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April 16, 2021

Honorable Robert G. Torricelli
Office of the Special Master
RGTspecialmaster@aol.com

Subject: 2020 Integrated Groundwater Monitoring Report (IGWMR)
Study Area 5, 6 & 7

Dear Senator Torricelli:

We are submitting on behalf of Honeywell the 2020 Integrated Groundwater Monitoring Report (IGWMR) for Study Areas 5, 6 & 7 prepared by our groundwater consultant, Cornerstone. Please note that this report includes all applicable conforming edits which plaintiffs provided on the 2019 version of the report.

Please contact the undersigned at 973-896-9366 should you have any questions or comments on this submittal.

Sincerely,

Wood Environment & Infrastructure Solutions, Inc.
sent on behalf of Honeywell

William Hague
Principal Consultant

Enclosures:

2020 Integrated Groundwater Monitoring Report (IGWMR)
Study Area 5, 6 & 7

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INTEGRATED ANNUAL GROUNDWATER PERFORMANCE REPORT FOR 2020

STUDY AREAS 5, 6, AND 7 JERSEY CITY, NEW JERSEY

Prepared for

HONEYWELL
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April 2021

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1 INTRODUCTION

1.1 General

The Long Term Monitoring Plan (LTMP) for the Study Area 7 (SA-7) deep overburden and bedrock groundwater remedy was originally developed in 2008 to monitor groundwater conditions relative to the Groundwater Extraction and Treatment (GWET) system. Annual progress reports have been prepared in accordance with this plan since the startup of the GWET system in December 2008 and thus this document represents the twelfth such annual performance report. In 2011, the GWET LTMP was expanded to integrate groundwater monitoring requirements for Study Areas 5, 6 and 7 (Project Area). Sampling and analysis within this integrated plan were performed consistent with the requirements set forth in the *Integrated Groundwater Sampling and Analysis Plan* (SAP) *for Study Areas 5, 6 and 7* revised September 17, 2020.

Groundwater monitoring in the Project Area is also governed by Remedial Action (RA) Permits issued by the NJDEP in 2018 for the shallow, deep overburden, and bedrock groundwater zones, and site-specific LTMPs applicable to SA-5 and SA-6 sites. RA Groundwater Permits are discussed further in Section 6.2. Site-specific LTMPs include:

- LTMP for SA-5 New Jersey City University (NJCU) (Sites 090 and 184) November 2016, updated May 2019 and Shallow Groundwater Monitoring and Extraction System Operation Plan (Appendix L of the LMTP)
- Draft LTMP for SA-5 Shallow Groundwater, June 2018; review in progress
- LTMP for SA-6 North and SA-6 South; revised December 2020.

1.2 Purpose and Objectives

The purpose of this document is to provide an integrated annual reporting format that characterizes regional groundwater conditions and documents compliance with area-specific remedial objectives. The specific objectives of this approach are to:

- Improve consistency and efficiency in field procedures including sample collection and scheduling.
- Provide a central database for monitoring well specifications and status.
- Compile groundwater data in one annual report.
- Provide regional groundwater flow interpretations that consider the impact of features such as subsurface barrier walls, drains, caps, and drawdown from pumping.

- Provide localized groundwater flow maps consistent with the regional contour maps.

1.3 Status of Integrated Monitoring Requirements for 2020

The two primary elements of groundwater monitoring within the Project Area are water level measurements and water quality sampling and analysis. Groundwater level monitoring is conducted in available monitoring wells and piezometers to fulfill various reporting requirements as shown on **Table 1-1**. Groundwater quality sampling is conducted in a subset of wells at various times in accordance with the requirements of the various monitoring plans. The status of groundwater sample collection for laboratory analysis in 2020 is shown on **Table 1-2**.

1.4 Document Organization

In accordance with the SAP, this report is organized in terms of its three primary elements: groundwater extraction (Section 3), groundwater elevations and flow direction (Section 4), and groundwater quality (Section 5). These sections are prefaced by a discussion of overall site conditions and events during the reporting period (Section 2). Conclusions and recommendations for modifications to the GWET LTMP are provided in Section 6.

2 GENERAL CONDITIONS

The GWET system was operated at its design rate throughout the year. Long term monitoring of the SA-6 Chromium Remedy continued at SA-6 South and SA-6 North in 2020. Groundwater pumping of the contingent groundwater extraction systems (CGWES) was conducted on an as-needed basis consistent with the requirements of the LTMP in the SA-6 North and South Open Space Areas. At NJCU, the contingent groundwater pumping system was operated throughout 2020.

2.1 Annual Precipitation

Monthly precipitation data recorded at Newark Airport, approximately 2.5 miles southwest of SA-7 are provided in **Table 2-1** and shown on **Figure 2-1**. Precipitation was approximately 6.5 inches below the 30-year average for the first half of 2020 and approximately 7.5 inches above the 30-year average for the second half. Total precipitation in 2020 was 47.19 inches or 0.94 inches above the annual average of 46.25 inches.

2.2 Tidal Monitoring

Tidal fluctuations in the Hackensack River were monitored relative to the NGVD-1929 vertical datum. This datum is used for all reported groundwater elevation data in this report. The datalogger is programmed to record river stage at 6-minute intervals. These data are used to correct groundwater levels for tidal impacts based on tidal lag and efficiency values previously determined for monitoring wells screened in the Intermediate, Deep, and Bedrock Zones. With the exception of wells installed directly adjacent to the Hackensack River, there are no tidal influences in the Shallow Zone monitoring wells. Wells containing dataloggers will not have the data tidally corrected. The mean tidal elevation is approximately +1.2 feet above mean sea level (msl) in the NGVD-1929 vertical datum.

2.3 Monitoring Well Inventory

A list of the groundwater monitoring wells in service within the Project Area during 2020 is provided in **Table 2-2**. The wells are organized by hydrogeologic zone and provide information regarding their location, total depth, screen interval, and reference point elevation. Two piezometers were abandoned in 2020 as a result of work for the SA-6 South Deferred Area Remedy. Piezometers 124-MW-19 and 124-MW-20 were abandoned on June 19 and July 24, respectively and replaced as 124-PZ-19R and 124-PZ-20R on December 15 and November 19, 2020 respectively.

Four temporary depressurization wells (DP-1 through DP-4) and four temporary observation wells (OW-1 through OW-4) were also installed for the SA-6 South Bulkhead

Deferred Area Chromium Remedy. These wells were installed with 10-foot-long screens in the Intermediate Zone below the Meadow Mat and were used for approximately 2.5 months between August 31 and November 13, 2020 as noted in Sections 3.5 and 4.8. All of these depressurization and observation wells were abandoned during site restoration of the SA-6 South Bulkhead Deferred Area project area.

3 GROUNDWATER EXTRACTION

3.1 GWET System Operation

The Deep Overburden Groundwater Extraction and Treatment (GWET) system was in operation throughout 2020 except for shutdowns discussed further below. The GWET system consists of three extraction wells pumping at a combined rate of 54.5 gallons per minute (gpm) with discharge via independent force mains to the wastewater treatment plant located on SA-6 North. Wells 087-PW-1 and 087-PW-3 are located on the Difeo property to the north of SA-6 North and are screened in the Deep and Intermediate Zones, respectively. Well 115-MW-215BR is located on the northwest side of Site 115 (SA-7) and pumps from the upper Bedrock zone. In December 2015, extraction well 087-PW-3 replaced well 087-PW-2. PW-3 is located approximately 120 feet east of PW-2 and is screened from 30 to 50 feet deep.

3.1.1 Pumping Rates

Flow rate monitoring was conducted on each of the three force mains using flow meters located within the treatment plant. The flow rates are controlled by a manually-operated valve and adjusted as necessary to maintain design rates of 40 gpm for PW-1, 7.5 gpm for PW-3 and 7 gpm for the bedrock extraction well 115-MW-215BR. The total system rate of 54.5 gpm was maintained throughout the period with the exception of occasional downtime for O&M activities. **Table 3-1** and **Figure 3-1** identify the events that resulted in a shutdown of more than 8 hours. The system was shut down for 10 days in October for rehabilitation of the continuous precipitation system. Shutdowns also occurred in the fourth quarter for pump replacement and acid wash line cleaning.

3.1.2 Force Main Acid Flushing

Force main cleanings for the GWET system occurred on December 8, 2020 for all 3 wells.

3.1.3 Well Redevelopment

GWET extraction well redevelopment activities were not required in 2020.

3.2 SA-6 North Contingent Groundwater Pumping System

The SA-6 North contingent groundwater pumping system design consists of a horizontal perforated drain located close to the centerline of the soil containment area. The drain consists of two sections extending from near Route 440 to the western barrier wall. In 2020, the western portion of the contingent system was pumped from April 21 through May 1, May 4 to May 8, and December 10 to December 21. The eastern portion was

operated more routinely throughout the year during the following periods: January 20 to March 21, May 11 to June 4, June 10 to July 10, August 19 to October 11, December 2 to 7, and December 23 through the end of the year. **Figure 3-2** compares the average daily flow rate of the contingent pumping system to interior groundwater levels at SA-6 North. During active pumping, the average pumping rate for the eastern pumping system was approximately 3 gpm. During the pumping cycles that took place in 2020, heads within the soil containment cell declined approximately 0.5 to 1 foot, which is a typical response to pumping.

3.3 SA-6 South Contingent Groundwater Pumping System

The SA-6 South contingent groundwater pumping system consists of a single horizontal perforated drain located close to the centerline of the soil containment area, which extends from near Route 440 to the western barrier wall in a continuous length. Two pumping cycles were conducted during 2020. These were from June 5 to October 10 and October 21 to November 24 to lower heads within the containment area. **Figure 3-3** compares the pumping rate of the contingent drain to interior groundwater levels at SA-6 South. An average pumping rate of 2.5 gpm throughout the year was observed during the two pumping periods. An average pumping rate around 4.25 gpm in June and July resulted in a rapid decline of groundwater levels, especially within the western piezometers and to a lesser extent within the eastern piezometers. After the cessation of pumping, heads within the soil containment cell rose to an average elevation of approximately 3.0 feet msl.

3.4 SA-5 NJCU Contingent Groundwater Pumping System

The contingent groundwater pumping system at the NJCU site was operated continuously throughout 2020 with the exception of October 30 to November 4 when the system was off due to damage to a PVC coupling on the effluent line. All pumping was conducted using extraction Sump B only; Sump A was not operated in 2020. The Sump B pump cycles on and off based on a water level probe set to an elevation of approximately 4.5 feet msl just below the drain line. When pumping, the discharge rate of the pump is 5 gpm; however, the average steady-state, long-term net yield of the drain was 0.25 gpm in 2020.

3.5 SA-6 South Bulkhead Deferred Area Dewatering & Depressurization Pumping

Soil excavations were conducted on the western end of SA-6 South in 2020 as part of the SA-6 South Bulkhead Deferred Area Remedy. This work included the installation of a new permanent sheetpile bulkhead along the Hackensack River to elevation -50 feet msl, a new structural sheet pile wall inboard of the existing SA-6 South western hydraulic barrier to elevation -47 feet msl, and an east-west cross wall on the south side of the excavation to elevation -35-feet msl. Due to the proposed removal of approximately 5,200 cubic yards of chromium impacted soil to the top of the Meadow Mat (elevation -10 feet msl) in the northern locations, four temporary pumping wells (DP-1 though DP-4) were installed below the Meadow Mat and pumped to depressurize the underlying head. Four

observation wells (OW-1 through OW-4) were also installed to monitor the drawdown during depressurization as shown on **Figure 3-4**. Localized temporary sumps and trash pumps were used to dewater the shallow soils above the Meadow Mat.

Depressurization pumping began on August 31, 2020 with the goal of lowering heads to an elevation of -12 feet msl on the northern end where the excavation is the deepest and to somewhat higher heads in the southern portions where the excavation is shallower. The target heads were achieved over the next several weeks with each well pumping approximately 3 to 6 gpm. Depressurization pumping continued until November 13, 2020 with over 1 million gallons of water removed and treated from below the Meadow Mat during this operation. In addition, localized temporary sumps and trash pumps were used in the excavation to dewater the soil above the Meadow Mat and remove any stormwater. The combined volume of water collected and treated from the depressurization wells and the sumps was approximately 1,650,000 gallons.

4 HYDRAULIC MONITORING

Hydraulic monitoring in 2020 consisted of four quarterly rounds of groundwater elevation measurements in available wells in March, June, September, and December. The measured depth to groundwater was subtracted from the reference point elevation to determine the elevation of the groundwater surface. For those wells that are tidally influenced, the measured values were adjusted using a time-series method developed by the U.S. Geological Survey (Halford, 2006). The results for the four quarterly rounds are provided in **Table 4-1**. Groundwater elevations from the September 2020 round are plotted for the Shallow, Intermediate, Deep, and Bedrock Zones on **Figures 4-1 through 4-4** respectively, and on **Figure 4-5** in cross section. Groundwater elevation data are reported in units of feet of water relative to mean sea level in the NGVD-29 vertical datum.

4.1 Regional Groundwater Flow

4.1.1 Shallow Zone

Due to the close spacing of monitoring wells and piezometers screened in the Shallow Zone, well location IDs are shown separately on **Figure 4-1A** to improve the readability of the groundwater elevations and contours provided on **Figure 4-1B**. Groundwater elevations in the Shallow Zone range from approximately 12 feet msl on Site 154 to less than 3 feet msl near the Hackensack River. As a point of reference, the river has a mean tide elevation of approximately +1.2 feet msl relative to the NGVD-29 datum. As shown on **Figure 4-1B**, shallow groundwater flow is generally from east to west across the region but is locally impacted by subsurface features such as the barrier walls installed at SA-5, SA-6, and SA-7, and deep sewer lines that run beneath JCMUA and Route 440.

A telemetry system was installed in the piezometers along the barrier walls of SA-6 North, SA-6 South, and the four monitoring wells within SA-7 in late January 2019. The telemetry units are connected to dataloggers that record the water level within each well at 6-hour intervals to aid in the determination of head gradients across the barrier walls as further discussed in Sections 4.5 and 4.6.

At the NJCU site in Study Area 5, groundwater flow is generally from east to west; however, the north-south oriented barrier walls, including the barrier wall extension installed in 2017, cause groundwater to be diverted to the north. The depression around the active groundwater extraction Sump B is also evident and further discussed in Section 4.3.

4.1.2 Intermediate Zone

Groundwater elevations in the Intermediate Zone are shown on **Figure 4-2** and range from over 5 feet msl in SA-5 to less than mean sea level near the GWET pumping wells.

Groundwater is diverted around the SA-7 barrier wall but is not impacted by near-surface features on SA-6 North to the same degree as in the Shallow Zone. Vertically, heads within the Intermediate Zone are generally one to three feet lower than in the Shallow Zone, which indicates a significant downward vertical gradient across Stratum D. **Figures 4-2 and 4-5** also illustrate that the combined groundwater depression in the vicinity of the GWET pumping wells fully encompasses the deep overburden plume and provides effective capture in the upper lacustrine soils.

4.1.3 Deep Zone

Groundwater elevations in the Deep Zone (**Figure 4-3**) are similar to those in the overlying Intermediate Zone, although the influence of the SA-7 barrier wall is not as prominent. As noted in prior reports, groundwater flow in the Deep Zone is, to a degree, able to move beneath the SA-7 barrier wall through gravel lenses in the underlying glacial till/ice contact deposits. At SA-5, the barrier wall does not extend down to the Deep Zone and thus does not influence flow. The area of influence of the GWET pumping wells on groundwater flow in the Deep Zone is also illustrated on **Figures 4-3 and 4-5**. The resulting combined groundwater depression in the vicinity of the GWET pumping wells fully encompasses the deep overburden plume and provides effective capture in this deeper flow zone.

4.1.4 Bedrock Zone

Groundwater elevation contours in the Upper Bedrock Zone are shown on **Figure 4-4.** The impact of the GWET pumping well 115-MW-215BR on groundwater flow is evident from the closely-spaced closed contours along the western border of SA-7. This area is characterized by the southwest-northeast trending high-permeability fracture zone which aids in the propagation of the capture zone parallel to the bulkhead as shown on **Figure 4-4**.

4.2 GWET System Capture Zone

Figure 4-5 illustrates that pumping from PW-1 and PW-3 created a combined zone of influence causing groundwater to flow both laterally and vertically into the capture zone of the wells. The drawdown associated with both wells during the startup of PW-3 was documented in Cornerstone's technical memorandum dated February 23, 2016. Based on these results and data provided in both plan view on **Figures 4-2 and 4-3** and in cross section on **Figure 4-5,** the combined groundwater depression in the vicinity of the GWET pumping wells fully encompasses the deep overburden plume and provides effective capture that meets its design objectives.

4.3 New Jersey City University

Quarterly groundwater elevation data for the NJCU property are compiled in **Table 4-2** and mapped on **Figures 4-6 through 4-9**. A barrier wall extension, connecting the open-ended wing-wall west of Building 5 and the Building 6 sheet pile wall, was constructed during May-June 2017. This wall completed the perimeter wall in the Shallow Zone

around the capped portion of the Commercial AOC. This was followed by the installation of four monitoring wells (MW-105 through MW-108) that, along with the four existing wells MW-101 through MW-104, provide four well pairs along the barrier wall extension. Data loggers were present throughout most of 2020 in the four well pairs (except as discussed below) as well as in Sumps A and B and wells 090-PZ-05 and 184-MW-05 to monitor groundwater elevation trends on a 3-hour interval. Due to construction and regrading activities for NJCU's Phase 2 roadway and infrastructure project, data loggers were removed from wells 184-MW-102, 103, 104, 106, 107, and 108 on November 6. Subsequently, manual readings were collected weekly from each of these 6 wells to determine hydraulic gradients. Hydrographs developed from these data were provided in the quarterly reports and indicate that groundwater elevations generally varied throughout the year in response to precipitation and that this response is often amplified in some locations due to ongoing construction.

For each piezometer equipped with an automatic datalogger, the arithmetic mean of the recorded values was calculated over a nominal one-month period and is plotted for 2020 in **Appendix B**. These averages were then used to determine if the head gradient across the barrier wall meets the performance criterion of an inward gradient of 0.1-foot or greater as defined in Appendix L of the LTMP. These comparisons are provided in **Table 4-4** and graphed for the year on **Figure 4-12**.

A review of the monthly average gradients indicates that outside heads at the MW-101/105 and MW-103/107 well pair met the 0.1-foot criterion during 6 of the 12 months. At the MW-104/108 well pair, average heads outside of the barrier wall were higher than those inside for 7 of the 12 months but met the 0.1-foot criterion in only 3 months.

At the MW-102/106 location, the head in the outside well MW-106 was consistently lower than that of MW-102 and thus indicated an outward gradient. As noted in previous reports, the screened interval in MW-106 is lower than that in MW-102 and thus is more representative of the lower regional heads beneath the level of the Meadow Mat. Well MW-106 is planned for replacement after the construction activities in the immediate area have been completed. The screened interval will be raised to a similar elevation as MW-102 to allow a direct comparison of heads across the wall.

As noted in previous correspondence and reports, the future roadway and utility corridor forms a temporary depression which will be regraded and paved as part of NJCU's Phase 2 roadway and infrastructure project, thereby improving stormwater drainage and reducing infiltration into the cap area. Honeywell expects that shallow groundwater levels will more accurately reflect the long-term impact of these changes after final grading and construction of the roadways is completed. It is premature to draw conclusions regarding shallow groundwater levels at this time; these levels should be evaluated after the grading/paving work is completed. For further details regarding groundwater levels, including monthly average head differences from logger data, refer to the quarterly reports.

Groundwater elevation maps are provided on **Figures 4-6 through 4-9** and indicate that groundwater flow is generally to the northwest as it moves onto Sites 90 and 184 from the east, but then turns north as it is forced around the barrier walls that block flow to the south and west. In addition, downward vertical gradients continue to be present as documented by the reported head in the deep zone well 090-MW-09, located between 184-MW-05 and Sump B in the Commercial AOC. These data suggest that groundwater bypasses the capped portion of the Commercial AOC and moves vertically downward into the underlying zones; a scenario that is supported by groundwater quality data from the sentinel wells as further discussed in Section 5.5.

4.4 Eastern SA-7 Perimeter Pools

The LTMP program includes monitoring of the hydraulic gradients across the soil-cement bentonite (SCB) barrier around the perimeter of SA-7. On May 4, 2017, Honeywell submitted to All Parties a "Study Area 7 (SA-7) Perimeter Pool Termination" letter to document Honeywell's intention to terminate the functional operation of the Perimeter Pools on SA-7 along the northern and southern edges of SA-7. Therefore, Honeywell is no longer operating the northern and southern perimeter pools but is still operating the eastern perimeter pool. This is accomplished through monitoring of the head in the eastern perimeter pools E-1 and E-2, and comparing these data to groundwater elevations in adjacent shallow piezometers E3-SO and E2-SO, respectively, located just outside of the SA-7 SCB. The location of the eastern pools, the design pool elevations, and water level trends are provided in **Appendix C**. Overall, the data indicate that water levels within the SA-7 eastern pools are greater than those outside of the SCB and thus outward gradients are occurring relative to the SA-7 SCB.

4.5 SA-6 North Containment Cell

Shallow groundwater elevations within the SA-6 North containment cell, as measured in September 2020, are illustrated on **Figure 4-1b** and include data from the ten piezometers installed around the perimeter of the soil containment cell and the six wells on the border of SA-7 and SA-6 North. At the time of the measurements, groundwater elevations within the cell ranged from approximately 3 to 4 feet above msl but varied during the year with pumping from the contingent drain system. Data from automatic loggers placed in each of the wells were used to construct the hydrographs provided in monthly data submittals and quarterly reports to assess the impact of precipitation events on heads in the short term. The logger data were also used to calculate monthly average heads for the longer-term assessment of hydraulic gradients across the barrier walls. The monthly average heads are provided on **Table 4-3** and plotted in **Appendix A** for the year. Head differences across the barrier walls for these well pairs are also provided in **Table 4-3** and plotted on **Figure 4-10**. Gradient determinations include the 5 piezometer pairs around the east, north, and west soil containment cell wall, and four well pairs that have been identified along the SA-7 SCB using wells 115-MW-502 and 115-MW-503.

A review of these data indicates that the performance standard requiring at least 0.1 foot of inward gradient, as defined by the SA-6 LTMP, was met at all but three well pairs as detailed below. For example, an outward gradient was present throughout the year along the western SA-6 North soil containment cell wall at the PZ-9/PZ-10 well pair due to the tidal influence of the Hackensack River. As discussed in the 2019 annual performance report, groundwater elevations in PZ-10 remain relatively high following periods of heavy precipitation which is likely the result of water buildup on the cap that increases the head beneath the cap. At the eastern-most piezometer pair (087-PZ-1/2), the average monthly head difference failed to meet the performance standard for three months, typically occurring when lower than average rainfall caused heads outside the cell to decline. Finally, gradients at the 115-MW-502/E5-SO pair failed to meet the 0.1-foot criteria during January, November, and December 2020. As a result, an investigation was conducted on January 14, 2021 to evaluate a drainage pipe that was installed above the liner during the SA-6 Chromium Remedy which drains the utility corridor depression near 115-E5-SO. Upon removal of the soil in SA-7 at the end of this drainpipe, it was revealed that the drainage line was broken allowing stormwater to collect in the utility corridor depression thus increasing the head on top of the cap in the vicinity of 115-E5-SO. The line has since been repaired and subsequent monitoring indicates decreasing head values in the well. In accordance with the SA-6 LTMP, the quality of groundwater along the inside of the barrier wall at selected locations was determined through laboratory analysis as further discussed in Section 5.3

4.6 SA-6 South Containment Cell

Shallow groundwater elevations within the SA-6 South containment area, as measured in September 2020, are illustrated on **Figure 4-1b** and include data from the ten piezometers installed around the perimeter of the soil containment cell and the five wells on the border of SA-7 and SA-6 South. At the time of measurement, groundwater elevations were approximately 1 to 3 feet above msl within the cell but varied throughout the year in response to pumping of the contingent drain system as discussed in Section 3.3.

Data from automatic loggers placed in each of the wells were used to construct the hydrographs provided in monthly data submittals and quarterly reports and to assess the impact of precipitation events on heads in the short term. The logger data were also used to calculate monthly average heads for the longer-term assessment of hydraulic gradients across the barrier walls. The monthly average heads are provided on **Table 4-3** and plotted in **Appendix A** for the year. Head differences across the barrier walls for these well pairs are also provided in **Table 4-3** and plotted on **Figure 4-11**. Gradient determinations include the 5 piezometer pairs around the east, south, and west soil containment cell wall, and three well pairs that have been identified along the SA-7 SCB using wells 115-MW-500 and 115-MW-501.

A review of these data indicates that the performance standard requiring at least 0.1 foot of inward gradient, as defined by the SA-6 LTMP, was met at all but the 124-PZ-19/20 well pair along the western soil containment cell wall. Gradients at this location were outward

toward the river for 4 of the 6 months during which monitoring was conducted prior to their abandonment for the SA-6 South Bulkhead Deferred Area Remedy as discussed in Section 3.5.

In accordance with the SA-6 LTMP, the quality of groundwater along the inside of the barrier wall at selected locations was determined through laboratory analysis as further discussed in Section 5.4

4.7 SA-5 Sites 117 and 153

Groundwater movement beneath Sites 117 and 153 is generally from northeast to southwest as illustrated on **Figures 4-1 through 4-3**. In the Shallow Zone, the 48-inch diameter Interceptor Sewer beneath Route 440 serves as a groundwater sink and together with the prevalent reducing conditions associated with the Meadow Mat, limits the further movement of groundwater to the south and west. This is supported by shallow groundwater quality in this area as discussed in Section 5.7 as well as the absence of chromium detections in the underlying Intermediate Zone in well 117-MW-I1 located between SA-5 and the Interceptor Sewer. Additional detail regarding Honeywell's position on the impact of this sewer was provided in Memoranda dated December 7, 2018, January 23, 2019, March 2, 2020, and August 10, 2020 and is the subject of continuing technical discussions with Plaintiffs.

4.8 Miscellaneous Events

As discussed in Section 3.5, soil excavations were conducted on the western end of SA-6 South in 2020 as part of the SA-6 South Bulkhead Deferred Area Remedy. Depressurization pumping from below the Meadow Mat temporarily lowered heads in the Intermediate Zone to approximately elevation -12 feet msl. However, due to the surrounding sheetpile walls, there was no impact to groundwater flow in the area.

In accordance with the Bulkhead Deferred Area Remedy design, a low permeability backfill was used along the outboard side of the SA-6 South soil containment cell sheetpile wall. This was done to allow groundwater to be retained at a higher elevation outside of the cell, thus aiding in the development of an inward gradient in this area. Head gradients across the wall will be tracked using the replacement piezometers 124-PZ-19R and 124-PZ-20R during 2021 to evaluate the impact of this approach.

5 GROUNDWATER QUALITY MONITORING

Groundwater quality monitoring within the project area was not conducted in 2020 in accordance with the GWET LTMP and the other applicable area-specific monitoring plans as discussed in Section 1.3 and listed on **Table 1-2**.

5.1 Deep Overburden Regional Plume Monitoring

In accordance with the September 30, 2020 SAP and the 2019 annual report, the next round of regional ground water quality monitoring is scheduled for May 2024. Therefore, no regional ground water quality monitoring was conducted in 2020 and thus the related tables and figures provided in the SAP have not been included in the report.

5.2 GWET Extraction Wells

Groundwater from the three GWET pumping wells was sampled quarterly in 2020 as shown in **Table 5-1**. The samples were unfiltered and analyzed for total and hexavalent chromium and volatile organic compounds (VOCs). The results for hexavalent chromium are plotted on **Figure 5-1** and indicate that concentrations in the Deep Zone (PW-1) have declined in an asymptotic fashion since 2009. Hexavalent chromium concentrations at the end of 2020 were approximately 17 ppm.

Concentrations in the Intermediate Zone extraction well discharge initially increased significantly from 10 ppm to 90 ppm when PW-3 came online in January 2016, but have also declined in an asymptotic fashion since then to approximately 20 ppm. Hexavalent chromium concentrations in the bedrock have been generally stable at approximately 15 ppm. The Intermediate Zone pumping well, PW-3, contains the highest concentrations of VOCs with the most prevalent compounds being chlorinated volatile organics such as trichloroethene **(Figure 5-2)** and its daughter products cis-dichloroethene and vinyl chloride. Carbon Tetrachloride was also detected as shown in **Figure 5-3** and follows the same general asymptotic trend as the other VOCs. With the exception of carbon tetrachloride and chloroform, VOCs have not been detected in the bedrock pumping well. As previously reported, the source of the VOCs in the groundwater is not related to historical Honeywell operations.

5.3 SA-6 North

As noted in Section 4.5 and shown on **Table 5-2**, shallow groundwater samples were collected from two of the five perimeter piezometers located inside of the SA-6 North soil containment area during 2020. Hexavalent chromium was not detected in any of the samples. Total chromium was detected in the filtered samples for 087-PZ-02 during the July and October sampling events at 4.4 parts per billion (ppb) and 4.8 ppb, respectively,

which is well below the GWQS of 70 ppb. Hexavalent chromium and total chromium were not detected in the 087-PZ-10 sample.

5.4 SA-6 South

As noted in Section 4.6 and shown on **Table 5-2**, shallow groundwater samples were collected from piezometer 124-PZ-20 located inside of the barrier wall of the SA-6 South soil containment area in May of 2020. Hexavalent chromium and total chromium were not detected in the 124-PZ-20 sample.

5.5 New Jersey City University

In accordance with the Shallow Groundwater Monitoring and Extraction System Operation Plan for the NJCU Commercial AOC, monitoring wells along the barrier wall extension (184-MW-101 through 184-MW-108) were sampled quarterly in 2020. The results are provided on **Table 5-3** and plotted on **Figure 5-4**. The results indicate that hexavalent chromium was only detected above the reporting limit of 5.5 ppb in 184-MW-103 during the December sampling round at a concentration of 28 ppb in the unfiltered sample and 27 ppb in the filtered sample. Well 184-MW-103 is located outside (upgradient) of the barrier wall. Total chromium in the unfiltered samples was reported above the GWQS of 70 ppb in two wells located inside the barrier wall, 184-MW-102 at 129 ppb in the March event and in well 184-MW-107 at 689 ppb, 2,790 ppb, and 84.7 ppb in the March, June, and December events, respectively. The corresponding filtered samples and hexavalent chromium results were non-detect for all three events for 184-MW-107. The filtered sample for 184-MW-102 in March was 7.5 ppb, well below the GWQS.

5.6 Plume Diversion Area Monitoring

Based on the results of groundwater monitoring in 2017, groundwater sampling of the Plume Diversion Area is no longer required.

5.7 SA-5 Site 117

In accordance with the September 30, 2020 SAP and the 2019 annual report, the next round of regional ground water quality monitoring is scheduled for May 2024. Therefore, regional ground water quality monitoring was not conducted in 2020 and the related tables and figures provided in the SAP have not been included in this report. In accordance with the SAP and NJDEP RA Groundwater Permit, sampling of shallow monitoring wells at Site 117 is required every two years. The next sampling event is scheduled for 2021.

5.8 SA-5 Sites 079/153

Groundwater quality sampling of the shallow monitoring wells is not required at Site 079. In accordance with the SAP and NJDEP RA Groundwater Permit, sampling of shallow monitoring wells at Site 153 is required every two years. The next sampling event is scheduled for 2021. In accordance with the SAP, groundwater quality monitoring of the

bedrock monitoring well 079-MW-13BR is required every five years. Sampling took place in May 2019; therefore, regional ground water quality monitoring was not conducted in 2020 and the related tables and figures provided in the SAP have not been included in this report.

5.9 In-Situ Sampling Beneath Riverbed Sediments

In accordance with Section 3.3 of the SA-7 Deep Overburden and Bedrock Groundwater Remedy Long-term Monitoring Plan, in-situ groundwater from within the lacustrine deposits directly beneath the soft riverbed sediments in the Hackensack River is to be sampled every five years until chromium concentrations are below the GWQS. The most recent sampling event took place in 2019 during which location PW-09-450 was sampled. Results of this investigation were provided in the July 23, 2019 Technical Memorandum. Based on these results, and in accordance with the SAP, location PW-09-450 will be resampled in 5 years, during the spring of 2024.

5.10 Miscellaneous Groundwater Quality

The mass of hexavalent chromium removed from the Deep Overburden Plume through pumping has been calculated for reference. As shown on **Figure 5-5**, historic pumping includes operation of the two depressurization wells, 115-DP-1 and 115-DP-2, during the SA-7 soil excavation remedy, and the GWET system pumping that has been ongoing since December 2008. The mass removed was calculated by multiplying the pumping rate of each well by the hexavalent chromium concentration of the discharge. The results indicate that over 95 tons of hexavalent chromium have been removed through groundwater extraction alone through the end of 2020 and does not include the 50 tons of chromium treated during the mass removal injection program conducted from 2011 to 2016.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Compliance with Monitoring Requirements

Hydraulic and groundwater quality monitoring conducted in 2020 have fulfilled the various monitoring plan requirements in accordance with **Tables 1-1 and 1-2**.

6.2 Status of Groundwater Classification Exception Areas

Groundwater Classification Exception Areas (CEAs) were approved by NJDEP on February 16, 2012 for the three principal water bearing zones in the Project Area (Shallow Zone, Deep Overburden, and Bedrock). In 2014, NJDEP notified Honeywell that CEA biennial certifications are not due until the applicable Groundwater Remediation Permits were issued. Honeywell submitted Groundwater Remedial Action (RA) Permit Applications to NJDEP in December 2017 and RA Permits were issued by the NJDEP in 2018. The RA Groundwater Permits include one permit for the Deep Overburden Zone, one permit for the Bedrock Zone, and five permits for the shallow zone as follows: SA-5 NJCU, Site 117, Site 153, SA-6 North and SA-6 South Open Space Cap areas. Biennial certification reports were submitted during July and August of 2020 and are due every 2 years thereafter.

6.3 Recommendations for Monitoring Well Network

Well 117-MW-I4S will be temporarily retained for groundwater level monitoring only. This well was installed to provide samples for treatability testing within the source area and not for long-term monitoring purposes. Water level monitoring will be conducted during and after roadway construction until such time that hydraulic gradient issues are resolved by the Parties, at which time it will be abandoned and removed from the monitoring program.

6.4 Recommendations for Water Level Monitoring Frequency

The frequency of regional groundwater level monitoring has been changed to annually beginning January 2021 in accordance with the Revised SAP (September 2020). However, groundwater level monitoring at specific sites will continue to be conducted in accordance with frequencies specified in the various site-specific LTMPs as indicated in **Table 1-1**.

6.5 Recommendations for Groundwater Quality Monitoring Frequency

As indicated in the September 2020 Revised SAP and previous correspondence and reports, it is recommended that water quality sampling at shallow well 117-MW-I4S be discontinued (Wood memoranda dated February 25, 2019 and March 2, 2020; Annual

Groundwater Performance Report for 2019 dated August 2020). This well was originally installed in the source area to provide samples for treatability testing and not for long-term monitoring purposes. Thus, this well be eliminated from future monitoring since results will likely show similar order of magnitude concentrations in the future, and down-gradient monitoring wells provide data for evaluation of potential migration and protectiveness of the shallow groundwater remedy. The well will remain for water level monitoring until such time that hydraulic gradient issues have been resolved by the Parties.

It is recommended that the quarterly sampling of the GWET pumping well discharge be changed to annual and that VOCs are no longer analyzed. As discussed in Section 5.2, chromium concentrations in the discharge have followed a steady and predictable asymptotic trend since startup that would be equally defined by annual data as with the current quarterly frequency. And as discussed in Section 5.2, the source of the VOCs in the groundwater is not related to historical Honeywell operations and does not provide useful information relative to the goals or operation of the GWET system.

The frequency of groundwater quality monitoring, well selection, and parameters for analysis are established in the site-specific LTMPs and the NJDEP RA Groundwater Permits for the various sub-areas.

Any changes to the monitoring program that differ from the requirements of RA Groundwater Permits will require approval from the NJDEP via permit modification prior to implementation. Following review and approval of the above recommendations by the Parties, Honeywell will submit required permit modifications to the NJDEP for approval prior to proceeding with implementation.

6.6 Other Recommendations

There are no further recommendations.

LIMITATIONS

The work product included in the attached was undertaken in full conformity with generally accepted professional consulting principles and practices and to the fullest extent as allowed by law we expressly disclaim all warranties, express or implied, including warranties of merchantability or fitness for a particular purpose. The work product was completed in full conformity with the contract with our client and this document is solely for the use and reliance of our client (unless previously agreed upon that a third party could rely on the work product) and any reliance on this work product by an unapproved outside party is at such party's risk.

The work product herein (including opinions, conclusions, suggestions, etc.) was prepared based on the situations and circumstances as found at the time, location, scope and goal of our performance and thus should be relied upon and used by our client recognizing these considerations and limitations. Cornerstone shall not be liable for the consequences of any change in environmental standards, practices, or regulations following the completion of our work and there is no warrant to the veracity of information provided by third parties, or the partial utilization of this work product.

TABLES

TABLE 1-1
GROUNDWATER LEVEL MONITORINGREQUIREMENTS
for Integrated Groundwater Monitoring Plan

Location	Monitoring Plan	Consent Decree	Depth	Frequency	# Wells
Regional[1]	GWET Long Term Monitoring Plan June 10, 2008	Deep Overburden and Bedrock Groundwater Remedies Consent Order	All Zones	Quarterly through 2021; Annually thereafter	115
Study Area 7	SA-7 Perimeter Pools	Final Judgement, ICO v Honeywell	Shallow	Monthly	2
Study Area 7 - Site 115	SA-6 Long Term Monitoring Plan[4] (February 2018)	Not Applicable	Shallow	Monthly manual readings; logger readings every 6 hours-averaged monthly	6
SA-6 South	SA-6 Long Term Monitoring Plan[4] (February 2018)	First Amended Consent Decree Regarding Remediation and Redevelopment of SA-6 South	Shallow	Annual manual readings; logger readings every 6 hours-averaged monthly	13
SA-6 North	SA-6 Long Term Monitoring Plan[4] (February 2018)	First Amended Consent Decree Regarding Remediation and Redevelopment of Study Area 6 North	Shallow	Annual manual readings; logger readings every 6 hours-averaged monthly	14
SA-5 (NJCU) Sites 90 & 184	Long Term Monitoring Plan[2] (November 2016)	Consent Decree Regarding Remediation of the New Jersey City University Redevelopment Area	Shallow	Quarterly manual readings; logger readings every 6 hours-averaged monthly	13 wells and 2 sumps
SA-5: Site 079	Long Term Monitoring Plan for Sites 079 and 153 South	Consent Decree Regarding Remediation of the Study Area 5 Shallow Groundwater and the Site 79 Residential Properties	Shallow	Quarterly	3
SA-5: Site153	Long Term Monitoring Plan for SA-5 Shallow GW[3]	Consent Decree Regarding Remediation of the Study Area 5 Shallow Groundwater and the Site 79 Residential Properties	Shallow	Quarterly	2
SA-5 Site 117	Long Term Monitoring Plan for SA-5 Shallow GW[3]	Consent Decree Regarding Remediation of the Study Area 5 Shallow Groundwater and the Site 79 Residential Properties	Shallow	Quarterly	5

[1]Includes available wells on SA-5, SA-6, SA-7, and surrounding areas historically considered part of the Deep Overburden Plume investigation.

[2]SA-5 NJCU LTMP (November 2016; updated May 2019); Shallow Groundwater Monitoring and Extraction System Operation Plan (Appendix L of the LTMP).

[3]Draft LTMP for SA-5 Shallow Groundwater includes Sites 117 and 153 in progess; pending ongoing technical discussions and correspondence with Plaintiffs.

[4]Revised December 2020.

[5]Remedial Action Groundwater Permits were issued in 2018 for the Deep Overbuden; Bedrock; and Shallow groundwater zones at SA-5 Sites 90/184, 117, 153, SA-6 North and South Open Space Cap Areas

TABLE 1-2
GROUNDWATER QUALITY MONITORING REQUIREMENTS
for Integrated Groundwater Monitoring Plan

Location	Monitoring Plan	Consent Decree	Depth	Frequency	# Wells	Estimated Start Date
Regional	Integrated Sampling and Analysis Plan; April 2014, revised October 2019	Deep Overburden and Bedrock Groundwater Remedies Consent Order	Intermediate Deep Bedrock Beneath River	Every 5 years[5] Every 5 years[5] Every 5 years[5] Every 5 years	6 10 9 1	On-going future events TBD
SA-5 (NJCU) Sites 90 & 184	Long Term Monitoring Plan / Shallow Groundwater Monitoring Document[1]	Consent Decree Regarding Remediation of the New Jersey City University Redevelopment Area	Shallow	Quarterly; Future TBD per Appendix L of LTMP	8	On-going
SA-5 Site 117	Long Term Monitoring Plan for SA-5 Shallow GW[2]	Consent Decree Regarding Remediation of the Study Area 5 Shallow Groundwater and the Site 79 Residential Properties	Shallow	Biennial[2]	5	On-going
SA-5: Site153	Long Term Monitoring Plan for SA-5 Shallow GW[2]	Consent Decree Regarding Remediation of the Study Area 5 Shallow Groundwater and the Site 79 Residential Properties	Shallow	Biennial[2]	2	On-going
SA-6 South	SA-6 LTMP (February 2018)[3]	First Amended Consent Decree Regarding Remediation and Redevelopment of SA-6 South	Shallow	As required by inward gradients across wall	5	On-going
SA-6 North	SA-6 LTMP (February 2018)[3]	First Amended Consent Decree Regarding Remediation and Redevelopment of SA-6 North	Shallow	As required by inward gradients across wall	5	On-going

Biennial = every two years

[1]SA-5 NJCU LTMP (November 2016, updated May 2019); Shallow Groundwater Monitoring and Extraction System Operation Plan (Appendix L of the LTMP).

[2]Draft LTMP for SA-5 Shallow Groundwater includes Sites 117 and 153 in progress; pending ongoing technical discussions and correspondence with Plaintiffs.

[3]Revised December 2020.

[4]Remedial Action Groundwater Permits were issued in 2018 for the Deep Overbuden; Bedrock; and Shallow groundwater zones at SA-5 Sites 90/184, 117, 153, SA-6 North and South Open Space Cap Areas.

[5]The current frequency in the Remedial Action Groundwater Permits issued in 2018 for the Deep Overbuden; Bedrock; and Shallow groundwater zones is every 2 years, thus a reduced frequency to every 5 years is subject to NJDEP approval via RA GW permit modification.

Table 2-1
2020 Monthly Precipitation Data

Month	2020 Precipitation	Average Precipitation
January	1.67	3.98
February	2.60	2.96
March	3.76	4.21
April	3.80	3.92
May	1.66	4.46
June	2.89	3.4
July	11.22	4.68
August	3.19	4.02
September	4.06	4.01
October	4.56	3.16
November	3.67	3.88
December	4.10	3.57
Annual Total	47.19	46.25

Data Source: http://www.nc-climate.ncsu.edu/cronos/?station=286026&temporal=monthly
Station name: Newark International Airport
Station ID: 286026

Table 2-2
Groundwater Monitoring Well Inventory

Well ID	Screen Zone	Ref. Pt. Elev.	Well Depth	Screen Length	Comments
		(ft msl)	(ft)	(ft)	
087-MW-08	Deep	12.98	99.0	10	
087-MW-34	Deep	12.73	70.0	5	
087-MW-A26T	Deep	9.92	56.0	15	
087-MW-W25T	Deep	19.06	91.0	15	
087-OBS-1L	Deep	15.27	67.1	5	
087-OBS-1T	Deep	15.23	105.0	10	
087-OBS-3L	Deep	12.68	65.0	5	
087-OBS-4T	Deep	11.60	75.5	5	
087-OBS-5T	Deep	12.62	81.9	10	
087-PW-1	Deep	10.27	69.0	10	
088-MW-G19T	Deep	13.25	93.0	15	
090-MW-09	Deep	18.81	75.0	5	
117-MW-D1	Deep	11.08	41.0	10	
117-MW-D2	Deep	17.62	48.0	10	
117-MW-D3	Deep	18.85	80.0	10	
117-MW-I4	Deep	15.49	75.0	10	
119-MW-01T	Deep	10.78	62.0	10	
119-MW-02T	Deep	8.80	70.0	10	
124-MW-106T	Deep	9.31	78.0	10	
153-MW-A13T	Deep	9.34	58.0	15	
SA6-MW-AA1T	Deep	15.31	70.0	10	
087-MW-136D	Intermediate	13.18	36.0	10	Installed July 2018, replaced 087-MW-O19D
087-MW-13	Intermediate	12.93	40.0	10	
087-MW-A26D	Intermediate	10.35	28.0	10	
087-MW-O29D	Intermediate	10.32	56.0	NA	
087-MW-W25D	Intermediate	16.98	66.0	10	
087-OBS-07	Intermediate	12.59	30.0	5	
087-OBS-1D	Intermediate	15.13	42.8	10	
087-OBS-2D	Intermediate	12.68	54.0	10	
087-OBS-5D	Intermediate	12.72	39.8	10	
087-PW-2	Intermediate	13.02	48.0	20	
087-PW-3	Intermediate	12.40	50.0	20	
088-MW-15R	Intermediate	12.83	35.0	10	
090-MW-07	Intermediate	17.20	40.0	10	
117-MW-I1	Intermediate	11.08	22.0	10	
117-MW-I2	Intermediate	17.59	28.0	10	
117-MW-I3	Intermediate	15.59	28.0	10	
117-MW-I5	Intermediate	18.76	37.0	15	
124-MW-G02D	Intermediate	10.47	28.0	10	
SA6-MW-AA1D	Intermediate	19.36	32.0	10	
DP-1	Intermediate	12.92	36.5	10	Temporary depressurization well in SA-6 South Deferred Area
DP-2	Intermediate	13.80	37.5	10	Temporary depressurization well in SA-6 South Deferred Area
DP-3	Intermediate	13.20	36.5	10	Temporary depressurization well in SA-6 South Deferred Area
DP-4	Intermediate	12.20	35.5	10	Temporary depressurization well in SA-6 South Deferred Area
OW-1	Intermediate	11.10	34.5	10	Temporary observation well in SA-6 South Deferred Area
OW-2	Intermediate	11.10	34.5	10	Temporary observation well in SA-6 South Deferred Area
OW-3	Intermediate	11.20	34.5	10	Temporary observation well in SA-6 South Deferred Area
OW-4	Intermediate	15.00	38.5	10	Temporary observation well in SA-6 South Deferred Area

Table 2-2
Groundwater Monitoring Well Inventory

Well ID	Screen Zone	Ref. Pt. Elev.	Well Depth	Screen Length	Comments
		(ft msl)	(ft)	(ft)	
073-MW-1BR	Rock	20.39	144.0	15	
079-MW-13BR-1	Rock	13.08	121.0	10	
079-MW-13BR-2	Rock	13.08	214.0	15	
079-MW-13BR-3	Rock	13.08	284.0	15	
090-MW-7BR-1	Rock	16.99	134.0	15	
090-MW-7BR-2	Rock	16.99	177.0	15	
090-MW-7BR-3	Rock	16.99	233.0	15	
115-MW-203BR	Rock	6.61	162.0	20	
115-MW-215BR	Rock	8.82	143.0	20	
117-MW-3BR-1	Rock	12.34	155.0	15	
117-MW-3BR-2	Rock	12.34	263.0	15	
117-MW-8BR	Rock	12.94	125.0	10	
119-MW-2BR-1	Rock	8.43	163.0	15	
119-MW-2BR-2	Rock	8.43	245.0	15	
119-MW-2BR-3	Rock	8.43	315.0	15	
119-MW-16BR-1	Rock	8.61	151.0	15	
119-MW-16BR-2	Rock	8.61	187.0	15	
119-MW-16BR-3	Rock	8.61	247.0	15	
124-MW-8BR	Rock	9.71	133.0	2	
SA6-MW-5BR-1	Rock	17.06	106.0	15	
SA6-MW-5BR-2	Rock	17.06	154.0	15	
SA6-MW-5BR-3	Rock	17.06	204.0	13	
SA6-MW-5BR-4	Rock	17.06	236.0	15	
SA6-MW-5BR-5	Rock	17.06	281.0	15	
SA6-MW-14BR	Rock	9.99	85.0	10	
SA6-MW-15BR	Rock	8.08	103.0	20	
079-MW-01	Shallow	8.80	8.9	5	
079-MW-A2	Shallow	8.10	11.5	10	
079-MW-C6	Shallow	11.00	13.0	10	
087-PZ-1	Shallow	10.04	11.0	5	Installed June 2016
087-PZ-2	Shallow	10.35	8.0	5	Installed June 2016
087-PZ-3	Shallow	13.28	13.0	5	Installed June 2016
087-PZ-4	Shallow	13.65	12.0	5	Installed June 2016
087-PZ-5	Shallow	19.49	13.0	5	Installed June 2016
087-PZ-6	Shallow	21.01	13.0	5	Installed June 2016
087-PZ-7	Shallow	16.24	26.0	5	Installed June 2016
087-PZ-8	Shallow	16.54	14.0	5	Installed June 2016
087-PZ-9	Shallow	17.19	12.0	5	Installed June 2016
087-PZ-10	Shallow	17.06	12.0	5	Installed June 2016
090-PZ-05	Shallow	18.08	16.4	NA	
090-PZ-06	Shallow	18.20	18.0	NA	
115-E1A-SO	Shallow	16.48	7.0	NA	Replaced 115-E1A-SO in 2015
115-E2-SO	Shallow	10.33	10.0	5	
115-E3-SO	Shallow	12.57	20.7	5	

Table 2-2
Groundwater Monitoring Well Inventory

Well ID	Screen Zone	Ref. Pt. Elev.	Well Depth	Screen Length	Comments
		(ft msl)	(ft)	(ft)	
115-E4-SO	Shallow	14.04	13.5	10	
115-E5-SO	Shallow	17.39	21.4	8	
115-PZ-500	Shallow	6.68	11.0	9	
115-PZ-501	Shallow	14.47	16.5	8.5	
115-PZ-502	Shallow	14.51	16.0	8	
115-PZ-503	Shallow	7.32	10.0	8	
115-W1-SO	Shallow	18.84	24.7	10	
115-W3-SO	Shallow	14.96	14.0	10	
115-W5-SO	Shallow	21.68	16.0	2	
115-W6-SO	Shallow	14.76	18.2	NA	
117-MW-A05	Shallow	18.48	16.0	NA	
117-MW-A14	Shallow	17.33	17.0	NA	
117-MW-I4S	Shallow	16.70	11.2	NA	
117-MW-A85	Shallow	17.40	15.0	NA	
117-MW-A89	Shallow	13.17	16.0	14	
117-MW-A99	Shallow	15.95	14.0	NA	
124-MW-10	Shallow	10.06	11.0	8	
124-MW-11	Shallow	9.05	8.0	6	
124-PZ-11	Shallow	9.69	9.5	5	Installed 2015
124-PZ-12	Shallow	10.63	9.5	5	Installed 2015
124-PZ-13	Shallow	10.62	9.5	5	Installed 2015
124-PZ-14	Shallow	15.15	14.1	5	Installed 2015
124-PZ-15	Shallow	13.34	10.1	5	Installed 2015
124-PZ-16	Shallow	17.70	19.6	5	Installed 2015
124-PZ-17	Shallow	15.15	12.0	5	Installed 2015
124-PZ-18	Shallow	18.28	16.2	5	Installed 2015
124-PZ-19	Shallow	17.91	10.4	5	Installed 2015, abandoned Q2 2020
124-PZ-20	Shallow	18.38	17.3	5	Installed 2015, abandoned Q3 2020
124-PZ-19R	Shallow	18.30	24.6	5	Installed Q4 2020
124-PZ-20R	Shallow	20.41	27.6	5	Installed Q4 2020
153-MW-A13	Shallow	9.62	10.0	6	
153-MW-A15	Shallow	11.00	12.2	10	
154-MW-A06	Shallow	19.87	15.1	NA	
154-MW-A5A	Shallow	19.16	14.0	NA	
184-MW-04	Shallow	8.70	6.8	NA	
184-MW-05	Shallow	14.71	13.0	NA	
184-MW-06	Shallow	18.75	15.0	NA	
184-MW-101	Shallow	14.85	13.0	5	
184-MW-102	Shallow	15.66	12.0	5	
184-MW-103	Shallow	15.85	14.0	5	
184-MW-104	Shallow	16.35	13.0	5	
184-MW-105	Shallow	15.10	12.0	5	
184-MW-106	Shallow	15.47	14.0	5	
184-MW-107	Shallow	15.89	11.0	5	
184-MW-108	Shallow	16.61	15.0	5	
Sump A	Shallow	15.98	21.0	NA	
Sump B	Shallow	13.08	15.0	NA	

NA - information not available

Table 3-1

GWET Pumping Outages in 2020

Well ID	Start Date	End Date	Duration Days and	Hours	Comment
087-PW-1	10-Oct-20	20-Oct-20	10	5.50	Continuous Precipitation System Rehabilation at the treatment plant
087-MW-215BR	10-Oct-20	20-Oct-20	10	5.50	Continuous Precipitation System Rehabilation at the treatment plant
087-PW-3	10-Oct-20	20-Oct-20	10	5.50	Continuous Precipitation System Rehabilation at the treatment plant
087-PW-1	8-Dec-20	9-Dec-20	1	4.50	Forcemain cleaning
087-PW-3	8-Dec-20	9-Dec-20	1	4.50	Forcemain cleaning

TABLE 4-1
GROUNDWATER ELEVATION DATA FROM QUARTERLY ROUNDS IN 2020

Well ID	Screen Zone	Ref. Pt. Elev.	Well Depth	Screen Length	Groundwater Elevation (NGVD-29)			
					3/27/20	6/29/20	9/29/20	12/9/20
		(ft msl)	(ft)	(ft)	(ft msl)	(ft msl)	(ft msl)	(ft msl)
087-MW-08	Deep	12.98	99	10	1.36	0.03	1.88	2.01
087-MW-34	Deep	12.73	70	5	-0.56	-1.25	-0.08	2.58
087-MW-A26T	Deep	9.92	56	15	3.32	2.77	2.84	3.60
087-MW-W25T	Deep	19.06	91	15	1.21	1.37	2.13	2.14
087-OBS-1L	Deep	15.27	67.05	5	1.39	1.52	2.55	2.77
087-OBS-1T	Deep	15.23	105	10	2.17	0.26	2.26	1.93
087-OBS-3L	Deep	12.68	65	5	0.92	0.73	1.77	2.25
087-OBS-4T	Deep	11.6	75.5	5	0.99	0.43	1.41	2.59
087-OBS-5T	Deep	12.62	81.9	10	0.02	-0.82	0.52	2.28
087-PW-1	Deep	10.266	69	10	-36.65	-38.43	-37.13	0.07
088-MW-G19T	Deep	13.25	93	15	2.65	2.42	2.45	3.19
090-MW-09	Deep	18.81	75	5	5.25	5.75	5.12	5.49
117-MW-D1	Deep	11.08	41	10	2.57	2.75	2.96	3.08
117-MW-D2	Deep	17.62	48	10	3.67	4.19	4.33	4.35
117-MW-D3	Deep	18.85	80	10	5.80	5.38	5.41	5.80
117-MW-I4	Deep	15.49	75	10	4.60	4.41	4.81	4.81
119-MW-01T	Deep	10.78	62	10	2.89	2.47	2.50	2.79
119-MW-02T	Deep	8.8	70	10	2.98	2.74	4.60	4.20
124-MW-106T	Deep	9.31	78	10	2.89	2.69	2.70	2.88
153-MW-A13T	Deep	9.34	58	15	3.66	3.19	2.69	3.21
SA6-MW-AA1T	Deep	15.31	70	10	0.80	0.35	1.81	2.41
087-MW-136D	Intermediate	13.18	36	10	1.91	2.13	1.81	2.26
087-MW-13	Intermediate	12.93	40	10	1.56	1.91	1.42	1.87
087-MW-A26D	Intermediate	10.35	28	10	3.36	2.83	2.87	3.60
087-MW-O29D	Intermediate	10.32	56	NA	N/A	1.60	1.47	2.75
087-MW-W25D	Intermediate	16.98	66	10	1.71	1.88	2.77	2.04
087-OBS-07	Intermediate	12.59	30	5	0.04	-1.00	0.62	1.64
087-OBS-1D	Intermediate	15.13	42.8	10	2.08	0.86	3.24	1.43
087-OBS-2D	Intermediate	12.68	54	10	-1.82	-2.64	-1.30	2.44
087-OBS-5D	Intermediate	12.72	39.83	10	0.21	-0.54	1.07	1.77
087-PW-2	Intermediate	13.02	48	20	1.14	0.57	2.52	1.48
087-PW-3	Intermediate	12.4	50	20	-6.12	-7.21	-5.02	1.68
088-MW-15R	Intermediate	12.83	35	10	2.79	2.30	2.32	3.24
090-MW-07	Intermediate	17.2	40	10	6.62	5.20	5.23	5.57
117-MW-I1	Intermediate	11.08	22	10	4.64	3.86	3.89	4.21
117-MW-I2	Intermediate	17.59	28	10	5.18	4.62	4.53	4.72
117-MW-I3	Intermediate	15.59	28	10	5.14	4.61	4.57	4.91
117-MW-I5	Intermediate	18.76	37	15	6.14	5.88	5.74	5.94
124-MW-G02D	Intermediate	10.47	28	10	2.92	2.42	2.49	2.67
SA6-MW-AA1D	Intermediate	19.36	32	10	0.86	0.21	2.13	2.11
073-MW-1BR	Rock	20.39	144	15	-0.50	-2.34	-0.64	-1.36
079-MW-13BR-1	Rock	13.08	121	10	N/A	6.83	7.13	7.82
079-MW-13BR-2	Rock	13.08	214	15	N/A	6.90	6.63	7.49
079-MW-13BR-3	Rock	13.08	284	15	N/A	6.80	7.01	7.53
090-MW-7BR-1	Rock	16.99	134	15	4.94	4.57	4.64	5.11
090-MW-7BR-2	Rock	16.99	177	15	5.23	4.82	4.90	5.25
090-MW-7BR-3	Rock	16.99	233	15	5.31	4.89	4.99	5.44
115-MW-203BR	Rock	6.61	162	20	-0.53	-2.14	-0.54	-1.02
115-MW-215BR	Rock	8.82	143	20	-3.26	-4.43	-2.98	-3.15
117-MW-3BR-1	Rock	12.34	155	15	5.66	5.26	5.43	5.63
117-MW-3BR-2	Rock	12.34	263	15	6.36	6.04	6.00	6.44
117-MW-8BR	Rock	12.94	125	10	5.43	5.27	5.34	5.68
119-MW-2BR-1	Rock	8.43	163	15	0.13	-1.17	-0.64	-1.37
119-MW-2BR-2	Rock	8.43	245	15	0.65	-1.71	-0.28	-0.82
119-MW-2BR-3	Rock	8.43	315	15	0.49	-0.91	-0.07	-0.25
119-MW-16BR-1	Rock	8.61	151	15	4.83	4.63	6.36	6.02
119-MW-16BR-2	Rock	8.61	187	15	4.58	4.21	4.37	4.65
119-MW-16BR-3	Rock	8.61	247	15	4.73	4.25	4.88	4.61
124-MW-8BR	Rock	9.71	133	2	3.62	3.50	2.75	4.01
SA6-MW-5BR-1	Rock	17.06	106	15	3.33	1.92	2.16	2.97
SA6-MW-5BR-2	Rock	17.06	154	15	3.26	2.51	2.97	3.59
SA6-MW-5BR-3	Rock	17.06	204	13	2.60	2.94	3.09	3.88
SA6-MW-5BR-4	Rock	17.06	236	15	3.55	3.21	3.23	3.93
SA6-MW-5BR-5	Rock	17.06	281	15	3.61	3.14	3.19	4.06
SA6-MW-14BR	Rock	9.99	85	10	3.51	3.19	3.28	3.89
SA6-MW-15BR	Rock	8.08	103	20	1.37	1.44	1.26	2.07

TABLE 4-1
GROUNDWATER ELEVATION DATA FROM QUARTERLY ROUNDS IN 2020

Well ID	Screen Zone	Ref. Pt. Elev.	Well Depth	Screen Length	Groundwater Elevation (NGVD-29)			
					3/27/20	6/29/20	9/29/20	12/9/20
079-MW-01	Shallow	8.8	8.88	5	3.27	3.19	2.99	3.32
079-MW-A2	Shallow	8.1	11.48	10	3.23	2.91	2.84	3.38
079-MW-C6	Shallow	11	13	10	N/A	4.40	4.36	4.87
087-PZ-1	Shallow	10.04	11.03	5	4.90	2.93	3.01	5.39
087-PZ-2	Shallow	10.35	8	5	3.60	3.30	3.62	4.04
087-PZ-3	Shallow	13.28	13	5	4.54	3.69	3.88	5.21
087-PZ-4	Shallow	13.65	12	5	3.67	3.11	3.32	4.11
087-PZ-5	Shallow	19.49	13	5	6.07	4.45	4.53	6.27
087-PZ-6	Shallow	21.01	13	5	4.61	3.36	3.50	3.44
087-PZ-7	Shallow	16.24	26	5	6.39	5.07	5.06	6.88
087-PZ-8	Shallow	16.54	14	5	4.21	3.22	3.52	3.89
087-PZ-9	Shallow	17.19	12	5	2.98	2.63	2.32	2.67
087-PZ-10	Shallow	17.06	12	5	4.71	3.27	3.59	4.64
090-PZ-05	Shallow	18.08	16.41	NA	7.02	6.21	6.27	7.30
090-PZ-06	Shallow	18.2	18	NA	8.85	8.29	8.67	9.02
115-E1A-SO	Shallow	16.48	7	NA	3.54	3.25	1.77	2.68
115-E2-SO	Shallow	10.33	10	5	6.55	6.23	6.14	6.28
115-E3-SO	Shallow	12.57	20.73	5	6.35	6.21	6.16	6.35
115-E4-SO	Shallow	14.04	13.45	10	3.22	3.00	3.26	3.65
115-E5-SO	Shallow	17.39	21.39	8	4.68	3.33	3.55	5.71
115-PZ-500	Shallow	6.68	11	9	4.78	4.43	4.18	4.54
115-PZ-501	Shallow	14.47	16.5	8.5	5.55	4.70	4.44	5.13
115-PZ-502	Shallow	14.51	16	8	5.31	4.54	4.13	4.40
115-PZ-503	Shallow	7.32	10	8	4.60	4.35	4.11	4.41
115-W1-SO	Shallow	18.84	24.66	10	4.19	3.18	3.51	3.66
115-W3-SO	Shallow	14.96	14	10	3.07	3.60	0.78	1.83
115-W5-SO	Shallow	21.68	16	2	3.93	3.37	1.37	2.79
115-W6-SO	Shallow	14.76	18.15	NA	4.32	3.21	3.50	4.21
117-MW-A05	Shallow	18.48	16	NA	6.77	6.21	6.01	6.46
117-MW-A14	Shallow	17.33	17	NA	5.29	4.60	4.50	4.74
117-MW-A85	Shallow	17.4	15	NA	5.47	4.75	5.08	4.75
117-MW-A89	Shallow	13.17	16	14	4.55	3.84	3.76	4.25
117-MW-A99	Shallow	15.95	14	NA	5.88	5.23	5.10	5.17
117-MW-I4S	Shallow	16.7	11.17	NA	5.61	4.97	5.22	5.40
124-MW-10	Shallow	10.06	11	8	5.20	4.81	4.89	5.06
124-MW-11	Shallow	9.05	8	6	5.06	3.65	4.15	5.15
124-PZ-11	Shallow	9.69	9.5	5	7.08	5.43	5.37	6.59
124-PZ-12	Shallow	10.63	9.5	5	4.07	4.43	3.08	3.12
124-PZ-13	Shallow	10.62	9.5	5	7.93	5.69	5.51	7.63
124-PZ-14	Shallow	15.15	14.1	5	4.10	3.35	1.92	2.49
124-PZ-15	Shallow	13.34	10.1	5	6.73	5.01	4.82	6.32
124-PZ-16	Shallow	17.7	19.6	5	3.61	3.60	1.78	2.50
124-PZ-17	Shallow	15.15	12	5	5.24	3.90	3.93	4.83
124-PZ-18	Shallow	18.28	16.2	5	3.72	3.31	0.78	2.44
124-PZ-19R	Shallow	18.3	24.55	5	N/A	N/A	N/A	N/A
124-PZ-20R	Shallow	20.41	27.55	5	3.48	3.20	N/A	1.91
153-MW-A13	Shallow	9.62	10	6	0.93	3.11	3.40	3.90
153-MW-A15	Shallow	11	12.15	10	N/A	2.00	1.93	N/A
154-MW-A06	Shallow	19.87	15.12	NA	13.28	13.56	11.86	14.07
154-MW-A5A	Shallow	19.16	14	NA	11.71	11.43	11.34	11.88
184-MW-04	Shallow	8.7	6.8	NA	3.55	3.39	3.37	3.52
184-MW-05	Shallow	14.71	13	NA	5.80	5.05	4.99	5.85
184-MW-06	Shallow	18.751	15	NA	7.82	7.30	7.41	8.07
184-MW-101	Shallow	14.85	13	5	6.53	4.87	4.83	6.34
184-MW-102	Shallow	15.66	12	5	6.32	5.75	5.74	6.49
184-MW-103	Shallow	15.85	14	5	6.50	5.83	5.84	6.72
184-MW-104	Shallow	16.35	13	5	6.93	6.34	6.47	7.15
184-MW-105	Shallow	15.1	12	5	5.70	5.55	5.52	5.65
184-MW-106	Shallow	15.47	14	5	6.18	5.37	5.36	6.23
184-MW-107	Shallow	15.89	11	5	6.41	5.68	5.78	6.58
184-MW-108	Shallow	16.61	15	5	6.90	6.16	6.26	7.08
SUMP A	Shallow	15.98	21	NA	5.83	5.64	5.56	5.72
SUMP B	Shallow	13.08	15	NA	5.00	5.03	4.92	4.91

NA- information not available
N/A - well abandoned or no access

Table 4-2
Summary of Groundwater Elevations Near NJCU
2020

Ref. Point Survey Date	As of Jan. 2019 Ref. pt.* ft, msl	03/27/20		06/29/20		09/29/20		12/30/20	
		Depth to GW (ft,)	GW Elev. (ft., msl)	Depth to GW (ft,)	GW Elev. (ft., msl)	Depth to GW (ft,)	GW Elev. (ft., msl)	Depth to GW (ft,)	GW Elev. (ft., msl)
Location									
079-MW-A02	8.10	4.87	3.23	5.19	2.91	5.26	2.84	4.77	3.33
Sump A	15.98	10.15	5.83	10.34	5.64	10.42	5.56	10.28	5.70
Sump B	13.08	8.08	5.00	8.05	5.03	8.16	4.92	11.19	1.89
090-PZ-5	18.08	11.06	7.02	11.87	6.21	11.81	6.27	10.49	7.59
090-PZ-6	18.20	9.35	8.85	9.91	8.29	9.53	8.67	9.04	9.16
184-MW-4	8.70	5.15	3.55	5.31	3.39	5.33	3.37	N/A	N/A
184-MW-5	14.71	8.91	5.80	9.66	5.05	9.72	4.99	8.79	5.92
184-MW-6	18.75	10.93	7.82	11.45	7.30	11.34	7.41	10.57	8.18
090-MW-09	10.81	5.56	5.25	5.06	5.75	5.69	5.12	5.50	5.31
090-MW-07	17.20	10.58	6.62	12.00	5.20	11.97	5.23	11.43	5.77
117-MW-I4S	16.70	11.09	5.61	11.73	4.97	11.48	5.22	11.18	5.52
117-MW-I5	18.76	10.89	7.87	12.88	5.88	13.02	5.74	12.68	6.08
184-MW-101	14.85	8.32	6.53	9.98	4.87	10.02	4.83	8.49	6.36
184-MW-102	15.66	9.34	6.32	9.91	5.75	9.92	5.74	9.01	6.65
184-MW-103	15.85	9.35	6.50	10.02	5.83	10.01	5.84	8.97	6.88
184-MW-104	16.35	9.42	6.93	10.01	6.34	9.88	6.47	9.08	7.27
184-MW-105	15.10	9.4	5.70	9.55	5.55	9.58	5.52	9.52	5.58
184-MW-106	15.47	9.29	6.18	10.01	5.46	10.01	5.46	9.06	6.41
184-MW-107	15.89	9.48	6.41	10.21	5.68	10.11	5.78	9.13	6.76
184-MW-108	16.61	9.71	6.90	10.45	6.16	10.35	6.26	9.38	7.23

NA - No access to well

* NGVD29 site datum

Table 4-3
Monthly Average Heads and Gradients Across Barrier Walls - SA-6

	087-PZ-1/087-PZ-2			087-PZ-3/087-PZ-4		
	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]
2020 - Month	PZ-1	PZ-2		PZ-3	PZ-4	
January	4.44	4.20	0.24	4.68	4.19	0.49
February	4.38	3.98	0.40	4.42	3.92	0.50
March	4.12	3.60	0.52	4.13	3.60	0.53
April	4.49	3.89	0.60	4.54	3.85	0.69
May	4.04	4.01	**0.03**	4.41	3.84	0.57
June	3.35	3.42	**-0.07**	3.81	3.21	0.60
July	4.21	3.52	0.69	4.28	3.31	0.97
August	4.09	3.98	0.11	4.57	3.64	0.93
September	3.41	3.64	**-0.23**	3.98	3.40	0.58
October	3.68	3.55	0.13	3.82	3.38	0.44
November	4.81	3.76	1.05	4.69	3.74	0.95
December	5.30	4.00	1.30	5.00	4.06	0.94

1. Average monthly head from datalogger
2. Average monthly gradient across barrier wall. **Bold** values do not meet the LTMP criterion of inward gradient (>0.1ft)
3. Positive value indicates inward gradient towards SA-6 North soil containment cell.

Table 4-3
Monthly Average Heads and Gradients Across Barrier Walls - SA-6

	087-PZ-5/087-PZ-6			087-PZ-7/087-PZ-8		
	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]
2020 - Month	PZ-5	PZ-6		PZ-7	PZ-8	
January	5.56	3.97	1.59	6.22	3.89	2.33
February	5.47	3.86	1.61	6.00	3.86	2.14
March	5.31	3.59	1.72	5.85	3.79	2.06
April	5.69	3.58	2.11	6.24	3.59	2.65
May	5.31	3.63	1.68	5.98	1.98	4.00
June	4.63	3.36	1.27	5.42	1.34*	4.08
July	5.55	3.17	2.38	6.08	3.28	2.80
August	5.47	3.27	2.20	5.89	3.42	2.47
September	4.70	3.31	1.39	5.26	3.52	1.74
October	4.76	3.28	1.48	5.25	3.55	1.70
November	5.82	3.32	2.50	6.29	3.71	2.58
December	6.07	3.43	2.64	6.54	3.68	2.86

1. Average monthly head from datalogger
2. Average monthly gradient across barrier wall. **Bold** values do not meet the LTMP criterion of inward gradient (>0.1ft)
3. Positive value indicates inward gradient towards SA-6 North soil containment cell.

* PZ-8 data suspect for June. Datalogger sent back to manufacturer for calibration, replaced for July, and reporting accurately based on comparison with manual readings.

Table 4-3
Monthly Average Heads and Gradients Across Barrier Walls - SA-6

	087-PZ-9/087-PZ-10			124-PZ-11/124-PZ-12		
	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,4]
2020 - Month	PZ-9	PZ-10		PZ-11	PZ-12	
January	2.54	4.65	**-2.11**	6.62	4.10	2.52
February	2.53	4.67	**-2.14**	6.76	3.89	2.87
March	2.63	4.56	**-1.93**	6.77	3.94	2.83
April	2.89	4.44	**-1.55**	6.83	4.38	2.44
May	2.63	3.11	**-0.48**	6.31	4.64	1.67
June	2.47	3.24	**-0.77**	5.77	4.59	1.18
July	2.77	3.59	**-0.82**	6.44	4.25	2.19
August	2.72	3.62	**-0.90**	6.35	3.81	2.54
September	2.50	3.62	**-1.12**	5.80	3.30	2.50
October	2.48	3.67	**-1.19**	5.86	2.93	2.93
November	2.50	4.30	**-1.80**	6.58	2.96	3.62
December	2.68	4.14	**-1.46**	6.88	3.20	3.68

1. Average monthly head from datalogger
2. Average monthly gradient across barrier wall. **Bold** values do not meet the LTMP criterion of inward gradient (>0.1ft)
3. Positive value indicates inward gradient towards SA-6 North soil containment cell.
4. Positive value indicates inward gradient towards SA-6 South soil containment cell.

Table 4-3
Monthly Average Heads and Gradients Across Barrier Walls - SA-6

	124-PZ-13/124-PZ-14			124-PZ-15/124-PZ-16		
	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]
2020 - Month	PZ-13	PZ-14		PZ-15	PZ-16	
January	7.25	2.83	4.42	6.16	2.58	3.58
February	7.44	3.17	4.27	6.26	3.03	3.23
March	7.36	3.59	3.77	6.23	3.44	2.79
April	7.58	4.17	3.41	6.49	3.94	2.55
May	6.97	4.49	2.48	5.98	4.09	1.89
June	6.15	4.02	2.13	5.28	2.45**	2.83
July	6.46	2.76	3.70	5.50	2.49	3.01
August	6.52	2.63	3.89	5.52	2.02	3.50
September	5.90	1.99	3.91	5.06	1.80	3.26
October	5.79	1.89*	3.90	4.92	1.72	3.20
November	6.93	2.15	4.78	5.64	1.84	3.80
December	7.55	2.68	4.87	6.22	2.51	3.71

1. Average monthly head from datalogger
2. Average monthly gradient across barrier wall. **Bold** values do not meet the LTMP criterion of inward gradient (>0.1ft)
3. Positive value indicates inward gradient towards SA-6 South soil containment cell.

* Due to extended pumping of the SA-6 South CGWES extraction pump for the Deferred Area Remedy, groundwater level in PZ-14 dropped below the elevation of the datalogger from 10/1/20 - 10/19/20. The elevation of the datalogger was 2.60 ft., msl. Datalogger was lowered to compensate for low water level on 10/19/20.

**PZ-16 data suspect for June. Datalogger sent back to manufacturer for calibration, replaced for July, and reporting accurately based on comparison with manual readings.

Table 4-3
Monthly Average Heads and Gradients Across Barrier Walls - SA-6

	124-PZ-17/124-PZ-18			124-PZ-19/124-PZ-20		
	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]
2020 - Month	PZ-17	PZ-18		PZ-19	PZ-20	
January	4.70	2.21	2.49	3.08	2.00	1.08
February	4.74	2.99	1.75	3.11	2.89	0.22
March	4.70	3.42	1.28	3.25	3.30	**-0.05**
April	5.11	3.95	1.17	3.25	3.66	**-0.41**
May	4.71	4.28	0.43	3.02	3.93	**-0.91**
June	4.21	3.95	0.26	3.11	3.57	**-0.46**
July	4.64	2.14	2.50	NA	NA	NA
August	4.55	1.09	3.46	NA	NA	NA
September	4.15	0.89	3.26	NA	NA	NA
October	4.07	0.87	3.20	NA	NA	NA
November	4.44	1.43	3.01	NA	NA	NA
December	4.84	2.61	2.23	NA	NA	NA

1. Average monthly head from datalogger
2. Average monthly gradient across barrier wall. **Bold** values do not meet the LTMP criterion of inward gradient (>0.1ft)
3. Positive value indicates inward gradient towards SA-6 South soil containment cell.
4. NA - Data not available due to SA-6 South Deferred Area Remedy. PZ-19 and PZ-20 abandoned on 6/19/20 and 7/24/20, respectively. Dataloggers were reinstalled in January 2021.

Table 4-3
Monthly Average Heads and Gradients Across Barrier Walls - SA-6

	115-PZ-500/115-W3-SO			115-PZ-501/115-E1A-SO		
	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]
2020 - Month	PZ-500	W3-SO		PZ-501	E1A-SO	
January	4.47	2.21	2.26	5.24	2.20	3.04
February	4.60	2.56	2.04	5.34	2.69	2.65
March	4.63	2.95	1.68	5.17	3.18	1.99
April	4.66	3.34	1.31	5.33	3.70	1.63
May	4.48	3.84	0.64	5.29	4.08	1.21
June	4.38	3.95	0.43	4.84	3.70	1.14
July	4.40	2.99	1.41	4.58	2.42	2.16
August	4.26	1.67	2.59	4.72	1.80	2.92
September	4.21	0.88	3.33	4.35	1.72	2.63
October	4.24	0.80	3.44	4.29	1.74	2.55
November	4.41	1.11	3.30	4.65	2.11	2.54
December	4.87	2.08	2.79	4.93	2.46	2.47

1. Average monthly head from datalogger
2. Average monthly gradient across barrier wall. **Bold** values do not meet the LTMP criterion of inward gradient (>0.1ft)
3. Positive value indicates inward gradient towards SA-6 South soil containment cell.

Table 4-3
Monthly Average Heads and Gradients Across Barrier Walls - SA-6

	115-PZ-501/115-W5-SO			115-PZ-502/115-E4-SO		
	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]
2020 - Month	PZ-501	W5-SO		PZ-502	E4-SO	
January	5.24	2.48	2.76	4.83	4.10	0.73
February	5.34	3.30	2.04	4.98	3.69	1.29
March	5.17	3.60	1.57	4.95	3.61	1.34
April	5.33	4.12	1.21	5.05	3.62	1.43
May	5.29	4.17	1.12	4.95	3.68	1.27
June	4.84	3.85	0.99	4.70	3.10	1.60
July	4.58	2.46	2.12	4.66	3.22	1.44
August	4.72	1.67	3.05	4.55	3.61	0.94
September	4.35	1.45	2.90	4.29	3.31	0.98
October	4.29	1.46	2.83	4.30	3.20	1.10
November	4.65	1.96	2.69	4.54	3.46	1.08
December	4.93	2.73	2.20	4.69	3.81	0.88

1. Average monthly head from datalogger
2. Average monthly gradient across barrier wall. **Bold** values do not meet the LTMP criterion of inward gradient (>0.1ft)
3. Positive value indicates inward gradient towards SA-6 South soil containment cell.
4. Positive value indicates inward gradient towards SA-6 North soil containment cell.

Table 4-3
Monthly Average Heads and Gradients Across Barrier Walls - SA-6

	115-PZ-502/115-E5-SO			115-PZ-503/115-W6-SO		
	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]
2020 - Month	PZ-502	E5-SO		PZ-503	W6-SO	
January	4.83	4.99	**-0.16**	4.36	4.17	0.19
February	4.98	4.85	0.13	4.55	4.20	0.35
March	4.95	4.47	0.48	4.62	4.20	0.42
April	5.05	4.70	0.35	4.60	4.18	0.42
May	4.95	4.41	0.54	4.52	2.89	1.63
June	4.70	3.48	1.22	4.42	3.06	1.36
July	4.66	3.90	0.76	4.41	3.26	1.15
August	4.55	4.32	0.23	4.34	3.37	0.97
September	4.29	3.63	0.66	4.19	3.42	0.77
October	4.30	3.63	0.67	4.19	3.45	0.74
November	4.54	5.05	**-0.51**	4.19	3.74	0.45
December	4.69	5.42	**-0.73**	4.22	3.64	0.58

1. Average monthly head from datalogger
2. Average monthly gradient across barrier wall. **Bold** values do not meet the LTMP criterion of inward gradient (>0.1ft)
3. Positive value indicates inward gradient towards SA-6 North soil containment cell.

Table 4-3
Monthly Average Heads and Gradients Across Barrier Walls - SA-6

	115-PZ-503/115-W1-SO		
	Exterior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft, msl)[1]	Average Gradient (ft)[2,3]
Month	PZ-503	W1-SO	
January	4.36	4.17	0.19
February	4.55	4.26	0.29
March	4.62	4.14	0.48
April	4.60	4.09	0.51
May	4.52	3.12	1.40
June	4.42	3.06	1.36
July	4.41	3.21	1.20
August	4.34	3.35	0.99
September	4.19	3.31	0.88
October	4.19	3.43	0.76
November	4.19	3.58	0.61
December	4.22	3.55	0.67

1. Average monthly head from datalogger
2. Average monthly gradient across barrier wall. **Bold** values do not meet the LTMP criterion of inward gradient (>0.1ft)
3. Positive value indicates inward gradient towards SA-6 North soil containment cell.

Table 4-4
Monthly Average Heads and Gradients Across Barrier Walls - NJCU

	184-MW-101/184-MW-105			184-MW-106/184-MW-102		
	Exterior Piezometer/Monitoring Well Average Head (ft. msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft. msl)[1]	Average Gradient (ft)[2]	Exterior Piezometer/Monitoring Well Average Head (ft. msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft. msl)[1]	Average Gradient (ft)[2]
2020 - Month	184-MW-101	184-MW-105		184-MW-106[3]	184-MW-102[3]	
January	6.10	5.73	0.37	6.04	6.35	**-0.31**
February	6.10	5.69	0.41	5.95	6.25	**-0.30**
March	5.96	5.68	0.28	5.84	6.15	**-0.31**
April	6.27	5.84	0.43	6.12	6.38	**-0.26**
May	5.90	5.91	**-0.01**	6.00	6.33	**-0.33**
June	5.35	5.81	**-0.46**	5.66	5.77	**-0.11**
July	5.58	5.63	**-0.05**	5.70	6.02	**-0.32**
August	5.57	5.78	**-0.21**	5.84	6.18	**-0.34**
September	5.14	5.59	**-0.45**	5.50	5.88	**-0.38**
October	5.24	5.45	**-0.21**	5.41	5.86	**-0.45**
November	5.81	5.44	0.37	5.94	6.30	**-0.36**
December	5.91	5.44	0.47	6.07	6.37	**-0.30**

Notes:

1. Average monthly head from data logger
2. Average monthly gradient across barrier wall. Bold values do not meet the LTMP criterion of inward gradient (>0.1 ft)
3. Data loggers removed from wells 184-MW-106,102,103,107, 104, and 108 on November 6. Monthly average gradients determined from weekly manual data.

Table 4-4
Monthly Average Heads and Gradients Across Barrier Walls - NJCU

	184-MW-103/184-MW-107			184-MW-104/184-MW-108		
	Exterior Piezometer/Monitoring Well Average Head (ft. msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft. msl)[1]	Average Gradient (ft)[2]	Exterior Piezometer/Monitoring Well Average Head (ft. msl)[1]	Interior Piezometer/Monitoring Well Average Head (ft. msl)[1]	Average Gradient (ft)[2]
2020 - Month	184-MW-103[3]	184-MW-107[3]		184-MW-104[3]	184-MW-108[3]	
January	6.51	6.46	**0.05**	6.92	6.96	**-0.04**
February	6.38	6.23	0.15	6.83	6.73	**0.10**
March	6.26	6.16	**0.10**	6.73	6.60	0.13
April	6.43	6.37	**0.06**	6.80	6.85	**-0.05**
May	6.33	6.18	0.15	6.71	6.76	**-0.05**
June	6.05	5.76	0.29	6.39	6.41	**-0.02**
July	6.17	6.05	0.12	6.74	6.53	0.21
August	6.29	6.19	**0.10**	6.70	6.67	**0.03**
September	5.99	5.90	**0.09**	6.26	6.31	**-0.05**
October	6.01	5.96	**0.05**	6.64	6.43	0.21
November	6.44	6.33	0.11	6.92	6.82	**0.10**
December	6.56	6.42	0.14	7.00	6.91	**0.09**

Notes:

1. Average monthly head from data logger
2. Average monthly gradient across barrier wall. Bold values do not meet the LTMP criterion of inward gradient (>0.1 ft)
3. Data loggers removed from wells 184-MW-106,102,103,107, 104, and 108 on November 6. Monthly average gradients determined from weekly manual data.

Table 5-1
Summary of Groundwater Quality Data from GWET Extraction Wells

Parameter	27-Mar-20			29-Jun-20			29-Sep-20			16-Dec-20		
	PW-1 (ug/L)	**PW-3** (ug/L)	**115-MW-215BR** (ug/L)	**PW-1** (ug/L)	**PW-3** (ug/L)	**115-MW-215BR** (ug/L)	**PW-1** (ug/L)	**PW-3** (ug/L)	**115-MW-215BR** (ug/L)	**PW-1** (ug/L)	**PW-3** (ug/L)	**115-MW-215BR** (ug/L)
Benzene	1.4	5.6	ND	1.2	5	ND	1.5	4.4	ND	1.5	4.5	ND
Carbon Tetrachloride	3.1	7.4	3.2	2.3	7.6	2.8	2.9	5.1	2.9	2.7	7.1	3.1
Chloroform	11.1	11	ND	9.9	9.2	ND	11.3	7.9	ND	11.2	8.1	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	62.6	53.7	ND	51.4	46.5	ND	62.9	45	ND	57.8	43.9	ND
trans-1,2-Dichloroethene	2	1.3	ND	1.7	1.2	ND	2.1	1.1	ND	2.4	1.2	ND
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	48.1	64.6	ND	37.9	55.8	ND	43.2	44.9	ND	44.2	50.9	ND
1,1-Dichloroethane	1.1	ND	ND	1.1	ND	ND	1.7	ND	ND	1.4	ND	ND
Methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	11.8	11.7	ND	10.4	13.6	ND	20.3	13.3	ND	12.5	10.9	ND
1,2-Dichlorobenzene	0.46	ND	ND	0.44	ND	ND	0.45	ND	ND	0.37	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexavalent Chromium	18,500	21,300	13,700	19,000	22,000	11,300	17,900	19,200	13,400	17,400	20,900	14,600
Total Chromium	21,000	23,500	15,100	18,000	22,000	10,600	16,600	17,800	14,200	17,300	20,500	14,600

ND = Not detected above reporting limit.
PW-3 replaced PW-2 in start of 2016

Table 5-2
Summary of Groundwater Quality Monitoring Results - SA-6 and SA-7

Sample Location	Sample Date	Total Chromium µg/l	Total Chromium µg/l (Filtered)	Hexavalent Chromium µg/l	Hexavalent Chromium µg/l (Filtered)
087-PZ-02	6/16/2020	7.9	4 U	5.5 U	5.5 U
	7/16/2020	7.2	4.4	5.5 U	5.5 U
	10/22/2020	6.1	4.8	5.5 U	5.5 U
087-PZ-10	5/26/2020	10 U	10 U	5.5 U	5.5 U
124-PZ-20	5/26/2020	10 U	10 U	5.5 U	5.5 U

Notes:

Bold Exceeds GWQS 70 µg/l

GWQS - Highest of NJDEP Ground Water Quality Standards, N.J.A.C 7:9C; last amended 6/1/2020

U - Not detected above reporting limit

J - Estimated value

µg/l - micrograms/liter

Table 5-3
Summary of Groundwater Quality Monitoring Results - NJCU

Sample Location	Sample Date	Total Chromium ug/l	Total Chromium ug/l (Filtered)	Hexavalent Chromium ug/l	Hexavalent Chromium ug/l (Filtered)
184-MW-101	3/12/2020	4.0 U	4.0 U	5.5 UJ	5.5 UJ
	6/3/2020	4.0 U	4.0 U	5.5 U	5.5 U
	9/11/2020	4.4	4	5.5 U	5.5 U
	12/10/2020	4.0 U	4.0 U	5.5 U	5.5 U
184-MW-102	3/12/2020	**129**	7.5	5.5 UJ	5.5 U
	6/3/2020	8.3	5.6	5.5 U	5.5 U
	9/9/2020	9.6	5.8	5.5 UJ	5.5 UJ
	9/9/2020 DUP	9.5	5.6	5.5 UJ	5.5 UJ
	12/11/2020	8	5.1	5.5 UJ	5.5 UJ
	12/11/2020 DUP	7.1	4.9	5.5 UJ	5.5 UJ
184-MW-103	3/11/2020	29.5	4.0 U	5.5 UJ	5.5 UJ
	6/2/2020	33.2	4.0 U	5.5 U	5.5 UJ
	9/9/2020	5.9	4.0 U	5.5 UJ	5.5 UJ
	12/10/2020	29.6	27.8	28	27
184-MW-104	3/11/2020	4.0 U	4.0 U	5.5 UJ	5.5 UJ
	3/11/2020 DUP	4.0 U	4.0 U	5.5 UJ	5.5 UJ
	6/2/2020	4.0 U	4.0 U	5.5 U	5.5 UJ
	9/9/2020	4.0 U	4.0 U	5.5 UJ	5.5 UJ
	12/10/2020	4.0 U	4.0 U	5.5 U	5.5 U
184-MW-105	3/12/2020	4.0 U	4.0 U	5.5 UJ	5.5 UJ
	6/3/2020	4.0 U	4.0 U	5.5 U	5.5 U
	9/11/2020	4.0 U	4.0 U	5.5 U	5.5 U
	12/10/2020	4.0 U	4.0 U	5.5 U	5.5 U
184-MW-106	3/12/2020	6.8	6	5.5 UJ	5.5 UJ
	6/2/2020	6.3	6	5.5 U	5.5 UJ
	9/9/2020	6.9	6.3	5.5 UJ	5.5 UJ
	12/10/2020	5.8	5.6	5.5 U	5.5 U
184-MW-107	3/11/2020	**689**	4.0 U	5.5 UJ	5.5 UJ
	6/2/2020	**2790**	4.0 U	5.5 U	5.5 UJ
	9/9/2020	61	4.0 U	5.5 UJ	5.5 UJ
	12/11/2020	**84.7**	4.0 U	5.5 UJ	5.5 UJ
184-MW-108	3/11/2020	20 U	4.0 U	5.5 UJ	5.5 UJ
	6/2/2020	4.0 U	4.0 U	5.5 U	5.5 UJ
	6/2/2020 DUP	4.0 U	4.0 U	5.5 U	5.5 UJ
	9/9/2020	21.7	4.0 U	5.5 UJ	5.5 UJ
	12/10/2020	4.0 U	4.0 U	5.5 U	5.5 UJ

BOLD Exceeds Groundwater Quality Standard

U - Value not detected above reporting limit

J- Estimated value

FIGURES

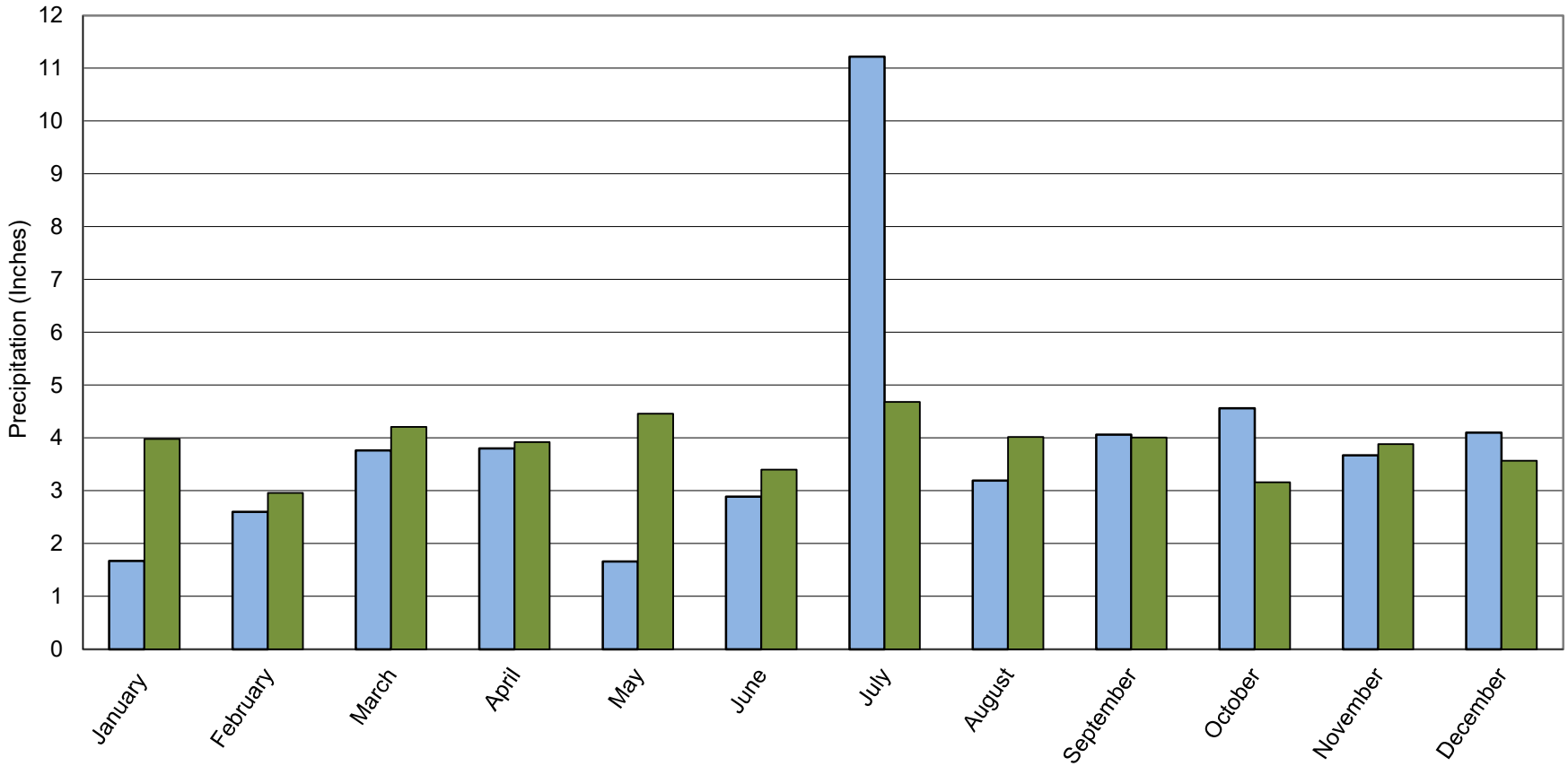

FIGURE 2-1

2020 Monthly Precipitation

Integrated Annual Groundwater Performance Report
2020

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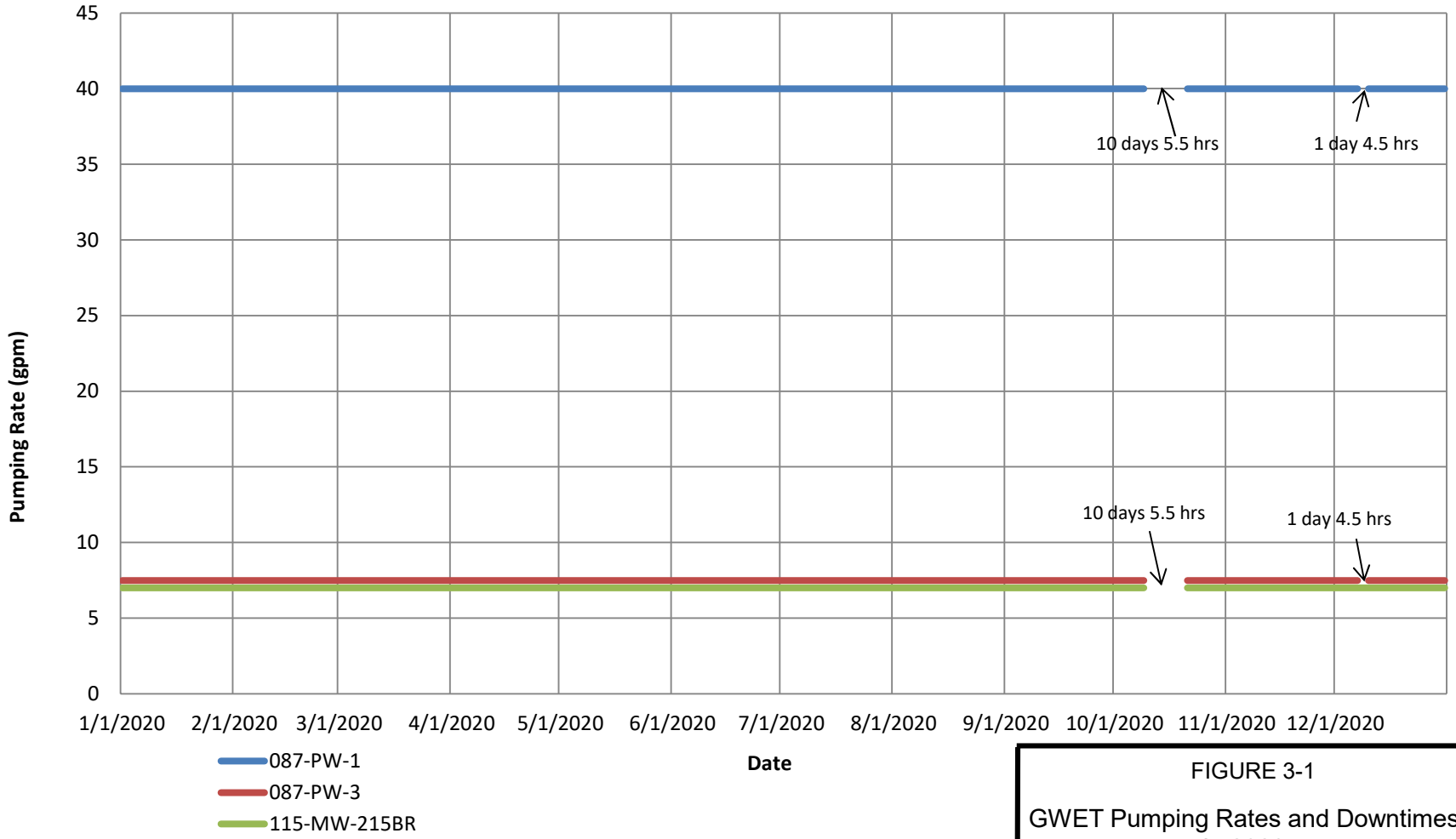
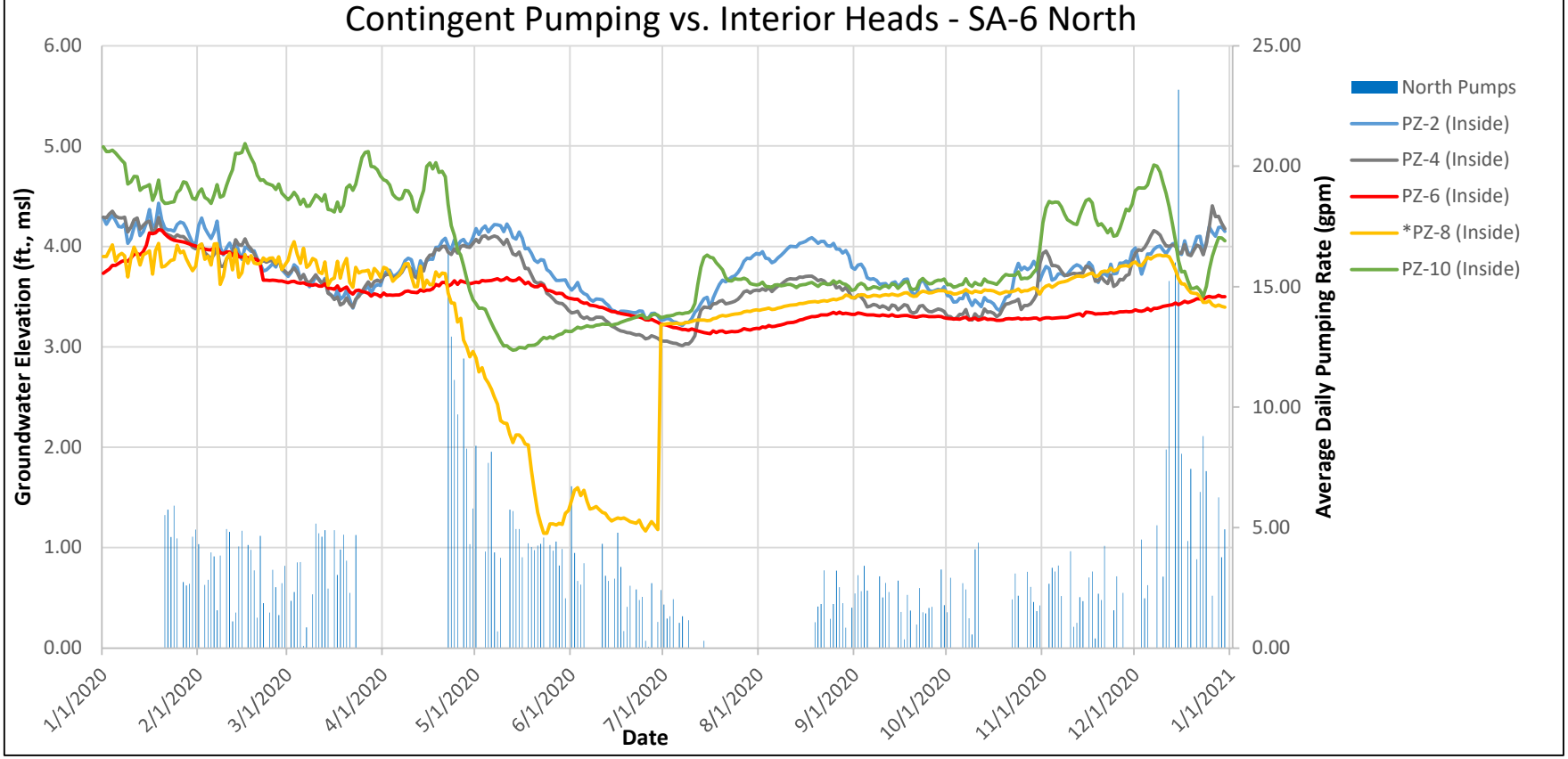


FIGURE 3-1

GWET Pumping Rates and Downtimes In 2020

Integrated Annual Groundwater Performance Report 2020

cornerstone environmental



Notes:

* PZ-8 datalogger sent back to manufacturer in June for calibration due to suspected data corruption. Replaced in July and reporting accurately based on comparison with manual readings.

FIGURE 3-2

Contingent Pumping vs.
Interior Heads – SA6 North

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2020

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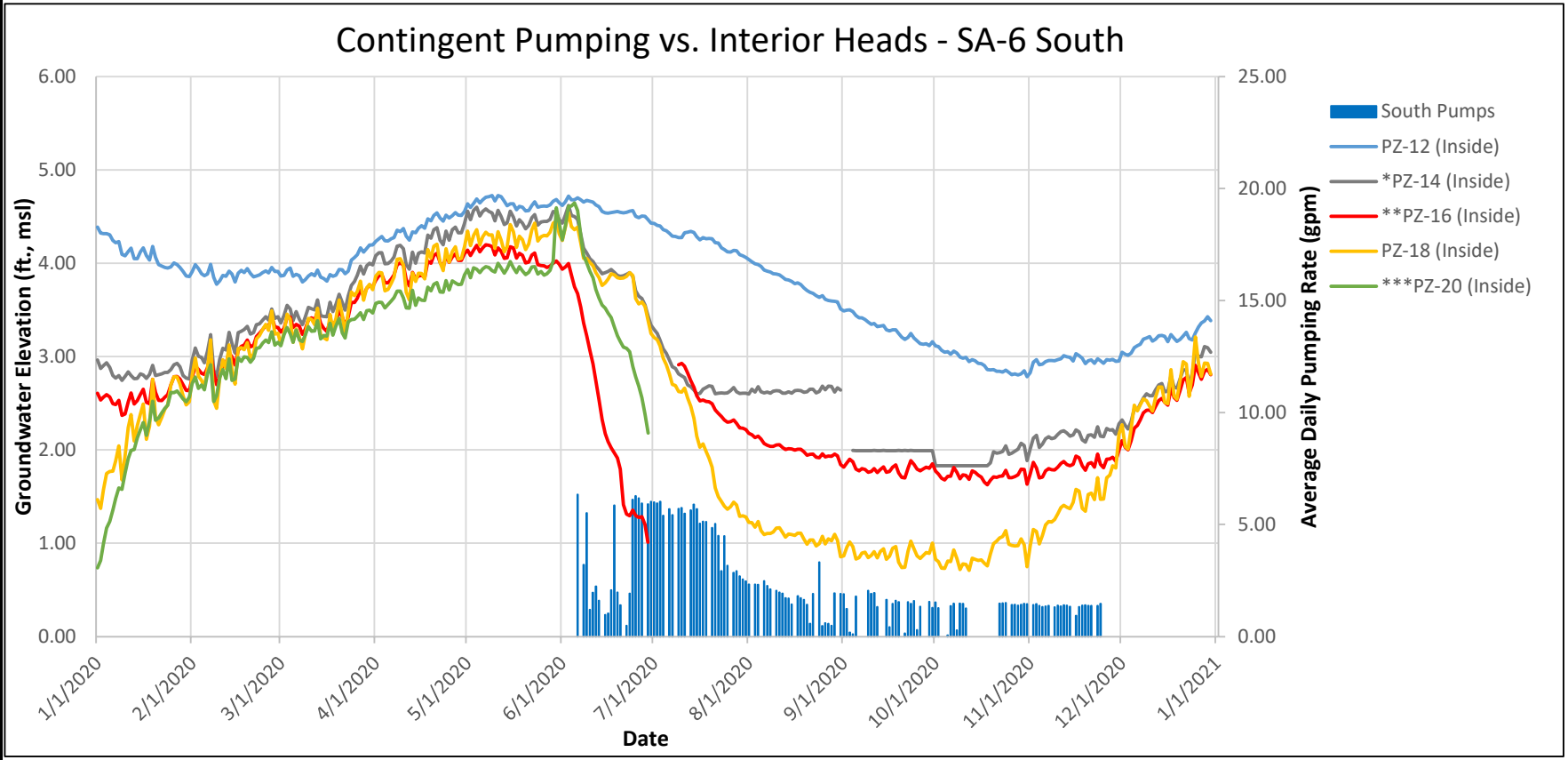

Notes:

* PZ-14 data missing 9/1/20 - 9/3/20 due to datalogger maintenance. Due to extended pumping of the SA-6 South CGWES extraction pump for the Deferred Area Remedy, groundwater level in PZ-14 dropped below the elevation of the datalogger from 10/1/20 - 10/19/20. The elevation of the datalogger was 2.60 ft., msl. Datalogger was lowered to compensate for low water level on 10/19/20.

** PZ-16 data suspect for June. Removed and sent back to manufacturer on 7/1/20 for calibration and replaced on 7/10/20.

*** PZ-20 abandoned on 7/24/20 due to SA-6 South Deferred Area Remedy. Datalogger was reinstalled in January 2021.

FIGURE 3-3

Contingent Pumping vs.
Interior Heads - SA6 South

Integrated Annual Groundwater Performance Report
2020

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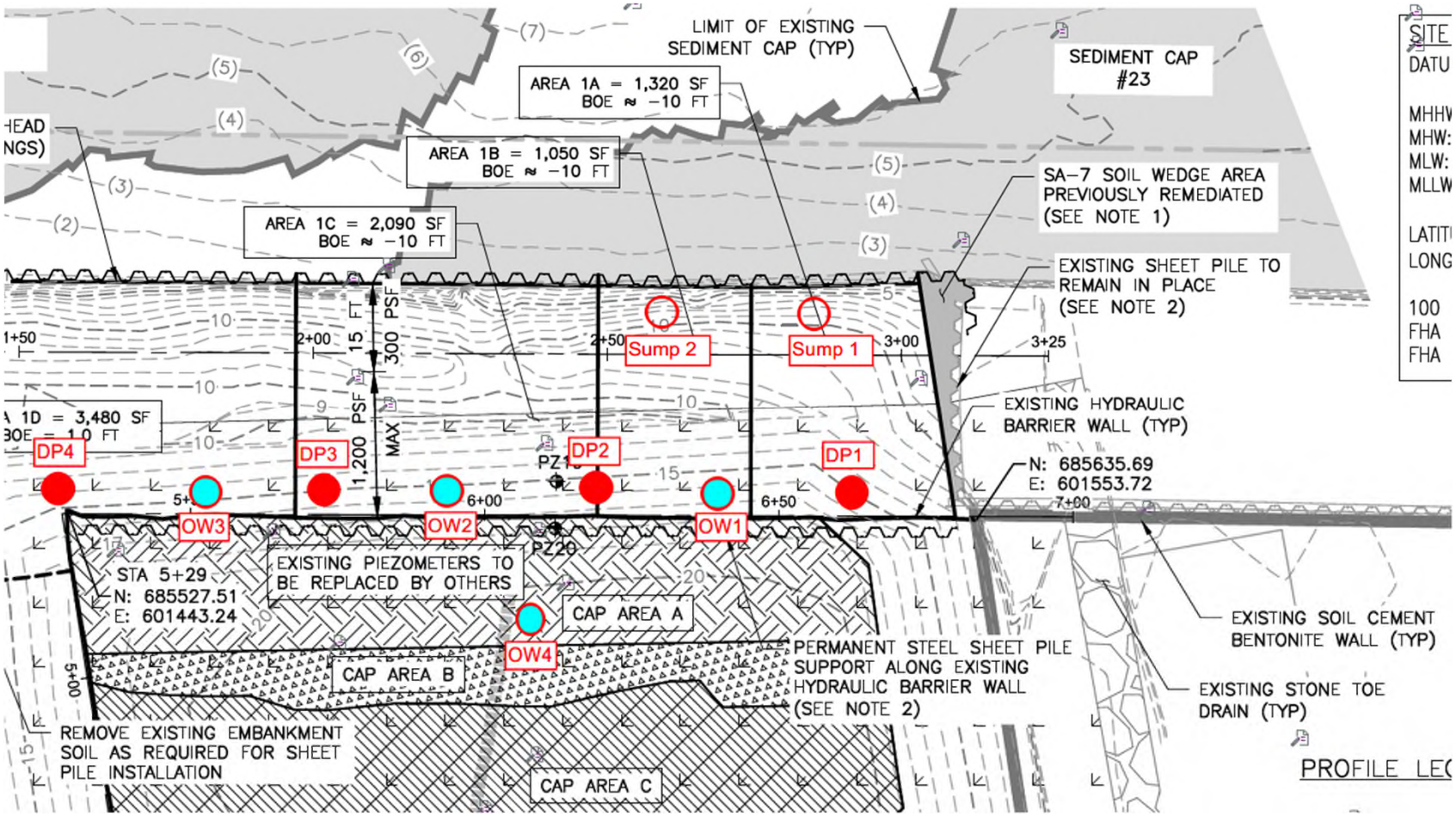

FIGURE 3-4

SA-6 South Deferred Area Depressurization and Observation Well Locations

Integrated Annual Groundwater Performance Report 2020

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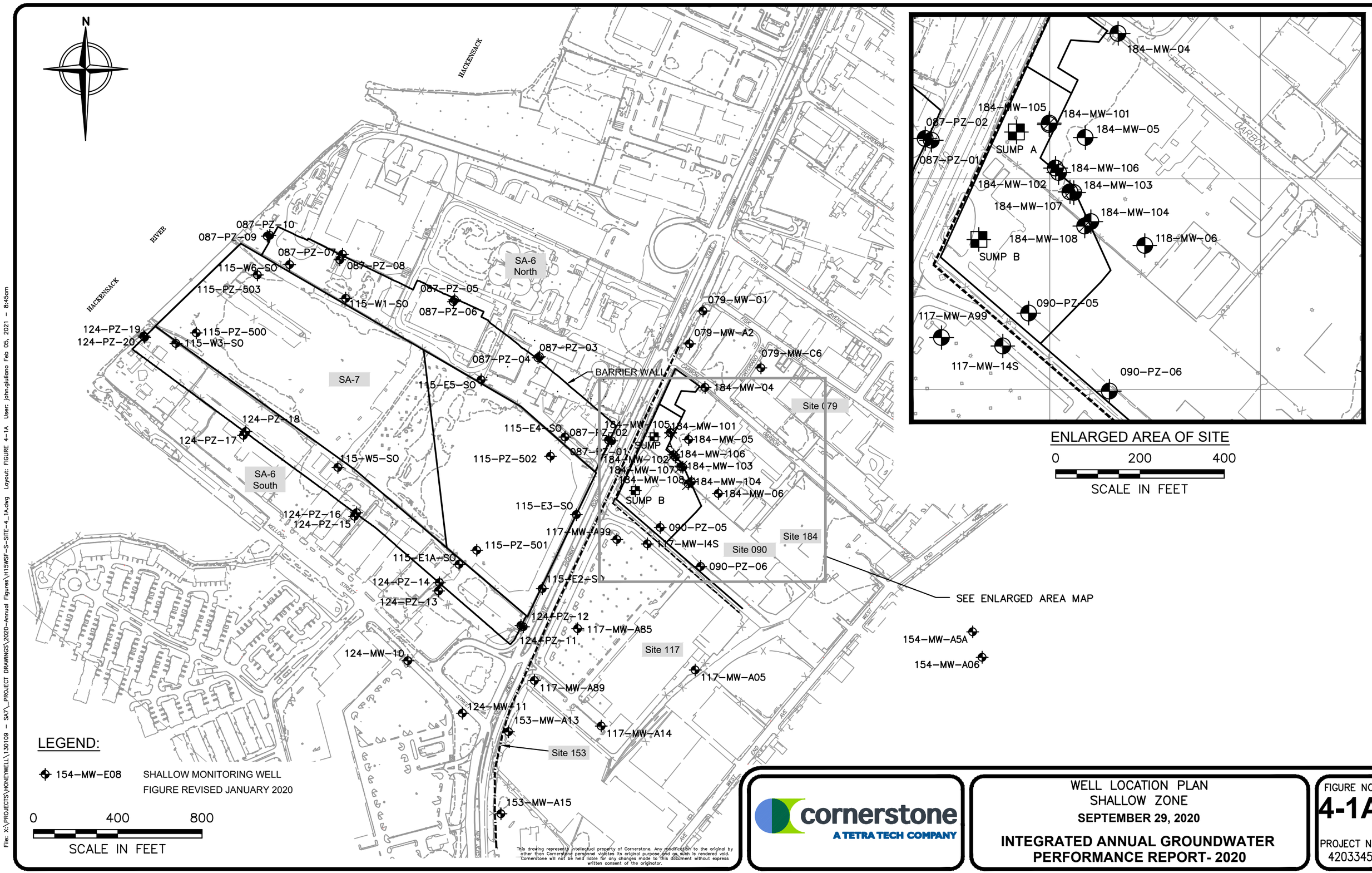

File: X:\PROJECTS\HONEYWELL\130109 - SA7_PROJECT DRAWINGS\2020-Annual Figures\H15WSF-S-SITE-4-1A.dwg Layout: FIGURE 4-1A User: john.giuliano Feb 05, 2021 - 8:45am

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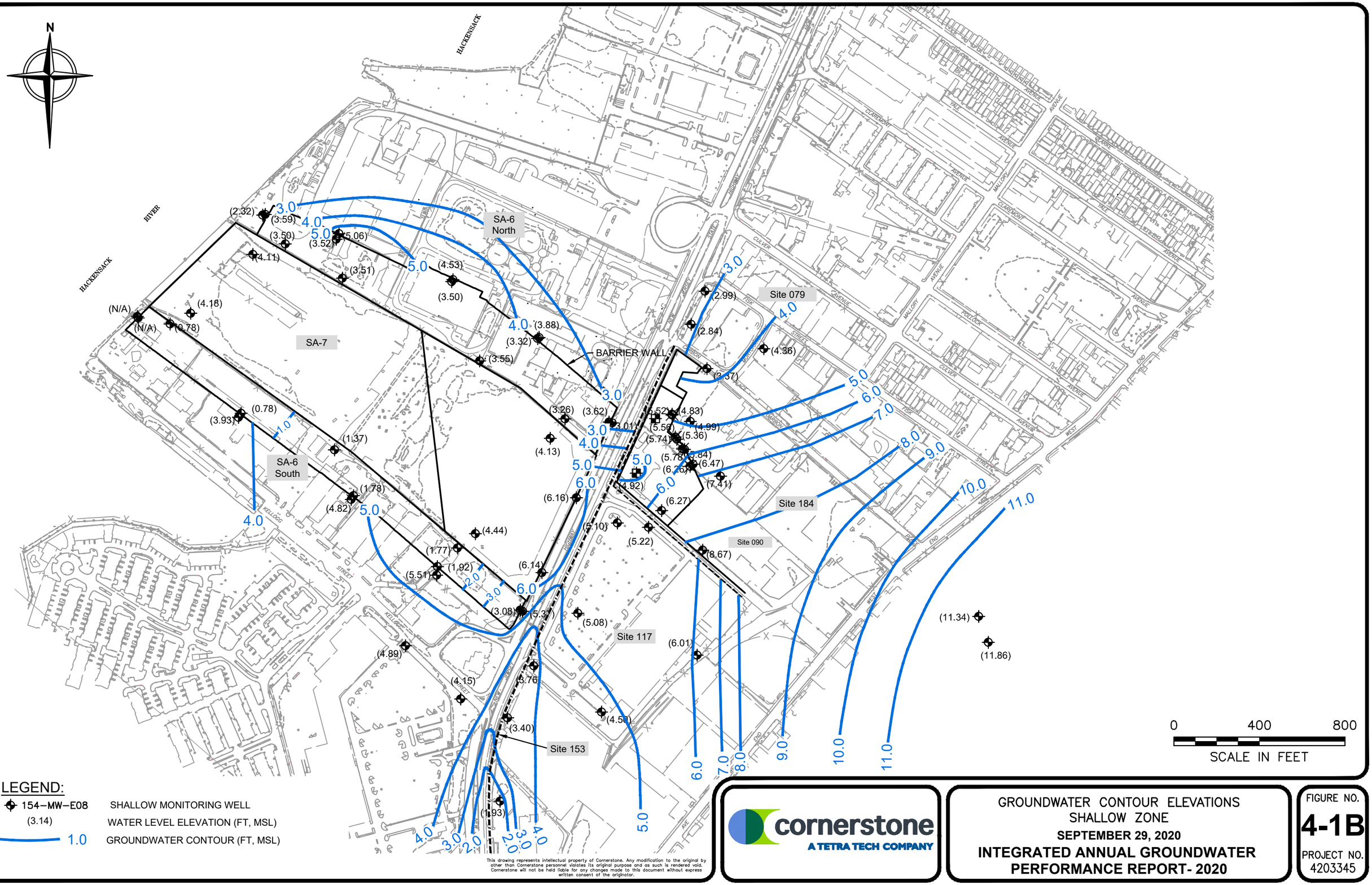
WELL LOCATION PLAN
SHALLOW ZONE
SEPTEMBER 29, 2020

INTEGRATED ANNUAL GROUNDWATER PERFORMANCE REPORT- 2020

FIGURE NO.
4-1A
PROJECT NO.
4203345



LEGEND:

- 154-MW-E08 (3.14) — SHALLOW MONITORING WELL; WATER LEVEL ELEVATION (FT, MSL)
- 1.0 — GROUNDWATER CONTOUR (FT, MSL)

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GROUNDWATER CONTOUR ELEVATIONS
SHALLOW ZONE
SEPTEMBER 29, 2020
INTEGRATED ANNUAL GROUNDWATER PERFORMANCE REPORT- 2020

FIGURE NO.
4-1B
PROJECT NO.
4203345

File: \\tts625fs2\ceg2\PROJECTS\HONEYWELL\130109 - SA7_PROJECT DRAWINGS\2020-Annual Figures\H15WSF-S-SITE-4_1B.dwg Layout: FIGURE 4-1B User: John.giuliano Feb 25, 2021 - 8:59am

N

SA6-MW-AA1D (2.13)

087-OBS-07 (0.62)

087-OBS-5D (1.07)

087-OBS-2D (-1.30)

087-OBS-1D (3.24)

087-PW-2 (2.52)

087-MW-13 (1.42)

PW-03 (-5.02)

087-MW-W25D (2.77)

087-MW-029D (1.47)

087-MW-136D (1.81)

087-MW-A26D (2.87)

088-MW-15R (2.32)

124-MW-G02D (2.49)

117-MW-I3 (4.57)

117-MW-I5 (5.74)

117-MW-I2 (4.53)

117-MW-I1 (3.89)

090-MW-07 (5.23)

3.0 2.0 1 4.0 5.0 6.0

SA-6 North

SA-7

SA-6 South

Site 079

Site 090

Site 184

Site 117

Site 153

BARRIER WALLS

HACKENSACK RIVER

0 400 800

SCALE IN FEET

LEGEND:

087-MW-029D — INTERMEDIATE ZONE MONITORING WELL

(3.45) — WATER LEVEL ELEVATION (FT, MSL)

1.0 — GROUNDWATER CONTOUR (FT, MSL)

* ELEVATION NOT USED IN CONTOURING

FIGURE REVISED JANUARY 2020

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A TETRA TECH COMPANY

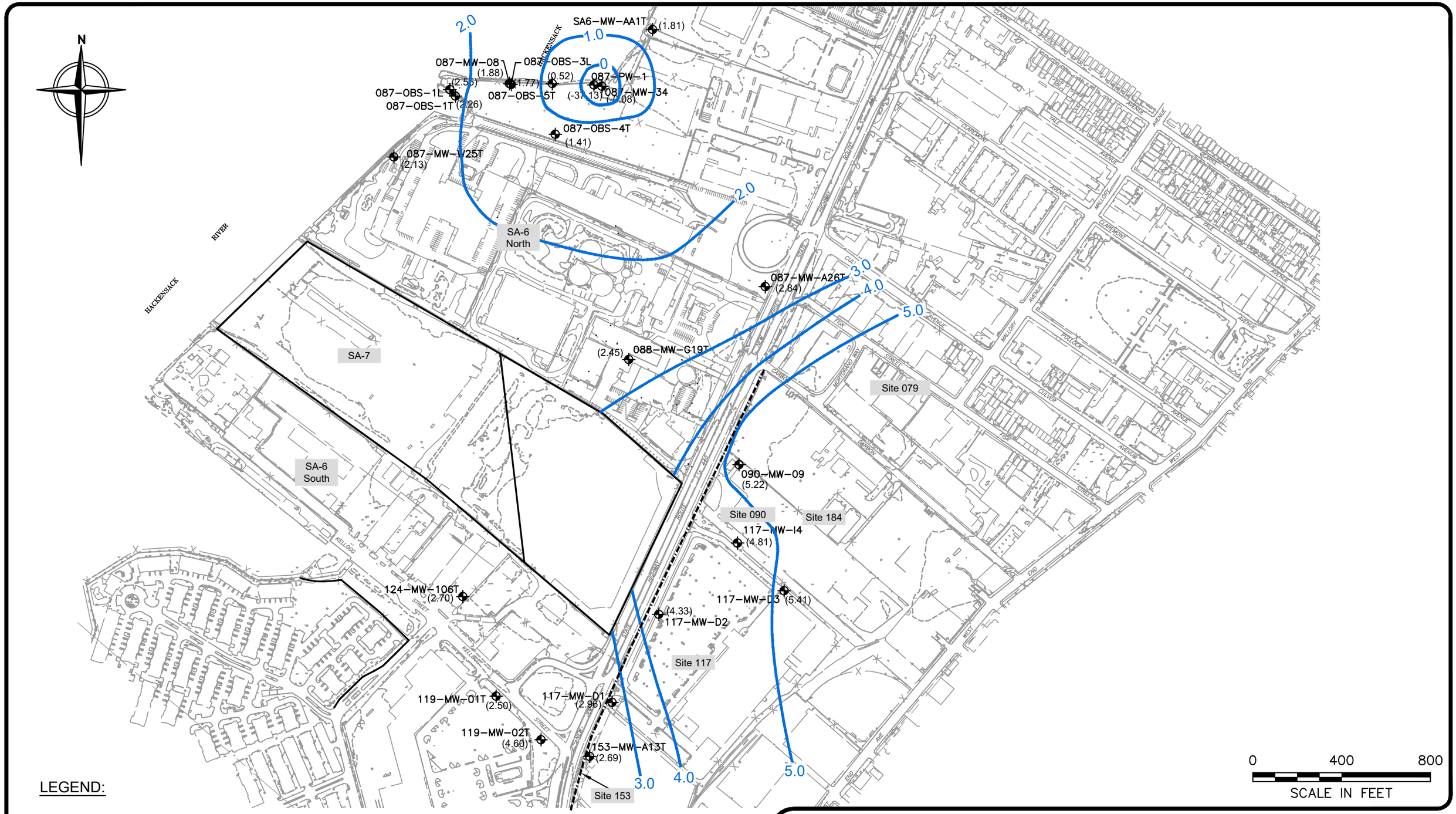
GROUNDWATER ELEVATION CONTOURS
INTERMEDIATE ZONE
SEPTEMBER 29, 2020

INTEGRATED ANNUAL GROUNDWATER PERFORMANCE REPORT- 2020

FIGURE NO. **4-2**

PROJECT NO. 4203345

File: X:\PROJECTS\HONEYWELL\130109 - SA7_PROJECT DRAWINGS\2020-Annual Figures\H15WSF-S-SITE-4_2.dwg Layout: FIGURE 4-2 User: john.giuliano Mar 02, 2021 - 3:27pm



LEGEND:

087-MW-029D	DEEP ZONE MONITORING WELL
(2.25)	WATER LEVEL ELEVATION (FT, MSL)
1.0	GROUNDWATER CONTOUR (FT, MSL)
*	VALUE NOT USED IN CONTOURING

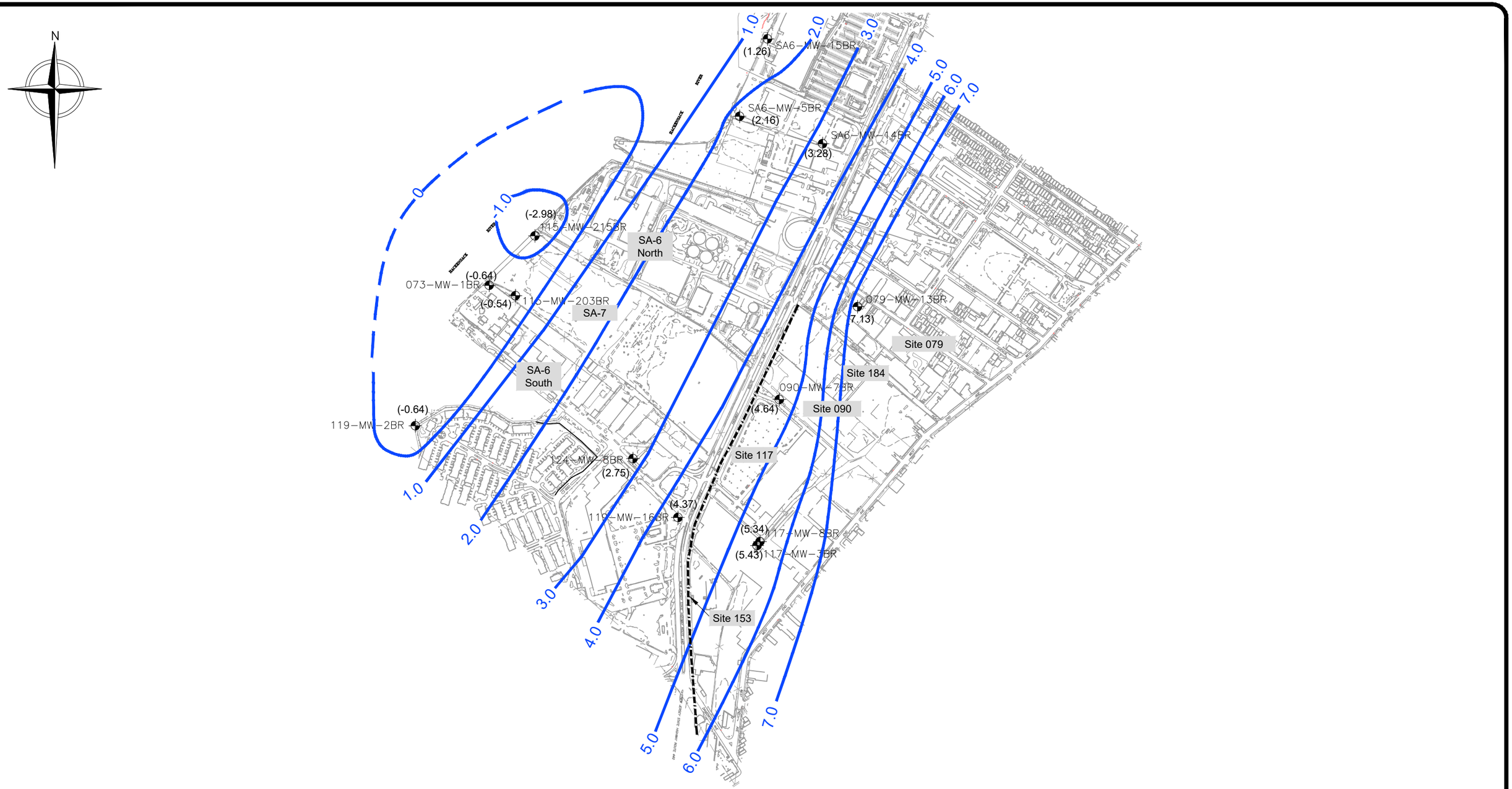
cornerstone
A TETRA TECH COMPANY

GROUNDWATER ELEVATION CONTOURS
DEEP ZONE
SEPTEMBER 29, 2020

INTEGRATED ANNUAL GROUNDWATER PERFORMANCE REPORT- 2020

FIGURE NO.
4-3
PROJECT NO.
4203345

File: \\tts625fs2\eg2\PROJECTS\HONEYWELL\130109 - SA7_PROJECT DRAWINGS\2020-Annual Figures\H15WSF-S-SITE-4_3.dwg Layout: FIGURE 4-3 User: John.giuliano Feb 25, 2021 - 9:03am



LEGEND:

119-MW-11BR	BEDROCK ZONE MONITORING WELL
(5.04)	WATER LEVEL ELEVATION (FT, MSL)
1.0	GROUNDWATER CONTOUR (FT, MSL)
*	VALUE NOT USED IN CONTOURING

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A TETRA TECH COMPANY

GROUNDWATER ELEVATION CONTOURS
BEDROCK ZONE
SEPTEMBER 29, 2020
INTEGRATED ANNUAL GROUNDWATER PERFORMANCE REPORT- 2020

FIGURE NO.
4-4
PROJECT NO.
4203345

File: X:\PROJECTS\HONEYWELL\130109 - SA7_PROJECT DRAWINGS\2020-Annual Figures\H15WSF-S-SITE-4_4.dwg Layout: FIGURE 4-4 User: John.giuliano Feb 25, 2021 - 10:15am

ELEVATION IN FEET ABOVE MEAN SEA LEVEL

20
0
-20
-40
-60
-80
-100

087 MW-W25 D,T
087-OBS-1D, L, T
087-OBS-3L
087-MW-13
087-MW-08
087-PW-3
087-PW-2
087-OBS-7
087-OBS-5D
087-OBS-5T
087-MW-34
087-OBS-2D
087-PW-1
SA6-MW-5BR
SA6-MW-AA1, D, T

FISK STREET OUTFALL

AA1 (NA)
AA1D (2.13)
AA1T (1.81)
5BR (2.16)
1D (3.24)
25D (2.77)
25T (2.13)
1L (2.55)
1T (2.26)
3L (1.77)
08 (1.88)
5D (1.07)
5T (0.52)
(1.42)
(0.62)
(-5.02)
(2.52)
(-1.30)
(-37.3)
(0.08)
1
2
3

0 100 200
SCALE IN FEET

LEGEND:

- FILL
- MEADOW MAT
- FINE TO MEDIUM SAND
- FINE, MEDIUM TO COARSE SAND
- INTERBED SILTS AND CLAYS
- GLACIAL TILL
- PASSAIC FORMATION
- FINE TO VERY FINE SAND

087-MW-W25T — WELL DESIGNATION
GROUND SURFACE
25T — SCREENED INTERVAL

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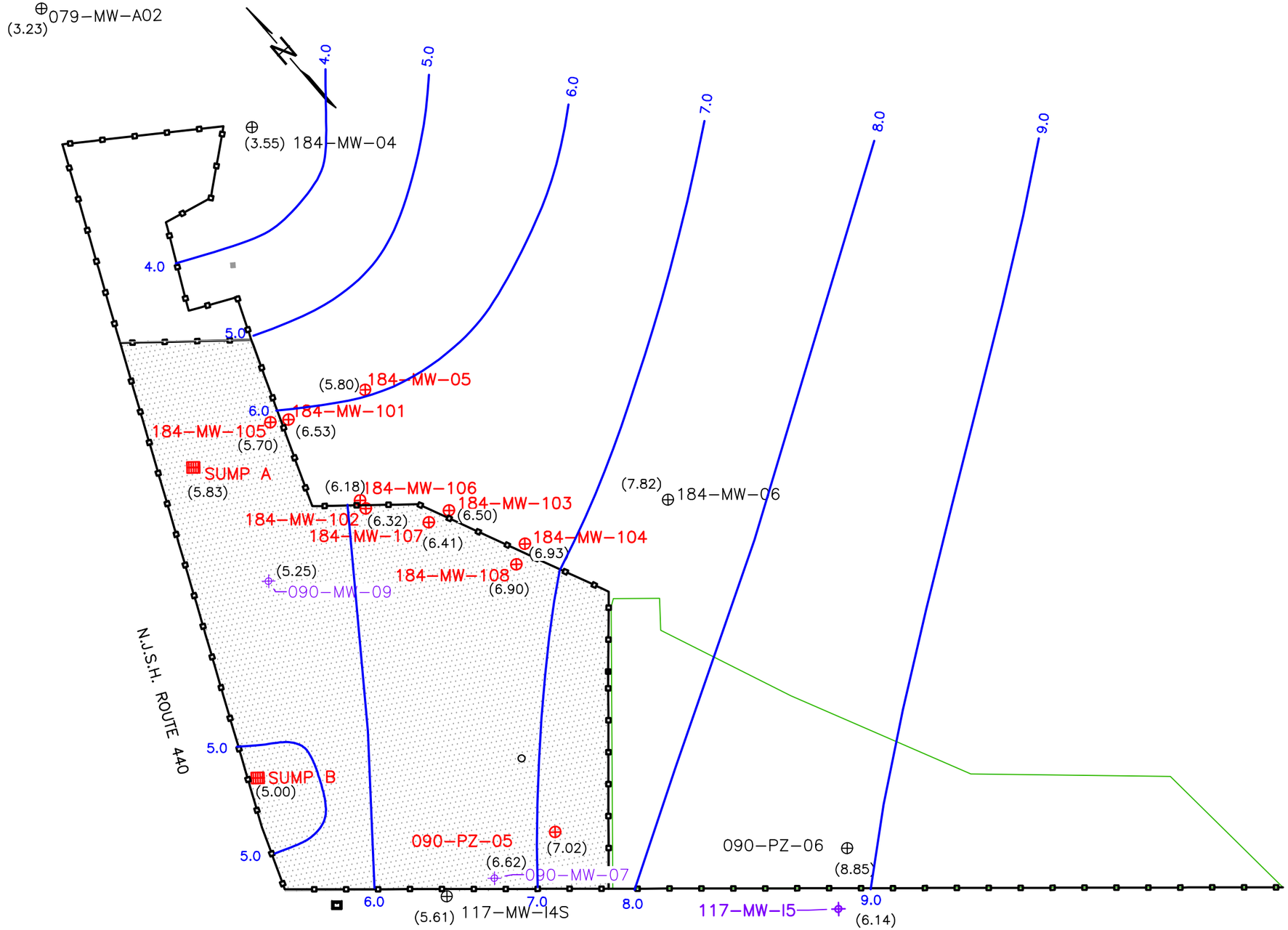
GROUNDWATER ELEVATIONS (FT, MSL)
IN CROSS-SECTION
SEPTEMBER 29, 2020
INTEGRATED ANNUAL GROUNDWATER PERFORMANCE REPORT- 2020

FIGURE NO.
4-5
PROJECT NO.
4203345



LEGEND

- MONITORING WELL
- PIEZOMETER
- SUMP
- SHEET PILE WALL
- CAP AREA
- SHALLOW MONITORING LOCATION WITH DATA LOGGER INSTALLED
- INDICATES INTERMEDIATE OR DEEP ZONE MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR
- TCE WELLS AS OF MAY 2019 ARE NO LONGER MEASURED

0 100 200

SCALE IN FEET

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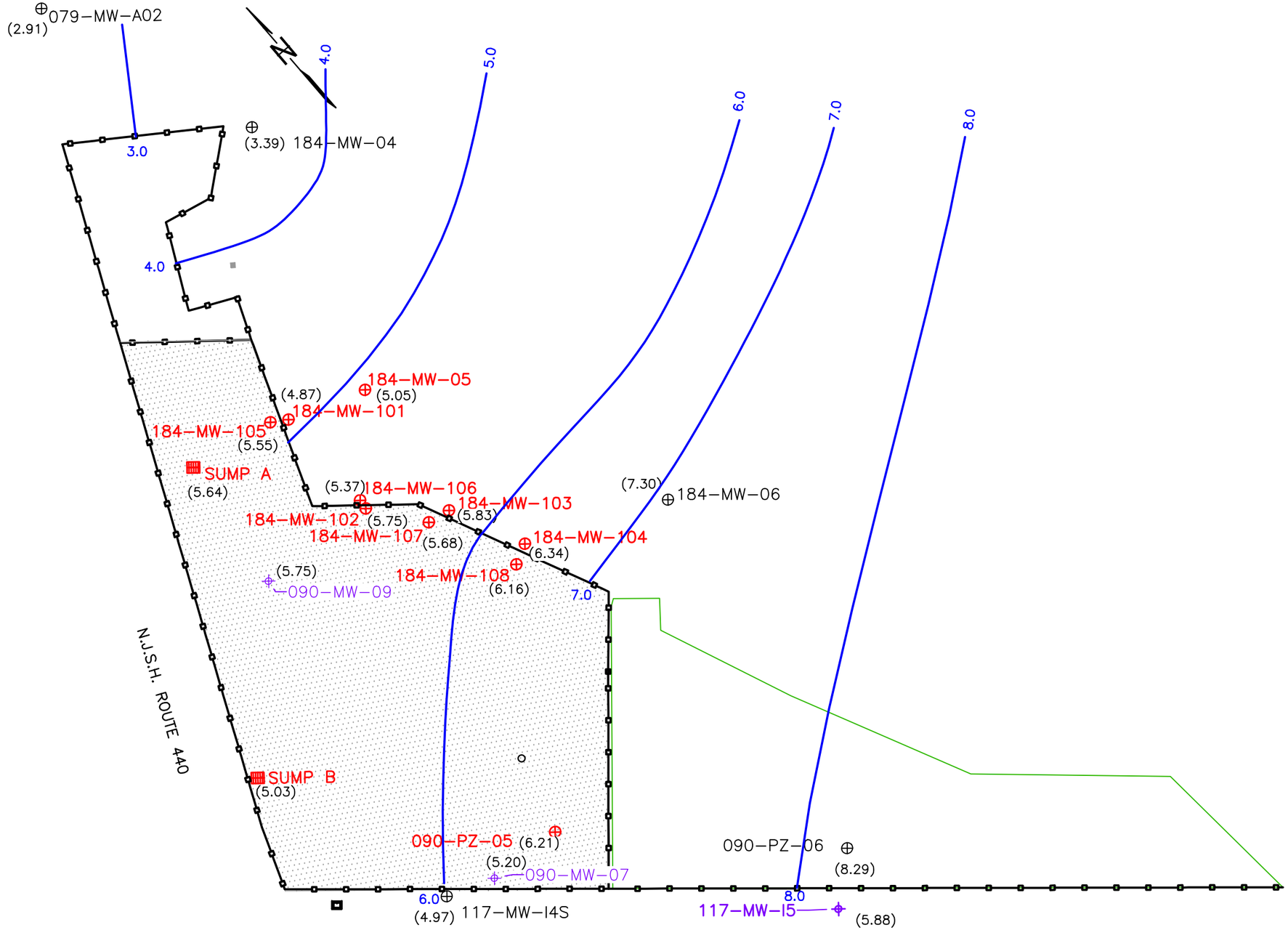
GROUNDWATER ELEVATION CONTOURS (ft.,msl)
MARCH 27, 2020
STUDY AREA 5 - NJCU
INTEGRATED ANNUAL GROUNDWATER PERFORMANCE REPORT- 2020

FIGURE NO.
4-6
PROJECT NO.
4203345



LEGEND

- MONITORING WELL
- PIEZOMETER
- SUMP
- SHEET PILE WALL
- CAP AREA
- SHALLOW MONITORING LOCATION WITH DATA LOGGER INSTALLED
- INDICATES INTERMEDIATE OR DEEP ZONE MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR
- TCE WELLS AS OF MAY 2019 ARE NO LONGER MEASURED

0 100 200

SCALE IN FEET

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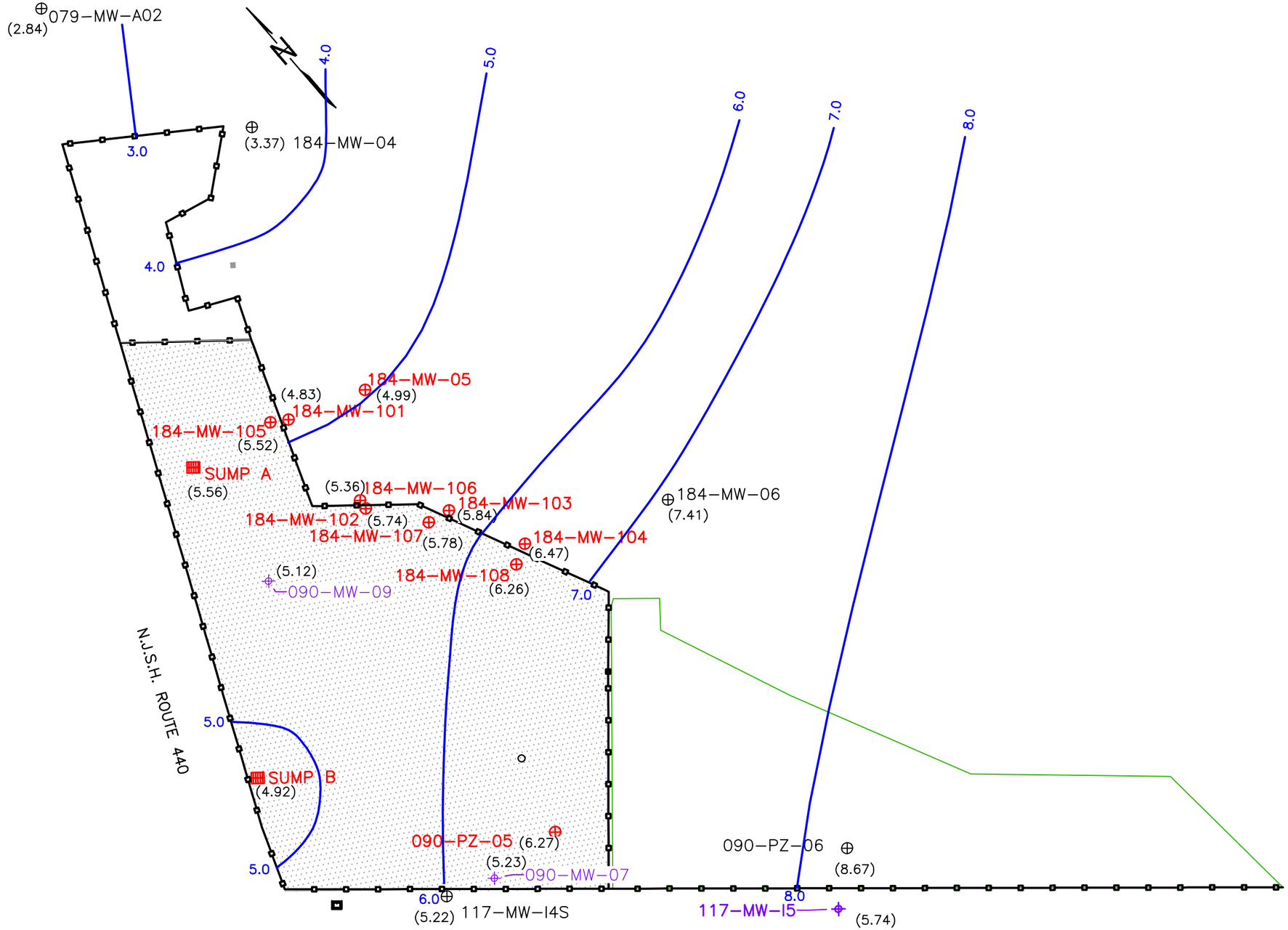
GROUNDWATER ELEVATION CONTOURS (ft.,msl)
JUNE 29, 2020
STUDY AREA 5 - NJCU
INTEGRATED ANNUAL GROUNDWATER PERFORMANCE REPORT- 2020

FIGURE NO.
4-7
PROJECT NO.
4203345



LEGEND

- MONITORING WELL
- PIEZOMETER
- SUMP
- SHEET PILE WALL
- CAP AREA
- SHALLOW MONITORING LOCATION WITH DATA LOGGER INSTALLED
- INDICATES INTERMEDIATE OR DEEP ZONE MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR
- TCE WELLS AS OF MAY 2019 ARE NO LONGER MEASURED

0 100 200

SCALE IN FEET

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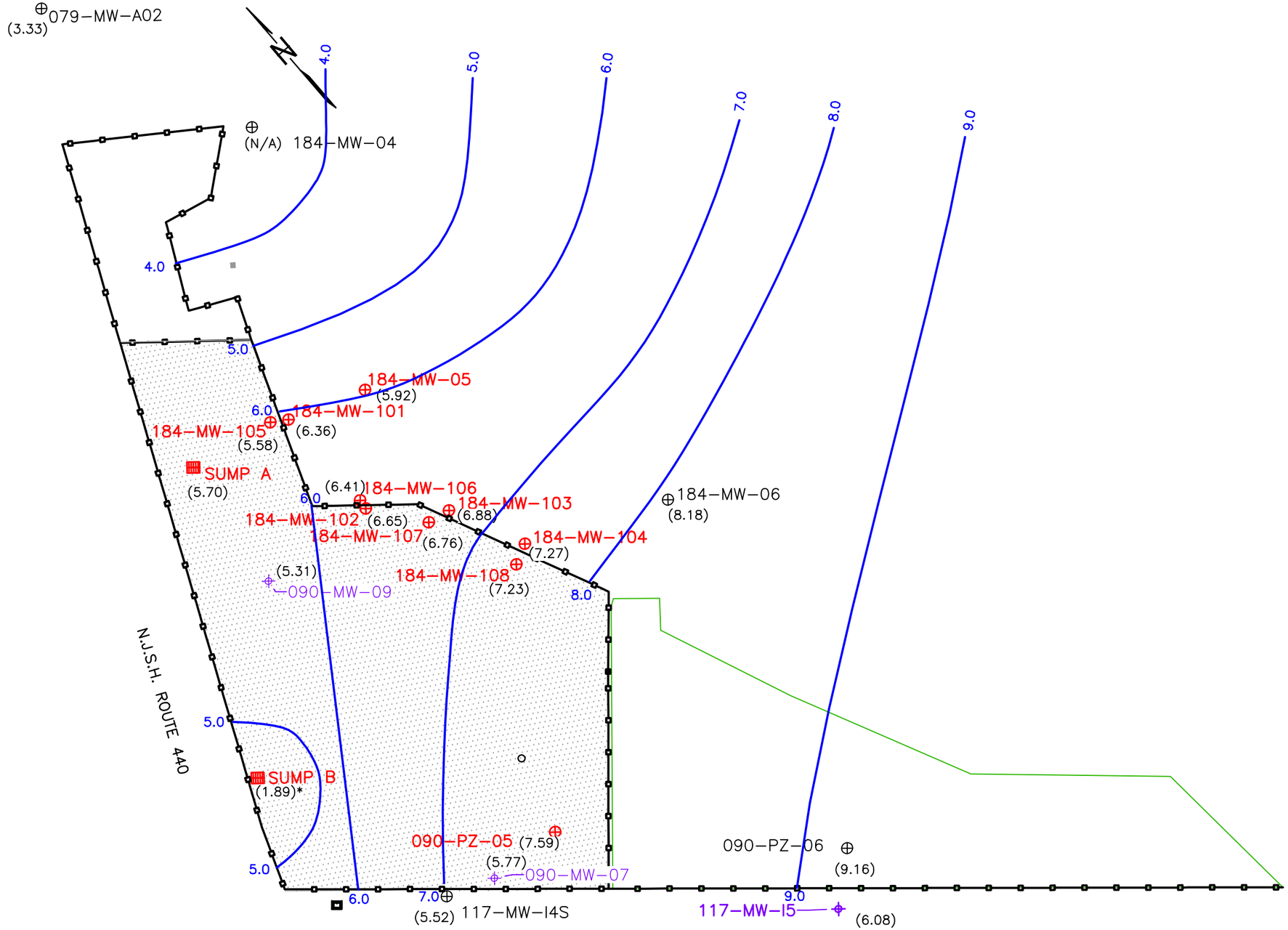
GROUNDWATER ELEVATION CONTOURS (ft.,msl)
SEPTEMBER 29, 2020
STUDY AREA 5 - NJCU
INTEGRATED ANNUAL GROUNDWATER PERFORMANCE REPORT- 2020

FIGURE NO.
4-8
PROJECT NO.
4203345



LEGEND

- MONITORING WELL
- PIEZOMETER
- SUMP
- SHEET PILE WALL
- CAP AREA

* PUMP RUNNING DURING MEASUREMENT

SHALLOW MONITORING LOCATION WITH DATA LOGGER INSTALLED

INDICATES INTERMEDIATE OR DEEP ZONE MONITORING WELL

GROUNDWATER ELEVATION CONTOUR

TCE WELLS AS OF MAY 2019 ARE NO LONGER MEASURED

0 100 200

SCALE IN FEET

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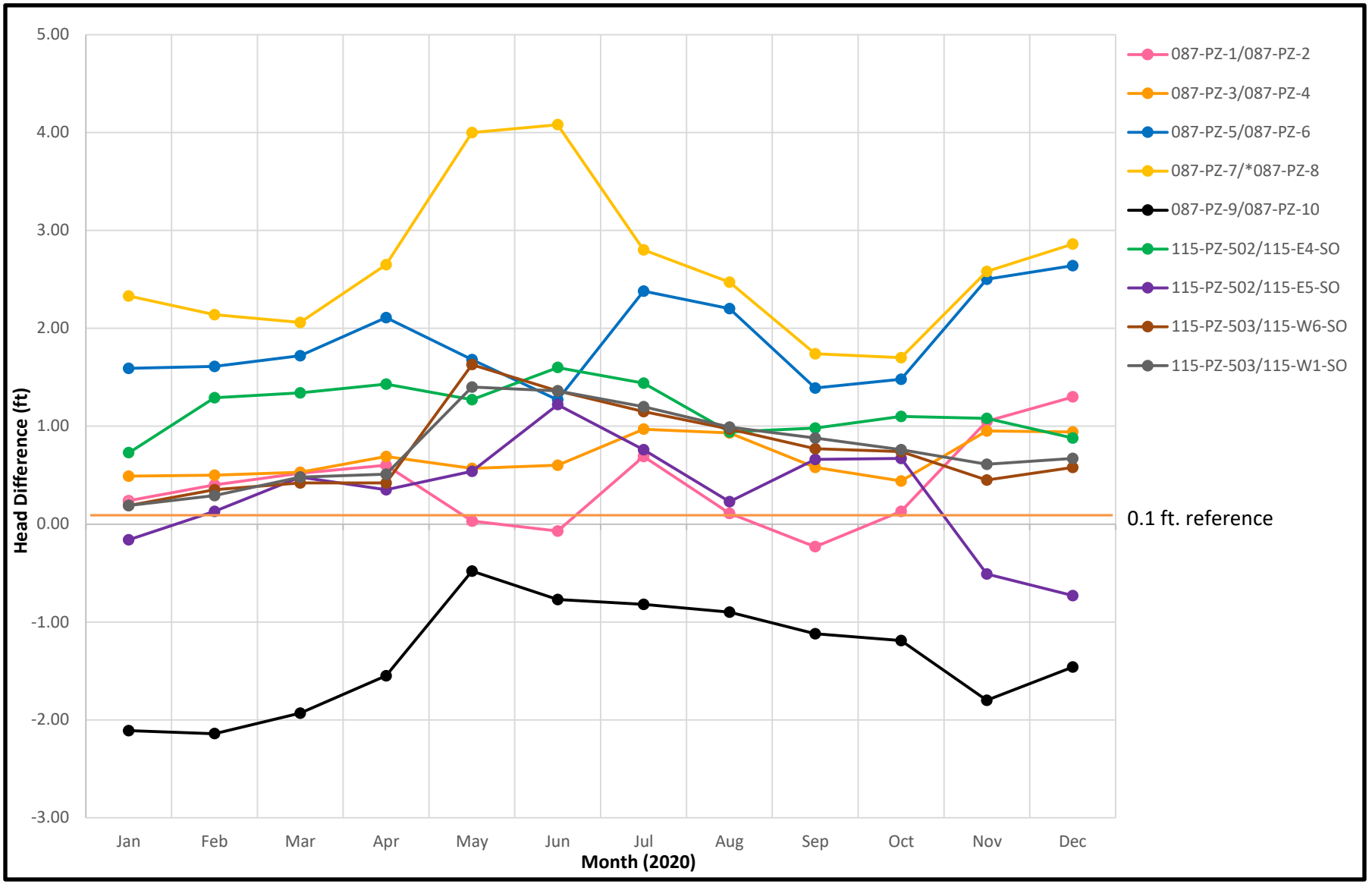
GROUNDWATER ELEVATION CONTOURS (ft.,msl)
DECEMBER 30, 2020
STUDY AREA 5 - NJCU
INTEGRATED ANNUAL GROUNDWATER PERFORMANCE REPORT- 2020

FIGURE NO.
4-9
PROJECT NO.
4203345



Note:
Positive head difference = inward gradient
Negative head difference = outward gradient
***Logger malfunctioned in June. Recalibrated by manufacturer and reinstalled in July.**

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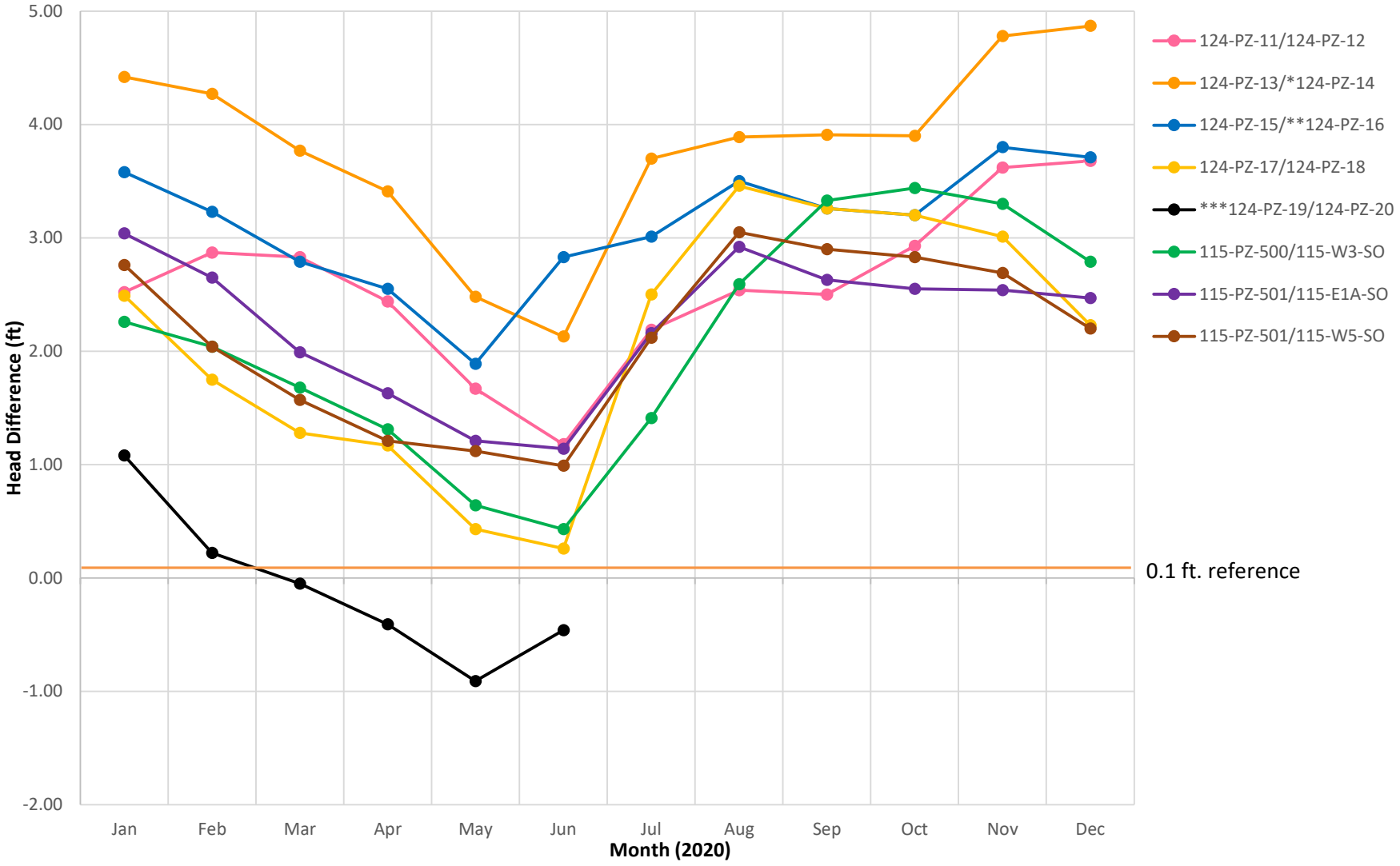
Integrated Annual Groundwater Performance Report 2020

Monthly Average Head Differences Across SA-6 North Barrier Wall

Figure 4-10



Note:
Positive head difference = inward gradient
Negative head difference = outward gradient
See Figure 3-3 for asterisk notes.

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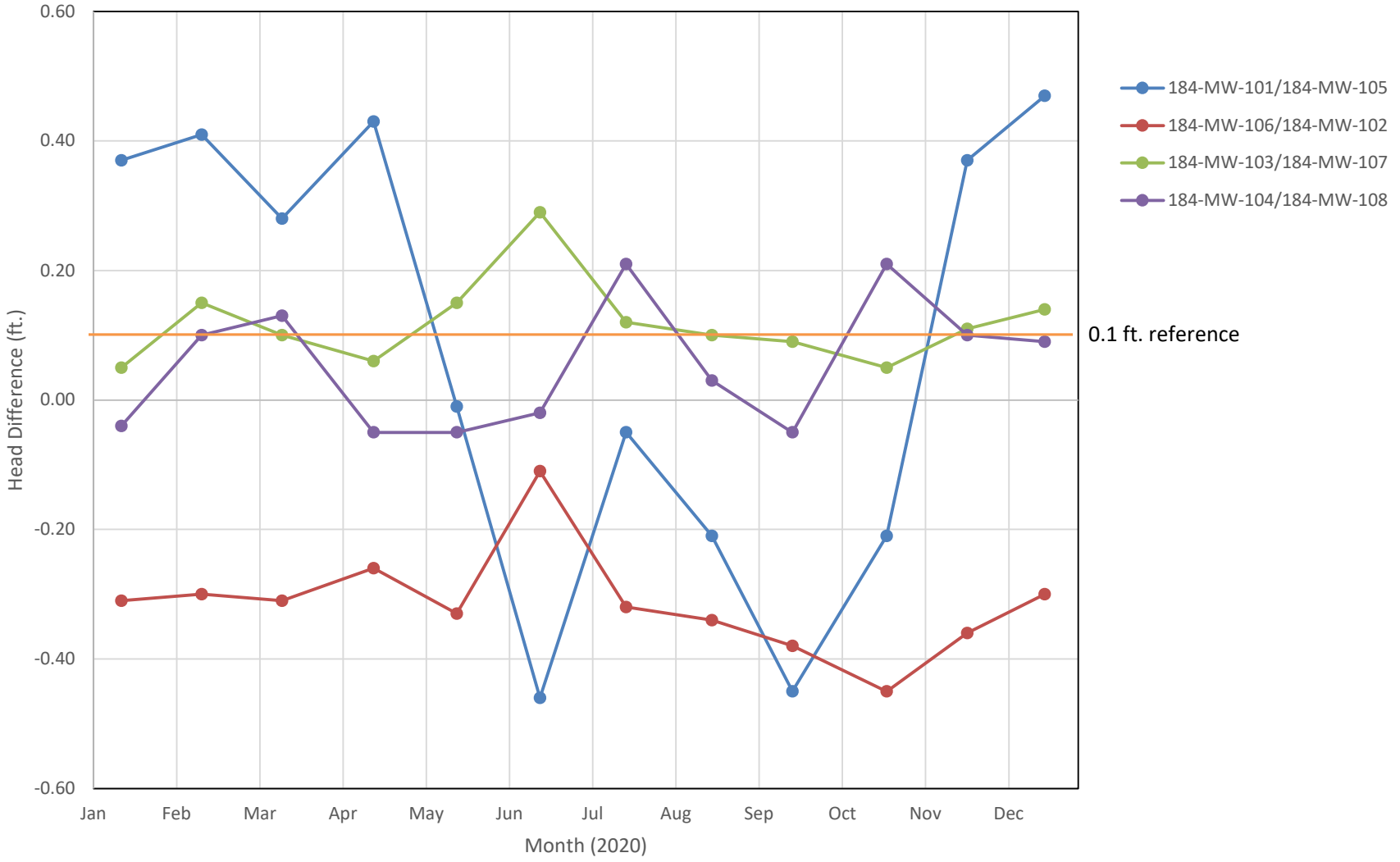
Integrated Annual Groundwater Performance Report 2020

Monthly Average Head Differences Across SA-6 South Barrier Wall

Figure 4-11



Note:
Positive head difference = inward gradient
Negative head difference = outward gradient

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Integrated Annual Groundwater Performance Report 2020

Monthly Average Head Differences Across NJCU Barrier Wall

Figure 4-12

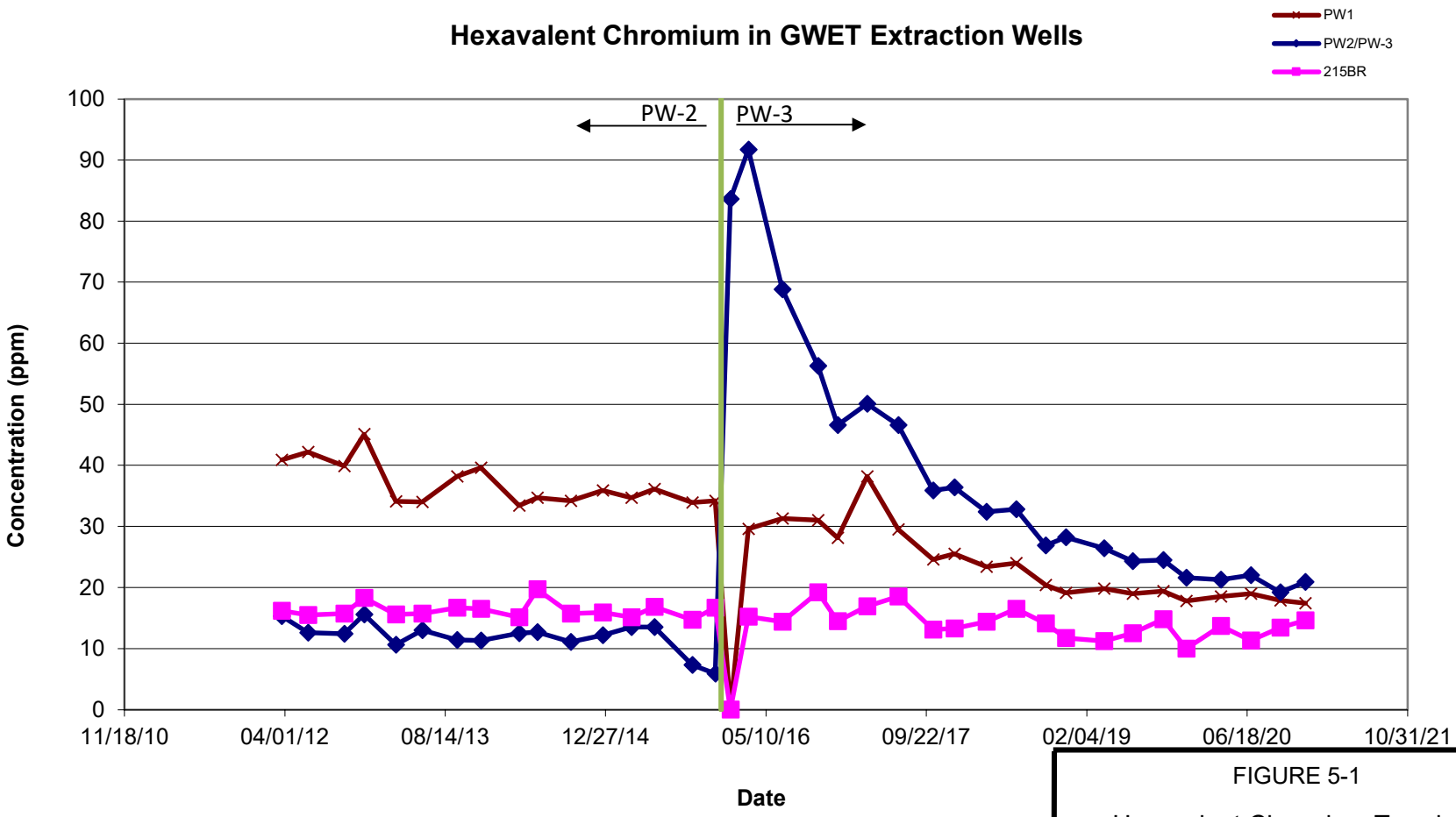

FIGURE 5-1

Hexavalent Chromium Trends in GWET Extraction Wells

Integrated Annual Groundwater Performance Report 2020

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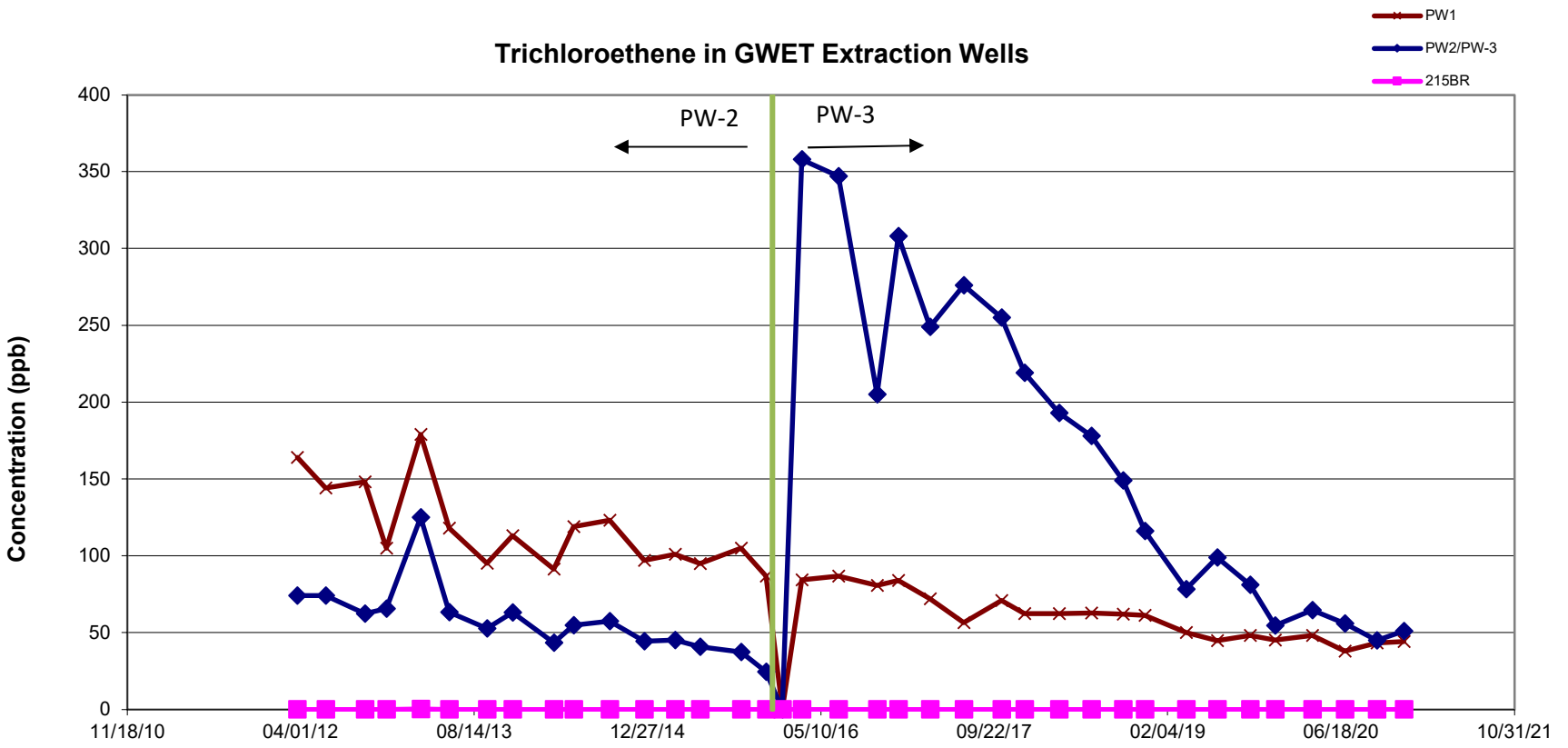

FIGURE 5-2

Trichloroethylene Trends in GWET Extraction Wells

Integrated Annual Groundwater Performance Report 2020

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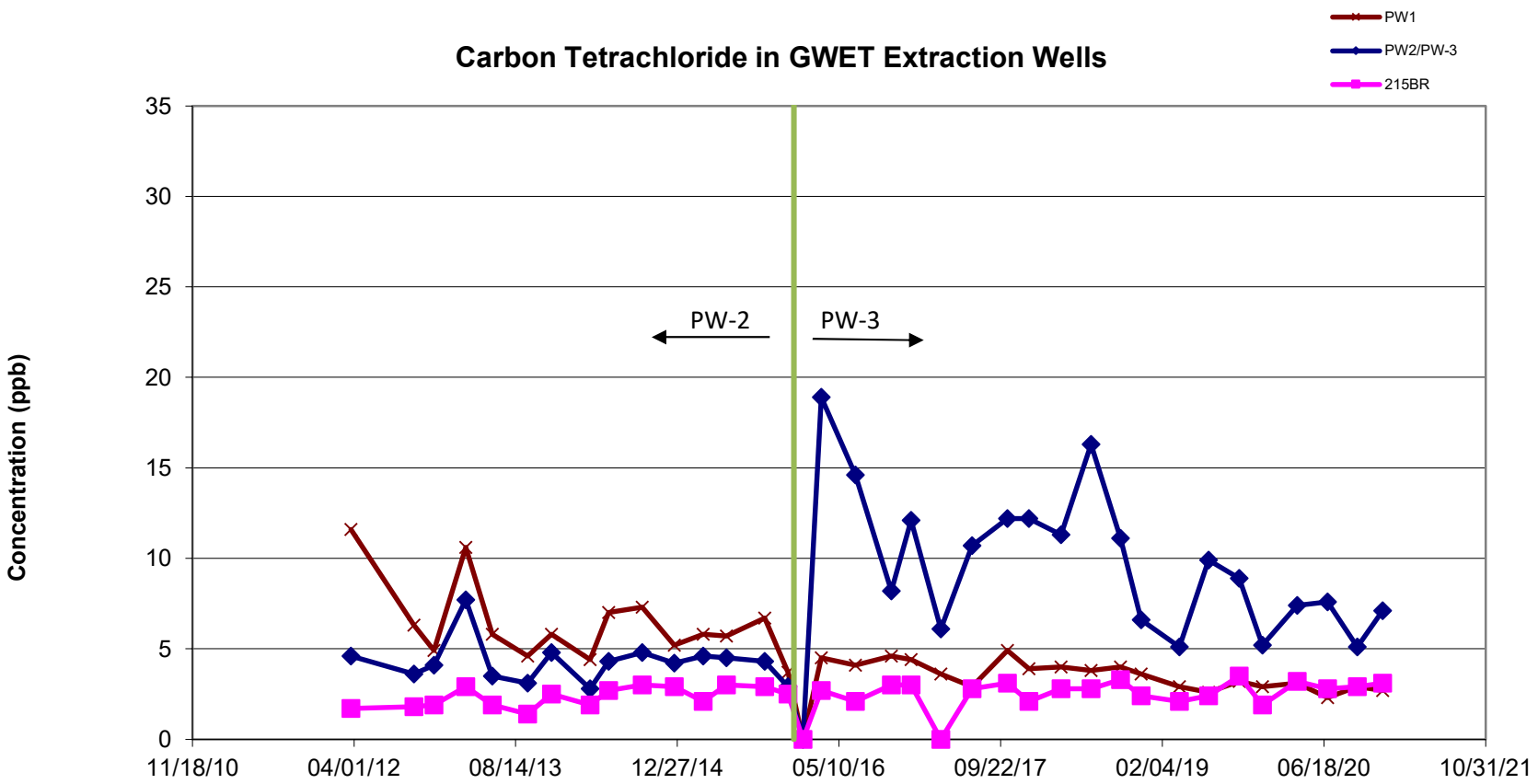


FIGURE 5-3

Carbon Tetrachloride Trends in GWET Extraction Wells

Integrated Annual Groundwater Performance Report 2020

cornerstone environmental

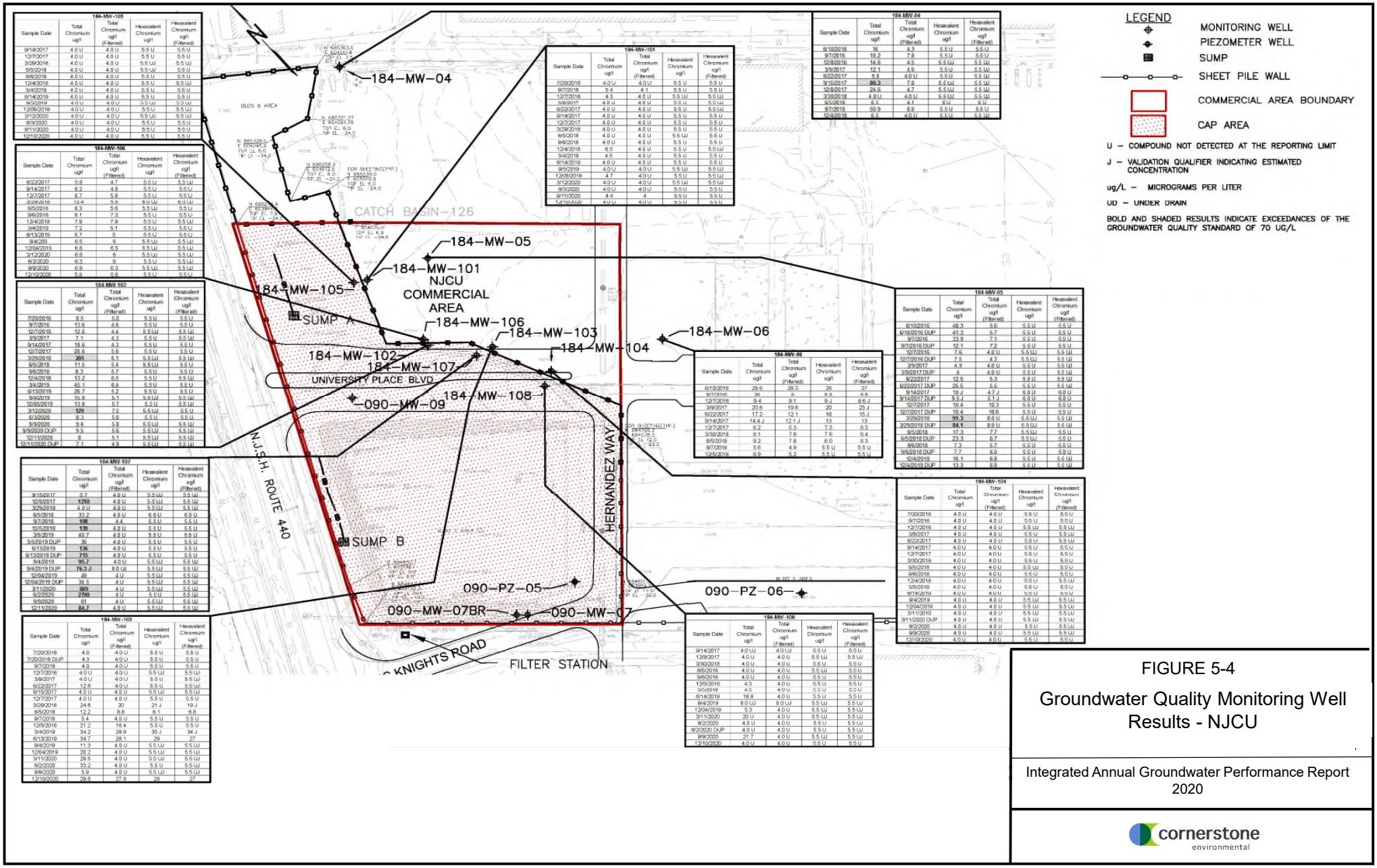


FIGURE 5-4

Groundwater Quality Monitoring Well Results - NJCU

Integrated Annual Groundwater Performance Report 2020

cornerstone environmental

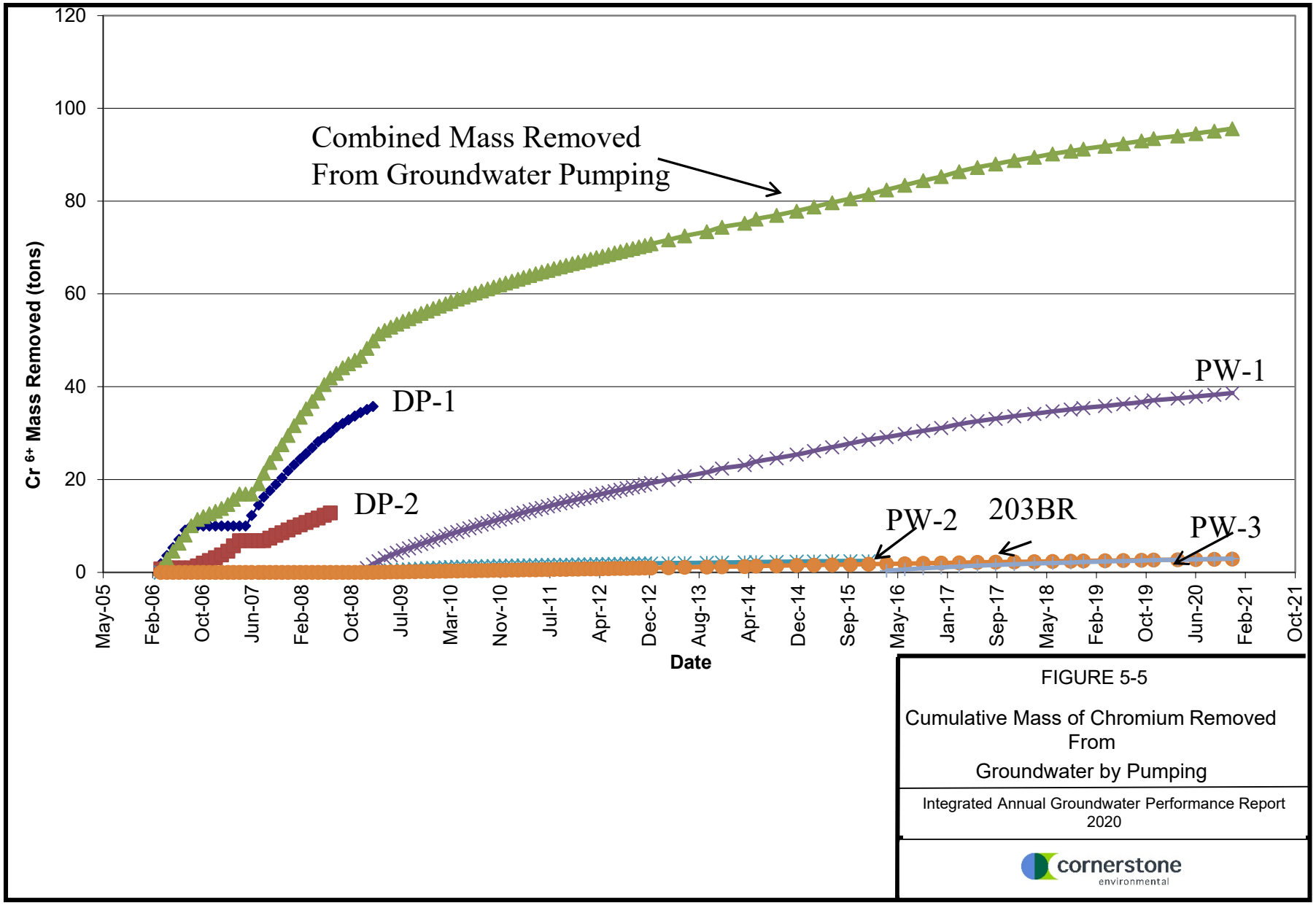


FIGURE 5-5

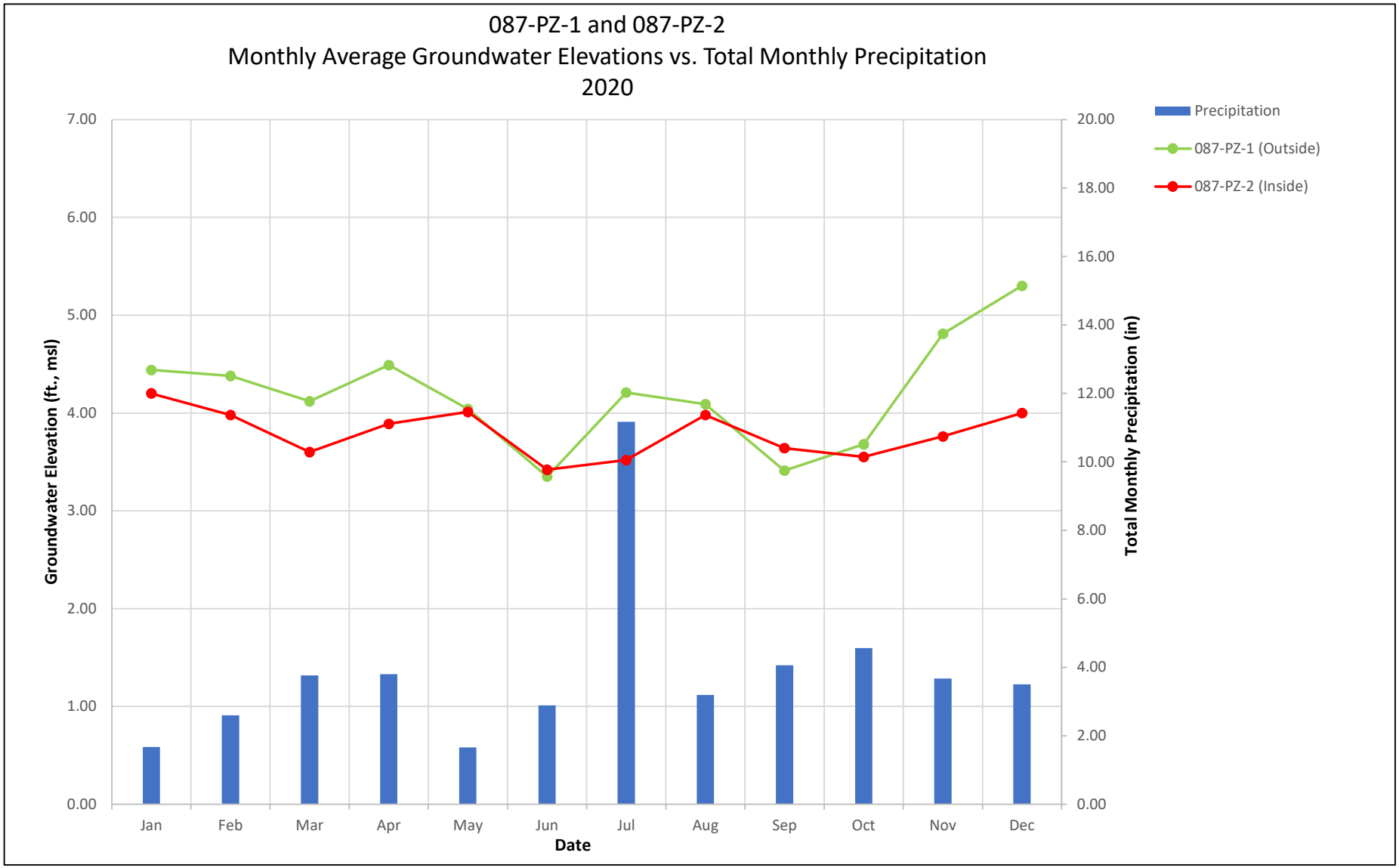
Cumulative Mass of Chromium Removed From Groundwater by Pumping

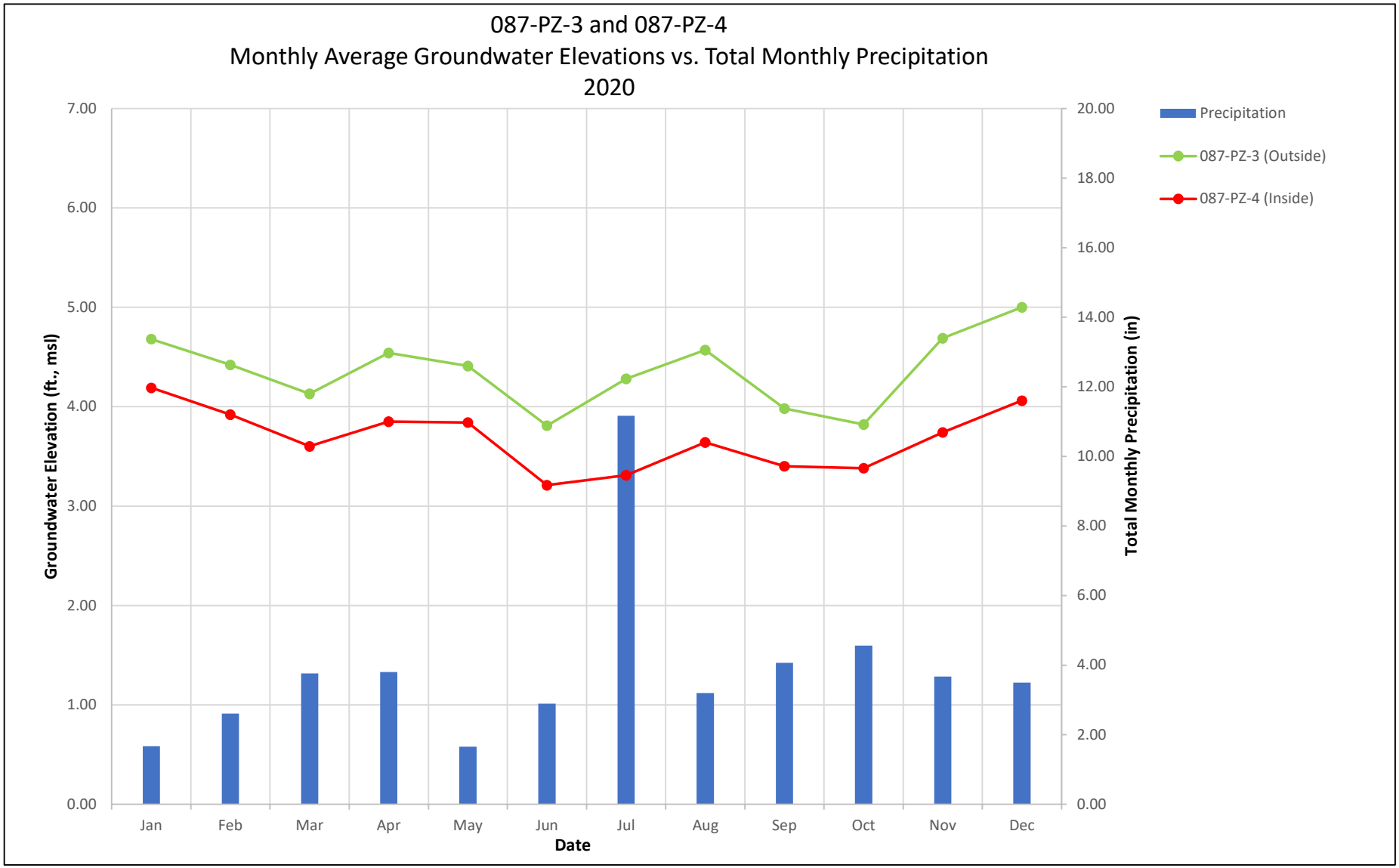
Integrated Annual Groundwater Performance Report 2020

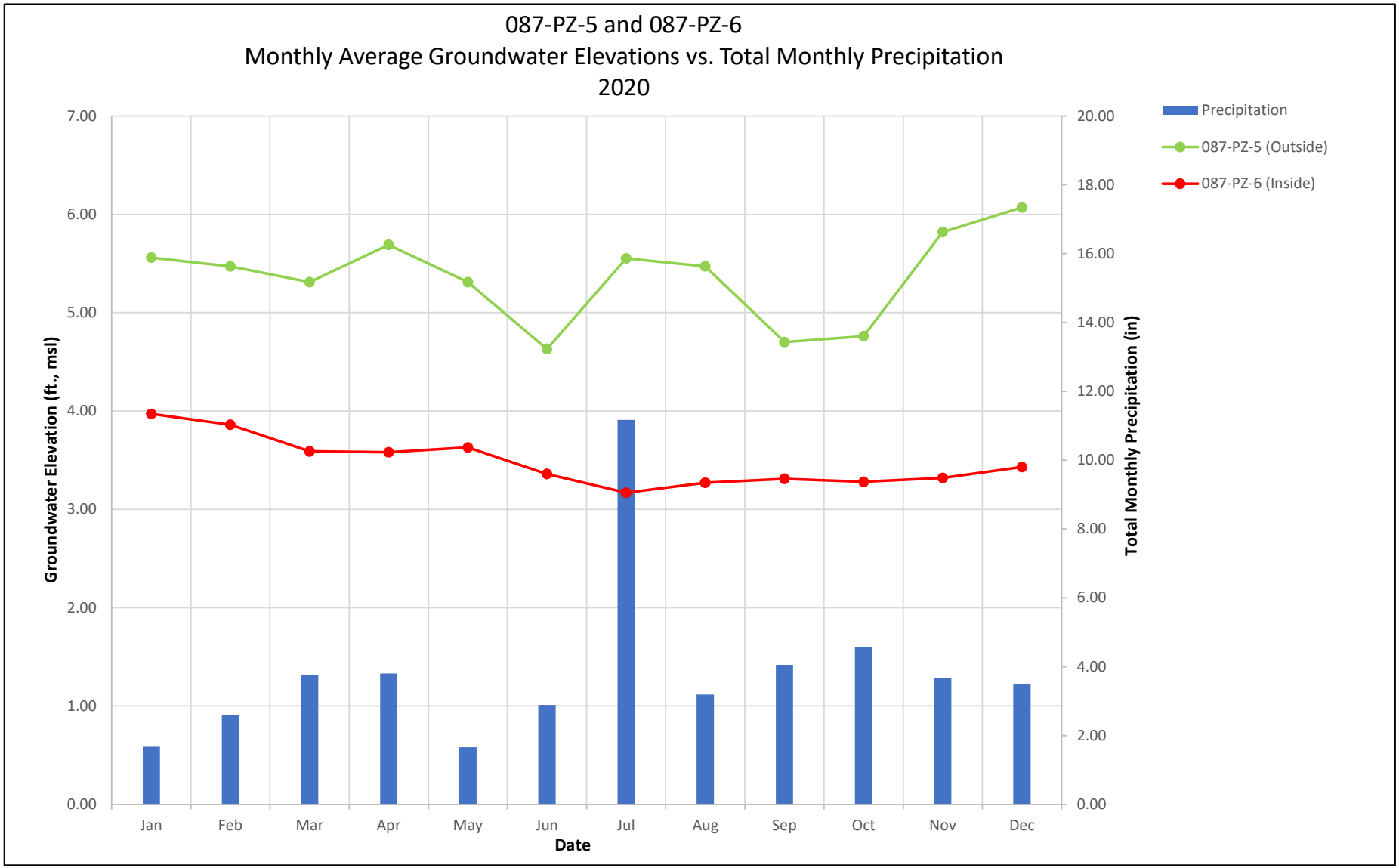
cornerstone environmental

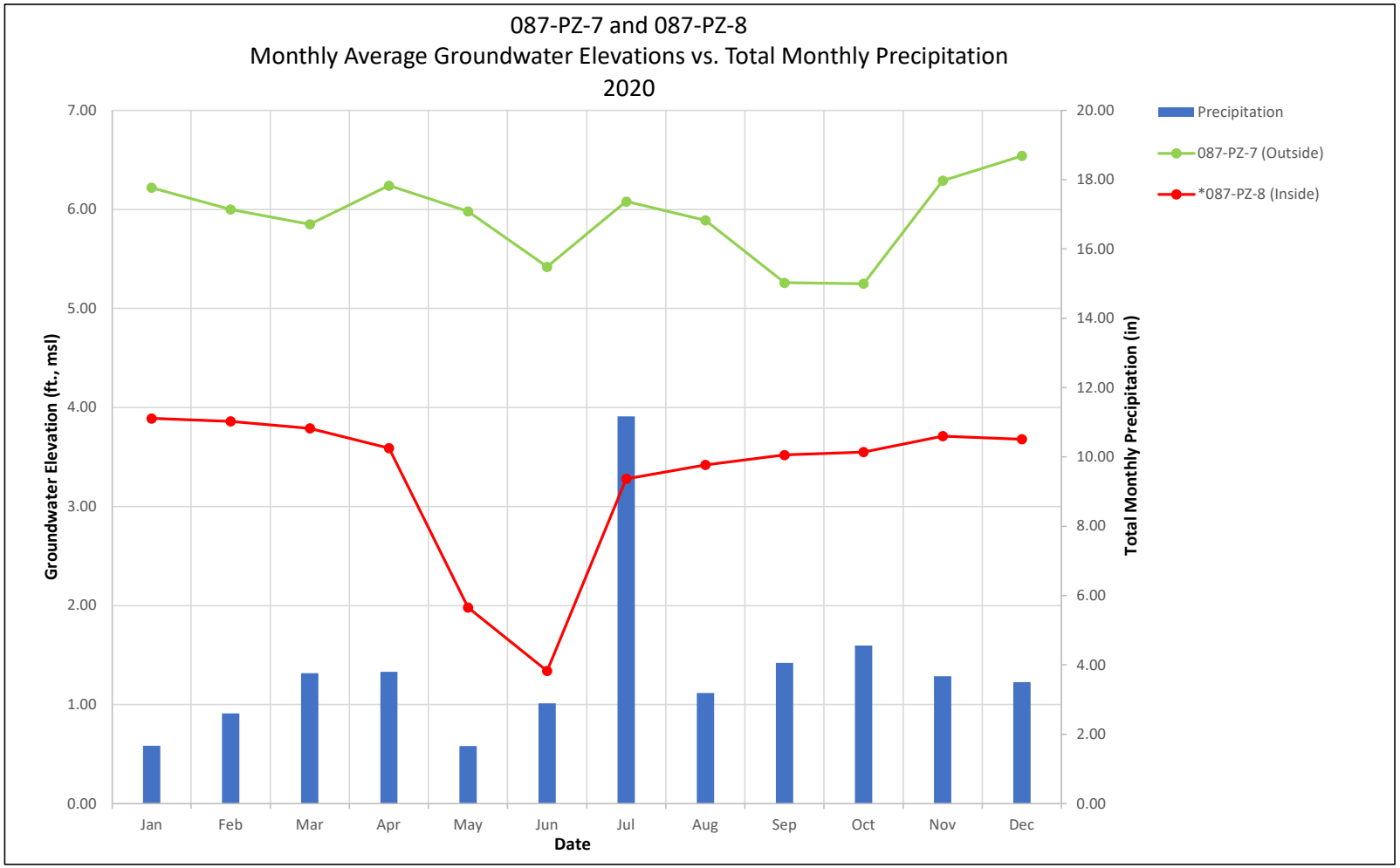
APPENDIX A

HYDROGRAPHS OF AVERAGE MONTHLY HEADS FROM SA-6 AND SA-7


087-PZ-1 and 087-PZ-2
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft., msl)
Total Monthly Precipitation (in)
Date
Precipitation
087-PZ-1 (Outside)
087-PZ-2 (Inside)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

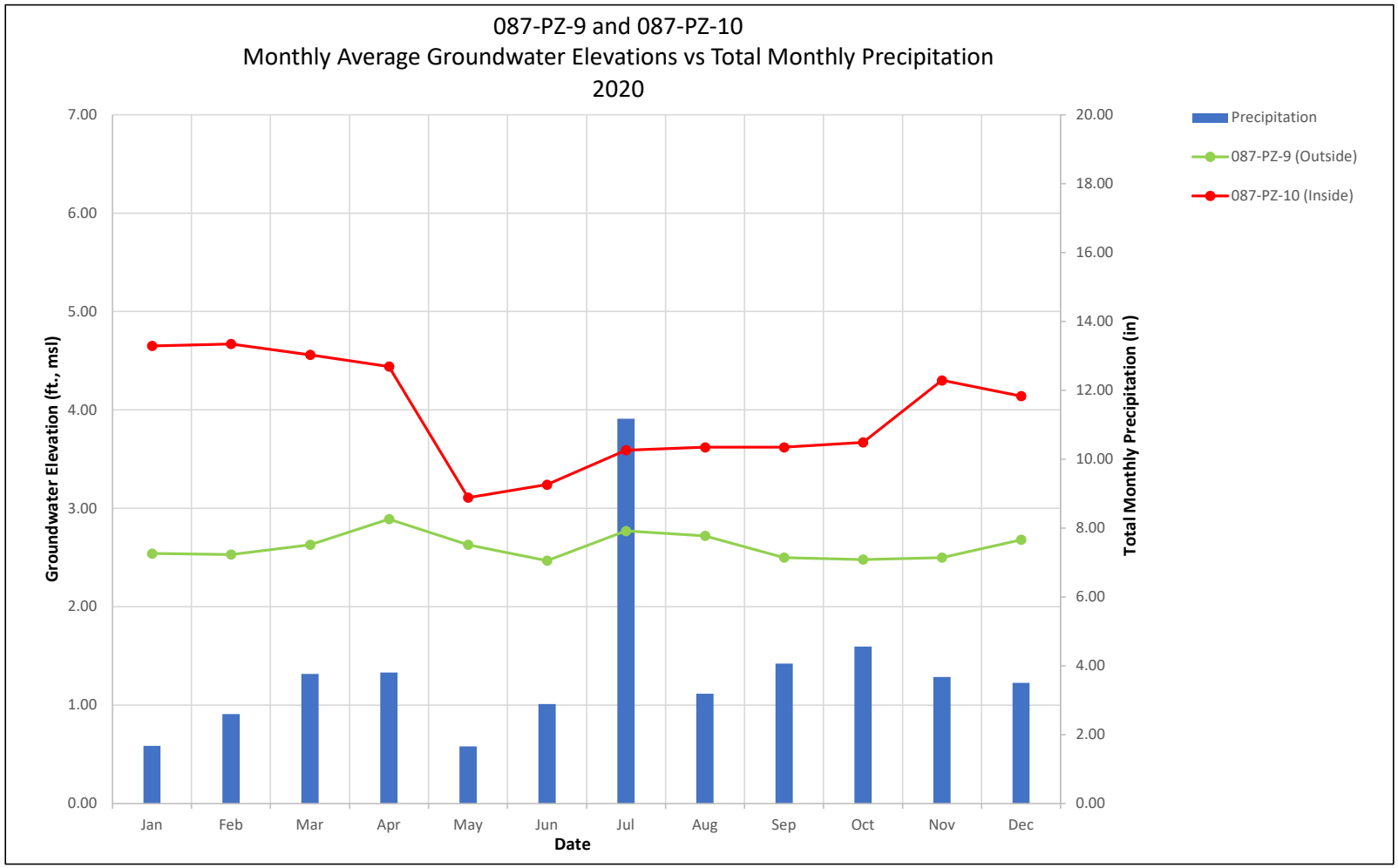

087-PZ-3 and 087-PZ-4
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft., msl)
Total Monthly Precipitation (in)
Date
Precipitation
087-PZ-3 (Outside)
087-PZ-4 (Inside)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

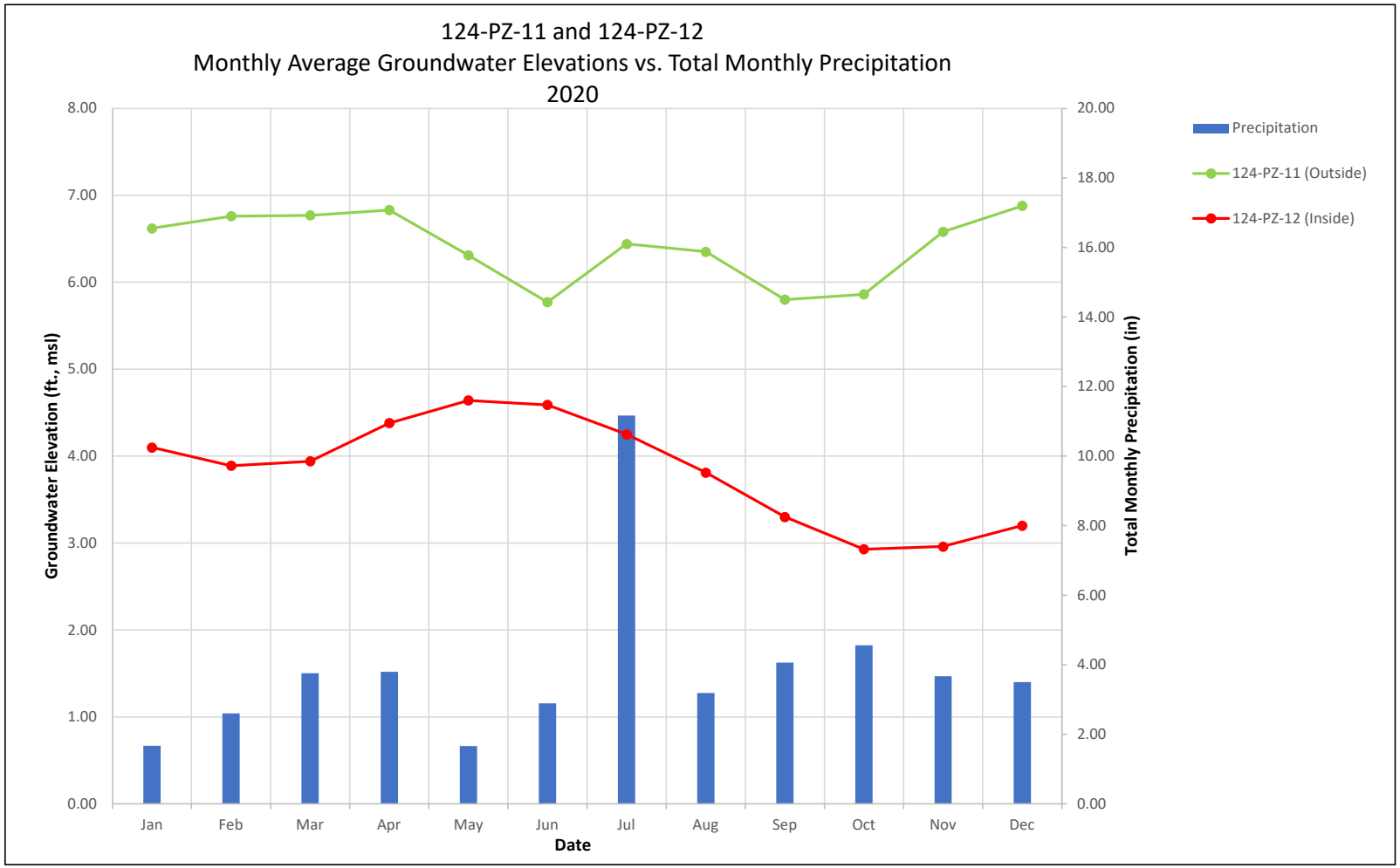

087-PZ-5 and 087-PZ-6
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft., msl)
Total Monthly Precipitation (in)
Date
Precipitation
087-PZ-5 (Outside)
087-PZ-6 (Inside)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

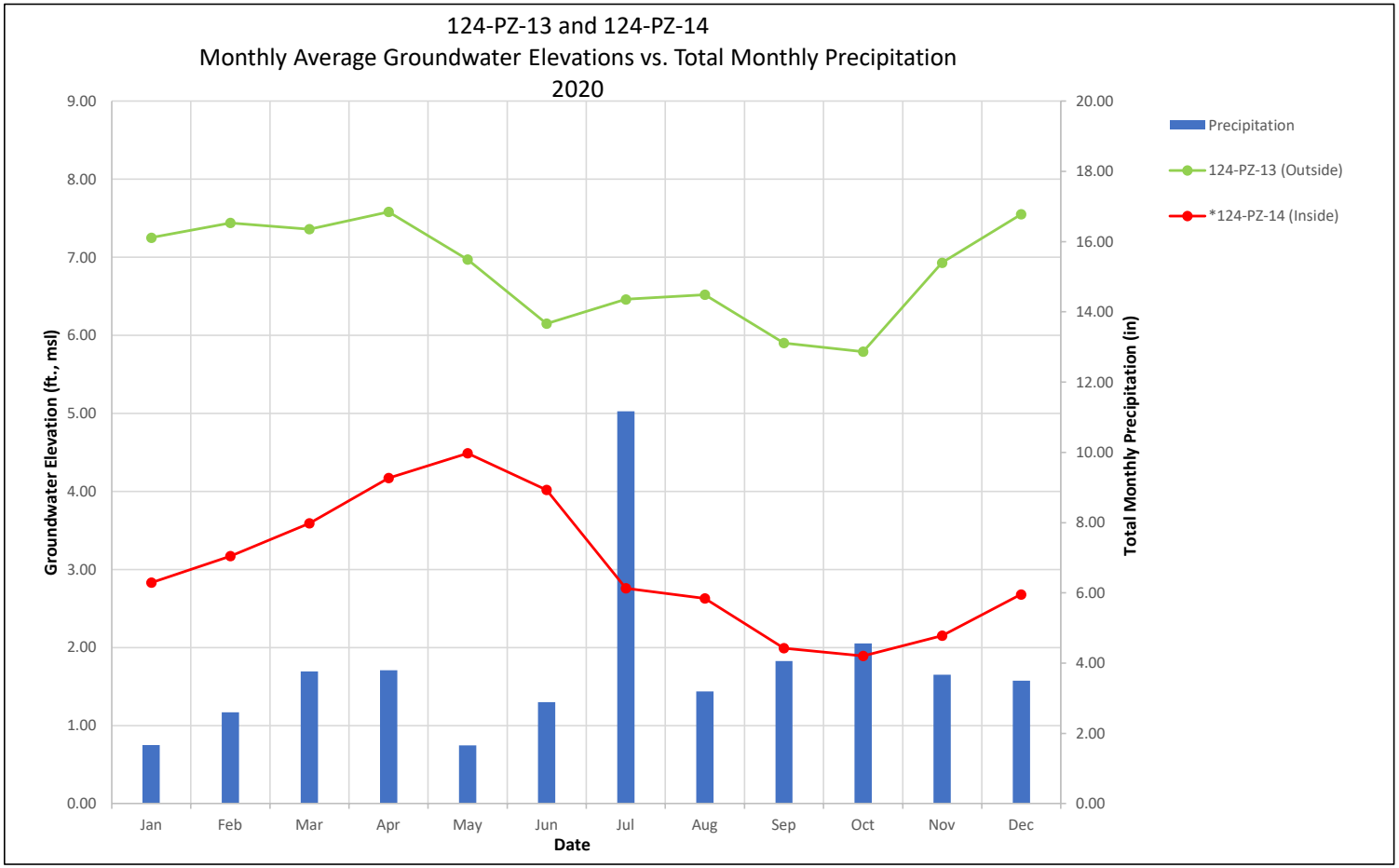


Notes:

* Based upon comparison to manual reading (3.08ft/ft on 6/16/20), PZ-8 data suspect for June. Datalogger sent back to manufacturer for calibration, replaced for July, and reporting accurately based on comparison with manual readings

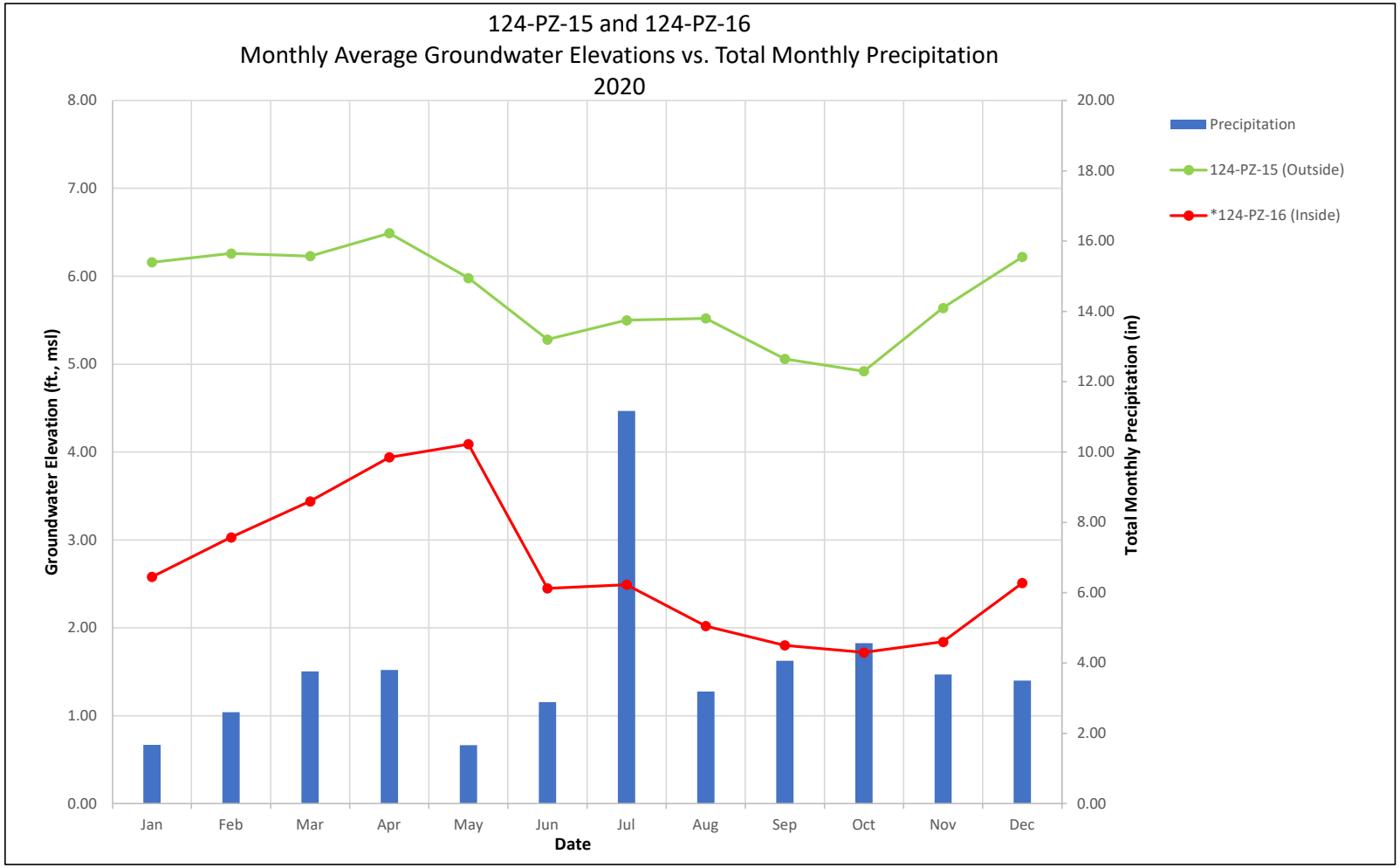

087-PZ-9 and 087-PZ-10
Monthly Average Groundwater Elevations vs Total Monthly Precipitation
2020
Groundwater Elevation (ft., msl)
Total Monthly Precipitation (in)
Date
Precipitation
087-PZ-9 (Outside)
087-PZ-10 (Inside)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


124-PZ-11 and 124-PZ-12
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft., msl)
Total Monthly Precipitation (in)
Date
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
Precipitation
124-PZ-11 (Outside)
124-PZ-12 (Inside)



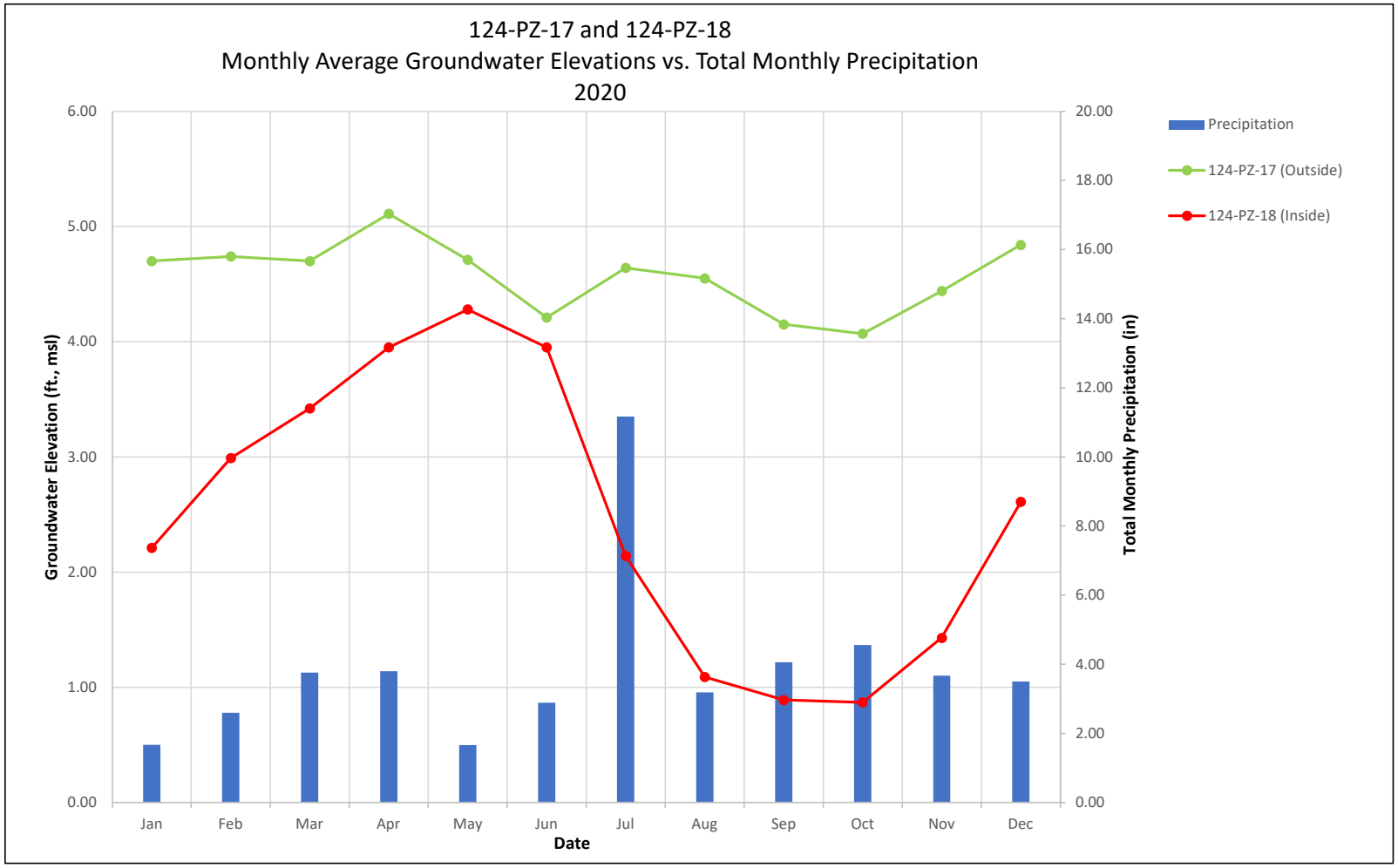
Notes:

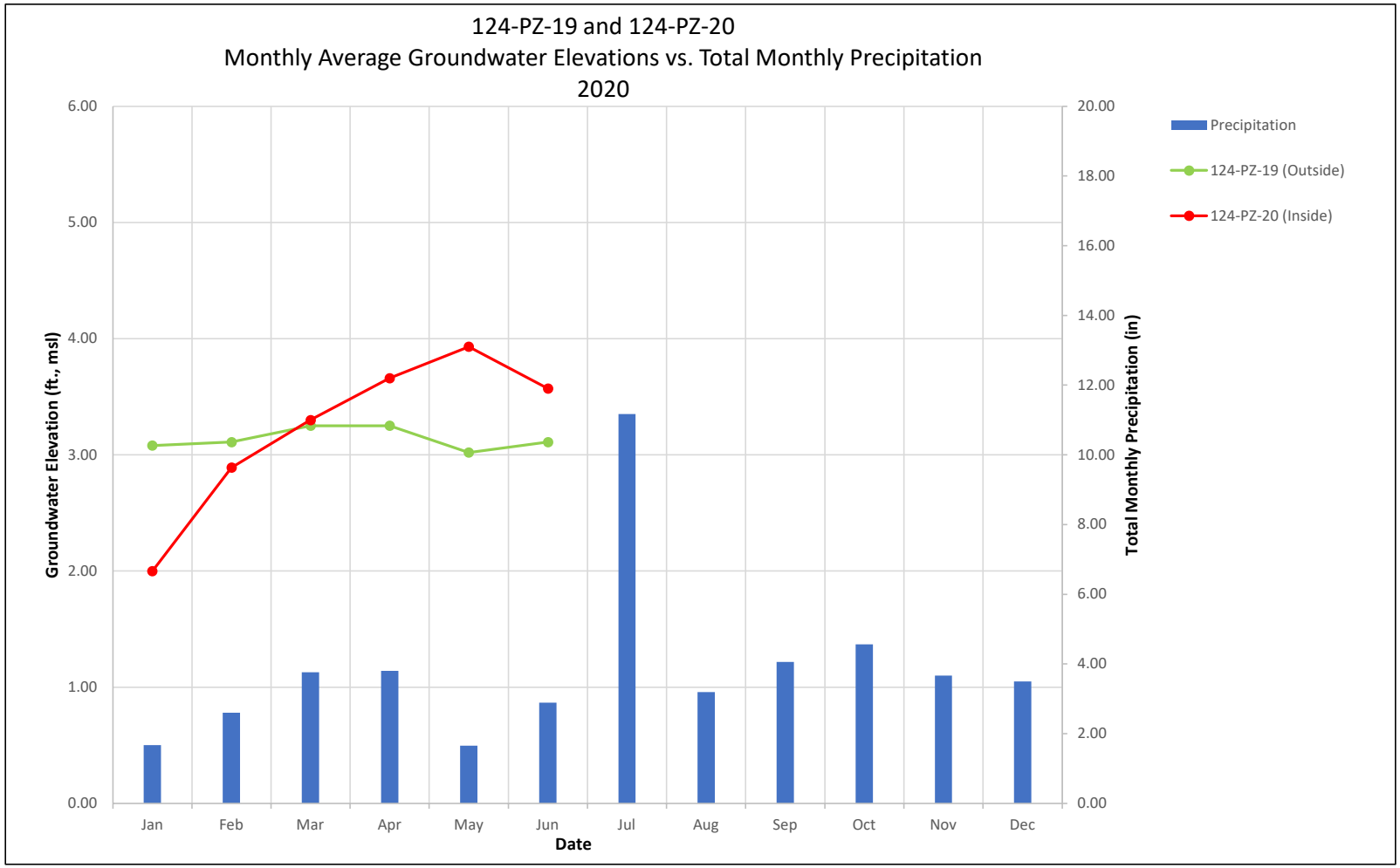
* Due to extended pumping of the SA-6 South CGWES extraction pump for the Deferred Area Remedy, groundwater level in PZ-14 dropped below the elevation of the datalogger from 10/1/20 - 10/19/20. The elevation of the datalogger was 2.60 ft. Datalogger was lowered to compensate for low water level on 10/19/20.



Notes:

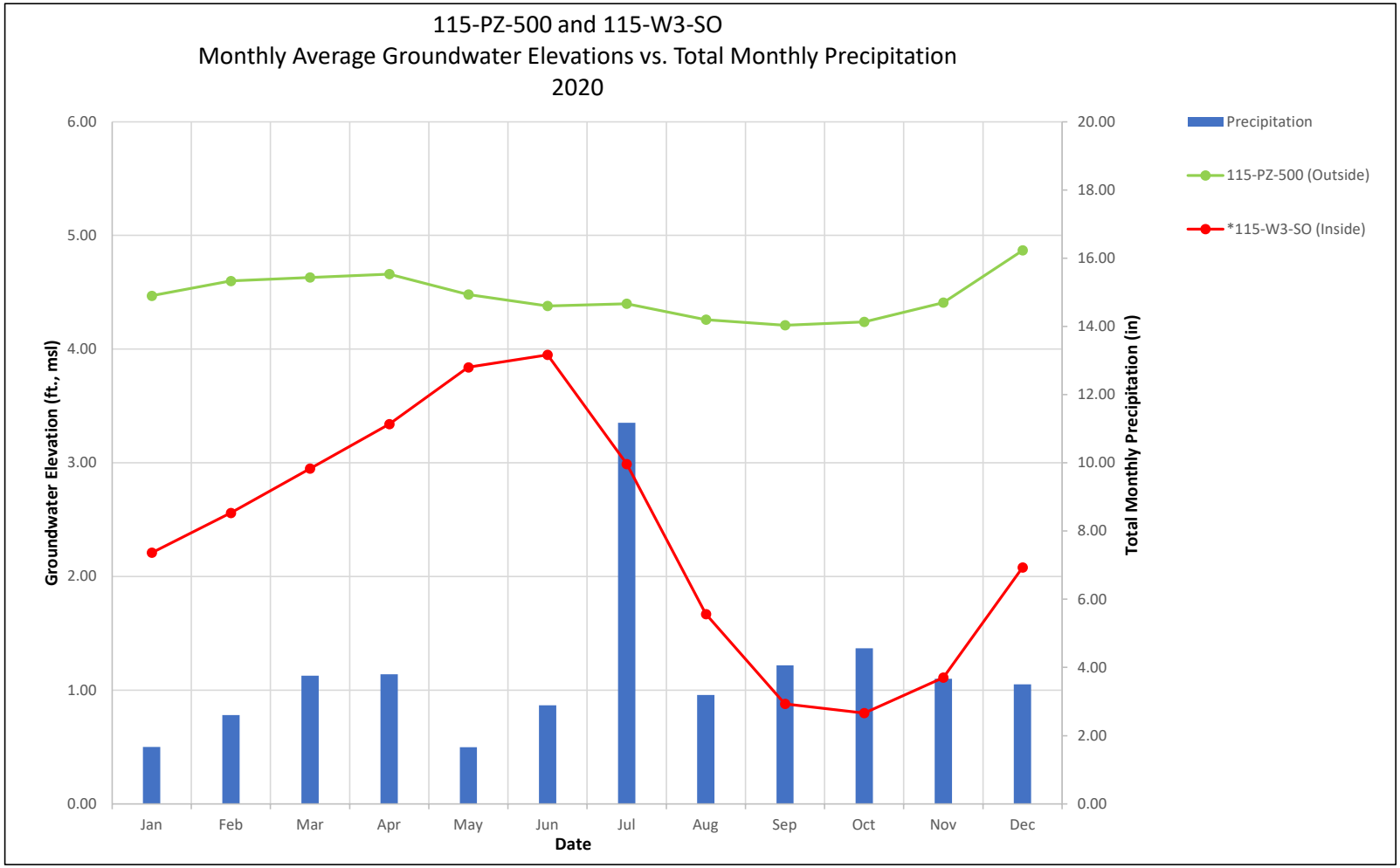
*Based upon comparison to manual reading (3.85ft/ft on 6/16/20), PZ-16 data suspect for June. Datalogger sent back to manufacturer for calibration, replaced for July, and reporting accurately based on comparison with manual readings


124-PZ-17 and 124-PZ-18
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft., msl)
Total Monthly Precipitation (in)
Date
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0.00
1.00
2.00
3.00
4.00
5.00
6.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
Precipitation
124-PZ-17 (Outside)
124-PZ-18 (Inside)



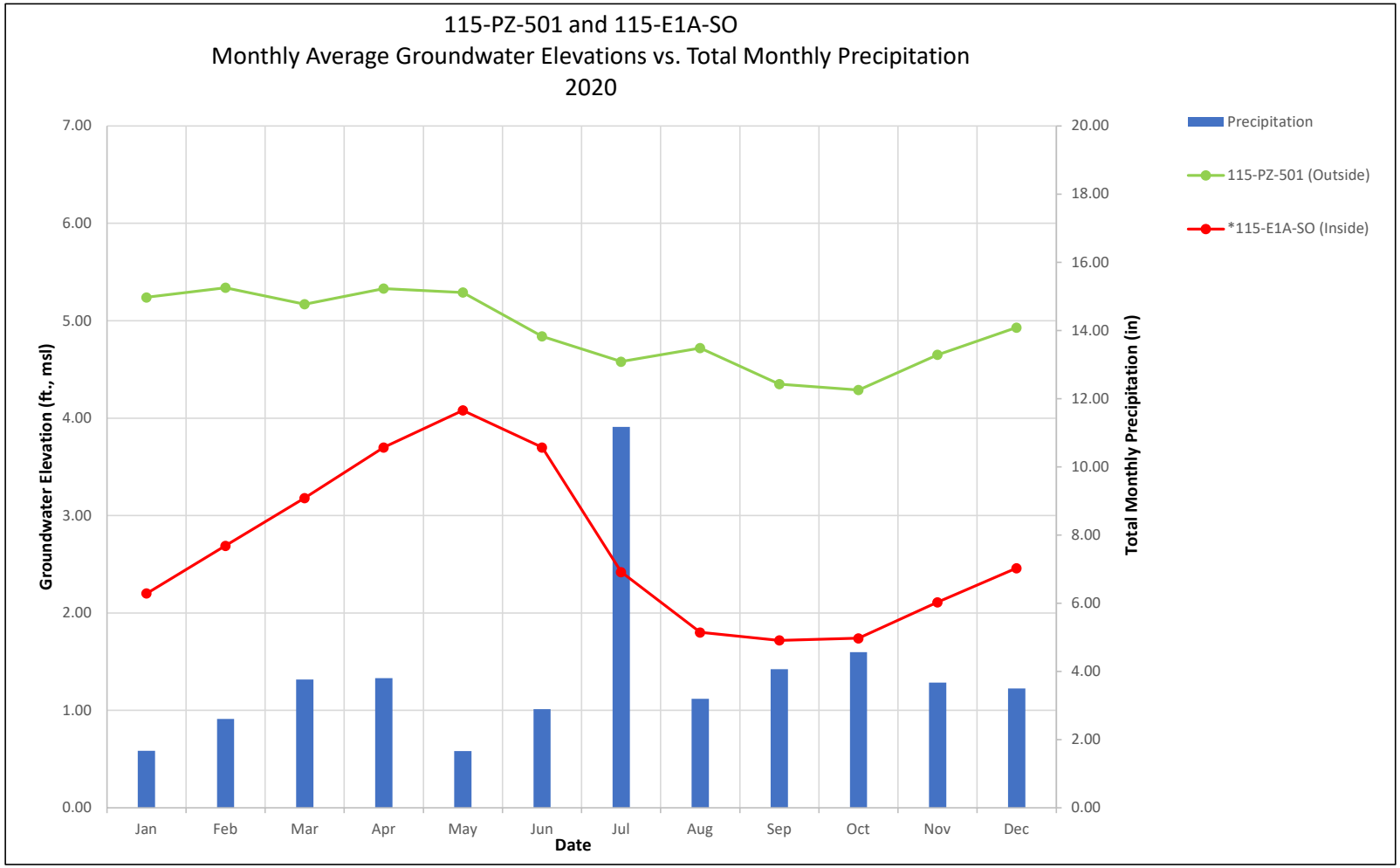
Notes:

Due to SA-6 South Deferred Area Remedy, PZ-19 and PZ-20 abandoned on 6/19/20 and 7/24/20, respectively. Dataloggers to be reinstalled in January, 2021.



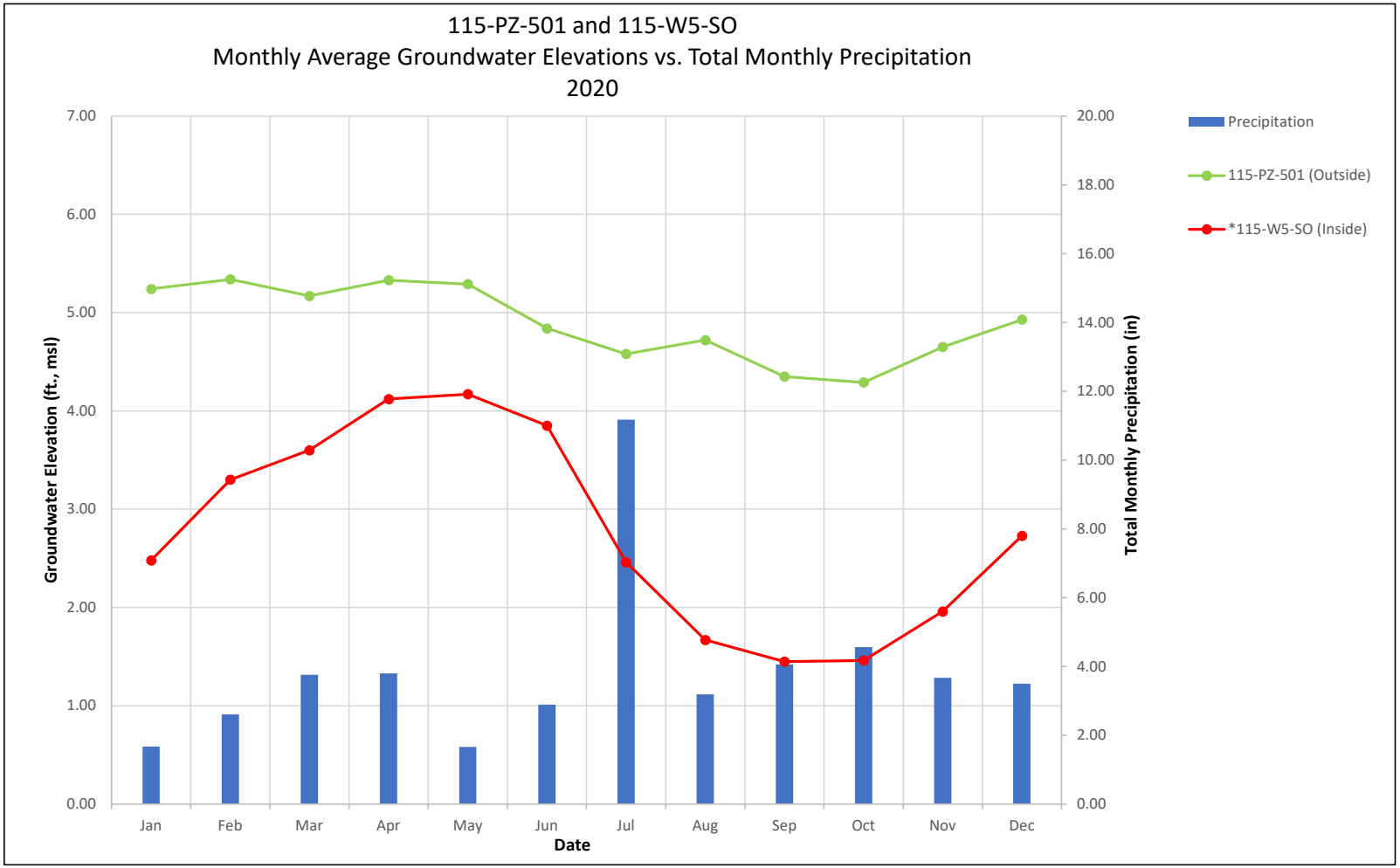
Notes:

*Pump station PS-1S was continuously operated during SA-6 South Bulkhead Remedy activities, but was turned off in November 2020



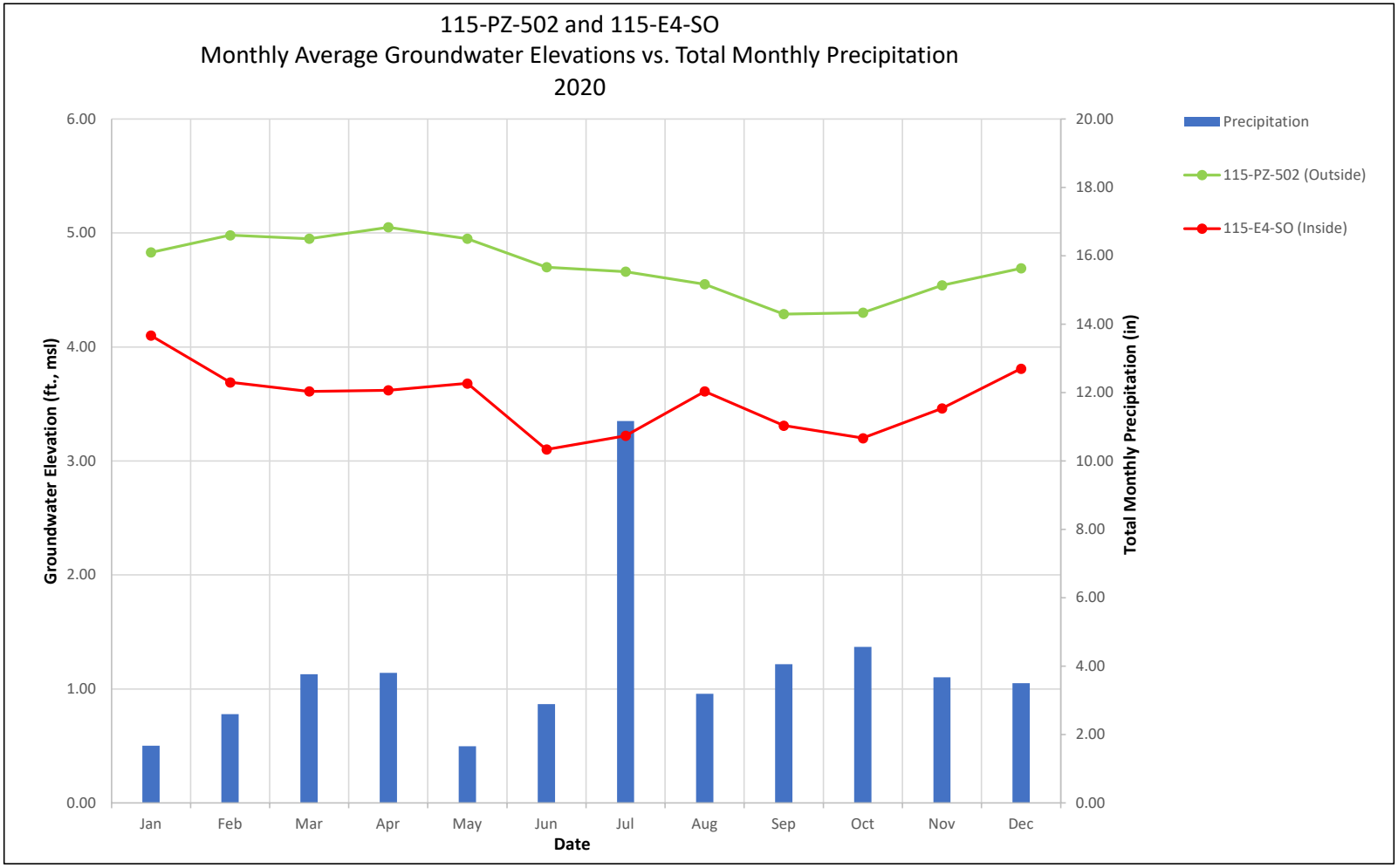
Notes:

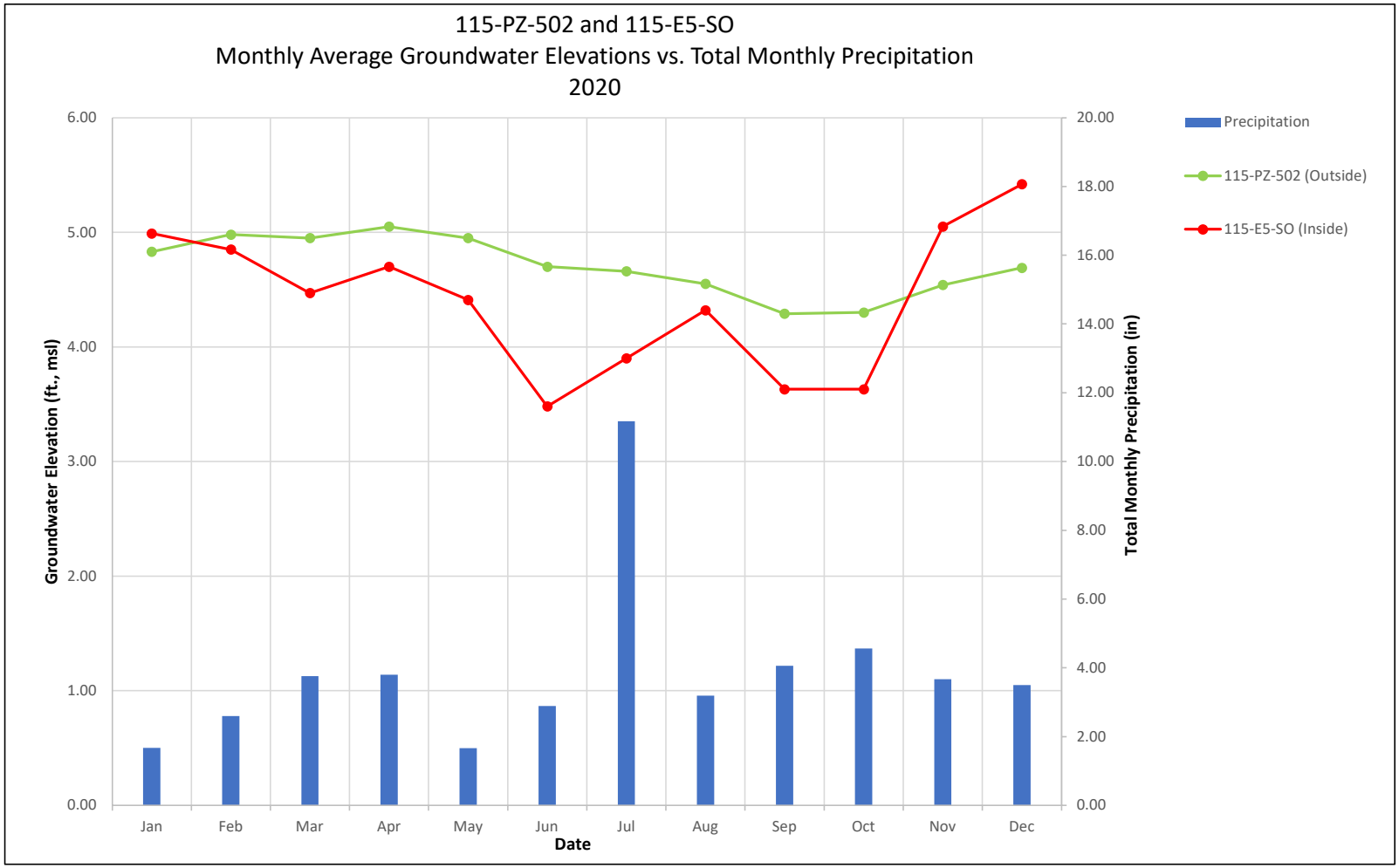
*Pump station PS-1S was continuously operated during SA-6 South Bulkhead Remedy activities, but was turned off in November 2020

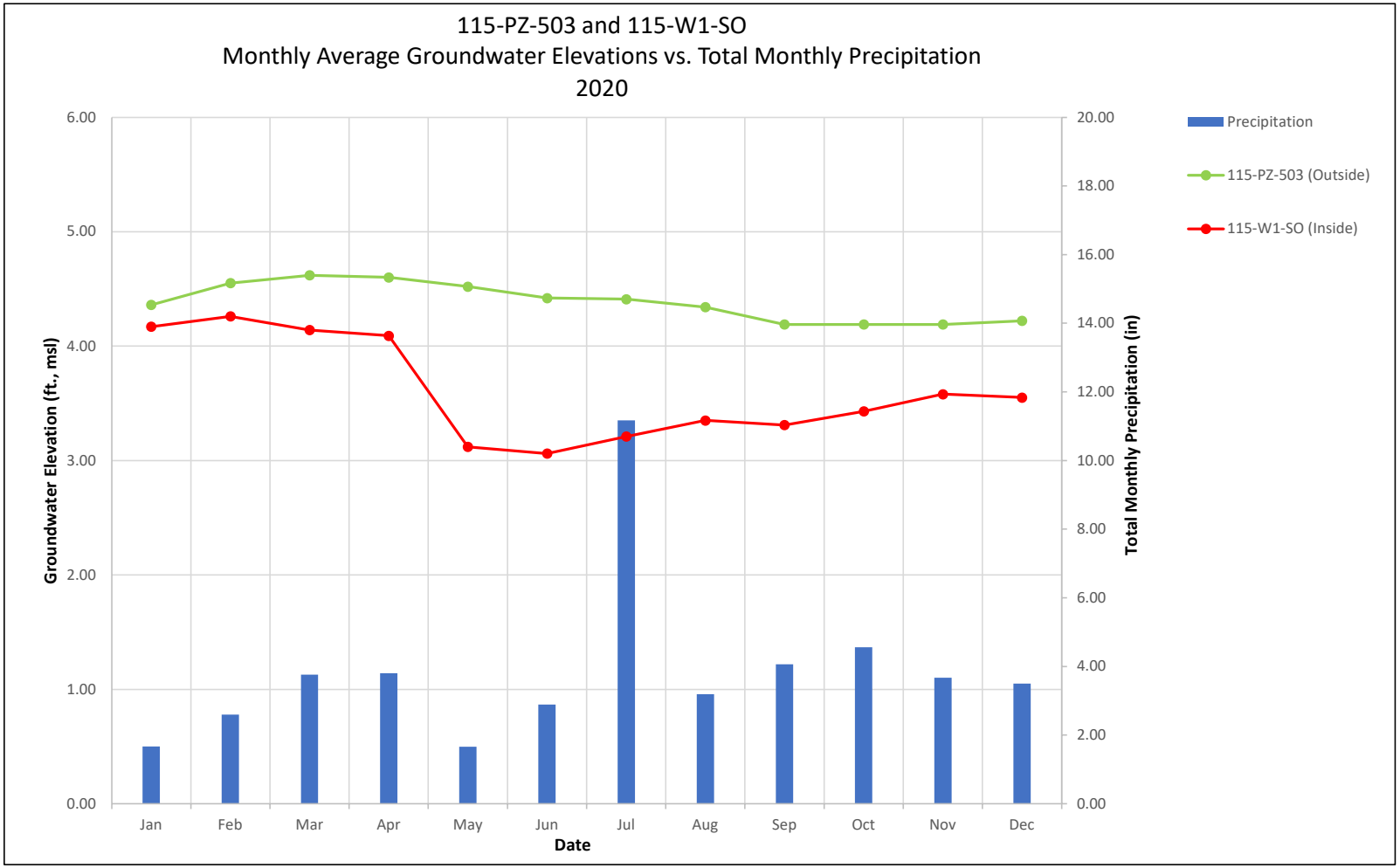


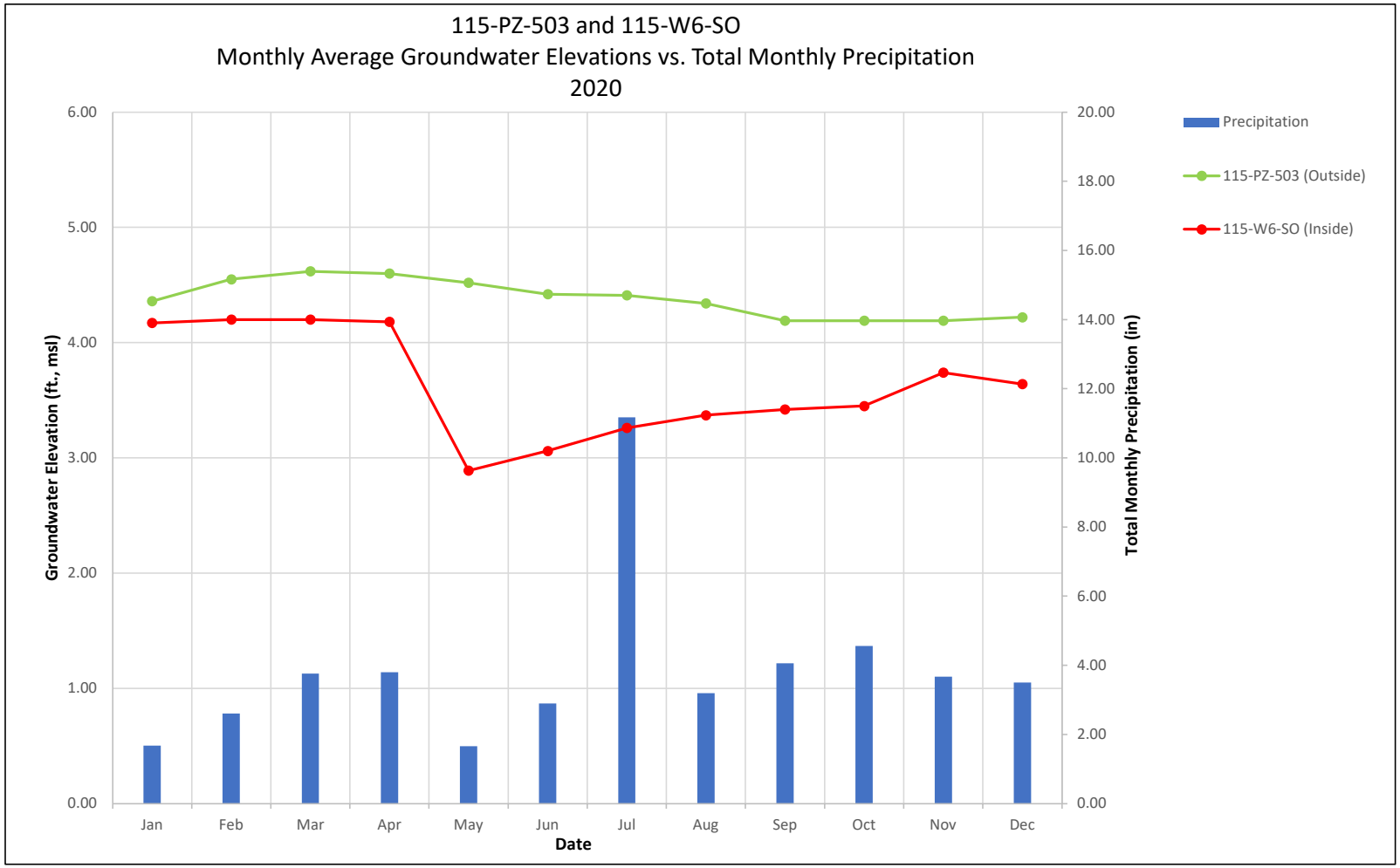
Notes:

*Pump station PS-1S was continuously operated during SA-6 South Bulkhead Remedy activities, but was turned off in November 2020


115-PZ-502 and 115-E4-SO
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft., msl)
Total Monthly Precipitation (in)
Date
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0.00
1.00
2.00
3.00
4.00
5.00
6.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
Precipitation
115-PZ-502 (Outside)
115-E4-SO (Inside)

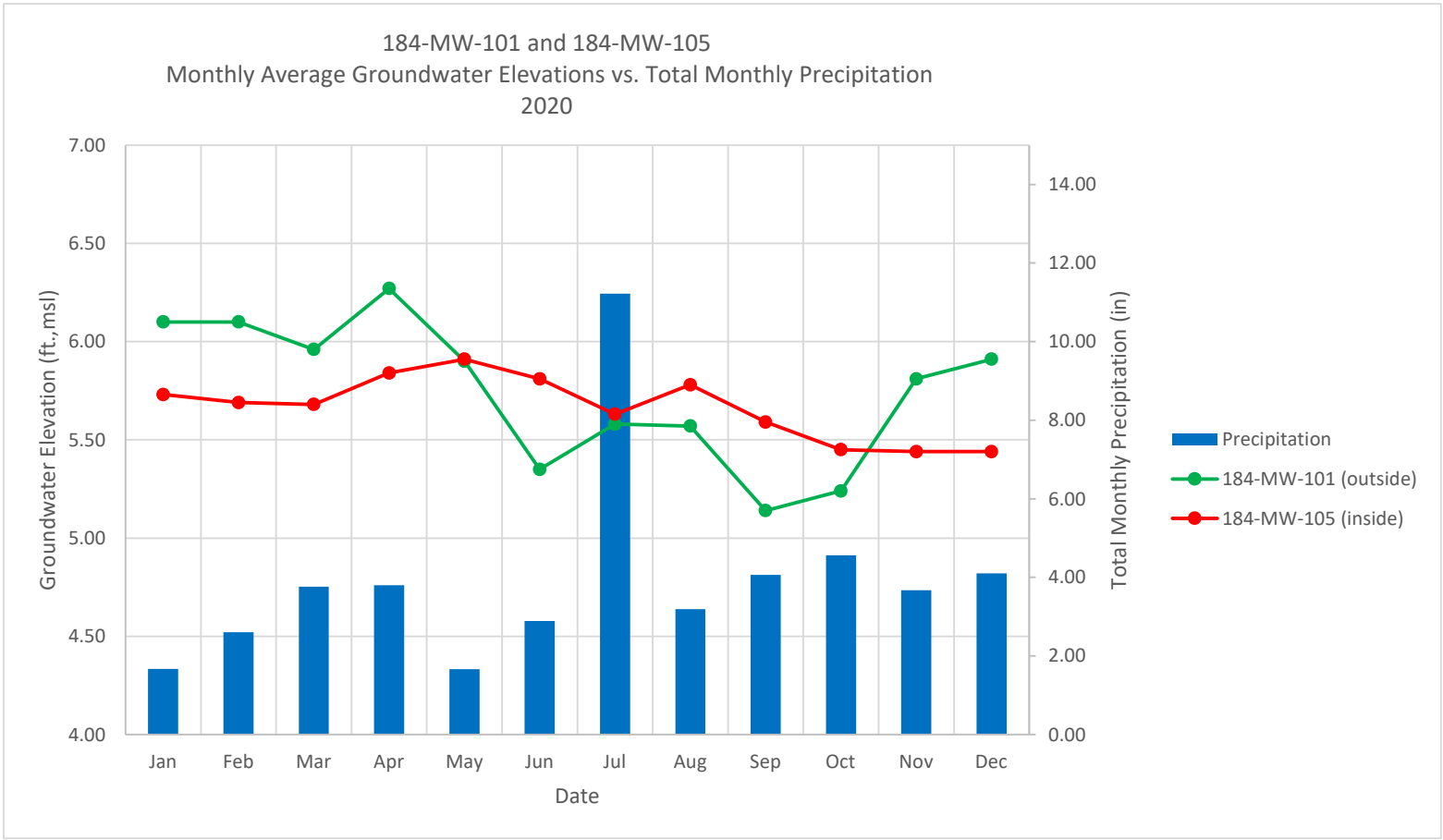

115-PZ-502 and 115-E5-SO
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft., msl)
Total Monthly Precipitation (in)
Date
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0.00
1.00
2.00
3.00
4.00
5.00
6.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
Precipitation
115-PZ-502 (Outside)
115-E5-SO (Inside)

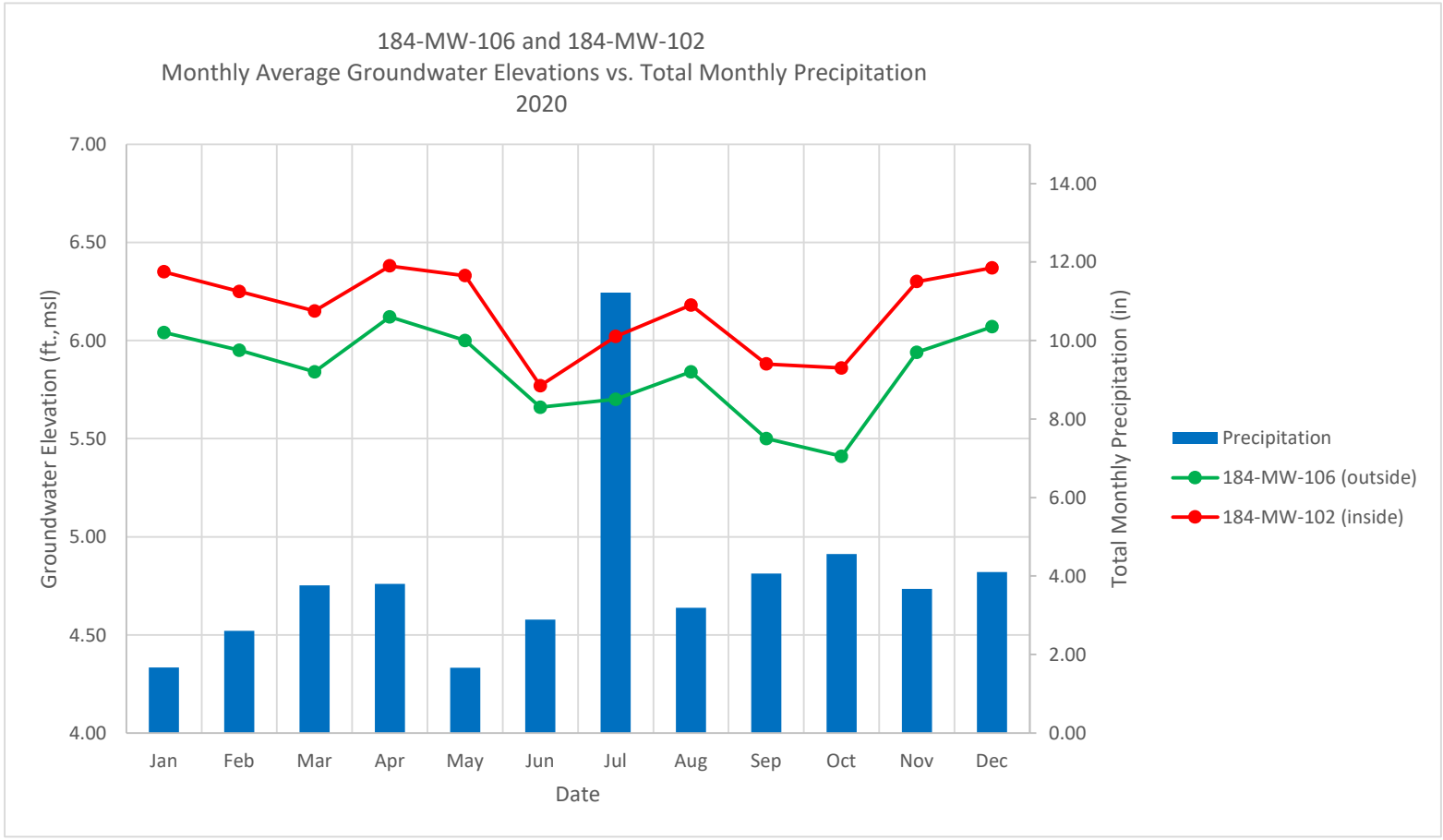

115-PZ-503 and 115-W1-SO
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft., msl)
Total Monthly Precipitation (in)
Date
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0.00
1.00
2.00
3.00
4.00
5.00
6.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
Precipitation
115-PZ-503 (Outside)
115-W1-SO (Inside)

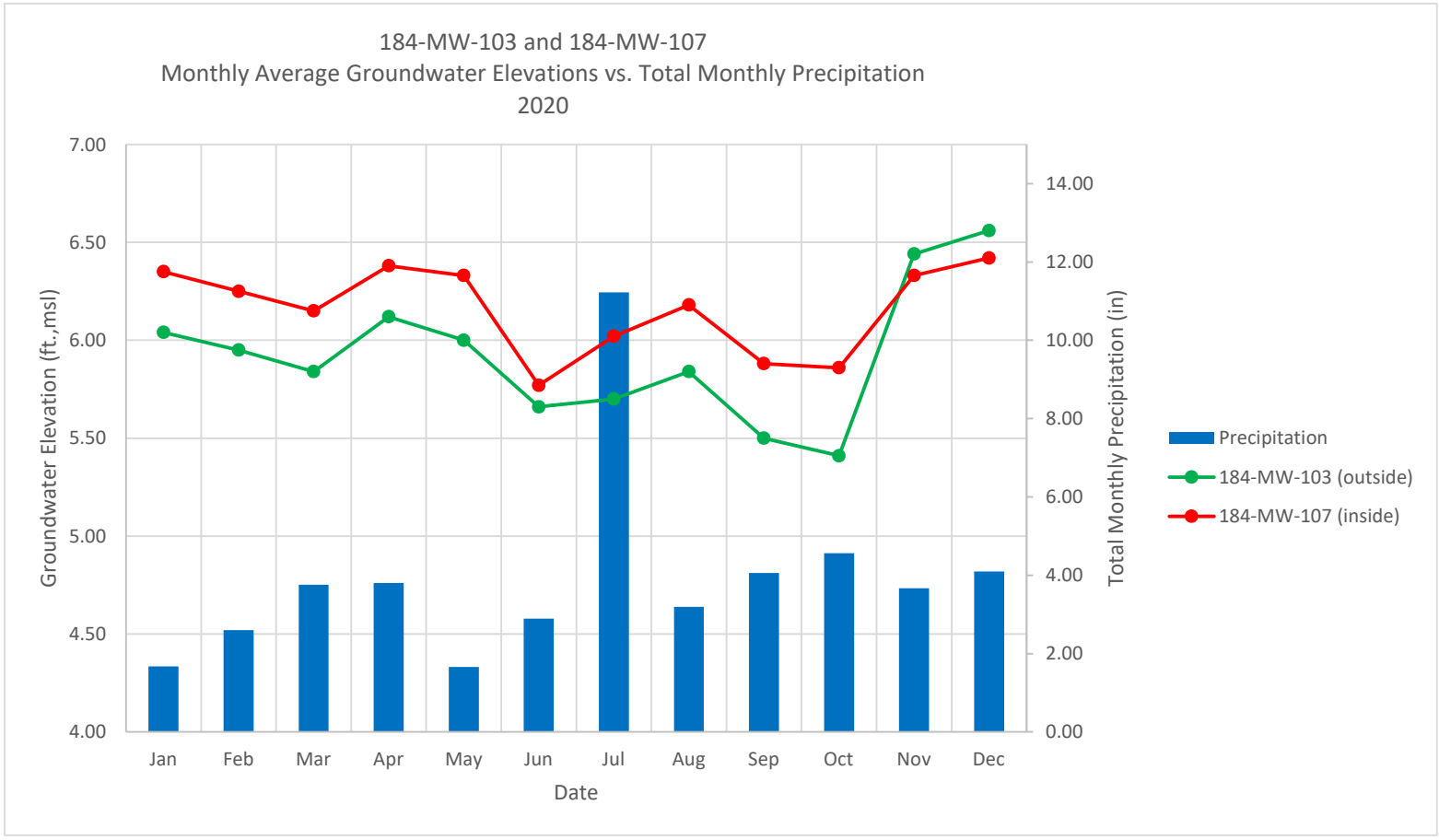

115-PZ-503 and 115-W6-SO
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft., msl)
Total Monthly Precipitation (in)
Date
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Precipitation
115-PZ-503 (Outside)
115-W6-SO (Inside)

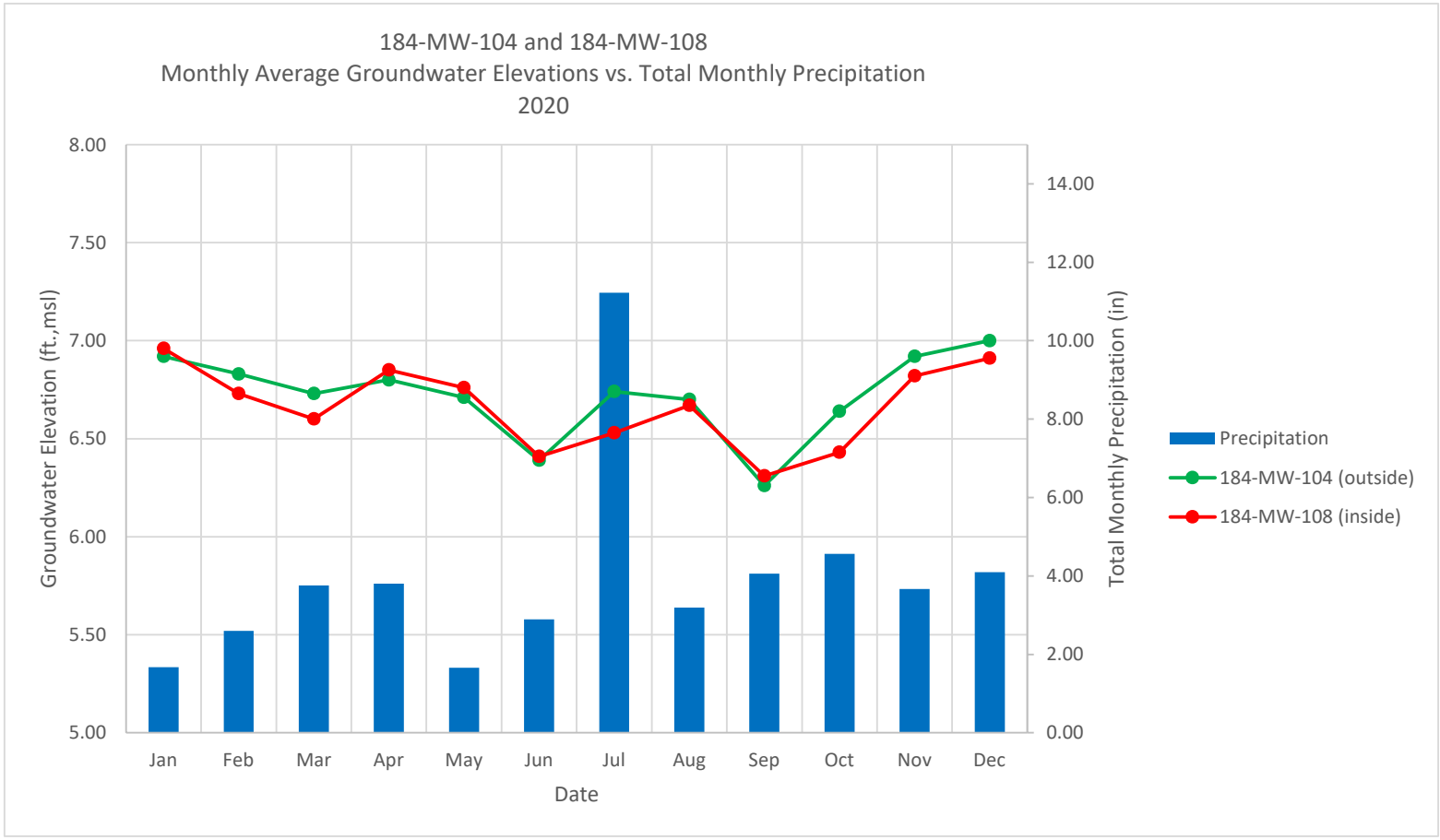
APPENDIX B

HYDROGRAPHS OF AVERAGE MONTHLY HEADS FROM SA-5 NJCU


184-MW-101 and 184-MW-105
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft.,msl)
7.00
6.50
6.00
5.50
5.00
4.50
4.00
Total Monthly Precipitation (in)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date
Precipitation
184-MW-101 (outside)
184-MW-105 (inside)

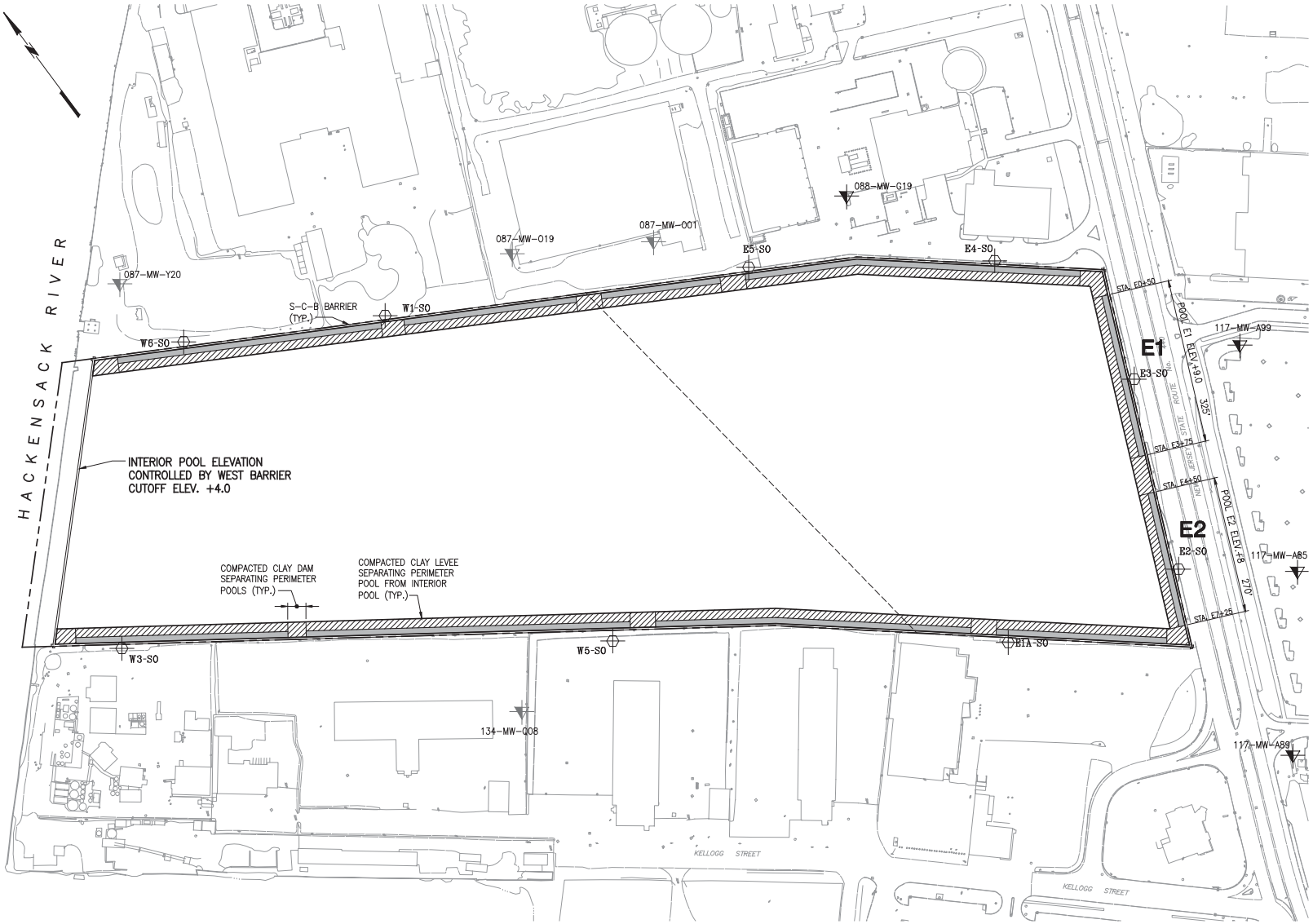

184-MW-106 and 184-MW-102
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft.,msl)
7.00
6.50
6.00
5.50
5.00
4.50
4.00
Total Monthly Precipitation (in)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date
Precipitation
184-MW-106 (outside)
184-MW-102 (inside)


184-MW-103 and 184-MW-107
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft.,msl)
7.00
6.50
6.00
5.50
5.00
4.50
4.00
Total Monthly Precipitation (in)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date
Precipitation
184-MW-103 (outside)
184-MW-107 (inside)


184-MW-104 and 184-MW-108
Monthly Average Groundwater Elevations vs. Total Monthly Precipitation
2020
Groundwater Elevation (ft.,msl)
8.00
7.50
7.00
6.50
6.00
5.50
5.00
Total Monthly Precipitation (in)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date
Precipitation
184-MW-104 (outside)
184-MW-108 (inside)

APPENDIX C

SA-7 EASTERN PERIMETER POOL HYDROGRAPHS



NOTES:

1. THE FOLLOWING WERE REMOVED FROM THIS DRAWING ON OCTOBER 15, 2018, AT THE REQUEST OF HONEYWELL:

   WELLS NORTH FS-1, NORTH FS-2, NORTH FS-3, NORTH FS-4, NORTH FS-5, NORTH FS-6, NORTH FS-7, NORTH FS-8, NORTH FS-9, NORTH FS-13, 087-MW-S19, 088-MW-G19, 090-MW-E1, 115-PZ-4, 115-PZ-5, 115-PZ-6, 073-MW-BB11, 073-MW-Y10, SOUTH-FS-1, SOUTH-FS-3, SOUTH-FS-4, SOUTH FS-5, SOUTH-FS-6, SOUTH FS-7, 134-MW-V09, 140-MW-06, 140-MW-07, 125-MW-L03, E1-SO, MW-124-103L, MW-124-103D, MW-124-103, MW-102D, MW-124-102T,

   PERIMETER POOL CALLOUTS N1, N2, N3, N4, S1, S2, S3, S4.

LEGEND

- FILL TYPE A CLAY
- FILL TYPE B GRANULAR FILL
- SHALLOW WELL INSTALLED BY OTHERS
- SHALLOW WELL ABANDONED IN 2014 IN ACCORDANCE WITH STUDY AREA 6 100% DESIGN
- SHALLOW WELL INSTALLED FOR STUDY AREA 7 REMEDIATION

GRAPHIC SCALE

100' 50' 0 100' 200'

NOTE: BEGINNING MARCH 1, 2018, PERIMETER POOLS DESIGNATED N1, N2, N3, N4, S1, S2, S3 AND S4 ARE NO LONGER MONITORED. PERIMETER POOLS E1 AND E2 WILL CONTINUE TO BE MONITORED AND WATER LEVEL DATA FOR THE REPORTING PERIOD IS ATTACHED.

IN PROGRESS
10-16-2018

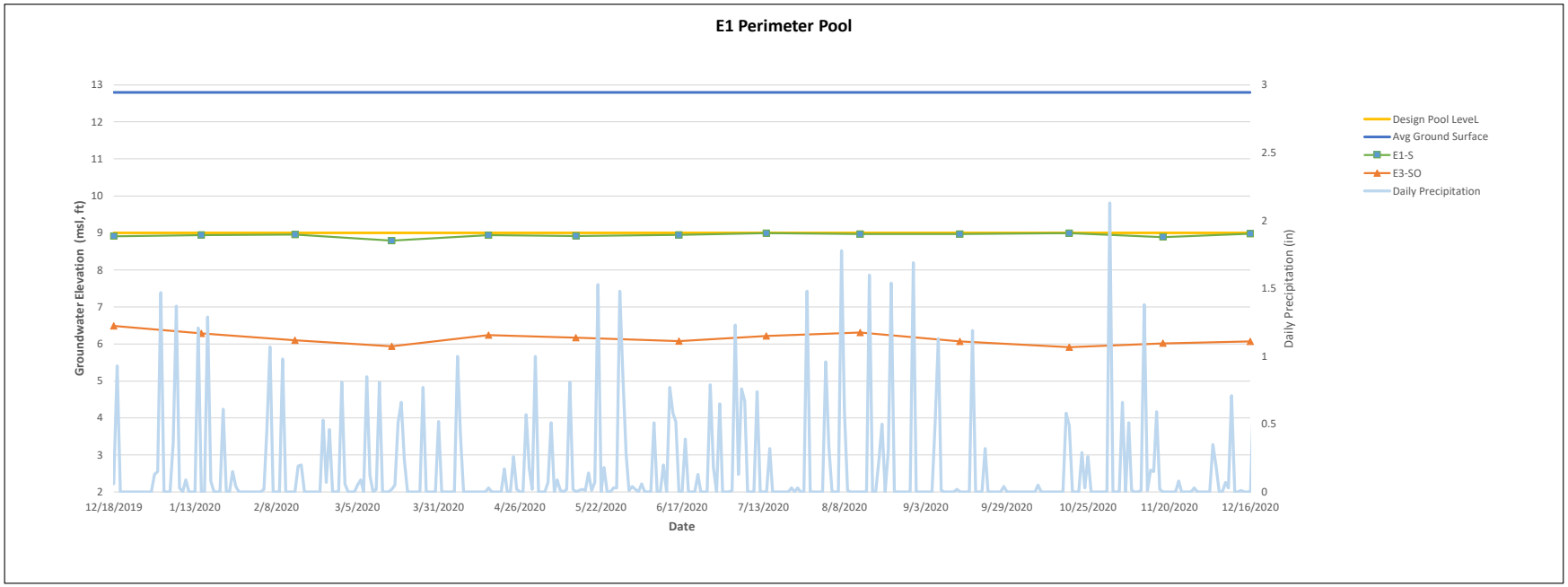
STUDY AREA 7
PERIMETER POOL DESIGN ELEVATIONS

NEW JERSEY

MUESER RUTLEDGE CONSULTING ENGINEERS
14 PENN PLAZA – 225 WEST 34th STREET

FILE NO. 10210
DRAWING NO. PP-1

Oct. 16, 2018 at 11:22am
G:\DWGS\102\10210\Dewatering\PP-1.dwg
bbascaino


E1 Perimeter Pool
Groundwater Elevation (msl, ft)
Daily Precipitation (in)
Date
13
12
11
10
9
8
7
6
5
4
3
2
3
2.5
2
1.5
1
0.5
0
12/18/2019
1/13/2020
2/8/2020
3/5/2020
3/31/2020
4/26/2020
5/22/2020
6/17/2020
7/13/2020
8/8/2020
9/3/2020
9/29/2020
10/25/2020
11/20/2020
12/16/2020
Design Pool LeveL
Avg Ground Surface
E1-S
E3-SO
Daily Precipitation

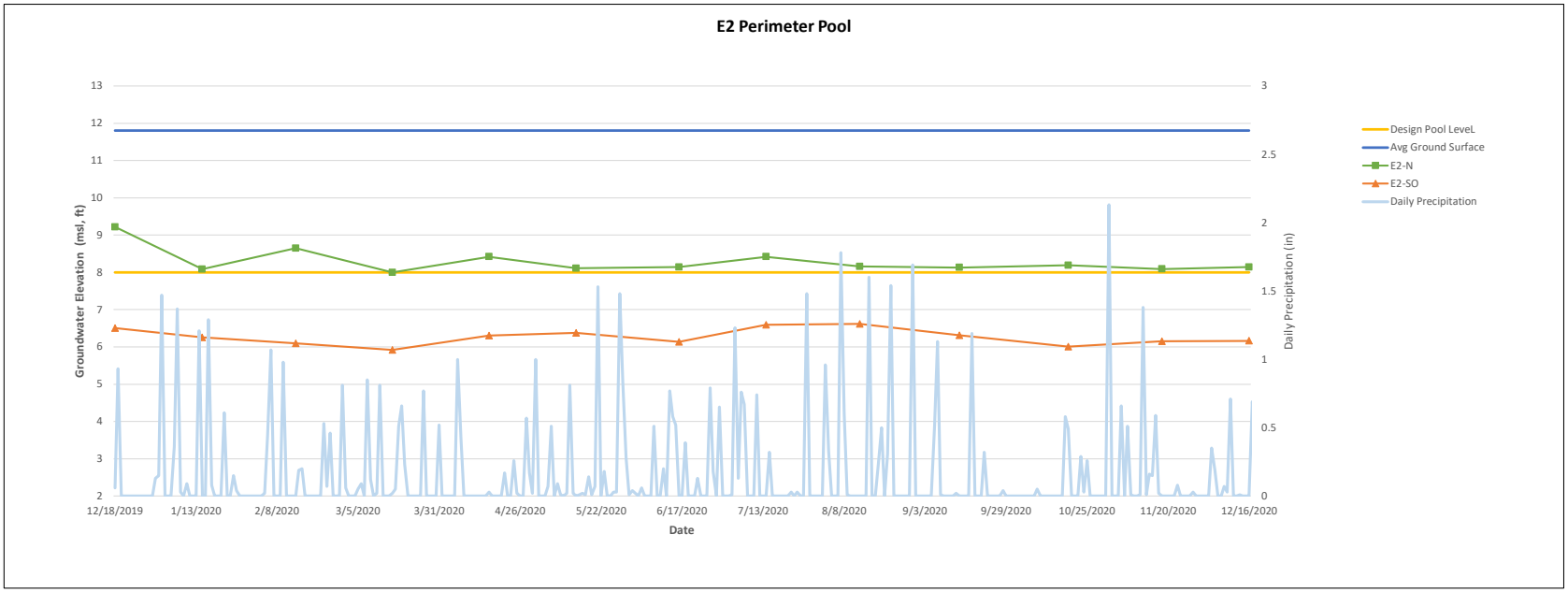

E2 Perimeter Pool
Groundwater Elevation (msl, ft)
Daily Precipitation (in)
Date
13
12
11
10
9
8
7
6
5
4
3
2
3
2.5
2
1.5
1
0.5
0
12/18/2019
1/13/2020
2/8/2020
3/5/2020
3/31/2020
4/26/2020
5/22/2020
6/17/2020
7/13/2020
8/8/2020
9/3/2020
9/29/2020
10/25/2020
11/20/2020
12/16/2020
Design Pool LeveL
Avg Ground Surface
E2-N
E2-SO
Daily Precipitation

Table 1 Shallow Groundwater Data		
Date	**E2-SO**	**E3-SO**
12/18/2019	6.50	6.49
1/15/2020	6.25	6.29
2/14/2020	6.09	6.10
3/16/2020	5.91	5.94
4/16/2020	6.30	6.24
5/14/2020	6.37	6.17
6/16/2020	6.13	6.08
7/14/2020	6.59	6.22
8/13/2020	6.61	6.31
9/14/2020	6.31	6.07
10/19/2020	6.00	5.91
11/18/2020	6.15	6.02
12/16/2020	6.16	6.07