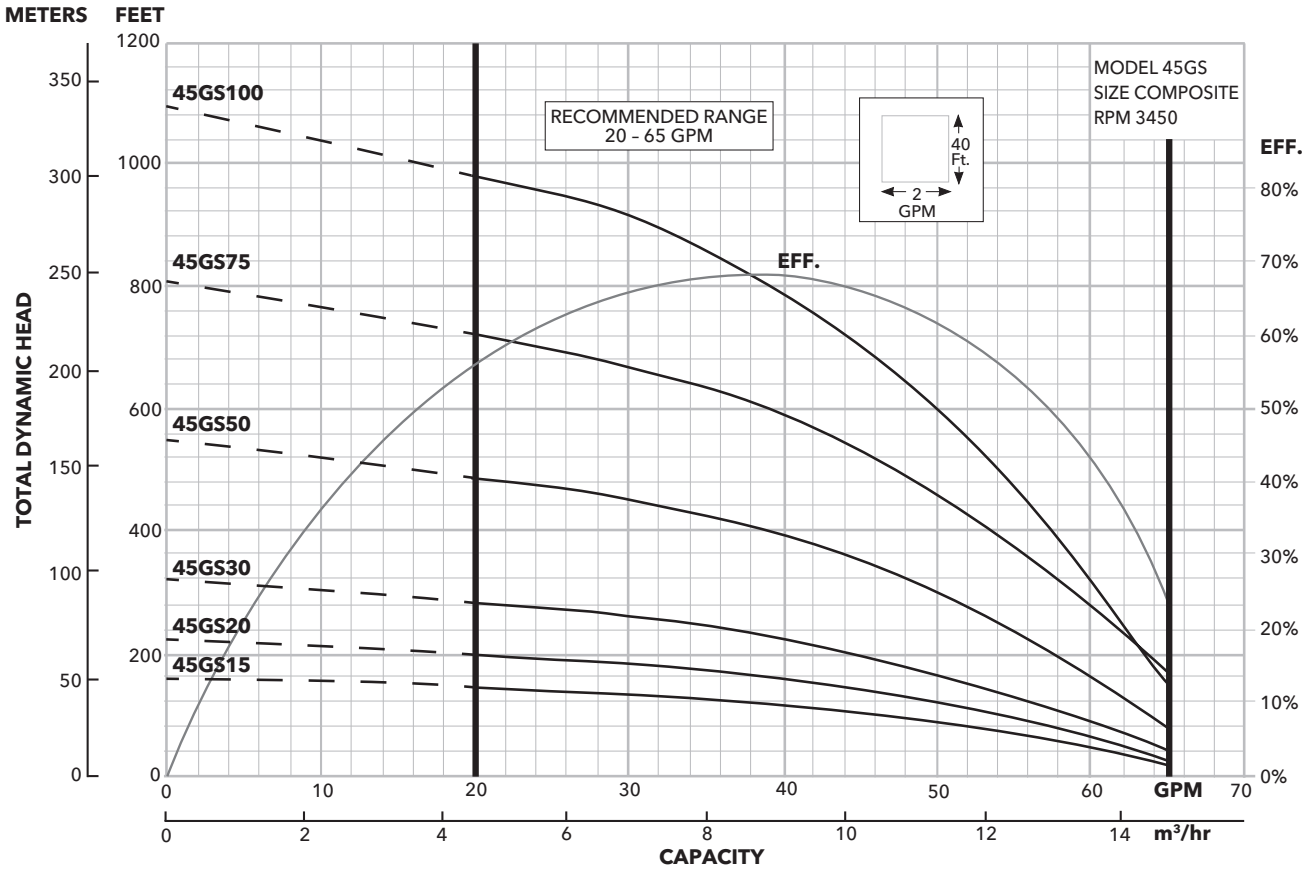


Model 35GS

Example Pump for Well 2 (PW-1)



Model 45GS

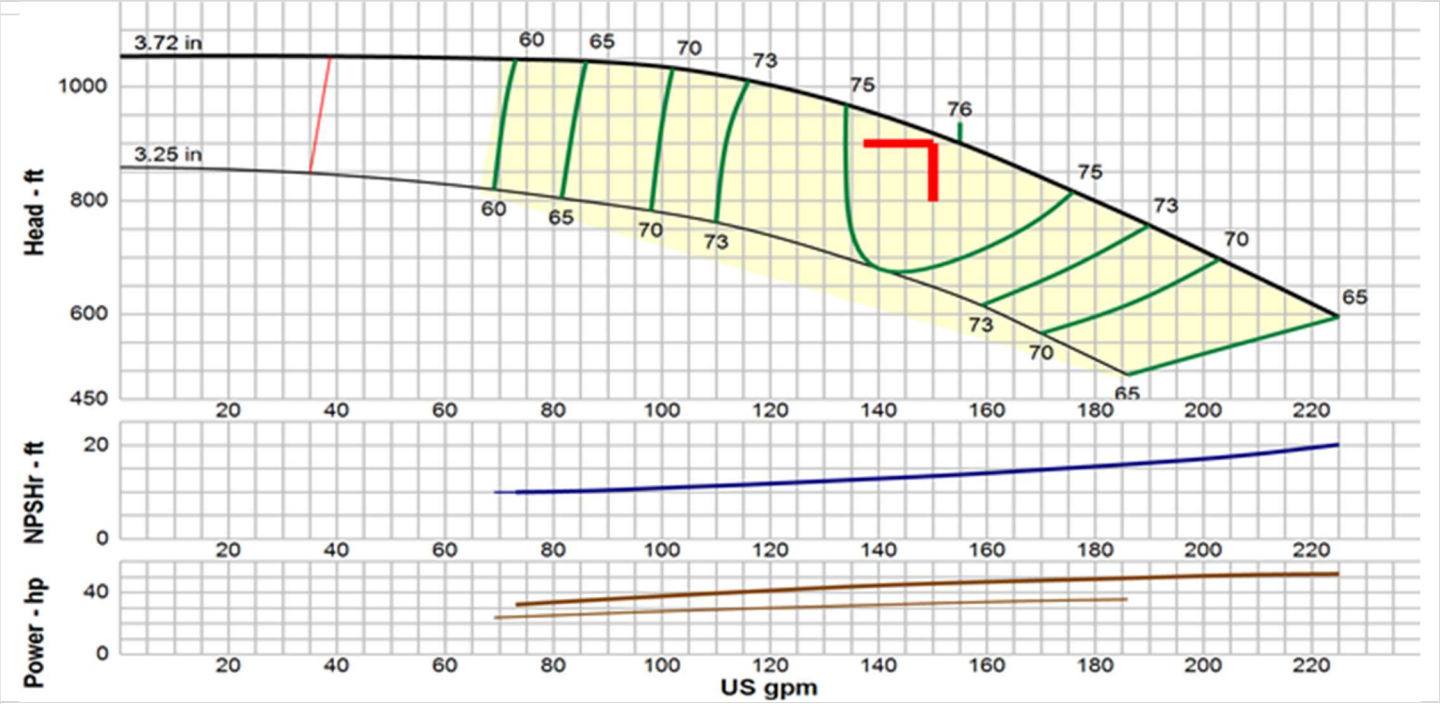


Example Pump for Well 3 (PW-4)

GOULDS WATER TECHNOLOGY a xylem brand

Performance Curve

Product Name: VIS - Submersible Vertical Turbine(Borehole) Pumps
Product Id: GWT_VIS
Quote Number 9003-190319-007



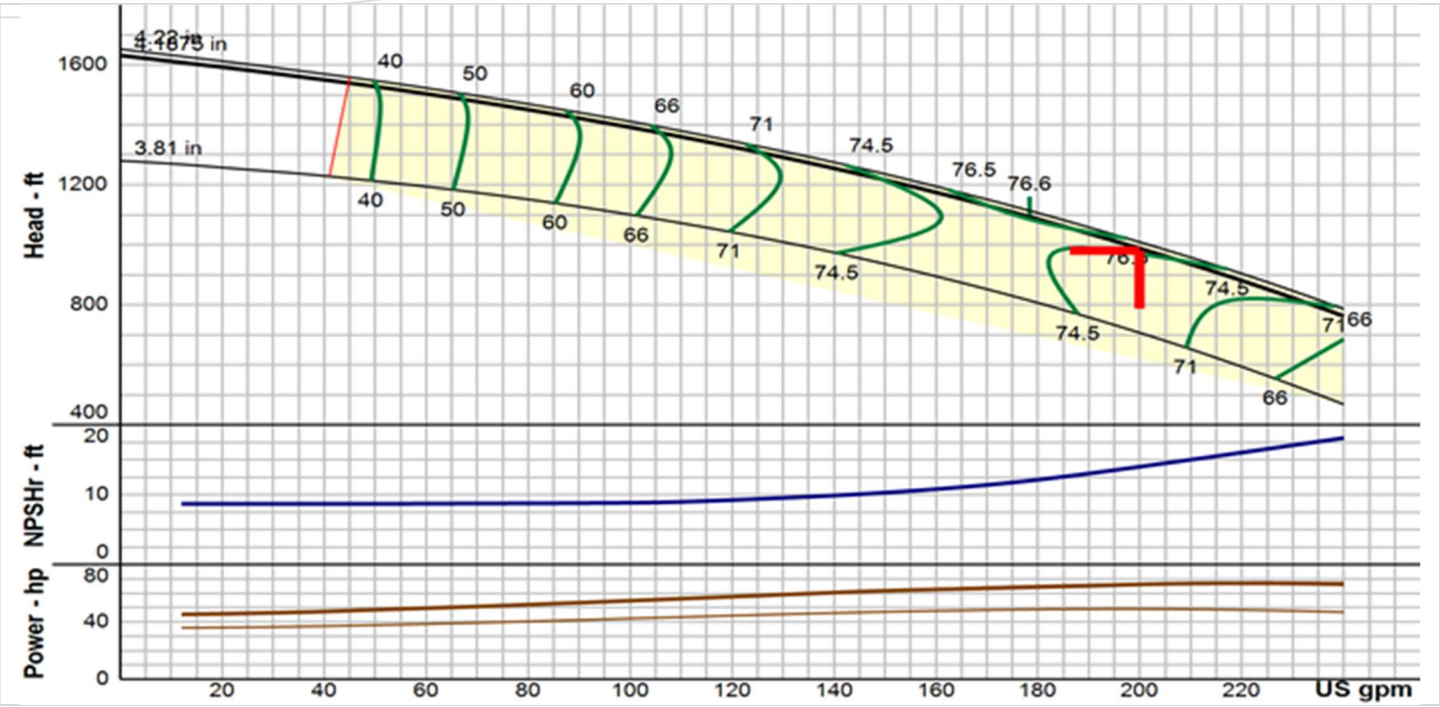
Curve & hydraulic data presented is nominal performance based on ANSI/HI 14.6 acceptance grade 2B. Design values are guaranteed within the following tolerances: Flow ± 8%, Head ± 5%, and optionally either Power + 8% or Efficiency - 5% at manufacturer's discretion.

Series	GWT_VIS	Max Power on Design Curve	52.00 Hp
Size	5CHC	Max Power on Max Imp Trim	52.00 Hp
Additional Size	-	Guaranteed Max Power on Design Curve	56.16 Hp
Speed	3,450 RPM	Guaranteed Max Power on Max Imp Trim	56.16 Hp
Number of Stages	17	Flow at BEP	155 USgpm
Frequency	60 Hz	Head at BEP	901 ft
Impeller Trim	3.72 in	NPSH Required	13.5 ft
Additional Impeller	-	Specified NPSH Avail.	33.17 ft
Impeller Maximum Trim	3.72 in	Specified NPSH Avail. Margin	1.1
Specified Flow	150 USgpm	Min Flow	38.8 USgpm
Specified Head	900 ft	Flow on Max Imp Trim @ Max Power	225 USgpm
Flow at Design	150 USgpm	Shut-Off Head	1,054 ft
Head at Design	900 ft	Shut-Off Disc Pressure	456 psi
Run-Out Flow	null USgpm	Fluid Type	Water
Run-Out Head	null ft	Water Temperature	68 °F
Efficiency at Design	75.80 %	Allowable Sphere Size	0.41 in
Guaranteed Efficiency at Design	72.01 %	Exact Bowl Diameter	5.2 in
Best Efficiency	76 %	Curve Id	E6205CCPC2
Driver Size	60 Hp	Thrust K Factor	1.3 lb/ft
Power at Design	45.90 Hp	Add Thrust K Factor	1.3 lb/ft
Guaranteed Power	49.57 Hp	Max Lateral	0.25 in
Flow on Design Trim @ Max Power	225 USgpm	Total Flow Derate Factor	1
Acceptance Grade	2B	Total Head Derate Factor	1
Service Factor	No	Total Efficiency Derate Factor	1

GOULDS WATER TECHNOLOGY a xylem brand

Performance Curve

Product Name: VIS - Submersible Vertical Turbine(Borehole) Pumps
Product Id: GWT_VIS
Quote Number 9003-190529-022



Curve & hydraulic data presented is nominal performance based on ANSI/HI 14.6 acceptance grade 2B. Design values are guaranteed within the following tolerances: Flow ± 8%, Head ± 5%, and optionally either Power + 8% or Efficiency - 5% at manufacturer's discretion.

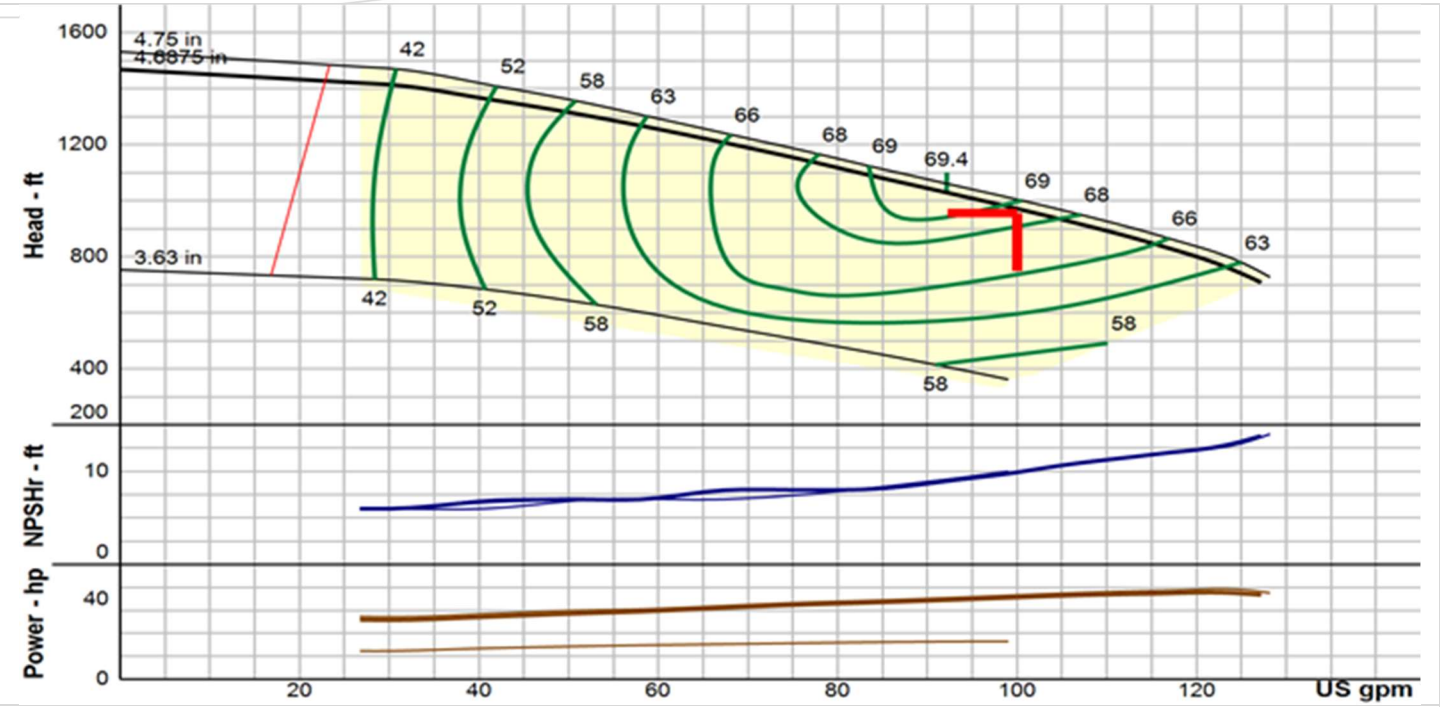
Series	GWT_VIS	Max Power on Design Curve	66.70 Hp
Size	6CLC	Max Power on Max Imp Trim	67.60 Hp
Additional Size	-	Guaranteed Max Power on Design Curve	72.04 Hp
Speed	3,450 RPM	Guaranteed Max Power on Max Imp Trim	73.01 Hp
Number of Stages	20	Flow at BEP	178 USgpm
Frequency	60 Hz	Head at BEP	1,093 ft
Impeller Trim	4.1875 in	NPSH Required	14.1 ft
Additional Impeller	-	Specified NPSH Avail.	33.17 ft
Impeller Maximum Trim	4.22 in	Specified NPSH Avail. Margin	1.1
Specified Flow	200 USgpm	Min Flow	44.6 USgpm
Specified Head	980 ft	Flow on Max Imp Trim @ Max Power	217 USgpm
Flow at Design	200 USgpm	Shut-Off Head	1,631 ft
Head at Design	986 ft	Shut-Off Disc Pressure	706 psi
Run-Out Flow	null USgpm	Fluid Type	Water
Run-Out Head	null ft	Water Temperature	68 °F
Efficiency at Design	75.20 %	Allowable Sphere Size	0.47 in
Guaranteed Efficiency at Design	71.44 %	Exact Bowl Diameter	5.88 in
Best Efficiency	76.6 %	Curve Id	E6206CFPC2
Driver Size	75 Hp	Thrust K Factor	2.1 lb/ft
Power at Design	66.10 Hp	Add Thrust K Factor	2.1 lb/ft
Guaranteed Power	71.39 Hp	Max Lateral	0.25 in
Flow on Design Trim @ Max Power	233 USgpm	Total Flow Derate Factor	1
Acceptance Grade	2B	Total Head Derate Factor	1
Service Factor	No	Total Efficiency Derate Factor	1

Example Pump for Well 7

GOULDS WATER TECHNOLOGY a xylem brand

Performance Curve

Product Name: VIS - Submersible Vertical Turbine(Borehole) Pumps
Product Id: GWT_VIS
Quote Number 9003-190606-011



Curve & hydraulic data presented is nominal performance based on ANSI/HI 14.6 acceptance grade 2B. Design values are guaranteed within the following tolerances: Flow ± 8%, Head ± 5%, and optionally either Power + 8% or Efficiency - 5% at manufacturer's discretion.

Series	GWT_VIS	Max Power on Design Curve	37.70 Hp
Size	7RALC	Max Power on Max Imp Trim	39.10 Hp
Additional Size	-	Guaranteed Max Power on Design Curve	40.72 Hp
Speed	3,450 RPM	Guaranteed Max Power on Max Imp Trim	42.23 Hp
Number of Stages	15	Flow at BEP	92.1 USgpm
Frequency	60 Hz	Head at BEP	1,029 ft
Impeller Trim	4.6875 in	NPSH Required	10 ft
Additional Impeller	-	Specified NPSH Avail.	33.17 ft
Impeller Maximum Trim	4.75 in	Specified NPSH Avail. Margin	1.1
Specified Flow	100 USgpm	Min Flow	23 USgpm
Specified Head	955 ft	Flow on Max Imp Trim @ Max Power	125 USgpm
Flow at Design	100 USgpm	Shut-Off Head	1,469 ft
Head at Design	971 ft	Shut-Off Disc Pressure	636 psi
Run-Out Flow	null USgpm	Fluid Type	Water
Run-Out Head	null ft	Water Temperature	68 °F
Efficiency at Design	68.60 %	Allowable Sphere Size	0.22 in
Guaranteed Efficiency at Design	65.17 %	Exact Bowl Diameter	7.5 in
Best Efficiency	69.4 %	Curve Id	1003-4
Driver Size	50 Hp	Thrust K Factor	1.61 lb/ft
Power at Design	35.70 Hp	Add Thrust K Factor	1.61 lb/ft
Guaranteed Power	38.56 Hp	Max Lateral	0.25 in
Flow on Design Trim @ Max Power	123 USgpm	Total Flow Derate Factor	1
Acceptance Grade	2B	Total Head Derate Factor	1
Service Factor	No	Total Efficiency Derate Factor	1

Attachment D
Well 4 Construction Specifications

TECHNICAL SPECIFICATIONS
RAW WATER SUPPLY WELL 4
GRASSY MOUNTAIN GOLD PROJECT

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all materials, labor, plant, equipment, tools, supplies, transportation, and appurtenances for drilling, casing, developing, completing, and testing of one raw water supply well (Well 4) at the Grassy Mountain Gold Project (Project) site for Calico Resources USA Corp (the Owner) as specified herein and in accordance with the requirements of the Contract Documents.

B. Approximate depths of drilling and lengths of well casings and screen are to be used for the purpose of price estimation only. Exact depths and lengths may be adjusted by the Engineer depending on subsurface conditions.

C. Work requirements for each well are summarized below. Each item is discussed in subsequent sections of the Specifications.

(1) Mobilize to the work site.
(2) Drill for, furnish, and install 16-inch diameter temporary steel surface casing through the surface sediments to an anticipated depth of 30 feet.
(3) Drill a minimum 14-inch diameter borehole to depth determined by Engineer, installing temporary casing as required to advance the bore.
(4) Furnish and install 10-inch I.D. steel casing (0.365-inch wall thickness) and 10-inch stainless steel well screen as directed by Engineer.
(5) Furnish and install Colorado Silica Sand filter pack and filter pack seal.
(6) Seal the annular space outside the casing with neat cement from the top of the filter pack seal to ground surface, withdrawing the temporary surface casing during installation of the seal.
(7) Develop the well.
(8) Furnish, install, operate, and remove test pump.
(9) Disinfect well.
(10) Demobilize from the work site.

D. All well construction work not specifically addressed in these specifications shall conform to the State of Oregon Water Resources Department (OWRD) Well Construction Standards (Oregon Administrative Rules (OAR) Chapter 690 Division 200, 205, 210, and 217).

E. All materials used for well construction, including drilling fluids, shall be certified to NSF Standard 60, NSF Standard 61, or equivalent.

F. All casing, screens, and materials shall be handled with care to avoid damage. The Contractor's methods of loading, transporting, and unloading materials shall conform to manufacturer recommendations. Casing and screen shall be kept free from dirt and foreign matter. Foreign material, including manufacturer labels, shall be removed from pipe interior prior to installation.

1.02 BEGINNING AND COMPLETION OF WORK

A. The work schedule shall be in accordance with Owner requirements.

1.03 SERVICES FURNISHED BY THE ENGINEER AND OWNER

A. The Owner will provide land and rights-of-way for the Work specified in this Contract. Provisions for access to the Work site will be provided by the Owner. The Contractor shall not enter on or occupy with laborers, tools, equipment, or material any ground outside the property and rights-of-way provided by the Owner unless stated otherwise by the Owner. Other Contractors, employees, or agents of the Owner may enter the work site and premises used by the Contractor for business purposes.

B. The Engineer (as the Owner's Representative) will participate in well testing, evaluation of drilling characteristics, sample examination, and geologic log interpretation, and will advise the Contractor on the final design placement of well casing, surface seal, filter pack and well screen. The Engineer shall be present during placement of well seals and for test pumping.

1.04 WORK SITE

A. The well site is located with the Project Permit Area as defined in the *Third Notice of Intent Pre-Application Phase of a Proposed Mining Operation: Calico Resources USA Corp. Grassy Mountain Gold Project (February 2017)*. The well site is located in a remote area approximately 22 miles south of Vale, Oregon and approximately 70 miles west of Boise, Idaho. The legal description of the well site is the SE ¼ of the NW ¼ of Section 32, Township 21S Range 44E in Malheur County, Oregon. The latitude and longitude coordinates of the proposed well site are 43°42'11.99" N and 117°21'57.01" W. The well site can be accessed from Vale, Oregon or Parma, Idaho via improved dirt road. The well site will be staked prior to Contractor mobilization.

1.05 DRILLING CONDITIONS

A. It is anticipated that drilling will be in clay, gravel, sandstone, conglomerate, and siltstone. Surface alluvium is expected to a depth of 30 feet. Static groundwater level is anticipated to be approximately 70 feet below ground surface. It is the Contractor's responsibility to make his own determination of subsurface conditions.

B. The drilling method for the well shall be determined by the Contractor based on anticipated drilling conditions. If the Contractor chooses to drill by air-rotary, the Contractor shall be prepared to drill by mud rotary if unstable subsurface conditions require it. If the Contractor chooses to drill by mud-rotary, the Contractor shall conduct geophysical logging of the borehole as directed by the Engineer.

C. The Contractor shall be responsible for providing notification to utility owners prior to beginning Work by requesting a facility locate through Oregon Dig Line at 811 or 1-800-332-2344.

D. It is the Contractor's responsibility to become informed about local conditions affecting this Work. Neither the information contained in these specifications, nor gleaned from the Engineer or Owner, or their agents, shall act to relieve the Contractor from any responsibility set forth in the Contract.

1.06 CONTRACTOR QUALIFICATION AND EQUIPMENT

A. The Contractor shall have at least five years of well drilling experience and shall have constructed at least 5 wells of comparable construction. A list of completed comparable projects shall be provided upon request.

B. The Contractor shall hold a valid Oregon Water Supply Well Constructor's License or work under the supervision of a licensed Water Supply Well Constructor.

C. The Contractor is responsible for filing a water well construction notice (start card) with the OWRD prior to commencing well construction. The Contractor is responsible for obtaining all other applicable permits.

D. The Contractor shall submit a list of equipment to be used on the project. The list shall include: (1) manufacturer; (2) load capacities; (3) year of manufacture; and (4) year of purchase by current Owner. The Contractor is responsible for providing equipment capable of performing the Work specified.

E. Damages to the well or surrounding property by the Contractor's equipment, leased or otherwise, shall be repaired or replaced at the Contractor's expense.

F. The Contractor shall have equipment capable of swabbing and airlifting the well to a total depth of 500 feet.

G. Upon completion of the well, the Contractor shall prepare, certify, and submit a water well report (log) to the OWRD and Owner.

1.07 SUBMITTALS

A. The Contractor shall provide submittals for all materials to the Engineer for review and approval prior to their use. The submittals shall be provided in an electronic format. Submittals shall be provided for casing, well screen, centralizers, seal materials, filter pack materials, and drilling fluids and additives. All materials shall be new and unused and in excellent condition.

B. The proposed test pump with curve shall be approved the by the Engineer prior to installation and test pumping.

1.08 CONTRACT DOCUMENTS

A. The form and detail of the various features of the Work are illustrated on the following drawings accompanying and made part of the Contract Documents:

- Figure 1 – Well 4 Location Map
- Figure 2 – Well 4 Conceptual Design

1.09 WATER, POWER, AND SITE IMPROVEMENTS

A. The Contractor shall be responsible for obtaining water supply for drilling. All water used for well construction purposes shall be of potable quality and adequately disinfected to prevent groundwater contamination. Water for drilling may be available from three on-site wells with approval from the Owner. These wells are located about 750 feet (PW-4),0.9 miles (Prod-1),

and 2.7 miles (PW-1) from the well site. These wells are equipped with pumps; the Contractor shall provide a portable generator to operate the pumps.

B. If the Owner does not grant approval to use on-site wells for water supply or the Contractor chooses to obtain water from an alternate source, the Contractor shall provide for the quantity and quality of water required at his own expense. Costs for pumps, water conveyance facilities, or transportation to the Work site shall be borne by the Contractor including all necessary pumps, piping and components.

C. The Contractor shall provide, at his own expense, all necessary piping and components to transfer discharged well water from the well site to a suitable disposal site during well development and testing. The Contractor can assume a suitable disposal site for clean water within 200 feet of the well site. Water must be discharged at least 50 feet from the well site. A plan for water disposal must be provided by the Contractor and approved by the Owner prior to commencing drilling. The BLM will be notified by the Owner of any water discharge on BLM land. Water shall not be discharged to streams, ponds, or lakes without proper regulatory authorization.

D. The Contractor shall provide, at his own expense, all power required for his operations under the Contract.

E. All drilling fluids or water containing drilling fluids must be discharged to a sump provided at the drill site by the Owner. The Contractor shall haul excess drilling fluids to a central disposal site provided by the Owner.

F. Preparation of the drill site and excavation or backfilling of mud pits, ditches, or settling ponds shall be the responsibility of the Contractor. The Contractor shall be responsible for protecting life and property from excavated mud pits and settling ponds and shall backfill pits as soon as drilling and testing operations are complete. Holes, pits, equipment, and chemicals shall be safely stored and fenced per OSHA standards. All materials shall be stored where safe from damage or contamination.

G. The Contractor will be responsible for complying with all applicable erosion and sediment control requirements including applicable erosion control permits. The Contractor shall implement best management practices, including erosion and sediment control (ESC) structures, practices, permits, and plans to meet all project, local, state, and federal requirements for water quality and erosion and sediment control.

1.10 WORKING HOURS AND SAFETY

A. The Contractor shall work on this project in a steady and diligent manner. The Contractor shall, during all work periods, provide an adequate crew of suitably qualified personnel to prevent unnecessary delays in project completion. The Contractor will be required to provide 24-hour per day maintenance of pumping and monitoring equipment during test pumping

B. The Contractor is responsible for compliance with all applicable safety laws of any jurisdictional agency and safety requirements of the Owner.

1.11 FINAL CLEANUP

A. The Contractor shall thoroughly clean the site after completion of the drilling, well construction, and test pumping operations. All excess drilling fluids, debris, and other materials used during

these operations shall be removed and properly disposed of by the Contractor. Backfilled mud pits shall be compacted to 90 percent maximum dry density as determined by Standard Proctor Test (ASTM 698-00).

B. The Contractor shall promptly remove his equipment, temporary facilities, and materials, and leave the site in a condition approved by the Engineer and Owner. The Contractor shall repair any damage to the property or facilities caused by his operations prior to final acceptance of the Work by the Engineer and Owner.

PART 2 - PRODUCTS

2.01 CASING

A. **Temporary Surface Casing:** Temporary surface casing may be used at the Contractor's option. If utilized, temporary surface casing shall be removed during installation of the surface seal.

B. **Well Casing:** The completed well shall be cased with nominal 10-inch I.D. casing from 2.5 feet above existing ground surface to a depth designated by the Engineer. The casing shall be new steel ASTM A-53 or equal with a minimum wall thickness of 0.365 inches. The casing shall be equipped with centralizers at a spacing of no more than 60 feet.

2.02 WELL SCREEN

A. Well screen shall be of the V-slot continuous wire-wound type in 304 stainless steel of 10-inch pipe size. The top of the well screen shall be equipped with a welding ring. The bottom of the well screen shall be equipped with a stainless steel plate bottom or a welding ring for connection to tail pipe. In order to provide adequate collapse, column, and tensile strengths, the screen construction shall include sufficient wire and rod sizes to be compatible with the depth and pressures of the installation, as recommended by the screen manufacturer.

B. Final screen length, slot size, and placement depths will be determined by the Engineer after completion of the borehole and receipt and evaluation of driller's logs and drill cuttings.

2.03 CENTRALIZERS

A. Centralizers shall be provided at nominal 60-foot intervals and at each screen section. Centralizers shall be welded to the casing. A shop drawing of the centralizer shall be submitted to the Engineer for review and approval prior to installation.

2.04 SAND FILTER PACK

A. A sand filter pack shall be placed around the well screen assembly. The filter pack shall be installed opposite the entire length of the screen assembly, and shall extend above the top screen a minimum of 20 feet (unless otherwise directed by the Engineer). The pack shall consist of clean, well-rounded siliceous material with a uniformity coefficient of 2.5 or less, manufactured by Colorado Silica Sand, Inc., Colorado Springs, CO (or approved equal), and conforming to one of the following gradation specifications to be determined following analysis of drill cuttings.

20-40 Filter Sand	16-30 Filter Sand

90-100% passing No. 20 sieve
90-100% retained on No. 40 sieve

90-100% passing No. 16 sieve
90-100% retained on No. 30 sieve

10-20 Filter Sand
90-100% passing No.10 sieve
90-100% retained on No. 20 sieve

8-12 Filter Sand
90-100% passing No. 8 sieve
90-100% retained on No. 12 sieve

6-9 Filter Sand
90-100% passing No.6 sieve
90-100% retained on No. 9 sieve

2.05 FILTER PACK SEAL

A. A filter pack seal shall be installed in the annulus above the filter pack to prevent grout used for the annular seal from infiltrating into the filter pack. The filter pack seal shall include a 5-foot thick layer of bentonite. Material for the bentonite seal shall be 3/8- to 3/4-inch sodium bentonite chips. Bentonite shall be specifically designed for sealing wells.

2.06 WELL SEAL

A. The annulus outside the 10-inch well casing shall be sealed with cement grout. Seal thickness shall meet the requirements of the OWRD Well Construction Standards (OAR 690-210).

B. The grout shall contain between 4.5 and 6 gallons of clean water per 94 pounds of Portland cement. Mix water quality and quantity shall follow manufacturer specifications paying close attention to cement grind and water ratios, eliminating free water. Additives may only be used if approved by OWRD.

C. A 50 percent excess volume of seal material shall be available on site if neat cement is used as seal material.

2.07 WELL HEAD

A. The completed well shall have 10-inch casing to 2.5 feet above existing ground surface. The Contractor shall install a temporary cap on the completed well (welded steel plate with access port).

PART 3 - EXECUTION

3.01 MOBILIZATION AND DEMOBILIZATION

Upon receiving the Notice to Proceed, the Contractor shall move in all tools, equipment, and supplies necessary for the Work, and upon completion of the Work, shall remove all such items from the premises promptly and leave the site in a clean and orderly fashion.

3.02 CONSTRUCTION SEQUENCE

A. The sequence of construction for this project shall consist of the following:

(1) Mobilize to the work site.

(2) Place a 16-inch diameter temporary steel surface casing through the surface alluvium to an anticipated depth of 30 feet.
(3) Drill a minimum 14-inch diameter borehole to depth determined by Engineer, installing temporary casing as required to advance the bore.
(4) Furnish and install 10-inch I.D. steel casing (0.365-inch wall thickness) and 10-inch stainless steel well screen as directed by Engineer.
(5) Furnish and install Colorado Silica Sand filter pack and filter pack seal.
(6) Install neat cement surface seal, withdrawing any temporary surface casing.
(7) Develop the well.
(8) Perform test pumping of the well.
(9) Disinfect the well.
(10) Provide temporary cap on the well and attach well tag.
(11) Clean work site and demobilize equipment.

3.03 DRILLING

A. The drilling method for the well shall be determined by the Contractor based on anticipated drilling conditions. If the Contractor chooses to drill by air-rotary, the Contractor shall be prepared to drill by mud rotary if unstable subsurface conditions require it. If the Contractor chooses to drill by mud-rotary, the Contractor shall conduct geophysical logging of the borehole as directed by the Engineer. The borehole shall be of sufficient diameter to meet the requirements of the OWRD Well Construction Standards (OAR 690-210).

B. The Contractor shall provide for and install temporary casing as required to advance the borehole to the target depth. The cost for temporary casing shall be included in the unit price for drilling or reaming on the bid schedule. The temporary casing shall be removed during backfilling or sealing of the borehole.

C. Drilling fluid properties shall be maintained in such a manner to ensure the structural integrity of the borehole and to circulate drill cuttings representative of the strata penetrated to the ground surface. Drilling fluid additives shall be certified to NSF Standard 60 or 61. A mud kit shall be available for measuring drilling fluid properties throughout the project if applicable.

D. The Contractor shall sample the drill cuttings at 5-foot intervals and at pronounced changes in geologic formation. These samples shall be saved and maintained on the job site in a clean dry area. All samples are to be submitted to the Engineer and Owner. The samples shall be of at least one-gallon size, shall be kept in cloth sample bags or zip-lock style plastic bags, to be provided by the Contractor, and shall be clearly labeled to show the depth and well from which the sample was collected.

E. All drilling fluids shall be managed to protect groundwater from contamination and disposed of in accordance with State and Federal regulations. Method and place of drilling fluid disposal shall be approved by the Owner. Costs incurred in connection with the disposal of drilling fluids and developed water shall be borne by the Contractor. The Owner will provide a sump at the drill site for disposal of drilling fluids. The Contractor shall haul excess drilling fluids to a central disposal site provided by the Owner.

F. The Contractor shall maintain a daily drilling log of the well. Logs and records shall be kept by the Contractor's drillers on forms suitable to the Engineer, which shall indicate each shift worked; the general character, thickness, and type of material penetrated; and the type of all other Work performed, including the exact time spent on each item of Work. Information that shall be listed on the drilling log includes: (1) drilling fluids and additives, including quantity of

materials used and volume of water or drilling fluid lost to the formation; (2) drilling fluid properties, including weight and viscosity (if applicable); (3) type and diameter of bits used for drilling and total footage for each bit; (4) depth where water encountered and an estimate of the quantity of water produced; and (5) any remarks or comments concerning the drilling characteristics of the borehole, including locations of any lost circulation zones. The forms shall be kept on-site for inspection by the Engineer. Forms shall be provided for Engineer approval prior to commencing construction.

G. Copies of the logs shall be available for inspection by the Owner and Engineer at all times. Copies of all logs shall be furnished to the Owner and Engineer following completion of all operations. The Contractor shall prepare, sign, and submit a water well report for each well constructed to the OWRD.

3.04 PLUMBNESS AND ALIGNMENT

A. The Contractor shall construct the well sufficiently straight and plumb to permit free installation and removal of a nominal 6-inch test or production pump with 8-inch motor. The hole shall be drilled to the depth designated by the Engineer with a total deviation of the casing not to exceed one degree per 100 feet of the well. The alignment will be considered satisfactory if the casing will permit the free lowering and raising of a dummy between land surface and the bottom of the 10-inch casing section. The dummy shall be constructed of a 40-foot length of standard 8-inch I.D. pipe. It shall be the responsibility of the Contractor to see that the well is being constructed straight and plumb within these limits at all times. Any indications of inadequate plumbness or alignment during drilling, casing, or pump setting operation shall be cause to require measurement of plumbness or alignment by a method approved the Engineer. No payment shall be made for tests of alignment; any such tests shall be considered subsidiary to other items in this Contract.

B. If the well has unacceptable plumbness or alignment, the Contractor shall undertake remedial measures. Any alignment work required by the Contractor in re-drilling or straightening the well shall be at his sole expense. If a well is deemed unacceptable following remedial measures, then as much casing as can be removed from the well shall be salvaged by the Contractor. Salvaged casing will be the property of the Contractor. The well shall be abandoned in accordance with OWRD requirements (OAR 690-220) at the Contractor's expense. All payments associated with construction of the abandoned well shall be credited to construction of a replacement well.

3.05 GEOPHYSICAL LOGGING

A. Geophysical logging of the borehole will be required if the Contractor drills by mud-rotary. If the Engineer or Owner requests geophysical logging, the Engineer shall be given at least 24 hours of notice of the time when the survey will be run in order to witness the performance of the survey. The logs run shall include normal resistivity (8", 16", 32", and 64"), single point resistivity, specific potential, natural gamma radiation, and temperature.

B. It is the Contractor's responsibility to ensure that the borehole remains open to the total completion depth for geophysical logging.

C. Three full-scale and three reduced-scale printed copies of the logs shall be provided. The logs shall also be provided in electronic format (ASCII or similar) on DVD or CD or transmitted by email.

3.06 INSTALLATION OF WELL CASINGS, SCREEN, AND CENTRALIZERS

A. The permanent well casing shall extend at least 5 feet into a clay confining layer overlying the target water-bearing zone.

B. Welding: Individual lengths of steel casing shall be joined by welding. Welding shall be performed by properly qualified operators following the manufacturer's recommendations and in accordance with AWWA C206. Welds shall penetrate the full thickness of the casing wall.

1. The standards of the American Welding Society, Structural Welding Code (AWS D1.1) shall apply for all welded joint casing and accessories. All welds shall conform to the latest revision of ANSI B31.1.

2. There shall be a minimum of three (3) weld passes on pipe sizes 6-inches and greater.

3. Welded casing joints shall have a tensile strength equal to or greater than that of the casing.

C. Weld Reinforcement: Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions.

D. When complete, the well casing shall extend a minimum of 30 inches above existing grade to provide a casing height of 18 inches above the future well house floor. The top of well casing shall be equipped with a welded steel plate, sanitary well seal, or vented well cap, as approved by the Engineer.

E. Centralizers shall be installed at intervals of no more than 60 feet.

3.07 INSTALLATION OF FILTER PACK

A. A sand filter pack shall be placed opposite the well screen and a maximum of 20 feet above the top of the screen. Filter pack shall be placed using a tremie pipe to avoid bridging and to ensure uniform placement. Potable water may be used to wash filter pack into place. The volume of water used shall be measured and recorded. The level of the filter pack shall be tagged at frequent intervals to confirm that it is not bridging. The top of the filter pack shall be tagged following installation to verify and document final placement depth. The volume of the filter pack shall be monitored during placement to confirm that the pack is not bridging.

B. Following installation, the pack shall be settled by swabbing or other means.

C. The pack shall be disinfected with a minimum 50-ppm chlorine solution prior to installation.

3.08 INSTALLATION OF FILTER PACK SEAL

A. A filter pack seal shall be installed in the annulus above the filter pack to prevent grout used for the annular seal from infiltrating into the filter pack. The filter pack seal shall consist of a 5-foot thick bentonite seal.

B. Material for the bentonite seal shall be 3/8- to 3/4-inch unhydrated sodium bentonite chips below the water table and hydrated sodium bentonite chips above the water table. Bentonite shall be specifically designed for sealing wells.

C. Bentonite chips shall be installed in a slow and continuous manner, with a pour rate of 2 minutes or slower per standard 50-pound bag. Unhydrated bentonite shall be screened across a minimum ¼-inch mesh screen before being introduced into the well. Bentonite chips installed above the water table shall be hydrated after placement with potable water pumped through a tremie pipe.

D. The bentonite seal shall be tagged during placement to determine if the seal is reaching its intended position. Seal level shall be checked by tagging with a sinker bar or other means. The volume of bentonite used shall be compared with the annular space volume to evaluate the potential for bridging. Adequate time shall be provided to allow the bentonite seal to hydrate (1 to 2 hours) prior to placing the grout annular seal.

3.09 INSTALLATION OF WELL SEAL

A. The 10-inch diameter well casing shall be installed in a minimum 14-inch diameter borehole. The annular space between the casing and bore wall shall be sealed with cement grout. The annular seal shall extend from the top of the filter pack seal to ground surface. The seal depth will exceed 18 feet. Any temporary casing shall be withdrawn as the seal is placed.

B. Seal thickness and installation shall meet the requirements of the OWRD Well Construction Standards (OAR 690-210).

C. Cement grout seals shall be installed by the tremie method. The grout shall be pumped into the annular space through a tremie pipe that shall be extended from ground surface to the bottom of the zone being grouted. Grout shall be placed from the bottom up in a continuous operation. The grout pipe shall be slowly raised as the grout is placed, but the discharge end of the tremie pipe must be submerged in the emplaced grout at all times until grouting is complete. The grout pipe shall be maintained full to the surface at all times until completion of the grouting of the entire specified interval.

D. Once grouting is complete, no further work shall be performed on the well for a minimum of 24 hours. No standby or rig time will be paid while grout is setting. The permanent well casing shall not be moved or driven following placement of the grout seal.

E. In the event of borehole collapse prior to placement of the grout, the Contractor shall take whatever steps are necessary to reopen the hole and to place the seal as specified. Any such remedial action shall be conducted at the Contractor's expense.

F. Volumes of seal material placed shall be carefully monitored and checked against calculated volume requirements.

G. The Engineer shall be notified a minimum of 24 hours prior to seal placement, and shall be present during seal placement.

H. Seals shall be installed in a slow and continuous manner, and temporary casing shall be withdrawn as the seal is placed.

3.10 DEVELOPMENT

A. Following seal placement and curing, the well shall be developed by pump surging (rawhiding), mechanical surging using a surge block or swab, air-lift surging, hydraulic jetting, or other methods approved by the Engineer. If the Contractor selects pump surging as the sole means of development and the well does not produce clear water free from sand or the well does not produce the target yield, then the Contractor may be required to perform mechanical development or jetting in addition to surge development. The Contractor shall provide a written log documenting development methods, discharge rates, and duration of each development operation.

B. Mechanical surging shall be performed using a surge block or swab. The outside diameter of the surge block or swab shall be only slightly smaller than the inside diameter of the casing (1/8 to 1/4-inch). Surging of the well shall begin in the casing immediately above the uppermost section of well screen. Initial surging shall be with a long stroke at a slow rate. Surging in the casing section shall continue until no additional appreciable quantity of sand, silt, or clay is brought into the well. Following surging of the casing, the surge block or swab shall be lowered into the lowest screened section and surge development continued. Surge development shall continue upward until the entire screen has been developed. The screen shall be surged in 20-foot sections. Surging shall then be repeated at a faster stroke starting at the bottom of the well. Periodically, the Contractor shall measure and bail from the well all sand, silt, and clay that has accumulated at the bottom. Surging shall continue until no more sediment is bailed from the well and the well produces clear water.

C. Hydraulic jetting shall be performed with a jetting tool to produce a minimum nozzle velocity of 150 feet per second. The jetting tool shall be lowered into the bottom of the screen, rotated slowly and continuously, and slowly raised throughout the entire screen length. Jetting shall be continued until the well produces clear water free from sediment. Simultaneous air-lift pumping may be employed to remove fines from the well.

D. The well may be developed using air-lift surging. For air-lifting, the Contractor shall have a compressor, tubing and eductor pipe to air-lift a minimum of 200 gpm average flow from 500 feet depth. Sufficient tubing or drill stem shall be available to reach the total depth of the well. It is anticipated that air development will take place in a staged manner throughout the lower portion of the well, and thus may include considerable addition and subtraction of pipe. For long screen sections, a double-packer tool shall be used to develop short sections of screen. Periodically, the Contractor shall measure and bail from the well all sand, silt, and clay that has accumulated at the bottom.

E. Final well development shall be performed by alternative pumping and surging with the test pump. The well shall be pumped at a restricted initial pumping rate. As water clears, the pumping rate shall be gradually increased until maximum discharge rate is reached. At regular intervals, the pump shall be stopped and the water in the pump column shall be allowed to surge back through the pump intake. Development pumping shall continue until discharged water is clear and sand free (less than 5 ppm sand at the design capacity of the well), as measured by the Engineer.

F. The Contractor may be required to use a dispersant or other well development additive to achieve satisfactory development. All additives must be approved by the Engineer prior to use.

G. Upon completion of the development, all material shall be thoroughly cleaned from the inside of the casing and screen. Material shall be removed by bailing or by suction pumping. If

removed by pumping, the Contractor shall have sufficient tubing or pipe to reach the total depth of the well.

H. Water containing drilling fluids, chemicals, or sediment must be discharged to a sump provided at the drill site by the Owner. The Contractor shall haul excess drilling fluids to a central disposal site provided by the Owner.

3.11 TEST PUMPING

A. Following completion of development operations, the well shall be allowed to recover for 24 hours, or less if approved by the Engineer, prior to starting the pumping tests. Within the hour prior to the start of test pumping, the Engineer will measure static water level in the well three times no less than 20 minutes apart.

B. Anticipated methods of aquifer testing include: (1) a step-test lasting approximately 8 hours, which will consist of pumping the well at various rates from approximately 50 gpm to the maximum capability of the pump or well; and (2) a constant-rate pumping test lasting a minimum of 7 days. The pumping test duration will be determined by the Engineer. The constant-rate test may be extended to 14 days if the well drawdown trend does not stabilize. Standby time will not be paid for the recovery periods between tests or at the conclusion of test pumping. The Engineer shall be present at the start of test pumping. The Contractor shall be responsible for maintaining a constant pumping rate during the test.

C. The test pump shall be capable of delivering a least 200 gpm from a pumping level of 400 feet. The Contractor shall furnish and install all necessary equipment for testing, including a discharge valve or throttle to control flow rate, orifices or flow meter for accurately measuring the discharge from the well, one nominal 1-inch PVC pipe to the top of the pump to facilitate the installation and removal of an electric-line water-level probe, and a sample tap. The Contractor shall measure and record water level, pumping rate (every hour), and elapsed time as directed by the Engineer. The Contractor shall provide a threaded port for attachment of a Rossum Sand Tester by the Engineer. The Engineer shall be responsible for sand testing.

D. Water level measurements shall be taken with a non-stretch electric-line water-level probe. Measurements during the first ten minutes of pumping shall be timed no more than two minutes apart. Water level measurements from ten to thirty minutes of pumping shall be timed no more than five minutes apart. Between 30 minutes of pumping and 2 hours, drawdown measurements shall be taken no more than 15 minutes apart. For the duration of the test, hourly measurements are acceptable unless otherwise directed by the Engineer.

E. After pumping stops, water level recovery measurements shall be taken for four hours or until the well reaches 90 percent recovery from the maximum drawdown, whichever occurs first. Recovery water level measurements shall be taken on the same schedule as for drawdown measurements.

F. The test pump and column pipe shall be disinfected with a minimum 50-ppm chlorine solution prior to installation in the well.

G. The Contractor shall be responsible for providing power for the test pump. The Contractor shall provide a means for safe refueling during operations to prevent even brief shutdowns during the testing. Shutdowns before the end of the testing procedure in excess of ten (10) percent of the total time anticipated for this testing procedure may require the Contractor to

allow the water level to recover to pre-pumping conditions and re-start the test, as determined by the Engineer.

H. The Contractor shall provide all necessary piping and components to transfer water produced during test pumping to a suitable disposal site. The Contractor can assume a suitable disposal site for clean water within 200 feet of the well site. Water must be discharged at least 50 feet from the well site. A plan for water disposal must be provided by the Contractor and approved by the Owner prior to test pumping.

I. The Engineer shall be responsible for collecting water quality samples during the pumping test. The Engineer shall be responsible for determining whether (1) the well productivity is adequate to meet the project requirements and (2) water quality meets Oregon Health Authority requirements.

3.12 DISINFECTION

A. Upon completion of all well construction activities and removal of test pumping equipment, the Contractor shall disinfect the well using calcium hypochlorite or sodium hypochlorite.

1. Calcium hypochlorite or sodium hypochlorite shall be added to achieve a chlorine concentration of 50 ppm in the well, refer to OAR 690-210-0380. The Contractor shall distribute the disinfecting compound throughout the well to achieve a uniform concentration for “in place” disinfection of the well.

2. Chlorine granules or tablets must be dissolved and placed into the well as a solution.

3. All interior surfaces of the well above the static water level shall be wetted with calcium hypochlorite or sodium hypochlorite solution.

B. Near the end of the constant-rate discharge test, duplicate samples shall be collected by the Engineer and the samples shall be tested for the presence of coliform bacteria. The Contractor shall leave the test pump in the well until test results are reported. If any sample shows the presence of coliform bacteria, the Contractor shall collect duplicate samples (without charging rig or standby time while waiting on sampling results). If the second sampling event shows the presence of coliform bacteria, the Contractor shall re-disinfect the well until duplicate samples show the absence of coliform bacteria.

C. The well shall be capped with a vented well cap or sanitary well seal following disinfection.

D. Chlorinated water shall be disposed of in accordance with federal, state, and local requirements. Where applicable, the Contractor shall obtain appropriate permits from regulatory agencies before discharging chlorinated water to the environment.

3.13 PROTECTION OF WATER QUALITY

A. All water used for drilling and development operations shall be of potable quality.

B. The Contractor shall take all necessary precautions to prevent contamination of the water in the well by the introduction of any foreign substance, including contaminated water, gasoline, oil, etc., and shall conform to all laws or regulations applicable to the protection of water quality.

C. All downhole materials (i.e., casing, pipe, pumps, sand filter pack, drilling tools, etc.) shall be disinfected with a minimum 50-ppm chlorine solution.

3.14 WELL IDENTIFICATION TAG

A. The Contractor shall permanently attach a well identification tag to the well casing within 30 days of well completion. The tag shall be furnished by OWRD and attached so as to be accessible and visible. The tag may be strapped to the casing using stainless steel bands, tag welded, or attached using rivets. The tag shall be installed at least 18 inches above existing grade to be at least 6 inches above the future well house floor.

B. The well identification number shall be recorded on the well driller's report.

3.15 FINAL CLEANUP

A. After completion of all Work associated with this Contract, the Contractor shall clean up the Work site and any property used by his operations to the satisfaction of the Engineer and Owner. The Contractor shall remove and dispose of all excess materials resulting from his work, and shall repair, replace, or restore all property of any type or nature which has been moved, damaged, or altered in any way by his operations, to the satisfaction of the Engineer and Owner. The Contractor shall return all landscape, roadway, and adjoining surfaces to their original condition and appearance as soon as reasonably feasible.

PART 4 - MEASUREMENT AND PAYMENT

4.01 SCOPE

A. The quantities of work or material stated in unit price items of the Bid are supplied only to give an indication of the general scope of the Work; the Engineer does not expressly or by implication agree that the actual amount of work or material will correspond therewith, and reserves the right after award to increase or decrease the quantity of any unit price item of the Work without a change in the unit price, and shall include the right to delete any Bid item in its entirety. Payment for materials and labor will be based on actual quantities furnished, installed, or constructed in accordance with the prices bid for unit price items.

B. The Engineer may terminate Work on the project at any point if, in the Engineer's judgment, the Engineer's or Owner's best interests are not served by continuation. Conditions which may lead to project termination include, but are not limited to, indications of low groundwater development potential as determined during drilling, geophysical logging, and testing. In such an event, the Contractor shall be paid for the value of Work completed at that time on the basis of the unit price and lump sum items listed on the Bid Schedule. In addition, if well construction is terminated by decision of the Engineer, the Contractor may be required to properly abandon the well. The well shall be abandoned in accordance with OWRD requirements (OAR 690-220). Materials used in abandonment shall be paid at invoice cost plus 10 percent to cover handling. Payment for rig time shall be at the bid unit price.

C. No payment shall be made for tests of borehole plumbness and alignment; it shall be the responsibility of the Contractor to ensure that the hole remains within plumbness and alignment specifications.

D. No payment shall be made for drilling fluid materials used during normal drilling operations. All such costs shall be considered to be included in the unit prices listed on the Bid Schedule.

E. No payment shall be made for time or expenses incurred in the recovery or replacement of tools or equipment lost during the drilling phase or any other phase of the Work.

F. No payment shall be made for time, materials, or labor costs incurred during remedial measures or operations in the event the well is of unacceptable plumbness or alignment.

G. No payment shall be made for time, materials, or labor costs incurred in abandoning the well in the event the well is of unacceptable plumbness or alignment following remedial measures, or if lost tools or equipment cannot be recovered from the borehole. The costs incurred for construction of the abandoned well shall be applied to construction of a replacement well.

4.02 MOBILIZATION/DEMOBILIZATION (ITEM 1; LUMP SUM ITEM)

A. Measurement for payment for mobilization/demobilization to and from the work site will be based upon completion of the Work as a lump sum unit. The lump sum price listed on the Bid Schedule shall be full compensation for the moving in of rigs, pumps, equipment, power, labor, fuel, tools, and incidentals necessary to do the Work, and moving out of all such equipment, materials, tools, and incidentals, and well disinfection and final site cleanup upon completion of the Work. For purposes of partial payment, the mobilization portion of this bid item shall be considered as 60% of the total lump sum.

4.03 DRILL MINIMUM 14-INCH DIAMETER BOREHOLE (ITEM 2; PRICES BASED ON LINEAR MEASUREMENT)

A. Measurement and payment for drilling the borehole will be based upon the number of vertical linear footage drilled below ground surface in accordance with these Contract Documents. Payment for drilling shall constitute full compensation for labor, fuel, bits, temporary casing, drive shoes, welding, drilling fluids, equipment, and incidentals necessary to drill the exploration borehole.

B. This item includes drilling for and placing the 16-inch temporary casing to an expected depth of 30 feet.

C. No payment shall be made for tests of borehole plumbness and alignment; it shall be the responsibility of the Contractor to ensure that the hole remains within plumbness and alignment specifications.

D. No payment shall be made for drilling fluid materials used during normal drilling operations. All such costs shall be considered to be included in the unit prices listed on the Bid Schedule.

E. Payment for drilling fluid materials used in regaining drilling fluid circulation in zones of lost circulation shall be paid at invoice cost plus 10 percent for handling.

F. No payment shall be made for time or expenses incurred in the recovery or replacement of tools or equipment lost during the drilling phase or any other phase of the Work.

G. No payment shall be made for time, materials, or labor costs incurred during remedial measures or operations in the event the well is of unacceptable plumbness or alignment.

H. No payment will be made for time, materials, or labor costs incurred in abandoning the well in the event the well is of unacceptable plumbness or alignment following remedial measures, or

if lost tools or equipment cannot be recovered from the borehole. The costs incurred for construction of the abandoned well shall be applied to construction of a replacement well.

4.04 GEOPHYSICAL LOGGING (ITEM 3, LUMP SUMP ITEM)

A. If geophysical logging is required, measurement for payment for geophysical logging will be based upon completion of the entire work as a lump sum unit, in accordance with these contract documents. Payment for geophysical logging shall constitute full compensation for labor, equipment, and incidentals necessary to perform the logging

B. No rig or standby time will be paid to the Contractor during the time that the Contractor's logging service is being brought to the site, or during the time that the logs are being run.

C. No rig or standby time will be paid to the Contractor following completion of logging during which an exact determination of the final well design will be made by the Engineer.

4.05 FURNISH AND INSTALL 10-INCH WELL CASING (ITEM 4; PRICES BASED ON LINEAR MEASUREMENT)

A. Measurement for payment for the nominal 10-inch steel well casing will be based upon the number of linear feet of such pipe actually installed in the borehole in accordance with these Contract Documents. Payment for the 10-inch casing shall constitute full compensation for materials, transportation, labor, fuel, equipment, centralizers, welding materials, and incidentals necessary to furnish and install the well casing.

4.06 FURNISH AND INSTALL 10-INCH WELL SCREEN (ITEM 5; PRICES BASED ON LINEAR MEASUREMENT)

A. Measurement and payment for furnishing and installing the well screen will be upon the number of linear feet of such well actually installed in the borehole in accordance with these Contract Documents. Payment for the well screen shall constitute full compensation for screen, weld rings, plate bottom, materials, transportation, labor, equipment, and incidentals necessary to furnish and install the well screen.

4.07 FURNISH AND INSTALL SAND FILTER PACK (ITEM 6; PRICES BASED ON LINEAR MEASUREMENT)

A. Measurement and payment for furnishing and installing the sand filter pack will be based on the linear feet of filter pack actually installed in the well in accordance with these Contract Documents. Payment for filter pack shall constitute full compensations for materials, transportation, labor, equipment, and incidentals necessary to furnish and install the filter pack.

B. This item includes installation of the filter pack seal.

4.08 FURNISH AND INSTALL ANNULAR WELL SEAL (ITEM 7; PRICES BASED ON LINEAR MEASUREMENT)

A. Measurement and payment for furnishing and installing the well seal will be based upon linear feet of well seal installed in the borehole. Payment for the well seal shall constitute full

compensation for materials, transportation, labor, equipment, and incidentals necessary to furnish and install the seal.

4.09 WELL DEVELOPMENT (ITEM 8; PRICES BASED UPON TIME, HOURS)

A. Measurement for payment for well development will be based on the actual number of hours of development operations. Payment will be made at the unit price listed in the Bid Schedule.

B. No payment shall be made for equipment acquisition, set-up, or installation, or for recovery periods required by the Engineer to ensure thorough well development.

C. Payment for chemicals as may be required by the Engineer to ensure thorough well development shall be reimbursed for the cost of the chemicals actually used at invoice cost plus 10 percent for handling.

4.10 FURNISH, INSTALL, AND REMOVE TEST PUMP AND RELATED EQUIPMENT (ITEM 9; PRICE BASED ON LUMP SUM)

A. Measurement and payment for furnishing, installing, and removing the test pump and related equipment will be based upon completion of the entire Work as a lump sum unit, all in accordance with the requirements of these Contract Documents. Payment for furnishing, installing, and removing will be at the price listed in the Bid Schedule, which price shall constitute full compensation for all work, including installation and removal of pump, motor, generator, cable, controls, valves, orifices, temporary piping, and associated appurtenances.

4.11 TEST PUMPING (ITEM 10; PRICES BASED UPON TIME, HOURS)

A. Measurement and payment for test pumping will be based on the actual number of hours of pumping operations. Payment for test pumping will be made at the unit price listed in the Bid Schedule, and shall constitute full compensation for all labor, fuel, equipment, and materials associated with operating the test pumping equipment.

B. No payment shall be made for standby time during the recovery periods between tests or for time spent transporting or maintaining equipment. All such costs for time and maintenance materials shall be included in the unit price listed in the Bid Schedule.

C. No payment shall be made for time, equipment, or materials used in a test aborted due to power failure or malfunction of pumping equipment.

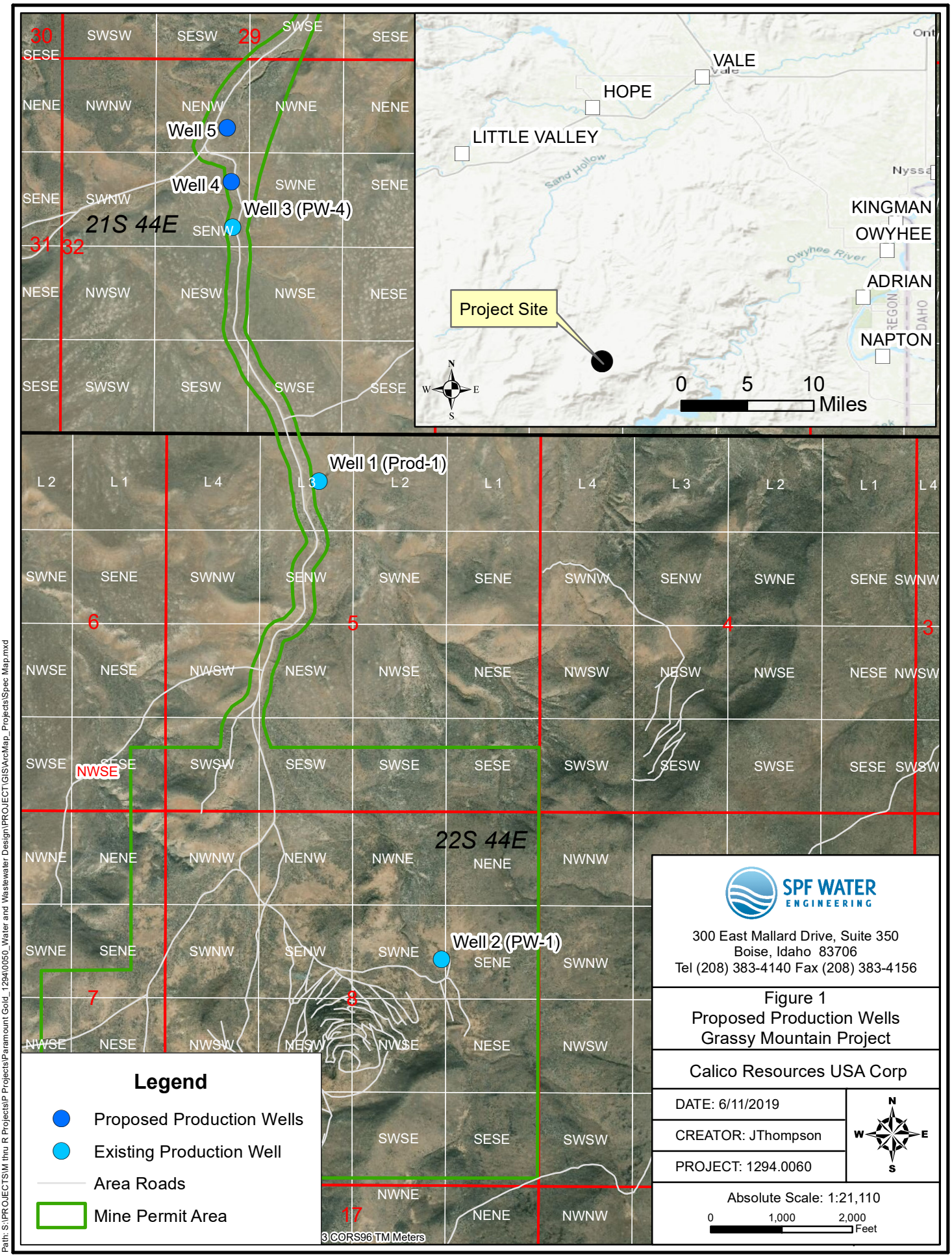
4.12 RIG TIME (ITEM 11; PRICES BASED UPON TIME, HOURS)

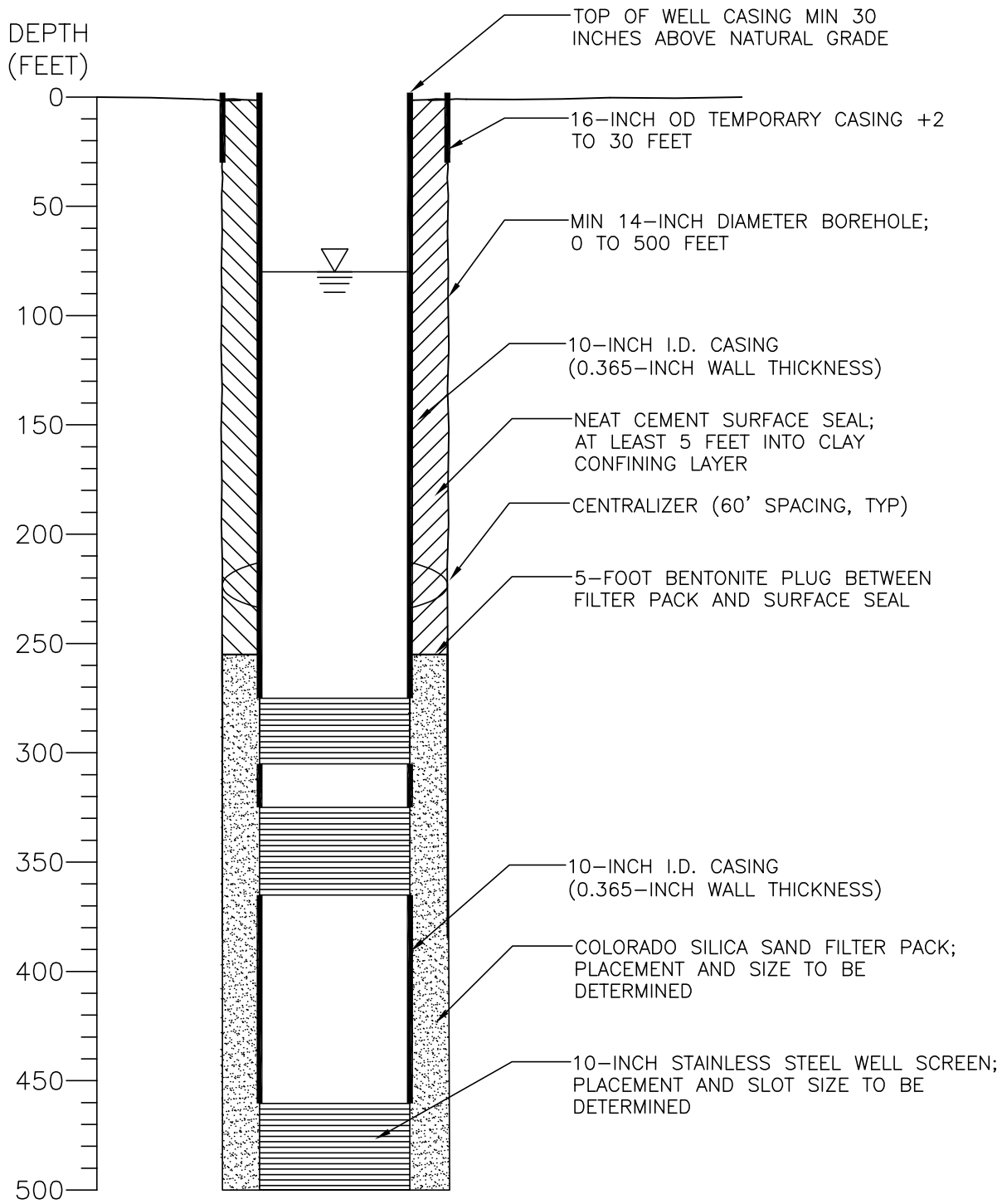
A. Measurement and payment for rig time will be based on the unit price listed on the Bid Schedule. Payment for rig time for additional work specifically directed by the Engineer not otherwise covered in these Contract Documents will be based on the actual number of hours of work done and shall be full compensation for rig, fuel, labor, equipment, and materials normally associated with Contractor's drilling activities. Additional materials, which may be required by the Engineer, shall be paid at the Contractor's invoice cost plus 10 percent for handling.

4.13 PLUGGING AND ABANDONMENT

A. In the event a well, successfully completed in accordance with these Contract Documents, requires plugging and abandonment, the cost for this work will either be negotiated with the Contractor or performed by others. The costs for plugging and abandonment of the well successfully completed in accordance with these Contract Documents shall not be considered as subsidiary to other bid items in the Contract.

- END OF TECHNICAL SPECIFICATIONS -


Well 5
Well 4
Well 3 (PW-4)
Well 1 (Prod-1)
Well 2 (PW-1)
21S 44E
22S 44E
VALE
HOPE
LITTLE VALLEY
KINGMAN
OWYHEE
ADRIAN
NAPTON
Project Site
0 5 10
Miles
Legend
Proposed Production Wells
Existing Production Well
Area Roads
Mine Permit Area
SPF WATER ENGINEERING
300 East Mallard Drive, Suite 350
Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156
Figure 1
Proposed Production Wells
Grassy Mountain Project
Calico Resources USA Corp
DATE: 6/11/2019
CREATOR: JThompson
PROJECT: 1294.0060
Absolute Scale: 1:21,110
0 1,000 2,000
Feet
Path: S:\PROJECTS\M thru R Projects\P Projects\Paramount Gold_1294\0050_Water and Wastewater Design\PROJECT\GIS\ArcMap_Projects\Spec Map.mxd



SPF WATER
ENGINEERING
300 East Mallard Drive, Suite 350
Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156

GRASSY MOUNTAIN GOLD PROJECT
WATER SUPPLY WELL 4
CONCEPTUAL DESIGN

SCALE: NTS
DRAWN BY: KJN

Figure 2 PROJ #1294.0050

BID SCHEDULE OF ITEMS AND PRICES
RAW WATER SUPPLY WELL 4
GRASSY MOUNTAIN GOLD PROJECT

The Bidder proposes the following schedule of prices for drilling, construction, development, and testing of one raw water supply well (Well 4) for Calico Resources USA Corp in accordance with the technical specifications. The quantities of work or material stated in unit price items of the bid are supplied only to give an indication of the general scope of the work. Payment for materials and labor will be based on actual quantities furnished, installed, or constructed in accordance with the prices bid for unit price items. The Bidder is solely responsible for completing all spaces below. The Bidder is responsible for the inclusion of all overhead and profit costs within each item.

Item	Description	Estimated Quantity	Unit	Unit Price	Total Amount
1	Mobilization and demobilization	1	lump sum	$_____	$_____
2	Drill min 14-inch diameter borehole	500	linear foot	$_____	$_____
3	Geophysical logging	1	lump sum	$_____	$_____
4	Furnish and install 10-inch I.D. casing	402	linear foot	$_____	$_____
5	Furnish and install 10-inch I.D. well screen	100	linear foot	$_____	$_____
6	Furnish and install sand filter pack	250	linear foot	$_____	$_____
7	Furnish and install annular well seal	250	linear foot	$_____	$_____
8	Well development	16	hours	$_____	$_____
9	Furnish, install, and remove test pump and related equipment	1	lump sum	$_____	$_____
10	Test pumping	176	hours	$_____	$_____
11	Rig time	2	hours	$_____	$_____

Total **$_____**

Submitted by: _____
Signature

_____
Title

_____
Company

_____
Address

_____ _____
Oregon Well Constructor's License Telephone Number

Attachment E
Well 5 Construction Specifications

TECHNICAL SPECIFICATIONS
RAW WATER SUPPLY WELL 5
GRASSY MOUNTAIN GOLD PROJECT

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all materials, labor, plant, equipment, tools, supplies, transportation, and appurtenances for drilling, casing, developing, completing, and testing of one raw water supply well (Well 5) at the Grassy Mountain Gold Project (Project) site for Calico Resources USA Corp (the Owner) as specified herein and in accordance with the requirements of the Contract Documents.

B. Approximate depths of drilling and lengths of well casings and screen are to be used for the purpose of price estimation only. Exact depths and lengths may be adjusted by the Engineer depending on subsurface conditions.

C. Work requirements for each well are summarized below. Each item is discussed in subsequent sections of the Specifications.

(1) Mobilize to the work site.
(2) Drill for, furnish, and install 16-inch diameter temporary steel surface casing through the surface sediments to an anticipated depth of 30 feet.
(3) Drill a 6-inch diameter exploratory pilot borehole to an anticipated depth of 1,000 feet, installing temporary casing as required to advance the bore.
(4) Remove temporary casing and backfill the pilot borehole to the depth determined the Engineer.
(5) Ream the pilot borehole to minimum 14-inch diameter to depth determined by Engineer, installing temporary casing as required to ream the bore.
(6) Furnish and install 10-inch I.D. steel casing (0.365-inch wall thickness) and 10-inch stainless steel well screen as directed by Engineer.
(7) Furnish and install Colorado Silica Sand filter pack and filter pack seal.
(8) Seal the annular space outside the casing with neat cement from the top of the filter pack seal to ground surface, withdrawing the temporary surface casing during installation of the seal.
(9) Develop the well.
(10) Furnish, install, operate, and remove test pump.
(11) Disinfect well.
(12) Demobilize from the work site.

D. All well construction work not specifically addressed in these specifications shall conform to the State of Oregon Water Resources Department (OWRD) Well Construction Standards (Oregon Administrative Rules (OAR) Chapter 690 Division 200, 205, 210, and 217).

E. All materials used for well construction, including drilling fluids, shall be certified to NSF Standard 60, NSF Standard 61, or equivalent.

F. All casing, screens, and materials shall be handled with care to avoid damage. The Contractor's methods of loading, transporting, and unloading materials shall conform to

manufacturer recommendations. Casing and screen shall be kept free from dirt and foreign matter. Foreign material, including manufacturer labels, shall be removed from pipe interior prior to installation.

1.02 BEGINNING AND COMPLETION OF WORK

A. The work schedule shall be in accordance with Owner requirements.

1.03 SERVICES FURNISHED BY THE ENGINEER AND OWNER

A. The Owner will provide land and rights-of-way for the Work specified in this Contract. Provisions for access to the Work site will be provided by the Owner. The Contractor shall not enter on or occupy with laborers, tools, equipment, or material any ground outside the property and rights-of-way provided by the Owner unless stated otherwise by the Owner. Other Contractors, employees, or agents of the Owner may enter the work site and premises used by the Contractor for business purposes.

B. The Engineer (as the Owner's Representative) will participate in well testing, evaluation of drilling characteristics, sample examination, and geologic log interpretation, and will advise the Contractor on the final design placement of well casing, surface seal, filter pack and well screen. The Engineer shall be present during placement of well seals and for test pumping.

1.04 WORK SITE

A. The well site is located with the Project Permit Area as defined in the *Third Notice of Intent Pre-Application Phase of a Proposed Mining Operation: Calico Resources USA Corp. Grassy Mountain Gold Project (February 2017)*. The well site is located in a remote area approximately 22 miles south of Vale, Oregon and approximately 70 miles west of Boise, Idaho. The legal description of the well site is the NE ¼ of the NW ¼ of Section 32, Township 21S Range 44E in Malheur County, Oregon. The latitude and longitude coordinates of the proposed well site are 43°42'19.02" N and 117°21'57.62" W. The well site can be accessed from Vale, Oregon or Parma, Idaho via improved dirt road. The well site will be staked prior to Contractor mobilization.

1.05 DRILLING CONDITIONS

A. It is anticipated that drilling will be in clay, gravel, sandstone, conglomerate, siltstone, and basalt. Surface alluvium is expected to a depth of 30 feet. Static groundwater level is anticipated to be approximately 70 feet below ground surface. It is the Contractor's responsibility to make his own determination of subsurface conditions.

B. The drilling method for the well shall be determined by the Contractor based on anticipated drilling conditions. If the Contractor chooses to drill by air-rotary, the Contractor shall be prepared to drill by mud rotary if unstable subsurface conditions require it. If the Contractor chooses to drill by mud-rotary, the Contractor shall conduct geophysical logging of the borehole as directed by the Engineer.

C. The Contractor shall be responsible for providing notification to utility owners prior to beginning Work by requesting a facility locate through Oregon Dig Line at 811 or 1-800-332-2344.

D. It is the Contractor's responsibility to become informed about local conditions affecting this Work. Neither the information contained in these specifications, nor gleaned from the Engineer or Owner, or their agents, shall act to relieve the Contractor from any responsibility set forth in the Contract.

1.06 CONTRACTOR QUALIFICATION AND EQUIPMENT

A. The Contractor shall have at least five years of well drilling experience and shall have constructed at least 5 wells of comparable construction. A list of completed comparable projects shall be provided upon request.

B. The Contractor shall hold a valid Oregon Water Supply Well Constructor's License or work under the supervision of a licensed Water Supply Well Constructor.

C. The Contractor is responsible for filing a water well construction notice (start card) with the OWRD prior to commencing well construction. The Contractor is responsible for obtaining all other applicable permits.

D. The Contractor shall submit a list of equipment to be used on the project. The list shall include: (1) manufacturer; (2) load capacities; (3) year of manufacture; and (4) year of purchase by current Owner. The Contractor is responsible for providing equipment capable of performing the Work specified.

E. Damages to the well or surrounding property by the Contractor's equipment, leased or otherwise, shall be repaired or replaced at the Contractor's expense.

F. The Contractor shall have equipment capable of swabbing and airlifting the well to a total depth of 1,000 feet.

G. Upon completion of the well, the Contractor shall prepare, certify, and submit a water well report (log) to the OWRD and Owner.

1.07 SUBMITTALS

A. The Contractor shall provide submittals for all materials to the Engineer for review and approval prior to their use. The submittals shall be provided in an electronic format. Submittals shall be provided for casing, well screen, centralizers, backfill materials, seal materials, filter pack materials, and drilling fluids and additives. All materials shall be new and unused and in excellent condition.

B. The proposed test pump with curve shall be approved the by the Engineer prior to installation and test pumping.

1.08 CONTRACT DOCUMENTS

A. The form and detail of the various features of the Work are illustrated on the following drawings accompanying and made part of the Contract Documents:

- Figure 1 – Well 5 Location Map
- Figure 2 – Well 5 Conceptual Design

1.09 WATER, POWER, AND SITE IMPROVEMENTS

A. The Contractor shall be responsible for obtaining water supply for drilling. All water used for well construction purposes shall be of potable quality and adequately disinfected to prevent groundwater contamination. Water for drilling may be available from three on-site wells with approval from the Owner. These wells are located about 1,700 feet (PW-4),1 mile (Prod-1), and 3 miles (PW-1) from the well site. These wells are equipped with pumps; the Contractor shall provide a portable generator to operate the pumps.

B. If the Owner does not grant approval to use on-site wells for water supply or the Contractor chooses to obtain water from an alternate source, the Contractor shall provide for the quantity and quality of water required at his own expense. Costs for pumps, water conveyance facilities, or transportation to the Work site shall be borne by the Contractor including all necessary pumps, piping and components.

C. The Contractor shall provide, at his own expense, all necessary piping and components to transfer discharged well water from the well site to a suitable disposal site during well development and testing. The Contractor can assume a suitable disposal site for clean water within 200 feet of the well site. Water must be discharged at least 50 feet from the well site. A plan for water disposal must be provided by the Contractor and approved by the Owner prior to commencing drilling. The BLM will be notified by the Owner of any water discharge on BLM land. Water shall not be discharged to streams, ponds, or lakes without proper regulatory authorization.

D. The Contractor shall provide, at his own expense, all power required for his operations under the Contract.

E. All drilling fluids or water containing drilling fluids must be discharged to a sump provided at the drill site by the Owner. The Contractor shall haul excess drilling fluids to a central disposal site provided by the Owner.

F. Preparation of the drill site and excavation or backfilling of mud pits, ditches, or settling ponds shall be the responsibility of the Contractor. The Contractor shall be responsible for protecting life and property from excavated mud pits and settling ponds and shall backfill pits as soon as drilling and testing operations are complete. Holes, pits, equipment, and chemicals shall be safely stored and fenced per OSHA standards. All materials shall be stored where safe from damage or contamination.

G. The Contractor will be responsible for complying with all applicable erosion and sediment control requirements including applicable erosion control permits. The Contractor shall implement best management practices, including erosion and sediment control (ESC) structures, practices, permits, and plans to meet all project, local, state, and federal requirements for water quality and erosion and sediment control.

1.10 WORKING HOURS AND SAFETY

A. The Contractor shall work on this project in a steady and diligent manner. The Contractor shall, during all work periods, provide an adequate crew of suitably qualified personnel to prevent unnecessary delays in project completion. The Contractor will be required to provide 24-hour per day maintenance of pumping and monitoring equipment during test pumping

B. The Contractor is responsible for compliance with all applicable safety laws of any jurisdictional agency and safety requirements of the Owner.

1.11 FINAL CLEANUP

A. The Contractor shall thoroughly clean the site after completion of the drilling, well construction, and test pumping operations. All excess drilling fluids, debris, and other materials used during these operations shall be removed and properly disposed of by the Contractor. Backfilled mud pits shall be compacted to 90 percent maximum dry density as determined by Standard Proctor Test (ASTM 698-00).

B. The Contractor shall promptly remove his equipment, temporary facilities, and materials, and leave the site in a condition approved by the Engineer and Owner. The Contractor shall repair any damage to the property or facilities caused by his operations prior to final acceptance of the Work by the Engineer and Owner.

PART 2 - PRODUCTS

2.01 CASING

A. **Temporary Surface Casing:** Temporary surface casing may be used at the Contractor's option. If utilized, temporary surface casing shall be removed during installation of the surface seal.

B. **Well Casing:** The completed well shall be cased with nominal 10-inch I.D. casing from 2.5 feet above existing ground surface to a depth designated by the Engineer. The casing shall be new steel ASTM A-53 or equal with a minimum wall thickness of 0.365 inches. The casing shall be equipped with centralizers at a spacing of no more than 60 feet.

2.02 WELL SCREEN

A. Well screen shall be of the V-slot continuous wire-wound type in 304 stainless steel of 10-inch pipe size. The top of the well screen shall be equipped with a welding ring. The bottom of the well screen shall be equipped with a stainless steel plate bottom or a welding ring for connection to tail pipe. In order to provide adequate collapse, column, and tensile strengths, the screen construction shall include sufficient wire and rod sizes to be compatible with the depth and pressures of the installation, as recommended by the screen manufacturer.

B. Final screen length, slot size, and placement depths will be determined by the Engineer after completion of the borehole and receipt and evaluation of driller's logs and drill cuttings.

2.03 CENTRALIZERS

A. Centralizers shall be provided at nominal 60-foot intervals and at each screen section. Centralizers shall be welded to the casing. A shop drawing of the centralizer shall be submitted to the Engineer for review and approval prior to installation.

2.04 SAND FILTER PACK

A. A sand filter pack shall be placed around the well screen assembly. The filter pack shall be installed opposite the entire length of the screen assembly, and shall extend above the top screen a minimum of 20 feet (unless otherwise directed by the Engineer). The pack shall consist of clean, well-rounded siliceous material with a uniformity coefficient of 2.5 or less, manufactured by Colorado Silica Sand, Inc., Colorado Springs, CO (or approved equal), and

conforming to one of the following gradation specifications to be determined following analysis of drill cuttings.

20-40 Filter Sand 90-100% passing No. 20 sieve 90-100% retained on No. 40 sieve	16-30 Filter Sand 90-100% passing No. 16 sieve 90-100% retained on No. 30 sieve
10-20 Filter Sand 90-100% passing No.10 sieve 90-100% retained on No. 20 sieve	8-12 Filter Sand 90-100% passing No. 8 sieve 90-100% retained on No. 12 sieve

6-9 Filter Sand
90-100% passing No.6 sieve
90-100% retained on No. 9 sieve

2.05 FILTER PACK SEAL

A. A filter pack seal shall be installed in the annulus above the filter pack to prevent grout used for the annular seal from infiltrating into the filter pack. The filter pack seal shall include a 5-foot thick layer of bentonite. Material for the bentonite seal shall be 3/8- to 3/4-inch sodium bentonite chips. Bentonite shall be specifically designed for sealing wells.

2.06 WELL SEAL

A. The annulus outside the 10-inch well casing shall be sealed with cement grout. Seal thickness shall meet the requirements of the OWRD Well Construction Standards (OAR 690-210).

B. The grout shall contain between 4.5 and 6 gallons of clean water per 94 pounds of Portland cement. Mix water quality and quantity shall follow manufacturer specifications paying close attention to cement grind and water ratios, eliminating free water. Additives may only be used if approved by OWRD.

C. A 50 percent excess volume of seal material shall be available on site if neat cement is used as seal material.

2.07 BOREHOLE BACKFILL MATERIAL

A. Non water-bearing zones within the pilot borehole must be backfilled with cement grout or unhydrated bentonite in accordance with OAR 690-220.

B. Unhydrated bentonite shall be 3/8- to 3/4-inch sodium bentonite chips specifically designed for sealing wells.

C. Cement grout shall contain between 4.5 and 6 gallons of clean water per 94 pounds of Portland cement in accordance with OAR 690-210-0310.

2.08 WELL HEAD

A. The completed well shall have 10-inch casing to 2.5 feet above existing ground surface. The Contractor shall install a temporary cap on the completed well (welded steel plate with access port).

PART 3 - EXECUTION

3.01 MOBILIZATION AND DEMOBILIZATION

Upon receiving the Notice to Proceed, the Contractor shall move in all tools, equipment, and supplies necessary for the Work, and upon completion of the Work, shall remove all such items from the premises promptly and leave the site in a clean and orderly fashion.

3.02 CONSTRUCTION SEQUENCE

A. The sequence of construction for this project shall consist of the following:

(1) Mobilize to the work site.
(2) Place a 16-inch diameter temporary steel surface casing through the surface alluvium to an anticipated depth of 30 feet.
(3) Drill a 6-inch diameter exploratory pilot borehole to an anticipated depth of 1,000 feet, installing temporary casing as needed to reach total depth.
(4) Remove temporary casing and backfill the pilot borehole to the depth determined the Engineer.
(5) Ream the pilot borehole to minimum 14-inch diameter to depth determined by Engineer.
(6) Furnish and install 10-inch I.D. steel casing (0.365-inch wall thickness) and 10-inch stainless steel well screen as directed by Engineer.
(7) Furnish and install Colorado Silica Sand filter pack and filter pack seal.
(8) Install neat cement surface seal, withdrawing any temporary surface casing.
(9) Develop the well.
(10) Perform test pumping of the well.
(11) Disinfect the well.
(12) Provide temporary cap on the well and attach well tag.
(13) Clean work site and demobilize equipment.

3.03 DRILLING

A. The drilling method for the well shall be determined by the Contractor based on anticipated drilling conditions. If the Contractor chooses to drill by air-rotary, the Contractor shall be prepared to drill by mud rotary if unstable subsurface conditions require it. If the Contractor chooses to drill by mud-rotary, the Contractor shall conduct geophysical logging of the borehole as directed by the Engineer. The borehole shall be of sufficient diameter to meet the requirements of the OWRD Well Construction Standards (OAR 690-210).

B. The Contractor shall provide for and install temporary casing as required to advance the borehole to the target depth. The cost for temporary casing shall be included in the unit price for drilling or reaming on the bid schedule. The temporary casing shall be removed during backfilling or sealing of the borehole.

C. Drilling fluid properties shall be maintained in such a manner to ensure the structural integrity of the borehole and to circulate drill cuttings representative of the strata penetrated to the

ground surface. Drilling fluid additives shall be certified to NSF Standard 60 or 61. A mud kit shall be available for measuring drilling fluid properties throughout the project if applicable.

D. The Contractor shall sample the drill cuttings at 5-foot intervals and at pronounced changes in geologic formation. These samples shall be saved and maintained on the job site in a clean dry area. All samples are to be submitted to the Engineer and Owner. The samples shall be of at least one-gallon size, shall be kept in cloth sample bags or zip-lock style plastic bags, to be provided by the Contractor, and shall be clearly labeled to show the depth and well from which the sample was collected.

E. All drilling fluids shall be managed to protect groundwater from contamination and disposed of in accordance with State and Federal regulations. Method and place of drilling fluid disposal shall be approved by the Owner. Costs incurred in connection with the disposal of drilling fluids and developed water shall be borne by the Contractor. The Owner will provide a sump at the drill site for disposal of drilling fluids. The Contractor shall haul excess drilling fluids to a central disposal site provided by the Owner.

F. The Contractor shall maintain a daily drilling log of the well. Logs and records shall be kept by the Contractor's drillers on forms suitable to the Engineer, which shall indicate each shift worked; the general character, thickness, and type of material penetrated; and the type of all other Work performed, including the exact time spent on each item of Work. Information that shall be listed on the drilling log includes: (1) drilling fluids and additives, including quantity of materials used and volume of water or drilling fluid lost to the formation; (2) drilling fluid properties, including weight and viscosity (if applicable); (3) type and diameter of bits used for drilling and total footage for each bit; (4) depth where water encountered and an estimate of the quantity of water produced; and (5) any remarks or comments concerning the drilling characteristics of the borehole, including locations of any lost circulation zones. The forms shall be kept on-site for inspection by the Engineer. Forms shall be provided for Engineer approval prior to commencing construction.

G. Copies of the logs shall be available for inspection by the Owner and Engineer at all times. Copies of all logs shall be furnished to the Owner and Engineer following completion of all operations. The Contractor shall prepare, sign, and submit a water well report for each well constructed to the OWRD.

3.04 PLUMBNESS AND ALIGNMENT

A. The Contractor shall construct the well sufficiently straight and plumb to permit free installation and removal of a nominal 6-inch test or production pump with 8-inch motor. The hole shall be drilled to the depth designated by the Engineer with a total deviation of the casing not to exceed one degree per 100 feet of the well. The alignment will be considered satisfactory if the casing will permit the free lowering and raising of a dummy between land surface and the bottom of the 10-inch casing section. The dummy shall be constructed of a 40-foot length of standard 8-inch I.D. pipe. It shall be the responsibility of the Contractor to see that the well is being constructed straight and plumb within these limits at all times. Any indications of inadequate plumbness or alignment during drilling, casing, or pump setting operation shall be cause to require measurement of plumbness or alignment by a method approved the Engineer. No payment shall be made for tests of alignment; any such tests shall be considered subsidiary to other items in this Contract.

B. If the well has unacceptable plumbness or alignment, the Contractor shall undertake remedial measures. Any alignment work required by the Contractor in re-drilling or straightening the

well shall be at his sole expense. If a well is deemed unacceptable following remedial measures, then as much casing as can be removed from the well shall be salvaged by the Contractor. Salvaged casing will be the property of the Contractor. The well shall be abandoned in accordance with OWRD requirements (OAR 690-220) at the Contractor's expense. All payments associated with construction of the abandoned well shall be credited to construction of a replacement well.

3.05 GEOPHYSICAL LOGGING

A. Geophysical logging of the borehole will be required if the Contractor drills by mud-rotary. If the Engineer or Owner requests geophysical logging, the Engineer shall be given at least 24 hours of notice of the time when the survey will be run in order to witness the performance of the survey. The logs run shall include normal resistivity (8", 16", 32", and 64"), single point resistivity, specific potential, natural gamma radiation, and temperature.

B. It is the Contractor's responsibility to ensure that the borehole remains open to the total completion depth for geophysical logging.

C. Three full-scale and three reduced-scale printed copies of the logs shall be provided. The logs shall also be provided in electronic format (ASCII or similar) on DVD or CD or transmitted by email.

3.06 BACKFILL OF EXPLORATORY PILOT BOREHOLE

A. The 6-inch diameter exploratory pilot borehole shall be backfilled to a depth determined by the Engineer.

B. The pilot borehole shall be backfilled with cement grout or unhydrated bentonite in accordance with OAR 690-220. Non water-bearing zones must be backfilled with cement grout or unhydrated bentonite. Documented water-bearing zones can be backfilled with clean gravel. OWRD must approve any continuous gravel placement exceeding 50 feet in length or where the length of gravel placed exceeds 50% of the total length of backfill.

C. Unhydrated bentonite may be placed to a maximum depth of 700 feet through water for casing or bores between 4 and 8 inches in diameter but may be installed deeper with OWRD approval. Unhydrated bentonite may be placed to a maximum depth of 1,000 feet through air for casing or bores between 4 and 8 inches in diameter but may be installed deeper with OWRD approval.

D. Bentonite chips shall be installed in a slow and continuous manner, with a pour rate of 2 minutes or slower per standard 50-pound bag. Unhydrated bentonite shall be screened across a minimum ¼-inch mesh screen during placement. Bentonite chips installed above the water table shall be hydrated after placement in maximum 10-foot lifts with potable water pumped through a tremie pipe

E. The bentonite chips shall be tagged during placement to determine if the chips are reaching their intended position. Seal level shall be checked by tagging with a sinker bar or other means. The volume of bentonite used shall be compared with the annular space volume to evaluate the potential for bridging. Adequate time shall be provided to allow the bentonite seal to hydrate (1 to 2 hours) prior to proceeding with well construction.

3.07 INSTALLATION OF WELL CASINGS, SCREEN, AND CENTRALIZERS

A. The permanent well casing shall extend at least 5 feet into a clay confining layer overlying the target water-bearing zone.

B. Welding: Individual lengths of steel casing shall be joined by welding. Welding shall be performed by properly qualified operators following the manufacturer's recommendations and in accordance with AWWA C206. Welds shall penetrate the full thickness of the casing wall.

1. The standards of the American Welding Society, Structural Welding Code (AWS D1.1) shall apply for all welded joint casing and accessories. All welds shall conform to the latest revision of ANSI B31.1.

2. There shall be a minimum of three (3) weld passes on pipe sizes 6-inches and greater.

3. Welded casing joints shall have a tensile strength equal to or greater than that of the casing.

C. Weld Reinforcement: Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions.

D. When complete, the well casing shall extend a minimum of 30 inches above existing grade to provide a casing height of 18 inches above the future well house floor. The top of well casing shall be equipped with a welded steel plate, sanitary well seal, or vented well cap, as approved by the Engineer.

E. Centralizers shall be installed at intervals of no more than 60 feet.

3.08 INSTALLATION OF FILTER PACK

A. A sand filter pack shall be placed opposite the well screen and a maximum of 20 feet above the top of the screen. Filter pack shall be placed using a tremie pipe to avoid bridging and to ensure uniform placement. Potable water may be used to wash filter pack into place. The volume of water used shall be measured and recorded. The level of the filter pack shall be tagged at frequent intervals to confirm that it is not bridging. The top of the filter pack shall be tagged following installation to verify and document final placement depth. The volume of the filter pack shall be monitored during placement to confirm that the pack is not bridging.

B. Following installation, the pack shall be settled by swabbing or other means.

C. The pack shall be disinfected with a minimum 50-ppm chlorine solution prior to installation.

3.09 INSTALLATION OF FILTER PACK SEAL

A. A filter pack seal shall be installed in the annulus above the filter pack to prevent grout used for the annular seal from infiltrating into the filter pack. The filter pack seal shall consist of a 5-foot thick bentonite seal.

B. Material for the bentonite seal shall be 3/8- to 3/4-inch unhydrated sodium bentonite chips below the water table and hydrated sodium bentonite chips above the water table. Bentonite shall be specifically designed for sealing wells.

C. Bentonite chips shall be installed in a slow and continuous manner, with a pour rate of 2 minutes or slower per standard 50-pound bag. Unhydrated bentonite shall be screened across a minimum ¼-inch mesh screen before being introduced into the well. Bentonite chips installed above the water table shall be hydrated after placement with potable water pumped through a tremie pipe.

D. The bentonite seal shall be tagged during placement to determine if the seal is reaching its intended position. Seal level shall be checked by tagging with a sinker bar or other means. The volume of bentonite used shall be compared with the annular space volume to evaluate the potential for bridging. Adequate time shall be provided to allow the bentonite seal to hydrate (1 to 2 hours) prior to placing the grout annular seal.

3.10 INSTALLATION OF WELL SEAL

A. The 10-inch diameter well casing shall be installed in a minimum 14-inch diameter borehole. The annular space between the casing and bore wall shall be sealed with cement grout. The annular seal shall extend from the top of the filter pack seal to ground surface. The seal depth will exceed 18 feet. Any temporary casing shall be withdrawn as the seal is placed.

B. Seal thickness and installation shall meet the requirements of the OWRD Well Construction Standards (OAR 690-210).

C. Cement grout seals shall be installed by the tremie method. The grout shall be pumped into the annular space through a tremie pipe that shall be extended from ground surface to the bottom of the zone being grouted. Grout shall be placed from the bottom up in a continuous operation. The grout pipe shall be slowly raised as the grout is placed, but the discharge end of the tremie pipe must be submerged in the emplaced grout at all times until grouting is complete. The grout pipe shall be maintained full to the surface at all times until completion of the grouting of the entire specified interval.

D. Once grouting is complete, no further work shall be performed on the well for a minimum of 24 hours. No standby or rig time will be paid while grout is setting. The permanent well casing shall not be moved or driven following placement of the grout seal.

E. In the event of borehole collapse prior to placement of the grout, the Contractor shall take whatever steps are necessary to reopen the hole and to place the seal as specified. Any such remedial action shall be conducted at the Contractor's expense.

F. Volumes of seal material placed shall be carefully monitored and checked against calculated volume requirements.

G. The Engineer shall be notified a minimum of 24 hours prior to seal placement, and shall be present during seal placement.

H. Seals shall be installed in a slow and continuous manner, and temporary casing shall be withdrawn as the seal is placed.

3.11 DEVELOPMENT

A. Following seal placement and curing, the well shall be developed by pump surging (rawhiding), mechanical surging using a surge block or swab, air-lift surging, hydraulic jetting, or other methods approved by the Engineer. If the Contractor selects pump surging as the sole means of development and the well does not produce clear water free from sand or the well does not produce the target yield, then the Contractor may be required to perform mechanical development or jetting in addition to surge development. The Contractor shall provide a written log documenting development methods, discharge rates, and duration of each development operation.

B. Mechanical surging shall be performed using a surge block or swab. The outside diameter of the surge block or swab shall be only slightly smaller than the inside diameter of the casing (1/8 to 1/4-inch). Surging of the well shall begin in the casing immediately above the uppermost section of well screen. Initial surging shall be with a long stroke at a slow rate. Surging in the casing section shall continue until no additional appreciable quantity of sand, silt, or clay is brought into the well. Following surging of the casing, the surge block or swab shall be lowered into the lowest screened section and surge development continued. Surge development shall continue upward until the entire screen has been developed. The screen shall be surged in 20-foot sections. Surging shall then be repeated at a faster stroke starting at the bottom of the well. Periodically, the Contractor shall measure and bail from the well all sand, silt, and clay that has accumulated at the bottom. Surging shall continue until no more sediment is bailed from the well and the well produces clear water.

C. Hydraulic jetting shall be performed with a jetting tool to produce a minimum nozzle velocity of 150 feet per second. The jetting tool shall be lowered into the bottom of the screen, rotated slowly and continuously, and slowly raised throughout the entire screen length. Jetting shall be continued until the well produces clear water free from sediment. Simultaneous air-lift pumping may be employed to remove fines from the well.

D. The well may be developed using air-lift surging. For air-lifting, the Contractor shall have a compressor, tubing and eductor pipe to air-lift a minimum of 200 gpm average flow from 500 feet depth. Sufficient tubing or drill stem shall be available to reach the total depth of the well. It is anticipated that air development will take place in a staged manner throughout the lower portion of the well, and thus may include considerable addition and subtraction of pipe. For long screen sections, a double-packer tool shall be used to develop short sections of screen. Periodically, the Contractor shall measure and bail from the well all sand, silt, and clay that has accumulated at the bottom.

E. Final well development shall be performed by alternative pumping and surging with the test pump. The well shall be pumped at a restricted initial pumping rate. As water clears, the pumping rate shall be gradually increased until maximum discharge rate is reached. At regular intervals, the pump shall be stopped and the water in the pump column shall be allowed to surge back through the pump intake. Development pumping shall continue until discharged water is clear and sand free (less than 5 ppm sand at the design capacity of the well), as measured by the Engineer.

F. The Contractor may be required to use a dispersant or other well development additive to achieve satisfactory development. All additives must be approved by the Engineer prior to use.

G. Upon completion of the development, all material shall be thoroughly cleaned from the inside of the casing and screen. Material shall be removed by bailing or by suction pumping. If

removed by pumping, the Contractor shall have sufficient tubing or pipe to reach the total depth of the well.

H. Water containing drilling fluids, chemicals, or sediment must be discharged to a sump provided at the drill site by the Owner. The Contractor shall haul excess drilling fluids to a central disposal site provided by the Owner.

3.12 TEST PUMPING

A. Following completion of development operations, the well shall be allowed to recover for 24 hours, or less if approved by the Engineer, prior to starting the pumping tests. Within the hour prior to the start of test pumping, the Engineer will measure static water level in the well three times no less than 20 minutes apart.

B. Anticipated methods of aquifer testing include: (1) a step-test lasting approximately 8 hours, which will consist of pumping the well at various rates from approximately 50 gpm to the maximum capability of the pump or well; and (2) a constant-rate pumping test lasting a minimum of 7 days. The pumping test duration will be determined by the Engineer. The constant-rate test may be extended to 14 days if the well drawdown trend does not stabilize. Standby time will not be paid for the recovery periods between tests or at the conclusion of test pumping. The Engineer shall be present at the start of test pumping. The Contractor shall be responsible for maintaining a constant pumping rate during the test.

C. The test pump shall be capable of delivering a least 200 gpm from a pumping level of 400 feet. The Contractor shall furnish and install all necessary equipment for testing, including a discharge valve or throttle to control flow rate, orifices or flow meter for accurately measuring the discharge from the well, one nominal 1-inch PVC pipe to the top of the pump to facilitate the installation and removal of an electric-line water-level probe, and a sample tap. The Contractor shall measure and record water level, pumping rate (every hour), and elapsed time as directed by the Engineer. The Contractor shall provide a threaded port for attachment of a Rossum Sand Tester by the Engineer. The Engineer shall be responsible for sand testing.

D. Water level measurements shall be taken with a non-stretch electric-line water-level probe. Measurements during the first ten minutes of pumping shall be timed no more than two minutes apart. Water level measurements from ten to thirty minutes of pumping shall be timed no more than five minutes apart. Between 30 minutes of pumping and 2 hours, drawdown measurements shall be taken no more than 15 minutes apart. For the duration of the test, hourly measurements are acceptable unless otherwise directed by the Engineer.

E. After pumping stops, water level recovery measurements shall be taken for four hours or until the well reaches 90 percent recovery from the maximum drawdown, whichever occurs first. Recovery water level measurements shall be taken on the same schedule as for drawdown measurements.

F. The test pump and column pipe shall be disinfected with a minimum 50-ppm chlorine solution prior to installation in the well.

G. The Contractor shall be responsible for providing power for the test pump. The Contractor shall provide a means for safe refueling during operations to prevent even brief shutdowns during the testing. Shutdowns before the end of the testing procedure in excess of ten (10) percent of the total time anticipated for this testing procedure may require the Contractor to

allow the water level to recover to pre-pumping conditions and re-start the test, as determined by the Engineer.

H. The Contractor shall provide all necessary piping and components to transfer water produced during test pumping to a suitable disposal site. The Contractor can assume a suitable disposal site for clean water within 200 feet of the well site. Water must be discharged at least 50 feet from the well site. A plan for water disposal must be provided by the Contractor and approved by the Owner prior to test pumping.

I. The Engineer shall be responsible for collecting water quality samples during the pumping test. The Engineer shall be responsible for determining whether (1) the well productivity is adequate to meet the project requirements and (2) water quality meets Oregon Health Authority requirements.

3.13 DISINFECTION

A. Upon completion of all well construction activities and removal of test pumping equipment, the Contractor shall disinfect the well using calcium hypochlorite or sodium hypochlorite.

1. Calcium hypochlorite or sodium hypochlorite shall be added to achieve a chlorine concentration of 50 ppm in the well, refer to OAR 690-210-0380. The Contractor shall distribute the disinfecting compound throughout the well to achieve a uniform concentration for “in place” disinfection of the well.

2. Chlorine granules or tablets must be dissolved and placed into the well as a solution.

3. All interior surfaces of the well above the static water level shall be wetted with calcium hypochlorite or sodium hypochlorite solution.

B. Near the end of the constant-rate discharge test, duplicate samples shall be collected by the Engineer and the samples shall be tested for the presence of coliform bacteria. The Contractor shall leave the test pump in the well until test results are reported. If any sample shows the presence of coliform bacteria, the Contractor shall collect duplicate samples (without charging rig or standby time while waiting on sampling results). If the second sampling event shows the presence of coliform bacteria, the Contractor shall re-disinfect the well until duplicate samples show the absence of coliform bacteria.

C. The well shall be capped with a vented well cap or sanitary well seal following disinfection.

D. Chlorinated water shall be disposed of in accordance with federal, state, and local requirements. Where applicable, the Contractor shall obtain appropriate permits from regulatory agencies before discharging chlorinated water to the environment.

3.14 PROTECTION OF WATER QUALITY

A. All water used for drilling and development operations shall be of potable quality.

B. The Contractor shall take all necessary precautions to prevent contamination of the water in the well by the introduction of any foreign substance, including contaminated water, gasoline, oil, etc., and shall conform to all laws or regulations applicable to the protection of water quality.

C. All downhole materials (i.e., casing, pipe, pumps, sand filter pack, drilling tools, etc.) shall be disinfected with a minimum 50-ppm chlorine solution.

3.15 WELL IDENTIFICATION TAG

A. The Contractor shall permanently attach a well identification tag to the well casing within 30 days of well completion. The tag shall be furnished by OWRD and attached so as to be accessible and visible. The tag may be strapped to the casing using stainless steel bands, tag welded, or attached using rivets. The tag shall be installed at least 18 inches above existing grade to be at least 6 inches above the future well house floor.

B. The well identification number shall be recorded on the well driller's report.

3.16 FINAL CLEANUP

A. After completion of all Work associated with this Contract, the Contractor shall clean up the Work site and any property used by his operations to the satisfaction of the Engineer and Owner. The Contractor shall remove and dispose of all excess materials resulting from his work, and shall repair, replace, or restore all property of any type or nature which has been moved, damaged, or altered in any way by his operations, to the satisfaction of the Engineer and Owner. The Contractor shall return all landscape, roadway, and adjoining surfaces to their original condition and appearance as soon as reasonably feasible.

PART 4 - MEASUREMENT AND PAYMENT

4.01 SCOPE

A. The quantities of work or material stated in unit price items of the Bid are supplied only to give an indication of the general scope of the Work; the Engineer does not expressly or by implication agree that the actual amount of work or material will correspond therewith, and reserves the right after award to increase or decrease the quantity of any unit price item of the Work without a change in the unit price, and shall include the right to delete any Bid item in its entirety. Payment for materials and labor will be based on actual quantities furnished, installed, or constructed in accordance with the prices bid for unit price items.

B. The Engineer may terminate Work on the project at any point if, in the Engineer's judgment, the Engineer's or Owner's best interests are not served by continuation. Conditions which may lead to project termination include, but are not limited to, indications of low groundwater development potential as determined during drilling, geophysical logging, and testing. In such an event, the Contractor shall be paid for the value of Work completed at that time on the basis of the unit price and lump sum items listed on the Bid Schedule. In addition, if well construction is terminated by decision of the Engineer, the Contractor may be required to properly abandon the well. The well shall be abandoned in accordance with OWRD requirements (OAR 690-220). Materials used in abandonment shall be paid at invoice cost plus 10 percent to cover handling. Payment for rig time shall be at the bid unit price.

C. No payment shall be made for tests of borehole plumbness and alignment; it shall be the responsibility of the Contractor to ensure that the hole remains within plumbness and alignment specifications.

D. No payment shall be made for drilling fluid materials used during normal drilling operations. All such costs shall be considered to be included in the unit prices listed on the Bid Schedule.

E. No payment shall be made for time or expenses incurred in the recovery or replacement of tools or equipment lost during the drilling phase or any other phase of the Work.

F. No payment shall be made for time, materials, or labor costs incurred during remedial measures or operations in the event the well is of unacceptable plumbness or alignment.

G. No payment shall be made for time, materials, or labor costs incurred in abandoning the well in the event the well is of unacceptable plumbness or alignment following remedial measures, or if lost tools or equipment cannot be recovered from the borehole. The costs incurred for construction of the abandoned well shall be applied to construction of a replacement well.

4.02 MOBILIZATION/DEMOBILIZATION (ITEM 1; LUMP SUM ITEM)

A. Measurement for payment for mobilization/demobilization to and from the work site will be based upon completion of the Work as a lump sum unit. The lump sum price listed on the Bid Schedule shall be full compensation for the moving in of rigs, pumps, equipment, power, labor, fuel, tools, and incidentals necessary to do the Work, and moving out of all such equipment, materials, tools, and incidentals, and well disinfection and final site cleanup upon completion of the Work. For purposes of partial payment, the mobilization portion of this bid item shall be considered as 60% of the total lump sum.

4.03 DRILL 6-INCH DIAMETER PILOT BOREHOLE (ITEM 2; PRICES BASED ON LINEAR MEASUREMENT)

A. Measurement and payment for drilling the exploratory pilot borehole will be based upon the number of vertical linear footage drilled below ground surface in accordance with these Contract Documents. Payment for drilling shall constitute full compensation for labor, fuel, bits, temporary casing, drive shoes, welding, drilling fluids, equipment, and incidentals necessary to drill the exploration borehole.

B. This item includes drilling for and placing the 16-inch temporary casing to an expected depth of 30 feet.

C. No payment shall be made for tests of borehole plumbness and alignment; it shall be the responsibility of the Contractor to ensure that the hole remains within plumbness and alignment specifications.

D. No payment shall be made for drilling fluid materials used during normal drilling operations. All such costs shall be considered to be included in the unit prices listed on the Bid Schedule.

E. Payment for drilling fluid materials used in regaining drilling fluid circulation in zones of lost circulation shall be paid at invoice cost plus 10 percent for handling.

F. No payment shall be made for time or expenses incurred in the recovery or replacement of tools or equipment lost during the drilling phase or any other phase of the Work.

G. No payment shall be made for time, materials, or labor costs incurred during remedial measures or operations in the event the well is of unacceptable plumbness or alignment.

H. No payment will be made for time, materials, or labor costs incurred in abandoning the well in the event the well is of unacceptable plumbness or alignment following remedial measures, or

if lost tools or equipment cannot be recovered from the borehole. The costs incurred for construction of the abandoned well shall be applied to construction of a replacement well.

4.04 GEOPHYSICAL LOGGING (ITEM 3, LUMP SUMP ITEM)

A. If geophysical logging is required, measurement for payment for geophysical logging will be based upon completion of the entire work as a lump sum unit, in accordance with these contract documents. Payment for geophysical logging shall constitute full compensation for labor, equipment, and incidentals necessary to perform the logging

B. No rig or standby time will be paid to the Contractor during the time that the Contractor's logging service is being brought to the site, or during the time that the logs are being run.

C. No rig or standby time will be paid to the Contractor following completion of logging during which an exact determination of the final well design will be made by the Engineer.

4.05 BACKFILL PILOT BOREHOLE (ITEM 4; PRICES BASED ON LINEAR MEASUREMENT)

A. Measurement and payment for backfilling the pilot borehole will be based upon linear feet of borehole requiring backfill. Payment shall constitute full compensation for materials, transportation, labor, equipment, and incidentals necessary to backfill the pilot borehole.

4.06 REAM PILOT HOLE TO MINIMUM 14-INCH DIAMETER BOREHOLE (ITEM 5; PRICES BASED ON LINEAR MEASUREMENT)

B. Measurement and payment for reaming the pilot borehole to minimum 14-inch diameter will be based upon the number of vertical linear footage reamed below ground surface in accordance with these Contract Documents. Payment for drilling shall constitute full compensation for labor, fuel, bits, temporary casing, drive shoes, welding, drilling fluids, equipment, and incidentals necessary to drill the exploration borehole.

C. No payment shall be made for tests of borehole plumbness and alignment; it shall be the responsibility of the Contractor to ensure that the hole remains within plumbness and alignment specifications.

D. No payment shall be made for drilling fluid materials used during normal drilling operations. All such costs shall be considered to be included in the unit prices listed on the Bid Schedule.

E. Payment for drilling fluid materials used in regaining drilling fluid circulation in zones of lost circulation shall be paid at invoice cost plus 10 percent for handling.

F. No payment shall be made for time or expenses incurred in the recovery or replacement of tools or equipment lost during the drilling phase or any other phase of the Work.

G. No payment shall be made for time, materials, or labor costs incurred during remedial measures or operations in the event the well is of unacceptable plumbness or alignment.

H. No payment will be made for time, materials, or labor costs incurred in abandoning the well in the event the well is of unacceptable plumbness or alignment following remedial measures, or if lost tools or equipment cannot be recovered from the borehole. The costs incurred for construction of the abandoned well shall be applied to construction of a replacement well.

4.07 FURNISH AND INSTALL 10-INCH WELL CASING (ITEM 6; PRICES BASED ON LINEAR MEASUREMENT)

A. Measurement for payment for the nominal 10-inch steel well casing will be based upon the number of linear feet of such pipe actually installed in the borehole in accordance with these Contract Documents. Payment for the 10-inch casing shall constitute full compensation for materials, transportation, labor, fuel, equipment, centralizers, welding materials, and incidentals necessary to furnish and install the well casing.

4.08 FURNISH AND INSTALL 10-INCH WELL SCREEN (ITEM 7; PRICES BASED ON LINEAR MEASUREMENT)

A. Measurement and payment for furnishing and installing the well screen will be upon the number of linear feet of such well actually installed in the borehole in accordance with these Contract Documents. Payment for the well screen shall constitute full compensation for screen, weld rings, plate bottom, materials, transportation, labor, equipment, and incidentals necessary to furnish and install the well screen.

4.09 FURNISH AND INSTALL SAND FILTER PACK (ITEM 8; PRICES BASED ON LINEAR MEASUREMENT)

A. Measurement and payment for furnishing and installing the sand filter pack will be based on the linear feet of filter pack actually installed in the well in accordance with these Contract Documents. Payment for filter pack shall constitute full compensations for materials, transportation, labor, equipment, and incidentals necessary to furnish and install the filter pack.

B. This item includes installation of the filter pack seal.

4.10 FURNISH AND INSTALL ANNULAR WELL SEAL (ITEM 9; PRICES BASED ON LINEAR MEASUREMENT)

A. Measurement and payment for furnishing and installing the well seal will be based upon linear feet of well seal installed in the borehole. Payment for the well seal shall constitute full compensation for materials, transportation, labor, equipment, and incidentals necessary to furnish and install the seal.

4.11 WELL DEVELOPMENT (ITEM 10; PRICES BASED UPON TIME, HOURS)

A. Measurement for payment for well development will be based on the actual number of hours of development operations. Payment will be made at the unit price listed in the Bid Schedule.

B. No payment shall be made for equipment acquisition, set-up, or installation, or for recovery periods required by the Engineer to ensure thorough well development.

C. Payment for chemicals as may be required by the Engineer to ensure thorough well development shall be reimbursed for the cost of the chemicals actually used at invoice cost plus 10 percent for handling.

4.12 FURNISH, INSTALL, AND REMOVE TEST PUMP AND RELATED EQUIPMENT (ITEM 11; PRICE BASED ON LUMP SUM)

A. Measurement and payment for furnishing, installing, and removing the test pump and related equipment will be based upon completion of the entire Work as a lump sum unit, all in accordance with the requirements of these Contract Documents. Payment for furnishing, installing, and removing will be at the price listed in the Bid Schedule, which price shall constitute full compensation for all work, including installation and removal of pump, motor, generator, cable, controls, valves, orifices, temporary piping, and associated appurtenances.

4.13 TEST PUMPING (ITEM 12; PRICES BASED UPON TIME, HOURS)

A. Measurement and payment for test pumping will be based on the actual number of hours of pumping operations. Payment for test pumping will be made at the unit price listed in the Bid Schedule, and shall constitute full compensation for all labor, fuel, equipment, and materials associated with operating the test pumping equipment.

B. No payment shall be made for standby time during the recovery periods between tests or for time spent transporting or maintaining equipment. All such costs for time and maintenance materials shall be included in the unit price listed in the Bid Schedule.

C. No payment shall be made for time, equipment, or materials used in a test aborted due to power failure or malfunction of pumping equipment.

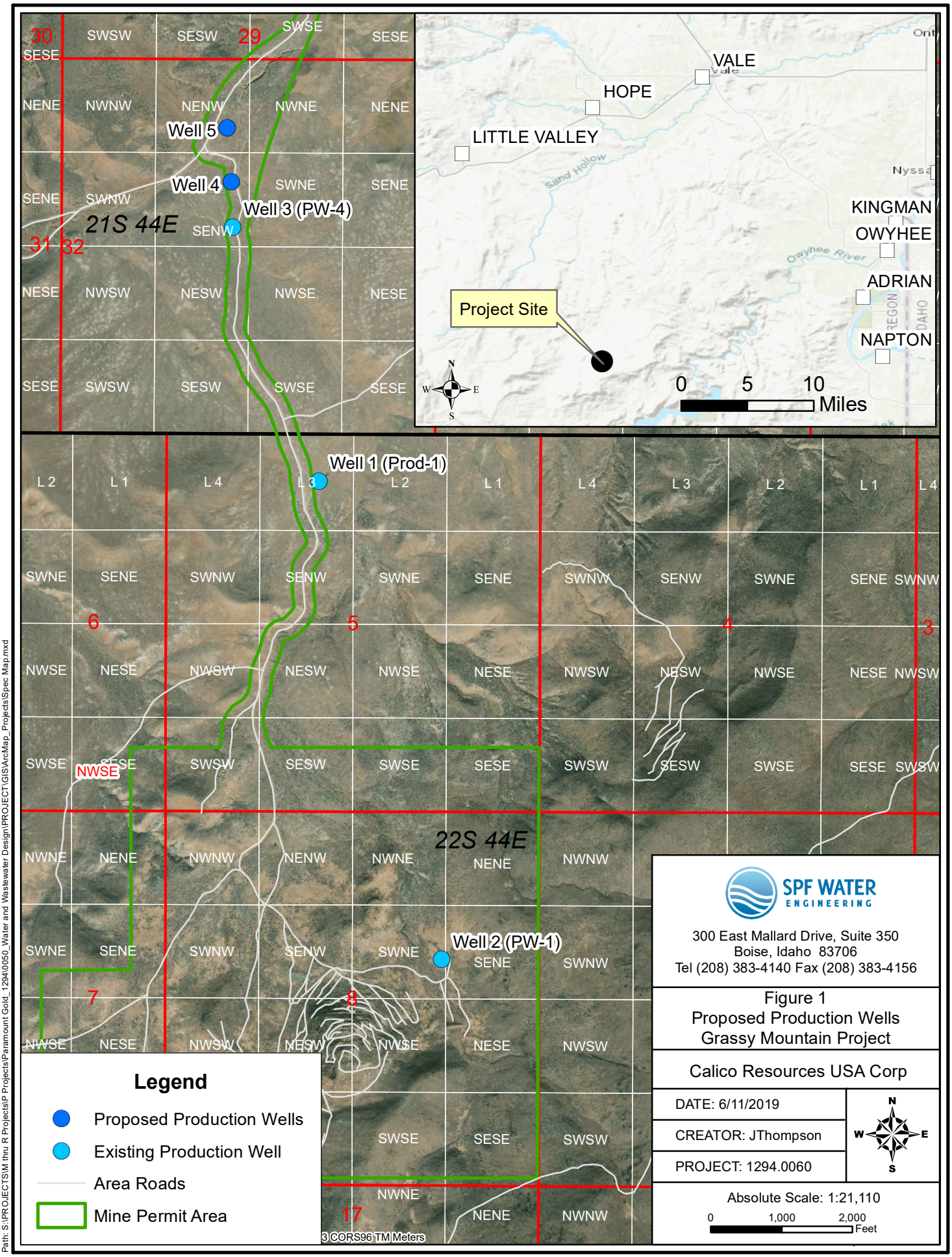
4.14 RIG TIME (ITEM 13; PRICES BASED UPON TIME, HOURS)

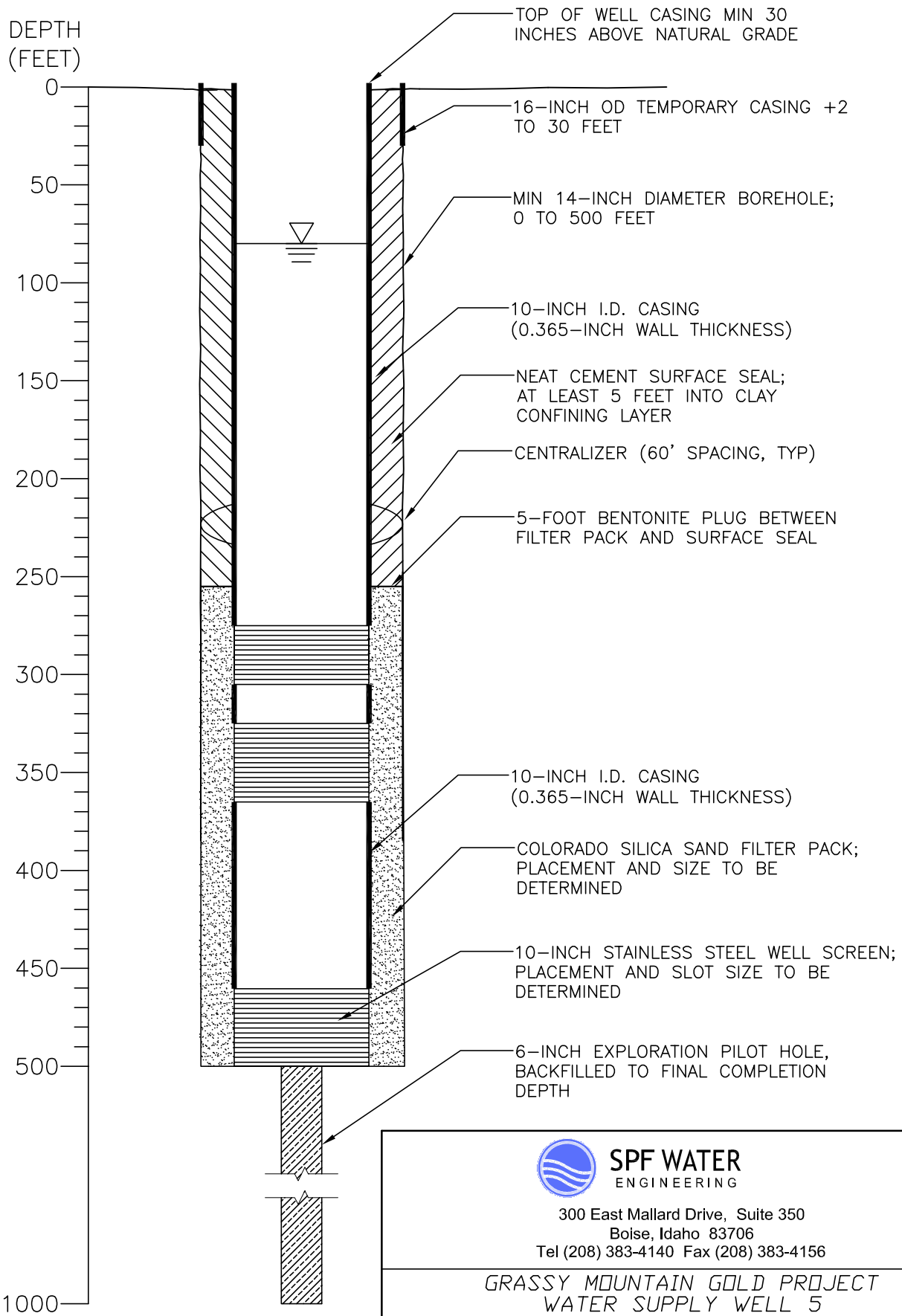
A. Measurement and payment for rig time will be based on the unit price listed on the Bid Schedule. Payment for rig time for additional work specifically directed by the Engineer not otherwise covered in these Contract Documents will be based on the actual number of hours of work done and shall be full compensation for rig, fuel, labor, equipment, and materials normally associated with Contractor's drilling activities. Additional materials, which may be required by the Engineer, shall be paid at the Contractor's invoice cost plus 10 percent for handling.

4.15 PLUGGING AND ABANDONMENT

A. In the event a well, successfully completed in accordance with these Contract Documents, requires plugging and abandonment, the cost for this work will either be negotiated with the Contractor or performed by others. The costs for plugging and abandonment of the well successfully completed in accordance with these Contract Documents shall not be considered as subsidiary to other bid items in the Contract.

- END OF TECHNICAL SPECIFICATIONS -


Well 5
Well 4
Well 3 (PW-4)
Well 1 (Prod-1)
Well 2 (PW-1)
21S 44E
22S 44E
VALE
HOPE
LITTLE VALLEY
KINGMAN
OWYHEE
ADRIAN
NAPTON
Project Site
0 5 10
Miles
Legend
Proposed Production Wells
Existing Production Well
Area Roads
Mine Permit Area
SPF WATER ENGINEERING
300 East Mallard Drive, Suite 350
Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156
Figure 1
Proposed Production Wells
Grassy Mountain Project
Calico Resources USA Corp
DATE: 6/11/2019
CREATOR: JThompson
PROJECT: 1294.0060
Absolute Scale: 1:21,110
0 1,000 2,000
Feet
Path: S:\PROJECTS\M thru R Projects\P Projects\Paramount Gold_1294\0050_Water and Wastewater Design\PROJECT\GIS\ArcMap_Projects\Spec Map.mxd



SPF WATER
ENGINEERING
300 East Mallard Drive, Suite 350
Boise, Idaho 83706
Tel (208) 383-4140 Fax (208) 383-4156

GRASSY MOUNTAIN GOLD PROJECT
WATER SUPPLY WELL 5
CONCEPTUAL DESIGN

SCALE: NTS
DRAWN BY: KJN

Figure 2 PROJ #1294.0050

BID SCHEDULE OF ITEMS AND PRICES
RAW WATER SUPPLY WELL 5
GRASSY MOUNTAIN GOLD PROJECT

The Bidder proposes the following schedule of prices for drilling, construction, development, and testing of one raw water supply well (Well 5) for Calico Resources USA Corp in accordance with the technical specifications. The quantities of work or material stated in unit price items of the bid are supplied only to give an indication of the general scope of the work. Payment for materials and labor will be based on actual quantities furnished, installed, or constructed in accordance with the prices bid for unit price items. The Bidder is solely responsible for completing all spaces below. The Bidder is responsible for the inclusion of all overhead and profit costs within each item.

Item	Description	Estimated Quantity	Unit	Unit Price	Total Amount
1	Mobilization and demobilization	1	lump sum	$_____	$_____
2	Drill 6-inch diameter pilot borehole	1,000	linear foot	$_____	$_____
3	Geophysical logging	1	lump sum	$_____	$_____
4	Backfill pilot borehole	500	linear foot	$_____	$_____
5	Ream pilot hole to min 14-inch diameter	500	linear foot	$_____	$_____
6	Furnish and install 10-inch I.D. casing	402	linear foot	$_____	$_____
7	Furnish and install 10-inch I.D. well screen	100	linear foot	$_____	$_____
8	Furnish and install sand filter pack	250	linear foot	$_____	$_____
9	Furnish and install annular well seal	250	linear foot	$_____	$_____
10	Well development	16	hours	$_____	$_____

11	Furnish, install, and remove test pump and related equipment	1	lump sum	$_____	$_____
12	Test pumping	176	hours	$_____	$_____
13	Rig time	2	hours	$_____	$_____
	Total				**$_____**

Submitted by: _____
Signature

_____
Title

_____
Company

_____
Address

_____ _____
Oregon Well Constructor's License Telephone Number