Town of Castle Rock

Agenda Memorandum

Agenda Date: 7/7/2020

Item #: 10. **File #:** TMP 2020-289

To: Honorable Mayor and Members of Town Council

From: Mark Marlowe, P.E., Director of Castle Rock Water
Matt Benak, P.E., Water Resources Manager
Heather Justus, P.G., Water Resources Project Manager

Update: Aquifer Storage and Recovery (ASR) Program

Executive Summary

The purpose of this memorandum is to update Town Council on Castle Rock Water's Aquifer Storage and Recovery (ASR) program and the projects that make up that program. ASR is defined as the ability to store water in an aquifer and recover that water through pumping when needed. The ASR projects are a key piece of Castle Rock Water's (CRW) long-term renewable water plan, as they will allow us to store our renewable water in the aquifers during times when excess renewable water is available and then use that water during periods of high demand (e.g. summer demand periods or in times of drought). ASR allows us to store water without evaporative losses (18% annually in our area for surface storage), and also boost hydrostatic pressure which increases pumping capacities in surrounding groundwater wells. In addition, ASR is a very cost-effective storage method at about $2,500 to $3,000 per acre foot compared with surface storage, which is two to five times more expensive depending on local factors. The only drawback is that water stored via ASR must be treated to drinking water standards before storage and treated again when recovered for use.

CRW's ASR program started in 2008 and gained real momentum in 2013 with the development of a pilot test program on our first two ASR wells (see ***Attachment A*** for full history of ASR work and ***Attachment B*** for the location of these wells). CRW has invested $600,000 to-date in testing and developing those two ASR wells, which should provide up to 235 acre feet of storage per year. The source of renewable water for these wells will be East Plum Creek. The primary remaining challenge to putting these wells into use is obtaining a permit from the United States Environmental Protection Agency (EPA). Obtaining a permit from EPA has been an ongoing challenge going back to 2017. CRW has been working closely with EPA in the last several months taking our concerns with permitting all the way to the Region 8 EPA Administrator. We believe a draft permit that is acceptable to CRW should be issued this summer.

Two new wells were drilled near Ray Waterman ***(see Attachment B)*** and those wells are under contract for ASR and expected to require $1,230,300 in investment this year for another 400 acre feet of storage per year. These wells will be able to store Water Infrastructure and Supply Efficiency (WISE) water. The plan is for these wells to be permitted under the same permit. CRW's long-term

ASR plan includes converting four existing wells to ASR over the next fifty years, with an ultimate goal of 1300 acre feet per year of ASR storage. The cost for this local ASR program is estimated to be $2.1M over this timeframe.

In addition to CRW's local ASR program, CRW has explored the possibility of ASR in the Lost Creek Basin near our Lost Creek water rights through a grant from the Colorado Water Conservation Board (CWCB). The goal of this program is to store junior water rights off of the South Platte River in the Lost Creek Basin, which would improve the operation of our Box Elder project. This preliminary study work has been done through a partnership with Aurora Water. The next steps in this project are to complete a full-scale pilot test in the Lost Creek Basin.

History of Past Town Council, Boards & Commissions, or Other Discussions

A history has been provided ***(Attachment A)***.

Discussion

In the 2019 *Analysis and Technical Update to the Colorado Water Plan* for the Colorado Water Conservation Board (CWCB), ASR is identified as one of the tools that will help Colorado meet the identified water supply gap in Colorado. Centennial Water and Sanitation District's operation of their successful ASR program in the Denver Basin Aquifers is a well-known example of ASR in Colorado. For thirty years, Centennial has captured surface water under junior water rights, treated and then injected that potable water into their Denver Basin wells at controlled rates and pressures. This program is key, along with multiple pilot tests including CRW's pilot test, to showing the viability of ASR and provides the technical basis for additional projects in the Denver Basin.

Based on the Water Resources Supply Demand Model, high population growth trend, aging infrastructure and the need for ASR, CRW continues to stay active in pursuing both local and regional ASR projects. It is important for our community that CRW staff understands the complexities of ASR and advances in technology as we move forward as a community. These advances will allow CRW to remain a leader in the industry and improve efficiencies. With the variability in WISE and renewable water supplies, a storage option is needed when WISE and renewable supplies are higher than demand. One of the solutions is ASR, which is the ability to store water in the aquifer and recover the water through pumping when needed. Currently, CRW has two facilities designed with one under construction and one complete. The first completed facility is located in the Meadows area and is able to receive renewable water from Plum Creek Water Purification Facility (PCWPF). The wells associated with this facility are CR-223 and CR-224. These are the wells on which ASR pilot testing was completed, and we are requesting EPA ASR permitting.

The second facility is the two new wells underway at Ray Waterman Water Treatment Plant, CR-232 and CR-233. The drilling and construction for Wells CR-232 and CR-233 are completed. Hydro is currently completing testing on the new wells. It is important to note that Dominion Water and Sanitation District (DWSD) is a partner with us on the ASR portion of the project. DWSD will be funding the cost of the ASR portion of this project in accordance with our 2016 Water Service Agreement. CRW is pilot testing new technology as a part of this ASR project that will allow energy to be generated when water is injected into the ASR wells. One of CRWs largest expenses is the

cost of power to pump water from the aquifers. The decline in water levels increases the cost to pump water. However, through ASR, we can increase the hydrostatic water level which effectively reduces pumping costs. In addition, by adding on the ability to generate green power during injection, CRW would be able to offset some of the pumping expenses. In a white paper that Hydro Resources provided to CRW, DR. Sale with Colorado State University (CSU) theorizes the following: "Using the results…, the following solution and example calculation is advanced for estimating power generation from a flow rate (Q) and total dynamic head (TDH). The result suggests that a single ASR well equipped with the study pump, with a flow of 500 gpm and a TDH of 1000 feet, would generate 48kW of electrical power, enough electrical power for 50 homes." Power generation only occurs during ASR operations of the wells. This will be the first full scale installation. To our knowledge, this type of pilot project is novel and Hydro Resources has advanced the technologies to a point that it is time to move the testing into a real world environment.

CRW will continue to pursue obtaining a Class V ASR Permit with the EPA. CRW staff hopes that an acceptable solution to CRW's concerns will be achieved. Once the ASR permit is issued, the permit will allow for additional wells to be added to the permit. This will allow CRW to apply to have wells CR -232 and CR-233 added to the permit through the defined permitting process. The next well facilities are planned in the five year and ten year periods. The best places for the ASR facilities are in close proximity to our renewable sources. At this time, we are planning another location near the Plum Creek Water Purification Facility and another near our local WISE infrastructure ***(see Attachment B)***. The timing for each would be as excess renewable supplies are available during the winter months and adequate budget for construction.

The next South Metro Water Supply Authority (SMWSA) ASR regional efforts meeting is scheduled for July 1st. CRW staff plan to continue to be active in these discussions with other regional water providers. CRW will continue to be active in these projects as they fit with CRW's future ASR plans and goals and are approved by CRW Management and Town Council.

Additionally, CRW plans to continue investigations and future projects with other entities for the potential of ASR projects in Weld County. In the 2019 *Analysis and Technical update to the Colorado Water Plan for Colorado Water Conservation Board (CWCB),* it identifies that ASR storage in the Lost Creek basin will be an essential part of storing water captured from the South Platte River system. CRW staff and Aurora Water staff have had multiple brainstorming meetings to discuss the viability and opportunity to partner on an ASR project in the basin.

Budget Impact

Through 2018, CRW staff estimate that CRW invested approximately $600,000 in ASR feasibility, pilot testing, and constructing ASR facilities. This investment does not include CRW staff hours for designing, testing, analyzing, and preparing memos, reports and applications. In 2019, CRW began design of the two new ASR wells CR-232 and CR-233 at Ray Waterman. CRW staff estimate that the project cost estimate associated with ASR is approximately $1,230,300. This will bring the total Town investment in ASR to $1,830,300.

Staff Recommendation

CRW continues to believe that ASR is an important aspect for storage of our excess renewable water and will aid in meeting our expected future high water demands. Additionally, ASR will help with declining water levels in the Denver Basin and increase well efficiencies and reduce power consumption. CRW staff support innovations and exploring new technologies as they become available to our community, and as the new technology fits with our values and goals.

Attachments

Attachment A: History
Attachment B: Map

History of Past Town Council, Boards & Commissions, or Other Discussions

History

In 2008 and 2009, Castle Rock Water (CRW) contracted with Camp Dresser and McKee (CDM) and Hemenway Groundwater Engineering, Inc. (HGE) to conduct an assessment of the potential role and feasibility of an ASR program to help address future water needs. The five elements of the Phase I study included the following:

1. Review of other ASR programs in the Denver Basin;
2. Future injection water sources;
3. Groundwater and aquifer matrix geochemical evaluation and analysis;
4. ASR pilot test well selection and evaluation; and
5. Renewable water delivery points and conceptual design.

The final report was titled *Aquifer Storage and recovery Pilot Testing Program, Phase I – Feasibility Evaluation*, (November 2009), prepared by CDM and HGE.

In July 2013, CRW issued a Request for Proposals for Aquifer Storage & Recovery Well Design Services. At that time, CRW contracted with GEI Consultants. The project included the following: geochemical modeling; pumping tests for Wells CR-223 and CR-224; evaluation of well conditions through videos; stratigraphic evaluation of the aquifers; ASR operation design including a flow control valve and infrastructure modifications; and initiation of the permitting process with the State Engineer's Office (SEO), Colorado Department of Public Health and Environment (CDPHE) and United States Environmental Protection Agency (EPA).

In March 2014, the Town contracted with Hydro Resources – Rocky Mountain, Inc. for rehabilitation of CR-223 and CR-224 in preparation for converting these two wells to be ASR wells.

In March 2014, the Town contracted with Applied Ingenuity, LLC to complete the re-equipping for wells CR-223 and CR-224 with the addition of a flow control valve.

In May 2014, CRW submitted an ASR Class V Injection Pilot Test application.

In October 2014, CRW responded to EPA's review letter requesting additional data.

In November 2014, EPA issued the first rule authorization for pilot testing CR-223 and CR-224.

In December 2014, the Town contracted with 53-Corporation to complete the pipeline to deliver renewable water to the ASR wells.

In December 2014, the Town contracted with GEI Consultants to perform on-call services with regards to field observations and construction support of the pipeline construction and project startup support, protocol assistance and regulatory agency sampling and testing.

In December 2014, the SEO issued the new well permits for CR-223 and CR-224 that allow for the extraction of artificially recharged groundwater from the existing wells.

In March 2015, EPA issued a revised Pilot Cycle Tests Procedures under the previous rule authorization.

In late 2015 and early 2016, CRW made revisions with CDPHE for the Public Water System Monitoring Plan to include aquifer storage and recovery.

In November 2015, representatives from Applied Ingenuity and BASKI with CRW staff performed a startup and protocol testing of the flow control valves in CR-223 and CR-224. At that time, it was determined that the flow control valve in CR-224 had failed. The flow control valve was under warranty and was replaced in 2016.

In 2016, the Town contracted with Hahn Water Resources to support the ASR Pilot Testing. The scope of work included assistance with testing evaluation, water quality support, development of a report on the results of the testing, and identifying permitting requirements.

In 2016 - 2017, CRW staff conducted the ASR pilot testing. ASR Pilot Cycle testing began in November 2016 and carried through March 2017. The pilot testing included four cycles with an increased length of time for each cycle. The results of the testing were very positive with the recommendation to move forward with an ASR program.

November 2016, South Metro Water Supply Authority hosted a regional ASR workshop with CDM Smith to discuss Phase 2 ASR Regional Feasibility.

March 2017, CRW and Aurora Water had Leonard Rice Engineers, Inc. prepare a scope of services for a Lost Creek Underground Storage Pilot Project. The pilot project showed which geophysical methods could be used for an investigation for an infiltration basin ASR Program.

May 2017, City of Aurora and CRW applied for a Colorado Water Conservation Board (CWCB) grant for the Lost Creek Underground Storage Pilot (LCUSP) Project. The project was approved and a grant was awarded for $100,000.

May 2017, SMWSA ASR regionalization task meeting to discuss project overview, regional ASR approach and brainstorming, members recharge objectives and data requests for members.

July 2017, CRW staff attended a lunch and learn that covered alternative ASR methods and new well technologies.

July 2017, CRW and Aurora Water entered into an Intergovernmental Agreement (IGA) to work together on the LCUSP Project. Each agreed to contribute $25,000 in addition to the $100,000 that was awarded through the CWCB grant.

September 2017, the final draft report was completed for the LCUSP Project and was submitted to CWCB.

In September 2017, CRW submitted the Summary of ASR Pilot Testing Program letter report. The letter report included a request for an ASR permit. The conclusions of the pilot testing showed that there is overall feasibility for ASR in the Denver and Arapahoe aquifers.

January 5, 2018, TCR applied for party status in Case No. 17GW05 in the matter of the Colorado Groundwater Commission proposing amendments to sections 5.6 and 5.8 of the Rules and Regulations for the Management and Control of Designated Ground Water to provide more detail and clarity on the requirements for approval of replacement plans and ASR.

July 2018, South Metro Water Supply Authority (SMWSA) hosted a meeting to review the Phase 2 of the ASR Feasibility Study Final Report.

Through 2018, CRW responded to multiple additional data requests from EPA regarding the application for an ASR permit.

July 2018, CRW staff began conceptual planning for an ASR Facility near Ray Waterman Treat Plant.

September 2018, EPA issued Meridian Metropolitan District's draft ASR permit for public comments. CRW staff reviewed the draft permit and provided comments in agreement with other South Metro Water Providers.

September 2018, TCR contracted with Leonard Rice Engineers, Inc. for engineering and hydrogeologic services for two new well facilities: Lanterns and Ray Waterman ASR.

October 19, 2018, CRW submitted rebuttal report and expert report regard Case No. 17GW05. The expert report was fundamental in providing information for the ASR rules.

October 2018, EPA issued Meridian Metropolitan District's Final ASR Permit.

October 2018, Hydro Resources representatives met with CRW staff to broach the idea of an ASR Downhole Power Generation Pilot Project.

November 7, 2018, CRW staff along with the Town's water right's attorney with Lyons Gaddis participated in the 17GW05 mandatory settlement meeting. CRW staff presented information from expert report and testified regarding technical ASR questions.

June 2019, EPA held a regional ASR Stakeholder meeting at Centennial Water and Sanitation District. The focus of the meeting included EPA's strategy for prioritizing/ addressing new ASR projects; evaluate existing authorized ASR operations; and revisions to information requests. During the stakeholder meeting, EPA staff stated that Meridian Metropolitan District's permit would be the model permit moving forward.

In July 2019, EPA requested additional data for the CRW ASR application. CRW staff responded to the data request within the week of the request.

July 30 2019, CRW staff met with EPA staff through a teleconference. The teleconference included an additional large data request. CRW staff supplied the information requested to EPA over several weeks.

July 2019 and August 2019, CRW staff sampled WISE water and finished water at Ray Waterman Water Treatment Plant with WISE based on the ASR water quality parameter list. The purpose of the sampling events is to understand the water quality of the potential

injectate water and to start collecting the data needed for ASR permit application for CR-232 and CR-233.

September 2019 – November 2019, CRW staff along with LRE began design for the Ray Waterman ASR, drafting the specifications, and drafting the downhole pilot testing agreements. The design of an ASR well is slightly modified to take into consideration the treated water that will be delivered into the aquifer through the well. Dominion Water and Sanitation District is a partner in this project.

September 2019 - EPA had multiple data requests, CRW staff responded within 24 hours with the requested information.

November 2019 – January 2020, EPA staff provided bi-weekly updates on their progress on the ASR authorization permit.

December 2019, TCR entered into a construction agreement with Hydro Resources, Inc. for the drilling, construction and testing for Wells CR-232 and CR-233.

January 2020, CRW staff sampled finished water from Ray Waterman Water Treat Plant. The sample did not have WISE water.

February 2020, EPA requested additional information and data for the ASR authorization. CRW staff was able to respond quickly to provide the requested information.

On February 21, 2020, CRW staff meet with EPA staff at EPA's office to discuss the proposed conditions included in CRW ASR Draft Permit. One of the conditions included Part I Mechanical Integrity Testing (MIT), which was not included in the Meridian Metropolitan District Final ASR Permit. During the meeting, CRW staff stated their objections to the MIT. CRW staff also provided questions based on the proposed permit changes. EPA staff responded the following week.

February 2020 – March 2020, CRW Staff began researching MIT. In addition, CRW staff began working with Hydro Resources and Leonard Rice Engineers, Inc. to determine a possible work plan for MIT, cement bond logging and caliper logging. This included developing a scope of work and proposal to determine cost of work. It is important to note, that EPA does not have an approved guidance document for Class V injection wells or ASR wells. CRW provided this information to EPA.

March 3, 2020, Town Council approved contract with Hydro Resources – Rocky Mountain Inc. for the ASR and downhole pumping equipment for wells CR-232 and CR-233. In April CRW staff asked for a delay with Hydro to determine the effects of COVID-19 on budgets and to allow us to have a downhole power generation pilot project agreement in place.

March 2020, CRW staff repeated the ASR water quality sampling event for WISE and Ray Waterman finished water to compare with the 2019 water quality results and in preparation for ASR permit application.

March 2020, CRW staff attended SMWSA ASR regional efforts workshop. Agenda included discussion on regional ASR logistics, development of pilot project boilerplate agreement, and discussions on HB 20-1344 and EPA permitting process.

On March 16, 2020, EPA staff informed CRW staff that they began to work remotely due to COVID-19 and that progress on the draft ASR Permit was delayed.

April 2020, EPA requested multiple clarifications including concerns regarding MIT and of the confining layer between the Denver and Arapahoe aquifers. Staff responded on the same day.

April 2020, CRW staff held multiple meetings internal and external with consultants and other Water Providers to discuss the possible risks of MIT and potential solutions.

April 17, 2020, Mark Marlowe called Darcy O'Connor with EPA to discuss CRW's concerns with the draft ASR permit.

April 21, 2020, CRW hosted regional discussion with multiple water providers, SMWSA, and consultants to inform them of the potential changes to the CRW ASR Permit which were different than Meridian's permit, to request their support for CRW and to voice their concerns with EPA.

April 21, 2020 EPA issued the draft permit and recalled the permit the next morning due to CRW's concerns.

April 23, 2020, CRW staff sent out a draft letter addressed to the EPA regarding CRW's MIT and Cement Bond Logging to regional water providers, SMWSA and selected consultants for feedback. Several entities provided feedback in a timely manner.

May 6, 2020, CRW sent a letter to the EPA regarding CRW's MIT and cement bond logging concerns.

May 7-14, 2020, Aurora Water, Inverness Water and Sanitation District, Cottonwood Water and Sanitation District, Dominion Water and Sanitation District, Meridian Metropolitan District, and South Metro Water Supply Authority sent letter to EPA in support of CRW's concerns regarding MIT and cement bond logging.

May 18, 2020, EPA requested cement records for Castle Rock wells CR-223 and CR-224. CRW explained where in the permit packet they would find the cement records and resent the information on the same day as the request.

May 22, 2020, EPA requested a copy of the 2014 letter response from CRW to EPA. CRW staff sent the requested file.

May 26, 2020, EPA requested permeability data for both CR-223 and CR-224. CRW Staff provided the information using the original submittal.

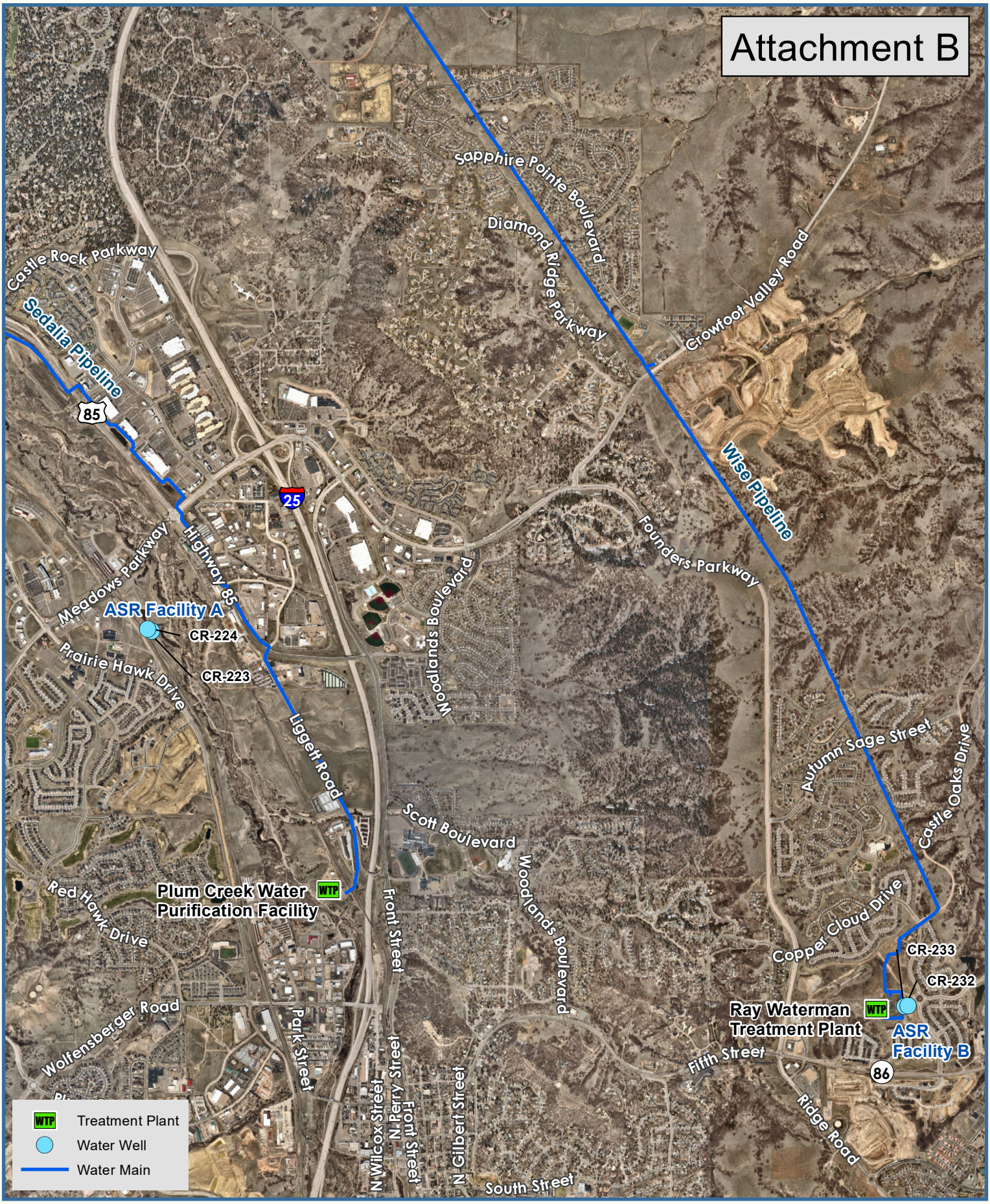
May 28, 2020, CRW Team met with the EPA team to discuss CRW concerns regarding MIT, cement bond logging and water quality testing. CR Water staff were able to voice their concerns and reasons for concerns.

June 1, 2020, CRW staff and EPA staff met through a WebEx meeting to discuss EPA's questions from previous meeting.

June 2, 2020, CRW staff provided figures from the June 1st meeting to EPA staff.

June 2, 2020, EPA staff had additional questions regarding one of the chemical constituents they were recommending for analysis. CRW staff responded to the questions.

June 3, 2020, CRW staff met through a web meeting to discuss additional technical questions from EPA including MIT, well video logging and chemical constituents recommended for analysis.



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