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SEPTEMBER–OCTOBER 2020 GROUNDWATER MONITORING REPORT

CHICO URBAN AREA NITRATE COMPLIANCE PROGRAM

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The staff of AECOM Technical Services, Inc. (AECOM), under the supervision of registered professionals, prepared this report for the Butte County Department of Public Health, Division of Environmental Health under Contract No. X22335 (dated September 13, 2016). Use of data and information obtained from field investigations formed the interpretations, conclusions, and recommendations in the report. Use of certain key assumptions made by AECOM occurred during the development of this report, which substantially affected the efforts. These assumptions, although believed to be reasonable and appropriate, may not prove true in the future. AECOM did not develop some of the data and assumptions and AECOM accepts them at face value and is not responsible for the validity or accuracy of that information. AECOM's experience and professional judgment governed the data interpretation, conclusions, and recommendations presented in the report.

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DRAFT

Scott Little   Date: 01/17/2021
Project Manager

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ACRONYMS AND ABBREVIATIONS

acesulfame-K	acesulfame-potassium
AECOM	AECOM Technical Services, Inc.
amsl	above mean sea level
bgs	below ground surface
Butte County	Butte County Department of Public Health, Division of Environmental Health
CI	confidence interval
CSA	County Service Area
CUA	Chico Urban Area
CUANCP	Chico Urban Area Nitrate Compliance Program
CVWB	Central Valley Water Board
DWR	California Department of Water Resources
DZA	deep zone aquifer
Eurofins	Eurofins–Eaton Analytical Laboratory, Inc.
ft/ft	feet per foot
IZA	intermediate zone aquifer
MCL	maximum contaminant level
mg/L	milligrams per liter
ng/L	nanograms per liter
NO_3	nitrate
SAP	Sampling and Analysis Plan
SWRCB	State Water Resources Control Board
SZA	shallow zone aquifer

EXECUTIVE SUMMARY

This report documents the September–October 2020 groundwater monitoring event for the Chico Urban Area Nitrate Compliance Program (CUANCP). The purpose of the CUANCP is to evaluate trends in nitrate concentrations in the Chico Urban Area (CUA) shallow groundwater aquifer. CUANCP was developed in response to Central Valley Regional Water Quality Control Board Prohibition Order No. 90-126, issued on April 27, 1990, which prohibited waste discharges from individual septic systems within the CUA. Historical CUANCP investigation results indicate that within portions of the CUA where public sewers do not exist, and where individual septic systems are the only means of wastewater treatment, elevated nitrate concentrations are present in the shallow groundwater aquifer. Per correspondence with Butte County Public Health, 2,149 septic tank destructions have occurred since program inception, thereby reducing septic loading as a source of nitrates in shallow groundwater. AECOM Technical Services, Inc. has prepared this report in accordance with the Butte County Department of Public Health, Division of Environmental Health under Contract No. X22335 (dated September 13, 2016).

Shallow groundwater elevations that were measured in September 2020 decreased, compared to levels encountered during CUANCP sampling activities in February 2020. Sufficient groundwater for monitoring was present during September–October 2020 at only three project monitoring wells. Measured groundwater elevations ranged from 122.94 to 183.50 feet above mean sea level. The calculated groundwater flow direction was to the northwest, with a horizontal gradient of 0.003 feet per foot. The average change in groundwater elevation between the February 2020 and September–October 2020 monitoring events was a decrease of approximately 8.68 feet.

Only three of the 10 site wells were sampled during the September–October monitoring event (DMW-11, DMW-3 and MW-21). The other seven wells did not contain enough water for sampling. Of the three wells sampled, nitrate (as NO_3) concentrations exceeded the maximum contaminant level of 45 milligrams per liter (mg/L) in two wells (DMW-3 and DMW-11). The samples also were analyzed for the artificial sweeteners acesulfame-potassium (acesulfame-K) and sucralose, to provide additional lines of evidence of septic system discharge to groundwater. Acesulfame-K was detected at DMW-3 and MW-11, and sucralose was detected at MW-21.

All nitrate (as NO_3) concentrations detected during the September–October 2020 monitoring event were within the previously reported range of 1.35 to 300 mg/L.

AECOM recommends that semi-annual sampling for nitrate (as NO_3), acesulfame-K, and sucralose continue for 5 years, to monitor concentration trends in the 10 site wells (DMW-3, DMW-5, DMW-7, DMW-11, DMW-13, DMW-14, DMW-18, DMW-19, MW-21, and MW-22).

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1.0 INTRODUCTION

AECOM Technical Services, Inc. (AECOM) has prepared this report for Butte County Department of Public Health, Division of Environmental Health (Butte County), in support of the Chico Urban Area Nitrate Compliance Program (CUANCP) and in accordance with Butte County Contract X22335 (dated September 13, 2016). Figure 1-1 shows the project area.

The CUANCP was developed in response to Central Valley Water Board (CVWB) Prohibition Order No. 90-126, issued on April 27, 1990, which prohibited waste discharges from individual septic systems in the Chico Urban Area (CUA). Historical CUANCP investigation results indicate that within portions the CUA where public sewers do not exist, and where individual septic systems are the only means of wastewater treatment, elevated nitrate concentrations are present in the shallow groundwater aquifer. County Service Area (CSA) 114 was established to fund environmental studies and project planning costs associated with nitrate concentrations in CUA groundwater. In response to the Prohibition Order, a collaborative effort between Butte County, the City of Chico, and the former Chico Redevelopment Agency established the Nitrate Action Plan to fund new sewer pipeline construction projects in the CUA that support long-term mitigation of individual septic system discharges. Figure 1-1 shows the new sewer project areas. Figure 1-2 shows the locations of the CUANCP wells.

As part of implementing Contract X22335 for the CUANCP, AECOM performed the following tasks in September–October 2020:

- completed groundwater elevation monitoring on September 14 and 15, 2020;
- completed groundwater re-sampling on October 27, 2020 (samples collected in September 2020 exceeded the recommended hold time because of laboratory instrument issues); and
- completed data validation, a trend analysis, and generated a semi-annual report.

Groundwater sampling and analysis were performed in accordance with the Groundwater Monitoring Work Plan, Chico Urban Area Nitrate Compliance Program (Dames & Moore 1999), the Chico Urban Area Nitrate Compliance Nitrate Compliance Groundwater Sampling, Field Sampling Plan (URS 2012a), Chico Urban Area Nitrate Compliance Nitrate Compliance Groundwater Sampling (Contract Number X19072), Work Plan Review and Proposed Deviations (URS 2012b), and the Final Work Plan for Investigation of Elevated Nitrate in Groundwater: Greater Chico Area, Butte County, California (URS 2013).

1.1 Purpose

The purpose of the CUANCP groundwater monitoring program is to collect groundwater quality data that can be used to determine whether nitrate concentrations in groundwater are decreasing over time as dwelling units are converted from individual septic systems to city sewer service.

To meet its objectives, Butte County contracted AECOM to perform groundwater monitoring for nitrate (as NO_3). The analytical results will be used to determine the extent to which shallow groundwater is affected by nitrate (as NO_3) at concentrations that exceed the drinking water maximum contaminant level (MCL), which is 45 milligrams per liter (mg/L), and to determine trends in concentration.

1.1.1 Regulatory Actions

In 1979, a private resident on Nord Avenue in Chico alerted the Butte County Health Department of high nitrate concentrations in the household's private water supply well. Subsequent groundwater sampling in the CUA showed elevated nitrate levels in groundwater (above the MCL of 45 mg/L) in approximately 30 percent of the wells sampled.

In 1983, the California Department of Water Resources (DWR) conducted two rounds of groundwater sampling to assess the extent of nitrate contamination in the CUA (DWR 1984). The DWR study showed that four areas in the CUA contained nitrate concentrations at levels exceeding the MCL. The four areas then delineated as containing elevated nitrate values were identified as the Lassen Avenue, Sacramento Avenue, Santa Clara Avenue, and Dayton Road areas.

Subsequent studies by Aqua Resources, Inc. (Aqua Resources 1985), Jerold Behnke (Behnke 1989), and the State Water Resources Control Board (SWRCB 1989) concluded that nitrate levels in the CUA exceeded MCLs and that residential septic systems were the source of elevated nitrate. Behnke (1989) suggested that in addition to septic effluent, agricultural areas were a significant additional source of the nitrate.

Based on the results of these studies, the CVWB issued Order No. 90-126, requiring a prohibition of discharge from individual waste systems installed after July 1, 1990. The Order generally prohibited waste discharge in the CUA after July 1, 1995. The Order allows exemptions in the CUA based on demonstrations that costs of connection to the sanitary sewer system are inordinately high relative to beneficial uses of water protected and that an alternate method is adequate to protect the environment. The Order also exempted waste systems that discharge less than 334 gallons per day per acre. Based on subsequent information, in 1995 the CVWB increased the maximum allowable discharge to 360 gallons per day per acre.

1.1.2 Previous Investigations

In 1992, Butte County initiated a groundwater investigation and nitrate source evaluation to support the CUANCP. For the first phase of the investigation, data were compiled from readily accessible regional monitoring, water supply, and irrigation and domestic wells in the CUA (Metcalf & Eddy 1992). The second phase of groundwater investigation included preparation of the Groundwater Nitrate Study Work Plan (Dames & Moore 1993). Under the approved work plan, 19 new monitoring wells were installed and sampled, and 21 existing monitoring wells in the shallow zone aquifer (SZA) and intermediate zone aquifer (IZA) were sampled. The results of the second phase of the investigation were presented in the Groundwater Nitrate Study, Chico Urban Area, Final Report (Dames & Moore 1994).

The next phase of work included nitrate source evaluation activities that consisted of installing soil-pore liquid suction-cup lysimeters in the vadose zone adjacent to individual and multifamily septic systems, completing soil borings to groundwater, and analyzing soil samples for nitrogen constituents. Two additional rounds of SZA sampling and analysis for nitrate were completed, evaluating the potential septic and agricultural sources of nitrate in the CUA. The results were presented in the Technical Memorandum, Hydrologic and Soils Investigation, Chico Urban Area (Dames & Moore 1996).

In response to data gaps identified in the CUANCP in 2001, eight additional groundwater monitoring wells (MW-21 through MW-28) were installed in June 2004 and monitored until 2005 by Hanover, Inc. Between September 2007 and August 2009, four groundwater compliance monitoring events were completed by Broadbent & Associates, Inc., and between June 2012 and July 2015, four groundwater compliance monitoring events were completed by URS Corporation.

1.1.3 Connection of Existing Properties to Public Sewer

In response to the CVWB's Prohibition Order No. 90-126, Butte County, the City of Chico, and the successor agency to the former Chico Redevelopment Agency are constructing new public sewer facilities to which citizens can connect to comply with the Prohibition Order. Project planning costs have been funded with CSA 114 revenue that is dedicated to this project. The costs of sewer pipeline construction are to be funded with a $38 million loan from the State Water Resources Control Board, which is to be repaid with tax incremental revenue received by the former Chico Redevelopment Agency. Further information regarding the CUANCP is available online at http://www.nitratecompliance.org.

A sewer expansion project is under construction in CSA 114, with priority being given to areas with the highest density of individual septic systems per acre. Six sewer pipeline project areas were established as part of CSA 114 (see Figure 1-1). Construction started in 2009, and as of the end of 2018, the following four of six sewer project areas had been completed:

- Project Area 1N–Lassen Avenue Area
- Project Area 1S–Chapman–Mulberry Neighborhood Area
- Project Area 2N–East Avenue–Cohasset
- Project Area 2S–East 5th–East 8th Avenue Area
- Project Area 3N Phase 5 Unit 2-North Esplanade

Project Area 3N (Phase 5) Unit 1 (Tonea Crossing) and 3S (Phase 6) Unit 5 currently are under construction. The remaining areas (i.e., Project Area 3N [Phase 5] Unit 5 and 3S [Phase 6] Unit 6) are scheduled to start construction in April 2020 (Duffey, pers. comm., 2020.)

"Closed out as of October 2020 for City of Chico - meet expectations" - Jon.revolinsky@chicoca.gov.

A Butte County-maintained database of septic tank destructions for locations in CSA 114 indicates that from program inception through October 31 2020, 2,149 septic tank destructions occurred.

1.1.4 Current Investigation of Potential Nitrate Sources in Groundwater

Elevated nitrate concentrations have historically been measured in groundwater samples collected from agricultural and domestic water supply wells in and surrounding Chico. To further investigate the source of the elevated nitrates, AECOM continues to implement the approach established by the November 2016 monitoring event, which mainly relied on consideration of acesulfame-K and sucralose in conjunction with other groundwater quality data, to indicate the source of the elevated nitrate.

The scope of the November 2016, and subsequent monitoring events, was determined at a project team meeting held on October 6, 2016, attended by Butte County, the CVWB, and AECOM, where program status, monitoring objectives, and sampling activity requirements were discussed. Meeting notes were finalized in agreement with all attendees on October 11, 2016.

1.1.5 Hydrogeology

In the Chico area, the regional groundwater system is composed of three principal water-bearing zones or aquifers within alluvial sediments. The SZA or "upper aquifer" is an unconfined system occurring at depths ranging from 10 to 50 feet below ground surface (bgs). The SZA is composed of alluvial gravels of late Pleistocene and Recent ages (Olmsted and Davis 1961). Most of the monitoring wells in the CUA are screened within the SZA.

Recharge to the SZA is from direct precipitation and local recharge from Big Chico Creek, Little Chico Creek, and the Lindo Channel. Groundwater flow in the SZA generally is to the west or southwest.

A sequence of fine-grained, less permeable units composed of cemented silts and clays separates the SZA from the IZA. The fine-grained units generally are found at depths ranging from 80 to 160 feet bgs and contain lenses of groundwater-bearing sandy deposits. The IZA, generally found at depths between 140 and 200 feet bgs, is composed predominantly of sands and gravels with minor fines, and interbedded silt and clay lenses. These deposits are classified as Pleistocene cemented alluvial deposits and are equivalent to the Riverbank member of the Modesto Formation. Both the IZA and deep zone aquifer (DZA) exist under semiconfined conditions. The IZA and DZA receive recharge through vertical leakage from the overlying aquifers. Some recharge to the DZA also comes from the foothills to the east (DWR 1984).

The DZA is separated from the IZA by a thick sequence of cemented silts and clays. The DZA is composed of volcanic mudflow sediments of the Tuscan Formation, which is Pliocene in age. The total thickness of the unit is more than 1,000 feet in areas. The formation consists of volcanic breccias, tuff-breccias, volcanic sandstone and conglomerate, coarse- to fine-grained tuff, and tuffaceous silt and clay units. The DZA is penetrated by numerous agricultural irrigation wells and potable supply wells that produce drinking water for private residents and California Water Service Company, the local municipal water purveyor for the CUA.

1.2 REPORT ORGANIZATION

This report consists of the following sections and appendices:

- **Chapter 1.0, Introduction**, presents introductory and background information including the regulatory actions, previous investigations, and hydrogeology.
- **Chapter 2.0, Fieldwork Performed**, summarizes fieldwork performed at the site during this reporting period and documents variances from the work plan.
- **Chapter 3.0, Groundwater Monitoring Results**, presents the horizontal groundwater flow direction and gradient, and the analytical results for groundwater samples.
- **Chapter 4.0, Conclusion**, summarizes the current status of conditions and discusses how current monitoring data compare to historic data.
- **Chapter 5.0, Recommendations**, makes recommendations based on the evaluation of the current hydrogeologic and analytical data presented herein.
- **Chapter 6.0, References**, lists documents cited in this report.
- **Appendix A, Groundwater Sampling Field Data Sheets**, provides documentation of field activities.
- **Appendix B, Data Quality Assessment and Analytical Data**, provides a narrative explaining the assessment of data quality and any qualifications placed on the results and the full analytical laboratory report.

Appendix C, Time Series Plots and Comparative Statistics, provides time series plot for all monitoring wells and comparative statistics of selected wells.

2.0 FIELDWORK PERFORMED

This chapter summarizes field activities performed from September 14 through October 27, 2020. Groundwater elevation monitoring was completed on September 14 and 15, 2020; and groundwater resampling was completed on October 27, 2020, after the samples collected in September 2020 exceeded the recommended hold time because of laboratory instrument issues.

Groundwater sampling field data sheets are provided in Appendix A. Data quality assessment and laboratory analytical reports are provided in Appendix B. Time series plots for all monitoring wells and comparative statistics of selected wells are provided in Appendix C.

Ten groundwater monitoring wells were proposed to be monitored during this event as per the Sampling and Analysis Plan (SAP) Update that was submitted to Butte County on February 25, 2014 (URS 2014) and confirmed during the October 6, 2016 project team meeting.

2.1 Depth-to-Groundwater Measurements

Depth-to-groundwater was measured to the nearest ±0.01 foot, using an electric water level sounder in all wells. Depth-to-groundwater was recorded on the groundwater sampling field data sheets, provided in Appendix A.

2.2 Groundwater Sampling

Sufficient groundwater for monitoring was present at only three project monitoring wells (DMW-3, DMW-11, and MW-21) in September–October 2020. Samples were collected using the low-flow methodology, in accordance with Standard Operating Procedure A.1 (URS 2014). Purged water from each well was tested for field parameters that included pH, specific conductivity, temperature, and turbidity, using field portable meters at 5-minute intervals. Field parameters were recorded on groundwater sampling field data sheets provided in Appendix A. Groundwater samples were collected after the properties of pH, specific conductivity, temperature, and turbidity had stabilized to within 10 percent of the previous measurements.

The samples were labeled in the field and placed in chilled coolers pending delivery to the analytical laboratory. Samples were transported under standard chain-of-custody protocol to Eurofins–Eaton Analytical Laboratory, Inc. (Eurofins) in Monrovia, California for analysis. Eurofins' laboratories analyzed the acesulfame-K and sucralose samples using high-performance liquid chromatography mass spectroscopy. Copies of the laboratory analytical reports, quality control documentation, and data assessment are provided in Appendix B. Time series plots for all monitoring wells and comparative statistics of select wells are provided in Appendix C.

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3.0 GROUNDWATER MONITORING RESULTS

This chapter discusses the September–October 2020 groundwater elevation data and groundwater sample analytical results.

3.1 Depth-to-Groundwater Measurements and Flow Data

Shallow groundwater elevations that were measured in September 2020 decreased, compared to levels encountered during CUANCP sampling activities in February 2020. Groundwater elevations ranged from 122.94 to 183.5 feet above mean sea level (amsl). The calculated groundwater flow direction was to the northwest, with a horizontal gradient of 0.003 feet per foot (ft/ft). The average change in groundwater elevation between the February and September–October 2020 monitoring events was a decrease of approximately 8.68 feet. Comparing the September–October 2020 and February 2020 sampling measurements, the largest decrease in groundwater elevations was 13.99 feet, as measured at DMW-3. This decrease in water levels was within the normal range of seasonal fluctuations encountered between the spring and fall groundwater monitoring events. Depth-to-groundwater was recorded on groundwater sampling field data sheets, provided in Appendix A. Table 3-1 summarizes depth-to-groundwater measurements and shows well construction details. Figure 3-1 shows groundwater elevation contours during the September–October 2020 monitoring event.

3.2 Groundwater Sampling Field Parameters

Field parameters, including pH, specific conductivity, temperature, and turbidity, were monitored during well purging. The parameters were recorded on groundwater sampling field data sheets (Appendix A) during purging until they stabilized. Table 3-2 summarizes the final, stabilized parameters that were measured before sample collection.

3.3 Groundwater Analytical Results

3.3.1 Nitrate

Eurofins reported nitrate concentrations as N in the laboratory analytical reports that are provided in Appendix B. These results then were converted to nitrate (as NO_3). Table 3-3 summarizes the groundwater analytical results of nitrate as N and NO_3. Figure 3-2 shows a nitrate concentration map using the nitrate (as NO_3) results.

The analytical results of nitrate (as NO_3) in groundwater ranged from 28.3 mg/L at MW-21 to 66.4 mg/L at DMW-11. The nitrate (as NO_3) concentrations detected at DMW-3 (48.7 mg/L) and DMW-11 (66.4 mg/L) exceeded the MCL of 45 mg/L. Comparing the September–October 2020 and February 2020 sampling results, nitrate (as NO_3), concentrations increased in two wells (DMW-3 and DMW-11), while concentrations decreased in one well (MW-21). The largest increase was measured at DMW-3 (14.4 mg/L), while the decrease at MW-21 was -7.1 mg/L.

Time series plots (NO_3 versus Time) were generated for the CUANCP wells nitrate concentration data (Appendix C).

Comparative statistics of the nitrate data were also evaluated with the Analyse-It software tool, for nitrate data. The tool calculates the mean, standard error, standard deviation, and the 95 percent confidence interval (CI) and produces the results graphically as a box-and-whiskers diagram. Variable "box" lengths shown in the diagram indicate differing population variances. Data that fall outside the “whiskers” indicate outliers. As shown in the box-and-whiskers diagram (Appendix C), as of September–October 2020, the mean nitrate (as NO_3) concentration was greater than the MCL at DMW-3 (70.8 mg/L), DMW-13 (62.7 mg/L), DMW-14 (86.6 mg/L), DMW-18 (77.2 mg/L), and DMW-19 (79.3 mg/L).

3.3.2 Artificial Sweeteners: Acesulfame-K and Sucralose

The Eurofins analytical reports showing the results of acesulfame-potassium (acesulfame-K) and sucralose in groundwater samples are provided in Appendix B. Table 3-4 summarizes the analytical results of acesulfame-K and sucralose and their relationship with nitrate (as NO_3). Figure 3-3 shows the acesulfame-K and sucralose results map. Time-series plots of acesulfame-K and sucralose are provided in Appendix C.

For artificial sweeteners such as acesulfame-K and sucralose to be a successful tracer, they must be present in measurable quantities. Artificial sweeteners are ubiquitous in many processed foods and beverages. When these products are consumed, both acesulfame-K and sucralose are metabolized poorly by the human body. Evidence suggests that both acesulfame-K and sucralose are useful in distinguishing anthropogenic sources of contamination down to the nanograms per liter (ng/L) concentration. The method reporting limits for acesulfame-K and sucralose for this study were established at 20 and 100 ng/L, respectively.

Acesulfame-K was detected in two of the three wells sampled. Concentrations ranged from 75 ng/L (MW-11) to 190 ng/L (DMW-3). Comparing the September–October 2020 and February 2020 Acesulfame-K results, concentrations increased at DMW-3 (90 ng/L) and decreased at DMW-11 (-75 ng/L).

Sucralose was detected in one of the three wells sampled. MW-21 had a concentration of 1,300 ng/L, which was a decrease from the concentration recorded in February 2020 (11,000 ng/L).

4.0 CONCLUSIONS

Drought conditions experienced between 2012 and 2016 caused shallow groundwater elevations to decline to levels not encountered since the inception of the CUANCP. The above-average amount of rainfall received in the winters of 2017–2019 helped the shallow groundwater level rise back to measurable elevations in all ten of the site wells during the February 2020 monitoring event.

Sufficient groundwater for monitoring was present at only three of the ten site monitoring wells during September–October 2020. Measured depth-to-groundwater ranged from 122.94 to 183.50 feet amsl. The calculated groundwater flow direction was to the northwest, with a horizontal gradient of 0.003 ft/ft. The average change in groundwater elevation between the February and September–October 2020 monitoring events was a decrease of approximately 8.68 feet.

The analytical results of nitrate (as NO_3) in groundwater ranged from 28.3 mg/L at MW-21 to 66.4 mg/L at DMW-11. The nitrate (as NO_3) concentrations detected at DMW-3 (48.7 mg/L) and DMW-11 (66.4 mg/L) exceeded the MCL of 45 mg/L. Long-term nitrate (as NO_3) concentration trends appeared to be stable in most of the wells, but local drought conditions between 2012 and 2016 have prevented the consistent collection of samples since 2014, hindering a determination of recent trends for the completed project areas. Time-series plots and comparative statistics are provided in Appendix C. The following discussion summarizes the analyte concentration trends that were observed in the three wells sampled during the September–October 2020 monitoring event.

DMW-3 (downgradient from Project Area 1N)

- Nitrate (as NO_3) was detected at a concentration of 48.7 mg/L during the September–October 2020 monitoring event. This was less than the mean concentration at DMW-3 (70.9 mg/L) and within the standard deviation. Nitrate as NO_3 concentrations track similarly with groundwater level fluctuations at DMW-3. For example, the highest nitrate (as NO_3) concentrations were reported during 2000–2001, which coincided with the highest recorded groundwater elevations at DMW-3. Water level elevations have slowly decreased since then, as have the nitrate (as NO_3) concentrations.
- Acesulfame-K was detected at a concentration of 190 ng/L during the September–October 2020 monitoring event. Acesulfame-K has been detected consistently at DMW-3, with concentrations showing a decreasing trend.
- Sucralose was not detected during the September–October 2020 monitoring event. Sucralose concentrations have shown no discernable trend, having fluctuated between non-detect and 530 ng/L since March 2014.
- Decreasing concentrations of nitrate (as NO_3) and acesulfame-K suggest that the sewer construction completion in Project Area 1N has had a positive effect on groundwater quality, while the sucralose data indicate no significant impact.

DMW-11 (upgradient from Project Area 3S, downgradient from Project Area 2S)

- Nitrate (as NO_3) was detected at a concentration of 66.4 mg/L during the September–October 2020 monitoring event. This was greater than the mean concentration at DMW-11 (44.98 mg/L) and outside the standard deviation. Since 2007, Nitrate (as NO_3) concentrations at DMW-11 have been relatively stable, and appear not to have tracked groundwater elevation changes.

- Acesulfame-K was detected at a concentration of 75 ng/L during the September–October 2020 monitoring event. Acesulfame-K has been detected consistently at DMW-11, with concentrations showing a decreasing trend.
- Sucralose was not detected during the September–October 2020 monitoring event. Sucralose has never been detected at DMW-11, dating from September 2018.
- Low groundwater elevations since 2013 have resulted in sporadic sampling, making it difficult to evaluate the impact that sewer construction completion in Project Area 2S has had on groundwater quality.

MW-21 (downgradient from Project Area 1S)

- Nitrate (as NO_3) was detected at a concentration of 28 mg/L during the September–October 2020 monitoring event. This was less than the mean concentration at MW-21 (37.23 mg/L) and within the standard deviation. Nitrate (as NO_3) concentrations tracked similarly with groundwater level fluctuations at MW-21. For example, the highest nitrate (as NO_3) concentrations were reported during March 2017, which coincided with the highest recorded groundwater elevations at MW-21. Because the highest concentration was reported relatively recently, the trend should continue to be tracked, to verify whether the decreasing trend remains statistically significant.
- Acesulfame-K was not detected during the September–October 2020 monitoring event. Previously, Acesulfame-K had been consistently detected at MW-21. Concentrations have decreased significantly from the initial result of 11,000 ng/L in March 2014 to 39 ng/L in February 2020.
- Sucralose was detected at a concentration of 1,300 ng/L during the September–October 2020 monitoring event. Sucralose has been detected frequently at MW-21, at concentrations higher than at any other well in the program. Although the concentrations have tended to fluctuate, a historical maximum of 15,000 ng/L was reported at MW-21 in February 2019.
- Decreasing concentrations of nitrate (as NO_3) and acesulfame-K suggest that sewer construction completion in Project Area 1S has had a positive effect on groundwater quality. However, the historical maximum sucralose concentration that was recorded in February 2020 indicates that waste discharges from individual septic systems continue to affect groundwater quality. Therefore, the overall impact of the completion of sewer construction in Project Area 1S is unclear and will need to be tracked in future monitoring.

5.0 RECOMMENDATIONS

AECOM recommends that semi-annual sampling for nitrate (as NO_3), acesulfame-K, and sucralose continue for 5 years, to monitor concentration trends in the 10 site wells (DMW-3, DMW-5, DMW-7, DMW-11, DMW-13, DMW-14, DMW-18, DMW-19, MW-21, and MW-22).

The next monitoring event is scheduled for February 2021.

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TABLES

FIGURES

APPENDIX A

Groundwater Sampling Field Data Sheets

APPENDIX B

Data Quality Assessment and Analytical Data

APPENDIX C

Time Series Plots and Comparative Statistics