City of Deming

40-Year Water Plan

December 28, 2018

Table of Contents

Section **Page**

List of Figures

List of Tables

List of Appendices

1. Introduction

The City of Deming (City), located in Luna County in southwestern New Mexico (Figure 1-1), retained the services of Daniel B. Stephens & Associates, Inc. (DBS&A) to prepare this 40-year water development plan. The plan includes future water demand projections to ascertain the amount of water the City will need to meet projected demand over the 40-year planning period.

This 40-year water development plan addresses key regulatory requirements regarding water rights (NMSA 72-5-28(C)):

- Section 72-1-9 (B) of the New Mexico Water Code allows covered entities such as the City of Deming to legally appropriate and preserve water that they cannot currently use but will need in the future to meet projected water requirements for the service area.

- Municipalities are specifically exempt from forfeiture of unused water rights if those rights have been appropriated for the implementation of a water development plan or for preservation of water supplies (NMSA 72-12-8 (F)).

Thus, by preparing the water development plan—which documents existing demand, projects future demand, and identifies the water rights needed to meet demand—the City can acquire and retain water rights to meet future needs without putting them to immediate beneficial use. The City of Deming prepared a 40-year water plan in 1997, and in 2009 the City retained DBS&A to update the 1997 plan. To further facilitate long-range water resource planning for the City of Deming, the City again retained DBS&A to update the 2009 plan to account for current conditions.

This water development plan provides information on the City of Deming's water system (Section 2), water supply (Section 3), current and projected demand demonstrating the need for water rights (Section 4), and currently held water rights and legal constraints to water supply (Section 5). The long-term strategy, including a discussion of conservation, to address the water needs of the City is presented in Section 6.

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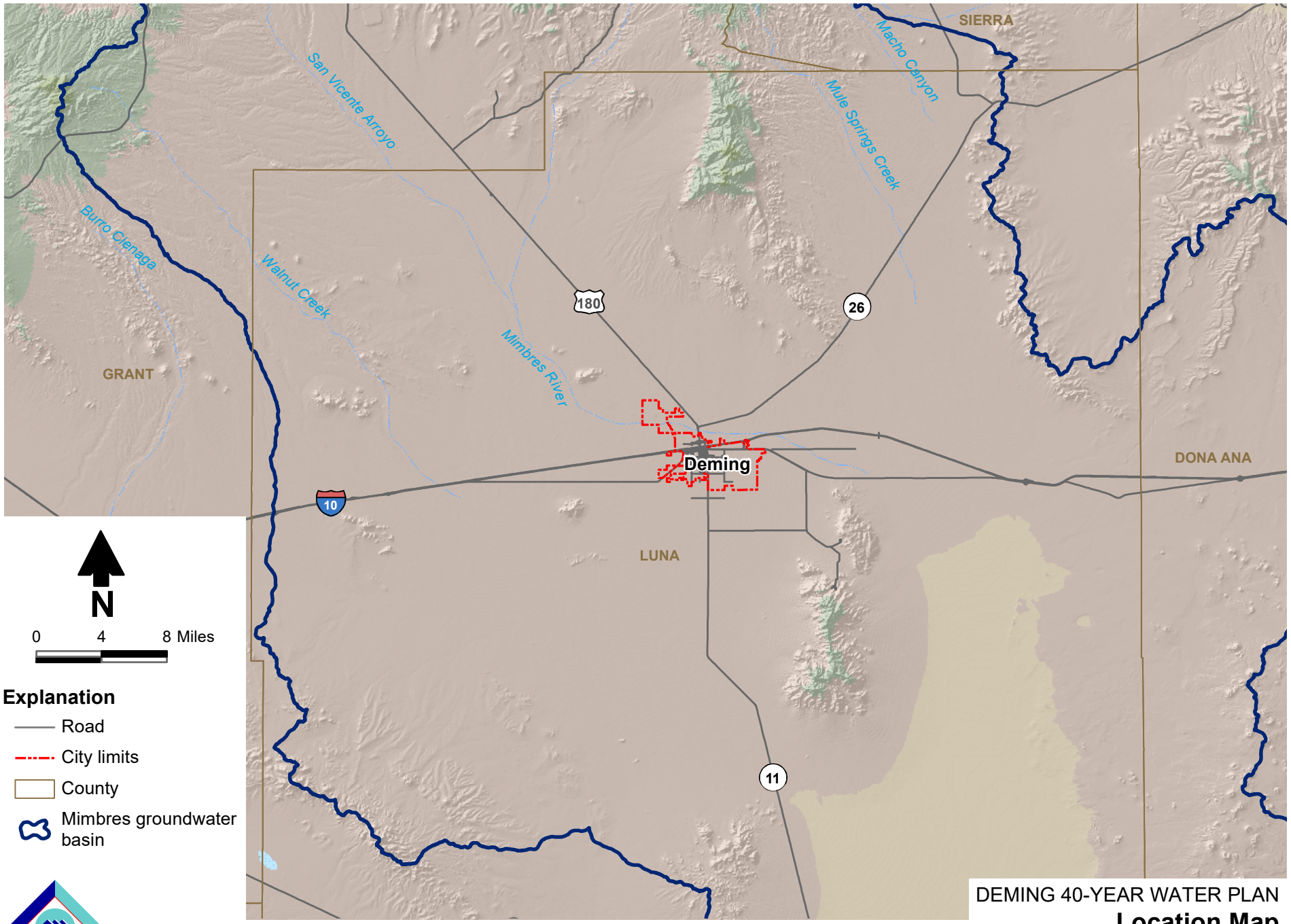

Figure 1-1

DEMING 40-YEAR WATER PLAN

Location Map

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2. Deming Water System

The City of Deming is located in Luna County, New Mexico (Figure 1-1) and is the county seat and largest population center, with a population of about 14,000. Originally a settlement known as Mimbres Junction, Deming was founded in 1881. Deming was later incorporated in 1902. U.S. Army Camp Cody was established in Deming in 1916 during the First World War. In 1942 the Deming Army Airfield was established with over 12,000 bombardier cadets graduating between 1942 and 1946 when it was closed. Interstate 10 came to town in 1964, resulting in additional growth.

The predominant land use in Deming is single family residential (SFR), with the majority of SFR lying south of the railroad tracks/I-10 corridor (City of Deming, 2017). Other land uses identified are multi-family residential, mobile home park, agricultural, parks/open space, commercial, governmental/institutional, industrial, utility, and vacant land. The City is generally growing to the southeast. Country Club Estates is the largest residential development, comprising a 300-lot senior community in the southern part of the City.

Commercial development generally occurs in the downtown area, along Golf Avenue, Pine Street, and Silver Avenue, and includes retail, restaurant, office, auto sales and repair, gas stations, hotels, and RV parks.

Institutional development includes Deming Public Schools, Deming Municipal Airport, Mimbres Memorial Hospital, churches, and the courthouse. Industrial development includes the Deming Industrial Park, located south of the Deming Municipal Airport which includes hangars, and the Peru Mill Industrial Park

The City of Deming water system relies entirely on groundwater from the Mimbres Basin for its municipal water supply. The Deming well field has 12 active wells. The majority of these wells provide potable water services to the residents of the City, and the remaining wells (not currently connected to/or isolated from the distribution system) provide irrigation service to the City's golf course, cemeteries, and municipal parks. The City has multiple wells that are leased out to nearby farms.

The City's water storage and distribution system includes two 500,000-gallon elevated storage tanks, one 3,000,000-gallon ground-level storage tank, and 140 miles of distribution pipeline of various materials, ranging in diameter from 4 to 18 inches (DBS&A, 2017). There is only one pressure zone in Deming, as there are minimal changes in elevation in the area. Accordingly, the City experiences no pressure problems in the system. System capacity averages 7,500 gpm with a peak capacity of 10.8 million gallons per day (mgd). Winter use averages 2 mgd.

A Preliminary Engineering Report (PER) completed in 2017 (DBS&A, 2017) noted system deficiencies related to aging infrastructure, and recommended upgrades to address deficiencies and to improve storage to support future growth.

The current City of Deming wastewater treatment plant was built in 1982 and is located 3 miles east-southeast of the City center. The design capacity for the plant is 3 mgd. The wastewater treatment plant treats approximately 1.4 million gallons of wastewater per day (City of Deming 2017).

The City reuses treated wastewater effluent, thereby lowering the demand on the potable water system, particularly in months of high demand. The City reuses treated wastewater effluent at three locations: a storage pond for the Luna Energy power plant, the golf course, and farmland located near the wastewater treatment plant (WWTP) (SMA, 2013). In the future, the City plans to also reuse effluent at a planned multi-sport complex. The City wants to build a recreation area and fishing pond fed by treated effluent. The City owns a separate reuse line from the WWTP to the golf course pond. Additional information including volumes of water reused is provided in Section 4.

The treated effluent is distributed from the WWTP to the farm and golf course through approximately 15,000 linear feet of 10-inch PVC reuse line. A 6-inch distribution pipeline from the booster pumps at the golf course to the cemetery exists but is not yet in use. The cemetery is currently irrigated from a dedicated well, but there are plans to irrigate with treated wastewater effluent in the future (City of Deming, 2013).

3. Water Supply

This section discusses the water resources in the vicinity of the City of Deming, including the sources of water, available water supply, reasonable projections of future availability, and current and anticipated future water quality. Water availability is defined in this section in the hydrologic rather than legal sense; availability of water from a water rights perspective is discussed in Section 4.

Sections 3.1, 3.2 and 3.3 describe the geography and climate, groundwater, and surface water resources, respectively. Section 3.4 describes the quality of area groundwater, which is the current source of the City's supply.

3.1 Groundwater

The City of Deming is located within the Mimbres Groundwater Basin (Figure 3-1), which provides the only water source for the City of Deming (Longworth et al., 2013). The State Engineer's administratively defined limits for the declared Mimbres Groundwater Basin (Section 5) encompass parts of Grant, Sierra, Doña Ana, and Luna Counties.

3.1.1 Geography and Climate

The City of Deming is located in a valley between the Florida Mountains to the southeast and Cooke's Range to the north. Maximum elevations in these ranges are 7,295 feet above mean sea level (ft msl) at Florida Peak and 8,408 ft msl at Cooke's Peak (City of Deming, 2017).

The climate in Deming is characterized by large ranges in annual temperature, with low humidity and a high evaporation rate. Average total annual precipitation in Deming was 9.35 inches for the period of 1914 through 2005 (WRCC, 2018); most precipitation occurs as heavy thunderstorms during July through September.

The City of Deming and the Mimbres Basin are located within the Mexican Highland Section of the Basin and Range province. The Basin and Range province is the result of extensional

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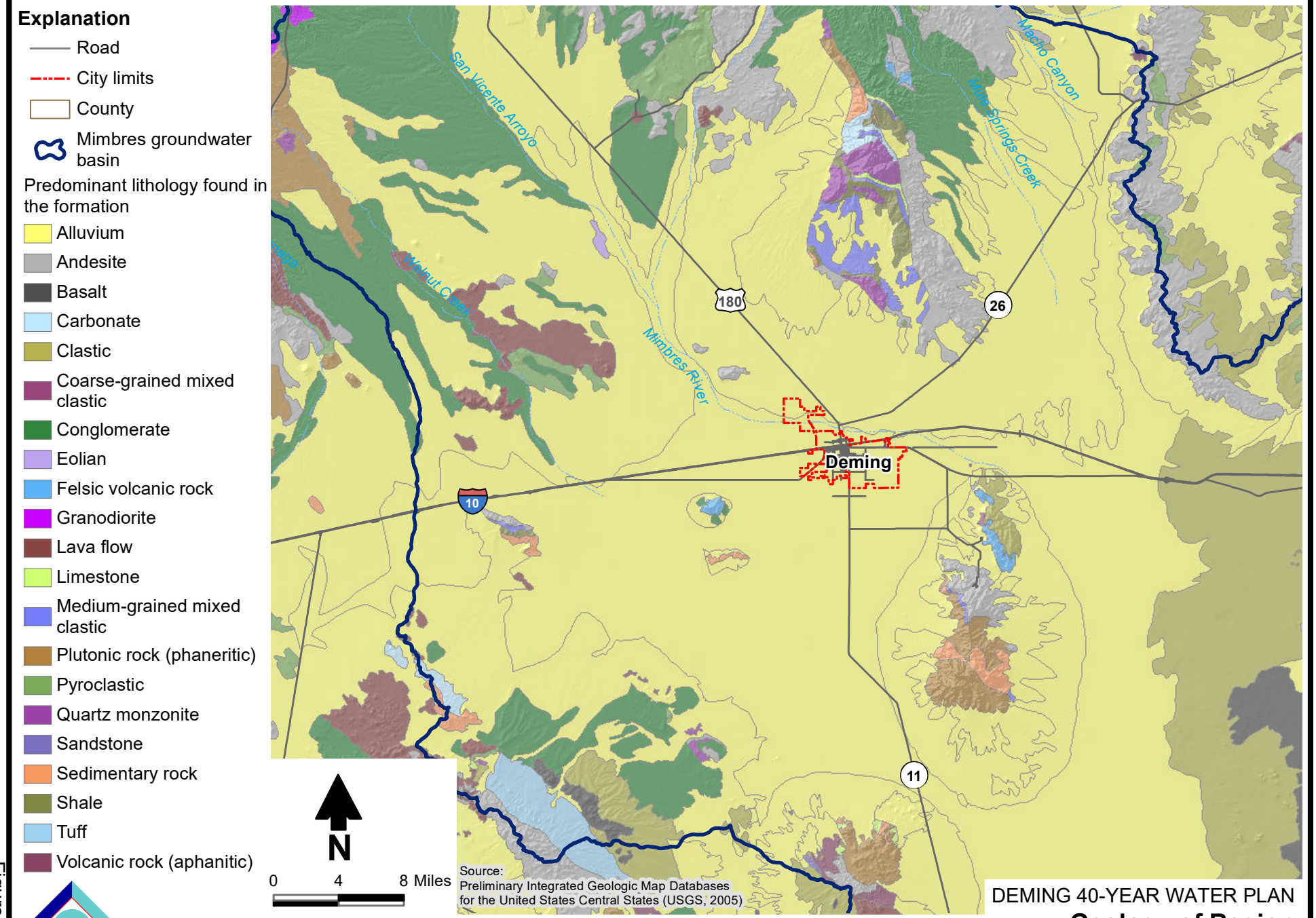

DEMING 40-YEAR WATER PLAN

Geology of Region

Figure 3-1

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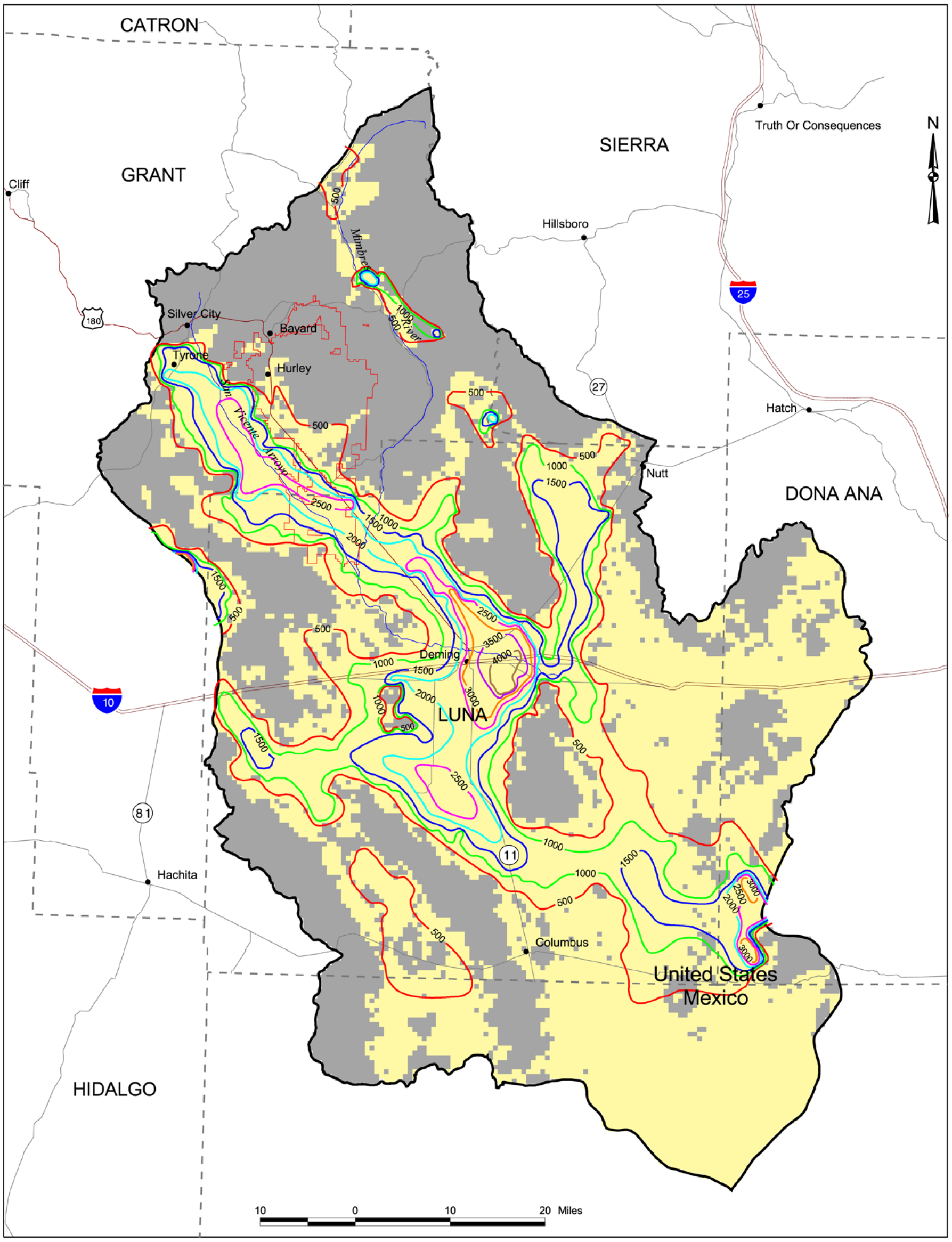
geotectonics that have occurred over the last 25 million years and is characterized by north-south trending mountain ranges separated by basins that have been partially filled with sediment eroded from the mountains. The mountains are comprised of bedrock and encompass approximately 20 percent of the Basin and Range province in New Mexico (Hawley et al., 2000). Basin fill includes several units of Quaternary alluvial and lacustrine deposits, as well as the Tertiary Gila Group. Within the Basin and Range province, the basin fill contains most of the readily available (i.e., economically viable) groundwater resources. The water table is generally within 200 feet of ground surface within the basin fill, aquifers are moderately to highly permeable, and the water is of good quality.

The Mimbres Basin is bounded on the north and west by the Continental Divide and on the east by the Lower Rio Grande Basin in Doña Ana County; to the south it extends into Mexico (Figure 3-2 [JSAI, 2006, Figure D7]). The overall province-scale geology of the Mimbres Basin is relatively complex (Figure 3-1); however, the geology that affects groundwater occurrence is limited mostly to near-surface basin fill. Intrabasin-scale structures divide the Mimbres Basin into seven different sub-basins that contain the vast majority of groundwater (Hawley et al., 2000):

- Upper Mimbres Sub-basin
- San Vicente Sub-basin
- Dwyer Sub-basin
- Florida Sub-basin
- Deming Sub-basin
- Hermanas Sub-basin
- Columbus Sub-basin

In the seven identified sub-basins, groundwater occurs primarily within basin fill materials comprised of Quaternary alluvium and the Tertiary Gila Group. Basaltic volcanics interbedded with basin fill can be locally important aquifers, mostly in the Upper Mimbres, Columbus, and San Vicente sub-basins. The thickness of the Mimbres Basin fill is 2,000 to 5,000 feet although productive water-bearing zones generally occur only in the upper 600 to 1,000 feet (Land, 2016). Figure 3-2 shows that the basin fill near Deming is several thousand feet thick.



Source: JSAI, 2006, Figure D7

Figure 3-2

DEMING 40-YEAR WATER PLAN
Basin Fill Thickness
Mimbres Basin

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12/28/2018

The Mimbres Basin system contains unconfined, semiconfined, and confined aquifers, depending on location. Inter-sub-basin hydrologic interactions are not well understood, but the general groundwater flow direction is from the northern highlands toward the U.S.-Mexico border. Pre-development discharge across the border, from the U.S. into Mexico, is estimated to have been 6,500 acre-feet per year (ac-ft/yr) (Hanson et al., 1994). Recharge from precipitation is estimated to be no more than 2 percent of the precipitation that falls across the area (Hawley et al., 2000).

Specific capacity data compiled by Hanson et al. (1994) for 278 wells completed in the basin fill indicate that the aquifer is highly productive but that the productivity of the aquifer decreases with depth. In general, specific capacities are between 13 and 17 gallons per minute per foot (gpm/ft) in wells completed within 330 feet of ground surface, between 8 and 12 gpm/ft in wells completed between 330 and 660 feet below ground surface (ft bgs), and between 7 and 9 gpm/ft in wells completed below 660 ft bgs. Transmissivities range from 75 to 375,000 gallons per day per foot (gpd/ft) (10 to 50,100 square feet per day [ft^2/d]), but the lower end of this range may reflect poor test conditions rather than actual aquifer characteristics (Hawley et al., 2000). Data from aquifer tests in City wells indicate that the transmissivities of wells in the Deming well field are very high, ranging from 11,250 gpd/ft (1,500 ft^2/d) to 120,000 gpd/ft (16,000 ft^2/d) (Johnson et al., 2002).

An analysis of groundwater level changes (Rhinehart et al., 2015) indicated that while variability does occur, large water level declines south and southwest of Deming were evident in the 1970s and continued into the 1980s and 1990s. In the 1990s two large zones of water level decline were observed north of Deming. By the 2000s water levels were declining in all directions surrounding Deming. Water level declines near Deming are further discussed in Section 3.1.2.

Analysis of available water quality data indicated that additional brackish water resources may be present at depth in the southern Mimbres Basin, but those have not yet been sufficiently investigated (Land, 2015).

3.1.2 Deming Well Field and Water Level Trends

The Deming well field has 12 active wells and is located in the vicinity of some of the deepest basin fill deposits (over 4,200 feet) found in the Mimbres Basin (DBS&A, 2017; Johnson et al., 2002). Figure 3-3 shows the location of the wells within the City of Deming, and Table 3-1 lists the construction details of the wells. Most of the wells are about 500 feet deep with a depth to water of about 150 feet.

Table 3-1. Active Wells

City Well No.	City Well Name	NMOSE Well ID	Capacity (gpm)	Year Drilled
1	Water Plant	M-299-S-6	480	1977
2	North Zinc	M-299-S-7	450	1966
3 [a]	Poplar	M-299-S-2	450	1966
4 [a]	Donaldson	M-299-S-15	500	1968
5	Martin	M-299-S-5	420	1950
6	South Iron	M-299-S	400	1954
7	Boy Scout	M-299-S-8	400	1966
8	Fairgrounds	M-299-S-11	300	1985
9	Ash/Grand	M-299-S-12	700	1980
10	SWIG	M-299-S-10	540	1960
11	Florida	M-299-S-4	530	1963
12 [a]	Cemetery	M-299-S-13	350	1951
14	Luchsinger	M-214	300	1972
15	Peru	M-271	590	1961
17	Bilbo	M-49 M-109 M-127	1,080	1978
18 [a]	Keeler	M-290	750	1976

[a] Well not currently used for public water supply

NMOSE = Office of the State Engineer
gpm = Gallons per minute

The USGS has eight monitor wells within 4 miles of Deming (Figure 3-4), with water level data starting in 1940. Water levels in these USGS-monitored wells have decreased at an average rate of 0.63 feet per year (ft/yr) (Table 3-2).

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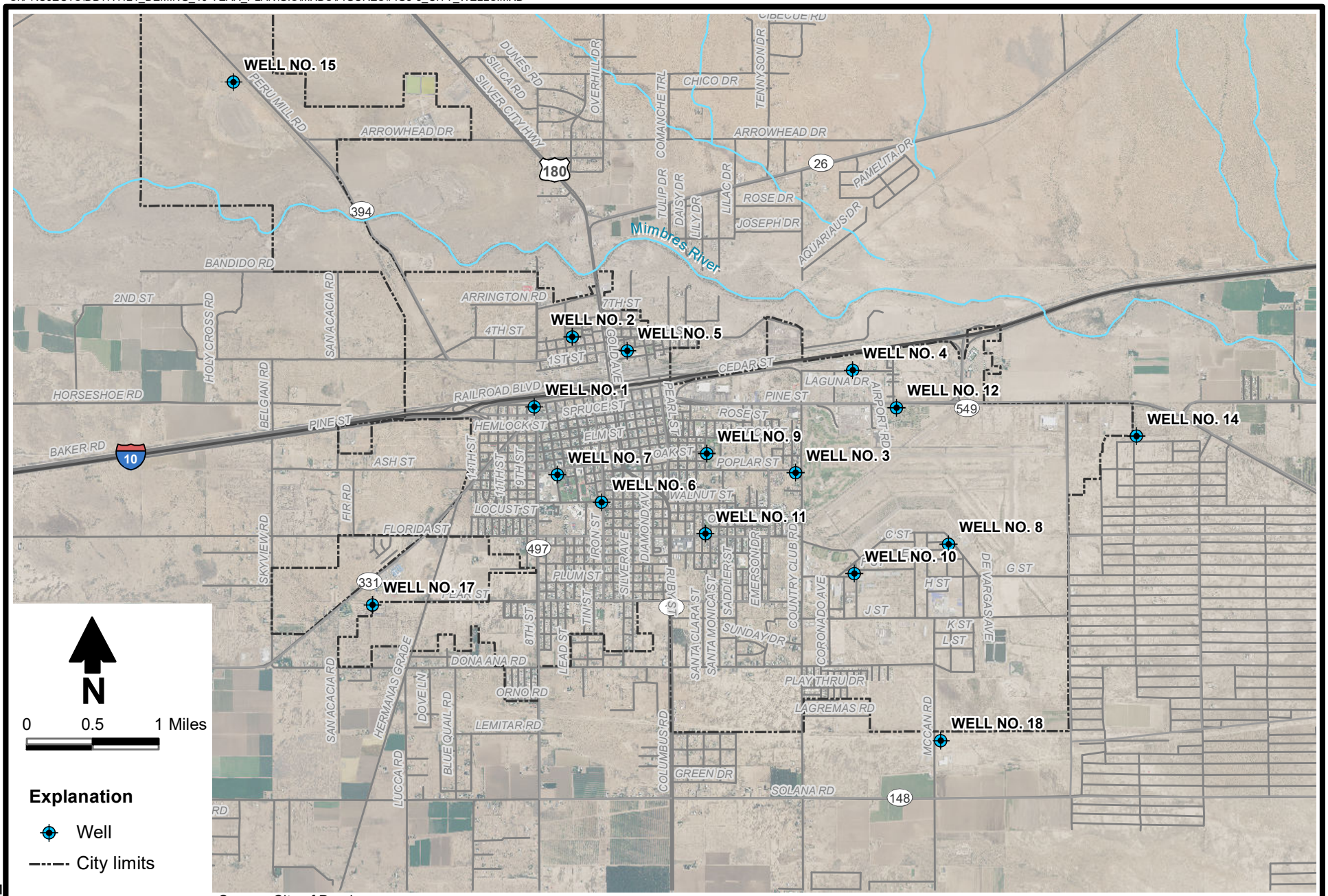

Source: City of Deming

Figure 3-3

DEMING 40-YEAR WATER PLAN

City Wells

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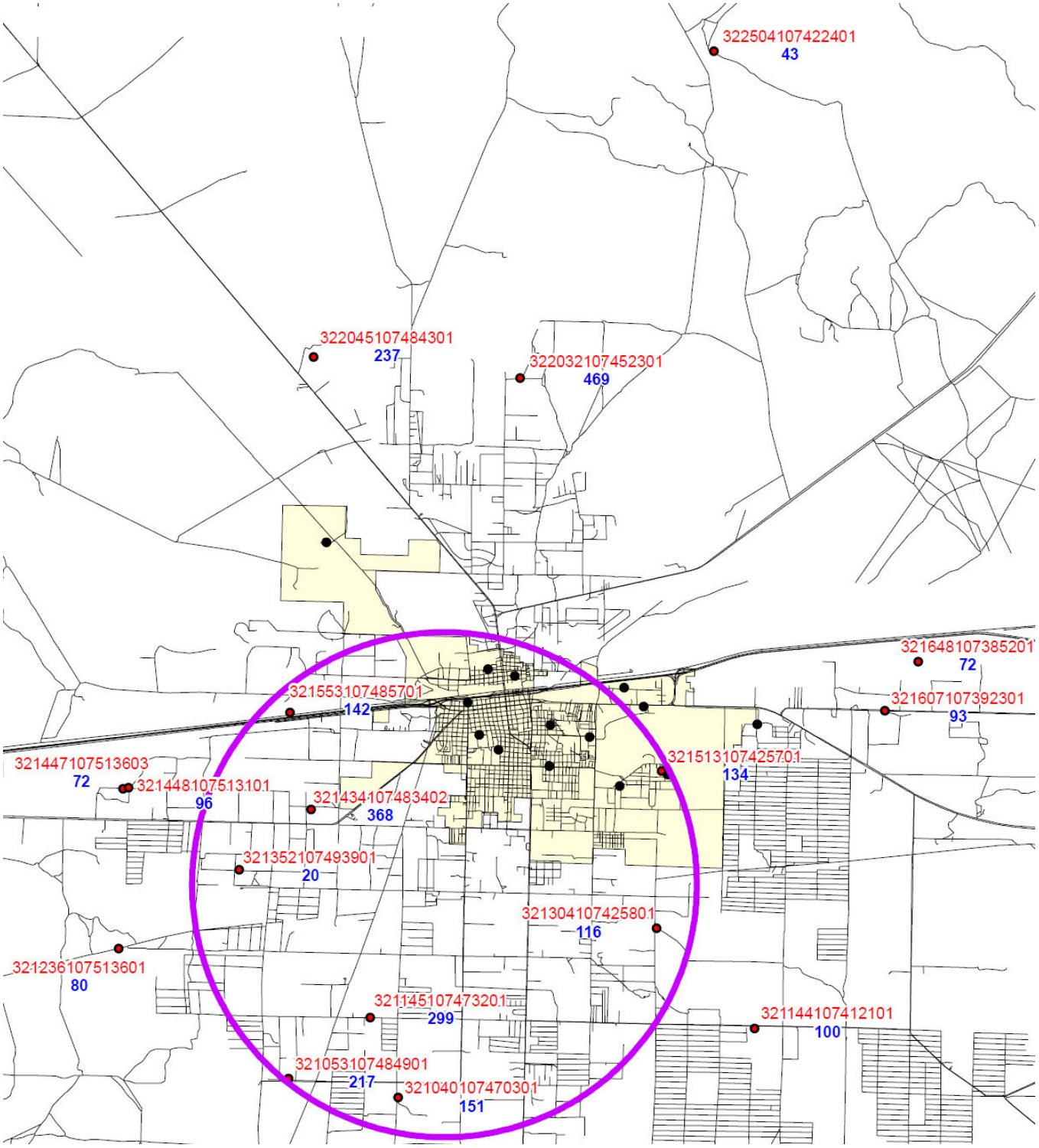

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DEMING 40-YEAR WATER PLAN

City Wells, Monitor Wells, and Aquifer Thickness

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1/3/2019 JN DB17.1121

Figure 3-4

Table 3-2. Change in Water Levels in USGS-Monitored Wells near Deming

Aquifer	Well ID	Change in Water Level			
		Period of Record		Amount [a] (feet)	Average Rate (ft/yr)
		Dates	No. of Years		
Alluvial	321145107473201	1958-1997	39	–36.20	–0.63
	321304107425801	1954-2002	48	–37.90	
	321352107493901	1939-2007	68	–35.56	
	321434107483402	1961-2012	51	–13.96	
	321513107425701	1942-2002	60	–48.59	
	321553107485701	1940-2012	72	–48.08	
	321607107392301	1931-2002	71	–46.02	
	321648107385201	1950-2002	52	–22.53	

Source: USGS, 2018 ft/yr = Feet per year

[a] Negative numbers signify a drop in water levels.

Groundwater flow models developed by the New Mexico Office of the State Engineer (NMOSE) predict much greater water level decline rates than those observed in the USGS monitor wells. The NMOSE drawdown estimates for 2020, 2040, and 2060 from the models indicate that the water table will decline on average approximately 1.75 ft/yr between 2000 and 2060 (Johnson et al., 2002). The NMOSE report concludes that estimated demand will exceed existing capacity of the Deming well field by the year 2015 and that Deming will therefore need to drill more wells to meet future demands. However, the NMOSE models simulated a higher rate of production than is currently predicted for future demand by the City of Deming: whereas the NMOSE model simulated well production of 16,442 ac-ft/yr in 2060, this planning document predicts a demand between 4,200 and 6,400 in 2060.

The Southwest New Mexico Regional Water Plan (NMISC/NMOSE, 2017) evaluated potential declines in groundwater resources based on model-predicted drawdown in a heavily stressed section within the area covered by the NMOSE Mimbres Basin model (Cuddy and Keyes, 2011). Decline in the Deming area was selected, as it was the maximum decline predicted by the model. Heavily stressed areas represent the locations most likely to be impacted in the future. While there is uncertainty in predicting the amount of drawdown, the plan recognized that there will be reductions in supply and that continued pumping at 2010 levels will not be likely without

relocating wells to new sources of supply away from heavily stressed areas, subject to the NMOSE permitting process. Using this approach, the supply in a normal (i.e., no drought) year during decade 2060 for the Mimbres Basin in Luna County was calculated to be 14 percent less than the 2010 supply, reduced from 40,200 ac-ft/yr to 34,400 ac-ft/yr (NMISC/NMOSE, 2017).

Water levels in the vicinity of Deming are also impacted by local irrigation wells. Most of the wells in the vicinity of Deming are less than 500 feet deep (Figure 3-5). Longworth et al. (2013) reports that in 2010, 24,800 acres were irrigated in the Mimbres Basin within Luna County, diverting more than 33,000 ac-ft/yr from the aquifer.

3.2 Surface Water

The City of Deming is located within the Mimbres River surface water basin. The Mimbres River is not a direct source of water supply for the City of Deming. The only perennial stream reach in the basin is part of the Mimbres River, which drains the Cooke's Range in the north and whose entire flow either evaporates, is transpired by plants, or recharges the Mimbres Basin. The Mimbres River is perennial only in its upper reaches; it is ephemeral below the USGS stream gage located at Faywood in northern Luna County, and surface water flow occurs in the Deming area (just north of Deming) only during periods of heavy rainfall. Mimbres River headwaters are located in Grant County, and the full river basin includes parts of Grant, Sierra, Doña Ana, and Luna Counties. The Mimbres River Basin is a closed basin, indicating that no surface water flows out from the basin.

3.3 Water Quality

Current and potential uses of Deming's water resources require that the groundwater be protected from contamination. Sources of contamination are of two types: (1) point sources, originating from a single location, or (2) nonpoint sources, originating over a more widespread or unspecified location. Additionally, there can be water quality issues due to naturally occurring constituents in the groundwater. Naturally occurring and anthropogenic contamination in Deming's city supply wells is discussed in Section 3.3.1. Point and nonpoint contamination sources in and near Deming are reviewed in Sections 3.3.2 and 3.3.3, respectively.

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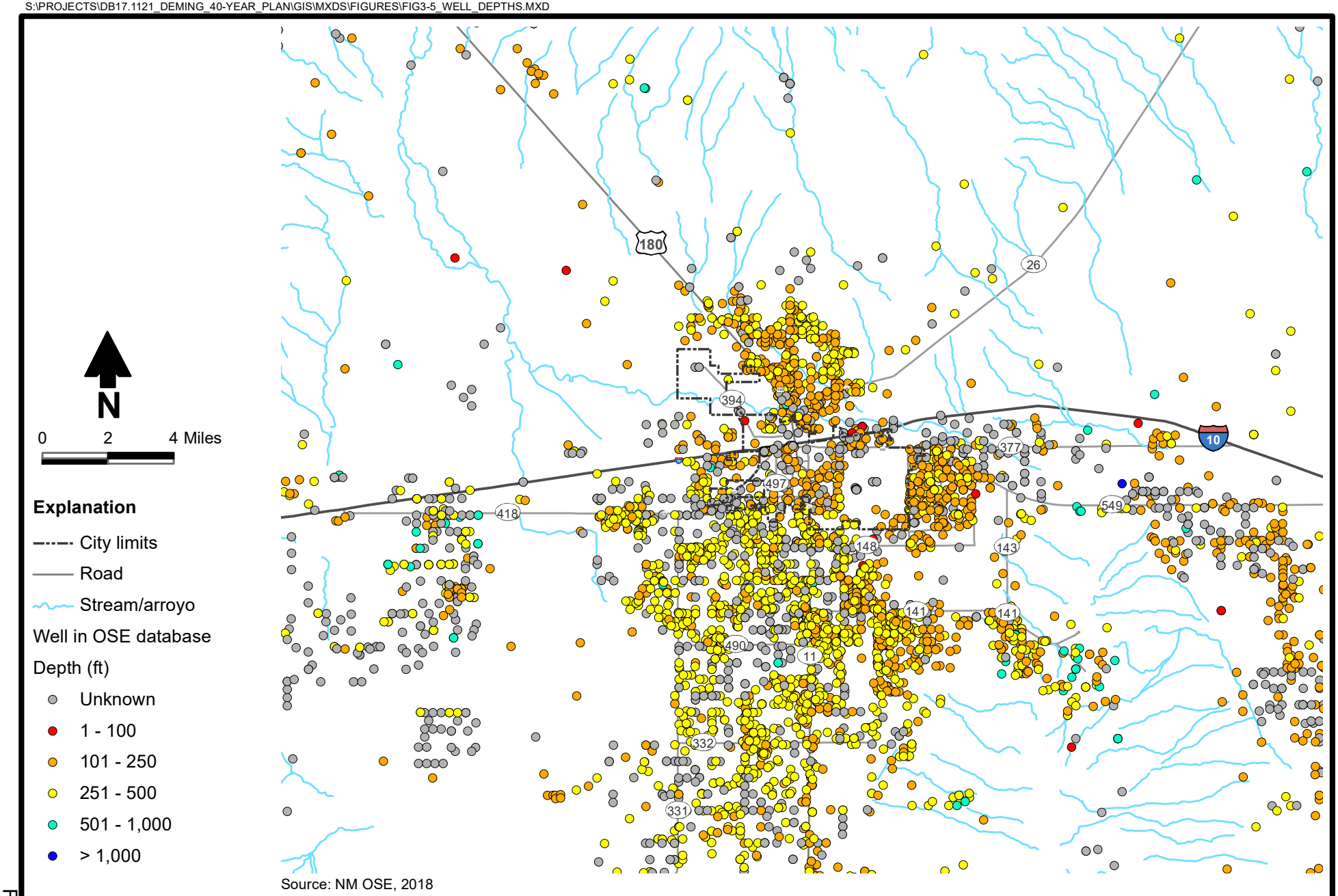

Source: NM OSE, 2018

Figure 3-5

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DEMING 40-YEAR WATER PLAN

Depths of Wells Near Deming

3.3.1 Deming Drinking Water Quality

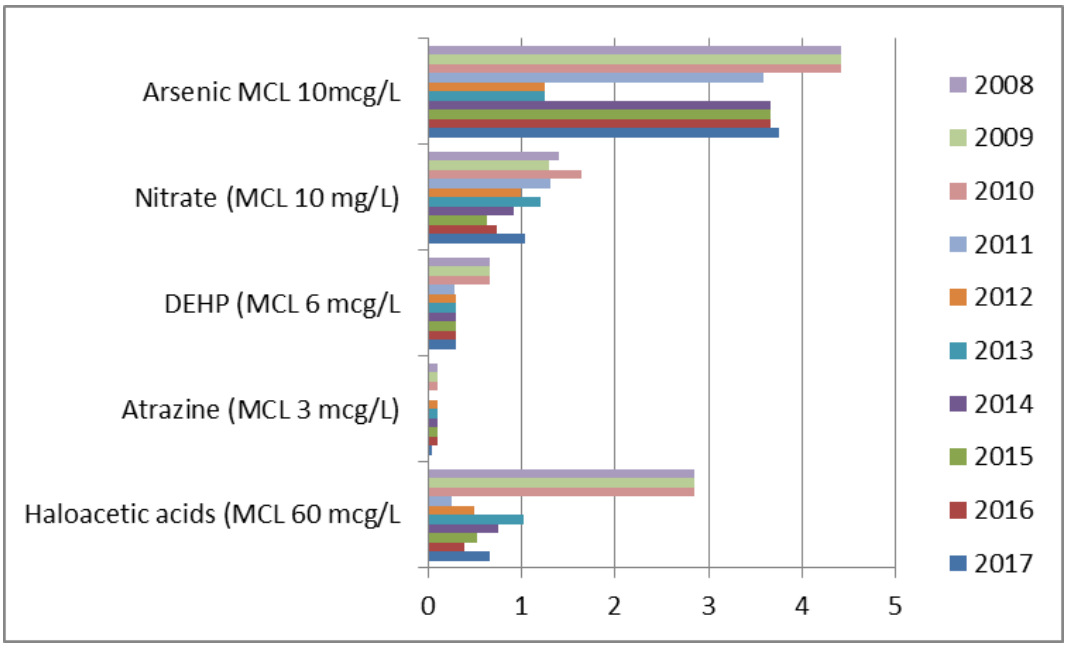
Deming production wells withdraw water from the Quaternary alluvium and Tertiary Gila Group in the Mimbres Groundwater Basin (Section 3.1.1). Hawley et al. (2000) indicated that the water quality of the alluvium in the vicinity of Deming was excellent, with total dissolved solids (TDS) values less than 250 milligrams per liter (mg/L) (aesthetic standard is 1,000 mg/L) and sulfate less than 25 mg/L (aesthetic standard is 600 mg/L)]). According to Hanson et al. (1994), however, groundwater quality concerns existed during the mid-1990s due to septic tanks and salinity in the area north of Deming. Those concerns were partially addressed by connecting that area to the County sewer system, but salinity is still present.

In addition, as discussed in Section 3.3.2.3, operations at Highway 549 Solvents, an active Superfund site 4 miles east of town, were suspected of contaminating groundwater with chlorinated solvents (NMWQCC, 2002). This site was investigated under the Superfund program, but due to its rural setting and the low population density, it did not meet the criteria for remedial action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The New Mexico Environment Department (NMED) continues to monitor the area to determine if site conditions change such that additional action under CERCLA is warranted.

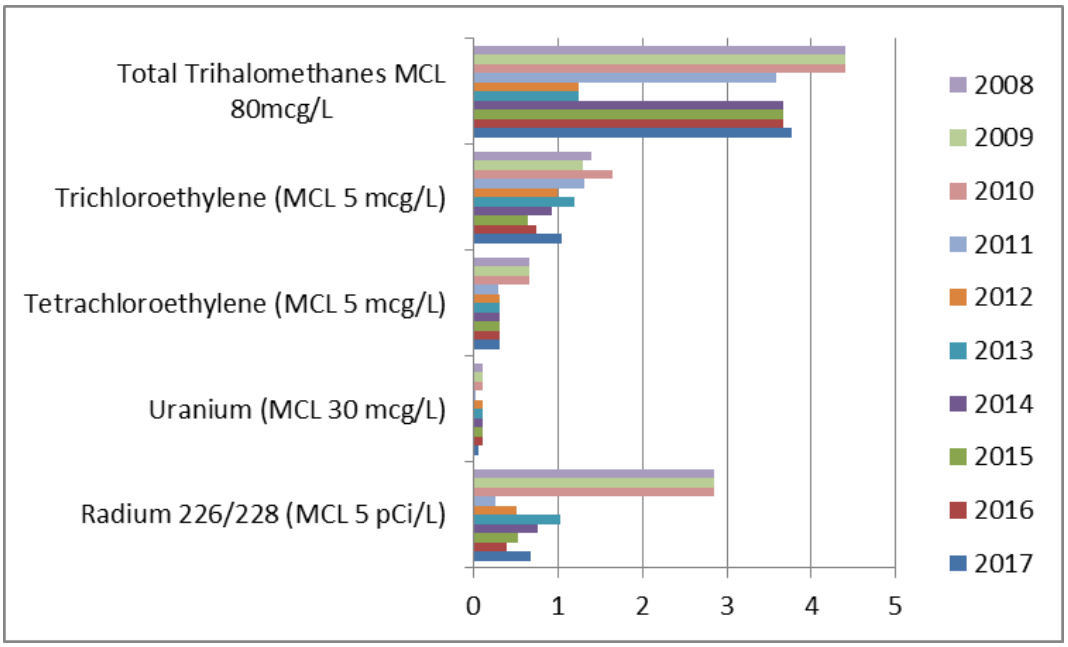
Water quality sample results are available from NMED Drinking Water Bureau (DWB) for New Mexico water systems, and data available for the Deming Municipal System were reviewed. A review of Deming contaminant analytical data indicates that water quality is good and water quality standard exceedances are rare. New Mexico Environmental Public Health Tracking data for the Deming Municipal Water System over the period 2008-2017 indicates recent improvements for several contaminant analytes (Figure 3-6). However, salinity of groundwater near Deming is expected to increase as the depth to groundwater increases, so Deming could face water quality issues in the future if groundwater levels decline.

Arsenic, an inorganic constituent that occurs naturally in groundwater, may be of particular concern to Deming in the future, due to a reduction in the U.S. Environmental Protection Agency (EPA) arsenic maximum contaminant level (MCL)—down to 10 micrograms per liter (µg/L) (0.010 mg/L)—that became effective in January 2006. The mean concentration of arsenic

a. Arsenic, Nitrate, Di(2-ethylhexyl)phthalate (DEHP), Atrazine, and Halocetic Acids



b. Total Trihalomethanes, Trichloroethylene, Tetrachloroethylene, Uranium, and Combined Radium 226 and 228



Source: NMEPHT, 2018

MCL = Maximum contaminant level (standard set by U.S. EPA [2009] for drinking water quality)

decreased from 4.41 µg/L in 2008, 2009, and 2010, to 3.59 µg/L in 2011, and to 1.25 µg/L in 2012 and 2013, but it was again higher in 2015, 2016, and 2017 (Figure 3-6). The 2009 40-Year Water Plan noted that Well 16 was the only well where the arsenic concentration had exceeded the new drinking water quality standard (the standard for fluoride had also been exceeded in this well). Well 16, which was an old irrigation well purchased as part of a water right transaction, was never connected to the City system and had since been abandoned.

The City of Deming has a source water protection plan to ensure the future safety of its water supply.

3.3.2 Point Sources of Groundwater Contamination

In 2002, the New Mexico Water Quality Control Commission (NMWQCC) reported the following statewide frequency of groundwater impacts from various point sources:

- Underground (fuel) storage tanks (USTs) 58.5 percent
- Oil and gas 13.7 percent
- Miscellaneous industry 10.1 percent
- Centralized sewage works 4.5 percent
- Mining 3.7 percent
- Aboveground (fuel) storage tanks/pipelines 3.4 percent
- Dairies and meat packing 2.8 percent
- Landfills 0.8 percent
- Unknown/other 2.5 percent

Figure 3-7 shows potential sources of contamination within Deming city limits. These include:

- 9 aboveground storage tank (AST) sites
- 20 underground storage tank (UST) sites
- 9 leaking LUST sites
- 2 voluntary remediation program (VRP) sites
- 6 active groundwater discharge permits

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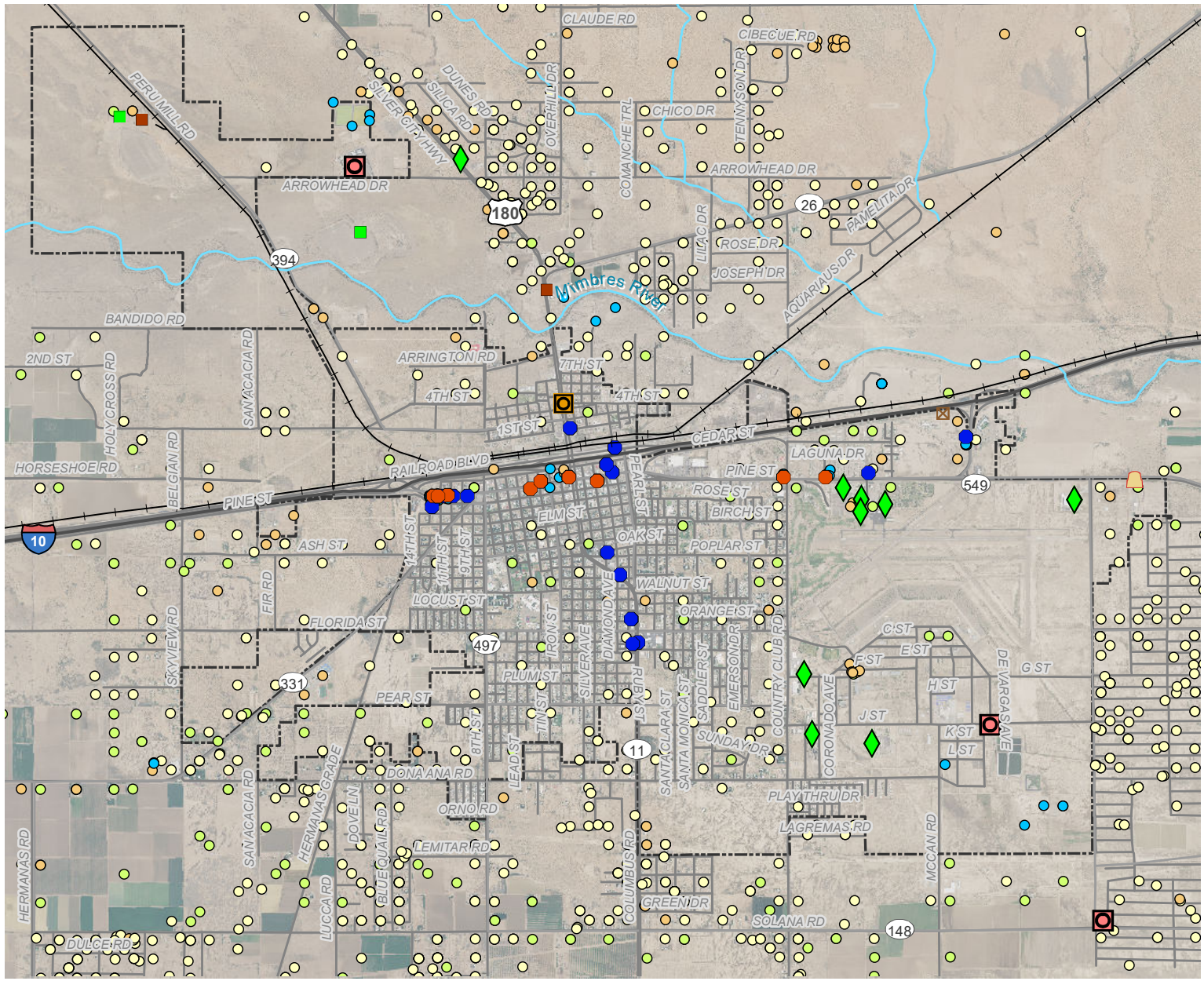

Source: NMED, 2018b

Figure 3-7

DEMING 40-YEAR WATER PLAN

Potential Sources of Contamination

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There are currently no abatement sites, animal feeding operations, National Pollutant Discharge Elimination System (NPDES), or active gas wells in Deming.

3.3.2.1 Underground Storage Tanks

Leaking USTs are one of the most significant point source contaminant threats to groundwater. As of July 12, 2018, NMED was reporting 12 active leaking USTs in the Deming area (Table 3-3), 9 of which are located within city limits (Figure 3-7) with the other 3 to the west along I-10. Active cases include those in the pre-investigation, investigation, cleanup, and monitoring phases (NMED PSTB, 2018). These UST facilities all pose possible risk to the environment, but are not currently being investigated by the NMED.

Table 3-3. Active Leaking Petroleum Sites Within City of Deming Municipal Boundaries

Release Name	RID	FID	Address	Status
Sun Mart 681	4600	51556	2319 E Motel Dr	Investigation, Responsible Party
Cano's Restaurant	4654	54744	1200 W Pine	Cleanup, Responsible Party
Savoy Truck Stop	3060	9762	14150 Highway 418 SW	Cleanup, Responsible Party
Savoy Truck Stop	4073	9762	14150 Highway 418 SW	Investigation, Responsible Party
Save Gas - No3	4089	27658	1312 W Pine	Cleanup, Responsible Party
On Sale Tire Co	3042	27082	101 W Pine St	Cleanup, Responsible Party
Deming Bulk Plant	4559	30038	2701 E Pine	Cleanup, Responsible Party
SAV-O-MAT C	3521	30493	321 W Pine St	Investigation, Responsible Party
TRIANGLE TRUCK STOP	3401	31200	1300 W Pine	Cleanup, Responsible Party
GONZALES SELF SERVE	2014	31494	422 W Pine	Cleanup, Responsible Party
Stuckeys Deming	2966	1843	15 Miles W of Deming ON I-10	Cleanup, Responsible Party
Snappy-Mart #258	2892	1805	306 E Pine	Investigation, Responsible Party

Source: NMED PSTB, 2018 RID = Release ID
FID = Facility ID

3.3.2.2 Groundwater Discharge Plans

The NMED Ground Water Quality Bureau (GWQB) regulates facilities with wastewater discharges that have a potential to impact groundwater quality. These facilities must comply with the NMWQCC regulations and obtain approval of a discharge plan, which provides for measures needed to prevent and detect groundwater contamination. In particular, NMWQCC regulations require cleanup of groundwater contamination detected under discharge plan

monitoring requirements, as any contamination discharged by these facilities affects the quantity and availability of the water supply. A variety of facilities fall under the discharge plan requirements, including sewage dischargers, dairies, food processors, sludge and septage disposal, and other industries.

As of 2018, six facilities with active discharge plans (NMED GWQB, 2018) were present in the Deming area (Figure 3-7). Four of the discharge locations are part of the City's WWTP. The other two facilities include the Ben Archer Health Center and the Luna Energy Facility. Details indicating the status of these discharge plans, waste type, and treatment for individual permittees can be obtained from the NMED web site (http://www.nmenv.state.nm.us/gwb/New_Pages/docs_policy/web_dp_list.xls).

3.3.2.3 Superfund Sites

CERCLA was enacted by the U.S. Congress on December 11, 1980. This law created the Superfund program to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. The EPA prepares a National Priorities List (NPL) that identifies, through a hazard ranking system, which Superfund sites warrant remedial action. Currently, no sites within Deming are included on the NPL (Table 3-4). Two Superfund sites in Deming are active (Figure 3-7); four more are archived (U.S. EPA, 2018a).

Table 3-4. Active Superfund Sites in Deming

EPA ID	Site Name	City	NPL Status
NM0000605167	Highway 549 Solvents	Deming	Not listed
NMD097119986	Peru Hill Mill	Deming	Not listed

Source: U.S. EPA, 2018a

EPA = U.S. Environmental Protection Agency
NPL = National Priorities List

Contamination at the Highway 549 Solvents site, located east of Deming near the junction of U.S. Highway 549 and State Road 377, was initially discovered in 1997 by a New Mexico Department of Health (DOH) water quality assessment of wells in southern New Mexico. Low levels of 1,1-dichloroethene (1,1-DCE) and 1,1,1-trichloroethane (1,1,1-TCA) were detected in samples collected from private domestic wells located approximately 2 miles east of the City.

NMED confirmed the results of the DOH investigation in 1998 and continued the investigation, sampling 41 drinking water wells. This investigation detected 1,1,1-TCA and 1,1-DCE in 11 of the sampled wells, 2 of which were found to be contaminated at concentrations exceeding the NMWQCC standards and federal MCL. Deming's water supply line was extended to serve those properties, and the domestic wells were abandoned (City of Deming, 2009). NMED's investigation under Superfund found that the site did not warrant listing on the NPL, due to the rural setting and its low population density. The site is listed as requiring no further remedial action (U.S. EPA, 2018b).

3.3.2.4 Landfills

Landfills used for disposal of municipal and industrial solid waste can contain a variety of potential contaminants that may impact groundwater quality. Landfills operated since 1989 are regulated under the New Mexico Solid Waste Management Regulations. Many small landfills throughout New Mexico closed before 1989 in order to avoid more stringent final closure requirements implemented in 1989.

The Butterfield Trail Regional Landfill is located 15 miles west of Deming, and it accepts contaminated soil, in addition to municipal solid waste and auto and truck tires. A waste transfer station is located on the east side of town. The Butterfield Trail Regional Landfill uses a liner to protect groundwater quality, and groundwater monitoring is being conducted.

3.3.2.5 Hazardous Waste

NMED provides regulatory oversight and management of hazardous waste in New Mexico under the federal Resource Conservation and Recovery Act (RCRA) of 1976. RCRA delegated authority to the U.S. EPA to control hazardous waste, including the generation, transportation, treatment, storage, and disposal of hazardous waste. Under RCRA, the NMED Hazardous Waste Bureau (HWB) provides regulatory oversight and technical guidance to hazardous waste generators and to treatment, storage, and disposal facilities in New Mexico. The objective of the HWB is to ensure protection of human health and the environment and to ensure that hazardous wastes are handled and disposed of and/or treated properly. No permitted hazardous waste facilities are located in the vicinity of Deming.

3.3.1 Nonpoint Sources of Groundwater Contamination

Nonpoint source pollution of groundwater is caused by widely dispersed sources of pollutants that often reach groundwater as the result of precipitation carrying pollutants from the land into sources of water. The principal contaminants contributed from this type of pollutant source are nutrients, sediments, toxic substances, organic matter, salts, metals, and petroleum and its byproducts.

A primary water quality concern in New Mexico is shallow groundwater contamination due to septic systems (NMED, 2016), because they are generally spread throughout rural and urban areas, are considered a nonpoint source. Most of the serious septic system impacts occur where groundwater is shallow. In these areas, septic system discharges can percolate rapidly to the underlying aquifer and increase concentrations of:

- Total dissolved solids (TDS)
- Iron, manganese, and sulfides (anoxic contamination)
- Nitrate
- Potentially toxic organic chemicals
- Bacteria, viruses, and parasites (microbiological contamination)

Collectively, septic systems and other on-site domestic wastewater disposal constitute the single largest known source of groundwater contamination in New Mexico (NMED, 2016). Many of these occurrences are in the shallow water table areas.

Protection of shallow groundwater quality in populous areas plays an important role in maintaining the available water resources in these areas. The NMED Liquid Waste (Septic Tank) Program regulates on-site disposal of liquid wastes, including septic tanks, under the Liquid Waste Disposal and Treatment Regulations, 20.7.3 NMAC (NMED, 2018a). A list of permitted liquid waste systems in and around Deming can be found on the NMED Liquid Waste (Septic Tank) Program web site (http://www.nmenv.state.nm.us/fod/LiquidWaste). More than 1,300 permitted septic tanks are present in and around Deming.

Other nonpoint sources of pollution include those associated with agriculture. The application of agricultural chemicals, such as pesticides and fertilizers, has led to contamination of groundwater at various locations in New Mexico with trace concentrations of various pesticides and nitrate (NMED, 2016).

4. Water Demand

This section discusses current and projected water demand that is supplied or anticipated to be supplied by the City of Deming water system.

4.1 Current Water Demand / Water Audit

In order to accurately evaluate current water demand, it is important to evaluate system efficiencies as well as metered and billed production. DBS&A used production and billing meter records to prepare a water audit of Deming water use during 2016 (Sections 4.1.1 and 4.1.2).

4.1.1 Water Demand by Sector

To analyze the City's metered water use, the accounts were divided into four demand sectors:

- *Residential:* Includes treated water sales to homes and trailers (residential per capita water use trends are discussed in Section 4.2).

- *Industrial, Commercial, and Institutional:* Includes treated water sales to local industry and businesses such as hotels, restaurants, and other commercial establishments including apartments and trailer parks, and to schools.

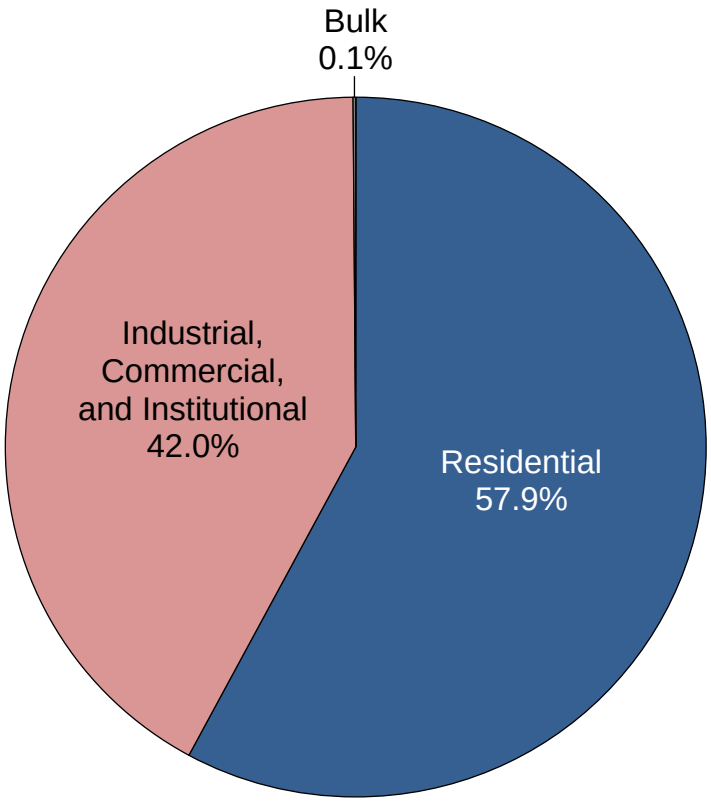
- *Bulk:* Includes metered use for temporary construction purposes.

- *Route 98 (Golf Course and Cemetery):* Includes unbilled metered water use for irrigation at City of Deming outdoor facilities.

The amount of water metered by month during 2016 for each of these sectors is provided in Table 4-1. The breakdown of billed water by demand sector in 2016 is provided in Figure 4-1, which shows that the residential sector used the majority of water in 2016 (58 percent).

Table 4-1. City of Deming Metered Water Use by Sector in 2016

Month	Metered Water Use (gallons)					
	Residential	Industrial, Commercial, and Institutional	Bulk	Total Billed	Route 98 *	Total
January	29,844,200	23,113,000	0	52,957,200	1,368,597	54,325,797
February	27,235,600	21,090,800	0	48,326,400	1,368,597	49,694,997
March	32,893,900	20,481,700	0	53,375,600	1,368,597	54,744,197
April	48,821,600	30,007,800	0	78,829,400	1,368,597	80,197,997
May	46,096,200	28,822,400	0	74,918,600	1,368,597	76,287,197
June	55,616,100	29,508,800	384,600	85,509,500	47,184,451	132,693,951
July	60,435,400	33,983,900	0	94,419,300	43,956,232	138,375,532
August	58,789,100	36,785,500	76,400	95,651,000	19,555,692	115,206,692
September	58,257,100	50,693,800	77,500	109,028,400	16,403,380	125,431,780
October	33,540,000	41,046,200	34,900	74,621,100	12,986,643	87,607,743
November	37,280,400	35,954,900	294,800	73,530,100	12,717,811	86,247,911
December	27,587,800	23,028,600	242,736	50,859,136	8,967,000	59,826,136
Total (gallons)	516,397,400	374,517,400	1,110,936	892,025,736	168,614,194	1,060,639,930
Total (acre-feet)	1,584.5	1,149.2	3.4	2,737.1	517.4	3,254.5



Total billed water use:
892,025,736 gallons
(2,737.1 acre-feet)

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DEMING 40-YEAR WATER PLAN

City of Deming
Billed Water Use by Sector in 2016

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Figure 4-1

4.1.2 Water Audit

The American Water Works Association (AWWA) water audit balance format is illustrated in Figure 4-2. Appendix A contains a printout of the completed AWWA water audit spreadsheet for 2016, along with the grading matrix tables. Table 4-2 compares the results of the 2016 audit to the North American dataset of validated water audit data for utilities with less than 50,000 connections.

Table 4-2. Deming AWWA Water Audit Results, 2016

Item	North American Dataset (2011 average)	City of Deming 2016
Non-revenue water (% by volume)	24.1	22.3
Non-revenue water (% by cost)	9.3	4.6
Apparent losses (gallons per connection per day)	10.38	7.82
Real losses (gallons per connection per day)	58.71	30.85
Customer retail unit cost ($/1,000 gallons)	5.09	2.35
Variable production cost ($/1,000 gallons)	0.98	0.41
Infrastructure leakage index	3.51	2.31
Water audit data validity score	70.44	53

When considering an audit of water use data, it is important to evaluate the accuracy of the data, which for Deming is collected through production and customer water meters. Meter error is most accurately estimated by performing system-specific field surveys. Annual meter accuracy and calibration surveys are not routinely conducted by the City. Production meters were replaced in 2012 and again 2017; therefore, error for the production meters has been estimated at 1 percent. Accuracy surveys for the customer meters are not routinely conducted; customer meter error has been estimated at 1 percent. Database errors were estimated at 0.25 percent for this analysis.

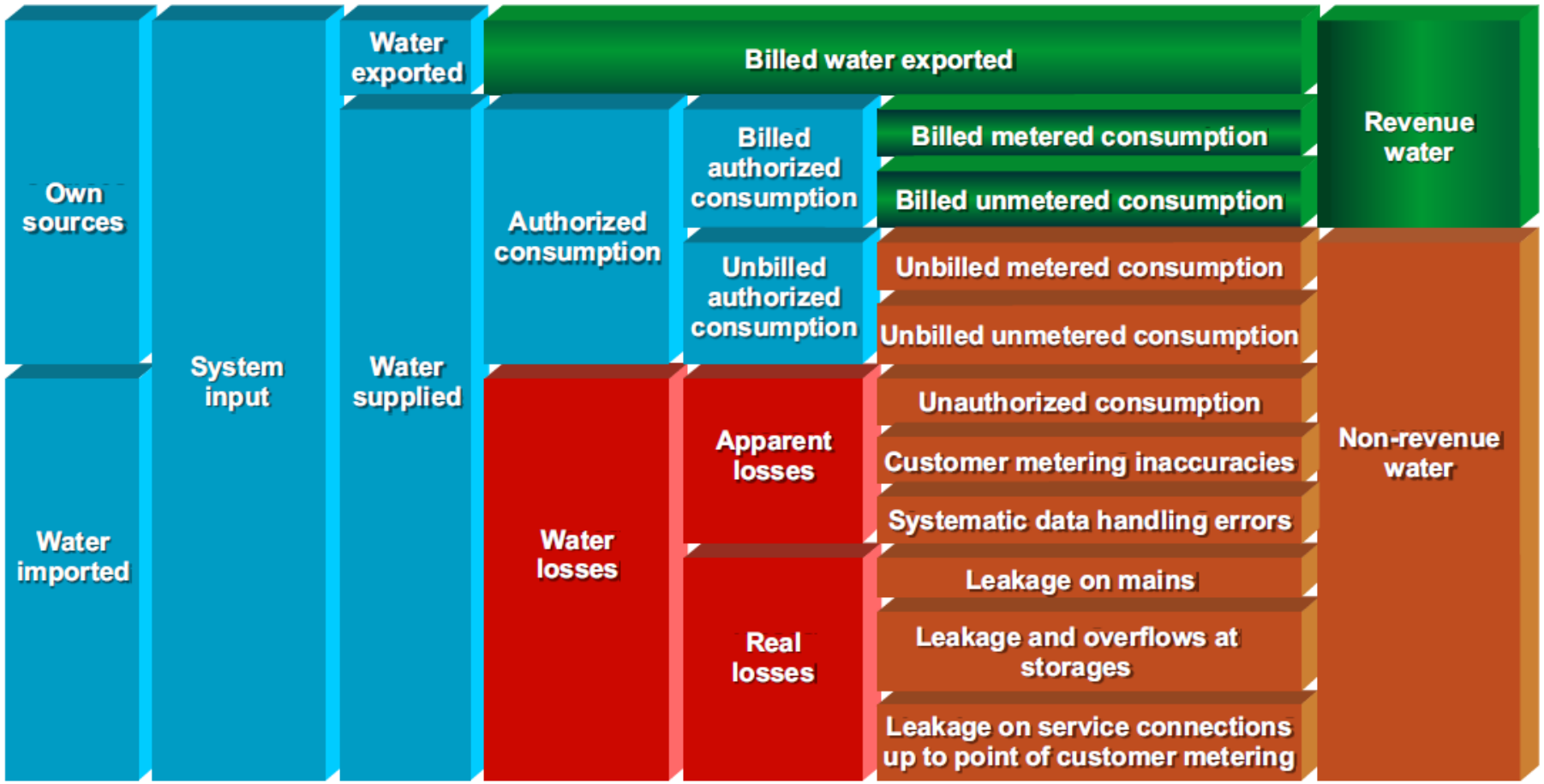

Figure 4-2

DEMING 40-YEAR WATER PLAN

AWWA Water Audit Format

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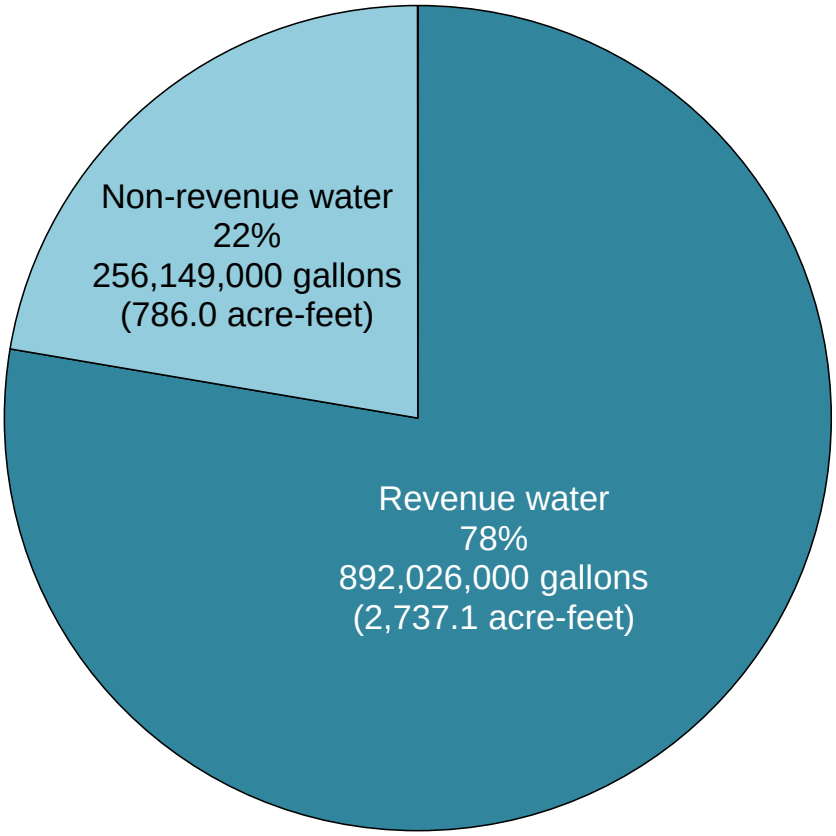
Because the production meter error, customer meter error, and database error were estimated for the audit, the values presented in Table 4-2 and Appendix A for total potential real water loss and total non-revenue water are also estimates. The AWWA water audit balance methodology includes estimates for real water losses, such as leaks, and for unaccounted-for water, such as water use that is not metered. In Deming there is authorized unbilled unmetered consumption that affects the water audit balance (estimated at 1.25 percent) and potentially unauthorized consumption (estimated at 0.25 percent).

Figure 4-3 shows the breakdown between revenue and non-revenue water for the City in 2016. Revenue water consists of billed water by demand sector (residential, industrial, commercial, institutional, and bulk sales) within the City of Deming. Non-revenue categories include total authorized unbilled metered use, total authorized unbilled unmetered use, total apparent losses (estimated customer meter error), and total potential real water loss (calculated by subtracting authorized consumption and apparent losses from adjusted production). A breakout for each of the non-revenue categories in 2016 is shown in Figure 4-4.

Several public works and water utility operations are part of the unbilled authorized use:

- City landscape irrigation
- Hydrant flushing
- Main line flushing or dead end line flushing
- Flushing and disinfection of water lines
- Other public works construction activities
- Street sweeping
- Cleaning the sanitary sewer system

Whether metered or unmetered, these activities contribute to the volume of non-revenue water. Further analysis of water use practices and data will allow the City to quantify these different types of water use.



DEMING 40-YEAR WATER PLAN

City of Deming
Revenue and Non-Revenue Water Use in 2016

Figure 4-3

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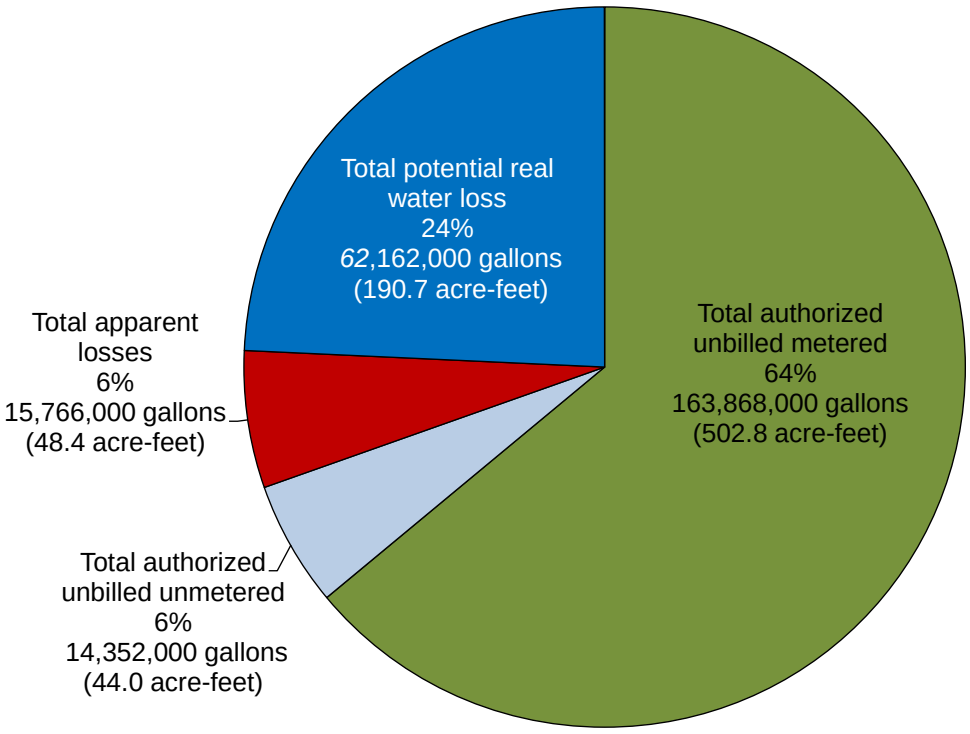

DEMING 40-YEAR WATER PLAN

City of Deming
Non-Revenue Water in 2016

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Figure 4-4

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4.2 Water Use Trends

Billed monthly water use by sector for 2016 is illustrated on Figure 4-5 , which demonstrates that residential water use is typically highest during the summer months, while industrial, commercial, and institutional water use is typically highest during the fall months, likely due to the chili harvest. Figure 4-6 shows unbilled monthly water use during 2016 and 2017. Data for January through May 2016 are the same value, possibly due to a meter or database error; therefore data for 2017 was obtained to conduct the seasonal analysis.

The increase in summer water use was calculated by subtracting the mean billed winter water use (January, February, and December) from the mean billed summer water use (June, July, and August) for each demand sector (Table 4-3). The largest increase in summer water use occurs in the residential sector Figure 4-7. The difference is traditionally attributed to outdoor uses such as irrigation and evaporative coolers.

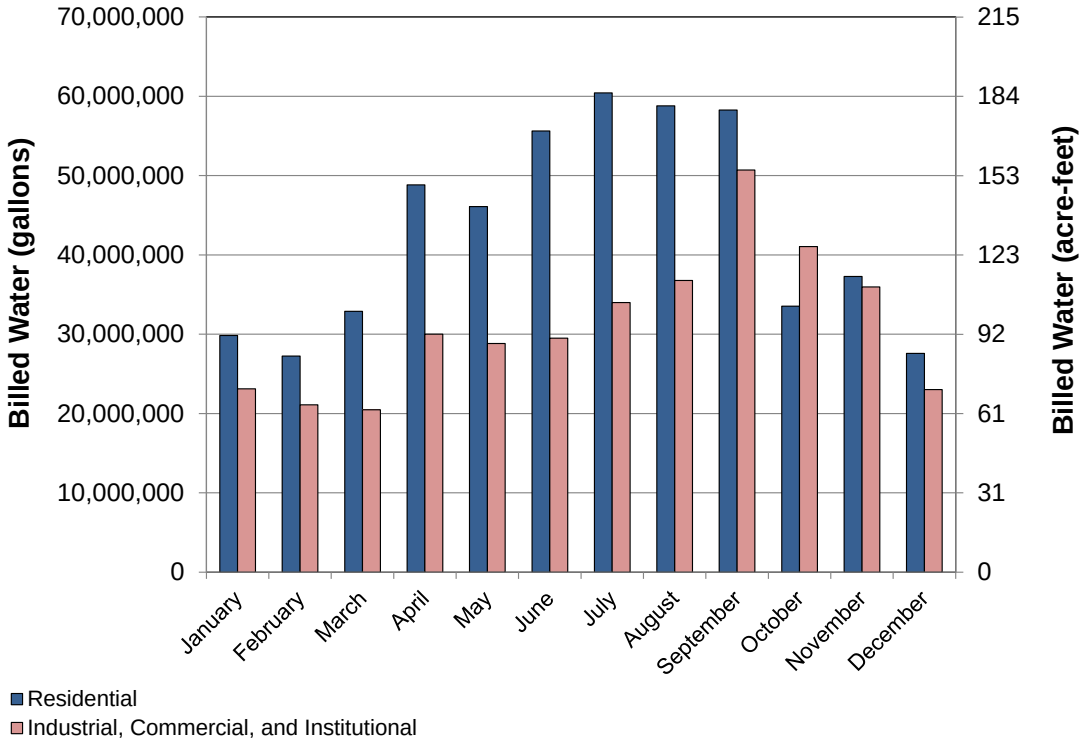
Table 4-3. Calculated Increase in Summer Water Use

	Metered Water Use Average, 2016 (gallons)				
Season	Residential	Industrial, Commercial, Institutional	Bulk	Route 98 [a]	Total
Winter mean	28,222,533	22,410,800	80,912	3,460,426	54,174,671
Summer mean	58,280,200	33,426,067	153,667	20,994,581	112,854,515
Increase in summer water use (gallons)	30,057,667	11,015,267	72,755	17,534,156	58,679,844
Increase in summer water use (acre-feet)	92.23	33.80	0.22	53.80	180.05

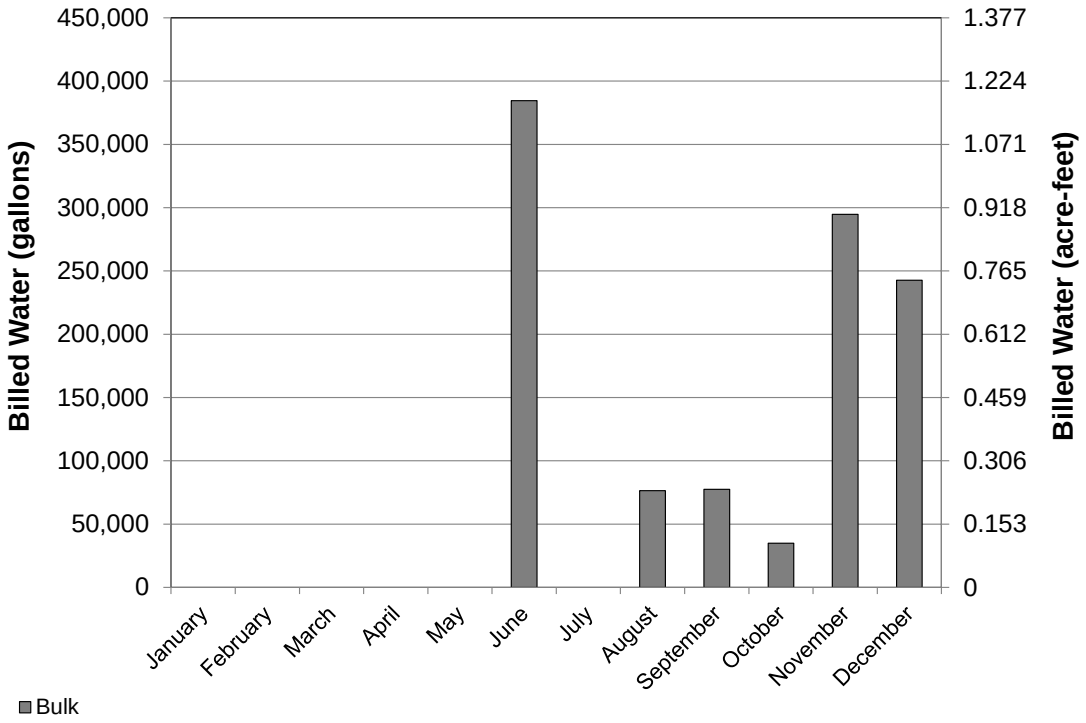
[a] Amounts based on 2017 monthly data.

The NMOSE has developed a GPCD (gallons per capita per day) calculation methodology to standardize per capita water use calculations in New Mexico. These values provide a baseline of water use that is not as susceptible to changes in population and can be used to evaluate water conservation potential and to track conservation programs' implementation results (NMOSE, 2015). The user inputs population, household size, and occupancy data from the most recent U.S. Census, as well as system-specific monthly data for as many as seven years at a time, and the GPCD calculator returns per capita values for several categories (NMOSE, 2015). The NMOSE GPCD calculator can be easily updated as more data become available, providing water suppliers with comparisons in per capita use over time.

a. Residential and Industrial / Commerical / Institutional



b. Bulk Sales



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DEMING 40-YEAR WATER PLAN

City of Deming

Monthly Water Use in 2016

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Figure 4-5

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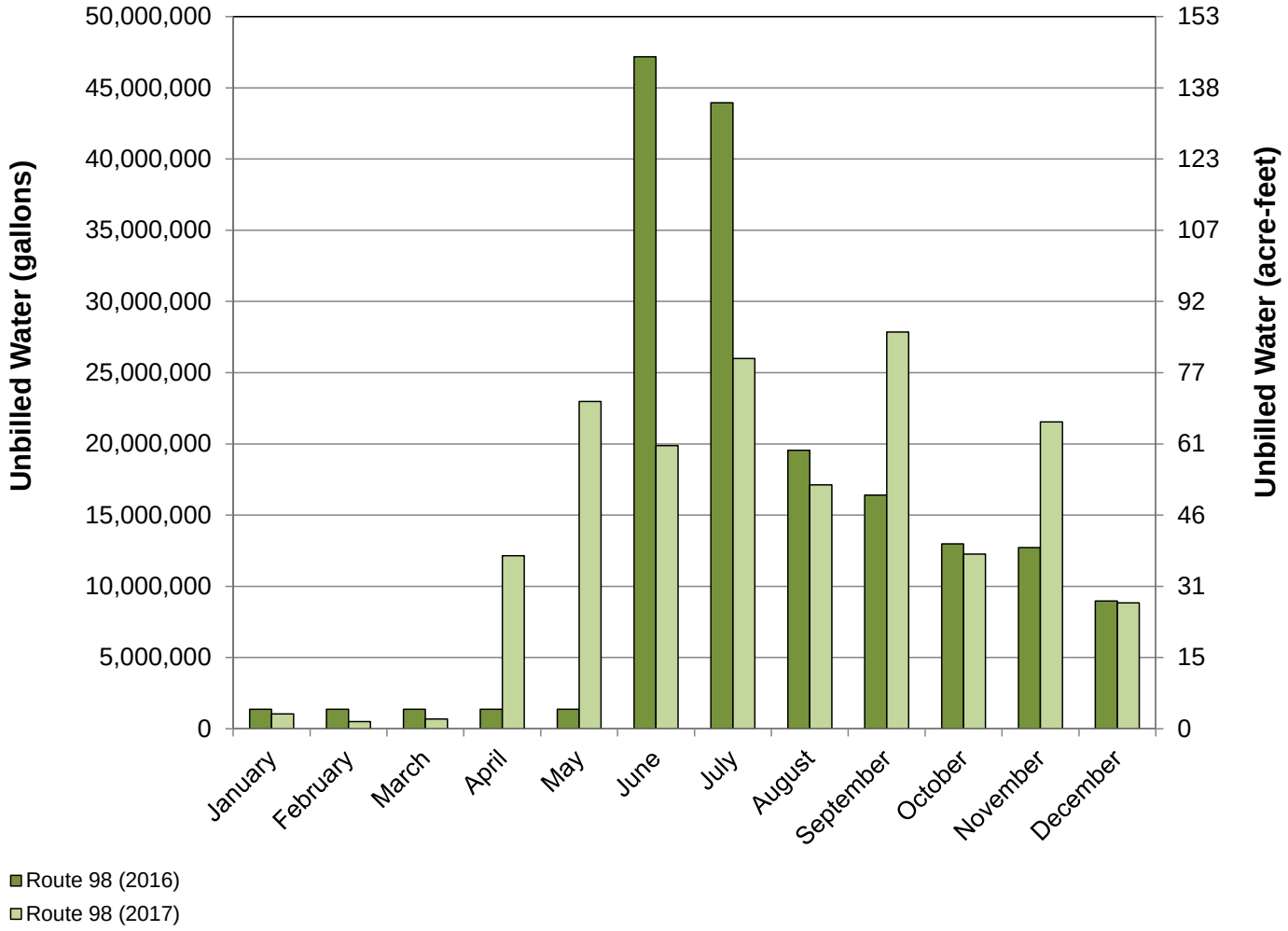

Figure 4-6

DEMING 40-YEAR WATER PLAN

City of Deming

Unbilled Water Use by Sector in 2016 and 2017

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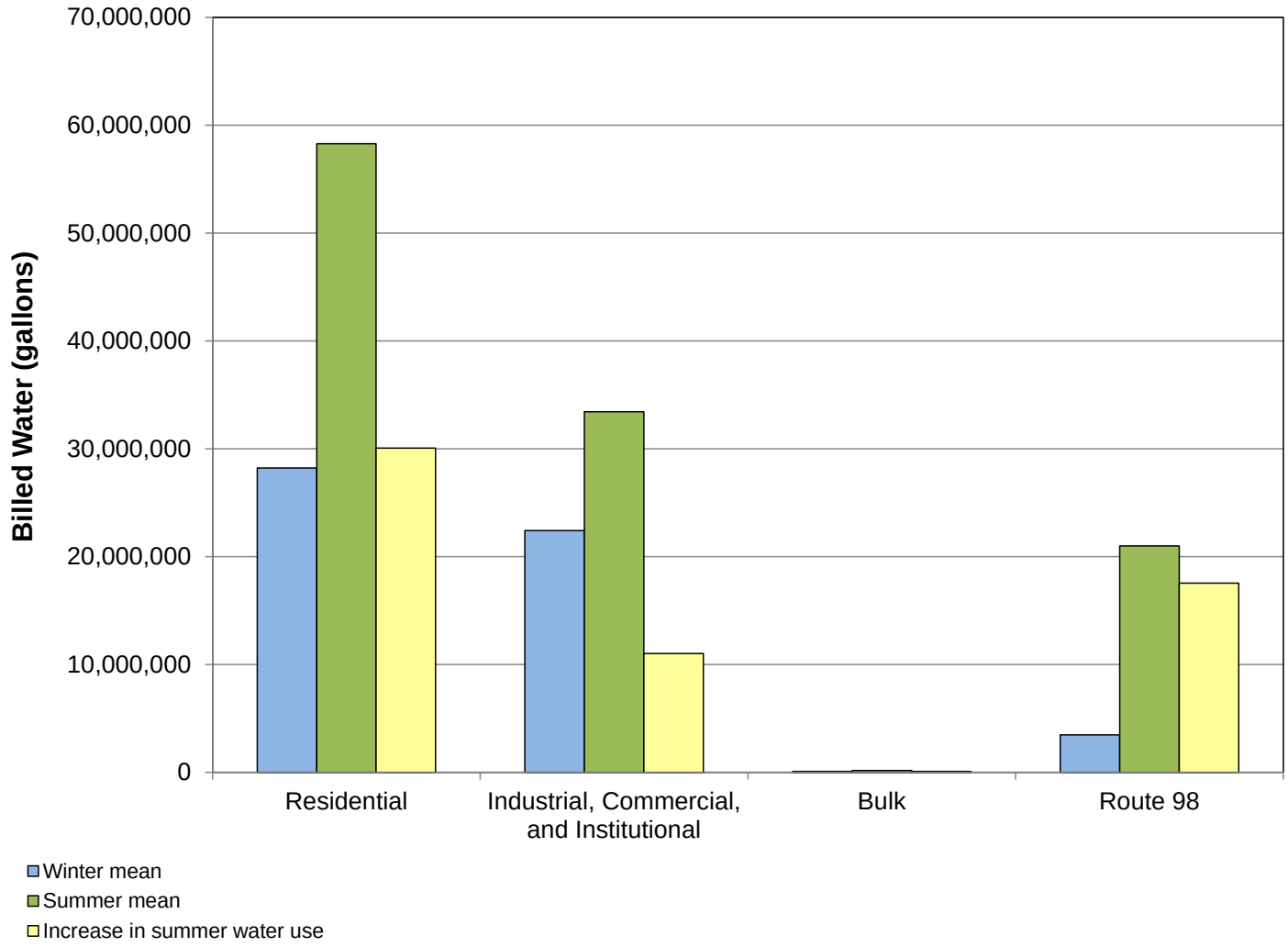

Figure 4-7

DEMING 40-YEAR WATER PLAN

City of Deming

Winter vs. Summer Water Use in 2016

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The GPCD calculator was used to calculate the City's per capita use for 2016 (Appendix B). Figure 4-8 shows the annual overall system per capita use by sector for the City of Deming during 2016. The GPCD calculator was also used to calculate the City's per capita use on a monthly basis for 2016. The 2016 monthly residential per capita values are shown in Table 4-4.

Table 4-4. City of Deming Monthly and Annual Residential Per Capita Water Use for 2016

Month	System Per Capita Residential Use [a] (gallons per day)
January	82
February	83
March	90
April	138
May	126
June	156
July	166
August	161
September	166
October	92
November	106
December	76
Annual Average	120

[a] Results derived using data in the NMOSE GPCD calculator (Appendix B; NMOSE, 2015).

Another simple method of calculating annual per capita use is to divide the total water produced by the population served. This method provides a good estimate of the relative magnitude of the per capita use when all of the monthly data needed for the NMOSE GPCD calculator are not available. Based on the estimated population in Deming during 2016 of 14,488 individuals, the City of Deming residential per capita demand averaged 98 gallons per capita per day (gpcd) during 2016. The average per capita demand for all sectors of water use was 236 gpcd during 2016.

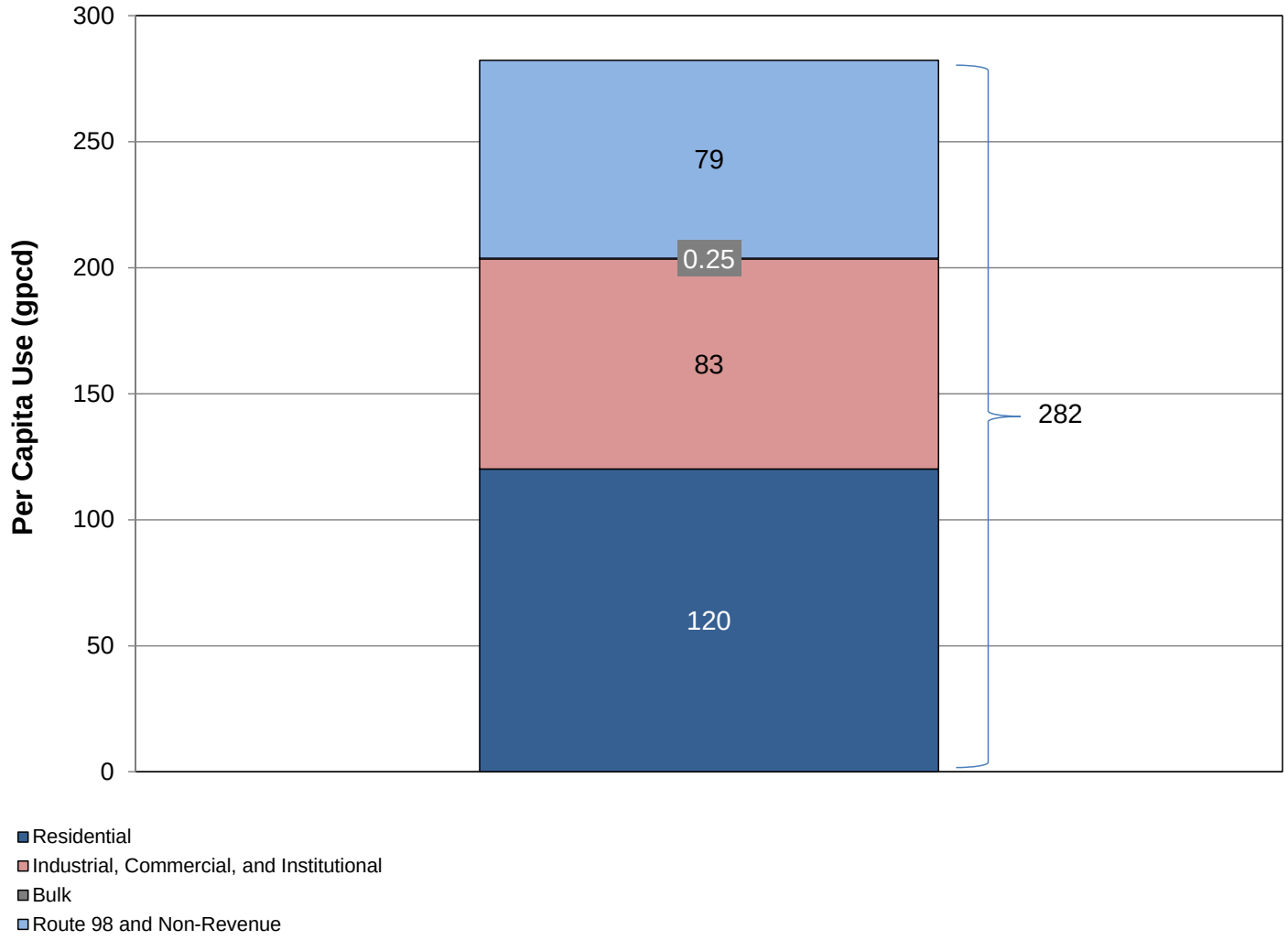

Figure 4-8

DEMING 40-YEAR WATER PLAN

City of Deming

Per Capita Water Use by Sector in 2016

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4.3 Analysis of Top Users

Evaluation of the largest water users can help the City target conservation efforts where they will have the greatest impact. In 2016, six accounts were billed for more than 4 million gallons of water each (Table 4-5), accounting for over 21 percent of the total billed metered water use.

Table 4-5. City of Deming Top Water Users in 2016

Customer Name	2016 Billed Total (gallons)	Identified Water Use Area
Mizkan America, Inc.	125,849,700	Border Foods Plant
Mizkan America, Inc.	29,269,800	Border Foods Plant (use during September through December)
Mizkan America, Inc.	19,337,700	Border Foods Plant
Luna County Detention Center	6,989,000	Jail facility
Kingdom of the Sun	4,567,400	Retirement center
Quality Inn	4,364,500	Hotel
Total	190,378,100	

The top three accounts combined include almost 175 million gallons for water delivered to the Border Foods Plant (Table 4-5).

4.4 Reuse

The City reuses treated wastewater effluent, thereby lowering the demand on the potable water system, particularly in months of high demand. As discussed in Section 2, the City currently uses reuse water at three locations: a storage pond for the Luna Energy power plant, the golf course, and farmland located near the WWTP (SMA, 2013). Monthly reuse water volumes for 2016 are provided in Table 4-6 and shown on Figure 4-9.

The largest wastewater effluent consumer would be Luna Energy if they used their contractual amount of 1 million gallons per day (mgd) of treated effluent. The 570-megawatt Luna Energy plant is located northwest of Deming and provides an annual schedule of proposed reuse water consumption to the City.

Table 4-6. City of Deming Reuse Water, 2016

Month	2016 Reuse Water (gallons)				
	Luna Energy	City Farm	Golf Course	Total	Luna Energy Current Storage
January	6,560,000	28,427,000	0	34,987,000	22,513,000
February	10,440,000	19,008,000	0	29,448,000	24,565,000
March	8,280,000	15,769,000	0	24,049,000	28,159,000
April	4,680,000	10,612,000	4,206,000	19,498,000	28,159,000
May	5,184,000	32,170,000	15,385,000	52,739,000	22,975,000
June	6,840,000	33,625,000	3,706,000	44,171,000	16,135,000
July	2,520,000	25,907,000	0	28,427,000	13,615,000
August	6,800,000	28,514,000	0	35,314,000	7,135,000
September	6,120,000	6,831,000	1,786,000	14,737,000	17,236,000
October	4,320,000	14,364,000	4,238,000	22,922,000	12,916,000
November	576,000	39,969,000	4,692,000	45,237,000	28,409,000
December	0	8,825,000	4,138,000	12,963,000	28,409,000
Total (gallons)	62,320,000	264,021,000	38,151,000	364,492,000	250,226,000

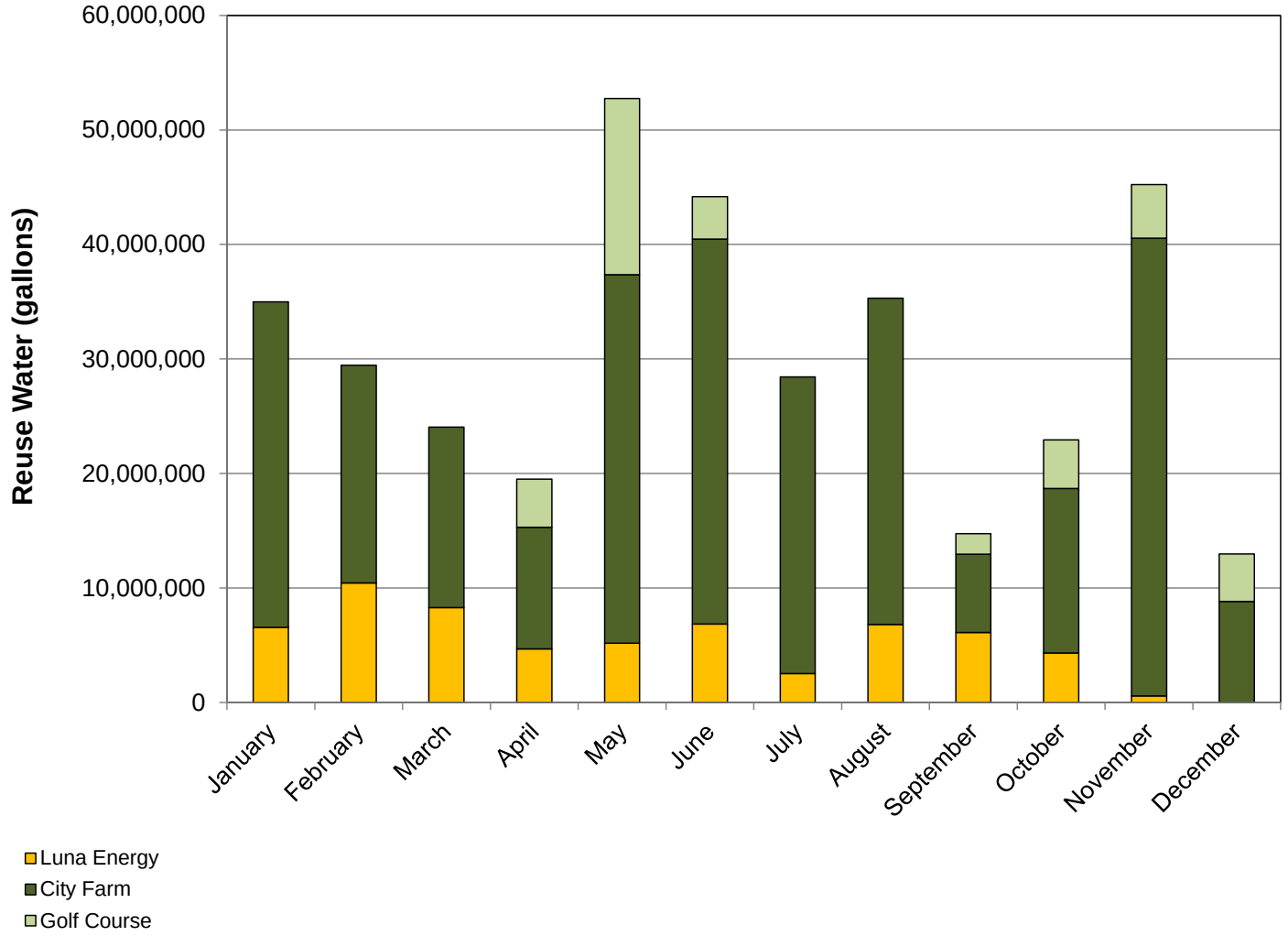

Figure 4-9

DEMING 40-YEAR WATER PLAN

City of Deming

Monthly Reuse Water Use in 2016

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In the future, the City plans to reuse effluent at a planned multi-sport complex. The City wants to build a recreation area and fishing pond fed by treated effluent. The cemetery is currently irrigated from a dedicated well, but there are plans to irrigate with treated wastewater effluent in the future.

4.5 Future Water Use Projections

Future demand for water from the City of Deming water system will be driven in large part by population growth and demand for water services. Future water use by the City will include:

- Continued service for existing uses, including residences, businesses, schools, and other commercial uses, and water for parks and other outdoor landscaping.
- Expansion to serve new residents, businesses, or other users coming into the area.

There is uncertainty regarding estimates of future use, which are dependent on population growth in the area (Sections 4.5.1 and 4.5.2) as well as on policy decisions yet to be made regarding expansion of the system to serve new customers. Therefore, DBS&A has developed a range of potential future water use projections as described in Section 4.5.3.

4.5.1 Population Growth

As part of the process of developing the population forecasts for this plan, DBS&A and Poster Enterprises evaluated past population growth rates and recent population projections and conducted interviews with local government and economic development and planning organizations in the Deming and Luna County area.

Deming has generally experienced steady population growth historically. Between the 2000 census and 2010 census, the City grew by 5.24 percent (Table 4-7). The U.S. Census Bureau (2018) reported that 14,855 people lived in Deming in 2010 and listed 5,582 occupied and 644 unoccupied housing units. Since 2010, the population has decreased slightly to 14,488 people (World Population Review, 2017).

Table 4-7. Historical Population and Growth Rates for Deming

Year	Population	Percentage Change (%)	Annual Growth Rate (%)
1900	1,100	—	—
1920	3,212	192.00	5.50
1930	3,377	5.14	0.50
1940	3,608	6.84	0.66
1950	5,672	57.21	4.63
1960	6,764	19.25	1.78
1970	8,343	23.34	2.12
1980	9,964	19.43	1.79
1990	10,970	10.10	0.97
2000	14,116	28.68	2.55
2010	14,855	5.24	0.51
2016	14,488	–2.47	–0.42

Source: World Population Review, 2017 — = Not applicable

4.5.1.1 Recent Population Forecasts

In updating the New Mexico regional water plans in 2016 and 2017, population and water use projections were prepared for each of the 16 water planning regions. The projection prepared for the *Southwest New Mexico Regional Water Plan* takes into consideration the variability in population growth the area has experienced by providing a forecast that anticipates a moderately optimistic and a less optimistic growth trend. The regional water plan includes projected population through 2060, based on two scenarios (low- and high-growth), for the planning region (NMISC/NMOSE, 2017). The plan summarized data gathered from local experts about the economic outlook to inform the projections. The 2012 Bureau of Business and Economic Research (BBER, 2012) statewide population projections through 2040 were used for the low population projection and extrapolated through 2060 for Luna County. The high projection is based on the 2012 Luna County comprehensive plan update: 1.0 percent annual growth through 2020 and 1.5 percent annual growth after 2020.

DBS&A evaluated and compared the regional water plan projections, the City's 2017 PER growth rate (0.56 percent annual growth), and historical growth rates for Deming (Figure 4-10). The reviewed datasets included the following (listed in order from largest to smallest growth rates):

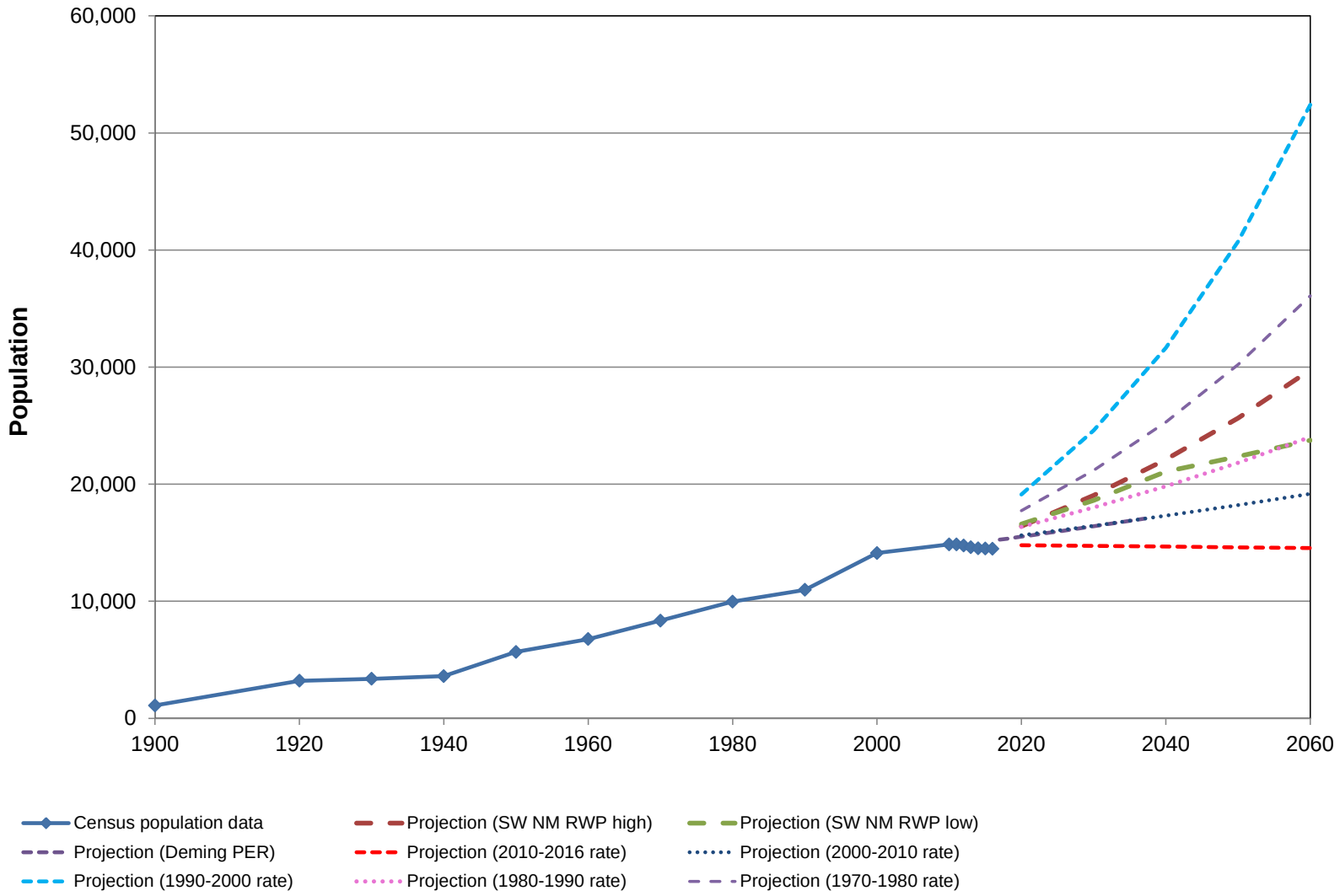

Figure 4-10

DEMING 40-YEAR WATER PLAN

City of Deming

Historical and Projected Future Population

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- 1990 to 2000 annual growth rate of 2.55 percent
- 1970 to 1980 annual growth rate of 1.79 percent
- *Southwest New Mexico Regional Water Plan* high-growth estimate (1 to 1.5 percent)
- *Southwest New Mexico Regional Water Plan* low-growth estimate (0.6 to 1.24 percent)
- 1980 to 1990 annual growth rate of 0.97 percent
- Deming PER annual growth rate of 0.56 percent
- 2000 to 2010 annual growth rate of 0.51 percent
- 2010 to 2016 annual growth rate of -0.42 percent

Based on this information and comparison of the different population forecasts available, DBS&A has selected the high-growth estimate used in the *Southwest New Mexico Regional Water Plan* and the recent 2000 to 2010 annual growth rate (similar to the recent Deming PER projection) to develop the population projections for the City of Deming.

4.5.2 Population Growth Projections for the City of Deming

The selected projected population growth rates (Table 4-8) were applied to the Deming population to project growth through 2060 (Table 4-9, Figure 4-11). The forecasts bracket a range of growth rates that allows the City to plan for a modest but steady growth under the high-growth scenario, as well as a much lower growth rate should the economic downturn continue.

Table 4-8. Projected Annual Growth Rate
City of Deming

	Annual Growth Rate (%)				
Projection	2010-2020	2020-2030	2030-2040	2040-2050	2050-2060
High	1.00	1.50	1.50	1.50	1.50
Low	0.51	0.51	0.51	0.51	0.51

Table 4-9. Projected Population
City of Deming

	City of Deming Population [a]					
Projection	2010 [b]	2020	2030	2040	2050	2060
High	14,855	16,407	19,042	22,100	25,650	29,769
Low	14,855	15,633	16,451	17,312	18,219	19,172

[a] Estimated by applying annual growth rates (Table 4-8) to Deming population.
[b] Based on 2010 census data.

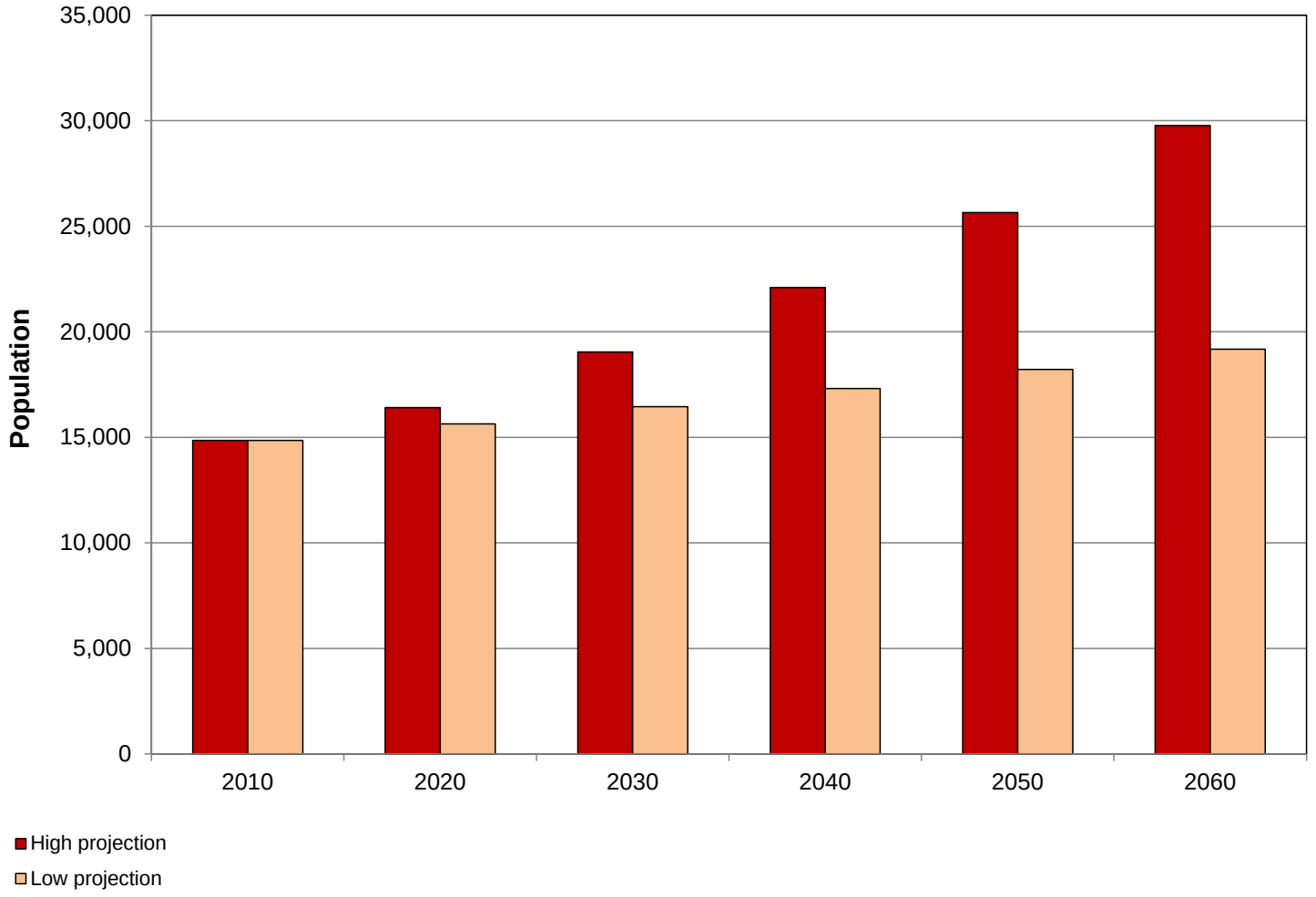


Figure 4-11

DEMING 40-YEAR WATER PLAN

City of Deming
Population Projections

Daniel B. Stephens & Associates, Inc.

12/28/18

4.5.3 Future Water Demand

Population projections inform future water demand in most of the water use categories served by the City of Deming. To project future water requirements, current billed water usage amounts for most demand sectors (Section 4.1.1) were projected forward under both a low and high population growth scenario (Section 4.5.2).

The water use shown on Table 4-10 is based on monthly billing and meter records and well production reports. Total future water demand estimates are based on the amount of water the City must divert in order to meet customer demand. During 2016, the City diverted 3,488 ac-ft/yr in order to provide metered use of 3,254 acre-feet of water. Thus, the City must divert 7 percent more water than is delivered (metered or sold) to meet demand.

Table 4-10. Current Water Demand by Sector
City of Deming

Year	Metered Water by Sector (acre-feet)					Total Metered Production (acre-feet)
	Residential	ICI	Bulk	Route 98 [a]	Total	
2016	1,585	1,149	3	517	3,254	3,488
2016 plus 7% diversion requirement	1,695	1,230	4	554	3,482	

[a] = Includes unbilled metered use from City's municipal and irrigation wells

ICI = Industrial, commercial, and institutional

Using the recent water uses by sector shown on Table 4-10 as starting values, future water demands were projected forward using the following assumptions:

- Low and high residential demand projections were developed by multiplying the 2016 billed amount from Table 4-10 by the low and high population annual growth rates shown in Table 4-8.

- Industrial, commercial, and institutional demand was assumed to grow proportionally to population growth, so the low and high annual growth rates from Table 4-8 were

multiplied by the 2016 billed amount in Table 4-10, to develop the low and high projections.

- For bulk sales, the low projection was assumed to remain at 2016 level, and the high projection was assumed to increase with the high annual growth rate of 1 to 1.5 percent. Use in this category is very low and does not have a significant impact on future demands for the City.

- For Route 98, the low projection was assumed to remain at the 2016 use level, and the high projection was assumed to increase at 1 percent per year from the 2017 use level. The increase accounts for possible additional outdoor park watering due to warmer temperatures or to new parks.

- Total projected future diversions were estimated at 7 percent more than the high and low total metered water projections.

The resulting projected demand under the low and high growth scenarios is shown on Figure 4-12 and Table 4-11. The projections indicate that metered water use is expected to range from about 3,300 to 3,400 acre-feet in 2020 and from about 3,900 to 6,000 acre-feet in 2060. Projected groundwater diversions to meet the metered water demand are expected to range from about 3,500 to 3,600 acre-feet in 2020 and from about 4,200 to 6,400 acre-feet in 2060 (Table 4-11).

As discussed previously, there is considerable uncertainty in the water use projections. The City will continue to evaluate its water use in comparison to projected demand and will update projections periodically to account for changed conditions. The range of projections presented is intended to provide a reasonable range of anticipated water needs.

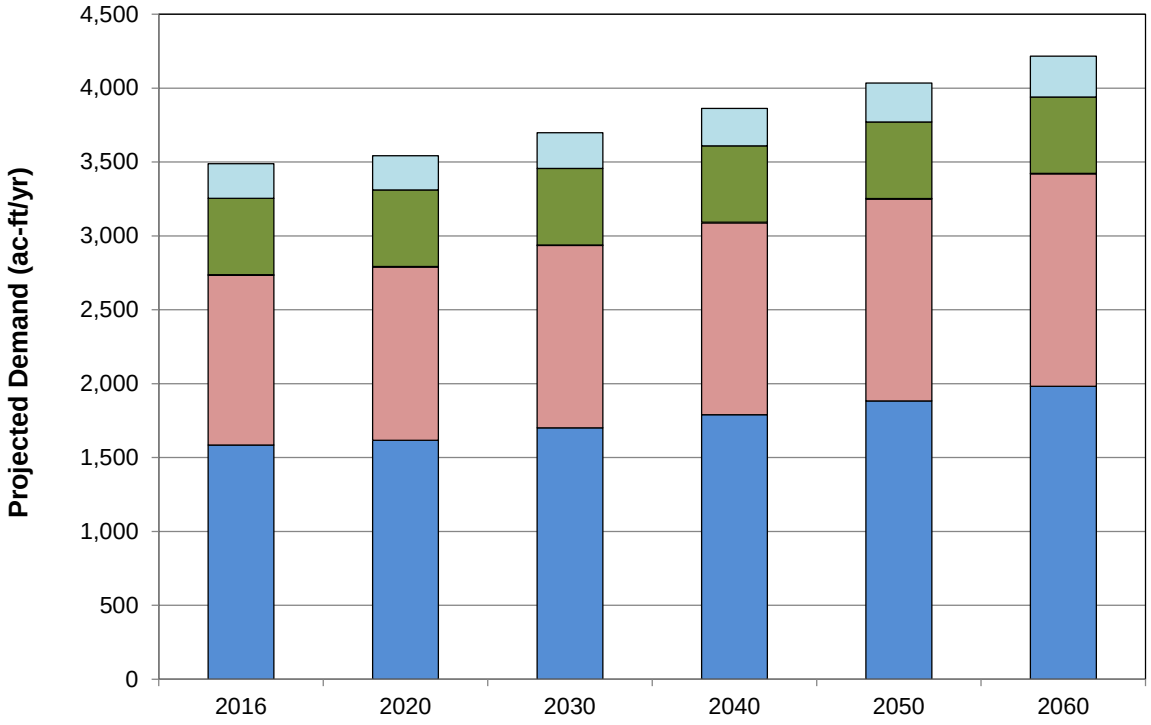
Table 4-11. Projected Water Demand
City of Deming

Demand Sector	Projection	City of Deming Water Use (ac-ft/yr)				
		2020	2030	2040	2050	2060
Residential	High	1,649	1,914	2,221	2,578	2,992
	Low	1,617	1,701	1,790	1,884	1,982
Industrial, commercial, institutional	High	1,196	1,388	1,611	1,869	2,170
	Low	1,173	1,234	1,298	1,366	1,437
Bulk	High	4	4	5	6	6
	Low	3	3	3	3	3
Total billed	High	2,848	3,305	3,836	4,453	5,168
	Low	2,793	2,939	3,092	3,253	3,423
Route 98 [a] (unbilled)	High	545	602	665	735	812
	Low	517	517	517	517	517
Total metered	High	3,394	3,908	4,502	5,187	5,979
	Low	3,311	3,456	3,609	3,771	3,940
Total projected demand	High	3,631	4,181	4,817	5,551	6,398
	Low	3,542	3,145	3,862	4,035	4,216

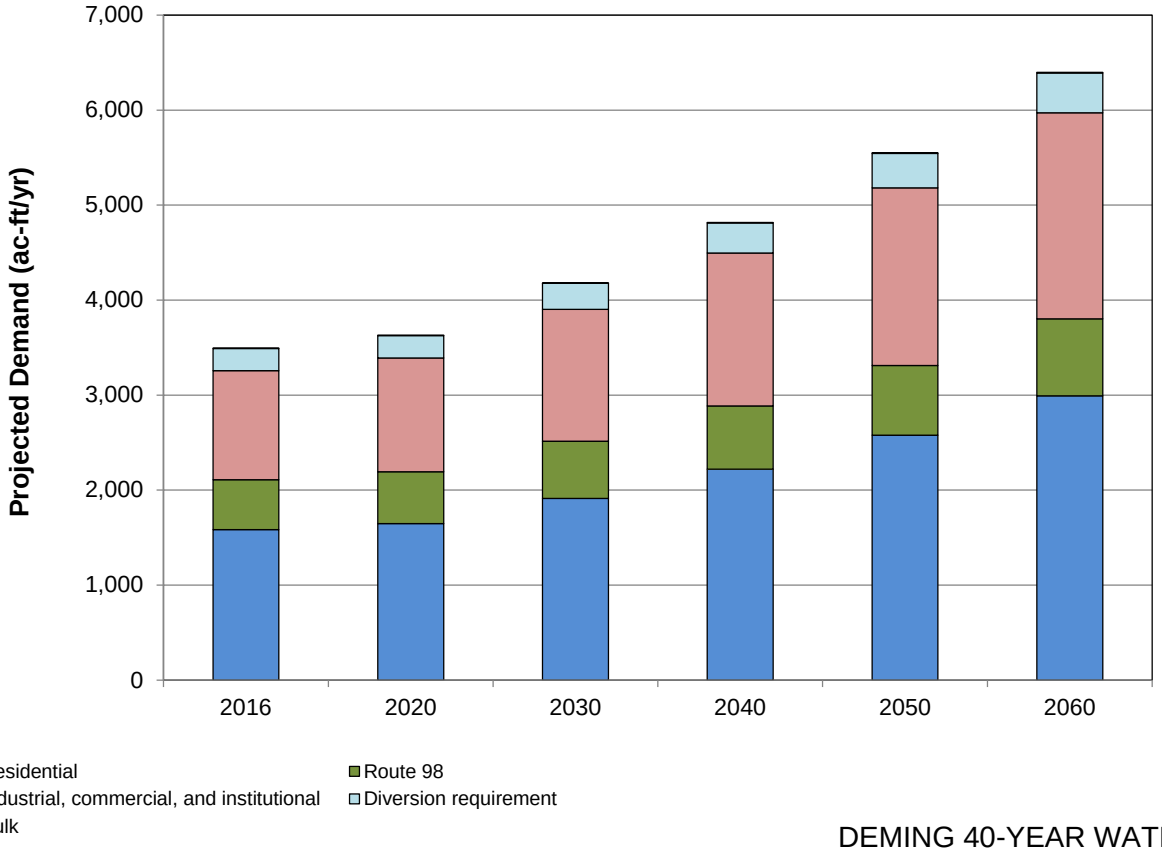
[a] Route 98 includes metered use from the City's municipal and irrigation wells.

ac-ft/yr = Acre-feet per year

a. Low Projection



b. High Projection



P:_DB17-1121\40-Year Plan.1-19\Figures\Fig 4-12_Projected Demand.docx

DEMING 40-YEAR WATER PLAN

City of Deming
Projected Water Demand

Daniel B. Stephens & Associates, Inc.

12/28/2018

Figure 4-12

5. Water Rights

This section describes the legal framework and administration of water resources in the Deming area and summarizes the water rights currently owned by or in the process of being transferred to the City.

5.1 Current Legal Framework

The Mimbres Underground Water Basin (UWB) was declared on July 29, 1931 under State Engineer Order No. 1. Since that date, the NMOSE has issued seven orders extending the boundaries of the basin.

Guidelines for the Deming-Columbus Administrative Area (DCAA) within the Mimbres UWB were adopted on May 20, 2011. The DCAA guidelines replace the Mimbres Basin Administrative Criteria adopted in 1982. These guidelines do not apply to the permitting of applications filed under NMSA Section 72-12-1.1, 72-12-1.2, and 72-12-1.3. The guidelines apply to applications within the DCAA that propose production from the basin-fill alluvium, which is composed of gravel, sand, clay, silt and interbedded basalt flows. Applications proposing diversion from other geologic units, or outside the boundaries of the DCAA, will be processed on a case-by-case basis.

A critical management area was designated in the Deming area; no new appropriations are allowed in the area.

5.2 Existing Permits

The City of Deming owns a total of 6,363 acre-feet of municipal use water rights in the Mimbres Basin (Table 5-1) and an additional 2,892 acres of land with appurtenant irrigation rights (Table 5-2). Many of the irrigation rights have been purchased in the last few years and have not yet been transferred to municipal use. Some irrigation rights cannot be feasibly transferred to the City due to the remote location. For example, water rights held under files M-514, M-811, and M-971 (Murdock) are appurtenant to 686 acres that are located approximately 16 miles outside the City limits, too far to be piped into the City's municipal service area, and they therefore cannot be used to meet future demand within the City.

Table 5-1. City of Deming: Municipal Use Water Rights
Page 1 of 2

Well or Subfile Number	OSE File Number	Previous Owner / Reference Name	Priority Date(s) [a]	Consumptive Use (ac-ft)	Comments
17	M-34-C	Merrill/Irani	1928	100.8	Converted to municipal use and transferred into M-109.
AM	M-47 & M-266 Combined A	American Minerals	1927	33.40	Change of ownership filed March 14, 2008. Can divert up to 80 ac-ft at the well, but only consumptively use 33.40 ac-ft. The May 1981 order lists this condition and states that "all diversion in excess of 33.40 acre-feet per annum shall be returned to the underground water basin as seepage and return flow." City cannot transfer this water into municipal system because of OSE administrative criteria, but in the future could use it for irrigation or consumptive use at the current place of use.
17	M-49 et al.	Bilbo	1926	566.34	M-49 et al includes M-49-S, M-109, M109-S, and M-127. Permit approving conversion to municipal use approved October 19, 2005 states, "total quantity of water to be transferred is 380.74 ac-ft."
	M-67 into M-49 acres		1918 1928 1942		M-67 & M-43S into M-49 et al. was approved in 2006, transferring 185.6 into M-49 et al.
14	M-214	Luchsinger	Between 1911 and 1945	477	The original right from this well was for irrigation use on 83.1 acres. Deming converted this to municipal use in 2003 for 132.96 ac-ft. Two additional transfers into M-214 increased the total consumptive use right to 409 ac-ft. The OSE approved the transfer of M-261-B (F. Hervol) for 160 ac-ft in June 2005. The OSE approved the transfer of M-110A and M110B (Ruebush) for 176 ac-ft in July 2005.
15	M-271, M-272, M-273	Peru Hill Mill	1928	441.9	Although originally a mining right, Deming may pump this water in the current place of use and physically move it into the municipal water system.

Note: All water rights in the Mimbres Basin have been adjudicated (see orders issued in Final Decree in Cause No. 6326 entered May 26, 1993 in the Sixth Judicial District Court in Luna County).

ac-ft = Acre-feet
NA = Not applicable

[a] Priority date as described in original right.

Table 5-1. City of Deming: Municipal Use Water Rights
Page 2 of 2

Well or Subfile Number	OSE File Number	Previous Owner / Reference Name	Priority Date(s) [a]	Consumptive Use (ac-ft)	Comments
25.9.30C	M-326 into M-272	Scott	1943	159.2	Water rights are commingled with the other water rights in files M-272 and M-273. Permit condition No. 3 states, "The amount of water diverted from Wells M-272 and M-272 under this permit shall not exceed 159.2 acre-feet per annum."
25.9.11B	M-190A into M-272	Bishop	1912, 1941, 1945	100.8	Water rights are commingled with the other water rights in files M-272 and M-273. Permit condition No. 3 states, "The amount of water diverted from Wells M-272 and M-272 under this permit shall not exceed 159.2 acre-feet per annum."
Multiple municipal wells	M-299	City of Deming	1913-1943	4,415	Original water rights for municipal system for a total of 4340 ac-ft. Various priority dates range from 1913 to 1943. Permit to commingle various water rights into M-299 approved July 31, 1992. Conditions include the following: (1) Maximum diversions from wells 1, 2, 4, 5, 6, 7, and 10 may not exceed 4,340 ac-ft per year. (2) Maximum diversion from any one well is not to exceed 1,210 ac-ft per year. This July 31, 1992 permit includes M-60-D for 75 ac-ft of municipal rights, bringing the total to 4415 ac-ft.
				28.48	The cemetery right (M-439) is also included on the permit, which states that a consumptive use right of 28.48 will be combined with the 4,415-ac-ft for municipal use, bringing the total consumptive use to 4443.48.
BTRL	M-328 into M-10346	City of Deming	1925 1943	40	For use at the City's Butterfield Trail Regional Landfill.
Total consumptive use water rights				6,362.92	

Note: All water rights in the Mimbres Basin have been adjudicated (see orders issued in Final Decree in Cause No. 6326 entered May 26th 1993 in the Sixth Judicial District Court in Luna County).

ac-ft = Acre-feet
NA = Not applicable

[a] Priority date as described in original right.

Table 5-2. City of Deming Irrigation Water Rights
Page 1 of 4

Subfile	File No.	Acreage Amount	Previous Owner / Reference Name	Diversion	Consumptive Use [a]	Priority Date(s [b])		Comments
						Date	Amount (acres)	
25.9.10	M-4	73.64	Yates/Marcak	220.92	117.82	1940 1944	23.62 50.02	In Deming files M-4 (73.64 acres), M-128 (56.5 acres), and M-128A (71.7 acres) are all listed together for the 200.64 acres (referred to as Yates 1). All of this land is in the USDA/FSA Conservation Reserve program (weed control) and is fallow. Deming filed a notice to irrigate specific blocks for 2005. M-4, M-128, M-128A, and M-328 (Yates 1) were all purchased from Yates and are owned by City of Deming.
25.9.6A	M-128	56.5	Yates/Home	169.5	90.4	1938 1944	49.5 7.0	City filed notice to irrigate in 2004 and 2005. Change of Ownership filed in April 2003.
25.9.6B	M-128A	71.7	Yates/Home	215.10	114.72	1938	71.7	Change of Ownership filed in April 2003.
25.9.17	M-143	150.2	Yates/Drip	450.60	240.32	1939	150.2	City filed change of ownership in December 2008. Land is enrolled in USDA/NRCS Conservation Reserve program and is leased to Kevin Penn.
25.9.10	M-328	80.2	Yates/Sunshine	240.6	128.32	1925 1943	45 95.2	Change of ownership filed in June 2002. Permit M-328 into M-1526 moves 16 acre-feet appurtenant to 10 acres transferred for domestic, school use as well as landscape irrigation. Reverts to original place and purpose of use in December 2013. Original right was for 105.2 acres with a diversion right of 168.32 acres. In permit M-328 into M-10346, the City has transferred water rights appurtenant to 25 acres (40-acre-foot diversion) to Butterfield Trail Regional Landfill.

Note: All water rights in the Mimbres Basin have been adjudicated (see orders issued in Final Decree in Cause No. 6326 entered May 26th 1993 in the Sixth Judicial District Court in Luna County).

[a] Reflects the number of acre-feet the City would obtain if this water right is transferred to municipal use using a duty of 1.6 ac-ft per acre.

[b] Priority date as described in original right. Since the City did not always buy all the land or water rights adjudicated, the acreage listed may be higher than the amount of land or water right owned by the City.

ac-ft/yr = Acre-feet per year
OSE = New Mexico Office of the State Engineer
--- = Not available

Table 5-2. City of Deming Irrigation Water Rights
Page 2 of 4

Subfile	File No.	Acreage Amount	Previous Owner / Reference Name	Diversion	Consumptive Use [a]	Priority Date(s [b])		Comments
						Date	Amount (acres)	
25.9.19A	M-15	251.95	Marcak	755.85	403.12	1912 1939 1940 1945	45.70 65.08 15.52 125.65	Change of ownership filed in April 2001. Well M-15 T leased to Waterloo farms to irrigate land under M-225. Permit to allow drilling of supplemental well (S-15 T) M-225 approved August 2007, expires December 31, 2016 with a 5-year option to extend the lease to 2021. Diversions at the move-to point may not exceed the M-225 permit amount.
25.9.30A	M23-282 Combined	100.6	Wood I	301.8	160.96	1912 1929	60 40.6	Purchased from Wood in 2004. Change of ownership filed by the City in November 2008. Farm is leased to Zach Penn until 2018 with a 5-year renewal option to extend the lease to 2023.
25.9.30B	M196	100	Wood II	300	160.00	1942 1940	40 71.4	City purchased in 2005, but hasn't filed a change of ownership. Land is leased and enrolled in USDA/NRCS Conservation Reserve program (weed control).
24.9.20	M-47	136.40	Clary	409.20	218.24	1931 1936 1943	9.0 20.4 107	Change of ownership filed in August 2002. Well was cleaned out in 1997. Land is fallow.
24.8.7A	M152	147.02	Keeler (Hal)	441.06	235.23	1939 1944	108.8 114.66	Change of ownership to City of Deming filed in February 1993. Construction of pipeline near this farm is planned. The City will then apply to move water from another Keeler farm in Section 18 to one well in Section 7 and then convert to municipal use. Land is irrigated with wastewater as part of the City's land application permit for wastewater.

Note: All water rights in the Mimbres Basin have been adjudicated (see orders issued in Final Decree in Cause No. 6326 entered May 26th 1993 in the Sixth Judicial District Court in Luna County).

[a] Reflects the number of acre-feet the City would obtain if this water right is transferred to municipal use using a duty of 1.6 ac-ft per acre.

[b] Priority date as described in original right. Since the City did not always buy all the land or water rights adjudicated, the acreage listed may be higher than the amount of land or water right owned by the City.

ac-ft/yr = Acre-feet per year
OSE = New Mexico Office of the State Engineer
--- = Not available

Table 5-2. City of Deming Irrigation Water Rights
Page 3 of 4

Subfile	File No.	Acreage Amount	Previous Owner / Reference Name	Diversion	Consumptive Use [a]	Priority Date(s [b])		Comments
						Date	Amount (acres)	
24.8.7B	M-290	53	Keeler (Hal)	159	84.80	1912 1928 1943 1944	6 12 18 60	Change of ownership filed in 1993. Land is irrigated with wastewater as part of the City's land application permit for wastewater.
24.8.18	M-340	95.3	Keeler (Hal)	285.9	152.48	1944	95.3	Change of ownership to Deming filed in 1993, includes grant of right of way or easement to the Keelers dated April 28, 1994. Land is irrigated with wastewater as part of the City's land application permit for wastewater.
24.9.14A	M-157 A	50.05	Seybert	150.15	80.08	1913 1940 1942	9.5 37.1 43.9	Change of ownership from Laharca/Seybert to City of Deming filed in February 2006. Original right appears to have been 49.75 acres and 0.3 acre of reservoir. City bought only the water rights and the well.
25.9.19C	M-225	149.11	Keeler (Waterloo Farms)	447.33	238.57	1902 1939 1942 1945 1947	30.40 11.20 63.40 23.82 20.29	Change of ownership from Waterloo Farms (Keeler) to Deming filed May 7, 2007. Leased to Keeler. Water pumped from M-15-T is also used to irrigate this farm.
23.9.31A	M-208	135.40	Diaz	406.2	216.24	1915 1944	94.4 41	Change of ownership filed from Terry to City of Deming in 1998. Irrigated acreage includes reservoirs. The City attempted to transfer these water rights into the municipal system in 2001. Application was protested and withdrawn. City has filed annual applications for extension of time; all have been approved by the State Engineer.

Note: All water rights in the Mimbres Basin have been adjudicated (see orders issued in Final Decree in Cause No. 6326 entered May 26th 1993 in the Sixth Judicial District Court in Luna County).

[a] Reflects the number of acre-feet the City would obtain if this water right is transferred to municipal use using a duty of 1.6 ac-ft per acre.

[b] Priority date as described in original right. Since the City did not always buy all the land or water rights adjudicated, the acreage listed may be higher than the amount of land or water right owned by the City.

ac-ft/yr = Acre-feet per year
OSE = New Mexico Office of the State Engineer
--- = Not available

Table 5-2. City of Deming Irrigation Water Rights
Page 4 of 4

Subfile	File No.	Acreage Amount	Previous Owner / Reference Name	Diversion	Consumptive Use [a]	Priority Date(s [b])		Comments
						Date	Amount (acres)	
24.9.29	M-230	78.2	Hervol (Joe)	234.6	125.12	1942	78.2	Water rights and well only were recently purchased by the City. Change of ownership will be filed in February 2009.
25.9.19A	M-325	53	Graves	159	84.80	1947	53	City purchased water rights only.
24.9.28B	M-333A	76.61	Lehman	229.83	122.58	1944	76.61	Change of ownership for land and water rights filed in April 2002. Land is fallow.
24.9.28A and B	M-333B	107.27	Lehman	321.81	171.63	1944	107.27	Change of ownership for land and water rights filed in April 2002. Land is fallow
25.10.13	M-352	160	Sweetser	480	256	1944 1943	153.1 (10.3)	City purchased this farm in 2006. Change of ownership filed in November 2008. The farm is enrolled in USDA/FSA Conservation Reserve program (weed control).
25.9.11C	M-388-S	72.12	Montano	216.36	115.39	1930 1945	36.7 35.42	City of Deming purchased the land and water rights in June 2001. Change of ownership was filed in November 2008. Land is fallow.
25.6.3B	M-514	305.15	Murdock	915.45	488.24	1950 1952-	450.6 464.7	Change of ownership filed in February 2000. All of this land is located several miles east of town and could be developed into an industrial park or used for industrial or commercial purposes.
25.6.3A	M-811	304.4	Murdock	913.2	487.04	1954	304.4	
25.6.15	M-971	76	Murdock	228	121.6	1952	76	
23.9.34	M-1033	8.0	Luna County	24	12.8	1931	8.0	Purchased from the County in 1998
Total		2,891.82		8,665.46	4,614.82			

Note: All water rights in the Mimbres Basin have been adjudicated (see orders issued in Final Decree in Cause No. 6326 entered May 26th 1993 in the Sixth Judicial District Court in Luna County).

[a] Reflects the number of acre-feet the City would obtain if this water right is transferred to municipal use using a duty of 1.6 ac-ft per acre.

[b] Priority date as described in original right. Since the City did not always buy all the land or water rights adjudicated, the acreage listed may be higher than the amount of land or water right owned by the City.

ac-ft/yr = Acre-feet per year
OSE = New Mexico Office of the State Engineer
--- = Not available

5.3 Future Water Rights Needs

Based on the future water demand projections shown in Table 4-11, the maximum anticipated demand for water from the City is 6,398 ac-ft/yr, which is only 5 acre-feet more than the City currently has permitted in its municipal wells. The low water demand projection is 4,216 ac-ft/yr. Therefore, the City of Deming has sufficient municipal water rights to meet the high and low demand projections through 2060. Additionally, transfer of the City's irrigation water rights to municipal use would allow the City to meet demand that exceeds the future demand projection.

Transfer of irrigation rights, however, raises two issues that may affect the feasibility of this option:

- It may not be economically feasible to convert some of the irrigation rights located several miles southeast of the City, due to the distance the water would have to be piped.

- The City may encounter difficulty converting irrigation water rights to municipal use due to protests from existing users and to limitations placed by the NMOSE in applying the DCAA Guidelines (administrative criteria).

Therefore, it cannot be assumed that all the City's irrigation water rights will be converted and available for future municipal use.

5.4 Water Use and Conservation

The City of Deming set forth its policy on water use through the *City of Deming Comprehensive Plan Update* (Sites Southwest, 2010) and regulates water use through its City Code.

The current Comprehensive Plan supplemented these policies and also recognizes that a new production source will be required to meet future water demand and provide for growth. Accordingly, the City of Deming has the following water policy goals: (1) ensure that water and wastewater systems are expanded or improved to accommodate future growth, (2) continue to

obtain water rights for future growth, (3) require that subdivisions have an adequate supply of water for each lot for at least 70 years, and (4) enhance the quality of life by providing safe, efficient, affordable, and responsible use of water by encouraging voluntary water conservation and expanding uses of wastewater effluent irrigation.

The Deming City code restricts water use through Section 9-4-7 of the Code. That section includes outdoor water conservation measures (§9-4-7(D)), time of day and day of week watering restrictions (§9-4-7(C)), waste of water prohibition (§9-4-7(E)), and restrictions on water use during water emergencies (§9-4-7(H)). In addition, Section 13-4-5 of the Code requires that subdivisions have an adequate supply of water (§13-4-5).

6. Water Supply Priorities and Strategies

The City of Deming will continue to expand and implement several initiatives as part of its long-term water supply strategy. Based on the analysis provided in Sections 2 through 5, DBS&A recommends that the City of Deming consider the actions detailed below.

6.1 Water System

This 40-year water development plan did not include an independent evaluation of water system infrastructure. However, to be prepared to meet future water needs of the community, it is important for the City of Deming to continue with implementation of infrastructure upgrades as recommended in the 2017 PER (DBS&A, 2017):

- Expanding the supervisory control and data acquisition system (SCADA) to 6 wells, 2 tanks, and the Bilbo booster station.
- Rehabilitating 6 wells, including cleaning and acidizing, test pumping, and video surveys of existing wells.
- Replacing piping, including aged and failing cast iron and undersized piping that cannot provide fire flow.
- Installing additional piping to provide fire flow.
- Constructing a new closed-loop booster station at Peru Mill to provide service in the Industrial Park.
- Adding 1.5 million gallons of water storage.

Further recommendations based on the results of the water audit include:

- Establish/revised policies and procedures for data collection.
- Establish ongoing mechanisms for customer meter accuracy testing, active leakage control, and infrastructure monitoring.

- Begin to assemble the economic business case for long-term needs based upon improved data becoming available through the water audit process.
- Establish long-term apparent and real loss reduction goals with at least a 10-year horizon.

The City should also continue to implement infrastructure upgrades recommended in the 2017 Comprehensive Plan (City of Deming, 2017).

6.2 Water Supply and Quality

Recommendations for preserving and enhancing water supply and quality include:

- Continue collecting depth to water measurements to monitor any changes in water levels and available physical supply.
- Evaluate potential locations for future well field development to replace the city's production wells currently located in the critical management area. Consider water quality (source water protection) and infrastructure when evaluating potential locations.
- Continue collecting water quality samples, paying particular attention to the levels of arsenic, fluoride, nitrate, TDS, sulfate, and volatile organic compounds (VOCs) in the Deming drinking water supply.
- Continue implementing the City's source water/wellhead protection program to ensure the future safety of the City's water supply.
- Continue participation in regional source water quality monitoring and watershed protection planning to improve water quality.

6.3 Future Water Demand

To ensure that adequate water supplies for available to meet future demands, the City should review population projections every 5 years to determine if the projections in the current plan are still valid and evaluate whether increases in demand are trending toward the high- or low-water-use projections. Should a higher trend be identified, the City should implement a targeted water rights acquisition program as recommended in Section 6.4.

An updated review of water conservation measures was not included in the scope of this plan. The City of Deming has water conservation ordinances in place to address shortages due to drought or system failure, and the City values conservation and will continue with implementation of the recommendations from its existing Water Conservation Plan (included in the 2009 40-Year Water Development Plan [DBS&A, 2009]) as follows:

- Continue the current water conservation program management and staffing by the Public Works Department.
- Expand the existing public education component to support the City's water conservation goals.
- Make residential water conservation a priority, since the majority of use occurs in this sector and the potential savings are higher than in other sectors.
- Work with the largest users in the commercial and industrial sectors to identify how water can be conserved by those customers.
- Continue tracking water use efficiency by conducting annual AWWA water audits and updating the NMOSE GPCD calculator annually.
- Work with public works and water utility operations staff to better quantify unbilled authorized uses within the water treatment and wastewater treatment plants and public works.
- Continue to maximize opportunities for wastewater reuse for outdoor watering.
- Adopt stricter codes regulating domestic outdoor watering methods and allocated times for watering.

- Continue to implement the customer water meter replacement program.
- Continue to conduct leak detection surveys and standards for water line construction.
- Develop an updated comprehensive conservation plan to improve water use efficiency. An updated plan should include quantitative assessments of water savings from various water conservation measures already implemented, as well as recommendations for additional measures that have the greatest potential for minimizing water use.

6.4 Water Rights

To ensure that the City has sufficient water rights to meet future water demand, the following priorities are recommended:

- Complete necessary paperwork to ensure that water right permit requirements continue to be met. For example, the City may be required to file requests for extensions of time to prove beneficial use and, for certain rights, notices of intent to irrigate. This system should also document which water rights require other paperwork preparation such as change of ownership forms.

- Develop a water rights tracking spreadsheet for all water right offers made to the City. Include evaluation of the water right, (owner, priority, location relative to the critical management areas, price) and the decision whether to purchase. Document water rights that have been evaluated for purchase, even if the City opted not to purchase the water right.

- Implement a program to reserve water rights in trust for certain water rights owners who may wish to transfer water rights to the City in the future. Identify opportunities to lease these water rights.

- Continue to evaluate agricultural water rights that are offered to the City for purchase, in accordance with the Deming Water Rights Acquisition Policy.

- Evaluate water right permit limitations to determine whether pumping limits on wells will affect total water availability for municipal use.

- Transfer irrigation rights to municipal use as applicable, and complete pending water rights transfers to move irrigation water rights into the municipal system.

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Appendix A

2016 AWWA Audit

AWWA Free Water Audit Software v5.0

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person:	Jim Massengill
Email Address:	jmassengill@cityofdeming.org
Telephone | Ext.:	575-546-8848
Name of City / Utility:	City of Deming
City/Town/Municipality:	Deming
State / Province:	New Mexico (NM)
Country:	USA
Year:	2016 Calendar Year
Audit Preparation Date:	11/3/2017
Volume Reporting Units:	Million gallons (US)
PWSID / Other ID:	NM3528616

The following guidance will help you complete the Audit

All audit data are entered on the ***Reporting Worksheet***

- Value can be entered by user
- Value calculated based on input data
- These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions
The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet
Enter the required data on this worksheet to calculate the water balance and data grading

Comments
Enter comments to explain how values were calculated or to document data sources

Performance Indicators
Review the performance indicators to evaluate the results of the audit

Water Balance
The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard
A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix
Presents the possible grading options for each input component of the audit

Service Connection Diagram
Diagrams depicting possible customer service connection line configurations

Definitions
Use this sheet to understand the terms used in the audit process

Loss Control Planning
Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits
Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements
Acknowledgements for the AWWA Free Water Audit Software v5.0

If you have questions or comments regarding the software please contact us via email at: wlc@awwa.org

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0

? Click to access definition
+ Click to add a comment

Water Audit Report for: City of Deming (NM3528616)
Reporting Year: 2016 1/2016 - 12/2016

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<---------- Enter grading in column 'E' and 'J' ---------->

Master Meter and Supply Error Adjustments

WATER SUPPLIED

						Pcnt:	Value:	
Volume from own sources:	3	1,136.693	MG/Yr	2	-1.00%			MG/Yr
Water imported:	n/a	0.000	MG/Yr					MG/Yr
Water exported:	n/a	0.000	MG/Yr					MG/Yr
WATER SUPPLIED:		**1,148.174**	MG/Yr					

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

				Pcnt:	Value:	
Billed metered:	10	892.026	MG/Yr			
Billed unmetered:	n/a	0.000	MG/Yr			
Unbilled metered:	9	163.868	MG/Yr			
Unbilled unmetered:	5	14.352	MG/Yr	1.25%		MG/Yr
AUTHORIZED CONSUMPTION:		**1,070.246**	MG/Yr			

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption)

77.928 MG/Yr

Apparent Losses

				Pcnt:	Value:	
Unauthorized consumption:		2.870	MG/Yr	0.25%		MG/Yr
Customer metering inaccuracies:	7	10.666	MG/Yr	1.00%		MG/Yr
Systematic data handling errors:	6	2.230	MG/Yr	0.25%		MG/Yr
Apparent Losses:		**15.766**	MG/Yr			

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **62.162** MG/Yr

WATER LOSSES: **77.928** MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: **256.149** MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	9	150.1	miles
Number of active AND inactive service connections:	9	5,521	
Service connection density:		37	conn./mile main
Are customer meters typically located at the curbstop or property line?		Yes	
Average length of customer service line:			(length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure:	4	45.0	psi

COST DATA

Total annual cost of operating water system:	5	$2,923,572	$/Year	
Customer retail unit cost (applied to Apparent Losses):	5	$2.35	$/1000 gallons (US)	
Variable production cost (applied to Real Losses):	3	$410.35	$/Million gallons	☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 53 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Variable production cost (applied to Real Losses)
3: Total annual cost of operating water system

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: City of Deming (NM3528616)
Reporting Year: 2016 | 1/2016 - 12/2016

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 53 out of 100 ***

System Attributes:

	Apparent Losses:	15.766	MG/Yr
+	Real Losses:	62.162	MG/Yr
=	**Water Losses:**	**77.928**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	26.94	MG/Yr
	Annual cost of Apparent Losses:	$37,050	
	Annual cost of Real Losses:	$25,508	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	22.3%	
	Non-revenue water as percent by cost of operating system:	4.6%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	7.82	gallons/connection/day
	Real Losses per service connection per day:	30.85	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.69	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	62.16	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	2.31	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
User Comments

Use this worksheet to add comments or notes to explain how an input value was calculated, or to document the sources of the information used.

General Comment:	

Audit Item	Comment
Volume from own sources:	System total production from _Summary Info.2016 Audit working file.xlsx, Monthly 2016 tab. Production volumes from Wells 3 and 12 (irrigation wells physically separated from the municipal water system) are excluded from the total production.
Vol. from own sources: Master meter error adjustment:	Production meters are all turbine meters (McCrometer) installed in 2012 (not replaced until February 2017). Personal communication from Archie Heddleston to Liie Hill, Deming, October 4, 2017. According to the manufacturer info, such meters should be + or - 2%. Per Jennifer Hill (DBS&A, 10/05/17), If they are installed properly (with 5 to 10 pipe diameters straight pipe upstream and 1 to 2 downstream) and sized correctly, they probably actually read with error less than 1%. Site inspection of one well showed that the meter was properly installed.
Water imported:	n/a
Water imported: master meter error adjustment:	n/a
Water exported:	n/a
Water exported: master meter error adjustment:	n/a
Billed metered:	Total billed metered calculated by DBS&A from 2016 City of Deming billings data (Water 2016 with location address.xlsx received April 2017), after corrections made to three erroneously high bills.
Billed unmetered:	n/a
Unbilled metered:	Route 98 consumption for 2016 less water provided by irrigation wells #3 and 12 (Data provided to Liie Hill by Deming October 2017)

Audit Item	Comment
Unbilled unmetered:	Default value assumed
Unauthorized consumption:	Default value assumed
Customer metering inaccuracies:	Communicated by Javier Reyes in an email dated 7/26/2017 (less than 1 percent)
Systematic data handling errors:	Default value assumed
Length of mains:	Communicated by Javier Reyes in an email dated 7/26/2017 (no change from 2015)
Number of active AND inactive service connections:	Communicated by Javier Reyes in an email dated 7/26/2017 (no change from 2015)
Average length of customer service line:	n/a
Average operating pressure:	Communicated by Javier Reyes in an email dated 7/26/2017 (no change from 2015)
Total annual cost of operating water system:	FY16 budget divided by 2 plus FY17 budget divided by 2. Based on total expenditures/expenses (water utility budget for FY17)
Customer retail unit cost (applied to Apparent Losses):	Line item 340 from water utility budget for FY17. FY16 Line item 340 divided by 2 plus FY17 line item 340 divided by 2. Divided by billed metered
Variable production cost (applied to Real Losses):	Operating costs and supplies for FY16 divided by 2 plus operating costs and supplies for FY17 divided by 2; divided by water supplied.

AWWA Free Water Audit Software: Water Balance

WAS v5.0

American Water Works Association.

Water Audit Report for:	City of Deming (NM3528616)	
Reporting Year:	2016	1/2/2016 - 12/2016
Data Validity Score:	53	

		Water Exported 0.000			Billed Water Exported	Revenue Water 0.000
Own Sources (Adjusted for known errors) 1,148.174	System Input 1,148.174	Water Supplied 1,148.174	Authorized Consumption 1,070.246	Billed Authorized Consumption 892.026	Billed Metered Consumption (water exported is removed) 892.026	Revenue Water 892.026
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 178.220	Unbilled Metered Consumption 163.868	Non-Revenue Water (NRW) 256.149
					Unbilled Unmetered Consumption 14.352	
			Water Losses 77.928	Apparent Losses 15.766	Unauthorized Consumption 2.870	
					Customer Metering Inaccuracies 10.666	
					Systematic Data Handling Errors 2.230	
Water Imported 0.000				Real Losses 62.162	Leakage on Transmission and/or Distribution Mains Not broken down	
					Leakage and Overflows at Utility's Storage Tanks Not broken down	
					Leakage on Service Connections Not broken down	

AWWA Free Water Audit Software:
Dashboard

WAS v5.0

The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

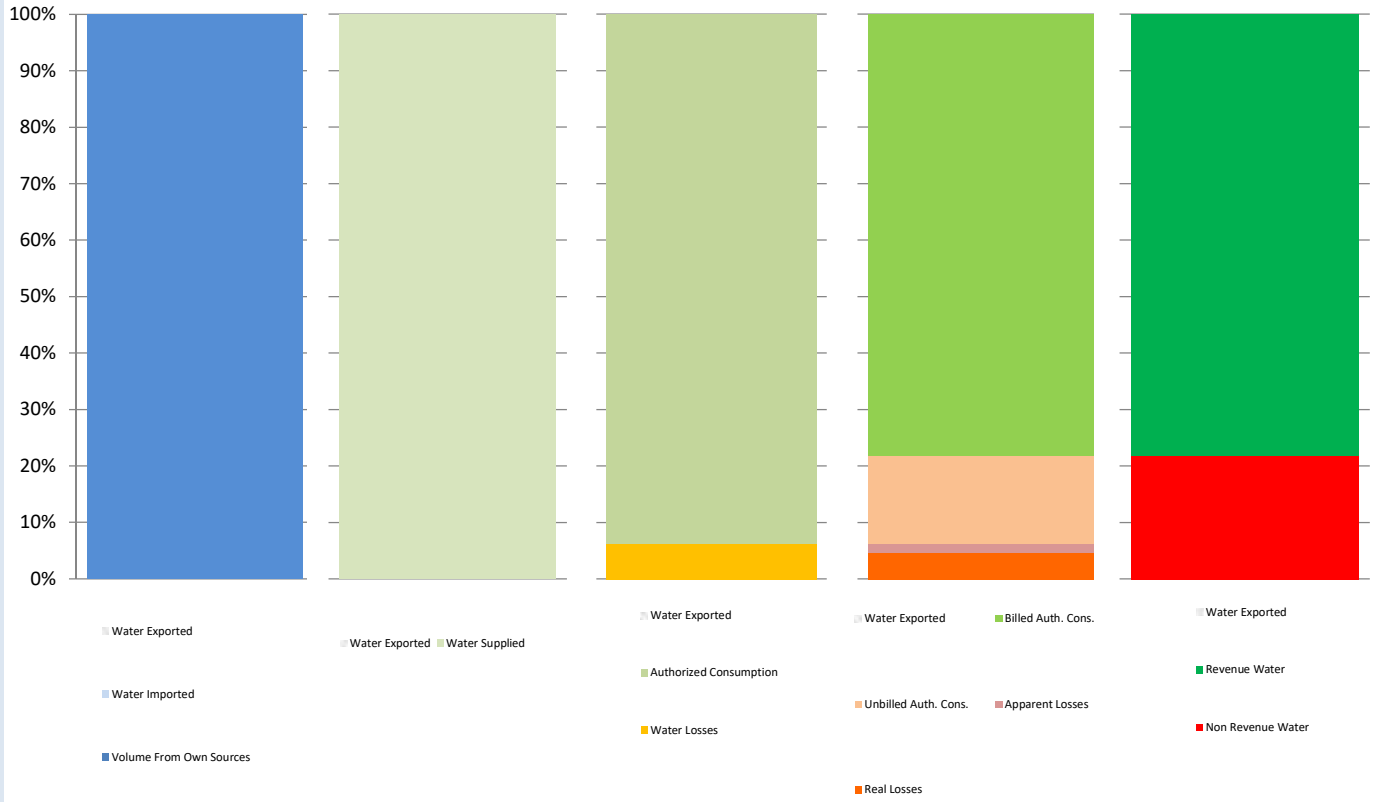
Water Audit Report for: City of Deming (NM3528616)

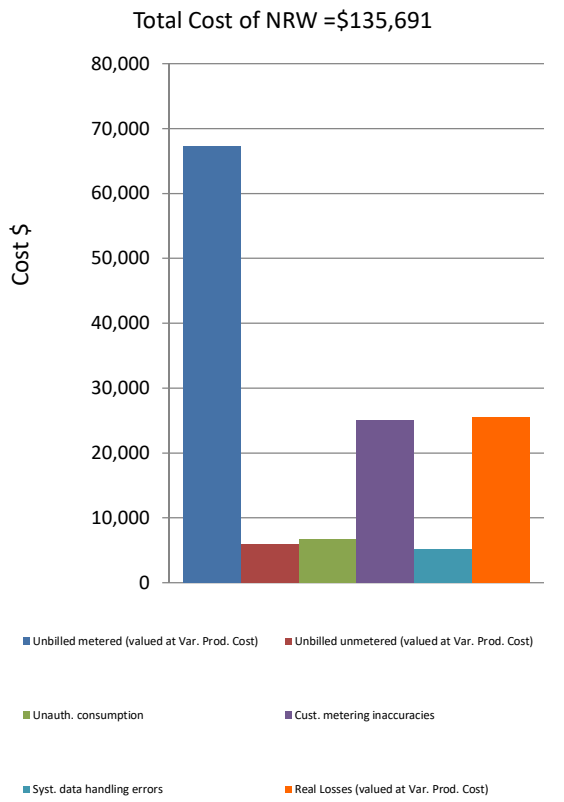
Reporting Year: 2016 | 1/2016 - 12/2016

Data Validity Score: 53

○ Show me the VOLUME of Non-Revenue Water

◉ Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software: Grading Matrix

WAS 5.0

The grading assigned to each audit component and the corresponding recommended improvements and actions are highlighted in yellow. Audit accuracy is likely to be improved by prioritizing those items shown in red

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
WATER SUPPLIED											
Volume from own sources:	Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)	Less than 25% of water production sources are metered, remaining sources are estimated. No regular meter accuracy testing or electronic calibration conducted.	25% - 50% of treated water production sources are metered; other sources estimated. No regular meter accuracy testing or electronic calibration conducted.	Conditions between 2 and 4	50% - 75% of treated water production sources are metered, other sources estimated. Occasional meter accuracy testing or electronic calibration conducted.	Conditions between 4 and 6	At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy. Procedures are reviewed by a third party knowledgeable in the M36 methodology.
Improvements to attain higher data grading for "Volume from own Sources" component:		to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: Locate all water production sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered water production sources and replace any obsolete/defective meters.		to qualify for 6: Formalize annual meter accuracy testing for all source meters; specify the frequency of testing. Complete installation of meters on unmetered water production sources and complete replacement of all obsolete/defective meters.		to qualify for 8: Conduct annual meter accuracy testing and calibration of related instrumentation on all meter installations on a regular basis. Complete project to install new, or replace defective existing, meters so that entire production meter population is metered. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Maintain annual meter accuracy testing and calibration of related instrumentation for all meter installations. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to further improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Volume from own sources master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its sources of supply	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined	No automatic datalogging of production volumes; daily readings are scribed on paper records without any accountability controls. Flows are not balanced across the water distribution system: tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and archived flow data is adjusted only when grossly evident data error occurs.	Conditions between 2 and 4	Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. "Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities. Meter data is adjusted when gross data errors occur, or occasional meter testing deems this necessary.	Conditions between 4 and 6	Hourly production meter data logged automatically & reviewed on at least a weekly basis. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and/or error is confirmed by meter accuracy testing. Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources" component, and data gaps in the archived data are corrected on at least a weekly basis.	Conditions between 6 and 8	Continuous production meter data is logged automatically & reviewed each business day. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and data gaps in the archived data are corrected on a daily basis.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically balances flows from all sources and storages; results are reviewed each business day. Tight accountability controls ensure that all data gaps that occur in the archived flow data are quickly detected and corrected. Regular calibrations between SCADA and sources meters ensures minimal data transfer error.
Improvements to attain higher data grading for "Master meter and supply error adjustment" component:		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature.	to qualify for 4: Install automatic datalogging equipment on production meters. Complete installation of level instrumentation at all tanks/storage facilities and include tank level data in automatic calculation routine in a computerized system. Construct a computerized listing or spreadsheet to archive input volumes, tank/storage volume changes and import/export flows in order to determine the composite "Water Supplied" volume for the distribution system. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps.		to qualify for 6: Refine computerized data collection and archive to include hourly production meter data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Use daily net storage change to balance flows in calculating "Water Supplied" volume. Necessary corrections to data errors are implemented on a weekly basis.		to qualify for 8: Ensure that all flow data is collected and archived on at least an hourly basis. All data is reviewed and detected errors corrected each business day. Tank/storage levels variations are employed in calculating balanced "Water Supplied" component. Adjust production meter data for gross error and inaccuracy confirmed by testing.		to qualify for 10: Link all production and tank/storage facility elevation change data to a Supervisory Control & Data Acquisition (SCADA) System, or similar computerized monitoring/control system, and establish automatic flow balancing algorithm and regularly calibrate between SCADA and source meters. Data is reviewed and corrected each business day.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters. Continue to replace or repair meters as they perform outside of desired accuracy limits. Stay abreast of new and more accurate water level instruments to better record tank/storage levels and archive the variations in storage volume. Keep current with SCADA and data management systems to ensure that archived data is well-managed and error free.
Water Imported:	Select n/a if the water utility's supply is exclusively from its own water resources (no bulk purchased/ imported water)	Less than 25% of imported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of imported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of imported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of imported water sources are metered, meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually for all meter installations. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Water Imported Volume" component: (*Note: usually the water supplier selling the water - "the Exporter" - to the utility being audited is responsible to maintain the metering installation measuring the imported volume. The utility should coordinate carefully with the Exporter to ensure that adequate meter upkeep takes place and an accurate measure of the Water Imported volume is quantified.*)		to qualify for 2: Review bulk water purchase agreements with partner suppliers; confirm requirements for use and maintenance of accurate metering. Identify needs for new or replacement meters with goal to meter all imported water sources.	To qualify for 4: Locate all imported water sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered imported water interconnections and replace obsolete/defective meters.		to qualify for 6: Formalize annual meter accuracy testing for all imported water meters, planning for both regular meter accuracy testing and calibration of the related instrumentation. Continue installation of meters on unmetered imported water interconnections and replacement of obsolete/defective meters.		to qualify for 8: Complete project to install new, or replace defective, meters on all imported water interconnections. Maintain annual meter accuracy testing for all imported water meters and conduct calibration of related instrumentation at least annually. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Conduct meter accuracy testing for all meters on a semi-annual basis, along with calibration of all related instrumentation. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Continue to conduct calibration of related instrumentation on a semi-annual basis. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Water imported master meter and supply error adjustment:	Select n/a if the Imported water supply is unmetered, with Imported water quantities estimated on the billing invoices sent by the Exporter to the purchasing Utility.	Inventory information on imported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined Written agreement(s) with water Exporter(s) are missing or written in vague language concerning meter management and testing.	No automatic datalogging of imported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Imported supply metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis by the Exporter with necessary corrections implemented. Meter data is adjusted by the Exporter when gross data errors are detected. A coherent data trail exists for this process to protect both the selling and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly Imported supply metered data is logged automatically & reviewed on at least a weekly basis by the Exporter. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error confirmed by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling and the purchasing Utility.	Conditions between 6 and 8	Continuous Imported supply metered flow data is logged automatically & reviewed each business day by the Exporter. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the Exporter. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling and purchasing Utility at least once every five years.
Improvements to attain higher data grading for "Water imported master meter and supply error adjustment" component:		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the selling and purchasing Utility.	to qualify for 4: Install automatic datalogging equipment on Imported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the Exporters to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		to qualify for 6: Refine computerized data collection and archive to include hourly Imported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		to qualify for 8: Ensure that all Imported supply metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		to qualify for 10: Conduct accountability checks to confirm that all Imported supply metered data is reviewed and corrected each business day by the Exporter. Results of all meter accuracy tests and data corrections should be available for sharing between the Exporter and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreement between the selling and the purchasing Utility; at least every five years.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the Exporter to help identify meter replacement needs. Keep communication lines with Exporters open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
Water Exported:	Select n/a if the water utility sells no bulk water to neighboring water utilities (no exported water sales)	Less than 25% of exported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of exported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of exported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of exported water sources are metered, meter accuracy testing and/or electronic calibration conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.
Improvements to attain higher data grading for "Water Exported Volume" component: (*Note: usually, if the water utility being audited sells (Exports) water to a neighboring purchasing Utility, it is the responsibility of the utility exporting the water to maintain the metering installation measuring the Exported volume. The utility exporting the water should ensure that adequate meter upkeep takes place and an accurate measure of the Water Exported volume is quantified.*)		to qualify for 2: Review bulk water sales agreements with purchasing utilities; confirm requirements for use & upkeep of accurate metering. Identify needs to install new, or replace defective meters as needed.	To qualify for 4: Locate all exported water sources on maps and in field, launch meter accuracy testing for existing meters, begin to install meters on unmetered exported water interconnections and replace obsolete/defective meters		to qualify for 6: Formalize annual meter accuracy testing for all exported water meters. Continue installation of meters on unmetered exported water interconnections and replacement of obsolete/defective meters.		to qualify for 8: Complete project to install new, or replace defective, meters on all exported water interconnections. Maintain annual meter accuracy testing for all exported water meters. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Maintain annual meter accuracy testing for all meters. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Water exported master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its exported supply interconnections.	Inventory information on exported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined Written agreement(s) with the utility purchasing the water are missing or written in vague language concerning meter management and testing.	No automatic datalogging of exported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Exported metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis, with necessary corrections implemented. Meter data is adjusted by the utility selling (exporting) the water when gross data errors are detected. A coherent data trail exists for this process to protect both the utility exporting the water and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly exported supply metered data is logged automatically & reviewed on at least a weekly basis by the utility selling the water. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error found by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling (exporting) utility and the purchasing Utility.	Conditions between 6 and 8	Continuous exported supply metered flow data is logged automatically & reviewed each business day by the utility selling (exporting) the water. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and any error confirmed by meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling (exporting) Utility and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the utility selling (exporting) the water. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling Utility and purchasing Utility at least once every five years.
Improvements to attain higher data grading for "Water exported master meter and supply error adjustment" component:		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the utility selling (exporting) the water and the purchasing Utility.	to qualify for 4: Install automatic datalogging equipment on exported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the purchasing utilities to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		to qualify for 6: Refine computerized data collection and archive to include hourly exported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		to qualify for 8: Ensure that all exported metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		to qualify for 10: Conduct accountability checks to confirm that all exported metered flow data is reviewed and corrected each business day by the utility selling the water. Results of all meter accuracy tests and data corrections should be available for sharing between the utility and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreements with the purchasing utilities; at least every five years.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the purchasing utilities to help identify meter replacement needs. Keep communication lines with the purchasing utilities open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
AUTHORIZED CONSUMPTION											
Billed metered:	n/a (not applicable). Select n/a only if the entire customer population is not metered and is billed for water service on a flat or fixed rate basis. In such a case the volume entered must be zero.	Less than 50% of customers with volume-based billings from meter readings; flat or fixed rate billing exists for the majority of the customer population	At least 50% of customers with volume-based billing from meter reads; flat rate billing for others. Manual meter reading is conducted, with less than 50% meter read success rate, remainding accounts' consumption is estimated. Limited meter records, no regular meter testing or replacement. Billing data maintained on paper records, with no auditing.	Conditions between 2 and 4	At least 75% of customers with volume-based, billing from meter reads; flat or fixed rate billing for remaining accounts. Manual meter reading is conducted with at least 50% meter read success rate; consumption for accounts with failed reads is estimated. Purchase records verify age of customer meters; only very limited meter accuracy testing is conducted. Customer meters are replaced only upon complete failure. Computerized billing records exist, but only sporadic internal auditing conducted.	Conditions between 4 and 6	At least 90% of customers with volume-based billing from meter reads; consumption for remaining accounts is estimated. Manual customer meter reading gives at least 80% customer meter reading success rate; consumption for accounts with failed reads is estimated. Good customer meter records eixst, but only limited meter accuracy testing is conducted. Regular replacement is conducted for the oldest meters. Computerized billing records exist with annual auditing of summary statistics conducting by utility personnel.	Conditions between 6 and 8	At least 97% of customers exist with volume-based billing from meter reads. At least 90% customer meter reading success rate; or at least 80% read success rate with planning and budgeting for trials of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) in one or more pilot areas. Good customer meter records. Regular meter accuracy testing guides replacement of statistically significant number of meters each year. Routine auditing of computerized billing records for global and detailed statistics occurs annually by utility personnel, and is verified by third party at least once every five years.	Conditions between 8 and 10	At least 99% of customers exist with volume-based billing from meter reads. At least 95% customer meter reading success rate; or minimum 80% meter reading success rate, with Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) trials underway. Statistically significant customer meter testing and replacement program in place on a continuous basis. Computerized billing with routine, detailed auditing, including field investigation of representative sample of accounts undertaken annually by utility personnel. Audit is conducted by third party auditors at least once every three years.
Improvements to attain higher data grading for "Billed Metered Consumption" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures.	to qualify for 4: Purchase and install meters on unmetered accounts. Implement policies to improve meter reading success. Catalog meter information during meter read visits to identify age/model of existing meters. Test a minimal number of meters for accuracy. Install computerized billing system.		to qualify for 6: Purchase and install meters on unmetered accounts. Eliminate flat fee billing and establish appropriate water rate structure based upon measured consumption. Continue to achieve verifiable success in removing manual meter reading barriers. Expand meter accuracy testing. Launch regular meter replacement program. Launch a program of annual auditing of global billing statistics by utility personnel.		to qualify for 8: Purchase and install meters on unmetered accounts. If customer meter reading success rate is less than 97%, assess cost-effectiveness of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system for portion or entire system; or otherwise achieve ongoing improvements in manual meter reading success rate to 97% or higher. Refine meter accuracy testing program. Set meter replacement goals based upon accuracy test results. Implement annual auditing of detailed billing records by utility personnel and implement third party auditing at least once every five years.		to qualify for 10: Purchase and install meters on unmetered accounts. Launch Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system trials if manual meter reading success rate of at least 99% is not achieved within a five-year program. Continue meter accuracy testing program. Conduct planning and budgeting for large scale meter replacement based upon meter life cycle analysis using cumulative flow target. Continue annual detailed billing data auditing by utility personnel and conduct third party auditing at least once every three years.		to maintain 10: Continue annual internal billing data auditing, and third party auditing at least every three years. Continue customer meter accuracy testing to ensure that accurate customer meter readings are obtained and entered as the basis for volume based billing. Stay abreast of improvements in Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) and information management. Plan and budget for justified upgrades in metering, meter reading and billing data management to maintain very high accuracy in customer metering and billing.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Billed unmetered:	Select n/a if it is the policy of the water utility to meter all customer connections and it has been confirmed by detailed auditing that all customers do indeed have a water meter; i.e. no intentionally unmetered accounts exist	Water utility policy does not require customer metering; flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach.	Water utility policy does not require customer metering; flat or fixed fee billing is employed. Some metered accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods. Data from these sample meters are used to infer consumption for the total customer population. Site specific estimation methods are used for unusual buildings/water uses.	Conditions between 2 and 4	Water utility policy does require metering and volume based billing in general. However, a liberal amount of exemptions and a lack of clearly written and communicated procedures result in up to 20% of billed accounts believed to be unmetered by exemption; or the water utility is in transition to becoming fully metered, and a large number of customers remain unmetered. A rough estimate of the annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 4 and 6	Water utility policy does require metering and volume based billing but established exemptions exist for a portion of accounts such as municipal buildings. As many as 15% of billed accounts are unmetered due to this exemption or meter installation difficulties. Only a group estimate of annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 6 and 8	Water utility policy does require metering and volume based billing for all customer accounts. However, less than 5% of billed accounts remain unmetered because meter installation is hindered by unusual circumstances. The goal is to minimize the number of unmetered accounts. Reliable estimates of consumption are obtained for these unmetered accounts via site specific estimation methods.	Conditions between 8 and 10	Water utility policy does require metering and volume based billing for all customer accounts. Less than 2% of billed accounts are unmetered and exist because meter installation is hindered by unusual circumstances. The goal exists to minimize the number of unmetered accounts to the extent that is economical. Reliable estimates of consumption are obtained at these accounts via site specific estimation methods.
Improvements to attain higher data grading for "Billed Unmetered Consumption" component:		to qualify for 2: Conduct research and evaluate cost/benefit of a new water utility policy to require metering of the customer population; thereby greatly reducing or eliminating unmetered accounts. Conduct pilot metering project by installing water meters in small sample of customer accounts and periodically reading the meters or datalogging the water consumption over one, three, or seven day periods.	to qualify for 4: Implement a new water utility policy requiring customer metering. Launch or expand pilot metering study to include several different meter types, which will provide data for economic assessment of full scale metering options. Assess sites with access difficulties to devise means to obtain water consumption volumes. Begin customer meter installation.		to qualify for 6: Refine policy and procedures to improve customer metering participation for all but solidly exempt accounts. Assign staff resources to review billing records to identify errant unmetered properties. Specify metering needs and funding requirements to install sufficient meters to significant reduce the number of unmetered accounts		to qualify for 8: Push to install customer meters on a full scale basis. Refine metering policy and procedures to ensure that all accounts, including municipal properties, are designated for meters. Plan special efforts to address "hard-to-access" accounts. Implement procedures to obtain a reliable consumption estimate for the remaining few unmetered accounts awaiting meter installation.		to qualify for 10: Continue customer meter installation throughout the service area, with a goal to minimize unmetered accounts. Sustain the effort to investigate accounts with access difficulties, and devise means to install water meters or otherwise measure water consumption.		to maintain 10: Continue to refine estimation methods for unmetered consumption and explore means to establish metering, for as many billed remaining unmetered accounts as is economically feasible.
Unbilled metered:	select n/a if all billing-exempt consumption is unmetered.	Billing practices exempt certain accounts, such as municipal buildings, but written policies do not exist; and a reliable count of unbilled metered accounts is unavailable. Meter upkeep and meter reading on these accounts is rare and not considered a priority. Due to poor recordkeeping and lack of auditing, water consumption for all such accounts is purely guesstimated.	Billing practices exempt certain accounts, such as municipal buildings, but only scattered, dated written directives exist to justify this practice. A reliable count of unbilled metered accounts is unavailable. Sporadic meter replacement and meter reading occurs on an as-needed basis. The total annual water consumption for all unbilled, metered accounts is estimated based upon approximating the number of accounts and assigning consumption from actively billed accounts of same meter size.	Conditions between 2 and 4	Dated written procedures permit billing exemption for specific accounts, such as municipal properties, but are unclear regarding certain other types of accounts. Meter reading is given low priority and is sporadic. Consumption is quantified from meter readings where available. The total number of unbilled, unmetered accounts must be estimated along with consumption volumes.	Conditions between 4 and 6	Written policies regarding billing exemptions exist but adherence in practice is questionable. Metering and meter reading for municipal buildings is reliable but sporadic for other unbilled metered accounts. Periodic auditing of such accounts is conducted. Water consumption is quantified directly from meter readings where available, but the majority of the consumption is estimated.	Conditions between 6 and 8	Written policy identifies the types of accounts granted a billing exemption. Customer meter management and meter reading are considered secondary priorities, but meter reading is conducted at least annually to obtain consumption volumes for the annual water audit. High level auditing of billing records ensures that a reliable census of such accounts exists.	Conditions between 8 and 10	Clearly written policy identifies the types of accounts given a billing exemption, with emphasis on keeping such accounts to a minimum. Customer meter management and meter reading for these accounts is given proper priority and is reliably conducted. Regular auditing confirms this. Total water consumption for these accounts is taken from reliable readings from accurate meters.
Improvements to attain higher data grading for "Unbilled Metered Consumption" component:		to qualify for 2: Reassess the water utility's policy allowing certain accounts to be granted a billing exemption. Draft an outline of a new written policy for billing exemptions, with clear justification as to why any accounts should be exempt from billing, and with the intention to keep the number of such accounts to a minimum.	to qualify for 4: Review historic written directives and policy documents allowing certain accounts to be billing-exempt. Draft an outline of a written policy for billing exemptions, identify criteria that grants an exemption, with a goal of keeping this number of accounts to a minimum. Consider increasing the priority of reading meters on unbilled accounts at least annually.		to qualify for 6: Draft a new written policy regarding billing exemptions based upon consensus criteria allowing this occurrence. Assign resources to audit meter records and billing records to obtain census of unbilled metered accounts. Gradually include a greater number of these metered accounts to the routes for regular meter reading.		to qualify for 8: Communicate billing exemption policy throughout the organization and implement procedures that ensure proper account management. Conduct inspections of accounts confirmed in unbilled metered status and verify that accurate meters exist and are scheduled for routine meter readings. Gradually increase the number of unbilled metered accounts that are included in regular meter reading routes.		to qualify for 10: Ensure that meter management (meter accuracy testing, meter replacement) and meter reading activities for unbilled accounts are accorded the same priority as billed accounts. Establish ongoing annual auditing process to ensure that water consumption is reliably collected and provided to the annual water audit process.		to maintain 10: Reassess the utility's philosophy in allowing any water uses to go "unbilled". It is possible to meter and bill all accounts, even if the fee charged for water consumption is discounted or waived. Metering and billing all accounts ensures that water consumption is tracked and water waste from plumbing leaks is detected and minimized.
Unbilled unmetered:		Extent of unbilled, unmetered consumption is unknown due to unclear policies and poor recordkeeping. Total consumption is quantified based upon a purely subjective estimate.	Clear extent of unbilled, unmetered consumption is unknown, but a number of events are randomly documented each year, confirming existence of such consumption, but without sufficient documentation to quantify an accurate estimate of the annual volume consumed.	Conditions between 2 and 4	Extent of unbilled, unmetered consumption is partially known, and procedures exist to document certain events such as miscellaneous fire hydrant uses. Formulae is used to quantify the consumption from such events (time running multiplied by typical flowrate, multiplied by number of events).	Default value of 1.25% of system input volume is employed	Coherent policies exist for some forms of unbilled, unmetered consumption but others await closer evaluation. Reasonable recordkeeping for the managed uses exists and allows for annual volumes to be quantified by inference, but unsupervised uses are guesstimated.	Conditions between 6 and 8	Clear policies and good recordkeeping exist for some uses (ex: water used in periodic testing of unmetered fire connections), but other uses (ex: miscellaneous uses of fire hydrants) have limited oversight. Total consumption is a mix of well quantified use such as from formulae (time running multiplied by typical flow, multiplied by number of events) or temporary meters, and relatively subjective estimates of less regulated use.	Conditions between 8 and 10	Clear policies exist to identify permitted use of water in unbilled, unmetered fashion, with the intention of minimizing this type of consumption. Good records document each occurrence and consumption is quantified via formulae (time running multiplied by typical flow, multiplied by number of events) or use of temporary meters.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Unbilled Unmetered Consumption" component:		to qualify for 5: Utilize the accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 2: Establish a policy regarding what water uses should be allowed to remain as unbilled and unmetered. Consider tracking a small sample of one such use (ex: fire hydrant flushings).	to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 4: Evaluate the documentation of events that have been observed. Meet with user groups (ex: for fire hydrants - fire departments, contractors to ascertain their need and/or volume requirements for water from fire hydrants).		to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process, and should focus on other components since the volume of unbilled, umetered consumption is usually a relatively small quatity component, and other larger-quantity components should take priority.	to qualify for 6 or greater: Finalize policy and begin to conduct field checks to better establish and quantify such usage. Proceed if top-down audit exists and/or a great volume of such use is suspected.	to qualify for 8: Assess water utility policy and procedures for various unmetered usages. For example, ensure that a policy exists and permits are issued for use of fire hydrants by persons outside of the utility. Create written procedures for use and documentation of fire hydrants by water utility personnel. Use same approach for other types of unbilled, unmetered water usage.		to qualify for 10: Refine written procedures to ensure that all uses of unbilled, unmetered water are overseen by a structured permitting process managed by water utility personnel. Reassess policy to determine if some of these uses have value in being converted to billed and/or metered status.		to maintain 10: Continue to refine policy and procedures with intention of reducing the number of allowable uses of water in unbilled and unmetered fashion. Any uses that can feasibly become billed and metered should be converted eventually.
APPARENT LOSSES											
Unauthorized consumption:		Extent of unauthorized consumption is unknown due to unclear policies and poor recordkeeping. Total unauthorized consumption is guesstimated.	Unauthorized consumption is a known occurrence, but its extent is a mystery. There are no requirements to document observed events, but periodic field reports capture some of these occurrences. Total unauthorized consumption is approximated from this limited data.	conditions between 2 and 4	Procedures exist to document some unauthorized consumption such as observed unauthorized fire hydrant openings. Use formulae to quantify this consumption (time running multiplied typical flowrate, multiplied by number of events).	Default value of 0.25% of volume of water supplied is employed	Coherent policies exist for some forms of unauthorized consumption (more than simply fire hydrant misuse) but others await closer evaluation. Reasonable surveillance and recordkeeping exist for occurrences that fall under the policy. Volumes quantified by inference from these records.	Conditions between 6 and 8	Clear policies and good auditable recordkeeping exist for certain events (ex: tampering with water meters, illegal bypasses of customer meters); but other occurrences have limited oversight. Total consumption is a combination of volumes from formulae (time x typical flow) and subjective estimates of unconfirmed consumption.	Conditions between 8 and 10	Clear policies exist to identify all known unauthorized uses of water. Staff and procedures exist to provide enforcement of policies and detect violations. Each occurrence is recorded and quantified via formulae (estimated time running multiplied by typical flow) or similar methods. All records and calculations should exist in a form that can be audited by a third party.
Improvements to attain higher data grading for "Unauthorized Consumption" component:		to qualify for 5: Use accepted default of 0.25% of volume of water supplied. to qualify for 2: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)	to qualify for 5: Use accepted default of 0.25% of system input volume to qualify for 4: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)		to qualify for 5: Utilize accepted default value of 0.25% of volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process.	to qualify for 6 or greater: Finalize policy updates to clearly identify the types of water consumption that are authorized from those usages that fall outside of this policy and are, therefore, unauthorized. Begin to conduct regular field checks. Proceed if the top-down audit already exists and/or a great volume of such use is suspected.	to quality for 8: Assess water utility policies to ensure that all known occurrences of unauthorized consumption are outlawed, and that appropriate penalties are prescribed. Create written procedures for detection and documentation of various occurrences of unauthorized consumption as they are uncovered.		to qualify for 10: Refine written procedures and assign staff to seek out likely occurrences of unauthorized consumption. Explore new locking devices, monitors and other technologies designed to detect and thwart unauthorized consumption.		to maintain 10: Continue to refine policy and procedures to eliminate any loopholes that allow or tacitly encourage unauthorized consumption. Continue to be vigilant in detection, documentation and enforcement efforts.
Customer metering inaccuracies:	select n/a only if the entire customer population is unmetered. In such a case the volume entered must be zero.	Customer meters exist, but with unorganized paper records on meters; no meter accuracy testing or meter replacement program for any size of retail meter. Metering workflow is driven chaotically with no proactive management. Loss volume due to aggregate meter inaccuracy is guesstimated.	Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing. Existing paper records gathered and organized to provide cursory disposition of meter population. Customer meters are tested for accuracy only upon customer request.	Conditions between 2 and 4	Reliable recordkeeping exists; meter information is improving as meters are replaced. Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory). A limited number of the oldest meters are replaced each year. Inaccuracy volume is largely an estimate, but refined based upon limited testing data.	Conditions between 4 and 6	A reliable electronic recordkeeping system for meters exists. The meter population includes a mix of new high performing meters and dated meters with suspect accuracy. Routine, but limited, meter accuracy testing and meter replacement occur. Inaccuracy volume is quantified using a mix of reliable and less certain data.	Conditions between 6 and 8	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters.	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Statistically significant number of meters are tested in audit year. This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters.	Good records of all active customer meters exist and include as a minimum: meter number, account number/location, type, size and manufacturer. Ongoing meter replacement occurs according to a targeted and justified basis. Regular meter accuracy testing gives a reliable measure of composite inaccuracy volume for the customer meter population. New metering technology is embraced to keep overall accuracy improving. Procedures are reviewed by a third party knowledgeable in the M36 methodology.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Customer meter inaccuracy volume" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Gather available meter purchase records. Conduct testing on a small number of meters believed to be the most inaccurate. Review staffing needs of the metering group and budget for necessary resources to better organize meter management.	to qualify for 4: Implement a reliable record keeping system for customer meter histories, preferably using electronic methods typically linked to, or part of, the Customer Billing System or Customer Information System. Expand meter accuracy testing to a larger group of meters.		to qualify for 6: Standardize the procedures for meter recordkeeping within an electronic information system. Accelerate meter accuracy testing and meter replacements guided by testing results.		to qualify for 8: Expand annual meter accuracy testing to evaluate a statistically significant number of meter makes/models. Expand meter replacement program to replace statistically significant number of poor performing meters each year.		to qualify for 9: Continue efforts to manage meter population with reliable recordkeeping. Test a statistically significant number of meters each year and analyze test results in an ongoing manner to serve as a basis for a target meter replacement strategy based upon accumulated volume throughput.	to qualify for 10: Continue efforts to manage meter population with reliable recordkeeping, meter testing and replacement. Evaluate new meter types and install one or more types in 5-10 customer accounts each year in order to pilot improving metering technology.	to maintain 10: Increase the number of meters tested and replaced as justified by meter accuracy test data. Continually monitor development of new metering technology and Advanced Metering Infrastructure (AMI) to grasp opportunities for greater accuracy in metering of water flow and management of customer consumption data.
Systematic Data Handling Errors:	Note: all water utilities incur some amount of this error. Even in water utilities with unmetered customer populations and fixed rate billing, errors occur in annual billing tabulations. Enter a positive value for the volume and select a grading.	Policies and procedures for activation of new customer water billing accounts are vague and lack accountability. Billing data is maintained on paper records which are not well organized. No auditing is conducted to confirm billing data handling efficiency. An unknown number of customers escape routine billing due to lack of billing process oversight.	Policy and procedures for activation of new customer accounts and oversight of billing records exist but need refinement. Billing data is maintained on paper records or insufficiently capable electronic database. Only periodic unstructured auditing work is conducted to confirm billing data handling efficiency. The volume of unbilled water due to billing lapses is a guess.	Conditions between 2 and 4	Policy and procedures for new account activation and oversight of billing operations exist but needs refinement. Computerized billing system exists, but is dated or lacks needed functionality. Periodic, limited internal audits conducted and confirm with approximate accuracy the consumption volumes lost to billing lapses.	Conditions between 4 and 6	Policy and procedures for new account activation and oversight of billing operations is adequate and reviewed periodically. Computerized billing system is in use with basic reporting available. Any effect of billing adjustments on measured consumption volumes is well understood. Internal checks of billing data error conducted annually. Reasonably accurate quantification of consumption volume lost to billing lapses is obtained.	Conditions between 6 and 8	New account activation and billing operations policy and procedures are reviewed at least biannually. Computerized billing system includes an array of reports to confirm billing data and system functionality. Checks are conducted routinely to flag and explain zero consumption accounts. Annual internal checks conducted with third party audit conducted at least once every five years. Accountability checks flag billing lapses. Consumption lost to billing lapses is well quantified and reducing year-by-year.	Conditions between 8 and 10	Sound written policy and procedures exist for new account activation and oversight of customer billing operations. Robust computerized billing system gives high functionality and reporting capabilities which are utilized, analyzed and the results reported each billing cycle. Assessment of policy and data handling errors are conducted internally and audited by third party at least once every three years, ensuring consumption lost to billing lapses is minimized and detected as it occurs.
Improvements to attain higher data grading for "Systematic Data Handling Error volume" component:		to qualify for 2: Draft written policy and procedures for activating new water billing accounts and oversight of billing operations. Investigate and budget for computerized customer billing system. Conduct initial audit of billing records by flow-charting the basic business processes of the customer account/billing function.	to qualify for 4: Finalize written policy and procedures for activation of new billing acocunts and overall billing operations management. Implement a computerized customer billing system. Conduct initial audit of billing records as part of this process.		to qualify for 6: Refine new account activation and billing operations procedures and ensure consistency with the utility policy regarding billing, and minimize opportunity for missed billings. Upgrade or replace customer billing system for needed functionality - ensure that billing adjustments don't corrupt the value of consumption volumes. Procedurize internal annual audit process.		to qualify for 8: Formalize regular review of new account activation process and general billing practices. Enhance reporting capability of computerized billing system. Formalize regular auditing process to reveal scope of data handling error. Plan for periodic third party audit to occur at least once every five years.		to qualify for 10: Close policy/procedure loopholes that allow some customer accounts to go unbilled, or data handling errors to exist. Ensure that billing system reports are utilized, analyzed and reported every billing cycle. Ensure that internal and third party audits are conducted at least once every three years.		to maintain 10: Stay abreast of customer information management developments and innovations. Monitor developments of Advanced Metering Infrastructure (AMI) and integrate technology to ensure that customer endpoint information is well-monitored and errors/lapses are at an economic minimum.
SYSTEM DATA											
Length of mains:		Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.	Paper records in poor or uncertain condition (no annual tracking of installations & abandonments). Poor procedures to ensure that new water mains installed by developers are accurately documented.	Conditions between 2 and 4	Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in a uncertain degree of error in tabulation of mains length.	Conditions between 4 and 6	Sound written policy and procedures exist for permitting and commissioning new water mains. Highly accurate paper records with regular field validation; or electronic records and asset management system in good condition. Includes system backup.	Conditions between 6 and 8	Sound written policy and procedures exist for permitting and commissioning new water mains. Electronic recordkeeping such as a Geographical Information System (GIS) and asset management system are used to store and manage data.	Conditions between 8 and 10	Sound written policy exists for managing water mains extensions and replacements. Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases. Records of annual field validation should be available for review.
Improvements to attain higher data grading for "Length of Water Mains" component:		to qualify for 2: Assign personnel to inventory current as-built records and compare with customer billing system records and highway plans in order to verify poorly documented pipelines. Assemble policy documents regarding permitting and documentation of water main installations by the utility and building developers; identify gaps in procedures that result in poor documentation of new water main installations.	to qualify for 4: Complete inventory of paper records of water main installations for several years prior to audit year. Review policy and procedures for commissioning and documenting new water main installation.		to qualify for 6: Finalize updates/improvements to written policy and procedures for permitting/commissioning new main installations. Confirm inventory of records for five years prior to audit year; correct any errors or omissions.		to qualify for 8: Launch random field checks of limited number of locations. Convert to electronic database such as a Geographic Information System (GIS) with backup as justified. Develop written policy and procedures.		to qualify for 10: Link Geographic Information System (GIS) and asset management databases, conduct field verification of data. Record field verification information at least annually.		to maintain 10: Continue with standardization and random field validation to improve the completeness and accuracy of the system.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Number of active AND inactive service connections:		Vague permitting (of new service connections) policy and poor paper recordkeeping of customer connections/billings result in suspect determination of the number of service connections, which may be 10-15% in error from actual count.	General permitting policy exists but paper records, procedural gaps, and weak oversight result in questionable total for number of connections, which may vary 5-10% of actual count.	Conditions between 2 and 4	Written account activation policy and procedures exist, but with some gaps in performance and oversight. Computerized information management system is being brought online to replace dated paper recordkeeping system. Reasonably accurate tracking of service connection installations & abandonments; but count can be up to 5% in error from actual total.	Conditions between 4 and 6	Written new account activation and overall billing policies and procedures are adequate and reviewed periodically. Computerized information management system is in use with annual installations & abandonments totaled. Very limited field verifications and audits. Error in count of number of service connections is believed to be no more than 3%.	Conditions between 6 and 8	Policies and procedures for new account activation and overall billing operations are written, well-structured and reviewed at least biannually. Well-managed computerized information management system exists and routine, periodic field checks and internal system audits are conducted. Counts of connections are no more than 2% in error.	Conditions between 8 and 10	Sound written policy and well managed and audited procedures ensure reliable management of service connection population. Computerized information management system, Customer Billing System, and Geographic Information System (GIS) information agree; field validation proves truth of databases. Count of connections recorded as being in error is less than 1% of the entire population.
Improvements to attain higher data grading for "Number of Active and Inactive Service Connections" component:	**Note: The number of Service Connections does <u>not</u> include fire hydrant leads/lines connecting the hydrant to the water main**	<u>to qualify for 2</u>: Draft new policy and procedures for new account activation and overall billing operations. Research and collect paper records of installations & abandonments for several years prior to audit year.	<u>to qualify for 4</u>: Refine policy and procedures for new account activation and overall billing operations. Research computerized recordkeeping system (Customer Information System or Customer Billing System) to improve documentation format for service connections.		<u>to qualify for 6</u>: Refine procedures to ensure consistency with new account activation and overall billing policy to establish new service connections or decommission existing connections. Improve process to include all totals for at least five years prior to audit year.		<u>to qualify for 8</u>: Formalize regular review of new account activation and overall billing operations policies and procedures. Launch random field checks of limited number of locations. Develop reports and auditing mechanisms for computerized information management system.		<u>to qualify for 10</u>: Close any procedural loopholes that allow installations to go undocumented. Link computerized information management system with Geographic Information System (GIS) and formalize field inspection and information system auditing processes. Documentation of new or decommissioned service connections encounters several levels of checks and balances.		<u>to maintain 10</u>: Continue with standardization and random field validation to improve knowledge of system.
Average length of customer service line:	Note: if customer water meters are located outside of the customer building next to the curb stop or boundary separating utility/customer responsibility, then the auditor should answer "Yes" to the question on the Reporting Worksheet asking about this. If the answer is Yes, the grading description listed under the Grading of 10(a) will be followed, with a value of zero automatically entered at a Grading of 10. See the Service Connection Diagram worksheet for a visual presentation of this distance.	Gradings 1-9 apply if customer properties are unmetered, if customer meters exist and are located inside the customer building premises, or if the water utility owns and is responsible for the entire service connection piping from the water main to the customer building. In any of these cases the average distance between the curb stop or boundary separating utility/customer responsibility for service connection piping, and the typical first point of use (ex: faucet) or the customer meter must be quantified. Gradings of 1-9 are used to grade the validity of the means to quantify this value. (See the "Service Connection Diagram" worksheet)									<u>Either of two conditions can be met for a grading of 10</u>: a) Customer water meters exist outside of customer buildings next to the curb stop or boundary separating utility/customer responsibility for service connection piping. If so, answer "Yes" to the question on the Reporting Working asking about this condition. A value of zero and a Grading of 10 are automatically entered in the Reporting Worksheet . b). Meters exist inside customer buildings, or properties are unmetered. In either case, answer "No" to the Reporting Worksheet question on meter location, and enter a distance determined by the auditor. For a Grading of 10 this value must be a very reliable number from a Geographic Information System (GIS) and confirmed by a statistically valid number of field checks.
		Vague policy exists to define the delineation of water utility ownership and customer ownership of the service connection piping. Curb stops are perceived as the breakpoint but these have not been well-maintained or documented. Most are buried or obscured. Their location varies widely from site-to-site, and estimating this distance is arbitrary due to the unknown location of many curb stops.	Policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. The piping from the water main to the curb stop is the property of the water utility; and the piping from the curb stop to the customer building is owned by the customer. Curb stop locations are not well documented and the average distance is based upon a limited number of locations measured in the field.	Conditions between 2 and 4	Good policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy.	Conditions between 4 and 6	Clear written policy exists to define utility/customer responsibility for service connection piping. Accurate, well-maintained paper or basic electronic recordkeeping system exists. Periodic field checks confirm piping lengths for a sample of customer properties.	Conditions between 6 and 8	Clearly worded policy standardizes the location of curb stops and meters, which are inspected upon installation. Accurate and well maintained electronic records exist with periodic field checks to confirm locations of service lines, curb stops and customer meter pits. An accurate number of customer properties from the customer billing system allows for reliable averaging of this length.	Conditions between 8 and 10	
Improvements to attain higher data grading for "Average Length of Customer Service Line" component:		<u>to qualify for 2</u>: Research and collect paper records of service line installations. Inspect several sites in the field using pipe locators to locate curb stops. Obtain the length of this small sample of connections in this manner.	<u>to qualify for 4</u>: Formalize and communicate policy delineating utility/customer responsibilities for service connection piping. Assess accuracy of paper records by field inspection of a small sample of service connections using pipe locators as needed. Research the potential migration to a computerized information management system to store service connection data.		<u>to qualify for 6</u>: Establish coherent procedures to ensure that policy for curb stop, meter installation and documentation is followed. Gain consensus within the water utility for the establishment of a computerized information management system.		<u>to qualify for 8</u>: Implement an electronic means of recordkeeping, typically via a customer information system, customer billing system, or Geographic Information System (GIS). Standardize the process to conduct field checks of a limited number of locations.		<u>to qualify for 10</u>: Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data.		<u>to maintain 10</u>: Continue with standardization and random field validation to improve knowledge of service connection configurations and customer meter locations.
Average operating pressure:		Available records are poorly assembled and maintained paper records of supply pump characteristics and water distribution system operating conditions. Average pressure is guesstimated based upon this information and ground elevations from crude topographical maps. Widely varying distribution system pressures due to undulating terrain, high system head loss and weak/erratic pressure controls further compromise the validity of the average pressure calculation.	Limited telemetry monitoring of scattered pumping station and water storage tank sites provides some static pressure data, which is recorded in handwritten logbooks. Pressure data is gathered at individual sites only when low pressure complaints arise. Average pressure is determined by averaging relatively crude data, and is affected by significant variation in ground elevations, system head loss and gaps in pressure controls in the distribution system.	Conditions between 2 and 4	Effective pressure controls separate different pressure zones; moderate pressure variation across the system, occasional open boundary valves are discovered that breech pressure zones. Basic telemetry monitoring of the distribution system logs pressure data electronically. Pressure data gathered by gauges or dataloggers at fire hydrants or buildings when low pressure complaints arise, and during fire flow tests and system flushing. Reliable topographical data exists. Average pressure is calculated using this mix of data.	Conditions between 4 and 6	Reliable pressure controls separate distinct pressure zones; only very occasional open boundary valves are encountered that breech pressure zones. Well-covered telemetry monitoring of the distribution system (not just pumping at source treatment plants or wells) logs extensive pressure data electronically. Pressure gathered by gauges/dataloggers at fire hydrants and buildings when low pressure complaints arise, and during fire flow tests and system flushing. Average pressure is determined by using this mix of reliable data.	Conditions between 6 and 8	Well-managed, discrete pressure zones exist with generally predictable pressure fluctuations. A current full-scale SCADA System or similar realtime monitoring system exists to monitor the water distribution system and collect data, including real time pressure readings at representative sites across the system. The average system pressure is determined from reliable monitoring system data.	Conditions between 8 and 10	Well-managed pressure districts/zones, SCADA System and hydraulic model exist to give very precise pressure data across the water distribution system. Average system pressure is reliably calculated from extensive, reliable, and cross-checked data. Calculations are reported on an annual basis as a minimum.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Average Operating Pressure" component:		to qualify for 2: Employ pressure gauging and/or datalogging equipment to obtain pressure measurements from fire hydrants. Locate accurate topographical maps of service area in order to confirm ground elevations. Research pump data sheets to find pump pressure/flow characteristics	to qualify for 4: Formalize a procedure to use pressure gauging/datalogging equipment to gather pressure data during various system events such as low pressure complaints, or operational testing. Gather pump pressure and flow data at different flow regimes. Identify faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) and plan to properly configure pressure zones. Make all pressure data from these efforts available to generate system-wide average pressure.		to qualify for 6: Expand the use of pressure gauging/datalogging equipment to gather scattered pressure data at a representative set of sites, based upon pressure zones or areas. Utilize pump pressure and flow data to determine supply head entering each pressure zone or district. Correct any faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) to ensure properly configured pressure zones. Use expanded pressure dataset from these activities to generate system-wide average pressure.		to qualify for 8: Install a Supervisory Control and Data Acquisition (SCADA) System, or similar realtime monitoring system, to monitor system parameters and control operations. Set regular calibration schedule for instrumentation to insure data accuracy. Obtain accurate topographical data and utilize pressure data gathered from field surveys to provide extensive, reliable data for pressure averaging.		to qualify for 10: Annually, obtain a system-wide average pressure value from the hydraulic model of the distribution system that has been calibrated via field measurements in the water distribution system and confirmed in comparisons with SCADA System data.		to maintain 10: Continue to refine the hydraulic model of the distribution system and consider linking it with SCADA System for real-time pressure data calibration, and averaging.
COST DATA											
Total annual cost of operating water system:		Incomplete paper records and lack of financial accounting documentation on many operating functions makes calculation of water system operating costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to estimate the major portion of water system operating costs.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. However, gaps in data are known to exist, periodic internal reviews are conducted but not a structured financial audit.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited periodically by utility personnel, but not a Certified Public Accountant (CPA).	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited at least annually by utility personnel, and at least once every three years by third-party CPA.	Conditions between 8 and 10	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited annually by utility personnel and annually also by third-party CPA.
Improvements to attain higher data grading for "Total Annual Cost of Operating the Water System" component:		to qualify for 2: Gather available records, institute new financial accounting procedures to regularly collect and audit basic cost data of most important operations functions.	to qualify for 4: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6: Establish process for periodic internal audit of water system operating costs; identify cost data gaps and institute procedures for tracking these outstanding costs.		to qualify for 8: Standardize the process to conduct routine financial audit on an annual basis. Arrange for CPA audit of financial records at least once every three years.		to qualify for 10: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		to maintain 10: Maintain program, stay abreast of expenses subject to erratic cost changes and long-term cost trend, and budget/track costs proactively
Customer retail unit cost (applied to Apparent Losses):	Customer population unmetered, and/or only a fixed fee is charged for consumption.	Antiquated, cumbersome water rate structure is used, with periodic historic amendments that were poorly documented and implemented; resulting in classes of customers being billed inconsistent charges. The actual composite billing rate likely differs significantly from the published water rate structure, but a lack of auditing leaves the degree of error indeterminate.	Dated, cumbersome water rate structure, not always employed consistently in actual billing operations. The actual composite billing rate is known to differ from the published water rate structure, and a reasonably accurate estimate of the degree of error is determined, allowing a composite billing rate to be quantified.	Conditions between 2 and 4	Straight-forward water rate structure in use, but not updated in several years. Billing operations reliably employ the rate structure. The composite billing rate is derived from a single customer class such as residential customer accounts, neglecting the effect of different rates from varying customer classes.	Conditions between 4 and 6	Clearly written, up-to-date water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average residential rate using volumes of water in each rate block.	Conditions between 6 and 8	Effective water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average composite consumption rate, which includes residential, commercial, industrial, institutional (CII), and any other distinct customer classes within the water rate structure.	Conditions between 8 and 10	Current, effective water rate structure is in force and applied reliably in billing operations. The rate structure and calculations of composite rate - which includes residential, commercial, industrial, institutional (CII), and other distinct customer classes - are reviewed by a third party knowledgeable in the M36 methodology at least once every five years.
Improvements to attain higher data grading for "Customer Retail Unit Cost" component:		to qualify for 2: Formalize the process to implement water rates, including a secure documentation procedure. Create a current, formal water rate document and gain approval from all stakeholders.	to qualify for 4: Review the water rate structure and update/formalize as needed. Assess billing operations to ensure that actual billing operations incorporate the established water rate structure.		to qualify for 6: Evaluate volume of water used in each usage block by residential users. Multiply volumes by full rate structure.	Launch effort to fully meter the customer population and charge rates based upon water volumes	to qualify for 8: Evaluate volume of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to qualify for 10: Conduct a periodic third-party audit of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		to maintain 10: Keep water rate structure current in addressing the water utility's revenue needs. Update the calculation of the customer unit rate as new rate components, customer classes, or other components are modified.
Variable production cost (applied to Real Losses):	Note: if the water utility purchases/imports its entire water supply, then enter the unit purchase cost of the bulk water supply in the Reporting Worksheet with a grading of 10	Incomplete paper records and lack of documentation on primary operating functions (electric power and treatment costs most importantly) makes calculation of variable production costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to roughly estimate the basic operations costs (pumping power costs and treatment costs) and calculate a unit variable production cost.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. Electric power and treatment costs are reliably tracked and allow accurate weighted calculation of unit variable production costs based on these two inputs and water imported purchase costs (if applicable). All costs are audited internally on a periodic basis.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Pertinent additional costs beyond power, treatment and water imported purchase costs (if applicable) such as liability, residuals management, wear and tear on equipment, impending expansion of supply, are included in the unit variable production cost, as applicable. The data is audited at least annually by utility personnel.	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent primary and secondary variable production and water imported purchase (if applicable) costs tracked. The data is audited at least annually by utility personnel, and at least once every three years by a third-party knowledgeable in the M36 methodology.	Conditions between 8 and 10	Either of two conditions can be met to obtain a grading of 10: 1) Third party CPA audit of all pertinent primary and secondary variable production and water imported purchase (if applicable) costs on an annual basis. or: 2) Water supply is entirely purchased as bulk water imported, and the unit purchase cost - including all applicable marginal supply costs - serves as the variable production cost. If all applicable marginal supply costs are not included in this figure, a grade of 10 should not be selected.
Improvements to attain higher data grading for "Variable Production Cost" component:		to qualify for 2: Gather available records, institute new procedures to regularly collect and audit basic cost data and most important operations functions.	to qualify for 4: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		to qualify for 6: Formalize process for regular internal audits of production costs. Assess whether additional costs (liability, residuals management, equipment wear, impending infrastructure expansion) should be included to calculate a more representative variable production cost.		to qualify for 8: Formalize the accounting process to include direct cost components (power, treatment) as well as indirect cost components (liability, residuals management, etc.) Arrange to conduct audits by a knowledgable third-party at least once every three years.		to qualify for 10: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		to maintain 10: Maintain program, stay abreast of expenses subject to erratic cost changes and budget/track costs proactively

Water Audit Report for: City of Deming (NM3528616)
Reporting Year: 2016 | 1/2016 - 12/2016
Data Validity Score: 53

Water Loss Control Planning Guide

	Water Audit Data Validity Level / Score				
Functional Focus Area	**Level I** (0-25)	**Level II** (26-50)	**Level III** (51-70)	**Level IV** (71-90)	**Level V** (91-100)
Audit Data Collection	Launch auditing and loss control team; address production metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs. Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc.	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or Automatic Meter Reading (AMR) system.	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process.	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon the Infrastructure Leakage Index (ILI) for performance comparisons for real losses (see below table)	Performance Benchmarking - ILI is meaningful in comparing real loss standing	Identify Best Practices/ Best in class - the ILI is very reliable as a real loss performance indicator for best in class service

For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.

Once data have been entered into the Reporting Worksheet, the performance indicators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI (without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term planning.
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

AWWA Free Water Audit Software Grading Matrix

Volume from own sources		
GRADE	✓	DESCRIPTION
n/a		Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)
1		Less than 25% of water production sources are metered, remaining sources are estimated.
	✓	No regular meter accuracy testing or electronic calibration conducted.
2	✓	25% - 50% of treated water production sources are metered; other sources estimated.
	✓	No regular meter accuracy testing or electronic calibration conducted.
3	✓	Conditions between 2 and 4
4	✓	50% - 75% of treated water production sources are metered, other sources estimated.
		Occasional meter accuracy testing or electronic calibration conducted
5		Conditions between 4 and 6
6	✓	At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources.
		Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually.
		Less than 25% of tested meters are found outside of +/- 6% accuracy.
7		Conditions between 6 and 8
8	✓	100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted annually,
		Less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy.
		Procedures are reviewed by a third party knowledgeable in the M36 methodology

City of Deming grading for 2016 audit

Volume from own sources master meter and supply error adjustment

GRADE	✓	DESCRIPTION
n/a		Select n/a only if the water utility fails to have meters on its sources of supply
1	✓	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined
2	✓	No automatic datalogging of production volumes; daily readings are scribed on paper records without any accountability controls.
	✓	Flows are not balanced across the water distribution system: tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and
	✓	Archived flow data is adjusted only when grossly evident data error occurs.
3		Conditions between 2 and 4
4		Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented.
		“Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities.
		Meter data is adjusted when gross data errors occur, or occasional meter testing deems this necessary.
5		Conditions between 4 and 6
6		Hourly production meter data logged automatically & reviewed on at least a weekly basis.
		Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and/or error is confirmed by meter accuracy testing.
		Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources" component, and
		Data gaps in the archived data are corrected on at least a weekly basis.
7		Conditions between 6 and 8
8		Continuous production meter data is logged automatically & reviewed each business day.
		Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing.
		Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and
		data gaps in the archived data are corrected on a daily basis.
9		Conditions between 8 and 10
10		Computerized system (SCADA or similar) automatically balances flows from all sources and storages;
		Results are reviewed each business day.
		Tight accountability controls ensure that all data gaps that occur in the archived flow data are quickly detected and corrected.
		Regular calibrations between SCADA and sources meters ensures minimal data transfer error.

Water Imported

GRADE	✓	DESCRIPTION
n/a	✓	Select n/a if the water utility's supply is exclusively from its own water resources (no bulk purchased/ imported water)
1		Less than 25% of imported water sources are metered, remaining sources are estimated..
		No regular meter accuracy testing
2		25% - 50% of imported water sources are metered; other sources estimated.
		No regular meter accuracy testing
3		Conditions between 2 and 4
4		50% - 75% of imported water sources are metered, other sources estimated.
		Occasional meter accuracy testing conducted
5		Conditions between 4 and 6
6		At least 75% of imported water sources are metered,
		Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually for all meter installations.
		Less than 25% of tested meters are found outside of +/- 6% accuracy
7		Conditions between 6 and 8
8		100% of imported water sources are metered,
		meter accuracy testing and electronic calibration of related instrumentation is conducted annually,
		less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of imported water sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations,
		Less than 10% of accuracy tests found outside of +/- 3% accuracy.

Water imported master meter and supply error adjustment

GRADE	✓	DESCRIPTION
n/a	✓	Select n/a if the Imported water supply is unmetered,
	✓	with Imported water quantities estimated on the billing invoices sent by the Exporter to the purchasing Utility
1		Inventory information on imported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition;
		data error cannot be determined
		Written agreement(s) with water Exporter(s) are missing or written in vague language concerning meter management and testing.
2		No automatic datalogging of imported supply volumes;
		Daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes.
		Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing
3		Conditions between 2 and 4
4		Imported supply metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis by the Exporter with necessary corrections implemented.
		Meter data is adjusted by the Exporter when gross data errors are detected.
		A coherent data trail exists for this process to protect both the selling and the purchasing Utility.
		Written agreement exists and clearly states requirements and roles for meter accuracy testing & data management.
5		Conditions between 4 and 6
6		Hourly Imported supply metered data is logged automatically & reviewed on at least a weekly basis by the Exporter.
		Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error confirmed by meter accuracy testing.
		Any data gaps in the archived data are detected and corrected during the weekly review.
		A coherent data trail exists for this process to protect both the selling and the purchasing Utility
7		Conditions between 6 and 8
8		Continuous Imported supply metered flow data is logged automatically & reviewed each business day by the Exporter.
		Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing.
		Any data errors/gaps are detected and corrected on a daily basis.
		A data trail exists for the process to protect both the selling and the purchasing Utility
9		Conditions between 8 and 10
10		Computerized system (SCADA/similar) automatically records data & is reviewed each business day by the Exporter.
		Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected.
		A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling and purchasing Utility at least once every five years.

Water Exported

GRADE	✓	DESCRIPTION
n/a	✓	Select n/a if the water utility sells no bulk water to neighboring water utilities (no exported water sales)
1		Less than 25% of exported water sources are metered, remaining sources are estimated.
		No regular meter accuracy testing.
2		25% - 50% of exported water sources are metered; other sources estimated.
		No regular meter accuracy testing.
3		Conditions between 2 and 4
4		50% - 75% of exported water sources are metered, other sources estimated.
		Occasional meter accuracy testing conducted.
5		Conditions between 4 and 6
6		At least 75% of exported water sources are metered,
		Meter accuracy testing and/or electronic calibration conducted annually.
		Less than 25% of tested meters are found outside of +/- 6% accuracy.
7		Conditions between 6 and 8
8		100% of exported water sources are metered,
		meter accuracy testing and electronic calibration of related instrumentation is conducted annually,
		less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of exported water sources are metered,.
		meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations,
		with less than 10% of accuracy tests found outside of +/- 3% accuracy

Water exported master meter and supply error adjustment

GRADE	✓	DESCRIPTION
n/a	✓	Select n/a only if the water utility fails to have meters on its exported supply interconnections.
1		Inventory information on exported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition;
		data error cannot be determined
		Written agreement(s) with the utility purchasing the water are missing or written in vague language concerning meter management and testing
2		No automatic datalogging of exported supply volumes;
		Daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes.
		Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.
3		Conditions between 2 and 4
4		Exported metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis, with necessary corrections implemented.
		Meter data is adjusted by the utility selling (exporting) the water when gross data errors are detected.
		A coherent data trail exists for this process to protect both the utility exporting the water and the purchasing Utility.
		Written agreement exists and clearly states requirements and roles for meter accuracy testing & data management.
5		Conditions between 4 and 6
6		Hourly exported supply metered data is logged automatically & reviewed on at least a weekly basis by the utility selling the water.
		Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error found by meter accuracy testing.
		Any data gaps in the archived data are detected and corrected during the weekly review.
		A coherent data trail exists for this process to protect both the selling (exporting) utility and the purchasing Utility.
7		Conditions between 6 and 8
8		Continuous exported supply metered flow data is logged automatically & reviewed each business day by the utility selling (exporting) the water.
		Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and any error confirmed by meter accuracy testing.
		Any data errors/gaps are detected and corrected on a daily basis.
		A data trail exists for the process to protect both the selling (exporting) Utility and the purchasing Utility.
9		Conditions between 8 and 10
10		Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the utility selling (exporting) the water.
		Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected.
		A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling Utility and purchasing Utility at least once every five years.

Billed Metered

GRADE	✓	DESCRIPTION
n/a		n/a (not applicable). Select n/a only if the entire customer population is not metered and is billed for water service on a flat or fixed rate basis. In such a case the volume entered must be zero.
1		Less than 50% of customers with volume-based billings from meter readings; flat or fixed rate billing exists for the majority of the customer population
2		At least 50% of customers with volume-based billing from meter reads; flat rate billing for others.
		Manual meter reading is conducted, with less than 50% meter read success rate, remaining accounts' consumption is estimated.
		Limited meter records, no regular meter testing or replacement.
		Billing data maintained on paper records, with no auditing.
3		Conditions between 2 and 4
4		At least 75% of customers with volume-based, billing from meter reads; flat or fixed rate billing for remaining accounts.
		Manual meter reading is conducted with at least 50% meter read success rate; consumption for accounts with failed reads is estimated.
		Purchase records verify age of customer meters; only very limited meter accuracy testing is conducted.
		Customer meters are replaced only upon complete failure.
		Computerized billing records exist, but only sporadic internal auditing conducted.
5		Conditions between 4 and 6
6		At least 90% of customers with volume-based billing from meter reads; consumption for remaining accounts is estimated.
		Manual customer meter reading gives at least 80% customer meter reading success rate; consumption for accounts with failed reads is estimated.
		Good customer meter records exist, but only limited meter accuracy testing is conducted.
		Regular replacement is conducted for the oldest meters.
		Computerized billing records exist with **annual auditing** of summary statistics conducting by utility personnel.
7		Conditions between 6 and 8
8		At least 97% of customers exist with volume-based billing from meter reads.
		At least 90% customer meter reading success rate; or at least 80% read success rate with planning and budgeting for trials of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) in one or more pilot areas.
		Good customer meter records.
		Regular meter accuracy testing guides replacement of statistically significant number of meters each year.
		Routine auditing of computerized billing records for global and detailed statistics occurs annually by utility personnel, and is verified by third party at least once every five years.
9		Conditions between 8 and 10
10	✓	At least 99% of customers exist with volume-based billing from meter reads.
	✓	At least 95% customer meter reading success rate; or minimum 80% meter reading success rate, with Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) trials underway.
	✓	Statistically significant customer meter testing and replacement program in place on a continuous basis.
	✓	Computerized billing with routine, detailed auditing, including field investigation of representative sample of accounts undertaken annually by utility personnel. Audit is conducted by third party auditors at least once every three years.

Billed Unmetered

GRADE	✓	DESCRIPTION
n/a	✓	Select n/a if it is the policy of the water utility to meter all customer connections and it has been confirmed by detailed auditing that all customers do indeed have a water meter; i.e. no intentionally unmetered accounts exist
1		Water utility policy does not require customer metering; flat or fixed fee billing is employed.
		No data is collected on customer consumption.
		The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach.
2		Water utility policy does not require customer metering; flat or fixed fee billing is employed.
		Some metered accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods.
		Data from these sample meters are used to infer consumption for the total customer population.
		Site specific estimation methods are used for unusual buildings/water uses.
3		Conditions between 2 and 4
4		Water utility policy does require metering and volume based billing in general. However, a liberal amount of exemptions and a lack of clearly written and communicated procedures result in up to 20% of billed accounts believed to be unmetered by exemption; or the water utility is in transition to becoming fully metered, and a large number of customers remain unmetered.
		A rough estimate of the annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.
5		Conditions between 4 and 6
6		Water utility policy does require metering and volume based billing but established exemptions exist for a portion of accounts such as municipal buildings.
		As many as 15% of billed accounts are unmetered due to this exemption or meter installation difficulties.
		Only a group estimate of annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.
7		Conditions between 6 and 8
8		Water utility policy does require metering and volume based billing for all customer accounts. However, less than 5% of billed accounts remain unmetered because meter installation is hindered by unusual circumstances.
		The goal is to minimize the number of unmetered accounts.
		Reliable estimates of consumption are obtained for these unmetered accounts via site specific estimation methods.
9		Conditions between 8 and 10
10		Water utility policy does require metering and volume based billing for all customer accounts.
		Less than 2% of billed accounts are unmetered and exist because meter installation is hindered by unusual circumstances.
		The goal exists to minimize the number of unmetered accounts to the extent that is economical.
		Reliable estimates of consumption are obtained at these accounts via site specific estimation methods.

Unbilled metered:

GRADE	✓	DESCRIPTION
n/a		Select n/a if all billing-exempt consumption is unmetered.
1		Billing practices exempt certain accounts, such as municipal buildings, but written policies do not exist; and a reliable count of unbilled metered accounts is unavailable.
		Meter upkeep and meter reading on these accounts is rare and not considered a priority.
		Due to poor recordkeeping and lack of auditing, water consumption for all such accounts is purely guesstimated.
2	✓	Billing practices exempt certain accounts, such as municipal buildings, but only scattered, dated written directives exist to justify this practice.
		A reliable count of unbilled metered accounts is unavailable.
		Sporadic meter replacement and meter reading occurs on an as-needed basis.
		The total annual water consumption for all unbilled, metered accounts is estimated based upon approximating the number of accounts and assigning consumption from actively billed accounts of same meter size.
3		Conditions between 2 and 4
4		Dated written procedures permit billing exemption for specific accounts, such as municipal properties, but are unclear regarding certain other types of accounts.
		Meter reading is given low priority and is sporadic.
		Consumption is quantified from meter readings where available.
		The total number of unbilled, unmetered accounts must be estimated along with consumption volumes.
5		Conditions between 4 and 6
6		Written policies regarding billing exemptions exist but adherence in practice is questionable.
		Metering and meter reading for municipal buildings is reliable but sporadic for other unbilled metered accounts.
		Periodic auditing of such accounts is conducted.
		Water consumption is quantified directly from meter readings where available, but the majority of the consumption is estimated.
7		Conditions between 6 and 8
8		Written policy identifies the types of accounts granted a billing exemption.
		Customer meter management and meter reading are considered secondary priorities, but meter reading is conducted at least annually to obtain consumption volumes for the annual water audit.
		High level auditing of billing records ensures that a reliable census of such accounts exists.
9	✓	Conditions between 8 and 10
10		Clearly written policy identifies the types of accounts given a billing exemption, with emphasis on keeping such accounts to a minimum.
	✓	Customer meter management and meter reading for these accounts is given proper priority and is reliably conducted.
	✓	Regular auditing confirms this.
	✓	Total water consumption for these accounts is taken from reliable readings from accurate meters.

Unbilled Unmetered

GRADE	✓	DESCRIPTION
1		Extent of unbilled, unmetered consumption is unknown due to unclear policies and poor recordkeeping.
		Total consumption is quantified based upon a purely subjective estimate.
2		Clear extent of unbilled, unmetered consumption is unknown, but a number of events are randomly documented each year, confirming existence of such consumption, but without sufficient documentation to quantify an accurate estimate of the annual volume consumed.
3		Conditions between 2 and 4
4		Extent of unbilled, unmetered consumption is partially known, and procedures exist to document certain events such as miscellaneous fire hydrant uses.
		Formulae is used to quantify the consumption from such events (time running multiplied by typical flowrate, multiplied by number of events).
5	✓	Default value of 1.25% of system input volume is employed
6		Coherent policies exist for some forms of unbilled, unmetered consumption but others await closer evaluation.
		Reasonable recordkeeping for the managed uses exists and allows for annual volumes to be quantified by inference, but unsupervised uses are guesstimated.
7		Conditions between 6 and 8
8		Clear policies and good recordkeeping exist for some uses (ex: water used in periodic testing of unmetered fire connections), but other uses (ex: miscellaneous uses of fire hydrants) have limited oversight. Total consumption is a mix of well quantified use such as from formulae (time running multiplied by typical flow, multiplied by number of events) or temporary meters, and relatively subjective estimates of less regulated use.
9		Conditions between 8 and 10
10		Clear policies exist to identify permitted use of water in unbilled, unmetered fashion, with the intention of minimizing this type of consumption.
		Good records document each occurrence and consumption is quantified via formulae (time running multiplied by typical flow, multiplied by number of events) or use of temporary meters.

Unauthorized Consumption

GRADE	✓	DESCRIPTION
1		Extent of unauthorized consumption is unknown due to unclear policies and poor recordkeeping. Total unauthorized consumption is guesstimated.
2		Unauthorized consumption is a known occurrence, but its extent is a mystery. There are no requirements to document observed events, but periodic field reports capture some of these occurrences. Total unauthorized consumption is approximated from this limited data.
3		Conditions between 2 and 4
4		Procedures exist to document some unauthorized consumption such as observed unauthorized fire hydrant openings. Use formulae to quantify this consumption (time running multiplied typical flowrate, multiplied by number of events).
5		Default value of 0.25% of volume of water supplied is employed
6		Coherent policies exist for some forms of unauthorized consumption (more than simply fire hydrant misuse) but others await closer evaluation. Reasonable surveillance and recordkeeping exist for occurrences that fall under the policy. Volumes quantified by inference from these records.
7	✓	Conditions between 6 and 8
8		Clear policies and good auditable recordkeeping exist for certain events (ex: tampering with water meters, illegal bypasses of customer meters); but other occurrences have limited oversight. Total consumption is a combination of volumes from formulae (time x typical flow) and subjective estimates of unconfirmed consumption.
9		Conditions between 8 and 10
10		Clear policies exist to identify all known unauthorized uses of water. Staff and procedures exist to provide enforcement of policies and detect violations. Each occurrence is recorded and quantified via formulae (estimated time running multiplied by typical flow) or similar methods. All records and calculations should exist in a form that can be audited by a third party.

Customer metering inaccuracies:

GRADE	✓	DESCRIPTION
n/a		Select n/a only if the entire customer population is unmetered. In such a case the volume entered must be zero.
1		Customer meters exist, but with unorganized paper records on meters; no meter accuracy testing or meter replacement program for any size of retail meter.
		Metering workflow is driven chaotically with no proactive management. Loss volume due to aggregate meter inaccuracy is guesstimated.
2		Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing.
	✓	Existing paper records gathered and organized to provide cursory disposition of meter population.
	✓	Customer meters are tested for accuracy only upon customer request.
3	✓	Conditions between 2 and 4
4	✓	Reliable recordkeeping exists; meter information is improving as meters are replaced.
		Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory).
	✓	A limited number of the oldest meters are replaced each year.
	✓	Inaccuracy volume is largely an estimate, but refined based upon limited testing data.
5		Conditions between 4 and 6
6	✓	A reliable electronic recordkeeping system for meters exists.
	✓	The meter population includes a mix of new high performing meters and dated meters with suspect accuracy.
		Routine, but limited, meter accuracy testing and meter replacement occur.
		Inaccuracy volume is quantified using a mix of reliable and less certain data.
7	✓	Conditions between 6 and 8
8	✓	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population.
	✓	Testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters.
9		Ongoing meter replacement and accuracy testing result in highly accurate customer meter population.
		Statistically significant number of meters are tested in audit year.
		This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters.
10		Good records of all active customer meters exist and include as a minimum: meter number, account number/location, type, size and manufacturer.
		Ongoing meter replacement occurs according to a targeted and justified basis.
		Regular meter accuracy testing gives a reliable measure of composite inaccuracy volume for the customer meter population.
		New metering technology is embraced to keep overall accuracy improving.
		Procedures are reviewed by a third party knowledgeable in the M36 methodology.

Systematic Data Handling Errors:

GRADE	✓	DESCRIPTION
n/a		Note: all water utilities incur some amount of this error. Even in water utilities with unmetered customer populations & fixed rate billing, errors occur in annual billing tabulations. Enter a positive value for the volume & select a grading.
1		Policies and procedures for activation of new customer water billing accounts are vague and lack accountability.
		Billing data is maintained on paper records which are not well organized.
		No auditing is conducted to confirm billing data handling efficiency.
		An unknown number of customers escape routine billing due to lack of billing process oversight.
2	✓	Policy & procedures for activation of new customer accounts & oversight of billing records exist but need refinement.
	✓	Billing data is maintained on paper records or insufficiently capable electronic database.
	✓	Only periodic unstructured auditing work is conducted to confirm billing data handling efficiency.
	✓	The volume of unbilled water due to billing lapses is a guess.
3	✓	Conditions between 2 and 4
4	✓	Policy and procedures for new account activation and oversight of billing operations exist but needs refinement.
	✓	Computerized billing system exists, but is dated or lacks needed functionality.
		Periodic, limited internal audits conducted and confirm with approximate accuracy the consumption volumes lost to billing lapses.
5		Conditions between 4 and 6
6	✓	Policy & procedures for new account activation and oversight of billing operations is adequate & reviewed periodically.
	✓	Computerized billing system is in use with basic reporting available.
	✓	Any effect of billing adjustments on measured consumption volumes is well understood.
	✓	Internal checks of billing data error conducted annually.
	✓	Reasonably accurate quantification of consumption volume lost to billing lapses is obtained.
7		Conditions between 6 and 8
8		New account activation and billing operations policy and procedures are reviewed at least biannually.
		Computerized billing system includes an array of reports to confirm billing data and system functionality.
		Checks are conducted routinely to flag and explain zero consumption accounts.
		Annual internal checks conducted with third party audit conducted at least once every five years.
		Accountability checks flag billing lapses.
		Consumption lost to billing lapses is well quantified and reducing year-by-year.
9		Conditions between 8 and 10
10		Sound written policy and procedures exist for new account activation and oversight of customer billing operations.
		Robust computerized billing system gives high functionality and reporting capabilities which are utilized, analyzed and the results reported each billing cycle.
		Assessment of policy and data handling errors are conducted internally and audited by third party at least once every three years, ensuring consumption lost to billing lapses is minimized and detected as it occurs.

Length of Mains

GRADE	✓	DESCRIPTION
1		Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.
2		Paper records in poor or uncertain condition (no annual tracking of installations & abandonments).
		Poor procedures to ensure that new water mains installed by developers are accurately documented.
3		Conditions between 2 and 4
4		Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in an uncertain degree of error in tabulation of mains length.
5		Conditions between 4 and 6
6		Sound written policy and procedures exist for permitting and commissioning new water mains.
		Highly accurate paper records with regular field validation; or electronic records and asset management system in good condition.
		Includes system backup.
7		Conditions between 6 and 8
8	✓	Sound written policy and procedures exist for permitting and commissioning new water mains.
	✓	Electronic recordkeeping such as a Geographical Information System (GIS) and asset management system are used to store and manage data.
9	✓	Conditions between 8 and 10
10	✓	Sound written policy exists for managing water mains extensions and replacements.
	✓	Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases.
		Records of annual field validation should be available for review

Number of active AND inactive service connections

Note: The number of Service Connections does not include fire hydrant leads/lines connecting the hydrant to the water main

GRADE	✓	DESCRIPTION
1		Vague permitting (of new service connections) policy and poor paper recordkeeping of customer connections/billings result in suspect determination of the number of service connections, which may be 10-15% in error from actual count
2		General permitting policy exists but paper records, procedural gaps, and weak oversight result in questionable total for number of connections, which may vary 5-10% of actual count.
3		Conditions between 2 and 4
4		Written account activation policy and procedures exist, but with some gaps in performance and oversight.
		Computerized information management system is being brought online to replace dated paper recordkeeping system.
		Reasonably accurate tracking of service connection installations & abandonments; but count can be up to 5% in error from actual total.
5		Conditions between 4 and 6
6		Written new account activation and overall billing policies and procedures are adequate and reviewed periodically.
		Computerized information management system is in use with annual installations & abandonments totaled.
		Very limited field verifications and audits.
		Error in count of number of service connections is believed to be no more than 3%.
7		Conditions between 6 and 8
8	✓	Policies and procedures for new account activation and overall billing operations are written, well-structured and reviewed at least biannually.
	✓	Well-managed computerized information management system exists and routine, periodic field checks and internal system audits are conducted.
	✓	Counts of connections are no more than 2% in error.
9	✓	Conditions between 8 and 10
10	✓	Sound written policy and well managed and audited procedures ensure reliable management of service connection population.
		Computerized information management system, Customer Billing System, and Geographic Information System (GIS) information agree; field validation proves truth of databases.
		Count of connections recorded as being in error is less than 1% of the entire population.

Average length of customer service line:

Gradings 1-9 apply if customer properties are unmetered, if customer meters exist and are located inside the customer building premises, or if the water utility owns and is responsible for the entire service connection piping from the water main to the customer building. In any of these cases the average distance between the curb stop or boundary separating utility/customer responsibility for service connection piping, and the typical first point of use (ex: faucet) or the customer meter must be quantified. Gradings of 1-9 are used to grade the validity of the means to quantify this value. (See the "Service Connection Diagram" worksheet)

GRADE	✓	DESCRIPTION
Note: if customer water meters are located outside of the customer building next to the curb stop or boundary separating utility/customer responsibility, then the auditor should answer "Yes" to the question on the Reporting Worksheet asking about this. If the answer is Yes, the grading description listed under the Grading of 10(a) will be followed, with a value of zero automatically entered at a Grading of 10. See the Service Connection Diagram worksheet for a visual presentation of this distance.		
1		Vague policy exists to define the delineation of water utility ownership and customer ownership of the service connection piping.
		Curb stops are perceived as the breakpoint but these have not been well-maintained or documented. Most are buried or obscured. Their location varies widely from site-to-site, and estimating this distance is arbitrary due to the unknown location of many curb stops.
2		Policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping.
		The piping from the water main to the curb stop is the property of the water utility; and the piping from the curb stop to the customer building is owned by the customer.
		Curb stop locations are not well documented and the average distance is based upon a limited number of locations measured in the field.
3		Conditions between 2 and 4
4		Good policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping.
		Curb stops are generally installed as needed and are reasonably documented.
		Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy.
5		Conditions between 4 and 6
6		Clear written policy exists to define utility/customer responsibility for service connection piping.
		Accurate, well-maintained paper or basic electronic recordkeeping system exists.
		Periodic field checks confirm piping lengths for a sample of customer properties.
7		Conditions between 6 and 8
8		Clearly worded policy standardizes the location of curb stops and meters, which are inspected upon installation.
		Accurate and well maintained electronic records exist with periodic field checks to confirm locations of service lines, curb stops and customer meter pits.
		An accurate number of customer properties from the customer billing system allows for reliable averaging of this length.
9		Conditions between 8 and 10
10	✓	Either of two conditions can be met for a grading of 10:
	✓	a) Customer water meters exist outside of customer buildings next to the curb stop or boundary separating utility/customer responsibility for service connection piping. If so, answer "Yes" to the question on the Reporting Working asking about this condition. A value of zero and a Grading of 10 are automatically entered in the Reporting Worksheet
		b). Meters exist inside customer buildings, or properties are unmetered. In either case, answer "No" to the Reporting Worksheet question on meter location, and enter a distance determined by the auditor. For a Grading of 10 this value must be a very reliable number from a Geographic Information System (GIS) and confirmed by a statistically valid number of field checks.

Average operating pressure

GRADE	✓	DESCRIPTION
1		Available records are poorly assembled and maintained paper records of supply pump characteristics and water distribution system operating conditions.
		Average pressure is guesstimated based upon this information and ground elevations from crude topographical maps.
		Widely varying distribution system pressures due to undulating terrain, high system head loss and weak/erratic pressure controls further compromise the validity of the average pressure calculation.
2	✓	Limited telemetry monitoring of scattered pumping station and water storage tank sites provides some static pressure data, which is recorded in handwritten logbooks.
	✓	Pressure data is gathered at individual sites only when low pressure complaints arise.
	✓	Average pressure is determined by averaging relatively crude data, and is affected by significant variation in ground elevations, system head loss and gaps in pressure controls in the distribution system.
3		Conditions between 2 and 4
4	✓	Effective pressure controls separate different pressure zones; moderate pressure variation across the system, occasional open boundary valves are discovered that breech pressure zones.
	✓	Basic telemetry monitoring of the distribution system logs pressure data electronically.
	✓	Pressure data gathered by gauges or dataloggers at fire hydrants or buildings when low pressure complaints arise, and during fire flow tests and system flushing.
	✓	Reliable topographical data exists.
	✓	Average pressure is calculated using this mix of data.
5		Conditions between 4 and 6
6		Reliable pressure controls separate distinct pressure zones; only very occasional open boundary valves are encountered that breech pressure zones.
		Well-covered telemetry monitoring of the distribution system (not just pumping at source treatment plants or wells) logs extensive pressure data electronically.
		Pressure gathered by gauges/dataloggers at fire hydrants and buildings when low pressure complaints arise, and during fire flow tests and system flushing.
		Average pressure is determined by using this mix of reliable data.
7		Conditions between 6 and 8
8		Well-managed, discrete pressure zones exist with generally predictable pressure fluctuations.
		A current full-scale SCADA System or similar realtime monitoring system exists to monitor the water distribution system and collect data, including real time pressure readings at representative sites across the system.
		The average system pressure is determined from reliable monitoring system data.
9		Conditions between 8 and 10
10		Well-managed pressure districts/zones, SCADA System and hydraulic model exist to give very precise pressure data across the water distribution system.
		Average system pressure is reliably calculated from extensive, reliable, and cross-checked data.
		Calculations are reported on an annual basis as a minimum.

Total annual cost of operating water system		
GRADE	✓	DESCRIPTION
1		Incomplete paper records and lack of financial accounting documentation on many operating functions makes calculation of water system operating costs a pure guesstimate
2		Reasonably maintained, but incomplete, paper or electronic accounting provides data to estimate the major portion of water system operating costs.
3		Conditions between 2 and 4
4	✓	Electronic, industry-standard cost accounting system in place.
	✓	However, gaps in data are known to exist, periodic internal reviews are conducted but not a structured financial audit.
5	✓	Conditions between 4 and 6
6	✓	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked.
		Data audited periodically by utility personnel, but not a Certified Public Accountant (CPA).
7		Conditions between 6 and 8
8		Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked.
		Data audited at least annually by utility personnel, and at least once every three years by third-party CPA.
9		Conditions between 8 and 10
10		Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked.
		Data audited annually by utility personnel and annually also by third-party CPA.

Customer retail unit cost (applied to Apparent Losses):		
GRADE	✓	DESCRIPTION
n/a		Customer population unmetered, and/or only a fixed fee is charged for consumption.
1		Antiquated, cumbersome water rate structure is used, with periodic historic amendments that were poorly documented and implemented; resulting in classes of customers being billed inconsistent charges.
		The actual composite billing rate likely differs significantly from the published water rate structure, but a lack of auditing leaves the degree of error indeterminate.
2		Dated, cumbersome water rate structure, not always employed consistently in actual billing operations.
		The actual composite billing rate is known to differ from the published water rate structure, and a reasonably accurate estimate of the degree of error is determined, allowing a composite billing rate to be quantified.
3		Conditions between 2 and 4
4	✓	Straight-forward water rate structure in use, but not updated in several years.
	✓	Billing operations reliably employ the rate structure.
	✓	The composite billing rate is derived from a single customer class such as residential customer accounts, neglecting the effect of different rates from varying customer classes.
5	✓	Conditions between 4 and 6
6	✓	Clearly written, up-to-date water rate structure is in force and is applied reliably in billing operations.
		Composite customer rate is determined using a weighted average residential rate using volumes of water in each rate block.
7		Conditions between 6 and 8
8		Effective water rate structure is in force and is applied reliably in billing operations.
		Composite customer rate is determined using a weighted average composite consumption rate, which includes residential, commercial, industrial, institutional (CII), and any other distinct customer classes within the water rate structure.
9		Conditions between 8 and 10
10		Current, effective water rate structure is in force and applied reliably in billing operations.
		The rate structure and calculations of composite rate - which includes residential, commercial, industrial, institutional (CII), and other distinct customer classes - are reviewed by a third party knowledgeable in the M36 methodology at least once every 5 years.

Variable production cost (applied to Real Losses):

GRADE	✓	DESCRIPTION
Note: if the water utility purchases/imports its entire water supply, then enter the unit purchase cost of the bulk water supply in the Reporting Worksheet with a grading of 10		
1		Incomplete paper records and lack of documentation on primary operating functions (electric power and treatment costs most importantly) makes calculation of variable production costs a pure guesstimate
2	✓	Reasonably maintained, but incomplete, paper or electronic accounting provides data to roughly estimate the basic operations costs (pumping power costs and treatment costs) and calculate a unit variable production cost.
3	✓	Conditions between 2 and 4
4	✓	Electronic, industry-standard cost accounting system in place.
	✓	Electric power and treatment costs are reliably tracked and allow accurate weighted calculation of unit variable production costs based on these two inputs and water imported purchase costs (if applicable).
		All costs are audited internally on a periodic basis.
5		Conditions between 4 and 6
6		Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked.
		Pertinent additional costs beyond power, treatment and water imported purchase costs (if applicable) such as liability, residuals management, wear and tear on equipment, impending expansion of supply, are included in the unit variable production cost, as applicable.
		The data is audited at least annually by utility personnel.
7		Conditions between 6 and 8
8		Reliable electronic, industry-standard cost accounting system in place, with all pertinent primary and secondary variable production and water imported purchase (if applicable) costs tracked.
		The data is audited at least annually by utility personnel, and at least once every three years by a third-party knowledgeable in the M36 methodology.
9		Conditions between 8 and 10
10		Either of two conditions can be met to obtain a grading of 10:
		1) Third party CPA audit of all pertinent primary and secondary variable production and water imported purchase (if applicable) costs on an annual basis.or:
		2) Water supply is entirely purchased as bulk water imported, and the unit purchase cost - including all applicable marginal supply costs - serves as the variable production cost. If all applicable marginal supply costs are not included in this figure, a grade of 10 should not be selected.

Appendix B

GPCD Calculator

NMOSE GPCD CALCULATOR

Gallons per Capita - v2.05

Release Date: August 2015

This spreadsheet-based GPCD calculator is designed to help quantify and track water uses associated with water distribution systems. The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons on the left below. Descriptions of each sheet are also given below.

It should be noted that all the recorded data should be from actual metered results and should not include any estimates.

THE FOLLOWING KEY APPLIES THROUGHOUT:

- Value to be entered by user
- Dropdown box, pick from list
- Value calculated based on input data
- No longer available for input

Look for the following boxes that provide additic Instructions Info

Please begin by providing the following information, then proceed through each sheet:

NAME OF CITY OR UTILITY: Deming New Mexico

REPORTING YEARS: Enter the most recent reporting year: 2016 Data can be entered back to: 2010

NAME OF CONTACT PERSON: Jim Massengill **E-MAIL:** jmassengill@cityofdeming.org **TELEPHONE:** 575-546-8848 **Ext.**

SELECT THE REPORTING UNITS FOR VOLUME DATA: Gallons (US) For unit converter click here: Converter

Instructions & Utility	This sheet
Census Data	Census data and the portal to get the data from the Census website
Single-Family	Single-Family residential gallons and population
Multi-Family	Multi-Family residential gallons and population
ICI & Other Metered	Other data including Commercial, Industrial and Institutional [1.3] and Other metered [1.4] categories
Reuse	Data related to water reuse projects
Total Diverted	Total Production and Diverted Water
Reported Data	The calculated data graphical review of most common performance indicators
Annual Performance	The calculated data graphical review of **annual** performance indicators
Monthly Performance	The calculated data graphical review of **monthly** performance indicators
Definitions	Use this sheet to understand terms used in the audit process

All parties reserve the right to validate the data recorded in this document. This does not bind the OSE or the Utility to the results. It is a tool used for planning purposes.

estions or comments regarding the software please contact us at: waternm@state.nm.us

Census Information Data Table 2.1

Info

Click here to access the Census Web site

OR

Click here for instructions on how to find the data on the Census website

2016 TO 2010

Use the most recent census data

Return to Instructions

DATA

US Census Table	Description		INPUT
DP-1	**Profile of General Population and Housing Characteristics**	**Census Year**	**2010**
Subject			
Relationship	In group quarters	Total	**549**
Housing Occupancy	Total housing units	Total	**6,226**
	Occupied housing units		**5,582**
	Vacant housing units		**644**
Households by Type	Average household size	Total	**2.56**

Formula: Household Size = Total Population / Total Number of Housing Units

Vacancy Rate %	10.3%

COMMENTS:

DATA INPUT SHEET

Deming

Instructions

3. SINGLE-FAMILY RESIDENTIAL (SFR)

Return to Instructions

MONTHLY DATA

TABLE 3.1 Info

2016 TO 2010

SFR BILLED WATER CONSUMPTION (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	29,844,200	27,235,600	32,893,900	48,821,600	46,096,200	55,616,100	60,435,400	58,789,100	58,257,100	33,540,000	37,280,400	27,587,800
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 3.2 Info

Active Connections Only

You have chosen to enter Active Connections Only, enter the monthly values below, or enter annual values in table 3.8 Check message above Table 3.3 to see if additional data is required.

NUMBER OF SFR CONNECTIONS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	4,562	4,584	4,606	4,608	4,607	4,629	4,597	4,615	4,574	4,578	4,592	4,573
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 3.3 Info

You have entered Active Connections Only in Table 3.2; leave the cells below blank

INACTIVE (ZERO USE) SFR CONNECTIONS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016												
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 3.4

Formula = (No. of Connections - No. of Zero Use Accounts) * Ave. Household Size

SFR POPULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	11,679	11,735	11,791	11,796	11,794	11,850	11,768	11,814	11,709	11,720	11,756	11,707
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

TABLE 3.5

Formula = Billed Water Consumption (SFR only) / Calculated Population (SFR only)

SFR GPCD CALCULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	82.43	82.89	89.99	137.96	126.08	156.44	165.66	160.52	165.84	92.32	105.71	76.02
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

COMMENTS:

Data for single and multi-family residential includes residential, residential homeowner, and residential trailer park categories.

ANNUAL DATA

TABLE 3.6

ANNUAL CONSUMPTION

TABLE 3.7

ANNUAL CALCULATION
516,397,400
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 3.8

AVG. ANNUAL CONNECTIONS

TABLE 3.9

AVG CONN. CALCULATION
4,594
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 3.10 Info

CALCULATED GROWTH RATE
N/A
N/A
N/A
N/A
N/A
N/A

Are you sure growth is zero?

TABLE 3.11

No. VACANT SFR CONNECTIONS

TABLE 3.12 Info

SIZE OF HOUSEHOLD
2.56
2.56
2.56
2.56
2.56
2.56
2.56

TABLE 3.13 Info

SFR POPULATION
11,760
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 3.14 Info

ANNUAL SFR GPCD
120.31
N/A
N/A
N/A
N/A
N/A
N/A

DATA INPUT SHEET

Deming

4. MULTI-FAMILY RESIDENTIAL (MFR)

Return to Instructions

Instructions

MONTHLY DATA

2016 TO 2010

TABLE 4.1 Info

MFR BILLED WATER CONSUMPTION (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016												
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 4.2

If only Current Number of Units is Known, put this number in Table 4.7

NUMBER OF MFR UNITS (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016												
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 4.3

Formula = (Number of Units - Vacant MFR Connections) * Ave. Household Size

MFR POPULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

TABLE 4.4

Formula = MFR Billed Water Consumption (Monthly) / MFR Population (Monthly)

MFR GPCD CALCULATION (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

ANNUAL DATA

TABLE 4.5

ANNUAL CONSUMPTION

TABLE 4.6

ANNUAL CALCULATION
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 4.7

No. CURRENT UNITS

TABLE 4.8

ANNUAL UNIT CALCULATION
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 4.9 Info

MFR POPULATION
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 4.10

VACANT MFR CONNECTIONS
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 4.11 Info

ANNUAL MFR GPCD
N/A
N/A
N/A
N/A
N/A
N/A
N/A

DATA INPUT SHEET

5. INDUSTRIAL, COMMERCIAL & INSTITUTIONAL (ICI) AND OTHER METERED

Return to Instructions

Info

Deming

Instructions

MONTHLY DATA

2016 TO 2010

TABLE 5.1

ICI WATER CONSUMPTION (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	23,113,000	21,090,800	20,481,700	30,007,800	28,822,400	29,508,800	33,983,900	36,785,500	50,693,800	41,046,200	35,954,900	23,028,600
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 5.2

OTHER METERED (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	0	0	0	0	0	384,600	0	76,400	77,500	34,900	294,800	242,736
2015												
2014												
2013												
2012												
2011												
2010												

COMMENTS:

ICI data all non-residential and non-bulk water sales (e.g. buisinesses, churches, schools, government, hospitals, non profit organizations).

Other metered are bulk water sales from 2016 billing database.

ANNUAL DATA

TABLE 5.3 ICI ANNUAL CONSUMPTION	TABLE 5.4 ICI GPCD	TABLE 5.5 ICI ANNUAL CALCULATED
	83.36	374,517,400
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A

TABLE 5.6 OTHER ANNUAL CONSUMPTION	TABLE 5.7 OTHER METERED GPCD	TABLE 5.8 OTHER ANNUAL CALCULATED
	0.25	1,110,936
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A
	N/A	N/A

DATA INPUT SHEET | Info

Deming

6. REUSE

Return to Instructions

MONTHLY DATA

Instructions

2016 TO 2010

TABLE 6.1

REUSE DIVERSIONS (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	34,987,000	29,448,000	24,049,000	19,498,000	52,739,000	44,171,000	28,427,000	35,314,000	14,737,000	22,922,000	45,237,000	12,963,000
2015												
2014												
2013												
2012												
2011												
2010												

COMMENTS:

All numbers from Reuse water summary spreadsheet, total reuse is sum of Jan through Dec 2016 metered reading for Luna Energy, City Farm and golf course.

ANNUAL DATA

TABLE 6.2

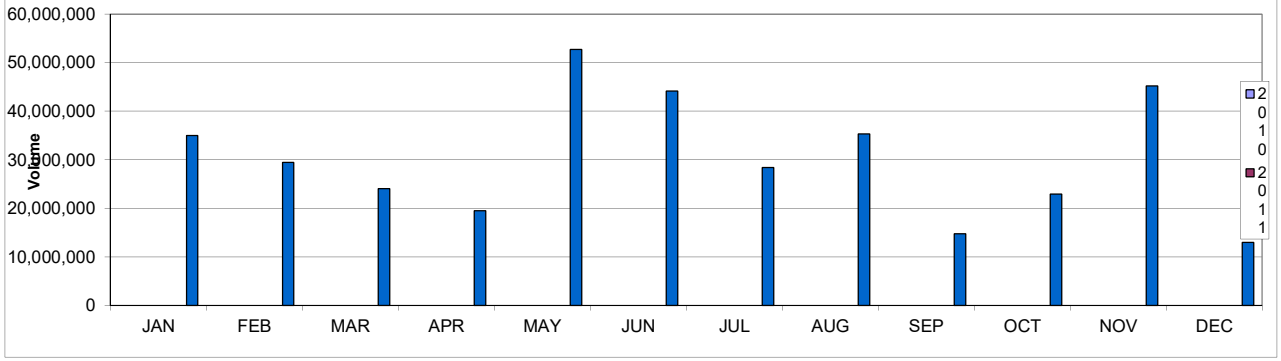
REUSE ANNUAL DIVERSIONS

TABLE 6.3

REUSE GPCD
81.13
N/A
N/A
N/A
N/A
N/A
N/A

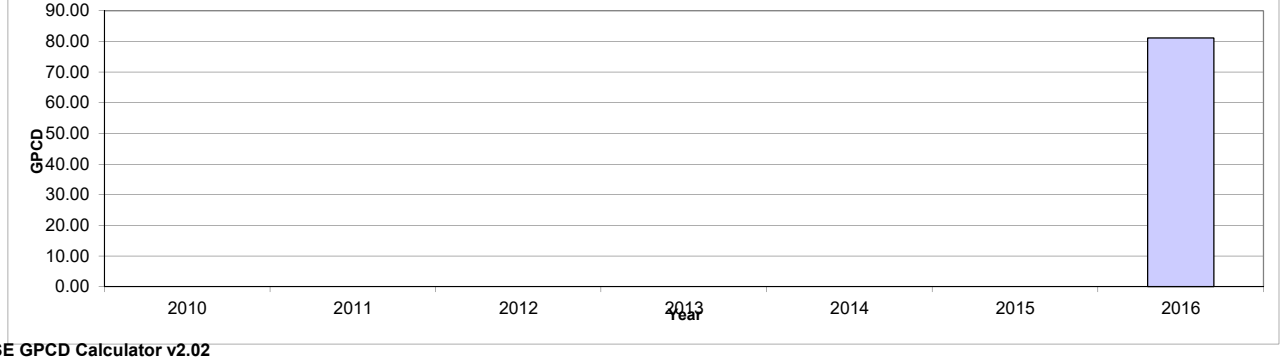
Reuse Volume

Graph 6.1



Reuse GPCD

Graph 6.2



DATA INPUT SHEET

Deming

7. TOTAL WATER DIVERTED AND SUPPLIED

Return to Instructions

MONTHLY DATA

TABLE 7.1 2016 TO 2010

TOTAL WATER DIVERTED (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	59,439,000	67,340,800	96,985,700	101,958,200	116,892,200	143,905,700	162,220,000	132,679,200	121,837,900	116,704,500	69,751,500	57,015,700
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 7.2

IMPORTED WATER (Monthly)(Gallons (US)) Info

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016												
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 7.3

EXPORTED WATER (Monthly) (Gallons (US)) Info

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016												
2015												
2014												
2013												
2012												
2011												
2010												

TABLE 7.4 Formula = Total Water Diverted + Imported water - Exported Water

TOTAL WATER SUPPLY (Monthly) (Gallons (US))

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	59,439,000	67,340,800	96,985,700	101,958,200	116,892,200	143,905,700	162,220,000	132,679,200	121,837,900	116,704,500	69,751,500	57,015,700
2015	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0

ANNUAL DATA

TABLE 7.6

ANNUAL TOTAL DIVERTED

TABLE 7.7

ANNUAL TOTAL DIVERTED CALC
1,246,730,400
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 7.8

ANNUAL TOTAL IMPORTED

TABLE 7.9

ANNUAL TOTAL IMPORT CALC
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 7.10

ANNUAL TOTAL EXPORTED

TABLE 7.11

ANNUAL TOTAL EXPORT CALC
N/A
N/A
N/A
N/A
N/A
N/A
N/A

TABLE 7.12

ANNUAL TOTAL WATER SUPPLY
1,246,730,400
0
0
0
0
0
0

TABLE 7.13

TOTAL POP. EST.
12,309
N/A
N/A
N/A
N/A
N/A
N/A

Table 7.5

SYSTEM TOTAL GPCD (Monthly)

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	156	195	254	276	306	390	425	348	330	306	189	149
2015	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2014	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2013	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2012	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2011	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2010	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

COMMENTS:

System total production from _Summary Info.2016 Audit working file.xlsx, System Total Production (MV) tab (includes production from wells #3 and #12 for irrigation)

TABLE 7.14

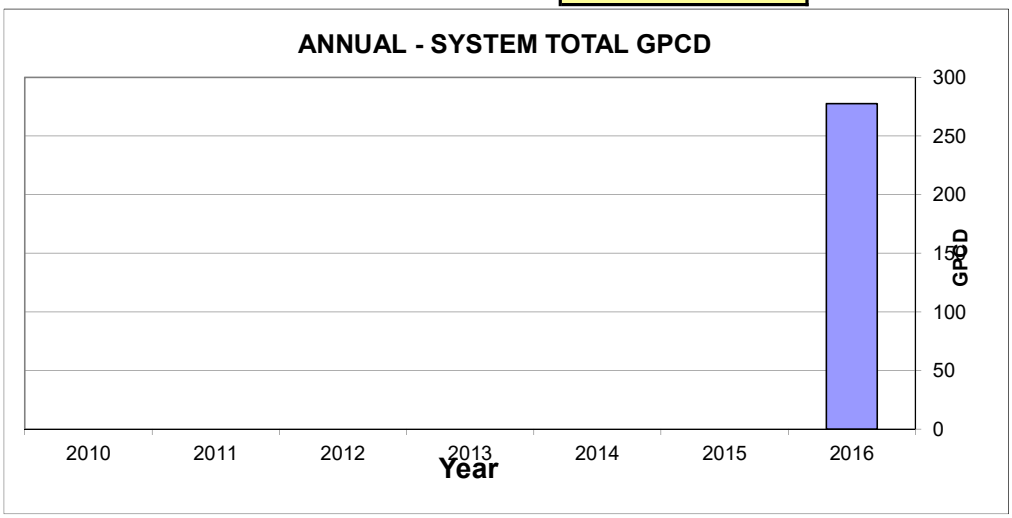
Year	SYSTEM TOTAL GPCD
2016	**277.50**
2015	**NA**
2014	**NA**
2013	**NA**
2012	**NA**
2011	**NA**
2010	**NA**

8. SUMMARY GPCD REPORTED DATA

Deming		
2016	To:	2010

ANNUAL

Year	SYSTEM GPCD
2016	277.50
2015	NA
2014	NA
2013	NA
2012	NA
2011	NA
2010	NA

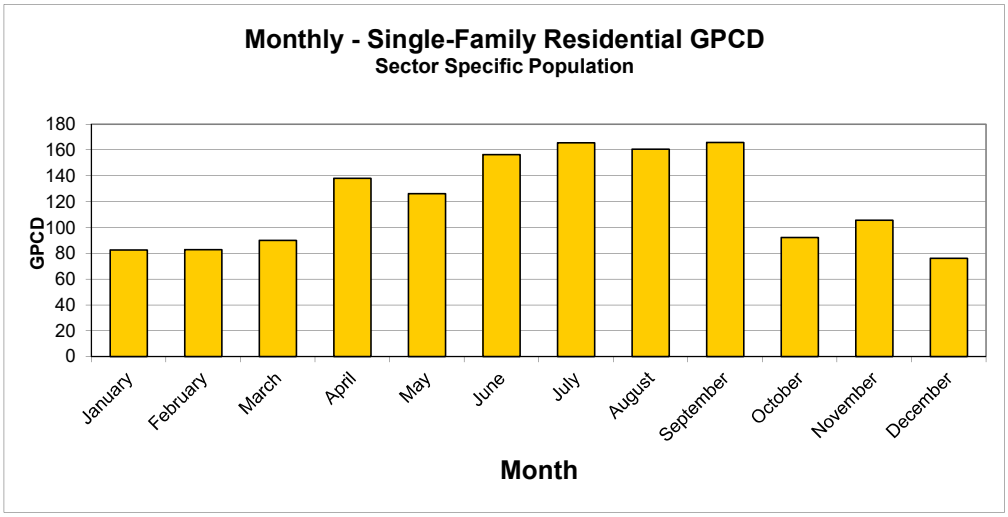


MONTHLY

Month	SFR GPCD
January	82.43
February	82.89
March	89.99
April	137.96
May	126.08
June	156.44
July	165.66
August	160.52
September	165.84
October	92.32
November	105.71
December	76.02

Year	2016

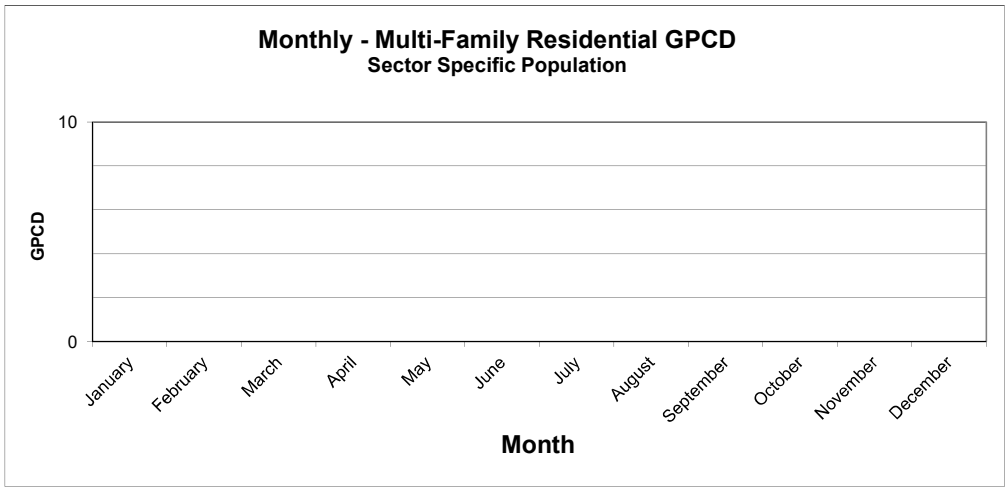
Peak/Ave	1.38



YEAR **2016**

Month	MFR GPCD
January	No Data
February	No Data
March	No Data
April	No Data
May	No Data
June	No Data
July	No Data
August	No Data
September	No Data
October	No Data
November	No Data
December	No Data

Peak/Ave	#DIV/0!



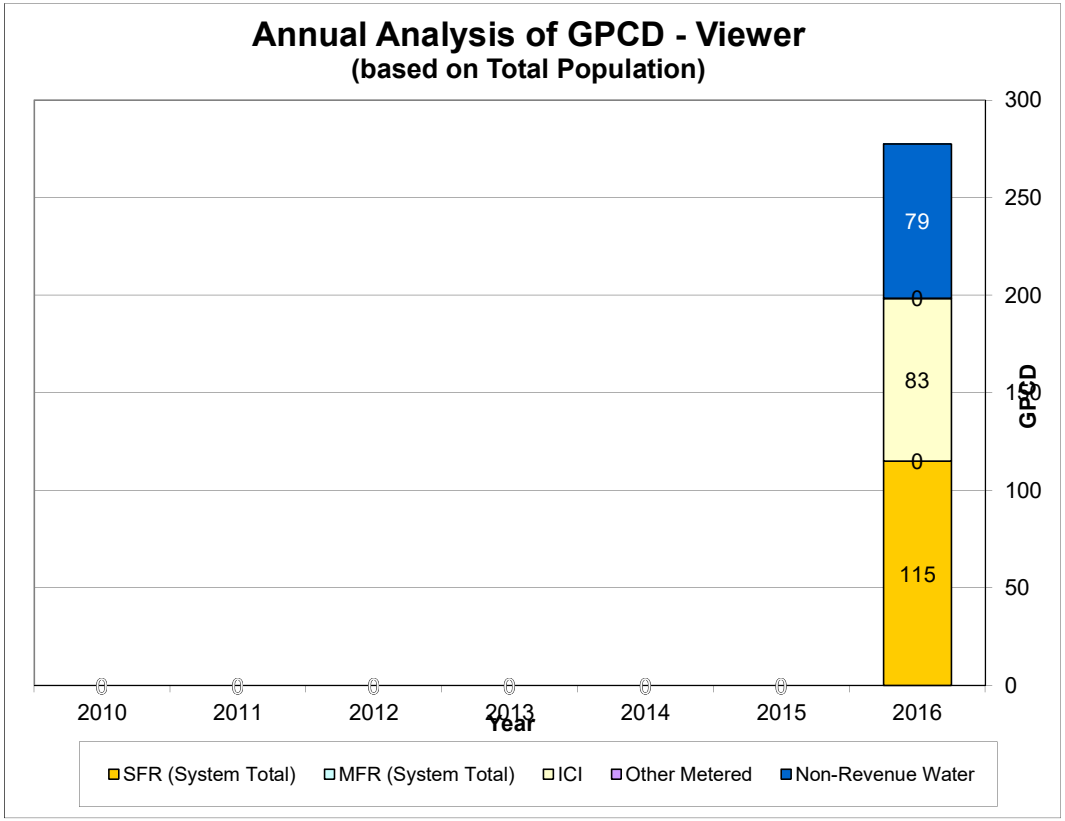
YEAR **2016**

9. System Total Annual Reporting Performance

Overall Annual GPCD (based on Total Population)

	SFR (System Total)	MFR (System Total)	ICI	Other Metered	Info Non-Revenue Water	Total Supplied	Non-Revenue Volume Million Gallons (US)
Year							
On Graph?	Yes	No	Yes	Yes	Yes		
2016	114.94	N/A	83.36	0.25	78.95	358.62	354.70
2015	N/A	N/A	N/A	N/A	######	#VALUE!	-
2014	N/A	N/A	N/A	N/A	######	#VALUE!	-
2013	N/A	N/A	N/A	N/A	######	#VALUE!	-
2012	N/A	N/A	N/A	N/A	######	#VALUE!	-
2011	N/A	N/A	N/A	N/A	######	#VALUE!	-
2010	N/A	N/A	N/A	N/A	######	#VALUE!	-

Deming		
2016	to	2010



10. Monthly Reporting Performance

Choose Year for Monthly Analysis **2016**

Choose Sector **Single-Family Residential**

Monthly GPCD

Month	Single-Family Residential GPCD	Multi-Family Residential GPCD	ICI GPCD	Other Metered GPCD	Non-Revenue GPCD
JAN	82.43	No Data	60.57	0.00	16.99
FEB	82.89	No Data	61.19	0.00	55.17
MAR	89.99	No Data	53.68	0.00	114.29
APR	137.96	No Data	81.26	0.00	62.63
MAY	126.08	No Data	75.53	0.00	110.00
JUN	156.44	No Data	79.91	1.04	158.14
JUL	165.66	No Data	89.06	0.00	177.68
AUG	160.52	No Data	96.40	0.20	97.04
SEP	165.84	No Data	137.28	0.21	34.69
OCT	92.32	No Data	107.57	0.09	110.29
NOV	105.71	No Data	97.37	0.80	-10.23
DEC	76.02	No Data	60.35	0.64	16.13

Deming		
2016	to	2010