Flambeau Mining Company
4700 Daybreak Parkway
South Jordan, UT 84095
801-204-2526

Flambeau Reclaimed
promises made, promises kept

January 31, 2020

Mr. Greg Pils
Bureau Director
Wisconsin Department of Natural Resources
101 S. Webster Street, GEF2
Madison, WI 53707-7921

Dear Mr. Pils:

The Flambeau Mining Company (Flambeau) is submitting 5 copies of the attached 2019 Annual Summary Memorandum pursuant to Parts 1-8 of the Flambeau Mine Permit (Docket No. IH-89-14). This submittal also addresses other requirements of the Mining Permit and associated approvals.

Monitoring and evaluations conducted during 2019 continue to document that the Flambeau River remains fully protected and Flambeau remains in full compliance with its permit standards.

If you have any comments or questions regarding this submittal, please contact me at (801) 204-2526 or dave.cline@riotinto.com.

Sincerely,

Dave Cline
President – Flambeau Mining Company

attachments

cc: Pete Boss, Rusk County Board of Supervisors
Tom Riegel, Town of Grant
Al Christianson, City of Ladysmith
Yvonne Johnson, Rusk County Zoning
Leland Roberts, Flambeau Mining Company
Steve Donohue, Foth Infrastructure & Environment, LLC
Foth File: 17F777.20\4000

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January 31, 2020

TO: Dave Cline, Flambeau Mining Company
Leland Roberts, Flambeau Mining Company

CC: Steve Donohue, Foth Infrastructure & Environment, LLC
Foth Project #: 17F777.20

FR: Sharon Kozicki, Foth Infrastructure & Environment, LLC
Steve Lehrke, Foth Infrastructure & Environment, LLC
Nick Glander, Foth Infrastructure & Environment, LLC

RE: 2019 Annual Summary Memorandum – Reclaimed Flambeau Mine;
Flambeau Mining Company

1 Purpose and Need

This 2019 Annual Summary Memorandum documents the work that was completed by Flambeau Mining Company (Flambeau) at the Reclaimed Flambeau Mine Site, Ladysmith, Wisconsin, in 2019, to satisfy the requirements of the Mining Permit (MP). These requirements are summarized in Table 1.

Table 1 – Mine Permit Location Information Key

Condition Number	Location of Information	Condition Requirement
MP, Part 1, Cond. 8	Section 2	*“Submit a report annually to the Department summarizing the activities which took place on the mining site during the year and shall include other additional information specified in this permit and associated plan approvals.”*
MP, Part 2, Cond. 4	Section 1	*“Include discussion of all modifications received during the previous year and shall include an inventory of all modifications received subsequent to permit issuance.*

Condition Number	Location of Information	Condition Requirement
		The annual report shall also discuss deviations from the approved Mining Plan as a result of final engineering refinements of subsequent plan approvals if these deviations do not require modifications, under Part 2, Conditions 2 and 3."
MP, Part 2, Cond. 6	There were no reportable or recordable incidents in 2019.	*"A summary of incidents subject to various Department reporting requirements shall be included in the annual report required under sec. 144.89, Stats."*
MP, Part 2, Cond 7	There were no exploration activities conducted in 2019.	*"The annual report required under sec. 144.89, Stats, shall include a summary of all exploration drilling activities conducted on the mining site during the previous year."*
MP, Part 4, Cond. 9	Section 2 and Attachment A	*"The annual report required in this permit shall summarize the year's monitoring activities and any observed trends in the monitoring data."*

Since 2018, the annual summary is presented in memorandum format as approved by the Wisconsin Department of Natural Resources (Department) in a letter received on December 7, 2018.

In the Request to Modify the Updated Monitoring Plan (November 2018), the monitoring frequency, number of wells, and number of parameters sampled was requested to be reduced. A public informational hearing was conducted by the Department at its service center in Ladysmith, WI on June 20, 2019. After the allotted comment and response period, the request was approved by the Department on October 4, 2019. Subsequent to the approval there was a 30-day review period. There were no requests for review. The 2020 monitoring will reflect the new monitoring plan. The Updated Monitoring Plan (July 1991) and Quality Assurance Project Plan (QAPP) (February 2015) will be amended in the first half of 2020 to incorporate the modifications.

2 2019 Site Monitoring

Environmental monitoring at the Reclaimed Flambeau Mine, during 2019, included assessing the quality of groundwater and backfill pore water. All data obtained during environmental monitoring continues to show that Flambeau remains in compliance with all permit standards and the Flambeau River remains protected.

2.1 Groundwater Sampling and Analysis

Quarterly groundwater monitoring was performed in accordance with descriptions provided in the Updated Monitoring Plan, the QAPP, and the Local Agreement. Results of the 2019 monitoring were submitted to the Department's Mine Reclamation Unit on June 7, 2019, August 12, 2019, and December 20, 2019. Those reports are incorporated by reference.

Figure 1 shows the groundwater potentiometric surface using data obtained during 2019. The map was generated using the shallowest measured water levels, and thus represents shallow groundwater flow in the native formations and in the replaced till and sandstone in the backfilled pit footprint. The potentiometric surface shows a direction of regional shallow groundwater flow toward the Flambeau River.

Figure 2 shows the potentiometric surface using the deeper water level for nested wells, where available, and the water levels for the B completion in the backfill monitoring wells. Beyond the pit footprint, the groundwater levels generally mimic the shallow groundwater conditions. Within the pit backfill, the surface reflects a general direction of groundwater flow in the backfilled Type I and Type II stockpile materials along the axis of the pit toward the Flambeau River.

Figure 3 shows hydraulic head in the cross section along the axis of the pit. The cross section is interpreted to show predominantly horizontal flow in the backfilled Type I and Type II stockpile materials but with a downward hydraulic gradient at the eastern pit area and an upward hydraulic gradient with convergent groundwater flow near the Flambeau River. These observations are consistent with previous, post-mining years.

2.1.1 Trend Analysis

A detailed analysis of statistical trends occurring in the groundwater and surface water data was performed. Statistical tests evaluated the long-term trends occurring during the post-mining period (October 1997 to the present) and the short-term trends for the most recent five years. Historical trend graphs of the data are also presented.

A detailed discussion of the trend results for each well nest is provided in Attachment A. In general, the majority of the trends with notable concentration changes occur in the quarterly groundwater indicator monitoring parameters.

Most recently for the intervention boundary wells, decreasing redox and increasing pH was observed, particularly at wells MW-1000R/1000PR/1010P (near the immediate southwest boundary and hydraulically downgradient of the reclaimed mine pit); MW-1004/1004S (near the immediate northwest boundary and hydraulically downgradient of the former mine pit); and MW-1015A (approximately 1,000 feet to the west and hydraulically downgradient of the former mine pit). Corresponding decreasing trends are also observed for hardness, manganese, total dissolved solids (TDS), and conductivity in MW-1000R; TDS and conductivity in MW-1000PR; and alkalinity in MW-1005S. While MW-1002G (northwest and hydraulically side-gradient to the former mine pit) also had a recent increasing trend in pH, the concentrations of alkalinity and hardness likewise had a small increasing trend instead of the decreasing trends observed elsewhere.

For the in-pit well nest at MW-1013, iron at MW-1013A decreased to non-detectable levels, while iron at MW-1013 continues to exhibit a large degree of variation, historically switching between increasing and decreasing trends. Copper and manganese continue decreasing trends at MW-1013B, while a smaller increasing trend of sulfate exists at this well. Smaller decreasing trends of TDS and conductivity occur at MW-1013C.

For the in-pit well nest at MW-1014, decreases in redox and increases in pH were observed similarly as in the intervention boundary wells. Corresponding decreasing trends in copper, manganese and conductivity were observed in MW-1014B, with decreased concentrations particularly observed during 2019.

The only statistical trends for surface water were recently small increasing trends for iron. However, iron concentrations in the surface water remain below those which were observed historically.

2.2 Wetland Monitoring

In accordance with Section 3.1.4.3 of the Updated Monitoring Plan, Flambeau monitored water levels in Wetland 1 (Staff Gauge WT-5) in 2019. Water levels were observed three times: spring, summer, and fall. Standing water at the staff gauge was observed during these times, however there were no recordable readings in summer and fall due to the heaving of the staff gauge. Figure 1 shows the staff gauge location.

In May 2001, Flambeau submitted a Wetland Area Hydrographic Assessment, prepared by Foth & Van Dyke and Associates, Inc. (FVD), evaluating the wetland water elevations and recommending cessation of monitoring of wetland surface water elevations, with the exception of Wetland 1, in accordance with the Updated Monitoring Plan. Based upon the Wetland Area Hydrographic Assessment, Flambeau requested the Department's approval of cessation of monitoring wetland surface water elevations for Wetlands 5C, 6C, 7, and 10A. During April 2002, the Department concurred with Flambeau's request to decrease the extent of wetland water level monitoring.

A request to end the required monitoring and reporting in Wetland 1 was submitted with the Request to Modify the Updated Monitoring Plan on November 13, 2018. This request was approved by the Department on October 4, 2019, and WT-5 is scheduled to be abandoned in 2020.

2.3 Protection of the Flambeau River

Potential impact to the Flambeau River was estimated by performing a concentration reduction factor (CRF) calculation in the Request to Modify the Updated Monitoring Plan. This calculation was initially presented in Appendix L of the Mine Permit Application for the Flambeau Project (December 1989), and then updated with current gradient and concentration data for copper, iron, manganese, and sulfate in a memorandum submitted by

Flambeau, to the Department, on October 17, 2000, entitled "Backfilled Pit Water Quality Assessment" (October 2000). The 2019 calculation, updated using the current gradient and concentrations, is incorporated by reference. The results of the 2019 calculation were consistent with the 1989 and 2000 CRF calculations, with the CRF being on the order of 0.00000010 and 0.0000010 milligrams per liter (mg/L) for average and low flow conditions, respectively. This CRF results in negligible, unmeasurable, incremental impacts to the Flambeau River that are 3 to 5 orders of magnitude lower than background concentrations in the Flambeau River indicating that the River remains protected. The 2019 Flambeau River analytical results are summarized in Attachment A.

2.4 Annual Site Inspection

The site was inspected quarterly during the 2019 groundwater monitoring events. During these events, there were no areas of erosion or settling observed, vegetative growth appeared normal, and all monitoring devices were functional, with the following exceptions:

- The staff gauge at WT-5 appears to have heaved and actual measurements could not be collected.
- The protective surface casing at MW-1005P would not close.
- OW-42 was inaccessible during the quarter 4 sampling event due to high water and a beaver dam impeding drainage to the weir.

Monitoring at staff gauge WT-5 will be eliminated in 2020 as approved by the Department on October 4, 2019. It will be scheduled for abandonment in 2020.

During the quarter 4 sampling event, Foth personnel observed the protective surface casing sunk and/or the PVC well casing heaved slightly not allowing the protective casing cap to close at MW-1005P. Following the quarter 4 event, (on November 5th) repairs on the well were completed by removing the dedicated pump, cutting 0.354 feet of PVC from the riser to make it flush with the protective casing again. The new total depth was measured (94.29 feet) from the top of the PVC riser to the bottom of the well utilizing a water level meter. After the repairs were performed and the pump was reinstalled, the protective casing cap was rinsed clean with distilled water and locked.

Also during the quarter 4 sampling event, beaver activity was observed at monitoring well OW-42, located in a wetland to the west of the former mine pit area and north of the former slurry wall, shown on Figure 1. On the southern edge of the wetland, there is a drainage way leading to a weir, which appears to have been impeded by beaver activity causing high water levels and flooding in the wetland. The crew also noted a berm along the north edge of the wetland preventing water from flooding into the forested area. Due to the high water level, the crew was unable to access OW-42 and perform depth to water measurements. In order to locate OW-42 in the future, it is recommended that the beavers be removed via trapping, and the dam be dismantled, ultimately helping lower the water level in the wetland area.

2.5 Other Activities

The Flambeau River was voluntarily monitored in the spring and fall for copper, iron, manganese, total hardness, zinc, and total suspended solids (TSS). These results are summarized in Attachment A. The results indicate that the Flambeau River remains protected.

3 References

2018 Annual Memorandum	January 2019
Request to Modify the Updated Monitoring Plan	November 2018
2017 Annual Report	January 2018
2016 Annual Report	January 2017
Copper Park Business and Recreation Area Supplement Construction Documentation Report	November 2016
2015 Annual Report	January 2016
2015 Flambeau Mining Company Surface Water Monitoring Plan	September 2015
Copper Park Business and Recreation Area Work Plan Supplement	May 2015
Quality Assurance Project Plan	February 2015
2014 Annual Report	January 2015
2013 Annual Report	January 2014
Copper Park Business and Recreation Area Maintenance and Monitoring Plan	February 2013
2012 Annual Report	January 2013
Copper Park Business and Recreation Area Construction Documentation Report	January 2013
2012 Annual Reclamation Report	November 2012
2011 Annual Report	January 2012
2011 Annual Reclamation Report	November 2011
Copper Park Business and Recreation Area Work Plan	May 2011
2010 Annual Report	January 2011
2010 Annual Reclamation Report	November 2010
2009 Annual Report	February 2010
2009 Annual Reclamation Report	November 2009
2008 Annual Report	January 2009
2008 Annual Reclamation Report	November 2008
2008 Monitoring Results and Copper Park Lane Work Plan	October 2008
2007 Annual Report	January 2008
COC Stipulation Monitoring Work Plan	December 2007
Quality Assurance Project Plan – Stipulation Monitoring Work Plan QAPP for the Flambeau Mine	December 2007
2007 Annual Reclamation Report	November 2007

Stipulation and Order	May 2007
2006 Annual Report	January 2007
Biofilter Management Plan	January 2007
2006 Annual Reclamation Report	November 2006
Construction Documentation Report – Flambeau Industrial Outlot	September 2006
2005 Annual Report	January 2006
2005 Annual Reclamation Report	November 2005
2004 Annual Reclamation Report	November 2004
2001 Annual Reclamation Report	November 2001
2000 Annual Report	January 2001
Revised Mining Permit Quality Assurance/Quality Control Plan	August 1991
Updated Monitoring Plan	July 1991
Mining Permit	January 1991
Operational Phase and Long Term Care Quality Assurance Plan	November 1993
Mine Permit Application	December 1989
Local Agreement	August 1988

4 Submittal Summary

Document	Date	Submittee
2018 Annual Memorandum	January 2019	Dave Siebert[1]
Environmental Groundwater Monitoring (First Quarter 2019)	June 2019	Dave Siebert[1]
Environmental Groundwater Monitoring (Second Quarter 2019)	August 2019	Greg Pils[1]
		Greg Pils[1]
Environmental Groundwater Monitoring (Third Quarter 2019)	August 2019	Greg Pils[1]
Environmental Groundwater Monitoring (Fourth Quarter 2019)	December 2019	Greg Pils[1]

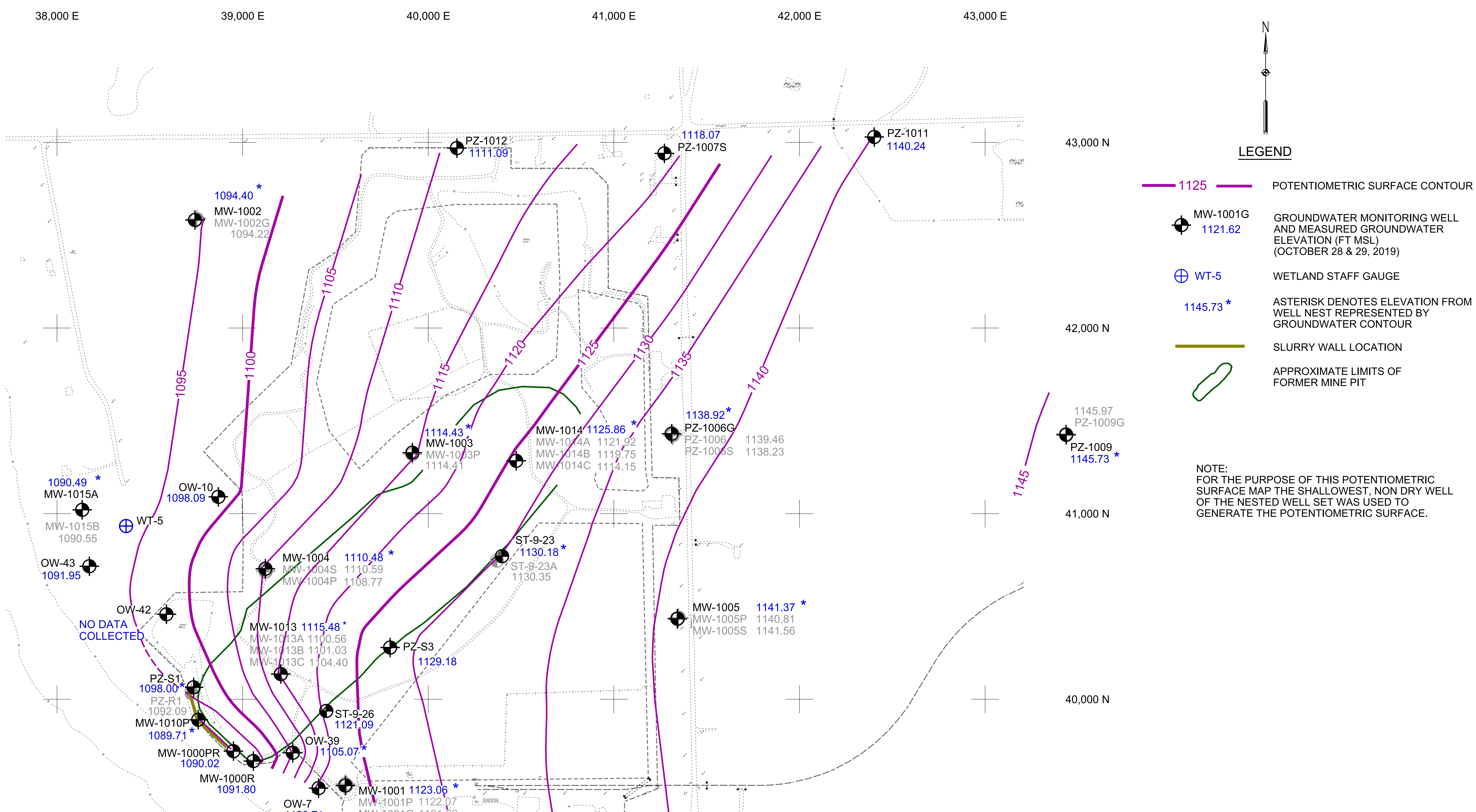
[1] Wisconsin Department of Natural Resources
Division of External Services
Bureau of Environmental Analysis & Sustainability

Attachments:

Figure 1 October 2019 Potentiometric Surface, Shallow Groundwater Levels
Figure 2 October 2019 Potentiometric Surface, Wells Screened at Mid-Depths
Figure 3 2019 Mine Pit Cross Section A-A' with In-Pit Groundwater Monitoring Wells

Attachment A Groundwater Quality & Elevation/Surface Water Quality Trends

Figures



Foth Infrastructure & Environment, LLC				FLAMBEAU MINING COMPANY
REVISED	DATE	BY	DESCRIPTION	FIGURE 1
				OCTOBER, 2019 POTENTIOMETRIC SURFACE, SHALLOW GROUNDWATER LEVELS
PREPARED BY:	NMG1	DATE:	JAN. '20	Scale: 0 250' 500'
REVIEWED BY:	MAN	DATE:	JAN. '20	Date: JANUARY 2020
APPROVED BY:	SVF	DATE:	JAN. '20	Drafted By: JOW / Project No. 17F777.20

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Flambeau Mining Company
2019 Annual Summary Memorandum

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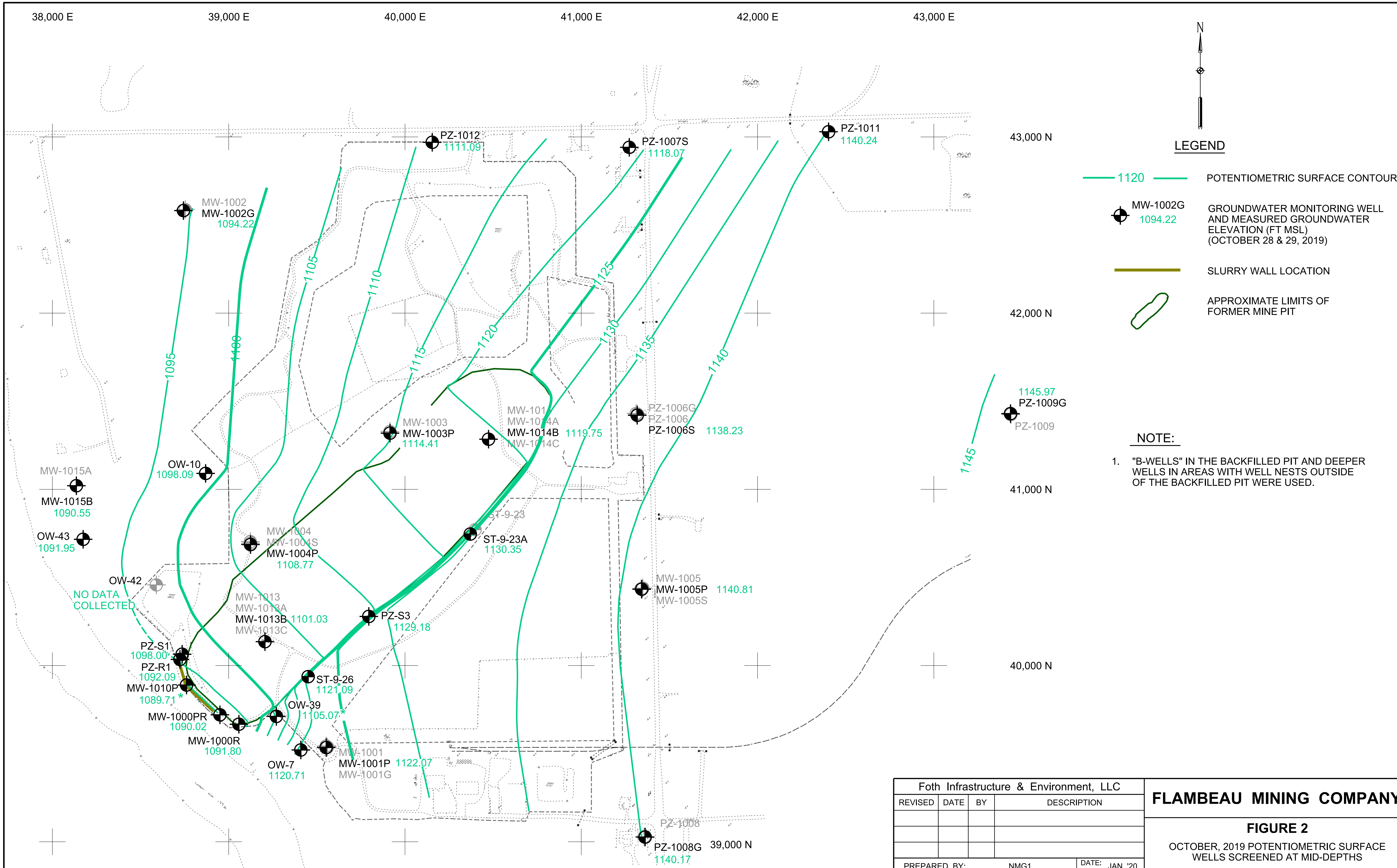

Flambeau Mining Company
2019 Annual Summary Memorandum

Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION

PREPARED BY:	NMG1	DATE:	JAN. '20
REVIEWED BY:	MAN	DATE:	JAN. '20
APPROVED BY:	SVF	DATE:	JAN. '20

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FLAMBEAU MINING COMPANY

FIGURE 2

OCTOBER, 2019 POTENTIOMETRIC SURFACE
WELLS SCREENED AT MID-DEPTHS

Scale: 0 250' 500'		Date:	JANUARY 2020
Drafted By:	JOW	Project No.	17F777.20

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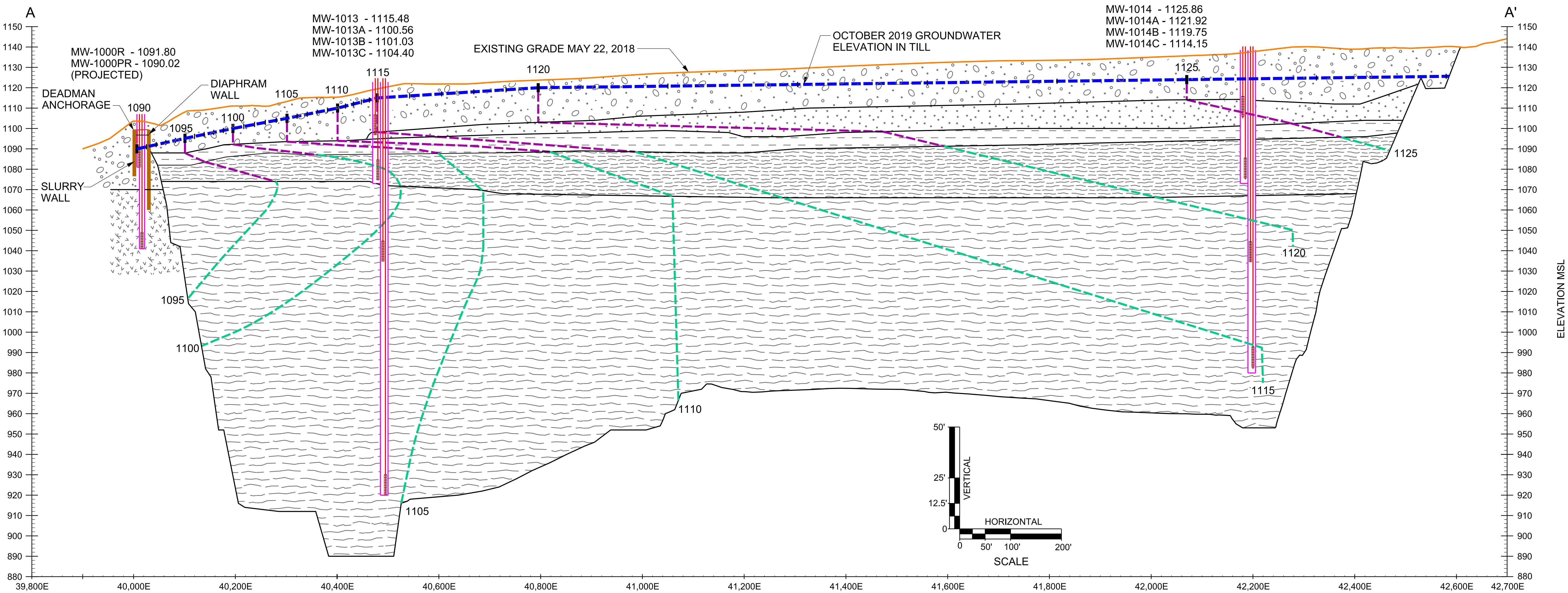
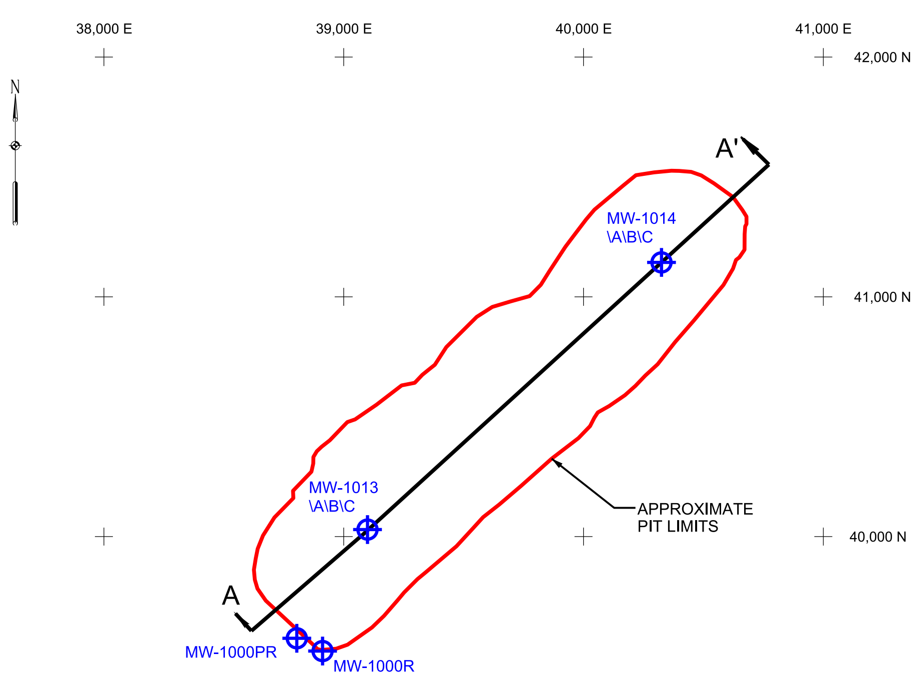
1/27/2020 11:17:57 AM jow



MINE PIT COORDINATES

SECTION A - A'



CROSS SECTION LOCATION MAP

SCALE: 1" = 600'

LEGEND

- TILL
- SANDSTONE
- SAPROLITE
- TYPE I MATERIAL
- TYPE II MATERIAL
- PRECAMBRIAN
- WATER TABLE
- GROUNDWATER EQUIPOTENTIAL LINE IN TYPE I AND II BACKFILL
- GROUNDWATER EQUIPOTENTIAL LINE IN SHALLOW FLOW SYSTEM

Flambeau Mining Company
2019 Annual Summary Memorandum

Foth Infrastructure & Environment, LLC

REVISED	DATE	BY	DESCRIPTION

PREPARED BY:	NMG1	DATE:	JAN. '20
REVIEWED BY:	MAN	DATE:	JAN. '20
APPROVED BY:	SVF	DATE:	JAN. '20

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FLAMBEAU MINING COMPANY

FIGURE 3

2019 MINE PIT CROSS SECTION A - A'
WITH IN-PIT GROUNDWATER
MONITORING WELLS

Scale:	SEE BAR SCALE	Date:	JANUARY 2020
Drafted By:	JOW	Project No.	17F777.20

Attachment A

Groundwater Quality & Elevation/Surface Water Quality Trends

Foth

Memorandum

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January 31, 2020

TO: Dave Cline, Flambeau Mining Company
Leland Roberts, Flambeau Mining Company

CC: Steve Donohue, Foth Infrastructure & Environment, LLC
Sharon Kozicki, P.G., Foth Infrastructure & Environment, LLC

FR: Stephen Lehrke, Ph.D., Foth Infrastructure & Environment, LLC
Allison Haus, Ph.D., Foth Infrastructure & Environment, LLC

RE: 2019 Annual Report Groundwater and Surface Water Trends

1 Background

Groundwater and surface water sample results collected during the 2019 monitoring programs were added to the analytical monitoring historical database. These results were statistically tested and graphically displayed to determine whether any significant increasing or decreasing trends are occurring in the groundwater or surface water chemistry. This is done to satisfy the requirements of Part 4, Condition 9 of the Mine Permit, to summarize the monitoring activities and any observed trends. The 2019 surface water samples from the Flambeau River were collected voluntarily by Flambeau Mining Company (Flambeau).

Groundwater quality results, trend graphs, and statistical test results are included as attachments: Attachment 1 presents the quarterly monitoring parameters, and Attachment 2 presents the annual monitoring parameters. Surface water quality results, trend graphs, and statistical test results are included as Attachment 3. Hydrographs are included as Attachment 4.

Intervention boundary wells included in the trend analyses are MW-1000PR, MW-1002, MW-1002G, MW-1004P, MW-1004S, MW-1005, MW-1005P, MW-1005S, and MW-1010P. The in-pit wells included in the trend analyses are MW-1013, MW-1013A, MW-1013B, MW-1013C, MW-1014, MW-1014A, MW-1014B, and MW-1014C. Wells MW-1015A and MW-1015B (also included in the analyses) were constructed in January 2001 approximately 1,000 feet northwest of the backfilled pit and adjacent to the compliance boundary.

Statistical trend test methods are described in Section 2 of this memorandum (memo), with more detailed results provided in Section 3, and a summary of conclusions of the trend results provided in Section 4.

2 Statistical Methods

Groundwater and surface water trends over time were assessed using the non-parametric Mann-Kendall test. This test indicates general increasing or decreasing trends over the time periods evaluated. Two data sets (utilizing two distinct start dates) were assessed: "short-term" trends encompass the results of 2015 through 2019, i.e., the last five years, and "long-term" trends encompass the results from October 1997, when the post-mining period began, through the end of 2019.

Annual monitoring, and long-term trend analyses, began in July 1999 for barium, cadmium, calcium, chloride, chromium, lead, magnesium, mercury, potassium, selenium, silver, sodium, and zinc. Monitoring and long-term trend analyses began in February 1999 for the in-pit wells (i.e., MW-1013B, MW-1013C, MW-1014A, MW-1014B, and MW-1014C), and in April 2001 for wells MW-1015A and MW-1015B. Trend analyses for wells MW-1013, MW-1013A, and MW-1014 began in October 2005, and for MW-1000R and MW-1004 in October 2010, when groundwater levels recovered sufficiently to collect samples.

The statistical results of the non-parametric Mann-Kendall test are used in conjunction with the graphs in Attachments 1, 2, and 3 to evaluate trend conditions within the context of the broader site hydrology. It should be noted that a statistically increasing or decreasing trend as determined through the Mann-Kendall test does not necessarily indicate a substantial increase or decrease in actual parameter concentrations. There are situations where variation in the data is small, allowing slight but consecutive increasing or decreasing concentration changes to be detected as a statistically significant trend. Although these minor trends may occur, they should not be construed as an indication of a broader impact on water quality.

In some cases, the Mann-Kendall trend test results of Attachments 1, 2, and 3 may indicate a statistical trend in the "long-term" data (i.e., results from October 1997), while "short-term" data do not illustrate trend. In these situations, higher or lower concentration data may have been observed in the past, and more recent concentration data has stabilized. The trend result discussion given below focuses on cases that exhibit trends only in the more recent "short-term" data of 2015 through 2019.

The procedure for the Mann-Kendall test is given in Gilbert (1987)[1] and U.S. Environmental Protection Agency (USEPA) (2009)[2]. The Type I error for each test was set to 0.01 (two-tailed), with the exception of the five-year trend tests for the annual parameters. To counteract the decrease in power due to small sample sizes in those cases, the type I error (two-tailed) was set to 0.05 to increase the statistical power (power of detecting existing trends). All non-detected values were replaced with a common value below the lowest detected value.

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[1]Gilbert, R.O., 1987. *Statistical Methods for Environmental Pollution Monitoring*, Van Nostrand Reinhold, New York.

[2]USEPA, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530-R-09-007. Office of Resource Conservation and Recovery, Program Implementation and Information Division, Washington, D.C.

In the trend test results of Attachments 1, 2, and 3, a "+" indicates a statistically increasing trend and a "-" indicates a statistically decreasing trend. If neither a "+" or "-" is given, no statistically significant trend is present.

3 Trend Results

The majority of trends, increasing and/or decreasing, were exhibited in the groundwater results for the quarterly parameters. Statistical trend results at each well are summarized below. Historical trend graphs from Attachment 1 (quarterly parameters), Attachment 2 (annual parameters), Attachment 3 (surface water), and Attachment 4 (hydrographs) aid in interpretation. The results are organized by well nest and location.

As previously noted, the Mann-Kendall test may at times indicate that a statistical trend exists due to slight but consecutive concentration changes (either increasing or decreasing). Therefore, in certain instances of the statistical trend results provided in Attachments 1, 2 and 3, increasing ("+") or decreasing ("-") results may be indicated by the trend tests which do not reflect a substantial overall change in concentration as observed in the concentration trend graphs. The discussion below is therefore limited to trends existing in the recent five-year dataset that show at least a modest change in relative concentration level.

3.1 Quarterly Parameters (Attachment 1)

3.1.1 Intervention Boundary Wells

- **MW-1000R/MW-1000PR/MW-1010P (Figures B-1a to B-1d):** These three wells are located near the immediate southwest boundary and hydraulically downgradient of the reclaimed mine pit.

  Changes in Reported Trends from Previous Annual Report:
  Total dissolved solids (TDS) and redox in MW-1000PR illustrate decreasing trends in the recent five-year dataset, continuing the trends observed in the long-term data. Hardness and redox in MW-1000R also illustrate decreasing trends in the recent five-year dataset, likewise continuing the trends in the long-term data. An increase in pH is observed for both MW-1000PR and MW-1000R.

  Copper is illustrating a decreasing trend in MW-1000R.

  MW-1010P has a decreasing trend of redox in the five-year dataset, reversing an increasing trend from the long-term data.

  Continuing Trends from Previous Annual Report:
  The decreasing trends of manganese, TDS, and conductivity in MW-1000R, and decreasing trend of conductivity in MW-1000PR continue to be observed in the five-year data.

- **<u>MW-1002/MW-1002G (Figures B-2a to B-2d)</u>:** This well nest is located approximately 1,800 feet to the northwest and hydraulically side-gradient to the former mine pit.

  <u>Changes in Reported Trends from Previous Annual Report</u>:
  An increasing trend of pH is observed for MW-1002G. The previously reported increasing trend of TDS in MW-1002G is no longer present.

  <u>Continuing Trends from Previous Annual Report</u>:
  Alkalinity and hardness in MW-1002G continue to have increasing trends in the five-year data.

- **<u>MW-1004/MW-1004S/MW-1004P (Figures B-3a to B-3d)</u>:** This well nest is located near the immediate northwest boundary, and is hydraulically downgradient of the former mine pit.

  <u>Changes in Reported Trends from Previous Annual Report</u>:
  The previously reported statistically decreasing trends of hardness, sulfate, TDS, and conductivity in MW-1004S have stopped with the data now indicating no five-year trends for these parameters.

  An increasing trend of pH is indicated for MW-1004 and MW-1004S, along with a decreasing trend of redox in MW-1004S.

  <u>Continuing Trends from Previous Annual Report</u>:
  None to report.

- **<u>MW-1005/MW-1005S/MW-1005P (Figures B-4a to B-4d)</u>:** This well nest is located approximately 1,000 feet to the southeast and hydraulically upgradient of the former mine pit.

  <u>Changes in Reported Trends from Previous Annual Report</u>:
  The previously reported statistically increasing trends of hardness, manganese, TDS, and conductivity for MW-1005 have stopped, with the data now either stabilizing or decreasing.

  A decreasing trend of alkalinity is observed for MW-1005S. Similar to alkalinity, statistically decreasing trends are also observed in MW-1005S for hardness, iron, manganese, TDS, and conductivity; however, the actual concentration change is only slight.

  <u>Continuing Trends from Previous Annual Report</u>:
  None to report.

- **MW-1015A/MW-1015B (Figures B-5a to B-5d):** This well nest is located approximately 1,000 feet to the west and hydraulically downgradient of the former mine pit.

  Changes in Reported Trends from Previous Annual Report:
  A decreasing trend in redox is observed for MW-1015A.

  Continuing Trends from Previous Annual Report:
  None to report.

3.1.2 In-Pit Wells

- **MW-1013/MW-1013A/MW-1013B/MW-1013C (Figures B-6a to B-6d):** This well nest is located within the former mine pit on the southwest side.

  Changes in Reported Trends from Previous Annual Report:
  Iron in MW-1013A has a decreasing trend with concentrations not detected since June 2017.

  Copper in MW-1013B has a decreasing trend in the five-year data, reversing a larger increasing trend in the long-term data. Sulfate in this well has a smaller increasing trend in the five-year data, but concentrations remain below those observed historically.

  MW-1013C has smaller decreasing trends of TDS and conductivity.

  Continuing Trends from Previous Annual Report:
  A decreasing trend of manganese continues in MW-1013B.

  Iron at MW-1013 has historically exhibited a large degree of variation. Between 2006 and 2009, seasonal effects were apparent, with iron being highest during the first and fourth quarter sampling events. While the seasonal effect seemed to diminish following 2009, iron concentrations in this well were elevated in 2013, and again in 2018 and to a lesser degree in 2019.

- **MW-1014/MW-1014A/MW-1014B/MW-1014C (Figures B-7a to B-7d):** This well nest is located within the former mine pit on the northeast side.

  Changes in Reported Trends from Previous Annual Report:
  Decreasing trends of redox are observed in MW-1014, MW-1014A, and MW-1014B.

  Decreasing trends of copper, manganese, and conductivity are observed in MW-1014B, with concentrations particularly decreased during 2019. An increase in pH is also observed in this well.

Continuing Trends from Previous Annual Report:
Arsenic at MW-1014C shows an increasing trend since 2003. Concentrations remain below those observed in this well prior to 2003.

3.2 Annual Parameters (Attachment 2)

Similar to previous trend analyses, the annual groundwater parameters of barium, cadmium, calcium, chloride, chromium, lead, magnesium, mercury, potassium, selenium, silver, sodium, and zinc illustrate few statistically significant trends. Of those trends that are noted, most reflect relatively small consecutive concentration changes. The following summary is limited to those trends which show at least a modest change in recent concentrations.

Historical trend charts for the annual parameters are illustrated on Figures B-8a through B-14e of Attachment 2.

Changes in Reported Trends from Previous Annual Report:

- The previously reported decreasing trends for calcium, magnesium, and sodium in MW-1000R have stopped, with no concentration trends currently reported.

- While not noted as statistical trends, a single point increase during 2019 was observed in MW-1014B for barium, while single point decreases were observed in MW-1014B for calcium, chloride, magnesium, potassium, and zinc.

Continuing Trends from Previous Annual Report:

- Several parameters in MW-1002 and MW-1002G increased slightly between 2009 and 2011, including calcium, chloride, magnesium, and sodium. These parameters generally have remained constant since then.

- Barium, calcium, chloride, magnesium, and sodium also had small increases in concentrations during 2011 in MW-1005, which remained consistent through 2015. Concentrations of these parameters rose again from 2016 through 2018, attributed potentially due to application of road salt on State Highway 27 along with rising water levels and evaporative concentration effects. During 2019, no additional increases of these parameters are observed.

3.3 Surface Water (Attachment 3)

Flambeau voluntarily continued surface water sampling of the Flambeau River in 2019. Sampling parameters currently include copper, hardness, iron, manganese, zinc, total suspended solids (TSS), pH, and conductivity. Concentrations were generally stable with few statistical trends, either increasing or decreasing. The only statistical trends noted were small increasing trends for iron, however, iron concentrations at both sample locations remain below those which were historically observed.

3.4 Hydrographs (Attachment 4)

As observed in the hydrographs (Figures B-16a through B-16p), water levels have stabilized in all wells that showed significant drawdown during the production period from 1993 to 1997.

Groundwater elevations increased steadily from 1999 through 2002 for the in-pit wells MW-1013A, MW-1013B, MW-1013C, MW-1014, MW-1014A, MW-1014B, and MW-1014C, and stabilized after 2003. At MW-1013, groundwater elevation rose through 2004 and stabilized during 2005.

Generally, higher groundwater elevations are noted for all wells during 2010 and 2011, reflecting the increased precipitation observed in those years. Elevations dropped in 2012, and rebounded during the summer of 2013. An increase in water levels was observed from 2014 through 2017 for both the intervention boundary and the in-pit wells. Decreased elevations were observed in 2018, followed by a rebound in 2019.

4 Conclusions

A detailed analysis of statistical trends occurring in the groundwater and surface water data was performed. Statistical tests evaluated the long-term trends occurring during the post-mining period (October 1997 to the present) and the short-term trends for the most recent five years. Historical trend graphs of the data are also presented.

A detailed discussion of the trend results for each well nest is provided in Section 3 above. In general, the majority of the trends with notable concentration changes occur in the quarterly groundwater indicator monitoring parameters.

Most recently for the intervention boundary wells, decreasing redox and increasing pH was observed, particularly at wells MW-1000R/1000PR/1010P (near the immediate southwest boundary and hydraulically downgradient of the reclaimed mine pit); MW-1004/1004S (near the immediate northwest boundary and hydraulically downgradient of the former mine pit); and MW-1015A (approximately 1,000 feet to the west and hydraulically downgradient of the former mine pit). Corresponding decreasing trends are also observed for hardness, manganese, TDS, and conductivity in MW-1000R; TDS and conductivity in MW-1000PR; and alkalinity in MW-1005S. While MW-1002G (northwest and hydraulically side-gradient to the former mine pit) also had a recent increasing trend in pH, the concentrations of alkalinity and hardness likewise had a small increasing trend instead of the decreasing trends observed elsewhere.

For the in-pit well nest at MW-1013, iron at MW-1013A decreased to non-detectable levels, while iron at MW-1013 continues to exhibit a large degree of variation, historically switching between increasing and decreasing trends. Copper and manganese continue decreasing trends at MW-1013B, while a smaller increasing trend of sulfate exists at this well. Smaller decreasing trends of TDS and conductivity occur at MW-1013C.

For the in-pit well nest at MW-1014, decreases in redox and increases in pH were observed similarly as in the intervention boundary wells. Corresponding decreasing trends in copper, manganese, and conductivity were observed in MW-1014B, with decreased concentrations particularly observed during 2019.

The only statistical trends for surface water were recently small increasing trends for iron. However, iron concentrations in the surface water remain below those which were observed historically.

Attachment 1

Groundwater - Quarterly Parameters

Trend Analysis
Trend Graphs
2019 Data

Trend Analysis Results - Groundwater (Quarterly Parameters)
Year Ending 2019

	Alkalinity	Arsenic	Copper	Hardness	Iron	Manganese	Sulfate	TDS	Field pH (su)	Cond (umhos /cm)	Redox (mV)	Grd Water El (Feet)
MW-1000PR												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	-57	56	-27	-30	36	-77	56	-88	97	-88	-90	38
p-Level	0.069	0.074	0.404	0.352	0.260	0.013	0.074	0.004	0.002	0.004	0.004	0.234
Trend								-	+	-	-	
Trend Results for All Data Since Oct. 1997												
Sample Size	89	70	89	89	89	89	89	89	89	89	73	89
Mann-Kendall S	1698	1088	-1014	-2734	-343	-2432	-2925	-2689	1283	-2916	-996	1287
p-Level	0.000	0.000	0.000	0.000	0.225	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Trend	+	+	-	-		-	-	-	+	-	-	+
MW-1000R												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	-66	-53	-102	-80	-26	-108	-49	-100	87	-104	-86	41
p-Level	0.034	0.092	0	0.01	0.422	0	0.12	0	0.004	0	0.004	0.197
Trend			-	-		-		-	+	-	-	
Trend Results for All Data Since Oct. 1997												
Sample Size	37	37	37	37	37	37	37	37	37	37	36	88
Mann-Kendall S	-331	7	-288	-316	-143	-251	-74	-321	42	-352	-222	1392
p-Level	0	0.938	0	0	0.063	0	0.342	0	0.594	0	0.002	0.000
Trend	-		-	-		-		-		-	-	+
MW-1010P												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	-4	-39	5	42	-23	-49	91	-2	-2	-27	-92	32
p-Level	0.924	0.221	0.898	0.186	0.480	0.120	0.003	0.974	0.974	0.404	0.002	0.318
Trend							+				-	
Trend Results for All Data Since Oct. 1997												
Sample Size	89	70	89	89	89	89	89	89	89	89	74	89
Mann-Kendall S	929	872	-831	2774	-1307	-780	2991	1128	851	2331	648	960
p-Level	0.001	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.003	0.000	0.003	0.001
Trend	+	+	-	+	-	-	+	+	+	+	+	+
MW-1002												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	25	-17	-41	22	-10	-39	-23	-12	72	-16	-66	21
p-Level	0.441	0.608	0.197	0.500	0.774	0.221	0.480	0.724	0.020	0.630	0.034	0.521
Trend												
Trend Results for All Data Since Oct. 1997												
Sample Size	89	67	89	89	89	89	89	89	89	89	24	89
Mann-Kendall S	1368	-26	31	1334	-574	-286	-1484	-7	-196	985	-94	924
p-Level	0.000	0.741	0.886	0.000	0.010	0.121	0.000	0.983	0.489	0.000	0.020	0.001
Trend	+			+			-			+		+
MW-1002G												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	155	0	-17	113	-18	-47	101	0	103	-10	-68	22
p-Level	0.000	1.000	0.608	0.000	0.586	0.137	0.000	1.000	0.000	0.774	0.028	0.500
Trend	+			+			+		+			
Trend Results for All Data Since Oct. 1997												
Sample Size	89	67	89	89	89	89	89	89	89	89	24	89
Mann-Kendall S	1501	-101	283	2464	-280	156	-715	1129	-374	1997	-76	889
p-Level	0.000	0.065	0.068	0.000	0.183	0.399	0.011	0.000	0.186	0.000	0.062	0.002
Trend	+			+				+		+		+

Trend Analysis Results - Groundwater (Quarterly Parameters)
Year Ending 2019

	Alkalinity	Arsenic	Copper	Hardness	Iron	Manganese	Sulfate	TDS	Field pH (su)	Cond (umhos /cm)	Redox (mV)	Grd Water El (Feet)
MW-1004												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	7	5	-17	12	-18	-17	-10	-25	98	24	-60	16
p-Level	0.847	0.898	0.608	0.724	0.586	0.608	0.774	0.441	0.002	0.46	0.054	0.63
Trend									+			
Trend Results for All Data Since Oct. 1997												
Sample Size	36	36	36	36	36	36	36	36	36	36	35	76
Mann-Kendall S	-165	14	203	-115	-68	-25	-82	80	70	-111	-278	732
p-Level	0.025	0.86	0.006	0.121	0.364	0.746	0.272	0.284	0.35	0.135	0	0.001
Trend			+								-	+
MW-1004S												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	37	-13	-36	29	-5	-9	43	-43	107	-37	-100	16
p-Level	0.247	0.701	0.260	0.369	0.898	0.798	0.175	0.175	0.000	0.247	0.000	0.630
Trend									+		-	
Trend Results for All Data Since Oct. 1997												
Sample Size	89	69	89	89	89	89	89	89	89	89	74	89
Mann-Kendall S	307	-27	1052	763	-668	-117	1891	-441	315	199	-826	1411
p-Level	0.278	0.702	0.000	0.007	0.001	0.613	0.000	0.117	0.265	0.483	0.000	0.000
Trend			+	+	-		+				-	+
MW-1004P												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	-10	0	1	30	2	-24	-50	-50	-2	-69	24	22
p-Level	0.774	1.000	0.987	0.352	0.974	0.460	0.112	0.112	0.974	0.026	0.460	0.500
Trend												
Trend Results for All Data Since Oct. 1997												
Sample Size	90	70	90	90	90	90	90	90	90	90	70	90
Mann-Kendall S	769	561	-791	1277	2123	1974	284	-201	441	880	-772	1590
p-Level	0.002	0.000	0.000	0.000	0.000	0.000	0.271	0.484	0.125	0.002	0.000	0.000
Trend	+	+	-	+	+	+				+	-	+
MW-1005												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	46	30	-66	73	-2	14	80	17	52	10	-45	-34
p-Level	0.146	0.352	0.034	0.018	0.974	0.678	0.010	0.608	0.098	0.774	0.155	0.288
Trend							+					
Trend Results for All Data Since Oct. 1997												
Sample Size	89	67	89	89	89	89	89	89	89	89	24	88
Mann-Kendall S	-1063	-301	799	1643	-88	618	1166	1612	-576	1687	-43	1278
p-Level	0.000	0.101	0.001	0.000	0.757	0.029	0.000	0.000	0.041	0.000	0.301	0.000
Trend	-		+	+			+	+		+		+
MW-1005S												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	-142	-24	-11	-97	-109	-107	89	-129	30	-146	-1	-32
p-Level	0.000	0.460	0.749	0.002	0.000	0.000	0.004	0.000	0.352	0.000	0.987	0.318
Trend	-			-	-	-	+	-		-		
Trend Results for All Data Since Oct. 1997												
Sample Size	89	67	89	89	89	89	89	89	89	89	24	89
Mann-Kendall S	128	-84	-13	429	-302	124	-418	-759	426	151	-5	1315
p-Level	0.640	0.651	0.892	0.118	0.284	0.657	0.098	0.007	0.131	0.595	0.922	0.000
Trend								-				+

Trend Analysis Results - Groundwater (Quarterly Parameters)
Year Ending 2019

	Alkalinity	Arsenic	Copper	Hardness	Iron	Manganese	Sulfate	TDS	Field pH (su)	Cond (umhos /cm)	Redox (mV)	Grd Water El (Feet)
MW-1005P												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	3	-16	-39	24	14	33	1	-15	75	-36	20	-46
p-Level	0.949	0.630	0.221	0.460	0.678	0.303	0.987	0.654	0.015	0.260	0.542	0.146
Trend												
Trend Results for All Data Since Oct. 1997												
Sample Size	89	67	89	89	89	89	89	89	89	89	76	89
Mann-Kendall S	213	203	-39	797	1936	1004	-386	-259	217	882	214	1039
p-Level	0.437	0.112	0.820	0.004	0.000	0.000	0.031	0.359	0.444	0.002	0.339	0.000
Trend				+	+	+				+		+
MW-1015A												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	93	0	-43	85	-28	87	34	34	7	-39	-118	45
p-Level	0.002	1.000	0.175	0.005	0.386	0.004	0.288	0.288	0.847	0.221	0.000	0.155
Trend	+			+		+					-	
Trend Results for All Data Since Oct. 1997												
Sample Size	83	76	83	83	84	84	83	83	84	84	60	84
Mann-Kendall S	1067	-143	221	1105	-29	-1138	-224	-26	319	1486	-358	668
p-Level	0.000	0.058	0.141	0.000	0.853	0.000	0.380	0.921	0.219	0.000	0.023	0.010
Trend	+			+		-				+		+
MW-1015B												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	-28	-61	7	25	9	-30	-26	22	-28	-66	-29	44
p-Level	0.386	0.050	0.847	0.441	0.798	0.352	0.422	0.500	0.386	0.034	0.369	0.164
Trend												
Trend Results for All Data Since Oct. 1997												
Sample Size	83	76	83	83	84	84	83	83	84	84	61	84
Mann-Kendall S	-274	96	109	1349	-126	-1161	221	138	527	1371	906	707
p-Level	0.215	0.422	0.188	0.000	0.629	0.000	0.125	0.589	0.042	0.000	0.000	0.006
Trend				+		-				+	+	+
MW-1013												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	11	39	-90	-47	89	-45	-103	-51	76	-97	-76	-29
p-Level	0.749	0.221	0.004	0.137	0.004	0.155	0.000	0.105	0.014	0.002	0.014	0.369
Trend			-		+		-			-		
Trend Results for All Data Since Oct. 1997												
Sample Size	57	57	57	57	57	57	57	57	57	57	57	84
Mann-Kendall S	320	-65	303	-298	53	691	-1272	-92	4	-614	-472	2407
p-Level	0.028	0.643	0.034	0.040	0.720	0.000	0.000	0.530	0.983	0.000	0.001	0.000
Trend						+	-			-	-	+
MW-1013A												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	53	-36	-53	-5	-87	-41	13	-19	89	-81	-38	32
p-Level	0.092	0.260	0.092	0.898	0.004	0.197	0.701	0.564	0.004	0.009	0.234	0.318
Trend					-				+	-		
Trend Results for All Data Since Oct. 1997												
Sample Size	57	57	57	57	57	57	57	57	57	57	56	84
Mann-Kendall S	397	-51	22	-43	179	600	-129	259	9	-266	-491	1888
p-Level	0.006	0.648	0.865	0.772	0.202	0.000	0.376	0.075	0.956	0.068	0.001	0.000
Trend	+					+					-	+

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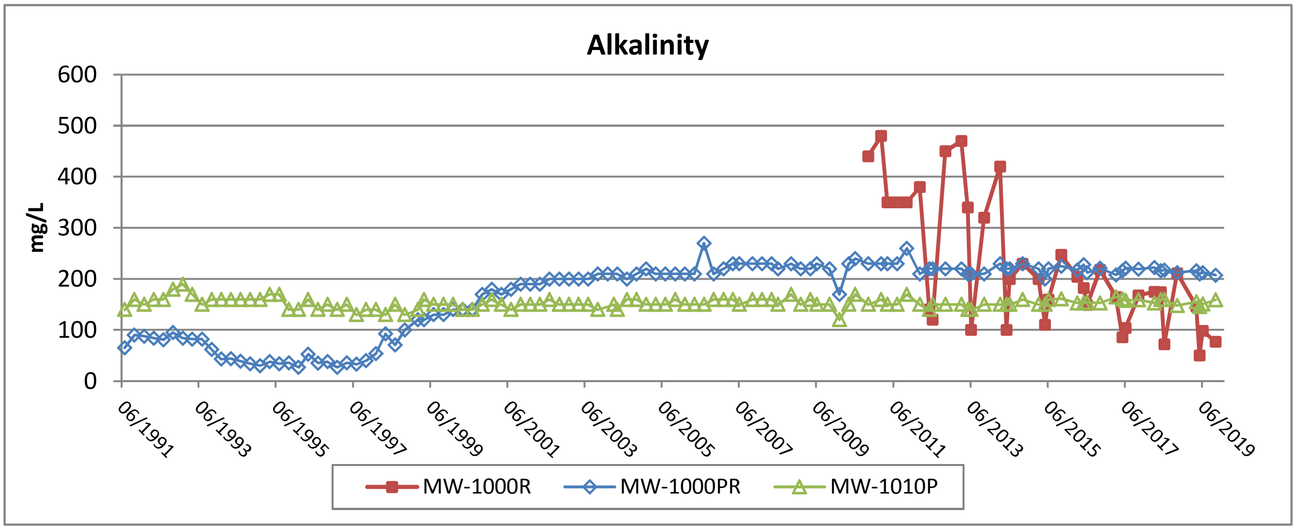
Trend Analysis Results - Groundwater (Quarterly Parameters)
Year Ending 2019

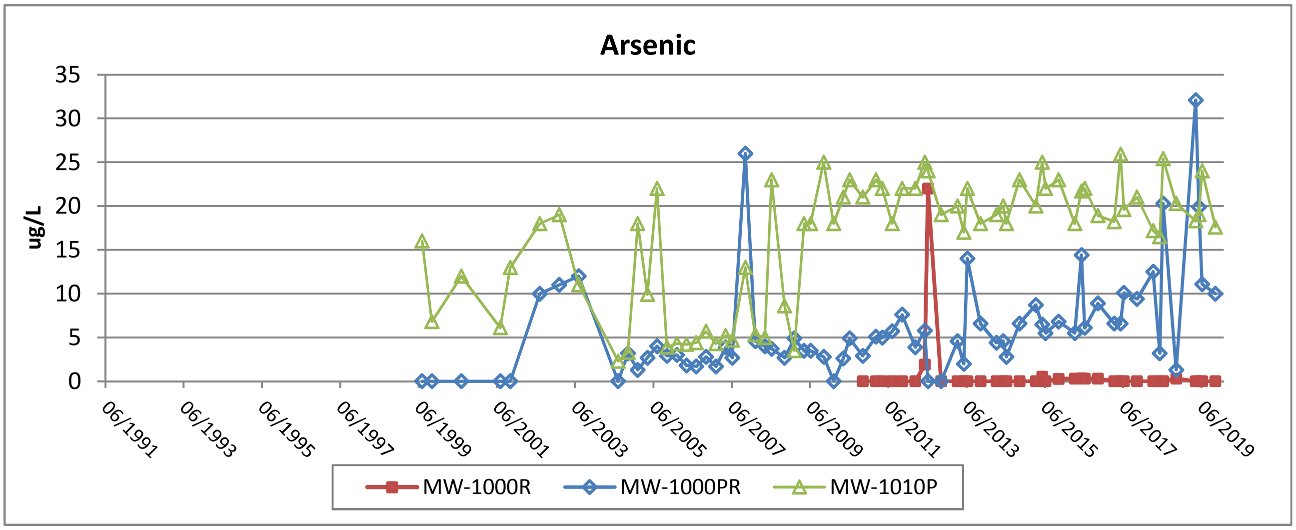
	Alkalinity	Arsenic	Copper	Hardness	Iron	Manganese	Sulfate	TDS	Field pH (su)	Cond (umhos /cm)	Redox (mV)	Grd Water El (Feet)
MW-1013B												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	0	50	-83	6	-69	-88	124	-72	76	-67	-26	6
p-Level	1.000	0.112	0.007	0.872	0.026	0.004	0.000	0.020	0.014	0.031	0.422	0.872
Trend			-			-	+					
Trend Results for All Data Since Oct. 1997												
Sample Size	84	72	84	84	84	84	84	84	84	84	76	84
Mann-Kendall S	-602	-72	1808	-739	-600	-641	1007	-1017	-241	-1150	-496	1918
p-Level	0.020	0.712	0.000	0.003	0.011	0.013	0.000	0.000	0.352	0.000	0.026	0.000
Trend			+	-			+	-		-		+
MW-1013C												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	5	36	8	-19	58	-63	42	-102	73	-84	-70	16
p-Level	0.898	0.260	0.822	0.564	0.064	0.043	0.186	0.000	0.018	0.006	0.024	0.630
Trend								-		-		
Trend Results for All Data Since Oct. 1997												
Sample Size	84	72	84	84	84	84	84	84	84	83	76	84
Mann-Kendall S	77	1280	156	-1437	2969	411	-575	-1842	324	-1548	30	1904
p-Level	0.768	0.000	0.438	0.000	0.000	0.111	0.023	0.000	0.211	0.000	0.896	0.000
Trend		+		-	+			-		-		+
MW-1014												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	-27	-12	-115	40	-15	2	87	0	69	-24	-116	-20
p-Level	0.404	0.724	0.000	0.208	0.654	0.974	0.004	1.000	0.026	0.460	0.000	0.542
Trend			-				+				-	
Trend Results for All Data Since Oct. 1997												
Sample Size	57	57	57	57	57	57	57	57	57	57	57	81
Mann-Kendall S	39	-37	-227	2	2	427	-610	-10	-112	-403	-723	1846
p-Level	0.790	0.695	0.118	0.994	0.991	0.003	0.000	0.950	0.444	0.006	0.000	0.000
Trend						+	-			-	-	+
MW-1014A												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	22	76	4	0	-49	-2	54	-23	27	-74	-89	-26
p-Level	0.500	0.014	0.924	1.000	0.120	0.974	0.086	0.480	0.404	0.016	0.004	0.422
Trend											-	
Trend Results for All Data Since Oct. 1997												
Sample Size	79	69	79	79	79	79	79	79	79	79	76	84
Mann-Kendall S	697	195	1010	-108	-1025	-1952	67	-563	-435	-1133	-578	2053
p-Level	0.003	0.277	0.000	0.630	0.000	0.000	0.779	0.014	0.065	0.000	0.010	0.000
Trend	+		+		-	-				-	-	+
MW-1014B												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	-26	34	-88	-73	-14	-95	18	-50	96	-91	-116	-12
p-Level	0.422	0.288	0.004	0.018	0.678	0.002	0.586	0.112	0.002	0.003	0.000	0.724
Trend			-			-			+	-	-	
Trend Results for All Data Since Oct. 1997												
Sample Size	84	72	84	84	84	84	84	84	85	85	76	85
Mann-Kendall S	-716	-136	-1192	-1676	-78	-2767	-878	-1720	518	-1960	-1553	1942
p-Level	0.006	0.498	0.000	0.000	0.611	0.000	0.001	0.000	0.049	0.000	0.000	0.000
Trend	-		-	-		-	-	-		-	-	+

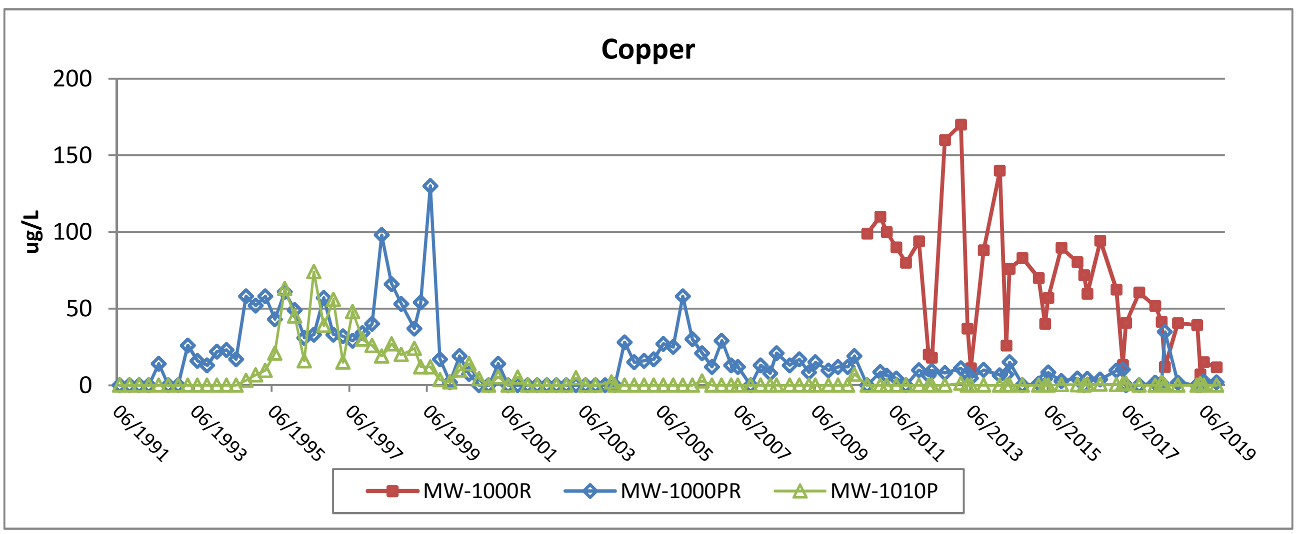
Trend Analysis Results - Groundwater (Quarterly Parameters)
Year Ending 2019

	Alkalinity	Arsenic	Copper	Hardness	Iron	Manganese	Sulfate	TDS	Field pH (su)	Cond (umhos /cm)	Redox (mV)	Grd Water El (Feet)
MW-1014C												
Trend Results for Most Recent 5 Years												
Sample Size	20	20	20	20	20	20	20	20	20	20	20	20
Mann-Kendall S	-35	94	-28	41	-1	-37	114	-2	58	-59	-10	-16
p-Level	0.274	0.002	0.386	0.197	0.987	0.247	0.000	0.974	0.064	0.059	0.774	0.630
Trend		+					+					
Trend Results for All Data Since Oct. 1997												
Sample Size	84	72	84	84	84	84	84	84	84	84	76	84
Mann-Kendall S	-2322	1559	180	-2130	-2660	-2516	-2151	-2102	891	-2653	120	1813
p-Level	0.000	0.000	0.312	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.593	0.000
Trend	-	+		-	-	-	-	-	+	-		+

Notes: Overall increasing trend denoted by "+".
Overall decreasing trend denoted by "-"
All trend tests performed at a Type I (two-tailed) error rate of 0.01.







Note: Fourth quarter 2010 was the first time MW-1000R had sufficient water recovery for sampling.

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Figure B-1a

Groundwater Trend Graphs - Quarterly Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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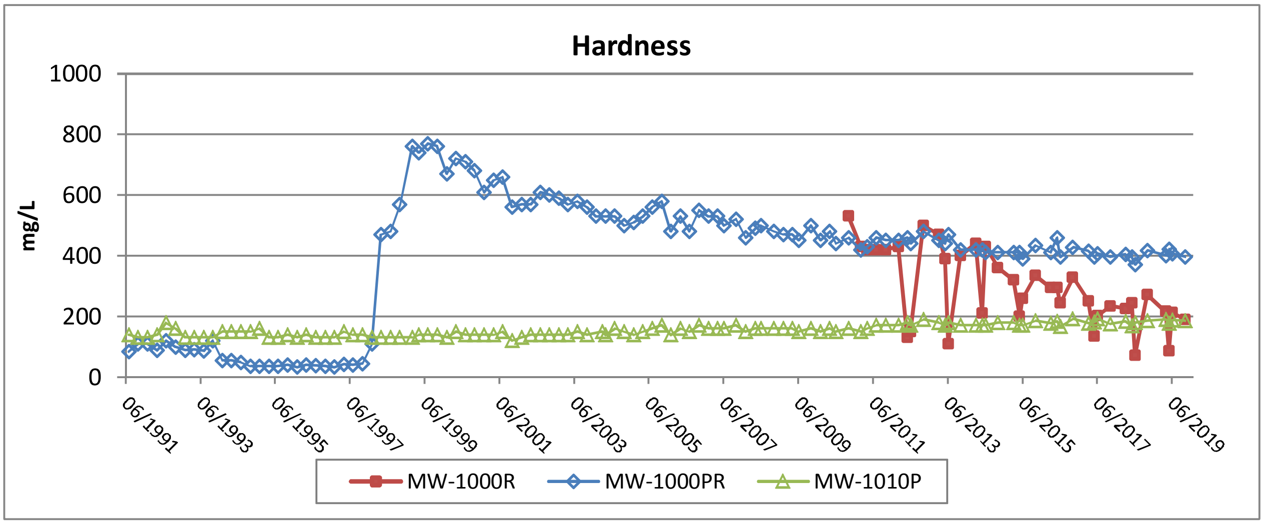
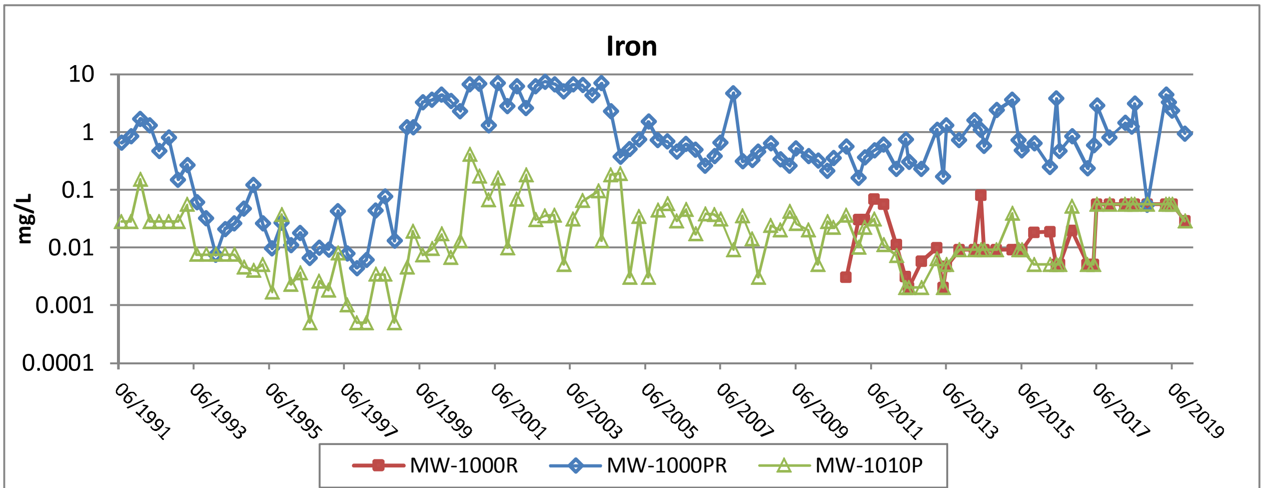
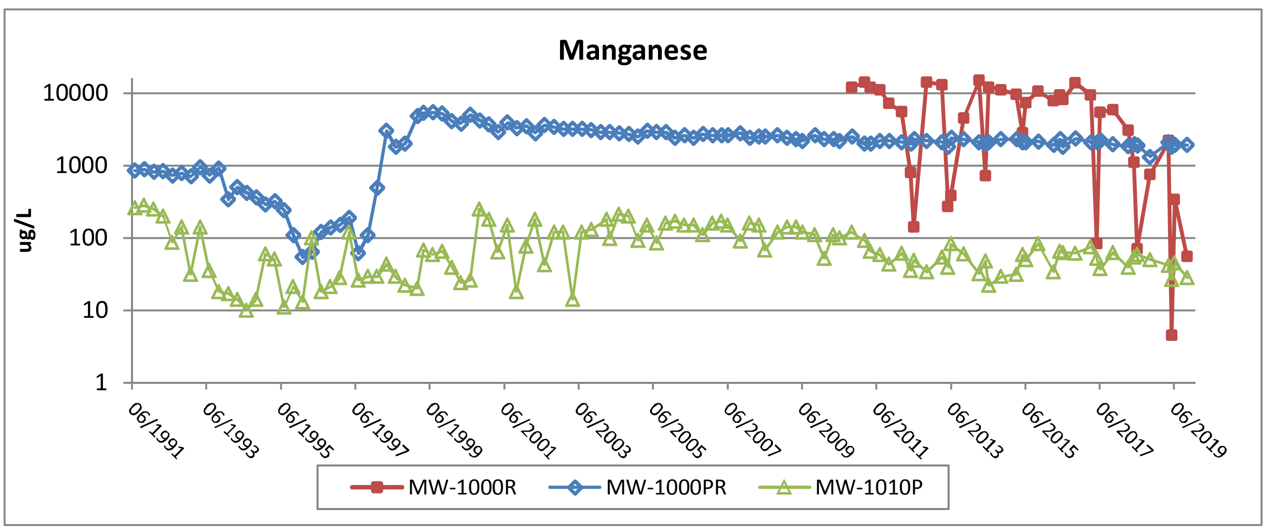




Note: Non-detected values indicated at one-half the detection limit.



Note: Iron trend graphs are displayed on a logarithmic scale so the trend patterns of MW-1000R, MW-1000PR and MW-1010P are visible at different concentration scales.

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Figure B-1b

Groundwater Trend Graphs - Quarterly Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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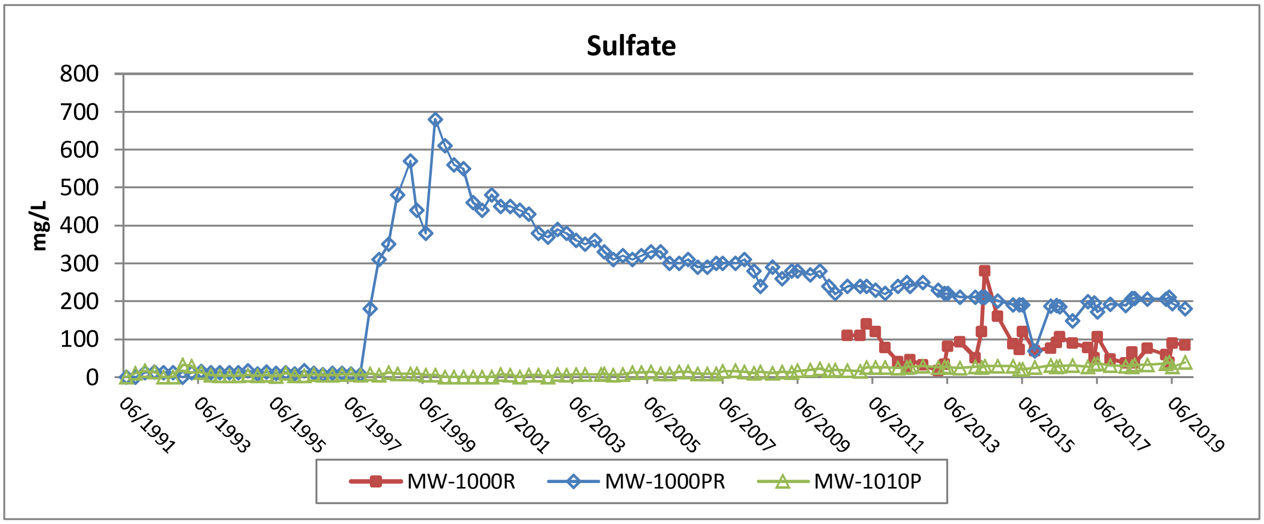

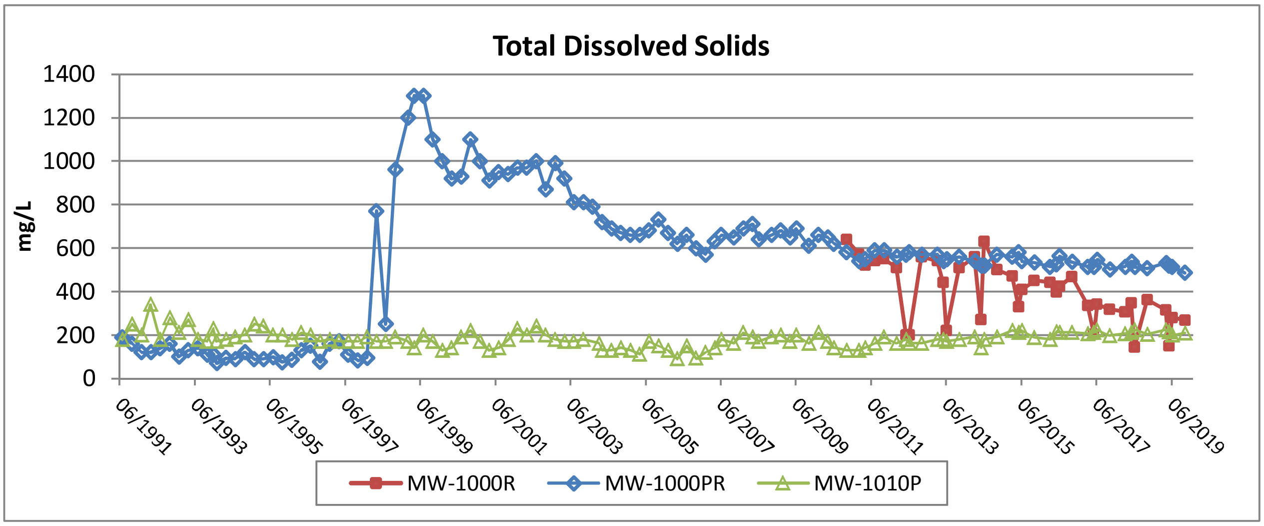

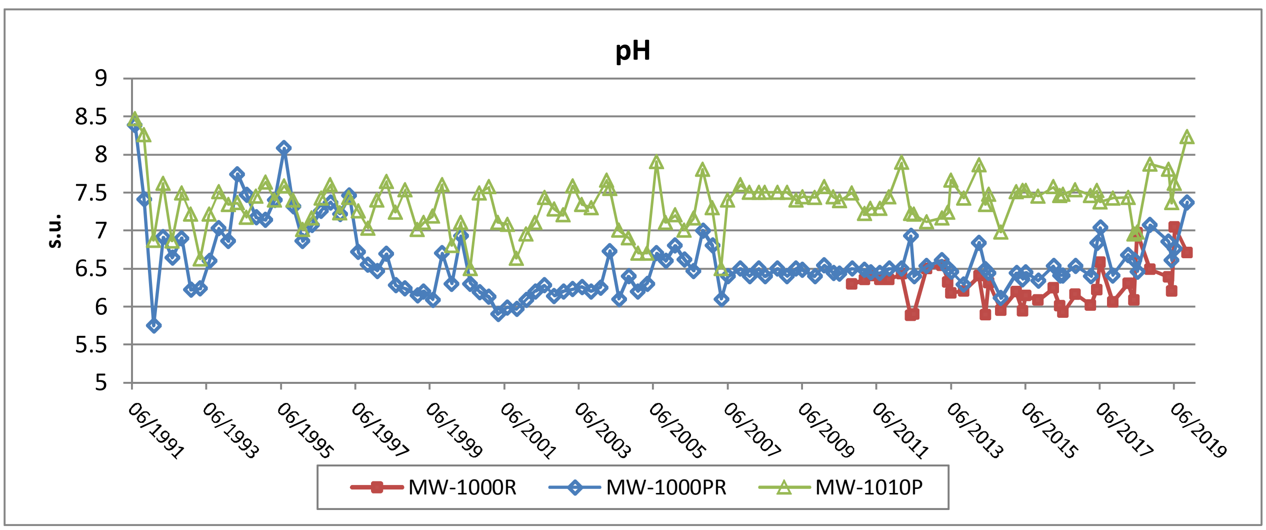

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Figure B-1c

Groundwater Trend Graphs - Quarterly Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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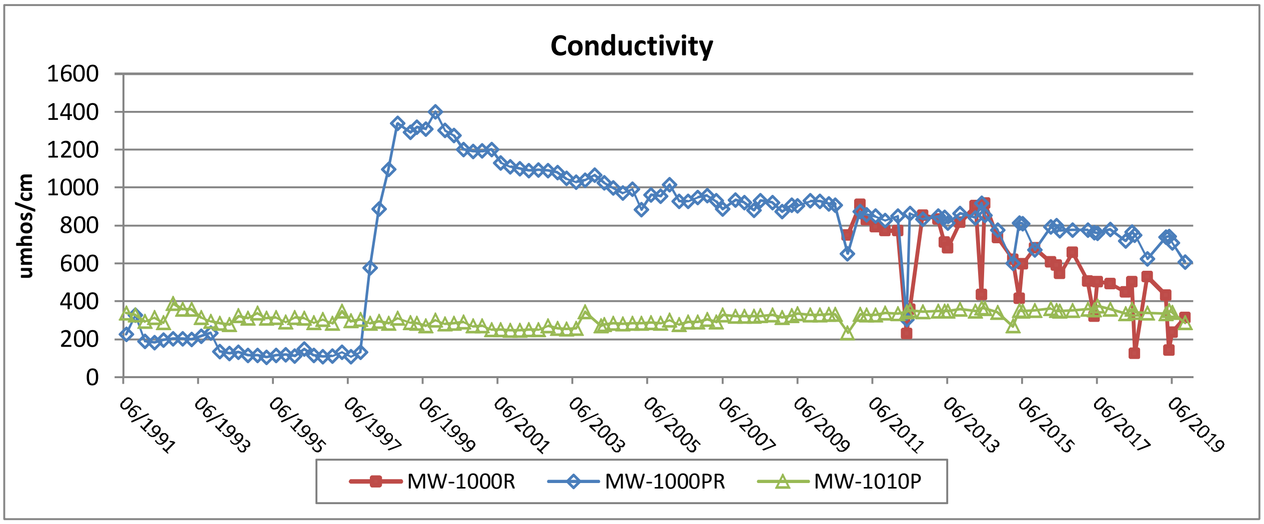

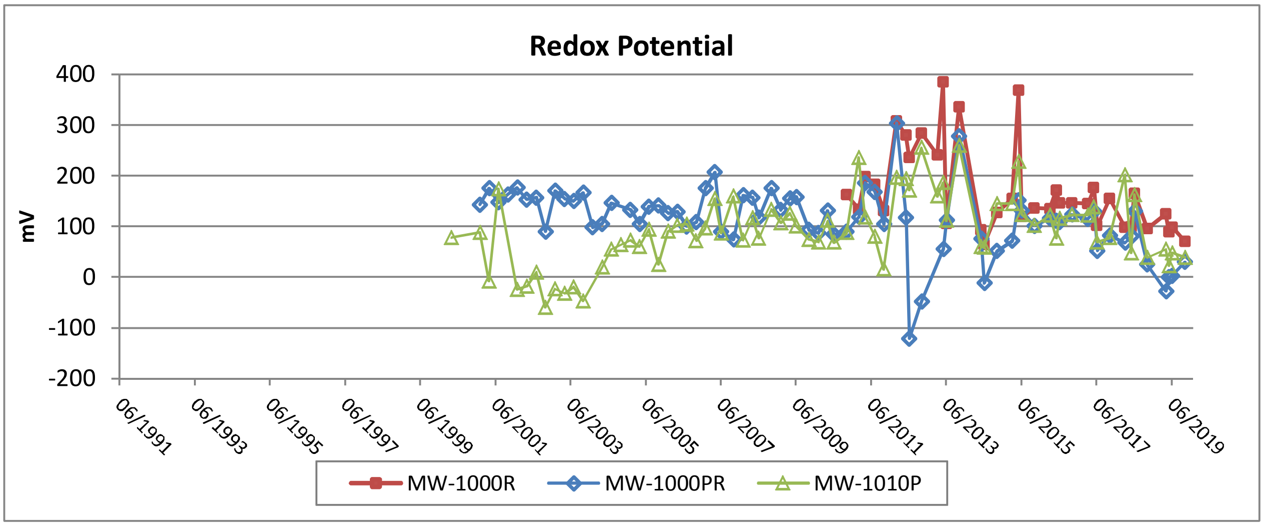

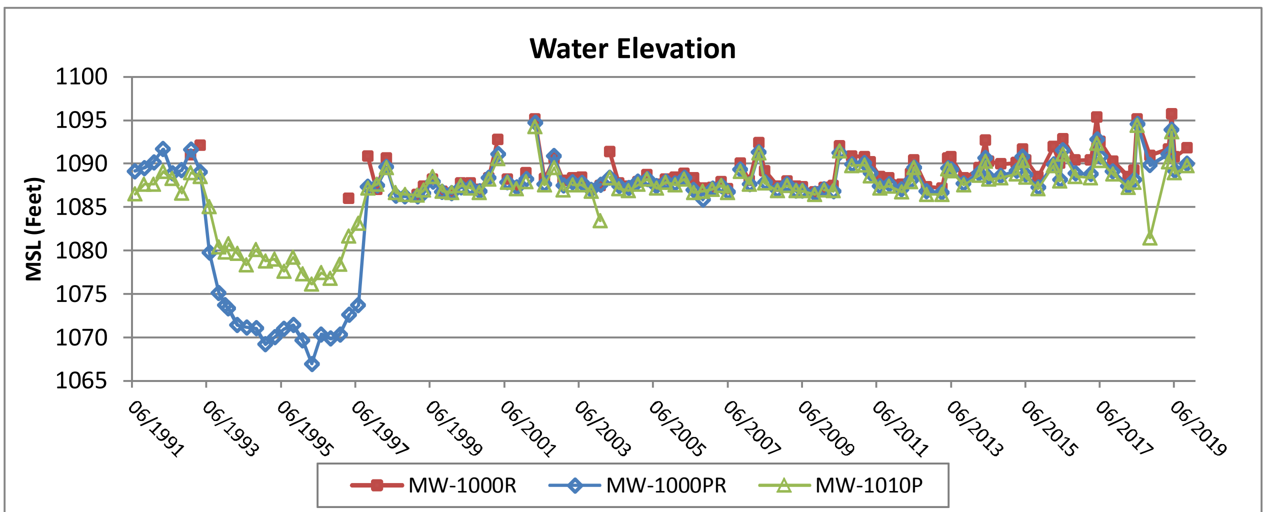

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Figure B-1d

Groundwater Trend Graphs - Quarterly Results

MW-1000R/MW-1000PR/MW-1010P

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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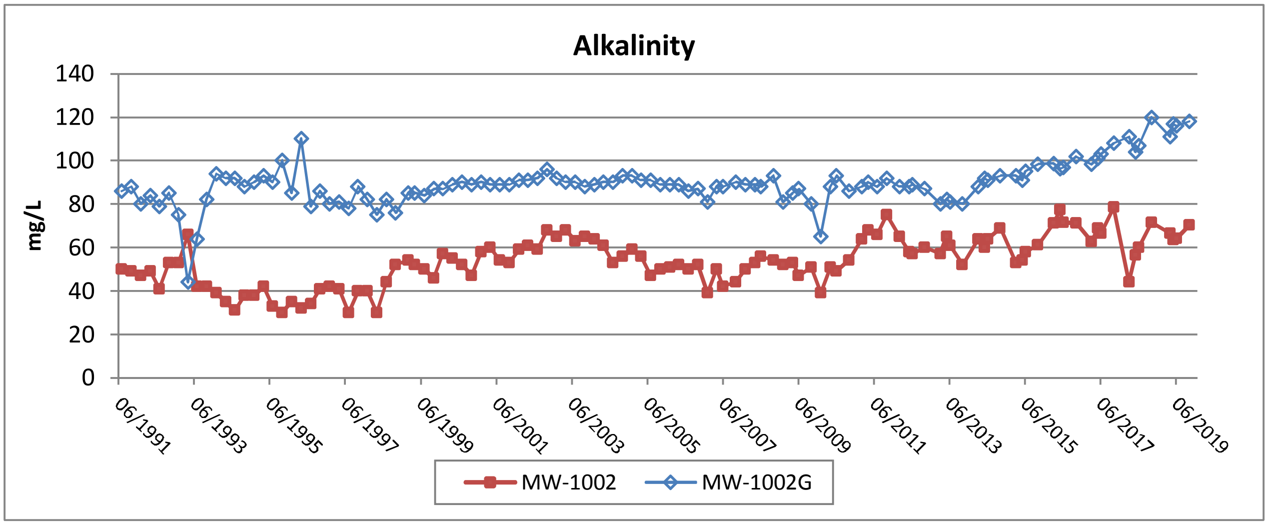

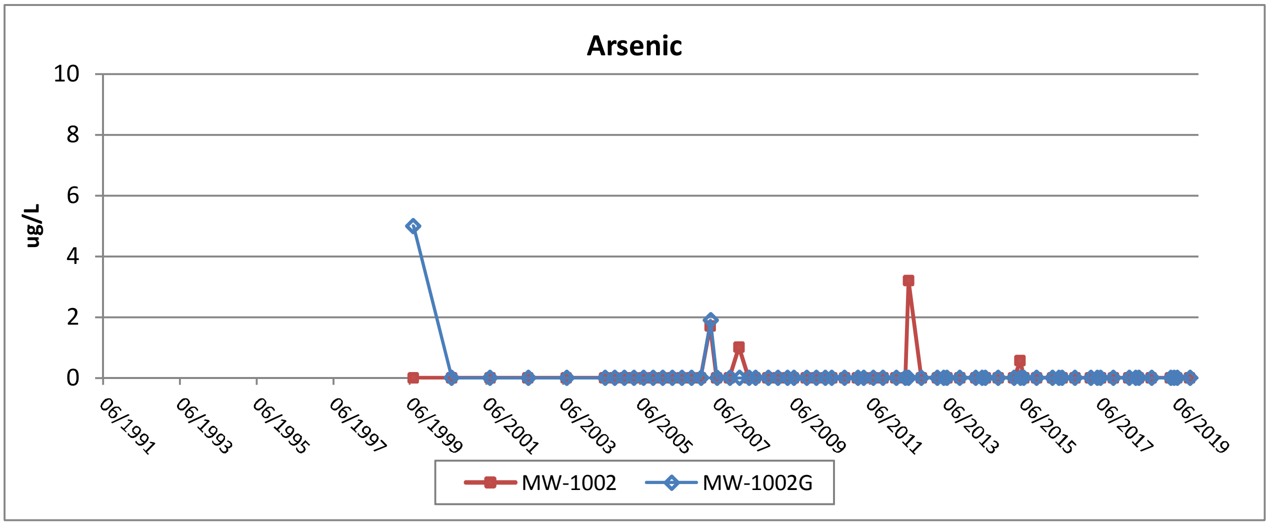

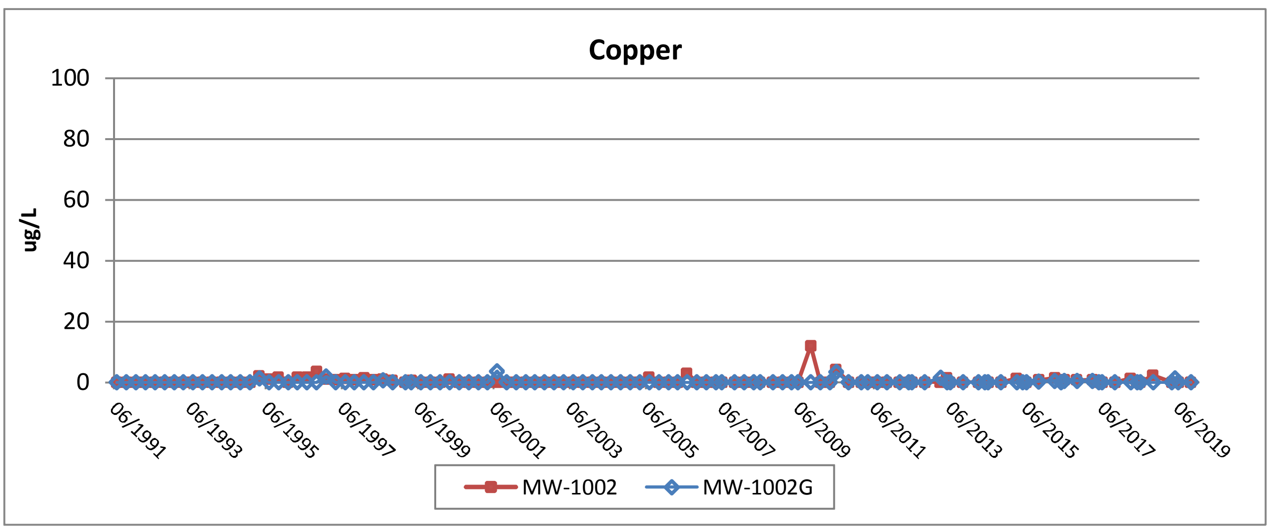

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Figure B-2a

Groundwater Trend Graphs - Quarterly Results

MW-1002/MW-1002G

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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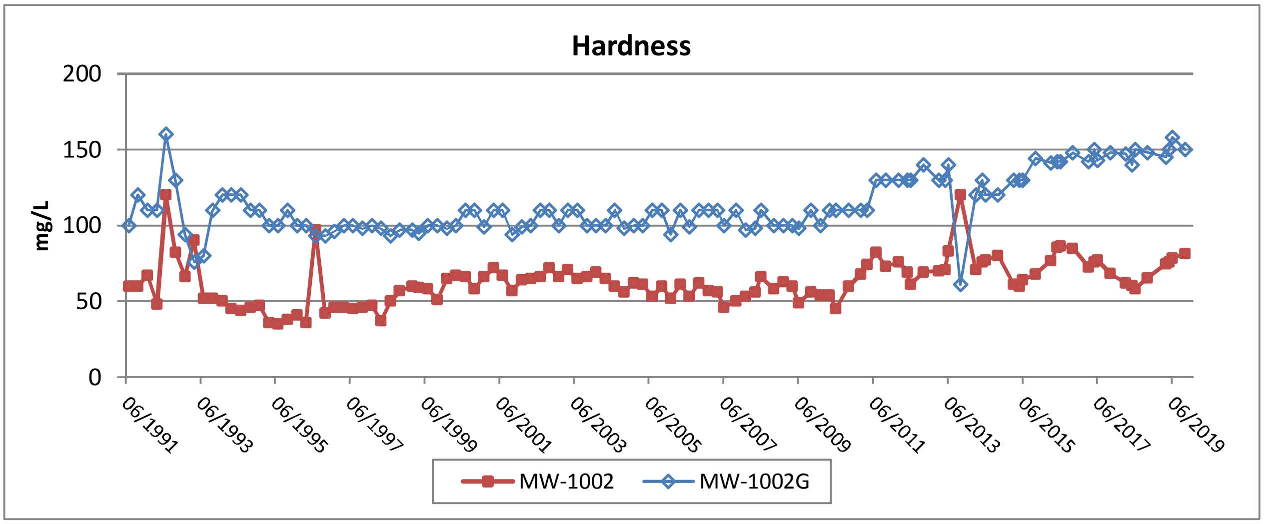

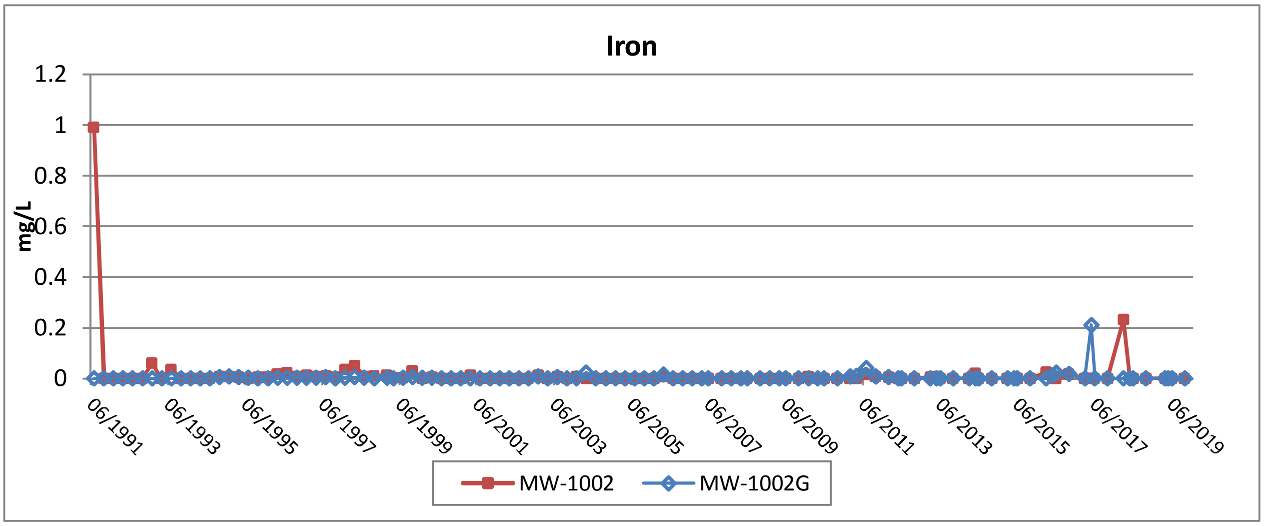

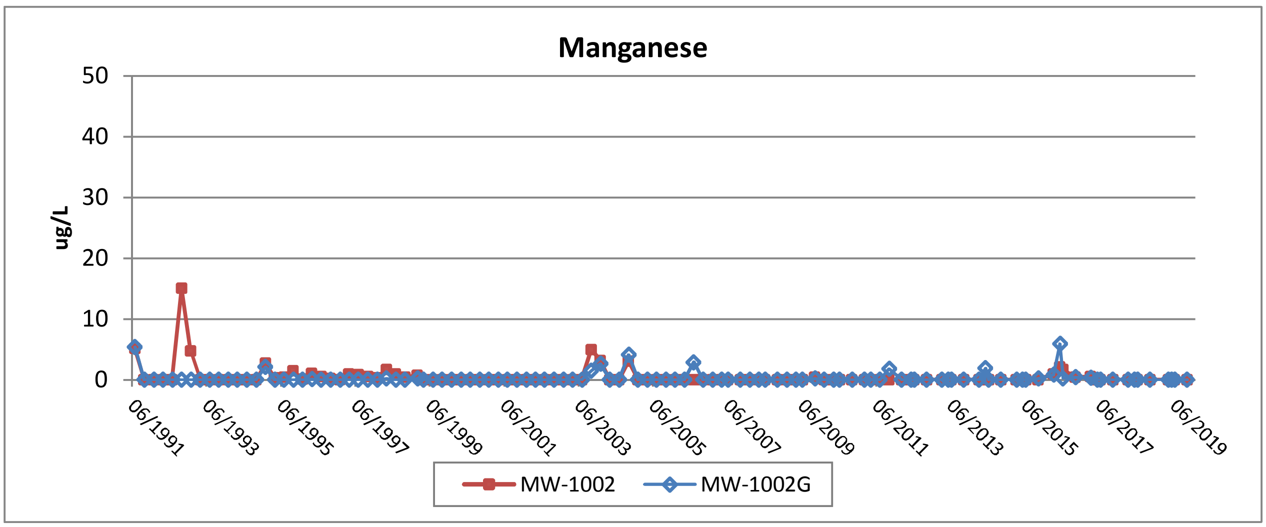

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Figure B-2b Groundwater Trend Graphs - Quarterly Results MW-1002/MW-1002G		
Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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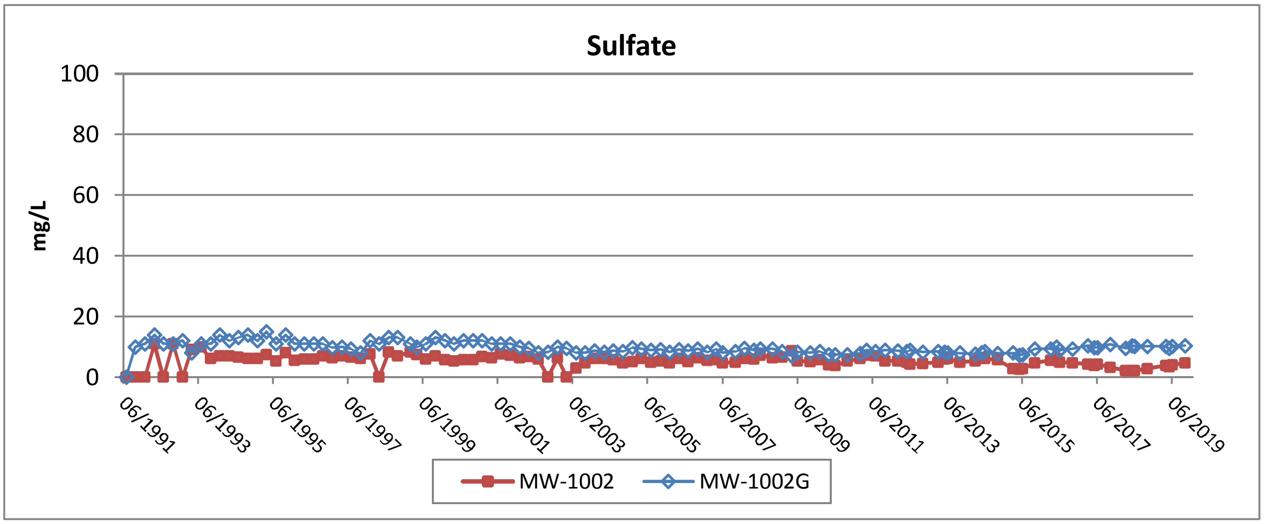

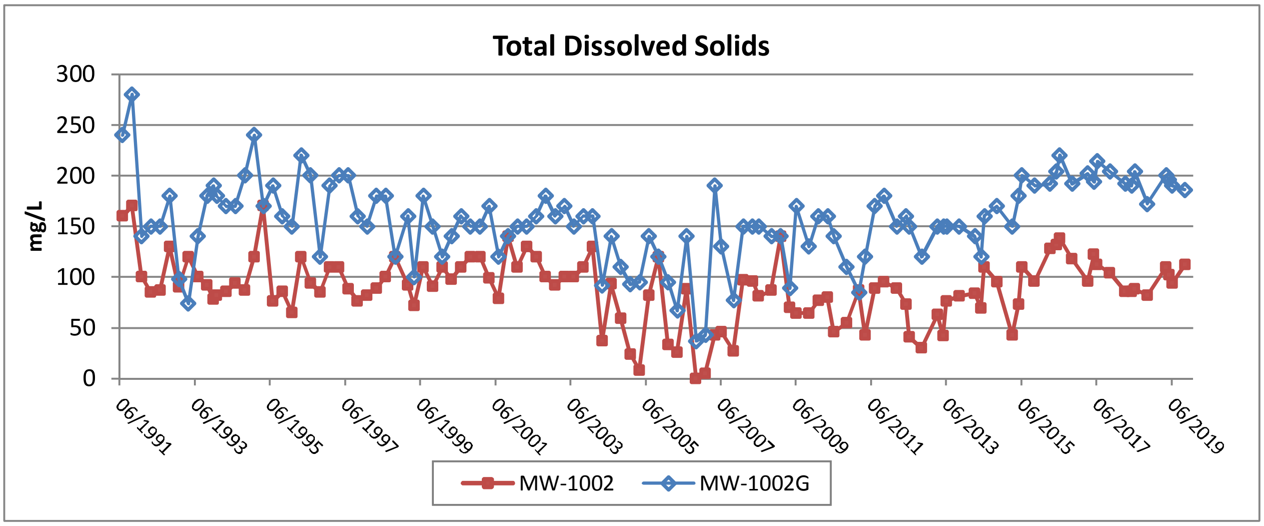

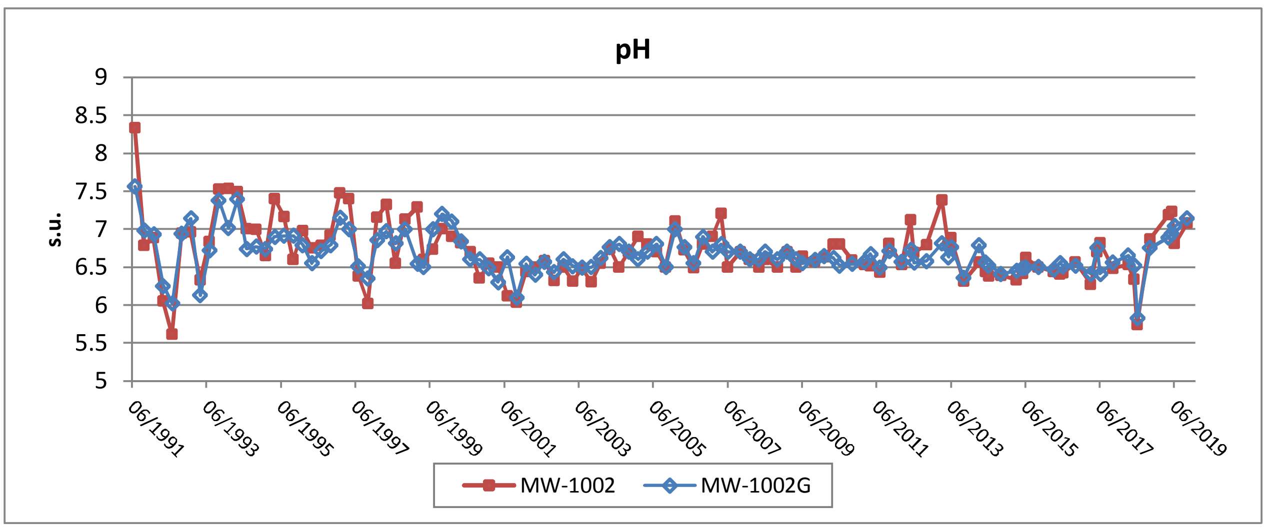

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Figure B-2c Groundwater Trend Graphs - Quarterly Results MW-1002/MW-1002G		
Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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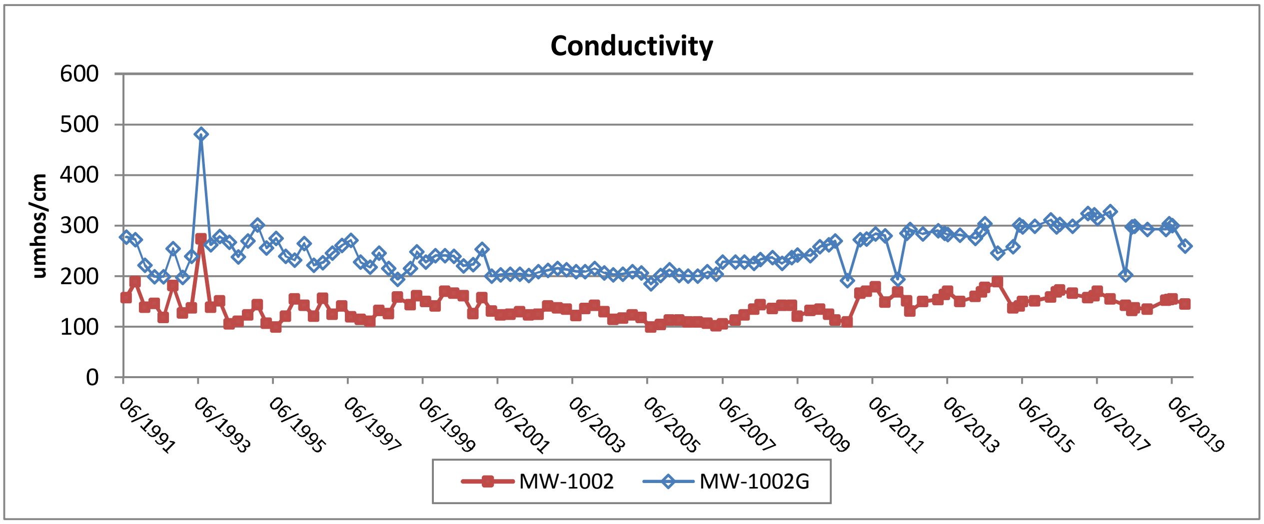

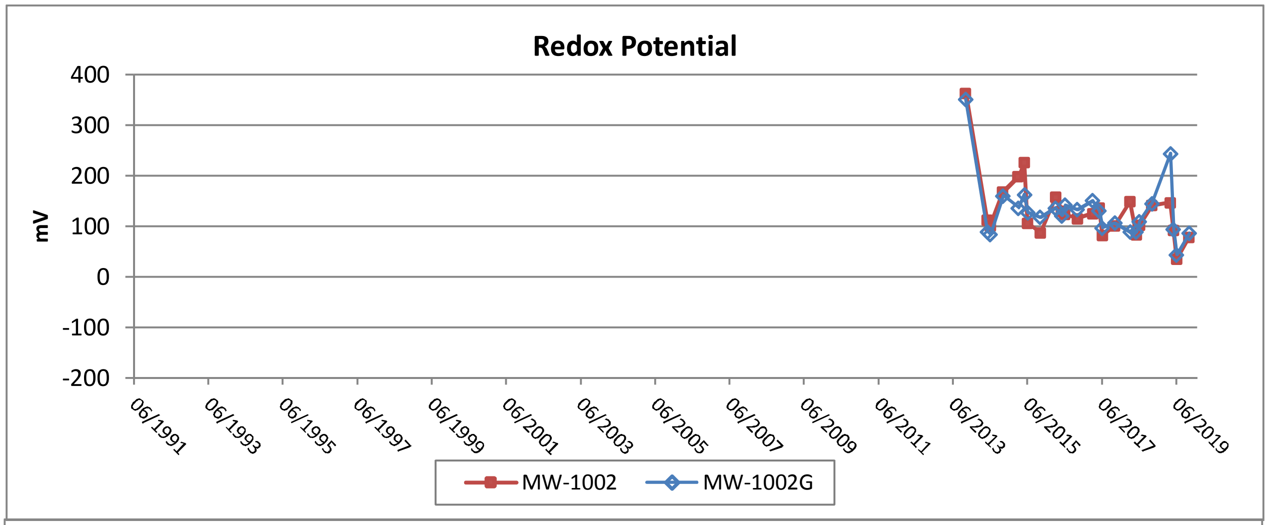

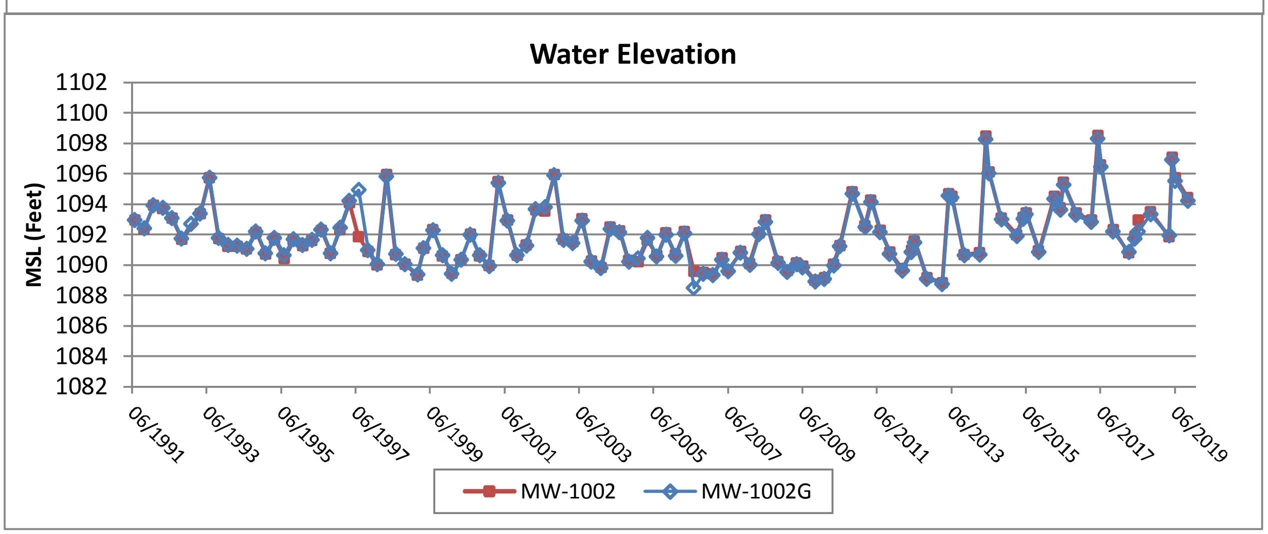

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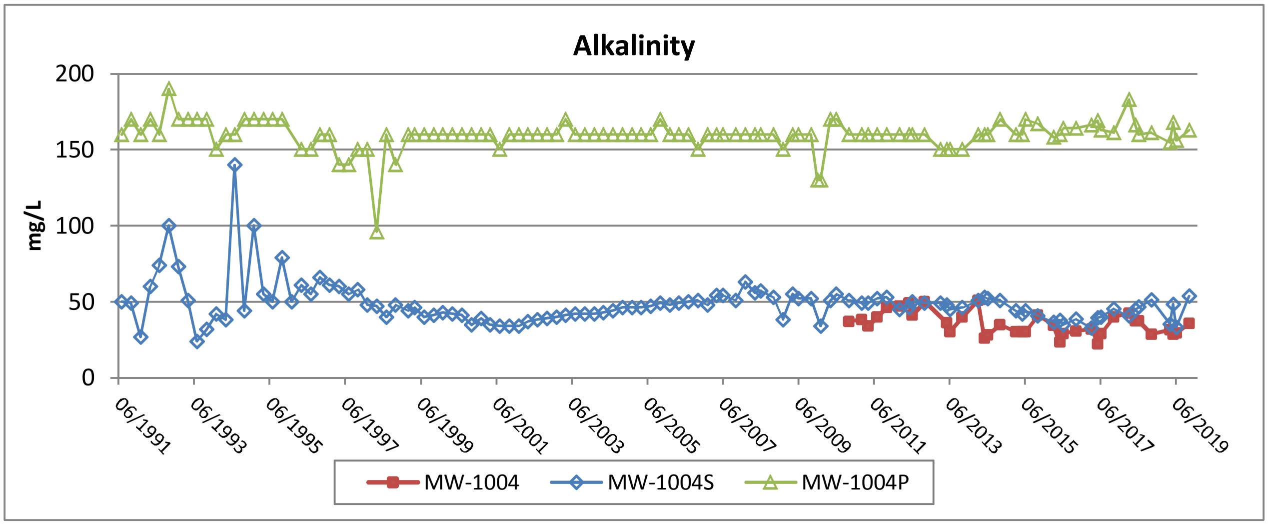
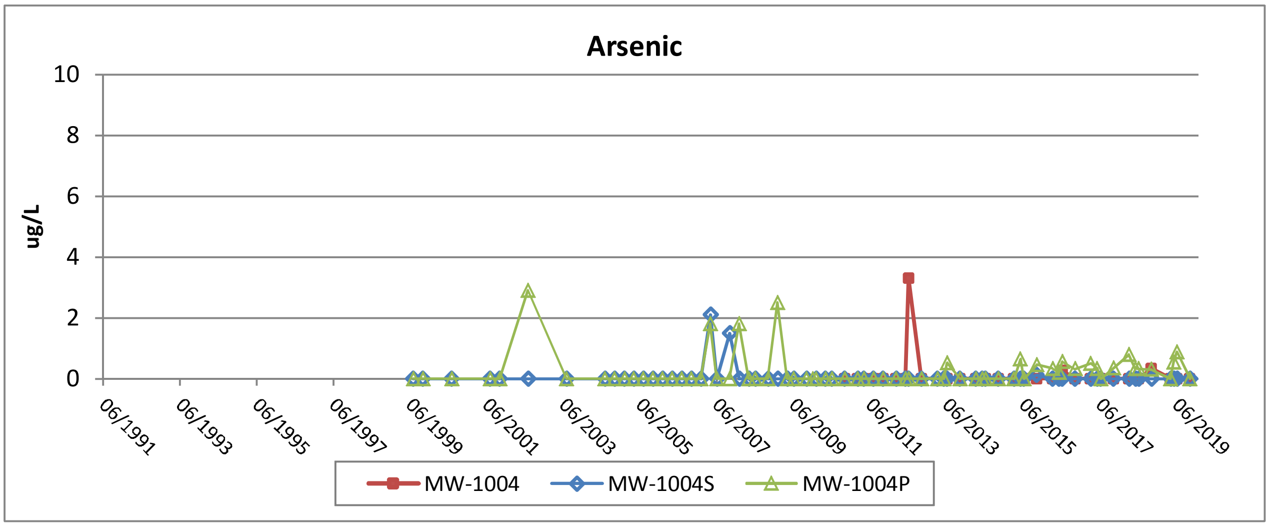
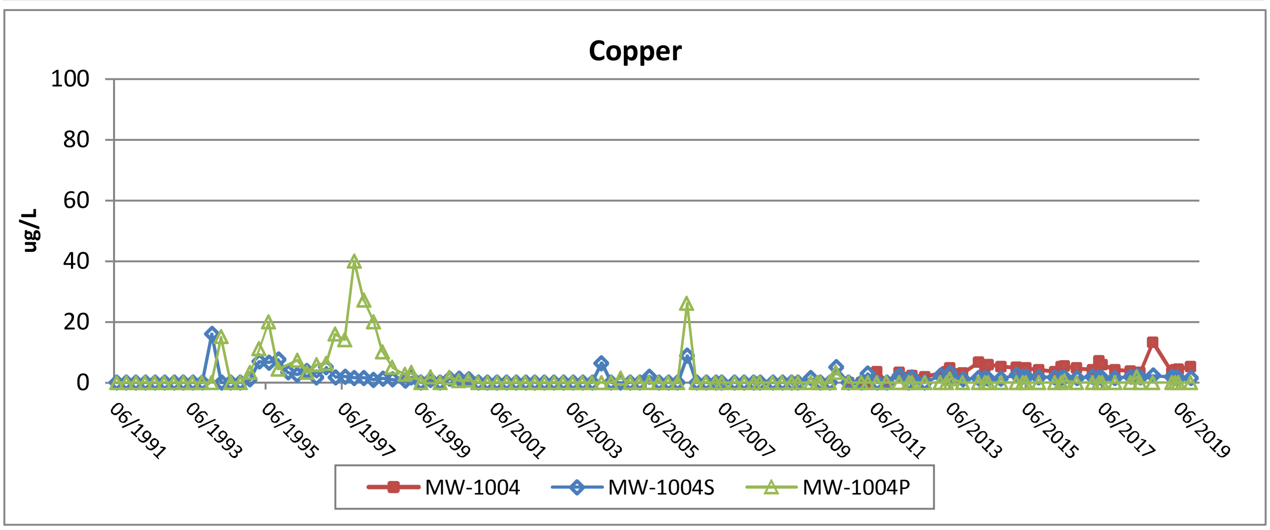
Figure B-2d Groundwater Trend Graphs - Quarterly Results MW-1002/MW-1002G		
Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19







Note: Fourth quarter 2010 was the first time MW-1004 had sufficient water recovery for sampling.

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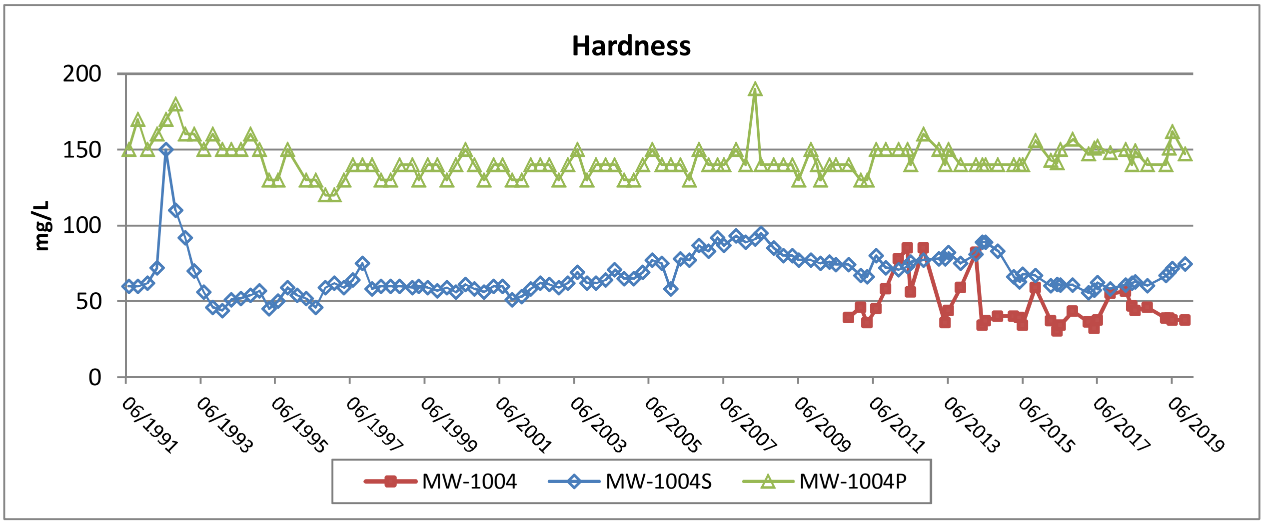
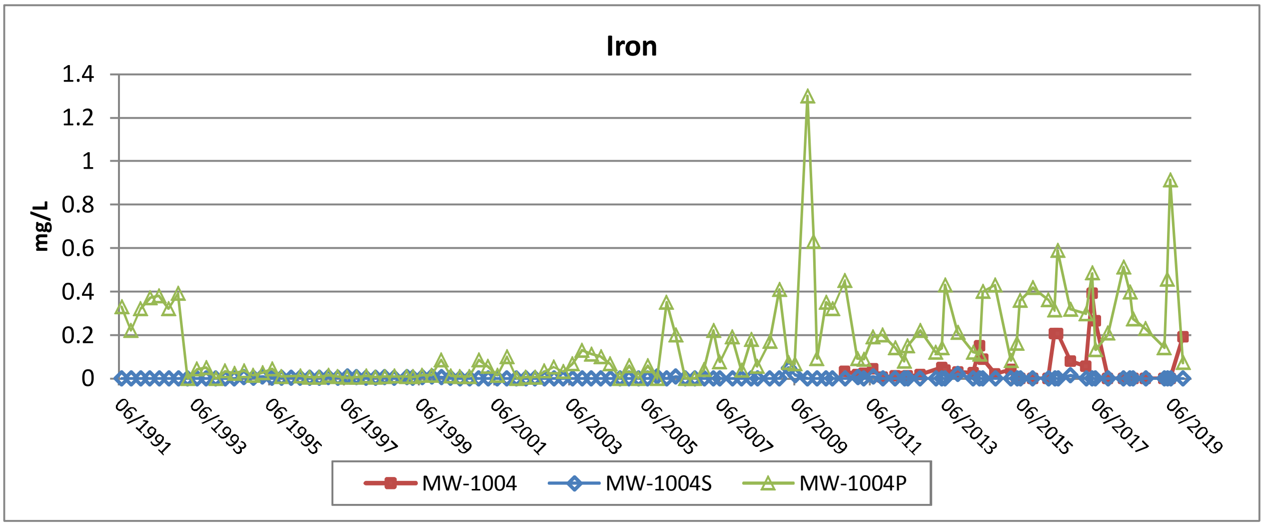
Figure B-3a Groundwater Trend Graphs - Quarterly Results MW-1004/MW-1004S/MW-1004P		
Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19





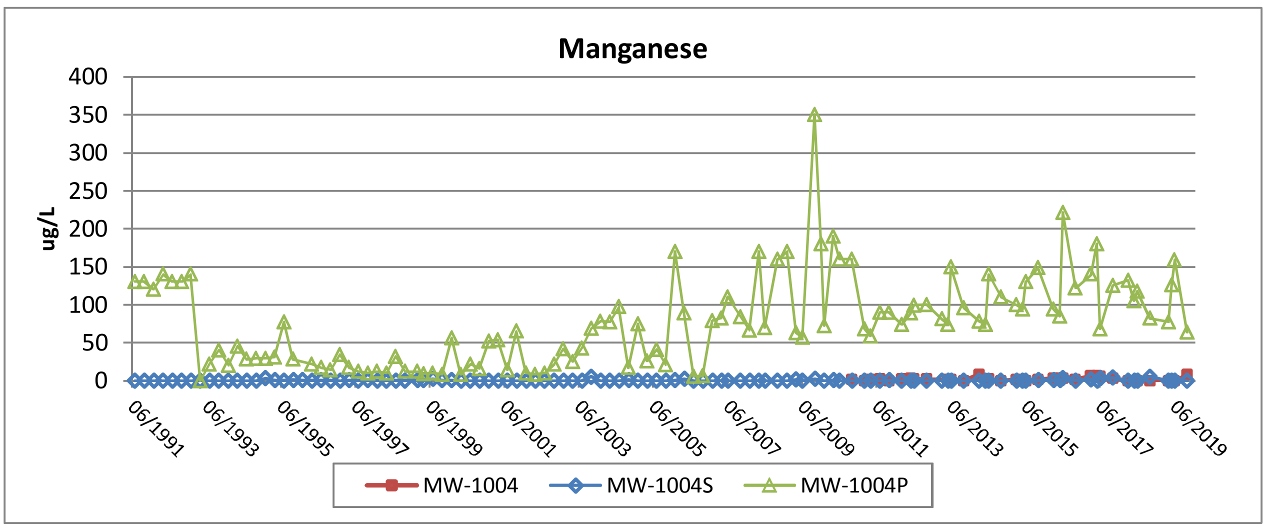


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Figure B-3b

Groundwater Trend Graphs - Quarterly Results

MW-1004/MW-1004S/MW-1004P

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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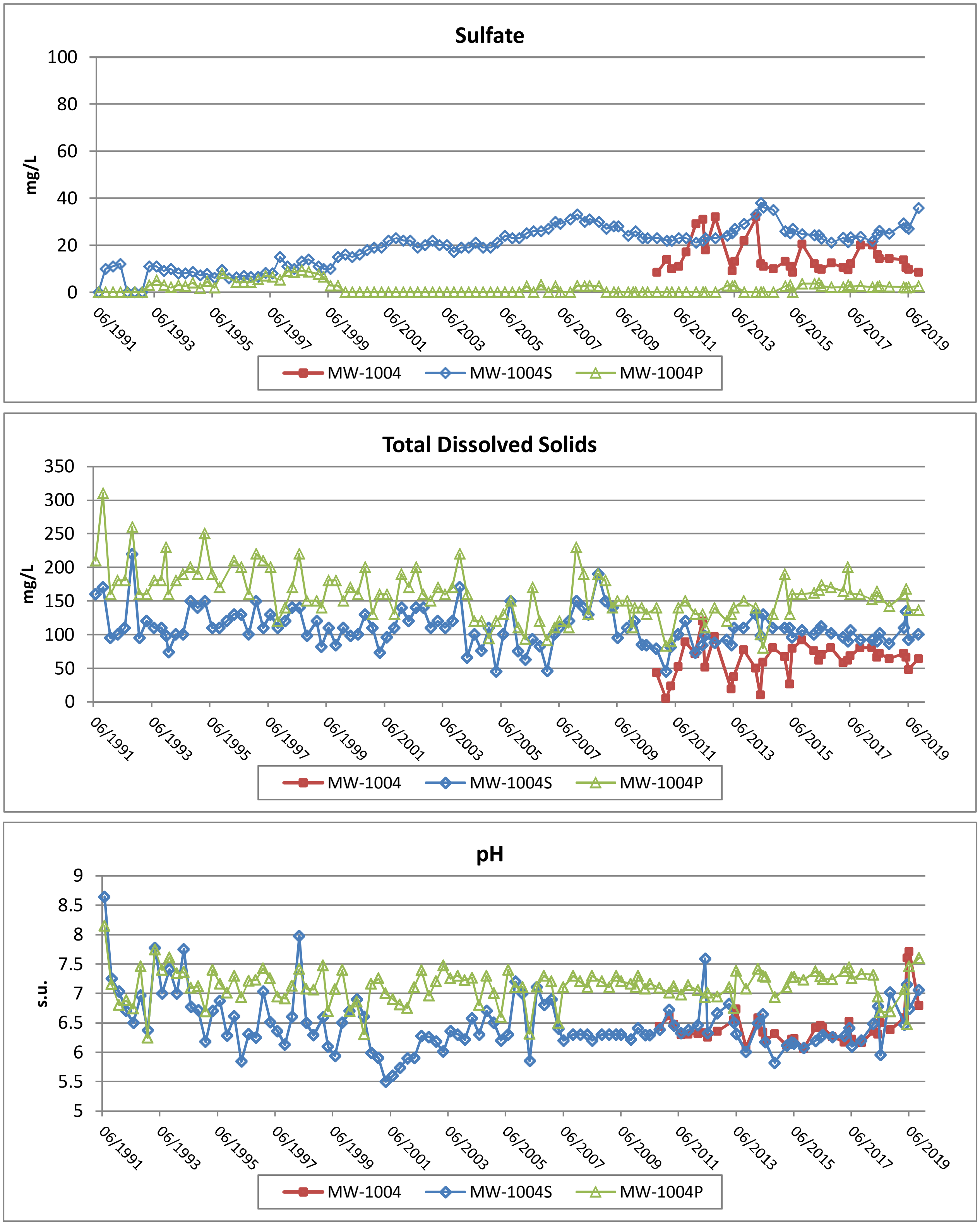

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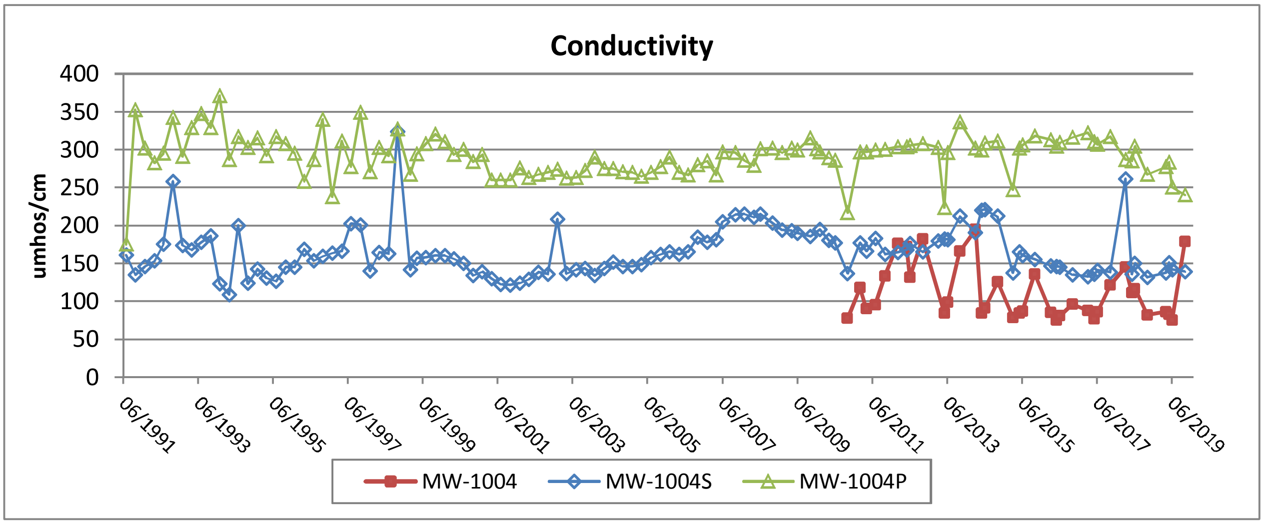
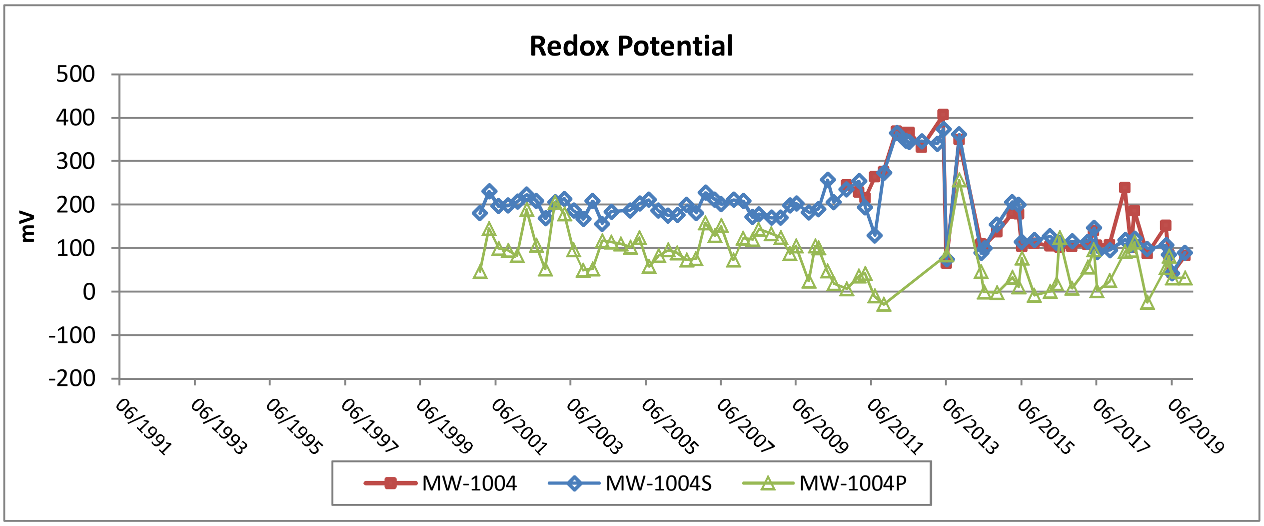
Figure B-3c

Groundwater Trend Graphs - Quarterly Results

MW-1004/MW-1004S/MW-1004P

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19





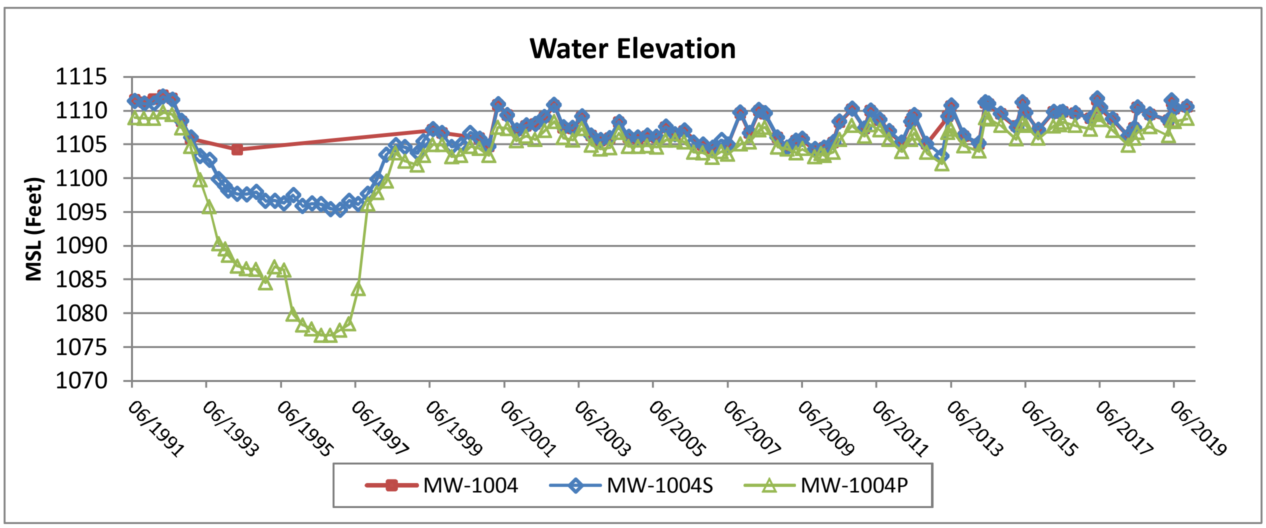


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Figure B-3d

Groundwater Trend Graphs - Quarterly Results

MW-1004/MW-1004S/MW-1004P

Scale: NA		Date: January 2020
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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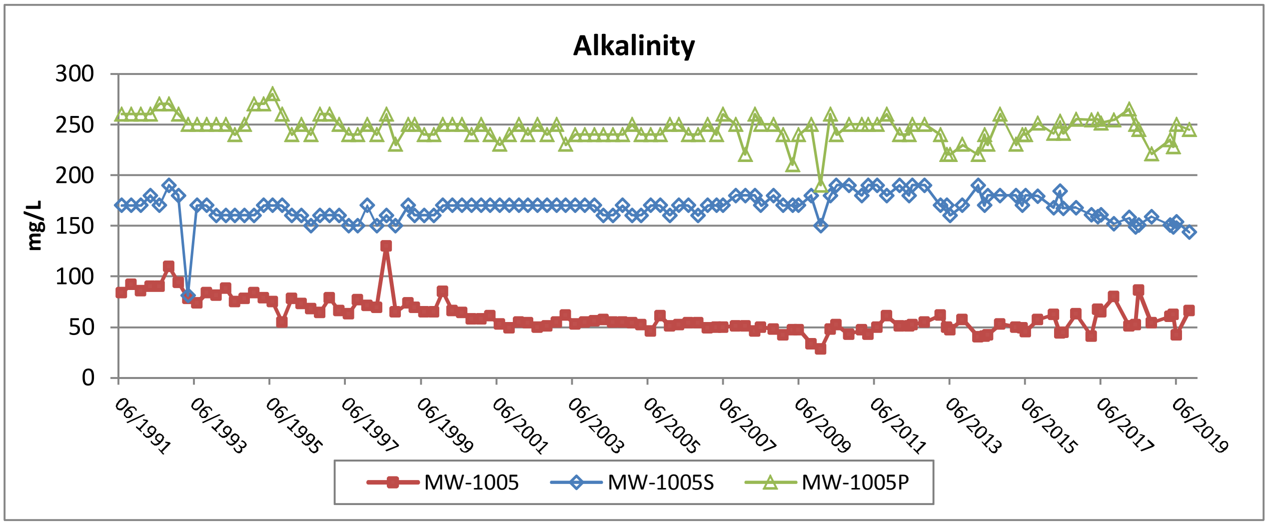

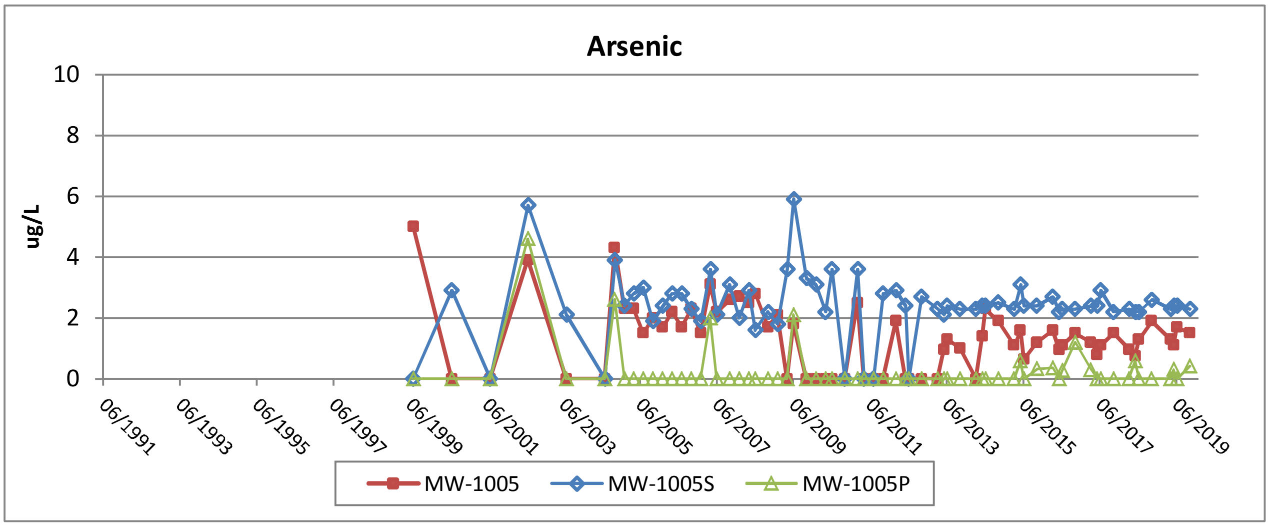

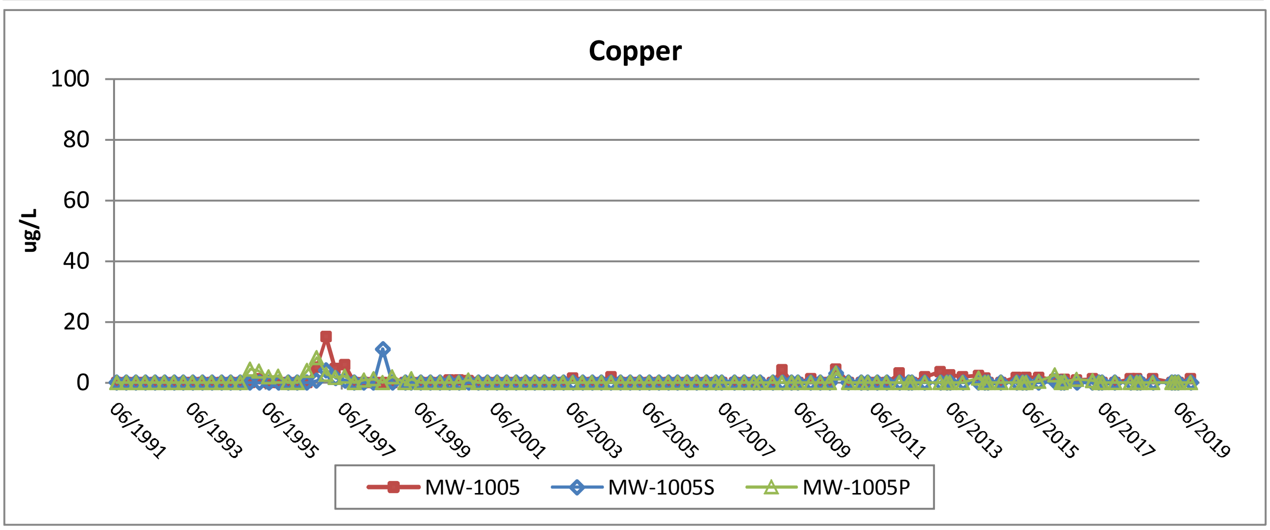

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Figure B-4a

Groundwater Trend Graphs - Quarterly Results

MW-1005/MW-1005S/MW-1005P

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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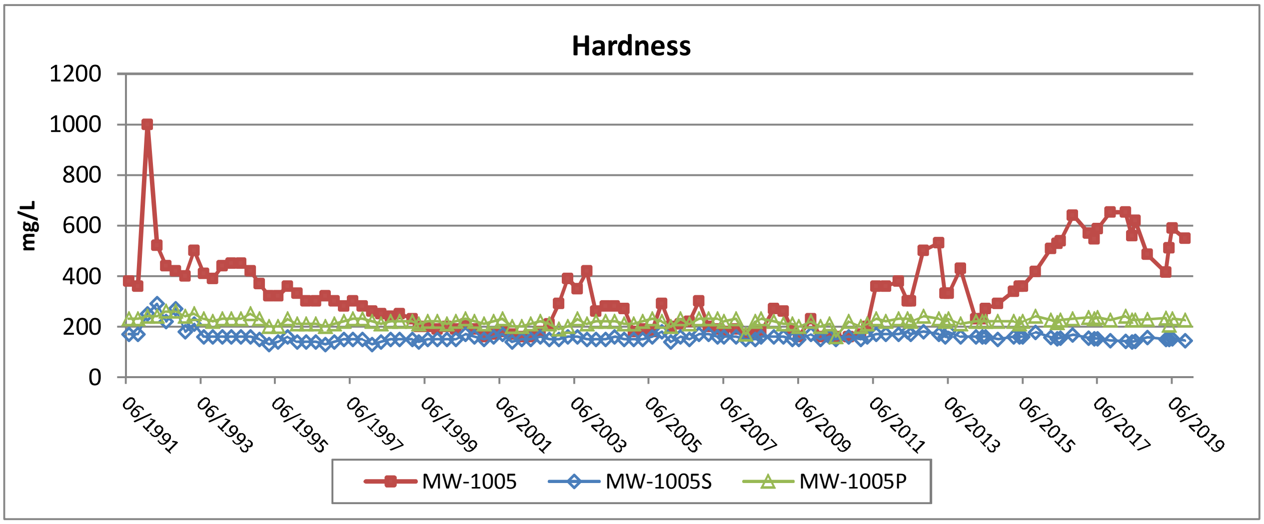

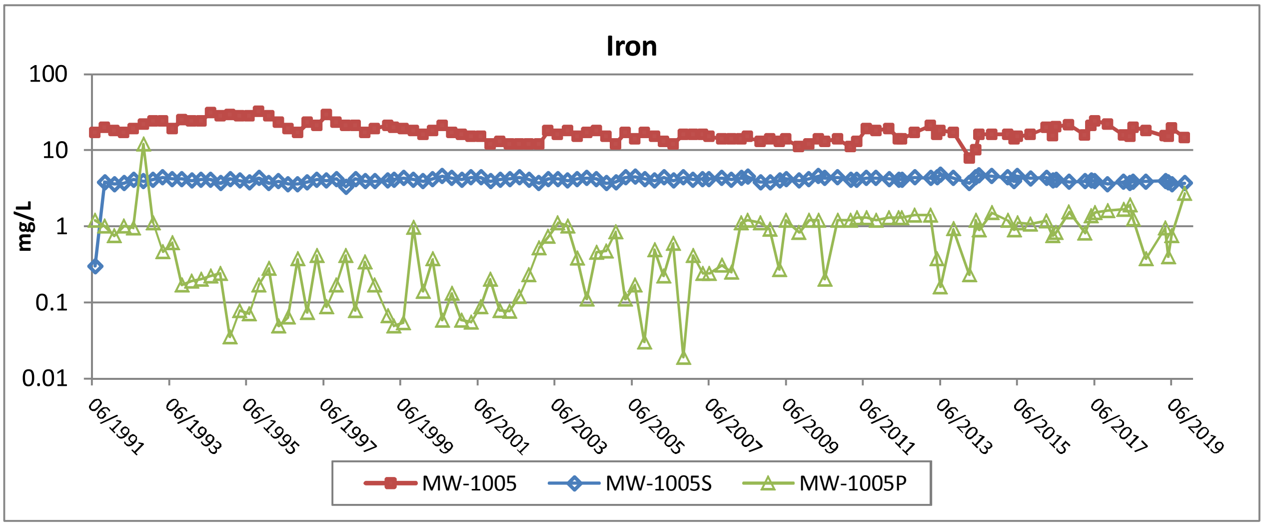

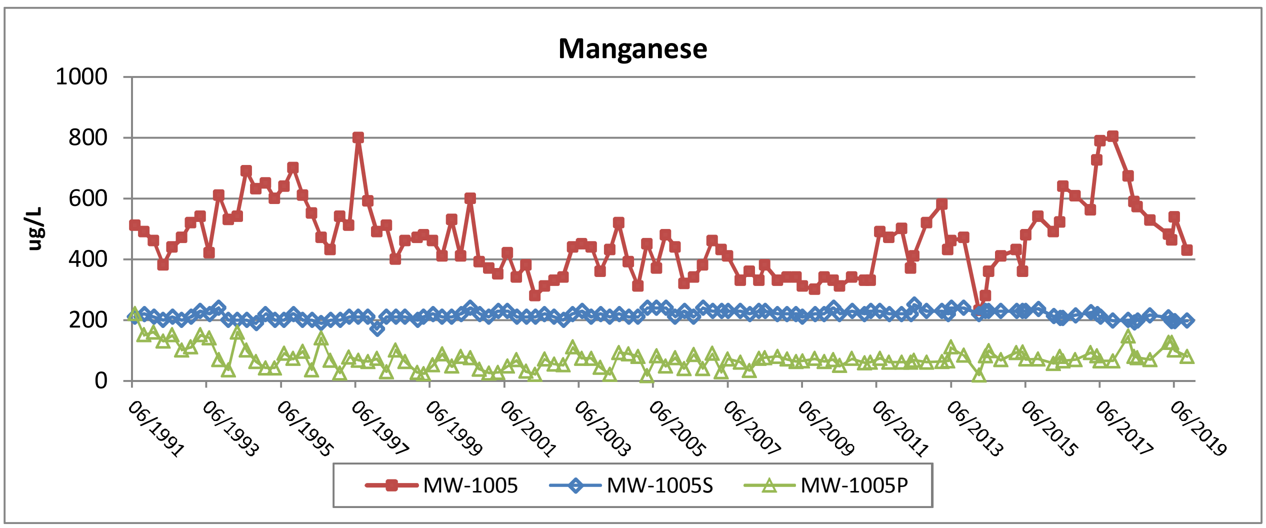

Note: Iron trend graphs are displayed on a logarithmic scale so the trend patterns of MW-1005, MW-1005S and MW-1005P are visible at different concentration scales.

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Figure B-4b

Groundwater Trend Graphs - Quarterly Results

MW-1005/MW-1005S/MW-1005P

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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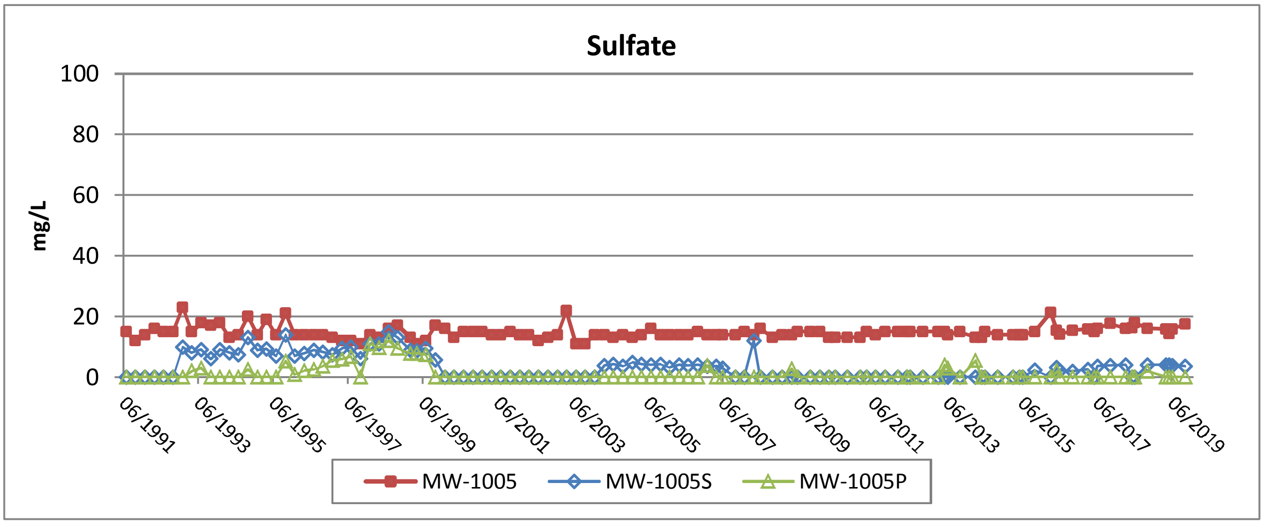

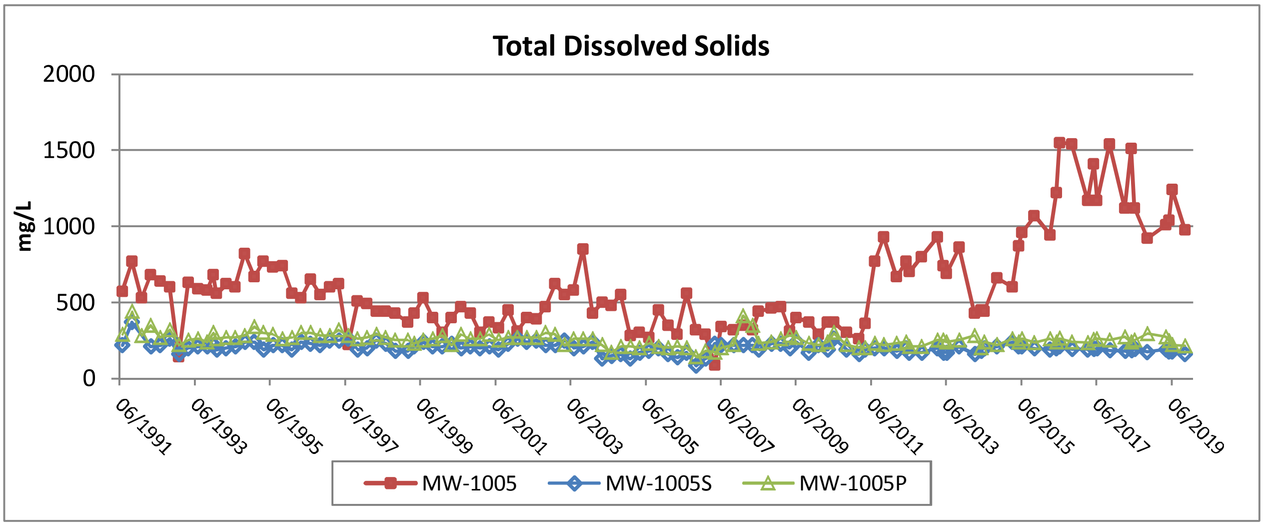

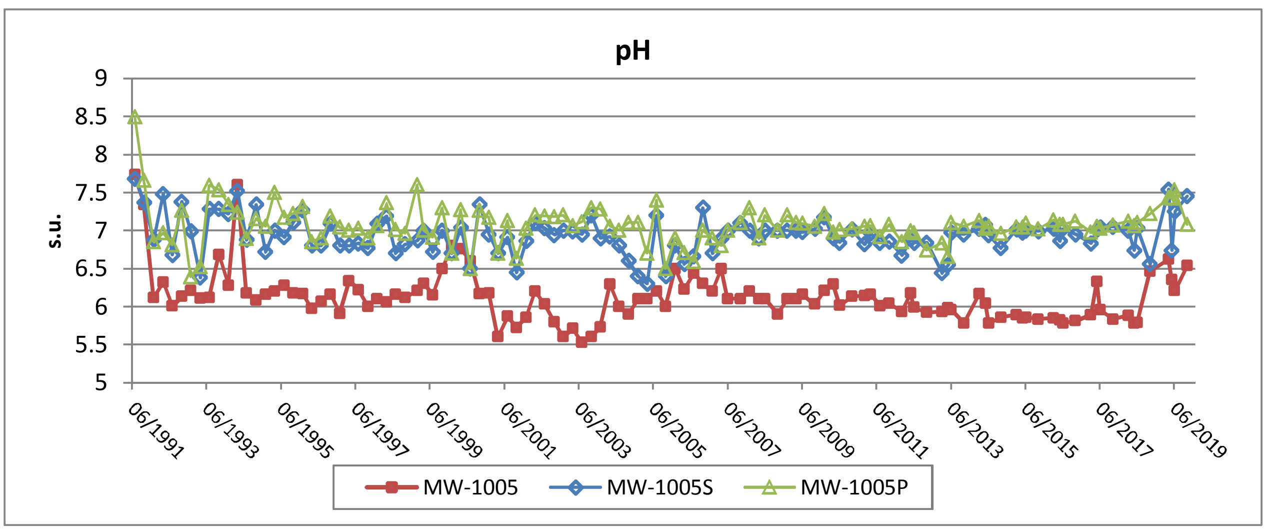

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Figure B-4c

Groundwater Trend Graphs - Quarterly Results

MW-1005/MW-1005S/MW-1005P

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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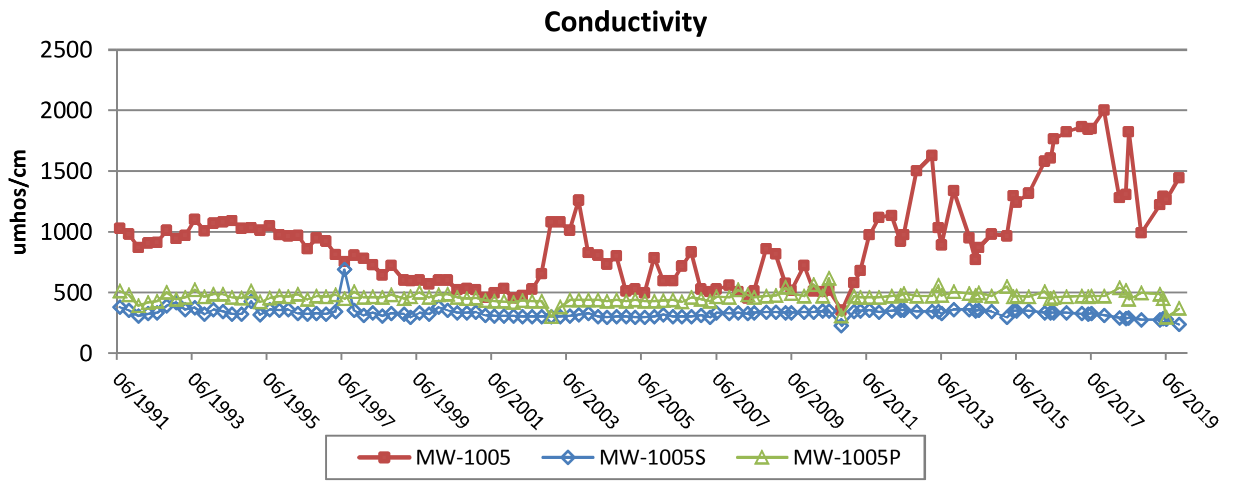

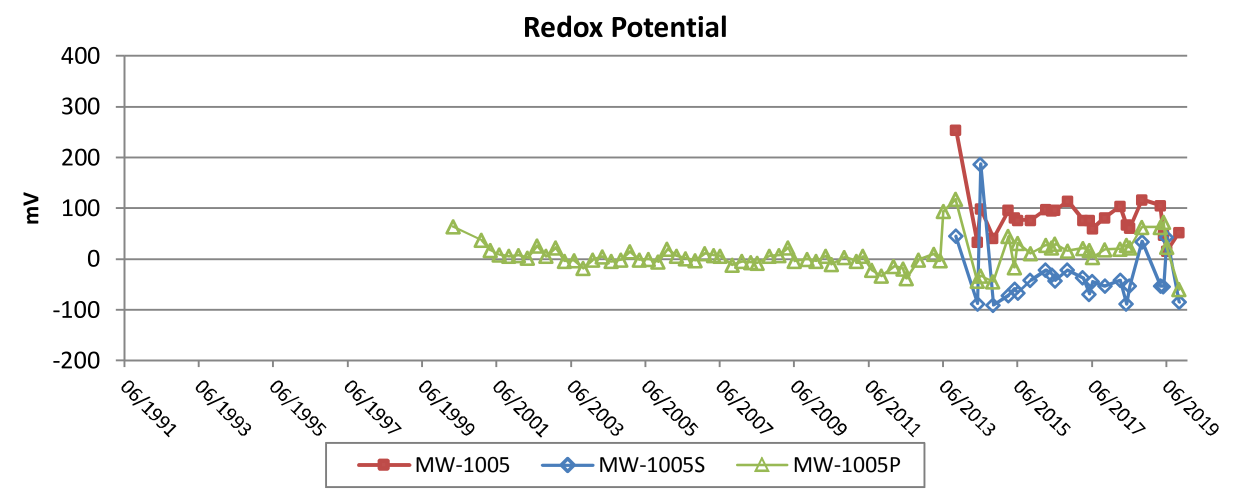

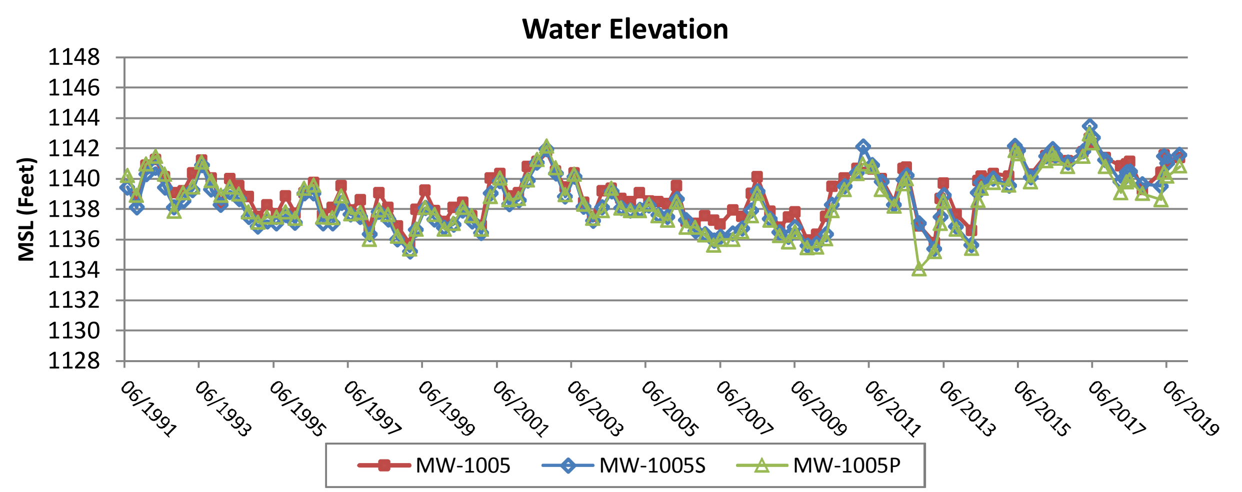

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Figure B-4d Groundwater Trend Graphs - Quarterly Results MW-1005/MW-1005S/MW-1005P		
Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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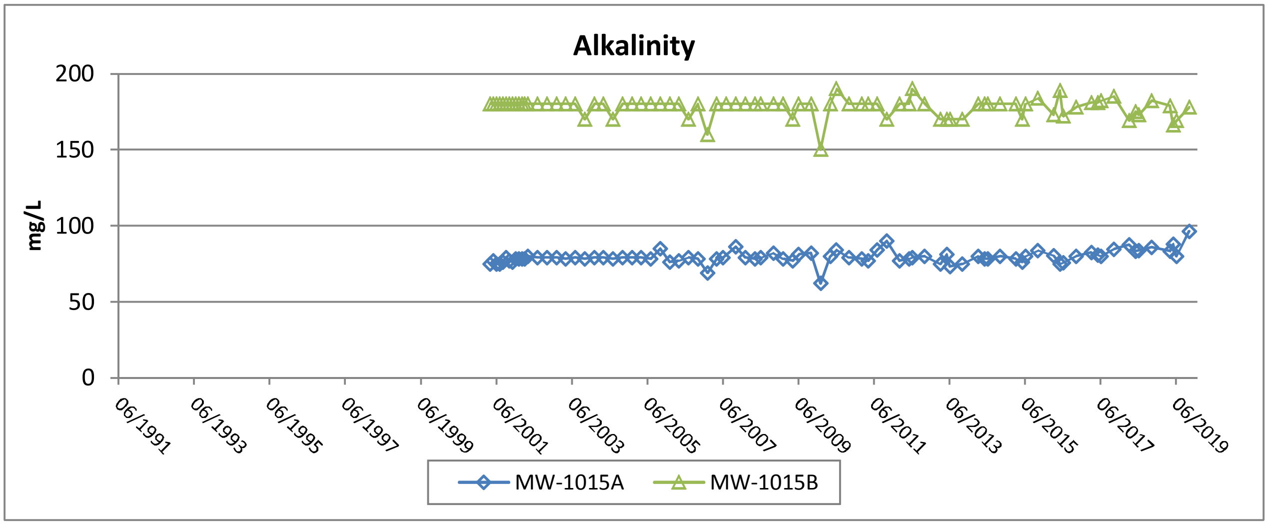

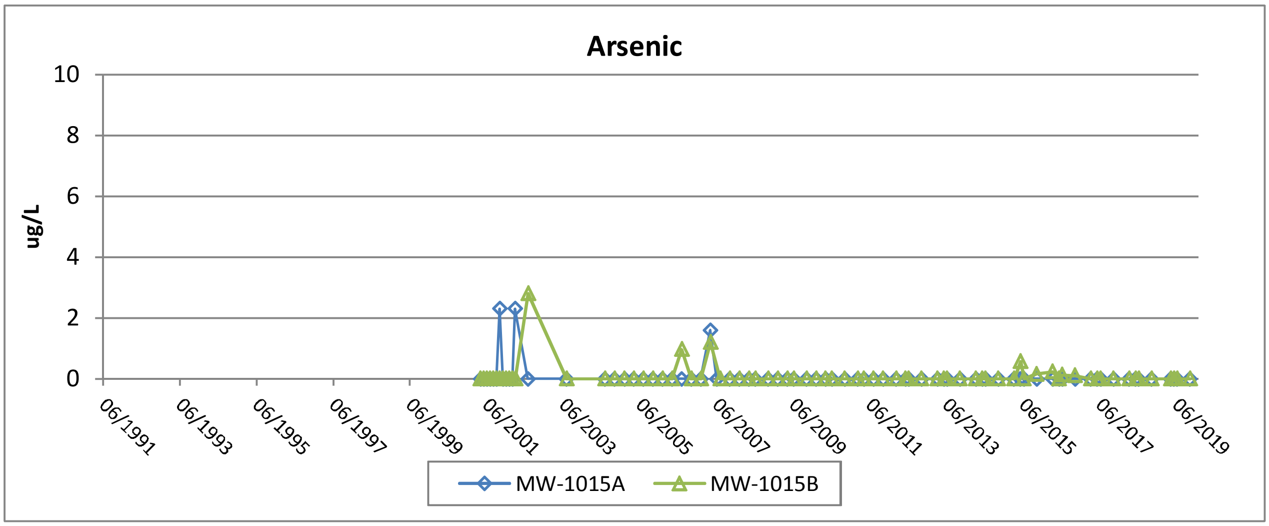

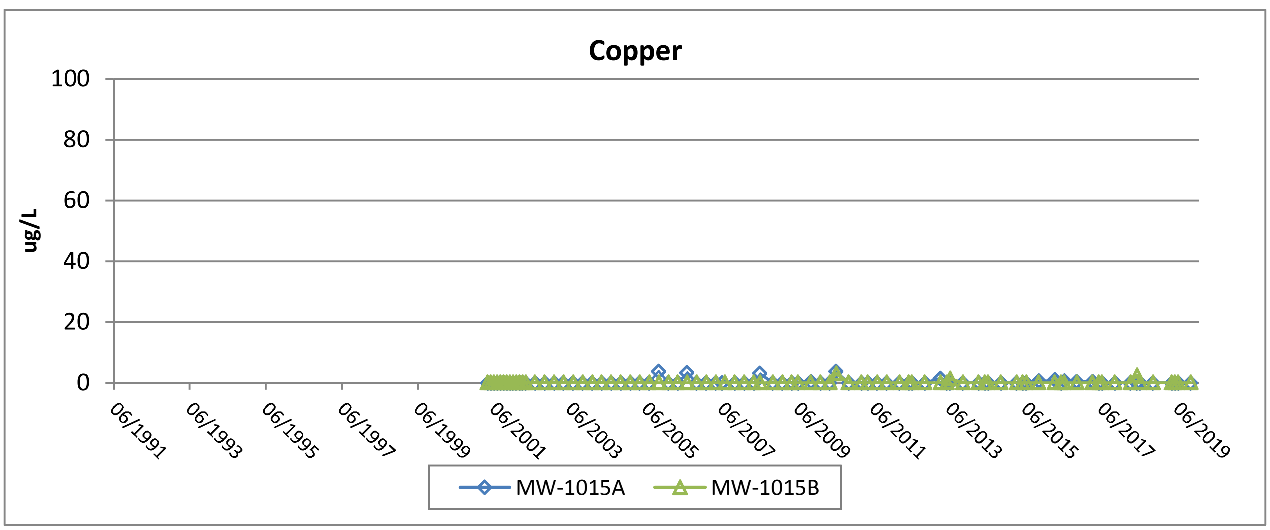

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Figure B-5a

Groundwater Trend Graphs - Quarterly Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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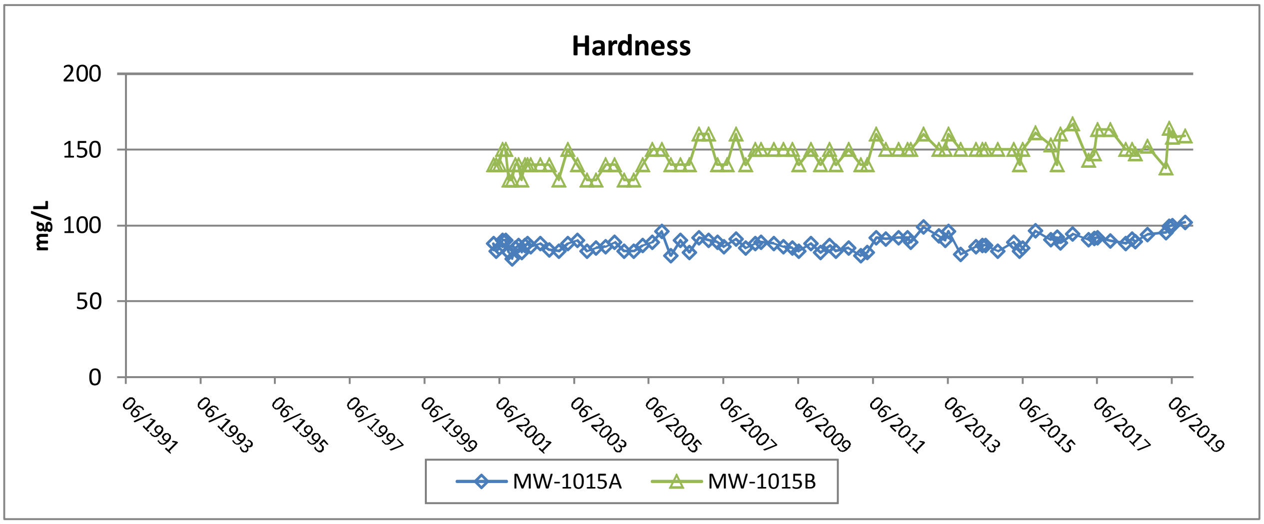

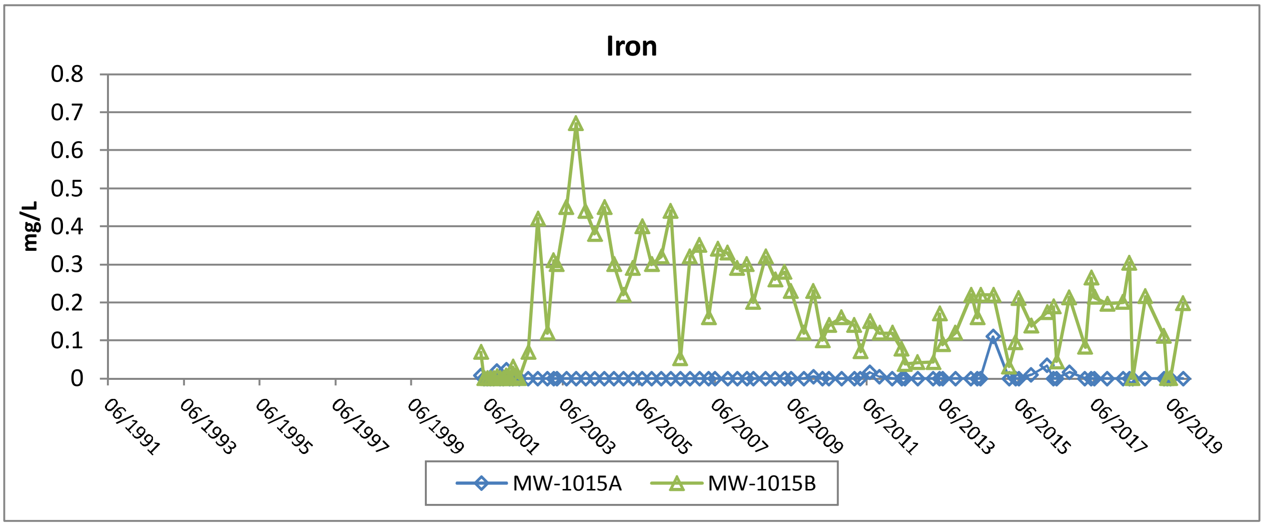

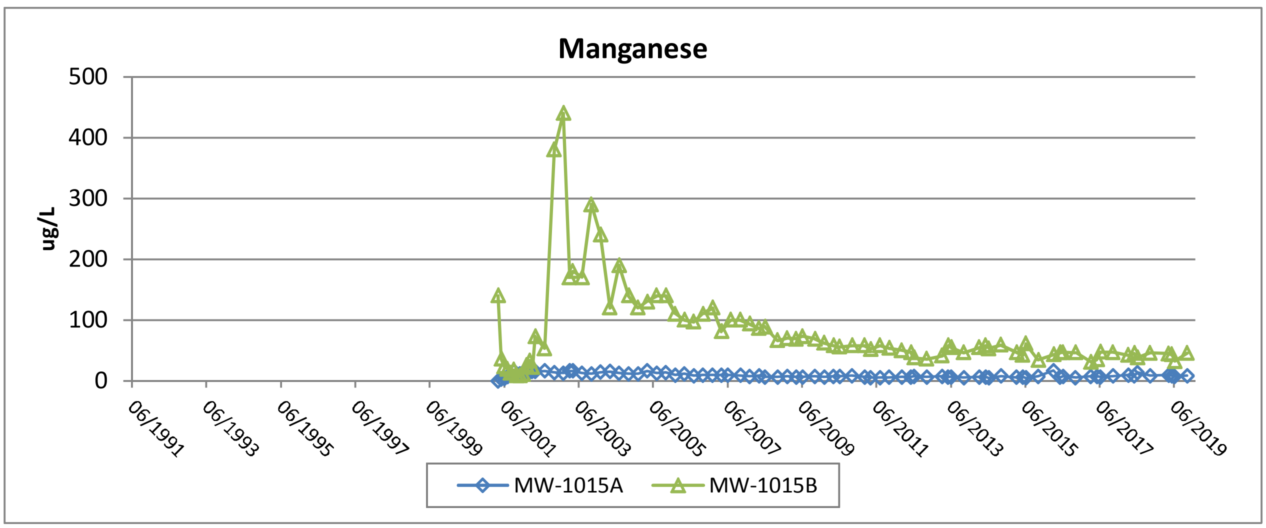

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Figure B-5b

Groundwater Trend Graphs - Quarterly Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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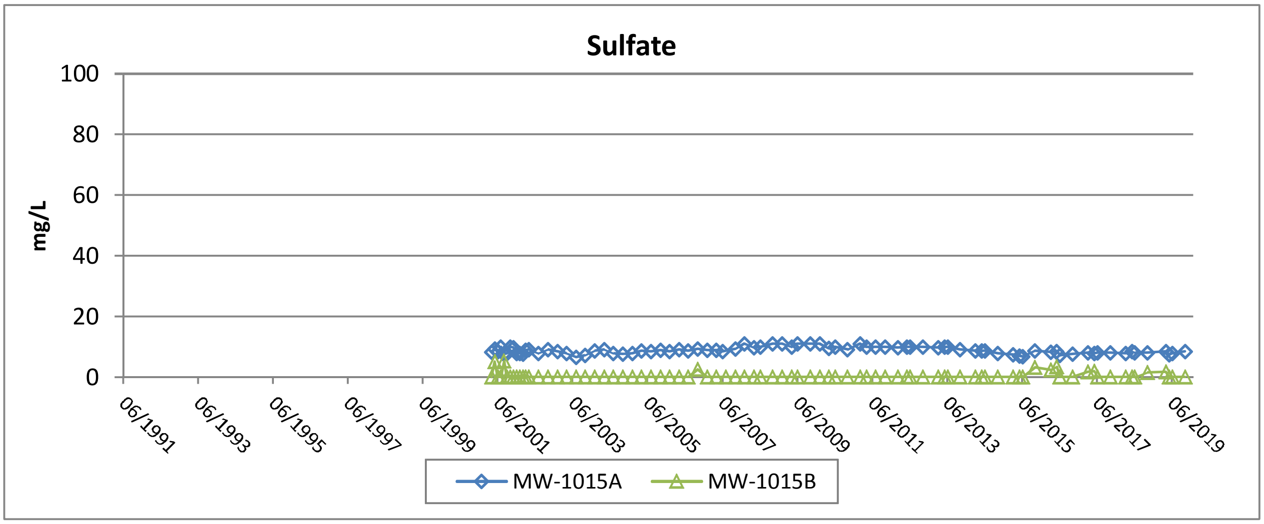

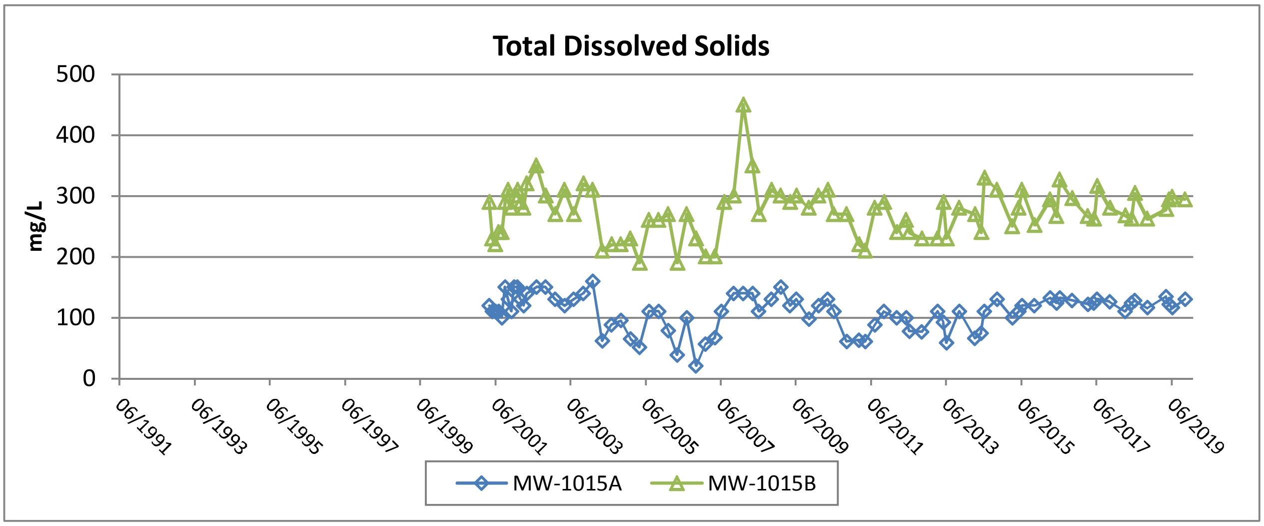

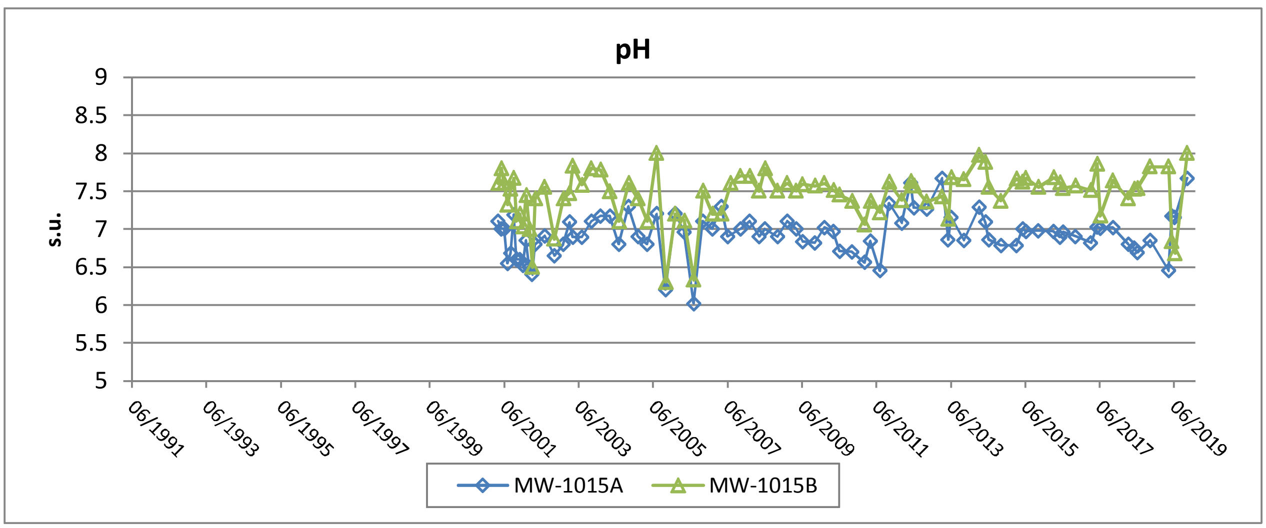

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Figure B-5c

Groundwater Trend Graphs - Quarterly Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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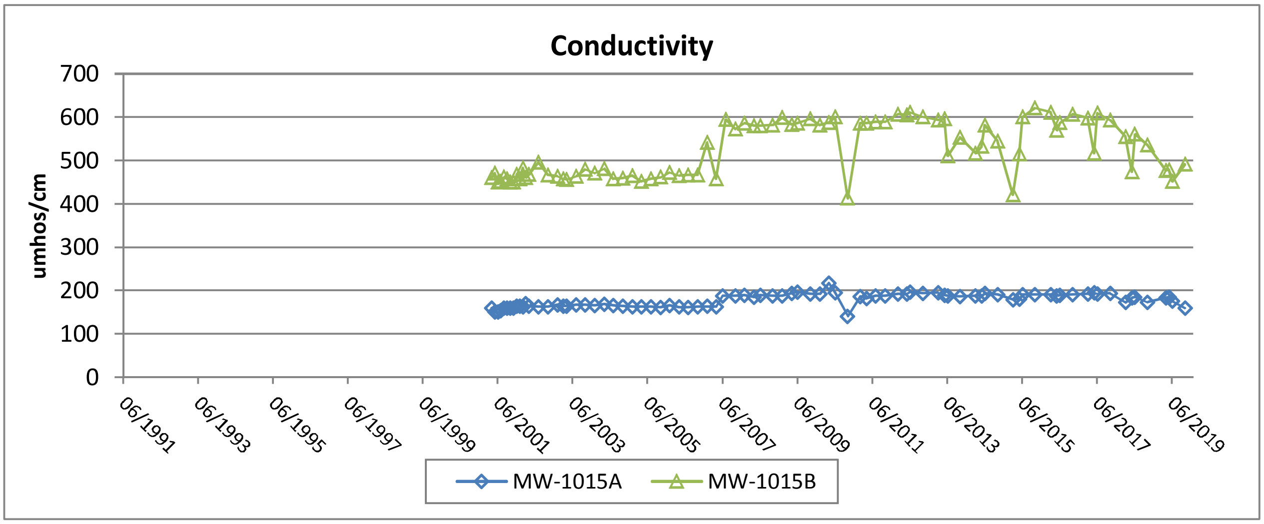

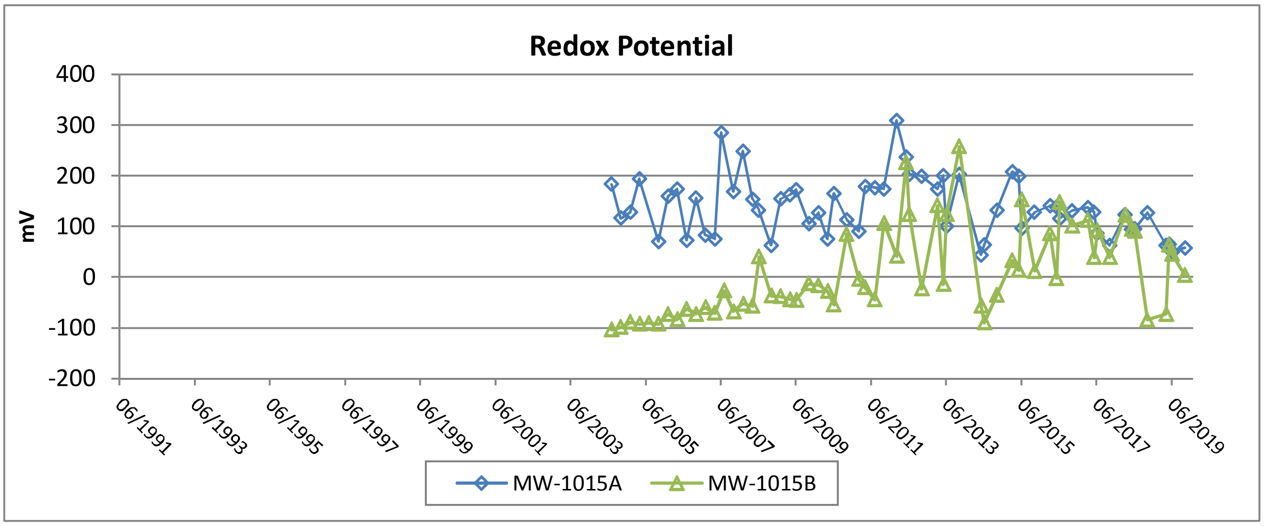

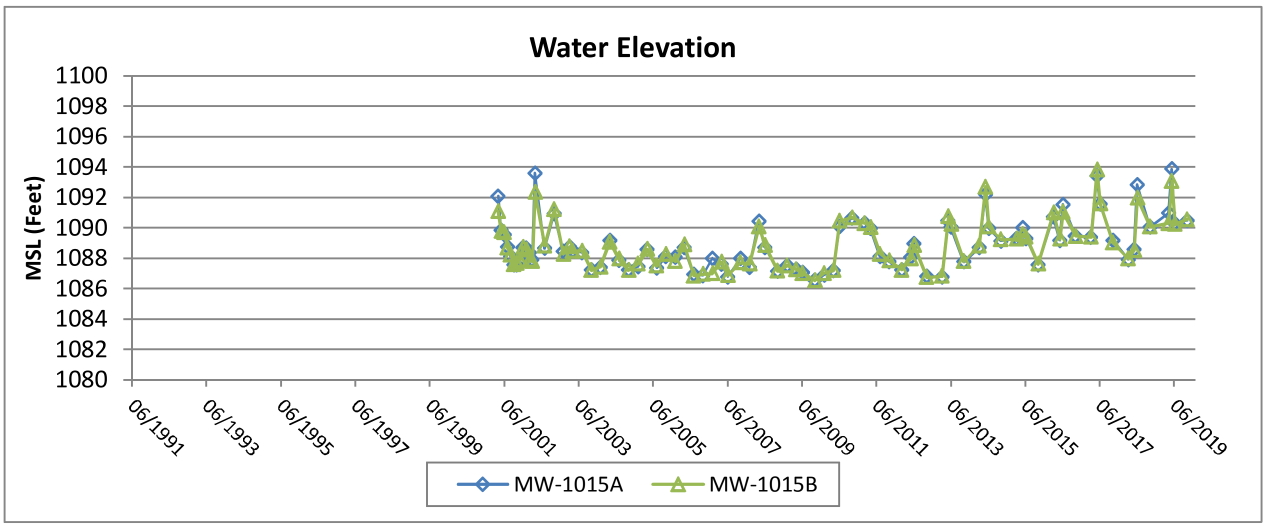

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Figure B-5d

Groundwater Trend Graphs - Quarterly Results

MW-1015A/MW-1015B

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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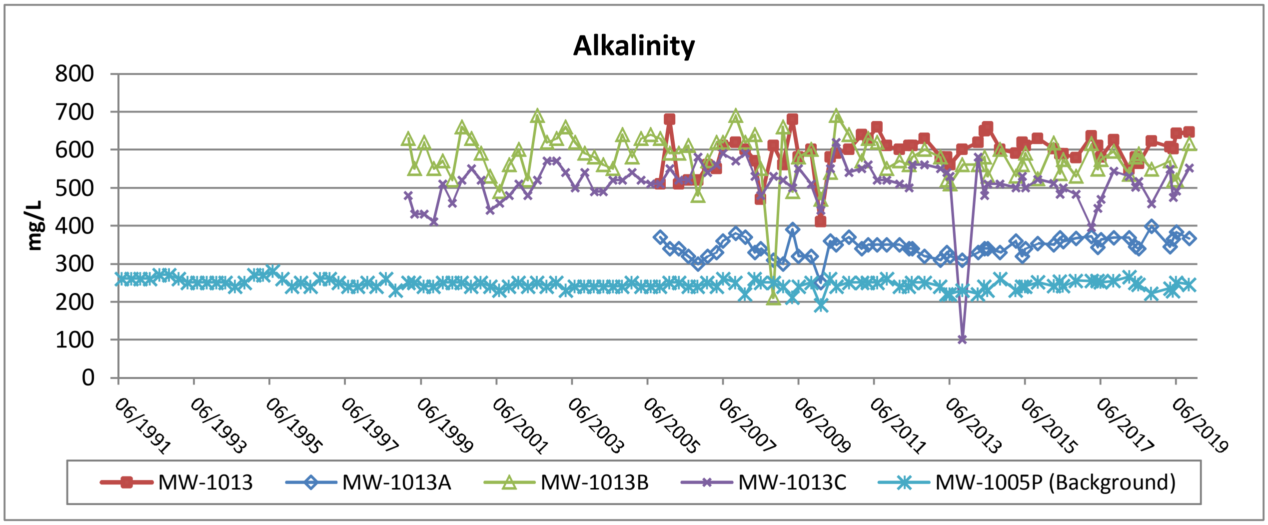

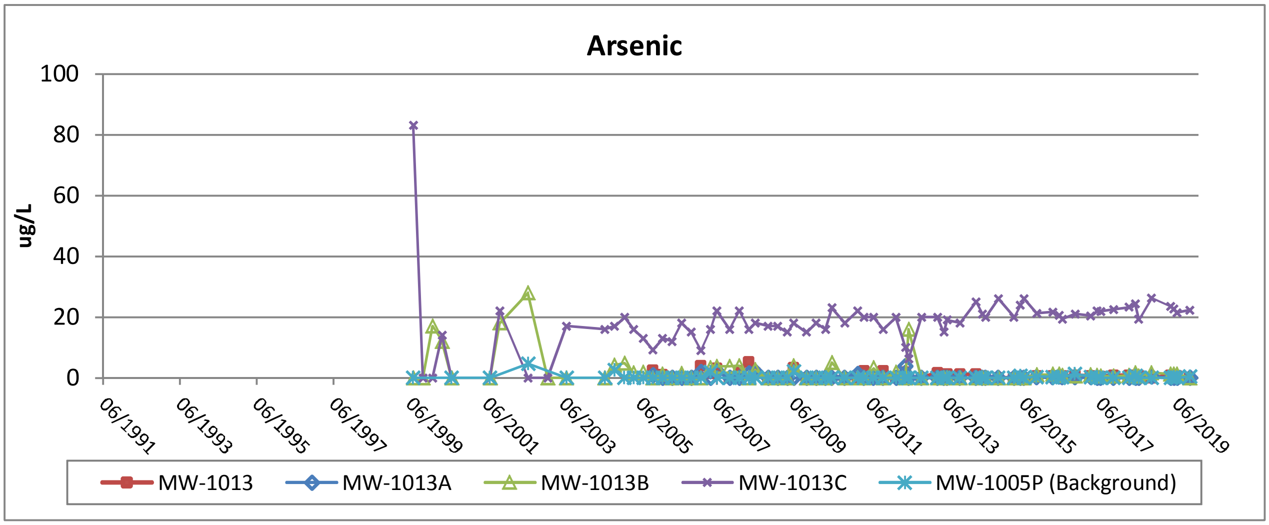

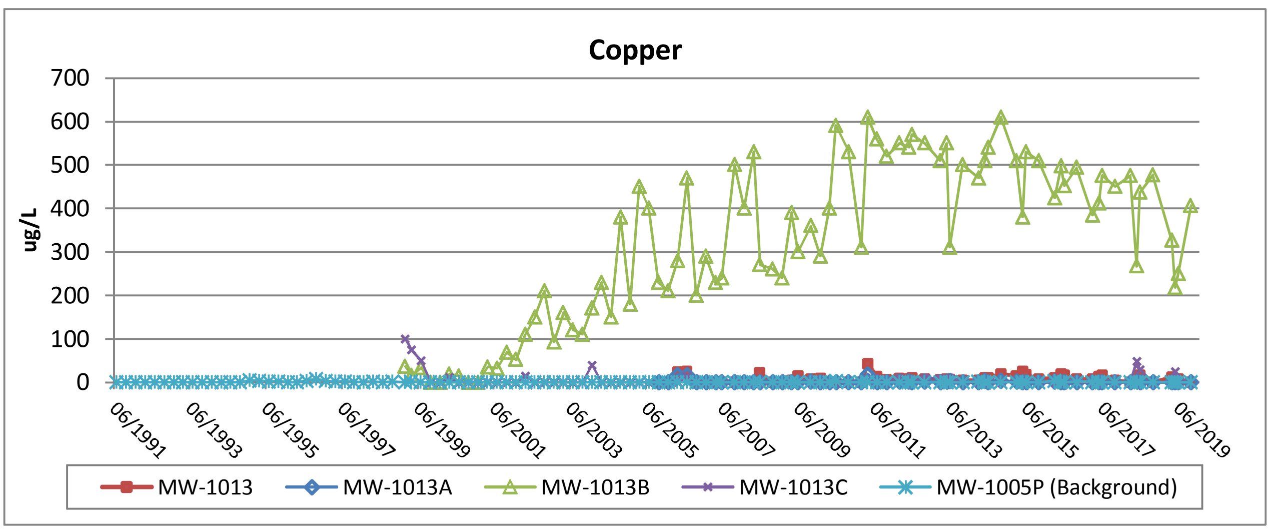

Note: Fourth quarter 2005 was the first time MW-1013 had sufficient water recovery for sampling.

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Figure B-6a

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1013/MW-1013A/MW-1013B/MW-1013C

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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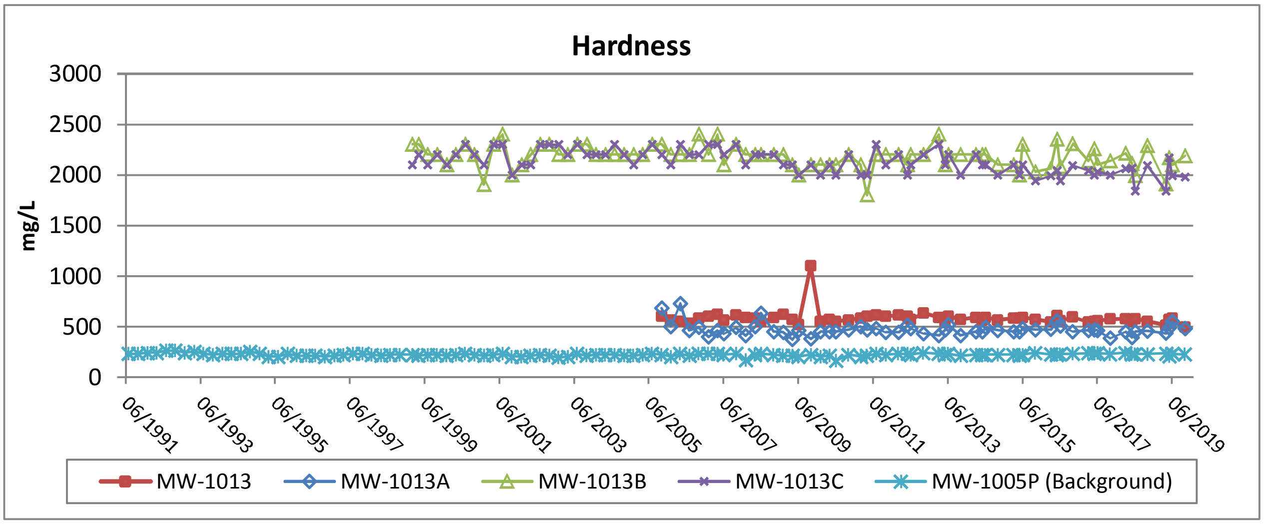

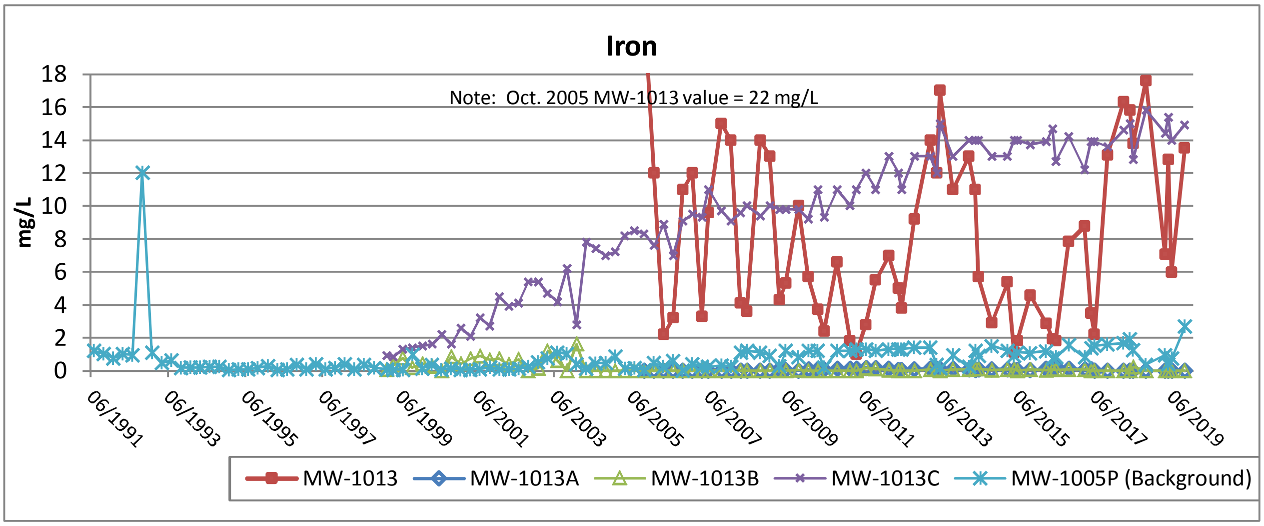

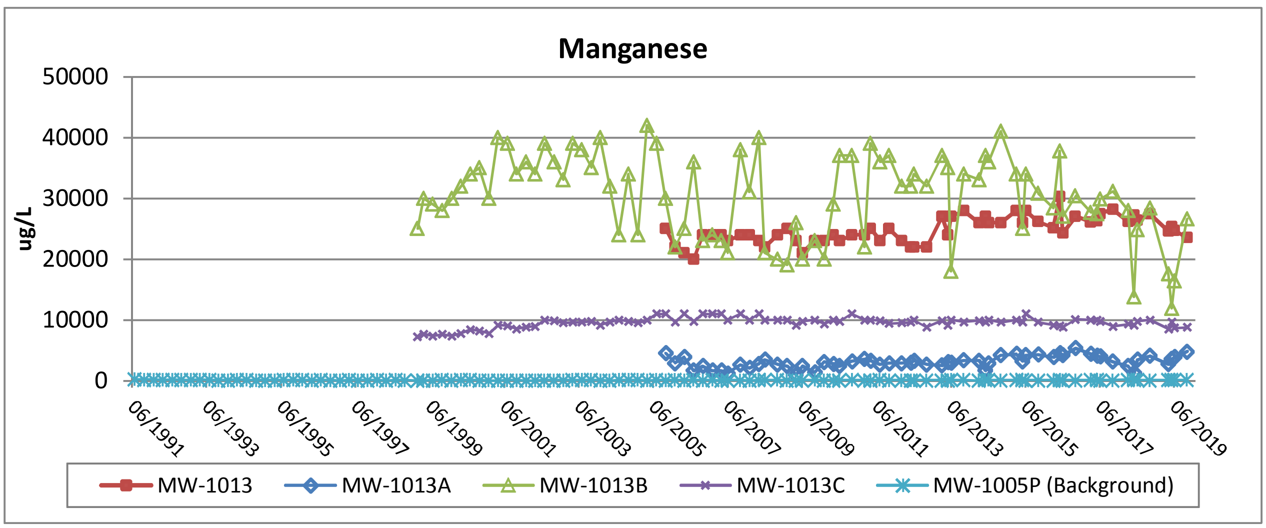

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Figure B-6b

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1013/MW-1013A/MW-1013B/MW-1013C

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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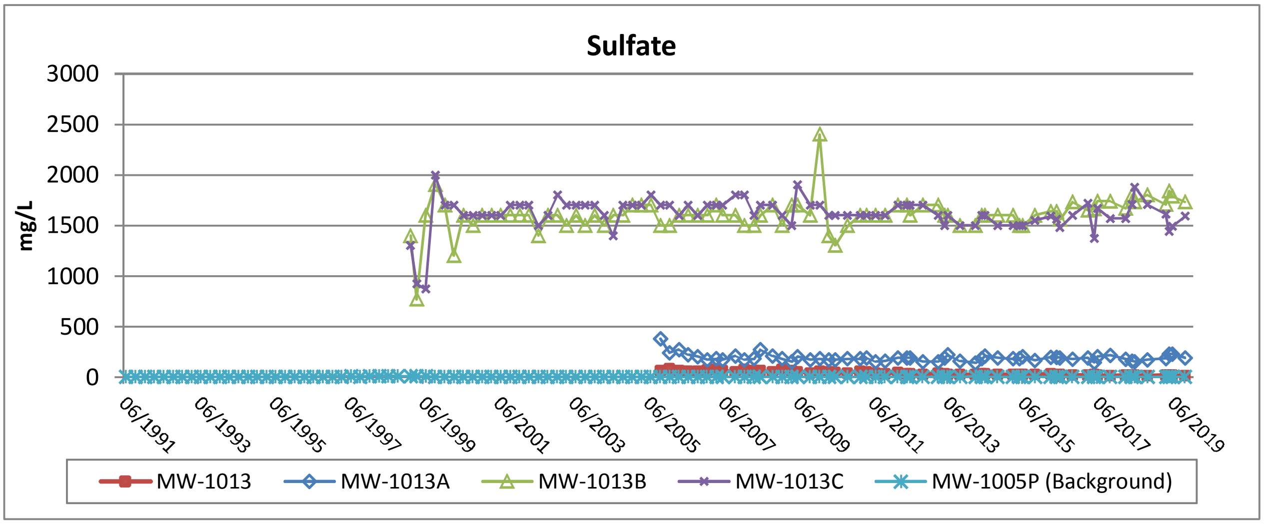

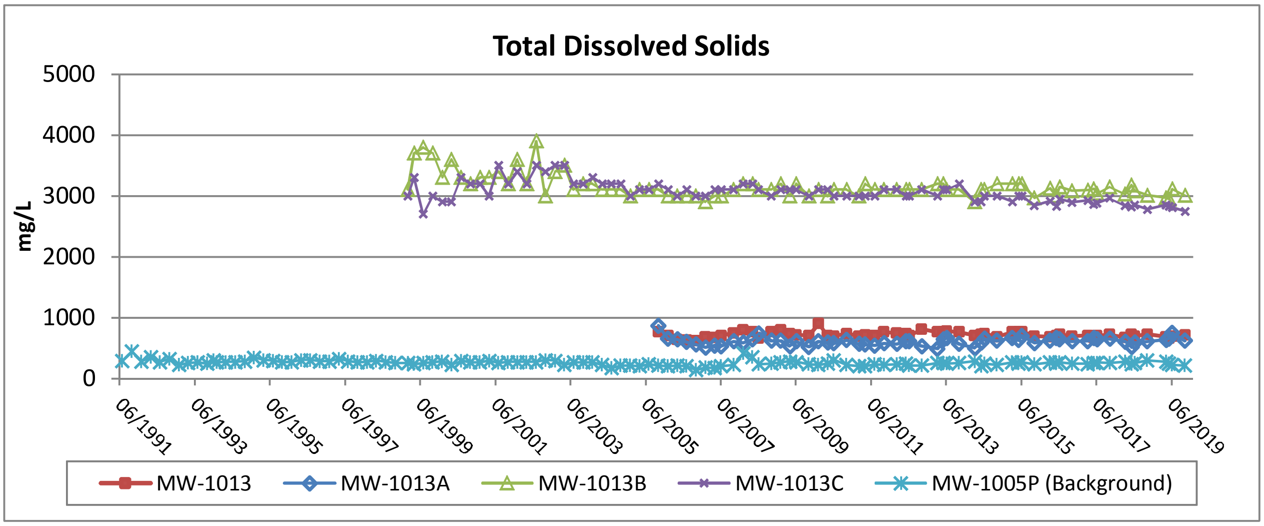

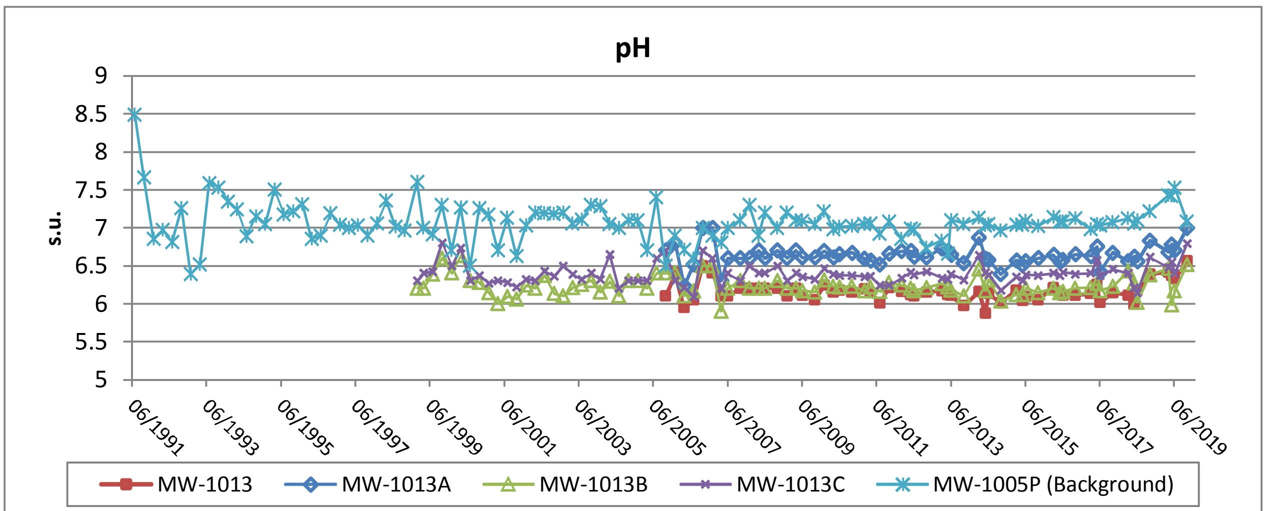

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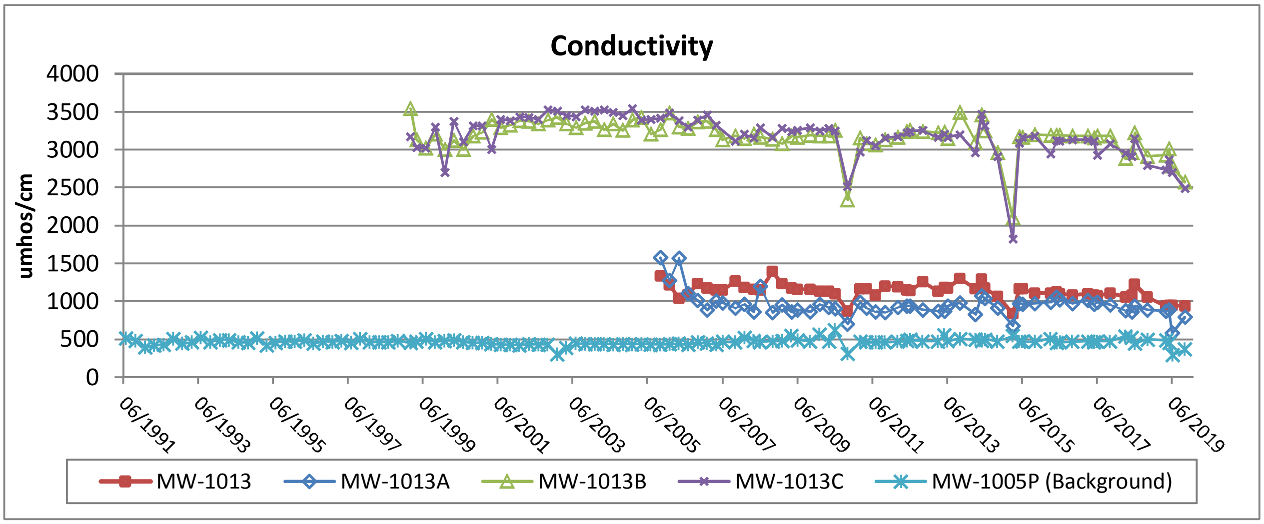
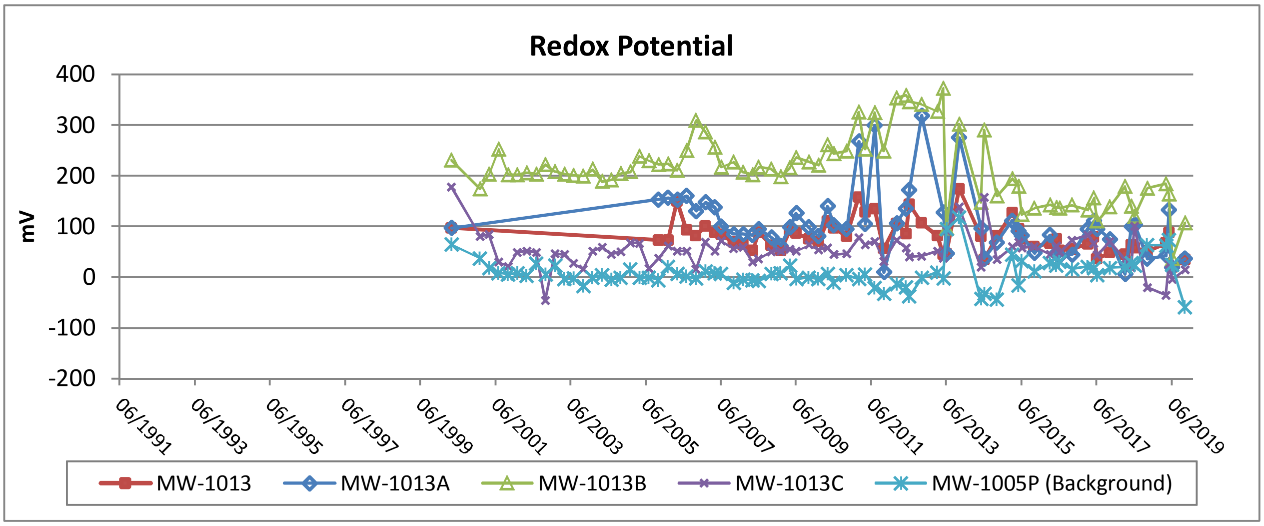
Figure B-6c

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1013/MW-1013A/MW-1013B/MW-1013C

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19





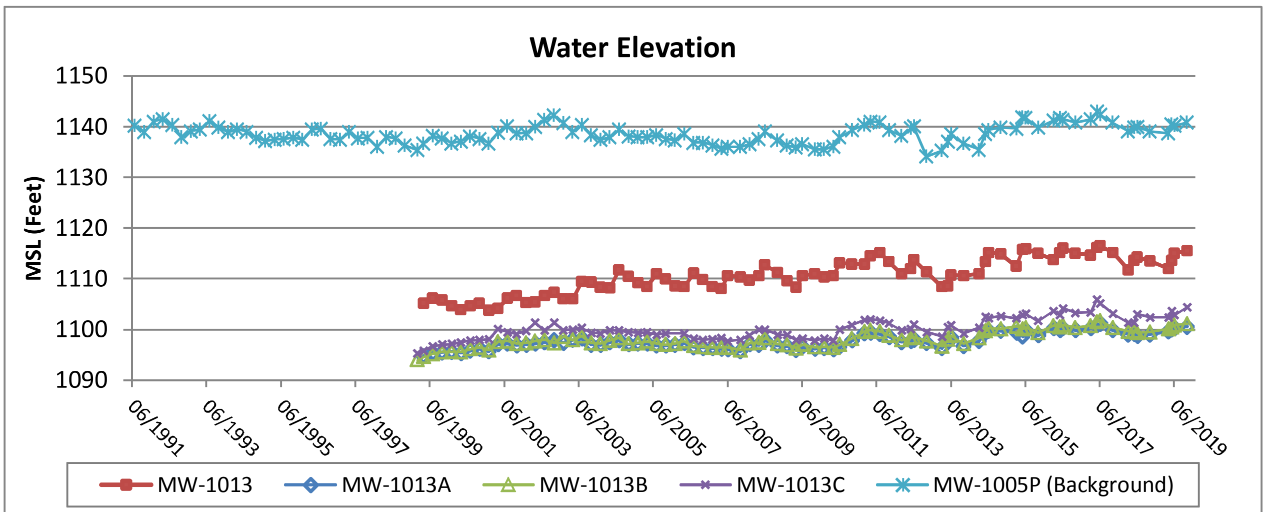


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Figure B-6d

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1013/MW-1013A/MW-1013B/MW-1013C

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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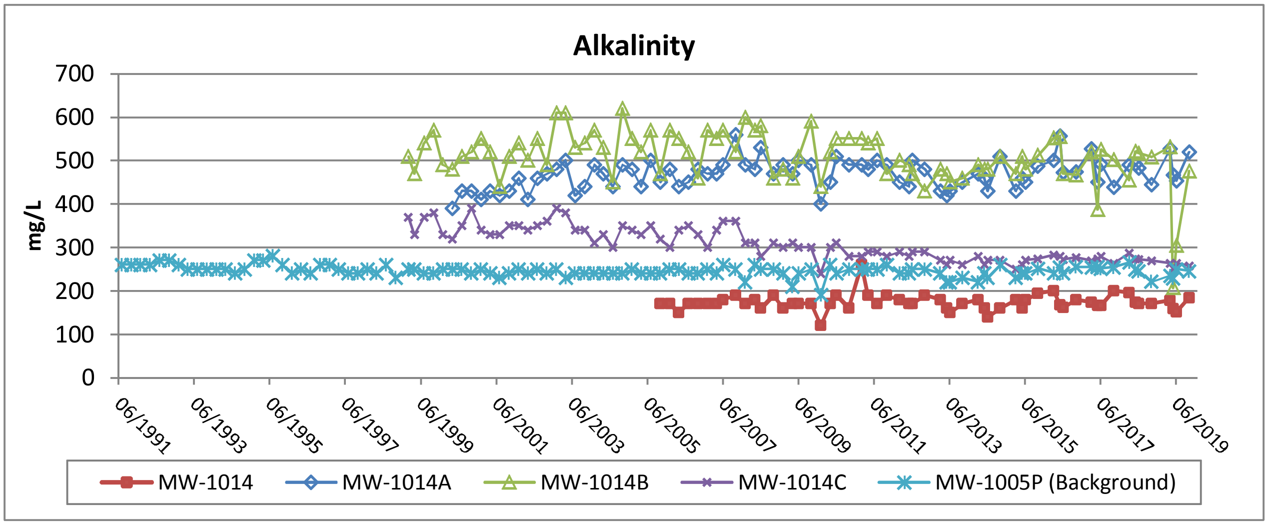

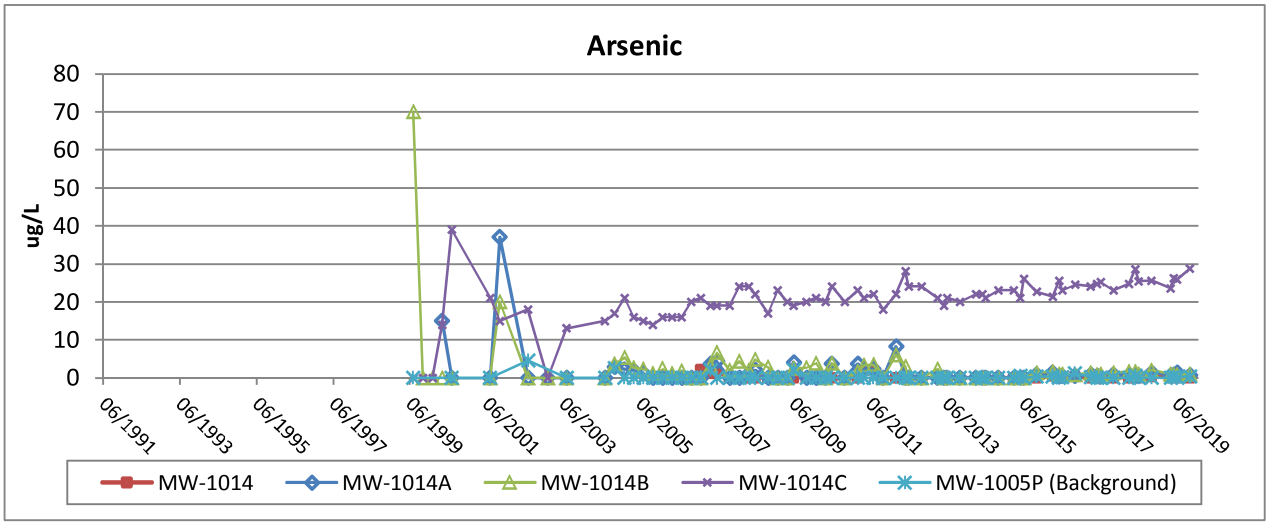

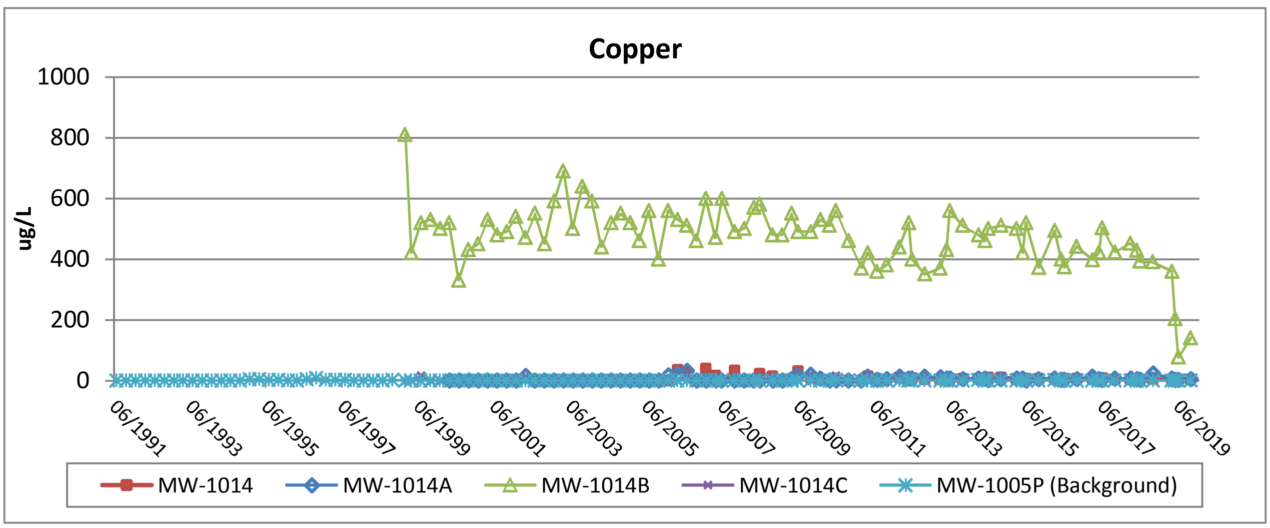

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Figure B-7a

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1014/MW-1014A/MW-1014B/MW-1014C

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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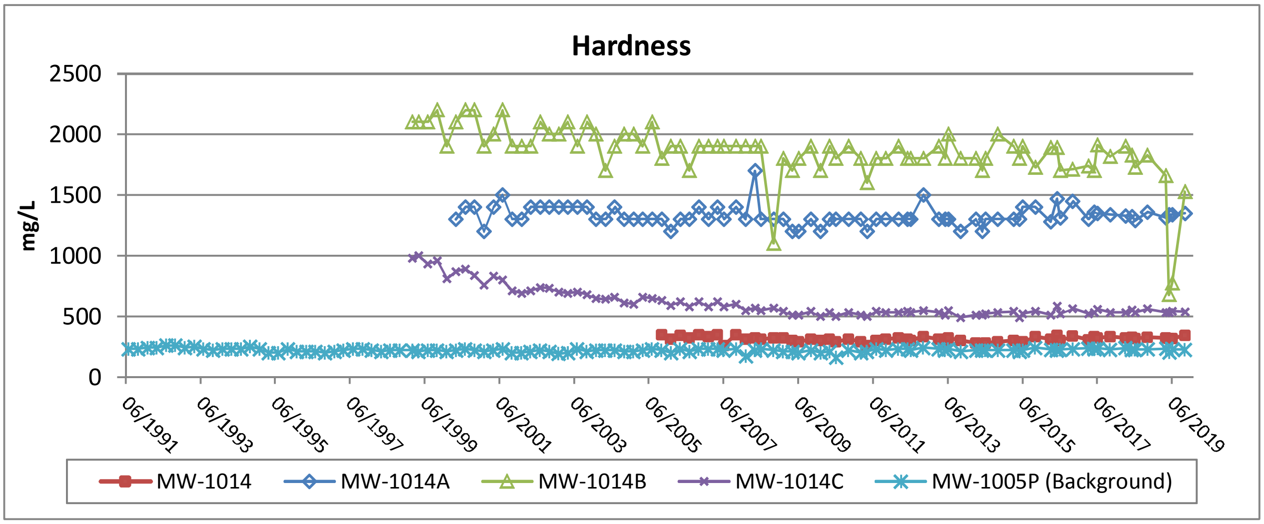

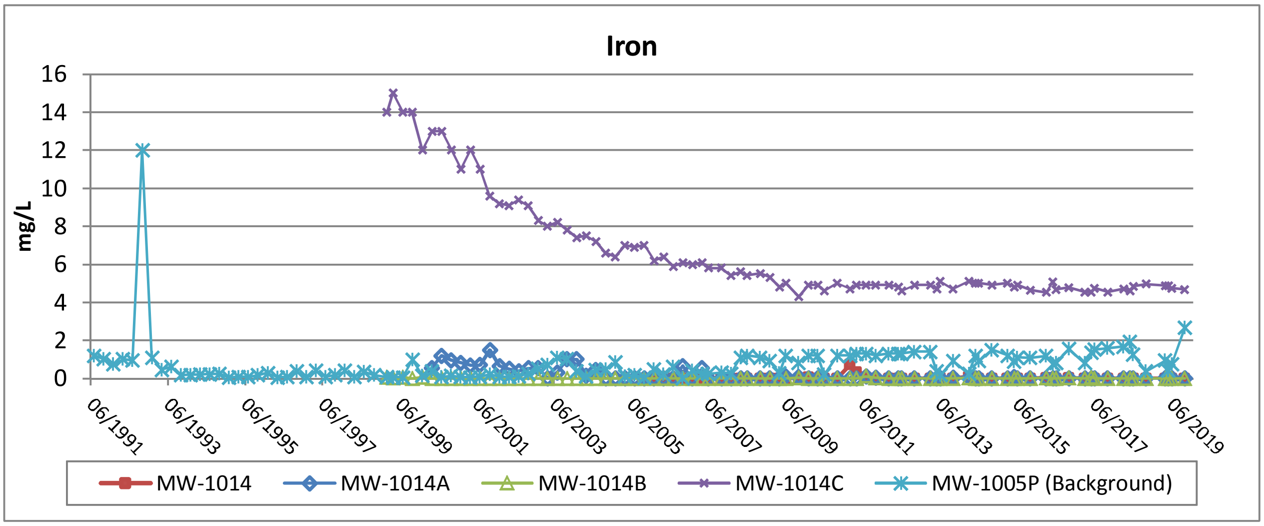

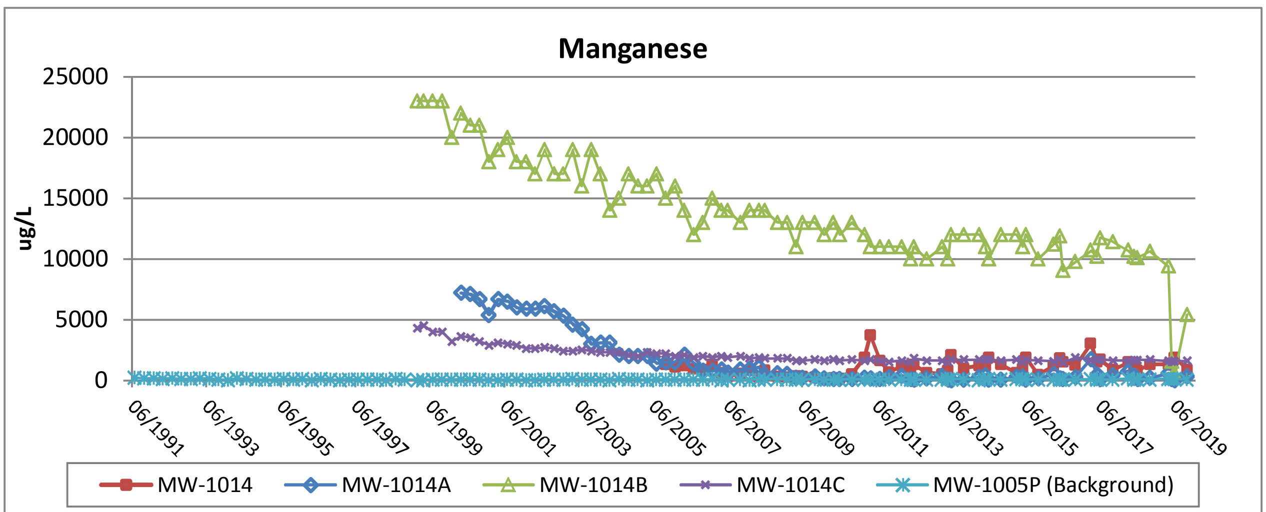

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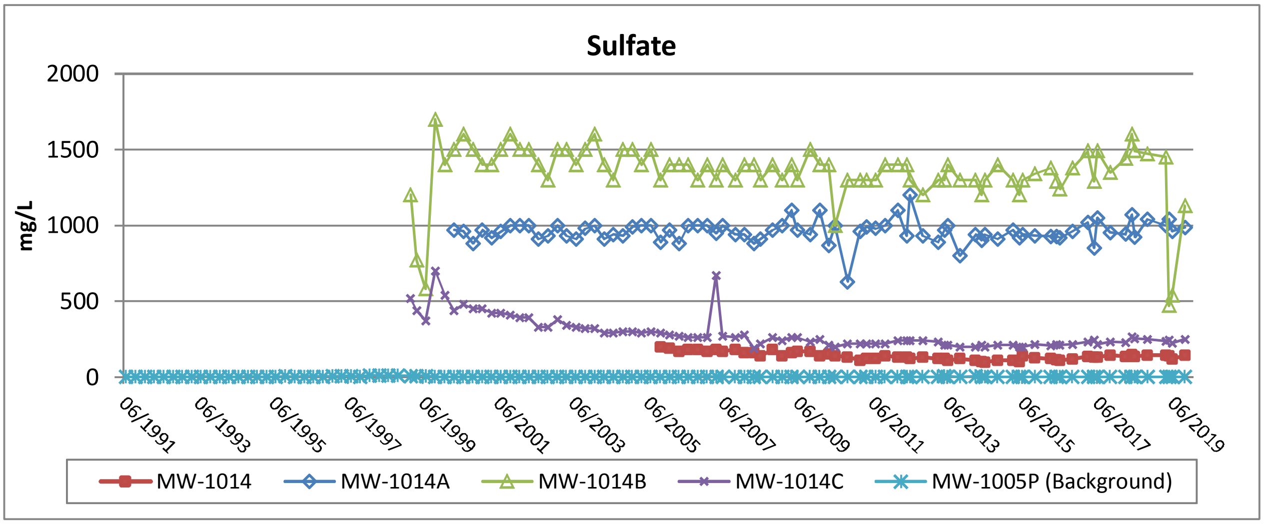
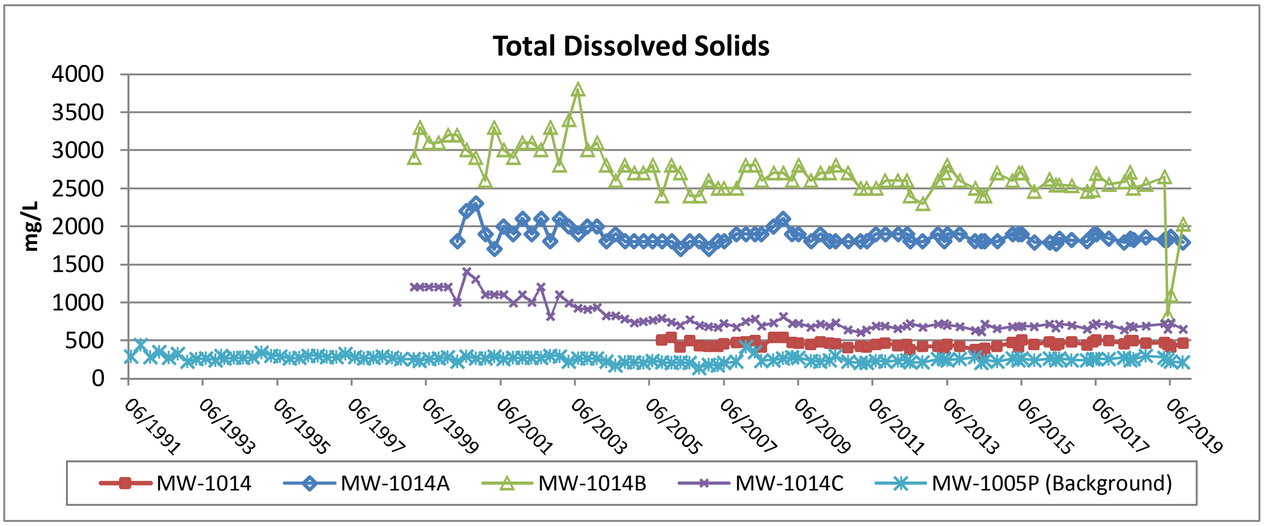
Figure B-7b

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1014/MW-1014A/MW-1014B/MW-1014C

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19





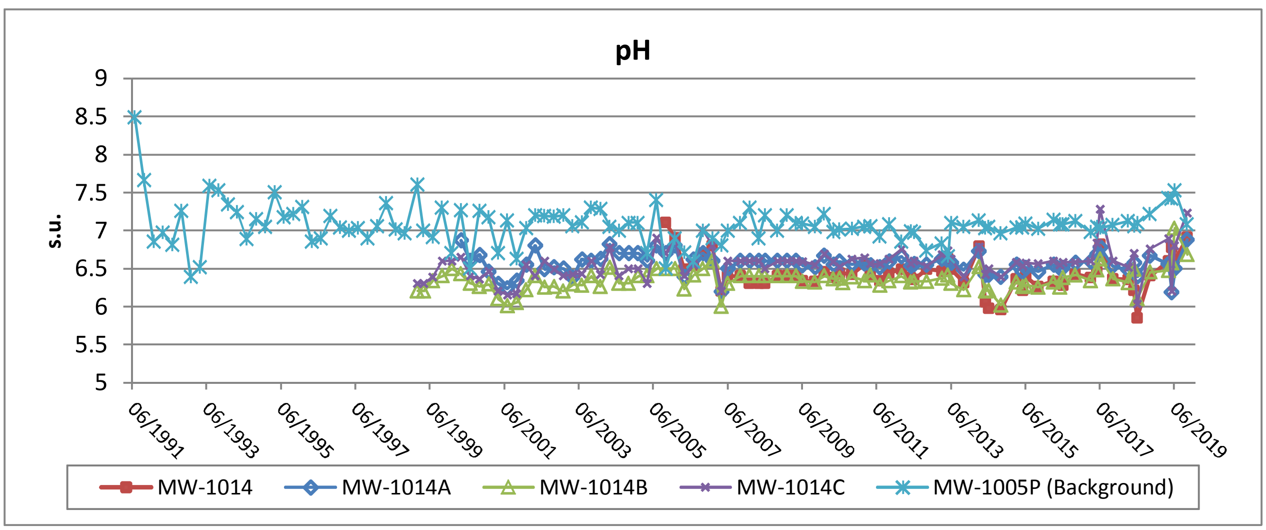


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Figure B-7c

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1014/MW-1014A/MW-1014B/MW-1014C

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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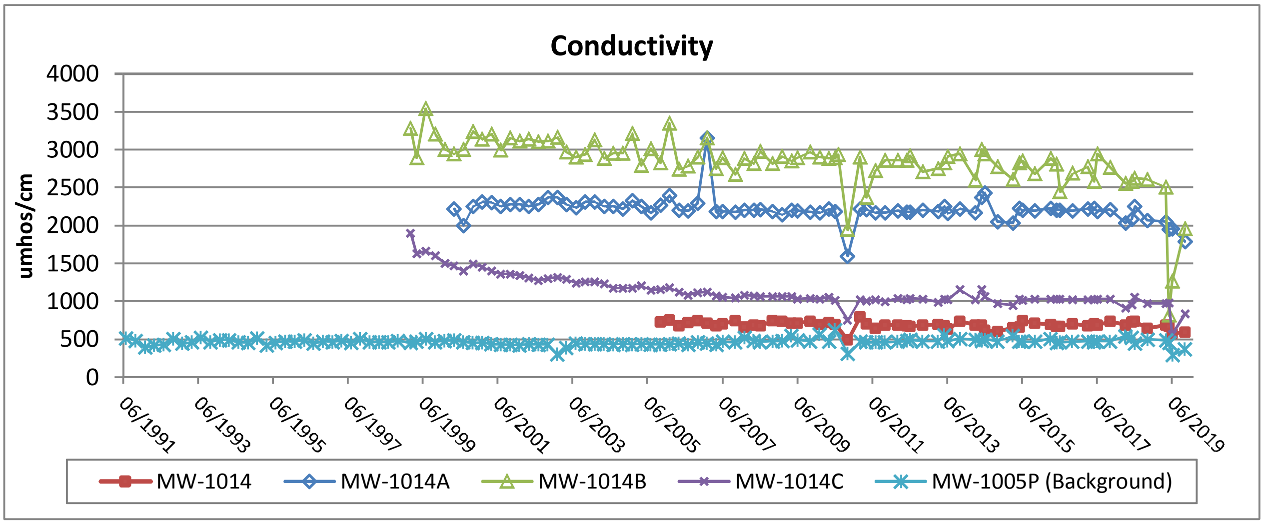

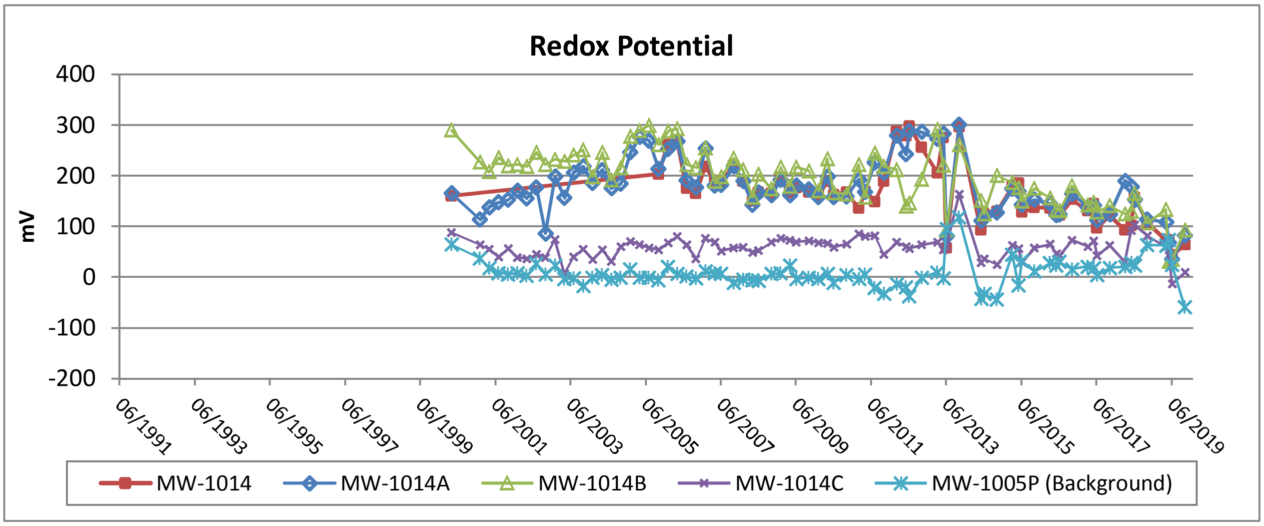

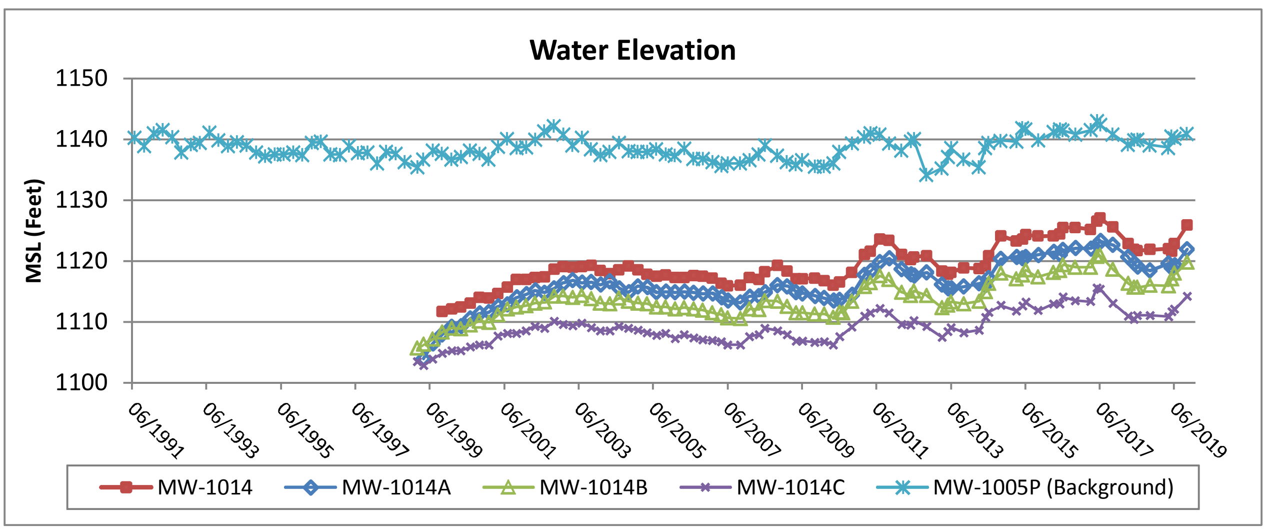

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Figure B-7d

Groundwater Trend Graphs - Quarterly Results (In-Pit Wells)

MW-1014/MW-1014A/MW-1014B/MW-1014C

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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2019 Groundwater Results - Quarterly Parameters

Sample Date (yyyy-mm)	Location		Water Elevation ft	Alkalinity as CaCO3 mg/l	Arsenic ug/l	Copper ug/l	Hardness mg/l	Iron mg/l	Manganese ug/l	Sulfate mg/l	Total Dissolved Solids mg/l	pH s.u.	Conductivity umhos/cm	Redox Potential mV
2019-04	MW-1000PR		1091.11	216	32.1	< 1.1	400	4.42	2090	205	532	6.85	738.19	-27.6
2019-04	MW-1000R		1091.67	146	< 0.28	39.2	216	< 0.111	2180	58.6	314	6.39	432.17	123.9
2019-04	MW-1002		1091.83	66.5	< 0.28	< 1.1	74.7	< 0.111	< 2.7	3.7	110	7.19	151.51	147.4
2019-04	MW-1002	Dup.		63.1	< 0.28	< 1.1	81.3	< 0.111	< 2.7	3.7	126			
2019-04	MW-1002G		1091.96	111	< 0.28	< 1.1	145	< 0.111	< 2.7	10.1	200	6.89	291.50	243.8
2019-04	MW-1004		1108.53	31.5	< 0.28	3.3	38.8	< 0.111	< 2.7	13.7	72.0	6.58	85.58	152.1
2019-04	MW-1004P		1106.25	155	< 0.28	< 1.1	140	0.14	77.2	2.1	160	7.07	277.65	54.0
2019-04	MW-1004S		1108.56	35.3	< 0.28	1.9	66.8	< 0.111	< 2.7	29.2	110	6.47	137.45	106.8
2019-04	MW-1005		1140.41	60.5	1.3	< 1.1	415	15.3	481	15.8	1010	6.62	1222.40	105.5
2019-04	MW-1005P		1138.59	235	< 0.28	< 1.1	233	0.948	125	< 1.0	272	7.43	484.45	61.9
2019-04	MW-1005S		1139.52	151	2.3	< 1.1	148	3.97	208	3.9	192	7.54	276.03	-53.3
2019-04	MW-1010P		1090.19	155	18.3	< 1.1	189	< 0.111	41.7	35.2	222	7.80	333.44	55.2
2019-04	MW-1013		1111.93	607	0.71	11.6	515	7.06	24600	16.8	680	6.41	931.90	66.8
2019-04	MW-1013A		1099.63	344	< 0.28	< 1.1	433	< 0.111	2710	182	638	6.68	869.50	42.4
2019-04	MW-1013B		1100.09	571	1.2	326	1910	< 0.111	17500	1710	2970	6.46	2928.20	183.8
2019-04	MW-1013C		1102.37	549	23.5	< 1.1	1840	14.4	8500	1610	2850	6.48	2727.80	-36.4
2019-04	MW-1014		1122.01	178	< 0.28	3.2	320	< 0.111	1290	143	472	6.60	679.29	73.4
2019-04	MW-1014A		1119.56	527	0.75	6.5	1310	< 0.111	584	998	1820	6.56	2051.20	107.9
2019-04	MW-1014B		1115.89	531	0.98	360	1660	< 0.111	9380	1450	2650	6.47	2504.70	132.8
2019-04	MW-1014C		1110.81	264	23.6	< 1.1	534	4.87	1590	234	718	6.89	968.70	59.7
2019-04	MW-1014C	Dup.		258	22.4	< 1.1	539	4.61	1600	245	710			
2019-04	MW-1015A		1090.98	83.4	< 0.28	< 1.1	95.1	< 0.111	9.0	8.4	134	6.45	182.84	62.6
2019-04	MW-1015B		1090.29	179	< 0.28	< 1.1	138	0.111	44.7	1.6	278	7.82	476.90	-73.1
2019-05	MW-1000PR		1093.9	210	19.9	< 1.1	422	3.27	1810	211	518	6.61	743	-0.5
2019-05	MW-1000R		1095.72	49.9	< 0.28	7.1	86.8	< 0.111	4.5	38.6	150	6.20	142	89.0
2019-05	MW-1002		1097.08	63.5	< 0.28	< 1.1	75.8	< 0.111	< 2.7	3.3	102	7.23	153	92.5
2019-05	MW-1002	Dup.		63.6	< 0.28	< 1.1	74.2	< 0.111	3.9	3.9	104			
2019-05	MW-1002G		1096.91	117	< 0.28	1.4	150	< 0.111	< 2.7	9.5	196	6.94	303	94.9
2019-05	MW-1004		1111.28	28.7	< 0.28	4.1	38.8	< 0.111	< 2.7	10.3	66.0	7.60	83	83.9
2019-05	MW-1004P		1108.56	168	0.55	< 1.1	151	0.455	126	1.8	168	6.47	283	81.4
2019-05	MW-1004S		1111.51	48.3	< 0.28	1.8	69.3	< 0.111	< 2.7	27.6	134	7.15	151	84.9
2019-05	MW-1005		1141.55	62.4	1.1	< 1.1	510	15.1	463	14.3	1040	6.35	1289	47.5
2019-05	MW-1005P		1140.41	228	0.30	< 1.1	205	0.395	125	< 1.0	248	7.42	447	72.5
2019-05	MW-1005S		1141.5	149	2.4	< 1.1	149	3.76	196	4.0	176	6.74	285	-54.1
2019-05	MW-1010P		1093.62	146	19.0	1.1	177	< 0.111	26.6	39.2	214	7.36	349	21.4
2019-05	MW-1013		1113.6	603	0.82	3.7	566	12.8	25300	17.5	660	6.37	945	88.1
2019-05	MW-1013A		1099.98	365	< 0.28	< 1.1	484	< 0.111	3590	225	656	6.78	885	132.8
2019-05	MW-1013B		1100.43	518	1.1	218	2170	< 0.111	11900	1840	2940	5.98	3011	163.3
2019-05	MW-1013C		1103.55	475	22.7	24.1	2170	15.4	9680	1440	2830	6.55	2869	25.3
2019-05	MW-1014		1121.58	158	< 0.28	3.0	315	< 0.111	1260	141	442	6.77	665	72.3
2019-05	MW-1014A		1118.82	467	0.85	3.0	1340	< 0.111	102	1040	1820	6.19	1948	67.5
2019-05	MW-1014B		1116.98	207	0.72	203	678	< 0.111	1540	470	828	6.57	817	30.3
2019-05	MW-1014C		1111.61	251	26.3	< 1.1	534	4.88	1540	245	648	6.20	979	42.5
2019-05	MW-1014C	Dup.		259	25.7	< 1.1	515	4.61	1480	254	674			
2019-05	MW-1015A		1093.86	87.8	< 0.28	< 1.1	99.6	< 0.111	8.3	7.3	122	7.17	185	65.2
2019-05	MW-1015B		1093.08	166	< 0.28	< 1.1	164	< 0.111	43.2	< 1.0	294	6.84	478	63.2
2019-06	MW-1000PR		1089.19	212	11.1	2.5	407	2.35	1940	194	514	6.76	708.45	2.9
2019-06	MW-1000R		1090.75	98.1	< 0.28	15.0	212	< 0.111	340	89.9	278	7.04	235.78	97.2
2019-06	MW-1002		1095.71	64.3	< 0.28	< 1.1	78.2	< 0.111	< 2.7	4.1	94.0	6.81	154.60	35.5
2019-06	MW-1002	Dup.		65.2	< 0.28	< 1.1	81.2	< 0.111	< 2.7	4.2	96.0			
2019-06	MW-1002G		1095.52	116	< 0.28	< 1.1	158	< 0.111	< 2.7	10.2	190	7.04	299.15	44.0
2019-06	MW-1004		1110.23	29.5	< 0.28	4.4	37.7	< 0.111	< 2.7	9.6	48.0	7.71	74.62	42.5
2019-06	MW-1004P		1108.35	156	0.87	< 1.1	162	0.914	159	2.2	136	7.46	250.23	31.2
2019-06	MW-1004S		1110.34	33.1	< 0.28	1.6	71.6	< 0.111	< 2.7	27.0	92.0	6.74	141.68	42.3
2019-06	MW-1005		1141.11	41.9	1.7	< 1.1	590	19.6	538	15.9	1240	6.21	1265.70	15.9
2019-06	MW-1005P		1140.17	250	< 0.28	< 1.1	229	0.746	99.4	< 1.0	220	7.53	292.62	23.5
2019-06	MW-1005S		1141.03	154	2.4	< 1.1	152	3.57	196	3.8	178	7.25	279.90	42.2
2019-06	MW-1010P		1088.89	151	24.0	< 1.1	188	< 0.111	44.9	27.3	198	7.62	339.10	47.2
2019-06	MW-1013		1114.98	642	0.48	7.5	584	5.97	24700	15.8	692	6.33	944.07	19.0
2019-06	MW-1013A		1100.29	384	< 0.28	< 1.1	547	< 0.111	3890	230	746	6.70	583.12	18.9
2019-06	MW-1013B		1100.79	520	1.3	250	2100	< 0.111	16400	1790	3110	6.17	2780.50	35.2
2019-06	MW-1013C		1102.86	491	21.4	2.0	1990	14	8660	1490	2810	6.40	2695.10	-4.1
2019-06	MW-1014		1122.79	151	< 0.28	3.6	317	< 0.111	1860	119	410	6.62	573.78	42.8
2019-06	MW-1014A		1119.27	454	1.3	2.6	1340	< 0.111	30.2	960	1860	6.50	1959.40	35.0
2019-06	MW-1014B		1117.92	305	0.83	76.6	775	< 0.111	614	540	1090	7.03	1260.10	34.0
2019-06	MW-1014C		1112.08	263	25.9	< 1.1	543	4.74	1560	225	728	6.80	564.46	-13.9
2019-06	MW-1014C	Dup.		258	26.3	< 1.1	561	4.99	1650	231	734			
2019-06	MW-1015A		1090.29	79.7	< 0.28	< 1.1	100	< 0.111	7.2	7.7	116	7.15	175.91	50.2
2019-06	MW-1015B		1090.22	169	< 0.28	< 1.1	158	< 0.111	32.0	< 1.0	298	6.68	451.94	45.1
2019-10	MW-1000PR		1090.02	207	10.0	2.0	397	0.939	1920	180	486	7.37	608.40	29.6
2019-10	MW-1000R		1091.8	76.9	< 0.28	11.8	190	< 0.0580	54.8	84.9	268	6.71	314.20	70.1
2019-10	MW-1002		1094.4	70.2	< 0.28	< 1.1	81.5	< 0.0580	< 1.2	4.6	112	7.08	143.76	79.2
2019-10	MW-1002	Dup.		67.9	< 0.28	< 1.1	81.7	< 0.0580	< 1.2	4.4	104			
2019-10	MW-1002G		1094.22	118	< 0.28	< 1.1	150	< 0.0580	< 1.2	10.3	186	7.14	258.84	86.5
2019-10	MW-1004		1110.48	35.8	< 0.28	5.2	37.4	0.192	8.3	8.5	64.0	6.79	178.56	83.1
2019-10	MW-1004P		1108.77	163	< 0.28	< 1.1	147	0.0713	63.6	2.5	136	7.60	240.64	30.7
2019-10	MW-1004S		1110.59	53.6	< 0.28	1.5	74.8	< 0.0580	< 1.2	35.9	100	7.06	138.84	89.7
2019-10	MW-1005		1141.37	66.3	1.5	1.2	549	14.5	429	17.4	974	6.54	1442.10	51.8
2019-10	MW-1005P		1140.81	245	0.42	< 1.1	224	2.68	79.6	< 1.0	212	7.08	366.12	-60.1

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2019 Groundwater Results - Quarterly Parameters

Sample Date (yyyy-mm)	Location		Water Elevation ft	Alkalinity as CaCO3 mg/l	Arsenic ug/l	Copper ug/l	Hardness mg/l	Iron mg/l	Manganese ug/l	Sulfate mg/l	Total Dissolved Solids mg/l	pH s.u.	Conductivity umhos/cm	Redox Potential mV
2019-10	MW-1005S		1141.56	144	2.3	< 1.1	143	3.7	198	3.6	162	7.45	239.40	-85.1
2019-10	MW-1010P		1089.71	159	17.6	< 1.1	185	< 0.0580	28.0	38.2	208	8.23	286.90	37.9
2019-10	MW-1013		1115.48	646	< 2.8	< 10.9	492	13.5	23500	13.4	714	6.56	939.21	34.9
2019-10	MW-1013A		1100.56	367	< 0.56	< 2.2	481	< 0.116	4780	187	622	7.00	795.86	36.3
2019-10	MW-1013B		1101.03	615	< 2.8	406	2190	< 0.58	26600	1730	3010	6.51	2567.70	106.9
2019-10	MW-1013C		1104.4	551	22.2	< 10.9	1980	14.9	8770	1590	2740	6.79	2487.10	13.9
2019-10	MW-1014		1125.86	184	< 0.28	2.6	341	< 0.0580	872	142	464	6.91	589.52	63.9
2019-10	MW-1014A		1121.92	519	0.76	5.4	1350	< 0.0580	339	985	1790	6.88	1787.50	82.0
2019-10	MW-1014B		1119.75	475	0.97	140	1530	< 0.0580	5430	1130	2030	6.68	1956.60	92.4
2019-10	MW-1014C		1114.15	258	28.7	< 1.1	536	4.66	1590	249	644	7.23	833.24	9.1
2019-10	MW-1014C	Dup.		270	27.9	< 1.1	537	4.64	1600	244	660			
2019-10	MW-1015A		1090.49	96.4	< 0.28	< 1.1	102	< 0.0580	7.9	8.4	130	7.67	159.88	57.5
2019-10	MW-1015B		1090.55	178	< 0.28	< 1.1	159	0.197	45.2	< 1.0	294	8.00	491.74	3.0

Attachment 2

Groundwater - Annual Parameters

Trend Analysis
Trend Graphs
2019 Data

Trend Analysis Results - Surface Water
Year Ending 2019

	Conductivity (Field) (umhos/cm)	pH(Field) (su)	Copper	Hardness	Iron	Manganese	Zinc	Redox Potential	Total Suspended Solids
SW-1									
Trend Results for Most Recent 5 Years									
Sample Size	8	7	10	10	9	6	8	7	10
Mann-Kendall S	-8	1	-4	-13	18	-7	-1	-11	11
p-Level	0.398	1.000	0.795	0.292	0.076	0.272	0.952	0.136	0.380
Trend									
Trend Results for All Data Since Oct. 1997									
Sample Size	45	44	47	44	37	34	45	10	21
Mann-Kendall S	-201	-41	-27	-103	234	27	-32	-5	-17
p-Level	0.050	0.686	0.801	0.302	0.002	0.702	0.722	0.728	0.633
Trend					+				
SW-2									
Trend Results for Most Recent 5 Years									
Sample Size	8	7	10	10	9	6	8	7	10
Mann-Kendall S	-6	-1	-7	-11	26	-5	1	-9	-2
p-Level	0.548	1.000	0.600	0.380	0.006	0.470	0.952	0.238	0.931
Trend					+				
Trend Results for All Data Since Oct. 1997									
Sample Size	45	44	47	44	37	34	45	10	21
Mann-Kendall S	-223	19	141	-158	164	-10	52	-9	-39
p-Level	0.030	0.855	0.174	0.112	0.032	0.895	0.566	0.484	0.255
Trend									

Notes: Overall increasing trend denoted by "+".
Overall decreasing trend denoted by "-"
All trend tests performed at a Type I (two-tailed) error rate of 0.01.

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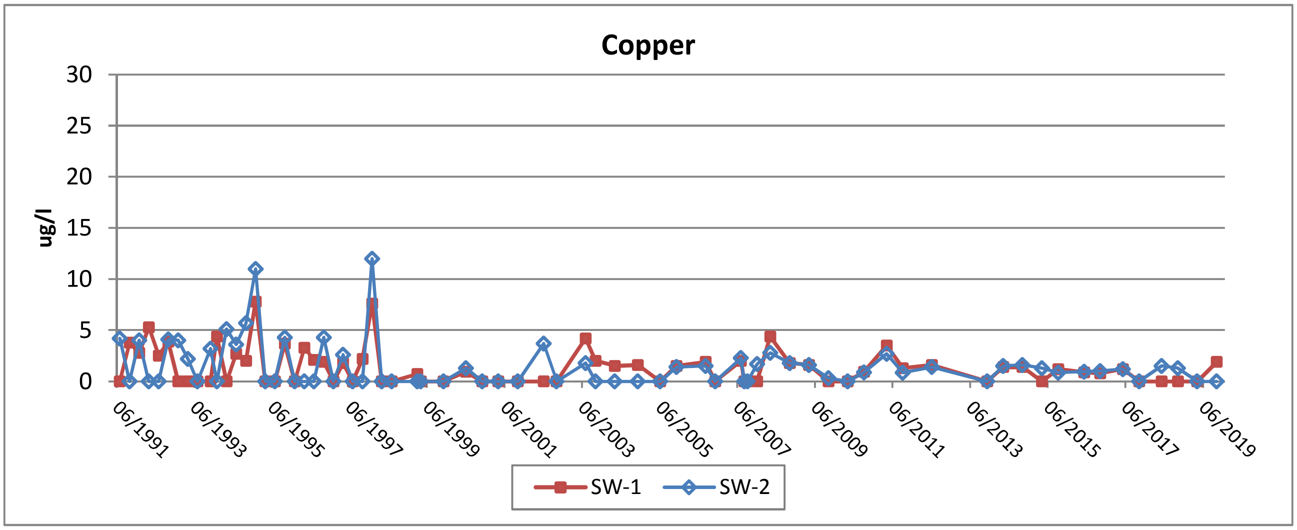

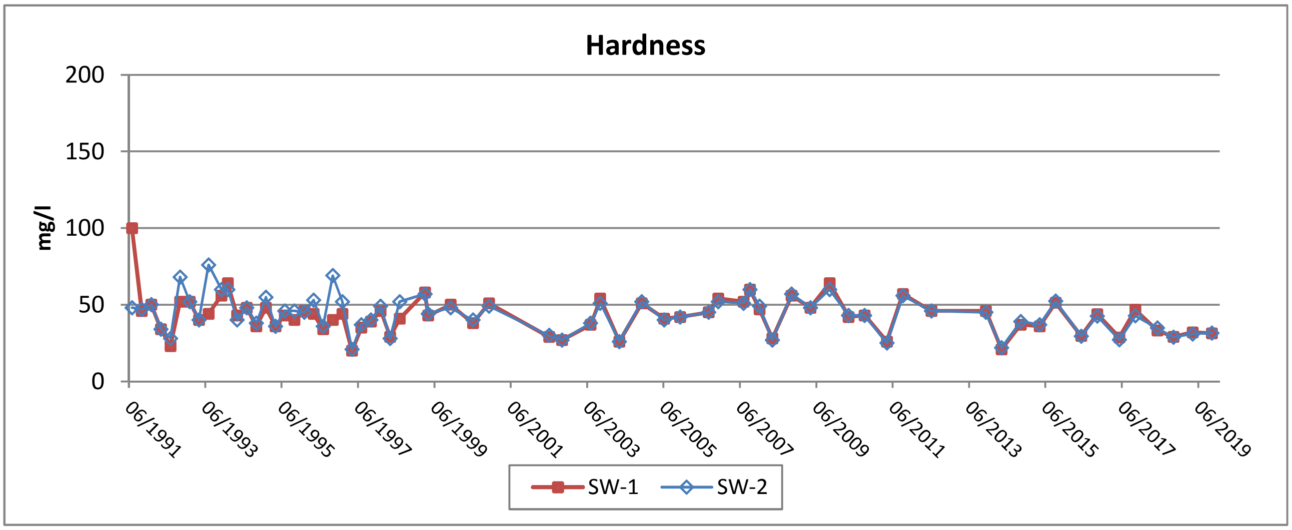

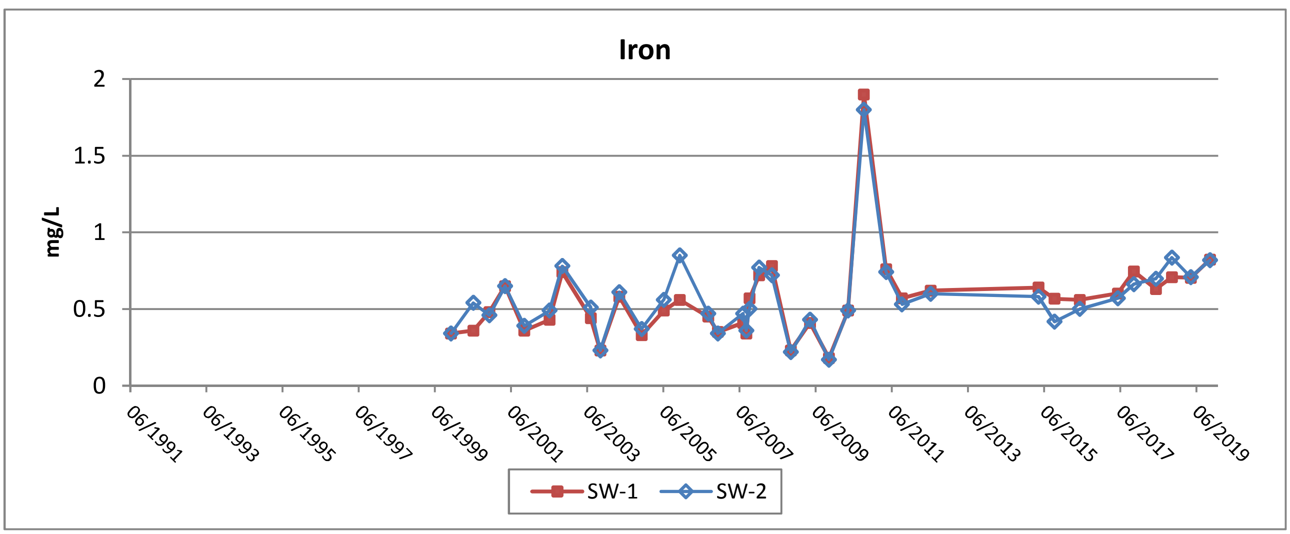

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Figure B-15a

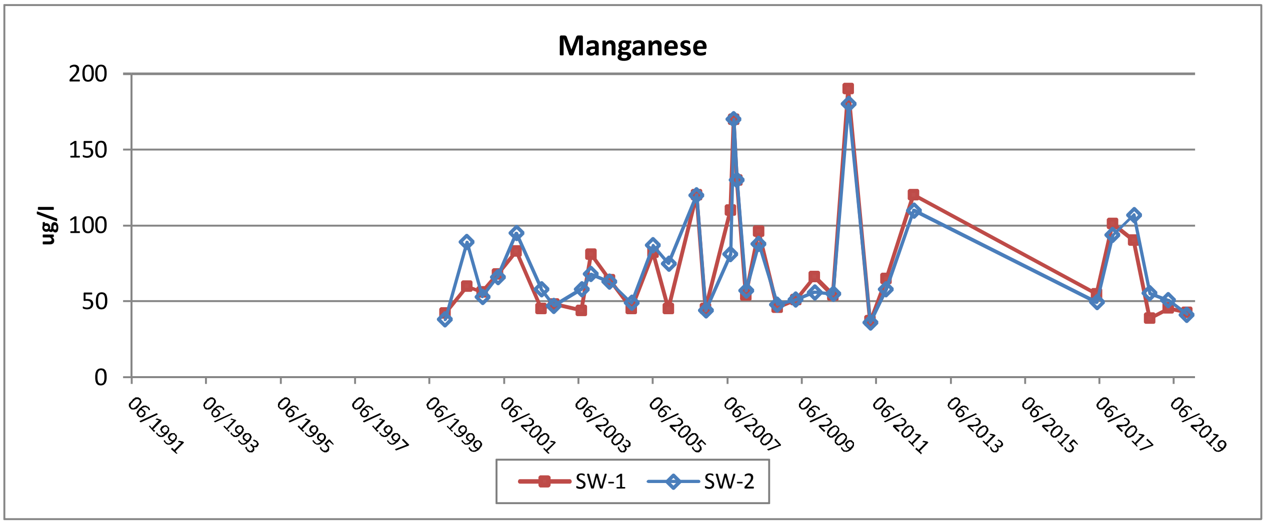
Surface Water Trend Graphs

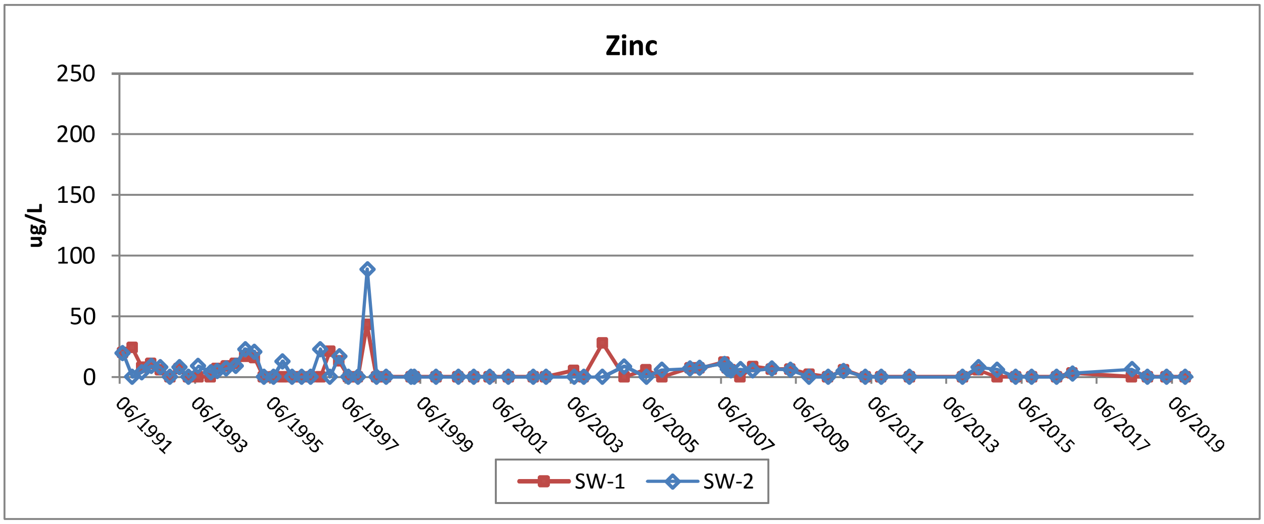
SW-1/SW-2

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19

pw:\Flambeau Mining\0017F777\10500 Reference Information\Stats\2019 Annual Report\SWGraphs.xlsm





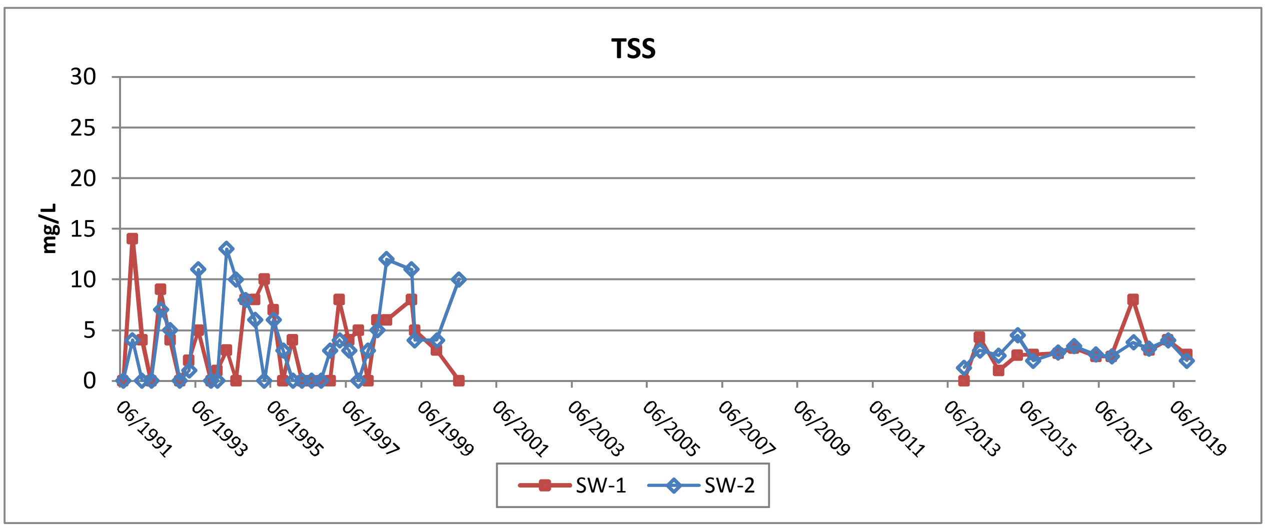


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Figure B-15b

Surface Water Trend Graphs

SW-1/SW-2

Scale: NA		Date: January 2020
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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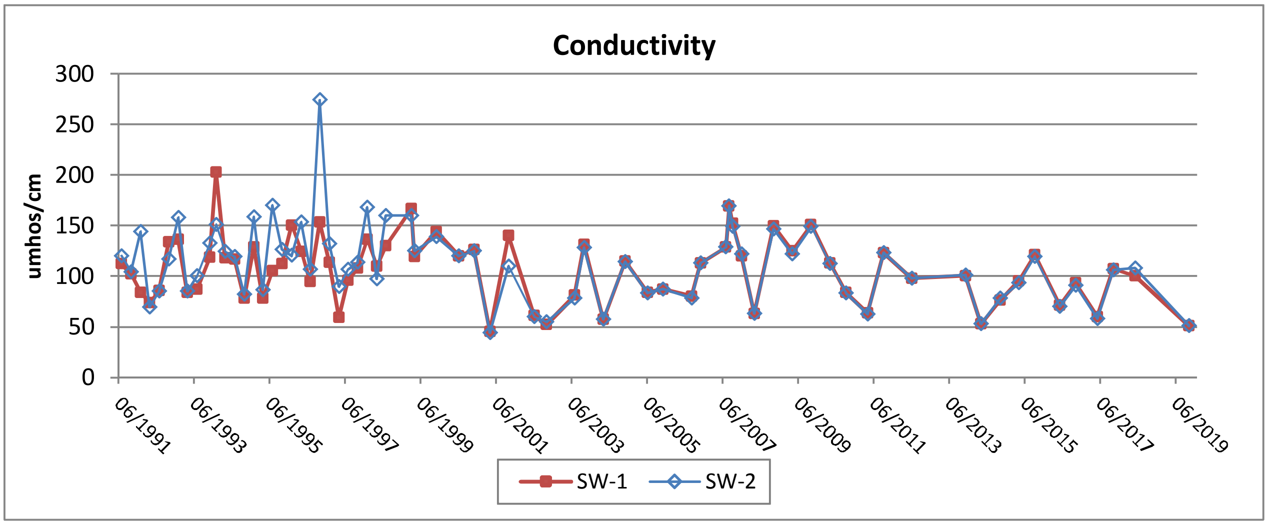

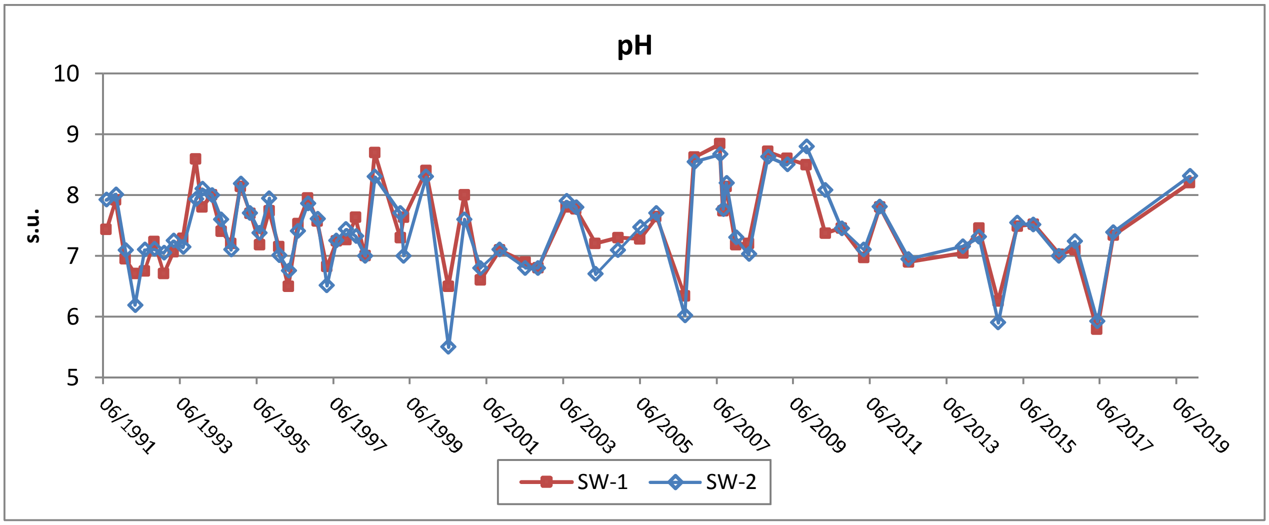

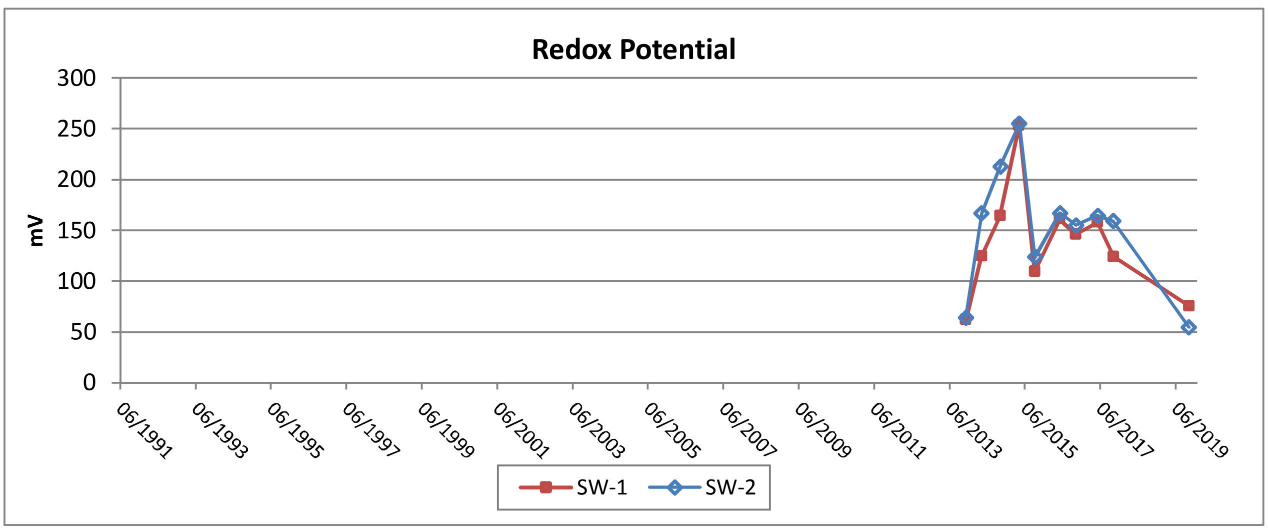

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Figure B-15c

Surface Water Trend Graphs

SW-1/SW-2

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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2019 Surface Water Results

Sample Date (yyyy-mm)	Location		Conductivity (Field) umhos/cm	pH (Field) s.u.	Copper ug/l	Hardness mg/l	Iron mg/l	Manganese ug/l	Zinc ug/l	Redox Potential mV	Total Suspended Solids mg/l
2019-04	SW-1				< 1.1	32.0	0.704	45.3	< 4.6		4.0
2019-04	SW-2				< 1.1	31.0	0.708	50.6	< 4.6		4.0
2019-10	SW-1		51.25	8.20	1.9	31.4	0.822	42.4	< 10.3	75.3	2.6
2019-10	SW-1	Dup.			< 1.1	31.2	0.782	41.2	< 10.3		2.0
2019-10	SW-2		50.89	8.31	< 1.1	31.6	0.819	41.2	< 10.3	54.6	2.0

Attachment 3

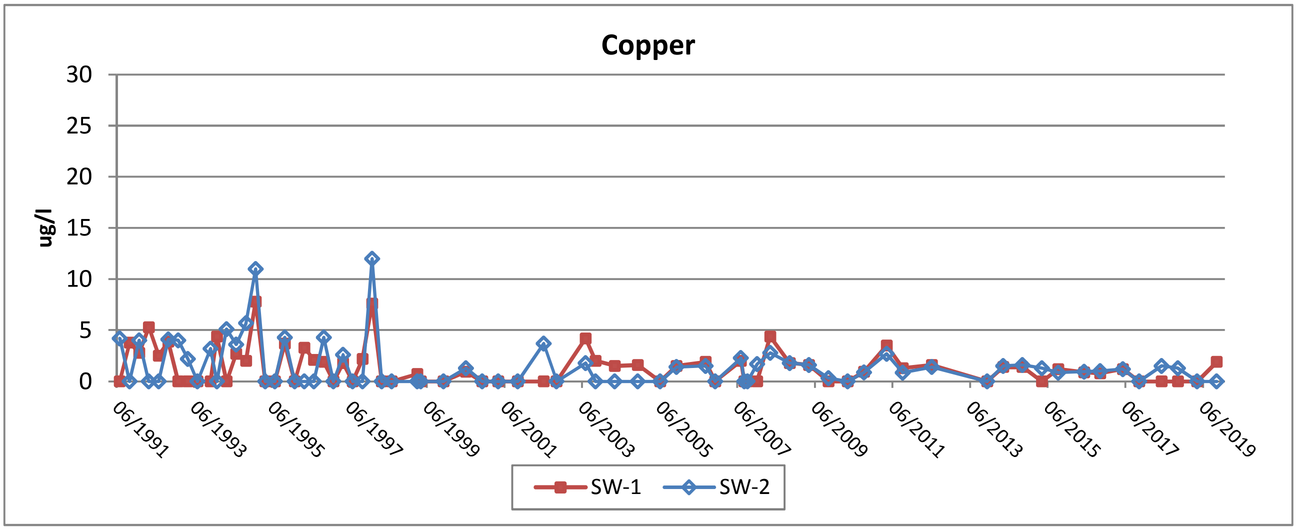
Surface Water

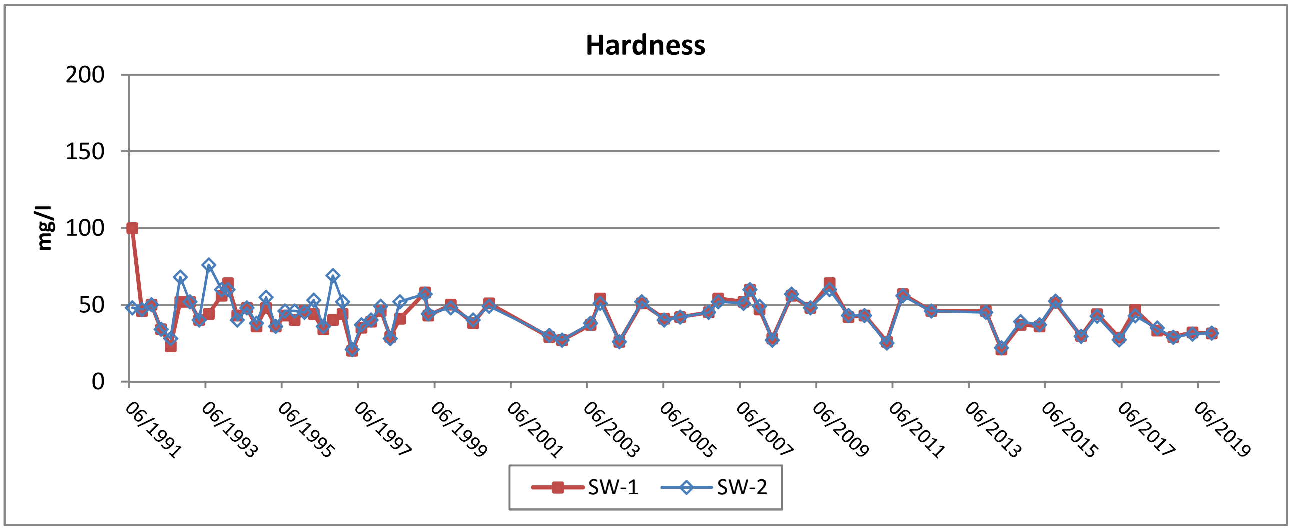
Trend Analysis
Trend Graphs
2019 Data

Trend Analysis Results - Surface Water
Year Ending 2019

	Conductivity (Field) (umhos/cm)	pH(Field) (su)	Copper	Hardness	Iron	Manganese	Zinc	Redox Potential	Total Suspended Solids
SW-1									
Trend Results for Most Recent 5 Years									
Sample Size	8	7	10	10	9	6	8	7	10
Mann-Kendall S	-8	1	-4	-13	18	-7	-1	-11	11
p-Level	0.398	1.000	0.795	0.292	0.076	0.272	0.952	0.136	0.380
Trend									
Trend Results for All Data Since Oct. 1997									
Sample Size	45	44	47	44	37	34	45	10	21
Mann-Kendall S	-201	-41	-27	-103	234	27	-32	-5	-17
p-Level	0.050	0.686	0.801	0.302	0.002	0.702	0.722	0.728	0.633
Trend					+				
SW-2									
Trend Results for Most Recent 5 Years									
Sample Size	8	7	10	10	9	6	8	7	10
Mann-Kendall S	-6	-1	-7	-11	26	-5	1	-9	-2
p-Level	0.548	1.000	0.600	0.380	0.006	0.470	0.952	0.238	0.931
Trend					+				
Trend Results for All Data Since Oct. 1997									
Sample Size	45	44	47	44	37	34	45	10	21
Mann-Kendall S	-223	19	141	-158	164	-10	52	-9	-39
p-Level	0.030	0.855	0.174	0.112	0.032	0.895	0.566	0.484	0.255
Trend									

Notes: Overall increasing trend denoted by "+".
Overall decreasing trend denoted by "-"
All trend tests performed at a Type I (two-tailed) error rate of 0.01.





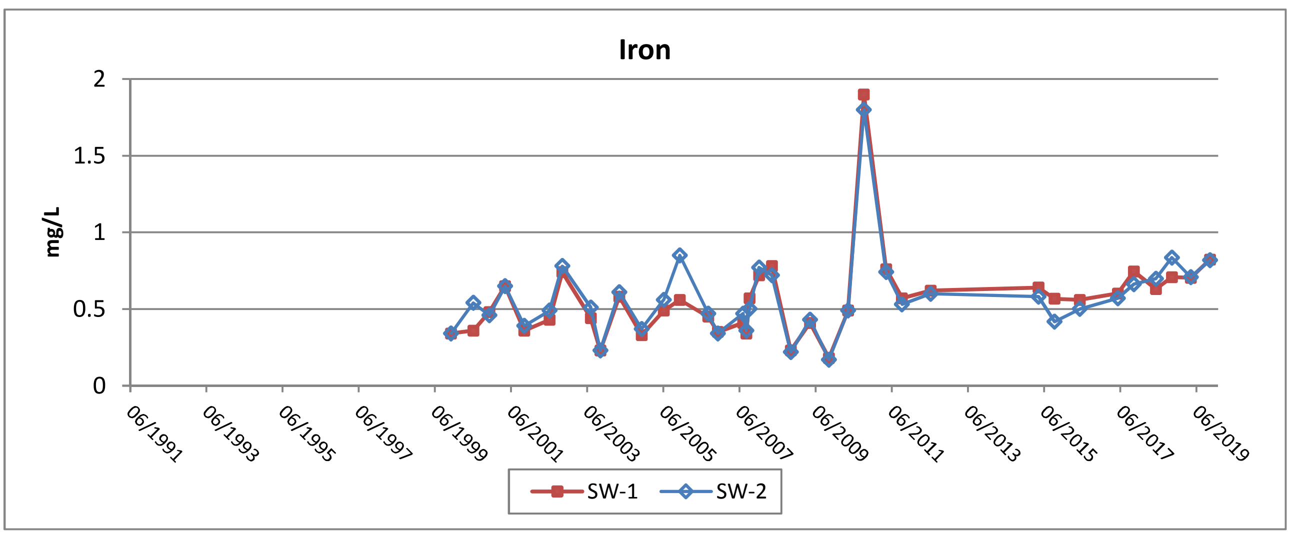


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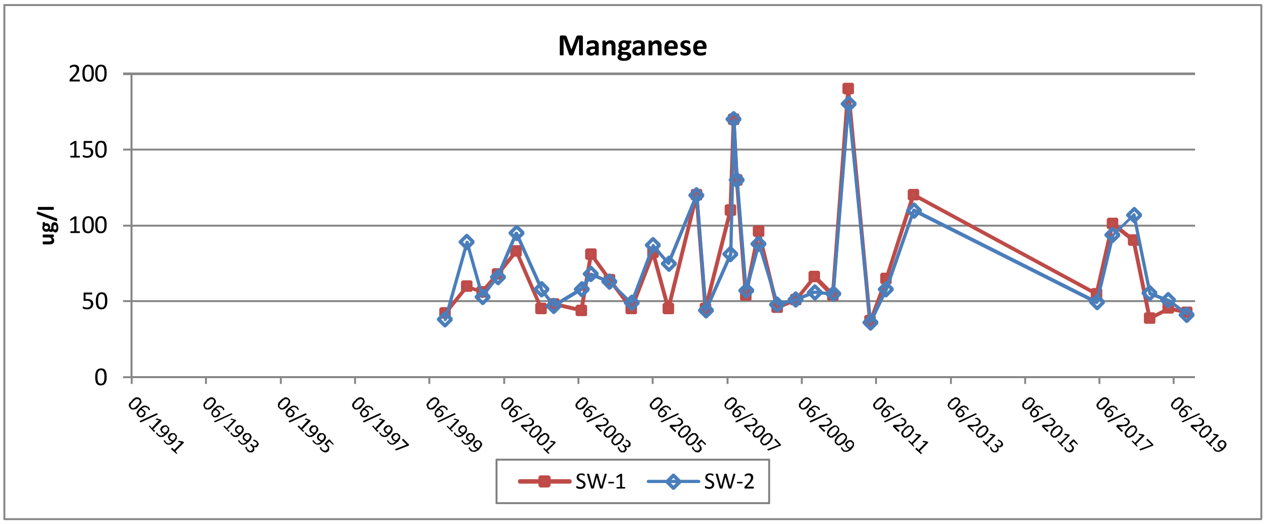
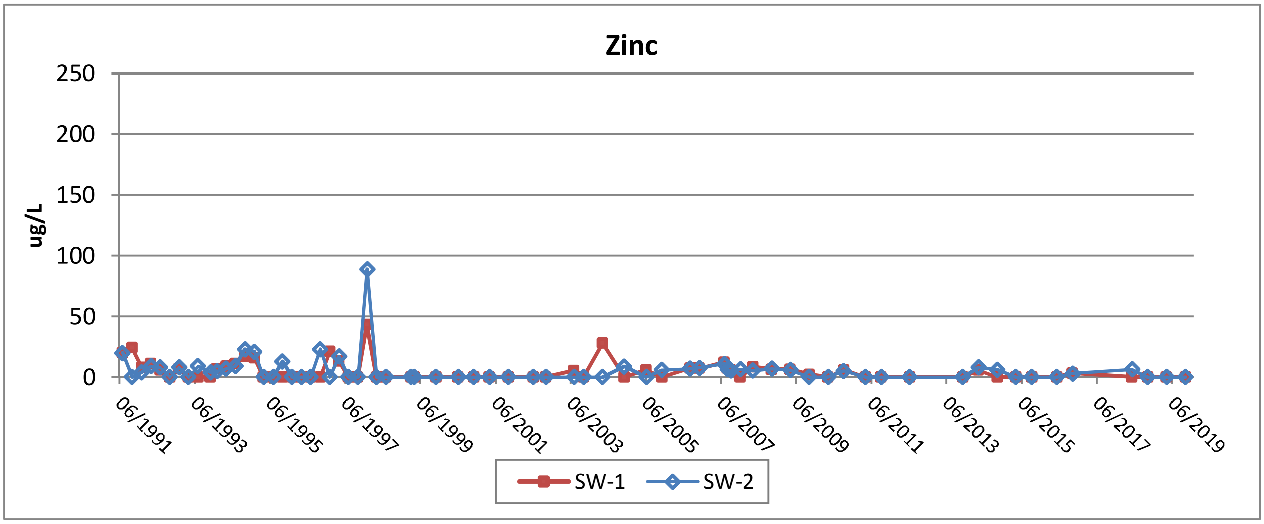
Figure B-15a
Surface Water Trend Graphs
SW-1/SW-2

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19





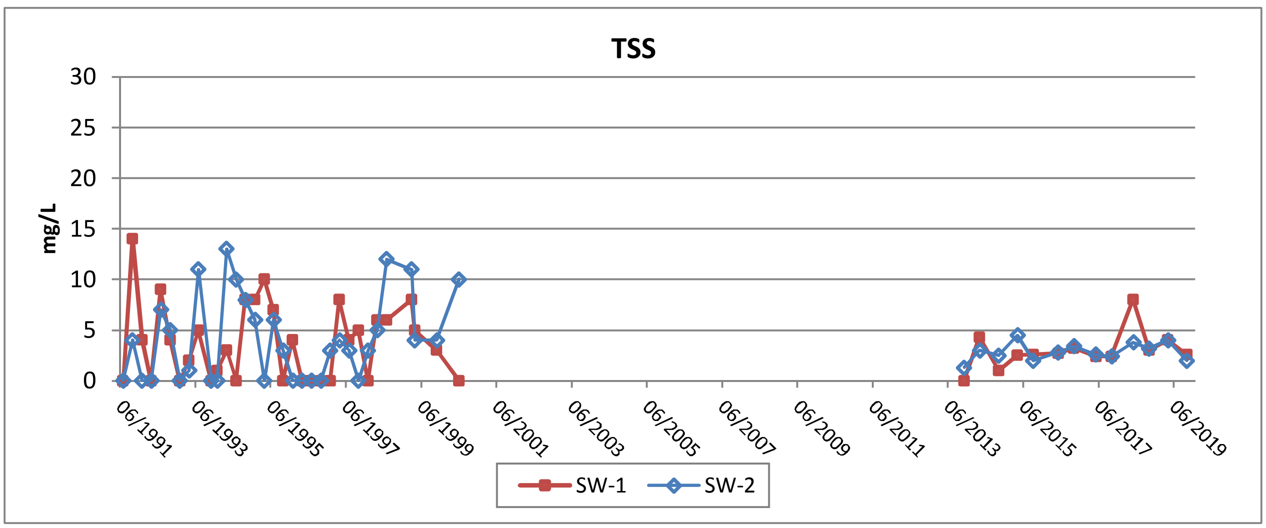


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Figure B-15b

Surface Water Trend Graphs

SW-1/SW-2

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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2019 Annual Summary Memorandum

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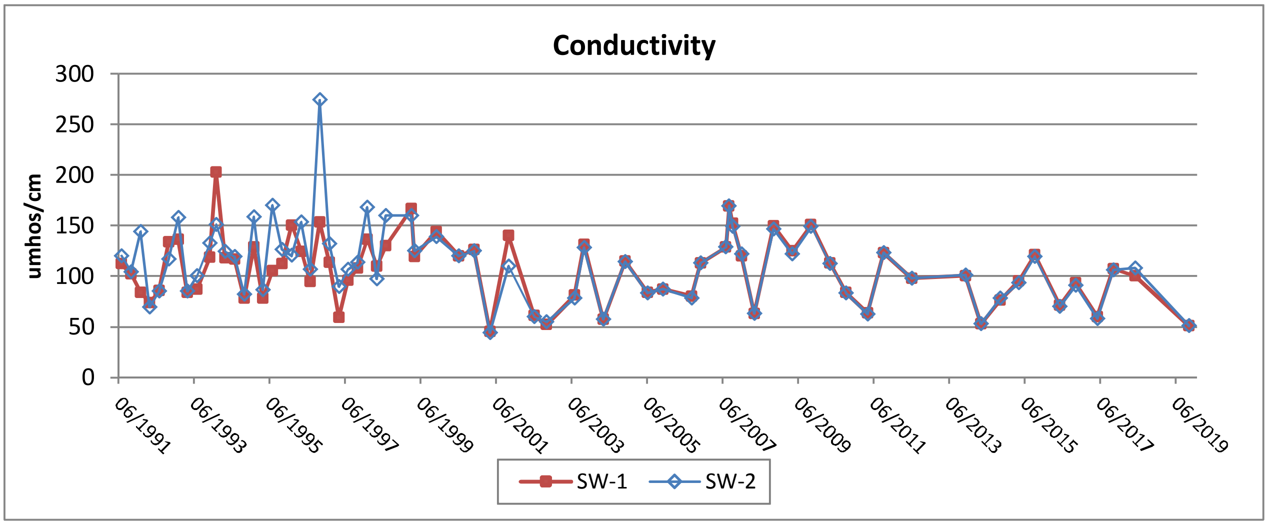

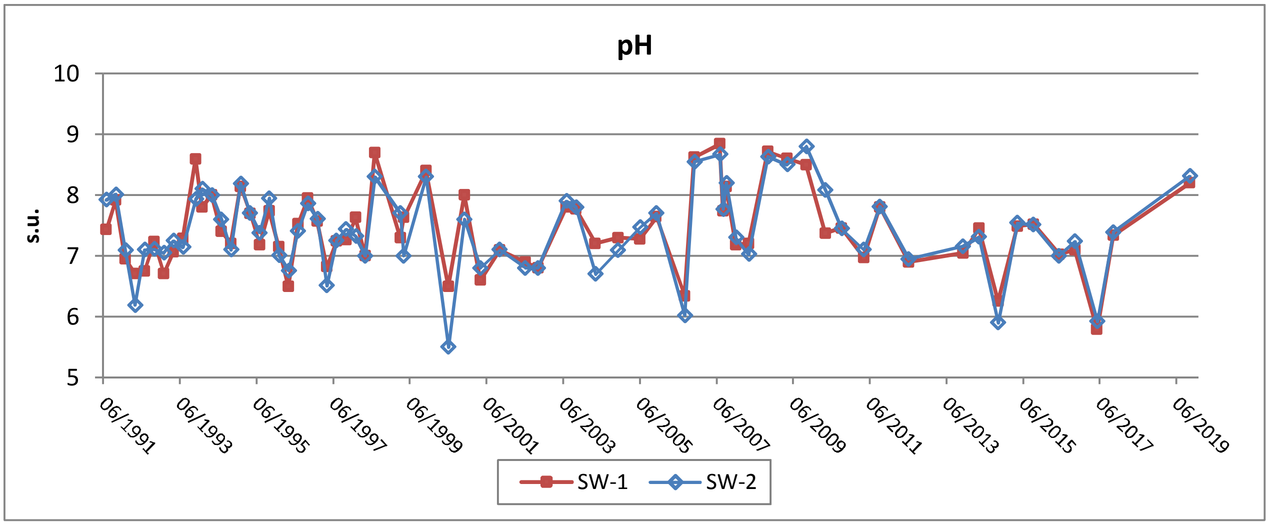

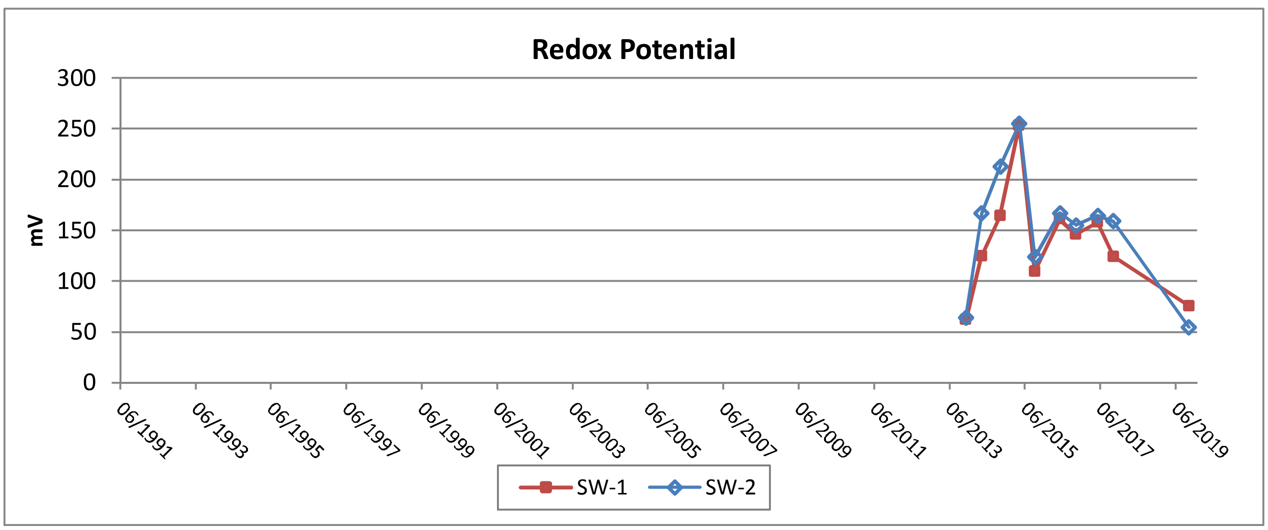

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Figure B-15c

Surface Water Trend Graphs

SW-1/SW-2

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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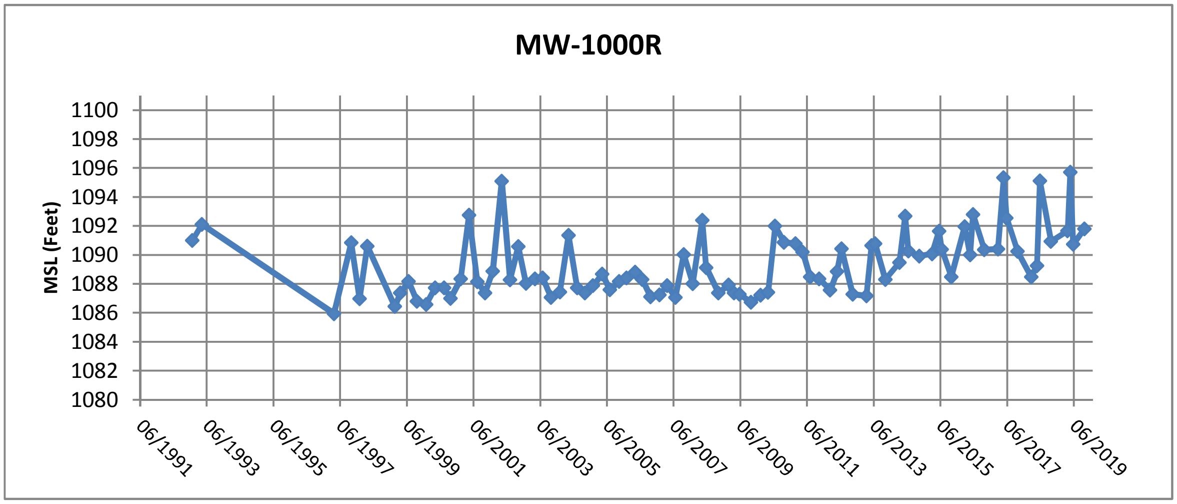
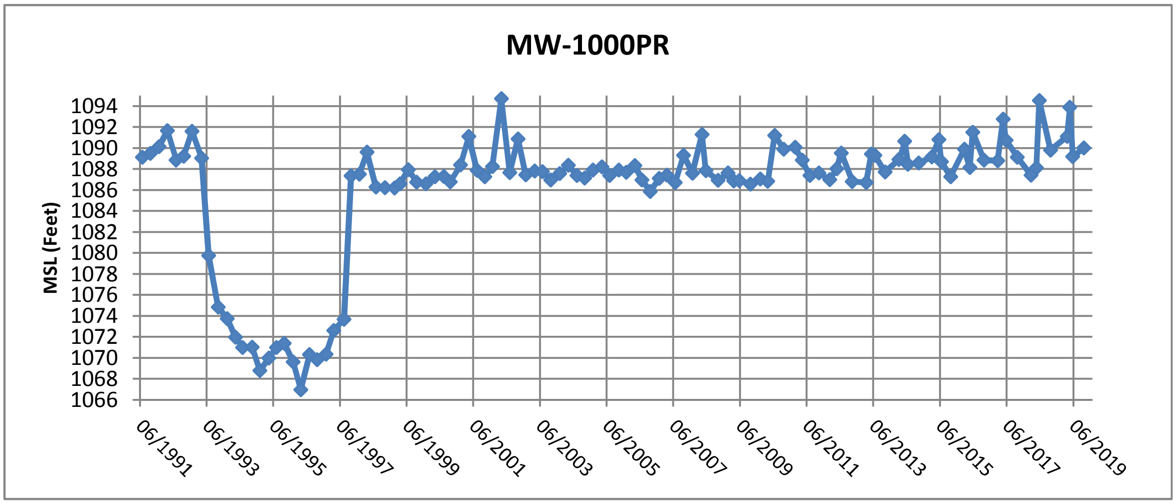
2019 Surface Water Results

Sample Date (yyyy-mm)	Location		Conductivity (Field) umhos/cm	pH (Field) s.u.	Copper ug/l	Hardness mg/l	Iron mg/l	Manganese ug/l	Zinc ug/l	Redox Potential mV	Total Suspended Solids mg/l
2019-04	SW-1				< 1.1	32.0	0.704	45.3	< 4.6		4.0
2019-04	SW-2				< 1.1	31.0	0.708	50.6	< 4.6		4.0
2019-10	SW-1		51.25	8.20	1.9	31.4	0.822	42.4	< 10.3	75.3	2.6
2019-10	SW-1	Dup.			< 1.1	31.2	0.782	41.2	< 10.3		2.0
2019-10	SW-2		50.89	8.31	< 1.1	31.6	0.819	41.2	< 10.3	54.6	2.0

Attachment 4

Hydrographs





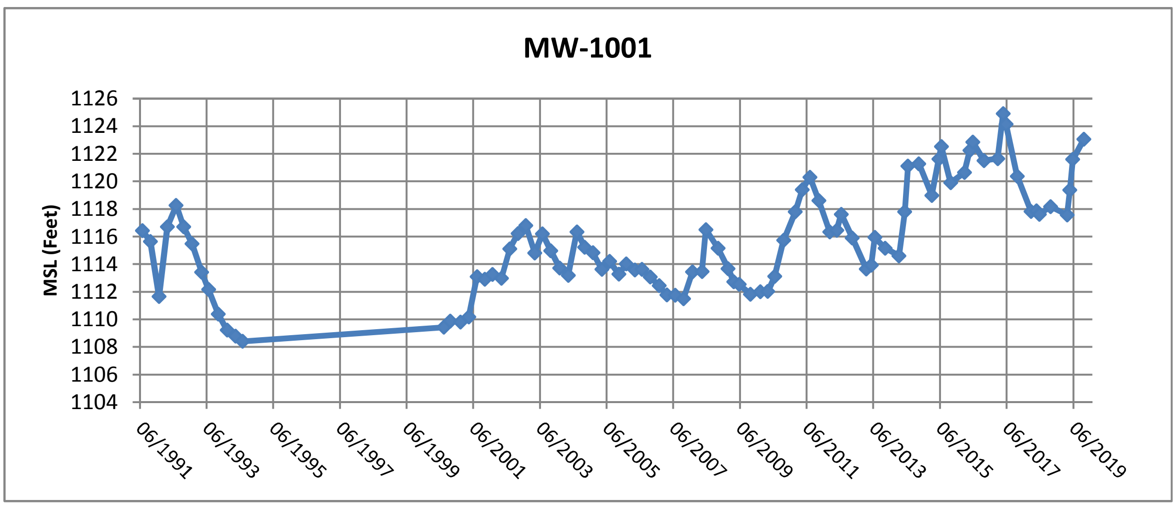


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Figure B-16a
Hydrographs

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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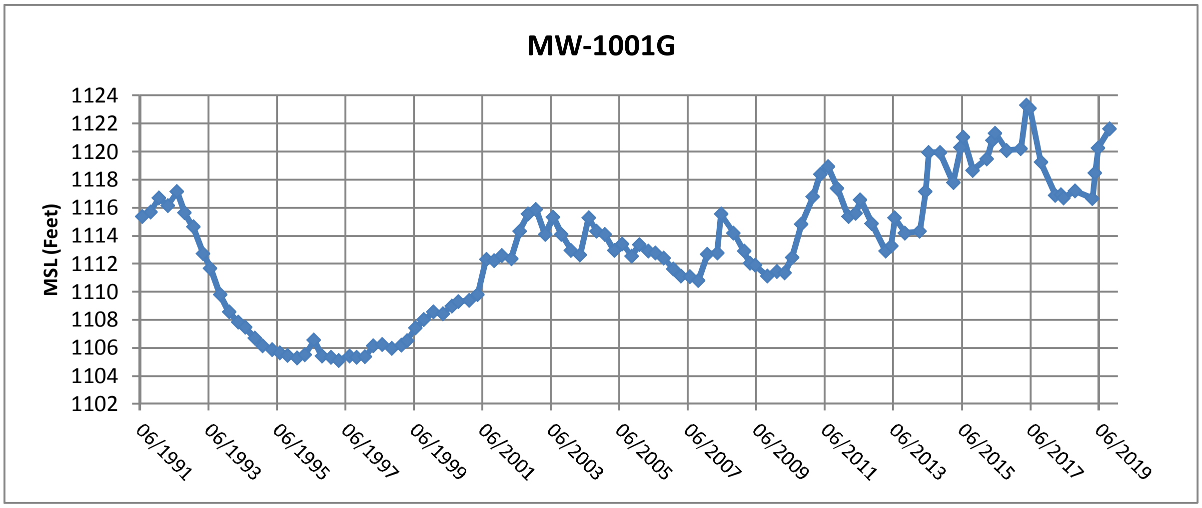

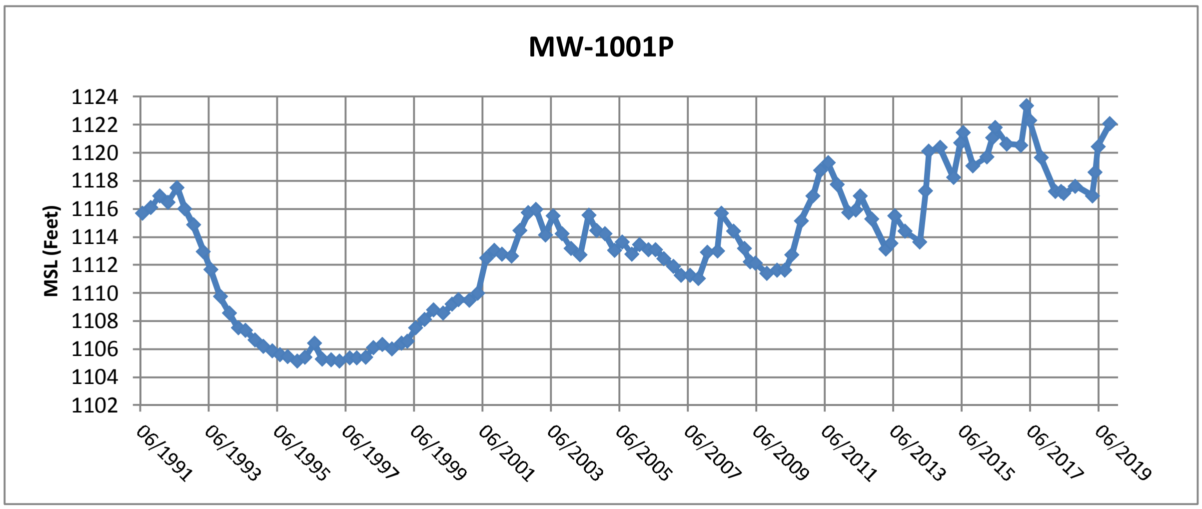

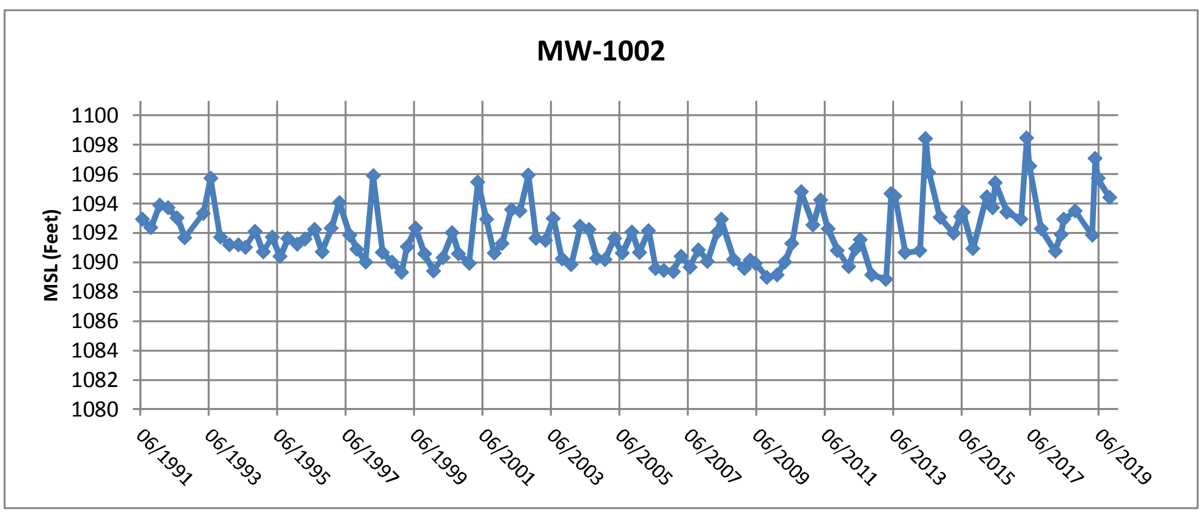

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Figure B-16b
Hydrographs

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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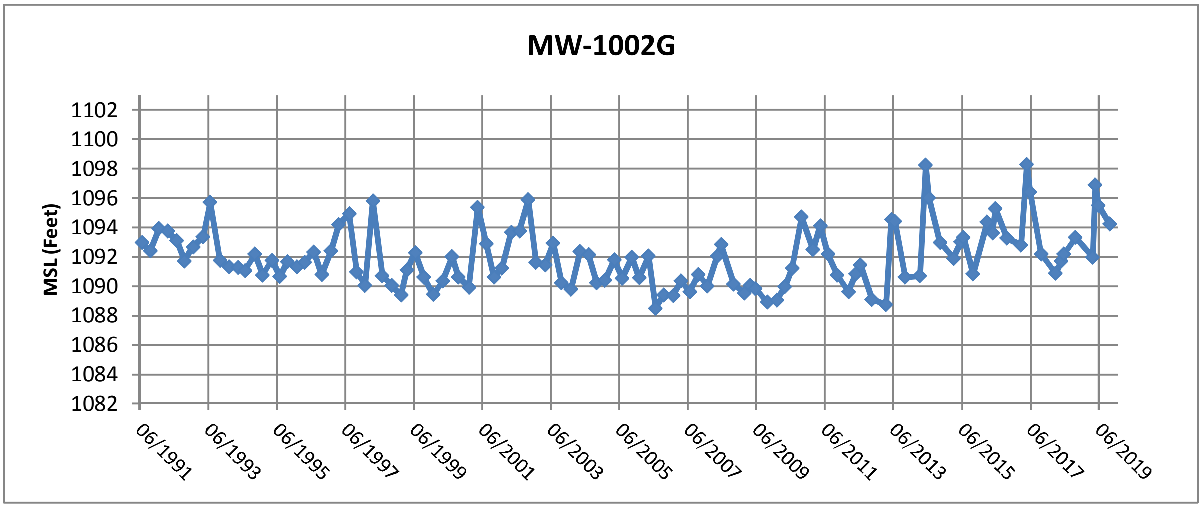

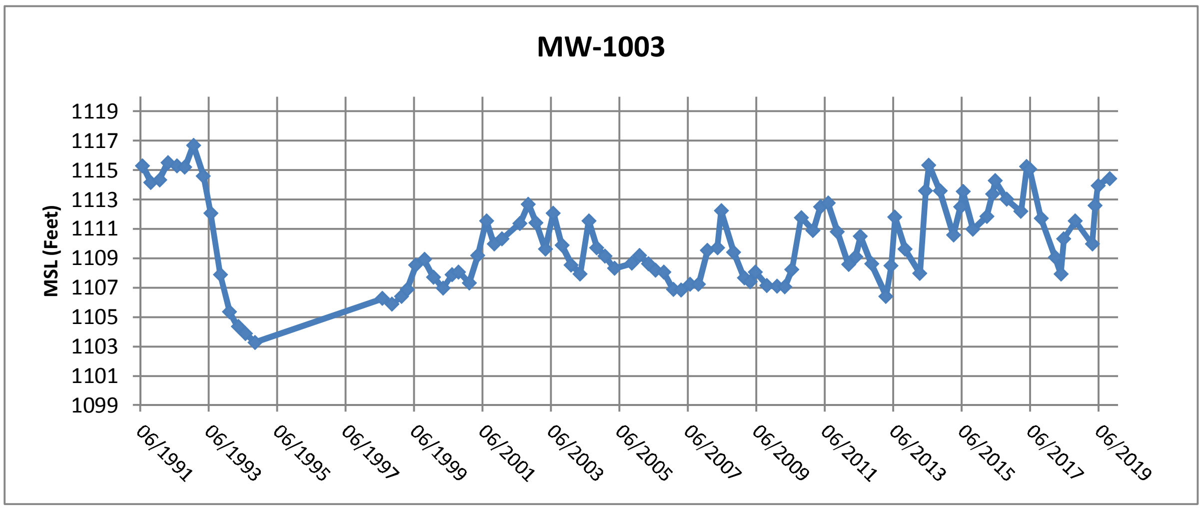

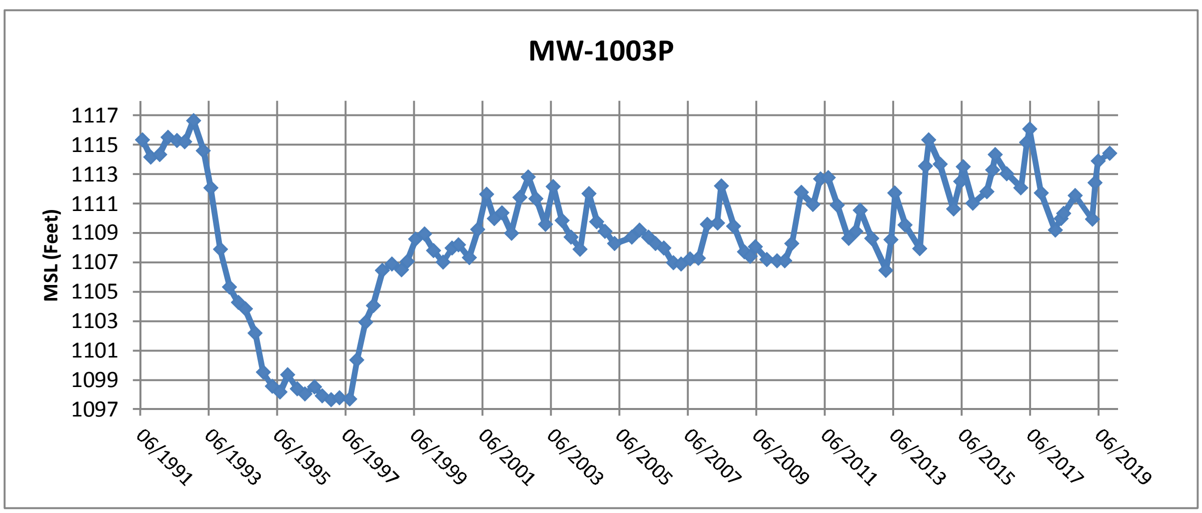

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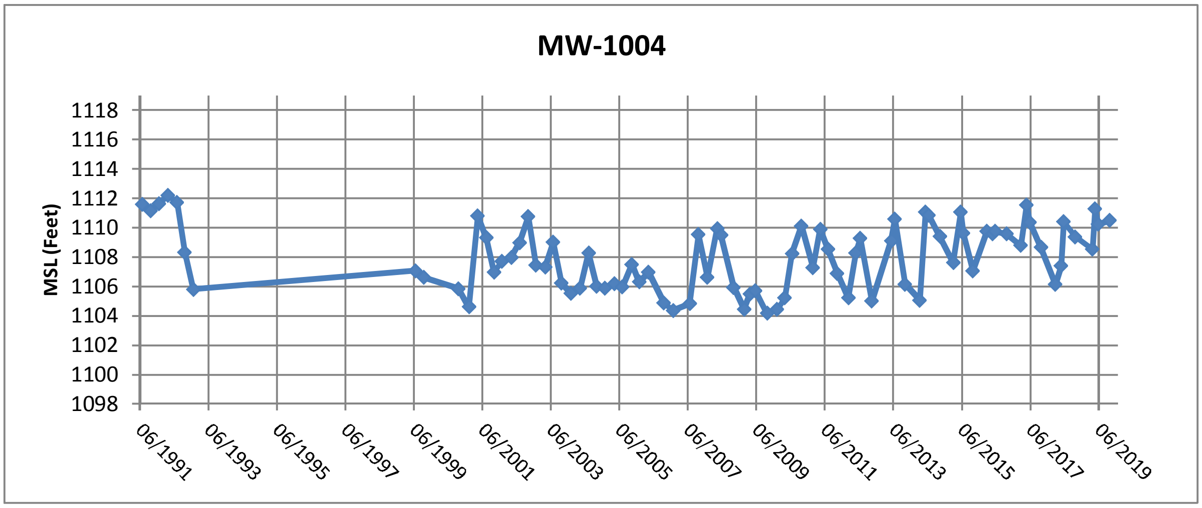
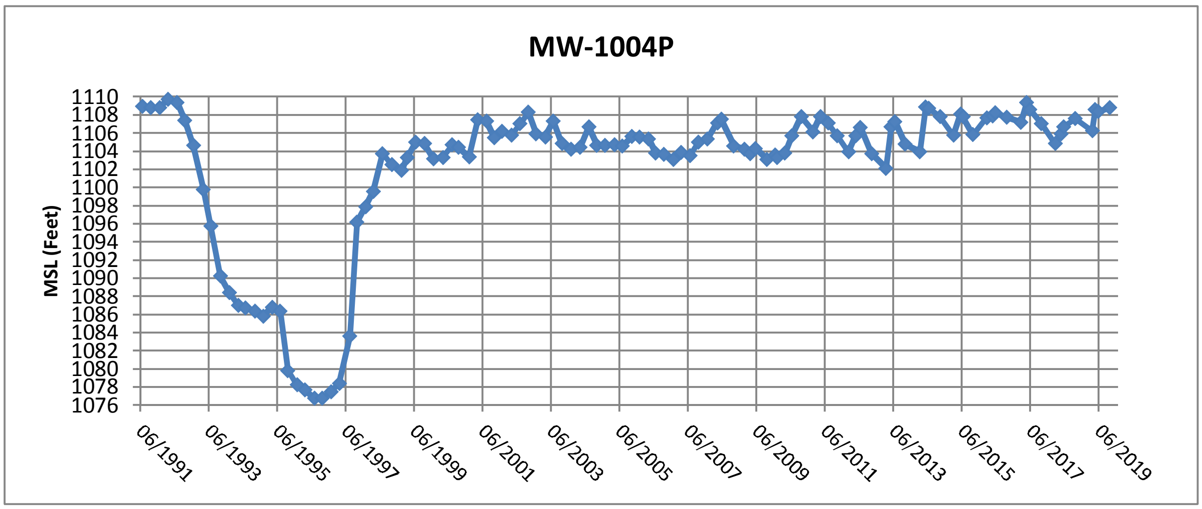
Figure B-16c
Hydrographs

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19





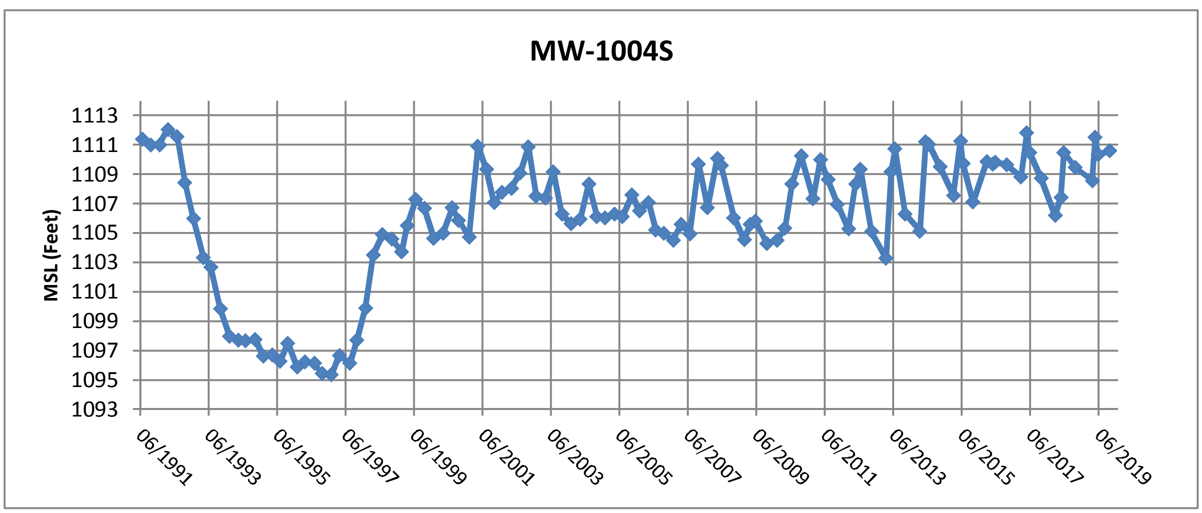


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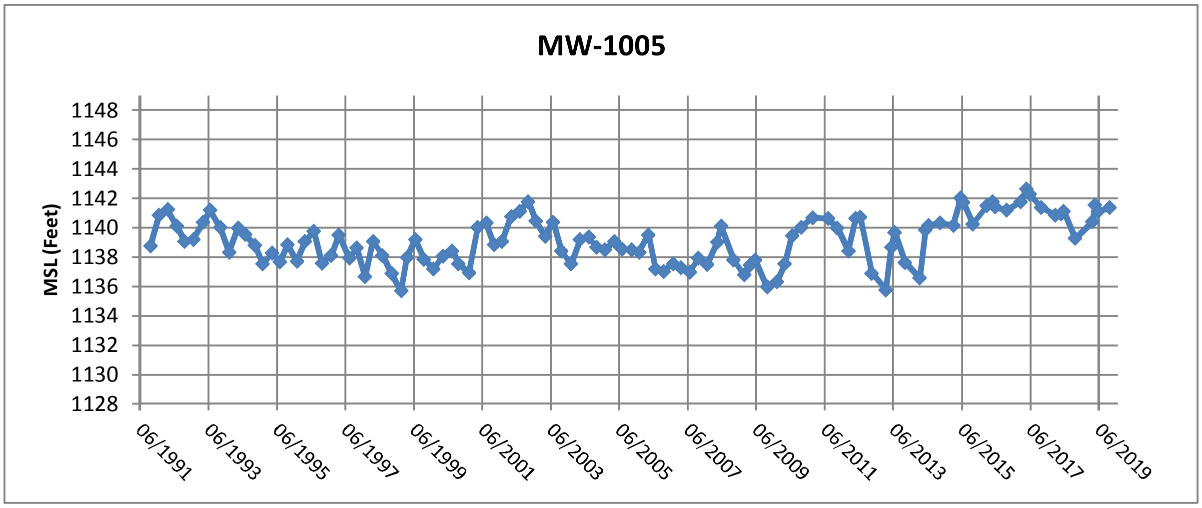
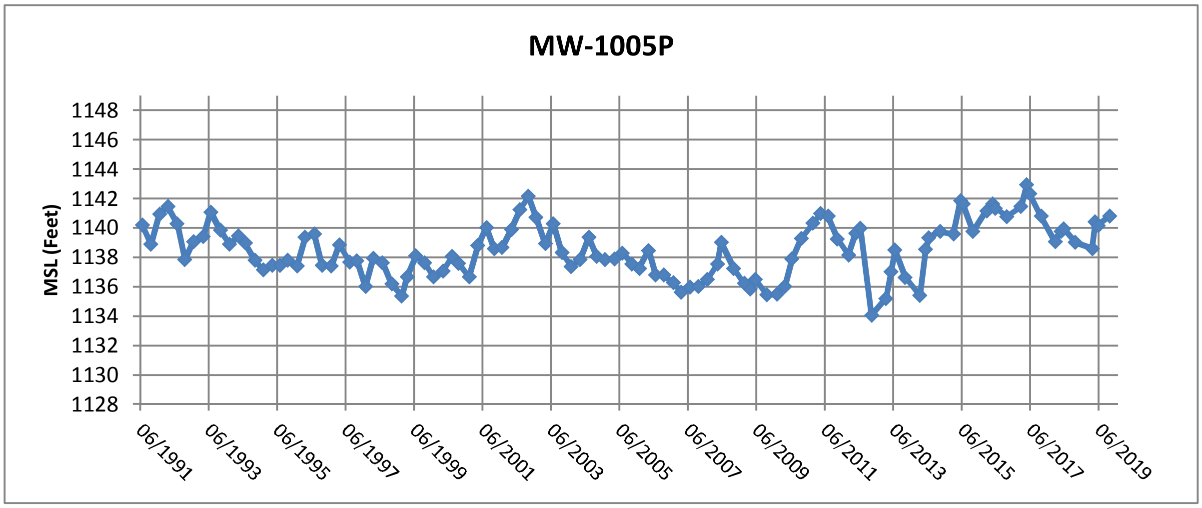
Figure B-16d Hydrographs		
Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19





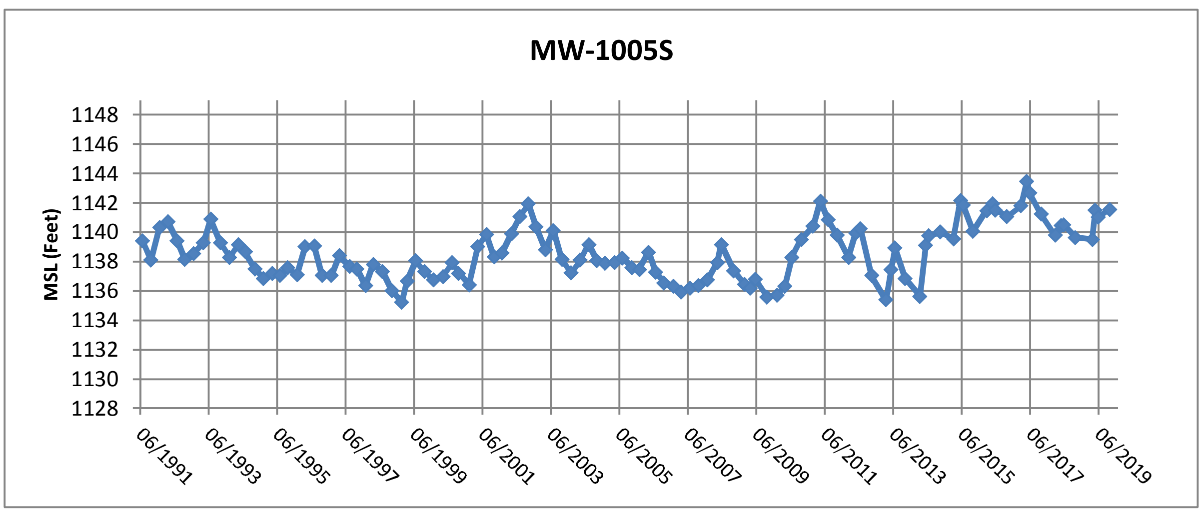


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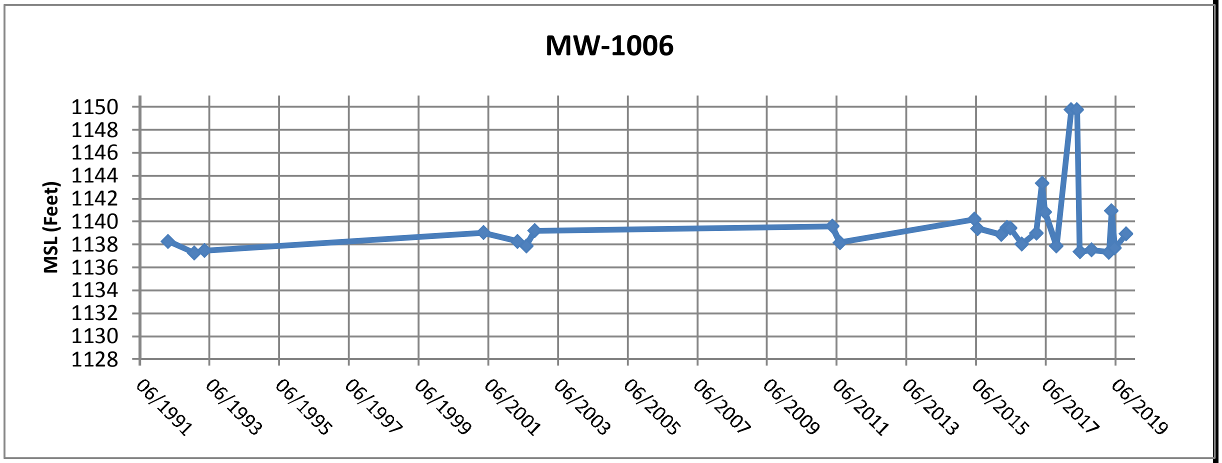
Figure B-16e

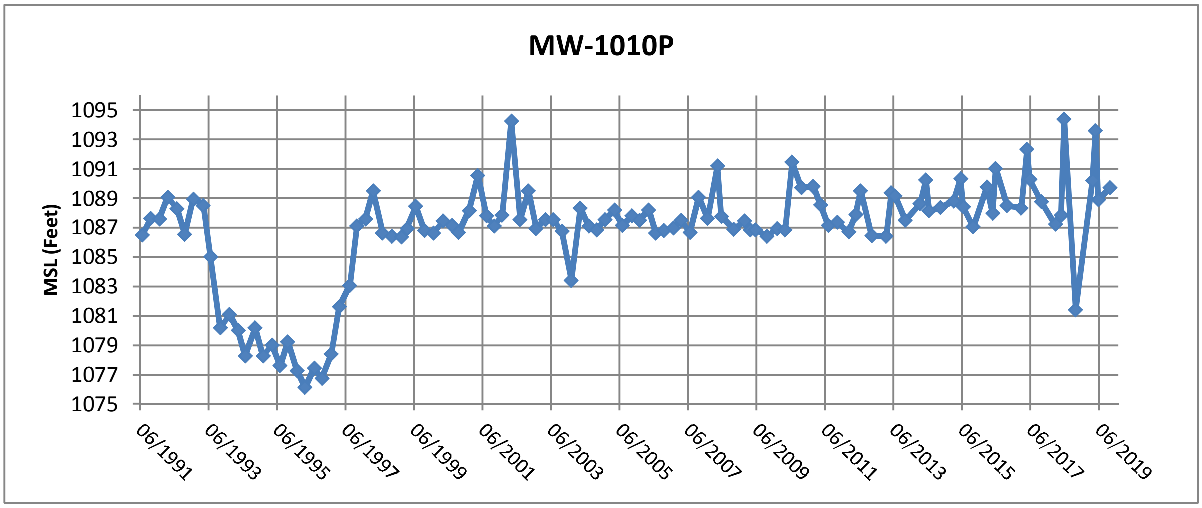
Hydrographs

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19



Note: Gaps between collected data are due to dry well.



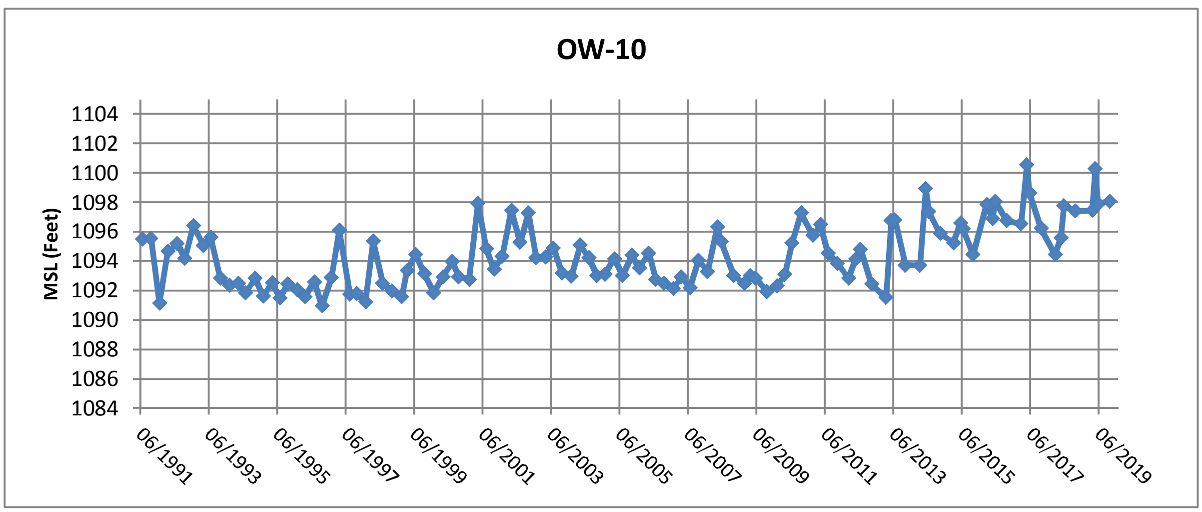


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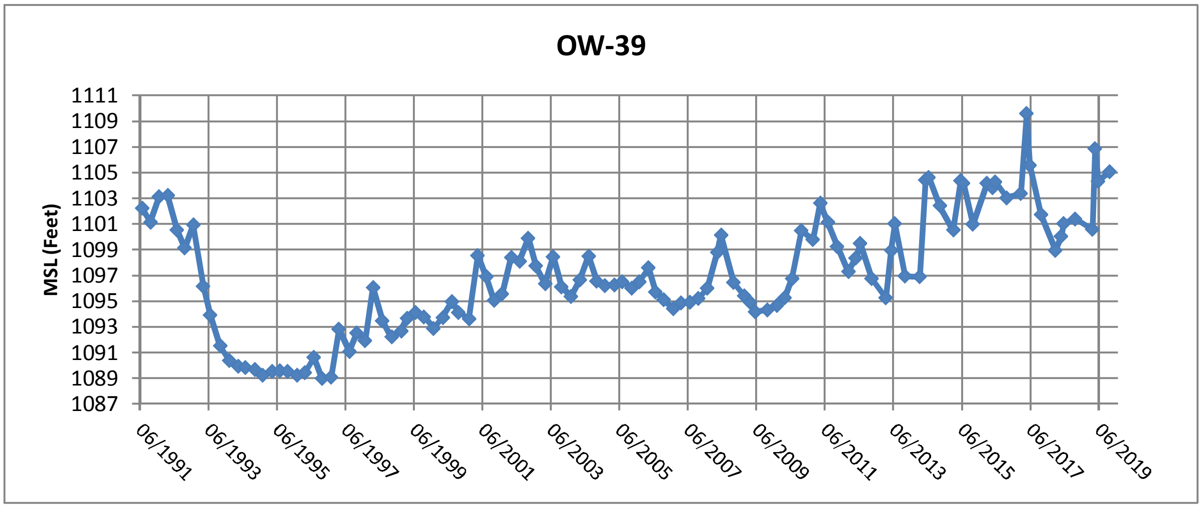
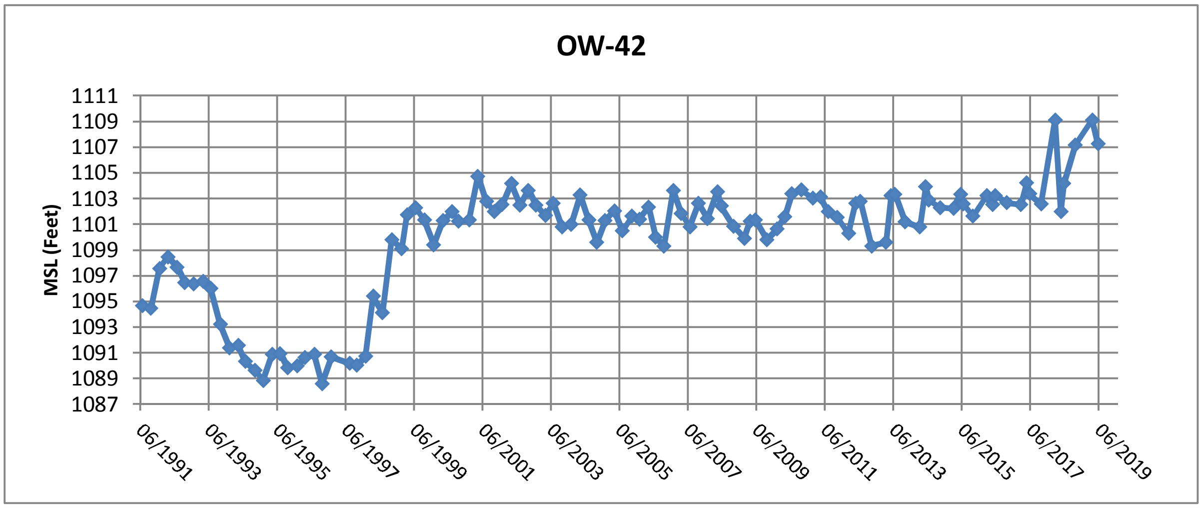
Figure B-16f
Hydrographs

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19





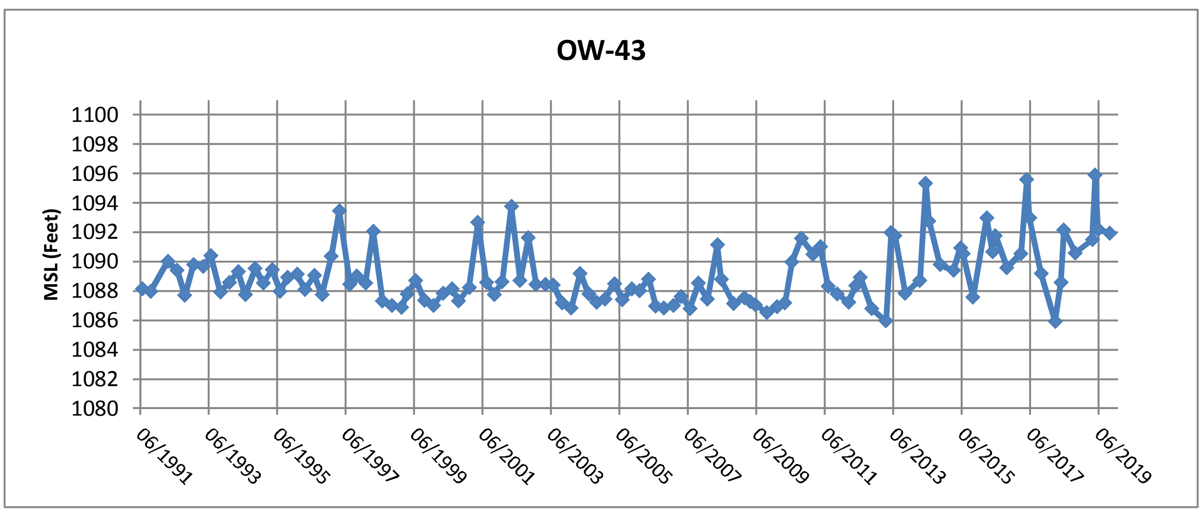


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Figure B-16g
Hydrographs

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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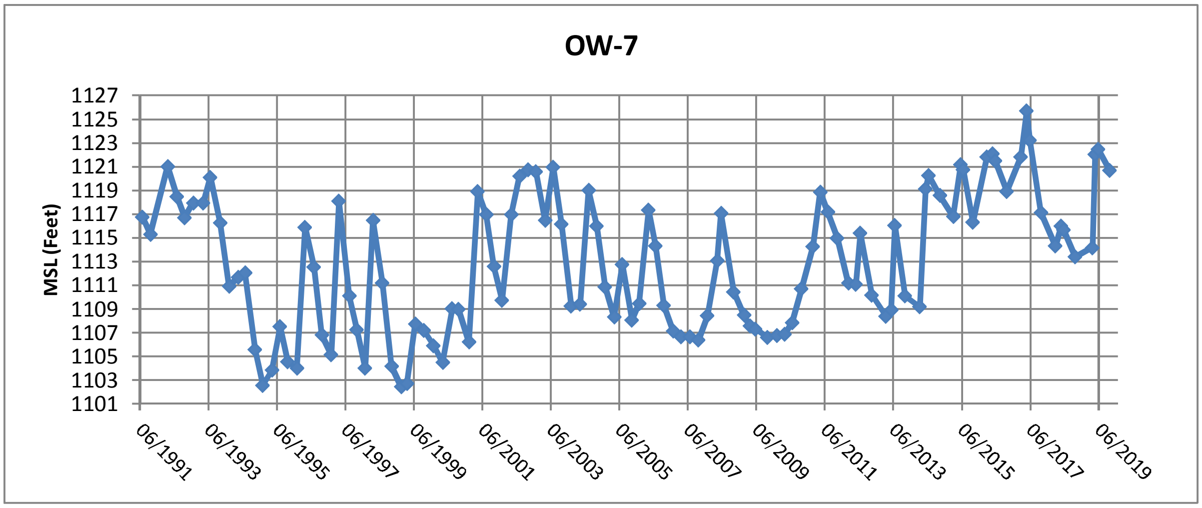

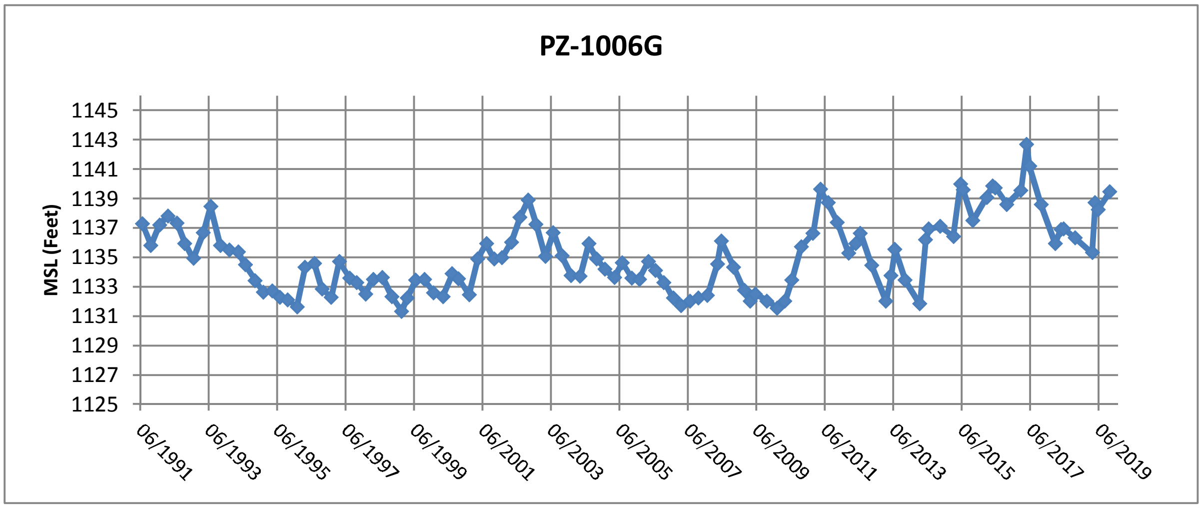

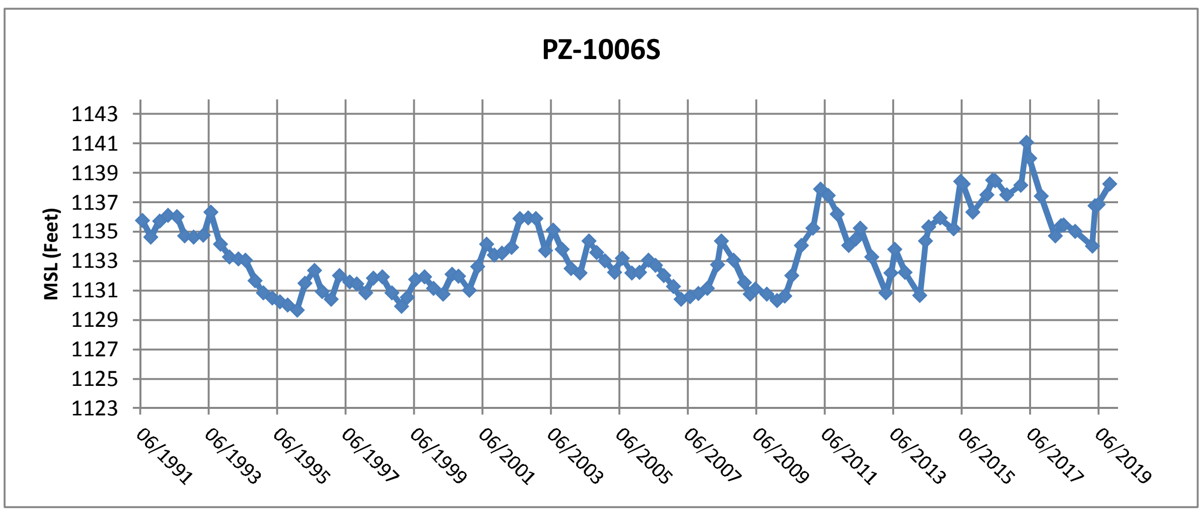

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Figure B-16h
Hydrographs

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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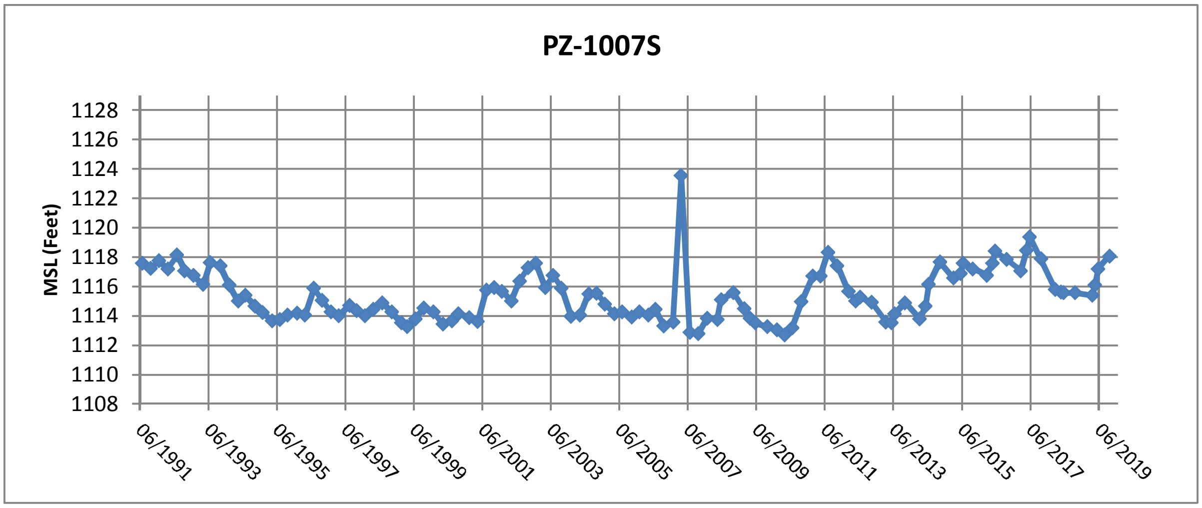

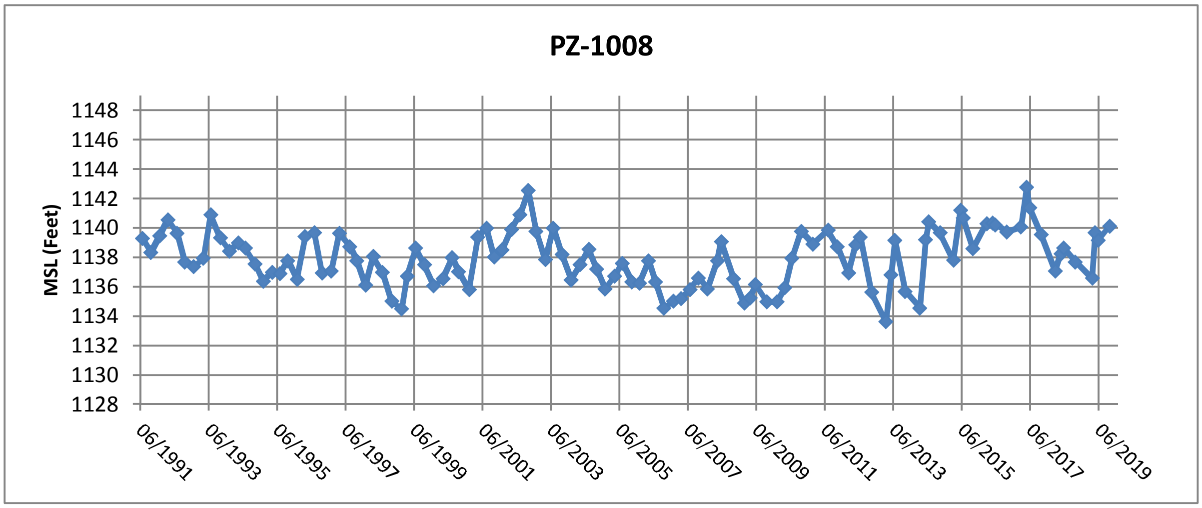

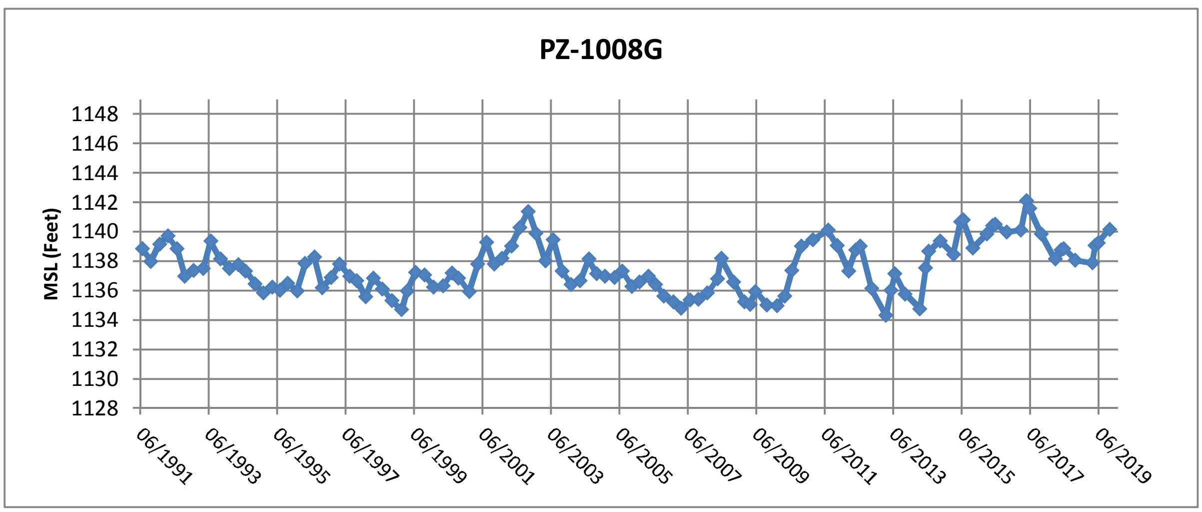

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Figure B-16i

Hydrographs

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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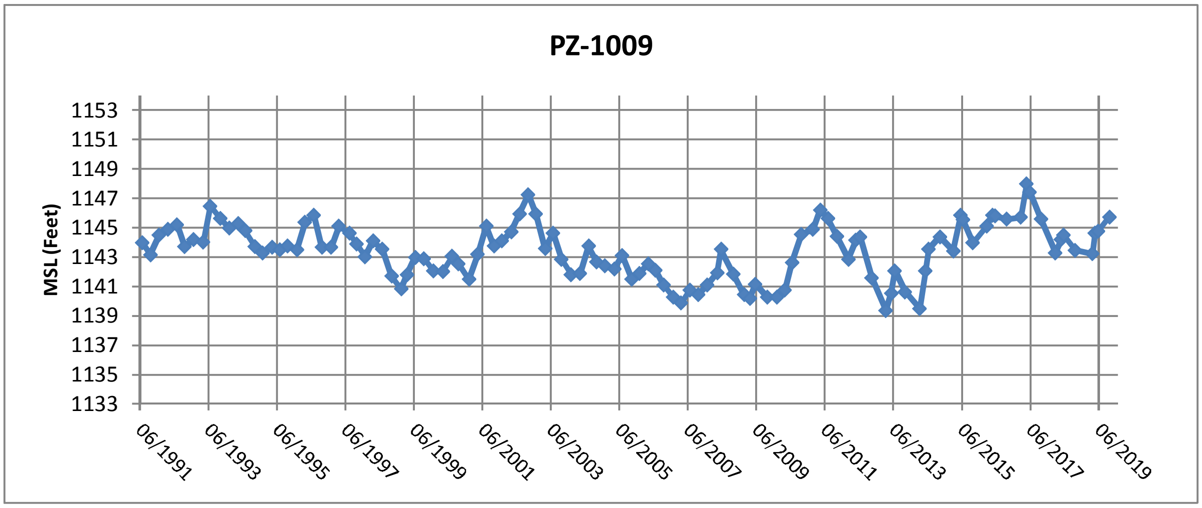

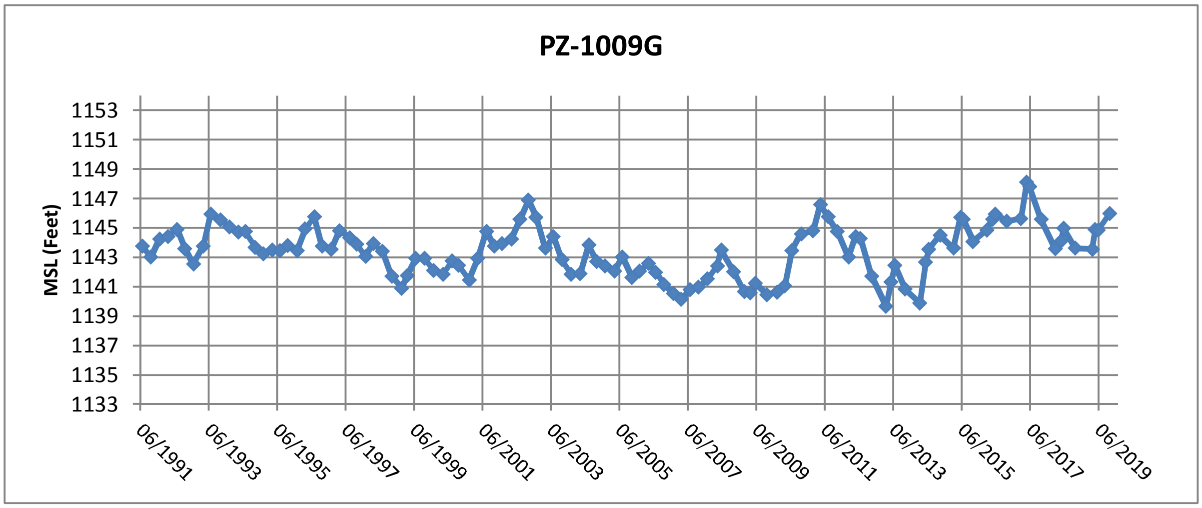

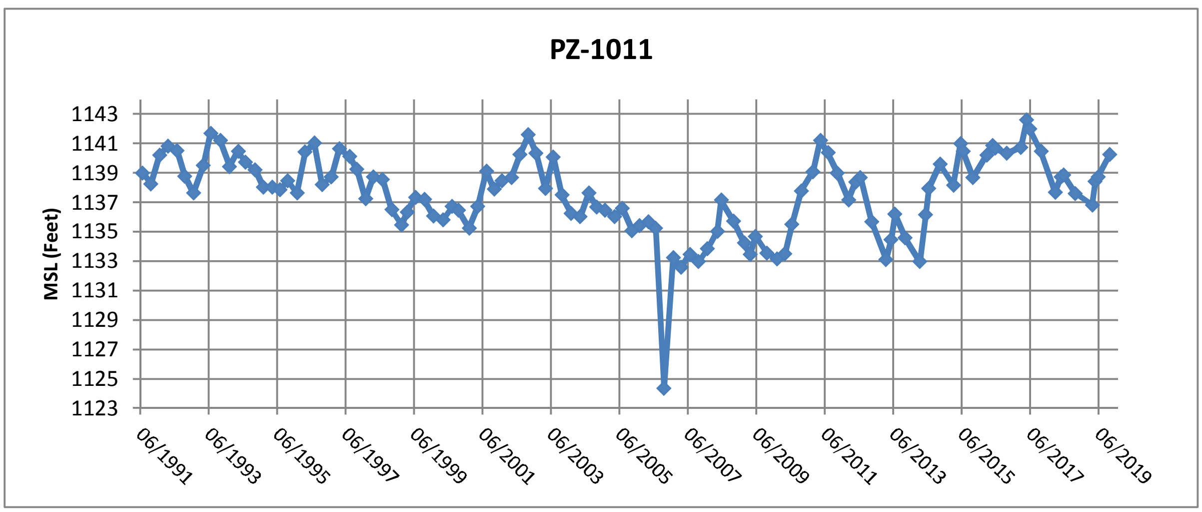

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Figure B-16j

Hydrographs

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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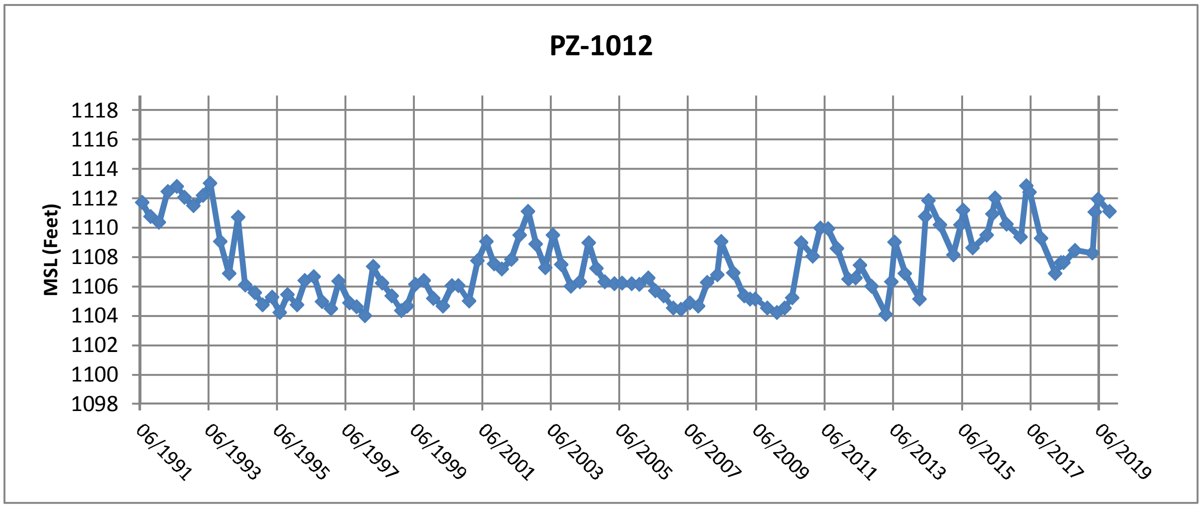

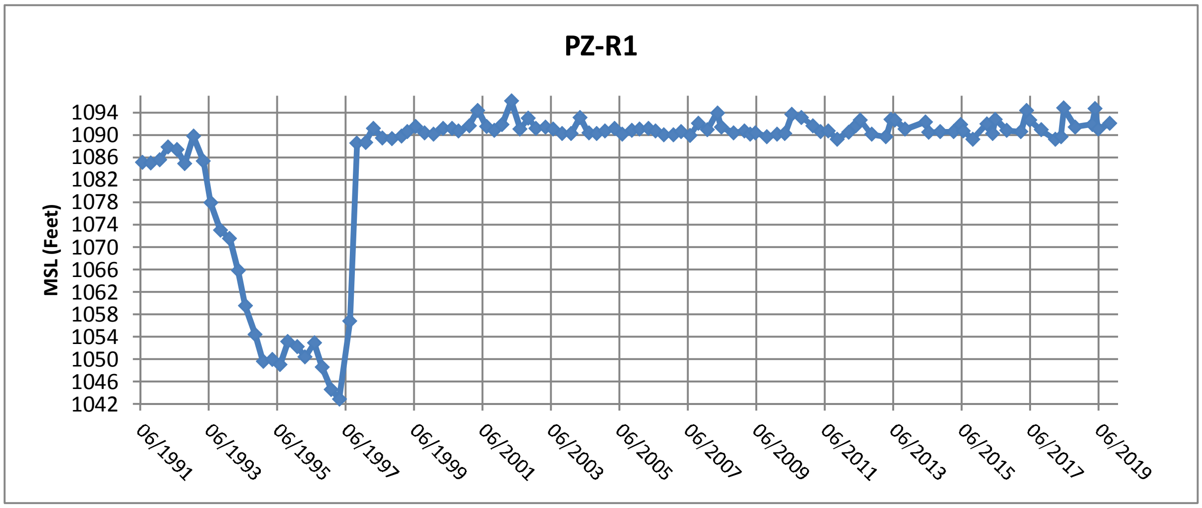

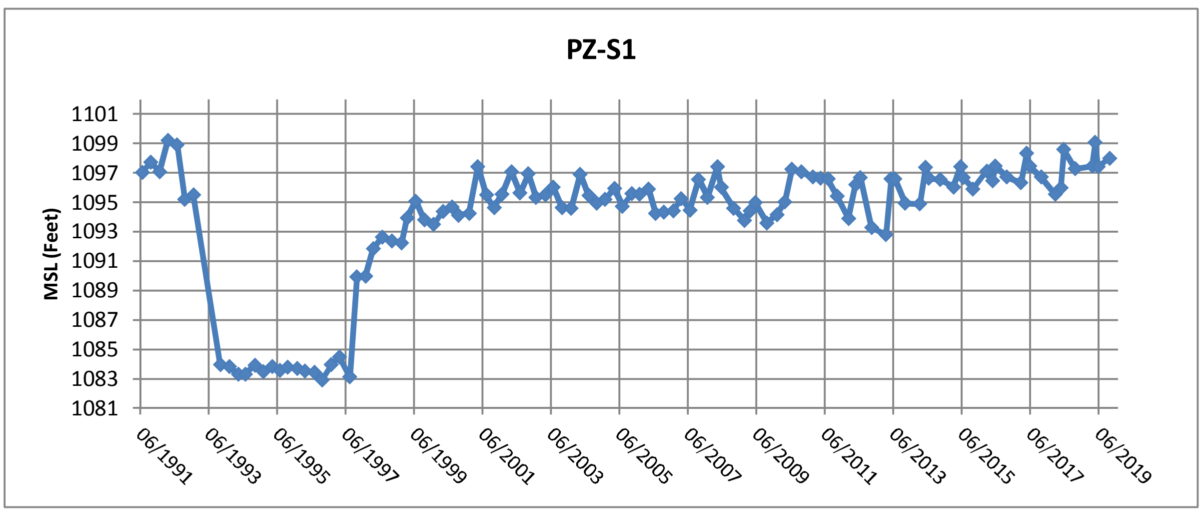

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Figure B-16k
Hydrographs

Scale: NA		Date: January 2020
Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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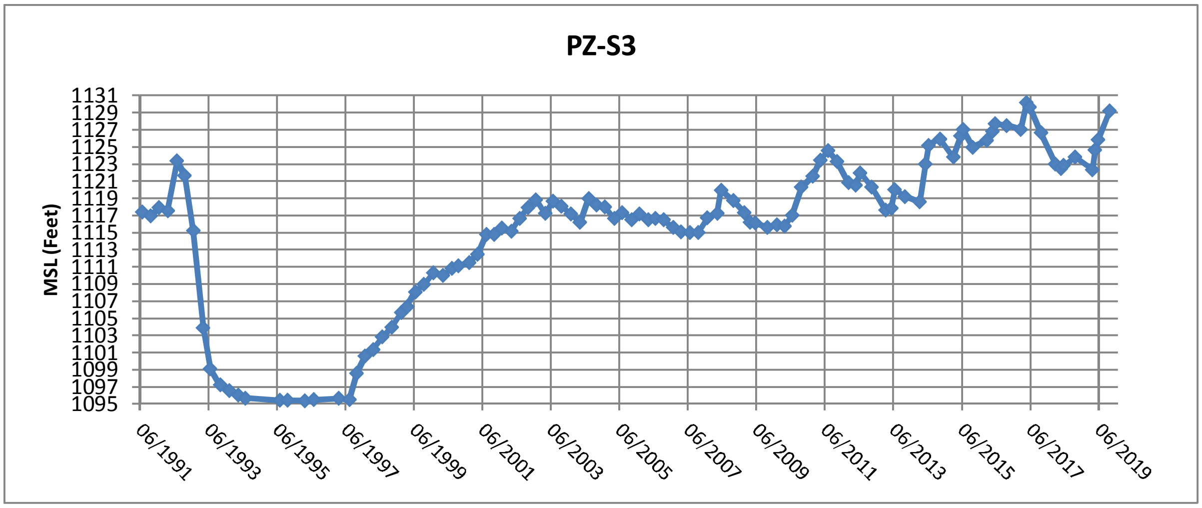

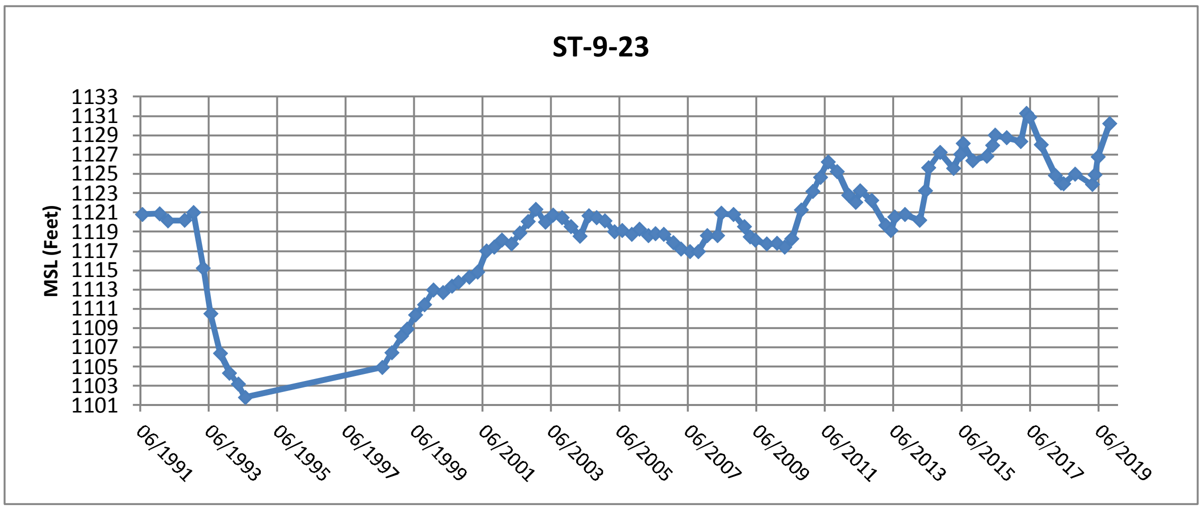

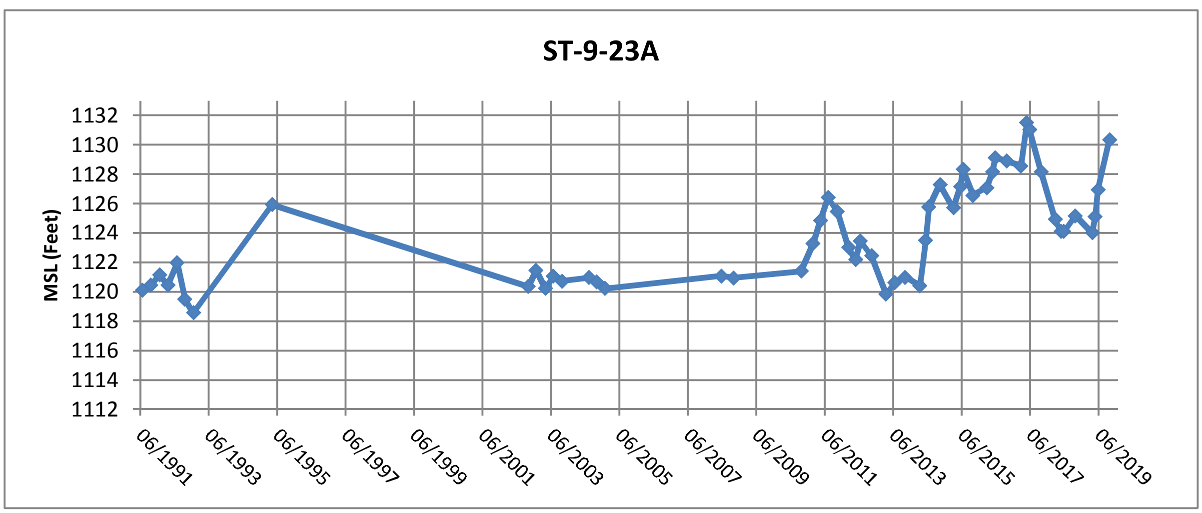

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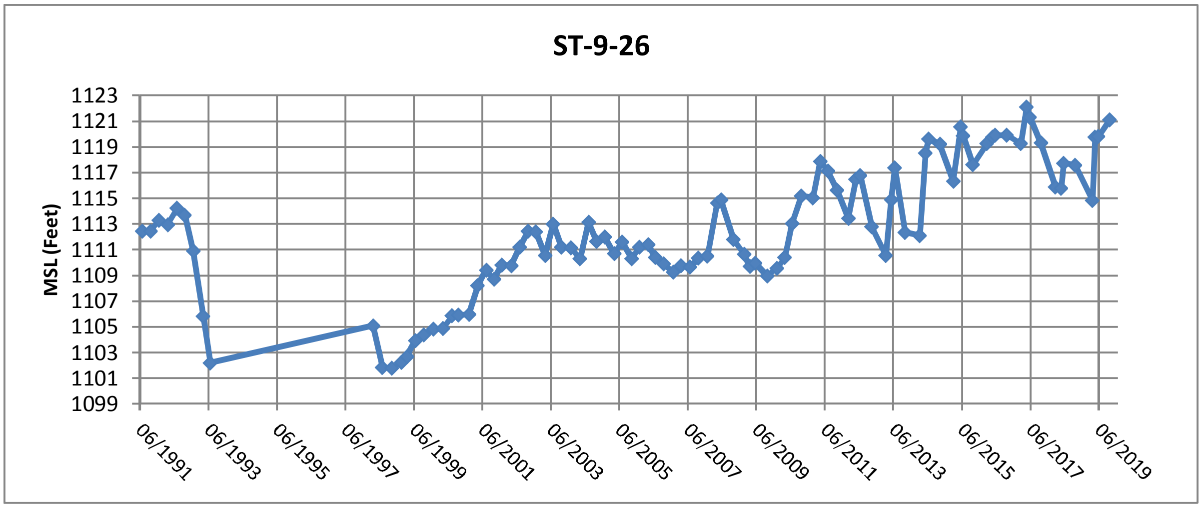
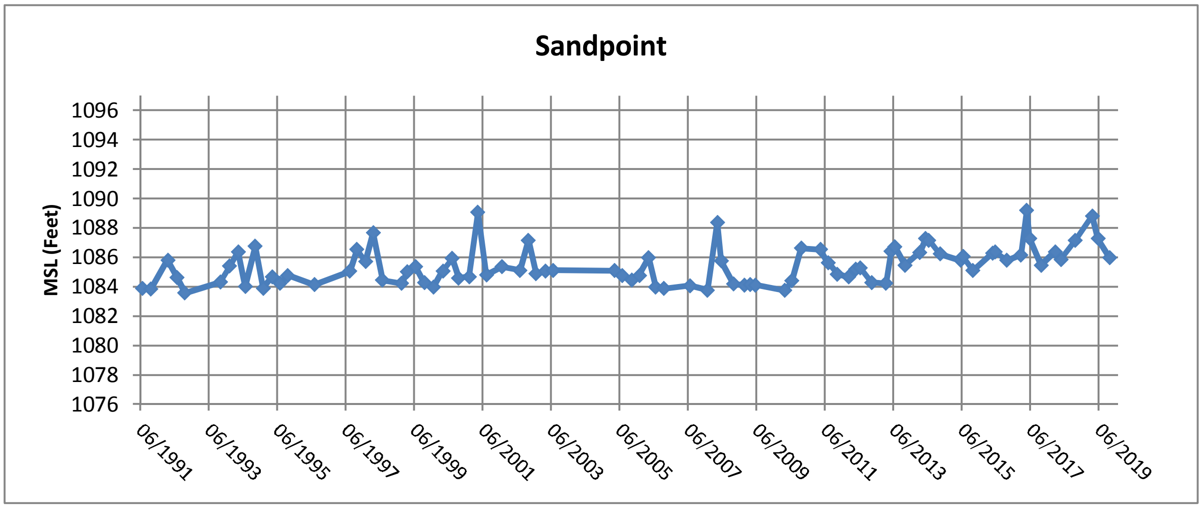
Figure B-16l
Hydrographs

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19





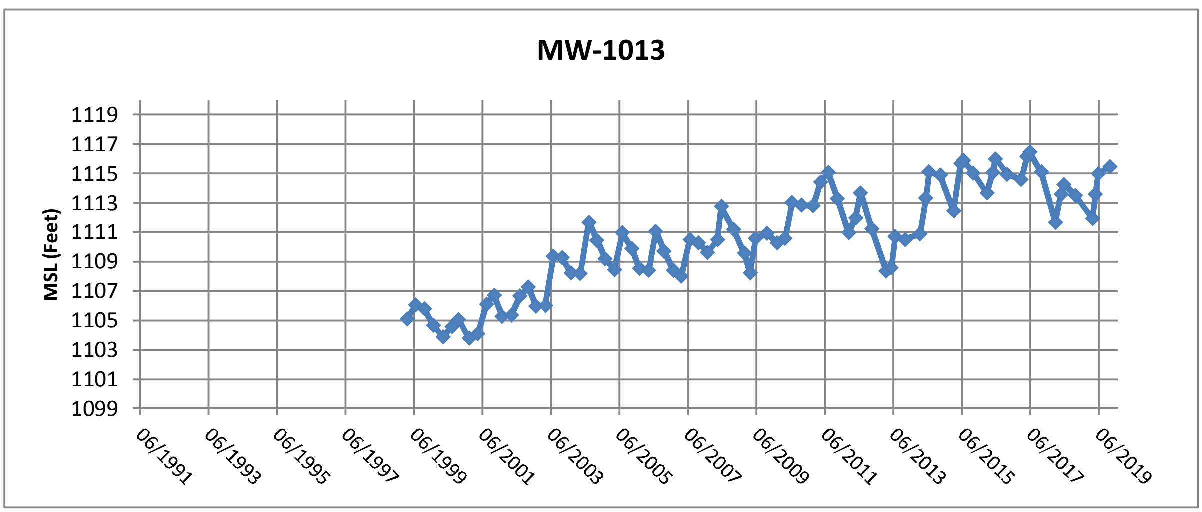


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Figure B-16m
Hydrographs

Scale: NA	Date: January 2020

Prepared By: SGL	Checked By: SVF	Project: 17F777.19

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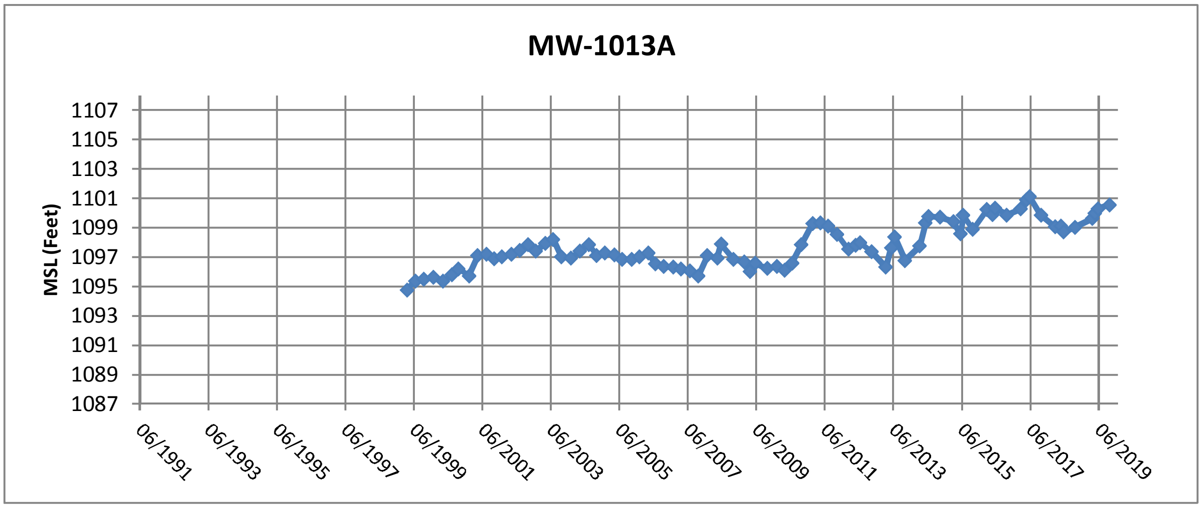

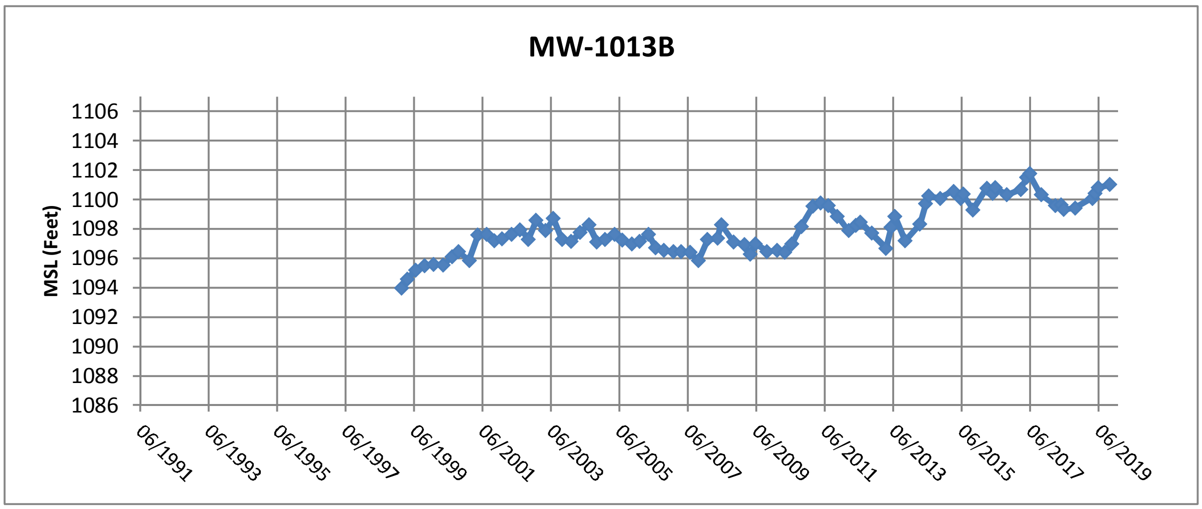

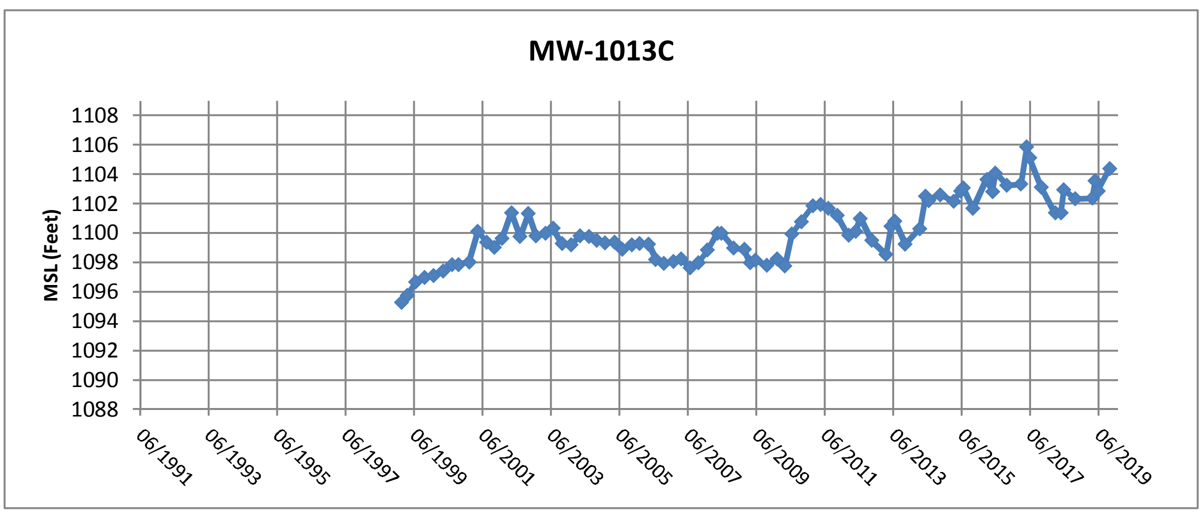

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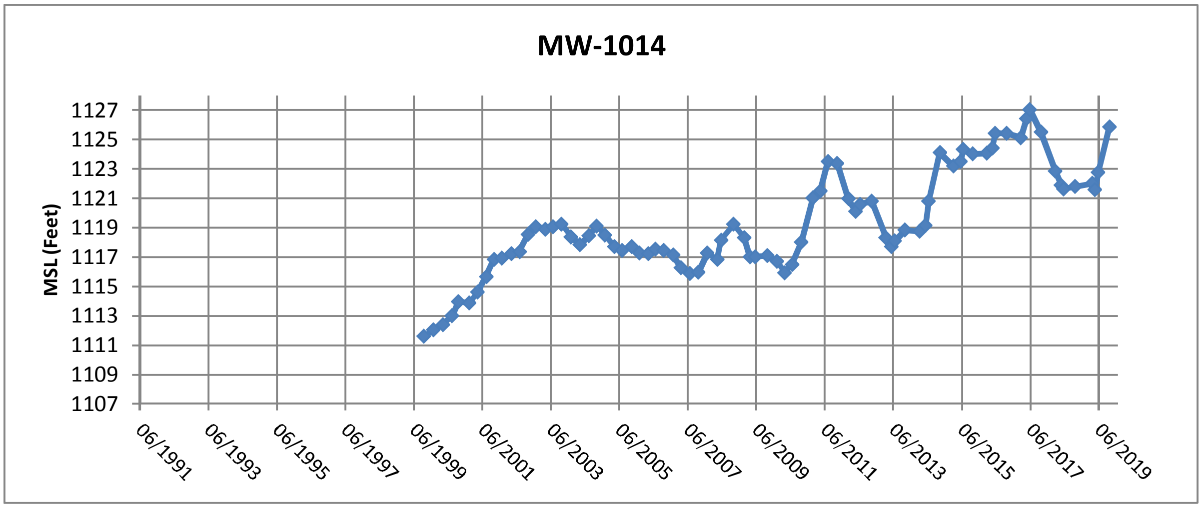
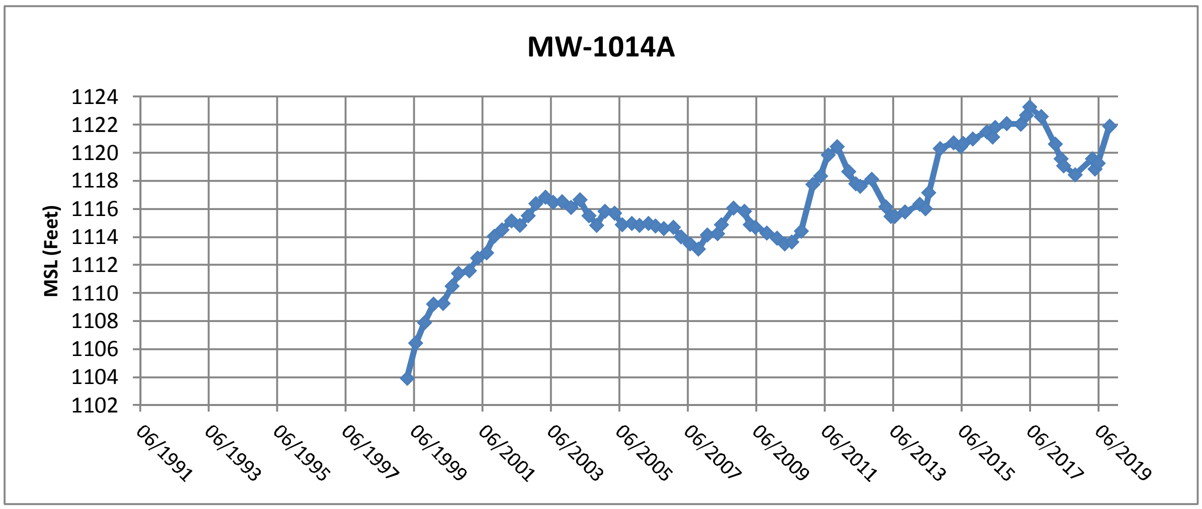
Figure B-16n

Hydrographs

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19





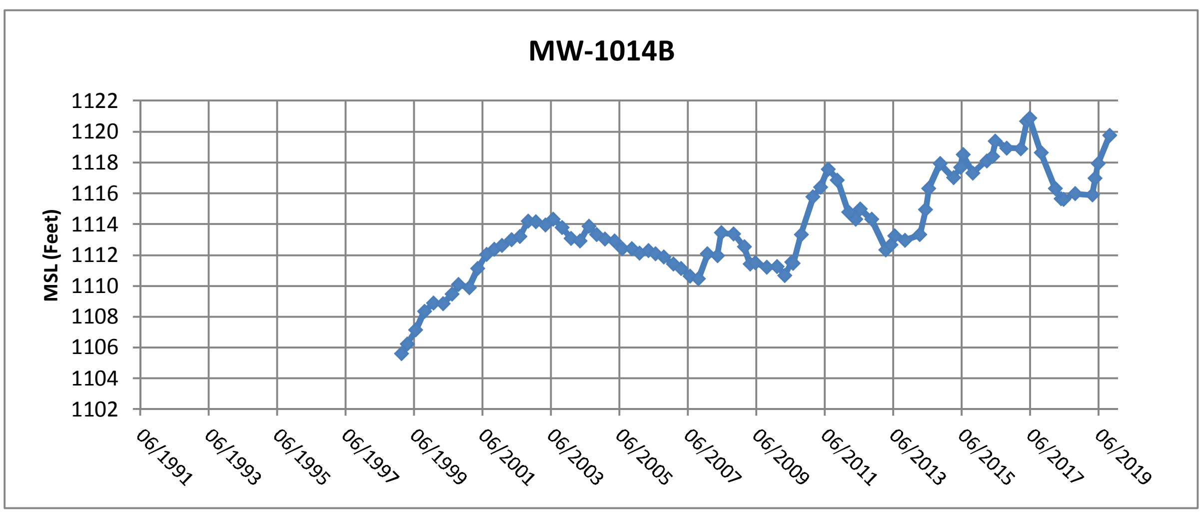


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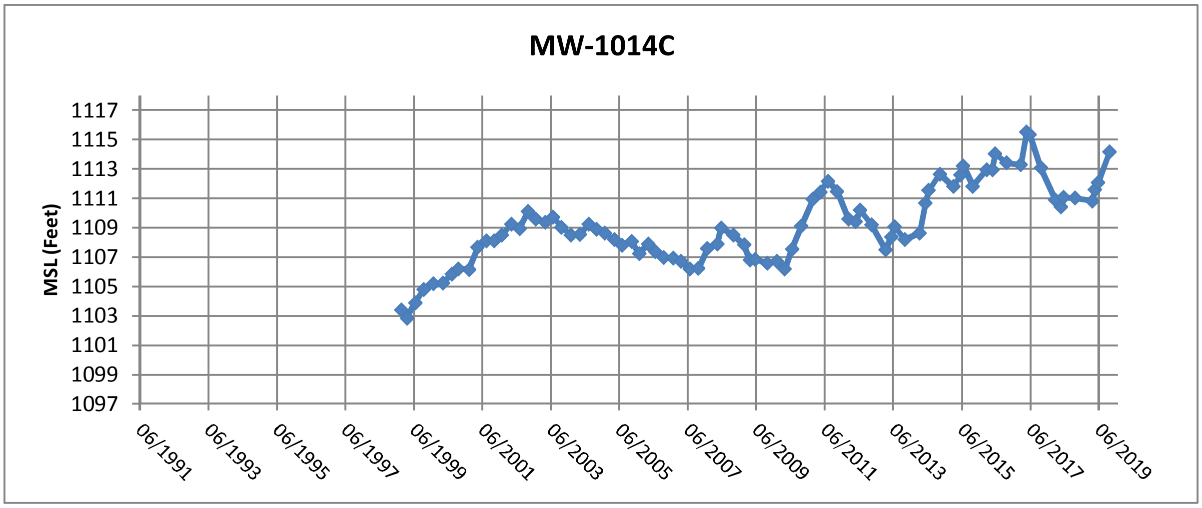
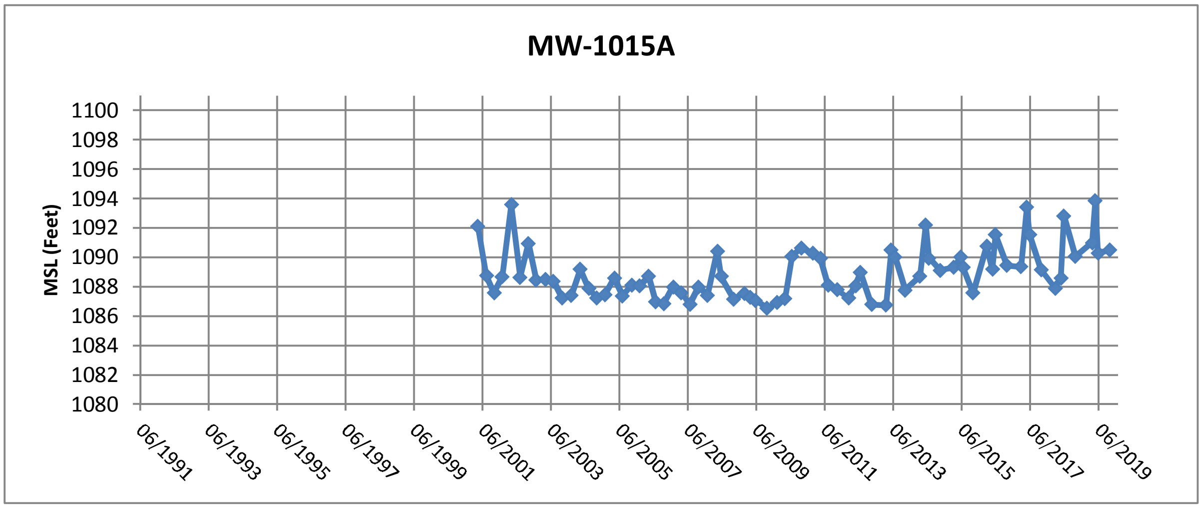
Figure B-16o
Hydrographs

Scale: NA	Date: January 2020	
Prepared By: SGL	Checked By: SVF	Project: 17F777.19





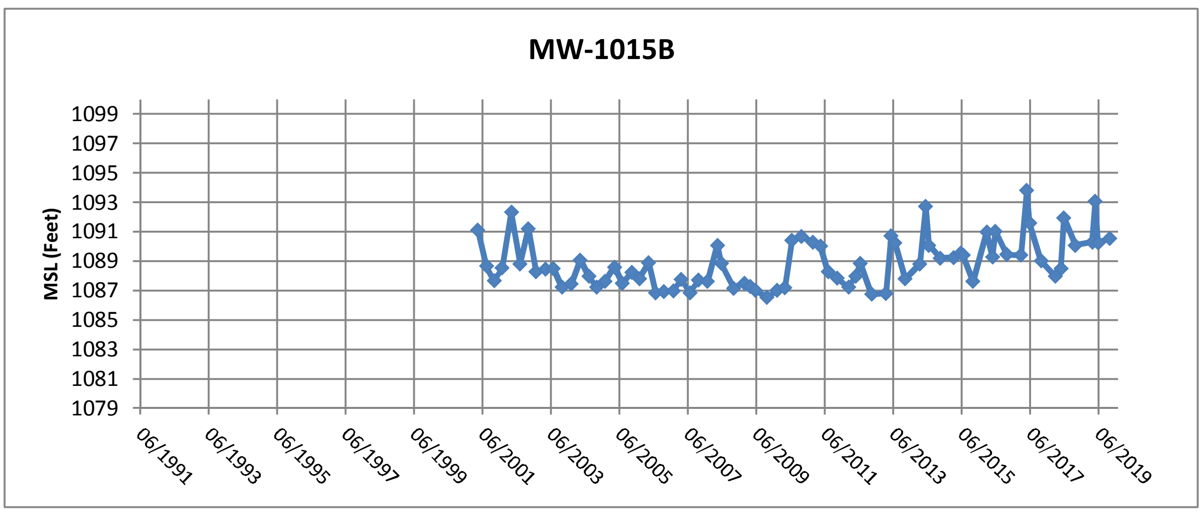


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Figure B-16p

Hydrographs

Scale: NA		Date: January 2020
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