

City of Cortez

2018 Water Conservation Plan

Prepared for:

CITY OF CORTEZ
PUBLIC WORKS DEPARTMENT
CORTEZ, COLORADO

Prepared in 2010 by:



Updated October 2017
By Richard Landreth

TABLE OF CONTENTS:

PART 1 - Introduction.	5
PART 2 - Existing Water System Profile.	8
2.1 Physical Characteristics of Existing Water Supply System.	8
2.2 Water Sources.	8
2.3 System Limitations.	9
2.4 Water Costs and Pricing.	11
2.5 Current Policies and Planning Initiatives.	12
2.6 Current Water Conservation Activities.	13
PART 3 - Water Use and Demand.	13
3.1 Current Water Use.	13
3.2 Demand Forecasting Method.	14
3.3 Demand Forecast.	14
PART 4 - Proposed Facility Improvements.	14
PART 5 - Water Conservation Goals.	15
5.1 Goal #1: In Short-Term Maintain Per Capita Water Demand at Current Reduced Levels; Over Long-Term, Reduce Per Capita Water Demand to 180 gpcd.	15
5.2 Goal #2: Full Metering / Monitoring.	16
5.3 Goal #3: Improve Quantification of Water Loss, Improve Water Loss to Less than 15%.	16
5.4 Goal #4: Investigate Advanced Metering Infrastructure.	17
5.5 Goal #5: Complete a Drought Contingency Plan.	17
5.6 Goal #6: Add a Planning Component to This Plan.	17
PART 6 - Water-Saving Measures / Programs.	17
6.1 Water-Saving Measures / Programs Considered.	17
6.2 Screening and Evaluation of Water-Saving Measures / Programs.	18
6.3 Selected Water-Saving Measures / Programs.	18
PART 7 - Quantitative Estimates of Water Savings.	34
PART 8 - Implementation Plan.	35
8.1 Role of Conservation Plan in Cortez's Water Supply Planning.	35
8.2 Implementation Schedule.	36
8.3 Public Participation.	37
8.4 Monitoring and Evaluation.	38
8.5 Annual Updates and Comprehensive Revision of Water Conservation Plan.	39
8.6 Plan Approval.	39
8.7 Solicitation of Additional Funds.	39
PART 9 - References / Additional Resources.	40

FIGURES AND CHARTS:

Chart 1: Average Monthly Maximum and Minimum Daily Temperatures (°F) in Cortez, Colorado. 5
 Chart 2: Average Monthly Precipitation (Inches of Water) in Cortez, Colorado. 6
 Figure A: Location of CWCB Model Water Conservation Plan Sections in Cortez’s Plan. 7
 Chart 3: Average per Capita Water Consumption in Select Cities. 9
 Figure B: Highlights of City’s Water Rate Structure. 11
 Chart 4: Estimated Breakdown of Indoor Household Water Use 18
 Figure C-1. Preliminary Projected Toilet Replacement Rebates and Estimated Water Savings..... 20
 Figure C-2. Preliminary Projected Washing Machine Replacement Rebates and Est. Water Savings. 20
 Figure C-3. Summary of Estimated Water Savings for Water-Efficient Fixtures & Appliances. 21
 Figure D. Estimated Water Savings Due to Waterwise Landscaping Program. 24
 Figure E. Estimated Water Savings Due to the City’s Commercial Water Audit Program. 26
 Figure F. Estimated Water Savings from Backwash Water Reduction / Recycling. 27
 Figure G. Estimated Water Savings Due to Acoustic Leak Detection and Repair Program..... 30
 Figure H. Est. Water Savings Due to Public Education, Customer Audits, Water-Saving Demos. 30
 Chart 5: Marginal Price Curve of Existing Water Rate Structure..... 31
 Chart 6: Average Price Curve of Existing Water Rate Structure. 32
 Figure I. Estimated Water Savings Due to Potential Future Conservation-Oriented Rate Structure..... 33
 Figure J. Estimated Water Savings Due to Regulatory Measures..... 34
 Figure K. Quantitative Estimates of Water Savings by Water-Saving Measure / Program. 34
 Figure L. Estimated Water Savings if Conservation Goal Met..... 35
 Figure M: Implementation Schedule. 36

APPENDICES:

- Tables and Graphs (see list on Page 4 of 41)
- Waterwise Landscaping Demonstration Garden Information & Draft Brochure
- Public Education Literature
- Regulatory Measures
- Local Newspaper Articles
- Preliminary Scope of Work for Future Water Rate Study
- APPENDIX ADDENDA:

- Memo to Council from Rich Landreth for June 12, 2018, Council Workshop: *Update of the 2010 Water Conservation Plan*
- Minutes: Cortez City Council Regular Workshop, June 12, 2018
- Memo to Council from Rich Landreth for August 14, 2018, Workshop: *Water Conservation Plan Goals, Water Saving Measures, and Implementation Schedule*
- Minutes: Cortez City Council Regular Workshop, August 14, 2018
- Agenda and Minutes: Cortez City Council Regular Meeting, August 28, 2018
- Minutes: Cortez City Council Regular Workshop, August 28, 2018
- Public Notice of Water Conservation Plan Public Comment Period
- Agenda and Minutes: Cortez City Council Regular Meeting, October 23, 2018
- Agenda and Minutes: Cortez City Council Regular Meeting, November 13, 2018
- Comments from Brett M. Schmidt, P.E. on City of Cortez’s Draft 2018 Water Conservation Plan, and Comment Responses from City
- Resolution No. WE-2017-1, Series 2017: *Establishing the Water Rate Charges and the Water Development Charges for the City of Cortez Water Enterprise*
- City of Cortez Ordinance No. 1257, Series 2018: *Adopting by Reference the 2018 Water Conservation Plan for the City of Cortez, Colorado*

TABLES AND GRAPHS:
(Located in Appendices)

- Table 1: City of Cortez & MCWD#1: Population, Annual Water Demand/ Supply, Per Capita Demand
- Graph 1a: Population in City of Cortez & MCWD#1 Service Area
- Graph 1b: Per Capita Water Demand in City of Cortez & MCWD#1 Service Area
- Graph 1c: Annual Water Demand and Available Supply for City of Cortez & MCWD#1, UMU Tribe
- Table 2: Water Demand by User, Metered and Estimated Unmetered (2008 & 2009)
- Graph 2: Water Demand by User Type (2008 & 2009)
- Table 3: No. & % of Taps, Water Demand, Average Water Demand by User Type (2008 & 2009)
- Graph 3: Taps by User Tap (2016)
- Table 4: Monthly Water Produced at Cortez WTP (2000 - 2017)
- Graph 4: Monthly Water Produced at Cortez WTP (2000 - 2017)
- Table 5: Monthly Water Produced for City of Cortez & MCWD#1 (2000 - 2017)
- Graph 5: Monthly Water Produced for City of Cortez & MCWD#1 (2000 - 2017)
- Table 6: Monthly Water Produced for Mountain Ute Mountain Tribe (2000 - 2017)
- Graph 6: Monthly Water Produced for Mountain Ute Mountain Tribe (2000 - 2017)
- Table 7: Monthly Water Production by User (2000 - 2017)
- Chart 7: Monthly Water Production by User (2000 - 2017)
- Table 8: Annual Water Production by User (2000 - 2017)
- Graph 8: Annual Water Production by User (2000 - 2017)
- Table 9: Monthly Per Capita Water Production for City of Cortez & MCWD#1 (2000 - 2017)
- Graph 9a: Monthly Per Capita Daily Water Production for City of Cortez & MCWD#1 (2000 - 2017)
- Graph 9b: Ave. Monthly Per Capita Daily Water Production for Cortez & MCWD#1 (2000 - 2017)
- Graph 10a: Monthly Water Produced for City of Cortez & MCWD#1
- Graph 10b: Per Capita Daily Water Produced for City of Cortez & MCWD#1
- Table 10: Estimates of Water Savings from Longer Filter Runs / Reduced Filter Backwash Frequency

PART 1 - INTRODUCTION.

Government, Population, and Land Use.

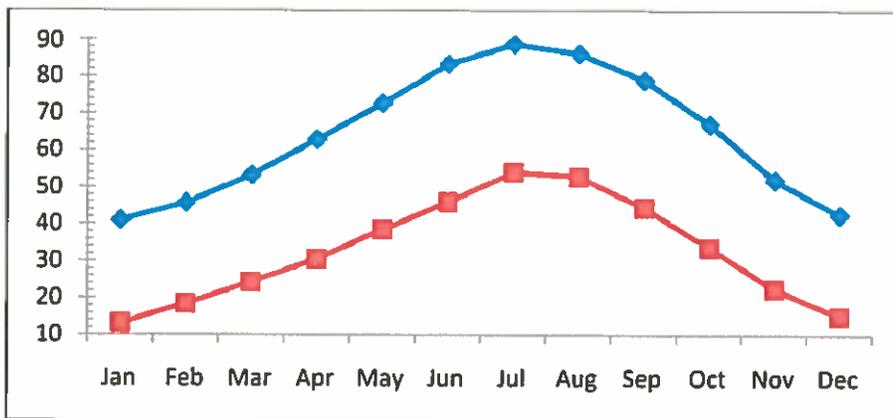
The City of Cortez is a home-rule municipality that is the seat of Montezuma County, Colorado, within the southwest portion of the state.

Cortez had a population of 9,007 in 2017, and is the most populous city within Montezuma County. The County population is approximately 27,000. Table 1 and Graph 1a, in the Appendix, shows the historic population of the City of Cortez and Montezuma County Water District #1 (MCWD#1) from 1970 to 2009, as well as projected populations to 2040.

Montezuma County is roughly one-third tribal land, one-third federal land (administered by the National Park Service, the United States Forest Service and the Bureau of Land Management), and one-third private or state/county land. The entrance to the Mesa Verde National Park is located nine miles east of Cortez, along State Highway 160. Much of Montezuma County is irrigated cropland, producing alfalfa, wheat, and beans, as well as large numbers of cattle and sheep.

Topography and Climate. Montezuma County is also varied topographically, ranging in elevation from about 6,000 feet to more than 14,000 feet, and from high Colorado Plateau Desert to Alpine Tundra. The La Plata and San Juan Mountains are located to the north and east, within sight of Cortez. Cortez itself is located at an elevation of approximately 6,200 feet. The local climate is characterized by an abundance of sun (approximately 300 days per year), minimal humidity, and an annual average precipitation of only thirteen inches. Significant precipitation often occurs during powerful storms, either strong thunderstorms or snowfall. In summer, average temperatures range from the low fifties to the mid-nineties degrees Fahrenheit. In winter, average temperatures range between the mid-teens and low forties degrees Fahrenheit. The average annual maximum and minimum daily temperatures in Cortez are 64.6°F and 32.9°F, respectively. Chart 1, below, shows the average monthly maximum and minimum daily temperatures in Cortez. Chart 2, below, shows the average monthly precipitation received within Cortez.

CHART 1: AVERAGE MONTHLY MAXIMUM AND MINIMUM DAILY TEMPERATURES (°F) IN CORTEZ, COLORADO.



Source: Western Regional Climate Center (<http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?cocort>)

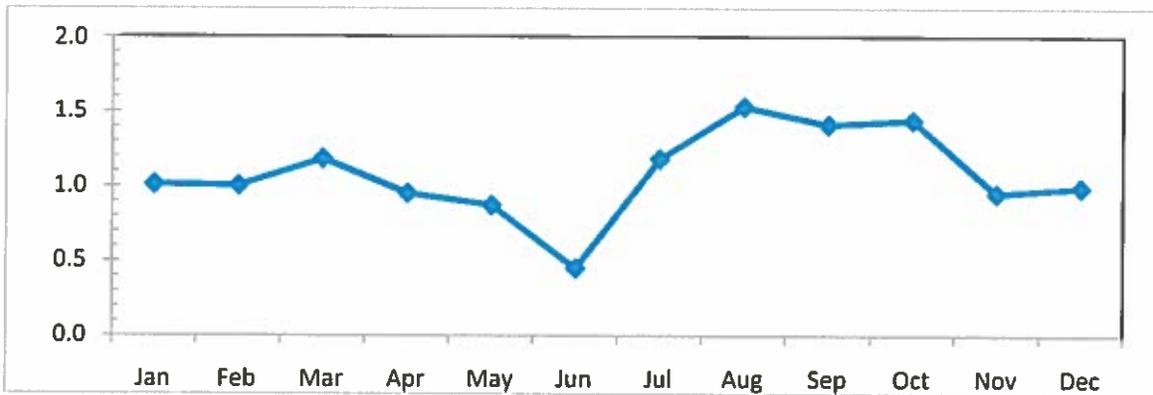


CHART 2: AVERAGE MONTHLY PRECIPITATION (INCHES OF WATER) IN CORTEZ, COLORADO.
 Source: Western Regional Climate Center (<http://www.wrcc.dri.edu/>)

Public Water System.

The City’s Department of Public Works operates its own drinking water system that supplies water to residents within the City of Cortez’s boundaries, as well as several adjacent areas – the MCWD#1 and the Ute Mountain Ute Tribe. The estimated population supplied by the City of Cortez & MCWD#1 water system is approximately 10,000. The Cortez water system is categorized as a Public Water System (PWS), as defined by the federal Safe Drinking Water Act and the U.S. Environmental Protection Agency. The water provided to the Ute Mountain Ute Tribe is from their annual allocation of municipal & industrial water, and is treated by the City of Cortez. The Ute Mountain Ute Tribe water is outside of the scope of this report, and is only discussed herein to the extent that it affects the operation of the Cortez WTP.

Purpose and Contents of Water Conservation Plan.

This plan constitutes the City of Cortez’s strategy for reducing the volume of water withdrawn from its water supply sources, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, and for increasing the reuse of water. The emphasis and overarching goal of this plan is to achieve lasting, long-term improvement in water use efficiency. This plan does this by identifying water conservation measures and programs that have been or will be implemented by the City of Cortez, as well as outlining how these measures and programs will be implemented. The target audiences for the plan include residents, commercial enterprises, governmental institutions, and other users of the Cortez drinking water supply.

Per Capita Water Demand.

Table 1 and Graph 1b in the Appendix show the historic and projected per capita daily water demand for the City of Cortez and MCWD#1. They show that per capita daily water demand fell consistently from approximately 325 gal / person / day (gpcd), leveling at approximately 230 gpcd for a few years then dropping to just above 200 gpcd in 2016. As described later in the plan, the City’s short-term goal is for per capita daily water use to remain at this level in the future, with an accompanying long-term commitment to reduce per capita water demand to at or below 180 gpcd.

Plan Resources.

The plan was developed using the additional resources listed in Section 8, particularly the Colorado Water Conservation Board (CWCB) Model Water Conservation Plan. Figure A, below, shows the location of CWCB’s Model Water Conservation Plan sections within Cortez’s plan. The plan builds upon and updates the City of Cortez’s 1996 Water Conservation Plan. Water demand projections were developed utilizing the per capita water demand and population methodology outlined in the American Water Works Association (AWWA) Manual of Water Supply Practices M50, “Water Resources Planning” (2007).

FIGURE A: LOCATION OF CWCB MODEL WATER CONSERVATION PLAN SECTIONS IN CORTEZ'S PLAN.

CWCB Model Water Conservation Plan Section	Location in Cortez's Plan
Step 1 – Profile the Existing Water System	
1.1 – Provide Physical Characteristics of Existing Water Supply System	Part 2, § 2.01
1.2 – Identify All Sources of Water	Part 2, § 2.02
1.3 – Identify System Limitations	Part 2, § 2.03
1.4 – Characterize Water Cost and Pricing	Part 2, § 2.04
1.5 – Review Current Policies and Planning Initiatives	Part 2, § 2.05
1.6 – Summarize Current Water Conservation Activities	Part 2, § 2.06
Step 2 – Characterize Water Use and Forecast Demand	
2.1 – Characterize Current Water Use	Part 3, § 3.01
2.2 – Select Forecasting Method	Part 3, § 3.02
2.3 – Prepare Demand Forecast	Part 3, § 3.03
Step 3 – Profile Proposed Facilities	
3.1 – Identify and Cost Potential Facility Needs	Part 4
3.2 – Prepare an Incremental Cost Analysis	Part 4
3.3 – Develop Preliminary Capacity and Cost Forecasts	Part 4
Step 4 – Identify Conservation Goals	
4.1 – Develop Water Conservation Goals	Part 5, §§ 5.01-5.03
4.2 – Document the Goal Development Process	Part 5
Step 5 – Identify Conservation Measures and Programs	
5.1 – Identify Conservation Measures and Programs	Part 6, § 6.01
5.2 – Develop and Define Screening Criteria	Part 6, § 6.02
5.3 – Screen Conservation Measures and Programs	Part 6, § 6.02
Step 6 – Evaluate and Select Conservation Measures and Programs	
6.1 – Create Combinations of Measures and Programs	Part 6, §§ 6.03-6.04
6.2 – Estimate Costs and Water Savings of Conservation Options	Part 6, § 6.02
6.3 – Compare Benefits and Costs	Part 6, § 6.02
6.4 – Define Evaluation Criteria	Part 6, § 6.02
6.5 – Select Conservation Measures and Programs	Part 6, §§ 6.03-6.04
Step 7 – Integrate Resources and Modify Forecasts	
7.1 – Revise Demand Forecast(s)	Part 7
7.2 – Identify Project-Specific Savings	Part 7
7.3 – Revise Supply-Capacity Forecast(s)	Part 7
7.4 – Summarize Forecast Modifications and Benefits of Conservation	Part 7
7.5 – Consider Revenue Effects	Part 7
Step 8 – Develop Implementation Plan	
8.1 – Develop Implementation Schedule	Part 8, § 8.02
8.2 – Develop Plan for Public Participation in Implementation	Part 8, § 8.03
8.3 – Develop Plan for Monitoring and Evaluation Process	Part 8, § 8.04
8.4 – Develop Plan for Updating and Revising the Conservation Plan	Part 8, § 8.05
8.5 – Define Plan Adoption / Completed / Approval Date	Part 8, § 8.06
Step 9 – Monitor, Evaluate and Revise Conservation Activities and the Conservation Plan	
9.1 – Implement the Plan	Part 8

PART 2 - EXISTING WATER SYSTEM PROFILE.

2.1 PHYSICAL CHARACTERISTICS OF EXISTING WATER SUPPLY SYSTEM.

The City of Cortez's drinking water system supplies the City's residents and several adjacent areas outside of the City's municipal boundaries, including Montezuma Water District No. 1 and the Ute Mountain Ute Tribe. The drinking water supplied to Cortez, MCWD#1 and the Ute Mountain Ute Tribe is their exclusive source of drinking water.

The water system is operated by the City of Cortez's Department of Public Works. The Public Works Director is Phillip Johnson. The Water Treatment Plant Superintendent is Richard Landreth.

The City's water system consists of raw water drawn from McPhee Reservoir, followed by a small water storage reservoir, water treatment plant, finished water storage tanks, a distribution system, and associated administrative offices. The treatment plant provides a series of treatment processes, including coagulation, flocculation, sedimentation, multimedia granular filtration, submerged membrane microfiltration, and chlorine disinfection. Adjacent to the treatment plant is a raw water storage pond (the "upper" pond) and a small backwash pond (the "lower" ponds). Water flows from the upper raw water storage pond to the treatment plant by gravity. Backwash water from the treatment plant flows by gravity into the lower backwash ponds, and is then returned via pumping to the upper raw water storage pond.

The City's drinking water system was originally constructed in 1960 and has undergone several subsequent upgrades. The treatment system was upgraded in 2007 to include submerged microfiltration treatment, complementing the existing treatment processes. In early 2010, additional upgrades were made to improve the filter backwash system, as described further in Part 4, below. The recent upgrades have improved system performance and reliability, and helped ensure compliance with increasingly stringent public health and environmental regulations.

Finished water is stored in three above-ground storage tanks that pressurize the distribution system and ensure adequate water is available during high demand periods. Each storage tank has a capacity of two million gallons (MG), and all are located near the drinking water treatment plant. Two tanks are located at a higher elevation than the lower tank. The upper two tanks provide water to the Ute Mountain Ute Tribe through a dedicated pipeline and to the lower tank. The lower tank provides water to the City of Cortez and Montezuma Water District No. 1.

2.2 WATER SOURCES.

The drinking water supply for the City is from the Dolores River and McPhee Reservoir, the second largest reservoir within Colorado.

The Dolores River is a tributary of the Colorado River, approximately 250 miles long, and flows through Colorado and Utah. It starts in southwestern Colorado near Dolores Peak and Mount Wilson in the San Miguel Mountains. It flows southwest, past the Town of Dolores, where it turns, flowing north and northwest. It then flows through the Dolores River Canyon, cuts across Paradox Valley before receiving the San Miguel River in Montrose County and crossing into Utah, where it joins the Colorado River in Grand County.

McPhee Reservoir was created via the construction of McPhee Dam on the Dolores River, and is part of the Dolores Project. The Dolores Project is managed by the Dolores Water Conservancy District

(DWCD), and consists of a system of canals, tunnels, and laterals that convey water from McPhee Reservoir to a number of nearby agricultural, residential, commercial, and governmental users. McPhee Reservoir has a maximum storage capacity of 229,000 acre-feet of water.

2.3 **SYSTEM LIMITATIONS.**

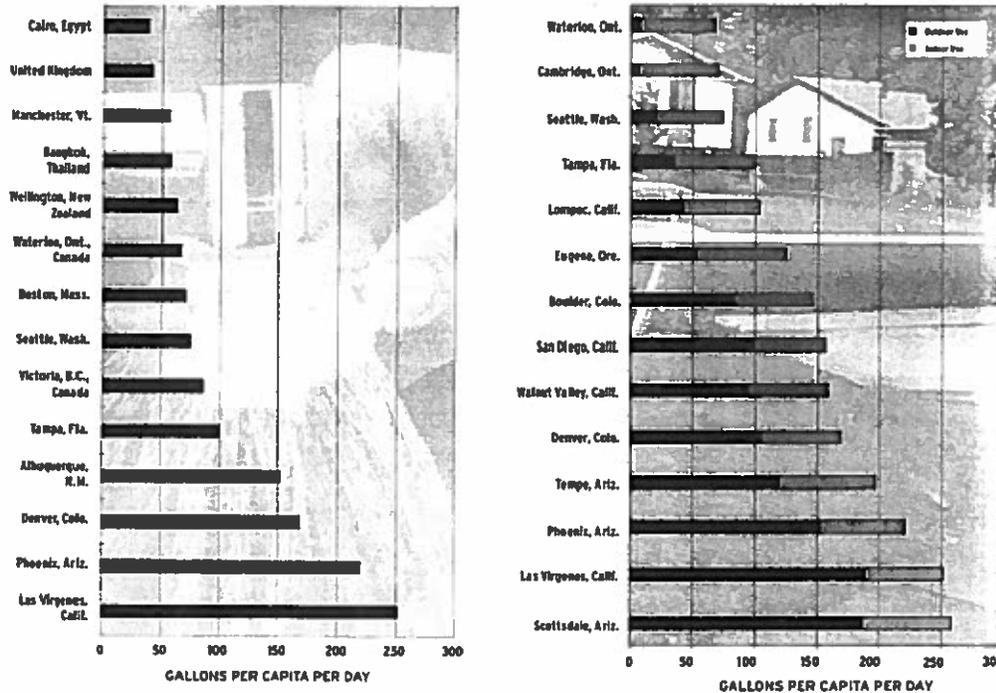
The City of Cortez drinking water system has five limitations, described below.

System Limitation #1: Per Capita Water Demand is Relatively High.

As shown in Table 1 and Graph 1b, in the Appendix, the current per capita daily water demand for the City of Cortez & MCWD#1 is just over 200 gallons per person per day (gpcd). This daily water demand reflects a reduction down from the per capita rate of 325 gpcd in 1990. Per capita daily water demand fell consistently between 1990 and 2002, and plateaued at 230 gpcd for a few years before dropping to 200 gpcd.

As shown in Chart 3, below, 200 gpcd is on the higher end of average water demand for a number of cities in the U.S. and elsewhere in the World. In particular, note how the per capita water demand in Albuquerque, NM; Boulder, CO; Denver, CO; and Tempe, AZ are all significantly lower than 200 gpcd. Note how the bulk of the water demand for cities above roughly 125 gpcd is for outdoor water use.

CHART 3: AVERAGE PER CAPITA WATER CONSUMPTION IN SELECT CITIES.



Source: Figures 2.2 & 3.2, Amy Vickers, "Handbook of Water Use and Consumption" (2001).

System Limitation #2: Annual Available Raw Water Limited.

The City's drinking water system's second limitation is the amount of raw water available from McPhee Reservoir and the Dolores River. The City currently has senior direct flow water rights for 3,040 acre-feet per year from the Dolores River. The City also purchases rights to 2,300 acre-feet per year from the McPhee Reservoir. Therefore, the City's total available raw water is 5,340 acre-feet per year or 1,740 million gallons (MG).

Table 1 and Graph 1a, in the Appendix, show the available annual water supply relative to the water demand from the City of Cortez & MCWD#1. (The drinking water consumed by the Ute Mountain Ute Tribe is from their municipal & industrial water rights allocation from the Dolores River, and does not count against the water rights for the City of Cortez & MCWD#1.) Table 1 shows that current annual water demand is approximately one-half of the available water supply. Water demand from the City of Cortez & MCWD#1 is projected to increase until 2040, due to anticipated population growth. However, a significant quantity of available water will remain accessible for unforeseen demand and other contingencies.

System Limitation #3: Drinking Water Used for Supplemental Park Irrigation, Street Sweepers.

The second limitation of the City's drinking water system is the use of treated drinking water for irrigation at City Park and the City's street sweepers. These uses are ideal for water reuse, such as from reclaimed treated wastewater or used pool water.

City Park, located in downtown Cortez across Montezuma Avenue from Centennial Park, currently uses drinking water for its irrigation system. City Park is the oldest and smallest of three main parks in Cortez, all of which are managed by the City's Department of Parks and Recreation. The irrigation for the other two parks – Centennial Park and Parque de Vida – is primarily from raw, untreated, irrigation water. Centennial Park includes two shelters, a duck pond, a Disc Golf Course, and two- and-a-half miles of paths for walkers and joggers. Irrigation for Centennial Park is from raw water, supplied by a pressurized irrigation pipeline managed by the Montezuma Valley Irrigation Company (MVIC). Treated water from the City's drinking water supply can supplement the normal irrigation supply at Centennial Park, on an as-needed basis. The third city park – Parque de Vida, located immediately across the street from Centennial Park – receives irrigation water primarily from raw, untreated, irrigation water, not treated drinking water. Parque de Vida includes three multi-purpose fields, a baseball field, softball field, two basketball courts, four tennis courts, a skateboard park, shelters, playground, sand volleyball courts, and a music amphitheater. Combined, Centennial Park and Parque de Vida consume 400,000 gallons of irrigation water per day during the peak summer recreation period, which is roughly from June to August.

Due to the cost of treating drinking water to potability standards and conveying it from the treatment plant, it is preferable to use either raw, untreated water or reclaimed wastewater for both park irrigation and street sweepers. Reused wastewater would need to be properly treated (including adequate disinfection) to protect public health, and the one-time use limitation, detailed later in the plan, would need to be addressed.

The City also has several additional parks – Montezuma Park, Shady Lane Park, Plaza Park, Market Street Pocket Park, and 3rd Street Pocket Park are all small in size and irrigated exclusively by potable water. Denny Lake Park is located on the east side of town, along State Highway 160. The irrigation water for this park also is supplied by the City's potable drinkingwater supply.

Conquistador Golf Course is a city owned facility and is irrigated by raw untreated water during the irrigation season. However, the golf course has the ability to irrigate the greens and fill ponds as needed during times when raw water is unavailable. This use was unmetered but is now metered.

Finally, the City's outdoor swimming pool – located in City Park – is filled with treated drinking water. The pool has a capacity of approximately 135,000 gallons, and is filled and emptied fully on an annual basis. The unwanted water from the pools is currently discharged into the wastewater system when emptying the pool. This water could be used for street sweeping purposes, or similar uses where potable water is not required, thereby displacing use of treated drinking water for these purposes.

System Limitation #4: Unmonitored Use for Supplemental Park Irrigation, Pool, Street Sweepers

A master water meter measures the quantity of drinking water consumed by Centennial Park’s supplemental irrigation system, the City’s outdoor swimming pool, and the City’s street sweepers. The water use data at the master meter is currently monitored and recorded.

Individualized water meters would be preferable to quantify and help the City conserve water individually from these separate flows. These meters should be monitored routinely and then recorded.

In lieu of individualized water meters, the data from the master meter on the line used by Centennial Park’s supplemental irrigation system, the City’s outdoor swimming pool, and the City’s street sweeper should be monitored routinely and recorded.

System Limitation #5: Hydrant Flushing Program Unmetered.

The third limitation of the City’s drinking water system is the lack of metering of the water consumed during the annual fire hydrant flushing program. The purpose of the program is to flush corrosion products and other unwanted debris trapped within the drinking water distribution system. The flushing both ensures the serviceability of each fire hydrant, but also improves drinking water quality.

The City performs two types of flushing: (1) high volume transmission line flushing, and (2) low volume distribution line flushing. During the high volume water main flushing, Public Works personnel flush three incoming transmission lines six times per year for 90 minutes at a flowrate of 3,000 gallons per minute (gpm). The high volume flushing consumes approximately 5 million gallons (MG) per year. During the low volume distribution line flushing, over 100 hydrants are flushed, and another 6 MG per year is consumed. Thus, the City’s entire flushing program consumes an average of 11 MG per year.

2.4

WATER COSTS AND PRICING.

The City’s current water rate structure was established by City Council Resolution No. WE-2017-1, Series 2017, passed in 2017. Resolution No. WE-2017-1, Series 2017 is included in the Appendix, and was effective January 1, 2018. Highlights of the City’s water rate structure are shown in Figure B, below.

FIGURE B: HIGHLIGHTS OF CITY’S WATER RATE STRUCTURE.

User Type	1st 1000 gal (min.)	Each Add'l. 1000 gal
Residential, single-family (3/4" x 5/8" diameter taps)	\$21.80 / month	\$2.92
Residential, master meter (multi-family residential or occupied mobile home space served by same tap, service line, and/or meter)	\$20.60 / month	\$2.92
Commercial (3/4" x 5/8" diameter taps)	\$21.80 / month ^a	\$2.92

Notes:

^a The minimum monthly rate increases as meter size increases.

See City Council Resolution No. WE-2017-1, Series 2017, in the Appendix, for more detail.

The City also has a “service line and development charge” for each new service line, with rates varying upon the type and size of the connection. The City also imposes service charges for connecting and reconnecting to the water supply.

The City’s water rate structure applies to all water service served within its City limits, as well as users outside. Unmetered services are charged a rate based on estimated usage as determined by the City’s Director of Finance.

CURRENT POLICIES AND PLANNING INITIATIVES.

The City has a number of existing policies in place that affect water use under both normal and drought conditions. These are detailed in the conservation measures – Part 5 – of the plan.

Future Drought Mitigation Planning Initiative.

While drought is mentioned indirectly by this Water Conservation Plan, the potential for drought is ever present in southwest Colorado, particularly in light of the 2002 drought and accompanying wild fires. During and following the historic 2002 drought, the City adopted a number of drought mitigation efforts, including public education and regulatory measures. These measures are addressed further later in the plan.

Starting in 2019, the City will develop a separate Drought Mitigation Plan to supplement and support its overall water supply management program, as well as the City's Comprehensive Plan.

The purpose of a Drought Mitigation Plan is to describe a strategy or combination of strategies for temporary supply management and demand management response(s) to temporary and potentially recurring water supply shortages and other water supply emergencies. Drought response measures in this context typically include mandatory restrictions on certain water uses, water allocation, or the temporary use of an alternative water supply. The underlying idea of drought mitigation planning is several fold: (a) while often unpreventable, short-term water shortages and other water supply emergencies can be anticipated; (b) the potential risks and impacts of drought can be considered and evaluated in advance of the actual event; (c) response measures can be determined with implementation procedures defined, in advance, to avoid, minimize, or mitigate the risks and impacts of drought related shortages; and (d) for water providers, the basic goal of drought mitigation planning is to ensure an uninterrupted supply of water in an amount sufficient to satisfy essential human needs, while also minimizing adverse impacts on quality of life, the economy, and the environment.

The City's future Drought Mitigation Plan will, at a minimum, include the following elements:

- **Drought Task Force.** The drought task force will combine various organizational entities and stakeholders that may influence preparation and implementation of a Plan into a communicating unit for purposes of preparing and implementing the Plan;
- **Drought Vulnerability Assessment of the Water Supply System.** The vulnerability assessment will consider seniority of water rights, reliability of infrastructure, availability of alternative supplies, and flexibility of water demand to identify key resource needs, and to support development of relevant policy, emergency response, and public education and awareness needs.
- **Drought Mitigation Policies.** Existing drought mitigation policies will be assessed and revised as necessary, with additional policies created if needed. These policies may include, but are not limited to, establishing drought response principals, objectives and priorities; authorities for declaring drought; triggers for drought-related actions; ordinances for drought measures; lines of internal and external communications protocols and content; and means for monitoring for drought and/or water supply scarcity.
- **List of Emergency Response Needs.** This list will include, but is not limited to, declarations of drought, emergency water supply programs and methods, managing new taps, and identifying funding partners and sources for assistance.

- Drought Preparedness Public Education / Awareness Program. Can tie into City's ongoing water conservation public education / awareness program.

The City's future Drought Mitigation Plan will be related to, but separate from, the City's Water Conservation Plan. That said, both will be integrated within the City's overall water supply management program.

2.6 CURRENT WATER CONSERVATION ACTIVITIES.

The City's existing Water Conservation Plan was most recently revised in 2010. It outlined eleven "water conservation approaches" that the City considered in order to reduce per capita water consumption. This plan builds upon and expands the 1996 plan. It includes more detail as to how the City will maintain its success at maintaining per capita water consumption since 2002.

PART 3 - WATER USE AND DEMAND.

3.1 CURRENT WATER USE.

Table 1 in the Appendix shows the annual water demand for the City of Cortez & MCWD#1 between 1990 and 2040. The data from 1990 to 2016 is historic, while the years out to 2040 are projected.

The City of Cortez & MCWD#1 used 665 and 683 MG in 2016 and 2017, respectively. The Ute Mountain Ute Tribe used 178 and 195 MG in 2016 and 2017, respectively. Thus, the total water used in both service areas was 843 and 878 MG in 2016 and 2017, respectively, well below the available annual water supply of 1,740 MG (5,340 acre-feet).

Table 2 breaks down by user type the water demand by the City of Cortez & MCWD#1 in 2016 and 2017. User types for the City of Cortez include the following categories:

- Residential (single unit);
- Residential (multi-unit);
- Commercial;
- Schools;
- Churches; and
- Government (City & Parks).

Table 3 and Graph 3, in the Appendix, show the number and percentage of taps by user type, and the average water demand per tap.

Tables 4-8 and Graphs 4-8 show the seasonal variation in water demand for the City of Cortez & MCWD#1 and Ute Mountain Ute Tribe, on an individual, collective, and average basis. It shows that water demand peaks during July and is low during December through February. This demand pattern is consistent with significant water use for outdoor, warm weather uses such as landscaping irrigation, vehicle washing, recreation (e.g., outdoor pools, kiddie sprinklers, slip-and-slides, etc.).

Table 9, and Graphs 9a, 9b, 10a, and 10b show the seasonal variation in water production and per capita water production between 2000 and 2017. This data, similar to Tables 4-8 and Graphs 4-8, shows significant seasonal variation in water consumption, with the highest rates in mid-summer and the lowest in mid-winter. This demand pattern is consistent with significant water consumption for outdoor use, particularly landscaping irrigation.

3.2

DEMAND FORECASTING METHOD.

The demand forecasting method used was the per capita and population methodology outlined in the AWWA's Manual of Water Supply Practices M50 ("Water Resources Planning"). Historic populations from 1970 to 2016 were tabulated, and a linear trendline was extrapolated to project population growth out to 2040. This projection uses an annualized growth rate that begins around 1.1% for 2010 through 2015 and declines to 0.7% for 2016 through 2040. This gradual decline in annualized growth rate is consistent with a maturing community approaching its carrying capacity (approximately 16,000 persons for the City of Cortez).

3.3

DEMAND FORECAST.

Table 1, in the Appendix, shows historic and projected population, per capita water use, and annual water demand for the City of Cortez & MCWD#1 between 1990 and 2040. Graphs 1a, 1b, and 1c also depict this data over time.

Demand forecasting was done by estimating population growth and changes in per capita daily water demand between 2016 and 2040. Based on historic population growth trends, it is estimated that the population within the City of Cortez grows on an annualized basis of approximately 0.7% per year.

Specifically, the demand forecasts followed the per capita methodology outlined in the AWWA's Manual of Water Supply Practices M50, titled "Water Resources Planning" (2nd Ed.), dated 2007. Historic populations were graphed from 1970 to 2016, and a linear trendline extrapolated growth out to 2040. This projection uses an annualized growth rate that begins around 1.1% for 2010-2015 and gradually declines to 0.7% for 2016-2040. This gradual decline in annualized growth rate is consistent with a maturing community that is gradually reaching its carrying capacity (16,000 persons).

PART 4 - PROPOSED FACILITY IMPROVEMENTS.

The City recently performed a series of improvements to its drinking water treatment system. These improvements consisted of the following:

- Removal and replacement of existing granular multi-media filter media (i.e., sand and gravel);
- Replacement of unserviceable filter componentry;
- Installation of additional piping, valves, fittings, and associated hardware in order to improve treatment system operation; and
- Upgrade of electrical and instrumentation & controls equipment, updating of operating software, and replacement of level control equipment.

The improvements were funded by State Revolving Fund (SRF) low-interest loans, administered by the Colorado Water Resources and Power Development Authority (CWRPDA). The improvements improved system performance, but did not add additional treatment capacity to the system. Thus, an incremental cost analysis is not appropriate at this time.

The existing drinking water system has the capacity to treat the available annual water supply of 1,740 MG from the McPhee Reservoir. The drinking water system – including the treatment plant, storage tanks, and distribution system – has a rated capacity of 9.0 MGD peak flow. The rated capacity is based on 9.0 MGD of pre-treatment capacity and 11 MGD of filtration capacity.

The plant has sufficient operational flexibility and physical robustness to satisfy demand peaks that occur during mid-Summer, as well as operating efficiently during periods of low demand that occur in mid-Winter. During periods of peak demand, the treatment train runs more often and for a longer cycle than under normal flow conditions. Similarly, during periods of low demand, the treatment train cycles less often and for shorter periods of time. In addition, not all of the treatment units (in particular, the submerged membrane microfiltration units, which are oriented in parallel so they are operationally independent) need be operated during low demand periods.

The capacity of the drinking water system shall remain the same over the 30-year planning horizon of this plan. No additions or retirements beyond the scope of the current engineering project are expected.

PART 5 - WATER CONSERVATION GOALS

The City of Cortez has four water conservation goals, described in §§ 5.1 to 5.4, below. These goals were originally developed as part of the City's 1996 Water Conservation Plan and updated in 2010. They have been updated and expanded by the City of Cortez, Department of Public Works.

5.1 GOAL #1: IN SHORT-TERM MAINTAIN PER CAPITA WATER DEMAND AT CURRENT REDUCED LEVELS; OVER LONG-TERM, REDUCE PER CAPITA WATER DEMAND TO 200 GPCD. This goal has essentially been reached, the new goal is to reduce per capita water demand to 180 gpcd.

As shown in Table 1 and Graph 1b, in the Appendix, the current per capita daily water demand for the City of Cortez & MCWD#1 is just above 200 gpcd. This daily water demand reflects a reduction down from the per capita rate of 325 gpcd in 1990. Per capita daily water demand fell consistently between 1990 and 2002, and plateaued at 230 gpcd for a few years then has dropped to just above 200 gpcd since that time. The City's short-term goal (i.e., over the next 1-2 years) is to maintain its per capita water demand for users supplied by its water system supply area at current reduced levels, and for per capita water demand not to increase. Over the long-term (namely, over the 7-year implementation period of the plan), the City's goal is to reduce per capita water demand to 180 gpcd. Reducing per capita water demand to 180 gpcd will bring the City's water conservation success in line with that seen elsewhere in the region, and will be the foundation for additional reductions in per capita water demand in subsequent years.

Reducing per capita water demand from the current 200 gpcd to 180 gpcd will require aggressive implementation of the water-saving measures / programs contained in this Water Conservation Plan. Future annual updates and comprehensive revision of the plan, detailed in § 8.5 of this plan, will quantitatively determine the City's achievement of this long-term commitment. If the City is not achieving measurable success in reducing the per capita water consumption from 200 gpcd over the medium-term (i.e., over a 3-5 year period), the annual updates will identify the need to more aggressively implement the water saving measures / programs. This would also include the need for additional financial resources to increase the available rebates, distribute free self-audit kits, offer a greater cost-share on professional commercial water audits, etc.

Additional reductions beyond the 180 gpcd goal will likely require very long-term efforts (i.e., over 7+ years) and significantly more financial resources than those tentatively outlined in this plan. This will require effectively a distinct cultural change amongst the City's residents with respect to water consumption and conservation, which will require a sustained and diligent water conservation program by the City as well as wide-spread recognition by City residents of the importance of water conservation.

Towards the end of the report, Figure L provides a quantitative estimate of water savings if per capita water demand falls from 200 to 180 gpcd. Future annual review and comprehensive revisions of the plan will carefully look at whether the city has met this goal, and will revise accordingly depending on the City's success. Again, the City's goal is to reduce per capita water consumption to 180 gpcd during the 7-year implementation period of this plan, and the City will strengthen its water-saving measures/ programs as necessary to achieve this goal.

5.2 **GOAL #2: FULL METERING / MONITORING. This goal has been reached for the most part, but remains a goal until completed.**

The City seeks to achieve full metering and monitoring of all users within the Cortez water system. Any existing facilities that are currently unmetered or become unmetered shall have meters installed to monitor water usage. At present, the only unmetered use of drinking water are the City's hydrant flushing program and several park connections to the potable water system. Drinking water is used for supplemental irrigation at Centennial Park, to fill the City's outdoor swimming pool, and to fill the tanks of the City's street sweepers. A single line with a master meter provides water to these three uses. The City will monitor and record this data.

The City's goal is to achieve 100% metering and monitoring of all water users within the City- operated distribution system.

5.3 **GOAL #3: IMPROVE QUANTIFICATION OF WATER LOSS. ATTAIN WATER LOSS OF <10%.**

A water system's water loss factor is the ratio of unaccounted water to the total amount of water distributed. Within the municipal drinking water industry, a water system that achieves a water loss factor of 10% or less is considered to be adequately minimizing water loss.

The City has an ongoing aggressive water leak detection and repair program, which has significantly reduced water loss within the City-operated distribution system. This includes replacing old water mains and repairing service lines with detectable water leaks.

The City DPW maintains an ongoing water accounting, comparing water produced at the water treatment plant versus water measured at the numerous users within the distribution system. The City's current water loss accounting estimates that there is less than 10% loss within the distribution system. Table 8 and Graph 8 show annual water production, as distinguished from water use, for the City of Cortez & MCWD#1, Ute Mountain Ute Tribe, and both together between 2000 and 2017. Note that the annual water production for City of Cortez & MCWD#1 of 665 and 683 MG in 2016 and 2017, respectively, differ from the water demand of 565 and 563 MG. The discrepancy is due to unaccounted for users, water loss, and errors in water meters, and accounts for about 15% of total water produced. Note that there is significant uncertainty with this estimated water loss percentage, due to factors including the lack of recent acoustic leak detection, potential for inaccurate measurement at water meters and unmetered uses, and lack of a detailed water budget or water loss study. Inherent with the goal of reducing water loss below 10% is to improve quantification of the water loss via a detailed water budget.

The City also committed to maintain a water loss ratio of less than 10% of water produced. Future annual updates of the Water Conservation Plan will seek to quantitatively verify this estimated water loss ratio and seek to keep it below 5%.

5.4 **GOAL #4: INVESTIGATE ADVANCED METERING INFRASTRUCTURE.**

Advanced Metering Infrastructure is a fixed base system that would allow us and our customers to monitor our water usage in real time. The system consists of three components. First, an automatic meter reading system needs to be installed. We have completed this component. Second, there is a communication network. This network includes transmitters and receivers communicating to central point, a computer or network. The third component is a management system, software program.

5.5 **GOAL #5: COMPLETE A DROUGHT CONTINGENCY PLAN.**

This Plan will be developed and used as a guide for water conservation during times of water shortage. A complete description is found in section 2.5 of this plan.

5.6 **GOAL #6: ADD A PLANNING COMPONENT TO THIS PLAN.**

This goal will soon become a required part of a Water Conservation Plan and so will be completed at the time that guidance documents are released.

PART 6 - WATER-SAVING MEASURES / PROGRAMS.

In the 1996 Water Conservation Plan, the City identified eleven potential “water conservation approaches” to reduce water demand. This plan organizes the water-saving measures / programs into nine groupings, in order to be consistent with CWCB guidance and water conservation planning requirements pursuant to state statutes.

6.1 **WATER-SAVING MEASURES / PROGRAMS CONSIDERED.**

A wide variety of water-saving measures / programs were considered during the development of this plan. The water-saving measures / programs considered included, but were not limited to, the following:

- Water-efficient fixtures & appliances (e.g., low-flow toilets & urinals, aerating showerheads & faucets, front-loading washing machines);
- Landscape efficiency (e.g., Xeriscaping, drip irrigation systems);
- Industrial and commercial efficiency (e.g., closed-loop cooling systems);
- Water reuse systems (e.g., reclaimed water for landscaping irrigation); and
- Distribution system efficiency (e.g., leak detection and repair).

¹ <http://waterefficiency.net/>

6.2 SCREENING AND EVALUATION OF WATER-SAVING MEASURES / PROGRAMS.

Water-saving measures / programs were selected for this plan based on four criteria:

- (1) Estimated breakdown of water consumption by use;
- (2) Presence within the 2010 Water Conservation Plan;
- (3) Feasibility of implementing conservation measures;
- (4) Non-duplication with ongoing water conservation measures.

If a water-saving measure / program was included within the 2010 plan and it is still applicable to the current drinking water system, then it was carried over into this plan. Additional conservation measures were added, if they were feasible (i.e., could be implemented given the context of Cortez's drinking water system) and not duplicative with any ongoing conservation measures.

Note that the City currently lacks sufficient data to perform a proper cost-benefit analysis of the ongoing and planned water-saving measures / programs.

6.3 SELECTED WATER-SAVING MEASURES / PROGRAMS.

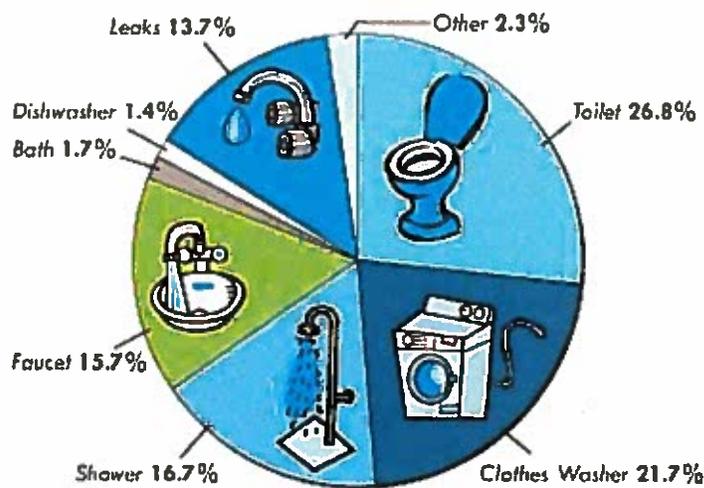
The City's water conservation program consists of nine water-saving measures and programs, as described below.

A. WATER-SAVING MEASURE / PROGRAM #1: WATER-EFFICIENT FIXTURES & APPLIANCES.

As shown in Chart 4, below, on average within the U.S., the majority of water use within residential dwellings is for toilet flushing and clothes washing. (Data on indoor water use for the City of Cortez is unavailable, but the City may develop estimates, based on voluntary and representative sampling, of indoor water use by its customers in the future.)

Therefore, beginning in 2020, the City will adopt an indoor water-efficient toilet and washing machine replacement rebate program. Under this rebate program, customers who purchase and install water-efficient toilets and washing machines will get a rebate applied toward their future water bills.

CHART 4: ESTIMATED BREAKDOWN OF INDOOR HOUSEHOLD WATER USE.



Source: AWWA Research Foundation (2001)

The specific rebate quantities and eligibility criteria for the water-efficient toilet and washing machine replacement rebate program will be developed in the future. What follows is a tentative discussion of the likely rebate quantities and eligibility criteria.

Most likely the toilets rebate will be for users with toilets currently using more than the federally-mandated 1.6 gallons per flush (gpf). As described in Section 2.1 (titled "Toilets") of Amy Vickers' "Handbook of Water Use and Conservation" (2001), 5.0+ gpf toilets were used prior to 1980 and 3.5, 4.1, and 4.5 gpf toilets were installed during 1980-1994 range. 4.5 gpf was used to estimate water saved per toilet replaced. The City's toilet rebate program will target the highest demand water toilets for replacement via two ways. First, the City will focus educational efforts on the toilet rebate program in parts of the City with the oldest housing stock. For example, the City may begin the toilet rebate program in the areas of oldest housing stock, before expanding eligibility to the entire city. Second, if the number of rebate applications will exhaust the funds available to support the rebate program, applications for replacement of the toilets with greatest use or the oldest, least efficient toilets will be prioritized over newer, more efficient toilets or those with relatively less use. This prioritization will maximize the water savings per rebate dollar. In the event that rebate funds are exhausted, additional resources will be allocated for subsequent years to meet the overall demand for rebate funds.

The rebates will likely require that the new toilet achieve at least 1.28 gpf, not merely the 1.6 gpm currently required for new construction or home renovation. 1.28 gpf toilets will likely involve use of dual flush, powerflush, or flapperless technologies, which offer higher performance than more conventional low-volume gravity-tank toilets. Thus each toilet replaced is estimated to save 3.22 gallons per flush.

The washing machine rebate is currently expected to be \$100 for all WaterSense-certified (a US Environmental Protection Agency water conservation program³) front-loading washing machines using 27 gallons per load or less. As described in Section 2.2 (titled "Clothes Washers") of Amy Vickers' "Handbook of Water Use and Conservation" (2001), 51 gallons per load washing machines were used prior to 1980, and 27, 39 or 43 gallon per load have been used to the present day. 43 gallons per load was used to estimate water saved per washing machine replaced. The City's washing machine rebate program will target the highest demand washing machines for replacement. In addition, rebate recipients will likely be offered free faucet aerators to improve the water efficiency of their faucets (kitchen, bathroom, etc.). The plan does not include estimates of water savings from distribution of water efficient faucets, but future plan updates / revision may take these water savings into account. The City will also include expanding the rebate program to include high efficiency showerheads as funding becomes available.

The toilet and washing machine replacement rebates are anticipated to be offered on a first-come, first-serve basis. No money will be distributed for toilets and washing machines installed prior to the beginning of the program. If the rebate money is exhausted in a particular year, applicants will be automatically rolled into the following year. The City will likely allocate additional funds if rebate funds are quickly exhausted. Similarly, if unused rebate money is available at the end of a year, it will either be carried over into the following year or used for other water conservation programs. The City is currently planning on budgeting a total of \$5,000 per year for the indoor water-efficient toilet and washing machine replacement rebate program. Figures C-1 and C-2, below, show the preliminary projected toilet and washing machine rebate rates, participation, and estimated water savings. Figure C-3, also below, summarizes the estimated water savings for these two rebate programs. The City will evaluate the effectiveness of its rebate program during the annual Water Conservation Plan review, beginning in 2021.

³ <http://www.epa.gov/WaterSense/>

FIGURE C-1. PRELIMINARY PROJECTED TOILET REPLACEMENT REBATES AND ESTIMATED WATER SAVINGS.

Year	2019	2020	2021	2022	2023	2024
Water-Efficient Toilet Replacement Rebate Program						
Toilet Rebates Issued Per Year	40	40	40	40	40	40
Cumulative No. of Toilet Rebates Issued	40	80	120	160	200	240
Rebate Per Toilet Replaced	\$25	\$25	\$25	\$25	\$25	\$25
Total Toilet Rebates Issued Per Year	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
Estimated Persons per Household ¹	2.64	2.64	2.64	2.64	2.64	2.64
Estimated Flushes per Person per Day ¹	5.1	5.1	5.1	5.1	5.1	5.1
Reduction in Water Use per Flush (gal) [from 4.5 to 1.28 gallons / flush]	3.32	3.32	3.32	3.32	3.32	3.32
Water Savings per Toilet Replaced (gpd)	44.7	44.7	44.7	44.7	44.7	44.7
Estimated Daily Water Savings (gpd)	1,788	3,576	5,354	7,152	8,940	10,728
Estimated Annual Water Savings (MG)	0.7	1.3	2.0	2.6	3.3	3.9

Notes:

¹Source: Table 2.2, Amy Vickers' "Handbook of Water Use and Conservation" (2001)

FIGURE C-2. PRELIMINARY PROJECTED WASHING MACHINE REPLACEMENT REBATES AND EST. WATER SAVINGS.

Year	2019	2020	2021	2022	2023	2024
Water-Efficient Washing Machine Replacement Rebate Program						
Washing Machine Rebates Issued Per Year	10	10	10	10	10	10
Cumulative Number of Washing Machine Rebates Issues	10	20	30	40	50	60
Rebate Per Washing Machine Replaced	\$100	\$100	\$100	\$100	\$100	\$100
Total Washing Machine Rebates Per Year	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
Estimated Persons per Household ¹	2.64	2.64	2.64	2.64	2.64	2.64
Estimated Loads per Person per Day ¹	0.37	0.37	0.37	0.37	0.37	0.37
Reduction in Water Use per Load (gal) [from 43 to 27 gallons / load]	16	16	16	16	16	16
Water Savings per Washing Machine Replaced (gpd)	15.6	15.6	15.6	15.6	15.6	15.6
Estimated Daily Water Savings (gpd)	156	312	468	624	780	936
Estimated Annual Water Savings (MG)	0.06	0.11	0.17	0.22	0.28	0.34

Notes:

¹Source: Table 2.17, Amy Vickers' "Handbook of Water Use and Conservation" (2001)

FIGURE C-3. SUMMARY OF ESTIMATED WATER SAVINGS FOR WATER-EFFICIENT FIXTURES & APPLIANCES.

Year	2019	2020	2021	2022	2023	2024
Water-Efficient Toilet Replacement Rebate Program (MG)	0.7	1.3	2.0	2.6	3.3	3.9
Water-Efficient Washing Machine Replacement Rebate Program (MG)	0.06	0.11	0.17	0.22	0.28	0.34
Total Estimated Water Savings for Water-Efficient Fixtures & Appliances (MG)	0.8	1.4	2.2	2.8	3.6	4.2

In addition, note that the City has adopted, within Sections 6 and 21 of its City Code, several international building codes, including the International Plumbing Code (IPC). The IPC mandates the use of water-efficient plumbing fixtures on all new construction and building remodeling. These requirements are enforced by City’s building inspectors during routine building construction and occupancy inspections.

In addition, the City educates the public generally, and plumbers and other building construction personnel specifically, on water efficient fixtures by distributing written literature, via the City’s website, and in routine interaction as to ongoing and future construction projects.

B. WATER-SAVING MEASURE / PROGRAM #2: WATERWISE LANDSCAPING PROGRAM (I.E., WATERWISE LANDSCAPES, DROUGHT-RESISTANT VEGETATION, EFFICIENT IRRIGATION, REMOVAL OF HIGH WATER DEMAND PLANTS).

Waterwise landscaping utilizes native and other climate-appropriate, low water-use plants and other landscaping features that require a minimum of additional watering beyond natural precipitation. Waterwise landscaping features can also include gravel beds, decorative rocks, and stone walkways. (Waterwise landscaping is also known as “Xeriscaping” – a combination of “xeros” (Greek for “dry”) and landscape. This term has generally fallen out of favor by water conservation professionals, however, because of public confusion over its meaning.)

No later than 2019, the City will implement a waterwise landscaping program. The core of this program is to more aggressively promote and encourage citizen involvement with the waterwise plant demonstration plots. The program will also involve distribution of a revised and finalized waterwise landscaping brochure, which will both help promote the waterwise plant demonstration plots as well as encourage residents to install waterwise landscaping at their properties.

The City has tentatively budgeted \$1,000 for 2019 to fund the waterwise landscaping program, and will allocate more money in subsequent years as required. The waterwise landscaping program will be a joint effort of the Department of Public Works and Parks & Recreation Department, given that DPW has expertise in terms of the water system while Parks & Recreation has experience in organizing programming and dealing with the public, particularly students and volunteers.

Several years ago, City personnel planted two waterwise plant demonstration plots: the first at the City Service Center within the Cortez Industrial Park (110 Progress Circle on the northwest side of town), the other as part of building landscaping of the Police Station near Centennial Park near downtown Cortez. In the Appendix is a schematic of the waterwise landscape demonstration garden planted at the City Service Center, as well as a species list. Both locations are relatively high traffic areas, particularly the downtown plot. Since their installation, however, the City has not sufficiently promoted the waterwise plant demonstration plots. As part of the waterwise landscaping program, the City will aggressively promote the waterwise landscaping demonstration plots and encourage greater utilization by the community. The City will also follow the waterwise landscaping program in future landscaping projects such as the 7th Street median landscaping

The City's waterwise landscaping program is anticipated to consist of six main elements:

- Element #1: Revise and distribute the waterwise landscaping brochure;
- Element #2: Rededication of waterwise landscaping demonstration plots and the addition of several new ones;
- Element #3: Volunteer programming at waterwise landscaping demonstration plots;
- Element #4: Educational programming at waterwise landscaping demonstration plots;
- Element #5: Evaluate future waterwise landscaping audit programs; and
- Element #6: Evaluate future waterwise landscaping rebate programs.

What follows is a detailed description of these six main elements of the City's new waterwise landscaping program.

First, the City will revise and distribute its waterwise landscaping brochure. The draft waterwise brochure included in the Appendix will be the basis for updating the brochure in the future. The draft brochure was originally developed to help promote the waterwise plant demonstration plots, and contains a detailed description of the plant species originally planted in the plots. The revised and finalized brochure will include more detailed guidance on the grass selection and use the term "waterwise" in lieu of "Xeriscape". This brochure will serve two purposes: 1) help promote the waterwise landscaping demonstration plots, and 2) serve as a guide to City residents to show how waterwise plants can be decorative yet require very little watering once established. The waterwise landscaping brochure will reference to Municipal Code Section 27-6(b)(3), which explicitly recommends that residents use water-saving grasses such as fescues, wheatgrasses, and Blue Grama, in-lieu of water-wasting grasses such as Kentucky Bluegrass. (The Municipal Code can be accessed online⁴ via the City's website. New ordinances, as they are passed by the City Council, are also posted online.) The City will distribute the waterwise landscaping brochure both online (via the City's website), and in hard copy (at City offices, at distribution boxes at the waterwise landscaping demonstration plots, and at City-sponsored waterwise landscaping programming).

Second, once the waterwise landscaping brochure is revised, finalized, and printed, the City will rededicate the waterwise landscaping demonstration plots in a formal public ceremony. The ceremony will be widely publicized in advance by the local media (particularly the *Cortez Journal*,⁵ the local newspaper), and maximum citizen participation will be encouraged. The timing is yet to be determined, but will likely occur on or about Earth Day 2019. It is anticipated that the ceremony will be attended by the Mayor, members of the City Council, select City staff, landscaping enthusiasts, school children, and other interested citizens. Prior to the rededication, the City will post clearly observable signage at the demonstration plots so residents can find them. In addition to the signage at the plots themselves, the City DPW will post road signs denoting "Waterwise Landscaping Demonstration Plots" to direct drivers to the location of the plots. Distribution boxes for the waterwise landscaping brochures will be installed at each of the plots, with City personnel responsible for routine replacement of the brochures as they are depleted. The City will seek to get the waterwise demonstration gardens published by online listing of xeriscape demonstration gardens maintained by CWCB⁶ as well as Colorado Waterwise.⁷

⁴ <http://www.cityofcortez.com>

⁵ <http://www.cortezjournal.com/>

⁶ <http://cwcb.state.co.us/public-information/education-outreach/Pages/LocalXeriscapeDemonstrationGardens.aspx>

⁷ <http://www.coloradowaterwise.org>

Third, the City Parks & Recreation Department will coordinate volunteer programming at the waterwise landscaping demonstration plots. This volunteer effort will be particularly important in order to improve the plots prior to finalization of the waterwise landscaping brochure, as neglect has likely resulted in the loss of certain waterwise landscaping plants as well as the introduction of unwanted non-waterwise weed species. Groups that will be targeted as part of this volunteer effort will include: school horticulture groups, scout troops, 4-H participants, landscaping clubs, retirement homes, and persons needing to perform community service hours. Young people, in particular, will be encouraged to perform “service learning” projects utilizing the waterwise landscaping demonstration plots. These projects can include, but are not limited to, including routine maintenance (e.g., weed removal, fall / spring cleanup), one-time upgrades (e.g., plot expansion, plant transplants, and construction of amenities such as benches, mulch walkways, etc.), as well as county fair exhibits. The City’s Parks & Recreation Department will investigate obtaining and distributing “Waterwise Landscaping” patches for distribution to scouts who perform a minimum number of volunteer hours at the plots. The City will also recognize volunteers who perform significant work at the demonstration plots, with the “Waterwise Landscaping Hero” designation. Such volunteers will receive a “Certificate of Recognition” signed by the Mayor, and their names will be added to a plaque located at an appropriate place in a public location.

Fourth, the City Parks and Recreation Department will coordinate with the Montezuma County Extension office⁸ to leverage the waterwise landscaping demonstration plots within their ongoing educational programming, such as the Master Gardener Program and the Native Plant Master Program. In addition, the Parks and Recreation Department will utilize the waterwise landscaping demonstration plots during annual Earth Day activities, that occur on or about April 22 each year. Educational programs on waterwise landscaping will also occur during the Earth Day activities, as well as volunteer opportunities for annual spring clean-up. The Parks and Recreation Department will organize and perform other educational programs at other times of the year, but the Earth Day- related activities at the landscaping demonstration plot will be the keystone event each year.

The City’s waterwise landscaping educational programs will address the following topics:

- Evaluation of water consumption by existing landscaping;
- Waterwise plant species;
- Planning and design of waterwise landscaping;
- Water-efficient irrigation system and practices;
- Locations where turf grass makes sense;
- Soil improvements / mulching; and
- Maintenance of waterwise landscaping.

These efforts will supplement the City’s waterwise landscaping brochure with literature distributed by the Colorado State University Extension office.⁹

Fifth, no later than 2019, as part of the annual update of the plan, the City will evaluate whether to institute an outdoor landscaping audit program. Under an outdoor landscaping audit program, residents would be offered free on-site audits of their landscaping by a xeriscape specialist (possibly a City staff member with extensive training and experience in efficient outdoor irrigation techniques and xeriscaping / waterwise landscaping). Participating residents would be offered a written report providing specific recommendations on optimizing outdoor irrigation, as well as potential xeriscape improvements. Note that a future outdoor irrigation audit program will require dedicated funding, and likely extensive staff training and time. Therefore, it is premature to implement an outdoor irrigation audit program in the immediate future (i.e., next 1-2 years).

⁸ <http://www.co.montezuma.co.us>

⁹ <http://www.ext.colostate.edu/pubs/pubs.html#water>

Sixth and finally, no later than 2020, as part of the annual update of the plan, the City will evaluate whether to institute a waterwise landscaping / xeriscaping rebate program. Under such a rebate program, residents who remove their existing water-inefficient landscaping (e.g., Kentucky bluegrass) with waterwise landscaping / xeriscaping (e.g., the water-saving grasses recommended by the Municipal Code) will receive a rebate on their water bill. Performance of an outdoor irrigation audit will be one of the prerequisites to receiving a waterwise landscaping rebate. Note that a future waterwise landscaping / xeriscaping rebate program will require dedicated funding, extensive public education, a verification component, and extensive staff training and time. Therefore, it is premature to implement a waterwise landscaping rebate program at this time. This program may be implemented at a future date, particularly if the educational elements and outdoor irrigation audit program of the waterwise landscaping program are determined to have achieved limited success at achieving reductions in outdoor water demand.

In terms of quantifying water savings from the waterwise landscaping program, it is very difficult at this point to estimate the water savings from removal of existing water-efficient landscaping and replacement with waterwise landscaping. The reduction in exterior watering will vary on a number of factors, including: property size, soil type, plant species removed and added, annual rainfall, seasonal temperature averages, topography, and sun exposure, amongst other factors. However, Figure D, below, is an effort to estimate the water savings for the City's waterwise landscaping program. It is estimated that, beginning in 2019, ten households will be inspired and motivated by the waterwise landscaping program to remove their existing water-wasting turf grass and install waterwise landscaping. (This estimate of participation is conservative given that Cortez is a community of roughly 9000 residents. Assuming 2.64 persons per household, 60 households constitutes 211 people switching from traditional landscaping to xeriscaping. This represents 2.5% of residents, a fairly conservative estimate.) It also is estimated that each household cuts its water consumption in half via the installation of the waterwise landscaping.

FIGURE D. ESTIMATED WATER SAVINGS DUE TO WATERWISE LANDSCAPING PROGRAM.

Year	2019	2020	2021	2022	2023	2024
Households Install Waterwise Landscaping	10	10	10	10	10	10
Cumulative Number of Households	10	20	30	40	50	60
Estimated Persons per Household ¹	2.64	2.64	2.64	2.64	2.64	2.64
Existing Exterior Water Usage (gpcd) ²	29	29	29	29	29	29
Existing Exterior Water Usage (gal / household / day)	77	77	77	77	77	77
Days During Annual Watering Period (mid-May to mid-October)	150	150	150	150	150	150
Existing Exterior Water Usage (gal / household / year) ³	11,550	11,550	11,550	11,550	11,550	11,550
Reduction in Exterior Water Usage	50%	50%	50%	50%	50%	50%
Reduction in Exterior Water Usage (gal / household / year)	5,775	5,775	5,775	5,775	5,775	5,775
Cumulative Water Savings (MG)	0.06	0.12	0.17	0.23	0.29	0.35

Notes:

¹Source, footnote in Table 2.2, Amy Vickers, "Handbook of Water Use and Conservation" (2001).

²Source: p. 141, Amy Vickers, "Handbook of Water Use and Conservation" (2001).

³Estimate is consistent with the annual estimate of 10,000 gallons of supplemental irrigation per year, with hotter, drier parts of the country using greater amounts, as cited by Vickers (above).

Note that each annual review of the Water Conservation Plan will attempt to gauge the success of the waterwise landscaping program, and reevaluate the water savings estimates previously provided. If it is found that insufficient success has been achieved through the educational programs outlined in waterwise program elements one through four, described above, then elements five and six – the outdoor irrigation audit program and the waterwise landscaping rebate program – will be implemented.

C. WATER-SAVING MEASURE / PROGRAM #3: WATER-EFFICIENT INDUSTRIAL & COMMERCIAL PROCESSES.

The City, no later than 2020, will implement a commercial water audit program. This program will consist of two parts: (1) an educational component consisting of the distribution of a free commercial water conservation self-audit kit, upon written request by commercial water users, and (2) the cost-share of professional water audit.

First, the City's Department of Public Works (DPW) will post educational information on the City's website with guidance for commercial entities (e.g., restaurants, hotels, supermarkets) on how to conserve water. Instructions will include detailed directions on how to perform a water conservation self-audit, within a packaged commercial water conservation self-audit "kit" distributed free to commercial water customers in good standing (i.e., no outstanding water bills), upon written request. These self-audit kits will address both indoor and outdoor water use, and will be applied as appropriate given each customer's unique water usage profile. (For example, a car wash would focus more on the outdoor water use component, while a restaurant with extensive dish-washing would focus more on the indoor water use component.)

Second, the City will cost-share with eligible businesses who request a water audit performed by a trained and experienced water conservation professional. Again, the professional water use audits would address both indoor and outdoor water use, tailored as necessary to the customer's unique water use profile. Likely, in order to be eligible for the cost-share, businesses must be a water customer in good standing (i.e., no outstanding water bills), have performed a water conservation self-audit, submitted a written report of their self-audit to the City, implemented some water conservation measures, and request in writing a cost share. Interested commercial entities will submit a short application to the City DPW for review and approval, before proceeding with the professional water conservation audit. During the audit, the professional water auditor will travel to the commercial enterprise's facility or facilities, perform the audit, and provide written recommendations of ways to reduce water use and an estimate of how it would save money over time. Prior to rolling out the commercial water audit program, the City DPW will determine more specifics about application procedure, eligibility, reimbursement protocol, qualifications required for the auditors and the like. Tentatively, it is anticipated that the cost share would be performed on a 50%/50% basis. The City currently anticipates budgeting at least \$2,000 per year, on an ongoing annual basis beginning in 2020, for this water-saving measure / program. If more commercial businesses apply for the professional audit cost-share program than the available funds allow, then either the amount of available funding will be increased or the City will select which businesses offer the greatest water conservation benefits.

In terms of quantifying water savings from the commercial water audit program, it is very difficult to estimate the water savings. The reduction in water consumption will vary on a number of factors, including: business type (e.g., restaurant, bar, hotel, grocery store, administrative office), size of business, number of employees, number of customers, hours of operation, seasonality of business, efficiency of existing water using processes. That said, Figure E, below, is an effort to estimate the

water savings for the City's commercial water audit program. It is estimated that, beginning in 2020, five commercial businesses will perform water self-audits, based on the City's guidance. The levels of water savings shown in Figure E, below, are consistent with AWWA's Manual of Water Supply Practice M36, "Water Audit and Loss Control Programs" (2009) as well as "Water Loss Control (2nd Ed.)" (2009) by Julian Thornton et al.

FIGURE E. ESTIMATED WATER SAVINGS DUE TO THE CITY'S COMMERCIAL WATER AUDIT PROGRAM.

Year	2020	2021	2022	2023	2024	2025
Commercial Water Audit Program						
Commercial Businesses Performing Water Self-Audit (Via Free "Kit")	0	0	5	5	5	5
Cumulative No. of Commercial Bizs Performing Water Self-Audit	0	0	5	10	15	20
Estimated Daily Water Savings per Commercial Business (gpd / biz)	100	100	100	100	100	100
Annual Water Savings per Business in Yr Self-Audit Performed (gal / yr)	0	0	182,500	182,500	182,500	182,500
Est. Water Savings in Year Self-Audit Performed (MG)	0	0	0.18	0.18	0.18	0.18
Commercial Businesses Receiving Professional Water Audits	0	0	1	2	3	4
Cumulative No. of Commercial Bizs Receiving Professional Water Audits	0	0	1	3	6	10
Estimated Daily Water Savings per Commercial Business (gpd / biz)	250	250	250	250	250	250
Est. Water Savings per Biz in Year Prof Water Audit Performed (gal / yr)	0	0	91,250	182,500	273,750	365,000
Est. Water Savings in Year Prof Water Audit Performed (MG)	0	0	0.09	0.18	0.27	0.37
Estimated Water Savings from Commercial Water Audits Program (MG)	0	0	0.26	0.37	0.45	0.55

Note that the City lacks significant industrial or institutional presence within Cortez. If significant industrial or institutional activities are located within the City, future updates or revisions of the plan will need to take their water demands into account.

D. WATER-SAVING MEASURE / PROGRAM #4: WATER REUSE SYSTEMS.

Raw water drawn from McPhee Reservoir is held in a raw water storage pond (the "upper" pond), prior to flowing into the City's water treatment plant. Backwash water -- produced when the filters within the treatment plant are backwashed -- flows into a backwash pond (the "lower" pond). Water within the lower pond is then pumped back into the upper pond, where suspended particulate matter settles out and the recycled water eventually flows back into the treatment plant. 45,000 gallons of backwash water is typically used per media filter backwash.

Filter operation at the Cortez WTP can generally be organized into three periods: a peak use period (June through August), a moderate peak use period (May and September), and an off-peak use period (October through April). Prior to the filter improvements, typically filters needed to be backwashed

every 24-hour period of operation. Typically four filters were operated during the peak use period, two filters during the moderate use period, and one filter during the off-peak use period. Therefore, on average, four filters were backwashed daily during the peak use period, two filters backwashed daily during the moderate use period, and one filter backwashed daily during the off-peak use period. Due to the recent filter improvements, the filters will need to be backwashed only every 48-hours of operation. Therefore, backwash frequencies are expected to fall to two, one, and one-half backwashes per day during the peak, moderate, and off-peak use periods, respectively.

The water treatment plant operators estimate that roughly one-third of the recycled backwash water is lost due to evaporation or groundwater infiltration, with two-thirds returned to the upper pond.

Figure F, below, contains estimates of the volumes of water recycled back to the upper pond, and the reduction of water lost in the lower pond due to evaporation / infiltration. The reduction of water lost in the lower pond due to evaporation / infiltration represents the water savings due to longer filter runs / reduced backwash frequency. Note that since the filter improvements have dramatically reduced the amount of backwash water going to the lower pond, the volume of water recycled from the lower pond to the upper pond has actually fallen from 21.1 MG/year to 10.5 MG/year.

FIGURE F. ESTIMATED WATER SAVINGS FROM BACKWASH WATER REDUCTION / RECYCLING.

Year	2018	2019	2020	2021	2022	2023
Water Recycled Back to Upper Pond (MG)	10.5	10.5	10.5	10.5	10.5	10.5
Reduction in Volume Lost in Lower Pond Due to Evaporation / Infiltration (MG)	5.26	5.26	5.26	5.26	5.26	5.26
Estimated Water Savings from Backwash Water Reduction / Recycling (MG)	15.8	15.8	15.8	15.8	15.8	15.8

Detailed calculations of these water savings estimates are provided in the Appendix. Note that given the uncertainties in the anticipated changes in backwash frequency, the above estimates of water savings do not account for anticipated changes in water production between 2018 and 2023. Future annual updates will seek to better quantify the water savings due to the longer filter runs / reduction in backwash frequency.

While the City is free to recycle backwash water at its treatment plant, the City is contractually limited in its ability to pursue reuse of “reclaimed” treated wastewater effluent. The City’s drinking water supply, provided by the Dolores Water Conservancy District (DWCD)¹¹, is subject to a contractual clause that reserves post-use water as belonging to the U.S. Bureau of Reclamation. In other words, like many Western Slope communities, the City’s water is subject to a one-time use limitation, and water reuse projects would currently violate this requirement. Therefore, for the anticipated 7-year duration of this plan, post-use water reuse is not a feasible option.

That said, over the very long-term (greater than 7-years), the City is interested in pursuing water reuse on a limited basis for irrigation of recreational fields requiring irrigation (e.g., baseball diamonds), vehicle washing at the City’s vehicle yard, and other uses where non-potable water is acceptable. The City would need to negotiate with DWCD to modify the water reuse prohibition, as well as coordinate with other interested stakeholders (e.g., U.S. Bureau of Reclamation) prior to utilizing water reuse. Moreover, wastewater within the City currently receives primary and secondary treatment by the Cortez Sanitation District prior to discharge into a nearby surface water source. Water reuse would require extensive additions to the existing wastewater treatment system to meet current environmental and public health regulatory requirements, in addition to a new and separate reclaimed water

distribution system. The Cortez Sanitation District is a separate governmental entity from the City of Cortez, and any future potential post-use water reuse would need to obtain their agreement and participation. In summary, any future potential water reuse is currently only at a conceptual level, and it is uncertain over what timeframe the City might proceed.

E. WATER-SAVING MEASURE / PROGRAM #5: DISTRIBUTION SYSTEM LEAK IDENTIFICATION AND REPAIR.

The City has an ongoing drinking water distribution system leak prevention, detection, and repair program. In their day-to-day activities running the water system (i.e., operating the water treatment plant, water storage tanks, and the water distribution system), DPW staff continuously evaluate the distribution system, looking for leaks and excessively corroded pipe, as well as faulty hydrants, valves, and other appurtenances. They also carefully observe water quality and pressure conditions both at the water treatment plant and at multiple locations within the distribution system.

The City's distribution system leak prevention, detection and repair program is broader than simply waiting to go out and fix catastrophic water main breaks. For example, as part of the City's fire hydrant maintenance and unidirectional distribution system flushing program, if DPW staff see or suspect a line or appurtenance is leaking (based on noise, cavitation, pressure disruptions, water color, water odor, external or internal pipe corrosion, or observable or measurable water leakage), DPW staff will investigate and make the appropriate repairs. If water system customers complain of water quality or pressure problems in a certain part of the distribution system, DPW staff will investigate and make the appropriate repairs.

When distribution system leaks are suspected, they are investigated immediately. If leaks are detected, they are repaired immediately by DPW staff. These repairs usually consist of either repair or replacement of faulty pipe or appurtenances. Alternatively, if upon investigation a leak cannot be identified, DPW staff will perform more careful inspections within that area of the distribution system looking for areas of concern. For example, if an area of the distribution system is suspected of having several small leaks, DPW staff will make note of the concern and investigate further, looking for the specific leaks, faulty valves or hydrants, or other problems (e.g., pipe obstructions, buckled pipe, extensive pipe corrosion, illegal water connections, etc.).

¹¹ <http://www.doloreswater.com>

Records of the distribution system leak identification and repair program are maintained by City DPW personnel and are available for review at the City Service Center. In particular, the DPW maintains and updates a detailed GIS database and AutoCAD drawings of the drinking water distribution system, showing the location, size, and material of each water line and appurtenance. Within these systems, DPW personnel annotate their subjective condition assessment of each line, as part of their routine distribution system maintenance activities. DPW personnel maintain written record drawings (as-builts) depicting when different sections of line were originally built or subsequently repaired. Records also include logs of appurtenance maintenance (e.g., valve opening closing, hydrant flushing, etc.). These records are used to identify water lines most needing replacement in the City's Capital Improvements Program (CIP). (Note that the City's water treatment plan has a sophisticated Supervisory Control and Data Acquisition (SCADA) system that its operators use to efficiently operate the drinking water treatment plant. The SCADA system is used exclusively to control the water treatment plant – particularly the treatment process – but is not used to manage the distribution system, such as the day-to-day operations & maintenance.)

Complementing the City's routine leak detection program, the City in the past has hired external consultants to acoustically evaluate (using sonic leak detection systems) water mains and other portions of the distribution system for otherwise undetectable leaks. Generally speaking, this work is performed as funding becomes available, and was most recently performed in the 2010s by a specialty contractor. In the past, City DPW personnel selected areas within the distribution system most needing leak detection evaluation, based on the age and condition of the lines, suspicion or previous presence of leaks, flowrate of water through the line, and time since the line was most recently evaluated. No later than 2020, the City will budget and allocate funds for a comprehensive acoustic leak detection survey. Given that comprehensive acoustic leak detection has not been done in more than 8-years, the comprehensive acoustic leak detection survey will include as much of the entire distribution system as possible.

Note that some areas of the distribution system (e.g., under waterway crossings, through challenging terrain or dense vegetation) may be inaccessible to leak detection survey crews, or the depth of the water lines may make acoustic leak detection ineffective. The goal of the comprehensive acoustic leak detection survey will be to survey as much of the distribution system as is safe and practicable to do so.

Following the comprehensive acoustic leak detection survey, more targeted acoustic leak detection efforts will be performed as necessary, utilizing the comprehensive survey as a baseline. Preliminary estimated cost for the comprehensive acoustic leak detection survey is \$50,000. Repairs required of leaky pipes and appurtenances (e.g., valves) identified during the survey are not included in this cost.

It is very difficult to estimate water savings from leak detection in advance, particularly when leak detection has not been performed in some time. The quantity of leaks can depend upon the pressures within the distribution system, variations in water flowrates, extent of corrosion in the water pipeline, extent to which leaks have been repaired upon detection, and other maintenance-related factors. Given these uncertainties, no estimates of water savings due to the 2020 acoustic leak detection have been developed. The future acoustic leak detection, as well as the future water audit / water loss control study, will seek to quantify the current level of water loss so that estimates of water savings from acoustic leak detection can be incorporated into future water conservation plans.

FIGURE G. ESTIMATED WATER SAVINGS DUE TO ACOUSTIC LEAK DETECTION AND REPAIR PROGRAM.

Year	2020	2021	2022	2023	2024	2025
Commercial Water Audit Program						
Estimated Water Savings Due to Leak Detection*	0	0	0	0	0	0

*NOTE: Not estimated due to uncertainties with current water loss and potential benefits of new acoustic leak detection program. Future revisions of water conservation plan will quantify savings from acoustic leak detection and repair program.

As part of implementation of this water conservation plan, the City will continue to refine and improve its water accounting system. In particular, the City will seek to ensure that all water users are metered and all meters are properly calibrated and the data recorded.

F. WATER-SAVING MEASURE / PROGRAM #6: PUBLIC EDUCATION, CUSTOMER WATER USE AUDITS, WATER-SAVING DEMONSTRATIONS.

The City actively seeks to educate its residents and improve public awareness of water conservation through literature distribution, educational programs, and responding to resident’s questions and comments. For example, public education literature on water conservation is available for free both at the City’s offices and at its website.¹² This literature covers the City’s water wasting prohibition and land watering restrictions, drought mitigation steps, and general water saving tips for both indoor and outdoor water uses. Examples of this public education literature are included in the Appendix. Annually, the City distributes to each residence connected to the water supply a Consumer Confidence Report (CCR). The CCR provides information on the water source and water quality, as well as information on how to use water wisely and avoid wasting water. Further, the City submits to the local newspaper short informational clips about water conservation. The Appendix contains an example of informational releases on drought mitigation submitted to the *Cortez Journal* in 2018, as well as articles published within the *Cortez Journal* in 2011 through 2017. The City also works with local schools to educate children on water conservation and organizes occasional public tours of the City’s drinking water system’s facilities. Finally, as they come in, City staff addresses any resident’s questions or comments on water conservation, drought mitigation, and the drinking water supply in general.

It is very difficult to estimate water savings due to public education. Water savings depend upon how many residents are reached by the educational program, how many and to what extent those who receive the public education reduce their water demand, whether the changes in water demand are permanent or temporary. As such, a 1% reduction in annual water demand was used as a “best guess” to estimate water savings, shown in Figure H, below. The City will revisit this estimate during future annual updates and comprehensive revisions of the Water Conservation Plan, and seek to more accurately quantify the water savings from educational efforts.

FIGURE H. EST. WATER SAVINGS DUE TO PUBLIC EDUCATION, CUSTOMER AUDITS, WATER-SAVING DEMOS.

Year	2018	2019	2020	2021	2022	2023
Commercial Water Audit Program						
Forecast Annual Water Demand (MG)	788	797	806	814	823	832
Reduction in Water Demand Due to Public Education, Audits, Demos (%)	1%	1%	1%	1%	1%	1%
Estimated Water Savings (MG)	7.9	8.0	8.1	8.1	8.2	8.3

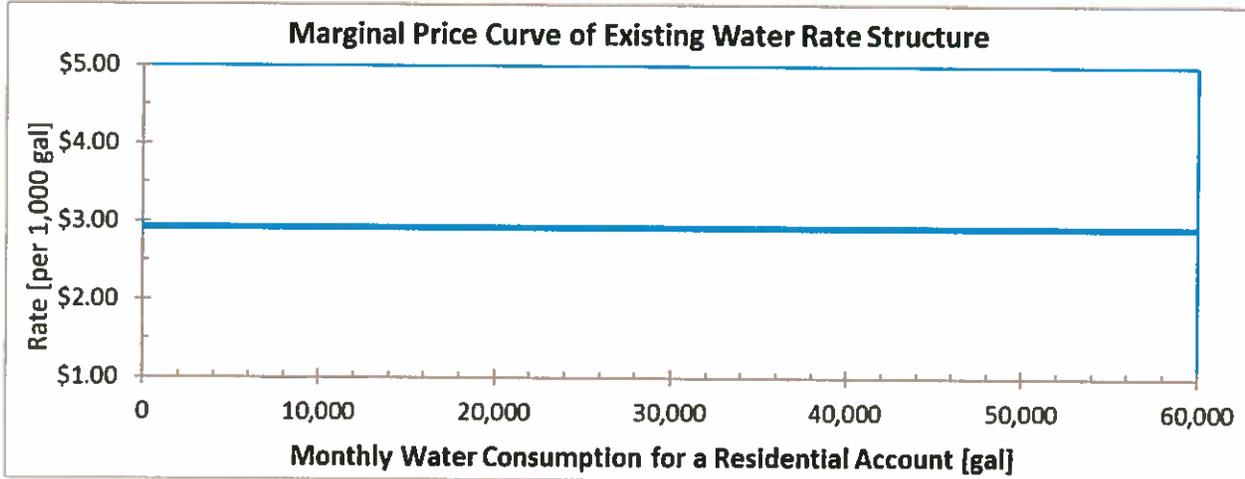
¹² <http://www.cityofcortez.com>

In future updates / revision of the plan, more detailed estimates of the water savings due to public education will be formulated. The City will, at some point during the plan's implementation, conduct a water conservation survey in which questions include whether people try to conserve water, in what ways do they try to conserve water, what steps the City could take to encourage water conservation, how much they might cut back on water use if water rates were adjusted, etc. The survey could be conducted both online and in hard copy (perhaps distributed as a stuffer within the routine utility bill). The survey likely would be performed over a 30 or 60-day period, after advertising it online, in the newspaper, and within a preceding utility bill. The results of the survey will help the City gauge the effectiveness of its water conservation program, as well as estimate water savings due to its various elements program, particularly public education, customer water-use audits, and water-saving demonstrations.

G. WATER-SAVING MEASURE / PROGRAM #7: WATER RATE STUDY / CONSERVATION PRICING.

The City currently uses a uniform water rate structure. Namely, the City currently charges a base rate for the first 1,000 gallons of monthly usage, with a set rate per each additional 1,000 gallons used. Chart 5, below, shows the flat marginal rate for each additional 1,000 gallons used.

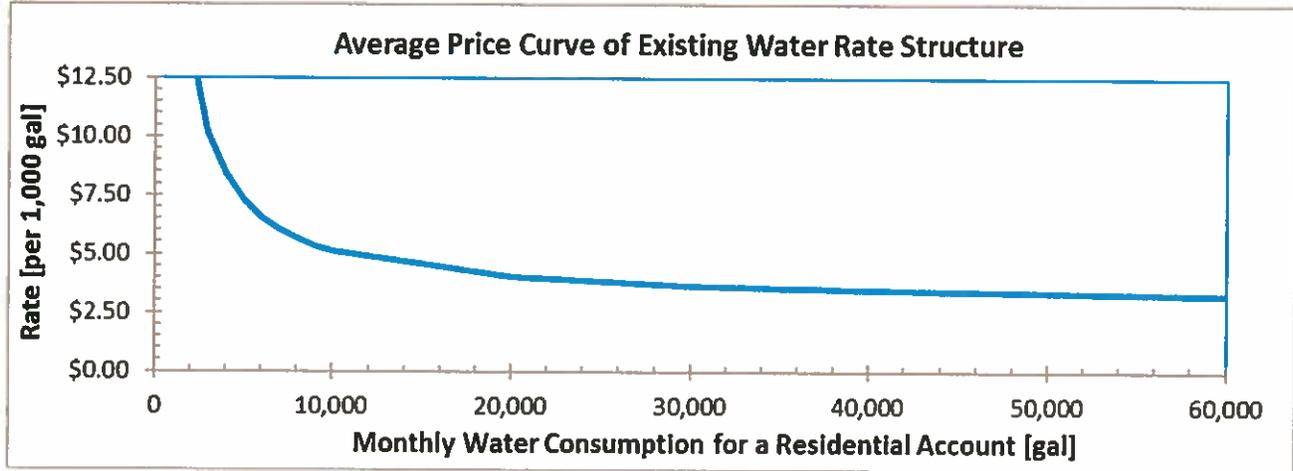
CHART 5: MARGINAL PRICE CURVE OF EXISTING WATER RATE STRUCTURE.



Uniform water rate structures do not provide a particularly strong price signal to encourage conservation, in contrast to conservation-oriented pricing structures such as increasing block rate or seasonal water rate structures. Chart 6, below, shows how the average price of Cortez's existing water rate structure decreases as water use increase. Generally, the positive slope or steepness of the average price curve indicates how effective the water rate structure in sending a conservation price signal. (Ref. Western Resource Associates, "Front Range Water Meter: Water Conservation Ratings and Recommendations for 13 Colorado Communities," November 2007¹³) Thus, the negative slope of Cortez's average price curve reflects its lack of a strong conservation price signal.

¹³ <http://www.westernresourceadvocates.org/media/watermeter/index.php>

CHART 6: AVERAGE PRICE CURVE OF EXISTING WATER RATE STRUCTURE.



Accordingly, the City will consider adjusting its water rate structure to encourage additional conservation by high water users, an approach known as “conservation-oriented rate structures.” A potential conservation-oriented rate structure could consist of increasing block rates, whereby the marginal water rate (e.g., dollars charged per 1,000 gallons of additional usage) increases as a customer’s monthly water use increases. (The opposite of an increasing block rate structure is a decreasing block rate structure, in which unit price decreases as consumption volume increases. Decreasing block rate structures discourage water conservation, and will not be adopted by the City.) Another conservation-oriented rate structure is seasonal rates, in which a higher rate is charged during the summer to discourage inefficient outdoor water use (e.g., excessive watersprinkling).

While the City has adjusted water rates as needed over time, a comprehensive water rate study has not been done for the City for approximately 30-years. As such, the City will hire a qualified consultant to perform a water rate study no later than 2019. The City has tentatively budgeted \$4 0,000 for this study. The purpose of the study is to guide a potential future conservation pricing rate structure. It is anticipated that a potential future conservation pricing rate structure would be implemented in 2020.

The Appendix contains a preliminary scope of work for the water rate study. The City’s DPW will modify this scope of work as necessary, prior to submitting a request for proposals. Any water rate study will be performed in accordance with standard water industry guidance, such as AWWA Manual of Water Supply Practices M1, “Principles of Water Rates, Fees, and Charges” (2000), and “Water and Wastewater Finance and Pricing: A Comprehensive Guide (3rd Ed.)” by George Raftelis (2005)

Conservation-oriented rate structures that send a strong “price signal” to customers have been shown to provide utilities with stable and sufficient revenue and reduce water use roughly 10 - 30%, based on the experience several Western utilities. (Ref. Western Resources Associates, Structuring Water Rates to Promote Conservation¹⁴). Accordingly a water savings rate that adjusts upwards from 0% to 10%, over a 4-year period to allow customers to adjust their behavior in response to the conservation pricing structure, has been used to estimate water savings from the potential future conservation-oriented rate structure.

¹⁴ <http://www.westernresourceadvocates.org>

Figure I, below, is an estimate of the water savings due to a potential future conservation pricing structure.

FIGURE I. ESTIMATED WATER SAVINGS DUE TO POTENTIAL FUTURE CONSERVATION-ORIENTED RATE STRUCTURE.

Year	2018	2019	2020	2021	2022	2023
Forecast Annual Water Demand (MG)	788	797	806	814	823	832
Est. Reduction in Water Demand from Conservation-Oriented Rate Structure	0%	0%	2.5%	5%	7.5%	10%
Estimated Water Savings (MG)	0	0	20.2	40.7	61.9	83.2

H. WATER-SAVING MEASURE / PROGRAM #8: REGULATORY MEASURES.

The City has adopted a series of regulatory measures to promote water conservation.

Specifically, City’s Municipal Code, Chapter 27, regulates its water system and provides the City with several measures to promote water conservation. Excerpts of Chapter 27 are in the Appendix.

First, Section 27-6 prohibits daytime watering between 10am and 5pm from May 15 to September 15. Those caught violating the daytime watering prohibition shall be given a warning upon the first offense, and have the water shutoff upon second offense. After payment of a re-connect fee, the offending resident’s water will be turned back on. Section 27-6 also establishes a “new lawn permit” for any new lawn that needs to be watered every day and during the restricted time of 10am to 5pm. The permit shall be issued upon payment of a fee, and is valid for twenty-one days of watering for newly-seeded lawns and fifteen days of watering for sod.

Second, Section 27-19 prohibits water wasting, including through hydrants and faucets, or the constant running of water through toilets or pipes to prevent their freezing.

Third, Section 27-44 mandates that residents keep all fixtures and pipes located on their property in good working order. The City has the power to shut off a resident’s water if they fail to make needed repairs after receiving notice.

The City’s regulatory measures are enforced via a joint effort of the City’s DPW personnel and the City Police Department. If City DPW personnel recognize a code violation – e.g., violation of lawn watering restrictions in time of drought – they will refer the issue to Police, who will issue the formal citation. In addition, City Police have the authority to issue citations without referral from DPW personnel.

Finally, note that the City – as a home-rule municipality – has the authority as part of its inherent governmental police powers to impose additional measures to protect public health, safety and welfare of its residents. Such emergency restrictions might be put in force during time of a prolonged, severe drought such that water level within McPhee Reservoir falls significantly, or if the water system were to become contaminated and water could only be used for non-potable purposes such as laundry and bath.

Like with educational efforts, it is very difficult to estimate the water savings due to regulatory measures. Water savings from regulatory measures depend upon a variety of factors, many of which are intangible and difficult to access. These include how aggressive current regulatory measures are enforced, the strength of fines or penalties assessed for non-compliance, the willingness of a community’s residents to pay fines and continue violating the regulations, and general public

perception of regulation breakers (i.e., is pressure amongst community residents to comply with the regulatory measures). As such, a 1% reduction in water savings was used as a “best guess” to estimate water savings, as shown in Figure J, below. The City will revisit this estimate during future annual updates and comprehensive revisions of the Water Conservation Plan, and seek to more accurately quantify the water savings from regulatory measures.

FIGURE J. ESTIMATED WATER SAVINGS DUE TO REGULATORY MEASURES.

Year	2018	2019	2020	2021	2022	2023
Forecast Annual Water Demand (MG)	667	671	642	646	617	621
Est. Water Savings from Regulatory Measures	1%	1%	1%	1%	1%	1%
Estimated Water Savings (MG)	6.7	6.7	6.4	6.5	6.2	6.2

I. WATER-SAVING MEASURE / PROGRAM #9: Rainwater Harvesting.

In 2016, rainwater harvesting became legal in Colorado. The new law allows a homeowner to collect up to 110 gallons of rainwater in barrels for outside use. The law requires that barrels must be equipped with a sealable lid. Single family households and multi-family households with four or fewer units may harvest rainwater. It would be difficult to quantify the amount of treated water saved so nothing is added to the estimate in Figure K.

PART 7 - QUANTITATIVE ESTIMATES OF WATER SAVINGS.

Figure K, below, shows the quantitative estimates of water savings by each of the nine water-saving measure / program. Each of these quantitative estimates was outlined earlier within the plan, and will be revised as needed during future annual updates and comprehensive revision of the plan.

FIGURE K. QUANTITATIVE ESTIMATES OF WATER SAVINGS BY WATER-SAVING MEASURE / PROGRAM.

Year	2018	2019	2020	2021	2022	2023
#1: Water-Efficient Fixtures & Appliances	0.8	1.4	2.2	2.8	3.6	4.2
#2: Waterwise Landscapes, Drought-Resistant Vegetation, Efficient Irrigation, Removal of High Water Demand Plants	0.06	0.12	0.17	0.23	0.29	0.35
#3: Water-Efficient Industrial & Commercial Processes	0	0	0.26	0.37	0.45	0.55
#4: Water Reuse Systems (Backwash Water Reduction / Recycling)	15.8	15.8	15.8	15.8	15.8	15.8
#5: Distribution System Leak Identification & Repair	0	0	0	0	0	0
#6: Public Education, Customer Water Use Audits, Water-Saving Demonstrations	7.9	8.0	8.1	8.1	8.2	8.3
#7: Water Rate Study / Conservation Pricing	0	0	20.2	40.7	61.9	83.2
#8: Regulatory Measures	0	8.0	8.1	8.1	8.2	8.3
#9: Rainwater Harvesting						
Est. Total Water Savings from Selected Water-Savings Measures / Programs (MG)	0	33.3	54.7	76.2	98.3	120.7
Estimated Total Water Savings from Selected Water-Savings Measures / Programs (acre-feet)	0	102.2	167.8	233.8	301.6	370.4

As shown in Table 1 and Graph 1b, in the Appendix, per capita water use has fallen between 1990 and 2002 from 325gpd then flat-lined at 230 gpcd for a few years then dropped to just above 200 gpcd, since approximately 2015. The demand forecasts within the Appendix utilize 200 to 180 gpcd as the per capita daily water demand to determine total annual water demand.

Goal #1 for this plan is to maintain per capita water demand at the current reduced levels of 200 gpcd in the short-term (1-2 years), while decreasing per capita water demand over the long-term (5-7 years) to 180 gpcd. Figure L, below, shows an estimate of the water savings if the 180 gpcd goal is met by the end of the 7-year duration of this plan, as compared to water use if the per capita water use remained at the current 200 gpcd level.

Also shown in Figure L are the estimated total water savings from the previously selected water- savings measures / programs. This side-by-side comparison shows that the estimated water savings of the selected water-saving measures / programs are sufficient to meet the 200 gpcd water conservation goal.

In other words, the estimated water savings from selected water-saving measures / programs are significantly greater than water savings required to achieve water conservation goal.

FIGURE L. ESTIMATED WATER SAVINGS IF CONSERVATION GOAL MET.

Year	2017	2018	2019	2020	2021	2022
Forecasted Population	9,007	9,142	9,279	9,595	9,699	9,802
Current Per Capita Water Use (gpcd)	206	200	200	200	200	200
Per Capita Water Use Goal (gpcd)	200	200	195	190	185	180
Water Savings (if Goal Achieved) (MG)	0	0	20.8	42.0	63.7	85.9
Water Savings (if Goal Achieved) (acre-feet)	0	0	63.8	129.0	195.6	263.5
Estimated Total Water Savings from Water- Savings Measures / Programs	0	32.4	33.3	54.7	76.2	98.3
Estimated Total Water Savings from Water- Savings Measures / Programs	0	99.4	102.2	167.8	233.8	301.6
Estimated Per Capita Water Use from Water- Savings Measures / Programs	0	200	195	190	185	180

Since this plan’s short-term goal is for per capita water use to remain at 200 gpcd, no revenue effects are anticipated, so increased water rates or surcharges will not be needed, at least in the short-term, due to declines in per capita water demand. Additionally, water conservation is not expected to reduce the need for future capital expenditures. If the long-term commitment – reducing per capita water use below 200 gpcd – does begin to impact the City’s water revenues, then annual reviews of the Water Conservation Plan will need to consider revenue effects.

PART 8 - IMPLEMENTATION PLAN.

8.1 ROLE OF CONSERVATION PLAN IN CORTEZ’S WATER SUPPLY PLANNING.

The City of Cortez believes that water conservation planning must and will play an integral role in its water supply planning. The City aims to integrate its water conservation program with its water supply planning effort. Given that water supply and demand are interconnected, simultaneous and coordinated water conservation and water supply planning efforts will help ensure these do not remain isolated from one another.

The City recognizes that its water supply from McPhee Reservoir is not unlimited, particularly in the event of a drought or other emergency water shortage. As previously discussed, McPhee Reservoir is managed by the Dolores Water Conservancy District (DWCD), a governmental entity separate and distinct from the City of Cortez. Given that the City does not have unilateral dominion and control over its raw water source, the City will continue to work collaboratively with the DWCD to ensure that McPhee Reservoir is properly managed to provide an adequate supply of water for current and future needs.

In addition, the City will aggressively implement this Water Conservation Plan to ensure that water will be available in the future for the City’s water customers, whether in times of water abundance or drought. In particular, the City has committed significant resources, not only to operate, maintain, and recently upgrade its drinking water treatment plant, but to also develop, obtain CWCB approval, and implement this Water Conservation Plan. The Water Conservation Plan is a dramatic improvement from the 1996 plan, and has been significantly strengthened in response to numerous CWCB comments. Section 8.03, below, describes the City’s implementation schedule for the plan. Over the plan’s 7-year duration, the City will implement the various water-saving measures and programs that the City has committed itself to.

It is important to note that the City DPW’s Water Division, which operates and maintains the drinking water system, is responsible for the City’s water supply. Accordingly, the Water Division was the proponent for development of this Water Conservation Plan, and is the lead for its implementation.

There is no other entity within the City that has greater expertise in water supply management or better understands the importance of water supply planning. Other City Departments will also be involved with the plan’s implementation, such as the water-wise landscape demonstration gardens, water conservation education and ordinance enforcement, as previously discussed. In addition, the City leadership is informed of and fully supports the water conservation program articulated by this plan. The Mayor and City Council reviewed the draft Water Conservation Plan, conducted a public hearing on the plan, directed staff to develop an ordinance to implement the plan, and subsequently unanimously passed that ordinance.

8.2 IMPLEMENTATION SCHEDULE.

Figure M, below, shows the implementation schedule for the Water Conservation Plan. The implementation schedule includes the “no later than” date that each individual water-saving measure / program will be implemented. Also included is an anticipated budget allocation for each water- saving measure / program.

FIGURE M: IMPLEMENTATION SCHEDULE.

Water Saving Measure / Program	Implementation Date	Anticipated Budget Allocation
#1: Water-Efficient Fixtures & Appliances	No later than 2020	TBD / year
#2: Waterwise Landscaping Program – City Projects	2019	\$30,000
#3: Water-Efficient Industrial & Commercial Processes	No later than 2020	TBD / year
#4: Water Reuse Systems	Ongoing	Not Applicable
#5: Distribution System Leak Identification & Repair	2019	\$50,000
#6: Public Education, Customer Water Use Audits, Water-Saving Demonstrations	Ongoing	TBD / year
#7: Water Rate Study / Conservation Pricing	2019	\$40,000 (one time)
#8: Regulatory Measures	Ongoing	Currently incurred
#9: Rainwater Harvesting	No later than 2020	TBD / year

8.3

PUBLIC PARTICIPATION.

Public participation in this Water Conservation Plan is integral to the accomplishment of its goals. The City has taken the following actions to promote participation by the public with the Water Conservation Plan:

- Post the Water Conservation Plan on City's website.

The City posted the draft plan on August 29, 2018, on the City's website.¹⁵ A copy of the internet notice is in the Appendix.

- Distribute copies of Water Conservation Plan at City's offices.

Since August 14, 2018, the City DPW has made available copies of the draft plan at the City Service Center and at City Hall. At the June 12, 2018, City Council workshop, hard copies of the draft Water Conservation Plan were distributed to Council members.

- Seek public written comment during a 60-day public comment period on the draft Water Conservation Plan.

The public comment period on the draft plan ran from August 31 to October 28, 2018, during which written comments were solicited.

Included in the Appendix is a 3-page interoffice memorandum from Rich Landreth to the City Manager and City Council summarizing the Water Conservation Plan and recommending a schedule for formal approval of the draft plan. During the Council workshops on June 12; August 14; and August 28, 2018, Director of Public Works Phil Johnson and Water Plant Superintendent Richard Landreth made presentations to the Council on the water conservation planning process and the draft plan (minutes from those workshops are included in the Appendix).

The Appendix contains the agenda for the August 28, 2018, meeting, with item 7.b. directing staff to advertise the Draft Water Conservation Plan for the required 60-day comment period; this item was unanimously approved by Council. Minutes from the August 28, 2018, regular City Council meeting are also included in the Appendix. A public notice was put in the newspaper and on the City's website, giving the public an opportunity to provide for oral and/or written public comment on the draft plan.

Also included in the Appendix is the agenda and minutes for the October 23, 2018, Council meeting, with item 7.a. being first reading of Ordinance No. 1257, Series 2018, adopting by reference the 2018 Water Conservation Plan for the City of Cortez.

The agenda for the November 13, 2018, Council meeting is in the Appendix, with item 5.a. being the public hearing and second reading of Ordinance No. 1257, Series 2018. City Council unanimously approved the motion to adopt the 2018 Water Conservation Plan.

- Designate a point-of-contact for public comment including phone number.

The public notice designated Richard Landreth, Water Treatment Plant Superintendent as the draft plan's point-of-contact.

- Issue a responsiveness summary to all comments received during the public comment period.

Only one comment was received from the public on the draft Water Conservation Plan, from Brett M. Schmidt. His comment and the City's response were presented to Council at the public hearing on November 13, 2018, and are included in the Appendix.

- ○ ¹⁵ <http://www.cityofcortez.com>

- Revise the draft Water Conservation Plan, as necessary, based on public comments received. *The draft plan has been revised several times, both based on comments provided by the CWCB as well as feedback from the City Council during the August 14, 2018, meeting.*
- Continue education and public awareness campaign. *Upon plan finalization, City staff will implement the public education elements of the plan.*

8.4 MONITORING AND EVALUATION.

The City's Department of Public Works (DPW) will be responsible for monitoring and evaluating performance of the Water Conservation Plan, including scrutinizing the costs and water savings of the selected conservation options. Mr. Richard Landreth, Water Treatment Plant Superintendent, DPW, will lead these efforts. The City Council, as advised by DPW staff, will need to ensure that adequate funding is provided to fulfill the goals and implement the water-saving measures / programs outlined in the plan.

8.5 **ANNUAL UPDATES AND COMPREHENSIVE REVISION OF WATER CONSERVATION PLAN.**

The City's DPW will perform an annual review of the Water Conservation Plan, and modify the plan in accordance with needs identified during the annual review. DPW will coordinate with other City offices, in particular the Planning and Building Department, the Parks and Recreation Department, and the City Manager's Department, as appropriate during the annual reviews.

Richard Landreth, Water Treatment Plant Superintendent, is designated as the current point-of-contact for the Water Conservation Plan. Richard is currently expected to lead the annual review process, but this may change depending on personnel changes and other requirements amongst City staff. For example, if the City at some point were to hire a water conservation coordinator, it is likely that person would lead the annual reviews of the Water Conservation Plan.

The end result of each annual review will be, at a minimum, a memorandum to the City Manager and City Council outlining the implementation of the water saving measures / programs within the Water Conservation Plan, budget requirements to finance future year's water conservation program efforts, and recommendations on additional steps to further the City's water conservation goals.

The City will perform a comprehensive revision of the plan if identified as directed by the annual reviews, but absolutely no later than 2024. Colorado state law requires that CWCB-approved Water Conservation Plans be revised on a maximum 7-year rotating cycle. The comprehensive revision will be guided by the annual reviews performed each year beginning in 2019, and will involve another 60- day (minimum) public review and comment period. The comprehensive revision will involve a complete reevaluation of the Water Conservation Plan, and the development of a revised plan.

The comprehensive Water Conservation Plan revision will be led by City staff but also involve a newly established "City of Cortez Water Conservation Planning Workgroup." The workgroup will likely consist of at least 3 sitting members of the City Council, members of City staff, and may also include several interested members from the local community. The purpose of the workgroup is to ensure that the new Water Conservation Plan adequately reflects the residents' wishes and desires, to ensure that the democratic representatives are integrally involved with the new plan (as opposed to simply approving the plan after it has already been developed without their active participation), and to involve City staffers who will be involved on a day-to-day basis in the implementation of the plan.

8.6 **PLAN APPROVAL.**

As previously discussed, the City Council held a 60-day public comment period from August 31 through October 28, 2018, on the draft Water Conservation Plan, as well as a public hearing during the City Council meeting on November 13, 2018. At that time, the City Council unanimously approved Ordinance No. 1257, Series 2018. The Appendix contains the relevant public notices, meeting agendas, and approved ordinances.

8.7 **SOLICITATION OF ADDITIONAL FUNDS.**

The City's Grants and Special Projects Division, with the City Manager's Department, will seek additional funds in order to support implementation of the plan.

PART 9 - REFERENCES / ADDITIONAL RESOURCES.

Government:

- Colorado State University Extension – <http://www.ext.colostate.edu>
- + Paper “Water Conservation In and Around the House” – <http://www.ext.colostate.edu/pubs/consumer/09952.html>
- Colorado Water Conservation Board (CWCB) – <http://cwcb.state.co.us/>
- + CWCB Water Conservation Plan Development Guidance Document – <http://cwcb.state.co.us/Apps/hb1365/index.htm>
- Dolores Water Conservancy District (DWCD) – <http://www.doloreswater.com/>
- U.S. Environmental Protection Agency (USEPA) – <http://www.epa.gov>
- + WaterSense Program – <http://www.epa.gov/watersense>
- + Water Use It Wisely – <http://wateruseitwisely.com>
- Water Information Program (for Dolores and San Juan Watersheds) - <http://www.waterinfo.org/>

Not For Profit Organizations:

- Alliance for Water Efficiency (AWE) – <http://www.allianceforwaterefficiency.org>
- American Water Works Association (AWWA) – <http://www.awwa.org>
- Colorado Water Wise - <http://coloradowaterwise.org/>
- Western Resource Advocates –
- + Water Conservation Tips – <http://www.westernresourceadvocates.org>
- + Water Rate Structures – <http://www.westernresourceadvocates.org>

Publications:

- AWWA, Manual of Water Supply Practices M1, “Principles of Water Rates, Fees, and Charges” (2000) - <http://awwa.org/>
- AWWA, Manual of Water Supply Practices M36, “Water Audits and Loss Control Programs” (2009) -
- AWWA, Manual of Water Supply Practices M50, “Water Resource Planning” (2007) -
- AWWA, Manual of Water Supply Practices M52, “Water Conservation Programs - A Planning Manual” (2006) -
- AWWA, Standard G200, “Distribution Systems Operation and Management” -
- Ellefson, Connie Lockhart and David Winger, “Xeriscape Colorado: The Complete Guide” (2004)
- Knopf, Jim; “WaterWise Landscaping with Trees, Shrubs, and Vines: A Xeriscape Guide for the Rocky Mountain Region, California, and Desert Southwest” (2005)
- Letterman, Raymond D. (Ed.); “Water Quality and Treatment: A Handbook of Community Water Supplies (5th Ed.)” (1999)

- Mays, Larry W. (Editor); "Water Distribution Systems Handbook" (2000)
- Raftelis, George A.; "Water and Wastewater Finance and Pricing: A Comprehensive Guide (3rd Ed.)" (2005)
- Seneviratne, Mohan; "A Practical Approach to Water Conservation for Commercial and Industrial Facilities" (2007)
- Thornton, Julian et al.; "Water Loss Control (2nd Ed.)" (2008)
- Vickers, Amy; "Water Use and Conservation" (2001) - <http://www.waterplowpress.com/>
- U.S. Environmental Protection Agency, "Water Conservation Plan Guidelines," Document No. EPA-832-D-98-001 (1998) - <http://www.epa.gov/>