SYSTEM INVENTORY AND ASSESSMENT STUDY FOR COLORADO SPRINGS UTILITIES WATER SYSTEM CONVERSION

for

CASCADE METROPOLITAN DISTRICT NO. 1

Volume 1 - Study

GMS, Inc.
Consulting Engineers

SYSTEM INVENTORY AND ASSESSMENT STUDY
FOR COLORADO SPRINGS UTILITIES WATER SYSTEM CONVERSION
OF
CASCADE METROPOLITAN DISTRICT NO. 1

PROJECT NO. 15061.100

DECEMBER 2015

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SECTION A
EXECUTIVE SUMMARY

This report is the System Assessment and Inventory of the Cascade Metropolitan District No. 1 (CMD1), a Special District providing water to the unincorporated community of Cascade, Colorado. CMD1 is subject to a negotiated Settlement Agreement (Agreement) with Colorado Springs Utilities (CSU) and other parties, a large portion of which addresses the parties' desire for CSU to take over ownership and operation of the existing water system (system conversion). The Agreement requires a comprehensive assessment of the components and assets of the CMD1 water system. The assessment requirements were established in Section 6 of the Settlement Agreement with CSU. CSU will develop a list of Minimum Required Improvements necessary for conversion using the information in this report. The Agreement requires CMD1 to conduct system improvements, as identified in the Minimum Required Improvements Report, within a five-year time frame prior to the transfer of system ownership and operational responsibility to CSU. This time frame is referred to as the Conversion period. Following the transfer of water system assets and operations to CSU, CMD1 will remain active as a Special District with its primary function to be the vehicle to retire the water system's debt.

Certain requirements by CSU, not addressed within this report, will need to be completed within the Conversion period prior to ownership transfer.

Recommended system improvements to be completed within the Conversion time frame are presented in Section 7 of this study that generally include:

- Replacement of all 2-inch galvanized iron distribution system.
- Removal of existing 150,000 gallon distribution system storage tank.
- Relocation of chlorination facility
- System looping to connect the north and south sides of the distribution system on the east side of the service area.
- Relocation of distribution system mains out of private properties and into public rights-of-way.
- Relocation of the water mains at Stream Crossings 24 and 26
- Replacement of water main at Rampart Terrace

- Replacement and relocation of water main at Fitz Gulch

Information and documentation provided with this report includes:

- Available system asset data presented in ArcGIS format
- Existing easement and property ownership documents
- Water loss assessment
- System Mapping in AutoCAD format
- Storage tank evaluation
- Distribution system modeling evaluation
- Field inventory and testing reports
- Customer service inventory
- Water quality assessment

Information and documentation to be generated within Conversion period includes:

- Written Water System standard operating procedures
- Ongoing water quality monitoring reports
- Documentation of valve condition, operation, repair, replacement, or removal
- Locations of existing facilities to remain in place that are not provided in this report because of facility inaccessibility
- Improvements to as-built documentation
- Repair documentation
- Maintenance and inspection records
- Pertinent operation and maintenance manuals
- Leak survey
- Survey of septic system locations and proximity to water mains
- Update and implementation of cross connection control program
- Detailed map of the whole distribution system ready for Conversion
- Water System easements for assets to remain on private property
- Legal documents for transfer of water system and assets
- Environmental Site Assessments for parcels, easements, etc. that will be transferred to the control of CSU

SECTION B
INTRODUCTION

The purpose of this report is to provide a comprehensive assessment of the Cascade Metropolitan District No. 1 (CMD1) water system and to present recommended improvements to it. This assessment has been formatted to follow the bullet points contained within the Agreement between CMD1 and CSU. Some areas overlap; however, for the sake clarifying the requirements set forth within the Agreement, they are addressed point by point in the sequence in which they are contained within the Agreement.

In 1990, the Cascade Public Service Co. entered into an Agreement with Colorado Springs Utilities (CSU) to provide the potable water supply to the constituents of the Cascade community. The Water Company subsequently discontinued use of its water treatment and pumping facilities. CMD1 was created in 2004 with the Company's assets assigned to it. In April 2015, CMD1, CSU, and other parties entered into a Settlement Agreement with respect to Water Court Case 2011CW42 and the case was dismissed. As part of the Settlement Agreement, CMD1 entered into an Agreement with CSU to convert the District's water system to a CSU owned and operated system provided that the District meets certain conditions. Those conditions of the Agreement include:

- Construction the Minimum Required Water System Improvements
- Provide CSU with required information of record
- Transfer District distribution system to CSU after completion of the improvements
- Assign all permits and licenses to CSU
- Convey all easements and rights-of-way to CSU

The required System Inventory and Assessment Study was completed by JDS Hydro Inc. and delivered to CSU by the required June 1, 2015 deadline. The study was compiled and presented to address the requirements of Appendix A of the Settlement Agreement titled "Standards for Water System Inventory Assessment". Extensive comments on the report were received by CMD1 from CSU. CMD1 subsequently retained a new consultant to compile a revised study. The revised System Inventory and Assessment Study has been prepared by GMS Inc., Consulting Engineers to address, as best possible, the CSU review comments as well as to provide in greater detail the

distribution system's proposed Minimum Required Improvements. This study is being submitted in accordance with the 180-day requirement contained in the Agreement period. Much of the data compiled and presented within the June 2015 study is used in this revised study.

Much of the information requested in CSU's comments is simply not available due to several factors. Some of the requested information such as Standard Operating Procedures have not been compiled by the District. Some of the information requested is not available. Also, some of the requested financial information has been taken by attorneys under discovery proceedings in the prosecution of Terry Malcom. With respect to the information requested by CSU that is not available, this report presents a means of how that information will be generated and presented in the future.

In accordance with the Agreement, CSU will provide the District with an Improvement Requirement Report within 60 days of the submittal of this study based on the recommendations contained herein. CMD1 has 90 days to determine whether to proceed with the transfer of the system to CSU (referred to as the Conversion) based upon CSU's recommendations, and, if CMD1 determines to proceed with the Conversion, it will have five years to complete the system improvements. An additional two-year extension may be permitted if CMD1 has reached substantial completion of the Conversion, as defined in the Settlement Agreement, by the 5 year deadline. It is during this Conversion period that the District will compile and produce the remaining outstanding CSU requested documentation.

The CMD1 water system dates back to the early 20th century. The system has been upgraded and improved over time. Much of the distribution system is typical of a small community water system with small diameter piping and limited system looping. One of the primary objectives of this study is to provide recommended water system improvements necessary to upgrade the existing system to best meet the 2014 CSU Water Line Extension and Service Standards (Water LESS).

The existing water system's assets consist primarily of typical distribution system components including piping, valves, hydrants and blow offs. Pipe materials include ductile iron (DI), polyvinylchloride (PVC), high density polyethylene (HDPE) and galvanized iron (GI) pipe. Sizes range from 2 inches to 8 inches in diameter. Hydrants are of various makes. Existing hydrants are compatible with equipment used by the Cascade Volunteer Fire Protection District. Water service lines are either copper or galvanized iron. The District provides service to 362 customers (3

customers have 2 metered services for a total of 365 meters), 30 of which are considered to be commercial. Treated water is provided by CSU at a single point of delivery through a meter vault and pressure reducing valve vault. A single 150,000 gallon welded steel storage tank is located on the east side of the service area. It was originally constructed in 1951. The tank was enlarged in 1978. This tank provides gravity storage for meeting variations in daily demand within the service area. The discharge piping from the storage tank is served by a booster chlorination system.

The following sections of this report are structured to follow the "Standards for Water System Inventory and Assessment" as appended to the Settlement Agreement. Data included in the appendices of this report as well as the report itself are also being provided to CSU electronically including the ArcGIS database compiled to meet the CSU format requirements.

SECTION C

WATER SYSTEM INVENTORY ASSESSMENT

1. WATER SYSTEM INVENTORY

A comprehensive inventory of the Cascade Metropolitan District No. 1 (CMD1) water system was conducted as part of this study. All system assets were field surveyed and photographed. Field and record information on all assets was tabulated as available. Accessible valves and hydrants were operated. All data collected has been entered into an ArcGIS database using the Colorado Springs Utilities (CSU) formats provided for each asset. Existing and proposed water system mapping has been prepared using AutoCAD and is provided within this report. This report and all Appendices, AutoCAD drawings and ArcGIS database files are also being provided to CMD1 and CSU in digital format.

The existing water system map is included in Appendix A1 and consists of two sheets. Individual asset maps have been prepared for valves, hydrants and pipelines. These maps have been annotated with an ArcGIS identifier. Individual asset maps are included in Appendix A2.

1.1. WATER MAINS

Water system pipeline data is presented in spreadsheet form in Appendix B2. The system consists of 155 pipeline segments totaling 50,939 feet of piping. Of this total, 53% is ductile iron (DI) or cast iron (CI), 17% is galvanized iron (GI) or steel (GS), 30% is polyvinylchloride (PVC) and a fractional percentage is high density polyethylene (HDPE) or unknown. The system pipe sizes consist of 35% 8-inch diameter, 22% 6-inch diameter, 14% 4-inch diameter, 8% 3-inch diameter and 21% 2-inch and smaller diameter.

1.2. EASEMENTS

- Field Mapping Process

Prior to field work being accomplished, horizontal and vertical data control was obtained from the CSU Facilities Information Mapping System (FIMS). A utility location request was not called in; however, coordination with CMD1 staff was made to identify existing CMD1 facilities.

- Provide the Following Information for All Easements

  a) Type of survey performed: A topographic survey of facilities was accomplished tying in CMD1 assets to the FIMS network.
  b) Equipment used: Two types of equipment were utilized for collection of the data - Topcon Hyper Light Global Positioning System (GPS) and a Trimble S3 Robotic Total Station. Horizontal and vertical data was obtained on all visible and marked facilities by the CMD1 staff.
  c) What horizontal vertical control was utilized: As previously discussed, the CSU FIMS Horizontal and Vertical Control Network was utilized.
  d) (Not used.)
  e) What utilities' coordinates were provided: Several FIMS control points were utilized in establishing additional control points throughout the CMD1 service area. Coordinate data for those control points was provided by CSU. No other utility coordinate data was provided by any other outside source.
  f) Who operated the equipment and their experience level: Mark A. Leasure, S.I., was in charge of the field operations and obtained the horizontal and vertical data on assets in the field. David R. Frisch, P.L.S., was the professional in charge overseeing the collection of the data.
  g) Were locates obtained prior to the field work: Location of utilities was accomplished only on those assets that were identified by CMD1 staff. When future improvement projects are being designed, utility location requests will be called in for all utilities and obtained at that time.
  h) What geospatial location specifications were followed: The Federal Geographic Data Committee (FGDC) standards were utilized in the collection and the processing of data obtained in the field.

- Septic System Locations Within 25 Feet of the Public Water Source

The specific locations of septic systems were not identified nor were they marked in the field. As future improvement projects are designed, that data will be obtained during the preliminary design surveying phase for each project.

- Numerous questions have been posed by CSU and the CMD1 staff regarding easements. We request reference be made to Paragraph 3.16 of this report where a detailed listing of recorded instruments, dedicated easements on subdivision plats and road rights-of-way that can accommodate public utilities have been identified.

1.3. NONPUBLIC ACCESS ROADS

There are several roads within the CMD1 service area that are private roads; however, in all cases, the private roads accommodate public utilities as indicated on the subdivision plats and/or recorded instruments. If there are no public utility easement provisions over the private road rights-of-way, they have been identified in Paragraph 3.16 of the report. Those nonpublic access roads that are currently identified include:

- Aspenglow Lane
- Chipita Pines Drive
- Dodd Road
- Pike Road
- Portions of Pyramid Mountain Road
- Portions of Topeka Avenue
- Portions of Severy Avenue
- Portions of Outpost Road

The above list may not be all inclusive, but includes those that are identified at this time. If easements have not been provided over the private road rights-of-way, they are addressed in Paragraph 3.16. Easements will be recommended for those areas where existing and proposed assets lie outside of recorded instruments and dedicated rights-of-way.

1.4. VALVES

Water system valve data is presented in spreadsheet form in Appendix B3. Field data collection forms and photographs are also contained in Appendix B3. All operable valves are noted in the spreadsheet. A summary of operable valves is presented in Table 8 of this study. All buried valves have been assumed to be line size.

1.5. FIRE HYDRANTS

Water system fire hydrant data is presented in spreadsheet form in Appendix B4. Field data collection forms and photographs are also contained in Appendix B4. All hydrants were operable except one that needs to be replaced. The summary spreadsheet also includes seven (7) yard hydrants located within the distribution system.

1.6. BLOW OFFS AND CURB STOPS

Water system blow off data is presented in spreadsheet form in Appendix B5. Photographs of blow offs are also included in the appendix. The District has eleven (11) blow offs. This table includes data on thirty-eight (38) curb stops identified in the field inventory effort. The District reports that all but a few of the customer service lines have curb stops.

1.7. PRESSURE REGULATING VALVES

The District's distribution system does not have any pressure regulating valves. The CSU connection vault includes 6-inch and 2-inch pressure reducing valves (PRV) in parallel. The existing storage tank has an altitude valve on the inlet pipeline that maintains the tank level approximately half full. These valves are listed in the Control Valve Data spreadsheet in Appendix B7.

1.8. PRESSURE ZONE

The CMD1 water system operates under two pressure zones. They are separated by the altitude valve at the storage tank. The upper zone has a static hydraulic grade line within

the system based on 165 psi available at the CSU delivery point at elevation 7, 824 feet above sea level (ASL). The high pressure zone serves areas on the east side of US Highway 24, north of Pyramid Mountain Road and Gardiner Road; and on the west side of US Highway 24, north of the intersection of Chipita Park Road and the Pikes Peak Highway. The low pressure zone has a static hydraulic grade line based on the storage tank water level at half full at an elevation of 7,783 feet ASL. The lower pressure zone serves areas on the east side of US Highway 24 south of Pyramid Mountain Road and Gardiner Road; and on the west side of US Highway 24, south of the intersection of Chipita Park Road and the Pikes Peak Highway. The differential static pressure is 18 psi.

1.9. AIR AND VACUUM RELIEF VALVES

The distribution system includes one air/vacuum release valve, which is located north of the intersection of Dodd and Pike Road. This valve is listed in the control valve spreadsheet in Appendix B7. Photographs of the valve are also included in this appendix.

1.10. PUMPING FACILITIES

Existing pumping facilities within the District's system have been abandoned and have not been used since the connection with the CSU system in 1990. As part of the recommended improvements, during the Conversion period, these pump stations will be demolished.

1.11. STORAGE FACILITIES

The District's water system includes a single active water storage tank. This 150,000 gallon welded steel storage tank was originally constructed in 1951 and its height increased in 1978. The overall condition of the tank is considered to be fair to poor. A detailed discussion of the tank is presented in Section 4.4 of this study. The December 2015 water storage tank inspection report is included in Appendix C2.

1.12. VALVES AND BUILDINGS

A summary of water system vaults is included in spreadsheet form in Appendix B16. This summary includes the two CSU vaults at the delivery point to CMD1, the storage tank altitude valve vault and meter vault for Santa's Workshop. The two existing pump stations within the system, an old abandoned storage tank and the 150,000-gallon storage tank are proposed to be demolished within the recommended improvements of this study. The existing Chlorination Building is recommended to remain in place for communications support for the Cascade Volunteer Fire Protection District (CVFPD). A discussion of the buildings within the District is presented in Section 4.11 of this study.

1.13. POST CHLORINATION SYSTEMS

A description of the existing post chlorination system is presented in Section 3.6 of this study. Product specifications and installation documentation are included in Appendix B8.

1.14. CATHODIC PROTECTION

A discussion of the existing pipeline cathodic protection is presented in Section 3.2 of this study. Distribution system mapping showing segments of pipeline with cathodic protection installed is included in Appendix A2.

1.15. FIRE SERVICE LINES

There are no residential or commercial customers within the service area that are equipped with fire protection sprinkler systems.

1.16. CORPORATION STOPS, CURB STOPS AND STOP COCKS

The District requires new services to be installed in accordance with Section 4 of the CMD1 Rules and Regulations. These regulations require a curb stop. The curb stop represents the delineation of ownership and maintenance responsibility. The District

owns and maintains the service line from the main to the curb stop. It is the Owner's responsibility to maintain the service line from the curb stop to the building. This does not include the meter and meter pit. Meters and meter pits are maintained by the District. The District operator has indicated that all service lines have curb stops with the exception of only a few. Curb stops located during the field inventory effort are tabulated with blow offs and are listed in Appendix B5. All service taps to 4-inch and larger piping are presumed to have been made with a corporation stop.

1.17. SERVICE LINES

Service line size, material, and length are tabulated in spreadsheet form in Appendix B9. The list consists of 382 service line segments to the 365 customer meters together with 17 segments of service lines to blow offs plus some customer services with multiple segments. This data was entered into ArcGIS. Of the total, 81% are copper, 15% are GI or GS, and 5% are PVC, HDPE or unknown.

1.18. SERVICE PRESSURE REGULATORS

All services have pressure regulators. Pressure regulators were not inventoried within this study. A discussion of service pressure regulators is presented in Section 3.5.

1.19. WATER METERS AND METER SETTERS

The June 2015 Water System and Assessment Study presented several customer meter counts. The detailed handwritten inventory tabulation sheets provided in the study were reviewed. The inventory lists 352 meters and 14 additional addresses with no indication of service. The inventory has been reviewed by the District Manager and District operators. The current customer billing list provided by the District Manager has been reviewed by the District's operators and the consultant. The current billing list is included in Appendix B11 of this study. The current list consists of 360 billed customers. Two additional services to the Cascade Volunteer Fire Protection District are metered. These services are covered under an informal Intergovernment Agreement. These are not included in the billing listing. They consist of the Cascade Volunteer Fire Protection District office on the north side of the library and the upper barn to the west of the library.

A third Cascade Volunteer Fire Protection District service is included in the billing summary. The billing list identified three (3) customers who have two (2) meters each and receive a single bill. These are for:

- 4585 Hagerman Avenue
- 7855 Marriott Road
- 8120 Chipita Park Road

Therefore, there are 365 metered service connections to the water system. There are no known unmetered services within the service area. One customer service has been shut off, but continues to be billed. The following is a summary count of the District's customers

TABLE 1

CUSTOMER SUMMARY [1)]

Meter/Customer	Number
Services Billed	360
Metered/Not Billed [3)]	+2
Two Services on Single Billing	+3
Total Services	365
Billed/No Service [2)]	-1
Total Active Services	364
Classification	
Commercial [3)]	30
Residential	335
Meter Location	
Inside House/Business	141
Outside in Meter Pit	224
Meter Sizes	
3/4 - inch	358
1 - inch	5
2 - inch	2

1) From December 2015 Billing

2) 8235 Oak Street, Service turned off

3) Includes Fire House Upper Barn and Office

The complete list of billed services is presented in Appendix B11 of this study. This list does not include the two (2) Cascade Volunteer Fire Protection District unbilled services. Three (3) billed accounts are for two (2) meters each.

The system operator has identified 28 services that would be considered to be commercial customers. These 28 are tabulated in Appendix B11. The total commercial count is therefore 30 with the addition of the two unbilled Fire Protection District services.

A summary of the existing meter manufacturers/models is presented in the following table.

TABLE 2

METER SUMMARY

Existing Meter	Number
Amco Model C700	215
Badger Model 25	30
Elster	18
Unknown	102
Total	365

Meter setters were not inventoried within the meter inventory. Existing meter setters are Mueller copper setters with an angle ball valve on the inlet. The setters do not have backflow dual check cartridges, thus are not in compliance with current state cross connection control requirements. The ¾-inch meter setters have a laying length of 7-½ inches.

1.20. AUTOMATIC METER READING SYSTEM

The District uses an automatic meter reading and billing system. Based on the meter inventory presented in the June 2015 study, there are 301 meters equipped with Itron W50 electronic read transmitters. Of the remaining meters, 23 are manually read and 41 are unknown. Manually read meters will not be equipped with electronic read transmitters during the Conversion as all meters and transmitters will be replaced by CSU during the Conversion period.

1.21. BACKFLOW PREVENTION

Backflow prevention devices have been installed at two customer services. These two are identified in Section 5 - Backflow Prevention. The District has identified 30 commercial customers within the service area and has required that all customers install backflow prevention devices by March 31, 2016. These 30 are identified in the meter summary spreadsheet in Appendix B10.

1.22. NON-POTABLE AND GREY WATER SYSTEMS

The District does not own, operate or sanction any non-potable or grey water systems within its service area.

1.23. SCADA AND TELEMETRY

The District does not use a supervisory control and data acquisition (SCADA) system for operation and control of the water system. The CVFPD utilizes the Chlorine Building for a radio transmitter. The meters use electronic read transmitters.

1.24. ABANDONED ASSETS

Appendix B12 includes a spreadsheet summary of abandoned pipelines identified within the District's service area. A second spreadsheet of abandoned items in Appendix B12 identifies the District's abandoned storage tank, fire hydrants and valves.

2. GEOSPATIAL INFORMATION

As a part of the Preliminary Engineering Report being provided to CMD1 and CSU, metadata for all assets has been compiled in accordance with Federal Geographic Data Committee Standards. The horizontal and vertical datums utilized for collecting data on the assets is in accordance with the CSU FIMS control network which is relative to the NAD 1983 horizontal datum and the NGVD 1929 vertical datum. The control points from the FIMS network utilized for this project are:

- E175
- GMF4
- 859A

The main base control point is the E175 FIMS monument. The two other monuments utilized were reference checks for the field equipment and to confirm the location of E175.

The parcel data utilized in the GIS base mapping was "CSU_lots" data provided by CSU. CSU _lots does not have lot data for the southerly portion of the CMD1 service area. Therefore, "County_Parcel" data was incorporated into the base mapping which was also provided by CSU. Please note there is a slight discrepancy between the "CSU_lots" data and the "County_Parcel" data.

The following data was utilized when transforming geodetic data to GIS data.

Linear Unit: Foot_US (0.3048006096012192)

Geographic Coordinate System: GCS_North_American_1983
Angular Unit: Degree (0.0174532925199433)
Prime Meridian: Greenwich (0.0)
Datum: D_North_American_1983
Spheroid: GRS_1980
Semimajor Axis: 6378137.0
Semiminor Axis: 6356752.314140356
Inverse Flattening: 298.257222101

3. INFORMATION OF RECORD

This section discusses currently available CMD1 hard copy records. The information collected has been placed into the "B" Appendices. There are pdfs available in the same format as the hard copies. The following list follows the order set forth in the Agreement between CMD1 and CSU.

3.1. AS-BUILT OR RECORD DRAWINGS AND SPECIFICATIONS FOR CMD1 WATER SYSTEM

A thorough review of the CMD1's files yielded only a single set of as-built documents in addition to several construction plans. These documents were provided to CSU at a November 13, 2015 progress meeting. Since that meeting, the documents have been separated based on as-built and construction documents. In addition to this information, there is one hand drawn document that is being provided to CSU to provide all available documentation for the area. Please note that all of this information is contained in Appendix B1.

The following represents the as-built set.

1. Water System Upgrades Pike and Dodd Roads / Hagerman Avenue & Fox Road

The following represents construction drawings for improvements undertaken, but there are not any known as-built drawings.

1. Cascade Metropolitan District No. 2 – Edward Place
2. Cascade Metropolitan District No. 2 – Bluff Road
3. Service Connection Project
4. Valve Replacement Project
5. Water System Upgrades Heizer Street

The following represents construction drawings for improvements that have not been undertaken, but are contained within the District's files.

1. Water System Upgrade Valve House – Park Street
2. Water System Upgrade – Topeka Avenue

The remaining document is a hand drawing of the intersection of Pyramid Mountain Road and Gardiner Road. It is the best available as-built drawing of this area.

1. Hand drawing of intersection of Pyramid Mountain Road and Gardiner Road

No other construction documentation was found in the review. During the next five years, there will be additional information collected. As-built documents for all new improvements undertaken will be generated in addition to being placed in the ArcGIS file. This information will be provided to CSU accordingly. Furthermore, during the course of the construction activities, the locations of existing facilities to remain in place will also be documented. This information will also be compiled with respect to as-built documentation and incorporated into ArcGIS. This will include locations where a line valve is replaced and the water main remains in service. This should result in a detailed map of the whole distribution system.

In addition to the improvements the District will be undertaking over the next five years, there is the possibility of additional development occurring within the District. Should development occur, the District will require all facilities to be designed in accordance with CSU requirements, provide the design documents to CSU for review, and have a project representative onsite to observe that the facilities are being built according to the approved plans and specifications. Once any new facilities have been completed, the District will provide a certification to CSU that the facilities were built according to the approved construction documents and provide the necessary as-built information in hard copy and ArcGIS. This will ensure any improvements made subsequent to January 1, 2016 will have the necessary information available for CSU's review and approval.

3.2. CATHODIC PROTECTION DATA

Cathodic protection in the District is limited to the more recently installed water mains. The cathodic protection requirements the District has been enforcing include:

1. Installing a 9 pound (lb) magnesium anode on all fittings for PVC water mains being installed.
2. Installing a 32 lb magnesium anode for every 300 feet of ductile iron pipe with each fitting/joint being double bonded.
3. Install a 9 lb magnesium anode on all fire hydrants.

A map showing the locations of all known cathodic protected mains is included in Appendix A2. The locations of the magnesium anodes are generally known from what as-built information is available and how the anodes were to be installed. The exact locations were not marked on the as-built drawings, thus the specific locations are unknown. In locations where as-built information is not available, the general and specific locations of the anodes are also unknown.

All future water mains to be installed will incorporate CSU's cathodic protection requirements. Locations of the anodes will be defined and placed on the record drawings for the project. This will include any improvements the District undertakes in addition to any development that occurs.

3.3. STANDARD OPERATING PROCEDURE

Duane Schorman has been operating the CMD1 water system since 1985. Over this period, Duane has created several standard operating procedures; however, these procedures are not written down. The District has timeframes throughout the year when specific procedures are conducted. The following presents the procedures the staff undertake throughout the year with further discussion in subsequent subsections.

1. Drive half of the distribution system alignment daily
2. Monitor chlorine residual and turbidity at the Topeka Avenue Pump House building daily
3. Record the master meter reading daily
4. Check the chlorination equipment, tubing and chlorine solution at least once per week
5. Seasonal tank operations
6. Bleed water from the 2" water main along US Highway 24 frontage road
7. Valve operation to take the tank out of service
8. Read and report user meter reading data to District Manager monthly
9. Sample for and provide monitoring results for bacteria and chlorine residual monthly
10. Sample for and provide monitoring results for Haloacetic Acid and Total Trihalomethane quarterly

11. Flush all fire hydrants annually

3.3.1. HYDRANT FLUSHING

The District conducts annual fire hydrant flushing to flush the distribution system. This typically occurs between September to early November and is predominately conducted in October. Timing is largely determined by weather and ground conditions. The goal of the District staff is to accomplish all flushing prior to frost forming in the ground. The flushing event includes all system fire hydrants in addition to the flushing hydrants located throughout the distribution system. Typically, this effort takes approximately one week. Each fire hydrant is flushed at least for one minute or until the water becomes clear.

This past October, all fire hydrants were flushed together with recording pitot tube readings. The results are contained in Appendix B4, which revealed the following needs:

1. Fire hydrant FH-E1 located within the Holy Cross Novitiate is inoperable and requires replacement. Please note this is a private fire hydrant, which is not the responsibility of the District to replace.
2. All hydrants need to have their cap threads cleaned and greased.
3. Four hydrants need to have their operation systems greased.
4. Three hydrants need their top covers replaced
5. Two hydrants need to have their operating nuts replaced.
6. One hydrant needs its pumper cap replaced.
7. One hydrant needs its stem replaced.

Moving forward, the District will continue to complete the required fire hydrant form when conducting flushing for each fire hydrant (Appendix B4). This information will be retained and provided to CSU upon taking over the operational procedures or made available as requested.

3.3.2. VALVE EXERCISING

The District has not historically had an active valve exercising program. Valves are operated on an as needed basis throughout the system. As a result, there are only a few valves that are operated a few times throughout the year while others rarely, if ever, are operated. There are specific valves in the distribution system that have been identified by CMD1 staff as non-operable based upon their age and unknown condition. The fear is operating these questionable valves may result in damage to the valve and potentially to the piping system, thus the valves are simply left in the open position. With this said, all valves were reviewed in the field. A form has been generated for this procedure (Appendix B3), which will be used for all future exercising procedures.

Moving into the future, the District will be operating one-half of their isolation valves on an annual basis. The form generated for the initial system review will be used for each valve. This will start to create a written history for each valve, provide the history of any needed repairs and overall operation of the valves. Please note that during the field data gathering effort, there were a total of 38 isolation valves that were not accessible. Reasons ranged from being under asphalt, concrete, or fill, and those directed by CMD1 staff to not operate. These valve related issues are being incorporated into the recommendations to have them exposed, evaluate their condition, replace or repair as needed, valve boxes raised as needed, and surface restoration undertaken as appropriate. This will ensure that all valves are operable and in good working order at the conclusion of the improvements.

3.3.3. CURRENT POSITION OF VALVES AND DISCUSSION

The District has a total of 117 isolation valves in the distribution system. Out of the 117 isolation valves, there are nine that are in the closed position and 108 in the open position. The following identifies the valves in the closed position and a discussion of why they are closed.

1. V-E48 – This valve is located in the intersection of Pyramid Mountain Road and Gardiner Road. Having this valve closed forces all water on

the east side of the District and the southwest portion of the District to flow through the District's water storage tank. Thus, it needs to be closed for proper operation of the tank.

2. V-E61 – This valve is located at the end of the water main in Rampart Terrace where a flush hydrant is located. This valve operates the flush hydrant.
3. V-E67 – This valve is located inside a vault that forces the supplied water through a 2" service line instead of the 8" water main within the Holy Cross Novitiate. The valve is intended to be opened during a fire, thus providing fire flow to the private fire hydrants contained within the Holy Cross Novitiate.
4. V-E68 – This valve is located within the Holy Cross Novitiate property at the end of the private 8" water main.
5. V-E76 – This is a wheel valve located on the east side of the water storage tank's drain line. The valve is normally closed to keep the tank's contents therein.
6. V-W56 – This valve is located at the intersection of Pike Road and Dodd Road. The main is a dead end main labeled on the drawings for potential future extension.
7. V-W58 – This valve is located 40-feet east of the intersection of Fountain Avenue and the Pikes Peak Highway in a ditch. The line is a dead end line and does not have any service taps at this location.
8. V-W77 – This valve is located southeast of the Park Street Pump House building. This valve opens one of two blow off lines coming from the pump house. Please note the proposed improvements will remove this valve from service.
9. V-W63 – This valve is located in the meter vault at Santa's Workshop. The valve is specifically located on the bypass line for the meter. If work needs to be undertaken on the meter, the bypass valve is opened and the two main line valves inside the valve are turned off.

3.3.4. STORAGE TANK OPERATING PROCEDURES

District staff have indicated the tank's level fluctuates between ⅓ to ¾ full. This variation may be adjusted within the altitude valve on the tank's inlet line; however, the tank is operated at the same level throughout the year. No adjustments are made. This ensures no overtopping occurs along with eliminating the potential of the ice cap impacting the tank's roof structure during the winter months.

3.3.5. PUMP OPERATING PARAMETERS

In 1990, CMD1 connected to CSU for its potable water supply through CSU's 12" water transmission main. Once the District was connected to CSU's system, all pumping operations were eliminated as a result of the system pressure being provided by CSU. There have not been any pumping operations since that time and there is no plan to change this operational procedure in the future.

3.3.6. SEASONAL OPERATING CONDITIONS

The District has one primary seasonal operational condition. This procedure focuses on keeping one of the 2" water mains from freezing. This particular main is approximately 18" deep and is located on a north-facing slope. The water main is a 2" galvanized iron pipe located in the southwest corner of the distribution system in the back yards of the properties located along US Highway 24's frontage road. This main is bled throughout late fall to mid spring at a rate of 1 to 1.5 gallons per minute (gpm). The specific location where the line is bled is on parcel 8300000112, just south of and east of the house. Outside of this condition, there are no other seasonal operations performed.

3.4. ISOLATED AREAS OF THE SYSTEM

There is only one segment of piping within the distribution system that is isolated. This is a ten-foot long segment of four-inch ductile iron pipe located in Pyramid Mountain Road at Gardiner Road. This line serves as a storage tank bypass for the 8-inch tank inlet line.

Valving at the Park Street pump house for piping from the abandoned storage tank has been shut off as depicted on the existing system drawing contained in Appendix A.

3.5. PRESSURE REDUCING VALVE OPERATING CONDITIONS

The CMD1 distribution system operates under two pressure zones. The upper zone is served by the CSU connection. The lower zone is served by the storage tank. There are no pressure reducing valves within the distribution system. The CSU connection to the CMD1 distribution system consists of a pressure reducing valve vault followed by a meter vault. The pressure reducing valve vault includes both 6-inch and 2-inch pressure reducing valves in parallel followed by a 6-inch pressure relief valve. The pressure reducing valves reduce CSU's delivery pressure from 250 pounds per square inch (psi) to 165 psi. The valve manufacturer was not provided. The combined capacity of the two pressure reducing valves range from 1 to 2,300 gpm based on a CLA-VAL Model 100-01.

Each customer service has a pressure reducing valve at the point of service, typically located after the meter. Pressure reducing valves are set to reduce high system pressures down to approximately 50 psi. The District uses a Watts Model 25AUB-Z3 pressure reducing valve on customer services; however, an inventory of customer pressure reducing valves was not conducted.

3.6. CHEMICAL DOSING

The CMD1 operates a booster chlorination system located at the 150,000-gallon water storage tank. The 6-inch discharge line from the tank is dosed with sodium hypochlorite in order to maintain an adequate chlorine residual in the distribution system. The Stenner Model 45MHP2 peristaltic feed pump is run continuously at five percent speed, or 0.15 gallons per day. A 15% sodium hypochlorite solution is fed adding 1.5 pounds of chlorine per day to the system. The residual chlorine is measured at the Park Street Pump House at a typical concentration of 0.4 milligrams per liter (mg/l). The actual dosing rate varies with the flow rate out of the tank.

3.7. FACILITIES OPERATION AND MAINTENANCE MANUALS

A thorough review of the CMD1's files did not reveal any operation or maintenance manuals. With this said, the District does not have any pieces of equipment that are not currently contained within CSU's water system. The only items outside of standard gate valves, fire hydrants, etc., include the altitude valve located adjacent to the water storage tank and the chlorination equipment.

Operation and maintenance manuals for all pieces of equipment installed in the future will be required within all CMD1 contract documents or any new private development. This will include, but will not be limited to, valves, fire hydrants, meters, etc. These documents will be provided to CSU once they have been received from the contractor and reviewed. These documents will be generated within the next five-year period and toward the end of the construction activities outlined herein or as any new development is undertaken.

3.8. MAINTENANCE AND INSPECTION RECORDS BY ASSET

The CMD1 has experienced two unforeseen situations that have severely limited their ability to provide any real financial and inspection history on the water system. The first unforeseen and the most damaging situation the District has experienced is the embezzlement of District funds by the then manager, Terry Malcom. As a result of the embezzlement, a significant portion of the District's records are with the District Attorney (DA). The DA has indicated to District representatives that they are unable to provide the documents back to the District given the potential of future legal proceedings with Mr. Malcom. Therefore, this has significantly limited the District's ability to collect and provide the requested data.

Detailed maintenance and inspection record keeping was traditionally accomplished by the water system operators in logbooks. The District staffs' log books were also taken for the embezzlement trial; however, two log books were found for the current 2015 calendar year and 2014. Scanned copies of the log books are contained in Appendix B13.

In addition to the embezzlement trial complications, the District has also recently transitioned to a new management company overseeing and managing the District. All

available maintenance and inspection information that remains is contained in the recent financial audits. All available information is contained in Appendix B13. Please note this type of information will be collected by the District's new manager, Schooler and Associates, during the next five years of operation. This data will be provided to CSU as requested or at the point of the operational transition.

3.9. LEAK LOCATIONS AND REPAIR HISTORY

No records are kept on leak repairs other than those notes made in the operator's calendar book. An interview with the operator noted five locations where leaks were repaired in 2015. These were located as follows:

- Rampart Terrace, 2" GI piping on the south side of 5330 Rampart Road
- Poplar Street, 3" DI piping adjacent to 8275 Poplar Street
- Severy Avenue, 4" DI piping adjacent to 7770 Severy Avenue
- Frontage Road, 2" GI piping adjacent to 7955 US Highway 24
- West of Frontage Road, 2" GI piping on west side of 7855 US Highway 24.
- West of Frontage Road, replacement of fire hydrant on west side of 7855 US Highway 24.

Leaks are typically repaired at the leak's location by cutting out a short segment of pipe and installing a short pup with mechanical couplings. The operator noted that four to five leaks are repaired annually.

3.10. WATER METER REPLACEMENT, TESTING AND CALIBRATION

The District does not conduct testing of customer meters. Meters are replaced when they stop or show a noticeable under-registration in monthly usage. As presented in Section 1.19, most customer services are equipped with an Amco Model C700 meter. This is the model used for replacement meters. The master meter at the CSU connection is a 6-inch Sensus Omni C2 compound meter. It is owned and maintained by CSU.

3.11. COPIES OF ALL AGREEMENTS FOR PROVIDING WATER SERVICE TO OTHERS

CMD1 has a single intergovernmental agreement (IGA) for providing water service. Outside of this agreement, there are no other agreements. The IGA is for providing water service between the District and Cascade District No. 2. This IGA has been included within Appendix B14 for review. Large or bulk water users connected to the system are charged by the rate structure created by District's board.

3.12. REPORTS AND STUDIES OF CMD1 WATER SYSTEM

The following items and documents provide information on the requested topics. These represent all of the known available documents.

3.12.1. ENGINEERING REPORTS

In total, the District has a single engineering report completed within the last 10 years. This report was conducted by JDS Hydro and is contained in Appendix C1. In addition to the engineering report, CMD1 has conducted a tank evaluation. This report is contained in Appendix C2. The only other related report provided herein is the ISO Public Classification Summary Report, June 2014. This report is located in Appendix C3. No other reports outside of these have been found as a result of the review.

3.12.2. REGULATORY COMPLIANCE REPORTS

Four letters were recovered in reference to correspondence to CMD1 from the Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Division (WQCD). They include the following:

1. Letter authored on November 5, 2008 from the CDPHE, WQCD, regarding Compliance Advisory – Monitoring and Reporting Requirements, Total Trihalomethanes and Haloacetic Acids. This Compliance Advisory focused specifically on the CMD1 missing one of two sample submission requirements for Total Trihalomethanes and

Haloacetic Acids. The District submitted the results of the Total Trihalomethanes and Haloacetic Acids, which was within the current quarter they were to be submitted; however, the samples were taken beyond the 90-day requirement from the previous sampling event. This was the result of the laboratory holding onto the samples beyond the allowed holding date, which required a resample of Total Trihalomethanes and Haloacetic Acids. The issue was resolved with the appropriate sample being provided.

2. Letter issued on October 27, 2011 from the CDPHE, WQCD, regarding the District's Sanitary Survey. The letter addressed one significant violation and 16 observations/recommendations. The violation was concerning the mesh size of the screen on the tank's vent while the observations/recommendations predominately focused on the need for the District to have specific written procedures in place. A few comments spoke specifically to items on the storage tank.
3. Letter issued on December 2, 2013 from the CDPHE, WQCD, regarding the District's Sanitary Survey. The letter noted one "Other Violation" and three observations/recommendations. The other violation was in reference to the need to have a Cross Connection Control Program while the three observations/recommendations pertained to the elevated levels of water loss, how record keeping was being undertaken and the need for an operation and maintenance plan.
4. A CDPHE, WQCD written notification on April 14, 2015 regarding monitoring and reporting Total Haloacetic Acid for the period between January 1, 2015 to March 31, 2015. The District was to sample Haloacetic Acid between January 1 and March 31 within no more than 90 days after the previous sampling event. The District sampled within the defined time frame, but exceeded the 90-day period from the previous sampling event. The District was notified of the error and has since arranged sampling to stay within the compliance monitoring schedule.

No other letters, violations, notifications, consent orders or compliance schedules have been issued to the District from the CDPHE, WQCD. These are all of the known documents.

3.12.3. FINANCIAL INFORMATION ON COST OF OPERATION AND MAINTENANCE, EXCLUDING LABOR COSTS

Specific receipts for financial related information for the District are limited. This directly relates to the embezzlement that occurred and subsequent legal activities. In order to provide some picture of the financial realities of operating and maintaining the District, audits starting in 2012 through 2014 were reviewed in addition to the 2016 budget. Please note all management, legal, engineering, audit, accounting labor and basic expenses associated with running an office have been left out of the following table. The expenditures associated with operating and maintaining the system are presented in the following table.

TABLE 3

WATER SYSTEM EXPENDITURES

Year	Utilities and Telephone	Repairs and Maintenance	Chemicals and Supplies	Water Quality Testing
2012 [1)]	$ 4,237	$ 24,863	$ 2,246	$ 1,906
2013 [1)]	$ 3,828	$ 6,558	$ 882	$ 612
2014 [1)]	$ 2,301	$ 8,600	$ 740	$ 1,798
2015 [2)]	$ 2,000	$ 25,000	$ 1,000	$ 2,500
2016 [3)]	$ 2,000	$ 10,000	$ 1,000	$ 2,500

1) From Audit exemption filings

2) Taken from 2016 budget for the 2015 amended values.

3) Taken from 2016 budget for the 2016 budget values.

3.13. ACTIVE ENVIRONMENTAL PERMITS AND PLANS ASSOCIATED WITH CMD1 WATER SYSTEM

The District does not have any active environmental permits or plans that are associated with the water system. Given the simplistic nature of the system, there are not any requirements CMD1 has to meet. With this said, the following information is provided.

In reference to the required underground water storage tank and the above ground storage tank inventory, the District has one partially buried and one above ground tank.

The original and still operational tank is the ground level water storage tank located below Pyramid Peak on the east side of the District. This tank was constructed in 1951 as a welded steel tank. At the onset, the tank was partially buried. The current thought is that all buried portions of the tank have not been exposed since the original construction. Twelve vertical feet of shell paneling was added to the tank shell in 1978. This brought the total volume of the tank to 150,000 gallons. The tank's diameter is approximately 32.5 feet with separate inlet and outlet lines. The last timeline for coating the tank is unknown. The tank also has a 2-inch drain line, which begins on the sidewall of the tank approximately 6 inches above the ground.

The District's other tank is a buried concrete tank with a concrete dome top. This tank was constructed around 1960 to serve the western portion of the District. The tank was removed from service in 1990, which is when the CMD1 connected to CSU's potable water system. As part of the forthcoming water system improvements, the abandoned tank will be programmed to have a physical break made between the active and abandoned system's facilities. Outside of these two tanks, the District does not have any other tanks within their water system.

Since the District is receiving treated water, there is a very limited need to add any additional chemicals to the water system. This significantly limits the amount of chemicals, products and materials needing to be stored that would have an MSDS sheet. The only products the District uses with MSDS (Appendix C5) sheets include: hypochlorite, oil and gas for the generator, and WD40. These items are stored at the Topeka Avenue Pump House. The Topeka Avenue Pump House also accommodates paint product storage. Outside of these items, the District does not store any other chemicals or products. The District does not see a need to transfer the Topeka Avenue Pump House to CSU. This should limit any concerns with the items stored therein.

Limited information exists about the location of water mains in close proximity to septic tanks. Within the replacement of the 2-inch main in Fitz Gulch, the District installed a 2-inch diameter HDPE pipe. The pipe was directionally drilled and was installed directly underneath a property's septic tank. The understanding is the tank is owned by the Stults'. Outside of this area, no other mains are known to be within 10 feet of a septic

system and its associated leach field. Recommended improvements include moving this water main.

3.14. DISCLOSURE OF ILLICIT DISCHARGES

The District staff was interviewed with respect to illicit discharges of non-potable water, potable water, chemicals, oil and associated contaminant plumes. The District has no known knowledge of, and has not received any Notice of Violation or fines for illicit discharges. Potable water discharges are presumed to be occurring from subsurface leaks and breaks within the distribution system. The District also operates a single bleeder discharge located at the southernmost end of the dead end main in US Highway 24's frontage road. The bleeder is a partially open blow off valve and is reported to flow at approximately 1 to 1.5 gpm during the winter months to prevent pipe main freezing.

3.15. MATERIALS STAGING AREAS LIST

CMD1 has a total of three separate locations where buildings house portions of the District's water facilities. These locations include the Park Street Pump House building, the Topeka Avenue Pump House building and the two chlorination buildings located at the water storage tank. Out of these facilities, the District only uses the Topeka Avenue Pump House for stored materials. The other two locations do not have any materials stored. Furthermore, the recommended improvements to the District's water system will provide for the ability to operate the water system without these facilities. Therefore, the District will maintain ownership of all three locations and not transfer the facilities to CSU's control. In addition to the storage facilities, CMD1 has limited pieces of equipment.

CMD1 does not own any heavy operating equipment. As a result, the District does not perform any of their excavation work and therefore does not have any staging and storage areas. All material the District owns is stored in the confines of the Topeka Avenue Pump House. Any piping, meter pit components, valves, etc. the District desires to store are stored adjacent to this building. The District does not own any gravel pits or borrow areas. In the event the District needs bedding, road base or borrow material, it is provided by the contractor undertaking the needed work on behalf of the District.

As previously noted, the District stores all of its materials at the Topeka Avenue Pump House. Based on conversations with District staff, we understand the stored materials consist of meter pits, replacement valves and fire hydrants, tapping saddles, corporation stops, curb stops, valve boxes, etc. in conjunction with the District's portable generator and paint for the fire and flush hydrants. Such results in a limited amount of MSDS sheets for the stored material. For the stored materials that have MSDS sheets, the sheets may be reviewed in Appendix C5.

A review was undertaken to see if any mining operations existed within the District's boundaries. Based on the Colorado Department of Natural Resources, Division of Reclamation and Mining Safety, the District's service area has contained one mine. The mine was owned and operated by the Joe Morin Casenda Company specifically for mining granite and granite gneiss. The specific location of the mine is not available on from the Division of Reclamation and Mining Safety. The mine has not been active for quite some time with the last status update dated March 3, 2002. The mine was not active at that time. No other known mining activity has occurred within the District's boundaries.

No known wildlife protection plans are known to exist within the District's boundaries. In the event any additional information is found on any of these topics over the next five years, this information will be provided to CSU accordingly.

3.16. LISTS OF EASEMENTS

Easements are typically dedicated to public use or to a specific entity in one of two ways: by dedication on a subdivision plat or by a recorded instrument/easement (Easements) whereby one party grants the use of property for specific purposes to another party. There are other ways easements can be granted; however, not as common. For the purposes of our research of easements within the CMD1 service area, we researched the two most common ways easements are dedicated.

Based on the research conducted, twenty-two (22) recorded subdivision plats and 1 land survey plat within the CMD1 service area were recorded, the earliest dating back to June

of 1887. All 23 plats were retrieved from the El Paso County records and reviewed for reference to dedicated easements. Easements were noted on most all of the subdivision plats platted in recent years and have been incorporated into our base mapping.

Researching the public records for Easements is much more difficult. The assistance of a title company was utilized in the research. Computerized records exist from the present back to 1984. Records prior to that time are on microfiche and must be researched by reviewing the grantor/grantee indexes of the County records. For the purposes of evaluating Easements, the computerized records were the only records utilized. In the review of other documents and subdivision plats, three additional documents where Easements were granted dating back to 1954, 1957 and 1958 were found.

As previously stated, twenty-two (22) subdivision plats and one (1) land survey plat within the service area of CMD1 were recovered. The following is a list of those plats with the corresponding recording date and a reference as to whether or not easements were dedicated on the plat.

TABLE 4

SUBDIVISION PLATS

SUBDIVISION PLAT	RECORDING DATE	EASEMENTS (?)
Town of Cascade	June 1887	No
Addition No. 1 to Cascade	October 1887	No
Addition No. 2 Cascade	August 1888	No
Blue Mesa Addition	May 1928	No
The Pyramid Mountain Addition	July 1928	No
Resub. Blocks 10 to 13 Town of Cascade	August 1888	No
Reeves Subdivision	December 1977	Yes
Nienhueser Subdivision	April 1978	No
Guier Subdivision	November 1978	Yes
Marigreen Subdivision	December 1978	Yes
Tesker Subdivision No. 2	December 1980	Yes
Boysen Subdivision	September 1982	Yes
Patchwork Pines	June 1983	Yes
Santa's Workshop North Pole	March 1984	Yes
Burroughs Subdivision	December 1986	Yes
Hagerman Subdivision	April 1990	Yes
Cascade Pines Subdivision Filing No. 1	June 1991	Yes

SUBDIVISION PLAT	RECORDING DATE	EASEMENTS (?)
Black Bear Inn Subdivision	January 1998	Yes
Cascade Pines Subdivision Filing No. 2	May 1998	Yes
Knapp Subdivision	June 1998	Yes
Pikes Peak Mountain Estates	November 2001	Yes
Striking W Ranch Filing No. 2	May 2012	Yes
LAND SURVEY PLAT		
Land Survey Plat of (2) Unplatted Parcels	June 2002	Yes

As noted there are several recorded easement documents and conveyances found in the public record within CMD1's service area. The configuration of each of these documents has been incorporated into the base mapping provided in this report depicting the specific location of each Easement. The following is a list of the recorded instruments found in the research.

TABLE 5

RECORDED INSTRUMENTS

RECORDED INSTRUMENT	RECORDING DATE	DESCRIPTION
Book 1443 @ Page 377 Deed w/Easement	July 8, 1954	Access & Utility Easement over a portion of Rampart Terrace Road & Blanket Easement over NW 1/4 of NW 1/4 of Sec 23 for use in common w/ other owners to use & connect to water pipeline
Book 705 @ Page 46 Deed/Easement	November 21, 1957	Easement to extend water main near NE'ly end of Topeka Ave. (No water line presently exists at this location)
Book 1703 @ Page 615 Deed/Easement	October 3, 1958	30' Easement for 3" pipeline & roadway from the "Valve House" to the intersection with the Pikes Peak Highway.
Book 2961 @ Page 800 Deed/Easement	September 16, 1977	Triangle parcel within NW 1/4 of NW 1/4 of Sec 23 for roadway, ingress, egress & public utilities
Reception No. 095062972 (Bk 6672 @ Pg 916) Quit Claim Deed	June 27, 1995	Conveys tank parcel from The Cascade Town Company, Inc. to the Cascade Public Service Company, Inc.
Reception No. 095062973 (Bk 6672 @ Pg 918) Agreement & Easement	June 27, 1995	Inflow and Outflow Easement from Pyramid Mountain Road to the water storage tank site
Reception No. 202096624 Grant of Easement	June 14, 2002	Private ingress, egress & utility easement from Cascade Town Co. to D. Williams
Reception No. 214102228 Utility Easement Agreement	November 6, 2014	30' wide easement over 8176 W US Highway 24; Assessor's Parcel # 83232-00-015

RECORDED INSTRUMENT	RECORDING DATE	DESCRIPTION
Reception No. 214102229 Utility Easement Agreement	November 6, 2014	30' wide easement over 8182 W US Highway 24; Assessor's Parcel # 83232-00-013

3.16.1. COPIES OF EASEMENTS AND FEE LANDS

For reference purposes, the subdivision plats and Easements noted above are found in Appendix D to this report. Appendix D has been broken into two categories.

The first category is titled D1 - Subdivision Plats and includes copies of each of the subdivision plats noted in Table 4. All easement references on the subdivision plats have been highlighted. All of the easements shown on the subdivision plats have been drawn into the base mapping.

The Easements referenced in Table 5 above are attached under Appendix D2 - Recorded Instruments. As with the subdivision plats, each Easement reference has been highlighted for reference and the Easement has been incorporated into the base mapping.

3.16.2. RIGHTS-OF-WAY

A search of the El Paso County records yielded several instruments granting utility easements to the CMD1 or ones that have been reserved for public utilities. In conjunction with those documents, several other documents referenced roadways/ingress/egress easements. Of particular interest are the easements for the inflow line and outflow line to the water storage tank parcel and the roadway corridor along the 3-inch pipeline extending from the valve house to its intersection with the Pikes Peak Highway.

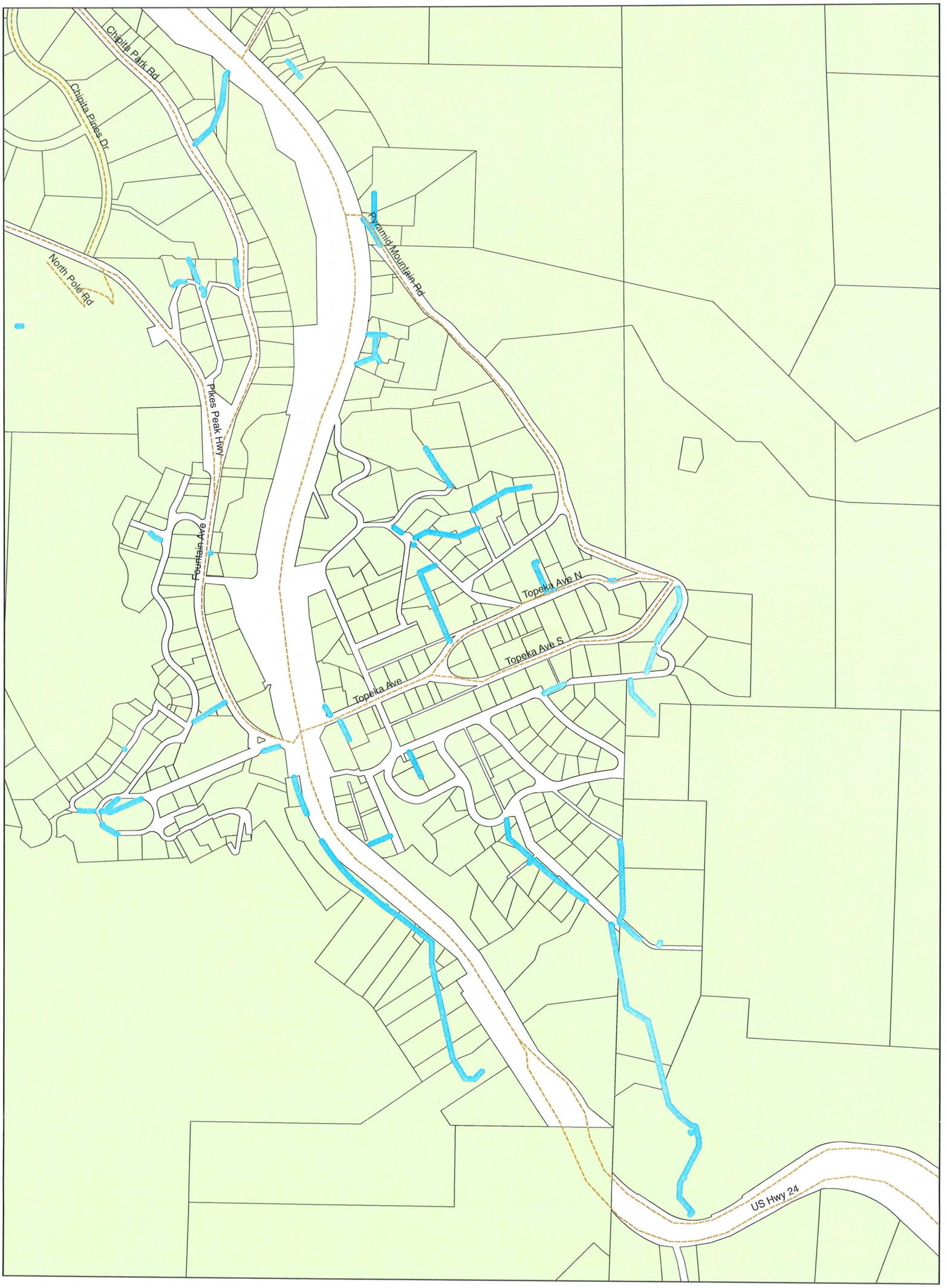
In addition to the easements dedicated on the subdivision plats and the easements found in the recorded instruments, the subdivision plats also reflect the road rights-of-way transferred to the public as a part of the dedication and acceptance of the subdivision plats. The majority of CMD1's assets lie within the

public road rights-of-way, which are generally owned and maintained by El Paso County. Historically and statutorily, public improvements are allowed within El Paso County road rights-of-way. In a recent conversation with El Paso County Public Services Department representatives, they are aware of CMD1's assets in the public rights-of-way. County representatives requested a permit be processed any time a right-of-way is disturbed to install new facilities, repair existing facilities or to access the existing facilities.

3.16.3. ASSETS NOT WITHIN EASEMENT, FEE LAND OR RIGHTS-OF-WAY

The following is a map and a list of properties where CMD1 assets encroach upon a property where no recorded document exists. The map shows the assets highlighted for reference. The parcel list identifies the parcel utilizing the El Paso County Assessor's Schedule Number as the reference.

Many assets have been in place for decades. In those cases where the assets have been in place for twenty years or more, an Easement by Prescription may exist if all components of the statutory requirements for a Prescriptive Easement are met, including, but not limited to, if the asset has been open, notorious, continuous, adverse, exclusive and under claim of right for the statutory period which is typically 18 to 20 years. The recommendation is made that an effort be made to have all assets covered with a recorded instrument as the Prescriptive Right, even though one may have a claim, must be proven. The following table represents the list of assets that do not lie within a recorded instrument, be it a road right-of-way, dedicated by subdivision plat or a recorded instrument.



N
W E
S

0 500 1,000 2,000
Feet

Legend

- DOT ROAD CENTERLINE
- ASSETS NOT WITHIN EASEMENT / R-O-W
- EL PASO COUNTY PARCELS

GMS, INC.
CONSULTING ENGINEERS
611 N. WEBER, SUITE 300
COLORADO SPRINGS, COLORADO 80903

TABLE 6

PARCEL LIST

ASSESSOR'S PARCEL	OWNERSHIP DOC	COMMENTS	EASEMENT REFERENCE
SCHEDULE #	REC. # and/or BK & PG		
8300000112	Hensley 204095470		
8322100007	Spruyt 10094869		
8322100086	Dubois 3950/578 208088743		
8322100089	Liby 203060002		
8322400002	Gobert 213041329		
8322400014	Gobert 213041329		
8322400017	Santa's Workshop 5460/669	Metering MH out of Easement	5832/114
8322400018	Gobert 213041329		
8322400020	McClure 208064778		
8322404024	Bontrager 210074335/210072742		
8323200006	Bonlinger 97029265	*Blanket Easement*	1443/377
8323200013	Stults 3924/430	May not be required	214102229
8323200015	Guthrie 203116724		
8323200017	Deeds 2314/963		
8323200027	Myers 214030267	*Blanket Easement*	1443/377
8323200029	Bingham 212057786	*Blanket Easement*	1443/377
8323201004	Hunter 213139461	*Blanket Easement*	1443/377
8323201005	Suuck 214039818	*Blanket Easement*	1443/377
8323201006	PB13 215073922	*Blanket Easement*	1443/377
8323201007	Main 213096410	*Blanket Easement*	1443/377
8323201008	Fuhrman 209055631	*Blanket Easement*	1443/377
8323201009	Billingiere 212068301		
8323201010	Johnson 213150329		
8323201011	Reid 202156896		
8323201012	Ahl 6056/780/215055831	*Blanket Easement*	1443/377
8323300014	Higens 209119608		
8323300029	Berryman 98097436		
8323300038	Smouse 6170/127		
8323300039	Husby 214019399		
8323300044	Zingale 203062484		
8323300049	Wagner 215043752		
8323300053	Kondratow 208034039	FH Lateral; short stub into property	
8323300065	Durben 200074477		
8323300070	Rossin 208035877		
8323300088	Eder 202008870		

ASSESSOR'S PARCEL	OWNERSHIP DOC	COMMENTS	EASEMENT REFERENCE
8323300104	Napier 202030167		
8323300105	Hagan 3184/777		
8323300106	Murdock 202183280		
8323300107	Wears 206106227		
8323300108	Berendt 5851/645		
8323300112	Foorman 6024/143		
8323300113	Spaulding 210010597		
8323300117	Borden 211089573		
8323303001	Thorne 214062743		
8323303005	Gafford 201140878		
8323303012	Rice 208110836		
8323303017	Sayers 5329/630		
8323303018	Denison 5161/19		
8323304011	Bromund 212099367	FH Lateral; short stub into property	
8323304016	Adelman 215127631		
8323304019	Heisch 2582/913		
8323306010	Herr/Pratt 200032087		
8323306011	Shaffer 212054241		
8323306018	Schultz 97048567		
8323306020	McGreevy 5460/1302-1310		
8323307006	Pinnow 211063669		
8326100001	Claire Cusack 206160995		
8326100002	Johnson 1646/573		
8326100003	Father Edward 212035910		
8326101001	Otis 212115229		
8326101002	Cusack-Hartman-Howard 211043066		
8326101006	Apotheker 213027205		
8326200014	Garrison 1613993		
8326200015	McCloskey 201157063		
8326200021	Houk 202190687		
8326200022	Drummond 212025883		
8326200034	Cowan/Reents 212094002		
8326200035	Berryman 213062592		
8326200042	Schormann 3239/498		
8326200043	McClure 98036078		
8326200044	Dillavou 206082228		
8326200045	Lichaj 212099454		
8326200046	Pence 205070013		
8326200049	Johnson 204097889		
8326200054	Wines of Colorado 200055617		

ASSESSOR'S PARCEL	OWNERSHIP DOC	COMMENTS	EASEMENT REFERENCE
8326200055	Vickerman 206116245		
8326200058	Correa-McCann 211068173		
8326200062	Ruyle 205145392		
8326200065	Mullen 200137256		
8326200074	Barnes 207017486		
8326200079	Smith & Smith 203282207		
8326204001	Vanauken		
8326204002	Blue Mesa LP 201111139		
8326204003	Thomas 5914/1253		
8326204004	Blue Mesa LP 201111139		
8326205015	Murdock 6702/533		
8326206006	Lowder Inv., LLC 214102074		
8326208002	Cascade Metro 215018821		
8326208005	Engle 97071804		
8326209007	Smith 213002541		
8326213001	Young 215017679		
8326213002	D&B Ent. 203272667		
8327102021	Dillon 205013924	Short stub into meter pit	
8327103006	Newman 6642/240		
8327105001	Cascade Colorado Park 5910/761	Park Parcel	

The CMD1 has two (2) water mains that cross US Highway 24 which are the Colorado Department of Transportation's (CDOT) right-of-way. In the review of CMD1 records, no CDOT permits were found that were issued for the two crossings. Historically that has not been an issue with CDOT as most crossing were undertaken decades ago and in many cases, the permit was issued to the Contactor performing the work. Any future work in the CDOT right--of-way will require the CMD1 obtain a CDOT permit.

3.17. WATER QUALITY ASSESSMENT

The District's treated water is provided by CSU by means of the Ute Pass Water Treatment Plant (WTP) to a single point of connection with the District's distribution system. The Ute Pass WTP also provides the treated water to the communities of Green Mountain Falls and Chipita Park. The District operates its public water system under the requirements of the Colorado Water Quality Control Commission (WQCC), Regulation

11, Colorado Primary Drinking Water Regulations (CPDWR). CMD1 is considered to be a Consecutive Water System per the CPDWR. The Colorado Department of Public Health and Environment (CDPHE) has designated the CMD1 system as PWSID CO–01121100. The CMD1 is required to have a minimum Class 1 Distribution System Operator. This certification requirement is being met by the District. The District's monitoring schedule still indicates a Class C water treatment operator is required; however, it needs to be updated to delete this requirement as water treatment is provided by CSU. Water quality compliance monitoring requirements are limited to distribution system monitoring. The 2015 CDPHE Monitoring Schedule for the District includes the following monitoring requirements:

- Total Coliform, two samples monthly.
- Free Chlorine residual, two samples monthly with total Coliform samples.
- Haloacetic acids (HAA5), one sample quarterly.
- Total Trihalomethanes, one sample quarterly.
- Lead and Copper sampling, five customer samples every three years.

A review of the compliance monitoring data submitted to the CDPHE indicates that the system has been in compliance with the regulations. The District's 2015 Consumer Confidence Report for 2014 indicates no violations or formal enforcement actions.

Water quality sampling data has been provided by the District for the period of 2006 through 2015. A summary of this data is provided in Appendix E1 of this study. Electronic copies of the sampling and reporting data are provided in Appendix E4. Some historical data is missing because the original data reports were subject to discovery during the Water Court Case No. 2011CW42. Copies of the District's 2015 Consumer Confidence Report and Drinking Water Monitoring Schedule are included in Appendix E2.

Existing Chlorine residual monitoring records of the distribution system show concentrations ranging from 0.05 to 1.8 mg/l, averaging 0.26 mg/l. The CDPHE has a new minimum Chlorine Residual Rule that requires a 0.2 mg/l minimum Free Chlorine residual in the distribution system. This Rule becomes effective April 1, 2016. This minimum level has been met since February 2014. Disinfection by-products in the distribution system have been in compliance with the CPDWR. Total Trihalomethanes

(TTHMs) have been in the range of 24.6 to 56.3 micrograms per liter (ug/l), averaging 36.8 ug/l. The regulated limit for TTHMs is 80 ug/l. The five surrogate Haloacetic Acids (HAA5) have been in the range of 18.9 to 44.2 ug/l, averaging 33.1 ug/l. The regulated limit for HAA5 is 60 ug/l. Monthly bacteriological sampling for Total Coliform and E. coli have consistently been absent of these contaminants. Lead and Copper sampling results of representative customer taps have been in compliance with the Lead and Copper Rule with the 90th percentile for Lead being less than 0.15 ug/l and Copper consistently less than 1.3 mg/l.

Specific water quality topics included in the Agreement as well as the CSU comments on the June, 2015 Assessment Study are discussed below:

3.17.0. WATER QUALITY REPORTING

CSU's comments requested the Total Coliform Rule sample results. Water quality records provided by the District have been summarized in a spreadsheet and are included in Appendix E1 of this study. Copies of the individual records are included in Appendix E4. Some data is missing from the District's hard copy files.

CSU's comments also requested supplemental water quality sampling be conducted from eight fire hydrants within the CMD1's system for Free Chlorine, pH, Temperature, Conductivity, Dissolved Oxygen, Total/Fecal Coliform, and Disinfection By-products. A sample map was provided with the comments showing the specific hydrants to be sampled. These supplemental water quality samples requested were not specified in the Standards for Water System Inventory and Assessment. The requested sampling has been initiated by the District. As of this writing, the results have not been received. Results will be included in Appendix E3 of this study when available.

3.17.1. AVERAGE AGE OR CHLORINE LEVELS IN THE SYSTEM

As presented above, the average Free Chlorine residual within the distribution system has been 0.26 mg/l based on the monthly sampling conducted.

3.17.2. AVERAGE DISTRIBUTION SYSTEM WATER AGE

The water age within the existing distribution system has been calculated using the Water CAD distribution system model for average day demand conditions. The model was also run to calculate distribution system water age with the proposed distribution system improvements. The average day demand was distributed evenly to each node in the model. Node demands at the two southerly system extensions of the system were adjusted to better approximate the average day demand. On the east side of the system, the average day demand to the Holy Cross Novitiate was estimated at 0.67 gpm. On the west side of the system, the demand to the southerly end of the US Highway 24 frontage road was estimated at 2.18 gpm. The following table presents average water age at the eight CSU requested sample points for both existing and proposed conditions. Average age is in hours from the CSU delivery point to the point modeled.

TABLE 7

DISTRIBUTION SYSTEM WATER AGE FROM CSU CONNECTION

CSU Requested Testing Location		Modeled Location	Modeled Water Age, hours	
			Existing Conditions	Proposed Conditions
1.	Fire hydrant on US Highway 24 frontage road in southwest corner of CMD1.	Existing Condition at end blow off. Node J-170. Proposed condition at end blow off. Node J-210.	55.1 [1)]	51.8
2.	Fire hydrant on southeast edge of service area at southern end of Outpost Road.	Hydrant FH-E01. Node J-28.	185.5 [1)]	177.6
3.	Fire hydrant at northern end of Aspenglow Lane.	North end of Aspenglow Lane, Hydrant FH-W22. Node J-83.	60.7	63.0
4.	Fire hydrant at intersection of US Highway 24 and Rampart Terrace Road.	US Highway 24 and Rampart Terrace. Hydrant FH-E21. Node J-89.	0.8	1.2
5.	Western end of Emporia Avenue.	Park Street Pump House. Node J-186.	58.0 [1)]	20.2
6.	Any fire hydrant in the vicinity of Santa's Workshop.	Santa's Workshop Meter. Node J-80.	27.2	30.6
7.	Fire hydrant at intersection of Pyramid Mountain Road and Gardiner Road.	Intersection of Pyramid Mountain and Gardiner. Node J-34.	4.9	16.6

CSU Requested Testing Location		Modeled Location	Modeled Water Age, hours	
			Existing Conditions	Proposed Conditions
8.	Fire hydrant at 8270 Chipita Park Road.	Chipita Park Road hydrant adjacent to delivery vaults. Node J-168.	0.2	1.1

1) Adjusted from modeled results to account for existing storage tank.

A review of the existing condition results shows a 2.17 hour age through the storage tank. This low value is likely attributed to the rapid short period filling of the tank when the altitude valve opens. Realistically, the storage tank would have an average day flow age of 39.01 hours when maintained at half full and an average day outflow of 36.1 gpm. The additional age of 36.84 hours (39.01 minus 2.17) has been added to the water age at points 1, 2 and 5 in the above table. The storage tank is not included in the proposed conditions as the tank is recommended to be removed from the system. Modeling results of water age are included in Appendix G2 (existing conditions) and G6 (proposed conditions).

Water quality sampling of the CSU requested eight locations has been conducted; however, the results from the laboratory have not been received. Once the data is available, a chlorine decay rate for the CMD1 system can be determined. The chlorine decay rate in a distribution system is a function of water quality and temperature. The typical decay factor, k, provided in the CSU comments, may not be representative of this system. Therefore, the estimated chlorine decay rate within the CMD1 system has not been calculated.

Overall, system improvements include a system connection loop on the west side of the distribution system. Currently the system is configured with potable water from the connection point flowing east then south to the storage tank, then flowing south and west across US Highway 24 to serve the southwest quadrant of the system. The proposed system loop provides better service to this southwest area. This is reflected in the reduced water age at Test Location No. 5 with the proposed improvements.

The highest water age is to the Holy Cross Novitiate. This is due primarily to the long 8-inch main extending to the site. The main was reportedly sized for fire

protection. The existing conditioned water age of 7.7 days is slightly reduced to 7.4 days with the elimination of the storage tank under proposed conditions. Sample results at this site will determine if the relatively high detention time is detrimental to the residual chlorine concentration and if additional system improvements will be necessary.

3.17.3. SAMPLE STATIONS

The District does not have any dedicated sample stations within the distribution system. Sample taps are provided and used at the Park Street Pump House, Topeka Avenue Pump House, Distribution System Storage Tank discharge pipeline as well as at the CSU connection point.

3.17.4. ANNUAL FLUSHING PROGRAM

The CMD1 typically flushes all hydrants once per year as part of their hydrant exercising program for the Cascade Volunteer Fire Protection District. However, there are no written standard operating procedures in place. Therefore, there is no specified sequence of hydrants flushed or duration for flushing.

3.17.5. CUSTOMER COMPLAINTS

Historically, customers contacted the District's water system's operator directly about problems. The problems were resolved at the operator's discretion and his actions were recorded in logbooks. The District did not maintain a customer complaint logbook. Logbooks prior to 2014 are not available. Customer complaints are now initially referred to the District Manager. The District Manager notifies the system operator, who contacts the individual customer to resolve the complaint. Once resolved, the operator reports back to the District Manager. Typical complaints consist of rusty water or chlorine odor. Complaints related to billings are also presented by individual customers at monthly board meetings. A copy of the June 24, 2014, board minutes are attached in Appendix E5 regarding a specific household problem that was determined by resampling not to be a true condition of the water system.

3.17.6. DEAD END MAINS AND LEAKS

The current configuration of the District's water system has a total of 36 dead end water mains. A detailed inventory may be reviewed in Appendix E7 for both the existing distribution system and the recommended improvements. The listing provides main size, material and total length of the dead end main. Mapping highlighting the dead end mains is also found in Appendix E7.

3.17.7. FLUSHING WATER DISCHARGE

Routine system flushing from blow offs and fire hydrants is typically discharged to the adjacent ground. Dechlorination of potable water is not conducted.

3.17.8. WATER QUALITY DATA

Attached in Appendix E1 is a summary of the water quality data provided by the District. Detailed water quality data is included in Appendix E4. Some data is missing from the District's hard copy files and could not be provided. CSU comments on the study requested a copy of the District's monitoring schedule be provided. This is included in Appendix E2.

3.17.9. COMPLIANCE WITH THE TOTAL COLIFORM RULE, LEAD AND COPPER RULE AND DISINFECTANT/DISINFECTION BY-PRODUCTS RULE

As discussed under this section, the District has been in compliance with the Total Coliform Rule, the Lead and Copper Rule and Disinfectant/Disinfection By-Products Rule. Additional monitoring may be required to comply with the upcoming CPDWR Minimum Chlorine Residual Rule

4. WATER SYSTEM ASSESSMENT

4.1. VISUAL ASSESSMENT

A visual assessment of the water system's assets was conducted within this study. In general, assets reviewed are typically in good condition. The existing 150,000-gallon storage tank was visually inspected with a report included in the June 2015 study. In general, the tank appears to be in good condition; however, the coatings are considered to be in poor condition. A second tank inspection was conducted within this recent study. The inspection as conducted by Marine Diving Solutions, Inc., Aurora, Colorado in December 2015 and is included in Appendix C2 of this report. A summary of the inspection's findings is presented in Section 4.4.

The two existing pump houses are no longer actively used for pumping into the system. They are generally used for system valving. Within this study's recommended improvements, the two existing pump houses will be bypassed and abandoned. The pump houses are generally in poor condition with compromised roofs. The hydrants and valves appear to be in good visual condition.

4.2. LEAK SURVEYS OF THE ENTIRE CMD1 WATER SYSTEM

CMD1 is aware of the need to provide CSU with a leak survey of the entire distribution system. As discussed during the October 2, 2015 and November 13, 2015 meetings, the District understands the leak survey effort may be undertaken after the District has completed the agreed upon recommended distribution system improvements. The District believes this is the most prudent pathway forward in financial terms and in providing an overall current review of the distribution system. This is largely based upon the fact that the areas in the distribution system that are in poor condition and causing water losses are being programmed for replacement. In the event the forthcoming leak survey finds additional areas that are not addressed within the improvements undertaken as a result of this study, the District will move forward to address those areas once identified. As a result, items 4.2.1 through 4.2.5 of the CSU comments list will be provided once the leak survey has been completed after the recommended improvements. It is anticipated to be undertaken in late 2017 to early 2018.

4.3. ASSET EXERCISING REPORT

As part of the asset survey conducted for this study, valves and hydrants were operated. Several valves were not accessible because they were under asphalt or excessively buried under gravel. A few valves were not operated under the advisement of the District's operator. A summary of the valves from the GIS database is included in Appendix B3 and an indication given as to operable, not operable or inaccessible. A summary of all hydrants is included in Appendix B4. They are considered to be operable if a flow or pressure is indicated in the table. The following is a summary of the operational condition of the District's valves and hydrants.

TABLE 8

VALVE AND HYDRANT OPERABILITY

Asset	Status	Number
Valves	Operable	63
	Inoperable	9
	Inaccessible	34
In-Vault Valves	Untested	11
	Total Inventoried	117
Fire Hydrants	Operable	40
	Inoperable	1
	Total Inventoried	41

4.4. CONDITION OF ASSETS

Storage Tank

The District's welded steel ground level storage tank was originally constructed in 1951. The height of the tank was increased in 1978 to increase capacity. The current capacity of the tank is 150,000 gallons. Inlet flows into the tank are controlled by an altitude valve on the north side of the tank. The tank's outlet line is to the south extending to the distribution system as depicted on the existing system drawing in Appendix A1. A visual inspection report was included in the June 2015 Inventory and Assessment Study. That report is included in Appendix C1 of this study. A detailed inspection report was conducted by Marine Diving Solutions, Inc. (MDS), Aurora, Colorado in December 2015. A copy of this tank inspection report is included in Appendix C2 of this report. Overall the

MDS study found the existing tank to be in fair to poor condition. The following is a summary of the report findings for various components of the tank.

TABLE 9

STORAGE TANK INSPECTION SUMMARY

Component	Condition	Recommended Improvements
Exterior:		
Wall Panels	Fair	Blast and recoat, add structural support ring
Ladder	Good	Replace
Manway	Fair	Recoat and add second manway and handrails
Overflow	Good	Replace with larger overflow pipe
Roof	Poor	Recoat and repair
Shell Hatch	Fair	Recoat
Vent	None	Add 24" screened vent
Interior:		
Wall Panels	Fair – Poor	Blast and recoat
Floor [1)]	Good	Blast and recoat
Manway	Poor	Blast and recoat
Roof	Poor	Blast and recoat
Inlet pipe	Good – poor	Recoat or replace
Outlet	Good – Fair	Recoat or replace
Drainpipe	Poor	Recoat or replace
Overflow	Good	Replace

1) Floor panel steel thickness was not measured due to standing water on the floor.

In addition to the recommendations of the inspection report, the existing backfill against the east side of the tank should be removed. Lead paint samples were taken during the December 2015 inspection. The results indicate no lead paint was found in the interior or exterior coatings. The laboratory results are included in Appendix C2.

Pipelines

The existing distribution system consists of piping ranging from one and a half inches in diameter to eight inches in diameter. As presented in the June 2015 study, approximately 67% of the distribution system predates 1996. Installation dates for this percentage of the system are not known. Approximately 33% of the system was installed between 1997 and 2007 and consists primarily of PVC piping. Pipelines are reported to be installed at a depth of approximately 5 feet of cover throughout the system; however, several segments of two-inch galvanized piping are reported to be relatively shallow. These shallow segments are vulnerable to pipe freezing. A summary of the piping segments within the distribution system are presented in Appendix B2 of this study.

Hydrants/Valves

As presented in the June 2015 study, approximately 50% of the distribution system valves predate 1996. The installation dates of these valves are not known. Valve sizes are assumed to be the same as the corresponding pipe sizes as depicted on the distribution system map included in Appendix A1. A summary of the distribution system valves, hydrants and curb stops/blow offs are presented in Appendices B3, B4 and B5, respectively. Also presented in the valve report is a listing of valve operability. Approximately 9 of the existing valves are recommended to be replaced as they were inoperable during the 2015 valve exercising effort.

Also conducted within the 2015 valve exercising program was the operation of all fire hydrants within the system. All fire hydrants have been determined to be functional with the exception of one hydrant that needs to be replaced. The system blow off hydrants and yard hydrants were not operated.

4.5. ESTIMATE OF REMAINING SERVICE LIFE FOR EACH ASSET

The District's water system is predominately comprised of the water distribution system, which is the largest asset. Other assets include the water storage tank, chlorination facilities and associated structures and four vaults. The remaining service life of each asset varies based on its material and age. In order to provide estimates for the remaining service life of each of the major assets, a few assumptions were made. The following lists the assumptions.

- The age of the water mains that are not known were assumed to be installed in 1950.
- The age of the altitude valve vault and the chlorination facilities were installed when the District connected to CSU for potable water service, which was 1991.
- The age of the water meter vault for Santa's Workshop was assumed to be installed in 1970.
- The age of the vault on the main to the Holy Cross Novitiate was assumed to be installed in 1970.
- The air/vacuum valve manhole was installed in 2005, which is confirmed in the Pike/Dodd as-built.
- Estimated average service life for piping is assumed to match that presented in AWWA's "Buried No Longer: Confronting America's Water Infrastructure Challenge" report. The CMD1 is represented by the report's "West" geographical area and "Very Small" water system.

With this information in hand, the following table provides the estimated life of the District's facilities.

TABLE 10

ESTIMATED SERVICE LIFE

Water Facility Item	Average Service Life	Number of Years in Service	Estimated Remaining Average Service Life
Ductile Iron Pipe (Installed prior to 1996)	110	65	45
PVC Pipe (Installed prior to 1996)	70	35	35
PVC Pipe (Installed after 1996)	70	8 - 18	52 - 62
Water Storage Tank	100	64	36
Chlorination Building	50	24	26
Chlorination Feed Equipment	15	0	15
Concrete Manhole for Air/Vacuum Valve	80	10	70
Concrete Manhole for Altitude Valve	80	24	56
Concrete Vault at the Holy Cross Novitiate	80	45	35
Concrete Water Meter Vault for	80	45	35

Water Facility Item	Average Service Life	Number of Years in Service	Estimated Remaining Average Service Life
Santa's Workshop			
Casing Pipe at North US Highway 24 Crossing	95	24	71
Casing Pipe at South US Highway 24 Crossing	95	64	31

4.6. UNACCOUNTED-FOR WATER LOSS ASSESSMENT

An evaluation of the CMD1 water system losses is presented in this section. A comparison of water delivered to water sales is presented. The CMD1 receives all of its treated water from the CSU system connection on Chipita Park Road. The CSU connection is metered by what appears to be a relatively new Sensus Omni C2 compound flow meter. The meter is equipped with a digital totalizer head. A remote totalizer is mounted below the vault hatch. Flows are transmitted from the meter via SCADA to CSU. The CMD1 customer meters are located inside in-ground meter pits or inside the customer's home or business. Customer meters were replaced under a District meter program beginning in 2005 with AMCO C700 meters and Itron-50W transmitters. Approximately 14% of the older customer meters remain in service. A CSU comment on the June 2015 study, Item 4.6.3, indicates that additional research is needed to confirm meter counts to determine if unaccounted-for water is attributable to unbilled customers. A discussion of the number of district customers is presented in Section 1.19 of this study.

An assessment of monthly water deliveries and water sales has been conducted for the period from 2007 through 2014. Water delivery and sales data were obtained from the June 2015 study. A CSU review comment on the June 2015 study stated that the system input volumes from CSU presented do not match the CSU data. The Water System Inventory and Assessment Requirements of the Agreement, item 4.6.2, indicates that the yearly totals of water supplied shall use values previously agreed upon by J. McGinn (JDS Hydro) and B. Rabideau (CSU). This would suggest that an adjustment to the data of record was used in the June 2015 study. The following table presents the monthly water deliveries, water sales and unaccounted- for water values for 2007 through 2014. Water delivery values from the June 2015 study are also presented. The Water System

Inventory and Assessment and Requirements, Item 4.6, requires an evaluation of the period from 2005 through present; however, water delivery data from CSU for 2005, 2006, and 2015 were not available. Water sales data from CMD1 for 2005 and 2006 is not available, and has not been provided for 2015.

TABLE 11

WATER PURCHASE AND SALES SUMMARY BY MONTH

Month	Metered Delivered, gal. [1]	Metered Sales, gal.	Unaccounted-for Water, gal.	Metered Delivered, gal.	Metered Sales, gal.	Unaccounted-for Water, gal.
	2007			2008		
January	1,639,242	1,051,400	587,842	1,776,350	1,202,000	574,350
February	2,017,805	1,159,200	858,605	2,335,929	1,132,800	1,203,129
March	2,377,892	1,117,700	1,260,192	2,829,834	1,141,000	1,688,834
April	1,734,238	1,209,600	524,638	2,787,871	1,412,800	1,375,071
May	1,982,424	1,648,500	333,924	2,745,160	1,987,000	758,160
June	2,867,907	2,373,200	494,707	3,805,974	2,784,100	1,021,874
July	2,963,426	2,505,700	457,726	4,262,702	3,150,600	1,112,102
August	2,580,151	2,224,900	355,251	3,005,165	2,379,500	625,665
September	2,500,938	2,201,100	299,838	2,623,535	1,926,000	697,535
October	1,841,052	1,544,900	296,152	2,662,356	1,966,400	695,956
November	1,508,940	1,273,600	235,340	2,199,120	1,220,900	978,220
December	1,593,016	1,963,400	-370,384	2,174,489	1,222,700	951,789
Annual Delivered, MG [2]	25.61			33.21		
Annual Sales, MG	20.27			21.53		
Annual Loss, MG	5.33			11.68		
Annual Loss %	20.8%			35.2%		

1) gal = gallons
2) MG = million gallons

Month	Metered Delivered, gal. [1]	Metered Sales, gal.	Unaccounted-for Water, gal.	Metered Delivered, gal.	Metered Sales, gal.	Unaccounted-for Water, gal.
	2009			2010		
January	2,356,670	1,164,200	1,192,470	3,122,077	1,243,200	1,878,877
February	2,085,424	1,141,200	944,224	1,909,120	1,089,600	819,520
March	2,422,398	1,363,300	1,059,098	2,061,563	1,088,100	973,463
April	2,186,404	1,335,200	851,204	1,938,218	1,309,600	628,618
May	2,978,611	1,779,300	1,199,311	2,284,542	1,541,000	743,542
June	3,428,159	2,222,400	1,205,759	3,151,848	2,856,800	295,048
July	3,493,310	2,145,500	1,347,810	3,324,486	2,632,700	691,786

Month	Metered Delivered, gal. [1]	Metered Sales, gal.	Unaccounted-for Water, gal.	Metered Delivered, gal.	Metered Sales, gal.	Unaccounted-for Water, gal.
August	3,660,488	2,325,800	1,334,688	2,577,159	2,003,400	573,759
September	3,374,452	1,768,400	1,606,052	3,482,239	2,230,400	1,251,839
October	2,706,114	1,415,500	1,290,614	2,367,270	1,570,600	796,670
November	2,538,338	1,221,000	1,317,338	1,629,967	1,228,800	401,167
December	2,691,828	1,457,100	1,234,728	1,821,530	1,205,500	616,030
Annual Delivered, MG [2]	33.92			29.67		
Annual Sales, MG	19.34			20.00		
Annual Loss, MG	14.58			9.67		
Annual Loss %	43.0%			32.6%		

1) gal = gallons
2) MG = million gallons

Month	Metered Delivered, gal. [1]	Metered Sales, gal.	Unaccounted-for Water, gal.	Metered Delivered, gal.	Metered Sales, gal.	Unaccounted-for Water, gal.
	2011			2012		
January	1,896,554	1,195,700	700,854	3,560,405	1,132,100	2,428,305
February	1,724,888	992,100	732,788	4,479,847	1,158,300	3,321,547
March	2,664,900	1,322,200	1,342,700	2,580,151	1,158,000	1,422,151
April	2,036,580	1,242,900	793,680	2,088,192	1,273,700	814,492
May	2,676,868	1,529,000	1,147,868	2,642,534	1,893,200	749,334
June	3,941,511	2,497,400	1,444,111	3,405,494	2,691,000	714,494
July	3,345,793	2,051,800	1,293,993	3,490,692	2,175,700	1,314,992
August	4,936,650	2,327,200	2,609,450	3,592,943	1,999,700	1,593,243
September	3,906,954	1,759,800	2,147,154	2,332,713	1,896,400	436,313
October	2,973,076	1,146,600	1,826,476	3,103,228	1,172,700	1,930,528
November	2,041,741	1,121,700	920,041	3,195,157	1,141,500	2,053,657
December	2,080,188	1,136,900	943,288	3,404,522	1,178,900	2,225,622
Annual Delivered, MG [2]	34.23			37.88		
Annual Sales, MG	18.32			18.87		
Annual Loss, MG	15.90			19.00		
Annual Loss %	46.5%			50.2%		

1) gal = gallons
2) MG = million gallons

Month	Metered Delivered, gal. [1]	Metered Sales, gal.	Unaccounted-for Water, gal.	Metered Delivered, gal.	Metered Sales, gal.	Unaccounted-for Water, gal.
	2013			2014		
January	3,780,691	1,172,800	2,607,891	1,745,982	1,135,300	610,682
February	3,486,578	1,532,400	1,954,178	1,537,439	1,301,670	235,769
March	3,916,004	1,059,800	2,856,204	1,718,680	953,810	764,870
April	3,890,498	1,012,600	2,877,898	1,639,691	1,083,310	556,381
May	4,176,234	2,608,900	1,567,334	2,174,735	568,050	1,606,685
June	4,262,104	1,764,900	2,497,204	3,379,913	1,980,060	1,399,853
July	3,056,478	1,566,000	1,490,478	2,538,263	1,362,540	1,175,723
August	2,690,855	1,128,100	1,562,755	2,284,841	1,478,610	806,231
September	2,325,756	1,267,900	1,057,856	2,139,354	1,436,196	703,158
October	2,206,226	1,479,600	726,626	2,016,150	1,216,160	799,990
November	2,254,771	1,218,900	1,035,871	1,925,561	1,064,990	860,571
December	2,268,759	1,179,900	1,088,859	2,276,397	1,127,950	1,148,447
Annual Delivered, MG [2]	38.31			25.38		
Annual Sales, MG	16.99			14.71		
Annual Loss, MG	21.32			10.67		
Annual Loss %	55.7%			42.0%		

1) gal = gallons
2) MG = million gallons

An annual summary of the water delivery, water sales and unaccounted-for water data is presented in the following Table 12 and Figure 2.

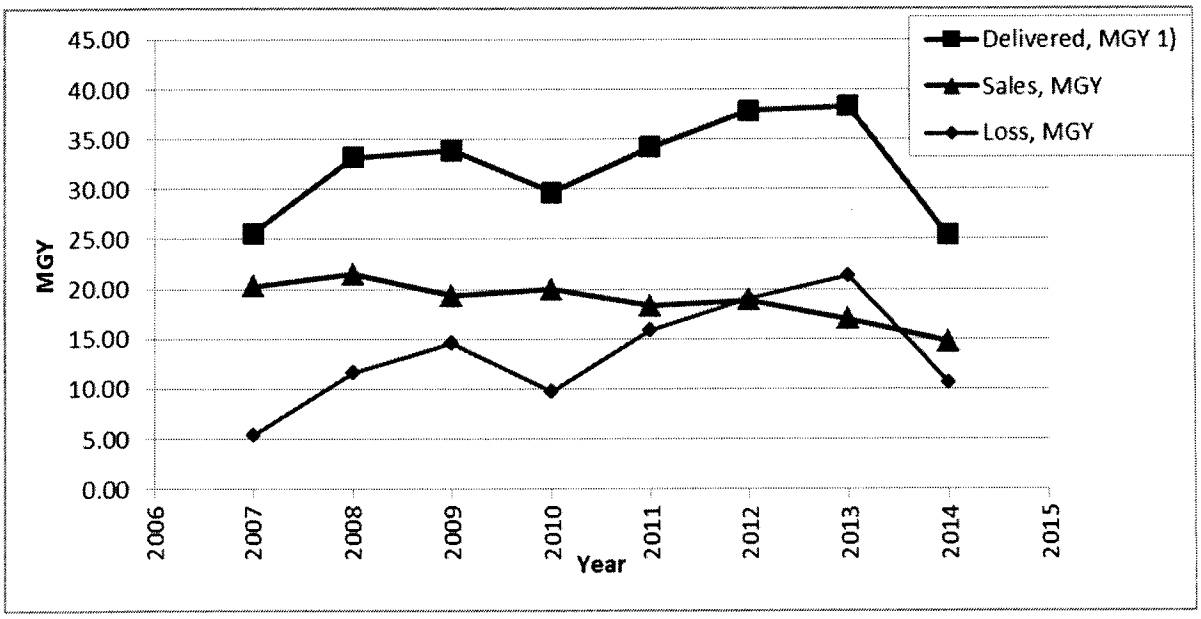
TABLE 12

WATER PURCHASE AND SALES SUMMARY BY YEAR

Year	Metered Delivered, MG	Metered Sales, MG	Unaccounted-for Water, MG.	Unaccounted-for Water, %
2007	25.61	20.27	5.33	20.8%
2008	33.21	21.53	11.68	35.2%
2009	33.92	19.34	14.58	43.0%
2010	29.67	20.00	9.67	32.6%
2011	34.23	18.32	15.90	46.5%
2012	37.88	18.87	19.00	50.2%
2013	38.31	16.99	21.32	55.7%
2014	25.38	14.71	10.67	42.0%

FIGURE 2

WATER PURCHASE AND SALES BY YEAR



1) MG = million gallons per year

The above Table and Figure show water deliveries to CMD1 increasing annually from 2007 through 2013 with a significant reduction in 2014. Water sales have declined steadily from 2007 through 2014. Unaccounted-for water in general has increased from 2007 through 2013 with a significant decline in 2014. This is directly reflected in the 2014 delivery reduction value. Water sales reduction is likely attributed to conservation by individual customers as well as a result of more accurate metering combined with increasing water rates. The dramatic drop in unaccounted-for water is a direct result of leak repairs.

Unaccounted-for water represents water that is delivered by CSU into the District's distribution system that is not measured by the District's customer meters. For the period from 2007 through 2014, unaccounted-for water averaged 41%. Unaccounted-for water is attributed to authorized and unauthorized water use. This includes hydrant flushing, hydrant water theft, tank overflows, water line leaks and breaks, water service line leaks and breaks, meter inaccuracies, unmetered customers and unmetered bleeder lines. These factors are not quantifiable. An unaccounted-for water value of 15 to 20% is not unreasonable. Values of 30 to 40% are not uncommon. The American Water Works Association recommends an unaccounted-for water goal of 10% with proactive efforts to

reach this goal. For the CMD1, an unaccounted-for water percentage for 2014 at 42% is a relatively high value.

The Water System Inventory and Assessment Requirements of the Agreement, Section 4.6.4, indicate a preference to use water system audit software by AWWA-M36 or WRF-4372. Short of speculation, there are no known details as to the volumes in each category of unaccounted-for water. Therefore, water loss software would simply be populated with assumed data. No further analysis of unaccounted-for water is presented in this study.

In 2015, five major water leaks were discovered and repaired. Repairs of these leaks should further reduce the District's unaccounted-for water. The following reflects available data on the 2015 repairs conducted.

- Rampart Terrace, 2" GI piping on the south side of 5330 Rampart Road
- Poplar Street, 3" DI piping adjacent to 8275 Poplar Street
- Severy Avenue, 4" DI piping adjacent to 7770 Severy Avenue
- Frontage Road, 2" GI piping adjacent to 7955 US Highway 24
- West of Frontage Road, 2" GI piping on west side of 7855 US Highway 24.

4.7. ASSESSMENT WATER SYSTEM COMPONENTS THAT ARE VULNERABLE TO DAMAGE FROM STORM WATER FLOWS, PARTICULARLY THE AREAS SUBJECT TO INCREASED STORM WATER FLOWS FROM WALDO CANYON BURN SCAR.

As presented within CSU's previous list of comments, 31 individual water line stream crossings were requested to be reviewed and assessed. Further discussion on those stream crossings that have a portion of their basins within the Waldo Canyon burn scar also need further assessment from the imparts of increased runoff from the burn scar. The assessments for these crossings may be reviewed in Appendix B15 with associated photographs. There are 18 stream crossings where the water main is not impacted by the stream crossing. The following recaps the remaining 13 stream crossings.

1. CSU Stream Crossing No. 8

This stream crossing is located on the southwest side of US Highway 24 at Aspenglow Lane. No portion of this watershed is contained within the Waldo Canyon burn scar. The water main crosses a drainage swale that only conveys water in higher precipitation events. The swale is in good condition, has a good vegetation stand and is in a stable state. The contributing drainage area is limited. This crossing does not present any significant risk.

2. CSU Stream Crossing No. 11

The water main crosses an unnamed tributary to Fountain Creek just east of the water main connection with CSU. The area is heavily vegetated, has a limited contributing drainage area and does not present any erosion concerns. The site is stable. Therefore, this crossing does not pose a risk to the water main.

3. CSU Stream Crossing No. 12

The District's water main crosses Fountain Creek east of the CSU water main connection. Fountain Creek is a perennial stream at this location. The contributing area contains portions of the Waldo Canyon burn scar's drainage basins, which increases the risk associated with this crossing. Since the fire, there have been several flood events with the most recent occurring in May through June of 2015. In an effort to mitigate problems associated with the flood events, the Natural Resources Conservation Service (NRCS) in combination with other Federal, State and local governmental agencies have undertaken numerous drainage projects. This has dampened to a degree the runoff impact from the burn scar.

Regarding the crossing itself, the channel is approximately seven feet wide. The channel's cross section consists of small cobbles on the west bank and a sand gravel mixture on the east bank. Above the normal depth channel, the banks consist of grasses, willows and coniferous trees, all which are older

growth vegetation. This indicates the stream is stable in this section, especially given the frequency of flood events since the Waldo Canyon fire. Significant improvements above and below this area have been undertaken on Fountain Creek.

The water main crossing at this location is a newer stream crossing. Therefore, the crossing meets today's standards. Based on the newer installation together with the channels overall stable condition, this crossing does not pose a risk to the water main.

4. CSU Stream Crossing No. 14

This stream crossing is located on Chipita Park Road above the Pikes Peak Highway cutoff. The contributing basin contains a small portion of the North Pole theme park while the remaining area is predominately forested. This area has a small drainage basin and only generates runoff during storm events. The water main crosses underneath a 24" corrugated metal culvert. As such, the channel is essentially hardened at this location. Therefore, this stream crossing does not pose any risks to the water main.

5. CSU Stream Crossing No. 15

This crossing is located along the northeast side of US Highway 24 at Forest Road. Even though this area is northeast of US Highway 24, the drainage basin was not impacted by the Waldo Canyon fire. The basin has a small catchment area and only generates runoff during storm events. The channel is comprised of a swale leading to a road side ditch section. Given the limited area, ground cover and the area's overall condition, this crossing does not pose any risk to the water main.

6. CSU Stream Crossing No. 16

This crossing is also located on the northeast side of US Highway 24, but is located on Pyramid Mountain Road north of Gardiner Road. The drainage area contributing to this location was not impacted by the Waldo Canyon fire. The water main crosses underneath a 24" steel culvert and is installed under an asphalt road. This effectively provides protection for the water main during runoff. In addition, the drainage is only active during storm events. Therefore, this stream crossing does not pose any risk to the water main.

7. CSU Stream Crossing No. 17

This stream crossing is located west of US Highway 24 on the north side of the Pikes Peak Highway bridge. Fountain Creek at this location is stable, has well protected banks and heavy vegetative cover. This water main is either a recent installation with the main crossing within the channel or is contained in the bridge itself. In either case, this location does not pose any risk to the water main given the channel's overall condition and bank armoring.

8. CSU Stream Crossing No. 18

This stream crossing is also located west of US Highway 24, but on the south side of the Pikes Peak Highway bridge. Again, Fountain Creek at this location is stable, has well protected banks with a heavy vegetative cover. The water main is either a recent installation with the main crossing within the channel or is contained in the bridge itself. In either case, this location does not pose any risk to the water main given the channel's overall condition and bank armoring.

9. CSU Stream Crossing No. 19

This stream crossing is located at South Topeka Avenue, which is located northeast of US Highway 24. This is the main drainage basin in the District that has experienced impacts from the increased Waldo Canyon fire runoff.

Approximately 81% of the basin's contributing area is in the Waldo Canyon's burn scar. A discussion with detailed information is presented farther in this section. Since the Waldo Canyon fire, significant channel improvements have been undertaken in this specific area. Armoring of the channel includes grouted riprap and boulders. As a result of the improvements, the channel is well protected thereby minimizing the potential risk to the water main. This will further diminish with time as vegetation re-establishes within the watershed. Therefore, this crossing poses a minimum risk to the water main given the recent drainage improvements.

10. CSU Stream Crossing No. 20

This stream crossing is located on Hagerman Road south of Topeka, which is just downstream from Stream Crossing No. 19. Stream Crossing No. 19's basin characteristics also apply at this location. The difference is that the crossing consists of a 60" corrugated metal culvert with boulders and large riprap upstream and downstream of the culvert's openings. This effectively has secured the channel and provides the necessary protection to the water main. Therefore, this crossing poses a minimum risk to the water main as a result of the recent drainage improvements. Furthermore, this crossing's risk potential will diminish with time as the basin revegetates.

11. CSU Stream Crossing No. 22

This stream crossing is located on Pyramid Mountain Road south of Topeka, which is upstream from Stream Crossing No. 19. Again, the same basin characteristics apply at this location as with Stream Crossing No. 19. The difference is that the crossing consists of a 6-foot diameter reinforced concrete pipe with boulders and large riprap upstream and downstream of the culvert's openings. This effectively has secured the channel and provides the necessary protection to the water main. Therefore, this crossing poses a minimum risk to the water main.

12. CSU Stream Crossing No. 24

This crossing is located on Park Street on the southwest side of US Highway 24. This is south of the District's Park Street Pump House building. The crossing is underneath a block bridge. The channel consists of a rock bed, well established vegetation on the banks with very low erosion potential; however, the water main is exposed within the stream channel. This poses significant risk during storm events and from debris conveyed down the channel. As a result, the water main at this location needs to be replaced and installed below the stream bed with a proper casing pipe for protection.

13. CSU Stream Crossing No. 26

This crossing is located along the west side of US Highway 24 adjacent to US Highway 24's eastbound on ramp. The water main is approximately 18" to 24" deep. Given this depth, the water main is at risk of failure in high flow events at the stream crossing. Therefore, the recommendation is made to replace this crossing with the proper casing pipe and water main sized to service the area downstream of this location.

In addition to the stream crossings identified by CSU, there are a total of four drainage basins extending into the Waldo Canyon burn scar area that flow through the District's service area. These locations have been assessed by the NRCS along with the development of proposed channel improvements together with the actual improvements already implemented. NRCS' review of the area, a review of the installed improvements and the design drawings of one location of the improvements are contained in Appendix C6. These four areas are known as Rampart Terrace, Fitz Gulch, Cascade Creek and Marigreen Pines. The following provides detailed information for each drainage basin and their associated water main crossings.

1. Rampart Terrace

Rampart Terrace is located on the far northeastern portion of the District. NRCS's evaluation of the basin indicated that the basin had approximately

75% of its tributary area burned in the Waldo Canyon fire. The burn severity ranged from moderate to high soil burn, which significantly increases the sediment yield. As a result, the NRCS proposed the installation of sand bags, trap bags, fence removal and sediment removal at specific locations. In 2012, actual improvements included a large sandbag wall. In 2013, additional improvements included removing sediment, replacing some of the sandbags with 2-foot tall RIBS Bags, installing cement blankets over vulnerable sandbags, removing trees and having private property owners sign maintenance contracts stating they would not change the mitigation structures and perform minor maintenance. Work is still required within the basin.

The areas being impacted and experiencing erosion issues are in locations that do not contain the District's water mains. Water service has not been negatively affected by erosion or sedimentation in this area in addition to the water mains not being detrimentally impacted.

The largest problem in this area is the deposition of sediment on the lower portions of the road next to US Highway 24. With this said, the small diameter water mains in this area need to be replaced by virtue of being undersized. The replacement water main segments will follow fairly close to the existing alignments. This will ensure the limited risk of impact as a result of storm water runoff will be similar to what has been experienced up to this point. With this barometer, the replacement water mains will have a low risk to impacts from erosion potential.

2. Fitz Gulch

Fitz Gulch is the next drainage basin south of Rampart Terrace. The overall drainage basin is the smallest of the four basins and has moderate burn severity based on NRCS' map information. NRCS did not provide any quantifiable information on this drainage. That said, Fitz Gulch has had some moderate improvements. To date, these have focused on saving structures with sand bags.

The past May through June 2015 storm events have created a significant headcut through the area. This has resulted in the District's recent directional drilled 2" water main's cover being reduced to 6 to 12 inches. Overall, this is an area of concern for several governmental agencies.

The concerns have resulted in the formal design to channelize the drainage and provide protection. Protection will come in the form of gabion baskets, which will also provide cover to the water main; however, the District's records indicate the new water main has been drilled underneath one of the adjacent property's septic tank. Therefore, the main is programmed to be abandoned in place with new service lines rerouted and tapped off the 8 inch main by US Highway 24. This will eliminate the need for the 2 inch main, provide a means of relocating the service lines out of the drainage channel's alignment and eliminate the potential health hazards associated with the septic tank and water main's location. Therefore, Fitz Gulch will not pose a risk to the water system's facilities as a result of the proposed modifications.

3. Cascade Creek

As previously stated, Cascade Creek has the largest drainage basin along the north side of the District. This basin was severely impacted as a result of the Waldo Canyon fire. NRCS states 81% of the watershed was burned with a moderate to high soil burn severity classification. This presents significant risks given the downstream structures. As a result, NRCS has undertaken a significant amount of work throughout the whole watershed. Sedimentation ponds, slope stabilization improvements and channel armoring have been undertaken. With regard specifically to the District water mains, the drainage channel extending through the District has predominately seen armoring improvements. They include boulders, grouted boulders, riprap, grouted riprap, concrete channels and large diameter reinforced concrete pipe. This has effectively stabilized the bottom portion of the channel such that erosion is not a risk. NRCS' review of the basin, design drawings and associated report may all be found in Appendix C6 for further review. In total, the basin does not pose a risk given the recent improvements.

4. Marigreen Pines

The final basin impacted by the Waldo Canyon fire is Marigreen Pines. The basin's configuration in relationship to the District's water facilities is such that one water main is located within the basin. The water main enters a small portion of the basin and changes ownership at an underground vault. The vault is approximately 10 to 15 vertical feet above the channel draining the basin. Based on this vertical elevation differential, the District's facilities in this basin are sited above any channel that may experience elevated water flows and erosion potential. Therefore, this basin does not pose any risk to the District's water system.

4.8. STANDARD PRACTICE FOR ENVIRONMENTAL SITE ASSESSMENTS

The District understands the need to undertake an Environmental Site Assessment of all easements and fee simple parcels prior to the transfer of ownership to CSU. A defined list of needed easements is documented herein; however, agreement between both CSU and the District on the recommended improvements has not been accomplished. In order to be prudent with the financial resources available to the District, the District believes the most cost effective approach in this effort is to first come into agreement with the required improvements. This has the potential of modifying what easements, and hence Environmental Site Assessments, are required to be undertaken. Once an agreement on recommended improvements is defined, the needed easements and associated Environmental Site Assessments may then be undertaken.

With this said, the District will not be transferring the following assets:

- Triangle building
- Topeka Avenue Pump House building and associated land
- Park Pump House building and associated land
- 25,000-gallon concrete underground water storage tank
- 150,000-gallon water storage tank and associated chlorination facilities

4.9. IDENTIFICATION OF ANY ADDITIONAL EASEMENTS OR OTHER PROPERTY INTERESTS NECESSARY FOR CSU TO HAVE FULL ACCESS TO, AND OWN AND OPERATE THE CMD1 WATER SYSTEM

As listed in Paragraph 3.16.3, numerous properties have assets crossing the parcel where no recorded instruments exist. In many cases, the recommended project will result in the relocation of the assets out of those properties, thereby eliminating the need for an easement to accommodate the existing asset. Considering both those assets that are presently crossing private property where easements exist and those that will be relocated, the following list of parcels still remain where additional easements will be required. Included in this list are those parcels previously identified as having a blanket easement that provides for common use and access to the water main in the Rampart Terrace area. Inasmuch as the original easement may provide an adequate easement, we recommend a new easement be procured, providing a well-defined corridor for the water main replacement in this area.

TABLE 13

ADDITIONAL EASEMENTS REQUIRED

ASSESSOR'S PARCEL	OWNERSHIP DOC	COMMENTS	EASEMENT REFERENCE
SCHEDULE #	REC. # and/or BK & PG		
8322100007	Spruyt 10094869		
8322100086	Dubois 3950/578 208088743		
8322100089	Liby 203060002		
8322400002	Gobert 213041329	Accommodate existing main	
8322400014	Gobert 213041329	Accommodate existing main	
8322400017	Santa's Workshop 5460/669	Metering MH out of Easement	5832/114
8322400018	Gobert 213041329	Accommodate existing main	
8322400020	McClure 208064778	Accommodate existing main	
8323200006	Bonlinger 97029265	*Blanket Easement*	1443/377
8323200012	Rakes 212003951		
8323200013	Stults 3924/430	May not be required	214102229
8323200015	Guthrie 203116724		
8323200029	Bingham 212057786	*Blanket Easement*	1443/377
8323201004	Hunter 213139461	*Blanket Easement*	1443/377

ASSESSOR'S PARCEL	OWNERSHIP DOC	COMMENTS	EASEMENT REFERENCE
8323201006	PB13 215073922	*Blanket Easement*	1443/377
8323201007	Main 213096410	*Blanket Easement*	1443/377
8323201008	Fuhrman 209055631	*Blanket Easement*	1443/377
8323201009	Billingiere 212068301		
8323201010	Johnson 213150329		
8323201011	Reid 202156896		
8323201012	Ahl 6056/780/215055831	*Blanket Easement*	1443/377
8323300029	Berryman 98097436	New main on east side of property	
8323300065	Durben 200074477		
8323300106	Murdock 202183280		
8323300107	Wears 206106227		
8323300114	Slaven 210070447		
8323304011	Bromund 212099367	FH Lateral; short stub into property	
8323304019	Heisch 2582/913	Possible main encroachment over corner of property	
8323307006	Pinnow 211063669	Possible main encroachment over corner of property	
8326100002	Johnson 1646/573		
8326100003	Father Edward 212035910		
8326101006	Apotheker 213027205		
8326200065	Mullen 200137256		
8326208002	Cascade Metro 215018821	Accommodate existing main	
8326209007	Smith 213002541		
8327105001	Cascade Colorado Park 5910/761	Park Parcel	

4.10. FLOW TESTING, VIBRATION MONITORING AND TESTING OF MAJOR SYSTEM COMPONENTS

System flow testing was conducted at each fire hydrant during the field survey and data collection effort within this study. A discussion of the flow testing is presented in Section 6.2. A summary of the hydrant flows is included in Appendix B4.

Vibration monitoring of the major system components was not conducted as part of this study. The only significant source of vibration on components contained within the District's water system originates from vehicular traffic on US Highway 24. Traffic

vibration may impact the two water main crossings under the highway. The depth of bury of the northerly 8-inch pipeline's highway crossing (at Rampart Terrace) is not known. Valve V-E58 suggests a depth of approximately seven feet. Valve depths on either side of the southerly pipeline crossing of the highway (at Topeka Avenue) would indicate a pipe bury of 14 feet. To the best of the District staff's recollection, these two highway crossings have not experienced any pipe breaks.

Major system components include the existing 150,000-gallon storage tank, the two inactive pump houses and the Chlorination Building. A comprehensive assessment of the storage tank was conducted by Marine Diving Solutions, Inc. (MDS) on December 14, 2015. The findings of the inspection are included in Section 4.4 of this study. The inspection report is presented in Appendix C2. Storage tank inspection requirements, as listed in Attachment 4 to the CSU review comments on the June 2015 study, were included in the MDS inspection report.

A structural assessment of the Park Street Pump House, Topeka Avenue Pump House and Chlorination Building have not been conducted. These structures and associated properties will be retained by the District after the Conversion period. Construction cost estimates presented in the study include demolition of the two pump houses. The Chlorination Building will be retained for the Cascade Volunteer Fire Protection District communication antenna and the chlorination equipment will be removed. An Environmental Assessment of the two pump houses and Chlorination Building also have not been conducted as these assets and associated properties will be retained by the District.

5. BACKFLOW PREVENTION

Backflow prevention is required in accordance with the Backflow Prevention and Cross Connection Control Program requirements of the CPDWR. The requirements become effective January 1, 2016. The program requires the preparation of a written Cross Connection Control Plan and includes a comprehensive system survey; identification of potential cross connections; customer installation of backflow prevention devices as necessary; backflow device testing; record keeping; and an annual report to the CDPHE. An annual compliance percentage is required starting at 60% with full compliance by January 1, 2021. During the

five-year Conversion period, the CMD1 will need to implement and conduct a cross connection control program in conformance with the regulation. Currently, the District has a simple written plan in place, but will need to update the plan in accordance with the regulation, conduct surveys, notify customers of backflow prevention requirements, and conduct annual reporting. The District's Cross Connection Control Plan dated 2006 is included in Appendix E8.

Backflow prevention is provided at the CSU connection to the CMD1 distribution system in the meter vault on both the 6-inch meter line and the 6-inch meter bypass line. The backflow protection consists of two (2) 6" Febco 800 check valves in series on each line.

Backflow prevention is currently provided at two commercial services as follows:

- 8045 W. US Highway 24, The Wines of Colorado, ¾-inch double check assembly.
- 8020 W. US Highway 24, Red Cloud Restaurant (Backroom Pizza), ¾-inch double check assembly.

No additional information is available on the backflow prevention devices at these locations. There are no records of backflow device testing. The District's 2006 Cross Connection Control Plan indicates a backflow prevention device at 4455 Fountain Avenue listed under the Apartment building boiler system category.

Comments by CSU on the June 2015 Inventory and Assessment Study requested locations of potential cross connections. That listing will be compiled by the District in compliance with the Backflow Prevention and Cross Connection Control Program requirements of the CPDWR within the five-year Conversion period.

As indicated in the water system inventory, seven yard hydrants were located within the system survey. Some of these hydrants are used for line flushing. Additional yard hydrants within the system are likely. None of the yard hydrants appear to be equipped with any form of backflow prevention device. As a minimum the District will need to retro-fit all existing public yard hydrants with vacuum breaker assemblies.

6. WATER LINE EXTENSION AND SERVICE STANDARDS (WATER LESS) COMPLIANCE EVALUATION

Within the evaluation of the water system components within the CMD1 system, they were compared to the CSU Water Line Extension and Service Standards (Water LESS) standards. In general, much of the existing distribution system does not meet CSU standards. Recommended water system improvements presented in this study are made to improve the system; however, it is either impractical or not possible to meet all of the CSU Water LESS standards. A discussion of each asset and its condition are presented in the following sections.

6.1 WATER SYSTEM MODELING

Water distribution system modeling for CMD1's system has been conducted using Bentley Watercad V8i software. Modeling of both existing and proposed operating conditions was conducted following the CSU Hydraulic Analysis Report process.

6.1.1. PRESSURE ZONES

The existing water distribution system operates under two pressure zones. The upper zone is served by the CSU connection at a static hydraulic grade line of 7,824. The lower zone is served by the storage tank, at half full, at a static hydraulic grade line of 7,783. Pressure zone delineation is shown on the modeling node map in Appendix G1. Existing static water pressures in the system range from 27 psi to 224 psi on its extremities. A majority of the service area operates in the 130 psi range. The lowest pressures are in the northeast quadrant of the system with a static pressure of 27 psi at the Pikes Peak Highway Toll House and 44 psi at Santa's Workshop. High static pressures are experienced at the southerly end of the system with 214 psi at the south end of the US Highway 24 frontage road and 224 psi at the Holy Cross Novitiate. These higher pressure areas could be reduced; however, they are within the pressure ratings of the system's components. System modeling of the proposed conditions associated with the recommended improvements found several fire hydrants with available fire flows below the required flow rate. As a result, recommended system changes include increasing the delivery pressure by 10 psi and adding

pressure reducing valves to the Holy Cross Novitiate and US Highway 24 frontage road pipelines.

6.1.2. DISTRIBUTION SYSTEM MODELING

Distribution system modeling has been conducted for both the existing and proposed conditions. The proposed conditions incorporate the recommended water system improvements contained in this study as presented in Section 7. The required average day, maximum day, peak hour, and maximum day plus fire flow conditions were modeled. For existing and proposed fire flow modeled conditions, the CSU delivery pressure was reduced by 12 psi to account for losses through the double check backflow preventer and flow meter. Summary tables of each modeled condition are presented in Appendix G. Existing and proposed system node maps are presented in Appendix G1 for reference.

The following table presents the available fire flow at each of the existing fire hydrants under current and proposed conditions.

TABLE 14

AVAILABLE FIRE FLOW

Hydrant No.	Location	Existing Condition, gpm [1)]	Proposed Condition, gpm [1)]
FH-E01	Marigreen Pines - east edge of access road	Not Operating, Not Modeled	Not Operating, Not Modeled
FH-E02	Marigreen Pines north of church building near yard hydrant	913	2,327
FH-E03	South end of Outpost Road	914	2,327
FH-E04	End of cul-de-sac Outpost Road	914	1,911
FH-E05	Across street from 4335 Heizer Street	384	2,326
FH-E07	Marriott Rd & Outpost Road	914	2,090
FH-E08	7765 Marriott Road	910	2,328
FH-E09	Hagerman Ave & Severy Ave	907	2,009
FH-E10	Heizer Street & Severy Ave	913	2,361

Hydrant No.	Location	Existing Condition, gpm [1)]	Proposed Condition, gpm [1)]
FH-E11	Across from 7725 Severy Ave	637	2,320
FH-E12	Hagerman Ave & Topeka Ave	894	1,399
FH-E13	N Topeka Ave & S Topeka Ave	945	2,401
FH-E14	7770 N Topeka Ave	967	2,329
FH-E15	Across street from 4890 Pyramid Mountain Road/Gardiner	2,105	2,048
FH-E16	Mesa Road & Fox Road	696	1,726
FH-E17	Hagerman Ave north of Topeka Ave	771	2,203
FH-E18	1/2 way up Pyramid Mountain Road from US Hwy 24	2,266	2,375
FH-E20	Pyramid Mountain Road & US Highway 24	2,500	1,999
FH-E21	Rampart Terrace Road	2,500	2,500
FH-E22	Timber Road & US Highway 24	1,617	2,500
FH-E23	Marigreen Pines north side access road into property	Sample Hydrant, Not Modeled	Sample Hydrant, Not Modeled
FH-E24	Marigreen Pines End of CMD main area	Not Operating, Not Modeled	Not Operating, Not Modeled
FH-W01	SW end of Town along US Highway 24	589	2,134
FH-W03	Emporia Ave behind Triangle building	903	2,500
FH-W04	Amemone Hill Road	683	939
FH-W05	4675 Fountain Ave	171	2239
FH-W07	Pike Road east of Pikes Peak Highway	856	1,941
FH-W08	Across from 8140 Chipita Park Road	1031	2,037
FH-W09	Pike Road & Dodd Road	856	1,815
FH-W10	Pikes Peak Highway & Chipita Pines Drive	664	1,228
FH-W11	5130 Chipita Pines Drive	588.59	1,055
FH-W13	South of 8270 Chipita Park Road	2500	2,500
FH-W14	Chipita Park Road & Aspenglow Lane	520	912

Hydrant No.	Location	Existing Condition, gpm [1)]	Proposed Condition, gpm [1)]
FH-W15	Across from Santa's Workshop - Pikes Peak Highway	474	819
FH-W16	Aspenglow Lane	462	795
FH-W17	Chipita Pines Drive	525	921
FH-W19	8420 Aspenglow Lane	443	758
FH-W20	8570 Aspenglow Lane	424	721
FH-W21	Entrance to Pikes Peak Highway tollgate	351	563
FH-W22	8615 Aspenglow Lane	418	709
FH-W23	Chipita Park Road - CSU vault area	Not Operating, Not Modeled	Not Operating, Not Modeled
FH-PROP1	Near 8270 Chipita Park Road	N/A	1,806
FH-PROP10	SW end of Town along US Highway 24	N/A	920
FH-PROP11	Near 8016 Ute Pass Ave	N/A	2,500
FH-PROP2	N End of Rampart Terrace Road	N/A	2,362
FH-PROP3	450' N of Emporia Ave on Fountain Ave	N/A	1,641
FH-PROP4	Oak Street and Martindale Ave Intersection	N/A	2,464
FH-PROP5	Prairie Street	N/A	2,491
FH-PROP6	Near 4705 Hagerman Road	N/A	2,244
FH-PROP7	End of Mariposa Lane	N/A	2,373
FH-PROP8	Near 7720 Severy Road	N/A	1,478
FH-PROP9	Oak Street and Poplar Street Intersection	N/A	2,044

1) gpm = gallons per minute

Water system recommendations presented in this study consist of primary looping on the west side of the system. This significantly improves pressures, flow delivery and flow circulation throughout the system.

Base demands presented in the following subsection have been distributed throughout the distribution system by applying an equal percentage of the

demand at each node. Fire flows as presented in the following sub-section are based on a needed fire flow of 750 gpm at each hydrant. As presented in the above table, these fire flows are met at all hydrants except the following: FH-W20 at 8570 Aspenglow Lane (721.17 gpm), FH-W21 at the entrance to Pikes Peak Highway tollgate (563.89 gpm), FH-W22 at 8615 Aspenglow Lane (709.76 gpm).

The recommended improvements in this study include the elimination of the existing 150,000-gallon storage tank. This recommendation is based on the assumption that available storage is available from CSU at the Ute Pass Water Treatment Plant facility. Cost estimates for the rehabilitation of the existing 150,000-gallon tank are also included in this study in the event CSU is not able to take on the storage component for the CMD1 service area.

6.1.3. PEAKING FACTORS

As presented in Section 4.6 of this study, water delivery and sales data is tabulated for 2007 through 2014 on a monthly basis. Over this period of time, total water sales only amounted to 58% of total water provided. The remaining 42% of water delivered is unaccounted-for. In general, unaccounted-for water within the water system is attributed to pipe leaks, pipe brakes, system flushing, firefighting, meter inaccuracy and other authorized and unauthorized unmetered usages.

For the purpose of this study, existing distribution system modeling was conducted using an average day demand value for the eight years of record. This includes the historic 42% unaccounted-for water percentage.

Unaccounted-for water values are expected to be significantly reduced as a result of the construction of the water system improvements recommended herein as well as the recommended proactive leak detection activities.

From 2007 through 2014, the average daily water system demand was 88,400 gpd or 61 gpm. A review of the eight years of delivered water data shows the highest months of delivery were in the months of June, July and August. The

maximum month has averaged 141% of average day deliveries. This maximum month value is typical for a small water system. Maximum day demand data was not available. The maximum day demand typically equates to 200% to 250 % of average day demand for a small water system. Based on the average maximum month demand factor observed, a maximum day demand factor of 250% of average day was selected for use in the distribution system modeling analysis.

The highest demand condition that stresses the system is that of peak hour demand which typically occurs for a short period of time during the maximum day demand condition. Typical peak hour demand values for a system of this size range from 300% to 400% of average day demand. A peak hour demand factor of 350% of average day demand was selected for this study.

The following table is a summary of the baseline water demand parameters used in this study for distribution system modeling.

TABLE 15

WATER DEMAND PARAMETERS

Parameter	Value
Historic average daily water demand, gpd/gpm [1)]	88,400/61
Historic maximum monthly water demand [2)]	141%
Typical maximum daily water demand [2)]	250%
Typical peak hour water demand	350%
Maximum day demand, gpd/gpm	221,000/153
Peak hour demand, gpd/gpm	309,400/214

1) gpd/gpm = gallons per day/gallons per minute
2) % of average day demand

6.2. FIRE FLOWS

The CMD1 service area is provided fire protection by the Cascade Volunteer Fire Protection District (CVFPD), a volunteer fire department. In 2014, the community's fire protection services were evaluated by the Insurance Services Office, Inc. (ISO). A copy of the ISO report is included in Appendix C3 of this study. On a one to ten scale, the

community received a fire protection community rating of 5/5X. Community ratings are used by insurance companies to set property insurance rates in an area.

The CVFPD utilizes ISO rating criteria for fire flow and hydrant standards. Needed fire flows are determined for each hydrant based on the surrounding area covered. Needed fire flow for commercial structures is calculated based on structure construction, occupancy, exposure and communications between buildings. For residential structures, needed fire flow is based only on structure separation. Individual needed fire flow calculations for individual hydrants have not determined by the CVFPD. The ISO report evaluated four fire hydrants. The hydrant, location, needed fire flow and calculated available fire flow from the report are summarized in the table below.

TABLE 16

ISO FIRE FLOWS

Hydrant No.	Location	Needed Fire Flow, gpm	Available Fire Flow, gpm	Coverage Type
F8-E15	Pyramid Mountain Rd. & Gardiner Rd.	500 [1)]	3,000	Residential
FH-E12	Hagerman Ave. & North Topeka	1,000-2,000	2,500	Commercial
FH-W04	Emporia Ave. & Park Street	1,500 [2)]	950	Residential
FH-W15	Pikes Peak Hwy. & Santa's Workshop	1,000	1,900	Commercial

1) Greater than 100' structure separation.
2) Less than 10' structure separation.

Available fire flow at the Emporia Avenue and Park Street fire hydrant fell short of needed fire flow due to the distribution system limitations of the existing system.

Residential needed fire flows range from 500 to 1,500 gpm. For structures with a separation between 31 ft. and 100 ft., the needed fire flow is 750 gpm. This is considered typical for the Cascade community and is used in the fire flow analysis of the existing and proposed system models.

The ISO criteria uses a maximum distance to a fire hydrant of 1,000 ft. for acceptable coverage. This criterion is also used by the CVFPD. The recommended water system improvements presented in this study include 11 additional fire hydrants on new pipelines to provide a minimum 1,000 ft. spacing between hydrants (500 ft. coverage length).

A summary of the 41 fire hydrants within the CMD1 system is presented in Appendix B-4. Field tests included the operation of 31 hydrants. Initial static, non-flowing pressures ranged from 27 to 190 psi. Pitot gauge flow measurements of the fire hydrants resulted in free flowing discharges ranging from 380 to 1,525 gpm. Residual hydrant pressure readings are required to calculate available fire flows at the minimum 20 psi system pressure. Residual hydrant pressures were not measured. Existing system available fire flows were calculated in the system distribution modeling.

6.2.1. FIRE PROTECTION IMPROVEMENTS

As presented in Section 6.2 above, the CVFPD utilizes the ISO rating criteria for needed fire flows. The CVFPD has not established needed fire flows for individual hydrants. A typical needed fire flow of 750 gpm is considered reasonable for the community based on typical residential structure separation. The 2014 ISO system evaluation tested hydrant FH-E12 and determined a needed fire flow of 1,000 - 2,000 gpm. Distribution system modeling of proposed conditions found needed fire flows of 750 gpm can be provided at all existing and proposed hydrants except at three locations. Calculated available fire flows at these three locations are in the range of 563 to 721 gpm. Available fire flows at hydrant FH-E12 was calculated at 2,402 gpm. The proposed modeled system conditions included the recommended 10 psi increase in delivery pressure, removal of the existing storage tank, installation of pressure reducing valves on the two southerly system extensions in the US Highway 24 frontage road and to the Holy Cross Novitiate, and all proposed distribution system piping.

Needed fire storage is determined using the ISO guidelines. The needed fire flow for residential housing having a separation of 31 to 100 feet (considered typical in Cascade) is 750 gpm. A maximum needed fire flow is assumed to be 2,000 gpm based on the 2014 ISO evaluation.

In the determination of fire storage requirements, the needed fire flow of 2,000 gpm is increased by the projected maximum day demand flow of 153 gpm and decreased by the maximum input capacity into the system. As presented in Section 3.5, the estimated maximum delivery rate through the CSU connection point is 2,300 gpm. The existing 12-inch pipeline extending from the Ute Pass WTP to the Cascade delivery point appears to have sufficient capacity to handle this flow rate and associated head loss. The net needed fire flow requirement from storage within the Cascade distribution system is zero as the available inflow exceeds the needed fire flow plus maximum day demand. The needed fire flow requirement from CSU's storage is 2,153 gpm.

The needed fire storage is a function of both the required flow rate and the duration over which is to be provided. In accordance with ISO guidelines, the available storage should provide two hours of firefighting capacity for needed fire flow rates up to 2,500 gpm. As such, the needed fire storage component from the CSU system is 258,000 gallons. The decision to keep or decommission the CMD1 ground level storage tank will need to be determined by CSU based on the ability to provide the needed fire flow rates and fire storage capacity to CMD1's system.

6.2.2. ADEQUACY OF FIRE SYSTEM TO MEET LOCAL JURISDICTION

The local fire protection jurisdiction is the Cascade Volunteer Fire Protection District (CVFPD). As previously discussed, the CVFPD utilizes the ISO rating criteria for a standard individual fire hydrant's flow. Fire hydrant flow testing was conducted as part of this study. Flow test data is presented in Appendix B4. Distribution system modeling demonstrates that available fire flows at all hydrants (except for the three previously noted) can be met.

6.3. WATER MAIN SEPARATION AND DEPTH

The depth of cover on the existing water mains is reported by the system operator to be approximately 5 feet. The 2005 water system improvements project plans for Pike, Dodd,

Hagerman, and Fox streets specify a depth of cover of 7.0 feet. Similarly, the 2007 water system improvements project plans for Heizer Street specify 7.0 feet of cover. Within the Water System Assessment Survey, the depth to the valve nut was measured for 55 valves. Assuming an AWWA C509 resilient wedge gate valve and considering the valve size, the depth of cover throughout the distribution system ranges from 3.4 to 15.8 feet, averaging 6.3 feet. The 2015 pipe breaks on the 2" galvanized iron pipe along the backside of the homes on the frontage road showed the pipe to only have two feet to three feet of cover.

Water main separation information from other utilities and septic systems are not known. The community does not have a centralized sanitary sewage collection system, so horizontal and vertical sewer line separation is not of concern. A 2-inch HDPE water main extension in the Crystola Circle area was reportedly bored under a septic tank/leach field. This area of the system has been recommended to be replaced. A full survey of the on-site waste treatment systems (OWTS) will need to be conducted by the District during the five-year Conversion period to determine if adequate water main separation is available and what improvements need to be added to the overall improvements as a result of inadequate separations, if any.

6.4. EVALUATION OF LOOPING

The District's current distribution system configuration results in a total of 36 dead end water mains. The lengths of the dead end lines vary from 149 feet to 2,008 feet in length. Thirty-two are under 6-inches in diameter with 2-inches being the predominate size. Comparing these configurations to the requirements in CSU's Water LESS requirements, the vast majority of the District's dead end mains do not meet the Water LESS requirements. Only three dead end mains meet the criteria. The areas meeting the criteria are located at the intersection of Chipita Pines Road and Aspenglow Lane, at the end of the cul-de-sac in Aspenglow Lane and the line running south of Outpost Road to the Holy Cross Novitiate. Information covering all dead end mains along with mapping showing the specific locations may be reviewed in Appendix E7.

The topography of the area together with the overall layout of the individual parcels of land have a significant factor in creating the dead end areas. These two factors make

some locations cost prohibitive to address while other locations may be addressed efficiently and effectively. The largest concern with the number of dead end mains focuses on water quality. Main sizes are the only item that keeps with water quality concern from being a consistent problem given few users and the length of the main. Since the water mains have a relatively small diameter, the volume in the main is small. This allows just a few users to keep the volume of water in the mains being exchanged on a regular basis.

6.5. EVALUATION OF EASEMENT WIDTHS

The evaluation of the existing easement widths was based on those easements dedicated in the subdivision plats and those easements granted by way of a recorded instrument.

The subdivision plats dedicated varying widths of utility easements ranging from 5 feet to 40 feet. For the purpose of this evaluation, only those easements where existing water lines are located were considered. The narrowest easement found on a subdivision plat that accommodates an existing water line was found in the Guier Subdivision where a portion of a 2-inch water line is located within a 12-foot wide easement. The width of the easement is likely adequate to access the line due to its small diameter. Major repairs and/or replacement would likely require additional easement width. The 12-foot wide easement only applies to Lot 4 of Guier Subdivision. Lots 5 through 8 of Guier Subdivision also have a 12-foot wide easement over the existing water line; however, it lies within the northwest quarter of the northwest quarter of Section 23 which, in 1954, had a blanket easement recorded which states "...for use in common with other owners to use and connect to water pipeline." All other easements dedicated by way of a subdivision plat that encompass existing water lines are 20 feet in width or greater. In some instances, the existing easements are sited adjacent to and adjoining an existing road right-of-way. This configuration provides sufficient room for removal, replacement and repair as required for operation and maintenance of the asset. This is evident in a few locations with platted front lot easements.

The second consideration is in regard to those easements acquired by recorded instruments. Of the eight (8) recorded instruments found in the El Paso County records,

one (1) is has an extremely narrow width. There is no existing water line at this easement location and, based on the review conducted, there would not be a need for a water line at this location. The narrowest easement where an existing water line exists is 20 feet in width. Those easements encompass the inflow and outflow lines from Pyramid Mountain Road to the water storage tank site. The 20-foot width appears to be adequate for access and operation and maintenance as necessary. All other easements are greater than 20 feet in width.

6.6. EVALUATION OF ACCESS ROADS

The evaluation of access roads is limited to those roads that are necessary for access to critical assets, i.e. the ground level water storage tank. There are two 20-foot wide easements leading to the water storage tank, one for the inflow line and a second for the outflow line. There is an existing traveled roadway that lies in close proximity to the 20-foot wide inflow easement. The elevation of the access road at Pyramid Mountain Road is approximately 6,682 feet ASL. The elevation at the top of the road near the water storage tank is approximately 6,798 ASL. Based upon an approximate distance between the two points, the slope of the road is approximately 14%. Because of the fixed elevations at each end of the existing roadway, there is no opportunity to flatten the slope unless an additional easement is acquired that would allow for a switchback type of alignment.

The existing roadway can be generally described as a two-track road surfaced with decomposed granite (DG). The condition of the road is generally considered good and can be accessed with a two-wheel drive vehicle under normal weather conditions. After a major storm event, be it rain or snow, a four-wheel drive vehicle may be required. When determining the "Designation" of the DG two-track road per the Pikes Peak Region Asphalt Paving Specifications, this road would be classified as a Trail and Pathway which has a volume and loading level of "<100,000 ESAL's - able to accommodate a 4,000 lb vehicle for safety and maintenance purposes." This volume and loading level corresponds with the actual use of this trail and pathway. Until such time the fate of the water storage tank is determined, it would appear impractical to upgrade the road.

HS-20 loading typically applies to structure's such as a bridge, vault or other structures subjected to 32,000 lb axle loading. There are no structures under the access road from Pyramid Mountain Road to the water storage tank. There appears to be no need to meet an HS-20 loading.

An evaluation of all the remaining roads in the CMD1 service area was not made. Based on historical use of these roads, the Colorado Springs Utilities electric division vehicles and El Paso County maintenance and snow removal equipment utilize the roads on an ongoing, as needed basis. With that in mind, the opinion is that the access roads in the CMD1 service area will provide the level of service required for the normal operation and maintenance of the assets.

7. RECOMMENDED MINIMUM IMPROVEMENTS

7.1. RECOMMENDED IMPROVEMENTS BEFORE CONVERSION

An assessment of the CMD1 water system was conducted within this study. A list of the minimum recommended water system improvements has been compiled in order to reach the following objectives:

- Address existing deficiencies and limitations within the existing water system.
- Improve the water system based on the CSU Water Line Extension and Service Standards (Water LESS).
- Improve available fire flows to fire hydrants within the system based on Cascade Volunteer Fire Protection District (CVFPD) standards.

Existing deficiencies within the system consist primarily of the use of small diameter galvanized iron piping. This pipe material is subject to corrosion and pipe breaks, and generally has a short service life and limited flow capacity.

Much of the distribution system consists of small diameter piping which is typical to a small rural water system. With the Conversion, distribution system improvements are necessary in order to meet the Water LESS standards. In many instances, the Water LESS standards cannot be met as they are not practical or reasonable; however,

recommended improvements have been developed to best meet those standards for minimum pipeline sizes, distribution system looping, pipe materials, valve spacing and bury depths.

Recommendations have also been made to the system to improve the fire protection coverage areas and available fire flows to meet CVFPD standards.

Recommended water system improvements basically fall under the following categories of justification and need:

- Protection of Public Health
- Protection of Public Safety
- System Reliability
- Operations and Maintenance

The Protection of Public Health improvements are those needs that are required for the protection of the potable water system providing service to the customers. This includes: providing safe water meeting the requirements of the Colorado Primary Drinking Water Regulations as well as the Regulations, Policies and Guidance of the Colorado Department of Public Health and Environment; protecting the water system from potential contamination resulting from unpredictable events including, but not limited to, flooding, freezing pipes, landslides, sabotage, etc.

The Protection of Public Safety primarily consists of providing the best fire protection services possible to the service area. Public safety items also include the protection of the general public and water system staff in regard to the water system facilities.

System reliability improvements consist of providing system redundancy in the form of distribution system looping with appropriate valving, backup facilities and equipment.

Operations and Maintenance improvements consist of typical system improvements that have been neglected such as assuring proper operability of valves, hydrants and blow offs as well as providing accessibility to system components. Maintenance of storage facilities include routine inspections and recoating surfaces as needed.

The recommended water system improvements to the CMD1 system are presented in the following discussions. The recommended distribution system improvements are shown on the drawings in Appendix F2 and are summarized in the project cost estimates presented in Appendix F1.

A systemwide recommendation consists of increasing the delivered water pressure from CSU by 10 psi. The delivered pressure is recommended to be increased from 165 psi to 175 psi. This would be accomplished by simply adjusting the existing pressure reducing valves at the CSU delivery point. Existing CSU delivery point equipment appears to be suitable for this change in pressure. The primary purpose of this change in service pressure is to increase the available fire flow to hydrants in the northwest quadrant of the system in order to meet the minimum fire flow requirements. The overall static pressure within the upper pressure zone of the distribution system will increase by 10 psi. The lower pressure zone will see pressure increases of 28 psi with the elimination of the storage tank combined with the 10 psi supply delivery pressure. At the southerly extent of the system, along the US Highway 24 frontage road and at the Holy Cross Novitiate, static service pressures as a result are estimated to increase to 235 psi and 245 psi, respectively. Recommended improvements as a result of this change include the addition of pressure reducing valves at these two extensions of the system.

The recommended pipeline material is ductile iron pipe. The Water LESS standards require a depth of bury for PVC piping of 9 feet as opposed to ductile iron pipe's 7 feet. Thus, PVC pipe as a result of the greater bury depth would have a higher installation cost. Also, Water LESS standards limit the use of PVC to 170 psi while ductile iron pipe is suitable up to 250 psi. Ductile iron pipe will be designed using the corrosion protection requirements of Water LESS including cathodic protection and pipe wrap. Valves will be line size and designed to meet Water LESS standards.

The following consists of the recommended improvements.

Improvement No. 1 - Chipita Park Road

Improvement No. 1 consists of the replacement of the 2-inch galvanized iron pipe in Chipita Park Road that serves six customers. A new fire hydrant is proposed at mid-length and a blow off at the end. This is a dead end line. As shown on the proposed Water System Improvements drawing, it is not practical to loop this pipeline. The pipe size selected for a portion of this line is smaller than that required by Water LESS. This selection was made to reduce the water age to the small number of customer services. The modeled available fire flow to the new fire hydrant meets CVFPD requirements. This improvement falls under the categories of System Reliability and Protection of Public Safety with the elimination of the existing 2-inch galvanized iron piping and the addition of a fire hydrant.

Estimated Construction Cost: $76,778

Improvement No. 2 - Rampart Terrace/US Highway 24 Area

Improvement No. 2 consists of the replacement of distribution system piping to three (3) clustered service areas abutting the west side of US Highway 24. These are shown on the existing and proposed water system improvements drawings, and are described as follows:

- Rampart Terrace area - 23 services
- Crystola Circle area (private road) - 4 services
- South of Pyramid Mountain Road - 7 services

The replacement of the existing 2-inch galvanized iron pipelines with 4-inch and 6-inch piping is recommended. A new fire hydrant is proposed at the west end of the new piping on Rampart Terrace. Blow offs are recommended at dead ends. The piping will be partially looped in Rampart Terrace and will continue to be dead ends in Crystola Circle and the south of the Pyramid Mountain Road areas. Pipeline sizes are smaller than that required by the Water LESS standards and have been selected to reduce the water age to the limited number of customers. The modeled available fire flow to the new hydrant at the end of Rampart Terrace meets CVFPD requirements.

The Rampart Terrace improvements fall under the category of System Reliability and Protection of Public Safety with the elimination of the 2-inch galvanized iron piping and the addition of a new fire hydrant. The Crystola Circle improvements fall under the categories of System Reliability and Protection of Public Health with the elimination of the 2-inch galvanized iron piping and the 2-inch HDPE piping installed under a septic tank/leach field. The improvements for the area south of Pyramid Mountain Road fall under the category of System Reliability with the elimination of the existing 2-inch galvanized iron piping.

Estimated Construction Cost: $231,549

Improvement No. 3 - Fountain/Chipita Park/Martindale Area

Improvement No. 3 consists of the extension of the 8-inch system piping southerly in Fountain Avenue connecting to the existing piping at Emporia Avenue. This new piping creates a major loop on the west side of the service area and greatly enhances the available fire flow throughout the system. Based on distribution system modeling, with this improvement, the District's existing storage tank is no longer required to provide adequate pressures for fire flows. The improvement also provides distribution system looping in Martindale Avenue and two additional fire hydrants. These improvements fall under the categories of System Reliability and Protection of Public Safety with the creation of a major loop of the entire distribution system as well as the additional fire hydrants.

Estimated Construction Cost: $536,720

Improvement No. 4 - Hagerman/Forest/Mariposa/Columbine/Mesa Area

Improvement No. 4 consists of improvements to five segments of existing piping within the older east side of the service area. A new 6-inch main in Hagerman Avenue extending from US Highway 24 up Hagerman Avenue creates a major loop within the system and replaces a short dead end segment of 2-inch galvanized iron piping. The existing 2-inch galvanized iron pipe in Forest Road is proposed to be replaced in its

existing location. The existing 2-inch galvanized iron piping extending cross country from Fox Road to North Topeka Avenue is proposed to be abandoned and replaced in Mesa Road with 6-inch piping. New and replacement piping in Columbine Lane and Mariposa Avenue are intended to replace considerable quantities of cross country piping and relocates the mains into existing rights-of-way. New service line connections are proposed within this improvement. A 2-inch HDPE (or PVC) pipeline has been selected for Columbine Lane as it serves a single customer. Four-inch piping is recommended in Forest Road in order to limit the water age to three customers. Within this improvement grouping one service line will be connected to Pyramid Mountain Road, five to Mesa Road, two to Fox Road and one to North Topeka Avenue. Improvements within this area also include two new fire hydrants. Recommended new and replacement piping in these areas are smaller than that required by Water LESS. Pipe sizes were selected to minimize the water age to the small number of customers on each line. These recommended improvements fall under the categories of System Reliability and Protection of Public Health with the elimination of the 2-inch galvanized iron piping and the addition of new fire hydrants.

Estimated Construction Cost: $385,526

Improvement No. 5 - Pyramid Mountain Road Area

Improvement No. 5 consists of the installation of a new 8-inch water main in Pyramid Mountain Road and Severy Avenue extending from Gardiner Road to Marriott Road. On the east half of the distribution system this represents a major looping limitation within the existing system. This improvement falls under the category of System Reliability with the creation of a significant loop connection on the west side of the system.

Estimated Construction Cost: $266,983

Improvement No. 6 - Poplar/Martindale Area

Improvement No. 6 consists of the replacement of existing 2-inch galvanized iron piping in this area. This service branch of the system off Fountain Avenue will continue to be a dead end service area. Looping of this line in Martindale Avenue to the south is

impractical. Blow offs are proposed at the dead ends of Poplar and Martindale Avenue as shown on the Water System Improvements drawings. One new fire hydrant is proposed. These improvements fall under the categories of System Reliability and Protection of Public Safety with the elimination of the 2-inch galvanized iron piping and the addition of a fire hydrant.

Estimated Construction Cost: $111,961

Improvement No. 7 - Prairie/Oak/Park Area

Improvements in this area consist of the replacement of the existing 3-inch ductile iron pipe dead end line as well as the creation of a pipe loop for Prairie Street. Improvements on Park Street consist of the replacement of the crossing of Severy Creek which is currently exposed in the stream bottom. This creek crossing will be encased under the stream. One new fire hydrant is proposed. These improvements fall under the categories of System Reliability and Protection of Public Safety with the looping of Prairie Street and the addition of a fire hydrant. With these improvements, the Park Street Pump House will be completely removed from the distribution system and bypassed.

Estimated Construction Cost: $137,392

Improvement No. 8 - US Highway 24 Frontage Road

Improvement No. 8 consists of the replacement of the 4-inch main in US Highway 24 frontage road extending south from Emporia Avenue. At the southerly extent of this line, the existing 2-inch galvanized iron piping leaves the right-of-way and continues south along the backside of eight customer parcels. In this segment, the line is proposed to be relocated to the frontage road right-of-way. Due to relatively high pressures in the line, a pressure reducing valve vault is proposed to be installed approximately 200 feet south of Emporia Avenue. Looping of this relatively long dead end line is impractical as it would require boring across Fountain Creek and US Highway 24. These improvements fall under the categories of Protection of Public Safety and System Reliability with the addition of a new fire hydrant and the elimination of the existing problematic 2-inch galvanized iron piping that is not in the right-of-way.

Estimated Construction Cost: $445,659

Improvement No. 9 - Modjeska/Hagerman/Severy Area

Improvements in this area consist of the replacement of several 1-½ and 2-inch galvanized iron pipes with a 4-inch loop from Severy Avenue to Outpost Road as well as an 8-inch extension in Severy Avenue terminating with a fire hydrant. The existing 2-inch line out of the right-of-way between Severy Avenue and Hagerman Avenue will be abandoned. New service lines will be extended to two customers served by this line which is to be abandoned. The location of these improvements is shown on the proposed Water System Improvements drawings in Appendix F2. These improvements fall under the categories of Protection of Public Safety and System Reliability with the elimination of the small diameter galvanized iron piping, system looping and the addition of a fire hydrant.

Estimated Construction Cost: $206,842

Improvement No. 10 - Heizer Street Area

Improvement No. 10 includes the replacement of the 2-inch PVC dead end line in Heizer Street with a 6-inch line looping Severy Avenue to Marriott Road. On the southerly end of Heizer Street, a 2-inch PVC loop is proposed to be replaced with a 6-inch line. In addition, a pressure reducing valve vault is proposed to be installed on the 8-inch main serving the Holy Cross Novitiate. These improvements fall under the category of System Reliability by providing adequate looping of Heizer Street extending from Severy Avenue to Outpost Road.

Estimated Construction Cost: $153,650

Improvement No. 11 - South Topeka Avenue

Improvement No. 11 includes the bypass piping at the Topeka Avenue Pump House as well as the replacement of an existing 2-inch galvanized iron dead end pipeline in South

Topeka Avenue. This will remain a dead end line as looping of South Topeka Avenue is not practical. A 4-inch line is proposed for the existing two services off this line. These proposed improvements fall under the category of System Reliability with the elimination of the existing 2-inch galvanized iron piping as well as bypassing and removing from service the Topeka Avenue Pump House.

Estimated Construction Cost: $28,780

Improvement No. 12 - Outpost Road

Improvement No. 12 consists of the replacement of the existing 8-inch main on the west side of Outpost Road extending south approximately 960 feet. This line is not in the right-of-way or the roadway. There is at least one structure over this line. A recommended 6-inch main will be located in the right-of-way. At least six service lines and the main in Bluff Road will need to be extended to the new main. The 6-inch loop in Outpost Road and Heizer Street has been determined sufficient for this service area. These improvements fall under the category of Operations and Maintenance and Public Safety by moving the main into the public right-of-way and out from under at least one structure.

Estimated Construction Cost: $122,453

Improvement No. 13 - Existing 150,000-Gallon Storage Tank

This improvement includes the recommendation to remove the existing storage tank from service. Extensive looping of the system makes it possible to provide adequate fire flows and pressures throughout the system with the single supply connection to the CSU system. Existing components within the delivery vaults, including the flow meter, backflow prevention devices, and pressure reducing valves appear to have adequate capacity to accommodate the needed fire flows within the District's distribution system. The reported capacity of the Ute Pass Water Treatment Plant (WTP) is 1.5 mgd, or 1,000 gpm. In order to undertake this recommendation, CSU will need to determine if adequate supply and storage capacity is available from the Ute Pass WTP site for the Green Mountain Falls, Chipita Park and Cascade systems. Within this recommendation, the existing storage tank would be removed from service and demolished. Existing inlet and

outlet piping would be abandoned and the existing chlorination system removed. The existing Chlorination Building will remain in service providing communication service for the Cascade Volunteer Fire Protection District. If, however, CSU determines that adequate storage is not available at the Ute Pass WTP, this tank could remain in service provided extensive rehabilitation of the structure is undertaken. Removal of the existing storage tank falls under the category of Operations and Maintenance due to the scope of repairs required to bring the tank up to an acceptable service condition.

Estimated Construction Cost - Tank Removal and Demotion: $100,000

Estimated Construction Cost - Tank Rehabilitation: $190,000

Improvement No. 14 - CSU Connection to System

This improvement consists of the addition of a chlorination booster station located at the CSU connection point. The existing booster chlorination system at the storage tank is proposed to be removed from service. At this point the need for additional chlorination has not been fully determined; however, with the new CDPHE Minimum Disinfectant Residual Requirements combined with the current need for booster chlorination, the presumption is that booster chlorination facilities will be required. This improvement falls under the category of Protection of Public Health with the ability to provide the necessary minimum chlorine residual within the distribution system.

Estimated Construction Cost: $45,000

Improvement Nos. 15, 16 and 17 - Replacement of Valves, Hydrants and Raising Buried Valve Boxes

These improvements consist of the replacement of seven (7) existing line valves identified as inoperable by the District operator. These valves are in addition to the valves being replaced or added within the recommended Improvement Nos. 1 through 12. Approximately nineteen (19) existing valves are inaccessible as the valve covers are under asphalt, fill or concrete. One fire hydrant has been identified as being inoperable and in need of replacement. These improvements fall under the categories of System

Reliability and Protection of Public Safety with the replacement of the inoperable valves, raising of buried valve boxes and the replacement of an existing fire hydrant.

Estimated Construction Cost: $28,700

Improvement Nos. 18, 19 and 20 - Demolition of Existing Assets

These improvements include the demolition of the Park Street Pump House, Topeka Avenue Pump House and the abandoned below grade concrete storage tank. These existing facilities have fallen into disrepair and are no longer required. Recommended distribution system piping improvements have bypassed the Park Street Pump House and the Topeka Avenue Pump House. With these facilities out of service, they become an attractive nuisance. Existing piping out of the abandoned storage tank is currently valved off and needs to be disconnected and plugged. These improvements fall under the category of Operations and Maintenance as these facilities are no longer required.

Estimated Construction Cost: $90,000

The following table presents a summary cost estimate of the recommended improvements to be conducted by the District within the Conversion. Details of the cost estimates are presented in Appendix F1.

TABLE 17

WATER SYSTEM IMPROVEMENTS - PRELIMINARY CONSTRUCTION COST ESTIMATE [1)]

Improvement	Location	Description	Total Cost
1.	**Chipita Park Road**	**Replace 2-inch Galvanized Iron Piping**	
a.	Chipita Park Road	Replace existing with 4" and 8" pipe	$76,778
2.	**Rampart Terrace US Highway 24 Area**	**Replace 2-inch Galvanized Iron Piping**	
a.	Rampart Terrace Road and Private Access Roads	Replace existing with 4" and 6" pipe	$169,199
b.	Crystola Circle	Replace existing with 4" pipe	$28,610
c.	US Hwy 24 West side, South of Pyramid Mountain Road	Replace existing with 4" pipe	$33,740
		Subtotal	$231,549
3.	**Fountain/Chipita Park/Martindale Area**	**New System Loop Piping and Replace 3-inch Ductile Iron Piping**	
a.	Chipita Park Road	New 8" pipe	$89,003
b.	Pike Road	New 8" pipe	$16,333
c.	Fountain Avenue	Replace existing and add new 8" pipe	$317,050

Improvement	Location	Description	Total Cost
d.	Martindale Avenue	Replace existing with 8" pipe	$114,333
		Subtotal	$536,720
4.	**Hagerman/Forest/Mariposa/Columbine/ Mesa Area**	**New System Loop Piping and Replace 2-inch Galvanized Iron Piping**	
a.	Hagerman Avenue	New 6" pipe	$115,727
b.	Forest Road	Replace existing with 4" pipe	$68,750
c.	Mariposa Lane and Gardiner Road	Replace existing with 6" pipe	$65,707
d.	Columbine Lane	New 2" pipe	$22,931
e.	Mesa Road thence west to Hagerman	New 6" pipe	$112,411
		Subtotal	$385,526
5.	**Pyramid Mountain Road Area**	**Replace 4-inch Ductile Iron Piping**	
a.	Pyramid Mountain Road	Replace existing with 8" pipe	$184,722
b.	Severy Avenue	Replace existing with 8" pipe	$82,261
		Subtotal	$266,983
6.	**Poplar/Martindale Area**	**Replace 3-inch Ductile Iron Piping**	
a.	Poplar Street	Replace existing with 8" pipe	$77,794
b.	Martindale Avenue	Replace existing with 4" pipe	$34,167
		Subtotal	$111,961
7.	**Prairie/Oak/Park Area**	**Replace 3-inch Ductile Iron Piping**	
a.	Prairie Street and Oak Street	Replace existing with 4" and 6" pipe	$111,381
b.	Park Street	Replace existing with 4" pipe	$26,011
		Subtotal	$137,392
8.	**US Highway 24 Frontage Road**	**Replace 4-inch Ductile Iron and 2-inch Galvanized Iron Piping**	
a.	Frontage Road	Replace existing with 6" and 8" pipe. Add Pressure reducing valve vault.	$445,659
9.	**Modjeska/Hagerman/Severy Area**	**New System Loop Piping and Replace 1 1/2-inch and 2-inch Galvanized Iron Piping**	
a.	Modjeska Street	Replace existing and add new 4" pipe	$34,572
b.	Hagerman Avenue	New 4" pipe	$79,514
c.	Severy Avenue	Replace existing with 8" pipe	$92,756
		Subtotal	$206,842
10.	**Heizer Street Area**	**New System Loop Piping and Replace 2-inch Galvanized Iron Piping**	
a.	Heizer Street	Replace existing and add new 6" pipe	$66,133
b.	Cross Country - Heizer Street to Outpost Road	Replace existing with 6" pipe. Add Pressure reducing valve vault.	$87,517
		Subtotal	$153,650
11.	**South Topeka Avenue**	**Replace 2-inch Galvanized Iron Piping**	
a.	South Topeka Avenue	Replace existing with 4" and 6" pipe	$28,780
12.	**Outpost Road**	**Replace 8-inch Ductile Iron Piping not in Right-of-Way**	
a.	Outpost Road	Replace existing with 6" pipe	$122,453
13.	**Existing 150,000 gal. Storage Tank**	Remove from service and demolish tank, demolish Chlorination Building, abandon existing piping.	$100,000
14.	**CSU Connection to System**	New booster chlorination station	$45,000
15.	**Replace Inoperable Valves**		
	8" valve	3 each @ $2,400	$7,200
	6" valve	1 each @ $2,000	$2,000
	4" valve	2 each @ $1,900	$3,800
	2" valve	1 each @ $1,200	$1,200
		Subtotal	$14,200

Improvement	Location	Description	Total Cost
16.	**Raise Buried Valve Boxes**	19 @ $500 ea.	$9,500
17.	**Replace Existing Hydrant**	1 @ $5,000 ea.	$5,000
18.	**Demolish Park Street Pump House**		$30,000
19.	**Demolish Topeka Avenue Pump House**		$30,000
20.	**Demolish Abandoned Storage Tank**		$30,000
Subtotal preliminary cost			$2,967,994
Project contingencies @ 15%			445,199
Engineering design/contract administration			276,200
Construction observation based on 210 calendar days			175,000
Other Engineering [2)]			166,000
Administrative expenses [2)]			33,000
Total preliminary project cost estimate			$4,063,393

1) See Appendix F1 for detailed quantities and unit prices for recommended work.
2) See breakdown contained in Appendix F1.

7.2. RECOMMENDED IMPROVEMENTS AFTER CONVERSION

The District understands all agreed upon improvements to the water system must be accomplished prior to transferring the system to CSU. Therefore, no recommended improvements will be undertaken after the Conversion. This understanding was verified with and acknowledged by CSU staff. That said, there is an understanding that coordination may be required after the Conversion.

The belief is the Conversion of the water system will happen within the warranty period of the newly installed facilities. Since the contract for the new facilities will be between CMD1 and the low responsive, responsible bidder, the District will be the official party the warranty work will have to pass through. Therefore, coordination and communication between the District and CSU will be required in this effort. CSU will be required to report any warranty items that need to be addressed to the District while the District's responsibility will be to contact and coordination the warranty work in a timely manner with the construction contractor. As the construction phase and ultimately the Conversion phase near, further discussions will have to be made to ensure all parties have the same understanding of responsibilities, the flow of communication and ultimately the satisfaction of the warranty work.