# Appendix R – 4.201 Permit Application

In addition to the materials listed at Section 2.303, application for a permit to conduct a new municipal or industrial water project shall be accompanied by the following information in the number required by the Director:

1. **Preliminary review and comment on the proposal by the appropriate agency of the Colorado Department of Natural Resources and the Colorado Department of Public Health and Environment within sixty (60) days of the date of submittal of the proposal for review.**

   The PFAS water treatment facility (WTF) Basis of Design Report submitted to the Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Division (WQCD) on October 6, 2026 is included in Exhibit A. Applicable rules and regulations as noted in the CDPHE WQCD's initial review of the PFAS WTF will be complied and included in the final design. No new water sources are proposed as part of this Project.

2. **Scope of Proposal**

   a. ***Provide detailed plans of the proposal, including proposed system capacity and service area plans mapped at a scale acceptable to the Department*.**

   The PFAS WTF will provide treated drinking water to Cherokee Metropolitan District (CMD) customers. The PFAS WTF, transmission pipelines, and distribution system improvements are located within the jurisdictional boundaries of El Paso County (EPC).

   Groundwater from CMD's existing North and South Well Fields will be conveyed to the PFAS WTF through existing raw water transmission pipelines. The PFAS WTF will utilize ion exchange (IX) treatment technology to remove per- and polyfluoroalkyl substances (PFAS) to produce drinking water that meets applicable state and federal water quality requirements.

   Raw water will be conveyed to the PFAS WTF through existing 16-inch and 24-inch raw water pipelines.

   Treated water will be conveyed from the PFAS WTF through an approximately two (2) mile 30-inch finished water transmission pipeline to the existing Ellicott storage tank and booster station along Colorado Highway 94 (CO-94). The finished water will be distributed from the Ellicott storage tank through the CMD existing water system to customers within the CMD primary service area and Schriever Space Force Base. Treated water will be conveyed from PFAS WTF through an approximately five (5) mile 8-inch finished water distribution pipeline to the Ellicott School District Service Area and the Ellicott Springs Subdivision Service Area along North Ellicott Highway.

   The PFAS WTF treatment capacity is 8.64 million gallons per day (MGD) and includes two (2) raw water storage tanks totaling approximately 1 MG and two (2) finished water storage tanks totaling approximately three (3) million gallons (MG). The PFAS WTF will treatment includes IX vessels, sodium hypochlorite storage and feed systems for

disinfection, and a 750 kilowatt (kW) standby generator for emergency backup power during utility outages.

The Entry Point Test Location (Sample Point ID: 017) for the finished water distribution system will be relocated from the Ellicott Tank Booster Pump Station to the PFAS WTF. The Entry Point Test Location will be located downstream of the finished water pumps inside the PFAS WTF.

The PFAS WTF will be constructed on CMD property located in unincorporated EPC. The PFAS WTF site is located near the intersection of North Ellicott Highway and CO-94. The PFAS WTF site is generally in the area east of CMDs primary service area and north of the Ellicott School District service area. The PFAS WTF site is approximately 38 acres with access to North Ellicott Highway.

The PFAST WTF finished water will be conveyed south on Ellicott Highway and West on CO-94 to the Ellicott Springs Subdivision service area and CMD service areas, respectively. The finished water pipelines will be located in the rights-of-way of roads and in private property easements as required.

The CMD service area map is included in Appendix O.

***b. Provide a description of all existing or approved proposed domestic water or sewage treatment systems within the Project area.***

Liquid, solid, and gas chlorination systems are located at the Ellicott Tank Booster Pump Station, a booster station near Tank 01, and the Ellicott Springs Booster Pump Station for disinfection. The treatment system has a capacity of 8.64 MGD, with chlorine applied at 2.0 mg/L and a contact time achieved within one (1) mile of the 30-inch transmission line to the west of the Ellicott Tank Booster Pump Station. The PFAS WTF and associated raw and finished water transmission pipelines will have a treatment and conveyance capacity of approximately 8.64 MGD, respectively.

CMD is the majority owner and sole operator of the Black Squirrel Water Reclamation Facility (BSWRF) which provides wastewater treatment services for CMD and the Meridian Service Metropolitan District (MSMD). The BSWRF has 4.8 MGD of maximum month permitted treatment capacity. Approximately 2.2 MGD of the BSWRF maximum month capacity is dedicated to the MSMD. The MSMD maximum month flow is approximately 0.5 MGD as of 2026. Approximately 2.6 MGD of the BSWRF maximum month capacity is dedicated to CMD. CMD's maximum month flow is approximately 1.1 MGD as of 2026. Total maximum month wastewater treatment plant flow is approximately 2.2 MGD as of 2026.

The BSWRF remaining maximum month capacity allocation is dedicated to future CMD and MSMD EPC customers including the Schriever Space Force Base.

***c. Describe the design capacity of each domestic water or sewage treatment system facility proposed and the distribution or collection network proposed in the Project area.***

The PFAS WTF and distribution system infrastructure has a capacity of 8.64 MGD or 6,000 gallons per minute (GPM). The capacity has been projected based on the projected peak day flow demands with buildout development of the land within the CMD's service area.

***d. Describe the excess capacity of each treatment system and distribution or collection network in the affected community or Project area.***

The PFAS WTF and distribution infrastructure has a treatment capacity of 8.64 MGD. The 2026 peak day system demand is approximately 5.76 MGD resulting in approximately 2.88 MGD (8.64 MGD– 5.76 MGD) of available treatment capacity for future demands and operational flexibility.

***e. Provide an inventory of total commitments already made for current water or sewage services.***

No additional water service commitments are proposed as part of this project.

CMD serves 25,000 residents with 9,258 taps as of 2026. The CMD water usage includes approximately 560 MG annually for residential customers and 172 MG annually for commercial, industrial, and irrigation customers. CMD serves an estimated 12,595 equivalent residential taps (ERTs) as of 2026.

***f. Describe the operational efficiency of each existing system in the Project area, including the age, state of repair and level of treatment.***

CMD's existing water facilities are at least 40 years old. Water is produced from 20 wells and collected in pipelines constructed between 1960 and 1980. The water is chlorinated at the Ellicott Booster Pump Station prior to conveyance to the CMD service area.

The chlorinator is a Hammonds calcium hypochlorite unit was constructed in 1985. The Hammonds unit cannot be controlled from the supervisory control and data acquisition (SCADA) system and is connected to specific pumps in the Ellicott Booster Pump Station. The Hammonds unit must be cleaned and reset manually to maintain chlorination levels and when the pump operation is changed. The Ellicott Booster Pump Station was constructed in 1982 and does not comply with 2026 building codes. The electrical system requires rebuilding in a new building to meet 2026 electrical code.

Water is pumped from the Ellicott Booster Pump Station into the CMD service area through a 17-mile, 30-inch welded steel pipeline constructed in 1965. The welded steel pipeline is in poor condition. The CMD had planned to replace the welded steel pipeline prior to the discovery of PFAS levels above the maximum containment level (MCL). Failure or major repair on the welded steel pipeline requires days of shutdown and a failure immediately threatens the health, safety, and welfare of the CMD customers. CMD intends to replace the welded steel pipeline at a future date when funding is available.

Finished water system chlorine levels are boosted at the west end of the 17-mile pipeline by a gaseous chlorine system constructed in 1965. The gaseous chlorine system is operable and the CMD intends to replace the gaseous chlorine system due to the

location in a populated area. The remainder of the finished water distribution system was constructed recently and has backup systems and redundant piping. The CMD is considering construction of an upgrade of the Ellicott Booster Pump Station to add variable frequency drives (VFD) for water level tank control.

***g. Describe the existing water utilization, including the historic yield from rights and use by category such as agricultural, municipal, and industrial supply obligations to other systems.***

CMD relies on groundwater supplies from the Upper Black Squirrel Creek Basin (UBS) Alluvial Aquifer and Denver Basin aquifers to meet municipal, commercial, irrigation, and bulk water service demands. CMD water portfolio totaled approximately 5,096 acre feet per year (AFY) in 2020 and includes UBS alluvial groundwater, Denver Basin groundwater, and non-potable irrigation supplies.

CMD Well No.'s 1 through 8 supply water to in-basin users including the Woodmen Hills Metropolitan District, Harding Nursery, Ellicott Springs, Ellicott School District, Antelope Acres, Diamond Moon Ranch, and El Paso County Telephone. The CMD historic well water use is shown in Table 1, and the reports are in Exhibit B.

**Table 1. Historic Well Water Use**

| Category | Water Rights Available (AFY) | 2018 Production (AFY) | 5-Year Average Production (AFY) (2020 to 2024) |
|---|---|---|---|
| **Well No.'s 1 to 8 (In-Basin)** | 653 | 456 | 532 |
| **Well No.'s 9 to 20** | 4,397 | 2,257 | 2,590 |
| **Totals** | **5,050** | **2,713** | **3,122** |

Additional groundwater supply is provided by Denver Basin groundwater wells, which produced approximately 311 AFY in 2018. The CMD maintains separate non-potable irrigation wells serving golf course irrigation demands.

The CMD water rights are used for the following purposes:

- Municipal supply
- Domestic use
- Commercial use
- Irrigation
- Agricultural use
- Institutional use
- Fire protection
- Replacement and augmentation uses where applicable

**Existing Uses and Obligations**

The CMD 2026 water use consists primarily of municipal and commercial demands within the CMD service area and bulk water deliveries to the Schriever Space Force Base.

The CMD municipal demand totaled approximately 1,995 AFY, while Schriever Space Force Base utilized approximately 290 AFY, in 2018. Additional commitments include parks irrigation, construction water use, and previously committed development allocations. The 2018 water demand by use category is shown in Table 2.

**Table 2. Existing Water Demand by Category**

| Use Category | 2018 Demand (AFY) |
|---|---|
| **Single-Family Residential** | 1,294.2 |
| **Multi-Family Residential** | 199.2 |
| **Commercial** | 375.4 |
| **Irrigation** | 126.0 |
| **Schriever Space Force Base** | 289.9 |
| **In-Basin Users** | 499.0 |

The CMD supply obligations to other systems include Woodmen Hills Metropolitan District, Harding Nursery, Ellicott Springs, Viewpoint and Antelope Acres, Ellicott School District, Diamond Moon Ranch, EPC Telephone, and Schriever Space Force Base. The commitments are supplied through existing groundwater rights and water delivery infrastructure. The CMD water resources reports conclude that existing water rights and planned future supplies are adequate to meet 2026 demands, existing commitments, and projected future growth within the CMD service area. The water allocation by user and use category is shown in Table 3.

**Table 3. Water Allocation by User**

| User and/or System | Allocation or Commitment (AFY) | Use Category |
|---|---|---|
| **Woodmen Hills Metropolitan District** | 350 | Municipal |
| **Harding Nursery** | 180 | Agricultural |
| **Ellicott Springs** | 60 | Municipal |
| **Viewpoint and Antelope Acres** | 50 | Municipal |
| **Ellicott School District** | 10 | Institutional |
| **Diamond Moon Ranch** | 2 | Domestic |
| **EPC Telephone** | 1 | Commercial |
| **Schriever Space Force Base** | 537 | Municipal and Institutional |

**3. Demonstration of Need**

***a. Provide population trends for the Project area, including present population, population growth and growth rates, documenting the sources used.***

CMD growth rate is based on the 2015 to 2025 average annual growth rate in the Cimarron Hills census designated place (CDP). The predicted population growth trend within the CMD service area with an estimated growth rate of one (1) percent per year is shown in Table 4.

**Table 4. 20-Year Population Projections**

| Year | Population |
|---|---|
| 2025 | 25,000 |
| 2026 | 25,250 |
| 2027 | 25,503 |
| 2028 | 25,758 |
| 2029 | 26,015 |
| 2030 | 26,275 |
| 2031 | 26,538 |
| 2032 | 26,803 |
| 2033 | 27,071 |
| 2034 | 27,342 |
| 2035 | 27,616 |
| 2036 | 27,892 |
| 2037 | 28,171 |
| 2038 | 28,452 |
| 2039 | 28,737 |
| 2040 | 29,024 |
| 2041 | 29,314 |
| 2042 | 29,608 |
| 2043 | 29,904 |
| 2044 | 30,203 |

***b. Specify the predominant types of developments to be served by the proposed new water and/or sewage systems or extensions thereof.***

The CMD service area land mainly residential. the CMD service area map is shown in Appendix O. The CMD service area zoning map is shown in Appendix F.

***c. Specify at what percentage of the design capacity the current system is now operating:***

i. Water treatment system.

ii. Wastewater treatment system.

The CMD water distribution system has production capacity of 4,301 AFY. The 2026 CMD demand is 3,140 AFY. The CMD water distribution system is operating at 73% (3,140 AFY / 4,301 AFY x 100%) capacity.

The Ellicott Booster Pump Station has a hydraulic design capacity of 8.64 MGD. The Ellicott Booster Pump Station operates at 66% or 5.62 MGD (8.64 MGD x 65%) of hydraulic design capacity to meet peak day demands.

The use of reuse water was considered and not part of the Project.

The BSWRF has a maximum month permitted treatment capacity of 4.8 MGD and is operating at a maximum month of 2.2 MGD in 2026. The BSWRF is operating at approximately 46% (2.2 MGD / 4.8 MGD x 100%) of its maximum month design capacity.

***d. Specify whether present facilities can be upgraded to accommodate adequately the ten-year projected increase needed in treatment and/or hydraulic capacity.***

CMD treatment facilities utilize chlorination as the primary treatment method. Chlorination is not effective for PFAS removal. PFAS compounds require advanced treatment technologies such as the IX vessels that will be incorporated at the PFAS WTF. The PFAS WTF is designed to provide treatment capacity to accommodate projected system demands for 20 years through 2047.

**4. Description of the water to be used by the Project and, to the extent identified by the Director in consultation with the applicant, alternatives, including: the source, amount, the quality of such water* ; the applicant's right to use the water, including adjudicated decrees or determinations and any substitute water supply plans, and applications for decrees or determinations; proposed points of diversion and changes in the points of diversion; the existing uses of the water; adequate proof that adequate water resources have been or can and will be committed to and retained for the Project, and that applicant can and will supply the Project with water of adequate quality, quantity, and dependability; and approval by the respective Designated Ground Water Management District if applicable. If an augmentation or replacement plan for the Project has been decreed or determined or an application for such plan has been filed in the court or with the Ground Water Commission, the applicant must submit a copy of that plan or application.**

The PFAS WTF will utilize the available groundwater from the CMD existing North and South Well Fields.

CMD completed PFAS sampling of the groundwater supply wells in 2023 and 2024. PFAS sampling and testing of the raw water wells have combined PFAS concentrations of 22 to 58 ng/L in Well No.'s 13, 15, 16, and 17. The maximum detected finished water Unregulated Contaminant Monitoring Rule (UCMR5) entry point concentration was 6.1 ng/L PFOA and 7.6 ng/L PFBS on October 15, 2024, as measured at the Ellicott Springs Subdivision. The Ellicott Tank Booster Station is the primary entry point for the CMD service area and has similar results of 4.2 ng/L PFOA and 5.1 ng/L PFBS. The sampled and tested wells which contain PFAS are shown in Table 5.

**Table 5. Groundwater Supply Wells with PFAS**

| Well No. | Source Name | Source Class | Source Description |
|---|---|---|---|
| 1 | Cherokee Well #1 | Groundwater | Supply to Ellicott Booster Station. |
| 2 | Cherokee Well #2 | Groundwater | Supply to Ellicott Booster Station. |

| Well No. | Source Name | Source Class | Source Description |
|---|---|---|---|
| 3 | Cherokee Well #3 | Groundwater | Supply to Ellicott Booster Station. |
| 4 | Cherokee Well #4 | Groundwater | Supply to Ellicott Booster Station. |
| 5 | Cherokee Well #5 | Groundwater | Supply to Ellicott Booster Station. |
| 6 | Cherokee Well #6 | Groundwater | Supply to Ellicott Booster Station. |
| 7 | Cherokee Well #7 | Groundwater | Supply to Ellicott Booster Station. |
| 8 | Cherokee Well #8 | Groundwater | Supply to Ellicott Booster Station. |
| 9 | Cherokee Well #9 | Groundwater | Supply to Ellicott Springs and Ellicott Booster Station. |
| 10 | Cherokee Well #10 | Groundwater | Supply to Ellicott Springs and Ellicott Booster Station. |
| 11 | Cherokee Well #11 | Groundwater | Supply to Ellicott Springs and Ellicott Booster Station. |
| 12 | Cherokee Well #12 | Groundwater | Supply to Ellicott Springs and Ellicott Booster Station. |
| 13 | Cherokee Well #13 (Sweetwater No. 1) | Groundwater | Supply to Ellicott Springs and Ellicott Booster Station. PFAS detected. |
| 14 | Cherokee Well #14 (Sweetwater No. 9) | Groundwater | Permanently offline. |
| 15 | Cherokee Well #15 (Sweetwater No. 8) | Groundwater | Supply to Ellicott Springs and Ellicott Booster Station. PFAS detected. |
| 16 | Cherokee Well #16 (Sweetwater No. 3) | Groundwater | Supply to Ellicott Springs and Ellicott Booster Station. PFAS detected. |
| 17 | Cherokee Well #17 (Sweetwater No. 11) | Groundwater | Supply to Ellicott Springs and Ellicott Booster Station. PFAS detected. |
| 18 | Owner's Well No. 18 (Sweetwater No. 2) | Groundwater | Supply to Ellicott Booster Station. |
| 19 | Owner's Well No. 19 (Sweetwater No. 5) | Groundwater | Supply to Ellicott Booster Station. |
| 20 | Owner's Well No. 20 (Sweetwater No. 13) | Groundwater | Supply to Ellicott Booster Station. |
| 21 | Owner's Well No. 21 (Sweetwater No. 15) | Groundwater | Supply to Ellicott Springs and Ellicott Booster Station. |
| 22 | Owner's Well No. 22 (Sweetwater No. 16) | Groundwater | Supply to Ellicott Booster Station. |

The 16-inch and 24-inch raw water pipelines will be constructed to connect the existing raw pipelines to the PFAS WTF. Water will be conveyed to the PFAS WTF through the existing raw water transmission pipelines. Treated water will be conveyed from the PFAS WTF through an approximately two (2) mile 30-inch finished water transmission pipeline to the existing Ellicott Storage Tank and Booster Station along

CO-94. Finished water will be distributed from the Ellicott Storage Tank and Booster Pump Station through the' existing water system to customers within 'the CMD service area and Schriever Space Force Base. Treated water will be conveyed from the PFAS WTF through an approximate five (5) mile 8-inch finished water distribution pipeline to the Ellicott School District Service Area and the Ellicott Springs Subdivision Service Area along North Ellicott Highway.

The Entry Point Test Location (Sample Point ID: 017) for the finished water distribution system will be relocated from the Ellicott Tank Booster Pump Station to the PFAS WTF. The Entry Point Test Location will be located downstream of the finished water pumps inside the PFAS WTF.

The PFAS WTF will treat existing well water containing PFAS. The existing groundwater sources have adequate water to supply the 8.64 MGD PFAS WTF. The CMD owns and controls the groundwater rights associated with the North and South Well Field wells. The CMD has 4,388 AFY of water rights consisting of 90% renewable alluvial groundwater and 10% deep bedrock aquifers. Average annual demand sits at 3,300 AFY with approximately 400 AFY of unrealized commitments. The CMD has approximately 1,500 AFY of reuse water available which will increase with wastewater flow.

The Project does not propose new groundwater wells or modifications to existing points of diversion. Groundwater will continue to be diverted from the CMD existing North and South Well Field wells. The PFAS WTF treats water after diversion and does not alter water rights administration. No Substitute Water Supply Plans are associated with the Project. The CMD has no pending applications for additional decrees or determinations associated with the Project. The Project is not located within a Designated Groundwater Basin and approval from a Designated Ground Water Management District is not required. No augmentation or replacement plan has been decreed, determined, or filed in connection with the Project.

The no-build alternative prevents CMD from utilizing groundwater wells affected by PFAS contamination and reduces available water supplies. Constructing the PFAS WTF is a practical and cost-effective alternative to maintain regulatory compliance and continue beneficial use of the CMDs existing groundwater resources and water rights.

Groundwater will be treated to federal and state standards at the PFAS WTF.

**5. Loss of Agricultural Productivity**

***a. Information on any agricultural water rights in the region converted to provide water for the Project now or in the future.***

The PFAS WTF and distribution infrastructure does not require the conversion of agricultural water rights. The Project will treat groundwater from 'CMD's existing well fields using existing District water rights. No agricultural irrigation systems or

agricultural water delivery infrastructure exist for the Project. No agricultural water rights will be converted for the Project now or in the future.

***b. Information on the amount of irrigated agricultural lands taken out of production, and a description of revegetation plans.***

No agricultural irrigation systems or agricultural water delivery infrastructure exist for the Project. No agricultural water rights will be converted for the Project now or in the future.

***c. Economic consequences of any loss of irrigated agriculture, including loss of tax base, in the region.***

The PFAS WTF will be built on agricultural land. No agricultural irrigation systems were in place and no decrease in agricultural productivity will occur. The pipelines will be constructed within agricultural land. Following construction, disturbed areas will be restored to pre-construction conditions, allowing the pipeline alignment land to continue supporting agricultural uses.

***d. Information as to loss of wildlife habitat, loss of topsoil, or noxious weed invasion, as a result of the transfer of water rights and subsequent dry-up of lands.***

The PFAS WTF will not contribute to the loss of wildlife habitat or noxious weed invasion. Topsoil will be lost as land will be cleared and grubbed to construct the PFAS WTF. The Project will include replacing topsoil and reseeding according to the EPC requirements.

***e. Information on impacts to agricultural head gates and water delivery systems.***

No agricultural irrigation systems or agricultural water delivery infrastructure exist for the Project. No existing infrastructure will be used for the Project now or in the future.

**6. The financial impact analysis of site selection and construction of major new water and sewage treatment facilities and/or major extension of existing domestic water and sewage treatment systems shall include but need not be limited to the following items:**

***a. A review and summary of any existing engineering and/or financial feasibility studies, assessed taxable property valuations and all other matters of financial aid and resources in determining the feasibility of the proposed new facility, including:***

***i. Service area and/or boundaries.***

The Project does not increase the CMD service area or boundaries.

***ii. Applicable methods of transmitting, storing, treating and delivering water and collecting, transmitting, treating and discharging sewage, including effluent and/or sludge disposal.***

The CMD North and South Well Field groundwater will be conveyed to the PFAS WTF through existing raw water transmission pipelines. The PFAS WTF will utilize IX media treatment technology to remove PFAS and produce 8.64 MGD of finished water that meets applicable state and federal water quality requirements. The 16-inch and 24-inch raw water pipelines will be constructed to connect the existing raw pipelines to the PFAS WTF. Water will be conveyed to the PFAS WTF through the existing raw water transmission pipelines.

Finished water will be conveyed from the PFAS WTF through an approximately two (2) mile 30-inch finished water transmission pipeline to the Ellicott Storage Tank and Booster Pump Station along CO-94. Finished water will be conveyed from the Ellicott Storage Tank and Booster Pump Station to the CMD to customers within the CMD service area and Schriever Space Force Base.

Finished water will conveyed from the PFAS WTF through an approximate five (5) mile 8-inc finished water distribution pipeline to the Ellicott School District Service Area and the Ellicott Springs Subdivision Service Area along North Ellicott Highway.

***iii. Estimated construction costs and period of construction of each new or extension facility component.***

The construction manager at risk (CMAR) cost estimate for the PFAS WTF is $57,000,000. The cost of the pipeline is estimated as $22,000,000. Construction of the PFAS WTF and pipelines will begin in 2027 and the PFAS WTF and pipelines will be operational in the summer of 2028 to achieve regulatory compliance. The cost opinion for the pipeline and the 30% price model for the PFAS WTF are included in Appendix P Exhibit B.

***iv. Assessed valuation of the property to be included within the service area boundaries.***

The PFAS WTF and pipeline do not alter the service areas of CMD or any other potential participant. The property for the proposed WTF is located at 23838 Highway 94 (Schedule No. 2400000310) and consists of approximately 37.72 acres. According to El Paso County Assessor records, the parcel has a current market value of $1,335 and an assessed valuation of $150. The property was acquired by Cherokee Metropolitan District on June 19, 2026, for $308,000.

***v. Revenues and operating expenses of the proposed new or extension facility, including but not limited to historical and estimated property taxation, service charges and rates, assessments, connection and tap fees, standby charges and all other anticipated revenues of the proposed new facility.***

The PFAS WTF will be supported through existing utility revenues, including water service charges, availability fees, and tap fees. CMD generates

approximately $16.8 million annually in operating revenue with an additional $4 million generated from tap fees and other sources. The CMD annual operating and administrative expenses are approximately $11 million. The PFAS WTF is anticipated to add approximately $328,000 per year in operation and maintenance (O&M) costs. CMD will continue to evaluate rates and charges to ensure adequate funding for operations, debt service, capital improvements, and long-term regulatory compliance as required.

***vi. Amount and security of the proposed debt and method and estimated cost of debt service.***

The CMD has $30 million in cash reserves. The CMD anticipates funding the Project through a combination of cash reserves and US Environmental Protection Agency (EPA) Emerging Contaminants in Small or Disadvantaged Communities (EC-SDC) grant funding, administered by CDPHE. CMD has received $299,848 of funding through this program and anticipates obtaining additional EC-SDC grant funds in 2027 with a maximum of $30 million from the program overall. CMD is also pursuing funding from the Colorado Water Resources and Power Development Authority (CWRPDA) state revolving fund (SRF) program. This ask is anticipated to be $30 Million and will be submitted during the January 2027 application window.

***vii. Provide the details of any substantial contract or agreement for revenues or for services to be paid, furnished or used by or with any person, association, corporation or governmental body.***

CMD maintains several customer service relationships that provide revenue to CMD through water service sales. CMD's largest customer is the Schriever Space Force Base which used approximately 83 MG of annual water usage and represents approximately 10% of CMD water system demands. The Schriever Space Force Base water sales generate approximately $643,359 in total annual revenue.

Additional customers include Tierra Vista Communities (Schriever Housing), Roberts Resorts, Ellicott Utility Company, LLC, and Smyrna Ready Mix Concrete LLC. The service relationships provide a stable revenue source for the CMD and support the continued operation, maintenance, and capital improvement of the water system.

**Exhibit A – Basis of Design Report**

COLORADO
Department of Public Health & Environment

# APPENDIX B: BDR Template
## Drinking Water Design Submittal
## Safe Drinking Water Program Implementation Policy #5

4300 Cherry Creek Drive South, B2
Denver, Colorado 80246-1530
CDPHE.WQEngReview@state.co.us, 303-692-6298

## COVER PAGE - BASIC INFO

| A. Project and System Information | |
|---|---|
| Supplier Name | Cherokee Metropolitan District |
| PWSID (Assigned by Division) | CO0121125 |
| Project Title | Water Treatment Facility |
| Submittal date | October 06, 2026 |
| Person to contact with design submittal questions | Kyria Bosma, PE |
| Email | kyria.bosma@ae2s.com |
| Phone | (720) 821-9078 |

**Signatures of System Representatives**

| Role | Date | Typed Name | Signature |
|---|---|---|---|
| Owner | 10/06/2026 | Kevin Brown | Kevin Brown |
| The owner is an individual, corporation, partnership, association, state or political subdivision thereof, municipality, or other legal entity. | | | |
| Applicant / System Legal Representative | 10/06/2026 | Kevin Brown | Kevin Brown |
| The system legal representative is the legally responsible agent and decision-making authority for a public water system (e.g. mayor, president of a board, public works director). The Designer or Consulting Engineer is not the legal representative. | | | |

Directions: Prior to submission to the department, the construction application must be signed by the Owner and/or a System Legal Representative. The department expects the public water system to send a duplicate copy to the local county health authority or county commissioner (if no county health authority) in whose jurisdiction(s) the drinking water facility is to be located. Signature is not required from the county.

For Community Systems, a Professional Engineer licensed in Colorado must stamp and sign design documents in accordance with Section 11.4(1)(b)(iii) of Regulation 11 and item 1.1.2 of the Design Criteria.

I was the engineer in responsible charge for (identify portions of work)

- Hydraulics and Basis of Design
- Raw Water Storage
- Raw Water Pumping
- Cartridge Filtration
- Adsorptive Media Treatment
- Chemical Storage and Feed Systems
- Finished Water Storage
- Finished Water Pumping

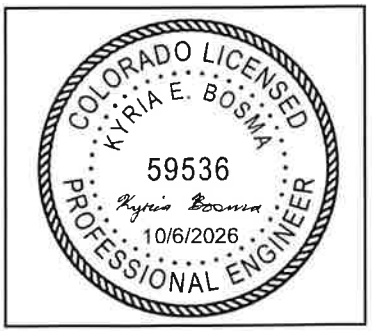
during the preparation of the basis of design report for the above-referenced project. To the best of my knowledge, the design is consistent with the most recent published version of the *Design Criteria for Potable Water Systems*, and that all site-specific deviations requests are listed in this report.

Kyria Bosma
Typed Name of Professional Engineer

10/06/2026
Date Signed

Kyria Bosma
Signature of Professional Engineer

59536
License #




P.E. Stamp and Signature

## Basis of Design Report (BDR)

In accordance with Regulation 11 and the *Design Criteria for Potable Water Systems*, the design review process must include a 'complete design' consisting of a basis of design report (BDR) and corresponding plans and specifications for review and approval by the Department. Please see Appendix A.1: Design Review Matrix for the required design submittal items for various project types. If Appendix A.1 indicates that a BDR submittal item is not required then please just put "n/a" in that section of the application.

## Section 1: Application for Construction Approval Form (DCPWS Section 1.2.1)

| **A/B. System information** | |
|---|---|
| Supplier name | Cherokee Metropolitan District |
| PWSID (assigned by Division) | CO0121125 |

**C. Project description**

*Please provide a project description including the description of existing waterworks, water treatment plants, unit processes, tank sizes, and distribution systems flows that affect and are affected by the project.*

The Cherokee Metropolitan District (District) is a Title 32 Special District serving approximately 29,000 residents, Schriever Space Force Base, and several smaller communities within a 5,000-acre area of unincorporated El Paso County, Colorado. The District operates a raw water system, a treatment facility, and a distribution network supplied by the Upper Black Squirrel Creek Alluvial Aquifer and Denver Basin Aquifers. Raw water is withdrawn from 21 wells along Ellicott Highway and conveyed to a central treatment facility. Raw water sources for the District are classified as groundwater and chlorinated prior to distribution to customers. The existing treatment facility contains a calcium hypochlorite feed system, pumps, and a storage tank along with ancillary pressure and flow monitoring components. The existing treatment facility has a diesel powered backup generator.

Raw water sampling conducted in 2023 indicates PFAS levels in blended water above promulgated regulatory limits. The District is developing a polyfluoroalkyl substances (PFAS) removal Water Treatment Facility (WTF) (Project) near Ellicott, Colorado to comply with EPA and Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Division (WQCD) maximum contaminant levels (MCL) of 4 parts per trillion (ppt) for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS). The Project will be delivered using the Construction Manager at Risk (CMAR) project delivery method. The District has acquired the land for the Project site prior to completion of design and construction.

The proposed WTF will include raw and finished water tanks, pumps, and pipes to convey finished water to the distribution system. The PFAS WTF will include an overflow basin for raw water and finished water tanks, a storm water detention pond, and an on-site septic tank and leach field for non-process wastewater. PFAS WTF treatment methods include cartridge filters and ion exchange (IX) vessels for the effective removal of PFAS present in the source water, as well as a sodium hypochlorite chlorination system for disinfection. The PFAS WTF equipment, pumps, and chemical storage will be located in a pre-engineered metal building.

The WTF is designed for a firm treatment capacity of 6,000 gpm (8.64 MGD). Unit processes follow a N+1 design criteria for redundancy.

**D. Scaled map illustrating any proposed structure or waterworks**

*Please attach a scaled map illustrating any proposed structure or waterworks.*

*Note: Suppliers serving less than 500 people may submit an aerial photograph (i.e., satellite image) or equivalent showing existing and proposed structures.*

See project map in Attachment 1 for the location of the PFAS WTF.

**E. Vicinity map illustrating any new or affected sources**

*Please attach a vicinity map illustrating any new or affected sources with regard to the pertinent watershed.*

*Note: Suppliers serving less than 500 people may submit an aerial photograph (i.e., satellite image) or equivalent showing existing and proposed waterworks.*

Not applicable – No changes to sources. See Attachment 2 for the vicinity map of the project.

**F. Rated capacity**

*Please provide the requested rated capacity for the project.*

- *Sources: maximum flowrate in gallons per minute*
- *Water treatment plants: Please fill out Section 5B below with the rated capacity in gallons per minute.*
- *Water storage tanks: volumes in gallons*

PFAS WTF

- Rated maximum flow rate: 6,000 gpm (8.64 MGD)
- Two (2) Raw Water Tanks: 500,000 gallons each
- Two (2) Finished Water Tanks: 1,500,000 gallons each

**G. Approximately total project cost including construction and design**

*Please provide an approximate construction cost for the project including both design costs and construction costs.*

*Note: Suppliers serving less than 500 people are exempt from this requirement.*

$57,000,000

**H. Requested Deviations**

*Please list any requested site specific deviation information below or provide a list of requested deviations. Suppliers may request site specific deviations from any Design Criteria requirement under Section 1.4 of the Design Criteria. Site specific deviation are for situations where the supplier has a technical justification for an alternative design parameter or alternative strategy for meeting the intention of the Design Criteria. Deviation requests must specify the Design Criteria requirement and justification for the deviation request.*

| No. | **DCPWS Requirement** (e.g., Section 4.3 Redundant filters) | **Site Specific Deviation Request** (e.g., The supplier requests a deviation from the Section 4.3 redundant filter requirement since the supplier has a backup connection to another public water system that could provide daily flows for the approximately 2 week period while replacement filter parts are shipped to the site) |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

**I. Implementation Plan and Schedule**

*Please discuss the proposed date to start construction and the estimated start up/completion date.*

The PFAS WTF design was initiated in the Fall of 2025. PCL Construction was selected as the CMAR in 2026. The PFAS WTF construction will begin in early 2027 and the estimated completion date is June 2028.

## Section 2: Sources of Potential Contamination (DCPWS Section 1.2.2)

**A. 100 Year Flood Plain**

*Please fill out the flood plain information below.*

General flood plain information (all suppliers):

All water facilities must have the potential 100-year flood threat evaluated based on available floodplain data from one or more of the following sources: the Colorado Water Conservation Board, U.S. Army Corps of Engineers, Housing and Urban Development, County Government, local flood districts, etc. A copy of any background information used in the 100-year flood threat determination process must be included along with a comparison of the site vertical elevation datum and floodplain reference elevation datum.

**The 100-year flood threat was evaluated for:**

**Cherokee Metropolitan District PFAS WTF – see attachment 3 for the floodplain map.**

(e.g. Well, Water Treatment Facility, Tank)

**100-year flood threat determination was based on the information enclosed from:**

**FEMA National Flood Hazard Layer Viewer**

(e.g. FEMA floodplain map, U.S. Army Corp, elevation)

Non-Community Public Water Systems

*For Non-Community Public Water Systems, an authorized representative of the system responsible for operation and compliance must sign the Floodplain Certification*

I hereby certify that a judgment has been made after evaluating all available floodplain data and in my opinion, these waterworks, as located and designed, are not subject to flood damage by a 100-year event.

Not Applicable
Typed Name of Authorized System Representative

Date Signed

Not Applicable
Signature of Authorized System Representative

Community Systems

*For Community Systems, a Professional Engineer licensed in Colorado must stamp and sign the Floodplain Certification.*

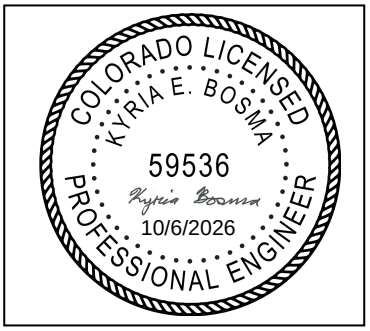
I hereby certify that a Professional Engineering judgment has been made after evaluating all available floodplain data and in my professional opinion, these waterworks, as located and designed, are not subject to flood damage by a 100-year event.

Kyria Bosma
Typed Name of Professional Engineer

10/06/2026
Date Signed

Kyria Bosma
Signature of Professional Engineer

59536
License #




**B .Existing and potential contamination sources**

*Please discuss the location of existing and potential sources of contamination that may affect the proposed waterworks within the following distance:*

i. *Groundwater sources: 500 feet*
ii. *Surface water sources: Not applicable – the Department recommends updating the source water protection plan.*
iii. *Water treatment: 500 feet.*
iv. *Storage: Underground - 500 feet; ground level or above – 100 feet.*

The District owns and operates 21 existing groundwater wells. The wells currently pump to the Ellicott Booster Pump Station which is higher in elevation than the proposed raw water tanks. The well pump speeds will be revised to the proposed hydraulic grade line which will be lower than the existing hydraulic grade line.

Contamination risks associated with the project are primarily internal to the building and sodium hypochlorite tanks. Pipes within the chemical room will be sealed, watertight, and fireproof. Waste from instrumentation will be directed to a waste tank on-site.

Sodium hypochlorite (12.5-percent liquid) is stored on-site. Sodium hypochlorite will be stored in a separate room in three (3) tanks, each with a minimum volume of 2,500 gallons, located inside a containment area. The liquid sodium hypochlorite will be delivered in bulk.

The eyewash, shower, and bathroom require potable water. The potable water will be delivered from the 24-inch finished water pump discharge pipe within the PFAS WTF and will be supplied with a backflow prevention device for cross contamination control.

Tank vents, overflow and hatches will be designed and installed in accordance with the Design Criteria for Potable Water Systems. Tanks will follow guidelines for protected water storage.

A diesel-powered backup generator is designed for the facility and will be located outside the building within its own enclosure. The fuel storage tank will be dual-walled with instruments to monitor if the primary tank leaks. The diesel storage tank will be located a minimum of 50 feet away from protected water storage tanks.

**C. Contamination source mitigation strategy**

*If existing and potential contamination sources are identified in Item B, then please discuss a mitigation strategy to prevent risk (see Item 1.2.2.c for examples).*

The eyewash, shower, and bathroom require potable water. The potable water will be delivered from the 24-inch finished water pump discharge pipe within the PFAS WTF and will be supplied with a backflow prevention device for cross contamination control.

The building will be equipped with floor drains. Floor drains will be directed to a dedicated drain line to the onsite process waste tank.

The potential sources of contamination for the water storage tanks include tank openings, back siphonage through drain and overflow pipes, water age, and sedimentation. Tank openings carry a potential risk for contamination from insects and animals, rainwater, dust, and debris that may enter the tank. The vent and overflow pipes of the tanks will be equipped with a non-corrodible mesh screen with openings that are less than 0.07 inches (16 mesh) in size to prevent insects, animals, and debris from entering the tank. The roof of the tanks will be conical and sloped so that snow and water does not accumulate on the roof of the tank and block the vent. The drain and overflow pipes of the tanks will be equipped with flap gate or duckbill type check valves and follow air gap methods in potable water criteria. Access hatches on the proposed tanks will be fitted with watertight gaskets to prevent water or insect intrusion into the tank. In addition, access hatches and tank openings will be locked to prevent any unauthorized access.

## Section 3: Water Quality Data (DCPWS Section 1.2.3)

**A. Source Data (See table 1.1 for required sampling). Please attach lab results.**

*Please provide at least two sets of water quality data for new sources and discuss any results above MCL or health advisory level. Required water quality parameters and frequency (e.g., different month or different quarter) depends on public water system classification (e.g., community, transient non-community). See Table 1.1 in the Design Criteria for more information.*

Not applicable – no new sources.

**B. Process Selection Data (See tables 1.2 and 1.3 for required sampling). Please attach lab results.**
*Please provide water quality results for all projects that impact treatment and discuss any relevant parameters below. Examples of waterworks projects that impact treatment works include, but are not limited to: new public water systems, new treatment plants, new sources treated at existing treatment plants, and modifications to existing treatment processes. Required water quality and frequency (e.g., different month or different quarter) depends on treatment process (e.g., disinfection, filtration), public water system classification (e.g., community, transient non-community). See Tables 1.2 and 1.3 in the Design Criteria for more information.*

No new raw water sources are added during this project. Raw water quality is provided in Attachment 4 and Attachment 5 PFAS Treatment Evaluation for Cherokee Metropolitan District – Table 2-2 with well PFAS results in Table 2-1. Additional UCMR5 entry point data is provided in Attachment 6.

The use of IX pressure vessels requires cartridge filters (5 micron filters) located upstream to remove particulate matter and protect the IX pressure vessels media.

The selection of IX for the PFAS removal process is based on pilot-scale column testing of multiple treatment methods performed by Hazen during a feasibility study. The IX media was tested with a minimum empty bed contact time (EBCT) of 2 minutes and longer changeout frequencies compared to the granular activated carbon (GAC) and Fluoro-sorb (FS) media. The IX treatment solution offered a considerably smaller footprint and cost savings over the larger GAC treatment alternative while also representing the highest treatment effectiveness of the piloted adsorbents. The IX media outperformed FS media in PFAS treatment during seven (7) months of adsorption piloting.

Chlorine by calcium hypochlorite is added in the existing system before and after the finished water tanks to meet the district target of 1.2 to1.4 mg/L in the summer and 1.4 to 1.6 mg/L in the winter. Chlorine dosing via sodium hypochlorite was selected as the method of chemical treatment for the new WTF. Jar testing by revealed an estimated chlorine demand of 0.6 mg/l. A 12.5% sodium hypochlorite solution was selected after evaluation of several alternative feed systems including gas chlorine, 0.8% chlorine onsite hydrogen generation, 10% liquid chlorine and solid calcium hypochlorite. The 12.5% sodium hypochlorite solution was shown to have the lowest estimated life cycle cost of the evaluated alternatives.

Jar testing was performed in September 2022, to determine a sodium hypochlorite dosing rate and to calculate the District's raw water chlorine demand. A stock volume solution of 2,000 milligrams/liter (mg/L) of sodium hypochlorite was prepared. Total chlorine dosing concentrations were determined as between 1.4 mg/L and 2.8 mg/L to target the District's preferred EP chlorine residual range of 1.2 to 1.4 mg/L. Dosing concentrations were created by adding a specific volume of stock solution to a one-liter jar of raw water. Free chlorine values were measured at various time intervals for each sample with a Hach DR\890 Pocket Colorimeter. The time intervals reflected the contact time between the existing chlorine injection location and the existing EP. Free chlorine concentrations were recorded in conjunction with the initial chlorine dose to calculate chlorine demand of the raw water. The jar testing results are summarized in Table 1.

**Table 1 – Jar Testing Results Summary**

| Test Concentration (mg/L) | Free Chlorine after 32 minutes[1] (mg/L) | Calculated Chlorine Demand[2] (mg/L) | Free Chlorine after 72 minutes[3] (mg/L) | Calculated Chlorine Demand[2] (mg/L) |
|---|---|---|---|---|
| 1.40 | 1.08 | 0.32 | 0.98 | 0.42 |
| 1.60 | 1.22 | 0.38 | 1.13 | 0.47 |
| 1.80 | 1.48 | 0.32 | 1.45 | 0.35 |
| 2.00 | 1.74 | 0.26 | 1.69 | 0.31 |
| 2.20 | 1.81 | 0.39 | 1.75 | 0.45 |
| 2.40 | 1.86 | 0.54 | 1.78 | 0.62 |
| 2.60 | 2.05 | 0.55 | 2.19 | 0.41[4] |
| 2.80 | 2.33 | 0.47 | 2.31 | 0.49 |

[1] 32 minutes is the calculated time it would take for the water to reach the EP at 6,000 gallons per minute (gpm)

[2] Demand = initial test concentration – measured chlorine residual at time x

[3] 72 minutes is the calculated time it would take for the water to reach the EP at 2,700 gpm. 2,700 gpm was the demand of the pump station at the time of testing and was chosen to reflect the most accurate current conditions.

[4] JVA acknowledges that chlorine demand should have increased and that this is an erroneous result.

It was determined that the raw water chlorine demand ranges from approximately 0.26 to 0.62 mg/L based on the results of the jar testing. The District targets a chlorine residual between 1.2 mg/L and 1.4 mg/L at the entry point for distribution. The average expected dosing rate used for the basis of design is 2.0 mg/L.

The required capacity of the chlorine dosing system is 2.0 mg/L plus the chlorine demand per CDPHE WQCD DW005 Section 4.4.1.2. The disinfection system feed pump is designed to meet the total dosage capacity of 2.6 mg/L at maximum treatment rate.

A maximum dosage of 2.6 mg/l was selected for addition before the water enters the finished water storage tanks. A pump capacity of 9.36 gallons per hour (GPH) was selected at the design water flow of 8.64 MGD.

An additional dosing location after the finished water tank allows for adjustments to residual chlorine as needed before finished water distribution. An average dose of 0.75 mg/L and a maximum dose of 1.0 mg/L were chosen as the basis for design. The dosing pump will have a capacity of 3.60 GPH at the design water flow rate. An online chlorine analyzer will monitor the chlorine residual after the finished water tanks and be used to control this secondary dose point.

The disinfection system at the summer average daily flow of 5.9 MGD will use 152.3 gallons per day of 12.5% sodium hypochlorite solution at the typical design dosage of 2.6 mg/L. Chemical storage was designed to store over 30 days of the required chemical, or a capacity of 4,569 gallons. Two (2) 2,500 gallon storage tanks provide a capacity of 5,000 gallons with an additional tank planned for redundancy.

## Section 4: Process Flow Diagram/ Hydraulic Profile (DCPWS Section 1.2.4)

**A. Process Flow Diagram**

*Please provide a process flow diagram (PFD) below or attach to the submittal. The PFD must show all major liquid and solids flow paths through various unit processes, proposed sampling locations, chemical feed locations, bypasses, flow metering and control locations.*

The process flow diagram is shown in Attachment 7.

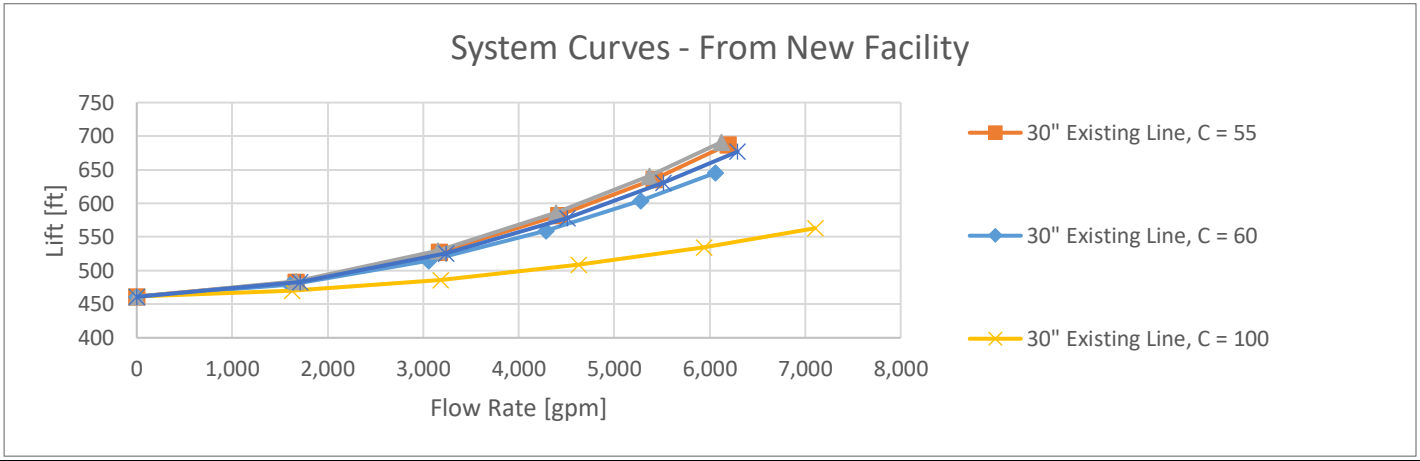
**B. Hydraulic Profile**

*Please provide a hydraulic profile below or attach to the submittal. At a minimum, the hydraulic profile(s) must include hydraulic elevations associated with the maximum and minimum water treatment plant flow conditions. Include the summary of calculations or a summary of the model used to arrive at the elevations presented. Additional evidence of calculations may be required by the Department on a case-by-case basis.*

*Note: Suppliers serving less than 500 people are exempt from this requirement.*

The hydraulic profile is shown in Attachment 8 which shows the maximum treatment capacity (8,000 gpm), firm capacity (6,000 gpm), and minimum capacity (680 gpm) flow rate hydraulic grade lines for sizing the raw pumps and motors. The hydraulic grade lines show losses through major equipment including cartridge filters, IX vessels, and backpressure valves as vertical drops.

The finished water pumps will discharge through a combination of new and existing transmission mains. The existing transmission mains were analyzed using hydraulic modeling along with historical flow and pressure data. The findings of the friction loss resulted in a dynamic system curve due to lower C-factors assigned to pipe using Hazen-Williams formula. The system curve for the finished water pumps with a TDH of approximately 665 feet TDH at 6,000 gpm is as follows. The finished water pumps are designed for 1,500 gpm at 680 feet TDH to account for valves and other fittings not included in the hydraulic model.



## Section 5: Capacity Evaluation and Design Calculations (DCPWS Section 1.2.5)

**A. For Source Projects**

*Please provide i) water rights information, ii) copy of the well permit (if applicable), and iii) source flowrate including permitted and pump capacity (pump curved preferred).*

This project does not modify the raw water sources – Not Applicable.

**B. For Treatment Projects**

*i. Please identify treatment goals (e.g., disinfection and filtration for compliance with the surface water treatment rule).*

The PFAS WTF Project includes the following treatment goals:

- Remove PFAS concentration to below the Maximum Contaminant Level (MCL).
- Provide minimum chlorine residual at the entry point and throughout the finished water distribution system.

The existing treatment technology cannot treat or remove PFAS as currently configured.

The best available technologies (BAT) as defined in the PFAS rule include adsorption through granular activated carbon (GAC) or ion exchange (IX) media or removal through reverse osmosis (RO) treatment. IX was selected through evaluation with pilot-scale testing.

*ii. Please identify the treatment plant's disinfection compliance method. For more information on groundwater treatment see Section 11.11(4) of Regulation 11 and for surface water see "Policy 4 Guidance: Guidance on Proper Operations of Water Treatment Processes for the Control of Microbiological Contaminants"*

*Groundwater treatment*

☒ *Triggered source water monitoring*
☐ *4 log inactivation of viruses (not typical)*

*Surface water or groundwater under the direct influence of surface water treatment*

☐ *Minimum chlorine monthly operating report*
☐ *Log inactivation monthly operating report*

☒ Not applicable, project does not impact disinfection

*iii/iv/v/vii Please provide information on the treatment process including each unit treatment processes. Please provide the overall treatment plant flowrate taking redundancy into account (see section 2.2) and identify the flow limiting unit process (see item 4.0.2 of the Design Criteria). For each unit treatment process please provide: design flow rate, hydraulic loading rate, process and equipment design parameters, technical assumptions, and design calculations. Please attach design calculations.*

Overall water treatment facility flowrate (gallons per minute): Maximum flowrate of 6,000 gpm (8.64 MGD)

Flow limiting unit treatment process: Finished water pumps.

Refer to Attachment 9 for basis of design summary.

| **Unit Processes** (e.g. flocculation, hypochlorite addition) | **Unit Process Description at Rated Capacity** |
|---|---|
| Raw Water Wells | The approximate flow of the combined wells: 14,340 gpm<br>The approximate firm capacity flow with largest well out of service: 12,545 gpm |
| Raw Water Pumps | There are four (4) end suction horizontal feed pumps with a design capacity of 2,000 gpm each at 120 feet total dynamic head (TDH) and a 100 HP motor. The firm capacity is 6,000 gpm with three (3) pumps in operation. |

| | |
|---|---|
| Cartridge Filters | Each cartridge filter vessel has a capacity of 2,000 gpm for a total of 8,000 gpm with four (4) vessels in operation. The firm capacity is 6,000 gpm with three (3) filters in operation.<br><br>The filters are 28 inches in diameter with ten (10) 60-inch long cartridges with a pore size of 5 microns.<br><br>The changeout pressure is set to 20 PSI with a maximum of 30 PSI. |
| Ion Exchange Vessels | There are four (4) IX units, each with two (2) vessels for eight (8) vessels total. Vessels are designed to operate in series (lead-lag) but may operate individually during media replacement. The design flow is 6,000 gpm. Each individual vessel is rated for 2,008 gpm using 537 cubic feet of media to provide the minimum two (2) minutes of empty bed contact time (EBCT) per CDPHE WQCD DW005 4.10.3.c.ii. Four (4) units are provided to meet redundancy requirements per CDPHE WQCD DW005 4.10.4.a and b (only three units at 2,000 gpm is needed to meet design flow of 6,000 gpm).<br><br>At the maximum flow rate of 18 gpm/$ft^2$ per CDPHE WQCD DW005 Section 4.10.6.a.i , each 12-foot diameter vessel has a capacity of 2,034 gpm. The EBCT criteria limits the maximum flow rate to 2,008 gpm through the unit. |
| Sodium Hypochlorite (Disinfection) | The sodium hypochlorite storage system is designed for the summer average day demand of 5.86 MGD flow rate.<br><br>The sodium hypochlorite feeder is designed for a 2.0 mg/L dose plus 0.6 mg/L of chlorine demand before finished water tanks at maximum flow rate per CDPHE WQCD DW005 Section 4.4.10.4.<br><br>The sodium hypochlorite feeder is designed for a 0.75 mg/L dose after finished water tanks at a maximum flow rate per CDPHE WQCD DW005 Section 4.4.10.4.<br><br>Bulk sodium hypochlorite solution will be delivered at a strength of 12.5%.<br><br>The sodium hypochlorite dose will be flow paced on a combined IX treated meter. The feeder for dosing after the finished water tanks uses a meter measuring finished water pump flow for flow pacing. |
| Finished Water Pumps | There are five (5) total pumps with a capacity of 1,500 gpm each at 680 feet of TDH. The firm capacity is approximately 6,000 gpm with four (4) of the five (5) pumps running. |
| | |
| | |

**C. For Storage Tank Projects**

*Please provide i) description of construction materials, ii) supporting calculations and technical assumptions for venting capacity, overflow capacity, buoyance (if applicable) and tank mixing system (if applicable), and iii) description of distribution and storage tank hydraulics and proposed operating regimes to promote adequate turnover and to minimize water age.*

*Please note that tanks less than 11,000 gallons do not have to submit supporting vent and overflow calculations (ii) and suppliers serving less than 500 people are exempt from the description of distribution and storage tank hydraulics and proposed operating regimes requirement.*

The raw and finished water storage tanks will be constructed in accordance with AWWA standard D110-13 for wire- and strand-wound, circular, prestressed concrete water tanks or AWWA standard D100-21 for welded carbon steel and will be above ground.

The raw and finished water storage tanks will be designed by the tank manufacturer, and ventilation will be specified to be sized for 12,000 gpm and 8,000 gpm, respectively. Raw water storage tank ventilation is based on all groundwater wells operating at one time, and finished water storage tank ventilation is based on the proposed water treatment facility's maximum production capacity.

Tank overflows will be 24-inch diameter piping for both the raw and finished water storage tanks. Tank overflow piping calculations are included in Attachment 10.

Buoyancy calculations are not required as the tank will be an aboveground tank and groundwater was not encountered onsite per the geotechnical report in Attachment 12.

**D. For Pumping and Distribution System Projects**

*For pump station projects, please provide supporting pump curves and limitations to provide adequate pumping capacity. For distribution system work: please provide line sizing, construction materials, and construction standards.*

The raw water and finished water pump curves are included as Attachment 11.

## Section 6: Monitoring and Sampling Evaluation (DCPWS Section 1.2.6)

**A. Proposed flow metering for sources and treatment**

*Please discuss the flow measurement provided for any individual sources and within any treatment plants. See Section 2.13 of the Design Criteria for flow metering requirements.*

The PFAS WTF will have a flow meter prior to each cartridge filter and a flow meter prior to each IX unit to ensure minimum and maximum filtration rates are maintained. Modulating butterfly valves will ensure the IX units are operating within minimum and maximum flow rates. The finished water pumps have a flow meter for total flow to the distribution system. An additional flow meter measures the portion of finished water discharge use for plant water.

**B. Water quality sampling evaluation**

*Please discuss the water quality sampling locations, the purpose and parameters being measured at the identified locations, and the means for feedback to operators (e.g., chlorine residual and turbidity compliance with Regulation 11, pH to monitor coagulation process via grab sample, online monitoring). Required sampling water quality locations depends on source type (e.g., groundwater, surface water) and treatment process (e.g., bag filter, conventional). See Section 2.9 of the Design Criteria for monitoring equipment requirements and Section 2.10 for sample tap requirements.*

A raw water sampling tap is provided to measure raw water pH, temperature, and other parameters.

Three (3) sample taps are provided on each IX vessel to measure the media life and adsorptive capacity remaining for PFAS removal. The sample taps will be placed at 25%, 50%, and 75% of media bed volume. The sample media is expected to last between 2 to 3 years in each vessel so a PFAS sample will be collected from the lead vessel during quarterly sampling for PFAS.

Post IX vessel sample taps are provided to measure PFAS removal and chlorine dose for disinfection.

A chlorine analyzer will be located downstream of the primary chlorine dose location prior to the finished water storage tank to monitor and regulate chlorine levels after sodium hypochlorite addition.

An online chlorine analyzer from the finished tank effluent will confirm chlorine residual at the entry point. A secondary sodium hypochlorite feed location is provided to boost chlorine residual if necessary.

Entry point sampling is located downstream of the finished water pumps and prior to the plant water supply for sampling requirements.

## Section 7: Geotechnical Report (DCPWS Section 1.2.7)

**Geotechnical report**

*Please attach a geotechnical report if the scope of the project includes a new structure with a foundation. At a minimum, the geotechnical report must include the following information as applicable to the design: site specific soil boring information that discusses seasonal and measured groundwater conditions, soil bearing capacity, excavation benching, shoring and sloping, bedding and backfill, compaction and moisture conditioning, alternative foundation design, an analysis of geotechnical hazards, and design recommendations based on the findings.*

*Note: Please note that a small slab on grade is typically not considered a foundation (e.g., supports a 10 ft by 10 ft shed). Building supported by a small slab on grade are exempt from this requirement.*

A geotechnical report is provided as Attachment 12.

## Section 8: Residuals Handling (DCPWS Section 1.2.8)

**Residuals handling plan – Chapter 9 of the DCPWS**

*If applicable, please discuss any treatment process wastewater (e.g., filter backwash, online monitoring wastewater) and the proposed discharge and/or disposal plan. See Chapter 9 of the Design Criteria for more information.*

The waste from the rinsing IX vessels and process area floor drains will be routed to a waste holding tank as shown on the PFD. The waste holding tank will be periodically drained via a vacuum truck and hauled off site. IX rinse to waste is anticipated during startup and media replacement and if disinfection of media is required during the life of the media.

Raw water tank overflow is routed to a raw water overflow basin with reinforced polypropylene liner.

## Section 9: Preliminary Plan of Operation (DCPWS Section 1.2.9)

**A/B. Staffing recommendations and relevant operator certification**

*Please discuss the project's impact (if any) on the operator requirements and if the supplier has a certified operator at the appropriate level. Please note that the approval letter will specify the certified operator requirement per Regulation 100.*

Matthew Mevis is the District's Operator in Responsible Charge (ORC) and is a Class A Certified Water Operator, as established by the Colorado Certified Water Professionals (CCWP) Program and Regulation 100. The PFAS WTF treatment will be a treatment system rating A, which is the highest rating.

Although there is a new treatment process, the District does not expect impacts on daily operation. The District does not anticipate the requirement to add staff to operate the new infrastructure. The design ensures access for perpetual operation and maintenance activities. Key activities include monitoring and media replacement. Media replacement is projected to be required every year and a half and will be completed by a qualified third-party contractor. The operators will be trained how to properly operate the PFAS WTF equipment and chemical addition.

**C. Basic operating configuration**

*Please discuss the expected normal operating configuration and process control procedures. Where initial operating conditions will be significantly less than design capacity, please discuss the design flexibility allowing the system to operate under differing flow rates.*

Integration into the District's SCADA network will allow for remote monitoring and control of PFAS WTF treatment processes. Instruments to monitor pressure and flow throughout the PFAS WTF tanks, raw and finished water pumps, and each of the cartridge filter and IX treatment units. Air vacuum valves are provided through the PFAS WTF to ensure meter accuracy and meters are installed per manufacturer recommendation with straight lengths and orientations.

IX operation will be provided with the vessels valved in series in a lead-lag configuration and remain until the lead vessel media is exhausted which is anticipated to take approximately 1.5 years. Average flow through both units is recommended to introduce fresh water into the vessels. Operators will switch lead-lag vessels by manually changing valve position. The vessels can operate between 680 to 2,008 gpm. A pressure sustaining valve downstream of the IX process will ensure minimum pressure in IX vessel is adequate. Each IX skid will have a modulating butterfly valve and flow meter to ensure the minimum and maximum flow rates are met.

To meet disinfection requirements, the sodium hypochlorite disinfection system will dose the treated IX water before entering the finished water tanks. A second feed allows dosing before the water enters the finished water pumps to account for changes in chlorine levels during storage. Chlorine analyzers are placed after the first chemical feed and before the second to accurately monitor and control the concentrations in the finished water. The chemical storage tanks are sized to meet 30 days of demand at the projected summer average water demand.

The District has a chlorine booster system located in the finished water distribution system near Tank 01. The chlorine booster system is at the end of the 30-inch transmission main. The PFAS WTF SCADA system monitors and increases chlorine dosage with gas chlorine as necessary prior to Tank 01.

**D. Phased operation**

*If applicable, discuss any phased operation of existing waterworks to maintain compliance during construction.*

*Note: Suppliers serving less than 500 people are exempt from this requirement.*

The existing chlorine booster systems and tanks will remain in service while the raw and finished tanks are constructed. Scheduled short periods of shut down for installing temporary piping during tie-in to the existing service lines will be performed. The Ellicott Booster Pump Station and the calcium hypochlorite feed system, pumps, and tank will be decommissioned following start-up of the PFAS WTF.

The existing Ellicott Booster Station will be taken offline and decommissioned once the PFAS WTF is installed, approved, and associated piping is connected and operational. Future water production will be through the PFAS WTF.

**E. Safety issues**

*Please discuss any safety issues for the source, water treatment plant, distribution system, individual components and/or equipment. See Section 2.18 of the Design Criteria.*

*Note: Suppliers serving less than 500 people are exempt from this requirement.*

The safety issue identified in the PFAS WTF is due to the presence of liquid sodium hypochlorite. An emergency eyewash and shower will be installed in the PFAS WTF chemical room in case personnel come into contact with sodium hypochlorite. No other safety issues are anticipated as a result of the proposed improvements.

**F. Redundancy**

*For treatment plant projects, please describe the approach towards redundancy. See Section 2.1 in the Design Criteria.*

Raw and finished water pumps, cartridge filters, and IX filters are designed to meet required PFAS WTF capacity, as well as one (1) additional unit, allowing design flow when a unit is shut down for repair or replacement.

The IX units are in a lead/lag configuration, and each unit can provide PFAS treatment for the PFAS WTF capacity with redundancy per CDPHE WQCD DW005 requirements.

## Section 10: Impact to Corrosivity (DCPWS Section 1.2.10)

**Project category (Category 1 – 4: see Appendix A, Table A.2 for Category descriptions).**

*Please note the proposed project's default corrosivity category in Appendix A, Table A.2. Table A.2 outlines default project categories, submittal requirements and LCR monitoring impacts. Please discuss if the submittal includes information (e.g., immersion coupon study results) to support a different category.*

*Note: Transient Non-Community Water System are exempt from this requirement.*

The IX process is listed as category 3 under Item TO-3 in Table A.1 Design Review Matrix. The switch from calcium hypochlorite to sodium hypochlorite is listed as category 2 under item TD-4 in Table A.1 Design Review Matrix.

**For Category 3 or 4 projects.**

*Category 3 projects have submittal requirements outlined in Table A.2. Please discuss or attach any required information. Category 4 projects require either Appendix K.1 or Appendix K.2. Appendix K submittals are typically done as part of the OCCT designation step. Please indicate the OCCT designation date or attach the Appendix K submittal.*

The IX process for PFAS adsorption is expected to create minimal impacts to water quality related to corrosivity. The IX vessels were observed to create minimal increases in the alkalinity or pH of the effluent during the pilot-scale PFAS study. The mass ratio of chlorine to sulfate was observed to change by less than 0.05.

The switch from calcium hypochlorite to sodium hypochlorite is expected to have minimal impact on corrosivity. Both chemicals slightly increase pH and alkalinity in the water.

## Section 11: Security and Emergency Response Program (DCPWS Section 1.2.11)

**Physical security design**

*Please discuss any physical infrastructure security measures and security related operational practices associated with the project. Designs must include physical controls such as fencing to restrict access, sturdy locking hardware on waterworks access points (e.g., tank hatches, building doors), and controlled human/vehicle access. See Section 1.2.11(a) of the Design Criteria for more information.*

Temporary barriers will be required during civil and building modification work during construction.

Exterior doors will be locked and the PFAS WTF will be visited by operators daily. Security cameras will be put in place to monitor intrusions. Access to hardware is provided from within the interior of the PFAS WTF with exterior access hatches present and locked. Sodium hypochlorite will be delivered in bulk and will be stored inside the locked and climate controlled PFAS WTF. Doors will be monitored via SCADA and remotely called out to operators.

Equipment will be inside the PFAS WTF building with locked access and an intrusion alarm, and no security concerns are anticipated. Hatches at the proposed water storage tanks will be locked and each tank will have an intrusion alarm. The proposed tanks and PFAS WTF building will be constructed within fencing on the site and security cameras will be installed. An automatic gate with restricted key card access will be provided a the PFAS WTF site.

The District has developed an emergency response plan (ERP) and the ERP is included in Attachment 13.

**Security and emergency response program**

*Please indicate if the supplier has developed a security and emergency response program. The design must include security and emergency response measures and address critical asset redundancy, monitoring, response and recovery. See Section 1.2.11(b) of the Design Criteria for more information and required plan components. A copy of the security and emergency response program does not need to be included in the submittal but the plans may be confirmed during sanitary surveys.*

*Note: Suppliers serving less than 500 people with only sodium hypochlorite treatment are exempt from this requirement.*

☒ Yes, the supplier has developed a security and/or emergency response program that addresses the Section 1.2.11(b) of the Design Criteria components.

☐ No, the supplier has a population less than 500 people, only sodium hypochlorite treatment, and does not have to develop a security and emergency response program.

## Section 12: Supplemental/Other Information (DCPWS Section 1.2.12)

**Any additional information that could be helpful for the design review?**

Alternative analysis and pilot results in attached PFAS Treatment Evaluation for Cherokee Metropolitan District – Attachment 5

## PLANS AND SPECIFICATIONS (DCPWS Section 1.3)

**Plans description and key sheets**

*Please attach plans and specifications for the proposed project. The purpose of plans and specifications are to confirm information contained in the BDR and to facilitate construction of the project. For suppliers utilizing the pre-accepted design packages or serving less than 500 people, process schematics and equipment cut sheets may be sufficient. See Section 1.3 of the Design Criteria for more information and required plan and specification components.*

*Please discuss the design status (e.g., 60% complete) and any key plans/specifications.*

Drawings and specifications are at 60% complete for state review only.

**Key Drawings:**

- **Sheet GEN-G002 – Drawing Index**
- **Sheet GEN-G003 – Vicinity Map**
- **Each discipline has general sheets for abbreviations, symbols, etc.**
- **Civil drawings for easements, property lines, right of way, datum control.**
- **Sheet GEN-P003, GEN-P004 and GEN-P005 – Process Flow Diagram with Basis of Design**
- **Sheet GEN-P006 – Hydraulic Profile**
- **Sheet WTF-P101 – Subgrade Level -Overall Plans**
- **Sheet WTF-P102 – Main Level – Enlarged Plan**
- **Sheet WTF-P103 through WTF-P108 – Main Level – Enlarged Plans**
- **IC Sheets – Process and Instrumentation Diagrams**
- **Sheet WTF-P701- Process Standard Details**

**Key Specifications:**

**01 33 00 - Submittals**

**Planning for CMAR delivery of the project and measures to mitigate construction activities will be added with the Division 00 specifications.**

## Chapter 2 checklist

Chapter 2: General Design Criteria outlines design criteria that applies to most projects. Below is a list of Chapter 2 requirements that may not be specifically addressed in the basis of design report. Please indicate the submittal location or indicate that the criteria is "n/a".

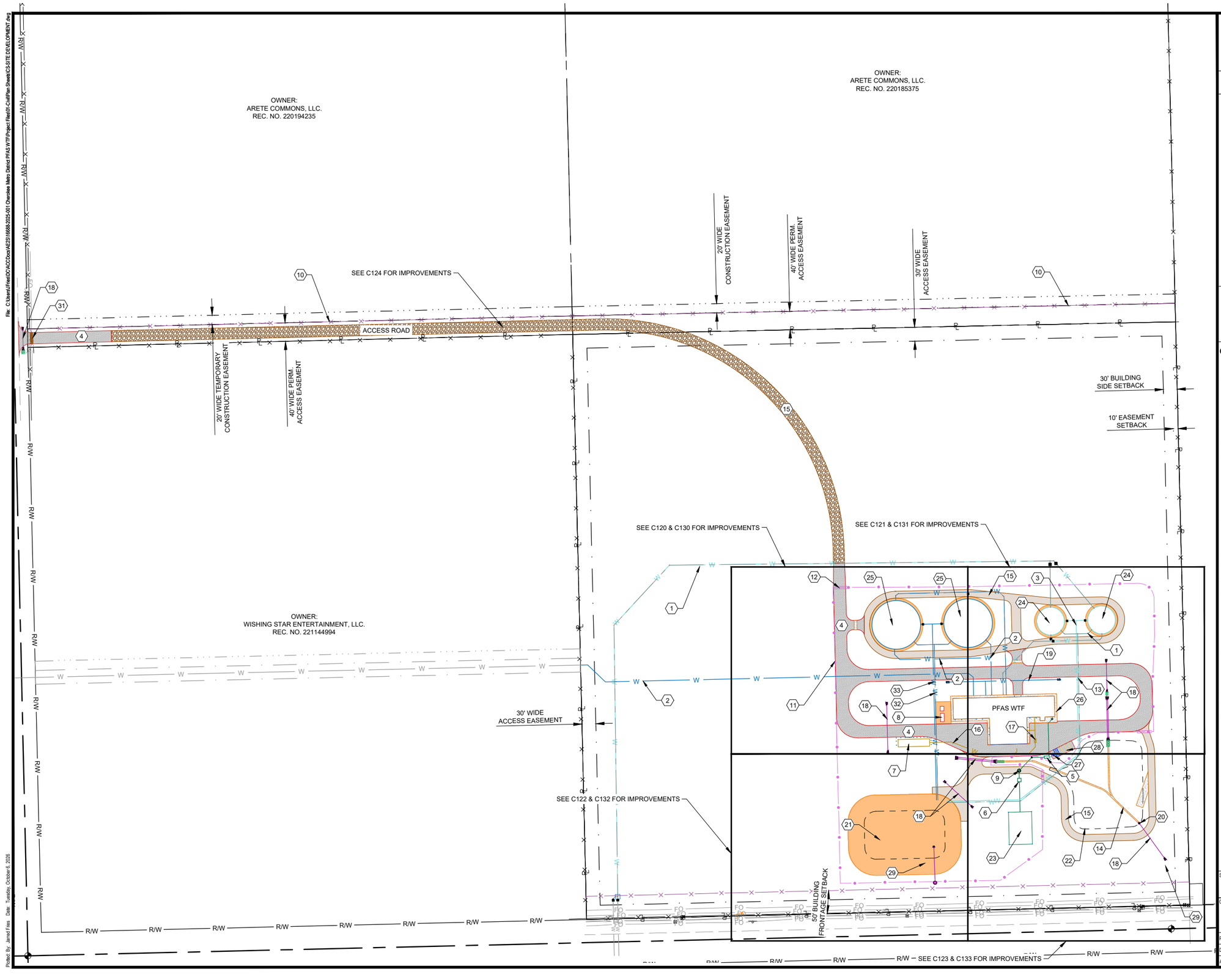
| Chapter 2 checklist | Submittal location |
|---|---|
| Redundancy discussion (Section 2.1), for treatment projects only | BDR Section 1.H |
| Location of structures (Section 2.4), applies to all projects | Attachment 1 |
| Electrical controls (Section 2.5), applies to all projects | 60% Drawings "E" and "IC" Sheets |
| Standby power/alternative supply (Section 2.6), applies to all projects | 60% Drawings "E" Sheets |
| Plant water (Section 2.11), for treatment projects only | 60% Drawings "P" and "M" Sheets |
| Disinfection of waterworks prior to initial use (Section 2.15), applies to all projects | 60% Specifications Section 46 05 10 |
| Operations and maintenance manual (Section 2.16), applies to all projects | 60% Specifications Section 01 33 00 |
| Operator instruction (Section 2.17), applies to treatment and pump stations projects | BDR section 9.A |
| Safety (Section 2.18), applies to treatment plant and chemical application projects | BDR Section 9.E |
| Materials in contact with partially treated or potable water (Section 2.21), applies to all projects | Specified "NSF" in specification sections. See 60% Specifications. |
| Other considerations (Section 2.22), as applicable | Not Applicable |

## Attachments

Please list any required or provided attachments below. If any attachments are not included then please put "n/a".

| Attachment list | Submittal location |
|---|---|
| Scaled map (Item 1.2.1(d)) | Attachment 1 |
| Vicinity map (Item 1.2.1(e)) | Attachment 2 |
| Floodplain map (Item 1.2.2(a)) | Attachment 3 |
| Water quality data (Item 1.2.3) | Attachment 4 |
| PFAS Treatment Evaluation for Cherokee Metropolitan District | Attachment 5 |
| UCMR5 Entry Point Data | Attachment 6 |
| Process flow diagram (Item 1.2.4(a)) | Attachment 7 |
| Hydraulic profile (Item 1.2.4(b)) | Attachment 8 |
| Basis of Design Summary (Item 1.2.5) | Attachment 9 |
| Tank overflow calculations | Attachment 10 |
| Raw and finished water pump curves | Attachment 11 |
| Geotechnical report (Item 1.2.7) | Attachment 12 |
| Emergency Response Plan | Attachment 13 |
| Plans (Section 1.3) | 60% Drawings |
| Specifications (Section 1.3) | 60% Specifications |

# ATTACHMENT 1: Scaled Map




File: C:\Users\JFreel\DOCDocs\AE2S\16688-2025-001 Cherokee Metro District PFAS WTP\Project Files\09-Civil\Plan Sheets\C-SITE DEVELOPMENT.dwg

Plotted By: Jarred Freel Date: Tuesday, October 6, 2026

Certification of Individual Project Design Disciplines Are Included On Their Individual Drawings, Respectively

Advanced Engineering and Environmental Services, LLC NOT FOR CONSTRUCTION PRELIMINARY

STATUS: **PRELIMINARY - NOT FOR CONSTRUCTION**

| REVISIONS | | | |
|---|---|---|---|
| SYM | DATE | | APPR |

NORTH

0 100
Scale in Feet

## CONSTRUCTION NOTES

1. RAW WATER MAIN, SEE SHEET C250 - C256
2. FINISHED WATER MAIN, SEE SHEETS C260 - C263
3. RAW WATER TANK DRAIN, SEE SHEET C252 AND C253
4. WIDE ASPHALT ROAD PER DETAIL 1/C705
5. SEPTIC TANK PER DETAIL 2/C704
6. SEPTIC PUMP TANK PER DETAIL 1/C704
7. WASTE HOLDING TANK
8. STANDBY GENERATOR, CT CABINET, AND XFRMR
9. SANITARY SEWER, SEE SHEET C290
10. 5-STRAND BARBED WIRE FENCE.
11. CHAIN LINK W/ 3-STRAND BARB-WIRE PER DETAIL 1/C706
12. AUTOMATIC CANTILEVER SLIDE GATE PER DETAIL 2/C706
13. RAW WATER TANK OVERFLOW, SEE SHEET C254 AND C255
14. TRICKLE CHANNEL PER DETAIL 2/C705
15. GRAVEL ROAD PER DETAIL 1/C705
16. WASTE DRAIN, SEE SHEET C291
17. SAND/OIL SEPARATOR
18. STORM CULVERT, SEE SHEETS C280 - C282
19. WATERMAIN TO HYDRANTS
20. POND OUTLET CONTROL STRUCTURE AND OUTFALL PIPE PER DETAIL 3/C705
21. TANK DRAIN AND OVERFLOW BASIN
22. WATER DETENTION POND
23. SEPTIC MOUND AREA
24. RAW WATER TANK, SEE SHEET P704 - P706
25. FINISHED WATER TANK, SEE SHEET P704 - P706
26. CONCRETE SIDEWALK PER DETAIL 3/C706
27. VAN ACCESSIBLE ADA SPACE
28. EMPLOYEE PARKING
29. TANK DRAIN AND OVERFLOW BASIN DEWATERING MANHOLE
30. CHAIN LINK DOUBLE SWING GATE
31. INSTALL STEEL WING CATTLE GUARD PER CDOT STANDARD DETAIL M-611-1. CONNECT TO BARBED WIRE FENCE ON EITHER SIDE OF ACCESS ROAD.
32. FINISH WATER TANK OVERFLOW, SEE SHEET C265 AND C266
33. FINISH WATER TANK DRAIN, SEE SHEET C264 AND C262

PROJECT TITLE:

**PFAS WATER TREATMENT FACILITY**

Advanced Engineering and Environmental Services, LLC www.ae2s.com

SHEET TITLE:

**SITE DEVELOPMENT PLAN**

CLIENT:

**CHEROKEE METROPOLITAN DISTRICT**

23838 CO-94, CALHAN, CO 80808

PREPARED BY: JJF
CHECKED BY: BG
APPROVED BY: BG

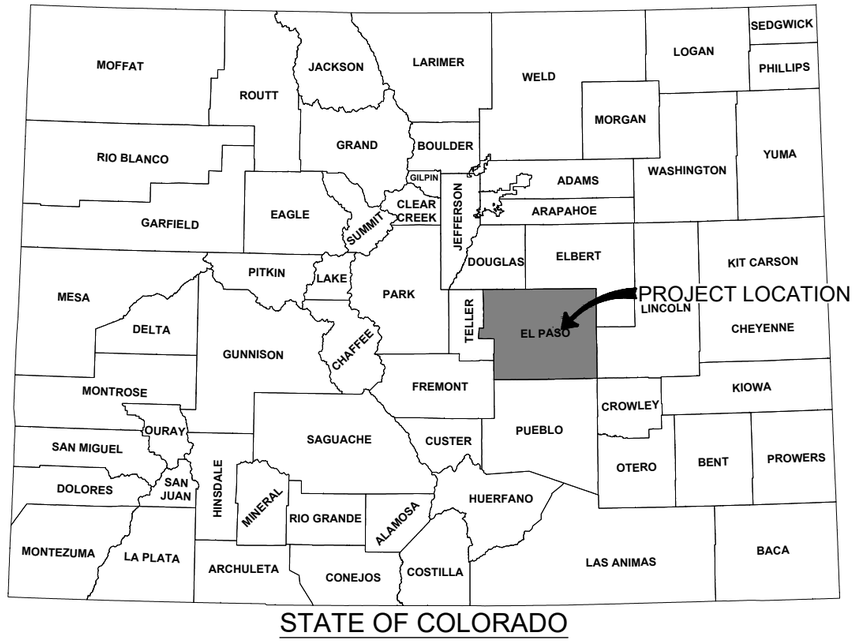
PROJECT NO: 16688-2025-001
DATE: OCTOBER 2026
ALT. PROJECT NO: 00000-0000

SHEET DESIGNATOR: **SW**

SHEET NO: **C100**

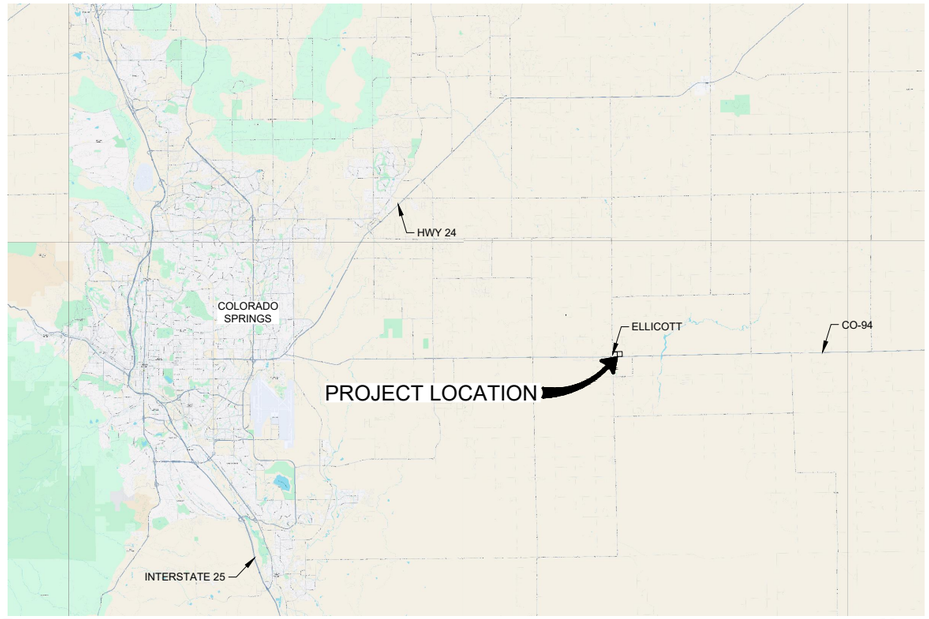
# ATTACHMENT 2: Vicinity Map

File: C:\Users\tkemp\DOCACDocs\AE2S\16688-2025-001 Cherokee Metro District PFAS WTP\Project Files\00-General\Plan Sheets\Cover_Index.dwg



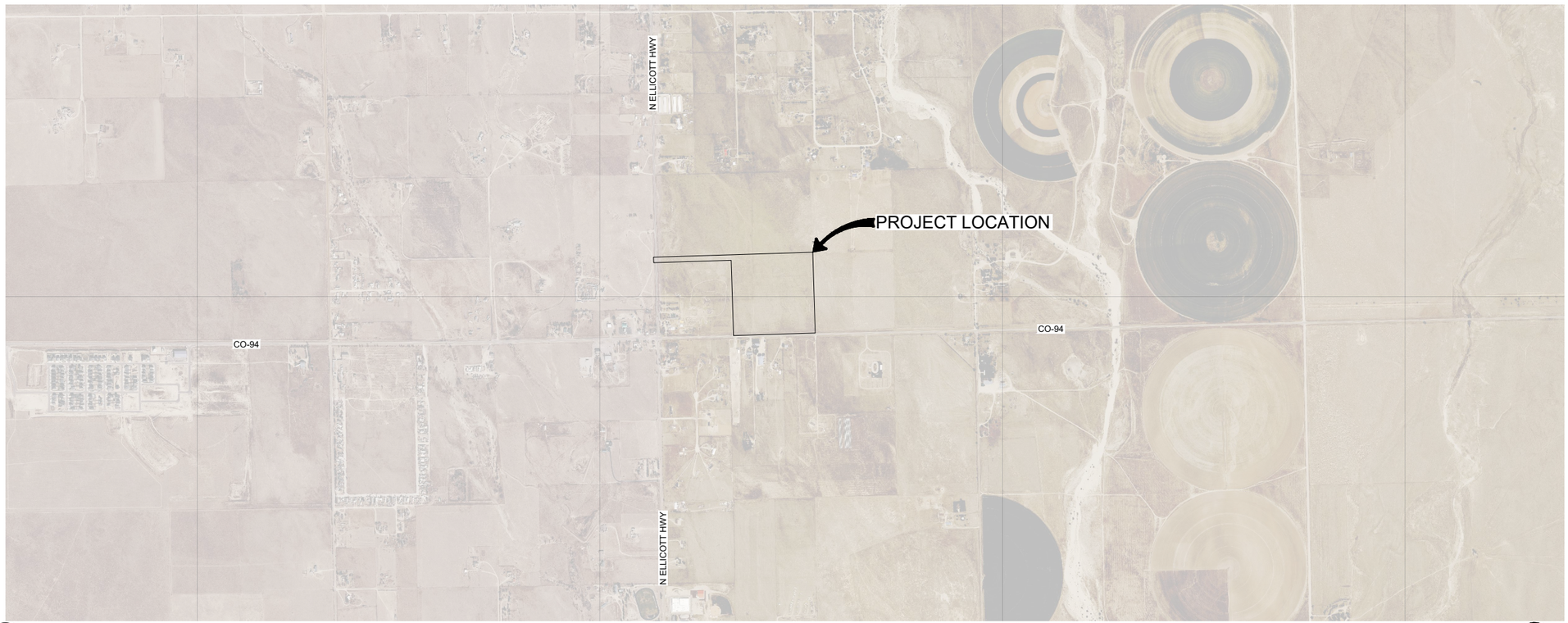

STATE OF COLORADO

1 G003 **PROJECT LOCATION MAP**
EL PASO COUNTY




2 G003 **PROJECT VICINITY MAP**
SCALE: NONE

NORTH




3 G003 **PROJECT AERIAL MAP**
SCALE: NONE

NORTH

Certification of Individual Project Design Disciplines Are Included On Their Individual Drawings, Respectively

Advanced Engineering and Environmental Services, LLC PRELIMINARY NOT FOR CONSTRUCTION

STATUS: **PRELIMINARY**

| REVISIONS | | | |
|---|---|---|---|
| SYM | DATE | | APPR |

PROJECT TITLE:

**PFAS WATER TREATMENT FACILITY**

**Advanced Engineering and Environmental Services, LLC** www.ae2s.com

SHEET TITLE:

**LOCATION AND VICINITY MAP**

CLIENT:
**CHEROKEE METROPOLITAN DISTRICT**
23838 CO-94 CALHAN, CO 80808

PREPARED BY: TRK
CHECKED BY: KEB
APPROVED BY: ARB

PROJECT NO: 16688-2025-001
DATE: OCTOBER 2026
ALT. PROJECT NO: 00000-0000

SHEET DESIGNATOR: **GEN**

SHEET NO: **G003**

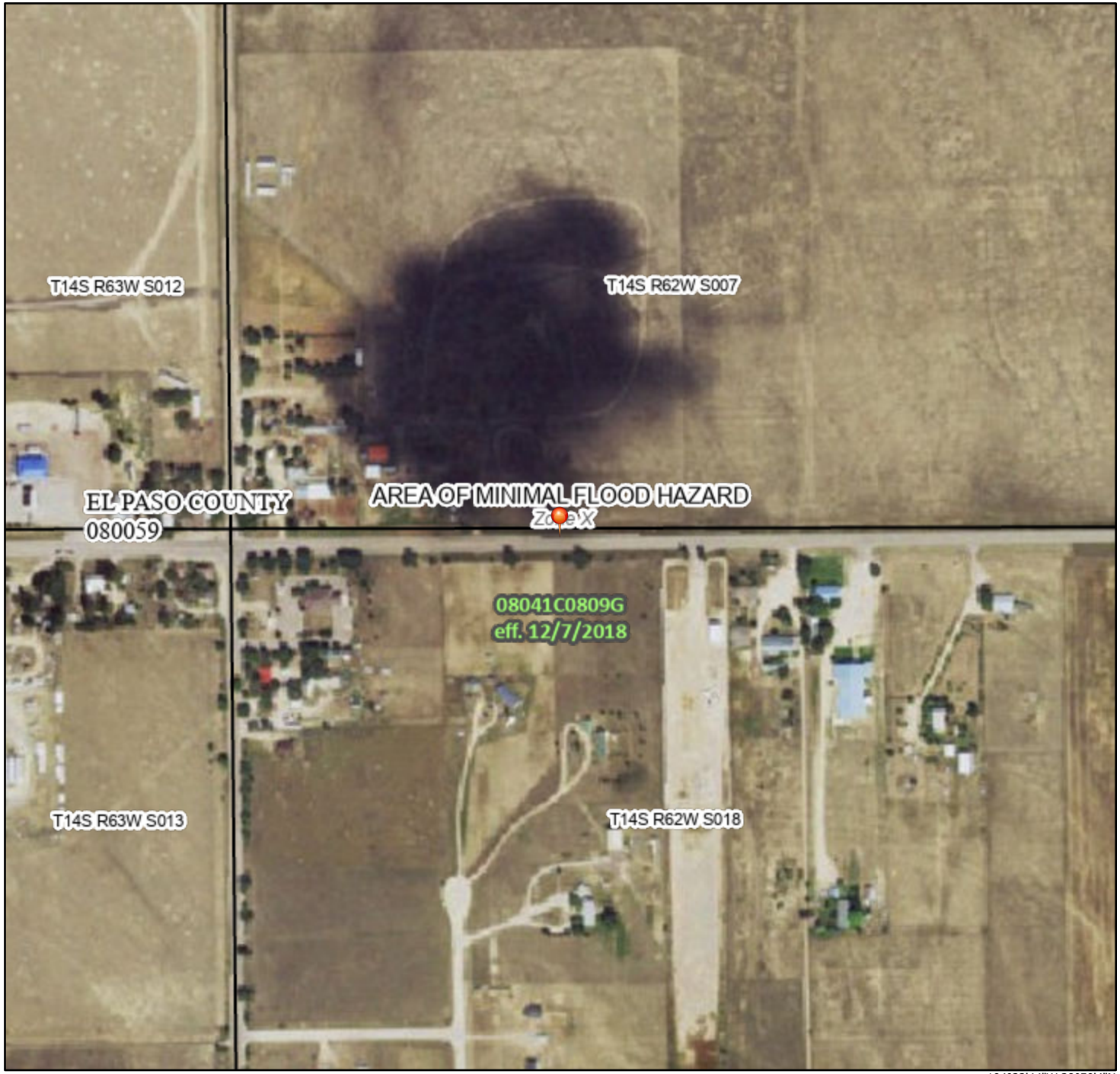
Plotted By: Twila Kemp Date: Monday, October 5, 2026

# ATTACHMENT 3: Floodplain Map

# National Flood Hazard Layer FIRMette

FEMA

104°23'21"W 38°50'32"N




104°22'44"W 38°50'4"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

*Basemap Imagery Source: USGS National Map 2023*

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

**OTHER AREAS**
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

**GENERAL STRUCTURES**
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/8/2025 at 8:41 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

# ATTACHMENT 4: Water Quality Data

**Raw Water Quality Data Summary**

| Date | pH | Temp (°C) | Turbidity | Total Hardness (mg/L as CaCO3) | Total Alkalinity (mg/L as CaCO3) | TDS (mg/L) | TOC (mg/L) | Conductivity | Flouride (mg/L) | Nitrate (mg/L) | Iron (mg/L) | Manganese (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/27/2022 | | | | | | | | | 0.36 | 5.2 | | |
| 2/9/2022 | | | | | | 424 | | | | | | |
| 3/15/2022 | 7.65 | 11.9 | | | | 526 | | 743 | | 5.62 | | |
| 3/23/2022 | 7.93 | 12.9 | | | | 527 | | 741 | | 5.65 | | |
| 3/29/2022 | 7.92 | 14.3 | | | | 481 | | 679 | | 5.94 | | |
| 4/5/2022 | | | | | | | | | | 5.59 | | |
| 4/13/2022 | | | | | | | | | | 6.29 | | |
| 4/19/2022 | | | | | | | | | | | | 0.02 |
| 4/20/2022 | | | | | | | | | | 5.13 | | |
| 4/27/2022 | | | | | | | | | | 5.67 | | |
| 5/4/2022 | | | | | | | | | | 6.91 | | |
| 5/10/2022 | | | | | | 348 | | | | 6.03 | | |
| 5/17/2022 | 7.7 | 15.7 | | | | 597 | | 703 | | 5.08 | | |
| 5/25/2022 | 7.63 | 16.2 | | | | 398 | | 558 | | 5.23 | | |
| 6/7/2022 | 7.79 | 16.9 | | | | 293 | | 413 | | 5.92 | | |
| 6/14/2022 | 7.34 | 16.8 | | | | 543 | | 638 | | 6.08 | | |
| 6/21/2022 | 7.43 | 15.7 | | | | 500 | | 588 | | 6.31 | | |
| 6/27/2022 | | | | | | | | | | 5.43 | | |
| 7/6/2022 | 7.36 | 16.1 | | | 166 | 517 | | 607 | | | | |
| 7/13/2022 | 7.32 | 16.8 | | | | 541 | | 637 | | | | |
| 7/20/2022 | 7.3 | 17.8 | | | | 529 | | 625 | | | | |
| 7/27/2022 | 7.45 | 17.8 | | | | 452 | | 635 | | | | |
| 8/16/2022 | 7.68 | 17.1 | | | | 287 | | 405 | | 5.55 | | |
| 8/24/2022 | 7.49 | 17 | | | | 462 | | 653 | | 5.2 | | |
| 8/29/2022 | 7.42 | 19.3 | | | | 497 | | 697 | | 5.37 | | |
| 9/6/2022 | | | | | | | | | | 5.66 | | |
| 9/14/2022 | | | | | | | | | | 5.71 | | |
| 9/20/2022 | | | | | | | | | | 5.65 | | |
| 9/27/2022 | | | | | | | | | | 5.66 | | |
| 10/4/2022 | | | | | | | | | | 5.64 | | |
| 10/17/2022 | | | | | | | | | | 6.01 | | |
| 10/25/2022 | | | | | | | | | | 5.76 | | |
| 11/1/2022 | | | | | | | | | | 6.49 | | |
| 11/8/2022 | | | | | | | | | | 5.64 | | |
| 11/15/2022 | | | | | | | | | | 7.41 | | |
| 11/21/2022 | | | | | | | | | | 6.75 | | |
| 11/29/2022 | | | | | | | | | | 5.43 | | |
| 11/21/2022 | | | | | | | | | | 6.75 | | |
| 12/6/2022 | | | | | | | | | | 5.29 | | |
| 12/13/2022 | | | | | | | | | | 4.65 | | |
| 12/20/2022 | | | | | | | | | | 5.24 | | |
| 12/30/2022 | | | | | | | | | | 5.6 | | |
| 1/4/2023 | | | | | | | | | | 6.32 | | |
| 1/12/2023 | 7.43 | 12.9 | | | | 436 | | 613 | | 5.22 | | |
| 1/17/2023 | 7.51 | 13.9 | | | | 617 | | 867 | | | | |
| 1/24/2023 | 7.58 | 11.7 | | | | 451 | | 636 | | 7.50 | | |
| 2/1/2023 | 7.46 | 14.1 | | | | 374 | | 526 | | 7.04 | | |
| 2/7/2023 | 7.68 | 14.5 | | | | 394 | | 554 | | 5.94 | | |
| 2/16/2023 | 7.45 | 13 | | | | 592 | | 703 | | 4.73 | | |
| 2/21/2023 | 7.37 | 15.2 | | | | 512 | | 721 | | 5.16 | | |
| 3/1/2023 | 7.11 | 12.6 | | | | 641 | | 761 | | 4.65 | | |
| 3/7/2023 | 7.3 | 12.1 | | | | 529 | | 626 | | 5.89 | | |
| 3/14/2023 | 7.36 | 13.6 | | | | 460 | | 542 | | 5.27 | | |
| 3/21/2023 | 7.66 | 11.8 | | | | 409 | | 577 | | 5.51 | | |
| 3/28/2023 | 7.58 | 13 | | | | 375 | | 529 | | 5.37 | | |
| 3/30/2023 | | | | | | 480 | 1.6 | | | 4.69 | ND | ND |
| 4/5/2023 | 7.41 | 15.7 | | | | 554 | | 780 | | 4.61 | | |
| 4/11/2023 | 7.41 | 13.6 | | | | 649 | | 913 | | 4.79 | | |
| 4/27/2023 | | | | | | 303 | 0.8 | | | 5.46 | ND | ND |
| 5/3/2025 | 7.42 | 14.6 | | | | 433 | | 613 | | 5.23 | | |
| 5/9/2023 | 7.12 | 13.7 | | | | 372 | | 439 | | 6.23 | | |
| 5/16/2023 | 7.31 | 16.1 | | | | 539 | | 763 | | 5.13 | | |
| 5/24/2023 | 7.44 | 17.3 | | | | 454 | | 536 | | 6.85 | | |
| 5/30/2023 | 7.47 | 15.9 | | | | 460 | | 648 | | 5.86 | | |
| 6/7/2023 | 7.59 | 16.1 | | | | 395 | | 556 | | 5.73 | | |
| 6/21/2023 | 7.84 | 16.4 | | | | 312 | | 440 | | 6.60 | | |
| 6/27/2023 | 7.46 | 15.2 | | | | 411 | | 581 | | 5.31 | | |
| 7/12/2023 | 7.35 | 16.2 | | | | 472 | | 666 | | | | |
| 7/19/2023 | 7.48 | 15.6 | | | | 365 | | 515 | | 5.77 | | |
| 7/26/2023 | 7.5 | 16.1 | | | | 443 | | 624 | | 5.49 | | |
| 9/6/2023 | | | | | | | | | | 7.10 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/13/2023 | 7.4 | 18.6 | | | | 705 | | 1019 | | 6.07 | | |
| 9/20/2023 | 7.66 | 18.4 | | | | 324 | | 458 | | 6.44 | | |
| 9/28/2023 | 7.85 | 17.6 | | | | 289 | | 410 | | 6.13 | | |
| 10/5/2023 | 7.63 | 16.5 | | | | 518 | | 731 | | 5.62 | | |
| 10/11/2023 | 7.5 | 19.9 | | | | 584 | | 828 | | 5.72 | | |
| 10/19/2023 | 7.57 | 14.5 | | | | 492 | | 696 | | 5.75 | | |
| 10/26/2023 | 7.64 | 15.3 | | | | 393 | | 551 | | 6.47 | | |
| 11/1/2023 | 7.7 | 16.5 | | | 124 | 413 | | 579 | | 6.52 | | |
| 11/8/2023 | 7.58 | 15 | | | | 529 | | 743 | | 3.23 | | |
| 11/14/2023 | 7.89 | 13.6 | | | | 390 | | 566 | | 0.02 | | |
| 11/28/2023 | 7.64 | 17.9 | | 138 | 118 | 348 | | 507 | | 7.00 | 0.012 | 0.143 |
| 1/11/2024 | 8.69 | 12.2 | | | | 295 | | 428 | | 6.77 | | |
| 2/1/2024 | 7.78 | 13 | | 196 | | 586 | | 863 | | 5.23 | ND | ND |
| 2/15/2024 | 7.71 | 14.2 | | | | 536 | | 754 | | 6.11 | | |
| 2/27/2024 | 7.61 | 13.6 | | | | 671 | | 919 | | 6.35 | | |
| 3/6/2024 | 7.91 | 13.5 | | | | 523 | | 730 | | 6.02 | | |
| 3/12/2024 | 7.51 | 13 | | | | 552 | | 776 | | 6.10 | | |
| 3/18/2024 | 7.78 | 9.8 | | | | 560 | | 840 | | 6.85 | | |
| 3/25/2024 | 7.84 | 11.8 | | 150 | | 580 | | 854 | | 6.20 | 0.05 | ND |
| 4/2/2024 | 8.37 | 12.3 | | | | 301 | | 445 | | 5.94 | | |
| 4/11/2024 | 7.86 | 16.1 | | 184 | 168 | 564 | | 814 | | 5.29 | 0.02 | ND |
| 4/30/2024 | 7.62 | 16 | | | | 416 | | 584 | | 4.62 | | |
| 5/6/2024 | 7.82 | 14.2 | | | | 395 | | 560 | | 5.01 | | |
| 5/13/2024 | 7.9 | 15.3 | | | | 457 | | 637 | | 6.47 | | |
| 5/31/2024 | 8.07 | 13.7 | | | | 304 | | 454 | | 6.30 | | |
| 6/3/2024 | | | | | | | | | | 6.30 | | |
| 8/6/2024 | 7.38 | 17.6 | | | | 416 | | 587 | | 6.79 | | |
| 8/15/2024 | 7.5 | 15.5 | | | | 465 | | 656 | | 6.83 | | |
| 8/20/2024 | | | | | | | | | | 6.71 | | |
| 8/27/2024 | | | | | | | | | | 6.37 | | |
| 9/3/2024 | | | | | | | | | | 5.80 | | |
| 11/18/2024 | | | | | | | | | | 6.00 | | |
| 1/15/2025 | | | | | | | | | | 5.20 | | |
| 4/1/2025 | | | | | | | | | | 5.00 | | |
| 5/14/2025 | | | | | | | | | 0.37 | | | |
| 7/29/2025 | | | | | | | | | | 6.70 | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **AVG** | **AVG** | **AVG** | **AVG** | **AVG** | **AVG** | **AVG** | **AVG** | **AVG** | **AVG** | **AVG** | **AVG** | **AVG** |
| - | 7.60 | 15.1 | - | 167 | 144 | 464 | 1.2 | 642 | 0.365 | 5.76 | 0.027 | 0.082 |
| **MAX** | **MAX** | **MAX** | **MAX** | **MAX** | **MAX** | **MAX** | **MAX** | **MAX** | **MAX** | **MAX** | **MAX** | **MAX** |
| - | 8.69 | 19.9 | - | 196 | 168 | 705 | 1.6 | 1,019 | 0.370 | 7.50 | 0.050 | 0.143 |
| **MIN** | **MIN** | **MIN** | **MIN** | **MIN** | **MIN** | **MIN** | **MIN** | **MIN** | **MIN** | **MIN** | **MIN** | **MIN** |
| - | 7.11 | 9.8 | - | 138 | 118 | 287 | 0.8 | 405 | 0.360 | 0.02 | 0.012 | 0.020 |

# ATTACHMENT 5: PFAS Treatment Evaluation for Cherokee Metropolitan District

April 30, 2025

To: Kevin Brown, PE
Brandon Zembles, EIT
Mathew Mevis

From: Rahul Subramanian, PE, PMP
Conner Murray, PhD, PE
Seth Donaldson
Jason Curl, PE

# PFAS Treatment Evaluation for Cherokee Metropolitan District

FINAL

## Executive Summary

Per- and polyfluoroalkyl substance (PFAS) occurrence in Cherokee Metropolitan District's (CMD) groundwater supplies motivated a preliminary investigation of treatment alternatives as well as a pilot-scale study to determine the best treatment approach to achieve compliance with the PFAS maximum contaminant levels (MCLs). This study has included an evaluation of multiple adsorption-based treatment approaches in the establishment of adsorption design parameters, estimation of conceptual capital costs, and the determination of adsorbent changeout intervals. While the pilot-scale study remains ongoing, the objective of this technical memorandum (TM) is to briefly summarize project progress to date while also offering some technical insight into the design parameters dictating capital cost estimates and future considerations for full-scale facility design.

Hazen

# Table of Contents


1. Introduction ..... 3
   1.1 Objective ..... 3
2. Data Review ..... 3
   2.1 Water Quality and PFAS ..... 3
3. Treatment Alternatives ..... 6
   3.1 Adsorption Treatment Sizing ..... 6
   3.2 Pressure Vessel Sizing ..... 6
      3.2.1 Auxiliary Treatment Components ..... 8
4. Treatment Operation Demonstration Testing ..... 8
   4.1 Piloting Setup ..... 9
   4.2 Preliminary Piloting Results ..... 10
5. Cost of PFAS Treatment Alternatives ..... 10
   5.1 Capital ..... 10
   5.2 Operational and Maintenance ..... 12
   5.3 Lifecycle Cost Comparison ..... 13
6. Recommendations ..... 13

Hazen

# 1. Introduction

The persistence of per- and polyfluoroalkyl substances (PFAS) in drinking water supplies has impacted numerous utilities across Colorado with a newly finalized National Primary Drinking Water Regulation (NPDWR) set for a variety of PFAS species. For Cherokee Metropolitan District (CMD), PFAS concentrations have exceeded the maximum contaminant level for some PFAS species in a few of their groundwater supply wells, which supply a major fraction of their total blended influent water, necessitating treatment to achieve compliance. With a large expansion of CMD's current water treatment infrastructure required to achieve PFAS treatment, CMD has initiated a preliminary treatment study to evaluate treatment alternatives in order to select a treatment process to move forward through design and construction.

## 1.1 Objective

CMD has tasked Hazen and Sawyer (Hazen) to investigate the feasibility of PFAS treatment to achieve compliance with the upcoming PFAS NPDWR. Desktop evaluations and a pilot-scale demonstration were conducted to compare the relative effectiveness and feasibility of multiple PFAS treatment strategies, including adsorption and membrane-based removal technologies.

The objective of this memo is to provide an overview of the pre-design treatment evaluation process used to facilitate treatment selection that will ensure CMD's compliance with the PFAS NPDWR by April 2029. As CMD continues to move forward with treatment design and construction, this TM provides technical details related to the basis of pressure vessel design as well as an opinion of probable construction costs to inform capital budgeting moving forward. This TM reviews PFAS concentrations and background water quality characterized by the anticipated impact on PFAS treatment design and treatment longevity. Although the pilot study and continued hydraulic evaluation associated with the ultimate treatment selection remain ongoing, process design criteria were used to inform treatment sizing and cost estimations which were combined with piloting results to date to make recommendations going forward.

# 2. Data Review

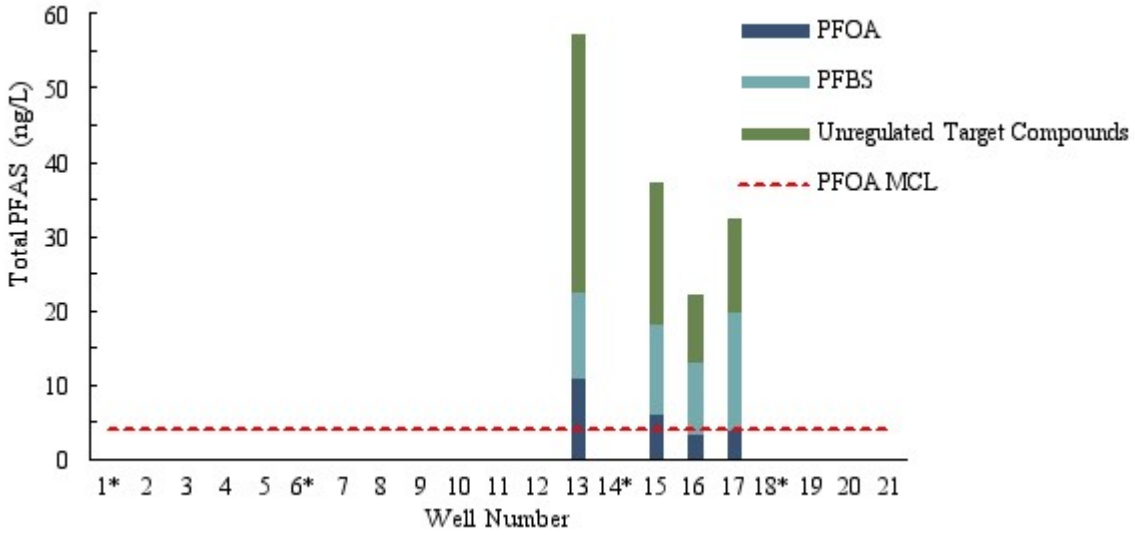
In the investigation of suitable PFAS treatment alternatives, the approach began with a sampling campaign to understand the geospatial variability of PFAS concentrations as well as other water quality constituents impacting adsorption effectiveness. Results from this sampling effort in tandem with blended groundwater quality collected over the course of more than 7 months are summarized in Section 2.1.

## 2.1 Water Quality and PFAS

A sampling campaign was initiated prior to pilot-scale studies to analyze the extent of PFAS contamination as well as the characterization of total organic carbon (TOC) at each individual groundwater well. The analysis of individual wells leads to a better understanding of the implications of well operation and its effect on the blended influent water via a mass balance approach. **Figure 2-1** shows the totalized PFAS concentrations found in the individual wells, approximately 17 out of 21 wells are projected to be operational for future water production and contribute a significant portion of CMD's total influent water.

Hazen

Wells 1, 6, and 18 have temporary flow restrictions, while well 14 is permanently offline. Therefore, wells 1, 6, 14, and 18 are not projected to contribute a significant portion of flow (<10%) to CMD's blended influent water in the future and were not considered as part of this analysis. **Table 2-1** summarizes the TOC and PFAS concentrations found in the wells with detected PFAS contamination (well 13, 15, 16, and 17). PFOA and PFBS concentrations are shown individually because they have maximum contaminant levels (MCLs) under the EPA NPDWR whereas the PFHxA and PFHpA are grouped together as unregulated compounds under the current EPA NPDWR. The wells with PFAS contamination are historically higher flow wells that contribute a substantial portion (~40%) of the overall flow distributed by CMD during higher water demand seasons. Therefore, due to the higher proportion of water coming from well 13, 15, 16, and 17 annually, the PFAS contamination within these wells is sufficient to cause the resulting blended influent water to be out of compliance with the MCL within the PFAS NPDWR. In particular, the elevated concentrations of PFOA has a high possibility of causing the total blended stream of distributed water to be above the MCL of 4.0 ng/L, if well 13 or 15 contribute a significant flow to the stream.




* Well 1, 6, 14, and 18 will not contribute significant flow to CMD's influent flow in the future and therefore were not considered as part of this analysis

**Figure 2-1: Well Specific PFAS Concentration**

**Table 2-1: Individual Well Analysis**

| Well | TOC (mg/L) | PFHxA (ng/L) | PFOA (ng/L) | PFBS (ng/L) | PFHpA (ng/L) |
|---|---|---|---|---|---|
| 13 | 1.5 | 31 | 11 | 12 | 4 |
| 15 | 1.0 | 17 | 6.2 | 12 | 2.4 |
| 16 | 0.7 | 9.3 | 3.4 | 9.6 | 0.0 |
| 17 | 0.9 | 10 | 3.9 | 16 | 2.3 |

Sampling of the blended influent water quality and PFAS constituents continued throughout the operation of the pilot adsorption demonstration. The average water quality of the influent water is summarized in **Table 2-2**. Characterization of the background water quality can have a substantial impact on the PFAS removal effectiveness for each adsorbent.

**Table 2-2: Average Influent Analyte Concentration throughout Pilot Operation**

| Parameter | Average Influent | Sample Quantity (n) |
|---|---|---|
| TOC (mg/L) | 1.3 | 12 |
| Alkalinity (mg/L) | 190 | 18 |
| Nitrate (mg/L) | 6.2 | 19 |
| Turbidity (NTU) | 0.52 | 20 |
| Sulfate (mg/L) | 67 | 20 |
| Chloride (mg/L) | 55 | 19 |

Concentrations of TOC were generally low for this groundwater with also low concentrations of competitive anions which, in conjunction with TOC, can inhibit adsorption effectiveness. The impact of these parameters on PFAS breakthrough will be further characterized in a subsequent piloting report.

The influent PFAS slightly varied during the piloting campaign, which began on July 16th, 2024 and is anticipated to end in May, 2025. **Figure 2-2** shows the influent PFAS concentrations throughout the duration of the adsorption pilot. PFOA was the sole compound that was detected with concentrations above compliance and thus will be dictating the adsorbent changeout frequency. The average influent PFOA concentration throughout the pilot was 5.1 ng/L. Hazen recommends a changeout criteria of 3 ng/L for PFOA to ensure compliance with the 4.0 ng/L PFOA MCL. Therefore, the changeout frequency will be dictated by when the PFOA concentration in the effluent from the adsorbents reaches approximately 59% of the influent PFOA concentration.

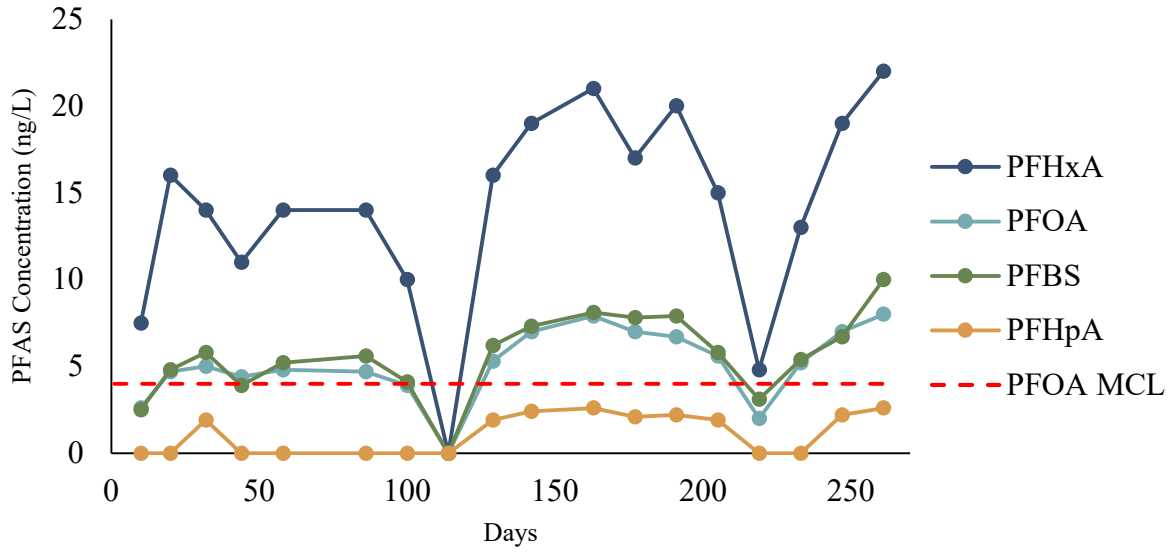



**Figure 2-2: Influent PFAS Concentration throughout Pilot Operation**

# 3. Treatment Alternatives

Best available PFAS treatment alternatives were evaluated for groundwater treatment in this study including granular activated carbon (GAC) adsorption, anion exchange resin (IX) adsorption, and high-pressure membranes as well as novel adsorbent materials such as Fluoro-Sorb (FS). Adsorption-based treatment approaches were piloted for further evaluation of treatment longevity including GAC, IX, and FS as discussed in greater detail in Section 4. While effective for the rejection for a range of trace organic contaminants, evaluation of high-pressure membrane treatment alternatives such as reverse osmosis (RO) and nanofiltration (NF) is not discussed in great detail in this TM (though will be included in the final schematic design evaluation report). Adsorption based PFAS treatment approaches are widely applied for groundwater applications of similar size across Colorado and are estimated to be more favorable with respect to land requirements for concentrate disposal and capital cost at this stage of the evaluation. As a result, preliminary design of adsorption-based treatment approaches is carried out in the following subsections.

## 3.1 Adsorption Treatment Sizing

Fixed bed adsorbents can be installed in pressure vessels or gravity contactors. The design flow of the treatment plant influences the choice between pressure vessels and gravity contactors. Pressure vessels are generally the preferred option for treatment systems under 10 MGD, due to the flexibility of pressure vessel operation with seasonal flow variations as well as the ability to easily changeout adsorbents after breakthrough and avoid re-pumping of water as may be required in gravity adsorbers. Gravity contactors are typically selected for higher design flow rates (>20 MGD) to efficiently utilize contactor area but generally incur higher capital costs for systems smaller than 10 MGD where pressurized systems can operate at higher hydraulic loading rates therefore enabling smaller facility footprints. This section will focus on the sizing of pressure vessels based on the design flow rate of CMD.

Pressure vessels can be designed in a lead/lag or a parallel configuration. Operation of pressure vessels in parallel can reduce required footprint but requires more frequent PFAS sampling to ensure the adsorption changeout frequency is sufficient to achieve compliance with PFAS MCLs. Parallel operation also requires diligent breakthrough monitoring and blending of vessel effluents to maintain finished water PFAS concentration targets. A lead/lag configuration has greater operational simplicity due to the lag vessel providing polishing of any PFAS breakthrough from the initial lead vessel. The design of lead/lag pressure vessels was determined to be a more favorable configuration to allow CMD to treat to non-detect PFAS concentrations and ensure consistent compliance with the PFAS MCLs.

## 3.2 Pressure Vessel Sizing

Pressure vessels were initially sized for the design flow of CMD of 6,000 gpm (8.6 mgd). **Table 3-1** shows the proposed design for pressure vessel application for GAC, IX, and FS. At the design flow conditions the GAC pressure vessel application requires 7 lead/lag pairs, while the IX and FS requires 4 lead/lag pressures vessels to maintain appropriate empty bed contact time (EBCT) and hydraulic loading rate (HLR). The EBCT and HLR are consistent with the values used for the pilot testing as well as within the range of recommended operating parameters from the adsorbent manufacturers.

**Table 3-1: Pressure Vessel Design Parameters at Design Flow (6,000 gpm)**

| Design Parameter | Unit | GAC | IX | FS |
|---|---|---|---|---|
| EBCT Lead Vessel | min | 10.4 | 2.3 | 2.3 |
| Hydraulic Loading Rate | gpm/ft$^2$ | 7.6 | 13 | 13 |
| Vessel Diameter | ft | 12 | 12 | 12 |
| Vessel Side Shell Height[a] | ft | 12 | 4 | 4 |
| Total # of Vessels | | 14 | 8 | 8 |
| Total # of Lead/Lag Pairs | | 7 | 4 | 4 |

[a] Vessel dimensions may vary slightly based on selected pressure vessel vendor

Additionally, pressure vessels operational parameters for CMD's average flow of 2,000 gpm have also been calculated to better understand operational conditions representing average flow operation, shown in **Table 3-2**. While flow demands may vary substantially over the course of the year, consideration of average flow conditions were used to estimate operational demands and costs for more typical pressure vessel operation though it should be noted that a range of flows from 1,000 to 3,100 gpm was observed in 2024. Under average flow conditions (2,000 gpm) CMD could consider operation of only a portion (approximately 40% for GAC and 50% for IX/FS) of the total vessel pairs while still maintaining sufficient EBCT and HLR to be within the recommended operational range.

**Table 3-2: Pressure Vessel Operational Parameters at Average Flow (2,000 gpm)**

| Design Parameter | Unit | GAC | IX | FS |
|---|---|---|---|---|
| EBCT Lead Vessel | min | 13.3 | 3.1 | 3.1 |
| Hydraulic Loading Rate | gpm/ft$^2$ | 5.9 | 8.8 | 8.8 |
| Vessel Diameter | ft | 12 | 12 | 12 |
| Vessel Side Shell Height | ft | 12 | 4 | 4 |
| Total # of Operational Vessels | | 6 | 4 | 4 |
| Total # of Operational Lead/Lag Pairs | | 3 | 2 | 2 |

Three-dimensional pressure vessel model renderings have been included for a single pair of both the GAC and IX/FS pressure vessel model sizes in **Figure 3-1**.

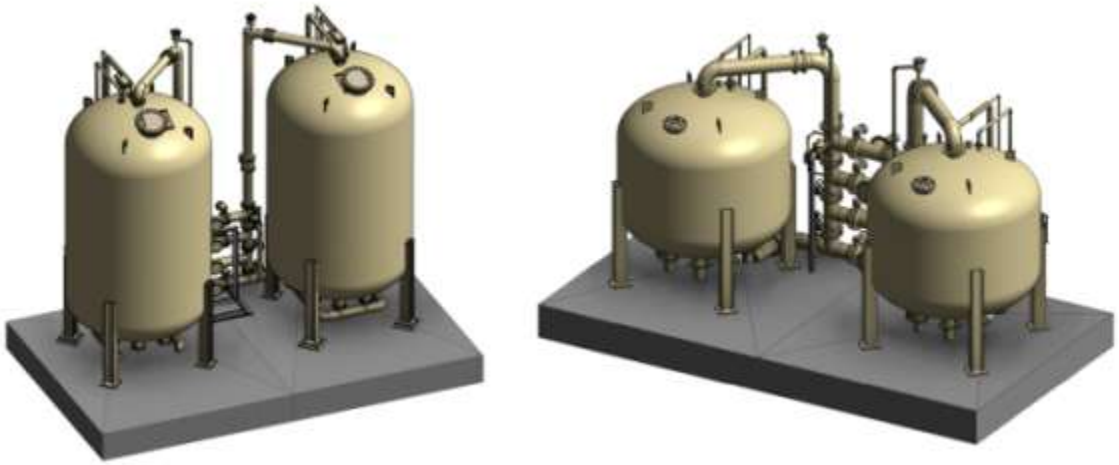


**Figure 3-1: Left GAC Pressure Vessel Pair, Right IX/FS Pressure Vessel Pair**

### 3.2.1 Auxiliary Treatment Components

The use of pressure vessels requires additional auxiliary components, particularly cartridge filters applied upstream to remove particulate matter prior to pressure vessel treatment to mitigate adsorbent head loss accumulation. **Table 3-3** shows the sizing for cartridge filters, based on the design flow of 6,000 gpm. Two UF30 cartridge filter housings can accommodate the design flow, and a third housing is included to allow one housing to be off duty during adsorber changeouts. Cartridge filter design may change slightly in subsequent project phases based on operator preference and facility layout constraints. Additional site development may be required to accommodate adsorbent startup waste generated in forward flushing (IX) or backwashing (GAC) of adsorbents in startup.

**Table 3-3: Preliminary Cartridge Filter Design Criteria**

| Design Parameter | Unit | Cartridge Filter |
|---|---|---|
| Model | | UF 30 |
| Length | in | 60 |
| Max Flow Rate | gpm | 3,000 |
| # of Cartridge Filter Housing | | 3 |
| # of Filters per Housing | | 12 |

# 4. Treatment Operation Demonstration Testing

With a variety of treatment alternatives considered for potential full-scale application, a pilot scale demonstration unit was used to evaluate the relative PFAS removal performance of GAC, IX, and FS. The pilot demonstration was conducted to establish expected changeout frequencies and inform estimated operational costs due to media changeout for each adsorbent investigated.

A demonstration test was not conducted for the membrane application due to well-established PFAS rejection performance of NF membranes considered in this investigation. Furthermore, it is anticipated that the sizing and operation of a full-scale membrane installation will be dictated by other non-PFAS water quality goals such as hardness reduction.

## 4.1 Piloting Setup

The pilot demonstration unit was located inside the 048-pumping and chlorination facility, directly off of highway 94. Flows from all the previously noted wells (Figure 2-1) are blended at this facility. CMD's blended influent water initially flowed into the equalization (EQ) tank. A feed pump was used to feed water from the EQ tank to the distribution manifold with sufficient head to achieve the desired hydraulic loading rates (HLR) in each column. The distribution manifold controlled the flow to each separate column. Effluent from the columns was directed to the nearby floor drain. PFAS samples were collected from the EQ tank (influent), column ½ depth sample port, and column outlets (effluent). Initially the midway ports were analyzed until sufficient breakthrough was observed, at which point the column outlets were analyzed. All samples were retained throughout pilot operation in case 50% breakthrough occurred rapidly and backlogged 100% samples were required to depict breakthrough at the full-scale design EBCT or samples required retesting. The pilot demonstration unit is shown in **Figure 4-1**.



**Figure 4-1: Adsorption Demonstration Unit**

## 4.2 Preliminary Piloting Results

Initial sampling was conducted on mid-column sampling points, to characterize PFAS breakthrough for ½ of the adsorbents designed EBCTs. Midpoint sampling allowed breakthrough to be observed for compounds and adsorbents with prolonged anticipated breakthrough intervals (i.e. PFOA). Once PFAS breakthrough was observed at the 50% column effluent, sampling was switched to the 100% column effluent, to more accurately inform full scale changeout costs. The changeout criteria was defined as breakthrough > 3 ng/L of PFOA for each adsorbent.

The estimated changeout frequencies are shown in **Table 4-1**. The reported changeout frequencies correspond to the operational EBCT observed in the deployed pilot unit. The 100% sampling ports for GAC correspond to a 12 min EBCT, while the 100% sampling ports for IX/FS correspond to a 2 min EBCT. GAC F400 and FS-200 100% sampling ports surpassed the changeout criteria at 129 days and 170 days, respectively. GAC AV 1240 100% sample port surpassed the changeout criteria at 235 days. For both IX's evaluated, the breakthrough of PFOA remains undetected at the 50% sampling port. Assuming adsorption usage rate is linear in respect to EBCT (i.e. longer EBCT achieved via more media depth translates to linear improvements in breakthrough time), the latest sampling event corresponding to 261 days was doubled to result in an inferred changeout frequency of at least 522 days.

**Table 4-1: Adsorbent Media Changeout Frequency**

| Media | Changeout Frequency (days) |
|---|---|
| GAC F400 | 129[a] |
| GAC AV 1240 | 235[a] |
| IX PSR2+ | 522[b] |
| IX CalRes 2301 | 522[b] |
| FS-200 | 170[a] |

[a] Observed PFOA > 3 ng/L at 100% sampling port

[b] PFOA undetected at 50% sampling ports, assumed full scale IX will last at least double the time of current pilot operation

# 5. Cost of PFAS Treatment Alternatives

Treatment alternatives were evaluated with respect to treatment cost both with capital infrastructure cost estimates and operational and maintenance cost estimates to provide insight into the cost viability of each treatment alternative. This section provides additional details into the provided estimates of capital, operation and maintenance (O&M), and lifecycle costs for each treatment alternative. Greater cost certainty may be provided for each treatment alternative with continued investigation and detailed design.

## 5.1 Capital

In the development of cost estimates for each of the alternatives noted to achieve the water treatment goals, a variety of assumptions were included in this preliminary AACE Class 5 cost estimate. Class 5 has a typical

accuracy range of –50% on the low end and +100% on the high end. Cost assumptions were added to all line items and are described in **Table 5-1**.

**Table 5-1: Capital Cost Assumptions**

| Markups and Indirect Cost | % |
|---|---|
| Special Conditions | 5% |
| Small Tools (Applied on Labor) | 2% |
| Indicental Overtime | 5% |
| General Conditions | 15% |
| Labor Escalation | 11.2% |
| Material/Equipment Escalation | 12.5% |
| Subcontractor Overhead, Profit, & Fee | 25% |
| Prime Contractor Overhead & Profit | 10% |
| Prime Profit on Subcontracted Work | 5% |
| Bond and Insurance | 3% |
| Design Contingency | 30% |

Capital cost estimates for each treatment alternative are summarized in **Table 5-2** with associated costs for treatment equipment as well as other necessary treatment components such as distribution components (e.g. two raw water tanks (1 million gallons each), finished water tank (0.5 million gallons), raw water and finished water pumping , electrical components, yard piping, and site modifications (including site building). Generally, the highest cost treatment alternatives were GAC treatment alternatives which contained a much larger building footprint size and more pressure vessels compared to IX/FS treatment alternatives. The lowest cost alternatives were associated with IX and FS treatment which have identical site footprints housed within the same pressure vessels. The small difference in capital cost is associated with the lower unit price of the initial media load which is more expensive for IX relative to FS. Note exclusions in these noted capital cost estimates are potential residuals management infrastructure required for adsorbent startup waste as well as engineering design fees and services during construction. It is noted that these costs include substantial design contingency as is appropriate at this time as the treatment site layout continues to develop.

Opportunities to reduce capital cost estimates may be realized with continued design efforts to optimize site footprint, options for less expensive construction materials, or staged procurement of treatment equipment. These cost reduction measures will be reviewed in greater detail in preliminary design of this treatment facility.

Hazen

**Table 5-2: Anticipated Capital Costs for Pressure Vessel Systems**

| Description | GAC | IX | FS |
|---|---|---|---|
| Process Building | *9,630,000* | *6,250,000* | *6,250,000* |
| Cartridge Filter System | *650,000* | *650,000* | *650,000* |
| Pressure Vessel System | *15,810,000* | *10,980,000* | *10,320,000* |
| Raw Water Pumping and Storage | *8,740,000* | *8,750,000* | *8,750,000* |
| Finished Water Pumping and Storage | *4,090,000* | *4,090,000* | *4,090,000* |
| GAC Backwash Tank | *370,000* | ~ | ~ |
| Disinfection | *750,000* | *750,000* | *750,000* |
| Yard Piping | *700,000* | *700,000* | *700,000* |
| Site Work | *1,610,000* | *1,090,000* | *1,090,000* |
| Electrical + I&C | *9,070,000* | *6,320,000* | *6,320,000* |
| **Capital Cost** | **$51,400,000** | **$39,600,000** | **$38,900,000** |

## 5.2 Operational and Maintenance

Annual O&M costs were developed for each alternative as summarized in **Table 5-3** where the most costly alternatives from an O&M perspective were generally associated with GAC treatment alternatives which included shorter changeout intervals (derived from piloting outcomes to date) and comparatively higher media changeout costs. Estimated annual O&M costs reflect an annual average flow of 2,000gpm and the level of design provided in this document.

O&M cost estimates were predominantly composed of adsorbent changeout costs. Labor costs and analytical components were also estimated for each alternative but may not substantially impact the annual O&M cost. Labor costs were assumed to be a function of required changeout events for a given adsorbent where the labor costs were lowest for IX which only requires changeout less than once per year. It is important to note that O&M costs do not include existing treatment costs associated with pumping and disinfection at the new treatment facility. The unit adsorbent costs noted in **Table 5-3** are inclusive of spent adsorbent disposal. Assumptions for the O&M cost development are noted in the table footnotes specifically related to adsorbent unit pricing and labor assumptions.

**Table 5-3: Annual O&M Costs**

| Parameter | Units | GAC | IX | FS |
|---|---|---|---|---|
| Media / Consumable Replacement[a] | $/yr | *400,000-666,000*[b] | *258,000* | *350,000* |
| Labor[c] | $/yr | *194,400* | *45,100* | *138,500* |
| Analytical | $/yr | *31,600* | *24,400* | *24,400* |
| **Total O&M ($/MG)** | | *595-850* | *312* | *487* |
| **Annual O&M ($/yr)** | | *626,000-892,000*[b] | *328,000* | *512,000* |

[a] Unit Costs for Adsorbents, including anticipated disposal costs ($/ft$^3$): GAC = $66/ft$^3$, IX= $480/ft$^3$, FS = $235/ft$^3$
Assumed 3x UF30 cartridge filters with 3 complete changeouts of cartridge filter elements per year

[b] O&M contingent on GAC media selection

[c] Labor Assumptions: FTE requirements corresponding to changeout events per year where a single FTE is $100,000 annually

### 5.3 Lifecycle Cost Comparison

In the cross comparison of multiple treatment alternatives a net present value cost analysis was performed based on the following assumptions below:

- Inflation rate = 3%
- Discount rate = 6%
- 20-year lifecycle cost

The capital cost estimates summarized in **Table 5-2** were combined with annual O&M costs in **Table 5-3** to calculate a 20-year net present value as summarized in **Table 5-4**.

**Table 5-4: Net Present Value of PFAS Treatment Alternatives**

| Parameter | Units | GAC | IX | FS |
|---|---|---|---|---|
| 20-yr Net Present Value | $ M | *$60.9 M – $64.9 M*[a] | *$44.5 M* | *$46.7 M* |

[a] *Net present value contingent on GAC media selection*

In review of the net present value calculations for each evaluated adsorbent, IX is the most cost-effective PFAS treatment alternative due to the similar capital cost of IX and FS alternatives coupled with a prolonged changeout interval reducing O&M costs.

## 6. Recommendations

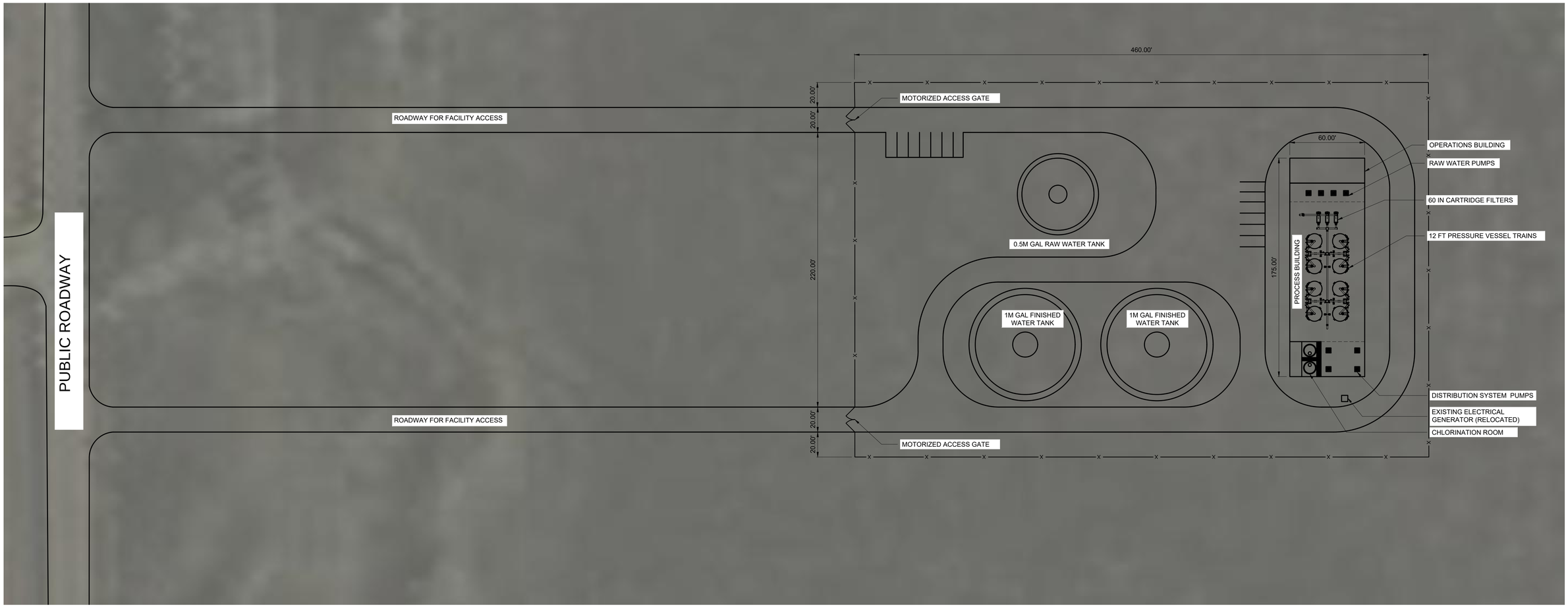
In the investigation of PFAS treatment alternatives to be applied at CMD, preliminary design of an adsorption pressure vessel system was used to inform projected site layouts and class 5 cost estimates for treatment infrastructure. Ongoing adsorption piloting is being conducted to inform adsorption changeout intervals for each adsorbent that can be used to estimate annual O&M costs for each alternative.

Outcomes of this investigation thus far favor the continued detailed design and installation of an IX treatment solution for PFAS compliance. An IX treatment solution offers considerable footprint and cost savings over the sized GAC treatment alternative while also representing the highest treatment effectiveness of piloted adsorbents with respect to treatment longevity. Through more than 7 months of adsorption piloting, the IX columns have far outperformed FS in PFAS treatment.

Continued detailed design of IX treatment is recommended to provide a robust treatment solution for CMD to achieve compliance with the new PFAS MCLs.

## NOTES:

1. PROCESS UNITS ALONG WITH OPERATIONS ROOM WILL BE LOCATED INSIDE A BUILDING.
2. EXACT LOCATION OF THE PLANT WITHIN THE PROPOSED SITE WILL BE DETERMINED DURING DETAILED DESIGN AND UPON COMPLETION OF SITE SURVEY AND TOPOGRAPHY




PLAN
SCALE: 1" = 40'

| REV | ISSUED FOR | DATE | BY |
|---|---|---|---|

| | |
|---|---|
| PROJECT ENGINEER: | C. MURRAY |
| DESIGNED BY: | S. DONALDSON |
| DRAWN BY: | J. PAYTON |
| CHECKED BY: | R. SUBRAMANIAN |

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE 0 1/2" 1"

PRELIMINARY DRAWING
DO NOT USE FOR CONSTRUCTION


Hazen
HAZEN AND SAWYER
1975 RESEARCH PARKWAY
COLORADO SPRINGS, CO 80920


CHEROKEE METROPOLITAN DISTRICT
COLORADO SPRINGS, COLORADO

PFAS TREATMENT FACILITY

CHEROKEE METROPOLITAN DISTRICT
PFAS TREATMENT FACILITY
PROPOSED SITE PLAN

| | |
|---|---|
| DATE: | JUNE 2025 |
| HAZEN NO.: | 70129-000 |
| CONTRACT NO.: | |
| DRAWING NUMBER: | C001 |


File: C:\USERS\JPAYTON\DOCACCDOCS\HAZEN AND SAWYER\70129-000\PROJECT FILES\1-DESIGN\01-HAZEN\000-SITE\70129-000-SP-PP.C Saved by JPAYTON Save date: 6/18/2025 8:22 AM
PLOT DATE: 6/18/2025 2:40 PM BY: JPAYTON

# ATTACHMENT 6: UCMR5 Entry Point Data

## Cherokee Metropolitan District UCMR5 PFAS Data Summary

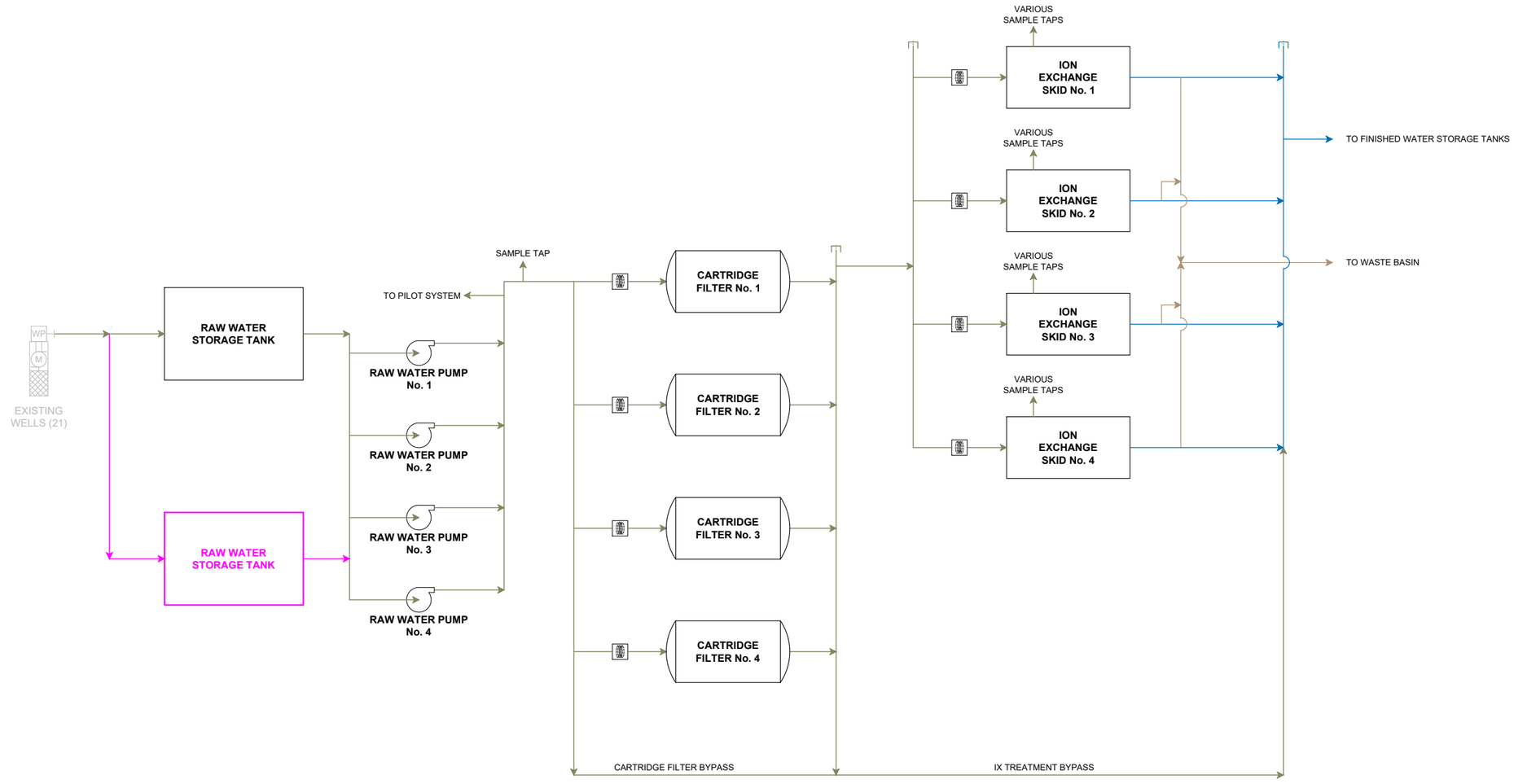
| PWSID | FacilityID | FacilityName | Facility Water Type | Sample Point ID | Sample Point Name | Collection Date | SampleID | Contaminant | MRL | Units | MethodID | Analytical Results Sign | Analytical Result Value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | 8:2 FTS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 4/23/2024 | 380-92789-1 | lithium | 9 | µg/L | EPA 200.7 | = | 23.9 |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFDoA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFHpA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFHxA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | 6:2 FTS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFHpS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFDA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFOS | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFMPA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 4/23/2024 | 380-92789-1 | PFTrDA | 0.007 | µg/L | EPA 537.1 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFNA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | 11Cl-PF3OUdS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 4/23/2024 | 380-92789-1 | NMeFOSAA | 0.006 | µg/L | EPA 537.1 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFMBA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | 9Cl-PF3ONS | 0.002 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFOA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFHxS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFPeA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | HFPO-DA | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | ADONA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 4/23/2024 | 380-92789-1 | PFTA | 0.008 | µg/L | EPA 537.1 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFBA | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFPeS | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | NFDHA | 0.02 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFEESA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | 4:2 FTS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 4/23/2024 | 380-92789-1 | NEtFOSAA | 0.005 | µg/L | EPA 537.1 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFBS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 5/29/2024 | 380-97804-1 | PFUnA | 0.002 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFUnA | 0.002 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFMPA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFDoA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFTrDA | 0.007 | µg/L | EPA 537.1 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | 8:2 FTS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | 6:2 FTS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFHpA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFPeA | 0.003 | µg/L | EPA 533 | = | 0.0126 |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFOS | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | NEtFOSAA | 0.005 | µg/L | EPA 537.1 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | 11Cl-PF3OUdS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | NMeFOSAA | 0.006 | µg/L | EPA 537.1 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFBS | 0.003 | µg/L | EPA 533 | = | 0.0051 |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | NFDHA | 0.02 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFEESA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFMBA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | ADONA | 0.003 | µg/L | EPA 533 | < | |

| PWSID | FacilityID | FacilityName | Facility Water Type | Sample Point ID | Sample Point Name | Collection Date | SampleID | Contaminant | MRL | Units | MethodID | Analytical Results Sign | Analytical Result Value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFHxA | 0.003 | µg/L | EPA 533 | = | 0.0122 |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | HFPO-DA | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | lithium | 9 | µg/L | EPA 200.7 | = | 16.5 |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFHxS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFOA | 0.004 | µg/L | EPA 533 | = | 0.0042 |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFNA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFHpS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | 9Cl-PF3ONS | 0.002 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFDA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFTA | 0.008 | µg/L | EPA 537.1 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | 4:2 FTS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFPeS | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 17 | Ellicott Tank Booster Station - CL2 | GW | 17 | Entry Point | 10/15/2024 | 380-118092-1 | PFBA | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | NFDHA | 0.02 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFHpS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFHpA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 4/23/2024 | 380-92789-2 | PFTA | 0.008 | µg/L | EPA 537.1 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFOS | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFPeA | 0.003 | µg/L | EPA 533 | = | 0.003 |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFEESA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFBS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFPeS | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | ADONA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFBA | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | 11Cl-PF3OUdS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFHxA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 4/23/2024 | 380-92789-2 | NEtFOSAA | 0.005 | µg/L | EPA 537.1 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | 6:2 FTS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFDA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | 8:2 FTS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 4/23/2024 | 380-92789-2 | lithium | 9 | µg/L | EPA 200.7 | = | 25.7 |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | HFPO-DA | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | 4:2 FTS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFNA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 4/23/2024 | 380-92789-2 | PFTrDA | 0.007 | µg/L | EPA 537.1 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFUnA | 0.002 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFMPA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFDoA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | 9Cl-PF3ONS | 0.002 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 4/23/2024 | 380-92789-2 | NMeFOSAA | 0.006 | µg/L | EPA 537.1 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFMBA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFHxS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 5/29/2024 | 380-97804-2 | PFOA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | lithium | 9 | µg/L | EPA 200.7 | = | 19 |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFNA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFHpA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFDA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | 6:2 FTS | 0.005 | µg/L | EPA 533 | < | |

| PWSID | FacilityID | FacilityName | Facility Water Type | Sample Point ID | Sample Point Name | Collection Date | SampleID | Contaminant | MRL | Units | MethodID | Analytical Results Sign | Analytical Result Value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFOS | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFUnA | 0.002 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFTA | 0.008 | µg/L | EPA 537.1 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFMPA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | 9Cl-PF3ONS | 0.002 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | 4:2 FTS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFMBA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFHxS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFOA | 0.004 | µg/L | EPA 533 | = | 0.0061 |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | NEtFOSAA | 0.005 | µg/L | EPA 537.1 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFBA | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFDoA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFTrDA | 0.007 | µg/L | EPA 537.1 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | NFDHA | 0.02 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFHpS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | HFPO-DA | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFHxA | 0.003 | µg/L | EPA 533 | = | 0.0176 |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | 8:2 FTS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | NMeFOSAA | 0.006 | µg/L | EPA 537.1 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFPeS | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | ADONA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | 11Cl-PF3OUdS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFPeA | 0.003 | µg/L | EPA 533 | = | 0.0198 |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFEESA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 20 | Ellicott Springs Subdivision WTP | GW | 20 | Entry Point | 10/15/2024 | 380-118092-2 | PFBS | 0.003 | µg/L | EPA 533 | = | 0.0076 |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFNA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFHpA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFDA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | 6:2 FTS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFOS | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFTrDA | 0.007 | µg/L | EPA 537.1 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | NMeFOSAA | 0.006 | µg/L | EPA 537.1 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFUnA | 0.002 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFMPA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | 9Cl-PF3ONS | 0.002 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | 4:2 FTS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFMBA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFHxS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFOA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFBA | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | lithium | 9 | µg/L | EPA 200.7 | = | 21.3 |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFDoA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFTA | 0.008 | µg/L | EPA 537.1 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | NFDHA | 0.02 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFHpS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | HFPO-DA | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFHxA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | 8:2 FTS | 0.005 | µg/L | EPA 533 | < | |

| PWSID | FacilityID | FacilityName | Facility Water Type | Sample Point ID | Sample Point Name | Collection Date | SampleID | Contaminant | MRL | Units | MethodID | Analytical Results Sign | Analytical Result Value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFPeS | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | ADONA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | 11Cl-PF3OUdS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFPeA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFEESA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | NEtFOSAA | 0.005 | µg/L | EPA 537.1 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 4/23/2024 | 380-92789-3 | PFBS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | HFPO-DA | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | 8:2 FTS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFDoA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | NMeFOSAA | 0.006 | µg/L | EPA 537.1 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFHpA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFHxA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | 6:2 FTS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | 9Cl-PF3ONS | 0.002 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFHpS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFDA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFOS | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFMPA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFNA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | 11Cl-PF3OUdS | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFTrDA | 0.007 | µg/L | EPA 537.1 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFMBA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFOA | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFHxS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFPeA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | lithium | 9 | µg/L | EPA 200.7 | = | 17.4 |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | ADONA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFBA | 0.005 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFPeS | 0.004 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFTA | 0.008 | µg/L | EPA 537.1 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | NFDHA | 0.02 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFEESA | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | NEtFOSAA | 0.005 | µg/L | EPA 537.1 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | 4:2 FTS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFBS | 0.003 | µg/L | EPA 533 | < | |
| CO0121125 | 41 | Sundance Pump Station & Chlorinator | GW | 41 | Entry Point | 10/15/2024 | 380-118092-3 | PFUnA | 0.002 | µg/L | EPA 533 | < | |

# ATTACHMENT 7: Process Flow Diagram




1 / P003 **PROCESS FLOW DIAGRAM**
NO SCALE

Certification of Individual Project Design Disciplines Are Included On Their Individual Drawings, Respectively

Advanced Engineering and Environmental Services, LLC NOT FOR CONSTRUCTION PRELIMINARY

STATUS: PRELIMINARY

| REVISIONS | | | |
|---|---|---|---|
| SYM | DATE | | APPR |

PROJECT TITLE:
**PFAS WATER TREATMENT FACILITY**

SHEET TITLE:
**PROCESS FLOW DIAGRAM**

CLIENT:
**CHEROKEE METROPOLITAN DISTRICT**
23838 CO-94 CALHAN, CO 80808

PREPARED BY: SAS
CHECKED BY: KEB
APPROVED BY: AB

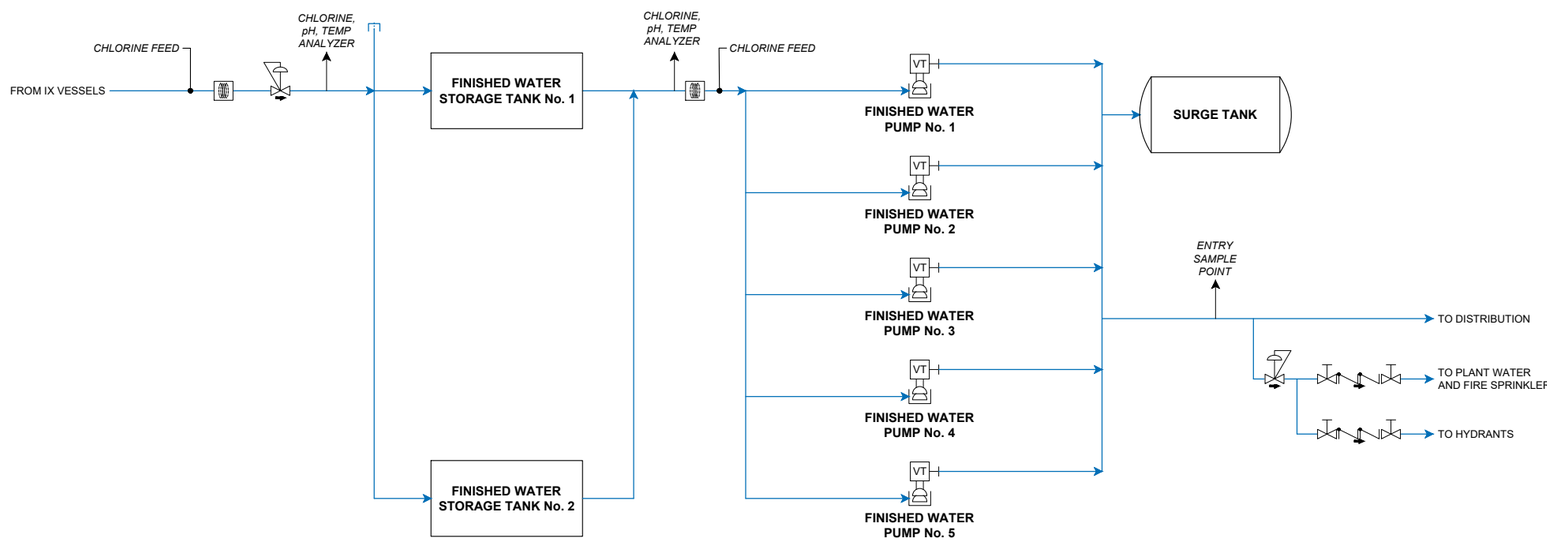
PROJECT NO: 16688-2025-001
DATE: OCTOBER 2026
ALT. PROJECT NO: 00000-0000

SHEET DESIGNATOR: **GEN**
SHEET NO: **P003**

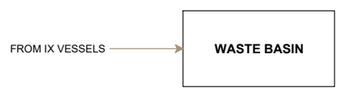
Advanced Engineering and Environmental Services, LLC www.ae2s.com

File: C:\Users\tkemp\DOCACDocs\AE2S\16688-2025-001 Cherokee Metro District PFAS WTP\Project Files\04-Process\Autocad\Plan Sheets\Process Flow Diagram.dwg
Plotted By: Twila Kemp Date: Friday, October 2, 2026

File: C:\Users\tkemp\DOCACCDocs\AE2S\16688-2025-001 Cherokee Metro District PFAS WTP\Project Files\04-Process\Autocad\Plan Sheets\Process Flow Diagram.dwg




1 P004 **PROCESS FLOW DIAGRAM**
NO SCALE




Plotted By: Twila Kemp Date: Friday, October 2, 2026

Certification of Individual Project Design Disciplines Are Included On Their Individual Drawings, Respectively

Advanced Engineering and Environmental Services, LLC NOT FOR CONSTRUCTION PRELIMINARY

STATUS: **PRELIMINARY**

| REVISIONS | | | |
|---|---|---|---|
| SYM | DATE | | APPR |

**PFAS WATER TREATMENT FACILITY**

PROJECT TITLE:

**Advanced Engineering and Environmental Services, LLC** www.ae2s.com

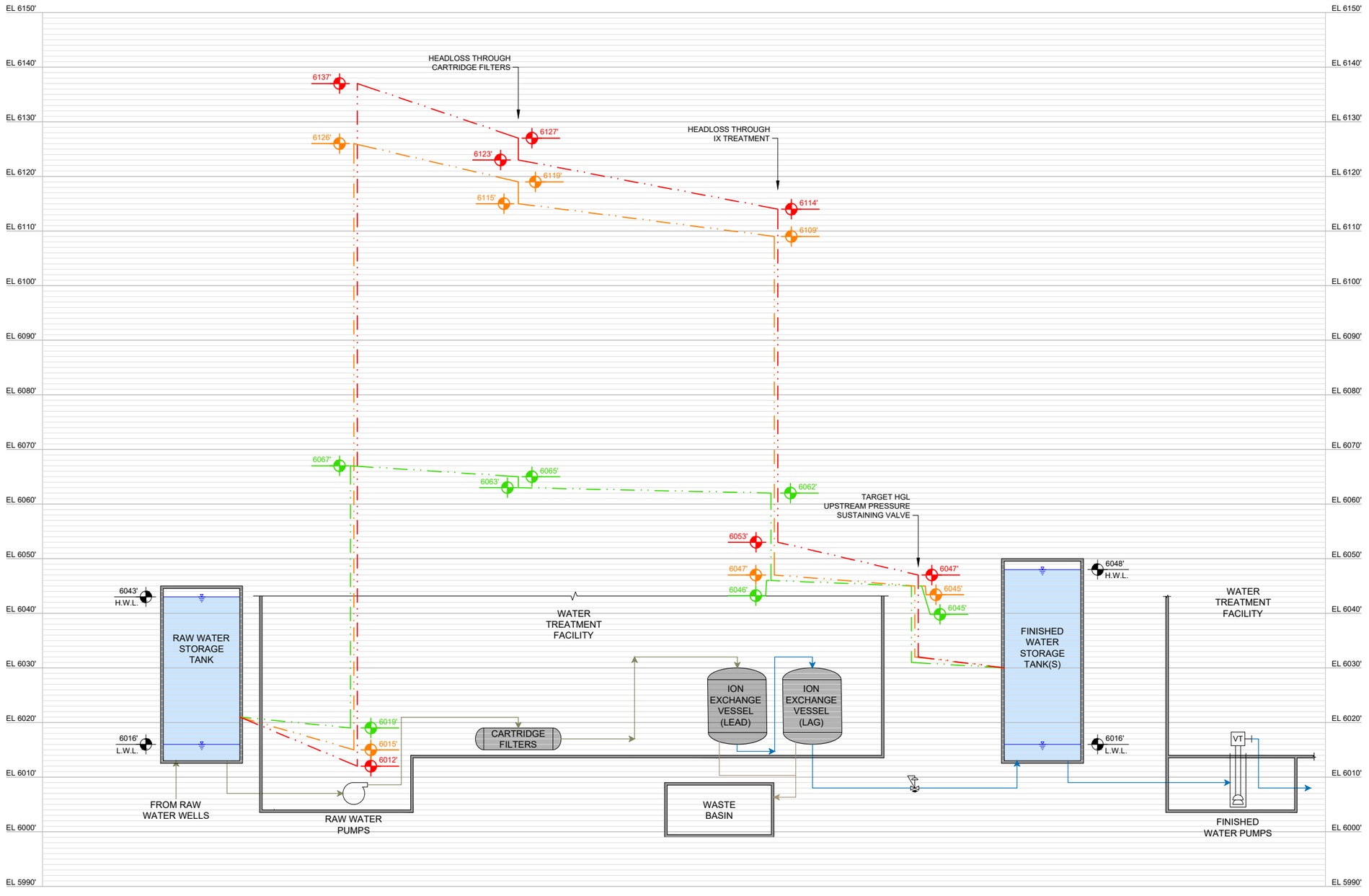
SHEET TITLE:

**PROCESS FLOW DIAGRAM**

| | |
|---|---|
| CLIENT: **CHEROKEE METROPOLITAN DISTRICT** 23838 CO-94 CALHAN, CO 80808 | PREPARED BY: SAS |
| | CHECKED BY: KEB |
| | APPROVED BY: AB |
| PROJECT NO: 16688-2025-001 | SHEET DESIGNATOR: GEN |
| DATE: OCTOBER 2026 | SHEET NO: P004 |
| ALT. PROJECT NO:00000-0000 | |

# ATTACHMENT 8: Hydraulic Profile

File: C:\Users\tkemp\DOCS\Docs\AE2S\16688-2025-001 Cherokee Metro District PFAS WTP\Project Files\04-Process\Autocad\Plan Sheets\Process Hydraulic Profile.dwg




1 P006 **PROCESS HYDRAULIC PROFILE**
NO SCALE

Certification of Individual Project Design Disciplines Are Included On Their Individual Drawings, Respectively

Advanced Engineering and Environmental Services, LLC PRELIMINARY NOT FOR CONSTRUCTION

STATUS: **PRELIMINARY**

| REVISIONS | | | |
|---|---|---|---|
| SYM | DATE | | APPR |

## ASSUMPTIONS

1. TARGET HGL OF 6045' UPSTREAM OF PRESSURE SUSTAINING VALVE IN ALL OPERATING SCENARIOS
2. RAW WATER TANKS AT 6020' WATER LEVEL
3. FINISHED WATER TANKS AT 6030' WATER LEVEL
4. 12' DIAMETER IX VESSELS WITH 546 CUBIC FEET MEDIA EACH VESSEL IN LEAD-LAG CONFIGURATION.

## LEGEND

- HYDRAULIC GRADE LINE (HGL) AT MAX. PLANT FLOW: 8,000 GPM / 4 IX SKIDS / 4 CLEAN CF
- HYDRAULIC GRADE LINE (HGL) AT FIRM PLANT FLOW: 6,000 GPM / 3 IX SKIDS / 3 CLEAN CF
- HYDRAULIC GRADE LINE (HGL) AT MIN. PLANT FLOW: 680 GPM / 1 IX SKID / 1 CLEAN CF

PROJECT TITLE:
**PFAS WATER TREATMENT FACILITY**
Advanced Engineering and Environmental Services, LLC www.ae2s.com

SHEET TITLE:
**PROCESS HYDRAULIC PROFILE**

CLIENT:
**CHEROKEE METROPOLITAN DISTRICT**
23838 CO-94 CALHAN, CO 80808

PREPARED BY: SAS
CHECKED BY: KEB
APPROVED BY: ABB

PROJECT NO: 16688-2025-001
DATE: OCTOBER 2026
ALT. PROJECT NO: 00000-0000

SHEET DESIGNATOR: **GEN**
SHEET NO: **P006**

Plotted By: Twila Kemp Date: Friday, October 2, 2026

# ATTACHMENT 9: Basis of Design Summary

| WATER DEMANDS | |
|---|---|
| ANNUAL (JAN. THROUGH DEC.) - EXISTING | |
| WINTER AVERAGE DAY | 1.77 MGD |
| SUMMER AVERAGE DAY | 2.93 MGD |
| MAXIMUM DAY | 4.52 MGD |
| ANNUAL (JAN. THROUGH DEC.) - BUILD-OUT | |
| WINTER AVERAGE DAY | 3.54 MGD |
| SUMMER AVERAGE DAY | 5.86 MGD |
| MAXIMUM DAY | 8.64 MGD |
| | |
| **DESIGN FLOWS** | |
| TREATMENT DESIGN CAPACITY - MAXIMUM | 6,000 gpm / 8.64 MGD |
| TREATMENT DESIGN CAPACITY - MINIMUM | 680 gpm / 0.98 MGD |
| CHEMICAL STORAGE DESIGN CAPACITY | 5.9 MGD / FUTURE SUMMER AVERAGE DAY DEMANDS - 30 DAYS OF STORAGE |
| | |
| **RAW WATER TANKS** | |
| CAPACITY | 500,000 GALLONS |
| NUMBER OF TANKS | 2 |
| DIMENSIONS | 60 FOOT DIAMETER / 24 FOOT WATER HEIGHT |
| BASE ELEVATION | 6,013 FT |
| OVERFLOW ELEVATION | 6,038 FT |
| CONSTRUCTION | CONCRETE |
| VENT CAPACITY | 12,000 GPM |
| OVERFLOW CAPACITY | 8,000 GPM |
| | |
| **RAW WATER FEED PUMPS** | |
| NUMBER OF PUMPS | 4 |
| PUMP TYPE | END SUCTION HORIZONTAL |
| DESIGN FLOW | 2,000 gpm AT 120 FT |
| MOTOR HP | 100 HP |
| | |
| **CARTRIDGE FILTERS** | |
| NUMBER OF CARTRIDGE FILTER VESSELS | 4 |
| DESIGN FLOW EACH FILTER VESSEL | 2,000 gpm |
| VESSEL CONFIGURATION | HORIZONTAL - TOP INLET END/SIDE OUTLET |
| VESSEL DIAMETER | 28 INCHES |
| CARTRIDGE PORE SIZE | 5 MICRON CARTRIDGES OR IX MANUFACTURER RECOMMENDATION |
| CARTRIDGES PER VESSEL | TEN (10) 60 INCH LONG CARTRIDGES |
| CARTRIDGE CHANGEOUT PRESSURE | 20 PSI (30 PSI MAXIMUM) |
| | |
| **PFAS TREATMENT ION EXCHANGE VESSELS** | |
| DESIGN FLOW | 6,000 gpm / 8.64 MGD TOTAL |
| FILTER MEDIA | ION EXCHANGE (IX) |
| NUMBER OF LEAD-LAG SKIDS | 4 |
| NUMBER OF VESSELS | 8 |
| VESSEL OPERATIONS | TYPICAL OPERATION IS LEAD-LAG, HOWEVER, PARALLEL OPERATION IS AVAILABLE. |
| VESSEL DIAMETER / AREA | 12 FEET / 113 SQUARE FEET |
| MEDIA BED DEPTH | 4.75 FEET |
| MEDIA BED VOLUME EACH VESSEL | 4,017 GALLONS / 537 CUBIC FEET |
| FILTER LOADING RATE | 6-18 gpm PER SQUARE FOOT |
| MINIMUM EMPTY BED CONTACT TIME (EBCT) | 2 MINUTES |
| MAXIMUM FLOW PER VESSEL | 2,008 gpm BASED ON MEETING MINIMUM EBCT |
| MINIMUM FLOW PER VESSEL | 679 gpm BASED ON MINIMUM FILTER LOADING RATE |
| TOTAL PRESSURE DROP LEAD-LAG VESSEL OPERATION (PSI) | 27 PSI AT 2,000 gpm |
| TOTAL PRESSURE DROP PARALLEL VESSEL OPERATION (PSI) | 11 PSI AT 2,000 gpm TOTAL SKID FLOW |
| | |
| **FINISHED WATER TANKS** | |
| CAPACITY EACH TANK | 1,500,000 GALLONS |
| NUMBER OF TANKS | 2 |
| DIMENSIONS | 105 FOOT DIAMETER / 23.5 FOOT WATER HEIGHT |
| BASE ELEVATION | 6,013 FT |
| OVERFLOW ELEVATION | 6,038 FT |
| CONSTRUCTION | CONCRETE |
| VENT CAPACITY | 8,000 GPM |
| OVERFLOW CAPACITY | 8,000 GPM |
| | |
| **FINISHED WATER PUMPS** | |
| HIGH SERVICE PUMP(S) | |
| NUMBER OF PUMPS | 5 |
| HSP No. 1 | |
| PUMP DESIGN POINT | 1,500 gpm @ 680 FT TDH |
| PUMP HORSEPOWER | 350 HP |
| HSP No. 2 | |
| PUMP DESIGN POINT | 1,500 gpm @ 680 FT TDH |
| PUMP HORSEPOWER | 350 HP |
| HSP No. 3 | |
| PUMP DESIGN POINT | 1,500 gpm @ 680 FT TDH |
| PUMP HORSEPOWER | 350 HP |
| HSP No. 4 | |
| PUMP DESIGN POINT | 1,500 gpm @ 680 FT TDH |
| PUMP HORSEPOWER | 350 HP |
| HSP No. 5 | |
| PUMP DESIGN POINT | 1,500 gpm @ 680 FT TDH |
| PUMP HORSEPOWER | 350 HP |
| SURGE TANK SIZE - AIR OVER WATER TYPE TANK | 3,000 GALLON |
| | |

| CHLORINE - SODIUM HYPOCHLORITE | |
|---|---|
| PURPOSE | DISINFECTION |
| PRODUCT | 12.5% STRENGTH SODIUM HYPOCHLORITE |
| STORAGE VOLUME EACH TANK | 2,500 GALLONS |
| NUMBER OF STORAGE TANKS | 3 |
| PRE-FW TANK DOSING GOAL | PRIMARY DISINFECTION |
| DISINFECTION MINIMUM DOSE FOR PRE-FW TANKS FEEDER SIZING | 1.8 mg/L as Cl - 31.8 GPD AT 1.77 MGD FLOW RATE - 1.33 GPH |
| DISINFECTION DESIGN DOSE PRE-FW TANKS | 2.0 mg/L as Cl |
| DISINFECTION MAXIMUM DOSE PRE-FW TANKS FOR FEEDER SIZING | 2.6 mg/L as Cl - 224.6 GPD AT 8.64 MGD FLOW RATE - 9.36 GPH |
| PRE-FW TANK DOSING PUMPS | 2 (DUTY / STANDBY) |
| PRE-FW TANK DOSING PUMP CAPACITY | 1.33 TO 9.36 GPH |
| POST-FW TANK DOSING GOAL | ADJUSTMENTS TO RESIDUAL CHLORINE AS NEEDED |
| DISINFECTION MINIMUM DOSE FOR POST-FW TANKS FEEDER SIZING | 0.18 mg/L as Cl - 3.2 GPD AT 1.77 MGD FLOW RATE - 0.13 GPH |
| DISINFECTION DESIGN DOSE POST-FW TANKS | 0.75 mg/L as Cl |
| DISINFECTION MAXIMUM DOSE FOR POST-FW TANKS FEEDER SIZING | 1.0 mg/L as Cl - 86.4 GPD AT 8.64 MGD FLOW RATE - 3.60 GPH |
| POST-FW TANK DOSING PUMPS | 2 (DUTY / STANDBY) |
| POST-FW TANK DOSING PUMP CAPACITY | 0.13 TO 3.60 GPH |
| DOSING PUMP TYPE | PERISTALTIC |
| | |
| **WASTE BASIN** | |
| BASIN CAPACITY | 50,000 GALLONS |
| DIMENSIONS | 12 FEET DIAMETER X 70 FEET |
| CONSTRUCTION | FIBERGLASS |
| | |

Certification of Individual Project Design Disciplines Are Included On Their Individual Drawings, Respectively

Advanced Engineering and Environmental Services, LLC — NOT FOR CONSTRUCTION — PRELIMINARY

STATUS: **PRELIMINARY**

| REVISIONS | | | |
|---|---|---|---|
| SYM | DATE | | APPR |

PROJECT TITLE:

**PFAS WATER TREATMENT FACILITY**

SHEET TITLE:

**BASIS OF DESIGN**

CLIENT:
**CHEROKEE METROPOLITAN DISTRICT**
23838 CO-94 CALHAN, CO 80808

PREPARED BY: SAS
CHECKED BY: KEB
APPROVED BY: AB

PROJECT NO: 16688-2025-001
DATE: OCTOBER 2026
ALT. PROJECT NO: 00000-0000

SHEET DESIGNATOR: **GEN**

SHEET NO: **P005**

Advanced Engineering and Environmental Services, LLC www.ae2s.com

File: C:\Users\tkemp\DOCACCDocs\AE2S\16688.2025-001 Cherokee Metro District PFAS WTP\Project Files\04-Process\Autocad\Plan Sheets\Process Flow Diagram.dwg
Plotted By: Twila Kemp Date: Friday, October 2, 2026

# ATTACHMENT 10: Tank Overflow Calculations

**2018 AWWA Article - Understanding the Impact of Mesh on Tank Overflow System Capacity**

**Weir Capacity**

| | | |
|---|---|---|
| Q (gpm) | 9390.238 | |
| Q (ft3/s) | 20.92299 | |
| C | 3.33 | |
| l (ft) | 6.28318 | |
| h (ft) | 1 | *excess height above weir* |
| h (inches) | 12 | |
| | | |
| Pipe Diameter (in) | 24 | |
| Circumference (ft) | 6.28318 | |

referred to as the Francis formula, is

$$q = Clh^{3/2} \quad (1)$$

where $q$ is the flow rate (ft$^3$/s), $C$ is a multiplier factor (unitless), $l$ is the weir length (ft), and $h$ is the excess height above the weir (ft). The value of the multiplier factor, $C$, was selected to be 3.33 for the systems described here but can vary depending on other factors in the system—specifically the ratio of the height above a weir to the weir length (see Horton 1907 for more information). The weir length for an upturned elbow is the circumference of the elbow, or $l = \pi * D$, where $D$ is the pipe diameter (ft).

**Overflow Pipe Capacity**

| | | |
|---|---|---|
| Q (gpm) | 13833.16 | |
| Q (ft3/s) | 30.82254 | |
| D (ft) | 2 | |
| D (inches) | 24 | *Pipe Diameter* |
| % open | 1 | |
| % blocked | 0.05 | |
| g (ft/s2) | 32.14 | |
| z (ft) | 27 | *vertical pipe length* |
| EH (ft) | 1 | *excess height above weir* |
| Kmesh | 1.5 | |
| f | 0.02 | *Darcy-Weisback friction factor* |
| L (ft) | 709 | *total pipe length in system* |
| Nb | 6 | *number of ##° elbows* |
| Kb | 1.5 | *K coefficient for elbows* |

$$Q_{max} = \pi\left(\frac{D}{2}\right)^2 (\%_{open})(1-\%_{blocked}) \times \sqrt{\frac{2g(z+EH)}{1+(\%_{open})^2(1-\%_{blocked})^2\left[K_{mesh}+f\frac{L}{D}+N_bK_b\right]}} \quad (3)$$

where $Q_{max}$ is the maximum flow rate (ft$^3$/s, multiply by 448.831 to get gpm), $D$ is the pipe diameter (ft), $\%_{open}$ is the percent open area of a mesh, $\%_{blocked}$ is the percentage of mesh that is blocked by debris, $g$ is the gravitational acceleration constant (32.147 ft/s$^2$), $z$ is the vertical drop in the system (ft), $EH$ is the excess height above the weir (ft), $K_{mesh}$ is the pressure drop coefficient for the mesh (unitless), $f$ is the Darcy–Weisbach friction factor (unitless), $L$ is the total pipe length in the system (ft), $N_b$ is the number of elbows (unitless), and $K_b$ is the resistance coefficient for bends (unitless). The $\%_{open}$ term

$\%_{open}$ equals 44.2%. $K_{mesh}$ approaches 1.5 for higher flow rates (see Padmanabhan & Vigander 1978), so this value was used for calculating $Q_{max}$. $K_b$ for a regular 90° elbow is reported as 30 $f_T$, where $f_T$ is the fully developed turbulence friction factor (Crane 1988). The $\%_{open}$ and

**Kalinske Formula for vertical overflow piping**

| | | |
|---|---|---|
| Q (gpm) | 12234.03 | |
| Q (ft3/s) | 27.25944 | |
| Ck | 3.4 | |
| g (ft/s2) | 32.14 | |
| D (ft) | 2 | |
| D (inches) | 24 | *Pipe Diameter* |
| h (ft) | 1 | *excess height above weir* |

Kalinske (1941) presented the equation for calculating flow through vertical overflow piping:

$$q = C_k g^{1/2} D^{1/2} h^2 \quad (2)$$

where $q$ is the flow rate (ft$^3$/s), $C_k$ is the multiplier factor (unitless), $D$ is the pipe diameter (ft), $g$ is the gravitational acceleration constant (32.147 ft/s$^2$), and $h$ is the excess height (ft). For these results, the factor $C_k$ was set to 3.4, which was the minimum value reported by Kalinske (1941). The rationale behind the selection of this value for $C_k$ will be discussed along with the implication that follows. Kalinske found that this formula held until a critical head for pipe sizes up to ~6 in.

# ATTACHMENT 11: Raw and Finished Water Pump Curves

# Pump Performance Datasheet

| | | | |
|---|---|---|---|
| Customer | : | Project Number / ID | : 2723001 |
| Customer ref. / PO | : | Model | : 60123 LF |
| Tag Number | : 001 | Stages | : 1 |
| Service | : | Based on curve number | : RC2010-SS Rev 0 |
| Quantity | : 1 | Basic model number | : - |
| | | Date last saved | : 03/12/2026 4:53 PM |

## Operating Conditions

| | |
|---|---|
| Flow, rated | : 2,000.0 USgpm |
| Differential head / pressure, rated (requested) | : 120.0 ft |
| Differential head / pressure, rated (actual) | : 120.3 ft |
| Suction pressure, rated / max | : 8.00 / 8.00 psi.g |
| NPSH available, rated | : Ample |
| Site Supply Frequency | : 60 Hz |

## Performance

| | |
|---|---|
| Speed, rated | : 1780 rpm |
| Impeller diameter, rated | : 11.63 in |
| Impeller diameter, maximum | : 12.10 in |
| Impeller diameter, minimum | : 9.00 in |
| Efficiency | : 88.66 % |
| NPSH required / margin required | : 14.32 / 0.00 ft |
| Ns (imp. eye flow) / Nss (imp. eye flow) | : 2,052 / 10,005 US Units |
| MCSF | : 433.8 USgpm |
| Head, maximum, rated diameter | : 138.3 ft |
| Head rise to shutoff | : 14.30 % |
| Flow, best eff. point | : 1,995.7 USgpm |
| Flow ratio, rated / BEP | : 100.22 % |
| Diameter ratio (rated / max) | : 96.12 % |
| Head ratio (rated dia / max dia) | : 85.65 % |
| Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010] | : 1.00 / 1.00 / 1.00 / 1.00 / 1.34 |
| Selection status | : Acceptable |

## Energy Indexes

| | |
|---|---|
| PEI (CL) | : 0.96 |
| ER (CL) | : 4 |

## Liquid

| | |
|---|---|
| Liquid type | : Cold Water |
| Additional liquid description | : |
| Solids diameter, max | : 0.00 in |
| Solids concentration, by volume | : 0.00 % |
| Temperature, max | : 68.00 deg F |
| Fluid density, rated / max | : 1.000 / 1.000 SG |
| Viscosity, rated | : 1.00 cP |
| Vapor pressure, rated | : 0.34 psi.a |

## Material

| | |
|---|---|
| Material selected | : Cast iron |

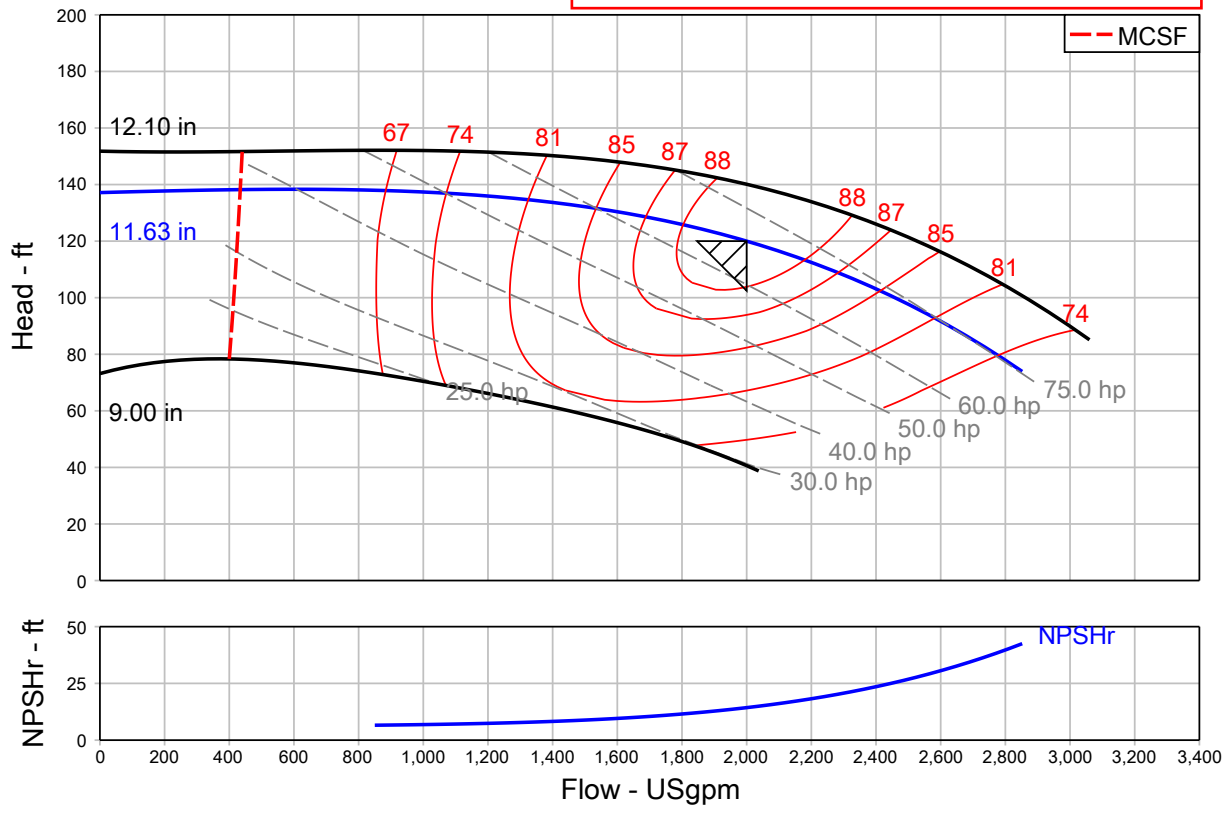
## Pressure Data

| | |
|---|---|
| Maximum working pressure | : 67.86 psi.g |
| Maximum allowable working pressure | : 175.0 psi.g |
| Maximum allowable suction pressure | : 175.0 psi.g |
| Hydrostatic test pressure | : 263.0 psi.g |

## Driver & Power Data (@Max density)

| | |
|---|---|
| Motor sizing specification | : Max power (non-overloading) |
| Margin over specification | : 0.00 % |
| Service factor | : 1.00 |
| Power, hydraulic | : 60.59 hp |
| Rated power (based on duty point) | : 68.34 hp |
| Max power (non-overloading) | : 75.45 hp |
| Nameplate motor rating | : 100 hp / 74.57 kW |

Cherokee PFAS WTF - Raw Water Pump Basis of Design Curve



# Pump Data Sheet - National Pump Company

Company:
Name:
Date: 07/21/2026

## Pump:

| | | | |
|---|---|---|---|
| Size: | M14MC (stages: 7) | Dimensions: | |
| Type: | SS.IMP_MATL | Suction: | --- |
| Synch Speed: | 1800 rpm | Discharge: | --- |
| Dia: | 11.28 in | Vertical Turbine: | |
| Curve: | CVM14MC4P6CYS | Eye Area: | 26.3 in² |
| Impeller: | M14MC (1/8 ) | Bowl Size: | 14.1 in |
| Specific Speeds: | Ns: 2200 | Max Lateral: | 1.13 in |
| | Nss: 9800 | Thrust K Factor: | 11.9 lb/ft |

## Search Criteria:

| | | | |
|---|---|---|---|
| Flow: | 1500 US gpm | Near Miss: | --- |
| Head: | 680 ft | Static Head: | 475 ft |

## Fluid:

| | | | |
|---|---|---|---|
| Name: | Water | | |
| SG: | 1 | Vapor Pressure: | 0.256 psi a |
| Density: | 62.4 lb/ft³ | Atm Pressure: | 14.7 psi a |
| Viscosity: | 1.1 cP | | |
| Temperature: | 60 °F | Margin Ratio: | 1 |

## Pump Limits:

| | | | |
|---|---|---|---|
| Temperature: | 180 °F | Sphere Size: | 0.6 in |
| Wkg Pressure: | 310 psi g | Power: | 652 hp |

## Motor:

| | | | |
|---|---|---|---|
| Standard: | NEMA | Size: | 350 hp |
| Enclosure: | WP-I | Speed: | 1800 rpm |
| Frame: | 447 | | |
| Sizing Criteria: | Max Power on Design Curve | | |

## Pump Selection Warnings:

Pump shutoff dP exceeds limit for the pump.

### --- Duty Point ---

| | |
|---|---|
| Flow: | 1500 US gpm |
| Head: | 684 ft |
| Eff: | 85% |
| Power: | 305 hp |
| NPSHr: | 13.1 ft |
| Speed: | 1770 rpm |

### --- Design Curve ---

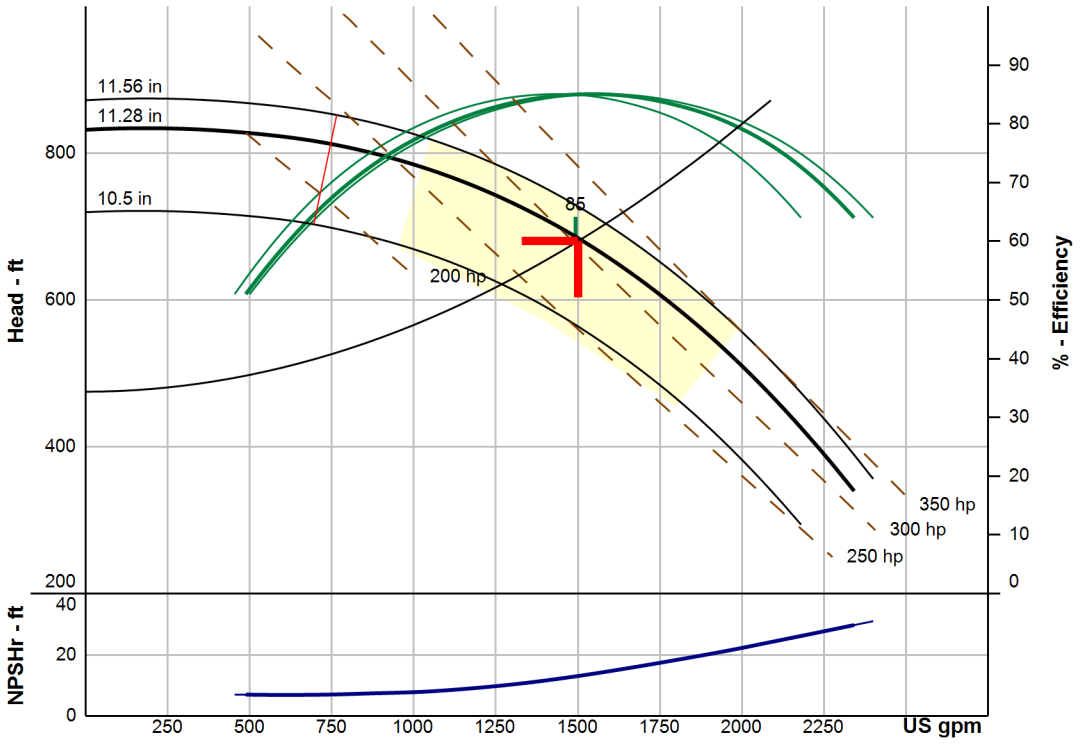
| | |
|---|---|
| Shutoff Head: | 832 ft |
| Shutoff dP: | 360 psi |
| Min Flow: | 747 US gpm |

BEP: 85% @ 1493 US gpm
NOL Power:
325 hp @ 1942 US gpm

### --- Max Curve ---

Max Power:
350 hp @ 1990 US gpm

Cherokee PFAS WTF - Finished Water Pump Basis of Design Curve




**UNLESS OTHERWISE SPECIFIED: [1] LIMITS AND PERFORMANCE BASED ON CI-EN BOWLS AND 316SS IMPELLERS. [2] PERFORMANCE SHOWN MEETS HI 14.6-2011 GRADE 2B TOLERANCES AT THE RATED CONDITION WITHIN THE SELECTION WINDOW. [3] NPSHR AT 1ST STAGE IMPELLER CENTERLINE.**

## Performance Evaluation:

| Flow | Speed | Head | Efficiency | Power | NPSHr |
|---|---|---|---|---|---|
| US gpm | rpm | ft | % | hp | ft |
| 1800 | 1770 | 589 | 83 | 322 | 18.3 |
| 1500 | 1770 | 684 | 85 | 305 | 13.1 |
| 1200 | 1770 | 752 | 82 | 278 | 9.3 |
| 900 | 1770 | 797 | 74 | 245 | 7.5 |
| 600 | 1770 | --- | --- | --- | --- |

# ATTACHMENT 12: Geotechnical Report

**Kumar & Associates, Inc.®**
Geotechnical and Materials Engineers
and Environmental Scientists

6735 Kumar Heights
Colorado Springs, CO 80918
phone: (719) 632-7009
email: kacolospgs@kumarusa.com
www.kumarusa.com

**An Employee Owned Company**

Office Locations: Denver (HQ), Parker, Colorado Springs, Fort Collins, Glenwood Springs, and Summit County, Colorado

# GEOTECHNICAL ENGINEERING REPORT
# CHEROKEE METROPOLITAN DISTRICT
# PFAS WATER TREATMENT FACILITY
# NEAR ELLICOTT HIGHWAY & SH94
# EL PASO COUNTY, COLORADO

*Prepared by*:

Duane P. Craft, P.E.

COLORADO REGISTERED
DUANE P. CRAFT
37553
PROFESSIONAL ENGINEER
6/3/26

*Reviewed by*:

Arben F. Kalaveshi, P.E.

*Prepared for*:

AE2S
9400 Station Street, Suite 300
Lone Tree, CO 80124

Attn: Ms. Kyria Bosma, P.E.

Project No. 25-2-263

June 3, 2026

TABLE OF CONTENTS

SUMMARY ..... 1
PURPOSE OF REPORT ..... 2
PROPOSED CONSTRUCTION ..... 2
SITE CONDITIONS ..... 2
SITE GEOLOGY ..... 3
FIELD EXPLORATION ..... 3
LABORATORY TESTING ..... 3
SUBSURFACE CONDITIONS ..... 4
GEOTECHNICAL ENGINEERING CONSIDERATIONS ..... 5
FOUNDATION RECOMMENDATIONS ..... 6
SITE SEISMIC CRITERIA ..... 7
FLOOR SLABS ..... 7
FOUNDATION WALLS & RETAINING STRUCTURES ..... 9
EXTERIOR FLATWORK ..... 10
WATER SOLUBLE SULFATES ..... 10
BURIED METAL CORROSION CONSIDERATIONS ..... 11
PERCOLATION TESTING ..... 11
UNDERDRAIN SYSTEM ..... 12
SURFACE DRAINAGE ..... 13
PAVEMENT DESIGN ..... 14
SITE GRADING AND EARTHWORK ..... 17
DESIGN AND SUPPORT SERVICES ..... 21
LIMITATIONS ..... 21

FIG. 1 - LOCATION OF EXPLORATORY BORINGS AND TEST PITS
FIGS. 2 THRU 4 - LOGS OF EXPLORATORY BORINGS AND TEST PITS
FIG. 5 - LEGEND AND NOTES
FIGS. 6 THRU 8 - SWELL-CONSOLIDATION TEST RESULTS
FIGS. 9 THRU 18 - GRADATION TEST RESULTS
FIG. 19 – LABORATORY RESISTIVITY TEST RESULTS

TABLE I - SUMMARY OF LABORATORY TEST RESULTS

SUMMARY

1. Beneath a layer of topsoil, the generalized subsurface profile encountered in the borings consisted of granular overburden soil types, to include silty sand (SM), poorly-to well-graded sand with varied amounts of silt (SP, SW, SP-SM, SW-SM), clayey sand (SC), and silty-clayey sand (SM-SC). Infrequent lenses of lean clay with varied amounts of sand (CL), were encountered in five of the borings, and ranged from approximately 0.5 to 4 feet in thickness where encountered. The overburden soils extended to the maximum 4 to 60-foot depths explored.

2. Groundwater was not encountered in the borings at the time of drilling, or when the borings were checked 7 to 8 days later. The borings were backfilled with auger cuttings after performing the follow-up water level check. Groundwater is expected to fluctuate over time due to seasonal and climatic factors as well as the irrigation regimen of the developed area. Based on our understanding of the proposed construction and the anticipated depths of construction, we do not expect groundwater to be a design consideration for this project.

3. With proper site preparation, shallow spread footing foundations with slab-on-grade floors or mat foundations should be feasible. Because of the loose upper soils encountered, proper site preparation should include complete removal of topsoil and organic materials down to the natural granular soils, followed by overexcavation, moisture conditioning and recompaction of the native subgrade to a depth of at least 3 feet below foundation and floor slab bearing elevations. During the subgrade moisture conditioning and recompaction process, any clay soils encountered should be replaced with suitable structural fill. The intent of this recommendation is to provide an anticipated total settlement potential of approximately 1 inch or less.

4. With proper moisture conditioning, the on-site granular soils will be suitable for reuse as structural fill, including structural fill beneath foundations, floor slabs, exterior flatwork, and pavements. Clay materials should be considered unsuitable, and should be placed in nonstructural or landscape areas, or removed from the site. The “Site Grading and Earthwork” section of the report provides additional discussion on suitability of the on-site soils and imported fill requirements.

5. The following table presents the recommended pavement thicknesses based on assumed traffic loading as discussed herein.

| PAVEMENT SECTION THICKNESS (in.) | | |
|---|---|---|
| Asphalt Over Aggregate Base Course | Aggregate Base Surfaced | Unreinforced Concrete over Aggregate Base Course |
| 5 over 6 | 6 | 6 over 6 |

*: We recommend truck areas where truck turning movements are concentrated be paved with a Portland Cement Concrete (PCC) section or aggregate surfacing rather than the asphalt alternative. The use of a flexible pavement in these areas could result in pavement fatigue cracking and/or rutting/shoving of the pavement due to the concentrated wheel loads.

PURPOSE OF REPORT

This report presents the results of a geotechnical engineering study for the proposed PFAS water treatment facility to be located in the vicinity of North Ellicott Highway and State Highway 94 in El Paso County, Colorado. The project site is shown on the attached Fig. 1. The study was conducted for the purpose of developing recommendations for site grading, foundations, pavements, and other geotechnical considerations related to the proposed construction. The study was performed in general accordance with our Proposal No. C25-274R, dated March 10, 2026.

This report has been prepared to summarize the data obtained during this study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to the proposed construction are included in the report.

PROPOSED CONSTRUCTION

We understand the proposed construction will include the components summarized in the table below and as generally shown on Fig. 1. Overall, site grading is anticipated to consist of maximum cuts/fill of less than 2 feet.

| Item | Grade | Details |
|---|---|---|
| Finished water tanks (2) | At-grade | 105’ diameter, 1.5 M gallon, prestressed concrete |
| Raw water tanks (2) | At-grade | 60’ diameter, 0.5 M gallon, prestressed concrete |
| Treatment facility building | At-grade, no basement. Structure will include a wet well which extends 12’ below grade. | Pre-fab metal building, approximately16,300 sf |
| Leach field | Assumed minimum of 12” to maximum of 48” below grade. | 100’x100’ leach field |
| Buried piping | Assumed invert depths below grade in range of 6’ to 10’ for water and sewer, and 4’ for electric and other conduits. | 6” to 24” diameter water and sewer lines |
| Driveway and parking | At-grade | Gravel surfaced or asphalt paved |

SITE CONDITIONS

The subject site is located on vacant land north of State Highway 94, east of N Ellicott Highway in El Paso County, Colorado. The site is generally surrounded by vacant land and livestock

pastures, with a pumpkin patch and farm located beyond to the west of the proposed development. The site is nearly level with a slight slope down to the east and south, and is vegetated by native grasses, weeds, and cacti.

## SITE GEOLOGY

The project site is located within the Colorado Piedmont of the Great Plains physiographic province. Structurally, this area is east of the Ute Pass and Rampart Range Faults, which bound this portion of the Front Range. Regional uplift east of the Front Range has exposed Upper Cretaceous to Paleocene-age, gently northeast dipping claystone, siltstone, sandstone and thin coal beds representing a regressional sea sequence. The entirety of the subject site is mapped as Louviers Alluvium. This alluvium is described as thin reddish-brown gravel to yellowish-brown sand deposited on terraces 60 to 70 feet above streams on the plains, dating to the Pleistocene epoch. This alluvial deposit is expected to be underlain by early Tertiary to late Cretaceous-age deposits of the Denver Basin Group at an unknown depth, which consist of arkosic sandstone interbedded with claystone.

## FIELD EXPLORATION

The field exploration of subsurface conditions consisted of drilling nine 4-inch diameter borings (B1-B9) and three 8-inch diameter percolation test holes (P1-P3), and excavating two test pits (EX1, EX2). The borings and percolation test holes were drilled between April 20 and 21, 2026 and the test pits were excavated on April 27, 2026. The locations were approximated using a handheld GPS unit, and are shown on Fig. 1. Logs of the exploratory borings and test pits are presented on Figs. 2 thru 4, and corresponding legend and notes are presented on Fig. 5.

The borings and test pits were logged by representatives of Kumar & Associates, Inc. Samples of the soils were taken with a 2-inch I.D. California sampler. The sampler was driven into the various strata with blows from a 140-pound hammer falling 30 inches. Penetration resistance values, when properly evaluated, provide an indication of the relative density or consistency of the soils. Bulk disturbed samples were also collected. Depths at which the samples were taken and the penetration resistance values are shown on the boring logs.

## LABORATORY TESTING

Samples obtained from the exploratory borings and test pits were visually classified in the laboratory and samples were selected for laboratory testing. Laboratory testing included index property tests such as in-situ moisture content and dry unit weight, grain size analysis, and

Atterberg limits. Additional testing included in-situ swell-consolidation, electrical resistivity, concentration of water soluble sulfates and water soluble chlorides, and pH. The testing was conducted in general accordance with recognized test procedures, primarily those of the American Society for Testing of Materials (ASTM). Results of the laboratory testing program are shown on Figs. 2 thru 4, and 6 thru 19, and are summarized on Table I.

SUBSURFACE CONDITIONS

Beneath a layer of topsoil, the generalized subsurface profile encountered in the borings consisted of granular overburden soil types, to include silty sand (SM), poorly-to well-graded sand with varied amounts of silt (SP, SW, SP-SM, SW-SM), clayey sand (SC), and silty-clayey sand (SM-SC). Infrequent lenses of lean clay with varied amounts of sand (CL), were encountered in five of the borings, and ranged from approximately 0.5 to 4 feet in thickness where encountered. The overburden soils extended to the maximum 4 to 60-foot depths explored. The following subsurface descriptions are of a generalized nature to highlight the soil types encountered in the borings drilled for this study. The boring logs should be reviewed for more detailed information.

Native Granular Soils: Native granular soils encountered included silty sand (SM), poorly-to well-graded sand with varied amounts of silt (SP, SW, SP-SM, SW-SM), clayey sand (SC), and silty-clayey sand (SM-SC). Occasional gravel was encountered in each of these soil types. The native granular soils extended to the maximum 4 to 60-foot depths explored in each of borings. The native granular soils varied from slightly moist to moist, with color varying from tan, brown, gray-brown, tan-gray, and tan-orange. Sampler penetration blow counts indicate the granular soils are generally medium dense to very dense, with occasional loose zones in the upper approximately 5 feet in some of the borings.

The in-situ moisture content of the granular soils tested varied from 1.6% to 13.4%, with an average of 5.7%. The in-situ densities varied from 93.4 pcf to 129.4 pcf, with an average of 116.2 pcf.

Swell-consolidation test results presented on Figs. 6 thru 8 indicate the tested samples of silty sand were nonexpansive when wetted under a 1,000 psf surcharge. A tested sample clayey sand had a low swell potential.

Native Clay Soils: Infrequent lenses of lean clay with varied amounts of sand (CL), were encountered in five of the borings, and ranged from approximately 0.5 to 4 feet in thickness where

encountered. The clay was slightly moist to moist, and brown, gray, and gray-brown in color. Sampler penetration blow counts indicate the clay soils are medium stiff to very stiff.

In-situ moisture content of the clay soils tested varied from 12.1% to 22.5%, with an average of 17.8%. The in-situ densities varied from 96.7 pcf to 106.7 pcf, with an average of 101.2 pcf. Swell-consolidation test results presented on Figs. 6 thru 8 indicate the tested sample of clay had a nil to low swell potential when wetted under a 1,000 psf surcharge.

Groundwater: Groundwater was not encountered in the borings at the time of drilling, or when the borings were checked 7 to 8 days later. The borings were backfilled with auger cuttings after performing the follow-up water level check. Groundwater is expected to fluctuate over time due to seasonal and climatic factors as well as the irrigation regimen of the developed area. Based on our understanding of the proposed construction and the anticipated depths of construction, we do not expect groundwater to be a design consideration for this project.

## GEOTECHNICAL ENGINEERING CONSIDERATIONS

As discussed above, the subgrade soils encountered were found to be loose in the upper approximately 5 feet in some of the borings. Without densification of the loose soils, foundations and floor slabs placed on loose granular materials can experience excess total and/or differential settlement, which may lead to distress to the structure or slab.

With proper site preparation, shallow spread footing foundations with slab-on-grade floors or mat foundations should be feasible. Because of the loose upper soils encountered, proper site preparation should include complete removal of topsoil and organic materials down to the natural granular soils, followed by overexcavation, moisture conditioning and recompaction of the native subgrade to a depth of at least 3 feet below foundation and floor slab bearing elevations. During the subgrade moisture conditioning and recompaction process, any clay soils encountered should be replaced with suitable structural fill. The intent of this recommendation is to provide an anticipated total settlement potential of approximately 1 inch or less. If extreme wetting of the subgrade is allowed, settlement could be greater.

The on-site granular soils encountered are suitable for reuse as structural fill with proper moisture conditioning. The “Site Grading and Earthwork” section of the report provides additional discussion.

The foundation recommendations that follow include spread footing and mat foundations. If other foundation alternatives are preferred, we should be consulted.

FOUNDATION RECOMMENDATIONS

The design and construction criteria presented below should be observed for a spread footing or mat foundation system. The construction details should be considered when preparing project documents.

1. We recommend that spread footing and mat foundations be supported on the native granular soils, with overexcavation, moisture conditioning and recompaction of the native subgrade to a minimum depth of 3 feet below foundation bearing elevation. During the subgrade moisture conditioning and recompaction process, any clay soils encountered should be removed and replaced with suitable structural fill.

2. Structural fill should meet the material and placement requirements outlined in the "Site Grading and Earthwork" section of this report. New structural fill should extend down from the edges of the foundations at a 1 horizontal to 1 vertical projection.

3. Footings supported on properly compacted structural fill as recommended herein should be designed for a maximum allowable soil bearing pressure of 2,500 psf.

4. If the mat cannot be considered rigid, the soil pressure distribution should be computed using a method which models the soil-structure interaction, such as the beam on an elastic foundation procedure. A modulus of vertical subgrade reaction of 150 pci can be used for compacted on-site soils. This value is based on correlations to a 1 ft. x 1 ft. sample plate and should be decreased as appropriate to account for the actual foundation size and geometry.

5. Spread footings should have a minimum footing width of 16 inches for continuous footings and of 24 inches for isolated pads.

6. Exterior footings and footings beneath unheated areas should be provided with adequate soil cover above their bearing elevation for frost protection. Placement of foundations at least 30 inches below the exterior grade is typically used in this area.

7. Criteria for the lateral resistance of a spread footing placed on native granular materials or properly compacted structural fill is presented in the “Foundation Walls & Retaining Structures” section of this report.

8. Continuous foundation walls should be reinforced top and bottom to span an unsupported length of at least 10 feet.

9. Granular foundation soils should be densified with a smooth vibratory compactor prior to placement of formwork and reinforcing steel.

10. A representative of the geotechnical engineer should confirm proper subgrade preparations have been met prior to placing foundation formwork. Loose disturbed material should be removed from the foundation subgrade prior to placement of concrete. Placement of structural fill should be observed and tested by a representative of the geotechnical engineer. In addition, representatives of the geotechnical and/or structural engineer should check reinforcement placement prior to concrete placement.

SITE SEISMIC CRITERIA

Using estimated shear wave velocities for the subgrade materials encountered based on standard penetration testing, calculations for an assumed 100-foot profile indicate a design Site Class D per the 2021 International Building Code (IBC). Based on the subsurface profile and area seismicity, liquefaction is not a design consideration. Using an online 3rd party graphical user interface tool developed by the Office of Statewide Health and Planning Development (OSHPD) that references USGS seismic design maps and ASCE 7-16, the following probabilistic values are reported for the project site.

| Type | Value |
|---|---|
| $MCE_R$ Ground motion, 0.2s period $S_s$ | 0.165 |
| $MCE_R$ Ground motion, 1.0s period $S_1$ | 0.052 |

FLOOR SLABS

Excluding the occasional loose upper native soils, the native granular soils are suitable to support light to moderately loaded slab-on-grade construction. Proper site preparation should include overexcavation of the native soils to a minimum a depth 3 feet below the proposed floor slab elevation as detailed below. Assuming floor slabs are properly constructed as described in this

report, and that good surface drainage and irrigation practices are designed, constructed and maintained, we believe the risk of slab movements will be relatively low, with potential movements of about 1 inch or less anticipated. If extreme wetting of the subgrade is allowed, settlement could be greater. The following measures should be taken to reduce the damage which could result from movement should the underslab materials be subjected to moisture changes.

1. Floor slabs should be supported on a minimum 3 feet of moisture-conditioned fill. During the overexcavation, moisture conditioning and recompaction process, any clay soils encountered should be removed and replaced with suitable structural fill.

2. Structural fill should meet the material and placement requirements outlined in the "Site Grading and Earthwork" section of this report.

3. Floor slabs should be designed using a subgrade modulus (k) of 150 pci.

4. Floor slabs should be separated from all bearing walls and columns with expansion joints which allow unrestrained vertical movement.

5. Floor slabs should not extend beneath exterior doors or over foundation grade beams, unless saw cut at the beam after construction.

6. Floor slab control joints should be used to reduce damage due to shrinkage cracking. The appropriate joint spacing is dependent on slab thickness, concrete aggregate size and slump, and should be consistent with recognized guidelines such as those of the Portland Cement Association (PCA) or American Concrete Institute (ACI). The joint spacing and any requirements for slab reinforcement should be established by the designer based on experience and the intended slab use.

7. If moisture-sensitive floor coverings will be used, mitigation of moisture penetration into the slabs, such as by use of a vapor barrier, may be required. If an impervious vapor barrier membrane is used, special precautions will be required to reduce potential differential curing problems which could cause the slabs to warp. Section 302.1R of the ACI Manual of Concrete Practice addresses this topic.

8. All plumbing lines should be tested before operation. Where plumbing lines or other slab protrusions enter through the floor, a positive bond break should be provided. Flexible connections should be provided for slab-bearing mechanical equipment.

The precautions and recommendations listed above will not prevent the movement of floor slabs if the underlying expansive materials are subjected to alternate wetting and drying cycles. However, the precautions should reduce the damage if such movement occurs.

FOUNDATION WALLS & RETAINING STRUCTURES

Foundation walls and retaining structures which are laterally supported and that are expected to undergo a moderate amount of deflection should be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of 55 pcf for backfill consisting of the on-site granular soils, or 50 pcf if imported CDOT Class I structural backfill is used. Cantilevered retaining structures that are expected to deflect sufficiently to mobilize the full active earth pressure condition should be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of 45 pcf for backfill consisting of the on-site granular soils, or 40 pcf for CDOT Class I structural backfill.

All foundation and retaining structures should be designed for appropriate hydrostatic and surcharge pressures such as adjacent buildings, traffic, construction materials and equipment. The pressures recommended above assume drained conditions behind the walls and a horizontal backfill surface. The buildup of water behind a wall or an upward sloping backfill surface will increase the lateral pressure imposed on a foundation wall or retaining structure.

The lateral resistance of a foundation or retaining wall footing placed on properly compacted nonexpansive fill material will be a combination of the sliding resistance of the foundation on the foundation materials and passive earth pressure against the side of the footing. Resistance to sliding at the bottoms of the footings may be calculated based on an allowable coefficient of friction of 0.30. Passive pressure against the sides of the footings may be calculated using an allowable equivalent fluid unit weight of 180 pcf.

The onsite granular soils, minus any clay soils, are suitable for use as wall backfill. Imported granular wall back fill, if used, should meet the requirements of a CDOT Class I structural backfill with less than 20% passing the No. 200 sieve. Proposed material should be approved by the geotechnical engineer prior to use.

The granular backfill behind foundation and retaining walls should be sloped from the base of the wall at an angle of at least 45 degrees from the vertical. Backfill should be placed in uniform lifts and compacted to the criteria presented in the "Site Grading and Earthwork" section of the report. Care should be taken not to overcompact the backfill since this could cause excessive lateral pressure on the walls. Some settlement of deep foundation wall backfills will occur even if the material is placed properly.

EXTERIOR FLATWORK

We recommend subgrade preparation beneath exterior flatwork immediately adjacent to the building and within a 10-foot zone around the perimeter of the building including sidewalks where reduction of settlement potential is considered more important be prepared to the same requirement of overexcavation required for the structure, which includes providing a minimum 3-foot depth of overexcavation, moisture-conditioning and recompaction below the bearing elevation of the flatwork.

Fill placed for support of exterior flatwork should meet the material and compaction requirements for structural fill presented in the "Site Grading and Earthwork" section of this report.

Proper surface drainage measures as recommended in the "Surface Drainage" section of this report are also critical to reducing moisture or frost-related movement. Settlement of fill below exterior flatwork adjacent to the buildings may result in adverse drainage conditions with runoff directed toward the structure. Site grading and drainage design should consider those possibilities, particularly at entryways. Positive drainage and grades should be maintained throughout the life of the facility.

WATER SOLUBLE SULFATES

The concentration of water soluble sulfates measured in samples of the on-site soils obtained from the borings ranged from less than 0.01% to approximately 0.04%. These concentrations of water soluble sulfates represent Class S0 severity exposures to sulfate attack on concrete exposed to these materials. The degree of attack is based on a range of Class S0, Class S1, Class S2, and Class S3 severity exposure as presented in ACI 201. Based on the laboratory data and our experience, we believe special sulfate resistant cement will not be required for concrete exposed to the on-site soils.

BURIED METAL CORROSION CONSIDERATIONS

The potential for corrosion of buried metal placed beneath the ground surface at the site was evaluated based on the results of laboratory tests on samples of well graded sand with silt and gravel (SW-SM) and lean clay (CL) obtained from the borings. The samples were tested to determine pH, water soluble sulfates, chlorides, and electrical resistivity. The laboratory test results are summarized in Table I, and shown on the boring logs, Figs. 2 thru 4. Electrical resistivity test results are presented graphically on Fig. 19.

The pH test results indicate a value of 8.2, which suggest the site materials are slightly alkaline. The concentration of water soluble sulfates ranged from less than 0.01% to approximately 0.04% as discussed in the previous section, and the concentration of water soluble chlorides was 0.02%.

The electrical resistivity test results presented on Fig. 19 indicate minimum resistivity values (saturated) of 10,000 ohm-cm and 800 ohm-cm for tested samples of well graded sand with silt and gravel and lean clay, respectively, with corresponding values at the in-situ moisture content of 14,960 ohm-cm and 865 ohm-cm for the tested samples. These values suggest excellent corrosion resistance for the granular soil sample, and poor corrosion resistance for the clay soil sample.

Corrosion of buried metal is a complex process and requires an understanding of the combined effects of pH, soil moisture, and other conditions not evaluated as part of this report. We recommend the applicable pipe designer or qualified corrosion engineer review the information presented herein to ultimately determine the need for and appropriate level of corrosion protection for buried metals at the site.

PERCOLATION TESTING

The location of percolation test holes (P1 thru P3), and the corresponding profile test pits (EX1 and EX2) are shown on Fig. 1. The percolation test holes were drilled to a depth of 4 feet using 8-inch diameter continuous-flight augers, and the test pits were excavated to a depth of 8 feet using a min-excavator. Below a layer of topsoil, the subgrade soils encountered were granular, and generally included silty sand (SM) in the upper approximately 1.5 to 4 feet, followed by well-graded sand with varied amounts of silt and gravel (SW-SM, SW). Groundwater was not encountered during the excavation of test pits or when the percolation tests were conducted. Logs of the percolation test holes and test pits are included on Fig.4 for reference.

Percolation tests were performed on April 28, 2026, following the "Regulations of the El Paso County Board of Health – El Paso County, Colorado", Chapter 8, On-site Wastewater Treatment Systems (OWTS) criteria. The measured percolation rates of the soils tested are presented below. The measurements were made at 10-minute intervals for a total of 8 readings at each location. Tests were performed 24 hours after a presoak period. The values presented reflect the final reading made at each test hole. The field percolation rate, which is the average rate of the percolation rates determined for all percolation test holes within the proposed soil treatment area, is 2.83 minutes/inch.

| Percolation Test Hole | Depth to Groundwater (ft) | Final Percolation Rate (min./inch) | EPC OWTS Soil Type[1] | USDA Hydrologic Soil Group[2] |
|---|---|---|---|---|
| P1 | (none) | 3.33 | 1 | A |
| P2 | (none) | 2.67 | 1 | A |
| P3 | (none) | 2.50 | 1 | A |

[1] The soil type presented in the table above was determined in accordance with the criteria listed in Table 10-1 of the El Paso County OWTS regulations, which considers USDA criteria for classification and texture. In accordance with USDA, the soils encountered within the percolation test holes classified as loamy sand to sand, single-grain, and structureless.

[2] The hydrologic soil group presented in the table above was determined for the soils within the proposed infiltration area in accordance with the criteria listed in the United States Department of Agriculture's *National Engineering Handbook, Part 630: Hydrology*. Group A soils are considered to have a low runoff potential and water is transmitted freely through the soil.

Several factors can affect the rate of percolation, including soil density and moisture content, the percentage of silt and clay, as well as other environmental and construction influences. The designer should consider that actual percolation rates can be highly variable and may differ by an order of magnitude or more from those indicated. Although unlikely, shallow groundwater will result in a lower percolation rate than that reported above if it is within about 4 feet of the proposed infiltration zone.

UNDERDRAIN SYSTEM

We understand the pump wet well will extend approximately 12 feet below grade. Typically, where below grade construction is used, we recommend consideration be given to protect the space with an underdrain system. Although free water was not encountered during our field exploration, localized perched water conditions can sometimes develop within the structure backfill zone

during times of heavy precipitation after construction. Such a system will likely require a sump and pump.

However, considering the proposed construction and the subsurface conditions encountered, it is our opinion that the use of an underdrain can be optional, and it's inclusion should be ultimately decided by the designer. The designer should be aware that without an underdrain, there may be an increased potential for periodic wetting of the interior space during times of precipitation, depending on the construction type. Water proofing the space can be utilized to reduce the magnitude of potential wetting.

If used, the underdrain system should consist of a perimeter drain placed at least 12 inches below the vault floor elevation, and consist of a perforated pipe placed in the bottom of a trench and surrounded above the invert level with free-draining gravel. This free-draining gravel should extend up to the slab level and should be surrounded with filter fabric. Free-draining gravel used in the drain system should consist of minus 2-inch aggregate with less than 20% passing the No. 4 sieve and less than 5% passing the No. 200 sieve. The perimeter drain pipe should be at least 4 inches in diameter. and graded at a minimum ½% slope to a gravity outlet or sump where water may be removed by pumping.

SURFACE DRAINAGE

Proper surface drainage is very important for acceptable performance of the development during construction and after the construction has been completed. Drainage recommendations provided by local, state and national entities should be followed based on the intended use. The following recommendations should be used as guidelines and changes should be made only after consultation with the geotechnical engineer.

1. Excessive wetting or drying of foundation and slab subgrades should be avoided during construction.

2. The ground surface surrounding the exterior of the buildings and other structures should be sloped to drain away from the foundations in all directions. We recommend a minimum slope of 6 inches in the first 10 feet in unpaved areas. Site drainage beyond the 10-foot zone should be designed to promote runoff and reduce infiltration. A minimum slope of 3 inches in the first 10 feet is recommended in the paved areas. These slopes may be

changed as required for handicap access points in accordance with the Americans with Disabilities Act.

3. Ponding of water should not be allowed in backfill material or in a zone within 10 feet of foundations or foundation walls, whichever is greater.

4. Roof downspouts and drains should discharge well beyond the limits of all backfill.

5. Irrigated turf and other excessive landscape irrigation should be avoided within 10 feet of foundations.

PAVEMENT DESIGN

Subgrade Materials: Based on the results of the field exploration and laboratory testing, the pavement subgrade materials encountered at the site classify as A-1-a, A-1-b, A-2-4, A-2-6, A-4, and A-6 with group index of 0 to 13 in accordance with the American Association of State Highway and Transportation Officials (AASHTO) soil classification system. A-1 and A-2 soils were the predominant soil classification, and were assumed for the design. Based on our experience with similar soil types, an R-value of 15 and a resilient modulus value of 4,195 psi were assumed for design of flexible pavements, and a corrected subgrade modulus of 150 pci was assumed for design of rigid pavements.

Design Traffic: Traffic loading information for the planned pavement areas was not available to us at the time of our report preparation. We have assumed traffic will primarily consist of automobiles and pickup trucks, with occasional truck traffic, to include tractor trailers for media replacement and equipment maintenance. Based on our experience with similar facilities, for our pavement thickness design calculations we assumed an equivalent 18-kip daily load application (EDLA) of 20 for areas of combined auto and truck traffic. If it is determined that actual traffic is significantly different from that estimated, we should be contacted to reevaluate the pavement thickness design.

Pavement Sections: The recommended sections were determined using the DARWin 3.01 pavement design software based on the 1993 AASHTO pavement design procedures. Based on the subgrade conditions encountered and the assumed traffic loading, we recommend the following pavement sections:

| PAVEMENT SECTION THICKNESS (in.) | | |
|---|---|---|
| Asphalt Over Aggregate Base Course | Aggregate Base Surfaced | Unreinforced Concrete over Aggregate Base Course |
| 5 over 6 | 6 | 6 over 6 |

*: We recommend truck areas where truck turning movements are concentrated be paved with a Portland Cement Concrete (PCC) section or aggregate surfacing rather than the asphalt alternative. The use of a flexible pavement in these areas could result in pavement fatigue cracking and/or rutting/shoving of the pavement due to the concentrated wheel loads.

A full-depth asphalt section alternative was not included because it has been our experience it can be difficult to construct given the presence of occasionally clean sands. The clean sands will have a tendency to rut from pavement vehicles even if properly compacted, potentially contaminating the bottom lift of asphalt. The usage of an aggregate base course layer will reduce the magnitude of this potential issue.

Pavement Materials: The asphalt pavement mix should conform to specifications for Superpave Hot Mix Asphalt (HMA). A PG 58-28 asphalt binder should be suitable for the mix. In the event that a PG 64-22 asphalt binder is used in the mix, the asphalt section will provide adequate structural support but will be subject to a higher potential for low temperature related transverse cracking.

Class 6 aggregate base course should be used for the base layer of both asphalt and concrete pavement options, and also where aggregate surfaced areas will be utilized. Aggregate base course should be a Class 6 material conforming to the requirements presented in the CDOT Standard Specifications for Road and Bridge Construction.

Concrete pavement should meet the requirements of a Class P Mix, per Section 601 of the CDOT Standard Specifications, and should be based on a mix design established by a qualified engineer. The concrete should contain transverse joints not greater than 12 to 15 feet on centers and longitudinal joints no greater than 14 feet. Joint spacing and geometry should be established by a qualified designer/engineer. The joints should be hand formed, sawed or formed by premolded filler. The joints should be at least 1/4 of the slab thickness. Expansion joints should be provided at the end of each construction sequence and between the concrete slab and adjacent structures. Expansion joints where required, should be filled with a ½ inch-thick asphalt impregnated fiber. Concrete should be cured by protecting against loss of moisture, rapid temperature changes and mechanical injury for at least three days after placement. The concrete

sections presented above are assumed to be unreinforced. Providing dowels at construction joints will help reduce the risk of differential movements between panel sections. Providing a grid mat of deformed rebar or welded wire mesh within the concrete pavement section will assist in mitigating corner breaks and differential panel movements. If a rebar mat is installed, we recommend that the bars be placed in the lower half of the pavement section. Also, if reinforcing is used, we have commonly seen No. 4 rebar placed at 24-inch center in each direction, however, we recommend that a structural engineer evaluate the placement and spacing of rebar if needed.

Subgrade Preparation: Fill placed for support of pavements should meet the material and compaction requirements for structural fill presented in the "Site Grading and Earthwork" section of this report. Prior to placing compacted fill or pavement materials, the exposed subgrade soils should be scarified to a depth of at least 12 inches, moisture conditioned, and compacted according to the specifications in the "Site Grading and Earthwork" Section of this report.

Proof Roll: Before paving, the subgrade should be proof rolled with a heavily loaded, pneumatic-tired vehicle. The vehicle should have a gross vehicle weight of at least 50,000 pounds with a loaded single axle weight of 18,000 pounds and a tire pressure of 100 psi. Areas which deform excessively (> 1/2") under heavy wheel loads are not stable and should be removed and replaced with suitable material to achieve a stable subgrade prior to paving or placement of base course.

Drainage: The collection and diversion of surface drainage away from paved areas is extremely important to the satisfactory performance of the pavement. Drainage design should provide for the removal of water from paved areas and prevent the wetting of the subgrade soils.

Maintenance: Periodic maintenance of paved areas is critical to achieve the design life of the pavement. Crack sealing should be performed annually as new cracks appear. Chip seals, fog seals, or slurry seals applied at approximate intervals of 3 to 5 years are usually necessary for asphalt. As conditions warrant, it may be necessary to perform patching and overlay at approximate 10-year intervals.

Aggregate Surfacing Option: For the pavement section presented, the owner should be aware that periodic maintenance will be required for the aggregate-surfaced areas. The majority of the maintenance will consist of periodic grading to remove ruts and potholes that will inevitably be created by the environment and traffic. Occasionally during the lifetime of the surface, the

aggregate base layer may have to be scarified, additional aggregate added to increase the thickness to that originally required, and the wearing surface recompacted to the specified density.

SITE GRADING AND EARTHWORK

Temporary Excavations: We recommend temporary excavation slopes be constructed in accordance with OSHA regulations. In accordance with OSHA criteria, the on-site native soils should be considered a Type C soil due to the variability. Temporary unretained excavations should have slopes no steeper than 1.5:1 (H:V) in Type C soils. A properly braced excavation or the use of a trench box should be used where the indicated unretained slopes cannot be accommodated. Flatter slopes will be required where groundwater seepage is encountered. OSHA regulations require that excavations greater than 20 feet in depth be designed by a professional engineer. If soils different from those indicated in this report are encountered, the OSHA soil type may vary and the required cut slopes may need to be adjusted. A contractor's competent person should make decisions regarding cut slopes.

Excavated slopes may soften or loosen due to construction traffic and erode from surface runoff. Measures to keep surface runoff from excavation slopes, including diversion berms, should be considered.

Excavation Considerations: In our opinion, the overburden soils encountered in the exploratory borings drilled for this study can be excavated with heavy-duty construction equipment. Groundwater was not encountered in our exploratory borings. Based on our understanding of the proposed construction and the anticipated depths of construction, we do not expect groundwater to be a design consideration for this project. If groundwater is encountered, we believe the excavation can be dewatered using perimeter and/or lateral trenches combined with sumps. The trenches should be sloped to sumps where water can be pumped from the excavation. The bottom and sides of the excavation may become unstable, especially in the granular soils if the groundwater level is not lowered in advance of excavation and maintained at a sufficient depth below the bottom of the excavation. Dewatering must be maintained through the time period the excavation is open. The dewatering system should be properly designed, installed, and maintained by an experienced dewatering contractor.

Cut and Fill Slopes: Permanent cut and fill slopes should not be steeper than 3:1 (horizontal to vertical). Slopes will generally be stable at 2:1; however, 2:1 slopes will be prone to increased surface erosion and it will be difficult to maintain vegetation on them. The risk of slope instability

will be significantly increased if seepage is encountered in cuts. If seepage is encountered in permanent excavations, an investigation should be conducted to determine if the seepage will adversely affect the cut stability.

We understand detention ponds may be constructed utilizing on-site soils and designed for infiltration, or lined and designed for detention. Evaluation of the pond slopes is beyond the scope of our study. The slopes recommended above are considered to be suitable for general embankment construction, however, in pond applications with rapid fill or drawdown considerations, the granular soils will have an increased potential for sloughing and erosion and flatter slopes in the range of 3:1 or 4:1 may be required.

No formal stability analyses were performed to evaluate the slopes recommended above. Published literature and our experience with similar cuts and fills indicate the recommended slopes should have adequate factors of safety. If a detailed stability analysis is required, we should be notified.

Good surface drainage should be provided for all permanent cuts and fills to direct the surface runoff away from the slope faces. Permanent cut and fill slopes and other stripped areas should be protected against erosion by revegetation or other means. Fills should be benched into any hillsides exceeding 4 horizontal to 1 vertical. Site grading should be planned to provide positive surface drainage away from all building and pavement areas.

Subgrade Stabilization: Unstable subgrade may be encountered during subgrade preparations. Unstable soils may be stabilized by scarifying/ripping the subgrade and allowing it to dry, or by overexcavation and replacement of the subgrade with suitable, imported, angular, well-graded materials. Other alternatives include the use of Type 2 biaxial geogrid reinforcement in combination with a layer of Class 6 aggregate base course. It has been our experience that the use of a crushed concrete product meeting a Class 6 gradation can perform well when trying to achieve stabilization. Specific stabilization requirements should be evaluated at the time of construction. We are unable to accurately predict or quantify areas where unstable subgrade conditions may occur, however, we recommend this work activity, if required, be included as a line item in the bid schedule to avoid cost overruns.

Fill Material: The following recommended material and compaction requirements are presented for fill placements on the project site. A geotechnical engineer should evaluate the suitability of all proposed fill materials for the project prior to placement.

1. *Structural Fill*: With proper moisture conditioning, the on-site granular soils (SP, SW, SP-SM, SW-SM, SM, SC-SM, and SC) will be suitable for reuse as structural fill, including structural fill beneath foundations, floor slabs, exterior flatwork, and pavements. Imported structural fill, if required, should consist of a nonexpansive soil material having a maximum particle size of 2 inches, a maximum of 40% passing the No. 200 sieve, and a maximum plasticity index of 10. (We recognize that some of the tested samples of the onsite granular soils do not meet the specification for gradation and/or plasticity index; however, given the properties, it is our opinion they will be acceptable for reuse, if properly moisture conditioned.)

2. *Reuse of Clay Soils*: Clay soils (CL, CH) should be considered unsuitable for use as structural fill, and should be placed in nonstructural or landscape areas, or removed from the site.

3. *Subgrade Preparation*: The ground surface shall be stripped of vegetation/organics down to the natural granular soils, followed by overexcavation, moisture conditioning and recompaction of the native subgrade to a depth of at least 3 feet below the foundation and floor slab bearing elevations. As discussed in the “Exterior Flatwork” section, the overexcavation zone should also include beneath exterior flatwork immediately adjacent to the building and within a 10-foot zone around the perimeter of the building including sidewalks where reduction of settlement potential is considered more important. During the subgrade moisture conditioning and recompaction process, any clay soils encountered should be replaced with suitable structural fill. The prepared subgrade should extend down and outward from the edges of the foundations at a minimum 1:1 horizontal to vertical projection.

   In pavement areas, the subgrade should be scarified to a depth of 12 inches, moisture conditioned as necessary, and compacted in a manner specified below for the subsequent layers of fill.

   Loose or unstable soils shall be removed, where present, in order to provide a stable platform prior to placement of fill.

4. *Pipe Bedding*: The use and requirements for bedding material should be in accordance with the pipe manufacturer's recommendations, local building authority, or utility district requirements. In confined areas of the pipeline where compaction is difficult, placement of a cementitious flowfill around the pipe should be considered, at the discretion of the designer.

5. *Utility Trench Backfill*: Materials excavated from the utility trenches may be used for trench backfill above the pipe zone fill provided they do not contain unsuitable material or particles larger than 2 inches.

6. *Material Suitability*: All fill material should be free of vegetation, brush, sod, trash and debris, and other deleterious substances, and should not contain rocks or lumps having a diameter of more than 2 inches.

7. *Lift Thickness*: The maximum allowable loose lift thickness should be limited to 8 inches.

Compaction Requirements: A representative of the geotechnical engineer should observe fill placement operations on a part- to full-time basis, depending on the speed at which grading and fill operations are occurring. We recommend the following minimum compaction criteria be used on the project.

| rea | Percentage of Modified Proctor Maximum Dry Density (ASTM D 1557) |
|---|---|
| Foundation Subgrade | 95 |
| Floor Slab Subgrade | 90 |
| Foundation Backfill | 90 |
| Pavement Subgrade | 90 |
| Aggregate Base Course | 90 |
| Exterior Flatwork/Utility Trenches | 90 |
| Landscape Areas, and Other Misc. Overlot Fill Areas | 90 |
| Compaction should be achieved at a moisture content within +/- 2% of the optimum. | |

Grading During Inclement Weather: If grading occurs during the time of year with freezing temperatures, fill should not contain frost or be placed on frozen ground. A loose lift or blanket of soil should be placed on prepared subgrade at the end of day to protect against frost, and the

presence of frost should be checked at the beginning of each day. Any frost should be removed prior to placement of new fill. During periods of precipitation, excessive wetting of building pad and pavement subgrades should be avoided. Measures should be implemented to keep surface runoff from ponding in subgrade areas, to include usage of diversion berms, creation of temporary low areas where water can be directed and removed by pumping, or other methods as appropriate.

## DESIGN AND CONSTRUCTION SUPPORT SERVICES

Kumar & Associates, Inc. should be retained to review the project plans and specifications for conformance with the recommendations provided in our report. We are also available to assist the design team in preparing specifications for geotechnical aspects of the project, and performing additional studies if necessary to accommodate possible changes in the proposed construction.

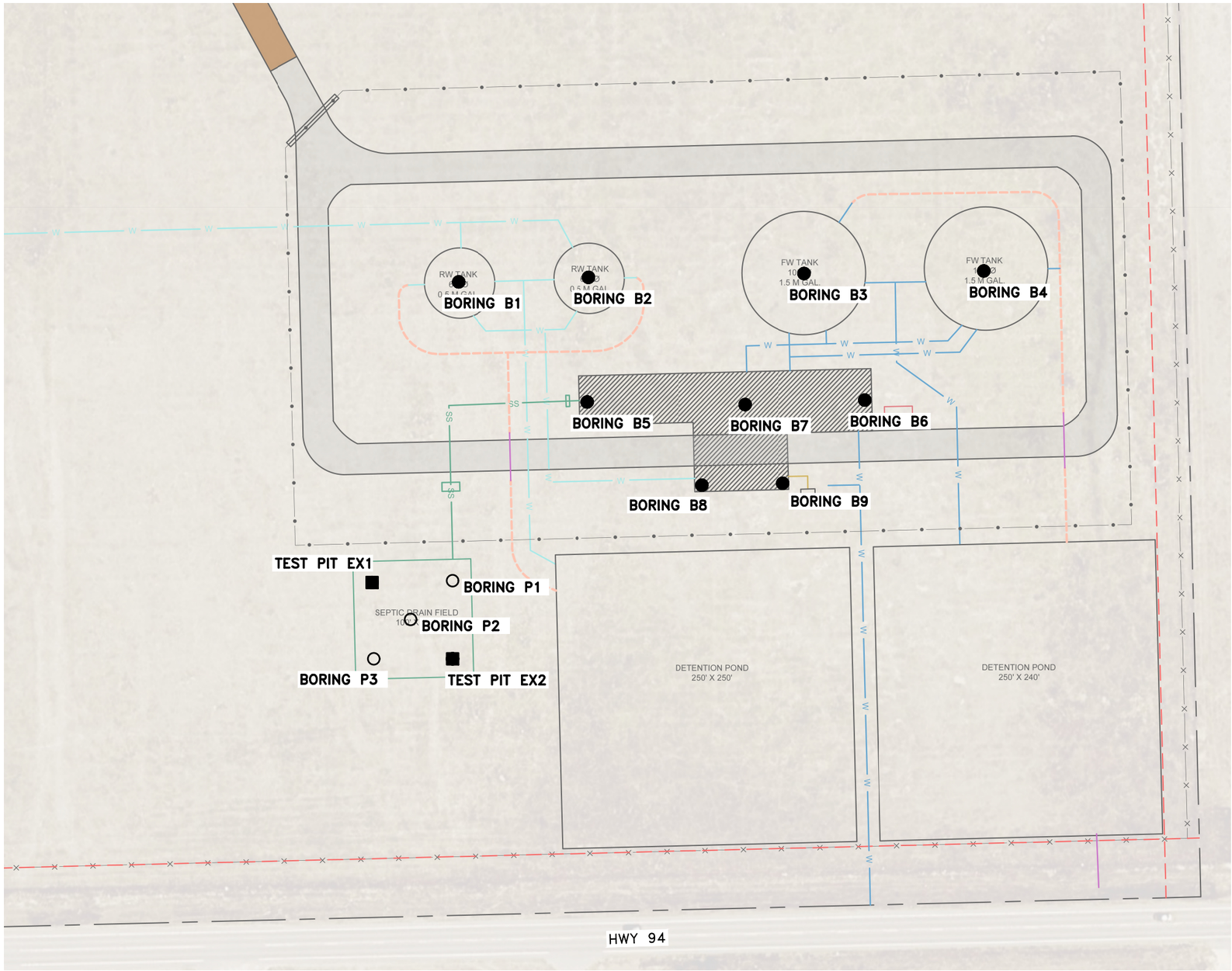
We recommend that Kumar & Associates, Inc. be retained to provide construction observation and testing services to document that the intent of this report and the requirements of the plans and specifications are being followed during construction. This will allow us to identify possible variations in subsurface conditions from those encountered during this study and to allow us to re-evaluate our recommendations, if needed.

## LIMITATIONS

This report has been completed for exclusive use by the client for geotechnical related design and construction criteria for the project. The conclusions and recommendations submitted in this report are based upon the data obtained from the exploratory borings and test pits at the locations indicated on Fig. 1 or as described in the report, and the proposed type of construction. This report may not reflect subsurface variations that occur, and the nature and extent of variations across the site may not become evident until site grading and excavations are performed. If during construction, fill, soil, rock or water conditions appear to be different from those described herein, Kumar & Associates, Inc. should be advised at once so that a re-evaluation of the recommendations presented in this report can be made. Kumar & Associates, Inc. is not responsible for liability associated with interpretation of subsurface data by others.

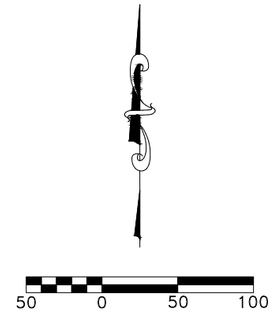
The scope of services for this project does not include identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken.

DPC:sw




LEGEND:

- ● EXPLORATORY BORING LOCATION.
- ○ PERCOLATION TEST HOLE LOCATION.
- ■ TEST PIT LOCATION.



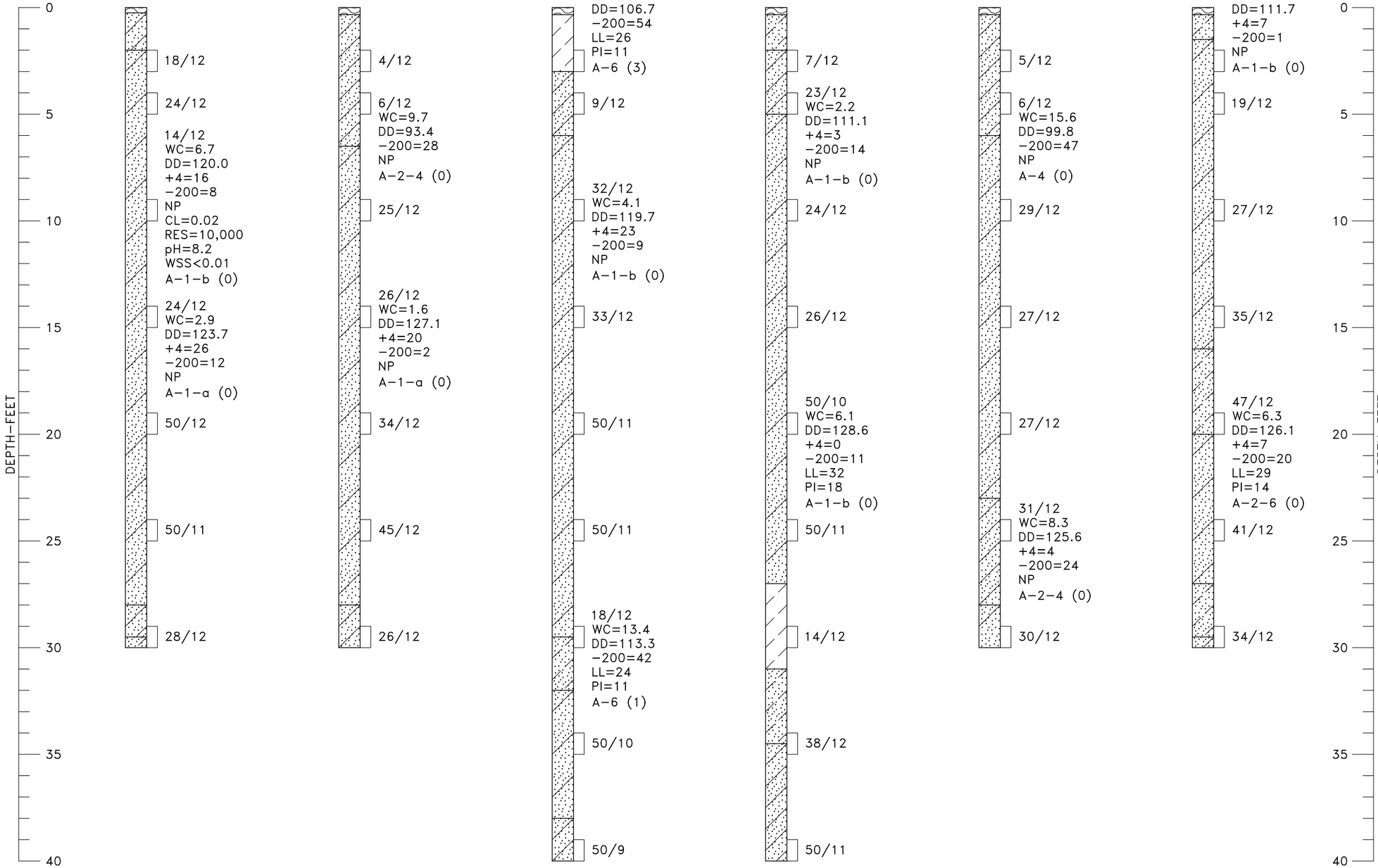

APPROXIMATE SCALE–FEET




VICINITY MAP
NOT TO SCALE

| | | | | |
|---|---|---|---|---|
| 25–2–263 | Kumar & Associates | | LOCATION OF EXPLORATORY BORINGS AND TEST PITS | Fig. 1 |

May 15, 2026 – 10:18am
V:\Projects\Den ARC 2021–2025 (ENG)\2025\25–2–263 Cherokee Metro District – PFAS Water Treatment Facility\Drafting\252263–01.dwg




| 25−2−263 | Kumar & Associates | | LOGS OF EXPLORATORY BORINGS | Fig. 2 |
|---|---|---|---|---|

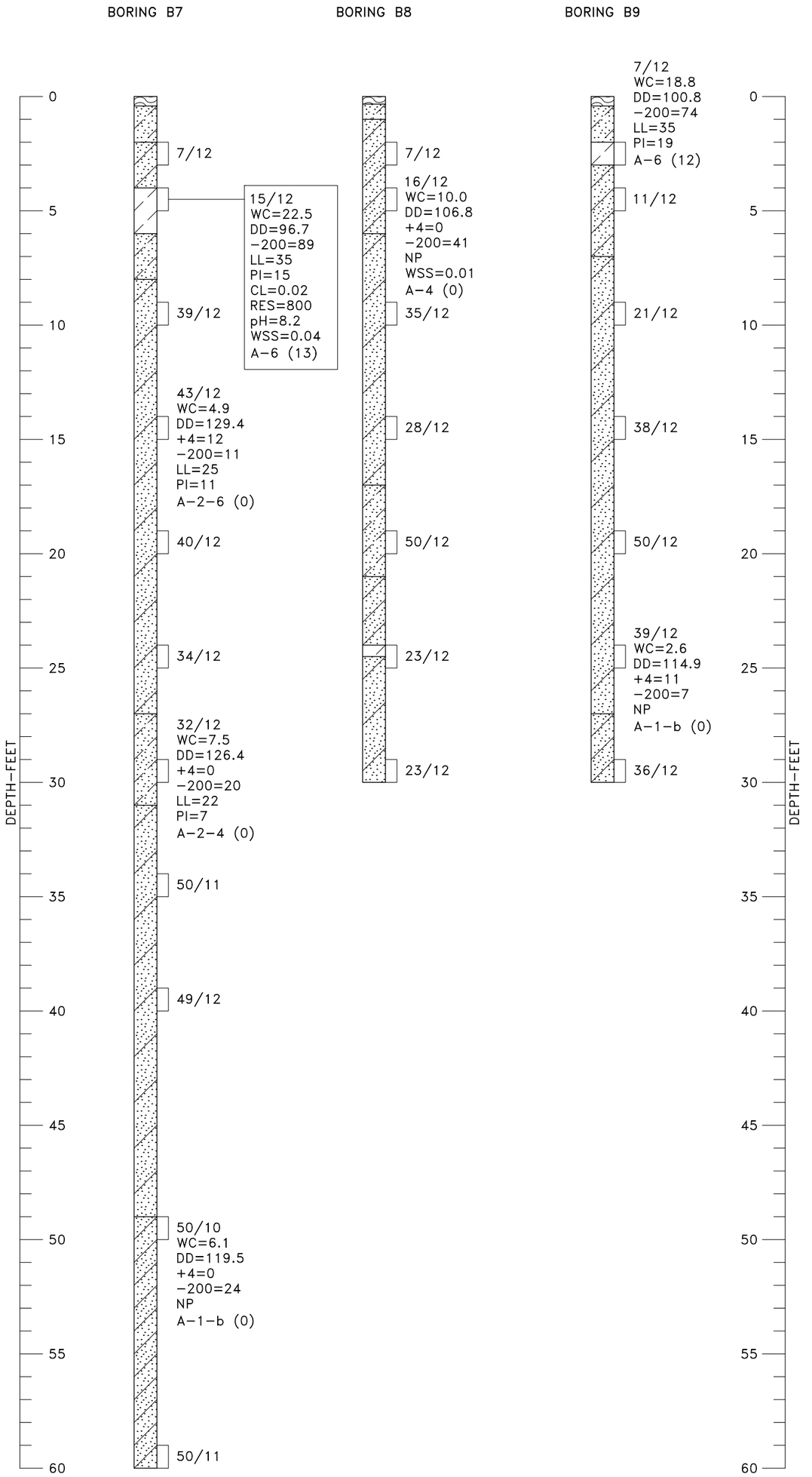
May 15, 2026 - 10:18am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-02 to 05.dwg

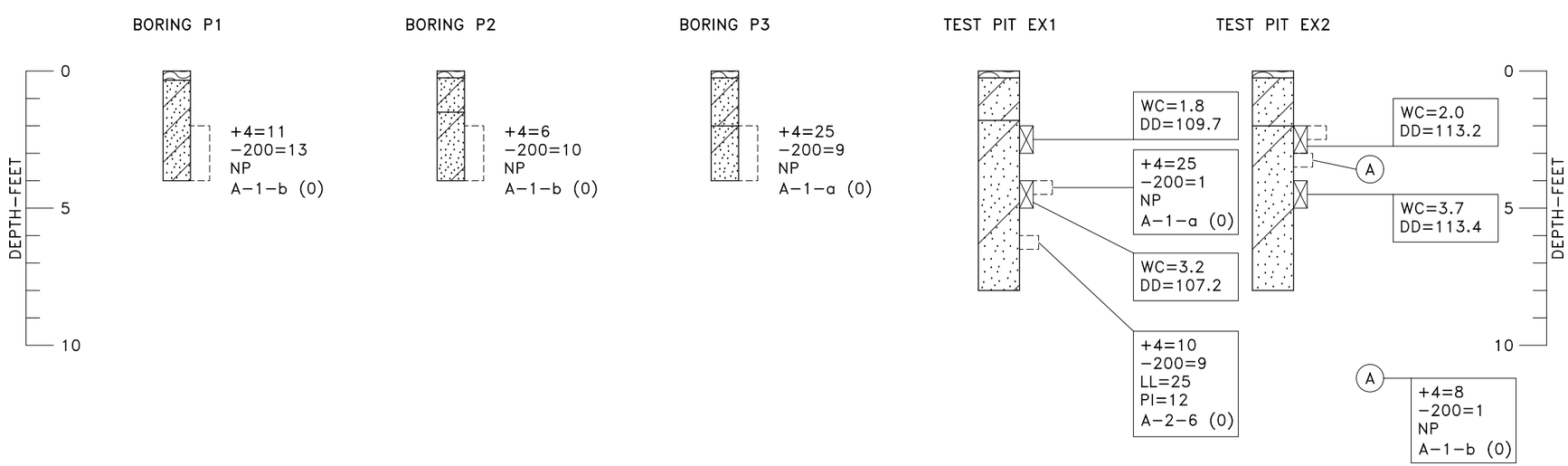
25-2-263

Kumar & Associates

LOGS OF EXPLORATORY BORINGS

Fig. 3






May 15, 2026 - 10:19am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-02 to 05.dwg

| | | | | |
|---|---|---|---|---|
| 25−2−263 | Kumar & Associates | | LOGS OF EXPLORATORY BORINGS AND TEST PITS | Fig. 4 |

## LEGEND


TOPSOIL.


SILTY SAND (SM), WITH OCCASIONAL GRAVEL, LOOSE TO VERY DENSE, SLIGHTLY MOIST TO MOIST, TAN, BROWN TO GRAY–BROWN.


POORLY TO WELL GRADED SAND WITH VARIED AMOUNTS OF SILT AND GRAVEL, (SP, SW, SP–SM, SW–SM), MEDIUM DENSE TO VERY DENSE, SLIGHTLY MOIST TO MOIST, TAN, BROWN, TAN–GRAY, AND TAN–ORANGE.


CLAYEY SAND (SC), AND SILTY CLAYEY SAND (SC–SM), WITH OCCASIONAL LENSES OF SANDY LEAN CLAY (CL), WITH OCCASIONAL GRAVEL, MEDIUM DENSE TO DENSE, SLIGHTLY MOIST TO MOIST, BROWN TO TAN.


LEAN CLAY (CL), WITH VARIED AMOUNTS OF SAND, MEDIUM STIFF TO VERY STIFF, SLIGHTLY MOIST TO MOIST, BROWN, GRAY, AND GRAY–BROWN.


DRIVE SAMPLE, 2–INCH I.D. CALIFORNIA LINER SAMPLE.


HAND DRIVE SAMPLE, 2–INCH I.D.


DISTURBED BULK SAMPLE.

18/12 DRIVE SAMPLE BLOW COUNT. INDICATES THAT 18 BLOWS OF A 140–POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

## NOTES

1. THE EXPLORATORY BORINGS WERE DRILLED BETWEEN APRIL 20 AND 21, 2026 WITH A CONTINUOUS–FLIGHT POWER AUGER (4–INCH DIAMTER FOR B1–B9 AND 8–INCH DIAMETER FOR P1–P3). TEST PITS EX1 AND EX2 WERE EXCAVATED MINI–EXCAVATOR ON APRIL 27, 2026.

2. THE LOCATIONS OF THE EXPLORATORY BORINGS AND TEST PITS WERE MEASURED APPROXIMATELY BY HANDHELD GPS DEVICE AND SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

3. THE ELEVATIONS OF THE EXPLORATORY BORINGS AND TEST PITS WERE NOT MEASURED AND THE LOGS OF THE EXPLORATORY BORINGS AND TEST PITS ARE PLOTTED TO DEPTH.

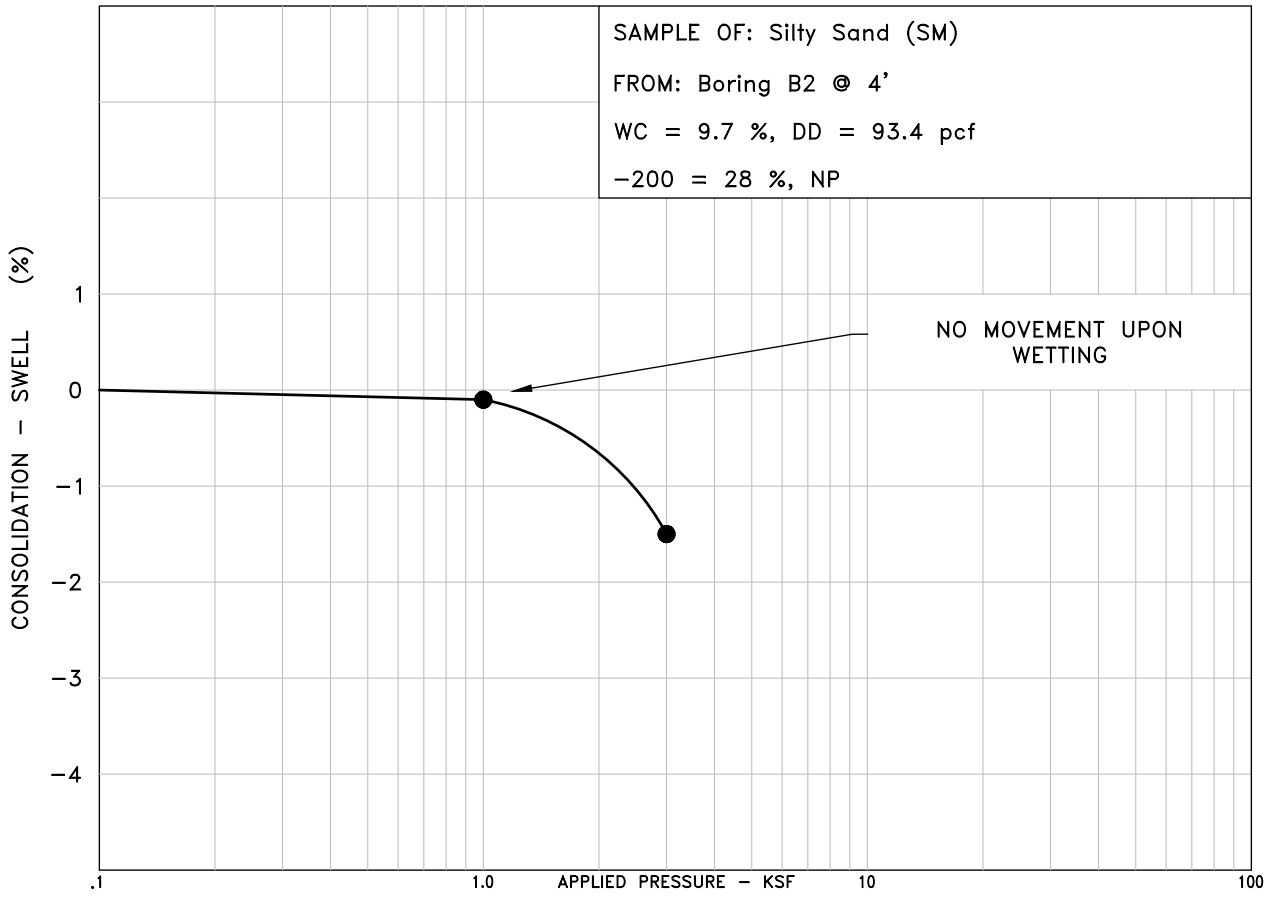
4. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS AND TEST PITS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.

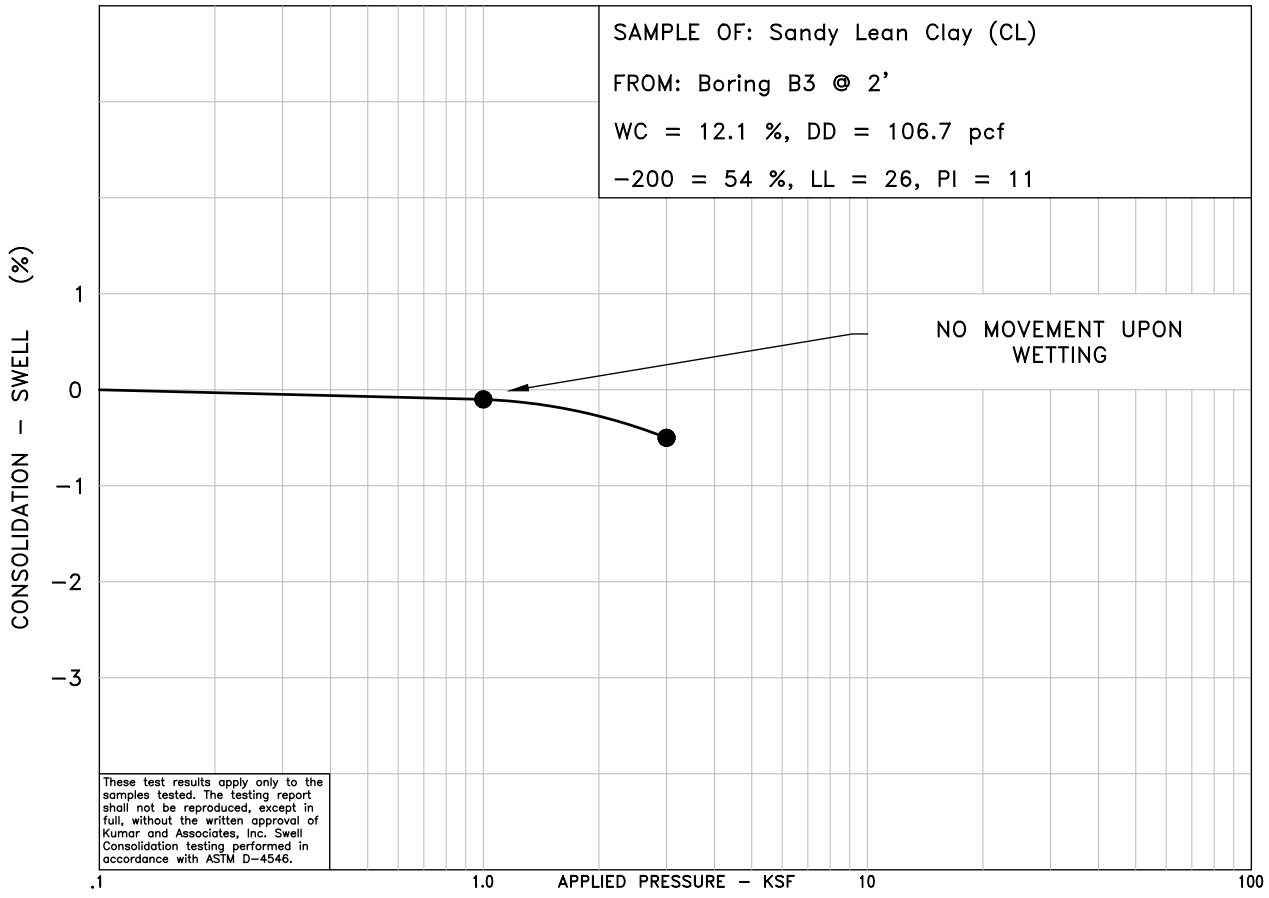
5. GROUNDWATER WAS NOT ENCOUNTERED IN THE BORINGS AT THE TIME OF DRILLING OR WHEN CHECKED 7 TO 8 DAYS LATER. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

6. LABORATORY TEST RESULTS:
   WC = WATER CONTENT (%) (ASTM D2216);
   DD = DRY DENSITY (pcf) (ASTM D2216);
   +4 = PERCENTAGE RETAINED ON NO. 4 SIEVE (ASTM D6913);
   –200= PERCENTAGE PASSING NO. 200 SIEVE (ASTM D1140);
   LL = LIQUID LIMIT (ASTM D4318);
   PI = PLASTICITY INDEX (ASTM D4318);
   NP = NON–PLASTIC (ASTM D4318);
   WSS = WATER SOLUBLE SULFATES (%) (CP–L 2103);
   pH = HYDROGEN ION CONCENTRATION (ASTM E 70);
   RES = MINIMUM LABORATORY RESISTIVITY (ohm–cm.) (ASTM G 57);
   A–2–6 (0) = AASHTO CLASSIFICATION (GROUP INDEX) (AASHTO M 145);
   CL = CHLORIDE CONTENT (%) (AASHTO T291).



May 15, 2026 – 10:19am
V:\Projects\Den ARC 2021–2025 (ENG)\2025\25–2–263 Cherokee Metro District – PFAS Water Treatment Facility\Drafting\252263–02 to 05.dwg

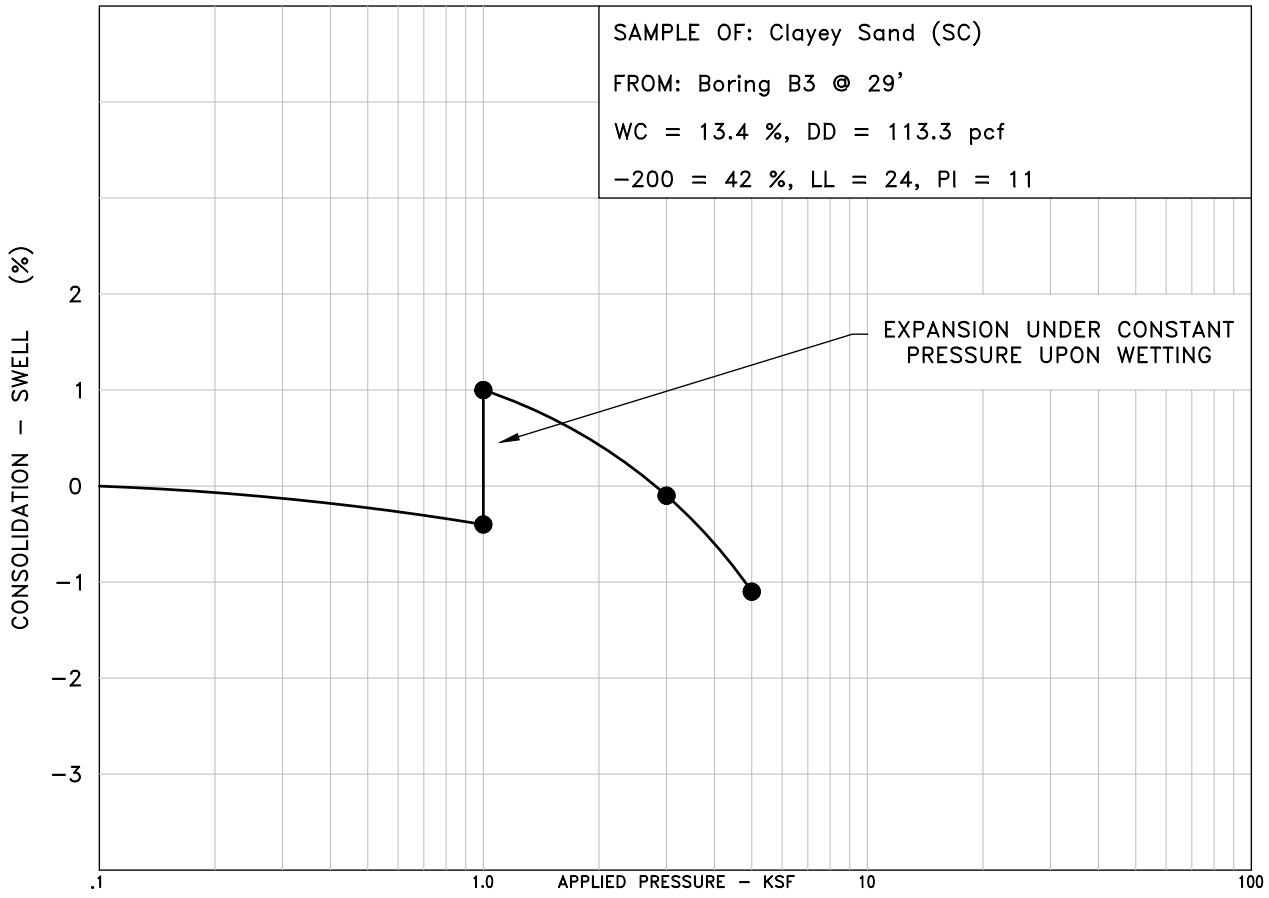


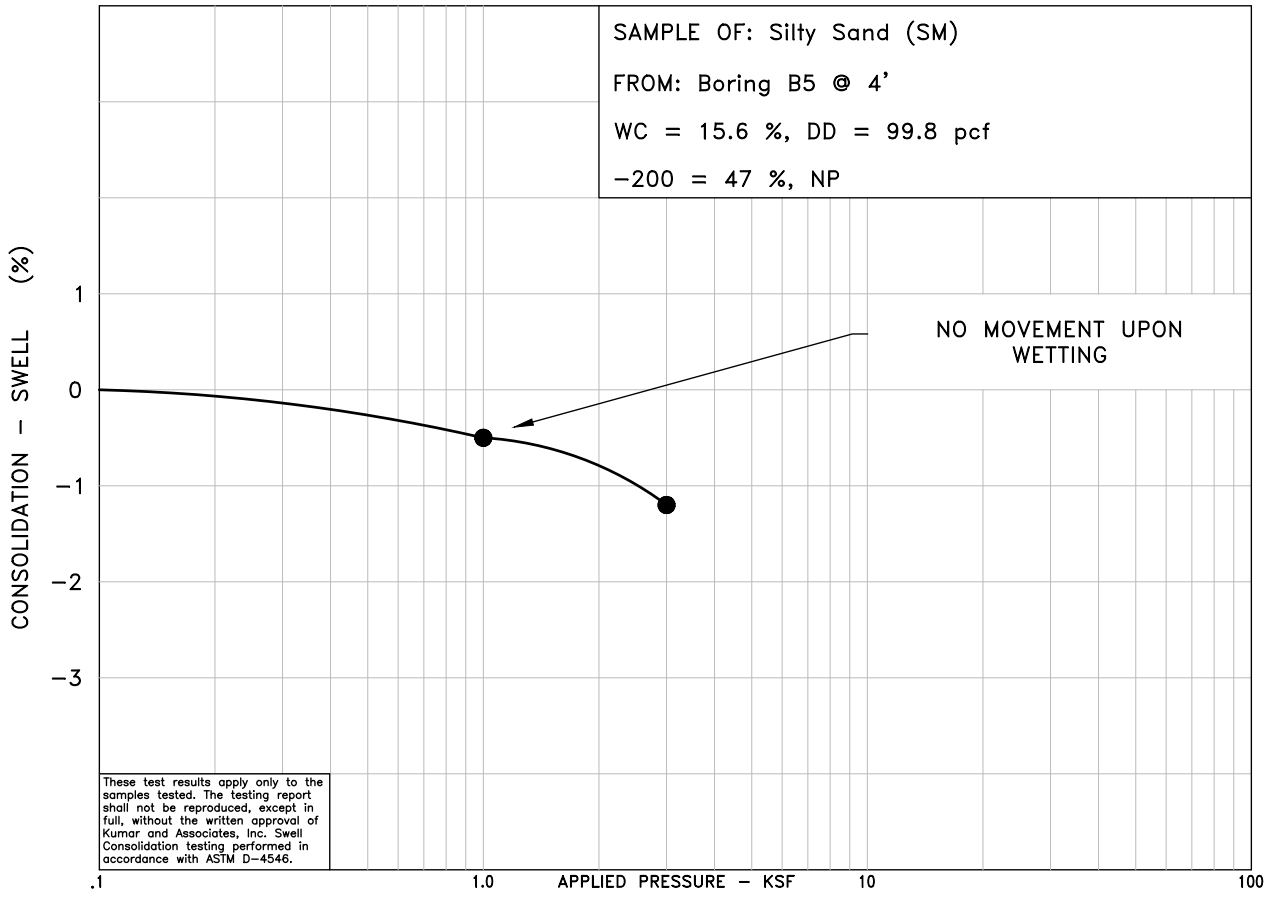




These test results apply only to the samples tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar and Associates, Inc. Swell Consolidation testing performed in accordance with ASTM D-4546.

| 25-2-263 | Kumar & Associates | SWELL-CONSOLIDATION TEST RESULTS | Fig. 6 |
|---|---|---|---|

May 15, 2026 - 10:19am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-06 to 08.dwg

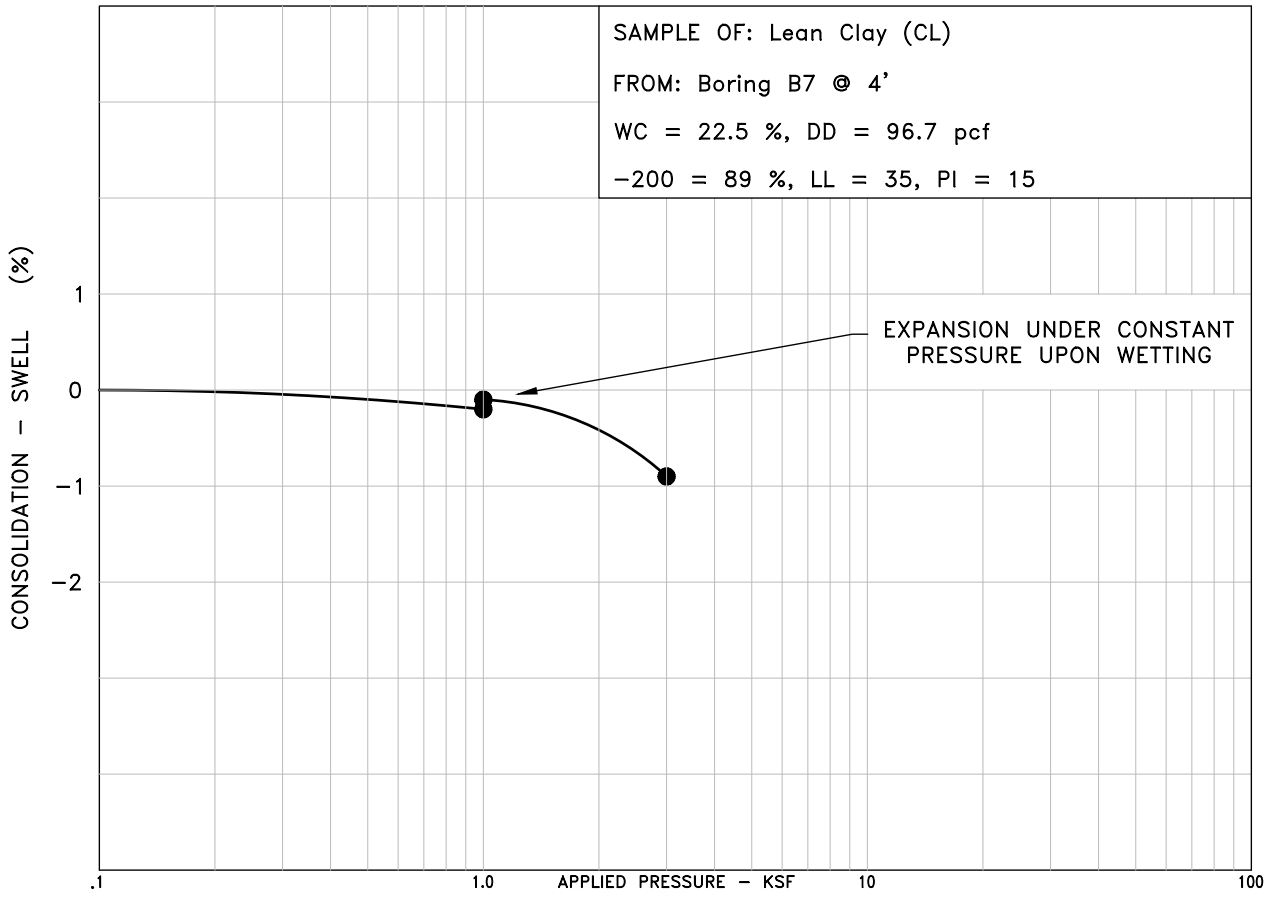


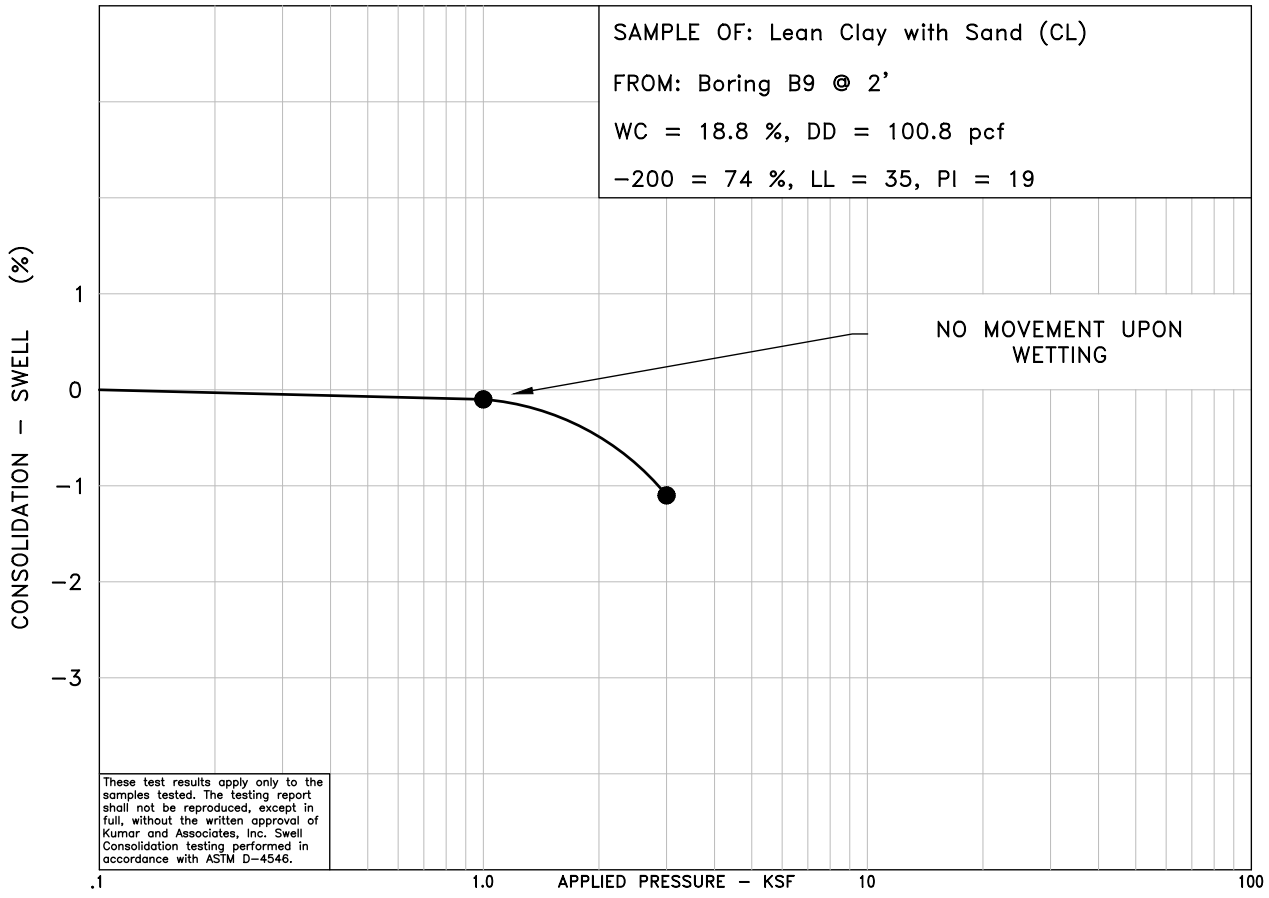




These test results apply only to the samples tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar and Associates, Inc. Swell Consolidation testing performed in accordance with ASTM D−4546.

| 25−2−263 | Kumar & Associates | SWELL−CONSOLIDATION TEST RESULTS | Fig. 7 |
|---|---|---|---|

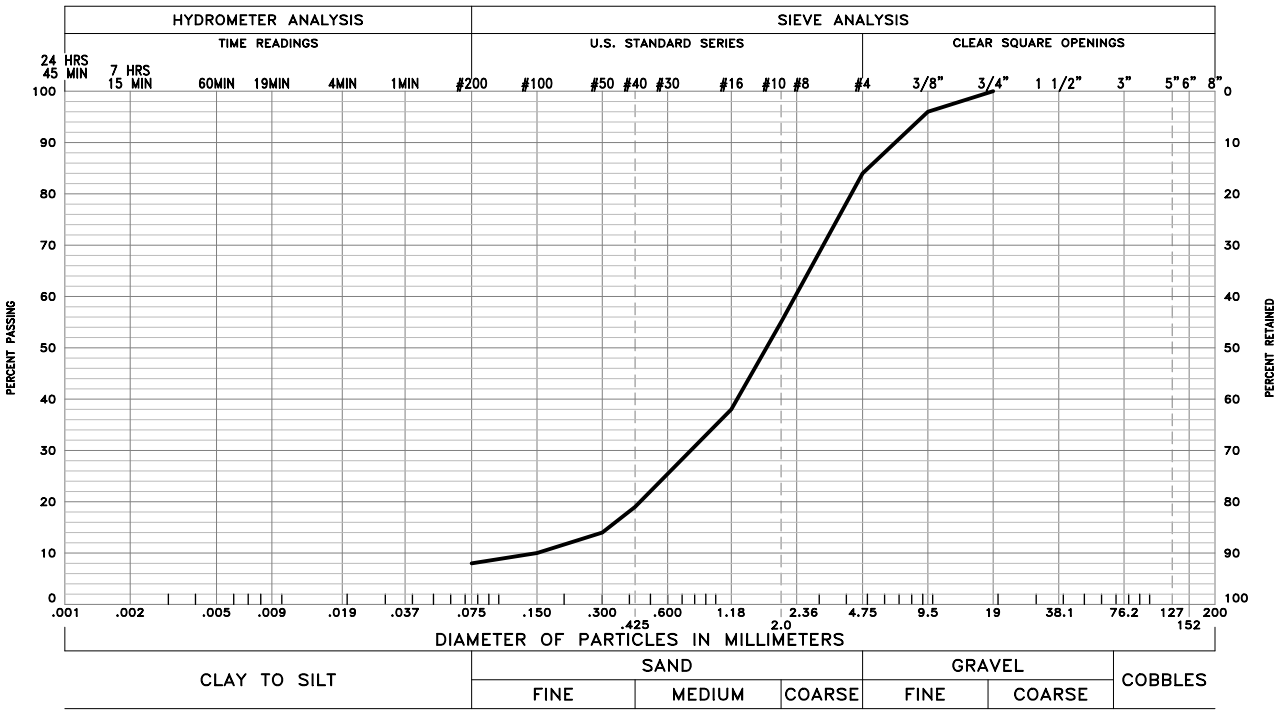
May 15, 2026 − 10:19am
V:\Projects\Den ARC 2021−2025 (ENG)\2025\25−2−263 Cherokee Metro District − PFAS Water Treatment Facility\Drafting\252263−06 to 08.dwg




| 25−2−263 | Kumar & Associates | SWELL−CONSOLIDATION TEST RESULTS | Fig. 8 |
|---|---|---|---|

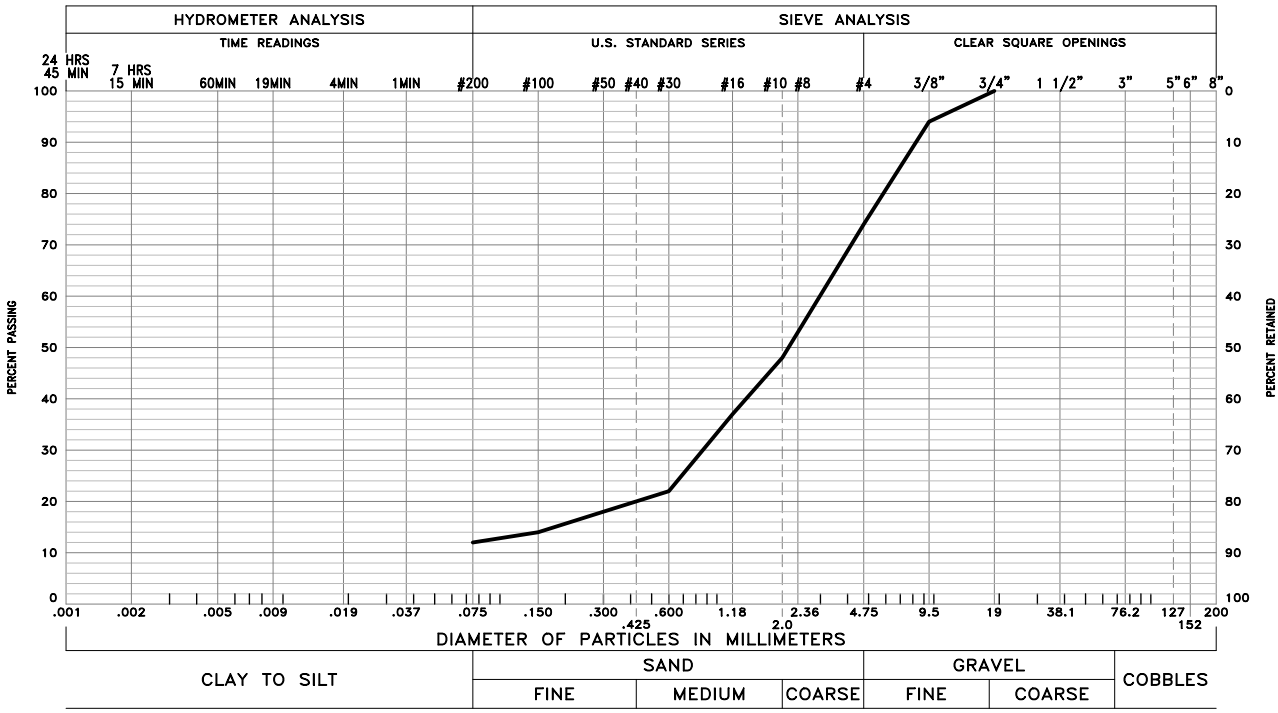
May 15, 2026 − 10:19am
V:\Projects\Den ARC 2021−2025 (ENG)\2025\25−2−263 Cherokee Metro District − PFAS Water Treatment Facility\Drafting\252263−06 to 08.dwg




GRAVEL 16 % SAND 76 % SILT AND CLAY 8 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Silt & Gravel (SW-SM) FROM: Boring B1 @ 9'




GRAVEL 26 % SAND 62 % SILT AND CLAY 12 %

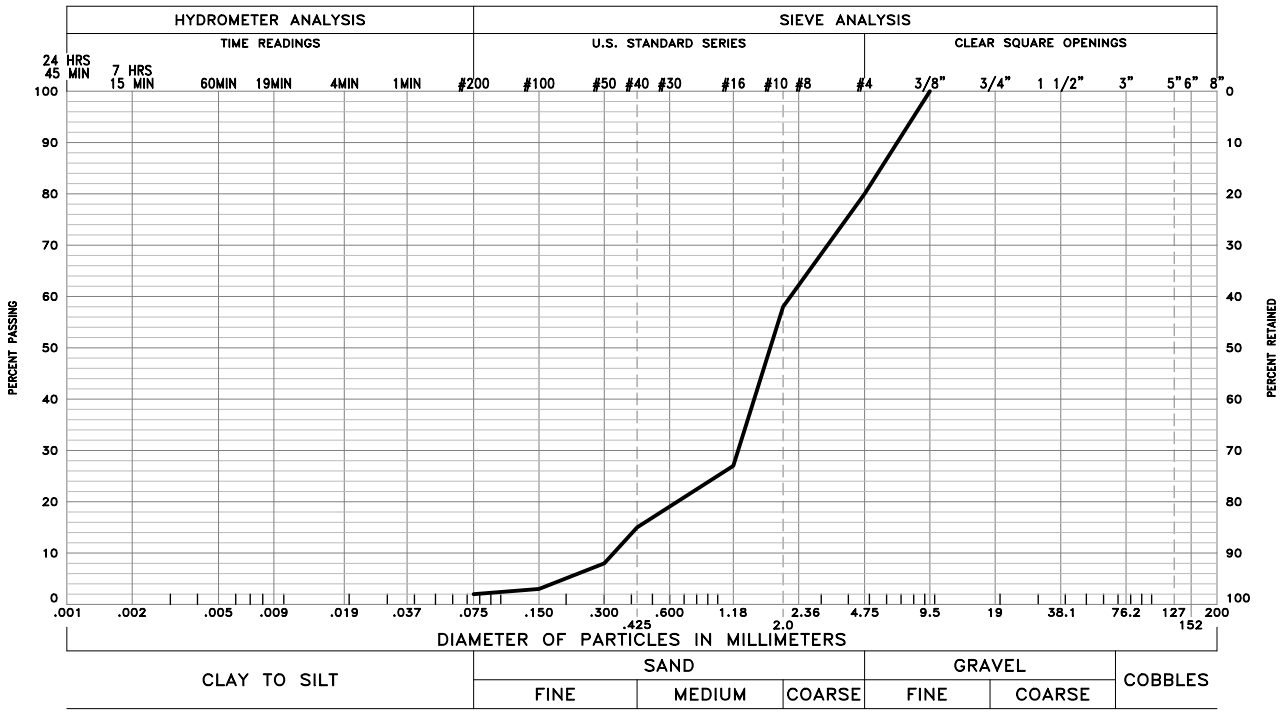
LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Silt & Gravel (SW-SM) FROM: Boring B1 @ 14'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

| 25-2-263 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 9 |
|---|---|---|---|

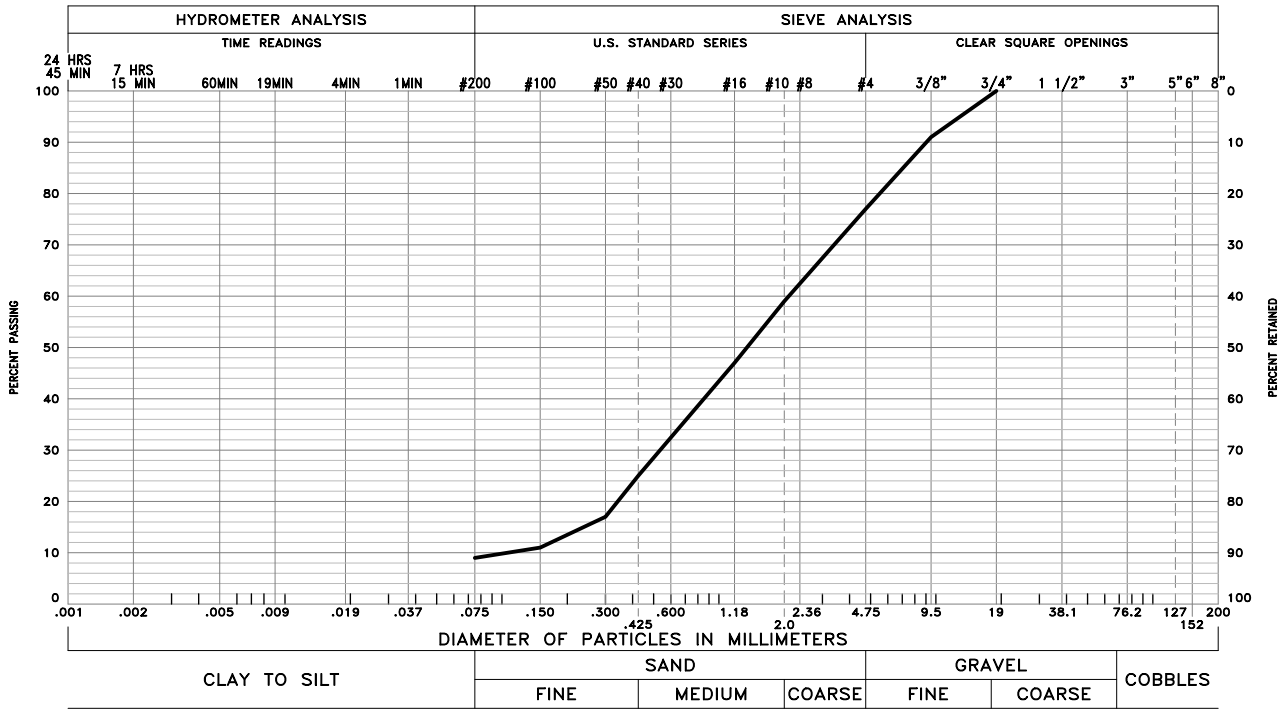
May 15, 2026 - 10:19am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-09 to 18.dwg




GRAVEL 20 % SAND 78 % SILT AND CLAY 2 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Gravel (SW) FROM: Boring B2 @ 14'




GRAVEL 23 % SAND 68 % SILT AND CLAY 9 %

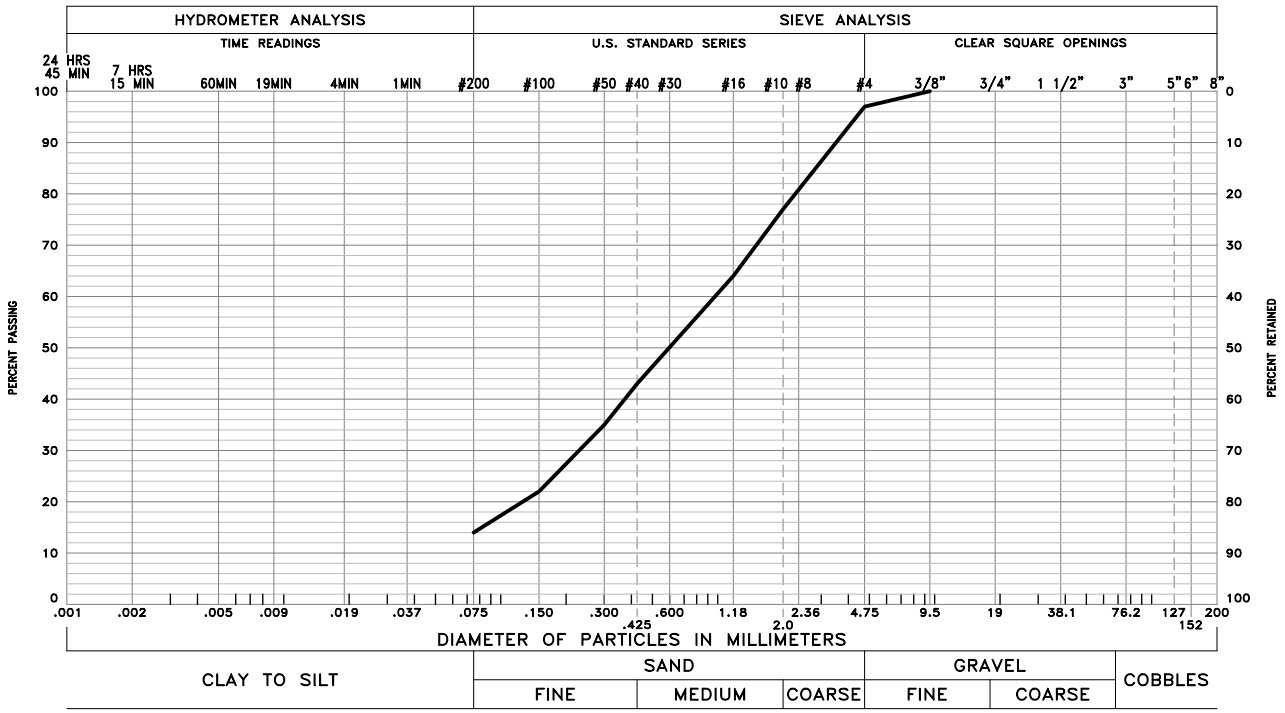
LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Silt & Gravel (SW-SM) FROM: Boring B3 @ 9'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.



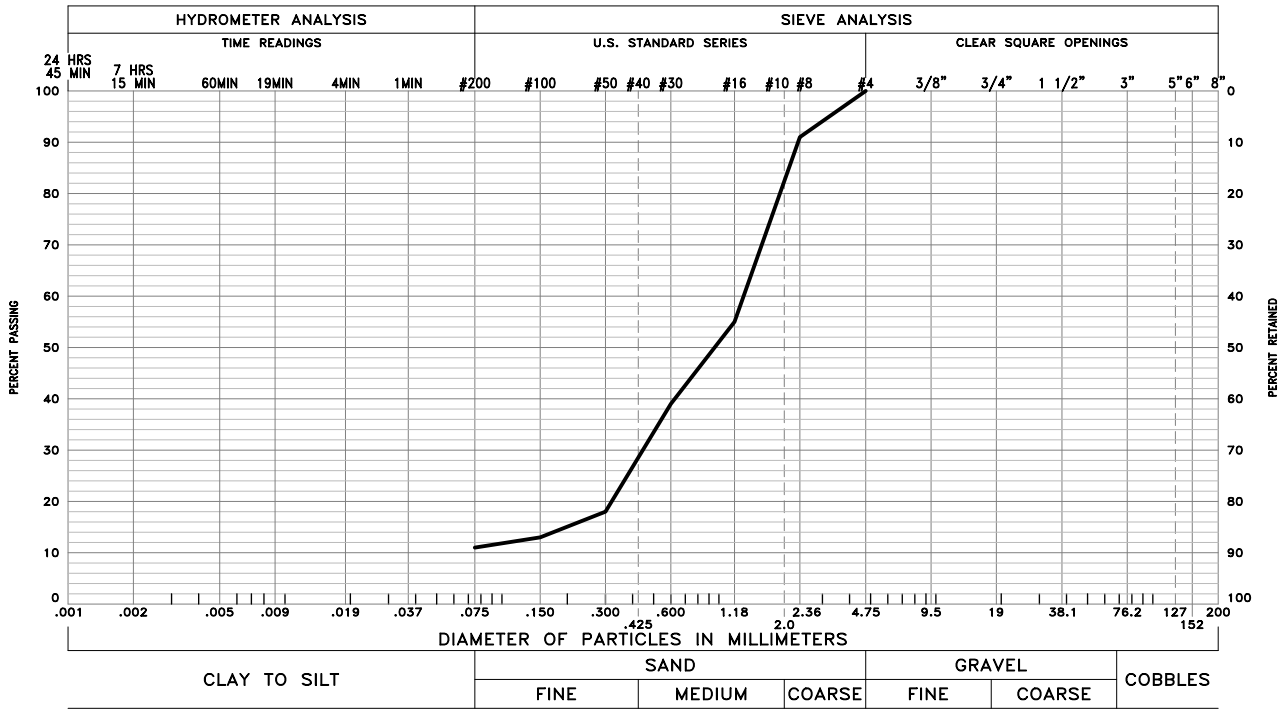
May 15, 2026 - 10:19am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-09 to 18.dwg




GRAVEL 3 % SAND 83 % SILT AND CLAY 14 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring B4 @ 4'




GRAVEL 0 % SAND 89 % SILT AND CLAY 11 %

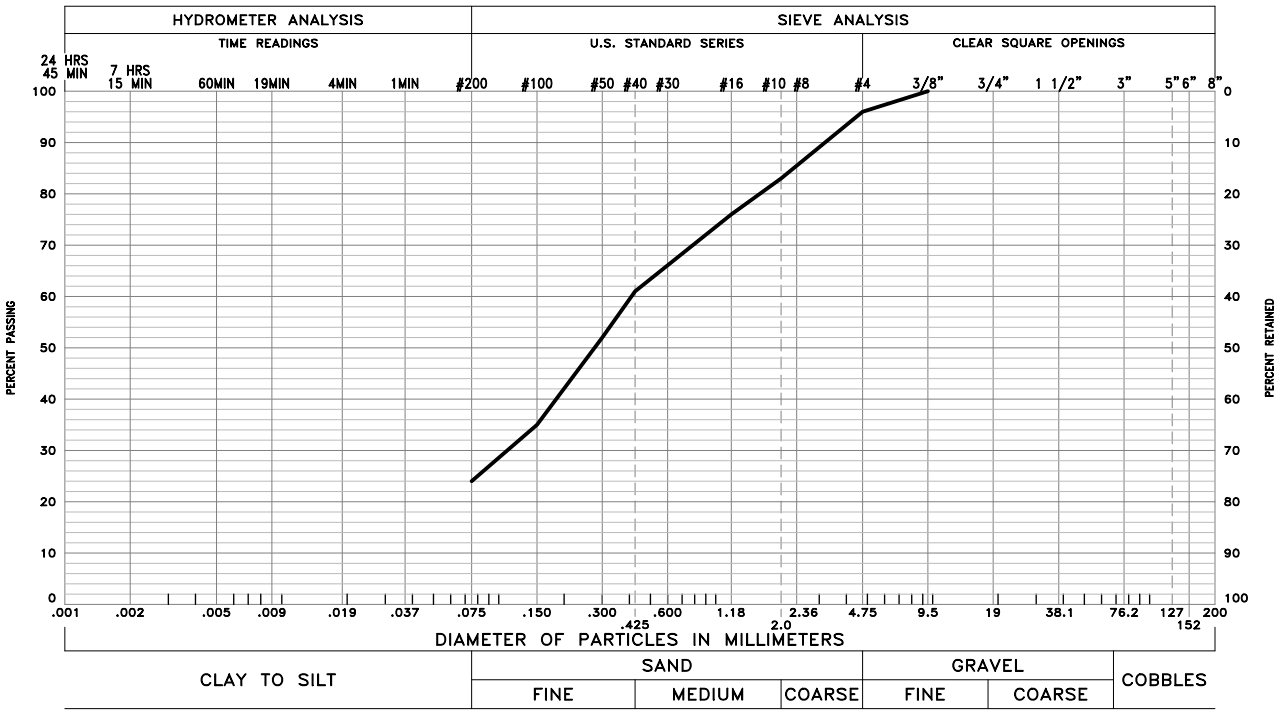
LIQUID LIMIT 32 PLASTICITY INDEX 18

SAMPLE OF: Well Graded Sand with Silt (SW-SM) FROM: Boring B4 @ 19'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.



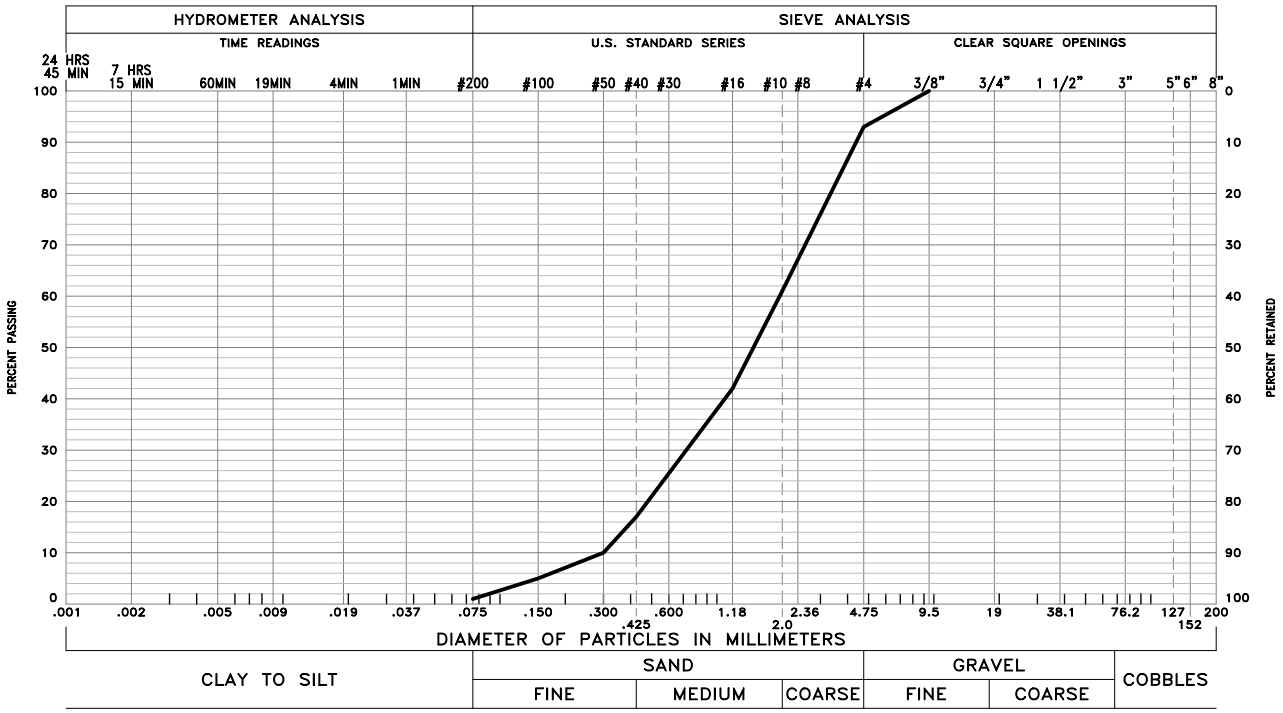
May 15, 2026 - 10:19am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-09 to 18.dwg




GRAVEL 4 % SAND 72 % SILT AND CLAY 24 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring B5 @ 24'




GRAVEL 7 % SAND 92 % SILT AND CLAY 1 %

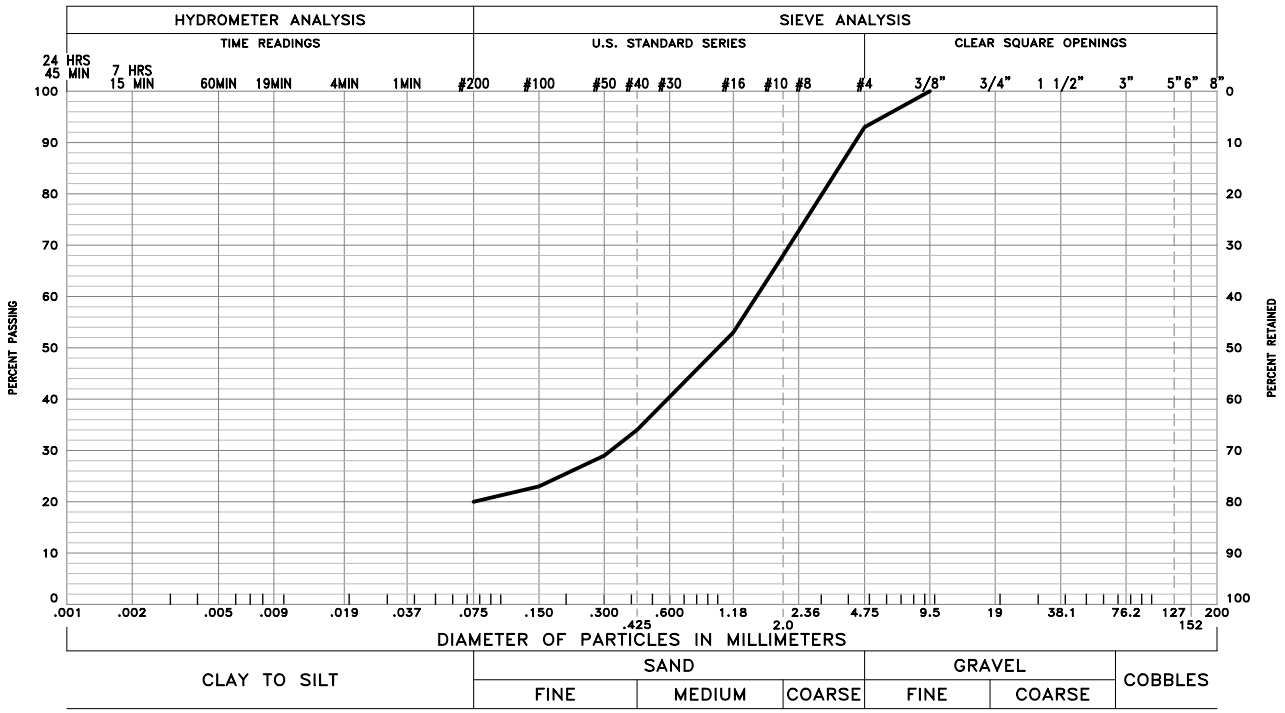
LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Poorly Graded Sand (SP) FROM: Boring B6 @ 2'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.



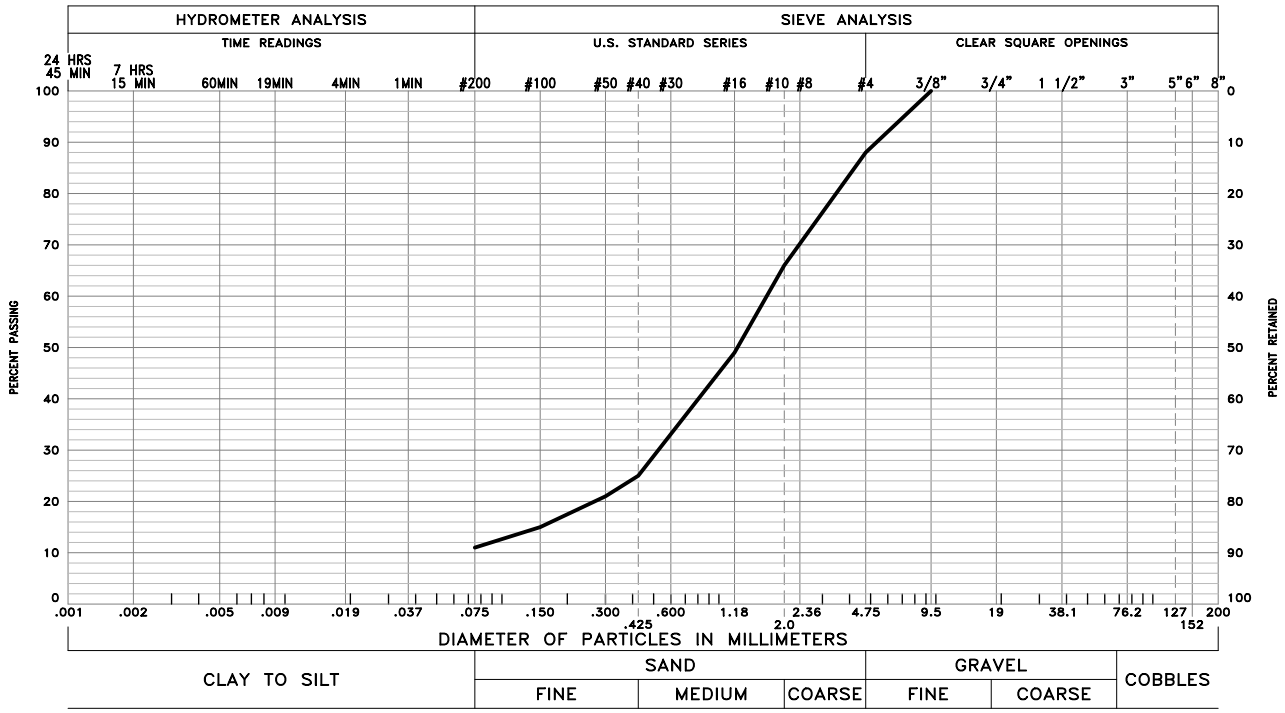
May 15, 2026 - 10:19am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-09 to 18.dwg




GRAVEL 7 % SAND 73 % SILT AND CLAY 20 %

LIQUID LIMIT 29 PLASTICITY INDEX 14

SAMPLE OF: Clayey Sand (SC) FROM: Boring B6 @ 19'




GRAVEL 12 % SAND 67 % SILT AND CLAY 11 %

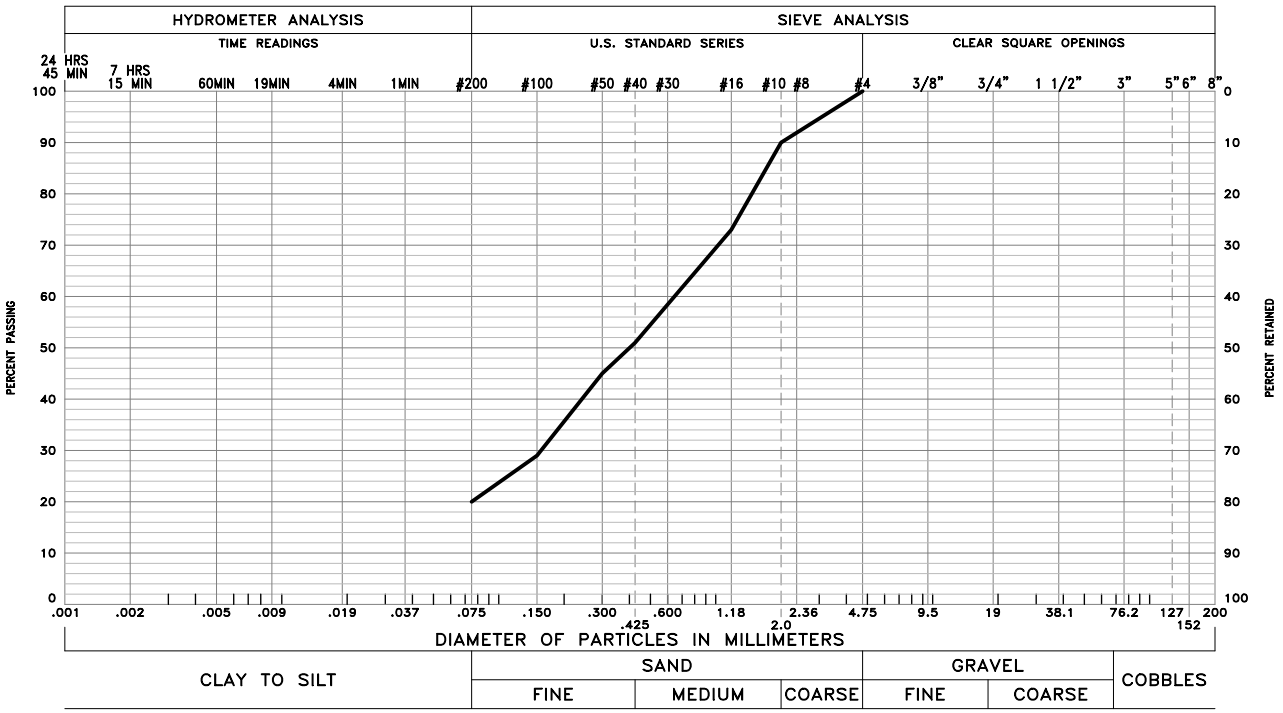
LIQUID LIMIT 25 PLASTICITY INDEX 11

SAMPLE OF: Well Graded Sand with Silt (SW-SM) FROM: Boring B7 @ 14'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

| 25-2-263 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 13 |
|---|---|---|---|

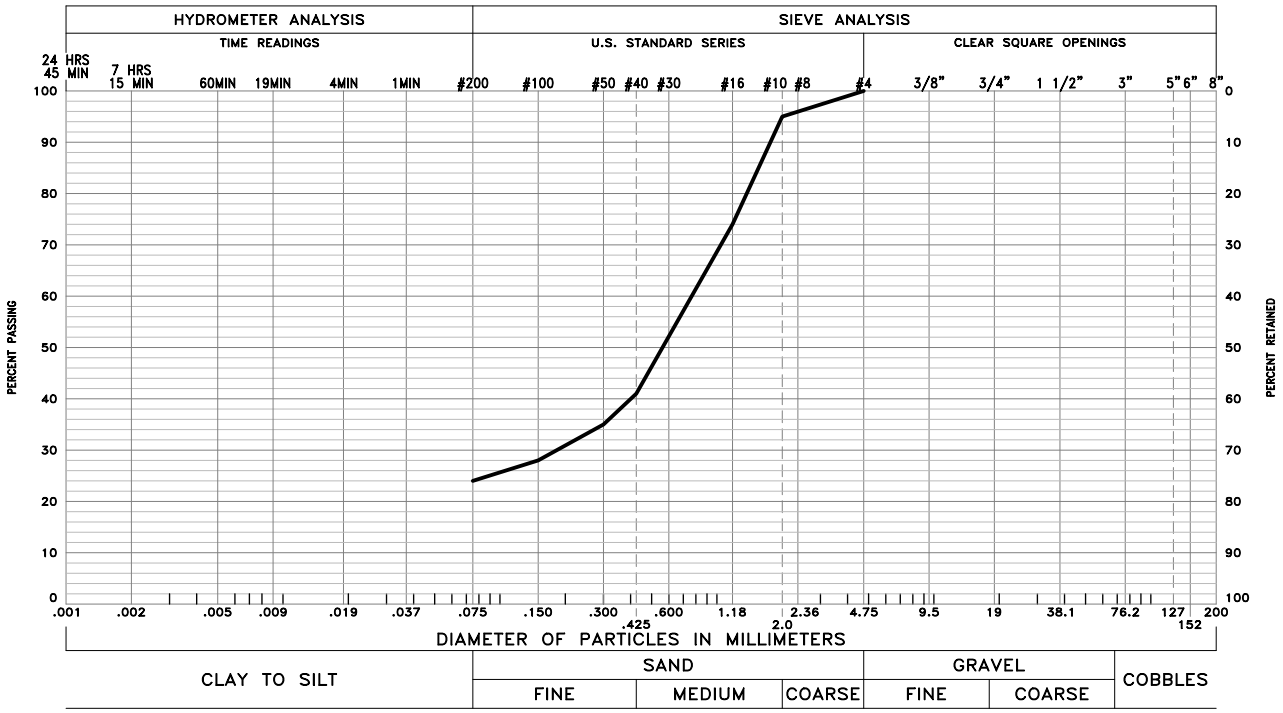
May 15, 2026 - 10:19am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-09 to 18.dwg




GRAVEL 0 % SAND 80 % SILT AND CLAY 20 %

LIQUID LIMIT 22 PLASTICITY INDEX 7

SAMPLE OF: Silty Clayey sand (SC-SM) FROM: Boring B7 @ 29'




GRAVEL 0 % SAND 76 % SILT AND CLAY 24 %

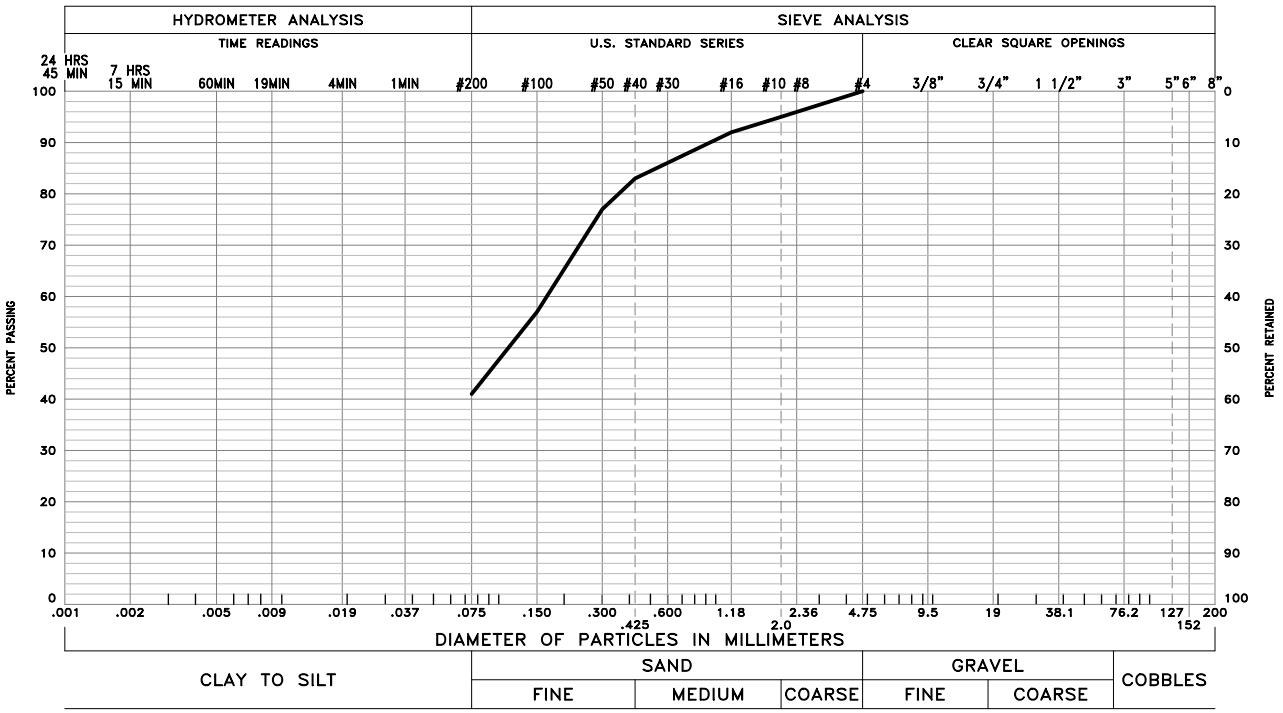
LIQUID LIMIT - PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring B7 @ 49'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

| 25-2-263 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 14 |
|---|---|---|---|

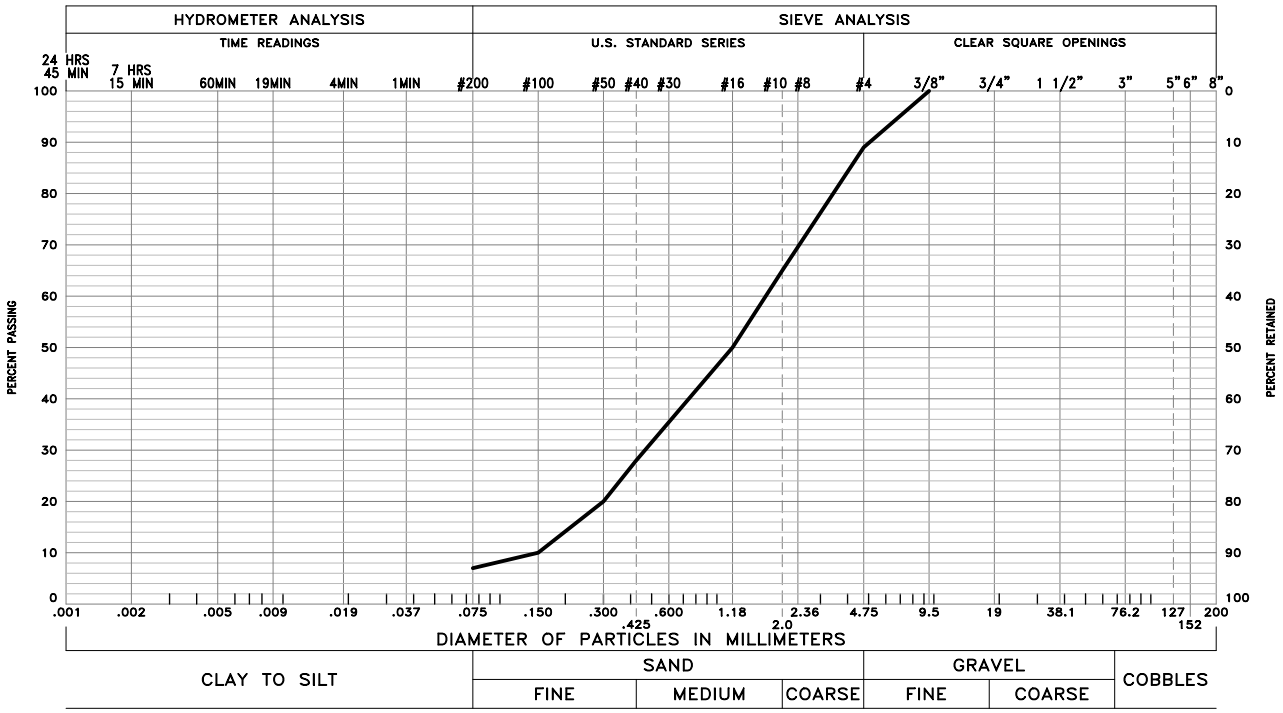
May 15, 2026 - 10:19am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-09 to 18.dwg




GRAVEL 0 % SAND 59 % SILT AND CLAY 41 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring B8 @ 4'




GRAVEL 11 % SAND 82 % SILT AND CLAY 7 %

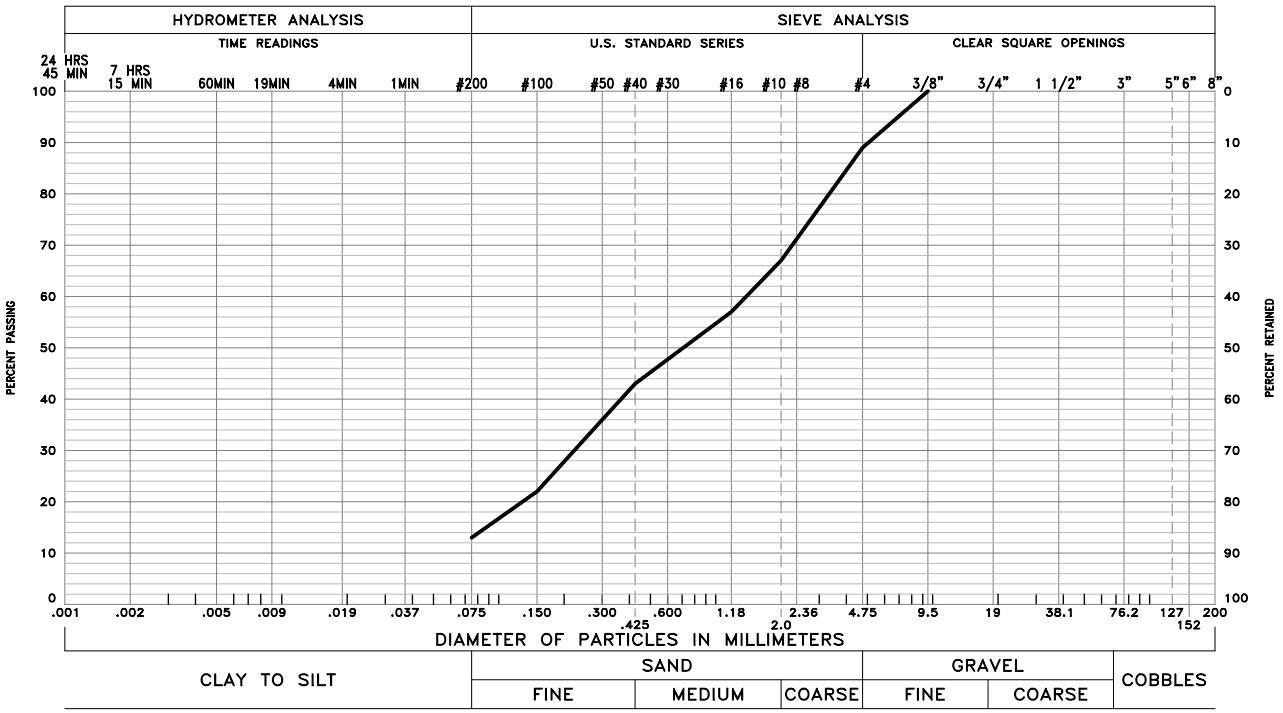
LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Poorly Graded Sand with Silt (SP-SM) FROM: Boring B9 @ 24'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

| 25-2-263 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 15 |
|---|---|---|---|

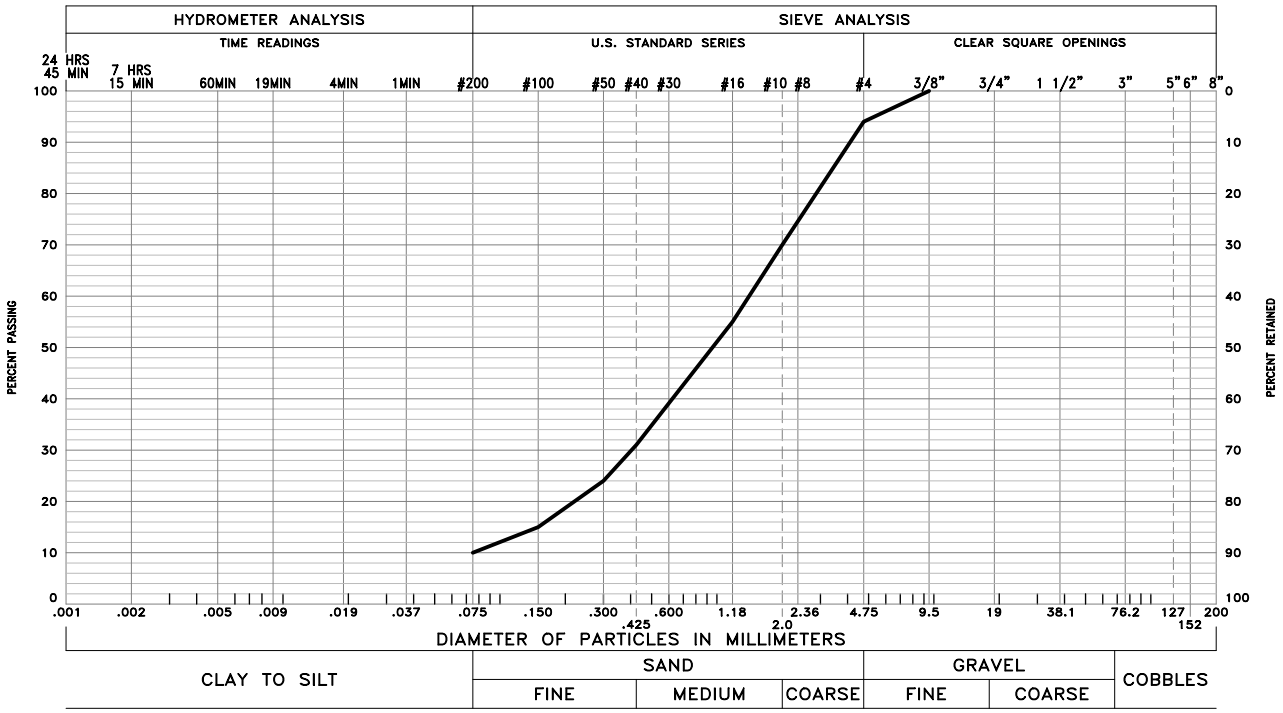
May 15, 2026 - 10:19am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-09 to 18.dwg




GRAVEL 11 % SAND 76 % SILT AND CLAY 13 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring P1 @ 2'–4'




GRAVEL 6 % SAND 84 % SILT AND CLAY 10 %

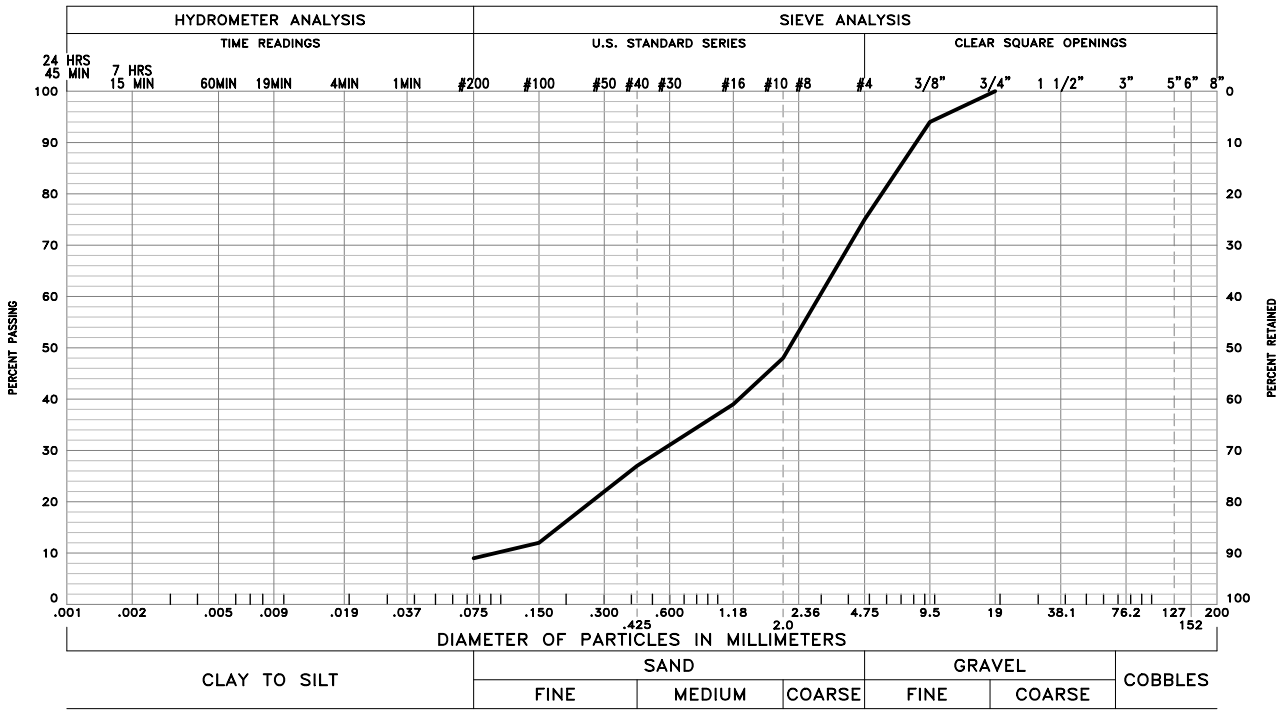
LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Silt (SW–SM) FROM: Boring P2 @ 2'–4'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.



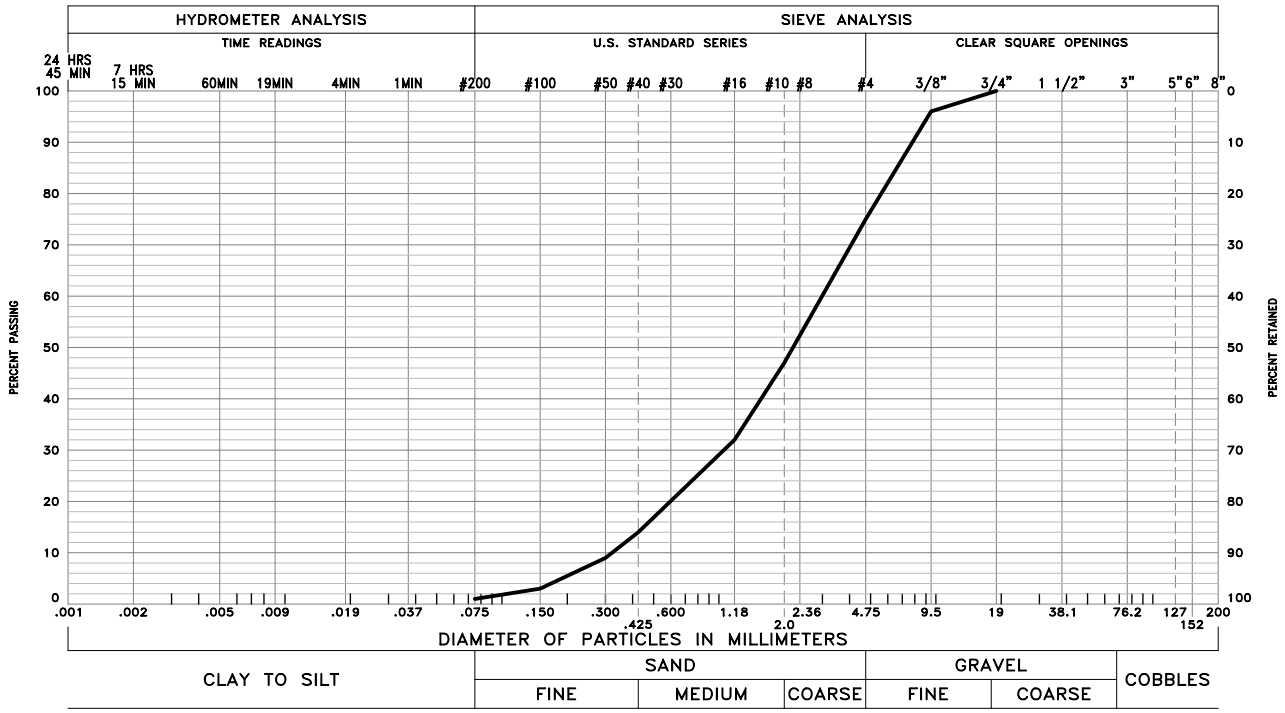
May 15, 2026 – 10:19am
V:\Projects\Den ARC 2021–2025 (ENG)\2025\25–2–263 Cherokee Metro District – PFAS Water Treatment Facility\Drafting\252263–09 to 18.dwg




GRAVEL 25 % SAND 66 % SILT AND CLAY 9 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Silt & Gravel (SW-SM) FROM: Boring P3 @ 2'-4'




GRAVEL 25 % SAND 74 % SILT AND CLAY 1 %

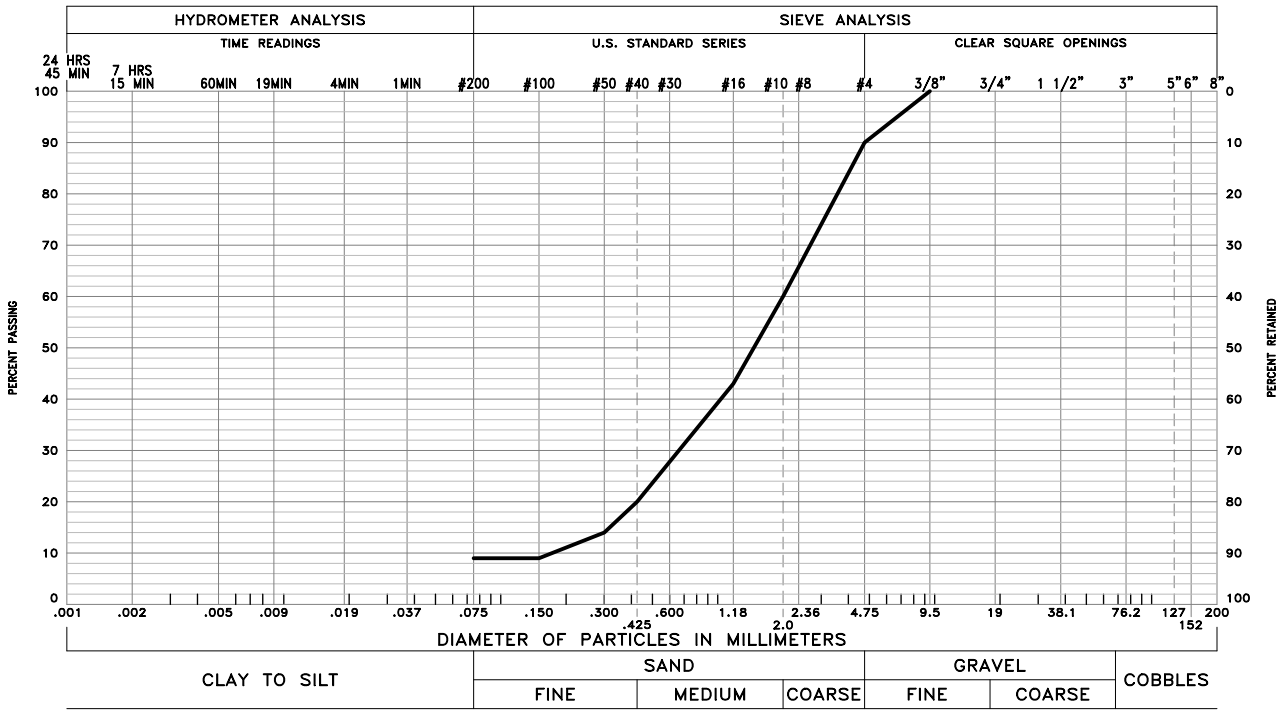
LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Gravel (SW) FROM: Boring EX1 @ 4'-4.5'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

| 25-2-263 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 17 |
|---|---|---|---|

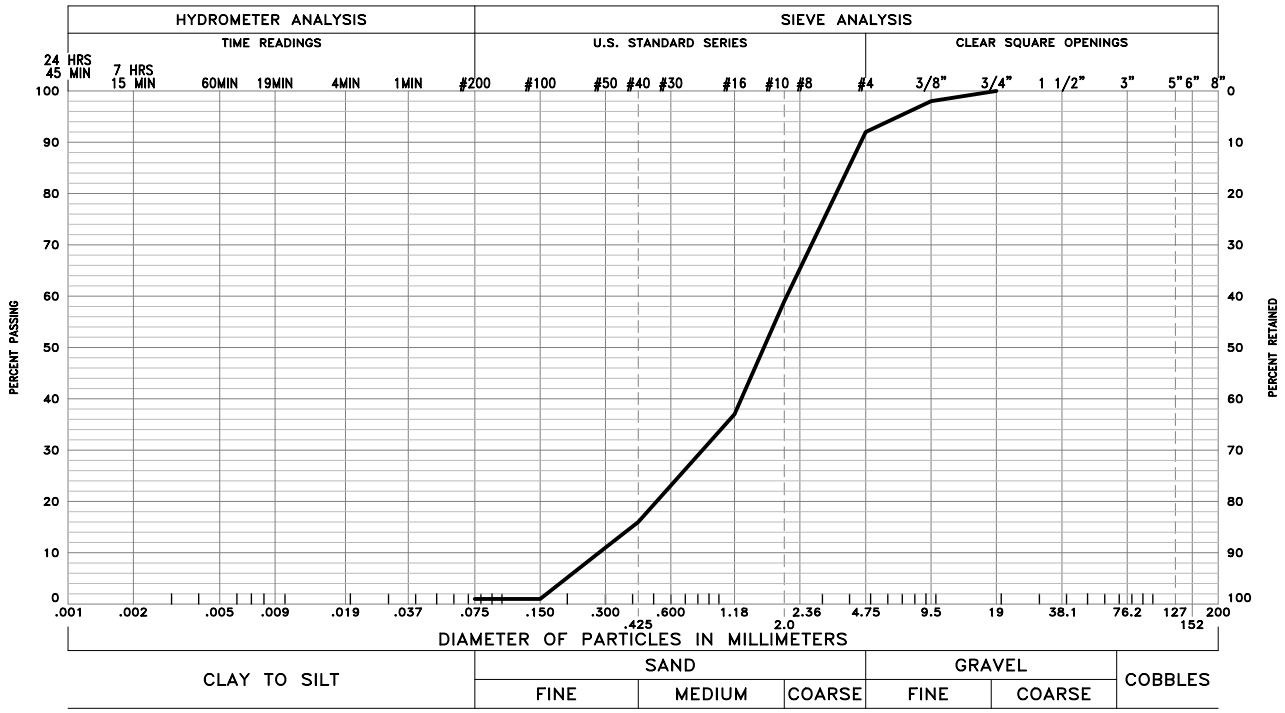
May 15, 2026 - 10:19am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-09 to 18.dwg




GRAVEL 10 % SAND 81 % SILT AND CLAY 9 %

LIQUID LIMIT 25 PLASTICITY INDEX 12

SAMPLE OF: Well Graded Sand with Silt (SW-SM) FROM: Boring EX1 @ 6'-6.5'




GRAVEL 8 % SAND 91 % SILT AND CLAY 1 %

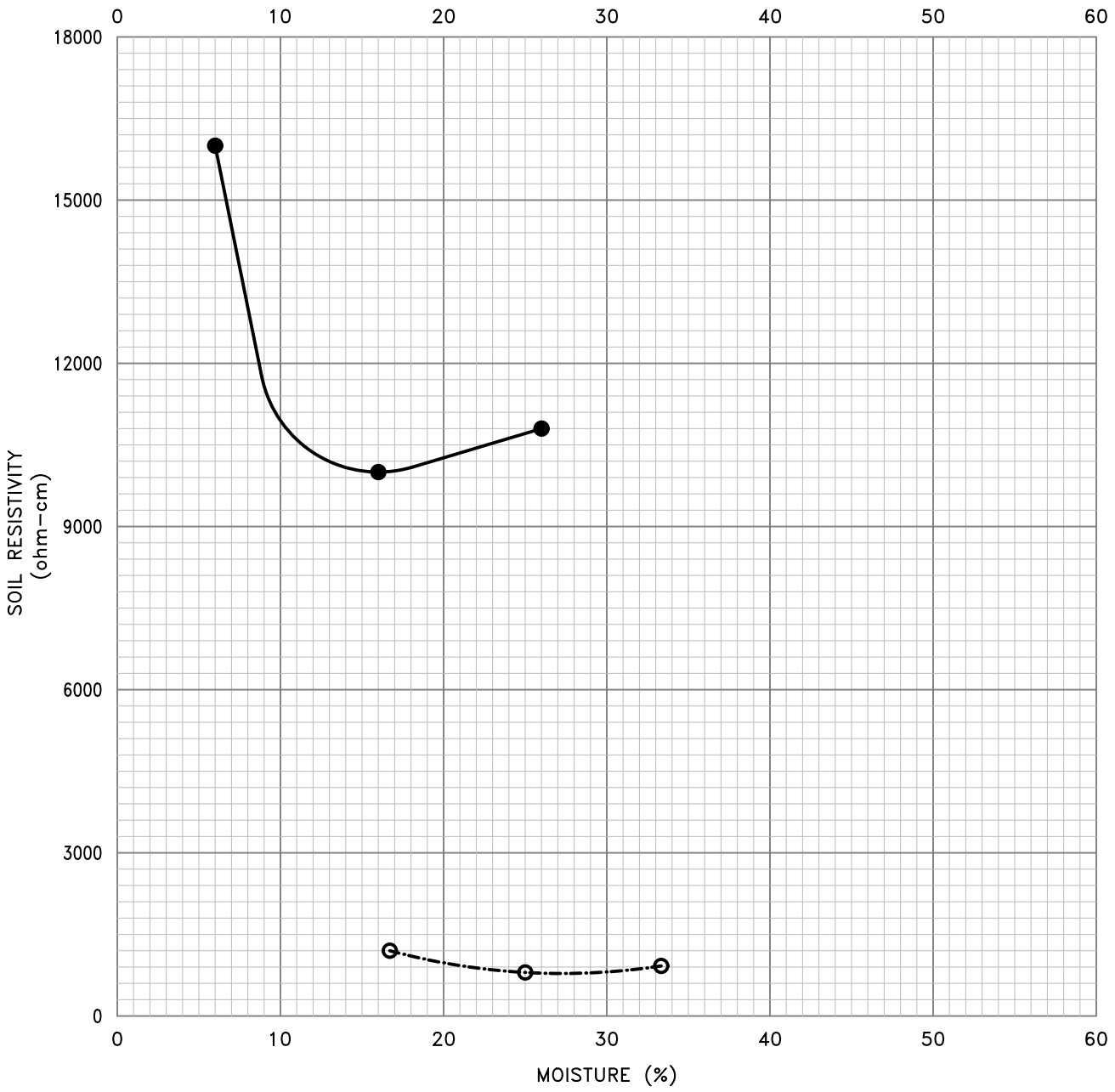
LIQUID LIMIT - PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand (SW) FROM: Boring EX2 @ 3'-3.5'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

| 25-2-263 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 18 |
|---|---|---|---|

May 15, 2026 - 10:19am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-09 to 18.dwg




| CURVE SYMBOL | SAMPLE IDENTIFICATION | SOIL OR BEDROCK TYPE | MINIMUM RESISTIVITY (ohm-cm) | RESISTIVITY AT IN SITU MOISTURE CONTENT (ohm-cm) |
|---|---|---|---|---|
| ● | Boring 1 @ 9' | Well Graded Sand with Silt & Gravel (SW-SM) | 10,000 | 14,960 |
| ○ | Boring 7 @ 4' | Lean Clay (CL) | 800 | 865 |

May 15, 2026 - 10:19am
V:\Projects\Den ARC 2021-2025 (ENG)\2025\25-2-263 Cherokee Metro District - PFAS Water Treatment Facility\Drafting\252263-19.dwg

| 25-2-263 | Kumar & Associates | LABORATORY RESISTIVITY RESULTS | Fig. 19 |
|---|---|---|---|

# Kumar and Associates, Inc.

## TABLE I

## SUMMARY OF LABORATORY TEST RESULTS



Project No.: 25-2-263
Project Name: Cherokee Metropolitan District - PFAS Water Treatment Facility
Date Sampled: 4/20/2026 - 4/27/2026
Date Received: 4/22/2026 - 4/28/2026

| SAMPLE LOCATION | | DATE TESTED | NATURAL MOISTURE CONTENT (%) | NATURAL DRY DENSITY (pcf) | GRADATION | | PERCENT PASSING NO. 200 SIEVE | ATTERBERG LIMITS | | WATER SOLUBLE CHLORIDES (%) | MINIMUM ELECTRICAL RESISTIVITY (ohm-cm) | pH | WATER SOLUBLE SULFATES (%) | AASHTO CLASSIFICATION (Group Index) | SOIL OR BEDROCK TYPE (Unified Soil Classification) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BORING | DEPTH (ft) | | | | GRAVEL (%) | SAND (%) | | LIQUID LIMIT | PLASTICITY INDEX | | | | | | |
| B1 | 9 | 5/8/26 | 6.7 | 120.0 | 16 | 76 | 8 | | NP | 0.02 | 10,000 | 8.2 | < 0.01 | A-1-b (0) | Well Graded Sand w/Silt & Gravel (SW-SM) |
| | 14 | 5/8/26 | 2.9 | 123.7 | 26 | 62 | 12 | | NP | | | | | A-1-a (0) | Well Graded Sand w/Silt & Gravel (SW-SM) |
| | | | | | | | | | | | | | | | |
| B2 | 4 | 5/8/26 | 9.7 | 93.4 | | | 28 | | NP | | | | | A-2-4 (0) | Silty Sand (SM) |
| | 14 | 5/8/26 | 1.6 | 127.1 | 20 | 78 | 2 | | NP | | | | | A-1-a (0) | Well Graded Sand w/Gravel (SW) |
| | | | | | | | | | | | | | | | |
| B3 | 2 | 5/8/26 | 12.1 | 106.7 | | | 54 | 26 | 11 | | | | | A-6 (3) | Sandy Lean Clay (CL) |
| | 9 | 5/8/26 | 4.1 | 119.7 | 23 | 68 | 9 | | NP | | | | | A-1-b (0) | Well Graded Sand w/Silt & Gravel (SW-SM) |
| | 29 | 5/8/26 | 13.4 | 113.3 | | | 42 | 24 | 11 | | | | | A-6 (1) | Clayey Sand (SC) |
| | | | | | | | | | | | | | | | |
| B4 | 4 | 5/8/26 | 2.2 | 111.1 | 3 | 83 | 14 | | NP | | | | | A-1-b (0) | Silty Sand (SM) |
| | 19 | 5/8/26 | 6.1 | 128.6 | 0 | 89 | 11 | 32 | 18 | | | | | A-1-b (0) | Well Graded Sand w/Silt (SW-SM) |
| | | | | | | | | | | | | | | | |
| B5 | 4 | 5/8/26 | 15.6 | 99.8 | | | 47 | | NP | | | | | A-4 (0) | Silty Sand (SM) |
| | 24 | 5/8/26 | 8.3 | 125.6 | 4 | 72 | 24 | | NP | | | | | A-2-4 (0) | Silty Sand (SM) |
| | | | | | | | | | | | | | | | |
| B6 | 2 | 5/8/26 | 1.9 | 111.7 | 7 | 92 | 1 | | NP | | | | | A-1-b (0) | Poorly Graded Sand (SP) |
| | 19 | 5/8/26 | 6.3 | 126.1 | 7 | 73 | 20 | 29 | 14 | | | | | A-2-6 (0) | Clayey Sand (SC) |
| | | | | | | | | | | | | | | | |
| B7 | 4 | 5/8/26 | 22.5 | 96.7 | | | 89 | 35 | 15 | 0.02 | 800 | 8.2 | 0.04 | A-6 (13) | Lean Clay (CL) |
| | 14 | 5/8/26 | 4.9 | 129.4 | 12 | 67 | 11 | 25 | 11 | | | | | A-2-6 (0) | Well Graded Sand w/Silt (SW-SM) |
| | 29 | 5/8/26 | 7.5 | 126.4 | 0 | 80 | 20 | 22 | 7 | | | | | A-2-4 (0) | Silty Clayey Sand (SC-SM) |
| | 49 | 5/8/26 | 6.1 | 119.5 | 0 | 76 | 24 | | NP | | | | | A-1-b (0) | Silty Sand (SM) |

# Kumar and Associates, Inc.

## TABLE I

## SUMMARY OF LABORATORY TEST RESULTS



Project No.: 25-2-263
Project Name: Cherokee Metropolitan District - PFAS Water Treatment Facility
Date Sampled: 4/20/2026 - 4/27/2026
Date Received: 4/22/2026 - 4/28/2026

| SAMPLE LOCATION | | DATE TESTED | NATURAL MOISTURE CONTENT (%) | NATURAL DRY DENSITY (pcf) | GRADATION | | PERCENT PASSING NO. 200 SIEVE | ATTERBERG LIMITS | | WATER SOLUBLE CHLORIDES (%) | MINIMUM ELECTRICAL RESISTIVITY (ohm-cm) | pH | WATER SOLUBLE SULFATES (%) | AASHTO CLASSIFICATION (Group Index) | SOIL OR BEDROCK TYPE (Unified Soil Classification) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BORING | DEPTH (ft) | | | | GRAVEL (%) | SAND (%) | | LIQUID LIMIT | PLASTICITY INDEX | | | | | | |
| B8 | 4 | 5/8/26 | 10.0 | 106.8 | 0 | 59 | 41 | | NP | | | | 0.01 | A-4 (0) | Silty Sand (SM) |
| | | | | | | | | | | | | | | | |
| B9 | 2 | 5/8/26 | 18.8 | 100.8 | | | 74 | 35 | 19 | | | | | A-6 (12) | Lean Clay w/Sand (CL) |
| | 24 | 5/8/26 | 2.6 | 114.9 | 11 | 82 | 7 | | NP | | | | | A-1-b (0) | Poorly Graded Sand w/Silt (SP-SM) |
| | | | | | | | | | | | | | | | |
| P1 | 2 - 4 | 5/8/26 | | | 11 | 76 | 13 | | NP | | | | | A-1-b (0) | Silty Sand (SM) |
| | | | | | | | | | | | | | | | |
| P2 | 2 - 4 | 5/8/26 | | | 6 | 84 | 10 | | NP | | | | | A-1-b (0) | Well Graded Sand w/Silt (SW-SM) |
| | | | | | | | | | | | | | | | |
| P3 | 2 - 4 | 5/8/26 | | | 25 | 66 | 9 | | NP | | | | | A-1-a (0) | Well Graded Sand w/Silt & Gravel (SW-SM) |
| | | | | | | | | | | | | | | | |
| EX1 | 2 | 5/8/26 | 1.8 | 109.7 | | | | | | | | | | | Well Graded Sand w/Silt (SW-SM) |
| | 4 | 5/8/26 | 3.2 | 107.2 | | | | | | | | | | | Well Graded Sand w/Silt (SW-SM) |
| | 4 - 4.5 | 5/8/26 | | | 25 | 74 | 1 | | NP | | | | | A-1-a (0) | Well Graded Sand w/Gravel (SW) |
| | 6 - 6.5 | 5/8/26 | | | 10 | 81 | 9 | 25 | 12 | | | | | A-2-6 (0) | Well Graded Sand w/Silt (SW-SM) |
| | | | | | | | | | | | | | | | |
| EX2 | 2 | 5/8/26 | 2.0 | 113.2 | | | | | | | | | | | Well Graded Sand w/Silt (SW-SM) |
| | 4 | 5/8/26 | 3.7 | 113.4 | | | | | | | | | | | Well Graded Sand w/Silt (SW-SM) |
| | 3 - 3.5 | 5/8/26 | | | 8 | 91 | 1 | | NP | | | | | A-1-b (0) | Well Graded Sand (SW) |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

# ATTACHMENT 13: Emergency Response Plan

# CHEROKEE METROPOLITAN DISTRICT
# (CMD)
# EMERGENCY RESPONSE PLAN

**Updated 12/24/2025.**

**TABLE OF CONTENTS**


..... 3

**Section 1. System Information ..... 3**

**Water Storage / Distribution System** ..... 6
**Water Treatment / Chemical Storage Facilities** ..... 6
**Collection System / Lift Station Facilities** ..... 7
**WRF Wastewater Treatment / Chemical Storage Facilities** ..... 7

**Section 2. Risk and Vulnerability Summary ..... 8**

**.....10**

**Section 3. Responsibilities .....10**

**Overall Responsibilities** ..... 10
**Notification Responsibilities & Procedures** ..... 11

**.....12**

**Section 4. Emergency Contact Information.....12**

**District Representatives** ..... 12
**District Representatives** ..... 13
**Water Treatment / Distribution - Personnel Information** ..... 13
**Wastewater Treatment WRF / Collections- Personnel Information** ..... 13
**District - Personnel Information** ..... 14
**Administration – Customer Service Personnel Information** ..... 14
**Parks - Personnel Information** ..... 14
**First Responders and Government Agencies** ..... 15
**Adjacent Water Systems** ..... 17
**Utilities** ..... 17
**Industry Organizations** ..... 18
**Customers / Out of District** ..... 18
**Local Media** ..... 19

**.....20**

**Section 5. Response to Emergencies .....20**

**A. Operations-Managed Emergencies.....20**
**Distribution or Transmission Line Break** ..... 20
**Power Outage** ..... 21
**Equipment Failure** ..... 21
**B. District-Managed Emergencies .....22**
**Access** ..... 24
**Physical Security** ..... 25
**Cyber Security** ..... 25
**C. District-External Emergencies.....26**
**D. Returning to Normal Operation .....26**

**Section 6. Locations of Keys, Tools & Documents.....28**

**Appendices** ..... **29**

**Appendix A. Board Member Contact Information** ..... **29**

..... **30**

**Appendix B. Vendor Information** ..... **30**

..... **36**

**Appendix C. Key and Access Information** ..... **36**

# Section 1. System Information

| System Information | | |
|---|---|---|
| **System Identification Number** | CO-0121125 | |
| **Colorado Tax Exemption Identification Number** | 98-02228-0000 | |
| **System Name and Address** | **Business Address**<br>Cherokee Metropolitan District<br>6250 Palmer Park Blvd<br>Colorado Springs, CO 80915-1721 | |
| **System Telephone Numbers** | 719 597-5080 office<br>719 597-5145 fax<br>www.cherokeemetro.org | |
| **Directions to the System District Offices** | Palmer Park Blvd, east of Powers Blvd (Hwy 21), North of Platte Ave., south of Constitution Ave. | |
| **Basic Description and Location of System Facilities** | CMD is located on the east side of Colorado Springs, in El Paso County. Water sources (wells) are in the eastern part of El Paso County, in Ellicott, and in the northern part of El Paso County, from Hodgen Rd. to County Line Rd. in Black Forest. | |
| **Location/Town** | Colorado Springs, CO | |
| **Population Served and Service Connections** | 31,660 | 9,312 |
| **System Owner** | Cherokee Metropolitan District | |

| System Emergency Response Plan (ERP) | |
|---|---|
| **Audience for and Implementation of this ERP** | 1) CMD representatives (i.e., District Manager, operations and maintenance personnel, and board of directors.<br>2) Outside agencies and emergency responders with whom CMD may need to coordinate in case of an emergency, including regional emergencies beyond the scope of CMD |
| **ERP Maintenance and Approval** | This plan, and changes to it, is officially in effect when approved by the CMD Board of Directors during an official meeting. Updates to key material such as policies and procedures as contained within the plan must also be approved by the Board. Contact information (i.e., for board members, vendors, customers, etc.) may be updated when needed and without Board approval. The ERP is maintained by the District Manager, in coordination with the Board of Directors and Operations |
| **Review of the ERP** | This ERP shall be reviewed no less than once every two years. |
| **Distribution of the ERP** | The body of the ERP may be shared with other local governments who may be collaborating in emergency response efforts. The appendices of the ERP contain private, proprietary and security information and may not be shared without board permission |

## Wells

| Well Name | Latitude | Longitude | Treatment Requirement |
|---|---|---|---|
| **Well #1** | 38.874991 | -104.377759 | n/a |
| **Well #1** | 38.865684 | -104.367921 | n/a |
| **Well #2** | 38.858178 | -104.362254 | n/a |
| **Well #3** | 38.888961 | -104.378390 | n/a |
| **Well #4** | 38.898031 | -104.385382 | n/a |
| **Well #5** | 38.934771 | -104.384683 | n/a |
| **Well #6** | 38.935437 | -104.394933 | n/a |
| **Well #7** | 38.946375 | -104.393564 | n/a |
| **Well #8** | 38.762792 | -104.390992 | n/a |
| **Well #9** | 38.758838 | -104.400769 | n/a |
| **Well #10** | 38.751620 | -104.404238 | n/a |
| **Well #11** | 38.751634 | -104.397304 | n/a |
| **Well #12** | 38.729117 | -104.403767 | n/a |
| **Well #13** | 38.723061 | -104.413960 | n/a |
| **Well #14** | 38.708352 | -104.403975 | n/a |

| Wells | | | |
|---|---|---|---|
| **Well Name** | **Latitude** | **Longitude** | **Treatment Requirement** |
| **Well #15** | 38.708378 | -104.409980 | n/a |
| **Well #16** | 38.694191 | -104.412561 | n/a |
| **Well #17** | 38.962310 | -104.394742 | n/a |
| **Well #18 (Tipton)** | 38.809365 | -104.366644 | n/a |
| **Well #19 (Duncan)** | 38.931770 | -104.385635 | n/a |
| **Well #20 (Goss)** | 38.982842 | -104.386107 | n/a |
| **Guthrie Well** | 38.957460 | -104.394445 | n/a |
| **Albrecht Well** | 38.729092 | -104.392674 | n/a |
| **SW-5 (Sweetwater 5)** | 38.837646 | -104.706277 | n/a |
| **SC-1 (Sand Creek 1)** | 38.837535 | -104.706953 | n/a |
| **SC-2 (Sand Creek 2)** | 38.837315 | -104.707338 | n/a |
| **SC-3 (Sand Creek 3)** | 38.836290 | -104.706449 | n/a |
| **SC-4 (Sand Creek 4)** | 38.864617 | -104.717434 | n/a |
| **SC-5 (Sand Creek 5)** | 38.864798 | -104.717157 | n/a |
| **SC-6 (Sand Creek 6)** | 39.070260 | -104.716995 | n/a |
| **AR-1 (Arapahoe 1)** | 39.060433 | -104.712857 | Sequestering agent – see Water Treatment / Chemical Storage Facilities |
| **DN-4 (Denver 4)** | 38.874991 | -104.377759 | n/a |

## Water Storage / Distribution System

| Location | Comments |
|---|---|
| **Ellicott Tank and Pump Station (048)**<br>22315 Highway 94<br>Colorado Springs, CO 80930 | 500,000 gal. tank |
| **Tank #1 and Pump Station #1 and Pump Station #1 addition.**<br>6657 Platte Avenue<br>Colorado Springs, CO 80915 | 3,000,000 gal. tank |
| **Tanks #2 and #4, and Pump Station #2 (064)**<br>2710 Peterson Rd.<br>Colorado Springs, CO 80922 | 3,000,000 gal. tank #2<br>4,000,000 gal. tank #4 |
| **Tank #3 (Tamlin Rd.)**<br>5045 N. Marksheffel Rd<br>Colorado Springs, CO 80922 | 5,000,000 gal. tank |
| **Frank Rd. Tank #6**<br>13410 Frank Rd.<br>Colorado Springs, CO 80908 | 2,000,000 gal. tank |
| **Sundance Pump Station and Tank #7**<br>5989 Hodgen Rd.<br>Colorado Springs, CO 80908 | 500,000 gal. tank |
| **Schriever S.F.B. Building #50**<br>Hubble Ave.<br>Colorado Springs, CO 80930 | Pump station, metering, and backflow device. |
| **Schriever S.F.B. Building #200**<br>Perimeter Trail.<br>Colorado Springs, CO 80930 | Metering and backflow device. |

## Water Treatment / Chemical Storage Facilities

| Organization or Department | Chemical(s) | Comments |
|---|---|---|
| **Ellicott Pump Station (048)**<br>22315 Highway 94<br>Colorado Springs, CO 80930 | Calcium Hypochlorite | Solid briquette form, plus an eye wash station in the pump house. |
| **Potable Water Treatment Station (192) Peterson S.F.B.**<br>310 Peterson Rd.<br>Colorado Springs, CO 80915 | Chlorine Gas | Gaseous form, plus a chlorine gas detection/alarm system. |
| **Sand Creek Lab**<br>6657 Platte Ave.<br>Colorado Springs, CO 80915 | Testing reagents | Minimum volume. |
| **Sundance Pump Station**<br>5989 Hodgen Rd.<br>Colorado Springs, CO 80908 | Calcium Hypochlorite | Solid briquette form, plus an eye wash and shower station in the pump house. |
| **Well AR-1 (Arapahoe 1)**<br>5969 Hodgen Rd.<br>Colorado Springs, CO 80908 | Poly & Otho phosphates (SeaQuest) | Control of corrosion, scaling and removal of iron and sequestering of iron and manganese. |
| **Frank Rd. Tank #6**<br>13410 Frank Rd.<br>Colorado Springs, CO 80908 | Sodium Sulfate | Dechlorination for tank cleaning. |

## Collection System / Lift Station Facilities

| Locations | Chemical(s) | Comments |
|---|---|---|
| **Lift Station Terminal Avenue (256)**<br>6050 Terminal Ave.<br>Colorado Springs, CO 80915 | Bioxide | Calcium nitrate solution to eliminate odors, corrosion associated with hydrogen sulfide. |
| **Lift Station #1**<br>6657 Platte Ave.<br>Colorado Springs, CO 80915 | Bioxide | Calcium nitrate solution to eliminate odors, corrosion associated with hydrogen sulfide. |
| **Lift Station #2**<br>405 Franceville Coal Mind Rd.<br>Colorado Springs, CO 80929 | n/a | |
| **Headworks (in-town)**<br>6657 Platte Ave.<br>Colorado Springs, CO 80915 | n/a | |
| **Schriever S.F.B. Building #800**<br>Enoch Rd.<br>Colorado Springs, CO 80930 | Bioxide | Calcium nitrate solution to eliminate odors, corrosion associated with hydrogen sulfide. |

## WRF Wastewater Treatment / Chemical Storage Facilities

| Locations | Chemical(s) | Comments |
|---|---|---|
| **Water Reclamation Facility (WRF)**<br>19174 Drennan Rd<br>Colorado Springs CO 80928 | See below for site specific buildings and content. | Buildings listed below are found on site at the Water Reclamation Facility. |
| **Headworks** | n/a | |
| **Filtration/RO Building** | Citric acid, Sulfuric acid, Sodium Bisulfate, Sodium Hydroxide, Sodium Hypochlorite, Hydrochloric Acid. | Treatment chemicals, leak detection/alarm system in place and secondary containment, to include emergency shower and eye-wash station. |
| **Chemical Building** | Sulfuric acid, Hydrochloric acid, Sodium Bisulfate. | Main storage building for acid, leak detection/alarm system in place and secondary containment, to include emergency shower and eye-wash station. |
| **Digester Building** | n/a | |
| **Solids Handling Building** | n/a | |
| **Effluent/UV Building** | n/a | |
| **Operations Building** | n/a | |

# Section 2. Risk and Vulnerability Summary

| Events that cause emergencies and District vulnerability | | | |
|---|---|---|---|
| **Type of Event** | **Probability** (High-Med-Low) | **Risk** (High-Med-Low) | **Comments (including vulnerability)** |
| **Distribution main break** | High | Medium | The district distribution infrastructure is aging and is highly prone to breaks. |
| **Equipment/power failure** | Medium | Medium | If a single treatment unit fails (or is otherwise off-line), the other treatment units can be bought online. In this case, bringing the failed unit back on-line should be done expeditiously but during normal business hours and in a cost-effective manner. Simultaneous failure of multiple treatment units constitutes a true emergency. |
| **Source water issues** | Medium | High-Medium | As above, the district faces different levels of risk depending on the failure of a single water source vs. failure of multiple water sources. |
| **Transmission line break** | Medium | High-Medium | The 30-inch transmission line from Ellicott pump station (048) to tank #1 has been subject to past failures. |
| **Fire** | Medium | Medium | District does have sufficient water storage capacity to support prolonged use of water in fighting a major fire (multiple houses or businesses). |
| **Drought** | Medium | Medium | If there is a significant drought, the district should be able to put a monitoring plan or contingency plan in place ahead of time. |
| **Vandalism** | Medium | Unknown | The district is in a low crime area; however, random vandalism is a possibility. |
| **Terrorism** | Medium | High | The district provides water to Schriever Space Force Base. |
| **Tornado** | Low | Medium | Tornado activity is rare against the front range of the Rockies and is unlikely to occur in the district proper or at eastern facilities. |
| **Avalanche** | Low | Low | The district is not in an area that would be subjected to avalanches. |
| **Storage tank failure** | Low | Medium | The district has multiple water storage tanks. If a tank fails, there is sufficient additional storage capacity available. |
| **Industrial accident** | Low | High | Currently, there are no industrial sites adjacent to any of the wells. |

| Events that cause emergencies and District vulnerability | | | |
|---|---|---|---|
| **Type of Event** | **Probability** (High-Med-Low) | **Risk** (High-Med-Low) | **Comments (including vulnerability)** |
| | | | |
| **Flood** | Low | Medium | The entryway to tank and pump station #1 (128) is through a dry creek bed that is susceptible to flooding during heavy rains. |
| **Severe Weather (Snow, Ice, Temperature)** | Medium | Low | Roads may become impassible several times during a typical winter, especially to the northernmost area of CMD, in the Black Forest area. |
| **Contaminated Water** | Medium | High | This could result from such events as waterborne disease outbreaks or accidental cross-connections. |
| **Unintentional hazardous chemical release** | Low | High | Gaseous chlorine is located inside boundary near the north entrance to Peterson A.F.B. This facility has a gas detection/alarm system. |
| **Unintentional hazardous chemical release** | Low | Medium | Although chemicals at the Water Reclamation Facility exist for treatment. The site is in a very low population area and would be contained on site. |
| **Earthquake** | Low | Unknown | Colorado does not have a reputation as a high earthquake zone. . |

# Section 3. Responsibilities

The district management and response team have three elements that are activated in responding to an emergency. Each of these has a role and distinct responsibilities. Operations has primary responsibility for responding to and assessing emergencies and has the responsibility for ensuring the district's compliance with state regulations. The District Manager has primary responsibility for customer communications and for coordinating activities across the team. The Board of Directors has ultimate oversight and decision-making authority. The operations and management teams both have a depth of resources and personnel beyond the designated leads identified below.

## Overall Responsibilities

| Responsible Party | Responsibilities During an Emergency |
|---|---|
| **Operator in Responsible Charge (ORC)** | -Act as initial contact for emergency calls.<br>-Act as overall coordinator of emergency response actions.<br>-Call all necessary personnel.<br>-Respond to water emergencies.<br>-Provide on-the-scene assessment of risks and impacts.<br>-Oversees vendors called to make repairs.<br>-Coordinate with CPDHE and other regulatory agencies as required by Colorado State law. |
| **District Manager** | -Notify the Board of Directors.<br>-Approve emergency related expenditures.<br>-Coordinate CMD-internal meetings (phone conferences and/or face-to-face meetings at treatment plants or other locations)<br>-Prepare and coordinate public notifications and health advisories.<br>-Provide coordination and oversight of activities with agencies other than CDPHE.<br>-Provide information to residents and media. |
| **Board of Directors** | -Approve major emergency repairs (particularly when there are alternative solutions).<br>-Ratifies emergency expenditures, including obtaining approvals from a majority of board members. |

## Notification Responsibilities & Procedures

- **Alert state drinking water and health agencies.**

| | |
|---|---|
| **Responsibility:** | ORC |
| **Procedures:** | -Call CDPHE incident reporting line. |

- **Alert local law enforcement, if necessary.**

| | |
|---|---|
| **Responsibility:** | ORC |
| **Procedures:** | -Contact Colorado Springs Police Department<br>-Contact El Paso County Sheriff<br>-Coordinate reverse 911 notifications, if necessary and available. |

- **Contact service and repair contractors.**

| | |
|---|---|
| **Responsibility:** | ORC |
| **Procedures:** | -Will Contact whichever service and repair contractors CMD uses depending on the situation at hand.<br>-Coordinate with Board as necessary to authorize emergency expenditures. |

- **Contact neighboring water systems, if necessary.**

| | |
|---|---|
| **Responsibility:** | ORC |
| **Procedures:** | -Will contact Colorado Springs Utilities, Woodmen Hills, and/or Meridian Ranch depending on the situation at hand. |

- **Notify water system customers of potential water shortage or issuing health advisories.**

| | |
|---|---|
| **Responsibility:** | District Manager |
| **Procedures:** | -Coordinate with operations and the Board.<br>-Write public notice or health advisory. These may include:<br>• Conservation Orders<br>• Water Use Advisories – “boil order” vs. “do not drink” vs. “do not use”.<br>-Post notices on the CMD website and distribute to residents (via email, regular mail and/or hand distribution).<br>-Notify local homeowners associations.<br>-Notify CDPHE of any health advisory and related issues.<br>-Provide copies of notices to operators for posting within the district.<br>If necessary, arrange for signs to be posted at key points in the district. |

- **Brief local media, if necessary.**

| | |
|---|---|
| **Responsibility:** | District Manager |
| **Procedures:** | -Respond to media requests for information.<br>-Coordinate and/or participate in any press conferences if necessary. |

# Section 4. Emergency Contact Information

| District Representatives | | | |
|---|---|---|---|
| **Department / Job Title** | **General Contact Info** | **Individual Contacts** | **Comments** |
| **District General Manager** | (o) 719-597-5080 x 0119<br>(c) 719-322-4339 | Brown, Kevin | |
| **Water Treatment / Distributions (ORC)** | (o) 719-597-5080 x 0035<br>(c) 719-313-8135 | Mevis, Matthew | |
| **Water Treatment / Distributions Lead Operator** | (o) 719-597-5080<br>(c) 719-439-9648 | Kidwell, Preston | |
| **Wastewater Treatment WRF/ Collections (ORC)** | (o) 719-259-1155<br>(c) 719-332-5511 | Watkins, Joshua | |
| **Wastewater Treatment WRF / Treatment Lead** | (o) 719-259-1155<br>(c) 719-464-9153 | Bates, Solomon | |
| **Collections Lead** | (o) 719-259-1155<br>(c) 719-306-9640 | Keeney, Adam | |
| **Water Operator** | (o) 719-597-5080<br>(c) 719-491-0417 | Cuchiara, Mark | |
| **System Specialist** | (o) 719-597-5080<br>(c) 719-491-0420 | Simmons, Lawrence | General maintenance. |
| **District Engineer** | (o) 719-597-5080 x 0032<br>(c) 719-330-8042 | Slocum, Troy | |
| **Assistant Engineer** | (o) 719-597-5080 x 0031<br>(c) 719-517-9289 | Zembles, Brandon | |
| **Control System Engineer** | (o) 719-597-5080 x 0169<br>(c) 719-401-8637 | Vogel, Noah | Programming, trouble shooting. |
| **Pretreatment Coordinator** | (o) 719-597-5080 x 0118<br>(c) 719-499-3277 | Drennan, Tyler | Industrial, business regulation enforcement. |
| **Safety Coordinator** | (o) 719-597-5080 x 0030<br>(c) 719-216-6514 | Gatlin, David | |

## District Representatives

| Department | General Contact Info | Individual Contacts | Comments |
|---|---|---|---|
| **Golf Course Superintendent** | (c) 719-472-4613 | Ragsdale, Phillip | |
| **Golf Course Assistant Superintendent** | | Vacant | |
| **District Administrative Supervisor** | | Vacant | |
| **District HR Administrator** | (o) 719-597-5080 x 0127 | Hughes, Connie | |
| **District Accountant** | (o) 719-597-5080 x 0120 | Wells, Julie | |

## Water Treatment / Distribution - Personnel Information

| Job Title | Name | Individual Contacts | Job Duties and Responsibilities |
|---|---|---|---|
| **Water Operator** | Cuchiara, Mark | (c) 719-491-0417 | Operations |
| **Water Operator** | Forbes, Sean | (c) 719-322-3139 | Operations |
| **Water Operator** | Heet, Maximus | (c) 719-663-9425 | Operations |
| **Water Operator** | Kondly, Josh | (c) 719-741-0967 | Operations |
| **Water Operator** | Meininger, Dan | (c) 719-685-6797 | Operations |
| **Water Operator** | Morrison, James | (c) 719-321-3864 | Operations |
| **Water Operator** | Pineda, Jario | (c) 719-606-9081 | Operations |

## Wastewater Treatment WRF / Collections- Personnel Information

| Job Title | Name | Individual Contacts | Job Duties and Responsibilities |
|---|---|---|---|
| **WRF Utility Operator** | Arceneaux, Anthonio | (c) 719-413-3287 | Operations |
| **WRF Utility Operator** | Crabill, Adam | (c) 719-521-8701 | Operations |
| **WRF Utility Operator** | Drury, Brian | (c) 719-413-3291 | Operations |
| **WRF Utility Operator** | Flores, Ian | (c) 719-413-3289 | Operations |
| **WRF Utility Operator** | Hinkley, Matt | (c) 719-413-3283 | Operations |
| **WRF Utility Operator** | Hirsch, Jesse | (c) 719-521-8721 | Operations |
| **WRF Utility Operator** | Hooper, Sonny | | Operations |
| **WRF Utility Operator** | Kaslan, Kris | (c) 719-323-7145 | Operations |
| **WRF Utility Operator** | Keeney, Adam | (c) 719-306-9640 | Operations |
| **WRF Utility Operator** | Leck, Robert | (c) 719-237-1481 | Operations |
| **WRF Utility Operator** | Solomon, Bates | (c) 719-464-9153 | Operations |
| **WRF Utility Operator** | Zirnheld, Chris | (c) 719-237-4075 | Operations |

| District - Personnel Information | | | |
|---|---|---|---|
| **Job Title** | **Name** | **Individual Contacts** | **Job Duties and Responsibilities** |
| **District Operator** | Banuelos, John | (c) 719-828-3551 | District / Customer Service |
| **District Operator** | Brown, Dino | (c) 719-313-2621 | Inspections & Locates |
| **District Operator** | Hernandez, Rene | (c) 719-726-2000 | District / Customer Service |
| **District Operator** | Meyer, Len | (c) 719-491-0419 | Inspections & Locates |

| Administration – Customer Service Personnel Information | | | |
|---|---|---|---|
| **Job Title** | **Name** | **Individual Contacts** | **Job Duties and Responsibilities** |
| **Billing Specialist** | Galbraith, Heather | (o) 719-597-5080 x 0126<br>(c) 719-500-1310 | |
| **Customer Service Technician** | | (o) 719-597-5080 x 0028 | |
| **Customer Service Technician** | Carpenter, Megan | (o) 719-597-5080 x 0110 | |
| **Customer Service Technician** | Matz, April | (o) 719-597-5080 x 0125 | |

| Parks - Personnel Information | | | |
|---|---|---|---|
| **Job Title** | **Name** | **Individual Contacts** | **Job Duties and Responsibilities** |
| **Parks Superintendent** | Ross, Lecil | (c) 719-322-4345 | Maintenance |
| **Parks Maintenance** | Rivera, Gabriella | (c) 719-466-0243 | Maintenance |

| First Responders and Government Agencies | | | |
|---|---|---|---|
| **Organization or Department** | **General Contact Info** | **Individual Contacts** | **Comments** |
| **Colorado Springs Police** – local law enforcement | 911<br>719-444-3140<br>(non-emergency) | | Tutt Ave.<br>Co. Spgs. Station |
| **El Paso County Sheriff** and County hazmat | 911<br>719-390-5555<br>(non-emergency) | Hazmat contacts:<br>Richard Heaverlo<br>719-575-8403 | |
| **Colorado State Patrol** | 911<br>719-635-0385<br>(non-emergency) | | Quail Lake Lp.<br>Co. Spgs. Station. |
| **Utility Notification Center of Colorado** | 811<br>1-800-922-1987<br>http://www.co811.org<br>www.uncc.org | | Federally mandated national "call before you dig" number to locate underground utilities |
| **Colorado Springs Fire Department –** and emergency medical services | 911<br>719-385-5950 (non-emergency) | | |
| **Cimarron Hills Fire Department** | 911<br>719-591-0960<br>719-591-0996 (fax) | Fire Chief:<br>Andrew York<br>(c) 719-437-0668 | Fire Departments are dispatched by El Paso Co. Sheriff's Office |
| **Black Forest Fire & Rescue** | 911<br>719-495-1400 (24 hrs.) | | |
| **Falcon Fire Protection Department** | 719-495-4050 | | Capital Dr.<br>Co. Spgs. Station |
| **Ellicott Fire Department** | 719-683-7211 (24 hrs.) | | |
| **Colorado Department of Public Health and Environment (CDPHE)** – state regulatory agency | Incident Reporting<br>877-518-5608 | | 24 Hour toll free, spills and drinking water emergencies |
| | Water Quality Control Division<br>303-692-3500 (main)<br>www.cdphe.state.co.us/wq | Paul Hanson, PE<br>Senior Field Engineer<br>Field Services Section<br>719-295-5074<br>Paul.hanson@state.co.us | |
| | Main Campus<br>4300 Cherry Creek Dr. South<br>Denver, CO 80246-1530<br>303-692-2000<br>800-886-7689<br>www.cdphe.state.co.us | | |

| First Responders and Government Agencies | | | |
|---|---|---|---|
| **Organization or Department** | **General Contact Info** | **Individual Contacts** | **Comments** |
| | Office of Emergency Preparedness and Response<br>303-692-2030<br>Cdphe.co.train@state.co.us<br>www.cdphe.state.co.us/epr | | |
| **El Paso County – County government and services** | Department of Transportation<br>3275 Akers Drive.<br>Colorado Springs, CO 80922<br>719-520-6460<br>719-520-6879 (fax) | | Road cuts and permits, Right-of-ways |
| | Environmental Division<br>3255 Akers Dr.<br>Colorado Springs, CO 80922<br>719-520-7879<br>719-520-7827 (fax) | Kathy Andrew<br>Division Manager<br>kathyandrew@elpaso.com | Focuses on natural resources, household waste, and environmental compliance |
| | Public Health<br>1675 W. Garden of the Gods Rd., Suite 2044<br>Colorado Springs, CO 80907<br>719-578-3199<br>healthinfo@elpasoco.com<br>www.elpasocountyhealth.org | | |
| | Office of Emergency Management (OEM) | 719-575-8422 (24hr)<br>719-575-8400 non-emergencies | Facilitate access to areas during disasters or storms |
| **Colorado Department of Local Affairs (DOLA)**<br>**State Agency** | Division of Emergency Management<br>9195 E. Mineral Ave., Suite 200<br>Centennial, CO 80112<br>720-852-6600<br>720-852-6750 (fax)<br>Dola.helpdesk@state.co.us | | Also has other local government services |
| | Division of Local Government<br>1313 Sherman St., Room 521<br>Denver, CO. 80203<br>303-866-2156<br>303-866-4819 (fax)<br>Dlg.helpdesk@state.co.us | | |
| **Environmental Protection Agency (EPA)** – U.S. regulatory agency | Safe Drinking Water Hotline<br>1-800-426-4791<br>Tools and Educational Info<br>Water.epa.gov/drink/index.cfm | | |

| Adjacent Water Systems | | | |
|---|---|---|---|
| **Organization or Department** | **Name & Position** | **Contact Info** | **Comments** |
| **Colorado Springs Utilities (CSU)** | Sean Higbee<br>Water Operations | 111 S. Cascade Ave. Co. Spgs. CO 80903<br>(o) 719-668-4595<br>(c) 719-649-6552 | |
| | Water Operations | (o) 719-668-4570 | 24-hour line |
| | David Mora<br>Dist. Water Quality | (o) 719-668-4570 | |
| **Woodmen Hills** | JD Shivvers<br>Water Manager<br><br>Wally Eaves<br>Wastewater Manager | 8046 Eastonville Rd. Falcon, CO 80831<br>(o) 719-495-2500 | WWTP 719-491-1849 |
| **Meridian Services Metropolitan District** | Sean Dearborn | 11886 Stapleton Dr. Falcon, CO 80831<br>719-684-4761 | |
| **Ellicott Utilities Co, LLC** | Phillip Cromwell<br>Operator | 18353 Hwy. 94 Co. Spgs. CO 80930 | |

| Utilities | | | |
|---|---|---|---|
| **Organization or Department** | **Name & Position** | **Contact Info** | **Comments** |
| **Colorado Springs Utilities (CSU)** – electric and natural gas utility | | 111 S. Cascade Ave.<br>Co Spgs. CO 80903<br>(o) 719-448-4800 | |
| **Mountain View Electric Association (MVEA)** – electric utility | | 11140 E. Woodmen Rd.<br>Falcon, CO 80831-8127 | 719-495-2283<br>719-495-3014 (fax) |
| **CenturyLink** – telephone company | | 3150 New Center Pt.<br>Co. Spgs. CO 80922 | 719-597-9519 |
| **Utility Notification Center of Colorado** | 811<br>1-800-922-1987<br>http://www.co811.org<br>www.uncc.org | | Federally Mandated national “call before you dig” number to locate underground utilities |

## Industry Organizations

| Organization or Department | General Contact Info | Individual Contacts | Comments |
|---|---|---|---|
| **American Water Works Association (AWWA)** | 6666 W. Quincy Ave.<br>Denver, CO 80235<br>303-794-7711 or<br>800-926-7337<br>303-347-0804 (fax)<br>www.awwa.org | | CMD is a system member |
| **Colorado's Water/Wastewater Agency Response Network (Co-Warn)** | CDPHE-WQCD<br>4300 Cherry Creek Dr. South<br>Denver, CO 80246-1530<br>303-908-7519 (Kyra Gregory)<br>1-877-518-5608 (24-hour emergency) | Kyra Gregory, CoWarn<br>CDPHE Liaison<br>Kyra.gregory@state.co.us | Colorado "utilities helping utilities." CoWarn is administered by CDPHE and DOLA |
| **Colorado Rural Water Association** | 176 W. Palmer Lake Dr.<br>Pueblo West, CO 81007<br>719-545-6748<br>719-545-6788 (fax)<br>www.crwa.net | | |
| **Colorado State University (CSU) Extension – El Paso County** | Elpaso.colostate.edu<br>www.ext.colostate.edu/drought/water.html<br>www.ext.colostate.edu/links/linkdisa.html | Barbara Bates, Director<br>305 S. Union Blvd.<br>Colorado Springs, CO 80910<br>719-520-7675<br>Barbara.bates@colostate.Edu | |
| **Cybersecurity and Infrastructure Security Agency (CISA)** | CISA Central 24x7: 1-888-282-0870<br>www.cisa.gov | Charlie Marmon-Colorado Coordinator: 303-362-3602 / Edward.marmon@cisa.dhs.gov<br>Kindra Brewer-Colorado Advisor: 719-281-5605 / Kindra.brewer@cisa.dhs.gov | |

## Customers / Out of District

| Organization or Department | General Contact Info | Individual Contacts | Comments |
|---|---|---|---|
| **Ellicott School District 22** | 322 So. Ellicott Hwy<br>Calhan, CO 80808<br>719-683-2700 | Maintenance<br>Dave Sanger<br>(c) 719-439-9715 | |
| **Antelope Acres** | 719-499-9993 | Richard Cromwell | |
| **Harding Nursery** | 719-491-5411 | Terry Shaw<br>Shawn Harding | |
| **Schriever Space Force Base** | 719-567-2300 | | |
| **Schriever Space Force Base Utility Manager** | 719-567-7122 | Abe Irshid | |

| Customers / Out of District | | | |
|---|---|---|---|
| **Organization or Department** | **General Contact Info** | **Individual Contacts** | **Comments** |
| **Peterson Space Force Base** | 719-556-7632 | Dan Rodriquez<br>Thomas Thompson | 21 CES Security Manager |
| **Woodmen Hills MD** | (o) 719-495-2500<br>(c) 719-491-6282<br>719-491-1849 | Gene Cozzolino<br><br>WWTP Jerry Jacobson | |
| **Meridian Services Metropolitan District** | Sean Dearborn | 719-684-4761 | |

| Local Media | | | |
|---|---|---|---|
| **Organization or Department** | **General Contact Info** | **Individual Contacts** | **Comments** |
| **The Gazette Colorado Springs regional newspaper** | 30 S. Prospect St.<br>Colorado Springs, CO 80903<br>719-632-5511<br>www.gazette.com | | Daily publication |
| **KKTV Colorado Springs TV Station** | 3100 North Nevada<br>Colorado Springs, CO 80907<br>(o) 719-634-2844<br>Fax – 719-632-0808<br>News Fax – 719-634-3741<br>www.kktv.com | | Local CBS affiliate |
| **KOAA Colorado Springs TV Station** | 530 Communication Circle, Suite 100<br>Colorado Springs, CO 80905<br>719-632-5030<br>www.koaa.com | | Local NBC affiliate |
| **KRDO Colorado Springs TV Station** | 399 S. 8th Street<br>Colorado Springs, CO 80905<br>www.krdo.com | | Local ABC affiliate |
| **KXRM Colorado Springs TV Station** | 560 Wooten Rd.<br>Colorado Springs, CO 80915<br>719-596-2100<br>www.fox21news.com | | Local Fox affiliate |

# Section 5. Response to Emergencies

The district has defined three levels of emergency: operations-managed, district-managed and district-external (all defined below). In all emergencies, there is a series of general steps to take:

1. Analyze the type and severity of the emergency.
2. Take immediate actions to save lives.
3. Take action to reduce injuries and system damage.
4. Make repairs based on priority demand, and
5. Return the system to normal operation.

## A. Operations-Managed Emergencies

Operations-Managed emergencies include customer outages as well as many distribution systems leaks and equipment failures. Corrective actions are within operations' expertise and are managed by operators, although they may be time-sensitive and require out-of-cycle approval of expenditures (i.e., emergency approval prior to a board meeting with subsequent ratification at the next board meeting). Other district representatives may provide help or support.

| Distribution or Transmission Line Break | |
|---|---|
| **Assessment** | -Determine extent of break (how much water is being lost) and urgency of repair required (potential damage being caused).<br>-Determine if there is a danger to structures or the community.<br>-Identify location of break, using any or all of the following methods:<br>• Sight (water surfacing, depressed areas, unexpected damp areas)<br>• Monitoring differences in flows between flow meters<br>• Leak detection services (including sound or gas) |
| **Immediate Actions** | -Close necessary valves to isolate the leak.<br>-If transmission line breaks, turn off appropriate wells and booster pump stations.<br>-Set up appropriate traffic control, contact El Paso County if road closure is required.<br>-Make the necessary repairs. |
| **Notifications** | -The District Manager if necessary and practical, notify impacted residents through district site and media as to why there is no water. |
| **Follow-up Actions** | -Take bacteriological samples to ensure water is safe for consumption.<br>-Check settings for PRVs that are uphill from any distribution system leak. |

| Power Outage | |
|---|---|
| **Assessment** | -Determine which district facilities are impacted. |
| **Immediate Action** | -The ORC confirms critical facilities generator is operational. Initiate generator start-up checklist. Develop generator fueling plan through outage (fuel type, fuel hrs., designated personnel in charge of refueling operation) |
| **Notifications** | -The District Manager will determine if the Board of Directors need to be notified.<br>-The ORC coordinates with power utility for expected restoration priorities and timing. |
| **Follow-up Actions** | -Verify that power interruptions or surges have not impacted controls. |

| Equipment Failure | |
|---|---|
| **Assessment** | -Determine if equipment failure has impacted on the quality of water delivered to the tanks and/or distribution system.<br>-Identify failed equipment or components.<br>-Determine if sensors and/or alarms are working correctly (no false signals). |
| **Immediate Actions** | -If necessary, take impacted treatment unit off-line and bring other treatment units on-line.<br>-Check tank water levels.<br>-Determine cause and formulate remediation plan.<br>-If necessary, implement a manual monitoring schedule until monitoring equipment is repaired. |
| **Notifications** | -Notify CPDHE and incorporate CDPHE requirements into notification and remediation plan.<br>-Notify the Board of Directors. Obtain any emergency spending authorization needed.<br>-If necessary, notify residents. |
| **Follow-up Actions** | -Purchase repair parts or schedule service as necessary.<br>-If necessary or directed by CDPHE, take chlorine and bacteriological samples in the distribution system to ensure water is safe to drink. |

## B. District-Managed Emergencies

District-Managed emergencies require response from operations, management, and board members ("all hands-on deck"). These emergencies can be handled with district resources, including working through business relationships with vendors or adjacent water districts.

| Drought or Reduction of Source Water Availability | |
|---|---|
| **Assessment** | -Estimate production capacity of wells, including potential recovery time needed for aquifers.<br>-Determine capability for wells/booster pump stations to meet demand, including seasonal demand and considering upcoming weather. |
| **Immediate Actions** | -Establish monitoring plan for tank levels and water production.<br>-If necessary, put water restrictions in place considering alternatives such as:<br>• Limited outdoor watering with limited schedules (alternating days based on house numbers)<br>• No outdoor watering<br>• Rotating outages through neighborhoods.<br>-Determine necessity of obtaining water from alternative sources, including:<br>• Purchase of water from Colorado Springs Utilities (implementing connection per standard operating procedures)<br>• Trucking in water from other sources<br>-If water restrictions (conservation orders) are instituted, establish conditions under which they will be lifted and/or date on which they will expire. |
| **Notifications** | -Notify residents in accordance with communication plan.<br>-If necessary, notify CDPHE. |
| **Follow-up Actions** | -Continue monitoring water production and tank levels.<br>-Modify water restrictions as conditions change. |

| Tank Failure | |
|---|---|
| **Assessment** | -Determine extent of tank failure and potential remediation. |
| **Immediate Actions** | -Determine if there is a danger to the surrounding community.<br>-Implement emergency "no tank" operating procedures, including:<br>• Getting emergency, temporary tanks in place<br>• Changing monitoring and alarms to accommodate smaller capacity of emergency tanks.<br>-Begin repair work on tank.<br>-Determine if water use restrictions are needed. |
| **Notifications** | -The District Manager, If necessary, notify customers. |
| **Follow-up Actions** | -Complete tank repairs.<br>-Return temporary tanks to vendor. |

| Vandalism/Criminal Activity/Terrorism | |
|---|---|
| **Assessment** | -Assess any damage to determine if water, facilities, or customers are at risk.<br>If an external threat has been received, record and document all information related to the threat. |
| **Immediate Actions** | -Turn off valves or facilities, if necessary, to prevent risk to customers and/or damage to district property.<br>-If SCADA/control systems are under attack, disconnect all remote access, reload programming, and implement local monitoring procedures.<br>-Do not disturb the site if it may be a possible crime scene.<br>If necessary, establish a security perimeter.<br>-Gather all parties in an emergency meeting to determine if water supplies and residents are at risk and to decide on a game plan.<br>-Record damage (including pictures and date/time events occurred). |
| **Notifications** | -Superintendent to notify law enforcement and state agencies (including CPDHE) as appropriate.<br>-The District Manager notify Board of Directors. If necessary, notify residents. |
| **Follow-up Actions** | -Superintendent completes any activities required by law enforcement or State agencies. |

| Natural Disaster (Flood/Earthquake/Avalanche/Tornado/Forest Fire) | |
|---|---|
| **Assessment** | -The ORC determines which (if any) district facilities are impacted by the natural disaster.<br>-Evaluate extent of damage to district facilities.<br>-Determine if primary or secondary flooding has caused water contamination.<br>If appropriate, tour entire district to identify potential risks to distribution system and residents' water supply. |
| **Immediate Actions** | -If necessary, turn off units and close valves to isolate damage and protect water supplies, water distribution and district facilities.<br>-If necessary, establish a security and safety perimeter.<br>-Gather all parties together for planning meeting, and to determine corrective actions. |
| **Notifications** | -Notify CDPHE and residents. |
| **Follow-up Actions** | -Begin any needed repairs.<br>-Complete any activities required by CDPHE.<br>-Complete the plan of action that was decided in the planning meeting. |

| Hazardous Materials Spill or Chemical Contamination | |
|---|---|
| **Assessment** | -Identify location (source) and extent of hazardous materials spill and/or chemical contamination.<br>-Cordon off the area to people and animals.<br>-Determine if district has control over the source of the contamination.<br>-If contamination is from an identified source outside the control of the district, identify the party having control of that source.<br>-If practical, identify materials included in the spill. |
| **Immediate Actions** | -To the extent possible, isolate district facilities and lines from the contamination source.<br>-If necessary, shut down treatment units to prevent system contamination.<br>-Begin appropriate clean-up activities, including contacting and engaging vendors who specialize in cleaning contamination. |
| **Notifications** | -If HAZMAT Spill, call 911 to notify Fire Department.<br>-Notify CDPHE (incident line).<br>-Notify CMD Pretreatment Coordinator.<br>-Notify residents. |
| **Follow-up Actions** | -Ensure all precautions were taken during clean-up (for all activities under district control).<br>-Review remediation actions taken by others and identify actual and potential risks to the district and its water supply.<br>-Identify residual chemicals and determine requirements for ongoing remediation (w/ timeframes). |

| Multiple Failures | |
|---|---|
| **Assessment** | -Identify the contributing failures.<br>-Conduct assessment activities for each failure. |
| **Immediate Actions** | -Take actions appropriate for each activity, giving priority to actions that will protect lives, public health, and district facilities.<br>-If necessary, pull in additional resources (people and contractors) to fully implement needed actions. |
| **Notifications** | -As appropriate, notify CDPHE, law enforcement, customers, and others.<br>-Establish communication plan for all relevant parties. |
| **Follow-up Actions** | -Establish plan(s) for correction, remediation, monitoring, and close-out of problems.<br>-Monitor activities until all contributing failures are corrected. |

| Access | |
|---|---|
| **Assessment** | -Determine facilities impacted. |
| **Immediate Actions** | -Identify alternate routes to impacted facilities.<br>-Identify need for debris clearing supplies or equipment needed to help with debris Clearing. This includes safety items/personal protective equipment, chainsaws, and debris earth moving equipment. Minimum **PPE Required: eye protection, gloves, hearing protection, and safety shoes**. |

| | |
|---|---|
| **Identification badges** | -Provide personnel with an official utility ID for access through police barricades or hazmat contaminated zones. Implement identification program for first responders, |
| **Notifications** | -Notify law enforcement and state agencies as appropriate.<br>-If necessary, notify residents. |
| **Follow-up Actions** | -Complete any activities required by law enforcement or state agencies. |

| **Physical Security** | |
|---|---|
| **Access control procedures-** | -Entry alarm system installed, key access, access card or pin entry required to access main office building. Alarm intrusion detection system and key access to facilities in place. |
| **Evidence Protection** | -Cordon area of physical tampering for evidence collection by law enforcement.<br>-Review security cameras for evidence. |
| **Security Culture** | -Report all suspicious activity to the Superintendent. Utilize “See Something, Say Something” when unsure of physical security occurrences. |
| **Follow-up Actions** | -Complete any activities required by law enforcement or state agencies. |

| **Cyber Security** | |
|---|---|
| **Assessment** | -Compromised computers |
| **Immediate Actions** | -If possible, disconnect compromised computers from the network to isolate breached components and prevent further damage, such as the spreading of malware. |
| **Assess procedure** | -Assess any damage to utility systems and equipment, along with disruptions to utility operations. |
| **Notifications** | -Notify Colorado ITC, LLC representative will initiate recovery protocols. |
| **Implementation processes** | -Implement actions to restore operations of mission critical processes (e.g., switch to manual operation if necessary) and provide public notification (if required). |
| **Documentation** | -Document key information on the incident, including any suspicious calls, emails, or messages before or during the incident, damage to utility systems, and steps taken in response to the incident (including dates and times). |

## C. District-External Emergencies

District-External emergencies are beyond the capabilities of CMD to handle. These may include emergencies that originate outside the district.

| Area-wide Emergency or Threat | |
|---|---|
| **Assessment** | -Identify area-wide emergency.<br>-Identify potential impact to district.<br>-Identify district resources that may be applied to the district. |
| **Immediate Actions** | -Contact appropriate emergency response organizations, including CDPHE, Co-Warn, Colorado Springs Police, and/or El Paso County Sherriff.<br>-Hold emergency meeting to identify potential actions. Establish plans, as appropriate. |
| **Notifications** | -If necessary, notify customers. |
| **Follow-up Actions** | -Continue coordination with emergency response organizations.<br>-Implement CMD-specific actions as per plans. |

## D. Returning to Normal Operation

The district will be considered as having returned to normal operations when all facilities are running as normal and when all CMD representatives have returned to performing their regular job functions.

| Action | Description and Actions |
|---|---|
| **Return facilities to normal operations.** | -Bring all facilities back on-line.<br>-Reverse any temporary programming or configurations made to address emergency.<br>-When returning to normal operations, CMD will work with CDPHE and follow all regulatory guidelines, including but not limited to, taking all required samples, following plant start-up procedures and proper notifications. |
| **CDPHE Notifications** | -Notify CDPHE in accordance with CDPHE requirements and consistent with the type of emergency. |
| **Customer Communications** | -Update customers on status of emergency<br>-When appropriate, lift (or let expire) health advisories, conservation orders or other notices. |
| **Other Communications** | -If necessary, update law enforcement, media, and other organizations. |

| | |
|---|---|
| **Conduct "After Action" Review** | -Review emergencies, including cause and actions taken.<br>-Identify and implement changes to procedures, if necessary.<br>-Identify potential system improvements that could prevent or mitigate emergencies or could improve responsiveness in case of emergency.<br>-Depending on cost, implement improvements or incorporate recommendations into Capital Improvement Plan.<br>-Identify additional tools or spares that should be kept on hand. Purchase, if necessary, with authorization of board at next board meeting.<br>-Track and report on all purchases and actions until completed. |

# Section 6. Locations of Keys, Tools & Documents

| Locations of Relevant Keys, Tools & Documents | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Resource** | **District Manager** | **Superintendent** | **Operator in Responsible Charge (ORC, Water and Wastewater)** | **Water Treatment / Distributions Operations Team** | **Wastewater Treatment / Collection Operations Team** | **Distribution / Collections Maintenance Team** | **SCADA Specialist** | **Safety Coordinator** | **Engineering Department District Office** | **Facility Sites** |
| **Keys to District Facilities** | x | x | x | x | x | x | x | x | x | |
| **Tools & Equipment:** | | | | | | | | | | |
| • Water Quality Test Equipment | | | x | x | x | | | | | |
| • Fire Hoses, Backflow Preventer, Meter | | | | x | x | x | | | | |
| • Backhoe, Leak Repair Equipment | | | | | | x | | | | |
| **Documents:** | | | | | | | | | | |
| • Emergency Response Plan | x | x | x | x | x | x | x | x | x | |
| • District Maps | x | x | x | x | x | x | x | x | x | |
| • Site Plans and Facility “As-built” Engineering Drawings | | | | | | | | | x | |
| • Operations & Maintenance Manuals | | x | x | x | x | x | x | x | x | x |
| • Safety Data Sheets (SDS) | | | x | x | x | x | | x | x | x |

# Appendices

## Appendix A. Board Member Contact Information

| Name | Title | Email |
|---|---|---|
| Dan Wall | President | 719-433-1461<br>dan.wall@cherokeemetroboard.org |
| Jeff Bandy | Secretary | jeff.bandy@cherokeemetroboard.org |
| Kim Hale | Treasurer | kim.hale@cherokeemetroboard.org |
| Bonnie Hunter | Director | bonnie.hunter@cherokeemetroboard.org |
| Vacant | Director | |

# Appendix B. Vendor Information

| Service / Repair Vendors | | | |
|---|---|---|---|
| **Service** | **Company** | **Individual Contacts** | **Comments** |
| **Authorized Testing Laboratory** | El Paso County Dept. of Health<br>1675 W. Garden of the Gods Rd., Suite 2044<br>Colorado Springs, CO 80907<br>719-578-3199 | | |
| | Colorado Analytical Laboratories, Inc.<br>www.coloradolab.com<br>Brighton Laboratory<br>240 So. Main St.<br>Brighton, CO 80601<br><br>Lakewood Laboratory<br>12860 W. Cedar Dr. Unit 100A<br>Lakewood, CO 80228 | 303-659-2313<br>303-659-2315 (fax) | |
| | Accutest Laboratories<br>4036 Youngfield Street<br>Wheat Ridge, CO 80033-3862<br>303-425-6021<br>303-425-6854 (fax)<br>www.accutest.com | | |
| | Pueblo City County Health Dept.<br>101 W. 9th Street<br>Pueblo, CO 81003<br>719-583-4300 | | |
| **Excavation** | Chiddix Excavating<br>8030 Industry Rd.<br>Colorado Springs, CO 80939<br>719-550-1810 | | |
| | Pate Construction<br>87 N. Mission Dr.<br>Pueblo, CO 81007<br>719-647-0463 | Erik 719-415-0327 | |
| | Frazee Construction<br>2875 E. Las Vegas St.<br>Colorado Springs, CO 80906<br>719-392-3443 | Jeremy 719-492-8051 | |

| Service / Repair Vendors | | | |
|---|---|---|---|
| **Service** | **Company** | **Individual Contacts** | **Comments** |
| | Kempton Construction<br>3125 Gil Johnson Pt.<br>Colorado Springs, CO 80922<br>719-597-5319 | Brandon 719-237-6761 | |
| | R&R Ditching<br>4145 Netley Grove<br>Colorado Springs, CO 80907<br>719-535-9999 | Sam 719-492-9999 | |
| **Asphalt Repair** | Cusic Construction<br>P.O. Box 5656<br>Colorado Springs, CO 80931<br>719-382-4663 | George 719-491-1261 | |
| **Rental Equipment Supplier** | Wagner Rents<br>990 Meadowbrook Pkwy.<br>Colorado Springs, CO 80915<br>719-309-4570<br>719-635-1669 | | |
| | Blue Line Rental<br>1490 Valley St.<br>Colorado Springs, CO 80915<br>719-574-7368 | | |
| | Bills Tool Rental<br>3455 E. Platte Ave.<br>Colorado Springs, CO 80909<br>719-471-9715 | | |
| | Titan Rental<br>120 N. Troy Hill Rd.<br>Colorado Springs, CO 80916<br>719-596-2924 | | |
| | All Rental Center<br>4780 Austin Bluffs Pkwy.<br>Colorado Springs, CO 80918<br>719-599-5118 | | |
| **Parts Supplier** | Colorado Springs Win Water<br>7821 Red Granite Loop<br>Colorado Springs, CO 80939 | Howie 719-572-0800<br>Emergency 719-641-9430 | Back flow devices |
| | HD Supply<br>2050 Reliable Cir.<br>Colorado Springs, CO 80906 | | |
| | Dana Kepner<br>640 Aviation Way<br>Colorado Springs, CO 80916<br>719-578-8733 | After Hours<br>719-499-0542 | |
| | Rampart Supply<br>1801 N. Union Blvd.<br>Colorado Springs, CO 80909<br>719-574-5074 | | |

| Service / Repair Vendors | | | |
|---|---|---|---|
| **Service** | **Company** | **Individual Contacts** | **Comments** |
| **Traffic Control** | Midwest Barricade<br>2760 Delta Dr.<br>Colorado Springs, CO 80910<br>719-392-3461 | Steve cell<br>719-229-7603 | |
| | Altus Traffic<br>957 Salida Way<br>Aurora, CO 80011<br>720-343-2335 | | |
| | National Trench Safety<br>3293 Oakland Street<br>Denver, CO 80010<br>303-341-4498<br>303-341-4773 (fax) | | |
| **Vehicle** | Towing<br>Springs Auto<br>719-382-0363 | Terry | |
| | Vehicle Repair<br>Bowers<br>719-596-4818 | | |
| **Wells & Piping Systems** | Hamacher Well Works, Inc.<br>31800 Hwy 24<br>P.O. Box 86<br>Simla, CO 80835 | Allen Hamacher<br>719-541-2460 | |
| | Colorado Pump Service & Supply<br>511 S. Gilbert St., Unit C<br>Castle Rock, CO 80104 | 303-688-6462 | |
| | Kunau Drilling<br>23945 Lucky Lane<br>Calhan, CO 80808 | 719-683-3720 | |
| **Meters & Meter Services** | National Meter & Automation, Inc.<br>7220 S. Fraser St.<br>Centennial, CO 80112<br>877 212-8340<br>303-339-9100<br>303-649-1017 (fax) | | Badger back flow devices<br><br>Leak detection service<br><br>Itron and Mini Mobile |
| **Chemical Supplier** | DPC Industries<br>Hudson, CO<br>303-536-4000<br>303-536-4004 (fax) | | Liquid sodium hypochlorite<br>Ellicott Springs |
| | Applied Products Groups<br>23623 N. Scottsdale Rd.,<br>Suite D-3270<br>Scottsdale, AZ 85255<br>480-595-9739<br>480-595-1633 (fax) | Devry Faddis<br>602-538-0127<br>dfaddis@apgwater.com | Calcium hypochlorite<br>Sundance and 048 |

| Service / Repair Vendors | | | |
|---|---|---|---|
| **Service** | **Company** | **Individual Contacts** | **Comments** |
| | Brenntag | Jason Yarbro<br>(o)303-427-2727<br>(fax) 303-427-2091<br>Brenntag.com | |
| | DEWCO<br>1841 Wadsworth Blvd<br>Lakewood, CO 80214<br>303 232-6861<br>303 232-3472 (fax) | Don Taylor<br>(c) 719-330-7764<br>dtaylor@dewcopumps.com | Sundance SeaQuest sequestration agent |
| | US Welding, Inc.<br>1165 Valley St.<br>Colorado Springs, CO 80915 | Ben Williams<br>719-574-8600 | Chlorine cylinders 192 |
| **Leak Detection & Locate Service** | American Leak Detection<br>Southern Colorado Offices<br>6510 A S. Academy Blvd. #302<br>Colorado Springs, CO 80906<br>719-520-5325<br>www.americanleakdetection.com | | Also see National Meter & Automation, Inc. under Meters & Meter Services |
| **Line Locators<br>Metal Locators** | Intermountain Sales<br>3792 S. Lipan St.<br>Englewood, CO 80110<br>303-762-1070<br>800-373-3212 | | |
| **Location Flags, Paint, Whiskers** | Blackburn Mfg. Co.<br>PO Box 86<br>Neligh, NE 68756<br>800-942-5816 | | |
| **Diesel Fuel** | Chief Petroleum<br>301 S. 10th St.<br>Colorado Springs, CO 80904<br>719-473-7760 | | |
| **Chemical Feed Equipment** | Flowmotion Systems Inc.<br>800-909-3569<br>716-691-3941<br>www.flowmotionsystems.com | | Sundance calcium hypochlorite feed system |
| | Hammonds Technical Services Inc.<br>15760 W. Hardy, Suite 400<br>Houston, TX 77060<br>281-999-2900<br>281-847-1857 (fax)<br>800-582-4224 | | 048 Calcium hypochlorite feed system |
| | Municipal Treatment Equipment Inc.<br>17301 W. Colfax Ave., #105<br>Golden, CO 80401<br>303-231-9175 | | 192 Chlorinator |

## Service / Repair Vendors

| Service | Company | Individual Contacts | Comments |
|---|---|---|---|
| | DEWCO<br>1841 Wadsworth Blvd<br>Lakewood, CO 80214<br>303-232-6861<br>303-232-3472 (fax) | Don Taylor<br>Cell 719-330-7764<br>dtaylorAdewcopumps.com | LMI parts and supplies |
| **SCADA & Control** | TLECC<br>Timber Line Electric and Control Corp.<br>Morrison, CO 80465<br>303-697-0440<br>www.tlecc.net | | |
| **Information Technology (IT)** | Colorado ITC LLC | Josh List | IT Specialist |
| **Control Valves & PRV's** | ISI West<br>4175 Mulligan Dr.<br>Longmont, CO 80504<br>970-535-0571<br>970-535-0572 (fax) | Barb | |
| **Electric Motors** | Wazee Electric<br>4850 Moline St.<br>Denver, CO 80239<br>303 623-8658<br>800-299-8658<br>303-623-2097 (fax) | Clint 303-815-0388 | |
| | Colorado Electric Motor Repair<br>316 Juanita Street<br>Colorado Springs, CO 80909<br>719-473-7744 | | |
| **Pump Repair** | Layne Christensen Company<br>17800 E. 22nd Ave<br>Aurora, CO 80011<br>303-755-1281<br>303-755-1236 (fax)<br>www.layne.com | Brian W. Dellett | |
| | Colorado Pump Service & Supply<br>511 S. Gilbert St., Unit C<br>Castle Rock, CO 80104<br>303-688-6462 | | |
| | Kunau Drilling<br>23945 Lucky Lane<br>Calhan, CO 80808<br>719-683-3720 | | |
| **Crane** | Don's Crane Service<br>719-421-9178 | | |
| **Portable Restroom Rental** | United Site Services | 800-864-5387 | |
| | 24 Hr. Toilet Rental | 719-387-7280 | |

| Service / Repair Vendors | | | |
|---|---|---|---|
| **Service** | **Company** | **Individual Contacts** | **Comments** |
| | S&B Porta-Bowl Restrooms | 888-812-3059 | |

# Appendix C. Key and Access Information

**KEYS:**

The district uses multiple codes, keys to access all the gates and doors at the tanks, pump stations, and wells to list them all separately.

**DOOR, GATE, TANK ACCESS AND ALARM CODES:**

Contact ORCs, and District Personnel.

**Exhibit B – Water Supply Reports**

# CHEROKEE METROPOLITAN DISTRICT

**6250 Palmer Park Blvd., Colorado Springs, CO 80915-2842**
**Telephone: (719) 597-5080 Fax: (719) 597-5145**


## Water Provider's Usage Report

January 20, 2026

This document was prepared to satisfy the requirements of El Paso County for a Water Provider's Report in support of developments from Cherokee Metropolitan District. All data sheets in support of the production of this report available upon request.

Bottom Line Up Front: Cherokee Metropolitan District (CMD) has 4,397.2 AFY of exportable supply and 4162.3 AFY of current commitments issued, decreed and/or contracted for. CMD has a water balance of 234.9 AFY of available commitments for new developments.

## Introduction

Cherokee Metropolitan District (CMD) is a Title 32 special District which provides water and wastewater to an approximately 5000-acre enclave of unincorporated El Paso County surrounded by the City of Colorado Springs. Currently CMD serves approximately 8000 residential customers and 650 commercial customers in addition to bulk users in eastern El Paso County including Schriever Space Force Base.

CMD water is sourced entirely from groundwater in two regions. The majority is withdrawn from the alluvial Upper Black Squirrel (UBS) Aquifer in eastern El Paso County through 22 wells. The remainder is sourced from two wells in deep Denver Basin bedrock aquifers in the northern part of the county on the "Sundance Ranch" property. Water from eight of the 22 wells in the eastern part of the county can only be used to serve a fixed set of customers. Water for the main service area of CMD comes only from the remaining 14 wells in UBS along with the two Denver Basin wells in Black Forest on the "Sundance Ranch" property.

## Water Supplies

Of Cherokee's 23 wells, eight wells (wells 1 – 8) are restricted to serving a maximum of 653 AFY to specified in-basin customers as ordered by Colorado Ground Water Commission, case No. 15-GW-15 as outlined in Table 1. Excess allocation for these wells is unavailable for new developments, even if they are inside the Basin, so this water is tracked separately from CMD's general supply portfolio. CMD's other alluvial wells and Denver Basin wells are

available for export outside the UBS basin. The total annual volume available to CMD from these exportable supplies is 4397.2 AFY (Table 2). The physical yield of these wells is significantly lower than their annual appropriation, allowing flexibility in satisfying summer peak demand.

**Table 1:** In-Basin, non-exportable commitments:

| **Commitment Name** | **Maximum Annual Allotment, AF/YR** | **5-YR Average Production (2020 - 2024) from Wells 1–8, AF/YR** |
|---|---|---|
| Woodmen Hills Metro District | 350 | 322.4 |
| Harding Nursery* | 180 | 163.7 |
| Ellicott Springs Village | 60 | 12.6 |
| Antelope Acre | 50 | 24.5 |
| Ellicott School District | 10 | 5.6 |
| Diamond Moon Ranch | 2 | 2.7 |
| El Paso County Telephone | 1 | 0.01 |
| Total | 653 | 531.6 |

**Table 2:** Water rights and tributary status of Exportable Wells

| **Well Number** | **Water Right, AFY & (5-YR AVG)** | **Permit Number** | **Aquifer** | **Aquifer Status** |
|---|---|---|---|---|
| Well 9 | 176 (168.2) | 14145-FP-R | UBS Alluvium | Tributary |
| Well 10 | 176 (160.3) | 14146-FP-R | UBS Alluvium | Tributary |
| Well 11 | 244 (175.5) | 6821-FP-R | UBS Alluvium | Tributary |
| Well 12 | 244 (156.3) | 11198-FP | UBS Alluvium | Tributary |
| Well 13, SW1 | 1268 (1004.1) | 49988-F | UBS Alluvium | Tributary |
| Well 14, SW9 | 0 (0) | 52429-F | UBS Alluvium | Tributary |
| **Well 15*,SW8** | 281 (83.2) | 54070-F | UBS Alluvium | Tributary |
| **Well 16*,SW3** | 219 (79) | 54069-F | UBS Alluvium | Tributary |
| **Well 17*,SW11** | 175 (44.2) | 63094-F | UBS Alluvium | Tributary |
| Well 18 | 225 (203.8) | 16253-RFP-R | UBS Alluvium | Tributary |
| Well 19 | 95 (53.2) | 20567-RFP-R | UBS Alluvium | Tributary |
| Well 20 | 400 (107.6) | 4332-RFP | UBS Alluvium | Tributary |

| | | | | | |
|---|---|---|---|---|---|
| Well 21 | 258.5 | (125.8) | 81782-F | UBS Alluvium | Tributary |
| Well 22, Albrecht | 153.5 | (0) | 27571-FP | UBS Alluvium | Tributary |
| Well23, Poleson | 72 | (0) | 11691-FP | UBS Alluvium | Tributary |
| **DN-4**** | 328.5 | (50.9) | 78315-F | **Denver** | **Non-Tributary** |
| **AR-1**** | 147.7 | (178) | 75881-F | **Arapahoe** | **Non-Tributary** |
| **Total** | **4397.2** | **(2590.1)** | | | |

*Wells 15-17 can produce a total of 609 AFY instead of their individual summed total of 675 AFY as Decreed from Water Division 2 District Court under Case No. 05CW06/05CW20 (Consolidated). This limitation is reflected in 4397.2 AFY total available production.

**CMD holds additional water rights and well sites in the Dawson, Denver, and Arapahoe Aquifers associated with the Sundance Ranch property. The volume presented is the reliable annual yield of each well.

## Water Commitments

**Table 3:** CMD Commitments before addition of new development

| Commitment Category | Volume (AFY) |
|---|---|
| In-District pre 2015 commitments * | 2693 |
| Committed since 2015** | 563 |
| Schriever Space Force Base*** | 537.5 |
| Mayberry Communities **** | 82 |
| Construction ***** | 25 |
| Parks ***** | 25 |
| **Total Commitments** | **3925.5** |

* Number is based off 2020 water supply report “In-District” number.
** This number is taken from all water commitments that have been filed in the El Paso County’s Electronic Development Application Review Program (EDARP) since January 2016 to the effective date of this report being submitted.
*** December 1985 Executed Contract with Department of The Army, titled “DACA45-83-C-0092”. Amount based off maximum daily demand estimate of 0.48 MGD
**** Agreement quantity between CMD and Mayberry Metropolitan District
***** Parks and Construction is a conservatively high number to account for park maintenance and developers using meter & hose assemblies for water when performing construction within the District.

## Water Balance

With 4,397.2 AFY of exportable supply and 3925.5 AFY of commitments, CMD has a water balance of 471.7 AFY of available commitments. Note that from Tables 1 and 2 the current Total available water rights vs average usage is as Table 4 outlines:

**Table 4:** Commitments compared to actual annual water production

| Non-Exportable Total | Exportable Total | Total Water Available | 5-YR Average Use |
|---|---|---|---|
| 653 Acre-ft | 4397.2 Acre-ft | 5050.2 Acre-ft | 3121.6 Acre-ft |

## Other Relevant Information

### Recent Water Acquisitions/Losses

CMD has acquired new water rights on 16 October 2024 under "Replacement Plan", Ground Water Commission Case No. 08GW71. In short, this allows the district to pull water additional water consistent with the amount of treated collected water through our Water Reclamation Facility (WRF) that then gets reintroduced into the UBS aquifer through our Rapid Infiltration Basins (RIBs). Test well drilling and well log reports are being produced to be used to design and construct three wells to utilize Replacement Plan water. Those three wells are scheduled to be brought into the system in 2027 (Table 4). CMD has not engaged in any water trades nor lost any water rights in the last 5 years. The District is not currently under contract to purchase new water rights.

**Table 5:** Replacement Plan Wells for Phase 1 build-out

| Well Number | Water Right, AFY | Aquifer | Aquifer Status |
|---|---|---|---|
| RPW 6 | Combined; up to 2118.4 Acre-ft in Phase 1. 2025 will be first full year eligible return credits | UBS Alluvium | Tributary |
| RPW 7 | | UBS Alluvium | Tributary |
| RPW 8 | | UBS Alluvium | Tributary |

CMD is currently pursuing the replacement plan in partnership with Meridian Service Metropolitan District (MSMD) to maximize the efficiency of its water supplies based on return recharge credits from the “Replacement Plan”.

**Major Water System Capital Improvements**

CMD has been actualizing owned water by drilling wells and beginning production on several well sites. The District will complete construction of the Albrecht Well (Well 22) in February 2026 and will bring the Poleson Well (Well 23) into the system in 2027. The District will also have completed the construction of three Replacement Plan Wells, No. 6, 7 & 8 and bring into the supply system by 2027.

Smaller-scale improvements to the distribution system to improve reliability and resiliency have been ongoing and include deeper computer integration, upgrades to treatment systems, rehabilitation of tanks, and emergency generator refurbishment.

Further development in the Denver Basin is not planned currently and instead CMD is focusing on constructing new wells in the Upper Black Squirrel Basin and gaining water credits through reintroduction of collected water into our Rapid Infiltration Basin as dictated by the Replacement Plan.

CMD has begun the design of a Water Treatment Facility that’s purpose is to remove PFAs from the Upper Black Squirrel Basin’s wells.




# Cherokee Metropolitan District Water Resources Report

## Prepared for the Colorado Division of Water Resources

December 2020

**Table of Contents**

1 Introduction ..... 2
2 Current Water Supplies ..... 4
2.1: CMD Wells 1-8 (In-Basin Use) ..... 4
2.2: CMD Wells 9-20 (In-District Use) ..... 5
2.3: Cherokee Water LLC ..... 7
2.4: Denver Basin Wells ..... 7
2.5: Nonpotable Irrigation Wells ..... 9
2.6: Water Supply Summary ..... 10
3 Commitments ..... 11
3.1: In-Basin Commitments ..... 11
3.2: Out of Basin Commitments ..... 11
3.3: Schriever Air Force Base ..... 13
3.4: Other Commitments Including Golf Course Irrigation ..... 14
3.5: Commitment Summary ..... 14
4 Water Balance ..... 15
4.1: Overview ..... 15
4.2: Per Capita Water Demand ..... 16
4.3: Future Water Supply Development ..... 17
4.4: Undeveloped and Other Future Supplies ..... 18
4.5: Future Demand ..... 18
4.6: Future Water Balance ..... 18
5 Conclusion ..... 19

**Table of Figures**

**Figure 1-1:** Cherokee Metropolitan District map with important regions highlighted ..... 3
**Figure 2-1:** CMD Upper Black Squirrel Creek Wells ..... 6
**Figure 2-2:** Denver Basin wells ..... 8
**Figure 4-1:** Single family water use since 2009 ..... 16

**Table of Tables**

**Table 2-1:** CMD Wells 1-8 ..... 4
**Table 2-2:** CMD Wells 9-20 ..... 5
**Table 2-3:** Cherokee LLC Water Rights ..... 7
**Table 2-4:** Denver Basin water rights held by CMD ..... 8
**Table 2-5:** Nonpotable Irrigation Wells ..... 10
**Table 2-6:** Categorical summary of water rights and 2018 production ..... 10
**Table 3-1:** In-Basin user commitments and demand in 2011 and 2018, in acre-feet per year .... 11
**Table 3-2:** Annual regular in-District use by category ..... 11
**Table 3-3:** In-District commitments since the 2016 Report ..... 12
**Table 3-4:** Schriever Air Force Base use in 2011 and 2018 ..... 14
**Table 3-5:** Commitments Summary ..... 14
**Table 4-1:** CMD In-District Water Balance ..... 15
**Table 4-2:** Single Family and Multi Family ..... 16
**Table 4-3:** Water supply development projects slated for construction or upgrade by 2021 ..... 17
**Table 4-4:** Undeveloped CMD Water Rights ..... 18

**Table of Appendices**

Appendix A: CMD Well Production 2010-2019
Appendix B: CMD User Demand 2011-2019
Appendix C: 2016 Report
Appendix D: In-Basin Wells 15GW15
Appendix E: Wells 9-12 90GW05
Appendix F: Wells 13-17, 21 05CW06
Appendix G: Well 18 Documents
Appendix H: Well 19 Documents
Appendix I: Well 20 Final Decree
Appendix J: Albrecht Well Final Decree
Appendix K: Sundance Augmentation Plan

**Summary**

This report serves to update to the Colorado Division of Water Resources (DWR) on the water supplies and commitments of Cherokee Metropolitan District (CMD). It is an update and refinement of the Technical Memorandum prepared by Forsgren Associates (2016 Report, Appendix C) which was submitted to DWR on May 18, 2016, and which DWR approved on June 10, 2016. In this report, the supply plan detailed in the 2016 Report has been revised and updated with a greater focus on development of renewable Upper Black Squirrel Creek groundwater rather than nonrenewable Denver Basin groundwater. New water acquisitions have allowed CMD to increase the water supply surplus presented in the previous report, and CMD's water supply planning provides a sustainable path to complete buildout of CMD.

# 1 Introduction

CMD is located in unincorporated El Paso County immediately east of the City of Colorado Springs. CMD provides water and sewer service to over 8,000 residential and commercial accounts, representing approximately 20,000 residents and 500 businesses. CMD's water supply is entirely sourced from groundwater including the alluvial aquifer in the Upper Black Squirrel Creek Designated Groundwater Basin (UBS Basin), the Denver Basin aquifers, and the Sand Creek alluvium (Figure 1-1).

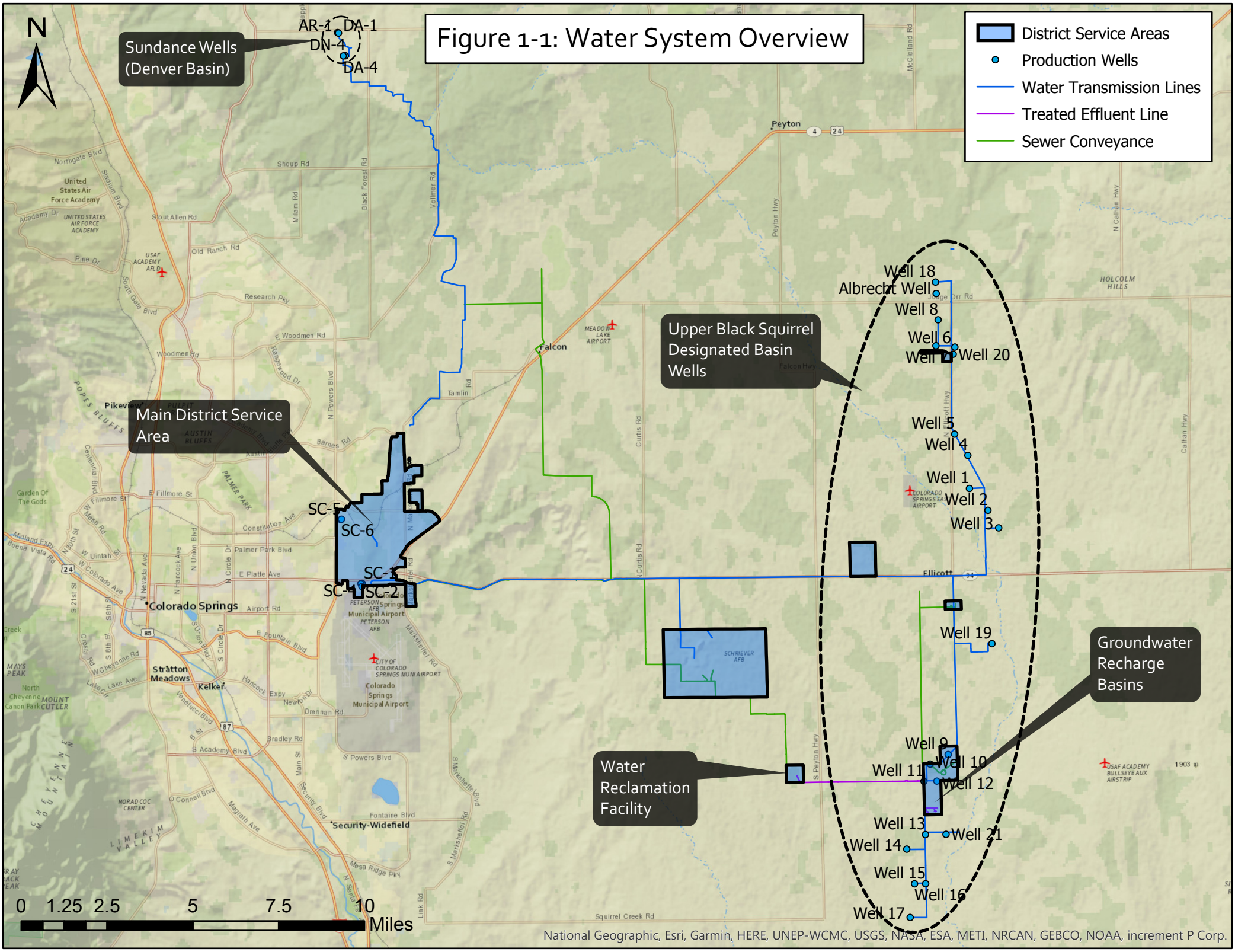
CMD's water supply portfolio is comprised of water rights and contractual interests totaling 5096 acre-feet per year (AFY) of water. The sources of CMD's water supply sources fall into five categories:

1. CMD Wells 1-8 (Use within UBS Basin)
2. CMD Wells 9-21 (Exportable to CMD)
3. Cherokee Water LLC
4. Black Forest Wells (Denver Basin Ground Water)
5. Sand Creek Wells (Golf Course Irrigation)

CMD's peak year total demand, to date, was 3040 AFY in 2011. These commitments and obligations fall into five categories:

1. In-Basin Use (CMD Wells 1-8)
2. In-District Use (Exportable Supplies, Black Forest Wells, and Cherokee Water LLC)
3. Bulk Customers (Schriever Air Force Base)
4. Non-Potable Irrigation (Sand Creek Wells)
5. Other (Parks Irrigation, Construction, etc.)

Throughout this report, the years of 2011 and 2018 are used as baseline years for production and consumption, respectively. CMD's highest per capita demand on record occurred in 2011 due to dry conditions and a different rate structure so it is a useful benchmark for peak demand. However, CMD's 2011 demand was partially satisfied by an interim water supply agreement between CMD and Colorado Springs Utilities, so 2011 is not the highest period of production for CMD's current water rights portfolio. 2018 is the highest annual production from CMD groundwater rights on record, so this year is a more useful benchmark for comparisons and analyses related to well production.


Figure 1-1: Water System Overview
N
Sundance Wells (Denver Basin)
AR-1
DA-1
DN-4
DA-4
District Service Areas
Production Wells
Water Transmission Lines
Treated Effluent Line
Sewer Conveyance
Upper Black Squirrel Designated Basin Wells
Main District Service Area
Groundwater Recharge Basins
Water Reclamation Facility
Well 18
Albrecht Well
Well 8
Well 6
Well 7
Well 20
Well 5
Well 4
Well 1
Well 2
Well 3
Well 19
Well 9
Well 10
Well 11
Well 12
Well 13
Well 21
Well 14
Well 15
Well 16
Well 17
SC-5
SC-6
SC-1
SC-4
SC-2
Peyton
Falcon
Ellicott
Colorado Springs
Stratton Meadows
Kelker
Security-Widefield
Fontaine Blvd
Squirrel Creek Rd
Mesa Ridge Pky
Drennan Rd
Bradley Rd
Airport Rd
Constitution Ave
Woodmen Rd
Barnes Rd
Shoup Rd
Old Ranch Rd
Research Pky
Tamlin Rd
Curtis Rd
Peyton Hwy
Falcon Hwy
Ellicott Hwy
Calhan Hwy
Marksheffel Rd
Powers Blvd
Palmer Park Blvd
E Platte Ave
Fountain Blvd
Hancock Expy
Academy Blvd
Security Blvd
Main St
Union Blvd
Circle Dr
Nevada Ave
Tejon St
Cascade Ave
Uintah St
Colorado Ave
Fillmore St
Garden Of The Gods
Pikeview
Austin Bluffs
Pope's Bluffs
Palmer Park
United States Air Force Academy
USAF Academy AFLD
Meadow Lake Airport
Colorado Springs Municipal Airport
Peterson AFB
Schriever AFB
Colorado Springs Municipal Airport
City of Colorado Springs Muni Airport
Colorado Springs East Airport
USAF Academy Bullseye Aux Airstrip
NORAD COC Center
Holcolm Hills
Limekiln Valley
Mount Cutler
North Cheyenne Canon Park
Mays Peak
Ray Peak
Black Forest Rd
Vollmer Rd
Miami Rd
McClelland Rd
N Calhan Hwy
Link Rd
1903 m
0 1.25 2.5 5 7.5 10
Miles
National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

# 2 Current Water Supplies

### 2.1: CMD Wells 1-8 (In-Basin Use)

CMD Wells 1-8 produce groundwater from the UBS Basin alluvial aquifer. Pursuant to a 1999 stipulation with the State and the Upper Black Squirrel Ground Water Management District in Case No. 98CW80, CMD Wells 1-8 can only be used within the legal boundaries of the UBS Designated Basin. In Case No. 15GW15, these wells' annual production was limited to the total annual demand of a fixed list of in-basin customers to a maximum of 653 AFY. As a result, in-basin supplies and demands are tracked separately from all other sources and commitments (Table 1-1). The combined 2018 water demand of in-Basin customers was 456 AFY, 70% of their total commitment.

**Table 2-1:** CMD Wells 1-8

| Well Number | 2018 Production (AFY) |
|---|---|
| Well 1 | 1.1 |
| Well 2 | 4.5 |
| Well 3 | 0.0 |
| Well 4 | 40.7 |
| Well 5 | 88.3 |
| Well 6 | 57.4 |
| Well 7 | 47.1 |
| Well 8 | 216.9 |
| **Total** | **455.9** |

### 2.2: CMD Wells 9-20 (In-District Use)

CMD Wells 9-20 provide 88% of In-District, Out-of-Basin water supplies. These wells are spread across 20 miles of the UBS Basin (Figure 2-1, Table 2-2). Water levels and physical production rates form these wells have remained stable or improved over the last 10 years.

**Table 2-2:** CMD Wells 9-20

| Well Number | 2018 Production (AFY) | Water Right (AFY) | Remainder (AFY) (Production – Water Right) | Percent Used (Production / Water Right) x 100 |
|---|---|---|---|---|
| Well 9 | 174.5 | 176 | 1.5 | 99% |
| Well 10 | 167.1 | 176 | 8.9 | 95% |
| Well 11 | 229.4 | 244 | 14.6 | 94% |
| Well 12 | 214.6 | 244 | 29.4 | 88% |
| Well 13 | 809.3 | 1268 | 458.7 | 64% |
| Well 14* | 0.0 | 0 | 0.0 | 0% |
| Well 15** | 81.1 | 281 | 199.9 | 29% |
| Well 16** | 87.6 | 219 | 131.4 | 40% |
| Well 17** | 102.6 | 175 | 72.4 | 59% |
| Well 18 | 144.4 | 225 | 80.6 | 64% |
| Well 19 | 60.5 | 95 | 34.5 | 64% |
| Well 20 | 186.1 | 400 | 213.9 | 47% |
| **Total** | **2257.1** | **3437** | **1245.9** | **64% (of total)** |

*Well 14 has been permanently decommissioned and the water right has been abandoned

**Wells 15-17 can produce a collective total of 609 acre-feet per year. This limit is reflected in the total of all water rights (3,437 AFY).

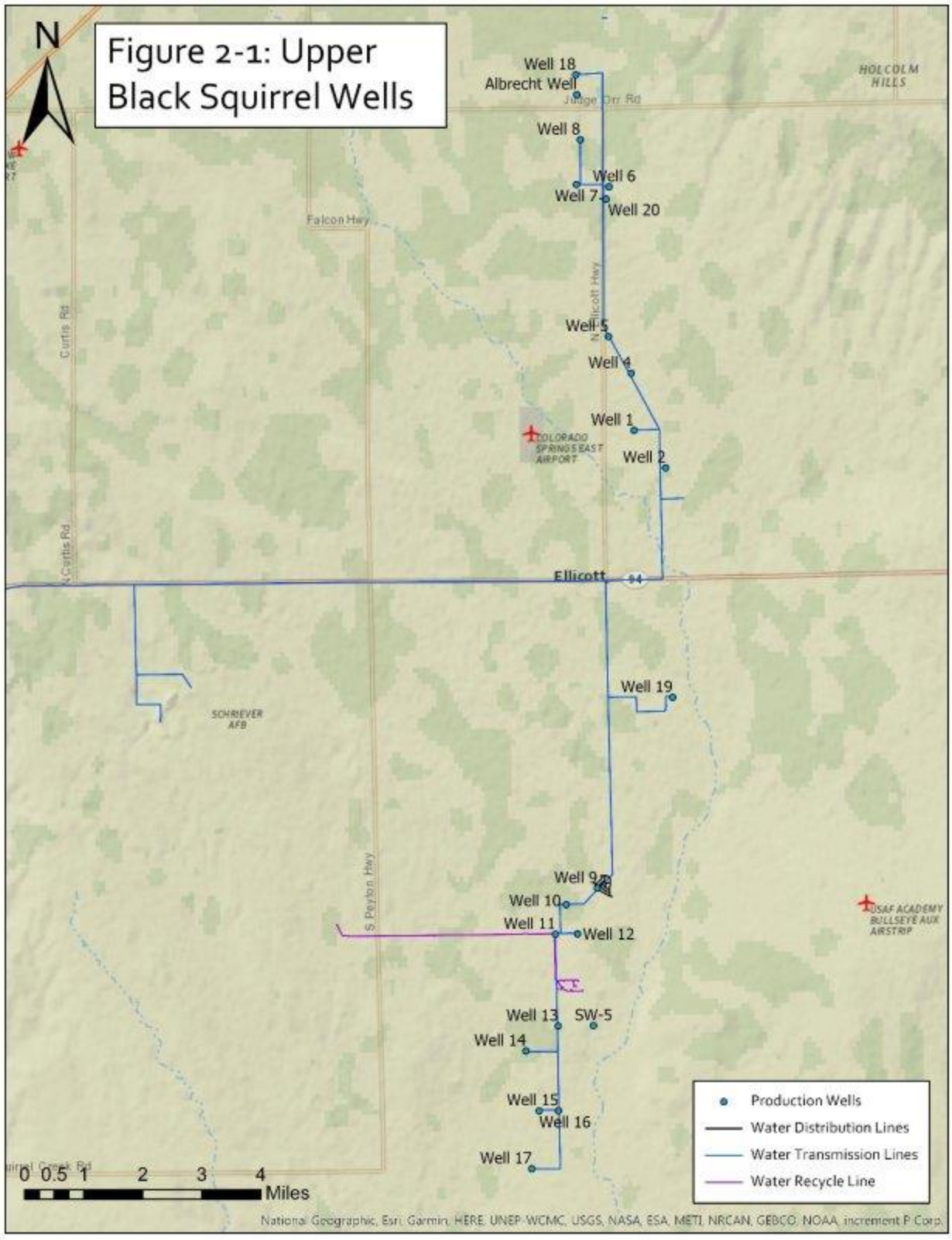



**Figure 2-1:** CMD Upper Black Squirrel Creek Wells

### 2.3: Cherokee Water LLC

In 2006, Cherokee Water LLC was formed by CMD and several developers to enable CMD to develop new infrastructure and serve demand from certain proposed developments. Cherokee Water LLC holds title to two water rights that are dedicated to serve specified commitments. The Tipton Right is a permitted right to withdraw up to 225 acre-feet per year from the District's Well 18 in the UBS Basin alluvial aquifer for export and use in CMD. The Kane Right is a contractual water right to the first 200 AFY produced from the collective Sweetwater absolute and conditional rights. DWR's opinion is that the Kane Right does not allow an increase in the production from the Sweetwater points of diversion (Case Nos. 05CW06/05CW20 and 88CW49) or drilling a new point of diversion. Therefore, the actual production for this water right is listed as zero because the commitments associated with this right are supplied from CMD's other Sweetwater rights.

The water rights held by the LLC are reserved for developments on specified areas of land within CMD. Like the in-Basin use of CMD Wells 1-8, this water is tracked separately from CMD's other supplies. Though several of the specified developments have not achieved full buildout as of 2020, CMD considers the full amount of water held by the LLC to be fully committed, and it is not available to other customers or new developments. Water for developments on land specified in the LLC agreements comes from this already-committed volume, and therefore commitments to these developments do not reduce water availability in the general portfolio. However, if a specified development exceeds the amount of water purchased under the original agreements, then the additional water may be supplied from CMD's general portfolio.

**Table 2-3:** Cherokee LLC Water Rights

| Category | Water Rights (AFY) | Commitments (AFY) | Remainder (AFY) |
|---|---|---|---|
| LLC Kane Right | 0 | 200 | -200 |
| LLC Tipton Right | 225 | 225 | 0 |

### 2.4: Denver Basin Wells

CMD owns Denver Basin groundwater rights under four parcels of land near the Douglas-El Paso County line (Figure 2-3, Table 2-3). To date, CMD has completed one Denver Aquifer well (DN-4) and one Arapahoe Aquifer well (AR-1) to withdraw these ground water rights. CMD operates a water treatment plant and pump system at the Sundance Ranch at the center of these properties. CMD's water rights for this well field include both nontributary and not-nontributary ground water located outside of a designated basin. An augmentation plan for replacement of depletions associated with withdrawals of not-nontributary water was approved in Case No. 14CW3061 on October 2, 2017. Due to the non-renewable nature of Denver Basin groundwater, CMD plans to use this water source as a bridge supply while developing and acquiring new renewable sources. Once the renewable sources have been developed, CMD plans to use this water as a drought protection supply.

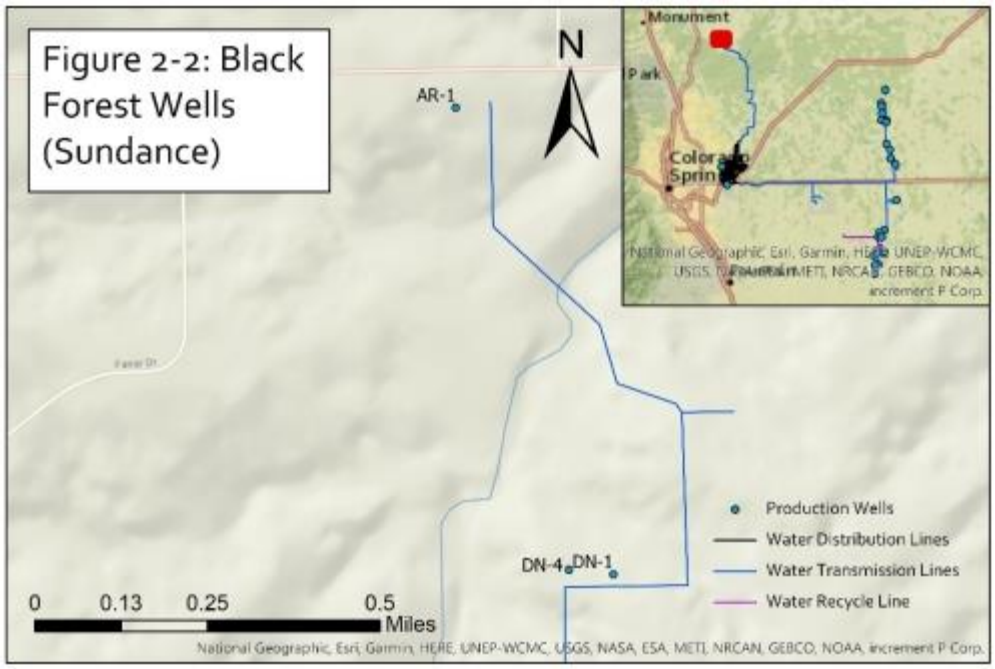



**Figure 2-2:** Denver Basin wells

**Table 2-4:** Denver Basin water rights held by CMD. Water rights listed without well numbers do not yet have a well permit.

| CMD Well Name/Location | CMD Abbr. | Permit # | Case/ Decree Number | Status | Augmentation Status | Water Right (AFY) | 2018 Production |
|---|---|---|---|---|---|---|---|
| **Sundance** | | | | | | | |
| Arapahoe | AR-1 | 84421-F | 99CW126 | Active | NT | 427.7 | 227.4 |
| Denver 1 | DN-1 | 75882-F | | Not Drilled | NT | 328.5 | 0 |
| Denver 2 | DN-4 | 78315-F | | Active | NT | | 83.3 |
| Denver 3 | | | | | NT | | 0 |
| Dawson 1 | DA-1 | 83604-F | | Drilled, Inactive | NNT | 361.3 | 0 |
| Dawson 2 | DA-4 | 83603-F | | Drilled, Inactive | NNT | | 0 |
| Laramie-Fox Hills | | | | | NT | | 0 |
| **Shamrock East** | | | | | | | |
| Arapahoe | | | 94CW023 | | NT | 0* | 0 |
| Denver 1 | | | | | NT | 600 | 0 |
| Denver 2 | | | | | NT | | 0 |
| Denver 3 | | | | | NT | | 0 |
| Denver 4 | | | | | NT | | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Denver 5 | | | | | NT | | 0 |
| Dawson | | | | | NNT | 591 | 0 |
| Laramie-Fox Hills | | | | | NT | 210 | 0 |
| **Shiloh** | | | | | | | |
| Arapahoe | | | | | NT | 220.3 | 0 |
| Denver 1 | | | | | NT | | 0 |
| Denver 2 | | | | | NT | 350.9 | 0 |
| Denver 3 | | | 96CW125 | | NT | | 0 |
| Denver 4 | | | | | NT | | 0 |
| Dawson | | | | | NNT | 423.6 | 0 |
| Laramie-Fox Hills | | | | | NT | 136.8 | 0 |
| **County Line** | | | | | | | |
| Arapahoe | | | | | NT | 143 | 0 |
| Denver 1 | | | | | NT | 209 | 0 |
| Denver 2 | | | 96CW110, 96CW169 | | NT | | 0 |
| Dawson | | | | | NNT | 261 | 0 |
| Laramie-Fox Hills | | | | | NT | 90 | 0 |
| | | | | | | | |
| **Total:** | | | | | | **4353.1** | **310.7** |

*Shamrock Ranch Arapahoe Aquifer rights were combined with the Sundance Arapahoe rights as well permit 84421-F as of June 19th, 2020

The Sundance rights include banked water that began accumulating on the final decree date of Case No. 99CW126 in July of 2000. CMD currently has just over 2,000 AF of banked water in the Arapahoe aquifer, which allows for production above yearly allocations. DWR recently approved a consolidation of this well permit that allows CMD to withdraw the Arapahoe aquifer water rights associated with underlying the adjacent Shamrock East parcel in addition to the Arapahoe aquifer water underlying the Sundance property. This allows for increased production from the Sundance Arapahoe pump well without drawing down banked water reserves.

### 2.5: Nonpotable Irrigation Wells

Two golf courses are located within CMD boundaries and are served by two separate, non-potable systems drawing tributary water from six wells, Sand Creek Wells 1-8, in the Sand Creek Alluvium (Table 2-4). The use of these wells is designated to irrigation of the two golf courses only and any out of priority depletions are replaced pursuant to the augmentation plan approved in Case No. 09CW115. The production from these wells has been stable over the last decade and is not expected to change.

**Table 2-5:** Nonpotable Irrigation Wells

| | Permit # | Decree | Allocation | WY 2019 Use |
|---|---|---|---|---|
| SC-1 | 31777-F | 09CW115 | 125 | 15.0 |
| SC-2 | 30957-F | 09CW115 | 125 | 1.6 |
| SC-3 | 30956-F | 09CW115 | 125 | 17.4 |
| SC-4 | 30955-F | 09CW115 | 125 | 0.0 |
| SC-5 | 67221-F | 09CW115 | 322 | 115.3 |
| SC-6 | 76859-F | 09CW115 | 322 | 61.6 |
| **Total** | | | **1144** | **210.9** |

### 2.6: Water Supply Summary

CMD holds an array of groundwater resources in El Paso County that provide consistent production of high quality water that remains stable during regional drought. The district's widely spread wells allow for uninterrupted service in the event of electrical or mechanical failures at single or multiple wells.

**Table 2-6:** Categorical summary of water rights and 2018 production

| Category | Water Rights (AFY) | 2018 Production (AFY) |
|---|---|---|
| CMD Wells 1-8* | 653 | 456 |
| CMD Wells 9-17, 19, 20 | 3212 | 2113 |
| Developed Denver Basin** | 337 | 311 |
| LLC Kane Right | 0 | 0 |
| LLC Tipton Right (Well 18) | 225 | 144 |
| **Total** | **4427** | **3024** |

*Pursuant to the order in Case No. 15GW15, water from Wells 1-8 in excess of demand is not available to new developments, even if they are in-Basin.

**Total of the highest annual production of each Denver Basin well (Section 2.4). More water rights are available in these aquifers but current production is physically limited to the amount shown here.

# 3 Commitments

Because CMD Wells 1-8 are restricted to in-Basin use only, CMD generally tracks its customer demand as in-Basin and in-District (out-of-Basin). Schriever Air Force Base is tracked separately as well because it is geographically outside the main district service area but must be served with out-of-Basin, in-District water.

### 3.1: In-Basin Commitments

CMD Wells 1-8 are limited to a maximum annual production of 653 AFY for a fixed list of in-Basin customers. The maximum deliverable and actual use of in-Basin customers are detailed in Table 3-1.

**Table 3-1:** In-Basin user commitments and demand in 2011 and 2018, in acre-feet per year

| | Allocation | 2011 Demand | 2018 Demand | % Change |
|---|---|---|---|---|
| Woodmen Hills | 350 | 358.8 | 348.3 | -3% |
| Viewpoint/Antelope Acres | 50 | 20.8 | 19.8 | -5% |
| EPC Telephone | 1 | 0.20 | 0.02 | -90% |
| Ellicott Springs | 60 | 16.2 | 16.3 | 1% |
| Ellicott School | 10 | 5.4 | 4.9 | -9% |
| Diamond Moon | 2 | 1.8 | 2.3 | 29% |
| Harding Nursery | 180 | 117.0 | 107.2 | -8% |
| **Total** | **653** | **520** | **499** | **-4%** |

### 3.2: Out of Basin Commitments

Out of Basin demand accounts for 85% of water deliveries and has accounted for all growth since 2006. Out of Basin water is used entirely within CMD's boundaries, the only exception being Schriever Air Force Base (Section 3.3). Out of District demands are billed and tracked by tap size. All tap categories have seen significant reduction in both bulk demand and per tap demand since the high flow year of 2011 (Table 3-2).

**Table 3-2:** Annual regular in-District use by category*. Commercial, multi-family and irrigation meters range in size from ¾" to 6" but are summarized by a single category in this table

| | Demand (AF) | | | Demand/Tap (AF) | | |
|---|---|---|---|---|---|---|
| Use Type | 2011 | 2018 | Change | 2011 | 2018 | Change |
| Single-Family | 1355.7 | 1294.2 | -5% | 0.24 | 0.21 | -14% |
| Multi-Family | 246.4 | 199.2 | -19% | 0.27 | 0.20 | -26% |
| Commercial | 420.4 | 375.4 | -11% | 1.03 | 0.78 | -25% |
| Irrigation | 144 | 126 | -13% | 1.16 | 0.95 | -18% |
| **Total** | **2166.5** | **1994.8** | **-8%** | | | |

The 2016 Report calculated a total annual commitment of 2,693 AFY by analyzing the average demand of taps during 2011 (year of highest demand). Since the 2016 Report, an additional 328.2 acre-feet per year has been committed from the exportable water supply portfolio including wells 9-20 and Denver Basin wells while excluding wells 14 and 18 (Table 3-3). Water commitments have also been made from the Kane and Tipton water rights to developments specified in the LLC agreements but these allocations are accounted for in the Kane and Tipton commitments.

**Table 3-3:** In-District commitments since the 2016 Report, commitments are organized in chronological order of initial application, some have had expiration dates extended

| Completed Developments Committed After 2016 Report (volumes in acre-feet per year) | | | | | |
|---|---|---|---|---|---|
| Commitment Name | Type | General | Kane | Tipton | |
| King Soopers Commercial Phase 1 | Commercial | 4.46 | | | |
| Constitution Apartments | Residential | 19 | 2 | | |
| Freedom Springs Apartments | Residential | 14.5 | | | |
| Covert Ops Paintball | Commercial | 0.15 | | | |
| King Soopers Commercial Phase 2 | Commercial | 4.46 | | | |
| Space Village Commercial | Commercial | 3.44 | | | |
| Claremont Ranch Filing 9C | Residential | 5.94 | | | |
| **Total** | | **51.95** | **2** | **0** | |
| | | | | | |
| Outstanding & Under Construction Commitments Made After 2016 Report | | | | | |
| Commitment Name | Type | General | Kane | Tipton | Status |
| Meadowbrook Crossing | Residential | 36.27 | | | Under Construction |
| Appaloosa Highway 24 Subdivision | Commercial | 1.25 | | | Under Construction |
| Hannah Ridge Filings 5, 6, 7 | Residential | | 60.5 | 76 | Under Construction |
| Midtown at Hannah Ridge | Residential | 33.84 | | | Under Construction |
| Claremont Business Park Tract C | Commercial | | 12.2 | | Pending; Expires 8-Aug-21 |
| Richmond Homes at Feathergrass | Residential | 33.6 | | | Under Construction |
| DWIRE Storage Yard | Commercial | 3.51 | | | Pending; Expires 11-Nov-21 |
| Gardens at North Carefree | Residential | 22 | | | Under |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | Construction |
| Mountain States Pipe & Supply | Commercial | 0.31 | | | Pending; Expires 13-Jan-21 |
| Claremont Business Park Filing 1C Lots 1 & 2 | Commercial | 0.64 | | | Under Construction |
| Solace Apartments Phase 1 | Residential | 61.8 | | | Pending; Expires 12-Feb-21 |
| Midtown at Hannah Ridge Filing C | Residential | 9.24 | | | Pending; Expires 27-May-21 |
| 6201 Platte Avenue | Commercial | 1.83 | | | Pending; Expires 11-Jun-21 |
| Windermere Subdivision | Residential | 68.8 | | | Pending; Expires 11-Jun-21 |
| Meadowbrook Park | Residential | 18.7 | | | Pending; Expires 21-Sep-21 |
| Villas at Claremont Ranch | Residential | 24.8 | | | Pending; Expires 19-Nov-21 |
| Crossroads Mixed Use | Mixed | 84.0 | | | Pending; Expires 8-Dec-21 |
| **Total Unbuilt Commitments Since 2015 Report** | | **400.6** | **72.7** | **76** | |
| **Total Commitments Since 2015 Report** | | **452.5** | **74.7** | **76** | |

The water volumes committed to each development are calculated at the time of plat based on building square footage, intended use, and landscaping square footage. For multi-family developments El Paso County presumptive use values per unit are used. For single-family neighborhoods the single family presumptive use value of 0.31 AFY/SFE (acre-feet per year per Single Family Equivalent) is used as explained in the previous report. Single family use has dropped below this value but this builds a safety factor into residential developments to account for high use years.

### 3.3: Schriever Air Force Base

CMD provides water to Schriever Air Force Base in eastern El Paso county immediately south of State Highway 94. The base is home to approximately 1,000 personnel around the clock and about 7,000 more during the workday. SAFB consumes about 10% of CMD's total water deliveries and has a commitment of 537 acre feet per year as specified in its original contract (Table 3-4). The population of the base has grown in recent years and is expected to continue growing. Despite this growth, the base itself has consistently reduced overall water consumption since 2011 and the housing has improved water efficiency.

**Table 3-4:** Schriever Air Force Base use in 2011 and 2018

| | 2011 | 2018 | % Change |
|---|---|---|---|
| Schriever Air Force Base | 246.1 | 204.0 | -17% |
| Schriever AFB Housing | 78.4 | 86.0 | 10% |
| **Total** | **324.5** | **289.9** | **-11%** |

### 3.4: Other Commitments Including Golf Course Irrigation

CMD maintains several parks within its boundaries which are supplied with potable water from the general system and have collectively reduced water demand from 30 acre-feet in 2011 to 21 acre-feet in 2019. CMD also provides water for construction which can vary substantially year to year but averages to approximately 15 acre-feet per year and has rarely exceeded 25 acre-feet per year. To be conservative, CMD's demand planning uses a projected annual demand of 25 acre-feet per year for construction.

The two golf courses in the District boundaries consume a large amount of irrigation water but this is provided from a separate, non-potable system (see Section 2.5) and no growth in demand is anticipated. The golf course clubhouses are supplied with potable water from the main potable system and are considered regular commercial customers.

### 3.5: Commitment Summary

Commitments served from CMD's exportable water portfolio are summarized in Table 3-5. The Kane and Tipton water commitments are reserved to members of Cherokee Water LLC and are thus considered fully committed despite the fact that construction has not started on several included projects.

**Table 3-5:** Commitments Summary

| Commitments | AFY |
|---|---|
| In-District (2015) | 2693 |
| Committed Since 2015 | 452.5 |
| Schriever Air Force Base | 537 |
| Kane* | 200 |
| Tipton* | 225 |
| Construction | 25 |
| Parks | 25 |
| **Total** | **4157.5** |

*The Kane and Tipton water rights are considered fully committed even though some of the subject developments are not completely developed.

# 4 Water Balance

### 4.1: Overview

CMD's water rights exceed its annual commitments, and actual deliveries are significantly lower than these commitments (Figure 4-1). Irrigation scheduling, communication about water scarcity, and a tiered rate system have reduced water use per customer in CMD to among the lowest in the region. Through dry and wet years since 2011, water use per customer has dropped across all customer types, indicating customer-led conservation measures  CMD's acquisition and development of new water rights has placed it in a strong position to better serve current customers and to provide for new customers as the District approaches buildout.

**Table 4-1:** CMD In-District Water Balance including Schriever Air Force Base. 2018 production indicates actual use in each of these categories in 2018.

| Commitments | Legal | 2018 Use | Difference |
|---|---|---|---|
| In-District (2015) | 2693 | 1995 | -26% |
| Committed Since 2015 | 452.5 | 123 | -73% |
| Schriever Air Force Base | 537 | 252 | -53% |
| Kane* | 200 | 200 | 0% |
| Tipton* | 225 | 225 | 0% |
| Construction | 25 | 17.1 | -32% |
| Parks | 25 | 21.2 | -15% |
| **Total** | **4157.5** | **2833** | **-30%** |
| | | | |
| Supply | | | |
| CMD Wells 9-17, 19, 20 | 3212 | 2568 | -25% |
| Developed Denver Basin** | 258 | 311 | 15% |
| LLC Kane Right | 0 | 0 | 0% |
| LLC Tipton Right | 225 | 144 | -36% |
| New Exportable Production 2020 | 748 | 0 | |
| **Exportable Total** | **4443** | **2879** | **-35%** |
| | | | |
| **Balance** | **285.5** | **AFY** | |

*The Kane and Tipton water rights are considered fully committed even though some of the subject developments are not completely developed.

**Denver Basin proven production includes production from banked water in the Arapahoe Aquifer (see Section 2.4).

### 4.2: Per Capita Water Demand

In the 2016 Report, CMD established an average water demand for planning of 0.31 acre-feet per single-family equivalent (AF/SFE) for single family homes. CMD's current actual per capita demand is less than this presumed use flow, but this conservative assumed demand remains useful to account for possible increases in outdoor watering in unusually dry summers or possible increases in average persons per household (Table 4-1). This lower flow figure has remained relatively constant through drought and is mainly a result of a more aggressive tiered rate structure implemented 2011-2012 (Figure 4-1). CMD has used 0.31 AFY/SFE to calculate commitment demand for all single family commitments since 2016, and CMD will continue to use this figure for future commitments unless specific features of the development may reduce water usage. CMD may seek to adjust this default figure in future reports for all single family developments in order to better match actual demand.

**Table 4-2:** Single Family and Multi Family (¾" tap) water use in calendar years 2011 and 2018

| | Demand (AF) | | | Demand/Tap (AF) | | |
|---|---|---|---|---|---|---|
| | 2011 | 2018 | % Change | 2011 | 2018 | % Change |
| Single Family | 1355.7 | 1294.2 | -5% | 0.24 | 0.21 | -14% |
| Multi Family | 144.8 | 134.0 | -7% | 0.17 | 0.15 | -16% |

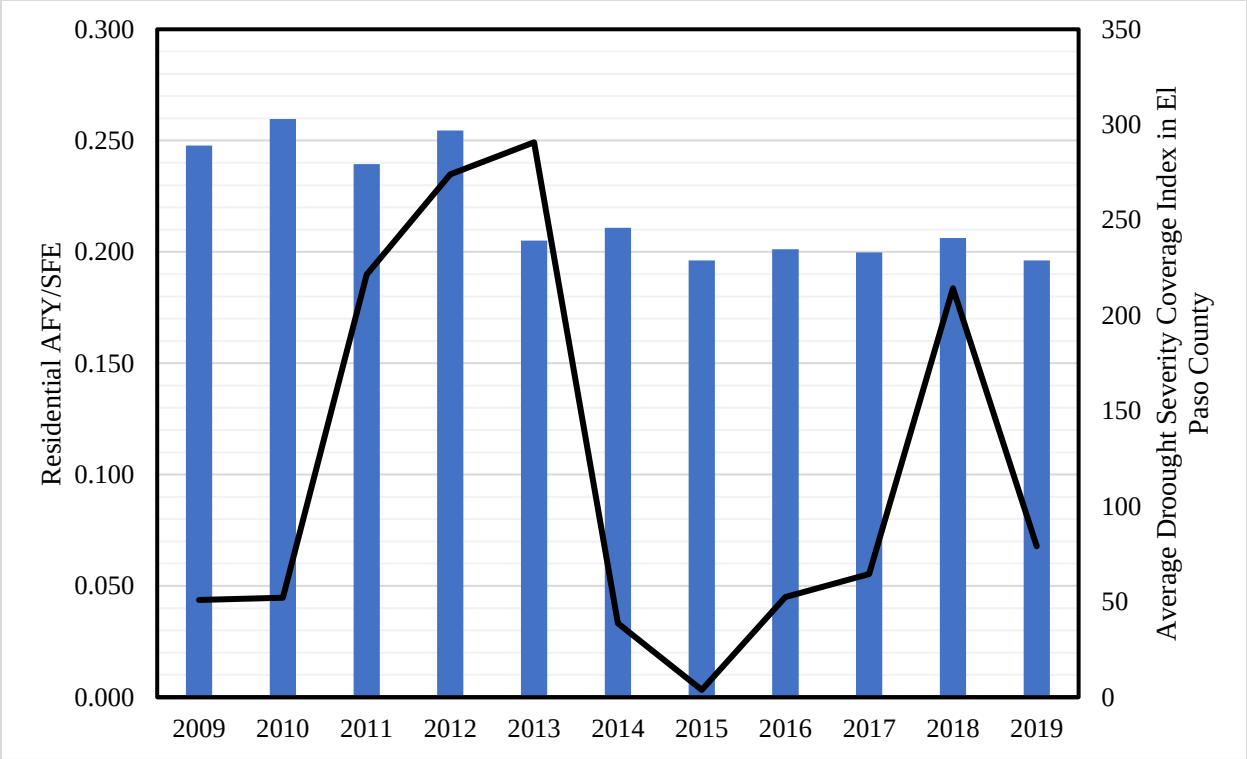



**Figure 4-1:** Single family water use since 2009 in blue compared to Drought Severity Coverage Index for El Paso County in black. In this index 0 is no drought in the county and 500 is stage 4 drought covering the entire county

Residential developments comprise the bulk of CMD's water deliveries and new commitments but commercial users have also seen a drop in actual water demand since 2011. New commercial commitments are estimated using development size and industry-specific American Water Works Association (AWWA) water demand averages.

### 4.3: Future Water Supply Development

CMD is currently developing several additional water sources to meet future demand. Six groundwater rights are slated for development or upgrade by the end of 2021 (Table 4-2). In addition to providing water for new users, these additional wells will provide greater flexibility in meeting peak demands.

**Table 4-3:** Water supply development projects slated for construction or upgrade by 2021

| | Decreed (AFY) | Planned (AFY) | Timeframe |
|---|---|---|---|
| Sweetwater #5 Well | 290.0 | 290.0 | 2020 |
| Albrecht Well | 153.5 | 153.5 | 2021 |
| AR-1 Right Consolidation | 280.0 | 200.0 | 2020 |
| DA-1 | 180.7 | 40.3 | 2021 |
| DA-4 | 180.7 | 64.5 | 2021 |
| **Total** | **1452.9** | **748.3** | |

The Sweetwater #5 Well is a conditional water right that CMD must make absolute by filing an application on or before February 26, 2021. CMD began pumping this well in February of 2020. This well is legally authorized to withdraw a maximum of 290 acre-feet per year pursuant to the final decree in Case No. 05CW6/05CW20.

The Albrecht Well is a recent water rights acquisition made by CMD since the 2016 Report. The well is permitted to withdraw a maximum of 153 acre-feet per year pursuant to Final Permit Nos. 27571 and 27572 (Appendix J). CMD is currently working to connect this well to its supply infrastructure.

The AR-1 right consolidation is a new well permit application for the highly productive Arapahoe Aquifer on the Sundance property made on April 9th, 2020 and approved on June 19$^{th}$, 2020 as Permit 84421-F. It combined the allocation from the Sundance property with the allocation for the adjacent Shamrock property into one point of diversion.

DA-1 and DA-4 are Dawson Aquifer wells currently drilled on the Sundance property that are currently drilled and awaiting pump installation. These wells will produce water from the Dawson Aquifer pursuant to the plan for augmentation decreed in Case No. 14CW3061.

In addition to these known production improvements CMD also has a pending replacement plan which could enhance the efficiency of CMD's portfolio through recovery and/or reuse of recharge water.

### 4.4: Undeveloped and Other Future Supplies

CMD holds undeveloped groundwater rights that may be developed in the future (Table 4-3). CMD is also actively pursuing additional purchases of renewable water rights in the Upper Black Squirrel Aquifer, with a general goal of acquiring an additional 200-500 AFY within the next decade.

**Table 4-4:** Undeveloped CMD Water Rights

| | Amount (AFY) | Plans |
|---|---|---|
| Sundance Ranch Denver Basin | 477 | Production increases in existing wells are planned |
| Other Owned Denver Basin | 4042 | Currently not planned for development, except as future replacements for current Denver Basin wells |
| Additional Renewable Supplies | 200-500 | Acquire additional rights as available |
| Replacement Plan | Unknown | Replacement plan will allow for reuse of a portion of recharged water |

### 4.5: Future Demand

CMD has 432 acres of developable land with no outstanding commitments, constituting 10% of total district area. To estimate the future water demand for this area, CMD first examined undeveloped land area in the district and compared its zoning composition to CMD's overall zoning composition. Although the undeveloped area contains a higher proportion of industrial and commercial zoning than CMD as a whole, and while these land use types generally require more water than residential use, in CMD the demand-per-acre for commercial and industrial uses is on average lower than that of residential. Therefore, to be as conservative as possible, CMD extrapolated the demand associated with single-family detached homes to the entire undeveloped area. CMD concluded that its production must increase by approximately 240 acre-feet per year to serve this undeveloped area.

Though the anticipated demand of undeveloped area falls slightly under the projected surplus, CMD is continuing to explore new water supplies in order to provide a factor of safety for zoning changes of undeveloped land as well as densification of developed land. An increase of water use intensity on properties within the District is unlikely in the near term but as housing and land costs continue to increase in El Paso County redevelopment of existing single family detached subdivisions into higher density developments is possible in the future.

### 4.6: Future Water Balance

The full-buildout demand (an additional 240 AFY) described above is less than the surplus projected by the end of 2021, meaning CMD is well-situated to serve the needs of its entire district. Nonetheless, CMD is pursuing purchases of additional water supplies as they become available in order to further increase this surplus, provide greater redundancy, and support higher

density development. CMD is not currently pursuing new acquisitions of Denver Basin groundwater, but it may continue to develop current holdings in those aquifers.

# 5 Conclusion

With its ongoing efforts to develop existing water supplies, CMD will be well-situated to serve its growing demand as it approaches total buildout of its boundaries with a water surplus of 285.5 acre-feet per year. CMD will continue to acquire new renewable water supplies as they become available, and it is moving forward with a replacement plan that will allow it to increase the overall efficiency of its system. In addition to providing for buildout demands, these water supplies will further increase CMD's operational surplus, provide greater redundancy, and provide for higher density development within the district. With connections to Colorado Springs Utilities, Woodmen Hills Metropolitan District, and Meridian Service Metropolitan District, CMD's infrastructure could facilitate regional water sharing agreements as El Paso County population growth continues.