Grants Project

Homestake Mining Company of California

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Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555–0001

Mr. Ron Linton, Project Manager
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Materials Decommissioning Branch
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Office of Nuclear Materials Safety and Safeguards
MS T-5A10, 11545 Rockville Pike
Rockville, MD 20852

Re: Response to "U. S. Nuclear Regulatory Commission Review of Homestake Mining Company of California's Reply to "Response to the Homestake Mining Company of California Letter, Dated July 26, 2018: Proposed Adjustment in Groundwater Monitoring of the San Andres-Glorieta Aquifer Near the Grants Reclamation Project", Dated January 23, 2020, Docket No. 040-08903, License No. SUA-1471

Dear Sirs:

Homestake Mining Company of California (HMC) has prepared this response to the U.S. Nuclear Regulatory Commission's (NRC) review of HMC's May 10, 2019 Letter (ML19143A097) concerning the groundwater monitoring program for the San Andres-Glorieta (SAG) aquifer in the area of former well 943. The NRC's review resulted in recommendations for additional testing to be performed to further evaluate the potential source(s) of contamination to the SAG aquifer (see NRC's January 23, 2020 Letter - ML20016A371). HMC has developed the following responses to NRC's review and recommendations.

Thank you very much for your time and attention, if you have any questions regarding the following information and discussion, I can be reached at 505-238-9701.

Respectfully,

David W. Pierce

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Closure Manager
HOMESTAKE MINING COMPANY OF CALIFORNIA

cc: M. Purcell, EPA, Dallas, Texas (electronic copy)
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Preface

Any leakage of higher uranium concentration water to the San Andres-Glorieta (SAG) aquifer in well 943 ceased with the abandonment of this well in July of 2018. HMC's previous analysis demonstrated that the impacts to the SAG aquifer were small and likely not presently detectable. The following presents HMC's additional information on the potential aquifer source of the 943 leakage. The request from the NRC is shown in italics, followed by HMC's response.

NRC Request for Additional Information – additional information on leakage source

The NRC staff, in coordination with the Agencies, requests additional information regarding the source of the contamination observed at well 943.

If additional information is available to support the hypothesis that the contamination observed at well 943 was due to leakage from the overlying aquifers, that information should be provided.

HMC Response

Existing uranium concentrations in the alluvial aquifer in 2018 near well 943 are much lower than the concentration that would have needed to be present in the leakage at well 943 in order to produce the elevated uranium concentrations in the area of the well prior to its abandonment. An analysis of the combination of leakage rate and uranium concentration in the leakage necessary to produce the impacts to the San Andres aquifer was included in the May 10, 2019 responses to the NRCs request for information, and the alluvial aquifer did not have high enough uranium concentrations or a high enough potential leakage rate to produce the observed impacts at the former well 943 location. The uranium concentrations in the alluvial aquifer near the former well 943 area are well defined and have been for many years. Historically, the alluvial aquifer in 1976 contained large uranium concentrations in western Broadview Acres but the fresh water injection that started in 1977 on the north side of Broadview Acres pushed these concentrations mainly to the south rather than to the west toward the well 943 location. Monitoring of the alluvial aquifer in the well 943 area after the start of the Broadview injection does not show any increase in COC concentrations. As previously stated, the alluvial aquifer does not have the transmitting capacity to yield the quantity of water or high enough uranium concentrations in the area of well 943 to cause this impact. Therefore, the alluvial aquifer is not considered a potential source for the well 943 leakage. The Upper Chinle aquifer does not extend to the former well 943 area and therefore is also not a potential source for the leakage into well 943 from an overlying aquifer.

The Lower Chinle aquifer exists in the well 943 area and therefore is also a potential source for the leakage into well 943 from an overlying aquifer. Recently measured uranium concentrations in the Lower Chinle aquifer wells south of well 943 in the northern portion of Section 3 are lower than the uranium concentration that had to exist in the leaking aquifer. Uranium concentrations greater than one mg/L existed in the Lower Chinle aquifer in the subcrop area in central Section 3 but these concentrations would have had to migrate 4000 feet in the Lower Chinle aquifer to reach the well 943 area. Therefore, it is not likely that the Lower Chinle aquifer was the source of the uranium concentrations in the well 943 leakage.

HMC agrees that recently measured concentrations in the Middle Chinle aquifer wells nearest to the former well 943 location are lower than the uranium concentration that had to exist in the leaking aquifer. However, there is still the potential for higher Middle Chinle aquifer COC concentrations to have been present in the immediate area of well 943 prior to and during the testing of the well. Higher

concentrations existed in Middle Chinle wells Y7, Y13 and CW45 in the southern portion of Felice Acres in 2018 and in Middle Chinle well 546R closer to the 943 location. These elevated uranium concentrations are from inflow of alluvial water into the Middle Chinle aquifer in the subcrop area in South Felice Acres and northeast Section 3. The continuity in the Middle Chinle aquifer between these higher concentrations and the Middle Chinle aquifer near well 943 is not defined but historical concentrations in South Felice Acres were higher than one mg/L.

The higher uranium concentrations in the Middle Chinle aquifer in northern Felice Acres is a likely source for the higher uranium concentrations in the overlying aquifer at well 943. Higher uranium concentrations existed in the early 1980's in northern Felice Acres in Middle Chinle wells 482 and 483. Figure 1 shows the 1982 uranium pattern for the Middle Chinle aquifer with the addition of the wells 482 and 483 labels and the location of former well 943. The 1982 uranium concentrations of 3.1 and 3.6 mg/L for wells 482 and 483 respectively and a pattern showing that these concentrations are above one mg/L were added to this figure. If the leakage into well 943 was causing a continual drain of 50 gpm from the Middle Chinle aquifer, this could have caused these concentrations to migrate in the Middle Chinle to the west toward well 943. As previously stated, the higher heads in the overlying aquifer would have controlled the leakage rate and the pumping of well 943 would not have appreciably changed the leakage rate.

In conclusion, the alluvial and Upper Chinle aquifers are not potential sources for the leakage that caused the impacts in well 943. The Lower Chinle is not likely the source of the past overlying leakage into well 943 due to the large distance that the impacted Lower Chinle aquifer water would have to migrate. HMC has concluded that the Middle Chinle aquifer is likely the source of the former well 943 leakage and that the higher concentrations from the northern portion of Felice Acres probably caused the elevated uranium concentrations in the Middle Chinle near well 943.

NRC Request for Additional Information – cause of alluvial water level declines

If additional information is not available, then additional information is needed to understand the source of contamination, including:

1. *Provide clarification as to the cause of the well drawdown observed in wells 555, 556, 844, and 845 as well as the wells located in the 100-Acre Center Pivot area (i.e., wells 881, 882, 884, 886, 893). In the 2018 Annual Monitoring Report, HMC did not discuss the decreases observed in these wells during the February 6, 2018, well sampling event. If the observed delayed well drawdown in could be related to the 943 well pump test, HMC should investigate and report on the potential pathway(s) from the Alluvial Aquifer to the SAG Aquifer during the pump test.*

HMC Response

The drawdown as referenced in the RAI is likely erroneous and is artifact of either faulty equipment or technician error. Additional information on the source of the leakage is presented in the preceding response and this response discusses the cause of the alluvial water level declines. Figure 2 presents Figure 5-4 from the 943 pump test report with the addition of manual water levels (green circles) collected during sampling of this well. This data shows that the static water level measured on 1/11/2018 fits the consistent transducer water levels prior to the brief drop in water levels during sampling, while the static water level on 1/29/2018 does not fit the data. This manual water level (green circle) indicates a water level drop or drawdown in alluvial well 845 that conflicts with the transducer

and other manual water levels (red circles) taken before, during and after the sampling on 1/29/2018. For clarification, the transducer data (blue dots) during sampling of the observation wells show a vertical stringing of the water level data on the graphs indicating the rapid drawdown during pumping for sample followed by a quick recovery to near the static water level. The water level measured prior to sampling on 2/6/2018 also indicates a dramatic water level drop from the final measurements taken during the pump test or approximately five feet of apparent drawdown occurring more than 11 days after pumping of well 943 ended. The static water levels measured during sampling events for Middle Chinle well CW76 (Figure 3), Lower Chinle well V1 (Figure 4) and San Andres well 943M (Figure 5) are also significantly lower than the corresponding transducer and pump test manual water level measurements. It should be noted that the water level monitoring during the pump test was performed by professional contractor staff and senior HMC personnel while the observation well water sampling was performed by HMC's technical staff. The consistency of the transducer data (blue dots) and the manual water levels (red circles) collected during the test reflects the careful and consistent use of the same water level measurement equipment throughout the test. In contrast, water level measurement equipment used during sampling (green circles) may have differed during the multiple sampling events depending on the assigned technical staff. Therefore, the significantly lower sampling water level measurements are very likely errors and are not a correct representation of water levels in these wells. These erroneous water levels were likely caused by use of a malfunctioning or improperly repaired or corrected water level measurement instrument during specific sampling events or cycles.

Alluvial water levels in the well 943 area were also monitored with a transducer in alluvial wells 844 and 556 (see Figures 6 and 7) and the static water levels measured during sampling events on 2/6/2018 also indicate apparent drawdown in these areas of the alluvial aquifer. These sampling water level data indicate roughly five feet of apparent drawdown occurring in the alluvial aquifer out to a distance of 1800 feet from well 943 approximately 11 days after pumping of well 943 ended. A simple calculation of aquifer storage reveals that this amount of water level drop over a circle with a radius of 1800 feet and a specific yield of 0.2 would yield roughly 28 times the amount of water that was pumped during the 943 pump test. Also, these indicated drawdowns in the alluvial aquifer are greater than the drawdown observed in pumping well 943. Static water levels measured during February 2018 sampling events in the 100-Acre Center Pivot area wells were also lower by a similar amount, and these wells are located more than a mile from the former well 943 location. All of these lower water levels are thought to be an error in the water level measurements associated with specific sampling cycles and were likely taken with a specific water level measurement instrument. The circumstances of the water level measurements in question indicate they are not plausibly delayed drawdown from the 943 pumping, and it was a coincidence that the erroneous measurements occurred shortly after the well 943 pump test. It should also be noted that the water levels in the affected wells returned to the range of normal static water level for subsequent measurements, further buttressing the interpretation that the measurements were erroneous.

NRC Request for Additional Information – potential sources

If additional information is not available, then additional information is needed to understand the source of contamination, including:

2. *As discussed above, uncertainty exists as to potential sources for the uranium contamination found in well 943. Please provide an analysis and map identifying zones within aquifers stratigraphically above the*

SAG that contain uranium concentrations high enough to result in the uranium contamination observed in the SAG Aquifer at well 943 during the pump test (i.e., uranium concentrations greater than or equal to 0.12 mg/L).

HMC Response

Additional information on the source of the leakage is discussed in a preceding HMC response.

NRC Request for Additional Information – conduct a 943M multi-well pump test

If additional information is not available, then additional information is needed to understand the source of contamination, including:

Additionally, HMC could conduct a pump test on well 943M to verify that contamination in the SAG Aquifer is not occurring in the vicinity or near-upgradient from well 943M, provided that the pump test water does not adversely impact ongoing restoration activities. This could include measurement of water elevations in the Alluvial Aquifer near well 943M and the Alluvial wells listed above during the pump test. If the pump test is conducted, the period of measurement of water elevations should be of sufficient time to detect well drawdown that is potentially delayed for a period of time after cessation of pumping, as described above.

HMC Response

HMC does not expect an additional multi-well pump test by pumping well 943M to produce useful information and testing is not warranted. The abandonment of well 943 has eliminated the known leakage in the vicinity of well 943M. Without a local leakage source, there is no potential for producing a measurable water-level response in the overlying aquifers to pumping of well 943M. There are also numerous stresses imposed on the SAG Aquifer by HMC and other users so it is also unlikely that pumping of well 943M could produce a hydraulic response in nearby SAG wells that was distinguishable from water level changes resulting from other pumping stresses. In summary, there is very little potential for inducing measurable drawdown in the overlying aquifers or in the SAG aquifer at nearby wells by pumping of well 943M.

NRC Request for Additional Information – additional SAG monitoring

If additional information is not available, then additional information is needed to understand the source of contamination, including:

The NRC staff, in coordination with the Agencies, agrees with the monitoring proposed by HMC in Table 1 of its July 26, 2018, letter. The NRC staff notes that monitoring for Deep #1R and Deep #2R, 943M, and 951R were recently approved on November 12, 2019, as part of HMC groundwater monitoring plan in material license SUA-1471, Condition 35A.10 HMC indicated that SAG wells 806R, 822, 949, 955, 986, 991 are not owned by HMC. However, these wells should be monitored for the constituents and at the frequency proposed by HMC, provided HMC can get access for sampling these wells.

HMC Response

HMC has obtained a sampling agreement in non-HMC SAG wells 806R and 991. HMC will attempt to obtain sampling agreements for SAG wells 822, 949, 955, 986 and 987. If an agreement is made with the owners of the wells, these wells will be sampled twice each year.

NRC Request for Additional Information – evaluate well integrity

If additional information is not available, then additional information is needed to understand the source of contamination, including:

To the extent practicable, HMC should evaluate well integrity for SAG wells that have not previously been tested.

HMC Response

The most practicable and most effective well integrity test on a non-HMC SAG well is the collection and analysis of numerous water samples during a sampling event with a high frequency of sampling immediately after pump start. This evaluation should define if an overlying aquifer is leaking water into a SAG well. This approach should be effective in evaluating the integrity of a SAG well due to the head in an overlying aquifer being greater than the head in the SAG aquifer and therefore leakage from the overlying aquifer will displace the SAG water in the casing when the well is not being pumped. With an appropriate sampling frequency for a multiple sample pump test of a SAG well with leakage into the casing from an overlying aquifer, the water quality will change from that of the leaking aquifer to that of a proportionate mixture of the leaking aquifer and SAG aquifer waters over the course of several casing volumes of pumping. A proposed multiple sample pump test procedure is described in the attached memorandum. This proposed procedure can be adapted to allow testing of SAG wells under a variety of pumping and discharge conditions.

The multiple sample pump test is expected to be a more direct indicator of potential leakage in a SAG well than well logging or video techniques. Unless there is relatively severe casing damage or failure with obvious leakage through the casing, the logging and video techniques can only be used to interpret of the condition of the well rather than as a direct indicator of leakage. The multiple sample pump test also has a significant advantage in that it can be performed on a well with an operational pump without the need for additional equipment or modification of the existing well configuration. This advantage is particularly important for non-HMC wells where obtaining an agreement to perform a multiple sample pump test is more likely than obtaining an agreement to perform more intrusive, disruptive and potentially damaging testing procedures. HMC proposes to conduct this multiple sample pump test and potential leakage evaluation during a sampling event for SAG wells 806R, 822, 949, 955, 986, 987 and 991, if a sampling agreement is obtained for these non-HMC SAG wells.

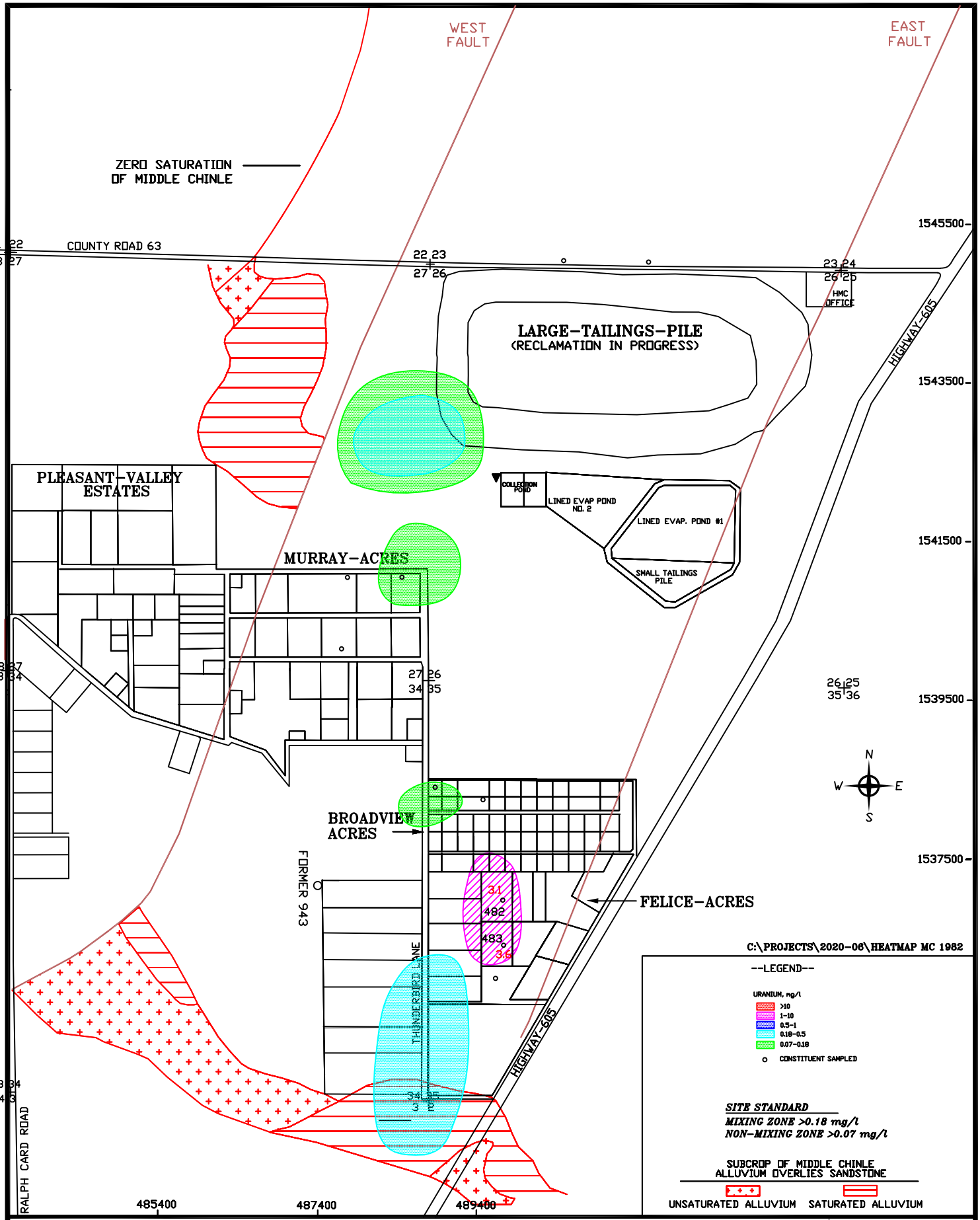

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FIGURE 1. MIDDLE CHINLE URANIUM CONCENTRATIONS 1982

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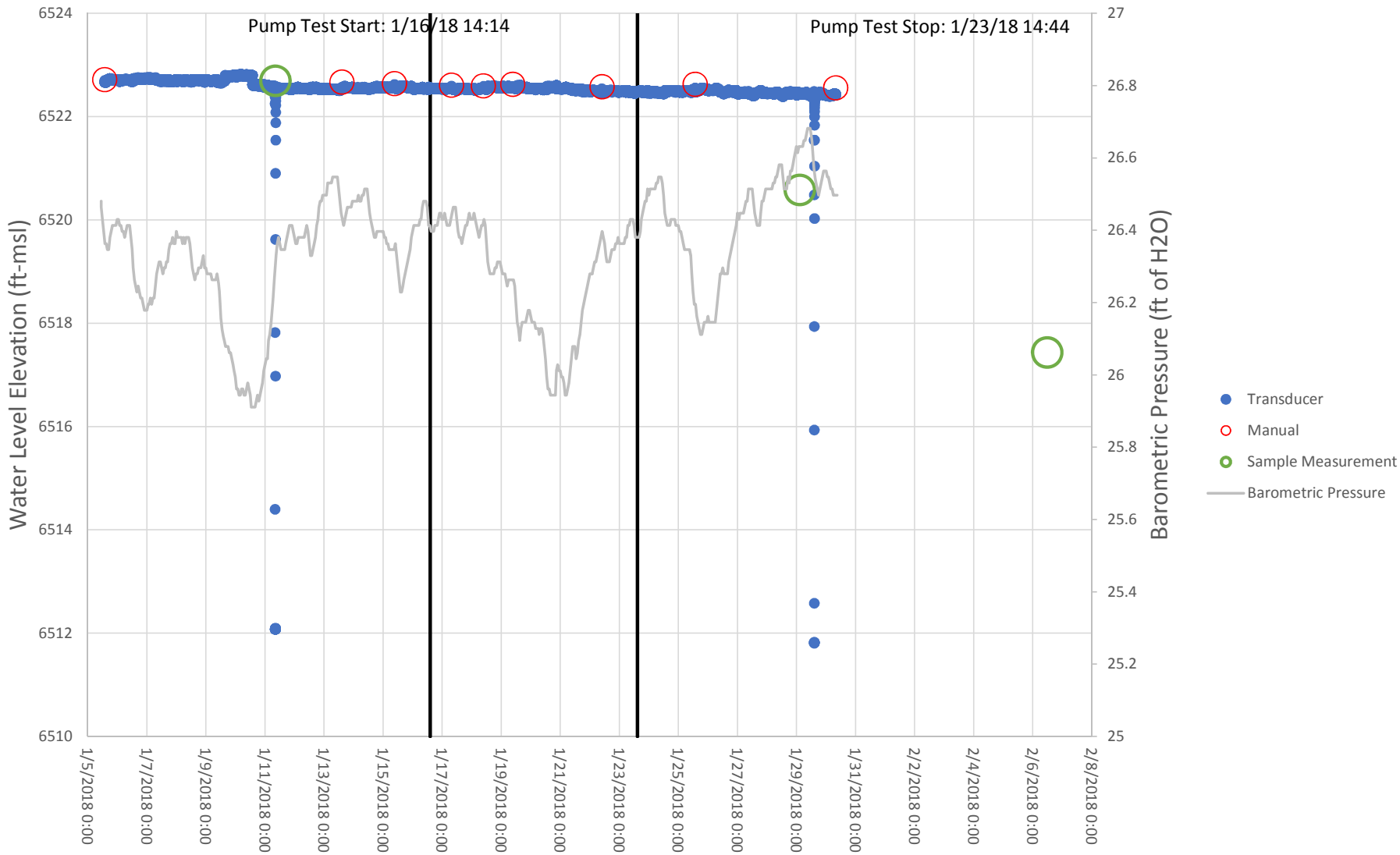

Figure 2. Water Level Elevation Versus Time for Observation Well 845

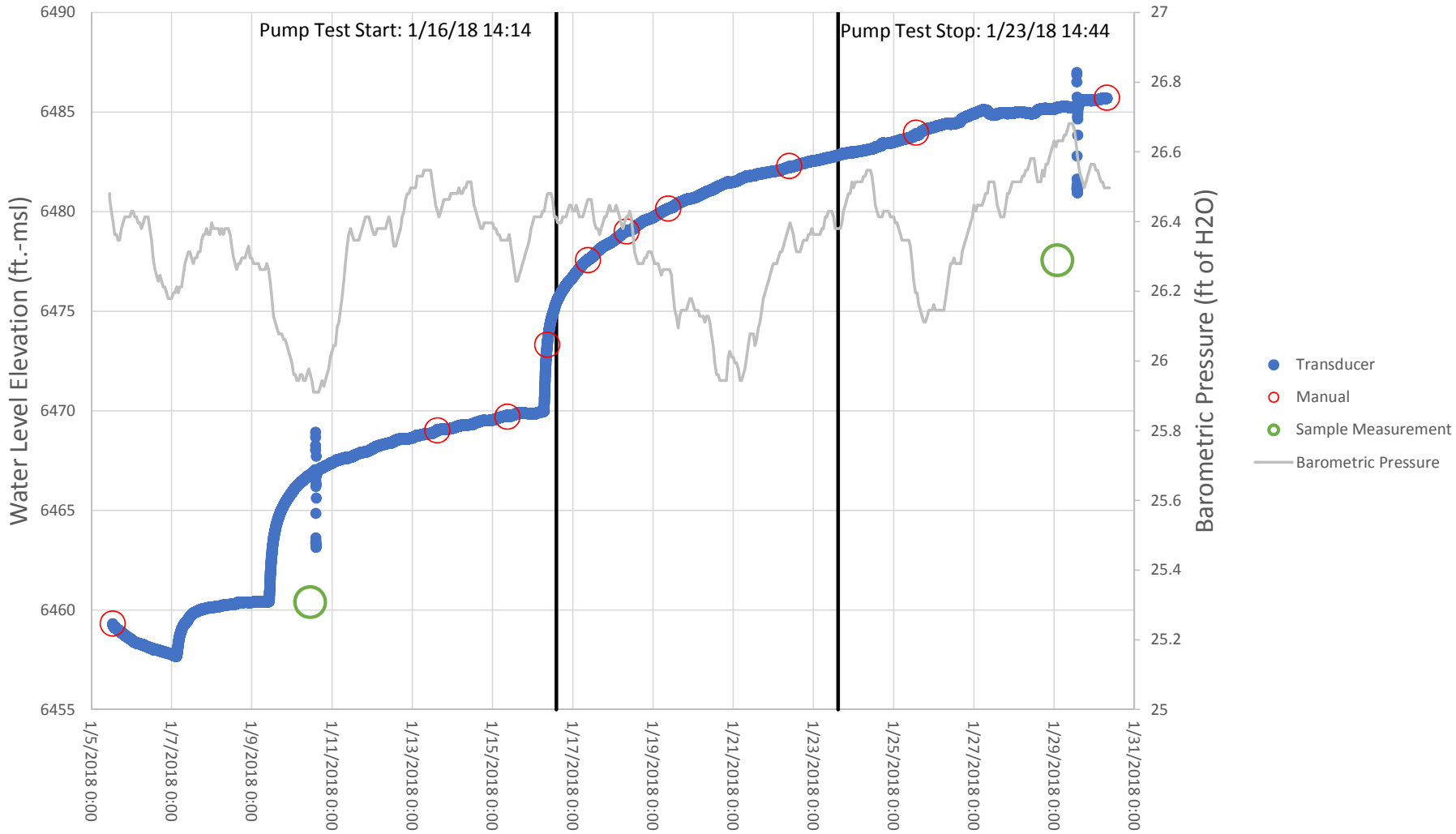

Figure 3. Water Level Elevation Versus Time for Observation Well CW76

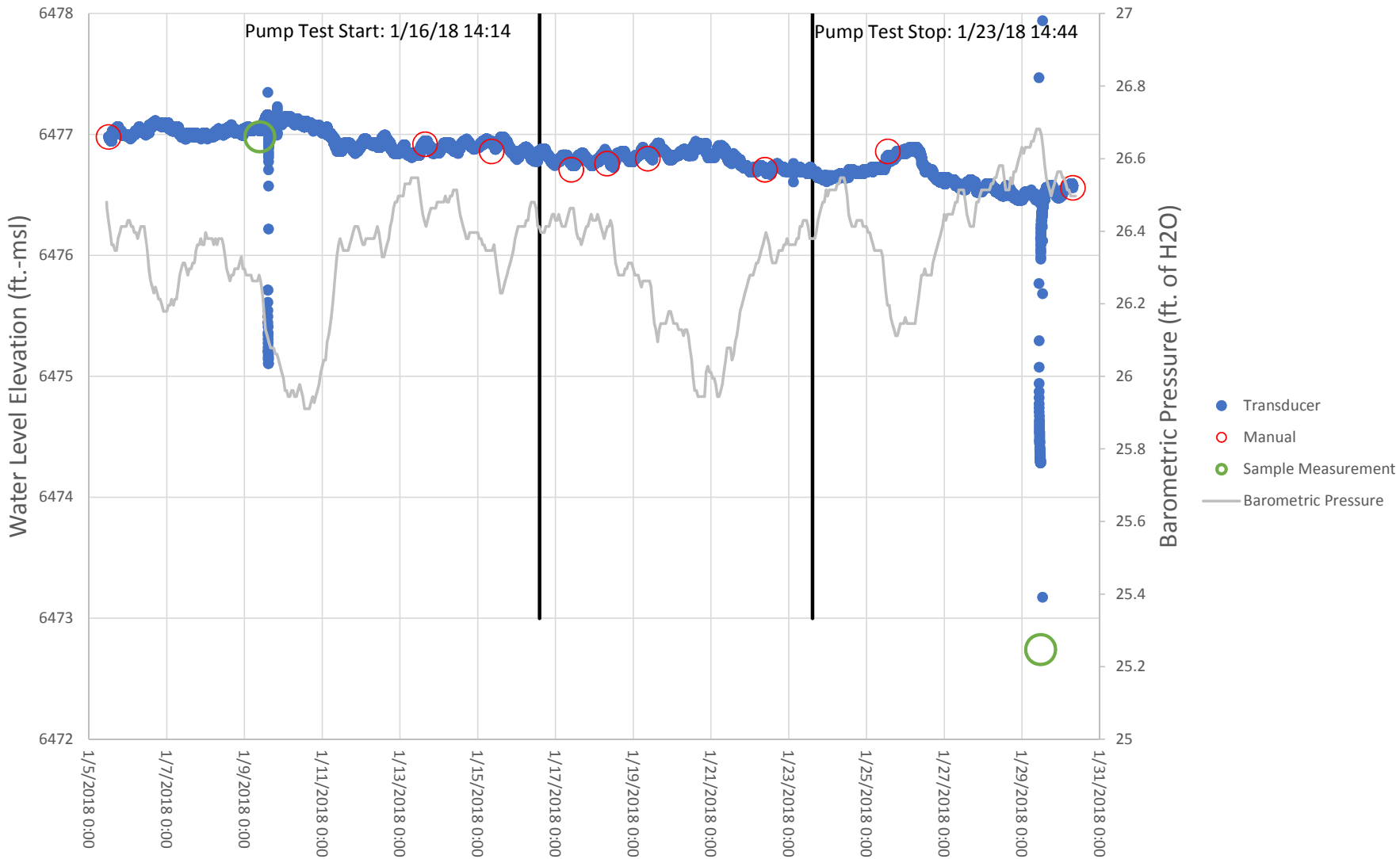

Figure 4. Water Level Elevation Versus Time for Observation Well V1

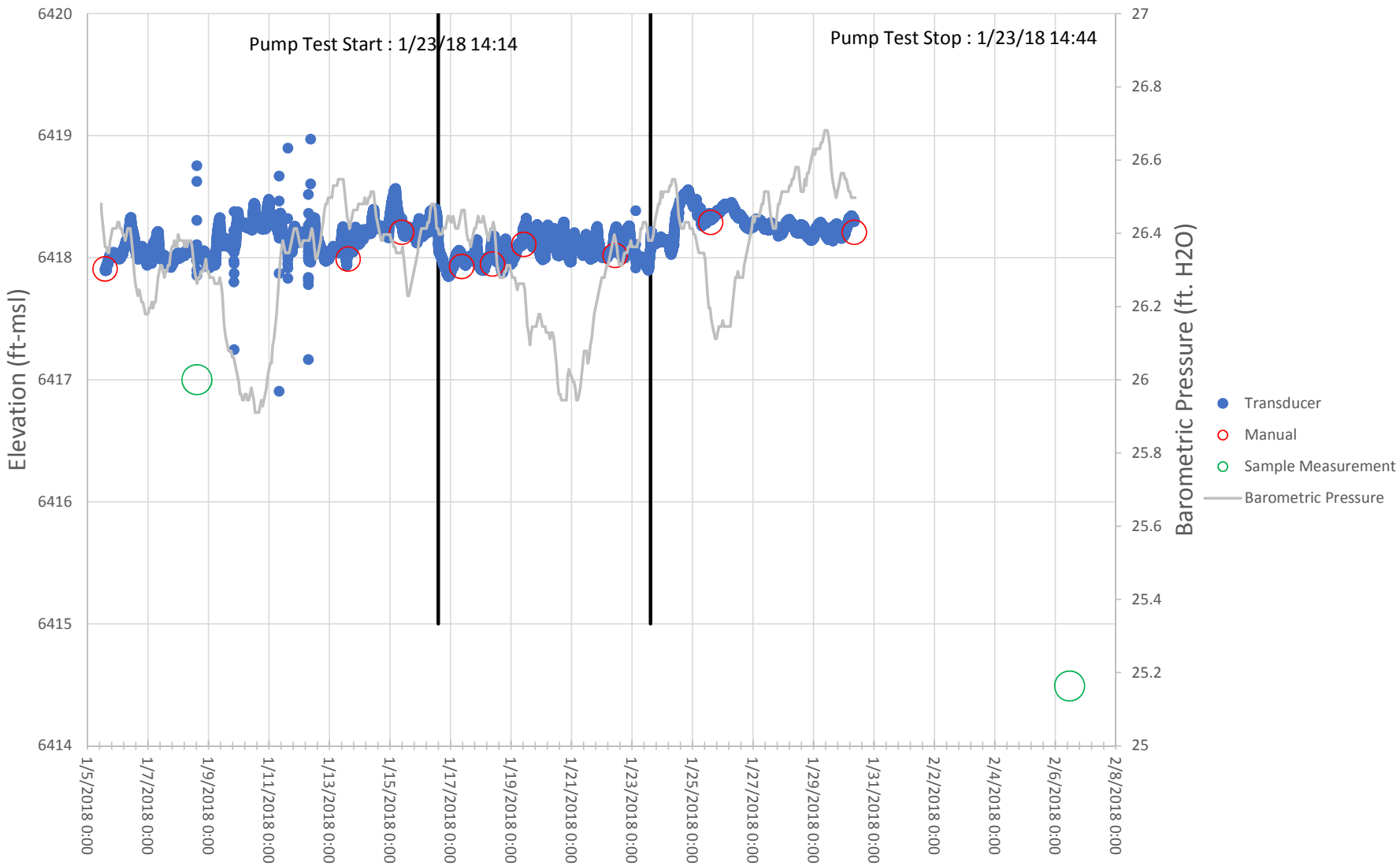

Figure 5. Water Level Elevation Versus Time for Observation Well 943M

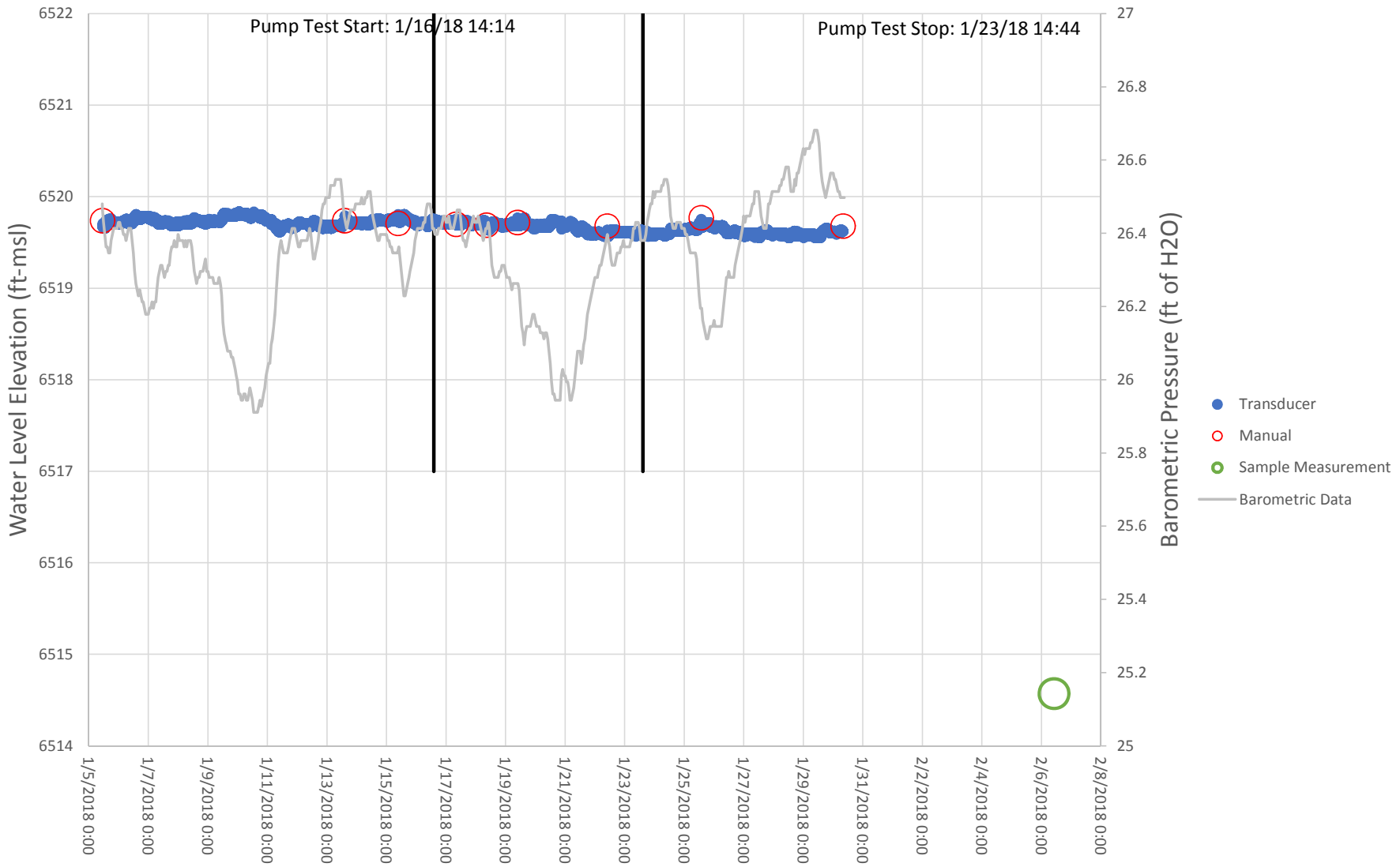

Figure 6. Water Level Elevation Versus Time for Observation Well 844

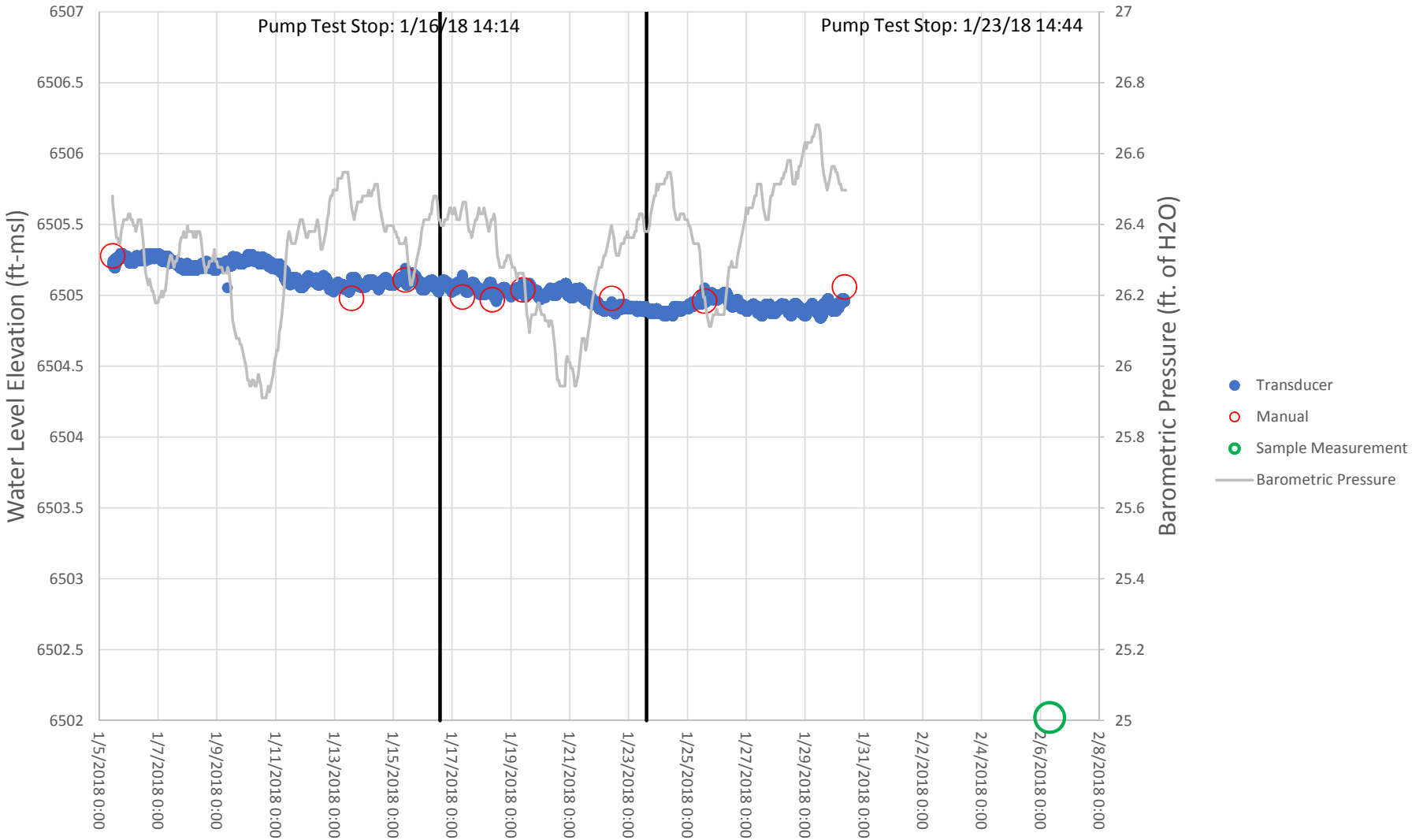

FIgure 7. Water Level Elevation Versus Time for Alluvial Observation Well 556