LAKESIDE WATER DISTRICT

URBAN WATER MANAGEMENT PLAN

2020

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1. Introduction

1.1 Lakeside's 2020 Urban Water Management Plan Executive Summary

This report is the 2020 update of Lakeside's 2015 Urban Water Management Plan including achieving per capita water use targets SBX7-7 as required by Water Code section 10608 and developing a Water Shortage Contingency Plan as required by Water Code section 10632. This 2020 UWMP provides an assessment of the District's water service reliability, discusses its sources of water supply, water use efficiency, demand management measures, implementation strategy and schedule, and other relevant information and programs. The 2020 UWMP also provides an evaluation of frequent and severe periods of drought in the Drought Risk Assessment, and the preparation and adoption of a Water Shortage Contingency Plan (WSCP) and compliance with the Water Conservation Act of 2009 established requirements for urban retail water suppliers to report water use and urban water use targets towards the goal of reducing statewide urban daily per capita water use by 20% by 2020 or SBX7-7. In accordance with the Act, Lakeside coordinated its planning efforts with the San Diego County Water Authority (CWA), its wholesale water supplier, to ensure that supply and demand data and issues are presented accurately. The checklist provided by the California Department of Water Resources was also utilized to assure that the Plan meets all requirements. Lakeside's completed DWR checklist is included in **Appendix A**.

The UWMP analyzes water demand and supply to 2045. Highlights of the draft UWMP include:

- The District's 2020 water use was 100 gpcd, well under the 2020 target of 149 gallons per capita per day (gpcd) as required by SBX7-7.
- Water supply sources include the Colorado River, State Water Project, and Carlsbad Desalination Plant water via supplies from CWA. In addition, the East County Advanced Water Purification project will start producing purified water starting in 2025 representing a significant drought-resilient supply source. Region-wide, other potable reuse supplies are projected to be online by 2025.
- No supply shortages are anticipated under normal year, single dry year, and multi-dry year scenarios for the 25-year planning horizon to 2045.
- A drought risk assessment scenario was modeled for 2021 through 2025 which assumed more extreme drought conditions. This scenario also resulted in no water shortages.
- A Water Shortage Contingency Plan, a new legal requirement for 2020, was developed to guide the District's response in case of water shortages.

Prior to adoption, Lakeside provided this Plan to its key stakeholders for review, including the San Diego County Water Authority and the County of San Diego. The Plan was placed on the District's website and copies were made available at the District office for public review. The District also notified its key stakeholders, at least 60 days prior to the public hearing on the Plan, that Lakeside will be reviewing the Plan and considering amendments or changes to the Plan. On August 3, 2021, Lakeside's Board of Directors held a public hearing and adopted the 2020 Plan. A copy of the resolution adopting the 2020 Plan is in **Appendix F**. The adopted Plan will be on the District's website, submitted to the City, County, and the California State Library within 60 days of adoption.

1.2 California Urban Water Management Planning Act

The California Urban Water Management Planning Act of 1983 (Act) which comprises sections 10610 through 10656 of the California Water Code, requires all urban water suppliers in the state to prepare and adopt an urban water management plan (Plan) and update it every five years, to assure the efficient use of urban water supplies and their reliability during normal, dry and multiple dry water years. The Act states,

> "The conservation and efficient use of urban water supplies are of statewide concern; however, the planning for that use and the implementation of those plans can best be accomplished at the local level."

The Water Conservation Act of 2009 established requirements for urban retail water suppliers to report water use and urban water use targets towards the goal of reducing statewide urban daily per capita water use by 20% by 2020 per SBX7-7 Water Code Section 10608.

In 2018 the legislature modified CWC Section 10632 to require a Water Shortage Contingency Plan (WSCP). Although there are overlapping aspects with the prior law, there are several new prescriptive elements that a water supplier's water shortage contingency plan must now include, such as:

- Six standard water shortage levels corresponding to progressive ranges of up to 10%, 20%, 30%, 40%, and 50% shortages, and greater than 50% shortage.
- Locally appropriate shortage response actions for each shortage level, with the corresponding estimate of the extent the action will address the gap between supplies and demands.
- Communication protocols and procedures to inform customers, the public, and government entities of any current or predictive water shortages and associated response actions.
- A reevaluation and improvement process to assess the functionality of its WSCP and make appropriate adjustments as may be warranted.

2. Plan Preparation

2.1 Chapter Summary

The District prepared its UWMP in a transparent manner that is accessible to all interested parties, including its customers, local government agencies, and its employees. In preparation of its UWMP, the District also proactively coordinated with neighboring water agencies as it is important for a successful operation of and planning for our community's water resources. This chapter of the District's UWMP summarizes the District's basis for its plan preparation (e.g., the quantity of service connections that the District serves), units of measure the District has adopted to quantify its reporting data (e.g., all water volumes are reported in acre-feet (AF)), and a summary of the local agencies that the District has reached out to and worked with during the update of its UWMP. Coordination and outreach are critical steps in the development of an effective plan. The District has included this summary of Chapter 2 in accordance with CWC Section 10630.5.

2.2 Preparing the 2020 Urban Water Management Plan

Lakeside Water District prepared the 2020 UWMP in conjunction with other local water districts and in coordination with San Diego's regional water supplier San Diego County Water Authority (CWA). Regional UWMP meetings were held by the regional supplier's and a meeting with Department of Water Resources regarding the 2020 changes from the 2015 UWMP. Meetings were held to coordinate with CWA and all 26-member agencies for all future water projects and water demand projections including estimated future demands. Public outreach was made by a listing in the local newspaper and a notice on the District's website regarding the review and adoption of the UWMP at a public hearing. Lakeside also sent a notice of the 2020's plan preparation to applicable cities and the county (see Appendix H).

The District prepared an UWMP in 1985, updated it in 1990, 1995, 2000, 2005, 2010, and 2015, and filed those plans with DWR. The 2020 UWMP is an update to the 2015 UWMP and meets the requirements of Sections 10608 and 10610 through 10657 of the California Water Code. The 2020 plan provides revisions to figures and projections in the 2015 plan as well as new information relevant to additional requirements. In Fiscal Year End 2020 the District supplied 3,472 acft to 6,850 connections with 31,000 people.

The District does not provide recycled water and consequently does not have a recycled water management plan.

The District board of directors, through Resolution Number 21-07, adopted the 2020 Water Shortage Contingency Plan, and 2020 UWMP update, respectively, on August 3, 2021, after conducting a public hearing. Copies of these resolutions are included in Appendix F of this UWMP. Notice of the public hearings was advertised in local publications prior to the hearing. A copy of the publications is provided in Appendix I. The 2020 WSCP and 2020 UWMP, have been submitted to DWR, the local coordination agencies noted in Section 2.2, and has been made available for public review in hard copy format at the District's Administration Office as well as electronically at the District's website (https://lakesidewater.org/about-lakeside-water-district/urban-water-management-plan/). Submittal of the 2020 WSCP and 2020 UWMP is discussed in detail in Chapter 10.

2.3 Coordination of 2020 Urban Water Management Plan Preparation

Meetings were held to coordinate with San Diego County Water Authority and all 24 member agencies for all future water projects and water demand projections including estimated future demands. This UWMP is coordinated with the UWMP updates prepared by both the San Diego County Water Authority (CWA) and the Metropolitan Water District of Southern California (MWD). The District does not send water projection data directly to MWD. The District (and other member agencies) reports its projected water demands directly to the CWA who reports those combined projected water demands to MWD. The District is a retail agency, and therefore only retail agency requirements described CWC 10631(h) are applicable to the District's UWMP. Documentation of outreach efforts between the District and CWA, which includes sharing of information on demand and supply projections, is included in Appendix J, pursuant to CWC 10631(h).

The District coordinated with the City of San Diego, Padre Dam Municipal Water District, Helix Water District, and Geosyntec on a Groundwater Monitoring Plan which is included at Appendix D.

3. System Description

3.1 Chapter Summary

The District provides a detailed overview of its history, service area, climate, and population demographics in this chapter. For 100 years, the District has provided water to the community of Lakeside which is diverse in social, economic, and demographic factors. The District has included this summary of Chapter 3 in accordance with CWC Section 10630.5.

3.2 History of Lakeside Water District

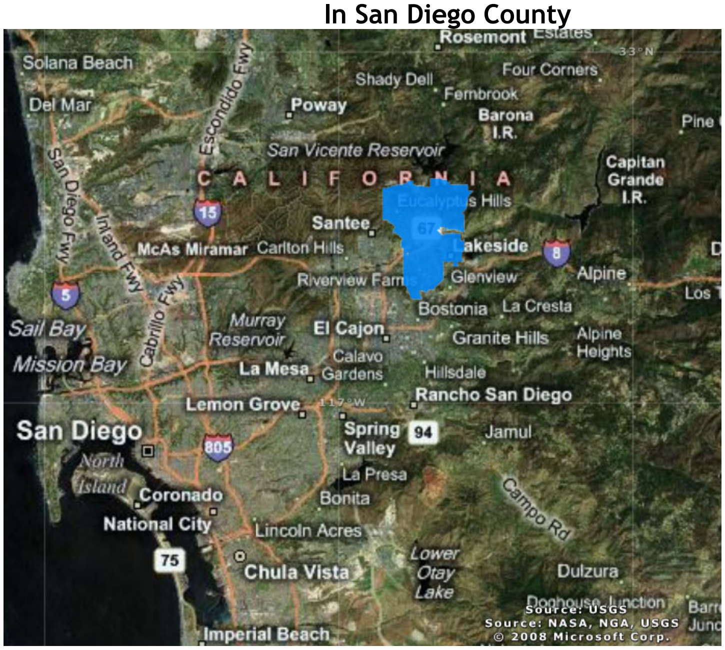
The District was organized as the Lakeside Irrigation District in 1924. Its source of water was ground water and a connection to the Cuyamaca Water Company. The District's function was primarily as an agricultural water provider. In 1980, the District changed its name to the Lakeside Water District. Lakeside is a single purpose agency providing retail domestic water service. In 2006 Lakeside consolidated with Riverview Water District which was formed in 1916 as Riverview Farms Mutual Water District. In 1954 Riverview Water District became a local Public Agency and the District began to purchase water from Metropolitan Water District via Padre Dam who was the wholesale distributor and the water supply came from the San Diego County Water Authority and the R. M. Levy Water Treatment and Filtration Plant, owned and operated by Helix Water District.

3.3 Service Area

3.3.1 Geography

Lakeside's service area spans approximately 20 square miles of the unincorporated community of Lakeside, including Eucalyptus Hills, Moreno Valley and Muth Valley, as shown in **Figure 3-1**. An elevation gain from Lakeside's water connections with SDCWA to its Reservoirs' is only 575 feet but requires 11 pumping stations because of the hilly terrain.

Figure 3-1
Map of Lakeside Water District's Service Area
In San Diego County



3.3.2 Climate

Lakeside's customers enjoy a Mediterranean climate with the average annual high and low temperatures of 78 degrees and 52 degrees. The annual precipitation is approximately 12 inches and over 80% of the precipitation occurs between December and March. Winter temperatures occasionally dip below freezing and summer temperatures often exceed 90 degrees Fahrenheit. The District's service area is entirely within an inland region of eastern San Diego County. Climate is warm and arid as is characteristic for the inland areas of the county. Water demands are generally dependent on weather patterns.

Evapotranspiration (ETo) data was obtained from the California Irrigation Management Information System (CIMIS), which maintains measuring stations throughout the state of California. The District uses CIMIS stations at Otay Lake (#147) and at Escondido (#153) for the western and eastern portions of the District, respectively, as they are adequate representations of the District's weather. The Otay Lake and Escondido stations recorded an average annual ETo of 51.49 inches and 54.19 inches, respectively, based on a period of recorded data that spans a minimum of the last five years.

3.3.2 Climate Change

Variations in weather patterns affect regional short-term water requirements, causing reductions in water use during wet cycles and demand spikes during hot, dry periods. On a monthly basis, water requirements tend to increase during the summer months when a decrease in rainfall combines with an increase in temperatures and an increase in evapotranspiration levels.

Climate change is an increasingly important issue to water utilities and both state and federal legislators. Changes in weather patterns that deviate from historical cycles could significantly affect water supply planning. Climate research has identified potential future risks to water resources. On behalf of its member agencies such as the District, the CWA recognizes the importance of adapting to climate change and being a leader in sustainability and natural resource stewardship.

Historical temperature and precipitation measurements have been recorded by NOAA for the District's area since 1899. NOAA publishes 30-year averages for measured temperatures and precipitation. The most recent 30-year measures can be observed in Table 3-1, for: 1961 to 1990, 1971 to 2000, 1981 to 2010 and 1991 to 2020. Note that although the data for 1991 to 2000 is preliminary and has not yet been formally published by NOAA, it has been included in this UWMP update to demonstrate measured effects of climate change. It can be observed in Table 3-1 that the temperature minimums and maximums are trending upwards, whereas the precipitation averages are trending downwards.

As previously noted, the District is a member agency of the San Diego County Water Authority (CWA). CWA has long supported efforts to develop renewable energy sources that are compatible with water operations. This has included investments to improve operational effectiveness, reduce greenhouse gases, and decrease CWA and member agency costs to help stabilize water rates. In June 2019, CWA's Board of Directors adopted an energy management policy that focuses on energy supplies, system operations, energy generation and storage, energy efficient equipment and features, collaborative relationships, and government relations. CWA recognizes the importance of adapting to climate change and is a leader in sustainability and natural resource stewardship. CWA is an active and founding member of the Water Utility Climate Alliance, which is dedicated to enhancing climate change research and improving water management decision making.

The key issues identified by CWA in its UWMP include advocating for improvement in modeling to provide precipitation data on a local and regional scale, encouraging focused scientific research on climate change to identify the impacts on the region's water supply, and partnering with other water utilities to incorporate the impacts of climate change on water supply planning and the development of decision support tools, all of which are described in CWA's UWMP. CWA has worked to analyze projected climate change impacts on water demands on behalf of its member agencies. Using advances in climate modeling that have occurred since the release of its 2015 UWMP, CWA adopted a qualitative approach that uses a manageable number of climate change scenarios to develop a range of potential demands. The scenarios account for the periods of 1981-2020, 2040-2060 and 2080-2099. Projected changes in temperature and precipitation were averaged within each scenario. Although no dramatic shifts in seasonal patterns of precipitation and average maximum daily temperature for the San Diego region were observed under any of the scenarios, on average the annual amounts of precipitation tend to be more concentrated in the winter with lesser proportions of total annual precipitation occurring in the spring and fall. It is noted that two of the climate change scenarios analyzed by CWA resulted in average annual precipitation estimates for 2040-2060 lower than the 1980-2010 historic average. Further, CWA indicates in Section 2.4.4 of its UWMP, all analyzed scenarios indicate warming on average relative to historical climate conditions, and the interaction to temperature and precipitation projections dictate the estimated impact on CWA's baseline demand forecasts of its member agencies, including that of the District. In 2013 CWA published its latest Regional Water Facilities Optimization and Master Plan, hereafter referred to as "RWF Plan". This document is available for review online at CWA's website (http://www.sdcwa.org/master-plan-documents) and is updated every 10 years, with the next update due to be completed in 2023. In Section 2.3.2 of the RWF Plan, CWA noted that impacts from climate change are not likely to be significant during the period of 2011 to 2035, which is the most current data available that is included in the projection time period under consideration for this update of District's UWMP (2020 to 2045). Further, CWA indicates in the RWF Plan that the primary effects of climate change will be experienced as shortages of imported water supply sources and not as significant increases in water demands.

It is important to note that the potential for impacts of imported supplies across multiple dry years in accordance with CWC 10635(a) and allocations to its member agencies, are accounted for by CWA in its UWMP. In accordance with CWC 10635(b), CWA's projections in its 2020 UWMP for the District for demands for five consecutive dry years are addressed by the District's drought risk assessment as required by CWC 10635(b). The projected dry year demands for the District, and measures established for addressing dry year projections, are discussed in Chapters 7 and 8 in this UWMP in accordance with CWC 10632(a).

Table 3-1: NOAA Historical Climate Data

Month	1961 to 1990			1971 to 2000			1981 to 2010			1991 to Current[1]		
	Avg Total Rainfall (inches)	Temp(°F) Max	Temp(°F) Min	Avg Total Rainfall (inches)	Temp(°F) Max	Temp(°F) Min	Avg Total Rainfall (inches)	Temp(°F) Max	Temp(°F) Min	Avg Total Rainfall (inches)	Temp(°F) Max	Temp(°F) Min
Jan	2.15	68.8	41.6	2.62	69.1	42.3	2.31	69.4	42	1.92	70.2	42.7
Feb	2.51	70.3	44	2.89	70	44.7	2.59	69.7	44.3	2.11	70.1	44.5
Mar	2.45	71.9	47	2.59	71.7	47.2	2.13	71.7	47.3	1.45	72.3	47.9
Apr	0.83	75.6	51.1	0.86	75.5	50.9	0.83	75.4	50.7	0.81	75.5	50.9
May	0.2	77	54.9	0.23	77.2	55.3	0.21	77.8	55.4	0.58	77.2	56
Jun	0.09	81.7	58.4	0.1	81.7	58.6	0.09	81.7	58.8	0.05	81.7	59.4
Jul	0	88	62.8	0.02	87.3	62.6	0.07	87.4	62.6	0.06	87	63.5
Aug	0.03	88.3	64	0.04	88.8	64	0.05	88.9	64	0.03	89.4	64.9
Sept	0.25	86.4	61.1	0.16	86.7	61.2	0.14	87.3	61.3	0.11	88.2	62.3
Oct	0.55	80.9	54.7	0.45	81.4	54.7	0.64	81.4	55.1	0.31	82.1	55.6
Nov	1.61	71.6	44.5	1.24	71.9	44.4	1.27	72.3	45.2	1.3	76	47.1
Dec	1.75	69.2	40.9	1.57	69.5	41.2	2.01	69.2	41.7	1.99	69.6	42
Annual Avg	**12.41**	**77.7**	**52.2**	**12.78**	**77.8**	**52.4**	**12.36**	**77.9**	**52.5**	**10.7**	**78**	**52.9**

1 Year range based on preliminary data as provided by NOAA.

3.3.3 Population

Lakeside currently serves 6,850 accounts and a population of about 31,000 per SANDAG in its Series 14 Growth Forecast Version 17 as per Appendix J-5. Population projections for Lakeside's service area are estimated with little to no growth because the district area is 95% built out. Population estimates for base year gallons per person per day and the 2020 population estimates for the UWMP were required to originate from the Department of Water Resources Population Tool and are presented below in **Table 3-2**. The population within the District's service area is diverse across social, economic, and demographic factors that demonstrate a wide range of communities must be considered when policy changes are made by the District. Customer economic factors within the district range widely.

Table 3-2
Current and Projected Service Area Population

	2020	2025	2030	2035	2040	2045
Service Area Population	31,016	34,007	34,466	33,742	33,335	33,088

3.4 Physical Water Delivery System

3.4.1 Water System Specifications

Lakeside's water distribution system is a Grade 4 system including 125 miles of water mains, 11 reservoir tanks with a total storage capacity of 14 million gallons, and 11 pumping stations.

Lakeside Water District also has two well fields. The Riverview well field has been inactive since 2007 due to MTBE Contamination and high levels of total dissolved solids (salt). The Vine Street Well Field produces a total of 800 acft per year or about 20% of Lakeside's usage.

3.4.2 Capital Improvement Program

Lakeside reviews its capital improvement program on an annual basis to provide flexibility and to meet the needs of the district.

3.5 Land Uses within Service Area

Land use data from the regional growth forecast was overlaid with the District's service area using a geographical information system (GIS). This provided for a summary of existing and projected land uses within the boundaries of the District. The data presented is for both existing land use as well as 2050 land use projections derived from SANDAG's regional growth forecast. Approximately 86% of the District's existing service area is dedicated to single-family residential land use and 8% is multi-family categories and is projected to increase by 2050. Growth in residential sectors will be driven by development of existing vacant lands and by redevelopment infill. Existing commercial land use data accounted for 4.5% and Governmental was 1.5% with little change projected.

4. System Water Use

4.1 Chapter Summary

The District quantifies its current and projected water uses. Currently, 90% of the District's water use is residential, which includes both single-family and multi-family water use. The remainder of the District's water use is comprised of commercial, landscape, and government uses. Water use in 2020 was 3,472 AF in which 80% is imported from the SDCWA and 20% produced from local wells. Projected water use in 2045 is 4,500 AF, which is a 29% increase over the next 25 years. This increase, which is modest by San Diego County standards, is due to the fact that the District's service area is mostly developed, meaning that there are no anticipated significant changes in the water use. With that said, some increase is expected as a result of development of the limited developable land remaining and changes to residential water use such as redevelopment infill of more dense residential units. These topics are discussed in detail in the following sections. The District has included this summary of Chapter 4 in accordance with CWC Section 10630.5.

4.2 Historic and Projected Water Use

4.2.1 Historic Water Use

There was a decline in water use during the early 1990s when water conservation measures were first adopted, followed by a gradual increase for the following 10 years to about 5,500 AFY at 2007. Water usage decreased by more than 20% in 2020 due to California statewide water restrictions after a slight increase in 2013. The 20% reduction in 2020 is in addition to the 20% in 2009 and 2010 due to drought conditions requiring water use restrictions with the adoption of the Conservation Plan and the increasing cost of water. There has been a decrease in water usage when compared with over 20 years ago in spite of a population increase.

4.2.2 Projected Water Use

Table 4-1 provides current and projected water deliveries to the District. Currently, the District's demand is approximately 52% single family; 31% multifamily; 8% commercial, industrial, and institutional; 6% System Loss, 2% Landscape, and about 1% other, including construction meters and fire service. The projected demand by land use category for 2030 is expected to be similar because it has not changed in the last 10 years. Lower income household usage in 2020 was 24 acre feet, and only consists of 165 residential apartment units. Lower income residential usage is less than one percent of the District's overall usage. The District maintains a database that compiles data on water use, categorized by the type of use. This data comes from meter records of all District customers and is recorded internally by the District on a semiannual basis in its Water Consumption Report, which includes water volume data for the current fiscal year of 2019-20. For the purpose of this 2020 update to its UWMP, the District has adapted data obtained from its Water Consumption Report by grouping some sector categories to better align the District's sector labels with the descriptions and labeling of sectors that are set forth by CWC 10631(d) and as noted in Section 4.2 of the Guidebook.

The District is reporting water usage for its prior fiscal years that followed the District's 2015 UWMP update. The data is being reported in Table 4-1 in accordance with CWC 10631(d)(1).

4. System Water Use

Table 4-1
Past, Current, and Projected Water Deliveries

Year	Water Use Sectors	Single Family	Multi-Family	Comm/Inst	Land Scape	Other	System Losses	TOTAL
2016	No. of Accounts	5829	675	271	26	20		6821
	Deliveries (AF/Y)	1667	987	255	64	32	180	3185
2017	No. of Accounts	5864	691	275	27	20		6877
	Deliveries (AF/Y)	1785	1048	270	68	34	176	3380
2018	No. of Accounts	5868	694	279	27	20		6888
	Deliveries (AF/Y)	1898	1131	292	73	36	218	3648
2019	No. of Accounts	5872	721	280	27	20		6920
	Deliveries (AF/Y)	1717	1031	266	67	33	213	3326
2020	No. of Accounts	5889	697	293	27	20		6926
	Deliveries (AF/Y)	1802	1076	246	69	35	243	3472
2025	No. of Accounts	6183	732	308	28	20		7271
	Deliveries (AF/Y)	2340	1395	360	90	45	270	4500
2030	No. of Accounts	6307	746	314	28	21		7416
	Deliveries (AF/Y)	2496	1488	384	96	48	288	4800
2035	No. of Accounts	6433	761	320	28	21		7564
	Deliveries (AF/Y)	2558	1525	394	98	49	295	4920
2040	No. of Accounts	6498	769	323	28	21		7639
	Deliveries (AF/Y)	2631	1569	405	101	51	304	5060

4.2.3 Distribution System Water Loss

In accordance with CWC § 10631(d)(3), the District is reporting its distribution system losses for the five years preceding this 2020 UWMP update. Prior year losses have been included in Table 4-1 and the related American Water Works Association (AWWA) Water Audits for each reporting year have been included in Appendix C. Additionally, the District is reporting the current fiscal year losses and projected losses in Tables 4-1. As shown in Table 4-1, the volumes of water losses per year in the prior five years show a low level of loss demonstrating the District is prepared to meet the State Water Board water loss standard once it is established, in accordance with CWC 10631(d)(d)(C).

Senate Bill 555, adopted in 2015, requires urban retail water suppliers to complete and submit annual distribution system water loss audits to the state starting in 2017. Per the regulations, water loss audits must be conducted in accordance with AWWA's Manual of Water Supply Practices – M36 methodology, utilize AWWA's Free Water Audit Software, and receive at least a Level 1 validation by a validator certified through CA-NV AWWA. Although SB 555 went into effect in 2017, the District has been voluntarily conducting water loss audits utilizing AWWA's methodology and software since 2007 as a best practice to manage nonrevenue water. Additionally, as of December 2020 the state is in the process of developing water loss performance standards for urban water retail suppliers which the District will need to meet in the future.

4.2.4 Codes and Other Considerations Used in Projections

Projections noted in Table 4-1 resulting from the analyses described in the preceding sections above, are estimates for normal water use, inclusive of various conservation applications.

Based on the DWR's endorsement in its Guidebook, CWA selected an off-the- shelf application developed by the Alliance for Water Efficiency (AWE) to estimate conservation savings for the San Diego region. The AWE Conservation Tracking Tool (AWE Tool) is an industry standard planning model that provides granular estimates of existing and future "passive" or code-based water savings and "active" savings resulting from the implementation of demand management programs. Estimates of water conservation savings were developed for each of CWA's member agencies, including the District, using the AWE Tool.

Per Section 2.4.2 of CWA's UWMP, key water savings assumptions are derived based on historical program efficiencies, current regional water savings assumptions that serve as the basis for regional incentives, and efficiency estimates by activity type that are contained in the AWE Tool Library.

Future active conservation savings are set at the 2020 level of conservation program activity moving forward, absent a large-scale turf replacement program and state- mandated water-use reductions. The passive conservation element includes estimated future savings from appliance standards and code changes, as well as savings from 2015 Model Water Efficient Landscape Ordinance (MWELO). An 80 percent MWELO compliance level is assumed on new residential development and a majority of this savings was assumed to continue over the UWMP planning horizon. To account for conservation included in the baseline regional demand forecast, passive water savings from before 2018 were subtracted from the estimated water savings.

A summary of the codes, standards and ordinances are provided below:

1. 1992 National Energy Policy Act (EPAct) set the standard for:
    a. Residential toilets
    b. Commercial toilets
    c. Residential showerheads
    d. Residential clothes washers
    e. Residential dishwashers
2. California AB 715 requires only high-efficiency toilets be sold or installed as of January 1, 2014
3. Title 20 of CA Code of Regulations for commercial pre-rinse spray valves as of January 1, 2006
4. 2015 MWELO
5. Passive Landscape Conservation (active landscape savings that migrate to passive)
6. Passive Turf Removal (residential customers that convert turf to water efficient landscape outside of rebate program)

Passive Water Savings from conservation is estimated at 507 acft in 2025, 573 acft in 2030, 659 acft in 2035, and 743 acft in 2040.

5. Baselines and Targets

5.1 Chapter Summary

In 2009, DWR released the 20x2020 Water Conservation Plan in response to a statewide plan to reduce urban water use by 20 percent by the year 2020. That same year SB X7-7, the Water Conservation Act of 2009, was signed into law as part of a comprehensive water legislation package which set the approaches of the 20x2020 Water Conservation Plan into effect.

As part of SB X7-7, urban water suppliers were required to develop a 2020 urban water use target that meets the plan's water conservation targets. In 2010, DWR released a manual titled Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use, which provided retail water agencies with specific requirements and methodologies for setting water use efficiency targets and compliance standards through 2020. The District used this guidance manual to develop its baseline water demands and water use efficiency targets.

This chapter describes the methodology the district used to calculate its 2020 urban water use target, its baseline, and how the baseline was calculated. It demonstrates that the District reduced water use by more than 20 percent by December 31, 2020, complying with the urban water use target regulations imposed by SB X7-7. The District has included this summary of Chapter 5 in accordance with CWC Section 10630.5.

5.2 Water Conservation Act of 2009 SB X7-7

The State Legislature passed Senate Bill 7 as part of the Seventh Extraordinary Session, referred to as SBX7-7, on November 10, 2009, which became effective February 3, 2010. This new law was the water conservation component to the Delta legislation package, and seeks to achieve a 20 percent statewide reduction in urban per capita water use in California by December 31, 2020. (See Appendix E) The law requires each urban retail water supplier to develop urban water use targets to help meet the 20 percent goal by 2020, and an interim water reduction target by 2015.

In the 2015 Plan, water agencies must demonstrate compliance with their established water use target for the year 2015. This will also demonstrate whether or not the agency is currently on track to achieve its 2020 target. Compliance is verified by DWR's review of the SB X7-7 Verification Form submitted with an agency's 2015 UWMP. The SB X7-7 Verification Form is found in Appendix E.

5.3 Baselines and Targets

There is a 10 year and a 5-year baseline period to determine what target must be met to comply. Lakeside's 10-year baseline period is from 1999 to 2008 and the 5-year baseline period is from 2003 to 2007. For those periods gross water use is compared with populations to get gpcd (gallons per capita per day) or how many gallons each person uses each day on average for each year. Populations figures used for this calculation are from DWR's Population tool online which is slightly lower population numbers when compared with SANDAG. Using DWR's population estimates Lakeside's baseline gpcd is 155.28 for the 10-year baseline period and 155.75 gpcd for the 5-year baseline period. As you can see both are very close so Lakeside's baseline target for 2020 is 20% less than the baseline of 155 gpcd which is a target of 124 gpcd by 2020. This is a fairly low gpcd due to past conservation efforts and conservation hardening which is why Lakeside decided to use Target Methodology 3 for the South Coastal Hydrological Region which has a 2020 regional target of 149 gpcd which was met.

5. Baselines and Targets

Table 5-1 provides historical data on Lakeside's daily per capita water use (GPCD). SBX7-7 was enacted to require retail urban water agencies within the state to achieve a 20 percent reduction in urban per capita water use by December 31, 2020. Lakeside's 10-year average from 1999 to 2008 is 155 gpcd. The region's target of 149 gpcd per method 3 of the CUWCC (region 4 "South Coast) is the goal Lakeside District is using. The District must still conserve 5% from the region's target. The Lakeside SBX7-7 target for 2020 is 141.6 gpcd with an interim target of 144.6 gpcd in 2015.

Table 5-1
Historical Gallons Per Capita Per Day

Year	DWR Population	Annual Water Use	Daily Per Capita Water Use (GPCD)
1999	30746	4736	138
2000	31000	5731	165
2001	30943	5321	154
2002	30935	5709	165
2003	30927	5191	150
2004	30914	5858	169
2005	30915	4981	144
2006	30897	5390	156
2007	30884	5541	160
2008	30862	5298	153
10 Year Average Baseline GPCD			**155**

5.4 Water Consumption and Population for GPCD

Interim target calculations use population estimates for 2015 from DWR's Population tool of 30,986 for 2015. SANDAG estimated about 35,000. All water sources into Lakeside's system in 2015 was 3706.8 acre feet which is converted to gallons and divided by the population of 30,986 and divided by 365 days in a year. Lakeside's actual gpcd for 2015 is 106.8. In 2020 DWR's Population tool has 31,016 but again the SANDAG estimate is about 35,000. Using DWR's population and water into the system of 3,472 acft Lakeside's actual gpcd for 2020 is 100 which is substantially lower than the target of 141.6.

5.5 Compliance with 2015 and 2020 Targets

Lakeside's 2015 interim target was 151 gpcd and the 2020 target is 141.6 gpcd. The actual consumption for 2015 was 106.8 gpcd which is lower than our interim target and exceeds the 2020 target by about 28%. In 2020 Lakeside used 100 gpcd which is substantially lower than the target of 141.6 gpcd.

6. Water Supply

6.1 Chapter Summary

In this chapter, the District describes and quantifies current and projected sources of water available to the District. Although the District primarily relies on imported water from CWA for the majority of its water supply, local groundwater from the District's wells are pumped and treated at our Vine Street Filtration Plant. The District has included this summary of Chapter 6 in accordance with CWC Section 10630.5.

6.2 Water Sources

The District purchased 80% of its water supply from CWA in 2020, which buys 57% from MWD. MWD imports water through the Colorado River Aqueduct and facilities of the State Water Project (SWP). CWA imports 91 percent of the water used by county residents; the remaining 9 percent is from local sources, such as water recycling, groundwater, local runoff, and a newly added desalinization plant. CWA also has transfer agreements with Imperial Valley Famers (IID transfer) 19% of water imported and the Quantification Settlement Agreement (QSA) transfer agreement for relining the All-American and Coachella Canals which is 15% of water imported. Critical issues in water resources planning, such as the County's rapidly growing population, limited storage capacity, water transmission facilities, uncertainties over water imported from northern California, and the loss of water imported from the Colorado River, are requiring CWA to develop long-range plans for meeting future water demands called the Supply Diversification Plan.

The District produced 20% of its water supply from local wells in 2020. The Vine Street well field has three wells with a dual media package treatment plant for iron and manganese that produced 593 acft in fiscal year 2020. The Riverview well field has four wells with an aeration treatment plant to remove MTBE, a gasoline additive, which was made inactive as of 2007.

6.2.1 Imported Water Connections

The District currently imports treated potable water through the CWA 12" metered connection with Helix Water District's 54" line at Channel Road through an 11.5 mgd maximum connection. The Helix WD treats raw water, stored at Lake Jennings, at its Levy WTP, which is located just to the east of the District's boundary. The District also has two emergency connections to Padre Dam's wholesale system. They are located on Woodside Avenue, one 6" and one 10". There is also one 6" emergency connection with Helix Water District on Melrose Street.

6.2.2 Groundwater

The District averages 20% of its water supply from local wells and proactively meets all groundwater management standards. There is currently not a groundwater management plan and the basin is not adjudicated. Lakeside is one of four agencies that have formed a voluntary cooperative groundwater monitoring association that complies with the Department of Water Resources "California Statewide Groundwater Elevation Monitoring" (CASGEM) program for the San Diego River Valley basin. The CASGEM voluntary program has been established in accordance with California State Senate Bill x7-6 that amended the State Water Code and mandates a statewide groundwater elevation monitoring program to track seasonal and long-term trends in groundwater elevation in California's groundwater basins. The intent of the CASGEM program is to establish a permanent, locally-managed program of regular and systematic monitoring in all of California's groundwater basins. The goal is to determine that the basins are sustainably managed and operated. The CASGEM report is at Appendix D.

6. Water Supply

Our well field on Vine Street has three wells with a package dual media treatment plant for iron and manganese that produced 593 acft in fiscal year 2020. The Riverview well field was made inactive in 2007 and is off of Highway 67 between Wintergardens Blvd. and Riverford Ave. It has four wells with an aeration treatment plant to remove MTBE, a gasoline additive. This well field's production was considerably lower when compared to the other well field and also contains high levels of total dissolved solids and nitrates. Table 4-1 quantifies the historical amount of local groundwater pumped by Lakeside. The District has estimated pumping 900 acre feet per year in the future.

Table 6-1
Local Groundwater Pumped by Lakeside in Acre Feet

	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
Local Water @ Vine St. Well Field	880	816	776	812	684	593
Total Imported Water from CWA	2,859	2,369	2,604	2,836	2,643	2,879
Total	**3,739**	**3,185**	**3,379**	**3,648**	**3,326**	**3,471**

Groundwater Basins

The primary aquifer within the District's service area is the Santee-El Monte aquifer. This aquifer is comprised of loose alluvial sediments that extend along the San Diego River and major tributaries. The Santee-El Monte Alluvial Aquifer provides significant groundwater storage capacity, and has excellent recharge characteristics which has not been identified as over drafted nor projected to become over drafted. Well yields within the Santee-El Monte Alluvial Aquifer are good (typically on the order of hundreds of gallons per minute). The Santee-El Monte alluvial groundwater aquifer covers an area of approximately 4,600 acres. The aquifer stretches approximately 11 miles along the San Diego River from the eastern portion of the community of Lakeside to the western portions of the City of Santee.

The Santee-El Monte Basin consists of three distinct sub basins. The Santee Sub basin comprises the western half of the basin, and extends along the broad San Diego River flood plain downstream from the intersection of San Vicente Creek and the San Diego River. The Moreno Valley sub basin extends downstream from San Vicente Reservoir to the San Diego River. The El Monte Sub basin comprises the eastern portion of the Santee-El Monte Basin. The El Monte Sub basin is situated in the relatively narrow river valley along the San Diego River upstream from the river's confluence with San Vicente Creek.

Hydrogeology and Water Use

Table 6-2 summarizes hydro geologic parameters for the three sub basins that comprise the Santee-El Monte Alluvial Aquifer. As shown in the table, hydro geologic conditions vary widely within the three sub basins. In general, however, groundwater storage coefficients, hydraulic conductivities, and well yields are higher in the upstream reaches of the basin.

Past studies have reported a wide range of estimates for the groundwater storage capacity of the overall basin. (These estimates range from approximately 50,000 acre-feet (AF) to 100,000 AF.) The best available information, however, indicates that overall combined storage in the three sub basins of the Santee-El Monte Alluvial Aquifer is on the order of 70,000 AF. Hydraulic conductivity values in the sub basins (as reported in past studies) range from approximately 25 feet per day to 125 feet per day.

Table 6-2
Summary of Hydro geologic Characteristics
Santee-El Monte Alluvial Aquifer

Parameter	Santee Subbasin	Moreno Subbasin	El Monte Subbasin
Principal Surface Watercourse	San Diego River	San Vicente Creek	San Diego River
Location	Santee	Moreno Valley	Lakeside
Basin Length [1]	6 miles	2 miles	5 miles
Average Basin Width [1]	4,500 feet	2,000 feet	2,500 feet
Basin Elevation [1]	300 – 400 feet MSL[2]	400-500 ft MSL[2]	400 – 800 ft MSL[2]
Primary Aquifer Type [3]	Unconfined alluvium	Unconfined alluvium	Unconfined alluvium
Aquifer Composition [3]	Medium to coarse grained sand, and gravel	Medium to coarse grained sand and gravel	Medium to coarse grained sand and gravel
TDS [4]	800-2500 mg/L	500 – 800 mg/L	300 – 800 mg/L
Hydraulic Conductivity [4,]	25 - 100 ft/day 50 ft/day average	25-125 ft/day 75 ft/day average	50-125 ft/day 100 ft/day average
Specific Yield [4]	5 percent-20 percent range 13 percent average	5 percent-22 percent range 13 percent average	10 percent-22 percent range 15 percent average
Average Basin Hydraulic Gradient [1]	0.003 ft/ft	0.009 ft/ft	0.015 ft/ft
Estimated Basin Storage [4]	30,000–50,000 AF	5,000-8,000 AF	20,000-30,000 AF
Aquifer Thickness [4]	200 feet maximum 100 feet average	150 feet maximum 100 feet average	200 feet maximum 100 feet average
Current Estimated Pumping [4]	400 AFY [5]	200 AFY [5]	4,000 AFY [5]
Approximate Well Pumping Capacity[4,6]	200 - 1000 gpm	200 – 1000 gpm	800 – 1600 gpm
Areas of Greatest Surface Infiltration [4]	Along the San Diego river channel	Upper reaches of basin; along San Vicente Creek channel	Along San Diego River channel

1 Measured or estimated from USGS topographic maps for the El Cajon, San Vicente, and Alpine quads.
2 Elevations listed in feet above mean sea level (MSL).
3 From USGS (1985) and NBS/Lowry (1995).
4 Estimate based on information presented in State of California Department of Water Resources (1984), USGS (1985), SDCWA (1987), Luke-Dudek (1987), Clean Water Program for Greater San Diego (1990), NBS/Lowry (1995), and Welch & SDCWA (1997). In general, storage coefficients and hydraulic conductivity are higher in the upstream (El Monte and San Vicente) subbasins. Highest well yields occur in the El Monte Subbasin.
5 Estimate based on well surveys conducted by Clean Water Program for Greater San Diego (1990) and NBS/Lowry (1995).
6 Based on large-diameter irrigation wells. Maximum pumping rates from small diameter private domestic wells within the subbasins may be on the order of 100 (gallons per minute) gpm or less. (See NBS/Lowry (1995).

Streamflow infiltration comprises the dominant source of recharge within the Santee-El Monte Basin. Much of this streamflow infiltration recharge is believed to occur in the El Monte Subbasin. Because of limited groundwater pumping within the Moreno and Santee Subbasins, these subbasins typically remain filled or nearly filled with groundwater. Thus, while the potential for significant streamflow infiltration exists within the Moreno and Santee Subbasins, streamflow infiltration is typically limited by a lack of available groundwater basin capacity.

Infiltration from agricultural and urban surface runoff also is a key component of groundwater recharge within the overall Santee-El Monte Alluvial Aquifer. Infiltrating applied waters, infiltrating precipitation, septic tank discharges, and subsurface inflow also contribute to groundwater recharge within the Santee-El Monte Alluvial Aquifer.

The Clean Water Program for Greater San Diego (1990) and NBS/Lowry (1995) conducted detailed well surveys of the Santee-El Monte Basin. These surveys show that groundwater use within the Santee Subbasin has decreased substantially within the past several decades (probably due to water quality limitations). While more than 20 historic wells existed within the Santee Subbasin, only a few wells remain active. Current groundwater use within the Santee Subbasin is on the order of several hundred acre-feet per year. The surveys report that many wells (over 20) are still active within the Moreno subbasin. Total existing groundwater use within the Moreno subbasin was estimated to be on the order of approximately 200 AFY.

A significant majority of the overall groundwater use within the Santee-El Monte Basin, however, occurs within the El Monte Subbasin. A total of more than 50 active irrigation and domestic wells exist within this basin. Total pumping within the El Monte Basin is estimated at approximately 4,000 AFY (NBS/Lowry, 1995). Groundwater users include private landowners and public entities. Lakeside Water District develops approximately 1,000 AFY of supply from the basin (Welch & SDCWA, 1997).

Basin Water Balance

Streamflow infiltration represents a key source of recharge to the Santee-El Monte Alluvial Aquifer. Infiltrating storm and urban runoff, percolating precipitation, percolating applied waters, septic tank discharges, and groundwater inflow from adjoining aquifers provide additional recharge to the aquifer. Once recharged to the basin, groundwater may exit the basin through groundwater pumping, withdrawal by phreatophytes (deep-rooted vegetation), surfacing groundwater, and subsurface outflow.

The quantity of basin recharge and discharge varies with hydrologic conditions, changes in land use, and changes in local water use. While depths to groundwater fluctuate in response to these factors, over a long period of time, overall basin and recharge and discharge are balanced. The recharge and discharge terms of this balance offer insight to appropriate strategies for developing additional water supply within the basin. Overall water balance estimates for the Santee-El Monte Basin have been presented in several previous studies, including DMJM and Lowry & Associates (1978), USGS (1985), NBS/Lowry (1994) and Bundy/Huntley/SDSU (2001). Differences exist between the studies in the manner in which individual recharge/discharge terms are defined and estimated. Even taking these differences into account, however, water balances presented in previous studies demonstrate that excess recharge capacity exists within the Santee-El Monte basin. (That is to say, increased pumping within the basin results in increased streamflow infiltration.)

Using information from these past studies to develop a water balance concluded that current long-term streamflow infiltration totals within the Santee-El Monte Basin are limited by the fact that the basins are typically too "full" to accept infiltrating streamflows. As a result, streamflow that would normally infiltrate into the basin flows out to the ocean.

6.3 Demonstration of Consistency with the Delta Plan

The District, the San Diego County Water Authority (CWA), and Metropolitan Water District of Southern California (MWD) are all acting to reduce dependence on the Sacramento-San Joaquin Delta. In addition to the various demand management measures discussed in Chapter 9 of this UWMP, Helix Water District is pursuing an advanced water purification program in a joint effort with Padre Dam Municipal Water District, the City of El Cajon, and the County of San Diego in order to develop a program that will yield a drought-proof local supply of potable water. This program is described in detail in Chapter 6 of this UWMP. As noted in Chapter 6, the District projects that as much as 28.6 percent of its future supplies will be from new, locally sustainable sources that would significantly reduce the District's reliance on the Delta. Additional information is available at Appendix J of CWA's 2020 UWMP, and Appendix 11 of MWD's 2020 UWMP to address this requirement.

6.3.1 Development of Desalinated Water

The District's wholesale water supplier, SDCWA, has developed a desalinated water supply. It is expected to provide 8% of the region's supply by the year 2020. Additional detail may be found in CWA's 2020 UWMP. Lakeside Water District does not have a desalination opportunity.

6.4 Energy Intensity

Beginning in its 2020 UWMP update, the District is required to report information that could be used to quantify or calculate the energy intensity of its water services. The information is limited to that which is readily reportable or obtainable by the District. Based on available data from power bills (individual service meters at the District's facilities), the District is able to report energy consumption. Per DWR's reporting table, 1,520,791 kwh and 3472 AF, the District's energy intensity for its water management process is approximately 438 kilowatt hour per AF.

7. Water Service Reliability and Drought Assessment

7.1 Chapter Summary

Assessing water service reliability is a fundamental component of an UWMP to prepare an urban water supplier for future drought risks. The water service reliability assessment reflects the District's ability to meet the water demand needs of its customers to ensure supplies are adequate even under strained circumstances that can arise due to an ongoing drought. As described in this chapter, given the development of CWA's supplies and the District's supplies as planned and the achievement of conservation targets, no shortages are anticipated for the District during the course of future normal, single-dry years, or a consecutive five-year drought through the 25-year planning horizon to 2045. This chapter also provides a Drought Risk Assessment (DRA) to enable the District to evaluate its risk under a severe drought period lasting for the next five consecutive years.

In accordance with CWC 10635(a), every urban water supplier shall include, as part of its UWMP, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. Per the CWC, the District's water supply and demand assessment shall compare the total water supply sources available to the District with the long-term projected water use over the next 20 or more years in five-year increments, for a normal water year, a single dry year, and a drought lasting five consecutive years. To comply with this requirement, the District is reporting its expected water service reliability for a normal year, single dry year, and five consecutive dry years projected out in five-year increments through 2045 in the following sections of this chapter.

These water service reliability and risk assessments are important to the District. Water service reliability affects the District's short-term and long-term water management decisions. As a planning tool, an intent of the UWMP is to assist the District in addressing potential problems before they become acute problems, whether by augmenting supplies or reducing demands. Moreover, the utility of the UWMP also encourages consideration of other water management conditions that may pervade under a longer planning horizon, such as climate change, development, or emerging technologies. The DRA, a new requirement for the UWMP for 2020, allows the District to test its near-term reliability by assuming the next five consecutive years are dry. This chapter constitutes a methodical outcome for assessing supplies and water uses that helps direct District management actions, funding allocations, and project prioritization, and serves to help the District forecast and begin planning for additional project development. The District has included this summary of Chapter 7 in accordance with CWC Section 10630.5.

7.2 Projected Normal Year Supply and Demand

Table 7-1 presents the projected supply and demand comparison. This table indicates that in average precipitation years, the District has sufficient water to meet its customers' needs, through 2040. This is based on continued commitment to conservation programs and additional water supply from CWA who says in their 2020 UWMP at section 9 "That no shortages are anticipated within CWA's service area in a normal year through 2045." The district has also added many ground water wells over its history. Adding new wells as old ones become inefficient to maintain supply reliability. The district currently has three active wells and one inactive on Vine Street and four inactive wells along Highway 67, west of Wintergardens Blvd.

Table 7-1 Single Dry Year Supply and Demand Comparison AFY					
Year	2020	2025	2030	2035	2040
Supply totals	4000	4564	4745	4779	4880
Demand totals	3472	4500	4600	4700	4900
Difference	528	64	145	79	80

7. Water Service Reliability and Drought Assessment

Pursuant to CWC 10635(b), the District shall include, as part of its UWMP, a drought risk assessment (DRA) for its water service to its customers as part of information considered in developing the demand management measures and water supply projects and programs to be included in the UWMP. The DRA is based on the District's five driest consecutive years on record. However, CWC 10635 also requires that the analysis include consideration for plausible changes in climate, regulations, and other locally applicable criteria. As such, the historic five driest consecutive years on record was used as a starting point in the analysis that is informed by other factors and considerations. The District then used these estimated supply conditions to prepare its DRA, assuming they occur over the next five years. A living document, the DRA can be modified or updated on an interim cycle, if necessary. This flexibility allows the District to modify the DRA as more information becomes available, supplies or uses change, and in the event of unforeseen circumstances.

7.3 Projected Dry Year and Multiple Dry Year Supply and Demand

Table 7-2 presents a supply and demand comparison for a single dry year and multiple dry years from 2025 through 2040. The District's ability to meet its customer demands in dry years is based on CWA's ability to provide a reliable water supply. CWA has documented its plans to provide a reliable water supply to the region, even in multiple dry years, in its 2003 Water Master Plan, 2004 Water Supply Report, 2015 and 2020 Urban Water Management Plans. The District's groundwater experiences little, if any, reduction in a single dry-year. SDCWA is diversifying its supply with the IID transfer, canal lining projects, carryover storage projects, and seawater desalination projects which are all considered "drought-proof" supplies. Metropolitan Water District allocates its supplies through their Supply Allocation Plan which allocates based on preferential rights. In years where shortages may still occur, the Water Shortage Contingency Plan (Appendix L) will be enforced to fill the supply shortage. Water use restrictions helped manage water supply shortages from 2007 through 2010 and again from 2015 to 2016.

Submittal Table 7-2 Retail: Multiple Dry Years Supply and Demand Comparison AFY

		2025*	2030*	2035*	2040*	2045* (Opt)
First year	Supply totals	4,564	4,745	4,779	4,880	4,973
	Demand totals	4,494	4,655	4,699	4,810	4,903
	Difference	70	90	80	70	70
Second year	Supply totals	4,564	4,745	4,779	4,880	4,973
	Demand totals	4,524	4,695	4,729	4,830	4,923
	Difference	40	50	50	50	50
Third year	Supply totals	4,610	4,792	4,827	4,929	5,023
	Demand totals	4,567	4,740	4,774	4,876	4,970
	Difference	43	53	53	53	53
Fourth year	Supply totals	4,656	4,840	4,875	4,978	5,073
	Demand totals	4,610	4,785	4,819	4,922	5,017
	Difference	45	56	56	56	56
Fifth year	Supply totals	4,702	4,889	4,924	5,028	5,124
	Demand totals	4,654	4,830	4,865	4,969	5,065
	Difference	48	59	59	59	59

***Units of measure (AF, CCF, MG)** must remain consistent throughout the UWMP as reported in Table 2-3.*

7.4 Drought Risk Assessment (DRA)

Pursuant to CWC 10635(b), the District shall include, as part of its UWMP, a drought risk assessment (DRA) for its water service to its customers as part of information considered in developing the demand management measures and water supply projects and programs to be included in the UWMP. The DRA is based on the District's five driest consecutive years on record. However, CWC 10635 also requires that the analysis include consideration for plausible changes in climate, regulations, and other locally applicable criteria. As such, the historic five driest consecutive years on record was used as a starting point in the analysis that is informed by other factors and considerations. The District then used these estimated supply conditions to prepare its DRA, assuming they occur over the next five years. A living document, the DRA can be modified or updated on an interim cycle, if necessary. This flexibility allows the District to modify the DRA as more information becomes available, supplies or uses change, and in the event of unforeseen circumstances. The District used information from Section 9.6 of CWA's UWMP. Calendar year 2020 estimated demand of 482,627 AF across all its member agencies. CWA then used multipliers based on a weather index to determine the impact of hot, dry weather on water demands. The calendar year 2020 demands were increased by 8 percent, 12 percent, 16 percent, 20 percent and 25 percent for years 2021, 2022, 2023, 2024 and 2025, respectively. The District then determined its own portion of the total demand on CWA based on the District's most recent five-year average of demands on CWA's regional demand. Available supply from CWA to the District was also determined based on information provided in Table 9-9 in CWA's UWMP. To determine the local supplies available to the District in a five consecutive dry year period, historical records since 1995 were used. To produce a worst-case scenario, the single driest year on record was used for all five of the years in the analysis period.

7.5 Reliability of Water Supply

Since the District imports most of its potable water, supply reliability issues are largely determined by the reliability of CWA and MWD supply systems. CWA is diversifying its supply with projects like the IID transfer, canal lining projects, carryover storage projects, recycled water, and seawater desalination projects which are all considered "drought-proof" supplies. In an emergency the District can also transfer water from Helix Water District or from Padre Dam Municipal Water District. No other exchange opportunities exist.

7.5.1 CWA Supply Reliability

The CWA is working to diversify its supply and decrease its dependence on MWD over the next 20 years. The imported supplies from CWA are made of a mix of sources including water from the Delta and Colorado River. Due to constraints on the Delta and Colorado supplies, CWA has developed a mix of projects to diversify the imported water supply portfolio to increase regional self- reliance and reliability and reduce dependence on the Delta and Colorado River. Projects completed by CWA to increase reliability of supply for the region and the District include the Imperial Irrigation Conservation and Transfer Agreement, All American Canal and Coachella Canal Relining Projects, San Vicente Dam Raise and Carryover Storage Project, and Carlsbad Desalination Project. These projects are verifiable water supplies to CWA and are used to supply the District's imported needs in normal and dry local water supply years.

CWA has also implemented an Emergency Storage Project (ESP), a system of reservoirs, interconnected pipelines and pumping stations designed to make water available to all communities in the San Diego region in the event of a disaster that would interrupt imported water deliveries. Some projects include increasing the height of San Vicente Dam and connecting San Vicente Lake to El Capitan Lake via pipes using El Capitan Lake for storage. San Vicente provides approximately 100,000 acre-feet of local storage. CWA plans to provide reliable supply in average, dry, and multiple dry year conditions.

7.5.2 District Supply Reliability

Single and multiple dry years do not lead to a reduction in local supplies. CWA is planning on the use of dry year options and transfers to meet the shortage scenarios without impacting reliability. **Table 7-1** presents the projected supply and demand comparison in AFY. **Table 7-2** provides the District's estimated water supply projections associated for a single dry year and multiple dry years. Supply and demand comparisons using maximum day capacity to assess service reliability can be found in Chapter 7

7.5.3 Water Quality Impacts on Reliability

Since CWA provides a majority of the District's water supply and CWA is providing treated water, any changes to water quality and resulting reliability over the next 20 years is overseen by CWA. Based on CWA's UWMP, no changes to water supply reliability as a result of water quality are expected for the next 20 years.

Water quality is tested at the Lake Skinner Treatment Plan and Helix's Levy Treatment Plant, where water is treated before it is supplied to the District. Based on the District's 2020 Water Quality Report, all primary and secondary standards showed both ranges and averages for all tested parameters to be within the maximum contaminant levels (MCL) required by the U.S. EPA and California Department of Public Health.
The District's well fields are sensitive to drought conditions and contamination from local runoff, MTBE, nitrates, and total dissolved solids. Water quality is constantly tested and currently meets all primary and secondary standards for all tested parameters to be within the maximum contaminant levels (MCL) required by the U.S. EPA and California Department of Public Health.

7.6 Potential Projects to Increase Water Supply

The District is part of a project to improve or increase water supply referred to as the East County Regional Treated Water Improvement Program/Eastern Service Area (ESA) Secondary Supply Connection Project.

The East County Regional Treated Water Improvement Program is a comprehensive integrated program of capital improvements and usage guarantees involving the District, CWA, Helix Water District, Padre Dam Municipal Water District, and Otay Water District. This program is intended to improve the regional treatment capacity in the East San Diego County, including the District's service area, by maximizing the use of the treatment capacity in Helix Water District's Levy Water Treatment Plant. Although it will not create a new supply, this program will reduce treated water demand from CWA and will provide a more reliable water supply to the District because the source of the raw water is locally stored imported water.

7.6.1 Development of Desalination Water

The District's wholesale water supplier, CWA, has developed Carlsbad Desalination Plan in Partnership with Poseidon Water which is the first desalination plant in San Diego County. Lakeside Water District does not have a desalination opportunity. Other San Diego County area desalination projects are also planned at Camp Pendleton and Rosarito Beach. Additional detail may be found in CWA's 2020 UWMP. The desalination of seawater is another way CWA has diversified its water resources, and contributes to the region's reduced dependence on imported supplies by providing a local, drought-proof water supply. The desalination plant can provide up to 56,000 AFY of potable water, of which 50,000 AFY is available to CWA to incorporate into its distribution system for its member agencies and the balance considered a member agency local supply (City of Carlsbad). Further, as noted in Section 4.5 of its UWMP, CWA reports that there is potential for additional expansion of potable water production to 61,000 AFY.

As a CWA member agency, the District's imported treated water supply contains desalinated water proportionate to what is blended into the imported treated supply. The District views all imported treated supply as one source and does not distinguish desalinated water separately. As a result, the District does not report the use of desalinated water, instead leaving this to CWA to report as part of its regional supply portfolio. The District does not have current or future plans for additional development of desalinated water supply to be used within the District's service area.

7.6.2 Recycled Water

The District looks to CWA and to the local sewer agencies to take the lead in developing and implementing waste water reclamation programs to make more water available to the entire region. Waste water collection, treatment and disposal or reclamation services within the District's boundaries are performed by completely separate and unrelated agencies so the District does not have recycled water opportunities. No recycled water is currently being used in the District.

8.1 Chapter Summary

The District has included this summary of Chapter 8 in accordance with CWC Section 10630.5. The CWC mandates that water agencies include in their UWMPs a water shortage contingency plan (WSCP). A WSCP, which is a detailed proposal for how an urban water supplier intends to act in the case of an actual water shortage condition, exists as a stand-alone document and can be amended, as needed, without amending the UWMP. A water shortage may occur due to a number of reasons, such as drought, climate change, or catastrophic events. A water shortage means that there are insufficient water supplies to meet the District's normal customer water use demands at a given point in time. The District has developed this WSCP to serve as an operating manual to prevent catastrophic service interruptions through proactive, rather than reactive management. If and when shortage conditions arise, the WSCP allows the District's board, staff, and the public to identify and efficiently implement predetermined steps to manage a water shortage. The District's WSCP includes and addresses the following elements:

1) Water supply reliability assessment
2) Annual water supply and demand assessment procedures
3) Six standard water shortage stages
4) Shortage response actions
5) Communication protocols
6) Compliance and enforcement
7) Legal authorities
8) Financial consequences of the WSCP
9) Monitoring and reporting
10) WSCP refinement procedures
11) Special water feature distinction
12) Plan adoption, submittal, and availability

The WSCP is intended to be consistent with the District's UWMP and CWA's UWMP and is further intended to implement CWA's WSCP. CWA's WSCP is a response program developed by CWA in consultation with its member agencies for responding to water supply limitations resulting from drought conditions. The response levels included in the District's WSCP correspond with CWA's WSCP.

8.2 Water Supply Reliability Analysis

The District is located in a region with limited local water supplies. Since 1948, the District has relied on imported water as its primary water supply source, and it maximizes the use of available local supplies to supplement imported supplies.

As discussed in Chapter 7 of the District's 2020 UWMP, historically, water from CWA has accounted for the majority of the District's water supplies and has accounted for 80% of the District's water supply on average. Imported water is purchased from CWA, the water wholesaler for the San Diego region. The imported supplies from CWA are a mix of sources including water from the Delta and Colorado River. Looking forward, imported water is estimated to account for 3,400 to 3,500 AF of the district's annual water supplies over the next 20 years. Due to constraints on the Delta and Colorado River supplies, CWA has developed a mix of projects to diversify the imported water supply portfolio to increase reliability and reduce dependence solely on the Delta and Colorado River. Projects completed by CWA to increase reliability of supply for the region and the District include the Imperial Irrigation Conservation and Transfer Agreement, All American Canal and Coachella Canal Relining projects, San Vicente Dam Raise and Carryover Storage project, and the Carlsbad Desalination project. Additional details on CWA's water supply reliability are discussed in Chapter 9 of CWA's UWMP and are incorporated by reference herein.

Local ground water accounts for 20% of the District's supplies on average. The district estimates that groundwater will provide 900 AF annually of the district's water supplies over the next 20 years. Groundwater, which is sourced from the El Monte Valley Basin within the San Diego River Valley Basin, is pumped from our well field located at the administrative headquarters. In fiscal year 2020, the well produced 593 AF.

Every five years, the District updates its Urban Water Management Plan, which includes projecting supplies over the next 25 years, in five-year increments, for a normal water year, a single dry year, and a drought lasting five consecutive years. CWA notes that certain of its supplies, which consist of the Imperial Irrigation District water transfer, All-American Canal and Coachella Canal lining projects, and regional seawater desalination, no reduction in the availability over the five-year drought period is assumed due to the drought resilience of those supplies.

Given the development of CWA's and the District's supplies as planned and the achievement of conservation targets, as quantified in the District's Urban Water Management Plan, the District anticipates having sufficient supplies to meet demand during future normal water years, single dry years, and for a drought lasting five consecutive years.

However, low probability, high impact events can result in sudden, unanticipated loss of water supply on a catastrophic scale. These threats can be naturally occurring, such as earthquakes, wildfires or lightning that could result in dependency hazards such as loss of utility power that in turn could affect the conveyance of imported water or the functionality of the District's treatment plant. These threats can also be malevolent, such as various forms of acts of terrorism. CWA, as the regional wholesaler, has created an Integrated Contingency Plan (ICP) in conjunction with its member agencies to address catastrophic events that could eliminate access to imported water supplies. CWA's ICP identifies potential emergency situations and incidents that could trigger activation of CWA's ICP and Emergency Operations Centers, along with the policies, procedures, multi-agency coordination, mutual aid agreements and activation/deactivation guidelines associated with emergency response activities.

CWA has also created the Emergency Storage Project which is a system of reservoirs, pipelines, pump stations and other conveyance facilities (See Section 8.2 of CWA's 2021 Water Shortage Contingency Plan) intended to improve San Diego County's regional water storage capacity and allow stored emergency water to be delivered to CWA's member agencies within San Diego County during a prolonged regional interruption. The ESP facilities can be used to help deliver emergency water supply to member agencies during two- and six-month emergency events in which the region is either completely unable or partially able to receive imported water deliveries due to a disaster that renders their transmission system inoperable. CWA also has Emergency Water Delivery Plans, which identify emergency water supply deliveries to its member agencies during two- and six-month emergency events through CWA Quantification Settlement Agreement transfers, spot transfers, out-of-region storage supplies, and MWD supplies.

8.3 Annual Water Supply and Demand Assessment Procedures

Water Code Section 10632(a)(2) requires urban water suppliers to conduct an annual water supply and demand assessment and submit an Annual Assessment Report to the state beginning July 1, 2022.

The information below provides an overview of the District's process to annually assess projected water supplies and customer demands. The assessment is used to determine if there will be a shortfall in District supplies for the current year and one dry year. If the assessment identifies a shortfall in District supplies, it would trigger the District's shortage response actions as outlined in the District's WSCP.

8.3.1 Decision-Making Process

This section summarizes the decision-making process that the District will use each year to determine, and subsequently report to the state, its annual water supply and demand assessment:

Table 8-A: Decision Making Process for Annual Water Supply and Demand Assessment Procedures

Timeframe (No Later Than)	Action	Responsible District Department
May 1	Authority announces member agency allocation determination for current year, if applicable	Authority provides to Systems, if applicable
May 1	Authority determines carryover (and emergency storage apportionments if under emergency), if applicable	Authority provides to Systems, if applicable
May 1	District determines District local supply available	Systems
May 1	District determines total supply available – inclusive of local and imported supplies	Systems
May 1	District determines infrastructure constraints	Systems
May 1	District determines expected demands	Finance
May 1	District compares supply and demand and makes a determination of the water supply reliability for the current and one dry year	Water Conservation
June 15	District prepares and submits Annual Assessment Report to the state in coordination with CWA	Water Conservation
July 1, if applicable	District implements its water shortage response actions as outlined in this WSCP, if there is a gap between available water supplies and projected demand	Water Conservation makes recommendation to General Manager and/or Board as outlined in WSCP, if applicable

8.3.2 Data and Methodologies

The District will evaluate current year available supply and one dry year available supply in its annual assessment. The District's systems department will conduct the water supply evaluation annually by May 1 and by assessing the following hydrological conditions:

8.3.2.1 Local Sources

- Local stored water - Determine storage in each reservoir available for transfer.
- Wells - Determine last year's production and potential production constraints.

8.3.2.2 Imported Sources

Imported water – Allocation determined by CWA, including available CWA carryover and CWA emergency storage, based on local and statewide hydrological conditions and contractual availability, if applicable CWA's supply allocation methodology, developed in collaboration with CWA and its member agencies, is detailed in CWA's WSCP. Since the District relies primarily on imported water, continued coordination with CWA is crucial in determining the District's available water supply.

8.3.2.3 Infrastructure Considerations

The District's systems department will also consider the District's existing infrastructure capabilities and potential constraints for the upcoming fiscal year and one dry year. The District's existing water supply infrastructure is documented in the District's geographical information system, including its treatment plant, storage tanks, pump stations, pipelines, and valves. Constraints that could potentially limit water supply availability include shutdowns due to maintenance, construction impacts, and water quality impacts. The District will also coordinate with CWA to identify regional infrastructure constraints to determine if, and how, they would impact District water supply availability. Once constraints have been identified, the District will determine if the total water supply identified as available under local and imported sources should be adjusted.

8.3.2.4 Projected Water Demand

The annual assessment will use the District's latest demand forecast. The demand forecast is completed by the District's finance department by May 1 each year. Key inputs include, but are not limited to, the District's unconstrained demand, recent water demand trends, pending water use efficiency regulations, mandatory water use restrictions, weather, and population and economic growth.

8.3.2.5 Water Supply Reliability Annual Assessment Report

The CWA's systems and finance departments will provide projected water supply and demand data to the water conservation department by May 1. CWA's water conservation department will compare supply and demand and make a determination of the water supply reliability for the current and one dry year by June 1. The District will complete and submit the District's Annual Assessment Report, and will coordinate with CWA as appropriate. The report will be submitted to the state within 14 days of receiving final allocation from the State Water Project or by July 1.

8.3.2.6 Gap Between Available Water Supplies and Projected Water Demand

If there is a gap between available water supply and projected water demand, the District's water conservation department will recommend implementation of the District's water shortage response actions as outlined in this WSCP, or reasonable alternative action, provided that descriptions of the alternative actions are submitted with the Annual Assessment Report pursuant to Water Code 10632.1.

8.4 Six Standard Water Shortage Levels

The District has established six levels of water shortages, outlined in this WSCP and in coordination with CWA, to be implemented in times of shortage, with increasing restrictions on water use in response to decreasing available supplies due to drought or emergency events. See Submittal Table 8-1 below. To determine the appropriate level, the District will assess the water supply and demand per the procedures outlined in Section 8.3.

Submittal Table 8-1 Water Shortage Contingency Plan Levels		
Shortage Level	Percent Shortage Range	Shortage Response Actions (*Narrative description)*
1	Up to 10%	Communicates supply shortage with customers and promotes voluntary water conservation measures including recommended watering schedules and ways to reduce water waste.
2	Up to 20%	Increases conservation communications. Begins the enforcement of mandatory water use prohibitions and places limits on watering days and times.
3	Up to 30%	Increases water use efficiency and conservation communication. Deploys more restrictive water use prohibitions and gives District opportunity to issue water allocations and/or ban new connections.
4	Up to 40%	Makes more restrictive water use prohibitions. Focuses communication on extraordinary need for conservation. Expands resources for customers to help avoid damage from extreme conservation.
5	Up to 50%	Stops all landscape irrigation except for specific reasons. Bans all new connections unless project meets stringent criteria. Focuses communication and messaging to handle imminent needs.
6	>50%	Limits exemptions for watering days. Communicates the need for all businesses and residents to work together to help weather the situation.
NOTES:		

8.5 Shortage Response Actions

Although the District has ongoing demand reduction measures in place, the District has identified three additional potential supply mitigation tools that can be utilized in response to water shortages:

1) Communication plan
2) Mandatory water use prohibitions
3) Operational changes

As noted in Table 8-B, below, the Shortage Response Matrix includes a list of potential shortage response actions available to the District at each of the six standard water shortage levels. To determine the locally appropriate actions that should be taken at each level, the District will evaluate conditions specific to the timing, supply availability, supply reduction levels, costs, and other variables. Depending on the situation, the District may not implement each of the identified actions in a response level but select only those that are most appropriate.

Table 8-B: Shortage Response Matrix

Water Shortage Level	Use Restrictions	Ongoing Water Use Efficiency	Communication Plan	Mandatory Water use Prohibitions	Operational Changes
Normal Conditions		X			
Level 1: Up to 10% (Voluntary)	Voluntary	X	X		
Level 2: Up to 20% (Mandatory)	Mandatory	X	X	X	X
Level 3: Up to 30% (Mandatory)	Mandatory	X	X	X	X
Level 4: Up to 40% (Mandatory)	Mandatory	X	X	X	X
Level 5: Up to 50% (Mandatory)	Mandatory	X	X	X	X
Level 6: Above 50% (Mandatory)	Mandatory	X	X	X	X

8.5.1 Demand Reduction

The District has adopted policies and procedures manual Section 10.1, which is also known as the Water Shortage Response Policy and Procedure and has been provided by the District in Appendix L. This policy and procedure establishes both permanent water use efficiency measures and additional demand reduction measures to be implemented during times of declared water shortages, or declared water shortage emergencies. It establishes six levels of water shortage response actions to be implemented in times of shortage, with increasing restrictions on water use in response to worsening drought conditions and/or decreasing available supplies. The demand reduction measures correspond to the District’s six water shortage levels and CWA’s WSCP, as noted in Table 8-B:

Additionally, Table 8-2 summarizes the demand reduction actions, estimated percent demand reduction per action, operational changes, and whether a penalty applies.

Submittal Table 8-2: Demand Reduction Actions				
Shortage Level	Demand Reduction Actions ***Drop down list*** *These are the only categories that will be accepted by the WUEdata online submittal tool. Select those that apply.*	How much is this going to reduce the shortage gap?	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement?
1	Expand Public Information Campaign	5%		No
1	Landscape - Restrict or prohibit runoff from landscape irrigation	2%		No
1	Other - Require automatic shut of hoses	1%		No
1	Other - Prohibit use of potable water for washing hard surfaces	1%		No
2	Expand Public Information Campaign	5%		No
2	Landscape - Limit landscape irrigation to specific times	1%		Yes
2	Landscape - Limit landscape irrigation to specific days	2%	3 days/wk	Yes
2	Water Features - Restrict water use for decorative water features, such as fountains	1%		Yes
2	Other - Customers must repair leaks, breaks, and malfunctions in a timely manner	1%	5 days	Yes
3	Expand Public Information Campaign	5%		No
3	Landscape - Limit landscape irrigation to specific days	1%	2 days/wk	Yes
3	Implement or Modify Drought Rate Structure or Surcharge	5%		Yes
3	Moratorium or Net Zero Demand Increase on New Connections	1%		No
3	Other - Customers must repair leaks, breaks, and malfunctions in a timely manner	1%	3 days	Yes
4	Expand Public Information Campaign	5%		No
4	Landscape - Prohibit certain types of landscape irrigation	1%		Yes
4	Implement or Modify Drought Rate Structure or Surcharge	5%		Yes
4	Increase Water Waste Patrols	1%		Yes
4	Other - Customers must repair leaks, breaks, and malfunctions in a timely manner	1%	2 days	No
5	Expand Public Information Campaign	5%		No
5	Landscape - Prohibit all landscape irrigation	1%		Yes
5	Implement or Modify Drought Rate Structure or Surcharge	5%		Yes
5	Other - Customers must repair leaks, breaks, and malfunctions in a timely manner	1%	1 day	Yes
5	Implement or Modify Drought Rate Structure or Surcharge	1%		No
6	Expand Public Information Campaign	3%		No
6	Landscape - Prohibit all landscape irrigation	5%		Yes
6	Implement or Modify Drought Rate Structure or Surcharge	5%		Yes
6	Increase Water Waste Patrols	2%		Yes
NOTES: In each progressing level restrictions are cumulative.				

PERMANENT WATER USE EFFICIENCY MEASURES

At all times, the following practices shall be in effect:

1. No outdoor watering during a rain event or within 48 hours after measurable rainfall.
2. No watering down a sidewalk with a hose instead of using a broom or a brush except to alleviate safety or sanitary conditions.
3. No washing of automobiles with hoses not equipped with a shut-off nozzle.
4. No overwatering a landscape in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots, or structures.
5. Home owners associations (HOAs) and local governments may not penalize homeowners for certain outdoor conservation practices during a declared shortage.
6. No use of a non-recirculated potable water in fountain or other decorative water feature.
7. No serving of drinking water other than upon request in eating or drinking establishments, including but not limited to restaurants, hotels, cafes, cafeterias, bars, or other public places where food or drink are served and/or purchased
8. No irrigation with potable water of ornamental turf on public street medians
9. No irrigation with portable water of landscapes outside of newly constructed homes and buildings in a manner inconsistent with regulations or other requirements established by the California Building Standards Commission and The Department of Housing and Community Development.

Level 1 through 6 Water Shortage Contingency Plan details are in Appendix L as updated from the Drought Response Plan in 2020.

8.5.2 Supply Augmentation

The District purchases the majority of its water from CWA, the regional water wholesaler for the San Diego region. As previously described, the District is dependent on both the CWA and the Helix Water District facilities to supply its potable water needs. CWA and its 24-member agencies, including the District, have worked collaboratively over the past two decades to diversify water supplies and develop robust water supply shortage plans. If CWA identifies a water supply shortfall, it evaluates the use of stored water reserves from CWA’s Carryover Storage or pursues supply augmentation measures, such as dry-year transfers, to reduce or eliminate the shortfall. Details on CWA’s supply augmentation plan are available in CWA’s WSCP, referenced and incorporated herein as Appendix K. These supply augmentations occur before the district purchases water from CWA.

At a local level, the District maintains imported treated water and local groundwater. In the event that the treated water supply was interrupted, the District would have to rely on the operational storage contained in its 10 potable water reservoirs. The wells can currently supply less than one-fifth of the normal day demands. If the District were to have supplies reduced by 50 percent for a lengthy duration, as might result from a severe drought, compensatory reductions in potable water consumption would need to occur. Therefore, a 50 percent reduction in the District’s supply would be matched by a 50 percent reduction in consumption throughout the District. A Level 5 would go into effect (Appendix L) and Tier 3 and Tier 4 pricing levels would also go into effect for high water usage customers.

The current combined total potable emergency water storage of 12.6 MG available in District reservoirs can provide approximately five days use under existing maximum day demand. With a 50 percent reduction in customer maximum day demand and outdoor use banned this reserve could last for 10 days. Additionally, the district maintains another 5 days of emergency storage or 11.73 MG in Padre Dams’s wholesale storage system. Combined storage could last up to 20 days with 50% conservation level. The district would consider using this emergency storage in shortage Levels 5 and above. The exact amount of emergency storage available, and how long it would last, depends on projected demands and the water shortage level.

8.5.3 Operational Changes

When faced with a potential water shortage, the District will consider the following operational changes, as appropriate, to help address the shortage on a short-term basis:

- Evaluate customer water monthly using bimonthly billing data which is available on a rolling basis
- Increase customer communications
- Reduce water budget allocations for irrigation accounts
- Implement customer water shortage penalties
- Begin water patrols and enforcement
- Expedite system repairs and prioritize maintenance projects to reduce water loss
- Defer routine maintenance projects that involve extensive flushing/draining

8.5.4 Additional Mandatory Restrictions

The District's mandatory restrictions, which include limitations on outdoor watering and restrictions on using water for certain functions, are outlined in the District's Water Shortage Levels 2 through 6. See Appendix L. These will be flexibly deployed as locally appropriate to each unique water shortage situation.

8.5.5 Emergency Response Plan

The District maintains an Emergency Response Plan that establishes policies, procedures, and organizational structure for responses to major emergencies such as natural disasters, power outages, and water supply disruptions. The plan establishes emergency organization, assigns tasks, specifies policies and general procedures, and provides for coordination of planning efforts that utilize the Standard Emergency Management System (SEMS), as described by Government Code 8607(a) for managing the response to emergencies in California. It also incorporates the elements of the National Incident Command System (NIMS) which is a nationwide standardized approach to incident management and response. The EOP meets state and federal emergency response and recovery requirements.

The District is a member of the East County Shared Service. network of water agencies that supports and promotes statewide emergency preparedness, disaster response and mutual assistance between agencies

Supply interruption is possible by several means, including but not limited to, natural disasters such as earthquakes and local or regional power interruptions. The District maintains several water supplies that include water emergency interconnections with agencies that border the District. The District also maintains a fleet of stationary and mobile power generators capable of operating District facilities in the event of local or regional power outages. Additionally, the District maintains an inventory of critical system supplies including piping and valves for use in system repairs.

The plan addresses assessment and utilization of all water supply sources, stationary and mobile power generators, and critical inventory as required to meet the emergency at hand in order to maintain system supply during emergency interruptions.

8.5.6 Seismic Risk Assessment and Mitigation Plan

In 2019, Helix Water District our wholesale imported water connection, commissioned Jacobs Engineering Group Inc. (Jacobs) to conduct a Risk and Resilience Assessment (RRA) in accordance with the relevant requirements of the America's Water Infrastructure Act of 2018 (AWIA), Section 2013. This RRA addresses the following key goals and objectives:

- Identifying and evaluating risks for the Helix water system by employing an all- hazards approach to include evaluation of natural hazard, dependency, and proximity threats in addition to malevolent threats.
- Conducting an RRA applying the current industry-standard methodology.
- Developing cost-effective risk-reduction recommendations to address the risks identified in accordance with industry best practices.

To meet these needs, the RRA team used the American Water Works Association's (AWWA's) methodology entitled J100-10 Standard for Risk and Resilience Management of Water and Wastewater Systems, which is the current water and wastewater industry standard for RRAs. See Helix Water District's UWMP for more information. The RRA contains seismic risk analysis and mitigation recommendations. Accordingly, the District relies on it and incorporates herein its RRA for its seismic risk assessment and mitigation plan. In general, the estimated annual likelihood of a mission-defeating seismic event on the District's systems is estimated to be very low, on the order of 2% per year or less.

8.6 Communication Protocols

The District's communication protocols include the various channels the District will utilize to convey critical messages regarding voluntary and mandatory water shortage actions and allocations, if applicable.

Public outreach programs can help increase awareness of water shortages, while customer classes and workshops can encourage ratepayers to actively participate in demand reducing strategies. A strong communication plan will help educate District customers, including local leaders and the business community, on the water supply situation; what actions are proposed; what the intended achievements are; and how these actions are to be implemented.

While specific types of messaging are deployed at various shortage response levels, how these messages can be conveyed to the public are described here. The communication protocols can be initiated upon declaration of a water shortage Level 1. Utilization of the communication protocols will continue through all subsequent water shortage levels. At times, specific communities may require specialized outreach. The District will ensure outreach efforts are reaching key audiences.

The District will communicate to ratepayers the following when urgent conservation is needed:

- Specific actions needed to save water;
- How much water needs to be saved and for how long;
- Why water needs to be saved; and
- What the district is doing to correct the supply problem or address the situation.

8.6.1 Regional Coordination

In order to communicate effectively, avoid confusion and maintain credibility, the District will work in close coordination with CWA at various organizational levels. These levels include the Joint Public Information Council/Conservation Coordinators (JPIC; staff level), the Member Agency Managers group (management level), and CWA Board's Legislation and Public Outreach Committee (Board level). During droughts or other times of limited supply, the frequency and extent of coordination will increase to ensure outreach tactics are consistent with the changing needs of the District and its ratepayers. The District will seek opportunities to leverage external resources to complement its own outreach.

8.6.2 Communication Objectives

Communication objectives during the various water shortage levels of the WSCP include the following:

- Motivate water users to quickly increase conservation in ways that are consistent with any voluntary or mandatory actions called for at the current level of the WSCP.
- Raise awareness and understanding of the drought, regulatory, or other condition affecting water supplies and the need for increased conservation.
- Minimize confusion and maintain regional consistency with conservation messages using an appropriate tone that preserves credibility and avoids noncompliance backlash.
- Make water users feel appreciated for existing accomplishments in improving their water-use efficiency, and for supporting regional and local investments in water supply reliability.
- Educate regional civic and business leaders, elected officials, and the public that the District, in conjunction with the Authority and its member agencies, has greatly improved its regional water supply reliability.
- Prepare the District for any potential escalation (or de-escalation) of the WSCP based on trending supply conditions.
- Ensure all stakeholders believe they are being treated fairly in relationship to other stakeholders.
- Maintain communication effectiveness by soliciting or monitoring feedback from member agencies, key stakeholders, and the general public to update or adapt messages or communication tools.
- Exit WSCP implementation having demonstrated the effectiveness and value of conservation actions and water supply reliability investments in minimizing impacts to the District's economy and quality of life.

8.6.3 Communication Channels

The District has developed various channels and means of implementing its communication to customers. The District may update its website, newsletters, envelope snipes, and direct mailers to reflect conditions and convey key messaging. The District may also provide press releases and host interviews or hold other events to announce or explain changes in conditions.

8.6.4 Communication Protocols for Current or Predicted Shortage

A current or predicted shortage, as determined by the annual assessment, will be communicated to the public upon submittal of the Annual Assessment Report in June of any given year.

The existence of a water shortage response Level 1 condition may be declared by the general manager upon a written determination of the existence of the facts and circumstances supporting the determination. A copy of the written determination shall be filed with the board secretary and provided to the board of directors. The general manager may post in the lobby of the administration office and publish a notice of the determination of existence of drought response Level 1 condition in one or more newspapers, including a newspaper of general circulation within the District. The District may also post notice of the condition on its website.

The existence of water shortage response Level 2, Level 3, Level 4, Level 5, or Level 6 conditions may be declared by resolution of the District board of directors adopted at a regular or special public meeting held in accordance with state law. The mandatory conservation measures applicable to drought response Level 2, Level 3, Level 4, Level 5, or Level 6 conditions shall take effect on the tenth calendar day after the date the response level is declared. Within five days following the declaration of the response level, the District shall publish a notice of the resolution in a newspaper used for publication of official notices and post it on the District's website. If the District establishes a water allocation, it shall provide notice of the allocation by including it in the regular billing statement or by any other mailing to the address to which the District customarily mails the billing statement or fees or charges for ongoing water service. Water allocation shall be effective on the fifth calendar day following the date of mailing or at such later date as specified in the notice.

The existence of a water shortage response Level 6 condition may be declared in accordance with the procedures specified in California Water Code Sections 351 and 352. The mandatory conservation measures applicable to water shortage response Level 6 conditions shall take effect on the tenth day after the date the response level is declared. Within five days following the declaration of the response level, the District shall publish a notice of the resolution in a newspaper used for publication of official notices.

The District's board of directors may declare an end to a water shortage response levels 2 through 6 by the adoption of a resolution at any regular or special meeting held in accordance with state law.

8.6.5 Water Shortage Communications

To reduce water consumption during any water shortage level, the District will increase its public education and outreach efforts to build awareness of needed action from the public. In addition, the District's outreach campaign will be regularly revised to reflect current conditions. Key communication strategies and associated water shortage level implementation are listed below. Communication strategies built from previous levels are assumed to be built upon as the Shortage Level increases. Communication strategies by water shortage level may include, but are not limited to, the following:

8.6.5.1 Levels 1 and 2

- Announce status change to key stakeholders and the general public.
- Share regular updates to customers on conditions.
- Promote consistent regional messaging and conservation programs to customers in coordination with CWA and neighboring agencies.
- Engage with member agencies to develop a more serious campaign message that reflects the need for compliance with mandatory water-use restrictions (Level 2)
- Conduct briefings of shortage and restrictions to key civic and business leaders (Level 2)
- Provide conservation information and other support as necessary to government officials for their own media events, hearings, community meetings, etc.

- Send clear, consistent, and understandable messages regarding mandatory water-use restrictions in effect.
- Enhance media relations activities and social media communications related to water-use restrictions, conservation programs and drought conditions.
- Expand community engagement on drought campaign through bill inserts and website information.
- Enhance efforts to encourage customers to report incidents of water waste.
- Promote available resources to aid vulnerable populations.

8.6.5.2 Levels 3 and 4

- Announce status change to key stakeholders and the general public.
- Share regular updates to customers on conditions.
- Promote available water assistance resources for vulnerable populations.
- Work with member agencies to develop and share a more serious campaign message that reflects the need for higher level of extraordinary conservation.
- Initiate targeted outreach to major CII water users to help them identify, prepare for and, as much as possible, avoid negative impacts from extreme water conservation requirements.
- Promote compliance with specific, District-wide water-use restrictions.
- Provide specialized technical assistance sessions or resources to help homeowners achieve immediate reductions in water use while minimizing landscape damage.
- Consider providing specialized technical assistance to large landscape customers (HOAs, cities, schools, etc.) to help achieve large-scale reductions in discretionary outdoor water use.
- Conduct specialized outreach to industries (hospitality, car washes, restaurants, etc.) or other large-scale water users (schools, park, and recreation districts) that will likely experience impacts from emergency conservation to determine solutions for minimizing economic or quality of life impacts.

8.6.5.3 Levels 5 and 6

- Work with member agencies to develop campaign messages and tactics that raise awareness of the extreme shortage conditions facing the region and the likely need to focus water use on essential public health and safety needs.
- Announce status change to key stakeholders and the general public.
- Share regular updates to customers on conditions.
- Suspend promotion of long-term water use efficiency programs/tools to focus on imminent needs.
- Promote all available resources to aid vulnerable populations.
- Send clear, consistent, and understandable messages regarding what uses of water or levels of water use remain acceptable for residential, commercial, and public water users.
- Emphasize the need for all residents and businesses to work together to help the region successfully weather the situation.
- Coordinate with regional emergency response agencies/services on messaging/additional outreach tactics if needed.

8.6.6 Catastrophic Communications

In the event of a catastrophic supply interruption that requires water use to be quickly prioritized for or limited to essential public health and safety needs, the District will immediately deploy appropriate strategies from Water Shortage Levels 1 through 6. In addition, outreach messaging will reflect emergency conditions and the need to focus on health and public safety. Catastrophic communications strategies may include, but are not limited to, the following:

- Announce status change to key stakeholders and the general public.
- Provide regular update to stakeholders and the media on conditions.
- Implementation of any appropriate strategies and tactics from Levels 1-6
- Shift to messages that reflect emergency condition and need to focus water use on health/safety needs
- Provide joint news release/news events with public health officials to announce conditions and explain needed action.
- Ensure ongoing coordination with emergency response services.
- Send clear, consistent, and understandable messages regarding what uses of water or levels of water use remain acceptable for residential, commercial and public water users, and the expected duration of this restricted level of water use.
- Conduct specialized outreach to landscape and related industries with significant outdoor water use to urge immediate end to landscape water use.

8.7 Compliance and Enforcement

The District's inclining block rate structure contains two or three different prices for water used in different quantities. The highest rate is called "High Water Usage" and is priced to discourage water used in quantities subject to these rates.

Contained within the District's Rules and Regulations are penalties or charges for violations of the water use restrictions during water shortage conditions. An increasing level of fines is levied for up to four violations at the same address. Any subsequent violations at the same address will result in appropriate limitation of service by use of a flow restrictor or discontinuance of service.

The District Policy 10.1-12 of the WSCP lists violations and penalties as follows:

(a) Any person, who uses, causes to be used, or permits the use of water in violation of this policy is guilty of an offense punishable as provided herein.

(b) Each day that a violation of this policy occurs is a separate offense.

(c) Administrative fines may be levied for each violation of a provision of this policy as follows:

1. A warning for a first violation.
2. One hundred dollars for a second violation.
3. Two hundred dollars for a third violation of any provision of this policy within one year.
4. Five hundred dollars for each additional violation of this policy within one year.

(d) Violation of a provision of this policy is subject to enforcement through installation of a flow-restricting device in the meter.

(e) Each violation of this policy may be prosecuted as a misdemeanor punishable by imprisonment in the county jail for not more than thirty (30) days or by a fine not exceeding $1,000, or by both as provided in Water Code section 377.

(f) Willful violations of the mandatory conservation measures and water use restrictions as set forth in Section 7.0 and applicable during a Level 4 condition may be enforced by discontinuing service to the property at which the violation occurs as provided by Water Code section 356.

(g) All remedies provided for herein shall be cumulative and not exclusive.

Procedures for notice, nonpayment and appeal of water shortage penalties, along with procedures for hardship variances, are outlined in the District's Water Shortage Response Policy and Procedures (Appendix L).

8.8 Legal Authority

The District has the legal authority to implement and enforce its WSCP. California Constitution Article X, Section 2 and Water Code Section 100 provide that water must be put to beneficial use, the waste or unreasonable use or unreasonable method of use of water shall be prevented, and the conservation of water is to be exercised with a view of the reasonable and beneficial use thereof in the interest of the people and the public welfare. Sections of Water Code Chapter 3 commencing with Section 350 of Division 1, provide the authority for the governing body of a water agency to declare a water shortage and to adopt and enforce water conservation restrictions. (Water Code §§ 350- 359, 375-378.0.)

If necessary, the District shall declare a water shortage emergency in accordance with Water Code Chapter 3 of Division 1. Once having declared a water shortage, the District is provided with broad powers to implement and enforce regulations and restrictions for managing a water shortage. For example: Water Code Section 375(a) provides:

> Notwithstanding any other provision of the law, any public entity which supplies water at retail or wholesale for the benefit of persons within the service area or area of jurisdiction of the public entity may, by ordinance or resolution adopted by a majority of the members of the governing body after holding a public hearing upon notice and making appropriate findings of necessity for the adoption of a water conservation program, adopt and enforce a water conservation program to reduce the quantity of water used by those persons for the purpose of conserving the water supplies of the public entity.

(Water Code Section 375(a).) CWC Section 375(b) grants the District with the authority to set prices to encourage water conservation. Under California law, including CWC Chapters 3.3 and 3.5 of Division 1, Parts 2.55 and 2.6 of Division 6, Division 13, and Article X, Section 2 of the California Constitution, the District is authorized to implement the water shortage actions outlined in this WSCP. In water shortage cases, shortage response actions to be implemented will be at the discretion of the District and will be based on an assessment of the supply shortage, customer response, and need for demand reductions as outlined in this WSCP and the District's adopted Water Shortage Response Policy and Procedure. The District has included a copy its Water Shortage Response Policy and Procedure in Appendix L.

It is noted that upon proclamation by the governor of a state of emergency under the California Emergency Services Act (Chapter 7 (commencing with Section 8550) of Division 1 of Title 2 of the Government Code) based on drought conditions, the state will defer to implementation of locally adopted water shortage contingency plans to the extent practicable. The District will coordinate with regional and local water suppliers for which it provides water supply services for possible proclamation of a local emergency as necessary under California Government Code, California Emergency Services Act (Article 2, Section 8558).

8.9 Financial Consequences of WSCP

The Act requires that water suppliers prepare a shortage contingency analysis to address the impacts on revenue and expenditures when water shortages occur. The District completed an analysis of financial impacts and methods to mitigate the effects of reduced revenues as a result of severe water shortages of various levels of severity. High Usage water tiers would be implemented and added or adjusted to balance revenues and expenditures by drought stages ranging from 10%to 50% reduced water supply.

Initially, drought conditions may result in increased usage and water sales revenue as outdoor water use increases due to higher temperatures and below average rainfall. Severe or prolonged drought conditions could decrease water availability and cause usage to be curtailed resulting in a reduction of the District's water sales revenues.

With the decreased usage during severe drought conditions, water purchase expenses, pumping expenses, and water treatment costs would decrease by a corresponding amount. Other operating expenses, such as administrative expenses, would be relatively unaffected unless specific actions are taken to reduce staff and or services.

The District relies on water sales revenue to cover operating expenses. A shortfall in water sales could be covered by increasing of water use tiers and increases water rates and by reserve fund balances in the short term. The District has a rate stabilization reserve fund along with general reserve funds that could be utilized to cover operating expenses. However, in severe drought situations where the offset of reserve fund balances and acceptable rate increases are not enough to cover operating expenses, the nonessential operating expenses may need to be cut back in order to offset lower revenues.

8.10 Monitoring and Reporting

The District monitors how effective the combination of water shortage response actions in each water shortage level is with meters. All residential, commercial, and irrigation customer accounts are metered. During times of declared water shortages under the District's Water Shortage Response Policy and Procedure, the District will review the metered billing data and compare this data with water billing data in prior months and during non-shortage years to determine if demand is being reduced. If the needed percent reductions are not being met, the District can implement additional shortage response actions. The District will be required to report its annual supply and demand to the state in the annual assessment report, due June 1 of each year starting in 2022. Additionally, the District reports total monthly production to the State Water Resources Control Board as originally required by Governor Brown's Executive Orders B-29-15 and B-36-15.

The District has a 24-hour telemetry system, installed in 1992 and updated to utilize current technology, which monitors the water flows in the distribution system, pump stations, and reservoirs (water storage tanks), as well as control valve settings on the turnouts. If any difficulties or questions of accuracy develop in the telemetry monitoring of the District's facilities, due to power outages, etc., crews will be dispatched at least twice a day to take manual readings. During emergencies, or 50% supply cutbacks, the reservoir levels will be reported to the General Manager on a daily basis.

8.11 Special Water Feature Distinction

Per Water Code Section 10632(b), for purposes of developing a WSCP pursuant to subdivision (a), an urban water supplier shall analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas, as defined in subdivision (a) of Section 115921 of the Health and Safety Code.

The District's demand reduction measures clearly define water features subject to restrictions to only include ornamental fountains, ornamental lakes, and ornamental ponds. Refer to Section 8.5.

8.12 Plan Adoption and Implementation

The District's adoption, submittal, and implementation of its WSCP is completed in a transparent manner that is accessible to all interested parties, including its customers, local government agencies and their employees, as well as proactive coordination with neighboring water agencies. Transparency is important for a successful operation and planning of our local, regional and state water resources.

In most cases, the District notices, adopts, submits and makes available its WSCP in conjunction with its UWMP every five years and follows the processes and schedule outlined in Chapter 10 of the District's UWMP. However, the WSCP may be periodically amended independently of the UWMP as needed. The District will adhere to the following steps for adoption, submittal and availability when independently amending the WSCP.

- Staff reviews WSCP and proposed amendments based on analysis
- Provide legally required notice to public, cities, and counties
- Public Hearing & Board Adoption, Implement
- Submit to Department of Water Resources
- Publish WSCP on website and notify customers via existing print/digital outreach channels

9.1 Chapter Summary

Demand management, better known as water conservation, comprises a number of methods to reduce the demand for water in Lakeside. Chapter 9 provides a comprehensive description of the water conservation programs. Lakeside is part of a bigger conservation program through SDCWA and MWD. Lakeside customers benefit by being part of the larger regional program. The water saved through conservation can be used to offset the demand on other water sources, which is why water conservation is a critical part of the long-term strategy of CWA to provide a diversified and reliable water supply for the County's future population and economy. Conservation programs: (1) reduce demand for expensive, imported water; (2) demonstrate a continued commitment to the Best Management Practices; (3) assist water districts in the County to meet the requirements of the Water Conservation Act of 2009 (SBX7-7) as discussed in section 5; (4) ensure a reliable future water supply; and (5) reduce reliance on the Delta. District has included this summary of Chapter 9 in accordance with CWC Section 10630.5.

9.2 Demand Management Measures

The District has used a combination of water metering, conservation pricing, public education and outreach, water waste prevention ordinances, and rebates for water conserving devices to help manage and reduce water demand. Active water conservation management strategies include participation in Metropolitan's regional programs and partnerships with San Diego Gas & Electric (SDG&E) on water and energy programs, and incentives to businesses and property owners based on actual water savings. Passive water conservation management strategies include programs that encourage long-term behavior change towards measurable reductions in outdoor water use; increase the landscape industry's basic knowledge regarding the interdependency between water efficiency design, irrigation design, and maintenance; and participation on statewide, national, and industrial committees to advance behavior-based conservation strategies. Additional passive programs and policies include outreach activities, plumbing code changes, legislation, and conservation-based rate structures.

The use of these active and passive water conservation measures, programs, and policies will facilitate market transformation and promote the behavioral change that is at the core of the long-term conservation planning.

9.2.1 Water Waste Prevention Ordinances

The District's policies and procedures manual, Section 10.1 - Water Shortage Response Policy and Procedure, provides for mandatory restrictions on water consumption and water waste (see Appendix L) during shortages and has provisions for penalties. This policy was adopted by a resolution of the District's board of directors in May 2021, preceding the adoption of the district's 2020 Urban Water Management Plan, and effective upon adoption.

9.2.2 Conservation Pricing and Metering

The district's rate setting process is compliant with Proposition 218 requirements. Billing is done through a combination of a base charge and volume of water used. For single-family domestic users, the District's largest class of water users, the District has a 2-tiered, increasing-block rate structure that reflects the District's cost of providing water service to each tier. Commercial, multi-family, and government class rates have uniform rates. The District established an inclining block rate structure to encourage decreased water use during times of supply shortages. There are normally two tiered levels of water usage; Life Line Rate, which is the lowest rate, and Standard Rate, which is the higher rate. The more water that is used by the customer the higher the rate is charged to that customer encouraging water conservation. Under a Level 3 condition a third highest tier was added to encourage conservation. Under Level 4 and 5 another tier can be added to penalize those who do not conserve water. Lakeside has a very low set meter charge of $13.80 bi-monthly for a 5/8" meter. If a customer reduces water usage it can be seen in the total amount of the bill so customers with low usage also have a low bill. Customers have the ability to save money by reducing their water usage. The District requires meters on all connections within its service area; all service connections are metered and accounts are billed based on metered volume of water use. The District maintains a computerized meter data system which tracks meter data including class, size, type, installation date, and consumption.

9.2.3 Programs to Assess and Manage Distribution System Real Loss

The District quantifies its volume of apparent and real water loss, and cost impacts, by completing an annual water audit and balance using the AWWA Water Loss software. The District achieved a water audit validity score of 71% for the 2019-20 reporting year. Unbilled water loss quantified in the audit is the difference between water sales and water production, and can be accounted for by miscellaneous losses such as fire protection, system flushing, meter error, pipeline breaks, etc.

The district has assembled a water loss task force to complete the annual water loss audit and make recommendations on additional processes to further prevent losses. Routine and planned system maintenance to reduce water loss includes:

- Ongoing meter replacement program;
- Meter accuracy testing program;
- Tracking water used for maintenance and capital project flushing, and mainline flushing;
- Repair detected system as soon as possible.

As noted in Section 4.2.3, a copy of the District's prior five-years of audit calculation worksheets have been provided in Appendix C and losses reported in Table 4-1.

9.3 Water Conservation Achievements

Lakeside is part of CWA Conservation Programs. This section provides information on CWA's recent achievements in water conservation. These programs and activities provide a foundation for the existing and future measures, programs, and policies. The District continues to offer rebates for a variety of water-efficient devices to residential, commercial, industrial, and institutional customers through a regional rebate program run by one of the District's wholesalers, MWD, through the SoCal Water$mart rebate program. Devices eligible for rebates as well as the rebated amount have fluctuated each year depending on plumbing codes, participation and funding levels. Additionally, in 2020, the District received funding from MWD to administer an in-house rebate program for Flume Flow Sensors, which provide customers with leak notifications and the ability to monitor their water use in real time.

9.3.1 Grant Funding

CWA supplements funding of its water conservation programs through the use of grant funding. CWA was awarded private, state, local, and federal grants. Grant funding sources include the Bureau of Reclamation, DWR, SDG&E. Examples of the types of programs awarded grant funding are shown in Table 9-1.

Table 9-1 Types of Programs Awarded Grant Funding

WaterSmart Landscape Makeover Program	Sustainable Landscape Program
Landscape Water Use Evaluations	School Education Programs
Drought Response Outreach and Communications	Agricultural Irrigation Efficiency Program
WaterSmart Turf Replacement Program	Detention Facility Retrofits

9.3.2 Water Authority Staffing

The Water Authority's Public Outreach and Conservation Department has 19 full-time staff members to design, implement and manage regional water-use efficiency and public outreach programs; develop and support water-use efficiency policy; manage the CWA's Small Contractor Outreach and Opportunities Program; provide technical assistance to its 24 member agencies; implement regional programs to support member agency compliance with SBX7-7; and perform grant acquisition and administration duties.

9.3.3 Regional WaterSmart Turf Replacement Program

The Water Authority implemented a regional, grant-funded turf replacement rebate program from December 2012 to January 2016 that provided financial incentives to participants who replace existing turf with water-efficient landscaping. The WaterSmart Turf Replacement Program promoted outdoor water-use efficiency through financial incentives of $1.50 per square foot to participants who replaced existing water-intensive turf grass with WaterSmart landscapes that included climate-appropriate plants and water-efficient irrigation systems. Turf replacement projects had to be in front or side yards and visible to the public and had to inspire others to pursue landscape conversions. Eligible residential sites received up to $3,000 in incentives; eligible commercial, institutional, and industrial sites up to $9,000. The program's rebates were funded with more than $1.7 million in grants from a combination of state and federal sources.

9.3.4 SoCal WaterSmart Residential Program

The SoCal WaterSmart regional residential program offers rebates for turf removal, high-efficiency clothes washers and toilets, weather-based irrigation controllers, rotating nozzles, and rain barrels for stormwater capture. Since the Water Authority joined the program in 2008, more than 52,000 high-efficiency clothes washers and 29,000 high-efficiency toilets were installed in the region through the program. In addition, more than 6.6 million square feet of turf grass was removed. The estimated lifetime water savings for these measures exceeds 59,000 acre-feet.

9.3.5 SoCal WaterSmart Commercial, Industrial, and Institutional Program

The SoCal WaterSmart Commercial, Industrial, and Institutional (CII) program offers an incentive to eligible CII customers to remove existing water-intensive turf grass and replace it with water efficient landscaping. Through this program, more than 6 million square feet of turf grass was replaced with water-efficient landscapes with a lifetime water savings of more than 8,000 acre-feet. The SoCal WaterSmart Program offered rebates to replace select, older, inefficient devices with water-efficient devices, including enhanced rebates for fixtures for fitness centers and enhanced rebates for public agencies for landscape devices. Since 2012 more than 105,000 water-efficient devices were installed in the region through the program with a lifetime water savings of more than 10,000 acre-feet. Examples of the types of efficient water-use devices are shown in Table 9-2.

Table 9-2 Water Efficient Devices Available through the SoCal WaterSmart CII Program

Plumbing Fixtures • High-efficiency toilets • Ultra-low and zero water urinals • Plumbing control valves	Landscape Equipment • Irrigation controllers • Rotating and large rotary nozzles • In-stem flow regulators • Soil moisture sensor systems
Food Equipment • Connectionless food steamers • Air-cooled ice machines	HVAC Equipment • Cooling tower conductivity controllers • Cooling tower ph controllers
Medical and dental equipment • Dry vacuum pumps	

9.3.6 Water Savings Incentive Program

The Water Savings Incentive Program targets commercial, industrial, institutional and agricultural customers with high water use to improve water-use efficiency through financial incentives for customized water efficiency projects. Projects eligible to participate included changing an industrial process water system to capture, treat and reuse process wastewater; installing new, water-efficient equipment in commercial kitchens and laundries; and contracting with a qualified water manager to improve landscape irrigation efficiency.

9.3.7 Water and Energy Efficiency Programs

For more than 25 years, the Water Authority and SDG&E have partnered on a variety of programs and projects to generate significant water and embedded energy savings. Highlights from the Water Authority and SDG&E partnership include showerhead distributions, pre-rinse spray valve installations, high-efficiency clothes washer rebates, energy efficiency assessments for water agencies, home energy and water savings kit distributions, joint marketing strategies, and a water-energy pilot program that evaluated embedded energy use in the water sector. Over the last five years, the focus on the relationship between water use and energy use in California increased and the California Public

Utilities Commission (CPUC) directed energy utilities to form partnerships with water agencies to reduce embedded energy use through water efficiency programs. Moving forward, Water Authority and SDG&E partnership activities include a continuation of the joint rebate for residential high-efficiency clothes washers, collaboration with SDG&E on its residential Energy Savings Assistance Program, cross-marketing of water and energy efficiency programs, and an assessment of additional joint program opportunities. Information on existing and previous partnership programs is shown below.

WaterSmart Landscape Efficiency Program

The WaterSmart Landscape Efficiency Program targeted a 20 percent reduction in water use at sites with multiple acres of irrigated landscape. The program achieved a portion of the water savings through a pre-implementation audit of the site's irrigation system to identify and fix any malfunctioning and broken irrigation components, and a portion of the water savings through services provided by a water management service company that adjusted the site's irrigation schedule to match the site's irrigation demand. The program is being redesigned to address the reduction of stormwater runoff associated with dry weather flows and inefficient irrigation.

9.3.8 WaterSmart Customer Education and Workforce Training

Consistent with its focus to promote the long-term market transformation of conventional urban landscapes to more water-efficient and sustainable landscapes, the Water Authority offers a variety of education and training opportunities for customers and landscape industry professionals, respectively. Course content is designed to promote best practices for landscape water-use efficiency while empowering customers to take action and make informed purchasing decisions when upgrading their landscapes. The following are offered in partnership with the Water Authority's 24-member agencies:

WaterSmart Landscape Makeover Series

The series of four workshops provides homeowners an overview and the basic skills necessary for the successful conversion of a traditional turf grass yard into a WaterSmart landscape. Participants receive technical assistance that includes a professional site inspection and development of a base plan to scale, in addition to a professional design consultation. Upon completion of the course, participants have a landscape design with planting and irrigation plans that are ready for implementation. Recent program upgrades include providing stormwater retention plans based on "first flush" calculations. The average size of the turf replacement projects planned by participants is more than 1,000 square feet.

WaterSmart Landscape Design for Homeowners Workshop

To accommodate homeowners who prefer an abbreviated version of the WaterSmart Landscape Makeover Series of classes, the Water Authority developed a three-hour version of the classes. This short-format workshop accommodates higher numbers of participants per session, which helps to accelerate the number of homeowners who will be empowered to convert existing water-intensive yards into landscapes that can achieve significant water savings through climate-appropriate plant choices, irrigation efficiency upgrades and stormwater runoff prevention.

WaterSmart Landscape Makeover Videos on Demand

To help make the main content of the WaterSmart Landscape Makeover Series even more widely available and convenient for homeowners to access, the Water Authority transformed the program Section 3. Demand Management into a series of online videos. These videos, as well as links to a variety of resources, take the participant through the steps to achieve a WaterSmart landscape. The steps include identification of their landscape target, creation of a basic plot plan, an evaluation of their site, soil analysis, landscape design, irrigation retrofit and landscape maintenance. Future videos will address sustainable landscape concepts such as capturing rainwater to prevent urban stormwater runoff.

California Friendly Landscape Training
The Water Authority and its member agencies partnered with Metropolitan to offer free introductory training classes on WaterSmart landscaping. The classes introduced a holistic approach to landscape design and maintenance that emphasized water-use efficiency. The three-hour classes were fast-paced and informative and offered solutions to common landscape problems. Participants learned to think about landscapes from the soil up. In addition, they learned how to design landscapes that are sustainable in the region's climate. Class topics included how to make the best use of the region's limited rainfall, irrigate efficiently, and choose the best plants for the site.

Qualified Water Efficient Landscaper (QWEL) Training
The Water Authority introduced this robust training program to San Diego County as a workforce training opportunity to help landscape industry professionals learn the latest techniques for landscape water-use efficiency. Originally developed by the Sonoma-Marin Saving Water Partnership, QWEL is recognized by U.S. Environmental Protection Agency (EPA) as a WaterSense labeled Professional Certification Program for Irrigation System Audits.

9.3.9 WaterSmart Tools and Resources

Feedback from polls and focus groups indicates the public understands the need for water-use efficiency and wants to do the right thing, but is often overwhelmed by how to accomplish it. In response, tools and resources were developed to inspire, educate and empower residents and business to take a water-efficient action. These tools and resources foster long-term behavioral change and market transformation by showcasing the beauty and value of WaterSmart landscapes, products and services. Tools and resources developed by the Water Authority are described below.

WaterSmartSD Website
In 2013, the Water Authority launched a comprehensive water conservation website as an online resource to inspire, educate, and empower the region's residents to make water-efficient lifestyle choices. The website, WaterSmartSD.org, features information about conservation incentives, tools and programs designed to make the most of the region's limited water supplies. The site is organized to provide content relevant to the residential and business sectors. The website also features news items and events, videos, a photo gallery highlighting successful WaterSmart landscaping projects, case studies and other information about indoor and outdoor water-use efficiency. It includes conservation tips and answers to frequently asked questions, along with links to helpful tools such as a water-use calculator, free garden design software and residential landscape design templates. The Water Authority updates WaterSmartSD.org regularly and visitors can sign up for automatic notifications relevant to their areas of interest.

eGuide to a WaterSmart Lifestyle
The eGuide to a WaterSmart Lifestyle is an online magazine that covers a wide array of topics, including landscape design, water-efficient plants, outdoor rooms, finding and fixing leaks, healthy soil, smart buys on plumbing fixtures, landscape maintenance and drought survival for gardens. It offers everything from design ideas for creating themed planting zones to strategies for using graywater at homes and irrigating efficiently.

A Homeowner's Guide to a WaterSmart Landscape
A Homeowner's Guide to a WaterSmart Landscape is the companion guide to the Water Authority's award-winning WaterSmart Landscape Makeover Series. This no-cost guide offers instructions for homeowners who want to make their landscapes more water-efficient. The guide reflects California's Model Water-Efficient Landscape Ordinance standards and explains the principles of a WaterSmart landscape design and irrigation, climate-appropriate plants and BMPs.

Residential Landscape Design Templates

Professionally drawn, water-efficient landscape plans are available online to provide ideas and inspiration for single-family homeowners, particularly for do-it-yourselfers. San Diego landscape architects designed four templates that support the state's 2020 Model Water Efficient Landscape Ordinance. Plans are themed to fit common family audiences, including Empty Nesters, Entertainer, Pet Friendly, Children Friendly, and Native/Wildlife Friendly Landscape.

Online Residential Water-Use Calculator

The Water Authority launched its Residential Water-Use Calculator (watersmartsd.org/watercalculator) in 2013 in partnership with the Alliance for Water Efficiency. The objective of the water-use calculator is to assess and educate homeowners about their indoor and outdoor water use and inspire them to make changes in their behavior, fixtures or landscape that will make their home more water-efficient.

Smart Water Application Technologies

The Water Authority collaborated with industry for many years to promote the research and application of the best practices and technologies to save water. Under the auspices of the Irrigation Association, water utilities, irrigation product manufacturers and other landscape professionals collaborated in the Smart Water Application Technologies (SWAT) committee. SWAT's achievements include the development of a standardized testing protocol for weather-based irrigation controllers to help water utilities establish product eligibility standards for rebates. The standardized testing protocol was also a precursor to the establishment of EPA's ongoing WaterSense product labeling standards. Looking ahead, SWAT testing protocols under development include pressure-regulating spray heads, spray head sprinkler nozzles, pop-up sprinkler head check valves, rain sensors, weather-based controllers, and soil moisture–based controllers. The test results will provide valuable information in the development of the next generation of water-efficient products.

Water Conservation Garden

The Water Conservation Garden opened in 1999 to educate the public about the steps they can take to conserve water in landscapes. It occupies nearly six acres adjacent to Cuyamaca College in the eastern part of the Water Authority's service area. The Garden showcases 16 different mini-gardens and exhibits and provides school-education programs and outreach, low-water-use classes and workshops, and community events. CWA joined the Garden's Joint Powers Authority in 2001 and continues to support its efforts to promote water efficiency in the landscape sector.

San Diego Botanic Garden

The San Diego Botanic Garden is located in the north-coastal area of San Diego County. The Water Authority supports its vision through a corporate sponsorship. The mission of the Botanic Garden is to promote sustainable use of natural resources. Low-water-use plants and water-saving technologies and displays make up the majority of the gardens. In an effort to reduce outdoor water use in the region, the Botanic Garden also provides classes on water conservation and garden tours throughout the year in an effort to reduce outdoor water use in the region.

9.4 Public Outreach

The District continues to actively promote water use efficiency and conservation through a variety of channels. Bills are sent to all customers every two months which may include messaging along with newsletters, website articles, messaging on the envelopes and bill inserts have proven effective.

CWA has consistently promoted water-use efficiency programs through its communications and outreach channels as part of its overall long-term strategy to improve the reliability of the region's water supplies by diversifying its water supply sources and advancing conservation. In addition, during times of shortage or drought, CWA dedicates additional resources to public awareness campaigns that call upon the public to take more immediate actions to save water.

"20-Gallon Challenge" Campaign

In response to worsening water supply conditions that began in 2007 and lasted until April 2011, the Water Authority conducted an aggressive outreach campaign branded as the "20-Gallon Challenge." The campaign's name reflected the initial call to cut urban water use voluntarily by 10 percent, or about 20 gallons per capita per day (GPCD) at the time. The outreach campaign was a multi-faceted approach to educate the community on the short- and long-term water supply challenges, specific tips to save water, and resources available to implement those changes. Tactics to help the region meet an 8 percent overall shortage allocation between July 2009 and April 2011 included traditional advertising, media relations, online communications, water agency relations, education curriculum and contests, government relations, and community outreach via presentations and events. The campaign, combined with the ongoing implementation of other Water Authority conservation programs and outreach efforts conducted by its local member agencies, helped achieve water savings well above the allocation target. Total potable water use dropped from 211 gallons per person per day in fiscal year 2007 to 140 gallons per person per day in fiscal year 2011.

Promoting WaterSmart Programs

Since the end of shortage allocations in 2011, the Water Authority has been focusing outreach efforts on building awareness and public acceptance for water-use efficiency as a desirable lifestyle and permanent civic responsibility through promoting the Water Authority's WaterSmart-branded conservation programs and classes. Staff promotes these resources primarily through ongoing media relations, community relations activities (such as attending special events and making presentations to community groups), targeted advertising, promotional materials, videos, electronic newsletters, innovative public-private partnerships such as the water-efficient plant fairs with local The Home Depot stores, and through tools such as social media (primarily Facebook, Twitter and YouTube) and the WaterSmartSD.org website.

"When in Drought" Campaign

In early 2014, water supply conditions worsened to the point where it again became necessary to launch an urgent drought-response outreach campaign as called for under the Water Authority's Water Shortage and Drought Management Plan. Since April 2014, the Water Authority has executed an aggressive drought response outreach campaign themed "When in Drought: Save Every Day, Every Way," to help achieve increased water conservation by the public, and to enhance public understanding of how ratepayers' investments in projects and their commitment to water conservation have reduced the region's vulnerability to shortages from drought conditions. The campaign was partially supported in 2014 and 2015 by state Proposition 50 grant funds. In May 2015, the Board authorized an additional $1 million to support enhanced outreach and water conservation programs designed to help the Water Authority's member agencies comply with state mandated water-use reduction targets that are in effect from June 2015 through October 2016. In anticipation of continued drought conditions in 2016, the Water Authority was awarded $1.1 million in Proposition 84 Final Round grant funds to sustain enhanced drought response outreach efforts in 2016 and potentially beyond.

The campaign employed a wide array of communications tactics, including paid advertising, ongoing media relations, website communications, electronic newsletters, social media posts, videos, a Speakers Bureau, school education programs, community partnerships and promotions, and government relations. Ads and messages were translated into Spanish, and advertising and community event schedules were constructed to ensure reach into a diverse set of audiences around the region. The Water Authority also launched a "When in Drought" smartphone app in August 2015 to make it more convenient for the region's residents to report potential incidents of water waste to local water districts so they can be fixed sooner. The Water Authority also used public opinion polls and other research opportunities to test messages and tactics and revise them as needed to increase effectiveness. If drought and water supply conditions ease to the point where maintaining the “When in Drought” campaign is no longer necessary, the Water Authority will continue to promote the “WaterSmart” brand or conduct other outreach on an ongoing basis that continues to advocate water-use efficiency as a desirable and permanent way of life in the San Diego region.

Other Outreach Efforts

In addition, the Water Authority consistently promotes conservation activities and programs through a range of activities, including the following:

- Conducting research on the public’s knowledge of water issues
- Support for water conservation and other supply management and development strategies, and attitudes toward water-efficient landscaping
- Using social media, electronic newsletters, community events, and speaker’s bureau presentations
- Supporting regional water-efficiency demonstration gardens, such as the Water Conservation Garden and the San Diego Botanic Garden
- Developing and providing school education materials, assemblies, and an exhibit at the Reuben H. Fleet Science Center in Balboa Park
- Administering a Citizens Water Academy that educates emerging leaders on regional water issues, including the importance of water-use efficiency and prudent investments in water supply reliability, through in-depth and engaging interactions with senior Water Authority staff and tours of key regional water facilities
- Sharing updates on local water issues, fact sheets, and information on Board meetings via a Water News smartphone app for Apple and Android devices

10. Plan Adoption, Submittal, and Implementation

10.1 Chapter Summary

The District's adoption, submittal, and implementation of its UWMP is completed in a transparent manner that is accessible to all interested parties, including its customers, local government agencies and their employees, as well as proactive coordination with neighboring water agencies. Transparency is important for a successful operation and planning of our local, regional, and state water resources. This chapter of the District's UWMP sets forth the procedures the District followed to adopt and implement its UWMP. The District has included this summary of Chapter 10 in accordance with CWC Section 10630.5.

10.2 Plan Adoption and Submittal

Public outreach was made to Lakeside residents by a listing in the local newspaper on May 28th for 2 weeks and a notice on the District's website regarding the review and adoption of the UWMP and WSCP at a public hearing on August 3, 2021, more than 60-day notice (Appendix I). Lakeside also sent a notice of the 2020's plan preparation to applicable cities and the county (see Appendix H) more than 60-day notice. The draft UWMP and WSCP were both posted on the District's website for public review at www.lakesidewater.org/about-lakeside-water-district/urban-water-management-plan/.

Pursuant to CWC Sections 10621(f) and 10644(a)(1), the District is required to submit its updated UWMP and WSCP to DWR on or before July 1, 2021 and within 30 days of plan adoption. The 2020 UWMP was adopted by the Board at a public hearing on August 3, 2021, at 5:30 pm at the District headquarters, with Resolution 21-07 (see Appendix F). Although the due date was July 2021, the Guidebook released March 29, 2021, and excel tables released May 20, 2021, were both much later than usual for this UWMP due to Covid-19 challenges so we are approving this UWMP and WSCP, then submitting it about 5 weeks behind schedule.

After the Board adopts the 2020 UWMP it is submitted electronically to DWR online along with all the excel tables copy and pasted into DWR's website, sent to the CA state Library and other applicable agencies, and is posted within days of approval at the District's website at www.lakesidewater.org/about-lakeside-water-district/urban-water-management-plan/.

APPENDIX A

DWR UWMP CHECK LIST

DWR UWMP Checklist

Retail	Wholesale	2020 Guidebook Location	Water Code Section	Summary as Applies to UWMP	Subject	2020 UWMP Location (Optional Column for Agency Review Use)
x	x	Chapter 1	10615	A plan shall describe and evaluate sources of supply, reasonable and practical efficient uses, reclamation and demand management activities.	Introduction and Overview	Chapter 1 & 3
x	x	Chapter 1	10630.5	Each plan shall include a simple description of the supplier's plan including water availability, future requirements, a strategy for meeting needs, and other pertinent information. Additionally, a supplier may also choose to include a simple description at the beginning of each chapter.	Summary	Chapters 1-10
x	x	Section 2.2	10620(b)	Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.	Plan Preparation	Chaper 1, 2.2
x	x	Section 2.6	10620(d)(2)	Coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.	Plan Preparation	Chapter 2, Appendix D & J
x	x	Section 2.6.2	10642	Provide supporting documentation that the water supplier has encouraged active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan and contingency plan.	Plan Preparation	Chapter 2 & 3
x		Section 2.6, Section 6.1	10631(h)	Retail suppliers will include documentation that they have provided their wholesale supplier(s) - if any - with water use projections from that source.	System Supplies	Chapter 2.3, Appendix J
	x	Section 2.6	10631(h)	Wholesale suppliers will include documentation that they have provided their urban water suppliers with identification and quantification of the existing and planned sources of water available from the wholesale to the urban supplier during various water year types.	System Supplies	Not Applicable
x	x	Section 3.1	10631(a)	Describe the water supplier service area.	System Description	Chapter 3.3
x	x	Section 3.3	10631(a)	Describe the climate of the service area of the supplier.	System Description	Chapter 3.3.2
x	x	Section 3.4	10631(a)	Provide population projections for 2025, 2030, 2035, 2040 and optionally 2045.	System Description	Chapter 3.3.3
x	x	Section 3.4.2	10631(a)	Describe other social, economic, and demographic factors affecting the supplier's water management planning.	System Description	Chapter 3.3.3
x	x	Sections 3.4 and 5.4	10631(a)	Indicate the current population of the service area.	System Description and Baselines and Targets	Chapter 3.3.3
x	x	Section 3.5	10631(a)	Describe the land uses within the service area.	System Description	Chapter 3.5
x	x	Section 4.2	10631(d)(1)	Quantify past, current, and projected water use, identifying the uses among water use sectors.	System Water Use	Chapter 4.2
x	x	Section 4.2.4	10631(d)(3)(C)	Retail suppliers shall provide data to show the distribution loss standards were met.	System Water Use	Chapter 4.2.3 , Appendix C
x	x	Section 4.2.6	10631(d)(4)(A)	In projected water use, include estimates of water savings from adopted codes, plans and other policies or laws.	System Water Use	Chapter 4.2.2, 4.2.4
x	x	Section 4.2.6	10631(d)(4)(B)	Provide citations of codes, standards, ordinances, or plans used to make water use projections.	System Water Use	Chapter 4.2.4
x	optional	Section 4.3.2.4	10631(d)(3)(A)	Report the distribution system water loss for each of the 5 years preceding the plan update.	System Water Use	Chapter 4.2.2, 4.2.3, Appendix C
x	optional	Section 4.4	10631.1(a)	Include projected water use needed for lower income housing projected in the service area of the supplier.	System Water Use	Chapter 4.2.2
x	x	Section 4.5	10635(b)	Demands under climate change considerations must be included as part of the drought risk assessment.	System Water Use	Chapter 3.3.2, 7
x		Chapter 5	10608.20(e)	Retail suppliers shall provide baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use, along with the bases for determining those estimates, including references to supporting data.	Baselines and Targets	Chapter 5.3, 5.4, 5.5
x		Chapter 5	10608.24(a)	Retail suppliers shall meet their water use target by December 31, 2020.	Baselines and Targets	Chapter 5.5
	x	Section 5.1	10608.36	Wholesale suppliers shall include an assessment of present and proposed future measures, programs, and policies to help their retail water suppliers achieve targeted water use reductions.	Baselines and Targets	Not Applicable
x		Section 5.2	10608.24(d)(2)	If the retail supplier adjusts its compliance GPCD using weather normalization, economic adjustment, or extraordinary events, it shall provide the basis for, and data supporting the adjustment.	Baselines and Targets	Not Applicable
x		Section 5.5	10608.22	Retail suppliers' per capita daily water use reduction shall be no less than 5 percent of base daily per capita water use of the 5 year baseline. This does not apply if the suppliers base GPCD is at or below 100.	Baselines and Targets	Chapter 5.3, 5.4, 5.5
x		Section 5.5 and Appendix E	10608.4	Retail suppliers shall report on their compliance in meeting their water use targets. The data shall be reported using a standardized form in the SBX7-7 2020 Compliance Form.	Baselines and Targets	Chapter 5.5, Appendix E
x	x	Sections 6.1 and 6.2	10631(b)(1)	Provide a discussion of anticipated supply availability under a normal, single dry year, and a drought lasting five years, as well as more frequent and severe periods of drought.	System Supplies	Chapter 6.2, 7.2, 7.3

DWR UWMP Checklist

Retail	Wholesale	2020 Guidebook Location	Water Code Section	Summary as Applies to UWMP	Subject	2020 UWMP Location (Optional Column for Agency Review Use)
x	x	Sections 6.1	10631(b)(1)	Provide a discussion of anticipated supply availability under a normal, single dry year, and a drought lasting five years, as well as more frequent and severe periods of drought, *including changes in supply due to climate change.*	System Supplies	Chapter 6.2, 7.3
x	x	Section 6.1	10631(b)(2)	When multiple sources of water supply are identified, describe the management of each supply in relationship to other identified supplies.	System Supplies	Chapter 6.2
x	x	Section 6.1.1	10631(b)(3)	Describe measures taken to acquire and develop planned sources of water.	System Supplies	Chapter 6.2
x	x	Section 6.2.8	10631(b)	Identify and quantify the existing and planned sources of water available for 2020, 2025, 2030, 2035, 2040 and optionally 2045.	System Supplies	Chapter 6.2, 7.2
x	x	Section 6.2	10631(b)	Indicate whether groundwater is an existing or planned source of water available to the supplier.	System Supplies	Chapter 6.2
x	x	Section 6.2.2	10631(b)(4)(A)	Indicate whether a groundwater sustainability plan or groundwater management plan has been adopted by the water supplier or if there is any other specific authorization for groundwater management. Include a copy of the plan or authorization.	System Supplies	Chapter 6.2.2, Appendix D
x	x	Section 6.2.2	10631(b)(4)(B)	Describe the groundwater basin.	System Supplies	Chapter 6.2.2, Appendix D, & Table 6-2
x	x	Section 6.2.2	10631(b)(4)(B)	Indicate if the basin has been adjudicated and include a copy of the court order or decree and a description of the amount of water the supplier has the legal right to pump.	System Supplies	Chapter 6.2.2
x	x	Section 6.2.2.1	10631(b)(4)(B)	For unadjudicated basins, indicate whether or not the department has identified the basin as a high or medium priority. Describe efforts by the supplier to coordinate with sustainability or groundwater agencies to achieve sustainable groundwater conditions.	System Supplies	Chapter 6.2.2, Appendix D
x	x	Section 6.2.2.4	10631(b)(4)(C)	Provide a detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years	System Supplies	Chapter 6.2.2, Table 6-1
x	x	Section 6.2.2	10631(b)(4)(D)	Provide a detailed description and analysis of the amount and location of groundwater that is projected to be pumped.	System Supplies	Chapter 6.2.2
x	x	Section 6.2.7	10631(c)	Describe the opportunities for exchanges or transfers of water on a short-term or long- term basis.	System Supplies	Chapter 6.2.1, 7.3
x	x	Section 6.2.5	10633(b)	Describe the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.	System Supplies (Recycled Water)	Chapter 7.6.2, Is Not Applicable
x	x	Section 6.2.5	10633(c)	Describe the recycled water currently being used in the supplier's service area.	System Supplies (Recycled Water)	Chapter 7.6.2, Is Not Applicable
x	x	Section 6.2.5	10633(d)	Describe and quantify the potential uses of recycled water and provide a determination of the technical and economic feasibility of those uses.	System Supplies (Recycled Water)	Chapter 7.6.2, Is Not Applicable
x	x	Section 6.2.5	10633(e)	Describe the projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected.	System Supplies (Recycled Water)	Chapter 7.6.2, Is Not Applicable
x	x	Section 6.2.5	10633(f)	Describe the actions which may be taken to encourage the use of recycled water and the projected results of these actions in terms of acre-feet of recycled water used per year.	System Supplies (Recycled Water)	Chapter 7.6.2, Is Not Applicable
x	x	Section 6.2.5	10633(g)	Provide a plan for optimizing the use of recycled water in the supplier's service area.	System Supplies (Recycled Water)	Chapter 7.6.2, Is Not Applicable
x	x	Section 6.2.6	10631(g)	Describe desalinated water project opportunities for long-term supply.	System Supplies	1.1, 6.2, 6.3.1, 7.3, 7.5.1, 7.6.1, 8.2
x	x	Section 6.2.5	10633(a)	Describe the wastewater collection and treatment systems in the supplier’s service area with quantified amount of collection and treatment and the disposal methods.	System Supplies (Recycled Water)	Chapter 7.6.2, Is Not Applicable
x	x	Section 6.2.8, Section 6.3.7	10631(f)	Describe the expected future water supply projects and programs that may be undertaken by the water supplier to address water supply reliability in average, single-dry, and for a period of drought lasting 5 consecutive water years.	System Supplies	Chapter 6.2, Appendix J
x	x	Section 6.4 and Appendix O	10631.2(a)	The UWMP must include energy information, as stated in the code, that a supplier can readily obtain.	System Suppliers, Energy Intensity	Chapter 6.4
x	x	Section 7.2	10634	Provide information on the quality of existing sources of water available to the supplier and the manner in which water quality affects water management strategies and supply reliability	Water Supply Reliability Assessment	Chapter 7.5.3
x	x	Section 7.2.4	10620(f)	Describe water management tools and options to maximize resources and minimize the need to import water from other regions.	Water Supply Reliability Assessment	Chapter 7.5.1

DWR UWMP Checklist

Retail	Wholesale	2020 Guidebook Location	Water Code Section	Summary as Applies to UWMP	Subject	2020 UWMP Location (Optional Column for Agency Review Use)
x	x	Section 7.3	10635(a)	Service Reliability Assessment: Assess the water supply reliability during normal, dry, and a drought lasting five consecutive water years by comparing the total water supply sources available to the water supplier with the total projected water use over the next 20 years.	Water Supply Reliability Assessment	Chapter 7.2, 7.3
x	x	Section 7.3	10635(b)	Provide a drought risk assessment as part of information considered in developing the demand management measures and water supply projects.	Water Supply Reliability Assessment	Chapter 7.1, 7.2, 7.4
x	x	Section 7.3	10635(b)(1)	Include a description of the data, methodology, and basis for one or more supply shortage conditions that are necessary to conduct a drought risk assessment for a drought period that lasts 5 consecutive years.	Water Supply Reliability Assessment	Chapter 7.3, 7.4
x	x	Section 7.3	10635(b)(2)	Include a determination of the reliability of each source of supply under a variety of water shortage conditions.	Water Supply Reliability Assessment	Chapter 7.4
x	x	Section 7.3	10635(b)(3)	Include a comparison of the total water supply sources available to the water supplier with the total projected water use for the drought period.	Water Supply Reliability Assessment	Chapter 7.3, 7.5.1, Table 7-2
x	x	Section 7.3	10635(b)(4)	Include considerations of the historical drought hydrology, plausible changes on projected supplies and demands under climate change conditions, anticipated regulatory changes, and other locally applicable criteria.	Water Supply Reliability Assessment	Chapter 7.4
x	x	Chapter 8	10632(a)	Provide a water shortage contingency plan (WSCP) with specified elements below.	Water Shortage Contingency Planning	Chapter 8, Appendix K&L
x	x	Chapter 8	10632(a)(1)	Provide the analysis of water supply reliability (from Chapter 7 of Guidebook) in the WSCP	Water Shortage Contingency Planning	Chapter 8.2, Appendix K&L
x	x	Section 8.10	10632(a)(10)	Describe reevaluation and improvement procedures for monitoring and evaluation the water shortage contingency plan to ensure risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented.	Water Shortage Contingency Planning	Chapter 8.3, 8.5.2, Appendix K&L
x	x	Section 8.2	10632(a)(2)(A)	Provide the written decision-making process and other methods that the supplier will use each year to determine its water reliability.	Water Shortage Contingency Planning	Chapter 8.3.1, Appendix K&L
x	x	Section 8.2	10632(a)(2)(B)	Provide data and methodology to evaluate the supplier’s water reliability for the current year and one dry year pursuant to factors in the code.	Water Shortage Contingency Planning	Chapter 8.3.2, Appendix K&L
x	x	Section 8.3	10632(a)(3)(A)	Define six standard water shortage levels of 10, 20, 30, 40, 50 percent shortage and greater than 50 percent shortage. These levels shall be based on supply conditions, including percent reductions in supply, changes in groundwater levels, changes in surface elevation, or other conditions. The shortage levels shall also apply to a catastrophic interruption of supply.	Water Shortage Contingency Planning	Chapter 8.4, Appendix K&L
x	x	Section 8.3	10632(a)(3)(B)	Suppliers with an existing water shortage contingency plan that uses different water shortage levels must cross reference their categories with the six standard categories.	Water Shortage Contingency Planning	Not Applicable, Appendix K&L
x	x	Section 8.4	10632(a)(4)(A)	Suppliers with water shortage contingency plans that align with the defined shortage levels must specify locally appropriate supply augmentation actions.	Water Shortage Contingency Planning	Chapter 8.5.2, Appendix K&L
x	x	Section 8.4	10632(a)(4)(B)	Specify locally appropriate demand reduction actions to adequately respond to shortages.	Water Shortage Contingency Planning	Chapter 8.5.1, Appendix K&L
x	x	Section 8.4	10632(a)(4)(C)	Specify locally appropriate operational changes.	Water Shortage Contingency Planning	Chapter 8.5.1, Appendix K&L
x	x	Section 8.4	10632(a)(4)(D)	Specify additional mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions are appropriate to local conditions.	Water Shortage Contingency Planning	Chapter 8.5.1, Appendix K&L
x	x	Section 8.4	10632(a)(4)(E)	Estimate the extent to which the gap between supplies and demand will be reduced by implementation of the action.	Water Shortage Contingency Planning	Chapter 8.5.1, Appendix K&L
x	x	Section 8.4.6	10632.5	The plan shall include a seismic risk assessment and mitigation plan.	Water Shortage Contingency Plan	Chapter 8.5.6, Appendix K&L
x	x	Section 8.5	10632(a)(5)(A)	Suppliers must describe that they will inform customers, the public and others regarding any current or predicted water shortages.	Water Shortage Contingency Planning	Chapter 8.6, Appendix K&L
x	x	Section 8.5 and 8.6	10632(a)(5)(B) 10632(a)(5)(C)	Suppliers must describe that they will inform customers, the public and others regarding any shortage response actions triggered or anticipated to be triggered and other relevant communications.	Water Shortage Contingency Planning	Chapter 8.5.1, 8.6, Appendix K&L
x		Section 8.6	10632(a)(6)	Retail supplier must describe how it will ensure compliance with and enforce provisions of the WSCP.	Water Shortage Contingency Planning	Chapter 8.7, Appendix K&L
x		Section 8.7	10632(a)(7)(A)	Describe the legal authority that empowers the supplier to enforce shortage response actions.	Water Shortage Contingency Planning	Chapter 8.8, Appendix K&L
x	x	Section 8.7	10632(a)(7)(B)	Provide a statement that the supplier will declare a water shortage emergency Water Code Chapter 3.	Water Shortage Contingency Planning	Chapter 8.8, Appendix K&L
x	x	Section 8.7	10632(a)(7)(C)	Provide a statement that the supplier will coordinate with any city or county within which it provides water for the possible proclamation of a local emergency.	Water Shortage Contingency Planning	Chapter 8.8, Appendix K&L
x	x	Section 8.8	10632(a)(8)(A)	Describe the potential revenue reductions and expense increases associated with activated shortage response actions.	Water Shortage Contingency Planning	Chapter 8.9, Appendix K&L

DWR UWMP Checklist

Retail	Wholesale	2020 Guidebook Location	Water Code Section	Summary as Applies to UWMP	Subject	2020 UWMP Location (Optional Column for Agency Review Use)
x	x	Section 8.8	10632(a)(8)(B)	Provide a description of mitigation actions needed to address revenue reductions and expense increases associated with activated shortage response actions.	Water Shortage Contingency Planning	Chapter 8.9, Appendix K&L
x		Section 8.8	10632(a)(8)(C)	Retail suppliers must describe the cost of compliance with Water Code Chapter 3.3: Excessive Residential Water Use During Drought	Water Shortage Contingency Planning	Chapter 8.9, Appendix K&L
x		Section 8.9	10632(a)(9)	Retail suppliers must describe the monitoring and reporting requirements and procedures that ensure appropriate data is collected, tracked, and analyzed for purposes of monitoring customer compliance.	Water Shortage Contingency Planning	Chapter 8.10, Appendix K&L
x		Section 8.11	10632(b)	Analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas.	Water Shortage Contingency Planning	Chapter 8.5, 8.11, Appendix L
x	x	Sections 8.12 and 10.4	10635(c)	Provide supporting documentation that Water Shortage Contingency Plan has been, or will be, provided to any city or county within which it provides water, no later than 30 days after the submission of the plan to DWR.	Plan Adoption, Submittal, and Implementation	Chapter 8.12
x	x	Section 8.12	10632(c)	Make available the Water Shortage Contingency Plan to customers and any city or county where it provides water within 30 after adopted the plan.	Water Shortage Contingency Planning	Chapter 8.12, 10.2
	x	Sections 9.1 and 9.3	10631(e)(2)	Wholesale suppliers shall describe specific demand management measures listed in code, their distribution system asset management program, and supplier assistance program.	Demand Management Measures	Not Applicable
x		Sections 9.2 and 9.3	10631(e)(1)	Retail suppliers shall provide a description of the nature and extent of each demand management measure implemented over the past five years. The description will address specific measures listed in code.	Demand Management Measures	Chapter 9.2, 9.3
x		Chapter 10	10608.26(a)	Retail suppliers shall conduct a public hearing to discuss adoption, implementation, and economic impact of water use targets (recommended to discuss compliance).	Plan Adoption, Submittal, and Implementation	Chapter 10.2, Appendix H
x	x	Section 10.2.1	10621(b)	Notify, at least 60 days prior to the public hearing, any city or county within which the supplier provides water that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. Reported in Table 10-1.	Plan Adoption, Submittal, and Implementation	Chapter 10.2, Appendix H
x	x	Section 10.4	10621(f)	Each urban water supplier shall update and submit its 2020 plan to the department by July 1, 2021.	Plan Adoption, Submittal, and Implementation	Chapter 10.2
x	x	Sections 10.2.2, 10.3, and 10.5	10642	Provide supporting documentation that the urban water supplier made the plan and contingency plan available for public inspection, published notice of the public hearing, and held a public hearing about the plan and contingency plan.	Plan Adoption, Submittal, and Implementation	Chapter 10.2, Appendix H & I
x	x	Section 10.2.2	10642	The water supplier is to provide the time and place of the hearing to any city or county within which the supplier provides water.	Plan Adoption, Submittal, and Implementation	Chapter 10.2, Appendix H & I
x	x	Section 10.3.2	10642	Provide supporting documentation that the plan and contingency plan has been adopted as prepared or modified.	Plan Adoption, Submittal, and Implementation	Chapter 10.2, Appendix F, L
x	x	Section 10.4	10644(a)	Provide supporting documentation that the urban water supplier has submitted this UWMP to the California State Library.	Plan Adoption, Submittal, and Implementation	Chapter 10.2
x	x	Section 10.4	10644(a)(1)	Provide supporting documentation that the urban water supplier has submitted this UWMP to any city or county within which the supplier provides water no later than 30 days after adoption.	Plan Adoption, Submittal, and Implementation	Chapter 10.2
x	x	Sections 10.4.1 and 10.4.2	10644(a)(2)	The plan, or amendments to the plan, submitted to the department shall be submitted electronically.	Plan Adoption, Submittal, and Implementation	Chapter 10.2
x	x	Section 10.5	10645(a)	Provide supporting documentation that, not later than 30 days after filing a copy of its plan with the department, the supplier has or will make the plan available for public review during normal business hours.	Plan Adoption, Submittal, and Implementation	Chapter 10.2
x	x	Section 10.5	10645(b)	Provide supporting documentation that, not later than 30 days after filing a copy of its water shortage contingency plan with the department, the supplier has or will make the plan available for public review during normal business hours.	Plan Adoption, Submittal, and Implementation	Chapter 10.2
x	x	Section 10.6	10621(c)	If supplier is regulated by the Public Utilities Commission, include its plan and contingency plan as part of its general rate case filings.	Plan Adoption, Submittal, and Implementation	Not Applicable
x	x	Section 10.7.2	10644(b)	If revised, submit a copy of the water shortage contingency plan to DWR within 30 days of adoption.	Plan Adoption, Submittal, and Implementation	Chapter 10.2

APPENDIX B

Glossary of Terms

Acronyms

Abbreviations

Abbreviations and Acronyms

AB - Assembly Bill

ACT - Urban Water Management Planning Act of 1983, including amendments

AF - Acre-Foot

Baseline – The average per capita water use for the following baseline periods and calculated in accordance with Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use, DWR 2011. A 10-15 year continuous period used to calculate baseline daily per capita water use per CWC Section 10608.20. A continuous 5-year period used to determine whether the 2020 urban water use target meets the legislation's minimum water use reduction requirement per CWC Section 10608.22.

BMP - Best Management Practice

Board - Lakeside Water District's Board of Directors

CEHTP - California Environmental Health Tracking Program

CASGEM - California Statewide Groundwater Elevation Monitoring Program

CII - Commercial, Industrial, Institutional, water use sectors

CIMIS - California Irrigation Management Information System

CIP – Capital Improvement Plan

Conservation Plan - Lakeside's Drought Response Conservation Program

Contingency Plan - Lakeside Water Shortage Contingency Plan

County - County of San Diego

CUWCC - California Urban Water Conservation Council

CWA – San Diego County Water Authority

CWC - California Water Code

District – Lakeside Water District

DMMs - Demand Management Measures

DOF - Department of Finance

DWR - Department of Water Resources

eARDWP - Electronic Annual Reports to the Drinking Water Program (SWRCB)

ETo - Reference Evapotranspiration

FCF – Flow Control Facility

GIS - Geographic Information System

GPCD - Gallons per Capita per Day

Gross Water Use – The volume of water entering a supplier's distribution system over a 12 month period. This volume may be adjusted based on changes in system storage, sales to other agencies, recycled water use, agricultural water use, and industrial process water use. This term is used in the context of SB X7-7, The Water Conservation Act of 2009.

Hydrologic Region – A geographical division of the state based on the local hydrologic basins. The California Department of Water Resources divides California into 10 hydrologic regions that correspond to the state's major water drainage basins: North Coast, North Lahontan, Sacramento River, San Francisco Bay, Central Coast, San Joaquin River, Tulare Lake, South Coast, South Lahontan, and Colorado River.

Interim Urban Water Use Target – The 2015 urban water use target that is the midpoint between the supplier's 10-15 year baseline GPCD and their 2020 target GPCD. 2015 UWMPs will compare the interim water use target to the actual water use of 2015. This term is used in the context of SB X7-7, The Water Conservation Act of 2009.

IFP – Integrated Facilities Plan

IRWM - Integrated Regional Water Management

ITP - Independent Technical Panel

LAFCO - Local Agency Formation Commission

Lakeside – Lakeside Water District

Methodologies – A shortened term for the publication Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use (For the Consistent Implementation of the Water Conservation Act of 2009). DWR 2011. The Water Conservation Act of 2009 (also known as SB X7-7) directed DWR to develop these technical methodologies and criteria to ensure the consistent implementation of the Act and to provide guidance to urban retail water suppliers in calculating and reporting their baseline and compliance water use.

MGRA – Major Geographical Regional Area

MOU – Memorandum of Understanding

MWD - Metropolitan Water District of Southern California

NA – Not Applicable

NOAA - National Oceanic and Atmospheric Administration

NPDES - National Pollutant Discharge Elimination System

PWS - Public Water System

RWQCB - Regional Water Quality Control Board

SANDAG – San Diego Association of Governments

SANGIS – San Diego Geographic Information System

SDCWA - San Diego County Water Authority

SB - Senate Bill

SB X7-7 - Senate Bill Seven of the Senate's Seventh Extraordinary Session of 2009

SGMA - Sustainable Groundwater Management Act

Standardized Tables – DWR has specified the use of standardized tables for reporting UWMP data. Use of these tables is required in the 2015 UWMP, to the extent that the information is available. However, water agencies may include the standardized tables in an appendix and present adapted versions of the standardized tables in the body of the Plan, if that is better adapted to the agency's records and/or better reflects the information available to the agency. The standardized tables are found in Appendix E of the UWMP Guidebook.

SWP - State Water Project

SWRCB - State Water Resources Control Board

Target – The target per capita water use calculated for 2020 and 2015 as per Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use, DWR 2011. This term is used in the context of SB X7-7, The Water Conservation Act of 2009.

Target Method – The water supplier selects one of four different target methods when determining their 2020 Urban Water Use Target. See the Methodologies document (DWR 2011) and Appendix E, SB X7-7 Verification Form for details. This term is used in the context of SB X7-7, The Water Conservation Act of 2009.

RUWMP - Regional Urban Water Management Plan

UWMP - Urban Water Management Plan

Water demand/use – Water conveyed through a distribution system that is used by a water agency and its customers for any purpose, including non-potable water uses, water losses, and other non-revenue water. For purposes of the Guidebook, the terms "Water Demand" and "Water Use" will be used interchangeably and refer to all the demand sectors listed in Section 4.2

WDR - Waste Discharge Requirement

WSCP - Water Shortage Contingency Plan

APPENDIX C

AWWA Water Loss Audits

FYE 2020 - 2016

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:	Brett Sanders	
Email Address:	BrettS@LakesideWater.org	
Telephone | Ext.:	619.443.3806	
Name of City / Utility:	Lakeside Water District	
City/Town/Municipality:	Lakeside	
State / Province:	California (CA)	
Country:	United States	
Year:	2020	Financial Year
Start Date:	07/2019	Enter MM/YYYY numeric format
End Date:	06/2020	Enter MM/YYYY numeric format
Audit Preparation Date:	9/23/2020	
Volume Reporting Units:	Acre-feet	
PWSID / Other ID:	3710013	

The following guidance will help you complete the Audit

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

(white cell)	Value can be entered by user
(yellow cell)	Value calculated based on input data
(purple cell)	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

? Click to access definition
\+ Click to add a comment

Water Audit Report for: Lakeside Water District (3710013)
Reporting Year: 2020 | 7/2019 - 6/2020

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: ACRE-FEET 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' ---------->

WATER SUPPLIED

	Grade	Value	Unit	Master Meter and Supply Error Adjustments: Grade	Pcnt	Value	Unit
Volume from own sources:	5	592.870	acre-ft/yr	9		-3.960	acre-ft/yr
Water imported:	7	2,878.800	acre-ft/yr	9			acre-ft/yr
Water exported:	n/a		acre-ft/yr				acre-ft/yr
WATER SUPPLIED:		**3,475.630**	acre-ft/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

	Grade	Value	Unit	Pcnt	Value	Unit
Billed metered:	7	3,231.180	acre-ft/yr			
Billed unmetered:	n/a		acre-ft/yr			
Unbilled metered:	n/a		acre-ft/yr			
Unbilled unmetered:	8	1.090	acre-ft/yr		1.090	acre-ft/yr
AUTHORIZED CONSUMPTION:		**3,232.270**	acre-ft/yr			

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

WATER LOSSES (Water Supplied - Authorized Consumption)

243.360 acre-ft/yr

Apparent Losses

	Grade	Value	Unit	Pcnt	Value	Unit
Unauthorized consumption:	8	0.900	acre-ft/yr		0.900	acre-ft/yr
Customer metering inaccuracies:	6	32.638	acre-ft/yr	1.00%		acre-ft/yr
Systematic data handling errors:		8.078	acre-ft/yr	0.25%		acre-ft/yr

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

Apparent Losses: **41.616** acre-ft/yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **201.744** acre-ft/yr

WATER LOSSES: **243.360** acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER: **244.450** acre-ft/yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

	Grade	Value	Unit
Length of mains:	8	125.0	miles
Number of active AND inactive service connections:	10	7,088	
Service connection density:		57	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

	Grade	Value	Unit
Average operating pressure:	7	100.0	psi

COST DATA

	Grade	Value	Unit
Total annual cost of operating water system:	10	$8,104,343	$/Year
Customer retail unit cost (applied to Apparent Losses):	9	$4.48	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	5	$1,433.90	$/acre-ft

☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 71 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: Water imported
2: Variable production cost (applied to Real Losses)
3: Billed metered

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Lakeside Water District (3710013)
Reporting Year: 2020 | 7/2019 - 6/2020

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 71 out of 100 ***

System Attributes:

Apparent Losses:	41.616	acre-ft/yr
+ Real Losses:	201.744	acre-ft/yr
= **Water Losses:**	**243.360**	acre-ft/yr
? Unavoidable Annual Real Losses (UARL):	194.84	acre-ft/yr
Annual cost of Apparent Losses:	$81,213	
Annual cost of Real Losses:	$289,281	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:	7.0%	
	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:	5.24	gallons/connection/day
	Real Losses per service connection per day:	25.41	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.25	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	201.74	acre-feet/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:	1.04	

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

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:	
Vol. from own sources: Master meter error adjustment:	
Water imported:	
Water imported: master meter error adjustment:	
Water exported:	
Water exported: master meter error adjustment:	
Billed metered:	Harris icis report "usage by meter type or by pump" +/- fye water accrual done with audit, + High Meadow Ranch billed in qb not icis.
Billed unmetered:	
Unbilled metered:	
Unbilled unmetered:	
Unauthorized consumption:	
Customer metering inaccuracies:	
Systematic data handling errors:	
Length of mains:	
Number of active AND inactive service connections:	Harris icis report "location listing" number on last page, less the number on report "location with inactive accounts" w/old from previous data merger. (note eaiser to take total on last page less the account that are not "old %"
Average length of customer service line:	
Average operating pressure:	
Total annual cost of operating water system:	
Customer retail unit cost (applied to Apparent Losses):	
Variable production cost (applied to Real Losses):	

AWWA Free Water Audit Software: Water Balance

WAS v5.0

American Water Works Association.

Water Audit Report for:	Lakeside Water District (3710013)	
Reporting Year:	2020	7/2019 - 6/2020
Data Validity Score:	71	

Own Sources (Adjusted for known errors) 596.830	System Input 3,475.630	Water Exported 0.000			Billed Water Exported	Revenue Water 0.000
		Water Supplied 3,475.630	Authorized Consumption 3,232.270	Billed Authorized Consumption 3,231.180	Billed Metered Consumption (water exported is removed) 3,231.180	Revenue Water 3,231.180
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 1.090	Unbilled Metered Consumption 0.000	Non-Revenue Water (NRW) 244.450
					Unbilled Unmetered Consumption 1.090	
			Water Losses 243.360	Apparent Losses 41.616	Unauthorized Consumption 0.900	
					Customer Metering Inaccuracies 32.638	
					Systematic Data Handling Errors 8.078	
Water Imported 2,878.800				Real Losses 201.744	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

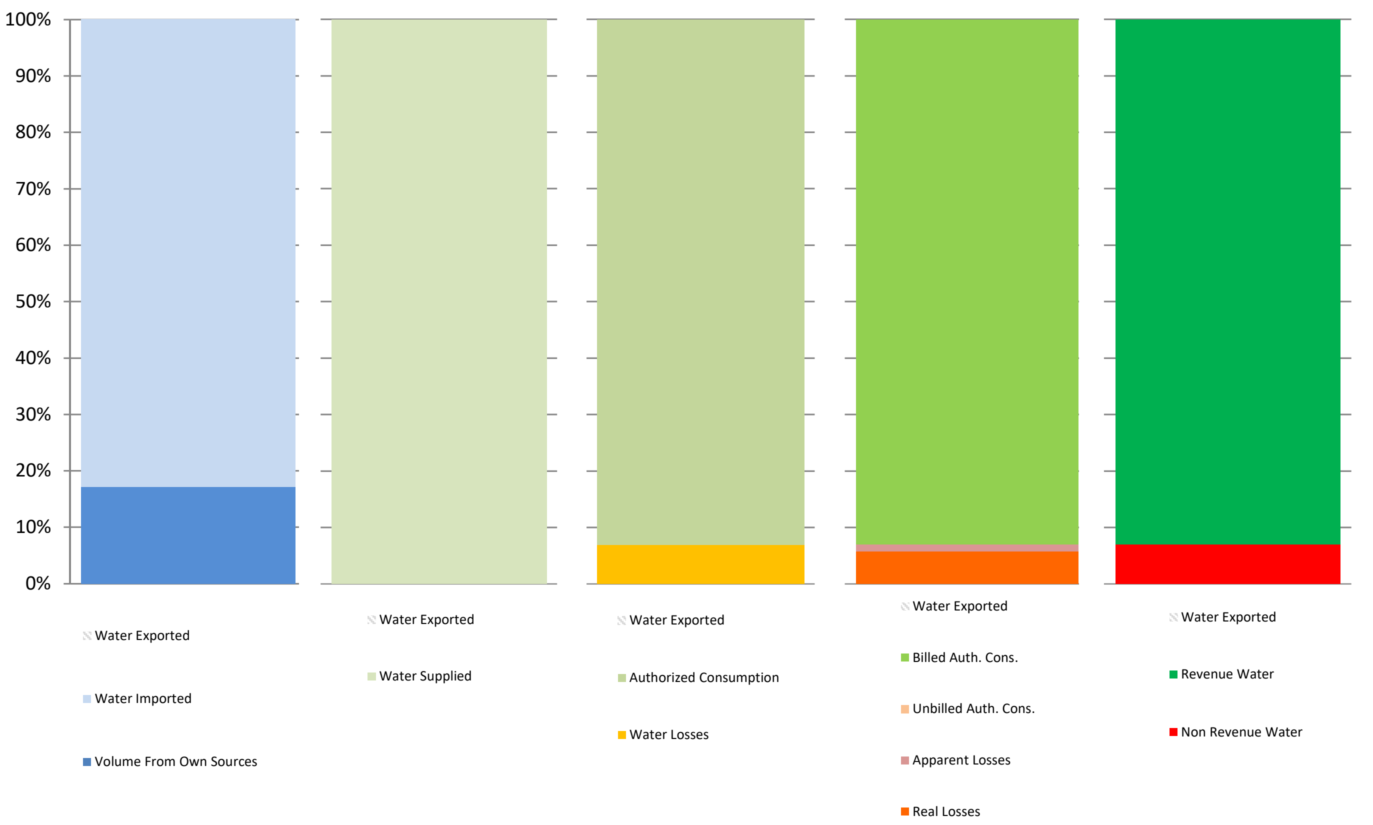
WAS v5.0

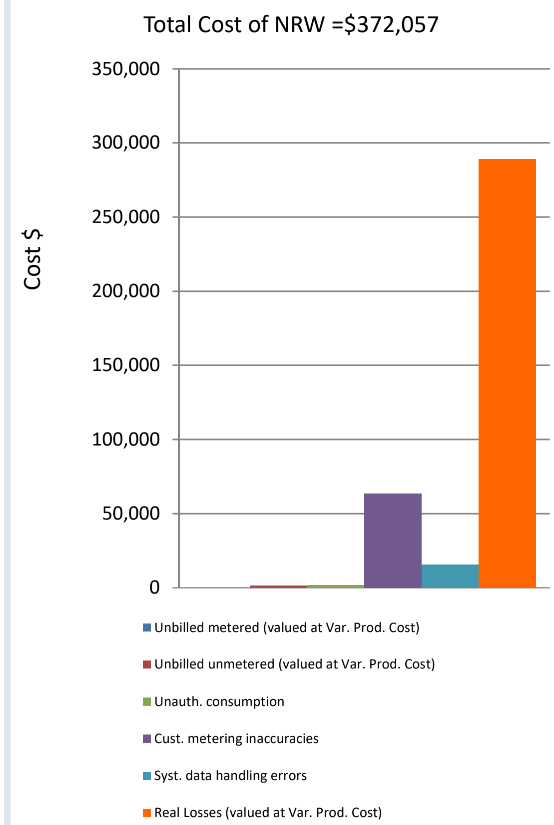
The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

Water Audit Report for:	Lakeside Water District (3710013)	
Reporting Year:	2020	7/2019 - 6/2020
Data Validity Score:	71	

○ Show me the VOLUME of Non-Revenue Water

◉ Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software: Grading Matrix

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 [illegible]	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 [illegible]

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Average length of customer service line:	...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...	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	...location 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 Worksheet 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...
Improvements to attain higher data grading for "Average Length of Customer Service Line" component:		to qualify for 2: 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...	to qualify for 4: 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...		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data.		to maintain 10: 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...	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...	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...	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...	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.
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...	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...		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...		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-...	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...	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...	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...
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...	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...	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...
Improvements to attain higher data grading for "Variable Production Cost" component:		to qualify for 2: Gather available records, institute new procedures to regularly collect cost data 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

AWWA Free Water Audit Software: Customer Service Line Diagrams

Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, Lp, for the three most common piping configurations.

Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration Lp = 0 since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where Lp is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building , where Lp is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the Lp will vary notably in a community of different structures, therefore the average Lp value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

Click for more information

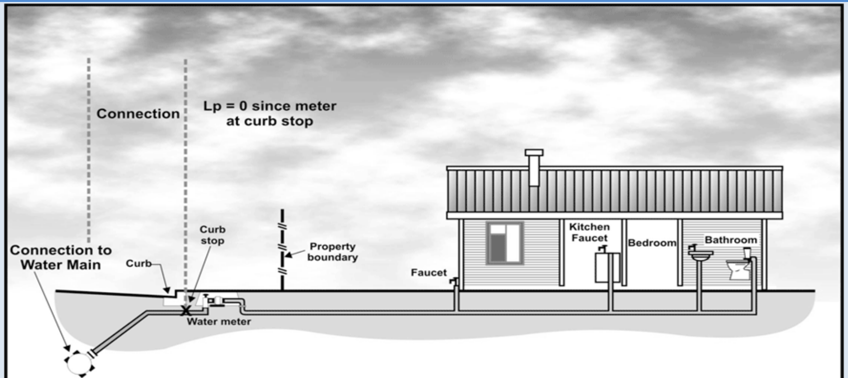


Figure 1

Typical house connection: Meter at curb stop
Not to scale

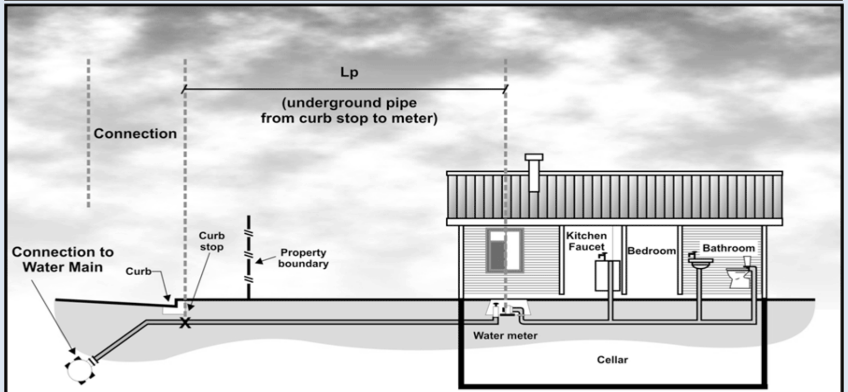


Figure 2

Typical house connection: Meter inside property
Not to scale

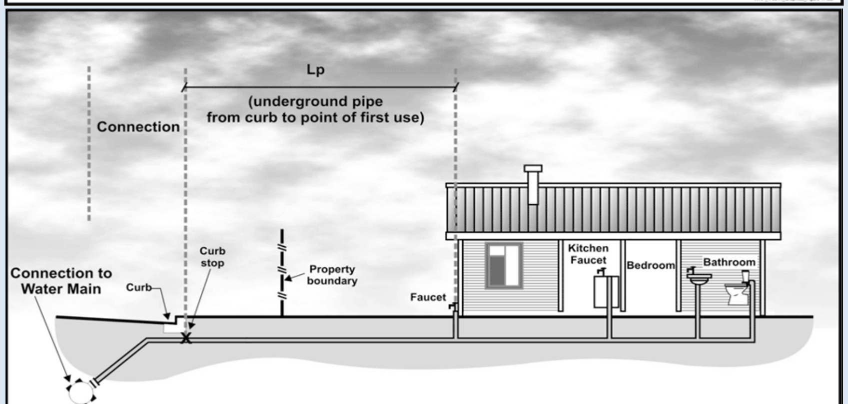


Figure 3

Typical house connection: Unmetered
Not to scale

Item Name	Description
NON-REVENUE WATER	= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potential to the utility.
Number of active AND inactive service connections	Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). **Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hyrants should be included in the "Length of mains" parameter.**
Real Losses	Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Revenue Water	Those components of System Input Volume that are billed and have the potential to produce revenue.
Service Connection Density	=number of customer service connections / length of mains
Systematic data handling errors	Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts; and any type of data lapse that results in under-stated customer water consumption in summary billing reports. **Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component.** Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex: monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. Data Transfer Errors result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors. Apparent losses also occur from Data Analysis Errors in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system. Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors. If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the the Billed Authorized Consumption volume. However, if the auditor has investigated the billing system and its controls, and has well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. Note: negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.
Total annual cost of operating the water system	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Unauthorized consumption	Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system. Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.
Unavoidable Annual Real Losses (UARL)	UARL (gallons)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres)=(18.0Lm + 0.8Nc + 25.0Lc) xP where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on determing the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, in gallons: (Lm x 32) + Nc < 3000 or P <35psi in litres: (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.
Unbilled Authorized Consumption	All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.
Unbilled metered consumption	Metered consumption which is authorized by the water utility, but, for any reason, is deemed by utility policy to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. **It does not include water supplied to neighboring utilities (water exported) which may be metered but not billed.**
Unbilled unmetered consumption	Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. **It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case.** This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value. If the water utility has carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities. Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.
Units and Conversions	The user may develop an audit based on one of three unit selections: 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes): Enter Units: 1 · Convert From... Million Gallons (US) = Converts to..... 3.06888329 Acre-feet (conversion factor = 3.06888328973723)
Use of Option Buttons	To use the default percent value choose this button To enter a value choose this button and enter the value in the cell to the right Pcnt: 1.25% Value: **NOTE:** For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above. If a default value is selected, the user does not need to grade the item; a grading value of 5 is automatically applied (however, this grade will not be displayed).
Variable production cost (applied to Real Losses)	The cost to produce and supply the next unit of water (e.g., $/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable. It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost. The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.
Volume from own sources	The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of treated drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.
Volume from own sources: Master meter and supply error adjustment	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration.
Water exported	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water: i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water. Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. **Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.**
Water exported: Master meter and supply error adjustment	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Water imported	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Water imported: Master meter and supply error adjustment	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
WATER LOSSES	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.

AWWA Free Water Audit Software:
Determining Water Loss Standing

WAS v5.0

Water Audit Report for: Lakeside Water District (3710013)
Reporting Year: 2020 | 7/2019 - 6/2020
Data Validity Score: 71

Water Loss Control Planning Guide

Functional Focus Area	Water Audit Data Validity Level / Score				
	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
>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 Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or "top-down", water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or "bottom-up", water audit using the same water audit methodology.

DEVELOPED BY:

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REFERENCES:

- Alegre, H., Hirner, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272

- Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65

- AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009

- Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.

VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/ 2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the requied data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknoweldgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.

Validator Provided

Certified Validation Report

Audit Level 1 Validation Document

Audit Information:

Utility: Lakeside Water District

PWS ID: 3710013

System Type: Potable

Audit Period: Fiscal Year 2019/20

Utility Representation: Brett Sanders

Validation Date: 9/23/2020 Time: 11:00am

Sufficient Supporting Documents Provided: Yes

Validation Findings & Confirmation Statement:

Key Audit Metrics:

Data Validity Score: 71

Data Validity Band (Level): Level IV (71-90)

ILI: 1.04

Real Loss: 25.41 (gal/conn/day)

Apparent Loss: 5.24 (gal/conn/day)

Non-revenue water as percent of cost of operating system: 4.6%

Certification Statement by Validator:

This water loss audit report has been Level 1 validated per the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34.

All recommendations on volume derivation and Data Validity Grades were incorporated into the water audit. ☒

Validator Information:

Water Audit Validator: Jeanne Swaringen

Validator Qualifications: Certified California Water Audit Validator

Certified Validation Report

Audit Level 1 Validation Document

Utility Provided

Water System Name:	Water System ID Number:	Water Audit Period:
Lakeside Water District	**3710013**	**07/01/2019 – 06/30/2020**

Water Audit & Water Loss Improvement Steps:

Steps taken in preceding year to increase data validity, reduce real loss and apparent loss as informed by the annual validated water audit:

Change in water storage and water sales accrual was accounted for this period. Previous sales accrual used number of weeks but now using accrual by number of days, same as the financial audit.

Certification Statement by Utility Executive:

This water loss audit report meets the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34 and has been prepared in accordance with the method adopted by the American Water Works Association, as contained in their manual, *Water Audits and Loss Control Programs, Manual M36, Fourth Edition* and in the Free Water Audit Software version 5.

Executive Name (Print)	Executive Position	Signature	Date
BRETT SANDERS	GENERAL MANAGER	Brett Sanders	9-24-2020

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:	Brett Sanders	
Email Address:	BrettS@LakesideWater.org	
Telephone | Ext.:	619.443.3806	
Name of City / Utility:	Lakeside Water District	
City/Town/Municipality:	Lakeside	
State / Province:	California (CA)	
Country:		
Year:	2019	Financial Year
Start Date:	07/2018	Enter MM/YYYY numeric format
End Date:	06/2019	Enter MM/YYYY numeric format
Audit Preparation Date:	9/23/2019	
Volume Reporting Units:	Acre-feet	
PWSID / Other ID:		

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: Lakeside Water District
Reporting Year: 2019 7/2018 - 6/2019

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: ACRE-FEET 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' ---------->

WATER SUPPLIED

	Grade	Value	Units	Master Meter and Supply Error Adjustments: Grade	Pcnt	Value	Units
Volume from own sources:	5	683.500	acre-ft/yr	9		2.980	acre-ft/yr
Water imported:	7	2,642.600	acre-ft/yr	9			acre-ft/yr
Water exported:	n/a		acre-ft/yr				acre-ft/yr

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

WATER SUPPLIED: 3,323.120 acre-ft/yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

	Grade	Value	Units	Pcnt	Value	Units
Billed metered:	7	3,107.900	acre-ft/yr			
Billed unmetered:	n/a		acre-ft/yr			
Unbilled metered:	n/a		acre-ft/yr			
Unbilled unmetered:	8	1.510	acre-ft/yr		1.510	acre-ft/yr

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

AUTHORIZED CONSUMPTION: 3,109.410 acre-ft/yr

WATER LOSSES (Water Supplied - Authorized Consumption)

213.710 acre-ft/yr

Apparent Losses

	Grade	Value	Units	Pcnt	Value	Units
Unauthorized consumption:	8	1.360	acre-ft/yr		1.360	acre-ft/yr
Customer metering inaccuracies:	6	31.393	acre-ft/yr	1.00%		acre-ft/yr
Systematic data handling errors:		7.770	acre-ft/yr	0.25%		acre-ft/yr

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

Apparent Losses: 40.523 acre-ft/yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 173.187 acre-ft/yr

WATER LOSSES: 213.710 acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER: 215.220 acre-ft/yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

	Grade	Value	Units
Length of mains:	8	125.0	miles
Number of active AND inactive service connections:	10	7,074	
Service connection density:		57	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: 7 100.0 psi

COST DATA

	Grade	Value	Units
Total annual cost of operating water system:	10	$7,705,882	$/Year
Customer retail unit cost (applied to Apparent Losses):	9	$4.43	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	5	$1,404.28	$/acre-ft

☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 71 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: Water imported
2: Variable production cost (applied to Real Losses)
3: Volume from own sources

WAS v5.0

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: Lakeside Water District
Reporting Year: 2019 | 7/2018 - 6/2019

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 71 out of 100 ***

System Attributes:

Apparent Losses:	40.523	acre-ft/yr
+ Real Losses:	173.187	acre-ft/yr
= **Water Losses:**	**213.710**	acre-ft/yr
? Unavoidable Annual Real Losses (UARL):	194.61	acre-ft/yr
Annual cost of Apparent Losses:	$78,197	
Annual cost of Real Losses:	$243,203	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:	6.5%	
Non-revenue water as percent by cost of operating system:	4.2%	Real Losses valued at Variable Production Cost

Operational Efficiency:

Apparent Losses per service connection per day:	5.11	gallons/connection/day
Real Losses per service connection per day:	21.86	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	0.22	gallons/connection/day/psi

From Above, Real Losses = Current Annual Real Losses (CARL):	173.19	acre-feet/year
? Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.89	

* 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

WAS v5.0

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:	
Vol. from own sources: Master meter error adjustment:	
Water imported:	
Water imported: master meter error adjustment:	
Water exported:	
Water exported: master meter error adjustment:	water in tanks 6/30/18 14.98 acft & 6/30/19 12 change of 2.98 acft
Billed metered:	Harris icis report "usage" +/- fye water accrual, + High Meadow Ranch billed in qb not icis. Qb has less than 1/10% difference.
Billed unmetered:	
Unbilled metered:	
Unbilled unmetered:	
Unauthorized consumption:	
Customer metering inaccuracies:	
Systematic data handling errors:	
Length of mains:	
Number of active AND inactive service connections:	
Average length of customer service line:	
Average operating pressure:	
Total annual cost of operating water system:	
Customer retail unit cost (applied to Apparent Losses):	
Variable production cost (applied to Real Losses):	

AWWA Free Water Audit Software: Water Balance

WAS v5.0

American Water Works Association.

Water Audit Report for:	Lakeside Water District
Reporting Year:	2019 / 7/2018 - 6/2019
Data Validity Score:	71

Own Sources (Adjusted for known errors) *680.520*	System Input *3,323.120*	Water Exported *0.000*			Billed Water Exported	Revenue Water **0.000**
		Water Supplied *3,323.120*	Authorized Consumption *3,109.410*	Billed Authorized Consumption *3,107.900*	Billed Metered Consumption (water exported is removed) *3,107.900*	Revenue Water **3,107.900**
					Billed Unmetered Consumption *0.000*	
				Unbilled Authorized Consumption *1.510*	Unbilled Metered Consumption *0.000*	Non-Revenue Water (NRW) **215.220**
					Unbilled Unmetered Consumption *1.510*	
			Water Losses *213.710*	Apparent Losses *40.523*	Unauthorized Consumption *1.360*	
					Customer Metering Inaccuracies *31.393*	
					Systematic Data Handling Errors *7.770*	
Water Imported *2,642.600*				Real Losses *173.187*	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

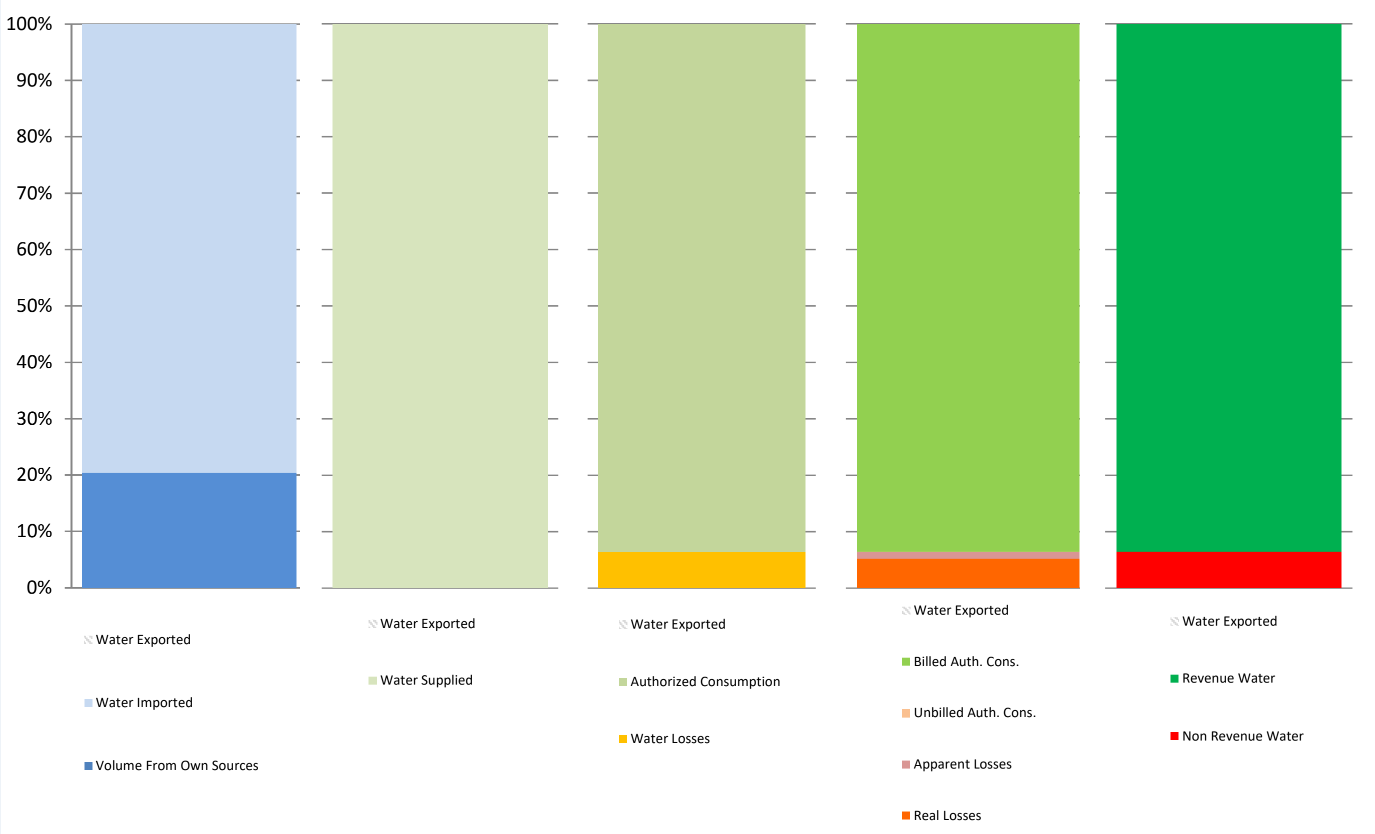
Water Audit Report for: Lakeside Water District

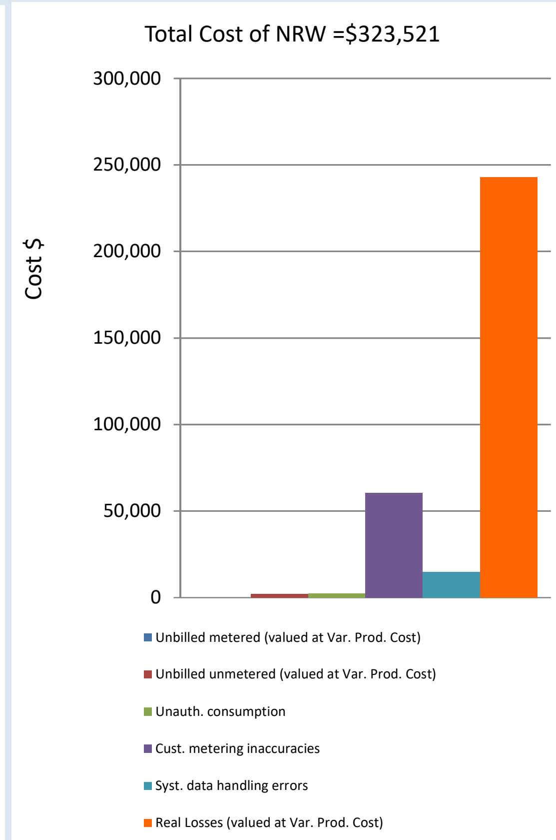
Reporting Year: 2019 | 7/2018 - 6/2019

Data Validity Score: 71

○ 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
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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 [illegible]	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 [illegible]
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. [illegible]		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 [illegible]
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 [illegible]	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 [illegible]	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 [illegible]	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" [illegible]	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 [illegible]

[illegible]

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Average length of customer service line:	the customer building ned 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	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	a) ... of customer buildings ned 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
Improvements to attain higher data grading for "Average Length of Customer Service Line" component:		to qualify for 2: 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	to qualify for 4: 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		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data.		to maintain 10: 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	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	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.	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	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.
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	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		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.		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	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	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	Straightforward 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	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
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	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
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

Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, Lp, for the three most common piping configurations.

Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration Lp = 0 since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where Lp is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building , where Lp is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the Lp will vary notably in a community of different structures, therefore the average Lp value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

Click for more information

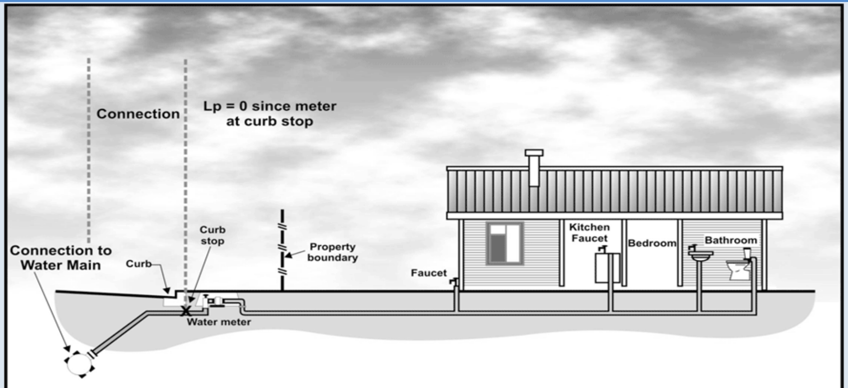

Figure 1

Typical house connection: Meter at curb stop
Not to scale

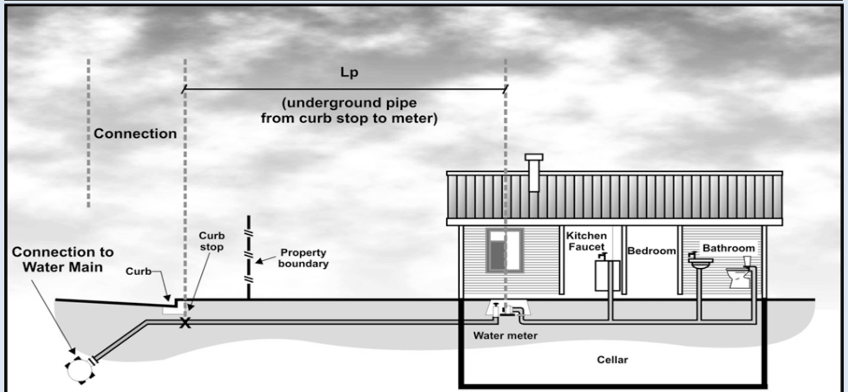

Figure 2

Typical house connection: Meter inside property
Not to scale

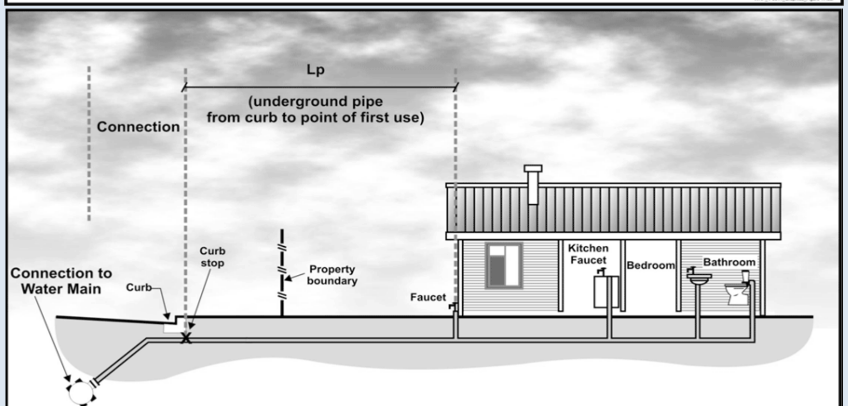

Figure 3

Typical house connection: Unmetered
Not to scale

AWWA Free Water Audit Software: Definitions

Item Name	Description
[illegible]	[illegible] … lag time adjustment value, which may or may not be significant.
Billed unmetered consumption	All billed consumption which is calculated based on estimates or norms from water usage sites that have been determined by utility policy to be left unmetered. This is typically a very small component in systems that maintain a policy to meter their customer population. However, this quantity can be the key consumption component in utilities that have not adopted a universal metering policy. **This component should NOT include any water that is supplied to neighboring utilities (water exported) which is unmetered but billed. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.**
Customer metering inaccuracies	Apparent water losses caused by the collective under-registration of customer water meters. Many customer water meters gradually wear as large cumulative volumes of water are passed through them over time. This causes the meters to under-register the flow of water. This occurrence is common with smaller residential meters of sizes 5/8-inch and 3/4 inch after they have registered very large cumulative volumes of water, which generally occurs only after periods of years. For meters sized 1-inch and larger - typical of multi-unit residential, commercial and industrial accounts - meter under-registration can occur from wear or from the improper application of the meter; i.e. installing the wrong type of meter or the wrong size of meter, for the flow pattern (profile) of the consumer. For instance, many larger meters have reduced accuracy at low flows. If an oversized meter is installed, most of the time the routine flow will occur in the low flow range of the meter, and a significant portion of it may not be registered. It is important to properly select and install all meters, but particularly large customer meters, size 1-inch and larger. The auditor has two options for entering data for this component of the audit. The auditor can enter a percentage under-registration (typically an estimated value), this will apply the selected percentage to the two categories of metered consumption to determine the volume of water not recorded due to customer meter inaccuracy. Note that this percentage is a composite average inaccuracy for all customer meters in the entire meter population. The percentage will be multiplied by the sum of the volumes in the Billed Metered and Unbilled Metered components. Alternatively, if the auditor has substantial data from meter testing activities, he or she can calculate their own loss volumes, and this volume may be entered directly. Note that a value of zero will be accepted but an alert will appear asking if the customer population is unmetered. Since all metered systems have some degree of inaccuracy, a positive value should be entered. A value of zero in this component is valid only if the water utility does not meter its customer population.
Customer retail unit cost	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied routinely to the components of Apparent Loss, since these losses represent water reaching customers but not (fully) paid for. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell. Finally, the weighted average cost should also include additional charges for sewer, storm water or biosolids processing, but only if these charges are based upon the volume of potable water consumed. For water utilities in regions with limited water resources and a questionable ability to meet the drinking water demands in the future, the Customer Retail Unit Cost might also be applied to value the Real Losses; instead of applying the Variable Production Cost to Real Losses. In this way, it is assumed that every unit volume of leakage reduced by leakage management activities will be sold to a customer. Note: the Free Water Audit Software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet, or $/1,000 litres) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. The monetary units are United States dollars, $.
Infrastructure Leakage Index (ILI)	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilities in operational management of real losses.
Length of mains	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant). It is also recommended to include in this measure the total length of fire hydrant lead pipe. Hydrant lead pipe is the pipe branching from the water main to the fire hydrant. Fire hydrant leads are typically of a sufficiently large size that is more representative of a pipeline than a service connection. The average length of hydrant leads across the entire system can be assumed if not known, and multiplied by the number of fire hydrants in the system, which can also be assumed if not known. This value can then be added to the total pipeline length. Total length of mains can therefore be calculated as: Length of Mains, miles = (total pipeline length, miles) + [{(average fire hydrant lead length, ft) x (number of fire hydrants)} / 5,280 ft/mile] or Length of Mains, kilometres = (total pipeline length, kilometres) + [{(average fire hydrant lead length, metres) x (number of fire hydrants)} / 1,000 metres/kilometre]
NON-REVENUE WATER	= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potential to the utility.
Number of active AND inactive service connections	Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). **Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hyrants should be included in the "Length of mains" parameter.**
Real Losses	Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Revenue Water	Those components of System Input Volume that are billed and have the potential to produce revenue.
Service Connection Density	=number of customer service connections / length of mains
Systematic data handling errors	Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts; and any type of data lapse that results in under-stated customer water consumption in summary billing reports. **Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component.** Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex: monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. Data Transfer Errors result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors. Apparent losses also occur from Data Analysis Errors in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system. Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors. If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the the Billed Authorized Consumption volume. However, if the auditor has investigated the billing system and its controls, and has well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. Note: negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.
Total annual cost of operating the water system	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Unauthorized consumption	Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system. Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.
Unavoidable Annual Real Losses (UARL)	UARL (gallons)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres)=(18.0Lm + 0.8Nc + 25.0Lc) xP where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on determing the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, in gallons: (Lm x 32) + Nc < 3000 or P <35psi in litres: (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.
Unbilled Authorized Consumption	All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.
Unbilled metered consumption	Metered consumption which is authorized by the water utility, but, for any reason, is deemed by utility policy to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. **It does not include water supplied to neighboring utilities (water exported) which may be metered but not billed.**
Unbilled unmetered consumption	Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. **It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case.** This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value. If the water utility has carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities. Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.
Units and Conversions	The user may develop an audit based on one of three unit selections: 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes): Enter Units: 1 — Convert From...: Million Gallons (US) = **Converts to.....**: 3.06888329 Acre-feet (conversion factor = 3.06888328973723)
Use of Option Buttons	To use the default percent value choose this button To enter a value choose this button and enter the value in the cell to the right  **NOTE:** For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above. If a default value is selected, the user does not need to grade the item; a grading value of 5 is automatically applied (however, this grade will not be displayed).
Variable production cost (applied to Real Losses)	The cost to produce and supply the next unit of water (e.g., $/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable. It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost. The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.
Volume from own sources	The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of treated drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.
Volume from own sources: Master meter and supply error adjustment	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration.
Water exported	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water: i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water. Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. **Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.**
Water exported: Master meter and supply error adjustment	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Water imported	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Water imported: Master meter and supply error adjustment	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
WATER LOSSES	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.

AWWA Free Water Audit Software:
Determining Water Loss Standing

WAS v5.0

Water Audit Report for:	Lakeside Water District	
Reporting Year:	2019	7/2018 - 6/2019
Data Validity Score:	71	

Water Loss Control Planning Guide

Functional Focus Area	Water Audit Data Validity Level / Score				
	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
>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 Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or "top-down", water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or "bottom-up", water audit using the same water audit methodology.

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REFERENCES:
- Alegre, H., Hirner, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272
- Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65
- AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009
- Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.

VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/ 2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the requied data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknoweldgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.

Certified Validation Report

Audit Level 1 Validation Document

Validator Provided

Audit Information:

Utility: Lakeside Water District

PWS ID: 3710013

System Type: Potable

Audit Period: Fiscal Year 2018/19

Utility Representation: Brett Sanders

Validation Date: 9/27/2019 Time: 10:00am

Sufficient Supporting Documents Provided: Yes

Validation Findings & Confirmation Statement:

Key Audit Metrics:

Data Validity Score: 71

Data Validity Band (Level): Level IV (71-90)

ILI: 0.89 Real Loss: 21.86 (gal/conn/day) Apparent Loss: 5.11 (gal/conn/day)

Non-revenue water as percent of cost of operating system: 4.2%

Certification Statement by Validator:

This water loss audit report has been Level 1 validated per the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34.

All recommendations on volume derivation and Data Validity Grades were incorporated into the water audit. ☒

Validator Information:

Water Audit Validator: Jeanne Swaringen

Validator Qualifications: Certified California Water Audit Validator

Certified Validation Report

Audit Level 1 Validation Document

Utility Provided

Water System Name:	Water System ID Number:	Water Audit Period:
Lakeside Water District	**3710013**	**07/01/2018 – 06/30/2019**

Water Audit & Water Loss Improvement Steps:

Steps taken in preceding year to increase data validity, reduce real loss and apparent loss as informed by the annual validated water audit:

Change in water storage and water sales accrual was accounted for this period.

Certification Statement by Utility Executive:

This water loss audit report meets the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34 and has been prepared in accordance with the method adopted by the American Water Works Association, as contained in their manual, *Water Audits and Loss Control Programs, Manual M36, Fourth Edition* and in the Free Water Audit Software version 5.

Executive Name (Print)	Executive Position	Signature	Date
BRETT SANDERS	GENERAL MANAGER	[signature]	9-27-19

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:	Brett Sanders
Email Address:	BrettS@LakesideWater.org
Telephone | Ext.:	619.443.3806
Name of City / Utility:	Lakeside Water District
City/Town/Municipality:	Lakeside
State / Province:	California (CA)
Country:	
Year:	2018 Financial Year
Start Date:	07/2017 Enter MM/YYYY numeric format
End Date:	06/2018 Enter MM/YYYY numeric format
Audit Preparation Date:	9/1/2017
Volume Reporting Units:	Acre-feet
PWSID / Other ID:	

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

? Click to access definition
\+ Click to add a comment

Water Audit Report for: **Lakeside Water District**
Reporting Year: **2018** | **7/2017 - 6/2018**

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: ACRE-FEET 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' ---------->

WATER SUPPLIED

Item	Grade	Value	Units	Master Meter and Supply Error Adjustments: Grade	Pcnt	Value	Units
Volume from own sources:	5	812.090	acre-ft/yr	9		2.420	acre-ft/yr
Water imported:	7	2,835.500	acre-ft/yr	9			acre-ft/yr
Water exported:	n/a		acre-ft/yr				acre-ft/yr
WATER SUPPLIED:		**3,645.170**	acre-ft/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

Item	Grade	Value	Units	Pcnt	Value	Units
Billed metered:	7	3,421.030	acre-ft/yr			
Billed unmetered:	n/a		acre-ft/yr			
Unbilled metered:	n/a		acre-ft/yr			
Unbilled unmetered:	8	6.250	acre-ft/yr		6.250	acre-ft/yr
AUTHORIZED CONSUMPTION:		**3,427.280**	acre-ft/yr			

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

WATER LOSSES (Water Supplied - Authorized Consumption)

217.890 acre-ft/yr

Apparent Losses

Item	Grade	Value	Units	Pcnt	Value	Units
Unauthorized consumption:	8	5.280	acre-ft/yr		5.280	acre-ft/yr
Customer metering inaccuracies:	5	34.556	acre-ft/yr	1.00%		acre-ft/yr
Systematic data handling errors:		8.553	acre-ft/yr	0.25%		acre-ft/yr

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

Apparent Losses: **48.388** acre-ft/yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **169.502** acre-ft/yr

WATER LOSSES: **217.890** acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER: **224.140** acre-ft/yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Item	Grade	Value	Units
Length of mains:	8	128.0	miles
Number of active AND inactive service connections:	10	7,066	
Service connection density:		55	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

Item	Grade	Value	Units
Average operating pressure:	7	100.0	psi

COST DATA

Item	Grade	Value	Units
Total annual cost of operating water system:	10	$7,548,261	$/Year
Customer retail unit cost (applied to Apparent Losses):	9	$4.43	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	5	$1,363.63	$/acre-ft

☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 70 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: Water imported
2: Customer metering inaccuracies
3: Variable production cost (applied to Real Losses)

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Lakeside Water District
Reporting Year: 2018 | 7/2017 - 6/2018

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 70 out of 100 ***

System Attributes:

Apparent Losses:	48.388	acre-ft/yr
+ Real Losses:	169.502	acre-ft/yr
= **Water Losses:**	**217.890**	acre-ft/yr
? Unavoidable Annual Real Losses (UARL):	196.29	acre-ft/yr
Annual cost of Apparent Losses:	$93,376	
Annual cost of Real Losses:	$231,137	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:	6.1%	
	Non-revenue water as percent by cost of operating system:	4.4%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	6.11	gallons/connection/day
	Real Losses per service connection per day:	21.42	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.21	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	169.50	acre-feet/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.86	

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

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:	
Vol. from own sources: Master meter error adjustment:	
Water imported:	
Water imported: master meter error adjustment:	
Water exported:	
Water exported: master meter error adjustment:	water in tanks 6/30/16 16.62 acft & 6/30/17 17.40 change of .78 acft
Billed metered:	Harris icis report "usage by meter type or by pump" +/- fye water accrual, + High Meadow Ranch billed in qb not icis. Qb has 3178.55 which is less then 1/10% difference.
Billed unmetered:	
Unbilled metered:	
Unbilled unmetered:	
Unauthorized consumption:	
Customer metering inaccuracies:	
Systematic data handling errors:	
Length of mains:	
Number of active AND inactive service connections:	Harris icis report "location listing" number on last page, less the number on report "location with inactive accounts" w/old from previous data merger. (note eaiser to take total on last page less the account that are not "old %"
Average length of customer service line:	
Average operating pressure:	
Total annual cost of operating water system:	
Customer retail unit cost (applied to Apparent Losses):	
Variable production cost (applied to Real Losses):	

AWWA Free Water Audit Software: Water Balance

WAS v5.0

American Water Works Association.

Water Audit Report for:	Lakeside Water District	
Reporting Year:	2018	7/2017 - 6/2018
Data Validity Score:	70	

<table>
<tr><td rowspan="8">Own Sources
(Adjusted for known errors)

809.670</td><td rowspan="11">System Input
3,645.170</td><td>Water Exported
0.000</td><td colspan="3">Billed Water Exported</td><td>Revenue Water
0.000</td></tr>
<tr><td rowspan="10">Water Supplied

3,645.170</td><td rowspan="4">Authorized Consumption

3,427.280</td><td rowspan="2">Billed Authorized Consumption

3,421.030</td><td>Billed Metered Consumption (water exported is removed)
3,421.030</td><td rowspan="2">Revenue Water

3,421.030</td></tr>
<tr><td>Billed Unmetered Consumption
0.000</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption

6.250</td><td>Unbilled Metered Consumption
0.000</td><td rowspan="8">Non-Revenue Water (NRW)

224.140</td></tr>
<tr><td>Unbilled Unmetered Consumption
6.250</td></tr>
<tr><td rowspan="6">Water Losses

217.890</td><td rowspan="3">Apparent Losses
48.388</td><td>Unauthorized Consumption
5.280</td></tr>
<tr><td>Customer Metering Inaccuracies
34.556</td></tr>
<tr><td>Systematic Data Handling Errors
8.553</td></tr>
<tr><td rowspan="3">Water Imported

2,835.500</td><td rowspan="3">Real Losses

169.502</td><td>Leakage on Transmission and/or Distribution Mains
Not broken down</td></tr>
<tr><td>Leakage and Overflows at Utility's Storage Tanks
Not broken down</td></tr>
<tr><td>Leakage on Service Connections
Not broken down</td></tr>
</table>

AWWA Free Water Audit Software: Dashboard

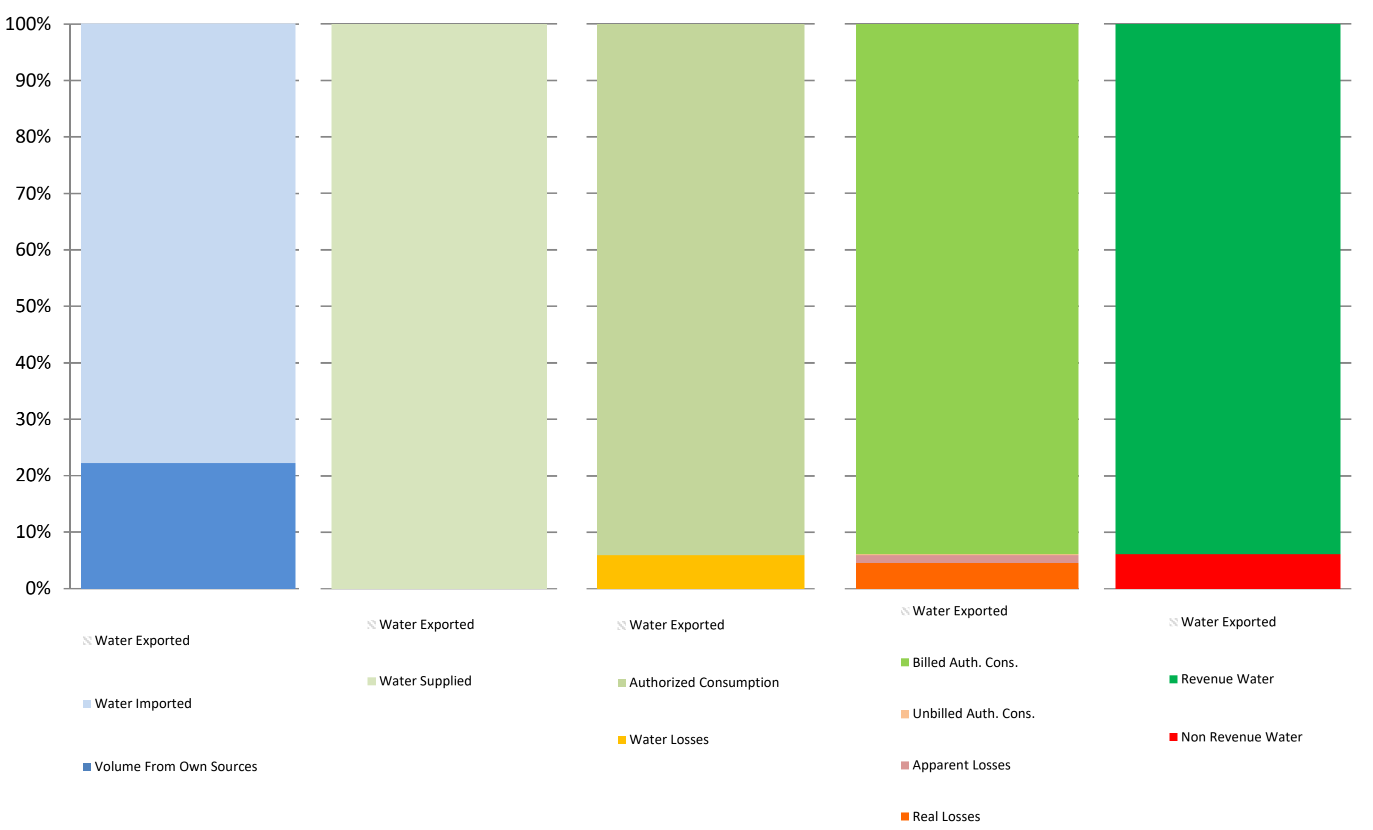
WAS v5.0

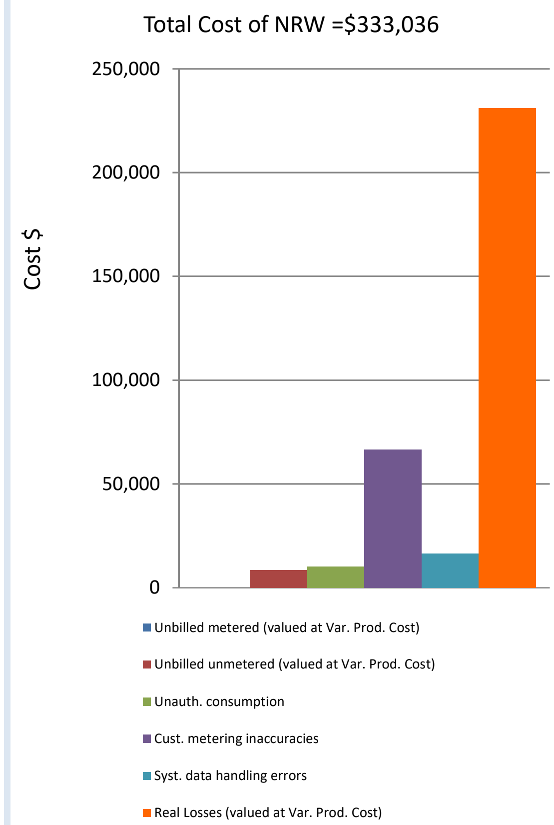
The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

Water Audit Report for:	Lakeside Water District	
Reporting Year:	2018	7/2017 - 6/2018
Data Validity Score:	70	

○ 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
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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	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
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%		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	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	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	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"	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		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	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		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		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		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		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.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Average length of customer service line:	... 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 ...	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	... 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 Worksheet 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 ...
Improvements to attain higher data grading for "Average Length of Customer Service Line" component:		to qualify for 2: 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 ...	to qualify for 4: 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 ...		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data.		to maintain 10: 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 ...	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 ...	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. ...	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 ...	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.
Improvements to attain higher data grading for "Average Operating Pressure" component:		[illegible]	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]
COST DATA											
Total annual cost of operating water system:	[illegible]	[illegible]	[illegible]	Conditions between 2 and 4	[illegible]	Conditions between 4 and 6	[illegible]	Conditions between 6 and 8	[illegible]	Conditions between 8 and 10	[illegible]
Improvements to attain higher data grading for "Total Annual Cost of Operating the Water System" component:		[illegible]	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]
Customer retail unit cost (applied to Apparent Losses):	[illegible]	[illegible]	[illegible]	Conditions between 2 and 4	[illegible]	Conditions between 4 and 6	[illegible]	Conditions between 6 and 8	[illegible]	Conditions between 8 and 10	[illegible]
Improvements to attain higher data grading for "Customer Retail Unit Cost" component:		[illegible]	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]
Variable production cost (applied to Real Losses):	[illegible]	[illegible]	[illegible]	Conditions between 2 and 4	[illegible]	Conditions between 4 and 6	[illegible]	Conditions between 6 and 8	[illegible]	Conditions between 8 and 10	[illegible]
Improvements to attain higher data grading for "Variable Production Cost" component:		[illegible]	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]

AWWA Free Water Audit Software: Customer Service Line Diagrams

WAS v5.0

Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, Lp, for the three most common piping configurations.

Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration Lp = 0 since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where Lp is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building , where Lp is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the Lp will vary notably in a community of different structures, therefore the average Lp value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

Click for more information

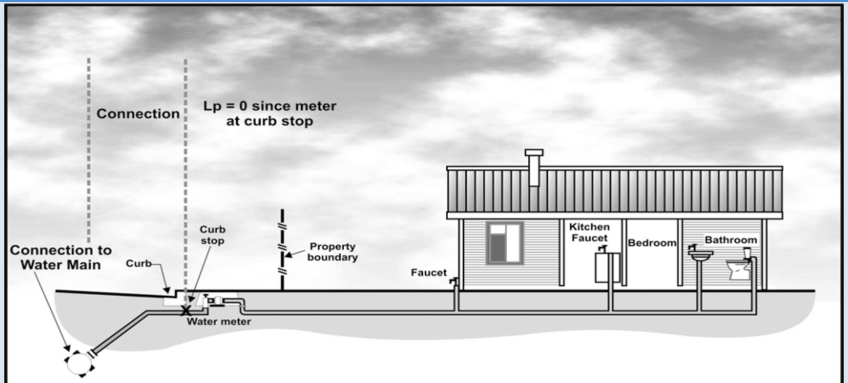


Figure 1

Typical house connection: Meter at curb stop
Not to scale

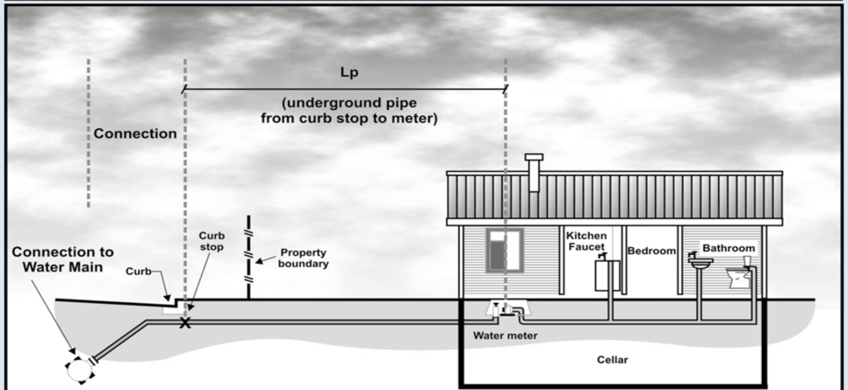


Figure 2

Typical house connection: Meter inside property
Not to scale

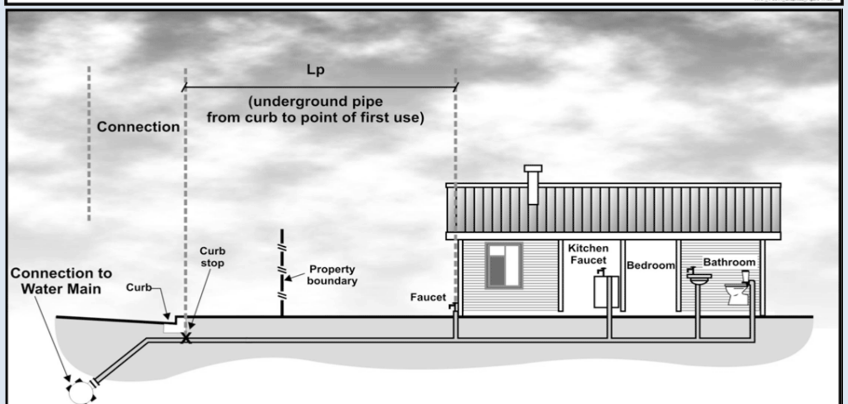
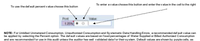


Figure 3

Typical house connection: Unmetered
Not to scale

AWWA Free Water Audit Software: Definitions

Item Name	Description
Apparent Losses	[illegible]
AUTHORIZED CONSUMPTION	[illegible]
Average length of customer service line	[illegible]
Average operating pressure	[illegible]
Billed Authorized Consumption	[illegible]
Billed metered consumption	[illegible]
Billed unmetered consumption	[illegible] … **utilities should be included only in the Water Exported component.**
Customer metering inaccuracies	Apparent water losses caused by the collective under-registration of customer water meters. Many customer water meters gradually wear as large cumulative volumes of water are passed through them over time. This causes the meters to under-register the flow of water. This occurrence is common with smaller residential meters of sizes 5/8-inch and 3/4 inch after they have registered very large cumulative volumes of water, which generally occurs only after periods of years. For meters sized 1-inch and larger - typical of multi-unit residential, commercial and industrial accounts - meter under-registration can occur from wear or from the improper application of the meter; i.e. installing the wrong type of meter or the wrong size of meter, for the flow pattern (profile) of the consumer. For instance, many larger meters have reduced accuracy at low flows. If an oversized meter is installed, most of the time the routine flow will occur in the low flow range of the meter, and a significant portion of it may not be registered. It is important to properly select and install all meters, but particularly large customer meters, size 1-inch and larger. The auditor has two options for entering data for this component of the audit. The auditor can enter a percentage under-registration (typically an estimated value), this will apply the selected percentage to the two categories of metered consumption to determine the volume of water not recorded due to customer meter inaccuracy. Note that this percentage is a composite average inaccuracy for all customer meters in the entire meter population. The percentage will be multiplied by the sum of the volumes in the Billed Metered and Unbilled Metered components. Alternatively, if the auditor has substantial data from meter testing activities, he or she can calculate their own loss volumes, and this volume may be entered directly. Note that a value of zero will be accepted but an alert will appear asking if the customer population is unmetered. Since all metered systems have some degree of inaccuracy, a positive value should be entered. A value of zero in this component is valid only if the water utility does not meter its customer population.
Customer retail unit cost	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied routinely to the components of Apparent Loss, since these losses represent water reaching customers but not (fully) paid for. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell. Finally, the weighted average cost should also include additional charges for sewer, storm water or biosolids processing, but only if these charges are based upon the volume of potable water consumed. For water utilities in regions with limited water resources and a questionable ability to meet the drinking water demands in the future, the Customer Retail Unit Cost might also be applied to value the Real Losses; instead of applying the Variable Production Cost to Real Losses. In this way, it is assumed that every unit volume of leakage reduced by leakage management activities will be sold to a customer. Note: the Free Water Audit Software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet, or $/1,000 litres) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. The monetary units are United States dollars, $.
Infrastructure Leakage Index (ILI)	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilities in operational management of real losses.
Length of mains	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant). It is also recommended to include in this measure the total length of fire hydrant lead pipe. Hydrant lead pipe is the pipe branching from the water main to the fire hydrant. Fire hydrant leads are typically of a sufficiently large size that is more representative of a pipeline than a service connection. The average length of hydrant leads across the entire system can be assumed if not known, and multiplied by the number of fire hydrants in the system, which can also be assumed if not known. This value can then be added to the total pipeline length. Total length of mains can therefore be calculated as: Length of Mains, miles = (total pipeline length, miles) + [{(average fire hydrant lead length, ft) x (number of fire hydrants)} / 5,280 ft/mile] or Length of Mains, kilometres = (total pipeline length, kilometres) + [{(average fire hydrant lead length, metres) x (number of fire hydrants)} / 1,000 metres/kilometre]
NON-REVENUE WATER	= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potential to the utility.
Number of active AND inactive service connections	Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). **Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hyrants should be included in the "Length of mains" parameter.**
Real Losses	Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Revenue Water	Those components of System Input Volume that are billed and have the potential to produce revenue.
Service Connection Density	=number of customer service connections / length of mains
Systematic data handling errors	Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts; and any type of data lapse that results in under-stated customer water consumption in summary billing reports. **Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component.** Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex: monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. Data Transfer Errors result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors. Apparent losses also occur from Data Analysis Errors in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system. Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors. If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the the Billed Authorized Consumption volume. However, if the auditor has investigated the billing system and its controls, and has well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. Note: negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.
Total annual cost of operating the water system	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Unauthorized consumption	Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system. Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.
Unavoidable Annual Real Losses (UARL)	UARL (gallons)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres)=(18.0Lm + 0.8Nc + 25.0Lc) xP where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on determing the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, in gallons: (Lm x 32) + Nc < 3000 or P <35psi in litres: (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.
Unbilled Authorized Consumption	All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.
Unbilled metered consumption	Metered consumption which is authorized by the water utility, but, for any reason, is deemed by utility policy to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. **It does not include water supplied to neighboring utilities (water exported) which may be metered but not billed.**
Unbilled unmetered consumption	Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. **It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case.** This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value. If the water utility has carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities. Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.
Units and Conversions	The user may develop an audit based on one of three unit selections: 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes): Enter Units: 1 — Convert From... Million Gallons (US) = Converts to..... 3.06888329 Acre-feet (conversion factor = 3.06888328973723)
Use of Option Buttons	 **NOTE:** For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above. If a default value is selected, the user does not need to grade the item; a grading value of 5 is automatically applied (however, this grade will not be displayed).
Variable production cost (applied to Real Losses)	The cost to produce and supply the next unit of water (e.g., $/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable. It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost. The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.
Volume from own sources	The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of treated drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.
Volume from own sources: Master meter and supply error adjustment	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration.
Water exported	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water: i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water. Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. **Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.**
Water exported: Master meter and supply error adjustment	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Water imported	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Water imported: Master meter and supply error adjustment	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
WATER LOSSES	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.

WAS v5.0

AWWA Free Water Audit Software:
Determining Water Loss Standing

Water Audit Report for:	Lakeside Water District	
Reporting Year:	2018	7/2017 - 6/2018
Data Validity Score:	70	

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
>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 Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or "top-down", water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or "bottom-up", water audit using the same water audit methodology.

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REFERENCES:
- Alegre, H., Hirner, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272
- Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65
- AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009
- Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.

VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/ 2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the requied data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknoweldgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.

Certified Validation Report

Audit Level 1 Validation Document

Validator Provided

Audit Information:

Utility: Lakeside Water District

PWS ID: 3710013

System Type: Potable

Audit Period: Fiscal Year 2017/18

Utility Representation: Brett Sanders

Validation Date: 9/21/2018 Time: 10:00am

Sufficient Supporting Documents Provided: Yes

Validation Findings & Confirmation Statement:

Key Audit Metrics:

Data Validity Score: 70

Data Validity Band (Level): Level III (51-70)

ILI: 0.86 Real Loss: 21.42 (gal/conn/day) Apparent Loss: 6.11 (gal/conn/day)

Non-revenue water as percent of cost of operating system: 4.4%

Certification Statement by Validator:

This water loss audit report has been Level 1 validated per the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34.

All recommendations on volume derivation and Data Validity Grades were incorporated into the water audit. ☒

Validator Information:

Water Audit Validator: Jeanne Swaringen

Validator Qualifications: Certified California Water Audit Validator

Certified Validation Report

Audit Level 1 Validation Document

Utility Provided

Water System Name:	Water System ID Number:	Water Audit Period:
Lakeside Water District	**3710013**	**07/01/2017 – 06/30/2018**

Water Audit & Water Loss Improvement Steps:

Steps taken in preceding year to increase data validity, reduce real loss and apparent loss as informed by the annual validated water audit:

Change in water storage and water sales accrual was accounted for this period.

Certification Statement by Utility Executive:

This water loss audit report meets the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34 and has been prepared in accordance with the method adopted by the American Water Works Association, as contained in their manual, *Water Audits and Loss Control Programs, Manual M36, Fourth Edition* and in the Free Water Audit Software version 5.

Executive Name (Print)	Executive Position	Signature	Date
BRETT SANDERS	GENERAL MANAGER	Brett Sanders	9-21-18

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:	Jeanne Swaringen
Email Address:	Jeanne@LakesideWater.org
Telephone | Ext.:	619.443.3806
Name of City / Utility:	Lakeside Water District
City/Town/Municipality:	Lakeside
State / Province:	California (CA)
Country:	
Year:	2017 Financial Year
Start Date:	07/2016 Enter MM/YYYY numeric format
End Date:	06/2017 Enter MM/YYYY numeric format
Audit Preparation Date:	9/1/2017
Volume Reporting Units:	Acre-feet
PWSID / Other ID:	

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

? Click to access definition
\+ Click to add a comment

Water Audit Report for: Lakeside Water District
Reporting Year: 2017 | 7/2016 - 6/2017

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: ACRE-FEET 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' ---------->

WATER SUPPLIED

	Grade	Value	Units	Master Meter and Supply Error Adjustments: Grade	Pcnt:	Value:	Units
Volume from own sources:	5	776.200	acre-ft/yr	9		-0.770	acre-ft/yr
Water imported:	7	2,603.700	acre-ft/yr	9			acre-ft/yr
Water exported:	n/a		acre-ft/yr				acre-ft/yr

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

WATER SUPPLIED: 3,380.670 acre-ft/yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

	Grade	Value	Units	Pcnt:	Value:	Units
Billed metered:	7	3,175.080	acre-ft/yr			
Billed unmetered:	n/a		acre-ft/yr			
Unbilled metered:	10	1.910	acre-ft/yr			
Unbilled unmetered:	8	26.860	acre-ft/yr		26.860	acre-ft/yr

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

AUTHORIZED CONSUMPTION: 3,203.850 acre-ft/yr

WATER LOSSES (Water Supplied - Authorized Consumption)
176.820 acre-ft/yr

Apparent Losses

	Grade	Value	Units	Pcnt:	Value:	Units
Unauthorized consumption:		8.452	acre-ft/yr	0.25%		acre-ft/yr

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

	Grade	Value	Units	Pcnt:	Value:	Units
Customer metering inaccuracies:	6	32.091	acre-ft/yr	1.00%		acre-ft/yr
Systematic data handling errors:		7.938	acre-ft/yr	0.25%		acre-ft/yr

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

Apparent Losses: 48.480 acre-ft/yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 128.340 acre-ft/yr

WATER LOSSES: 176.820 acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER: 205.590 acre-ft/yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

	Grade	Value	Units
Length of mains:	8	128.0	miles
Number of active AND inactive service connections:	10	7,102	
Service connection density:		55	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

	Grade	Value	Units
Average operating pressure:	7	70.0	psi

COST DATA

	Grade	Value	Units
Total annual cost of operating water system:	10	$7,133,434	$/Year
Customer retail unit cost (applied to Apparent Losses):	9	$4.40	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	5	$1,615.00	$/acre-ft

☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 71 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: Water imported

2: Volume from own sources

3: Variable production cost (applied to Real Losses)

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: **Lakeside Water District**
Reporting Year: **2017** | **7/2016 - 6/2017**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 71 out of 100 ***

System Attributes:

Apparent Losses:	48.480	acre-ft/yr
+ Real Losses:	128.340	acre-ft/yr
= **Water Losses:**	**176.820**	acre-ft/yr
? Unavoidable Annual Real Losses (UARL):	137.83	acre-ft/yr
Annual cost of Apparent Losses:	$92,919	
Annual cost of Real Losses:	$207,269	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:	6.1%	
	Non-revenue water as percent by cost of operating system:	4.9%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	6.09	gallons/connection/day
	Real Losses per service connection per day:	16.13	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.23	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	128.34	acre-feet/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.93	

* 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

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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:	
Vol. from own sources: Master meter error adjustment:	
Water imported:	
Water imported: master meter error adjustment:	
Water exported:	
Water exported: master meter error adjustment:	water in tanks 6/30/16 16.62 acft & 6/30/17 17.40 change of .78 acft
Billed metered:	Harris icis report "usage by meter type or by pump" +/- fye water accrual, + High Meadow Ranch billed in qb not icis. Qb has 3178.55 which is less then 1/10% difference.
Billed unmetered:	
Unbilled metered:	
Unbilled unmetered:	
Unauthorized consumption:	
Customer metering inaccuracies:	
Systematic data handling errors:	
Length of mains:	
Number of active AND inactive service connections:	Harris icis report "location listing" number on last page, less the number on report "location with inactive accounts" w/old from previous data merger. (note eaiser to take total on last page less the account that are not "old %"
Average length of customer service line:	
Average operating pressure:	
Total annual cost of operating water system:	
Customer retail unit cost (applied to Apparent Losses):	
Variable production cost (applied to Real Losses):	

AWWA Free Water Audit Software: Water Balance

WAS v5.0

American Water Works Association.

Water Audit Report for:	Lakeside Water District
Reporting Year:	2017 — 7/2016 - 6/2017
Data Validity Score:	71

Own Sources / Water Imported	System Input	Water Supplied				Revenue / Non-Revenue Water
		Water Exported 0.000			Billed Water Exported	Revenue Water 0.000
Own Sources (Adjusted for known errors) 776.970	System Input 3,380.670	Water Supplied 3,380.670	Authorized Consumption 3,203.850	Billed Authorized Consumption 3,175.080	Billed Metered Consumption (water exported is removed) 3,175.080	Revenue Water 3,175.080
					Billed Unmetered Consumption 0.000	
				Unbilled Authorized Consumption 28.770	Unbilled Metered Consumption 1.910	Non-Revenue Water (NRW) 205.590
					Unbilled Unmetered Consumption 26.860	
			Water Losses 176.820	Apparent Losses 48.480	Unauthorized Consumption 8.452	
					Customer Metering Inaccuracies 32.091	
					Systematic Data Handling Errors 7.938	
Water Imported 2,603.700				Real Losses 128.340	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

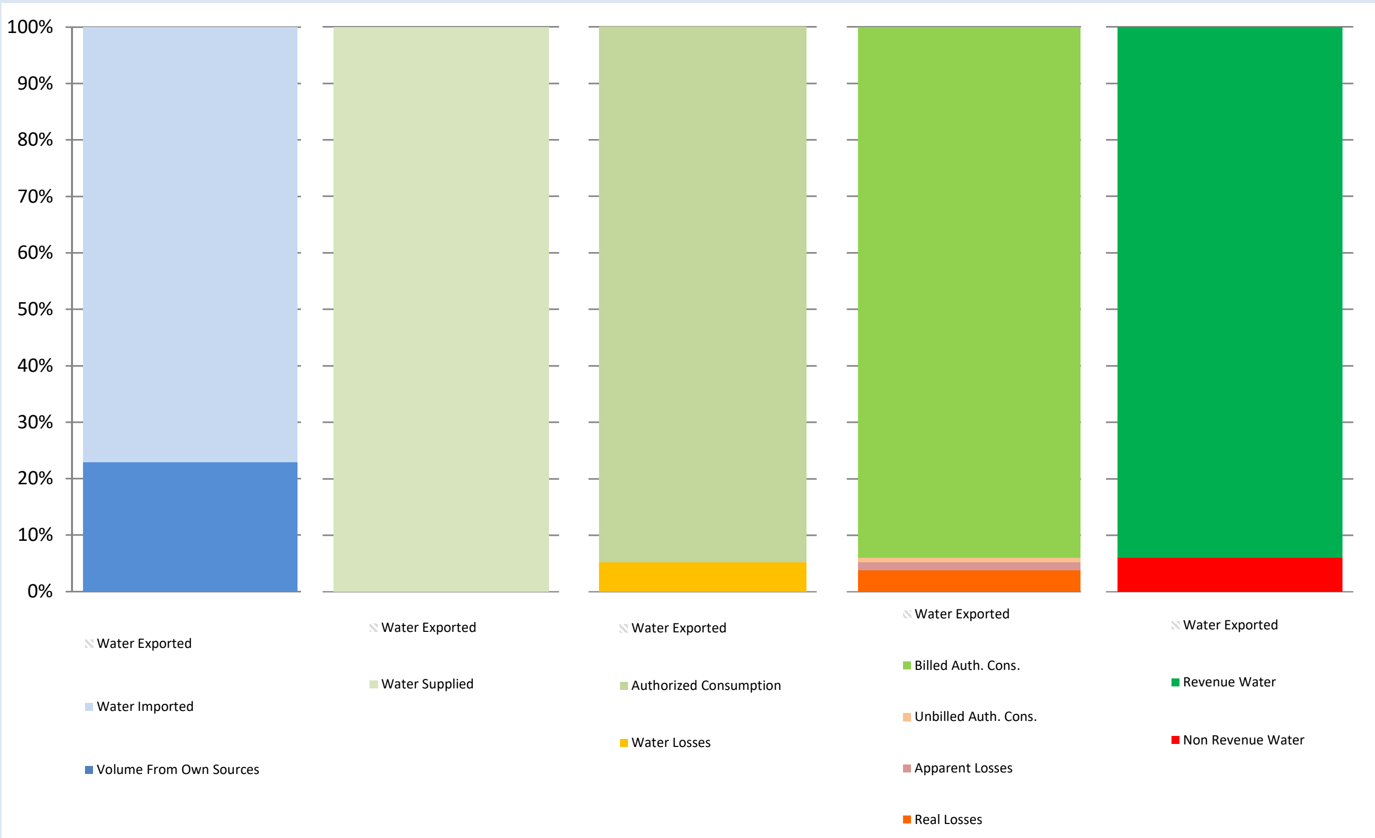
WAS v5.0

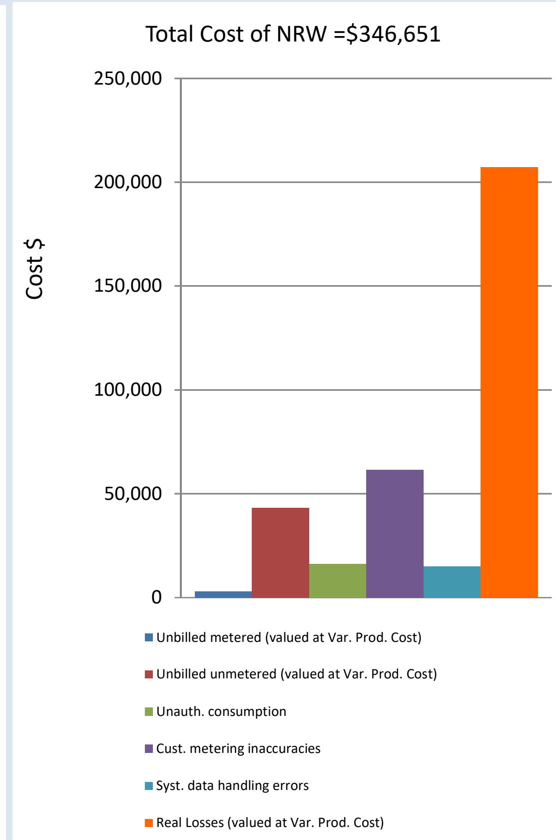
The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

Water Audit Report for:	Lakeside Water District	
Reporting Year:	2017	7/2016 - 6/2017
Data Validity Score:	71	

○ 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

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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 [illegible]	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 [illegible]
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% [illegible]		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 [illegible]
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 [illegible]	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 [illegible]	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 [illegible]	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" [illegible]	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 [illegible]
Improvements to attain higher data grading for "Master meter and [illegible]		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 [illegible]	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 [illegible]		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 [illegible]		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 [illegible]		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 [illegible]		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. [illegible]

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Average length of customer service line:	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	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	location 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:
Improvements to attain higher data grading for "Average Length of Customer Service Line" component:		to qualify for 2: 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	to qualify for 4: 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		to qualify for 6: 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.		to qualify for 8: 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.		to qualify for 10: Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data.		to maintain 10: 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	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	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	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	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.
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	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		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.		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-	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	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	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
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	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
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

AWWA Free Water Audit Software: Customer Service Line Diagrams

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Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, Lp, for the three most common piping configurations.

Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration Lp = 0 since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where Lp is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building , where Lp is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the Lp will vary notably in a community of different structures, therefore the average Lp value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

Click for more information

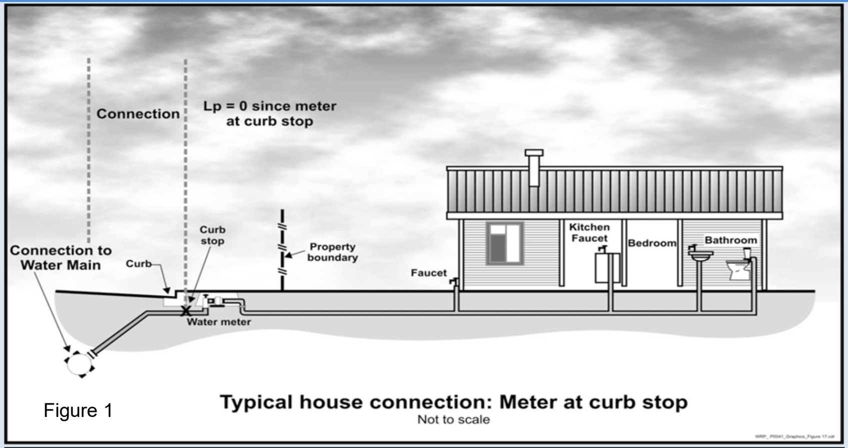


Figure 1

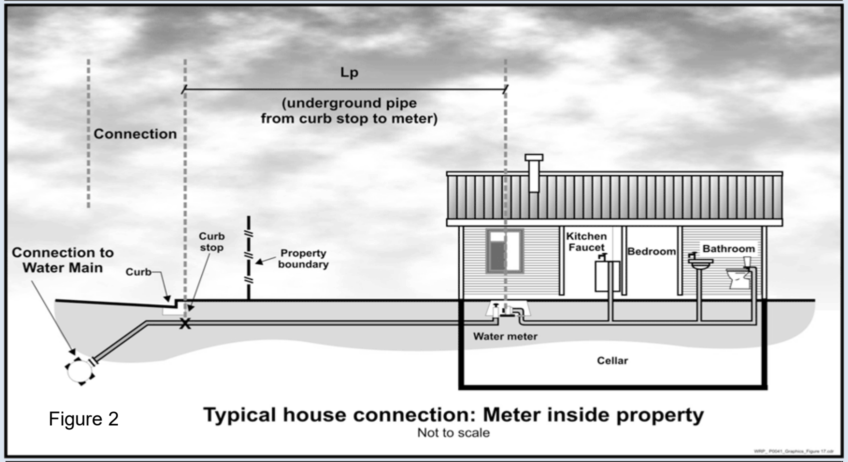


Figure 2

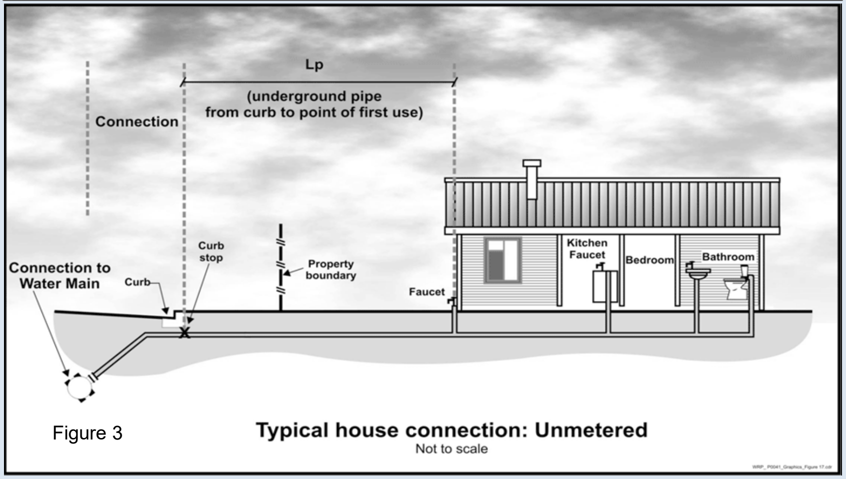


Figure 3

AWWA Free Water Audit Software: Definitions

Item Name	Description

Apparent Losses

= unauthorized consumption + customer metering inaccuracies + systematic data handling errors

[illegible]

Systematic Data Handling Errors result in a direct loss of revenue potential. ...

[illegible]

Service Connection Density

=number of customer service connections / length of mains

Systematic data handling errors

Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts; and any type of data lapse that results in under-stated customer water consumption in summary billing reports.

Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component.

Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex: monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. Data Transfer Errors result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors.

Apparent losses also occur from Data Analysis Errors in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system.

Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors.

If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the the Billed Authorized Consumption volume. However, if the auditor has investigated the billing system and its controls, and has well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. Note: negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.

Total annual cost of operating the water system

These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.

Unauthorized consumption

Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system.

Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.

Unavoidable Annual Real Losses (UARL)

UARL (gallons)=(5.41Lm + 0.15Nc + 7.5Lc) xP,

or

UARL (litres)=(18.0Lm + 0.8Nc + 25.0Lc) xP

where:

Lm = length of mains (miles or kilometres)
Nc = number of customer service connections
Lp = the average distance of customer service connection piping (feet or metres)
(see the Worksheet "Service Connection Diagram" for guidance on deterring the value of Lp)
Lc = total length of customer service connection piping (miles or km)
Lc = Nc X Lp (miles or kilometres)
P = Pressure (psi or metres)

The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both.

NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If,
in gallons:
(Lm x 32) + Nc < 3000 or
P <35psi
in litres:
(Lm x 20) + Nc < 3000 or
P < 25m
then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.

Unbilled Authorized Consumption

All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.

Unbilled metered consumption

Metered consumption which is authorized by the water utility, but, for any reason, is deemed by utility policy to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. **It does not include water supplied to neighboring utilities (water exported) which may be metered but not billed.**

Unbilled unmetered consumption

Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. **It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case.** This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value.

If the water utility has carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities.

Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.

Units and Conversions

The user may develop an audit based on one of three unit selections:
1) Million Gallons (US)
2) Megalitres (Thousand Cubic Metres)
3) Acre-feet
Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes):

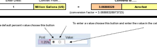
Enter Units:	Convert From...		Converts to.....	
1	Million Gallons (US)	=	3.06888329	Acre-feet

(conversion factor = 3.06888328973723)

Use of Option Buttons

To use the default percent value choose this button

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



NOTE: For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above.

If a default value is selected, the user does not need to grade the item; a grading value of 5 is automatically applied (however, this grade will not be displayed).

Variable production cost (applied to Real Losses)

The cost to produce and supply the next unit of water (e.g., $/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable.

It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost.

The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.

Volume from own sources

The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of treated drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.

Volume from own sources: Master meter and supply error adjustment

An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration.

Water exported

The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water: i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water.

Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. **Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.**

Water exported: Master meter and supply error adjustment

An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.

Water imported

The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.

Water imported: Master meter and supply error adjustment

An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.

WATER LOSSES

= apparent losses + real losses

Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.

AWWA Free Water Audit Software:
Determining Water Loss Standing

Water Audit Report for:	Lakeside Water District	
Reporting Year:	2017	7/2016 - 6/2017
Data Validity Score:	71	

Water Loss Control Planning Guide

Functional Focus Area	Water Audit Data Validity Level / Score				
	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
>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 Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or "top-down", water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or "bottom-up", water audit using the same water audit methodology.

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REFERENCES:

- Alegre, H., Hirner, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272

- Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65

- AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009

- Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.

VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/ 2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the requied data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknoweldgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.

Validator Provided

CA-NV AWWA Water Loss Technical Assistance Program

Wave 4 Water Audit Level 1 Validation Document

Audit Information:

Utility: Lakeside Water District PWS ID: 3710013

System Type: Potable Audit Period: Fiscal Year 2016/17

Utility Representation: Jeanne Swaringen

Validation Date: 9/14/2017 Call Time: 9:00am Sufficient Supporting Documents Provided: Yes

Validation Findings & Confirmation Statement:

Key Audit Metrics:

Data Validity Score: 70 Data Validity Band (Level): Band III (51-70)

ILI: 0.93 Real Loss: 16.13 (gal/conn/day) Apparent Loss: 6.09 (gal/conn/day)

Non-revenue water as percent of cost of operating system: 4.9%

Certification Statement by Validator:

This water loss audit report has been Level 1 validated per the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34.

All recommendations on volume derivation and Data Validity Grades were incorporated into the water audit. ☒

Validator Information:

Water Audit Validator: Lucy Andrews / Kevin Burgers (support) Validator Qualifications: Contractor for CA-NV AWWA Water Loss TAP

CA-NV AWWA Water Loss Technical Assistance Program

Wave 4 Water Audit Level 1 Validation Document

Utility Provided

Water System Name:
Lakeside Water District

Water System ID Number:
3710013

Water Audit Period: Select
07/01/2016 – 06/30/2017

Water Audit & Water Loss Improvement Steps:

Steps taken in preceding year to increase data validity, reduce real loss and apparent loss as informed by the annual validated water audit:

Change in water storage and water sales accrual was accounted for this period.

Certification Statement by Utility Executive:

This water loss audit report meets the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34 and has been prepared in accordance with the method adopted by the American Water Works Association, as contained in their manual, *Water Audits and Loss Control Programs, Manual M36, Fourth Edition* and in the Free Water Audit Software version 5.

BRETT SANDERS	GENERAL MANAGER	Brett Sanders	9-28-17
Executive Name (Print)	Executive Position	Signature	Date

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:	Jeanne Swaringen	
Email Address:	Jeanne@LakesideWater.org	
Telephone | Ext.:	619.443.3806	
Name of City / Utility:	Lakeside Water District	
City/Town/Municipality:	Lakeside	
State / Province:	California (CA)	
Country:		
Year:	2016	Financial Year
Start Date:	07/2015	Enter MM/YYYY numeric format
End Date:	06/2016	Enter MM/YYYY numeric format
Audit Preparation Date:	9/1/2016	
Volume Reporting Units:	Acre-feet	
PWSID / Other ID:		

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

? Click to access definition
\+ Click to add a comment

Water Audit Report for: Lakeside Water District
Reporting Year: 2016 | 7/2015 - 6/2016

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: ACRE-FEET 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

	Grade	Value	Units	Pcnt:	Value:	
Volume from own sources:	5	816.100	acre-ft/yr			acre-ft/yr
Water imported:	7	2,368.900	acre-ft/yr			acre-ft/yr
Water exported:	n/a		acre-ft/yr			acre-ft/yr
WATER SUPPLIED:		**3,185.000**	acre-ft/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

	Grade	Value	Units	Pcnt:	Value:	
Billed metered:	7	2,965.000	acre-ft/yr			
Billed unmetered:	n/a		acre-ft/yr			
Unbilled metered:	n/a		acre-ft/yr			
Unbilled unmetered:		39.813	acre-ft/yr	1.25%		acre-ft/yr

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

AUTHORIZED CONSUMPTION:		**3,004.813**	acre-ft/yr

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

WATER LOSSES (Water Supplied - Authorized Consumption)

180.188 acre-ft/yr

Apparent Losses

	Grade	Value	Units	Pcnt:	Value:	
Unauthorized consumption:		7.963	acre-ft/yr	0.25%		acre-ft/yr

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

	Grade	Value	Units	Pcnt:	Value:	
Customer metering inaccuracies:	6	29.949	acre-ft/yr	1.00%		acre-ft/yr
Systematic data handling errors:		7.413	acre-ft/yr	0.25%		acre-ft/yr

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

Apparent Losses:		**45.324**	acre-ft/yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:		**134.863**	acre-ft/yr
WATER LOSSES:		**180.188**	acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER:		**220.000**	acre-ft/yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

	Grade	Value	Units
Length of mains:	8	128.0	miles
Number of active AND inactive service connections:	8	7,096	
Service connection density:		55	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

	Grade	Value	Units
Average operating pressure:	10	70.0	psi

COST DATA

	Grade	Value	Units
Total annual cost of operating water system:	10	$7,061,227	$/Year
Customer retail unit cost (applied to Apparent Losses):	9	$4.11	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	7	$1,598.00	$/acre-ft

☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 70 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: Water imported
2: Volume from own sources
3: Billed metered

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: Lakeside Water District
Reporting Year: 2016 | 7/2015 - 6/2016

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 70 out of 100 ***

System Attributes:

Apparent Losses:	45.324	acre-ft/yr
+ Real Losses:	134.863	acre-ft/yr
= **Water Losses:**	**180.188**	acre-ft/yr
? Unavoidable Annual Real Losses (UARL):	137.76	acre-ft/yr
Annual cost of Apparent Losses:	$81,145	
Annual cost of Real Losses:	$215,511	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:	6.9%	
	Non-revenue water as percent by cost of operating system:	5.1%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	5.70	gallons/connection/day
	Real Losses per service connection per day:	16.97	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.24	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	134.86	acre-feet/year
	? Infrastructure Leakage Index (ILI) [CARL/UARL]:	0.98	

* 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

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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:	
Vol. from own sources: Master meter error adjustment:	
Water imported:	
Water imported: master meter error adjustment:	
Water exported:	
Water exported: master meter error adjustment:	water in tanks 6/30/15 is 14.53 acft. 6/30/16 16.62 acft change of 2.09 acft
Billed metered:	Harris icis report "usage by meter type or by pump" +/- fye water accrual, + High Meadow Ranch billed in qb not icis.
Billed unmetered:	
Unbilled metered:	
Unbilled unmetered:	
Unauthorized consumption:	
Customer metering inaccuracies:	
Systematic data handling errors:	
Length of mains:	
Number of active AND inactive service connections:	Harris icis report "location listing" number on last page, less the number on report "location with inactive accounts" w/old from previous data merger. (note eaiser to take total on last page less the 1st 2 pages that are not "old %"
Average length of customer service line:	
Average operating pressure:	
Total annual cost of operating water system:	
Customer retail unit cost (applied to Apparent Losses):	
Variable production cost (applied to Real Losses):	

AWWA Free Water Audit Software: Water Balance

WAS v5.0

Water Audit Report for:	Lakeside Water District	
Reporting Year:	2016	7/2015 - 6/2016
Data Validity Score:	70	

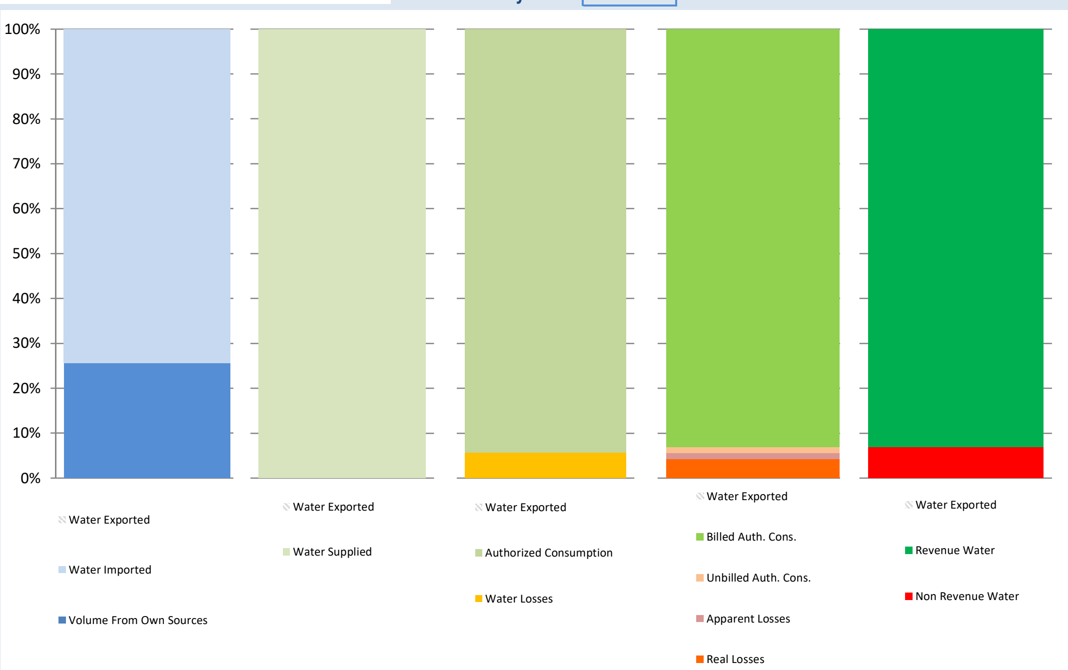
Own Sources (Adjusted for known errors) *816.100*	System Input *3,185.000*	Water Exported *0.000*	Billed Water Exported			Revenue Water 0.000
		Water Supplied *3,185.000*	Authorized Consumption *3,004.813*	Billed Authorized Consumption *2,965.000*	Billed Metered Consumption (water exported is removed) *2,965.000*	Revenue Water 2,965.000
					Billed Unmetered Consumption *0.000*	
				Unbilled Authorized Consumption *39.813*	Unbilled Metered Consumption *0.000*	Non-Revenue Water (NRW) 220.000
					Unbilled Unmetered Consumption *39.813*	
			Water Losses *180.188*	Apparent Losses *45.324*	Unauthorized Consumption *7.963*	
					Customer Metering Inaccuracies *29.949*	
					Systematic Data Handling Errors *7.413*	
Water Imported *2,368.900*				Real Losses *134.863*	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*	

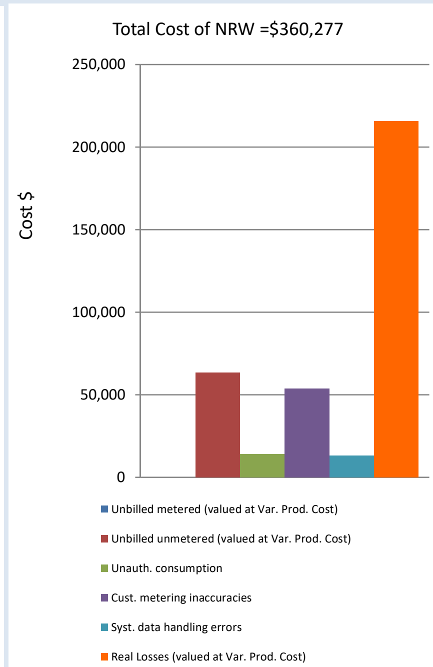
AWWA Free Water Audit Software: Dashboard

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:	Lakeside Water District	
Reporting Year:	2016	7/2015 - 6/2016
Data Validity Score:	70	

○ Show me the VOLUME of Non-Revenue Water
◉ Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software: Grading Matrix

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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 [illegible]	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 [illegible]
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% [illegible]		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 [illegible]
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 [illegible]	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 [illegible]	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 [illegible]	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" [illegible]	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 [illegible]
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 [illegible]	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 [illegible]		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 [illegible]
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% [illegible]	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% [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AWWA Free Water Audit Software: Definitions

WAS v5.0

Item Name	Description
Apparent Losses Find	= unauthorized consumption + customer metering inaccuracies + systematic data handling errors Apparent Losses include all types of inaccuracies associated with customer metering (worn meters as well as improperly sized meters or wrong type of meter for the water usage profile) as well as systematic data handling errors (meter reading, billing, archiving and reporting), plus unauthorized consumption (theft or illegal use). NOTE: Over-estimation of Apparent Losses results in under-estimation of Real Losses. Under-estimation of Apparent Losses results in over-estimation of Real Losses.
AUTHORIZED CONSUMPTION Find	= billed water exported + billed metered + billed unmetered + unbilled metered + unbilled unmetered consumption The volume of metered and/or unmetered water taken by registered customers, the water utility's own uses, and uses of others who are implicitly or explicitly authorized to do so by the water utility; for residential, commercial, industrial and public-minded purposes. Typical retail customers' consumption is tabulated usually from established customer accounts as billed metered consumption, or - for unmetered customers - billed unmetered consumption. These types of consumption, along with billed water exported, provide revenue potential for the water utility. **Be certain to tabulate the water exported volume as a separate component and do not "double-count" it by including in the billed metered consumption component as well as the water exported component.** Unbilled authorized consumption occurs typically in non-account uses, including water for fire fighting and training, flushing of water mains and sewers, street cleaning, watering of municipal gardens, public fountains, or similar public-minded uses. Occasionally these uses may be metered and billed (or charged a flat fee), but usually they are unmetered and unbilled. In the latter case, the water auditor may use a default value to estimate this quantity, or implement procedures for the reliable quantification of these uses. This starts with documenting usage events as they occur and estimating the amount of water used in each event. (See Unbilled unmetered consumption)
View Service Connection Diagram Average length of customer service line Find	This is the average length of customer service line, Lp, that is owned and maintained by the customer; from the point of ownership transfer to the customer water meter, or building line (if unmetered). The quantity is one of the data inputs for the calculation of Unavoidable Annual Real Losses (UARL), which serves as the denominator of the performance indicator: Infrastructure Leakage Index (ILI). The value of Lp is multiplied by the number of customer service connections to obtain a total length of customer owned piping in the system. The purpose of this parameter is to account for the unmetered service line infrastructure that is the responsibility of the customer for arranging repairs of leaks that occur on their lines. In many cases leak repairs arranged by customers take longer to be executed than leak repairs arranged by the water utility on utility-maintained piping. Leaks run longer - and lose more water - on customer-owned service piping, than utility owned piping. If the customer water meter exists near the ownership transfer point (usually the curb stop located between the water main and the customer premises) this distance is zero because the meter and transfer point are the same. This is the often encountered configuration of customer water meters located in an underground meter box or "pit" outside of the customer's building. The Free Water Audit Software asks a "Yes/No" question about the meter at this location. If the auditor selects "Yes" then this distance is set to zero and the data grading score for this component is set to 10. If water meters are typically located inside the customer premise/building, or properties are unmetered, it is up to the water auditor to estimate a system-wide average Lp length based upon the various customer land parcel sizes and building locations in the service area. Lp will be a shorter length in areas of high density housing, and a longer length in areas of low density housing and varied commercial and industrial buildings. General parcel demographics should be employed to obtain a composite average Lp length for the entire system. Refer to the "Service Connection Diagram" worksheet for a depiction of the service line/metering configurations that typically exist in water utilities. This worksheet gives guidance on the determination of the Average Length, Lp, for each configuration.
Average operating pressure Find	This is the average pressure in the distribution system that is the subject of the water audit. Many water utilities have a calibrated hydraulic model of their water distribution system. For these utilities, the hydraulic model can be utilized to obtain a very accurate quantity of average pressure. In the absence of a hydraulic model, the average pressure may be approximated by obtaining readings of static water pressure from a representative sample of fire hydrants or other system access points evenly located across the system. A weighted average of the pressure can be assembled; but be sure to take into account the elevation of the fire hydrants, which typically exist several feet higher than the level of buried water pipelines. If the water utility is compiling the water audit for the first time, the average pressure can be approximated, but with a low data grading. In subsequent years of auditing, effort should be made to improve the accuracy of the average pressure quantity. This will then qualify the value for a higher data grading.
Billed Authorized Consumption	All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Billed metered consumption Find	All metered consumption which is billed to retail customers, including all groups of customers such as domestic, commercial, industrial or institutional. **It does NOT include water supplied to neighboring utilities (water exported) which is metered and billed. Be sure to subtract any consumption for exported water sales that may be included in these billing roles. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.** The metered consumption data can be taken directly from billing records for the water audit period. The accuracy of yearly metered consumption data can be refined by including an adjustment to account for customer meter reading lag time since not all customer meters are read on the same day of the meter reading period. However additional analysis is necessary to determine the lag time adjustment value, which may or may not be significant.
Billed unmetered consumption Find	All billed consumption which is calculated based on estimates or norms from water usage sites that have been determined by utility policy to be left unmetered. This is typically a very small component in systems that maintain a policy to meter their customer population. However, this quantity can be the key consumption component in utilities that have not adopted a universal metering policy. **This component should NOT include any water that is supplied to neighboring utilities (water exported) which is unmetered but billed. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.**
Customer metering inaccuracies Find	Apparent water losses caused by the collective under-registration of customer water meters. Many customer water meters gradually wear as large cumulative volumes of water are passed through them over time. This causes the meters to under-register the flow of water. This occurrence is common with smaller residential meters of sizes 5/8-inch and 3/4 inch after they have registered very large cumulative volumes of water, which generally occurs only after periods of years. For meters sized 1-inch and larger - typical of multi-unit residential, commercial and industrial accounts - meter under-registration can occur from wear or from the improper application of the meter; i.e. installing the wrong type of meter or the wrong size of meter, for the flow pattern (profile) of the consumer. For instance, many larger meters have reduced accuracy at low flows. If an oversized meter is installed, most of the time the routine flow will occur in the low flow range of the meter, and a significant portion of it may not be registered. It is important to properly select and install all meters, but particularly large customer meters, size 1-inch and larger. The auditor has two options for entering data for this component of the audit. The auditor can enter a percentage under-registration (typically an estimated value), this will apply the selected percentage to the two categories of metered consumption to determine the volume of water not recorded due to customer meter inaccuracy. Note that this percentage is a composite average inaccuracy for all customer meters in the entire meter population. The percentage will be multiplied by the sum of the volumes in the Billed Metered and Unbilled Metered components. Alternatively, if the auditor has substantial data from meter testing activities, he or she can calculate their own loss volumes, and this volume may be entered directly. Note that a value of zero will be accepted but an alert will appear asking if the customer population is unmetered. Since all metered systems have some degree of inaccuracy, a positive value should be entered. A value of zero in this component is valid only if the water utility does not meter its customer population.
Customer retail unit cost Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied routinely to the components of Apparent Loss, since these losses represent water reaching customers but not (fully) paid for. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell. Finally, the weighted average cost should also include additional charges for sewer, storm water or biosolids processing, but only if these charges are based upon the volume of potable water consumed. For water utilities in regions with limited water resources and a questionable ability to meet the drinking water demands in the future, the Customer Retail Unit Cost might also be applied to value the Real Losses; instead of applying the Variable Production Cost to Real Losses. In this way, it is assumed that every unit volume of leakage reduced by leakage management activities will be sold to a customer. Note: the Free Water Audit Software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet, or $/1,000 litres) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. The monetary units are United States dollars, $.
Infrastructure Leakage Index (ILI) Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilities in operational management of real losses.
Length of mains Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant). It is also recommended to include in this measure the total length of fire hydrant lead pipe. Hydrant lead pipe is the pipe branching from the water main to the fire hydrant. Fire hydrant leads are typically of a sufficiently large size that is more representative of a pipeline than a service connection. The average length of hydrant leads across the entire system can be assumed if not known, and multiplied by the number of fire hydrants in the system, which can also be assumed if not known. This value can then be added to the total pipeline length. Total length of mains can therefore be calculated as: Length of Mains, miles = (total pipeline length, miles) + [{(average fire hydrant lead length, ft) x (number of fire hydrants)} / 5,280 ft/mile] or Length of Mains, kilometres = (total pipeline length, kilometres) + [{(average fire hydrant lead length, metres) x (number of fire hydrants)} / 1,000 metres/kilometre]
NON-REVENUE WATER Find	= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potential to the utility.
Number of active AND inactive service connections Find	Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). **Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hydrants should be included in the "Length of mains" parameter.**
Real Losses Find	Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Revenue Water	Those components of System Input Volume that are billed and have the potential to produce revenue.
Service Connection Density Find	=number of customer service connections / length of mains
Systematic data handling errors Find	Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts, and any type of data lapse that results in under-stated customer water consumption in summary billing reports. **Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component.** Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex: monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. Data Transfer Errors result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register and conversion factor in the automatic meter reading equipment, or a variety of similar errors. Apparent losses also occur from Data Analysis Errors in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system. Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors. If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the the Billed Authorized Consumption volume. However, if the auditor has investigated the billing system and its controls, and has well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. Note: negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.
Total annual cost of operating the water system Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Unauthorized consumption Find	Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system. Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.
Unavoidable Annual Real Losses (UARL) Find	UARL (gallons)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres)=(18.0Lm + 0.8Nc + 25.0Lc) xP where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on deterring the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, in gallons: (Lm x 32) + Nc < 3000 or P <35psi in litres: (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.
Unbilled Authorized Consumption	All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.
Unbilled metered consumption Find	Metered consumption which is authorized by the water utility, but, for any reason, is deemed by utility policy to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. **It does not include water supplied to neighboring utilities (water exported) which may be metered but not billed.**
Unbilled unmetered consumption Find	Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. **It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case.** This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value. If the water utility has carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities. Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.
Units and Conversions	The user may develop an audit based on one of three unit selections: 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes): Enter Units: 1 · Convert From... **Million Gallons (US)** = **Converts to.....** **3.06888329** **Acre-feet** (conversion factor = 3.06888328973723)
Use of Option Buttons	To use the default percent value choose this button · To enter a value choose this button and enter the value in the cell to the right  **NOTE:** For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above. If a default value is selected, the user does not need to grade the item; a grading value of 5 is automatically applied (however, this grade will not be displayed).
Variable production cost (applied to Real Losses) Find	The cost to produce and supply the next unit of water (e.g., $/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable. It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost. The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.
Volume from own sources Find	The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of treated drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.
Volume from own sources: Master meter and supply error adjustment Find	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration.
Water exported Find	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water: i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water. Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. **Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.**
Water exported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Water imported Find	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Water imported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
WATER LOSSES Find	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.

Water Audit Report for:	Lakeside Water District	
Reporting Year:	2016	7/2015 - 6/2016
Data Validity Score:	70	

Water Loss Control Planning Guide

Functional Focus Area	Water Audit Data Validity Level / Score				
	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
>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 Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or "top-down", water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or "bottom-up", water audit using the same water audit methodology.

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REFERENCES:
- *Alegre, H., Hirner, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272*
- *Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65*
- *AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009*
- *Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.*

VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/ 2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the requied data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknoweldgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.

APPENDIX D

CASGEM Groundwater Elevation Monitoring by Geosyntic

Prepared for

San Diego River Valley Basin
Voluntary Cooperative Groundwater Monitoring Association
and
County of San Diego, Department of Planning and Development Services

GROUNDWATER MONITORING PLAN

SAN DIEGO RIVER VALLEY BASIN
SAN DIEGO COUNTY, CALIFORNIA

CALIFORNIA STATEWIDE GROUNDWATER ELEVATION MONITORING PROGRAM

Prepared by

Geosyntec consultants

engineers | scientists | innovators

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Project Number: LA034401

July 2015

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1 INTRODUCTION

This Groundwater Monitoring Plan (Monitoring Plan) was prepared for the San Diego River Valley Basin Voluntary Cooperative Groundwater Monitoring Association (Voluntary Cooperative) to comply with California Senate Bill X7-6 and the related California Statewide Groundwater Elevation Monitoring (CASGEM) program for the San Diego River Valley Groundwater Basin (Basin No. 9-15).

The Voluntary Cooperative was established in a Memorandum of Understanding (MOU) dated July 10, 2015 (last signatory), in which the City of San Diego, Padre Dam Municipal Water District, Lakeside Water District, and Helix Water District agreed to establish a cooperative groundwater monitoring association pursuant to California Water Code Division 6, Section 10935 to function as a Monitoring Entity. The MOU indicates that the contributing agencies will follow "Scenario C" from the CASGEM Program, Procedures for Monitoring Entity Reporting, dated December 2010, wherein an umbrella Monitoring Entity coordinates and reports groundwater elevation data collected by multiple agencies.

This Monitoring Plan was prepared by Geosyntec Consultants (Geosyntec) as a subcontractor to the County of San Diego, Department of Planning and Development Services (County) in support of the County's goal for County-wide CASGEM compliance. This Monitoring Plan was prepared by Mr. Douglas Baumwirt, PG of Geosyntec, and reviewed by representatives at the County and the Voluntary Cooperative prior to submittal to the California Department of Water Resources (DWR) for approval.

1.1 Objective

The objective of this Monitoring Plan is to outline a detailed scope of work for establishing and maintaining a regular and systematic groundwater elevation monitoring program to demonstrate seasonal and long term trends in the San Diego River Valley Basin, and to make this information readily available to the public in accordance with the CASGEM program requirements.

1.2 Groundwater Monitoring Plan Organization

To address the requirements for a CASGEM-compliant monitoring plan, the remainder of this document is organized into the following sections:

- Section 2, "Basin Background and Description" presents the basin description and location, basin groundwater monitoring history, and basin geology and hydrogeology;
- Section 3, "Rationale for Monitoring Plan and Well Network" describes the rationale for the well network design, presents the specifications for selected monitoring wells, and outlines the monitoring frequency;

- Section 4, “Field Methods” presents the procedures and methods to monitor groundwater elevations;
- Section 5, “Data Reporting” presents the methods of data reporting and the appropriate information to be submitted; and
- Section 6, “References,” presents a list of documents referenced in this Monitoring Plan.

2 BASIN BACKGROUND AND DESCRIPTION

2.1 Basin Location and Description

The San Diego River Valley Basin is located in the eastern portion of the greater San Diego metropolitan area, and is comprised of commingling alluvial valleys of the San Diego River, San Vicente Creek, Forester Creek, Los Coches Creek, and Sycamore Canyon Creek. The San Vicente and El Capitan Reservoirs are located at the eastern and northern edges of the basin, respectively [SDCWA, 2001].

The basin boundary includes an area of 13.8 square miles, and is identified as Groundwater Basin Number 9-15 in the DWR Bulletin 118 [DWR, 2003]. The basin floor is approximately 15 miles long, ranges between approximately 500 and 5,000 feet in width, and ranges from 280 feet mean sea level (MSL) at Mission Gorge to approximately 480 feet MSL at San Vicente Dam and approximately 600 feet MSL at El Capitan Dam [SDCWA, 2001]. The basin, as delineated in Bulletin 118, is slightly skewed from the actual alluvial basin as observed in the field and aerial photographs, and may warrant revision. The Voluntary Cooperative may pursue the basin delineation revision process with the DWR, if deemed warranted. However, the existing Bulletin 118 basin boundary continues to serve as a generally functional representation of the alluvial basin.

Currently four water districts span the basin area, including the City of San Diego Public Utilities, Padre Dam Municipal Water District, Lakeside Water District, and Helix Water District (Figure 1).

2.2 Basin Geology and Hydrogeology Setting

San Diego River Valley Groundwater Basin lies within the two major physiographic zones of the greater San Diego metropolitan area: The Peninsular Range Province in the east and the Pacific Coastal Plain in the west. The eastern portion of the basin is generally surrounded by rolling hills and mountains composed of Mesozoic plutonic and metavolcanic bedrock, whereas the western portion is surrounded by mesas composed of Eocene sedimentary rocks [SDCWA, 2001].

There are four hydrogeologic units within the basin that exhibit water bearing characteristics. These units include the alluvium, unweathered fractured plutonic and metamorphic rocks, residuum, and Eocene sedimentary rocks [SDCWA, 2001]. However, the basin primarily consists of alluvium deposited by San Diego River and its tributaries. The unweathered fractured plutonic and metamorphic rocks, Eocene sedimentary rocks, and residuum lie adjacent to and underlie the alluvium. Therefore, the Quaternary alluvial deposits form the principal water-bearing unit [SDCWA, 2001]. At the point the San Diego River discharges to Mission Gorge in the western, downgradient extent of the basin, a bedrock constriction raises groundwater levels [Izbicki, 1985].

The Quaternary Alluvium consists of young alluvial flood plain deposits and young colluvial deposits (Holocene to late Pleistocene). The flood plain deposits are mostly poorly consolidated, poorly sorted, and permeable. The colluvial deposits encompass mostly poorly consolidated, poorly sorted, sand and silt slope wash deposits. Underlying these deposits are old alluvial flood plain deposits (late to middle Pleistocene) comprised of fluvial sediments deposited on canyon floors consisting of moderately well consolidated, poorly sorted, permeable, commonly slightly dissected gravel, sand, silt and clay-bearing alluvium [Kennedy & Tan, 2005].

In the alluvial aquifer, the most productive materials are the well-sorted sands located in buried river channels, along with a layer of coarse gravel near the base of the aquifer. Alluvium thickness exceeds 200 feet near Lakeside, but typically is approximately 70 feet. The alluvium typically exhibits more silt and clay west of the town of Santee. Groundwater in the alluvium is unconfined with specific yield estimates ranging from 5 percent for partially cemented sands to 22 percent for clean sands. In more productive parts of the alluvium, wells yield up to 2,000 gallons per minute (gpm) [Izbicki, 1985].

Historically, the primary recharge sources were stream runoff from the San Diego River and San Vicente Creek. The El Capitan and San Vicente dams were completed in 1935 and 1943, respectively, and have altered recharge patterns. At present, the most significant recharge occurs from relatively infrequent dam releases and to a lesser extent underflow past the dams. Though the recently raised San Vicente Dam includes a tight grout curtain at the base of the dam; therefore, underflow may be severely limited. The El Capitan Reservoir spilled in 1938, 1939, 1941, 1980, and 1993. San Vicente Reservoir spilled in 1978, 1980, 1983, and 1993 [Anchor, et al, 2004]. Other sources of recharge are stream-flow from Forester Creek and other smaller creeks, precipitation, and discharges from municipal wastewater-treatment plants [DWR, 2004].

Water quality in the alluvial aquifer varies in character. The eastern portion of the basin contains water of a bicarbonate character, while the western portion of the basin contains water of a chloride character. TDS content ranges from 260 to 2,870 mg/L, with higher values to the west and lower values to the east [DWR, 2004].

2.3 Groundwater Level Trends

Groundwater levels within the basin generally correlate with annual fluctuation of precipitation, with peak water levels occurring during winter months and the highest peaks occurring during years with increased annual precipitation. Review of available historical groundwater elevation data also indicate relatively stable elevations, fluctuating less than four feet since 2011.

3 RATIONALE FOR MONITORING PLAN AND WELL NETWORK

This section outlines the basis for selection of monitoring wells included in the CASGEM well network, provides pertinent well characteristics, and discusses the monitoring frequency.

3.1 Well Network Design

The DWR provides minimum quantitative measures of monitoring well density, with recommended spatial densities ranging from 2 to 10 monitoring wells per 100 square miles [DWR, 2010b]. Based on the basin size of 13.8 square miles, this equates to a minimum of 1 to 2 wells. However, to obtain sufficient representation of the various branches of the basin and assess the significance of tributary alluvial valleys, this monitoring plan includes an initial well network comprised of five monitoring wells (Figure 1). Selected wells are expected to be sufficiently distant from pumping wells such that water levels would not be significantly affected, are accessible, and are representative of the unconfined alluvial aquifer within basin.

The rationale for the siting of the five wells is presented below:

- **Helix Water District - HWD-2:** To assess the easternmost, upgradient portion of the basin, one monitoring well (HWD-2) is located within El Monte Valley along the San Diego River, approximately four miles downgradient of the El Capitan Dam. Groundwater elevations measured in this well will represent a baseline of recharge from El Capitan Reservoir and the upgradient watershed. This well will also represent the effect of seasonal trends related to the precipitation and releases from the El Capitan Reservoir.
- **San Diego County Water Authority - AMW-2:** To assess the northernmost, upgradient portion of the basin, one monitoring well (AMW-2) is located within the San Vicente Creekbed, approximately 3,000 feet southwest of the San Vicente Dam. Groundwater elevations measured in this well will represent a baseline of recharge from the San Vicente Reservoir. Although this well lies just outside the delineated San Diego River Valley Basin as provided by Bulletin 118, it is expected to yield data representative of conditions in the northern portion of the basin. The well drilling log for well AMW-2 indicates that it is constructed and screened within alluvium with a thickness greater than 70 feet.
- **City of San Diego - Confluence Well:** To assess conditions downgradient of the confluence of San Vicente Creek and the San Diego River, one monitoring well is located along the San Diego Riverbed, approximately 2,000 feet southwest of the confluence. Groundwater elevations measured in this well will represent cumulative recharge conditions from the upgradient branches that comprise the eastern portion of the basin. Further, this well will represent seasonal trends related to the precipitation and releases from the upgradient reservoirs.

- **Lakeside Water District – Vine Street Well**: Nearby the Confluence Well, to assess variability of groundwater elevations outside the riverbed compared to those measured in the Confluence Well, one monitoring well is located approximately 1,000 feet from the San Diego Riverbed.

- **City of San Diego - Marilla Well:** Similar to the Confluence well, to assess conditions downgradient of the confluence of Los Coches Creek and the San Diego River, one monitoring well is located in the approximate center of the basin. Groundwater elevations measured in this well will represent conditions in the central portion of the basin, and is expected to represent seasonal trends.
- **Padre Dam Municipal Water District - MW-2:** Lastly, to assess conditions in the broadest and most densely developed portion of the basin, one well is located in the San Diego Riverbed, approximately 1,800 feet upgradient of the Carlton Oaks Golf Course to avoid influence from golf course irrigation wells. Groundwater elevations measured in this well will represent conditions in the western portion of the basin, and is expected to represent seasonal trends.

Additional wells may be added to the network based on ongoing data results and analysis of data gaps, as described in Section 3.4 of this monitoring plan.

3.2 Monitoring Frequency

The coastal southern California climate is generally bi-seasonal with rainfall occurring mostly in the winter, and little rainfall throughout most of the rest of the year. Although available hydrographs for wells in the basin are relatively stable, hydrographs support a correlation with precipitation. Therefore, semi-annual monitoring is considered appropriate for the wells to be monitored. Water levels should be measured in the fall during November, before the winter wet period, and in the spring during May, following the wet season; thus capturing both the typical lowest and highest seasonal water levels in the basin.

3.3 Monitoring Well Specifications

Pertinent well specifications as required by the CASGEM program for the five monitoring wells that comprise the San Diego River Valley Basin's CASGEM well network are summarized in Table 1, and the well locations are plotted on Figure 1. In addition to the summary table, individual well specifications have been uploaded to the CASGEM Online Submittal System. If additional wells are added to the network, the additional well specifications would be added to the summary table and the online system.

3.4 Data Gap Analysis

The DWR specifies a data gap as an area where the seasonal and long-term trends in groundwater elevations cannot be determined for the basin, sub-basin, or a portion thereof due to insufficient spatial density of monitoring wells [DWR, 2010a]. Data gaps may exist for a variety of reasons, including a lack of suitable monitoring wells, the lack of groundwater use, access issues; and jurisdictional issues, among others.

Following each annual fall monitoring event, the cumulative data collected to date for the basin should be evaluated by a qualified professional for representativeness, and consistency of data and trends. Following the evaluation, a determination will be made regarding the continued adequacy of the well network to effectively meet CASGEM program objectives. If suspected data gaps are identified, the significance of the data gaps will be evaluated. If warranted, additional wells or replacement wells proposed to address the deficiency will be presented to the DWR in a revised monitoring plan for concurrence.

Spatial Data Gaps

The members to the Voluntary Cooperative have combined to make an effort to report groundwater elevations for wells that give a representative distribution across the San Diego River Valley Groundwater Basin (Figure 1). The overall spatial distribution of the wells covers the portions of the San Diego River Valley groundwater basin where water production occurs and wells exist. Minor spatial data gaps may exist in the northern arm of the basin between proposed monitoring wells AMW-2 and Confluence, and also in the eastern part of the basin from monitoring well HWD-2 to the El Capitan Reservoir.

The Voluntary Cooperative will continue to evaluate and, if necessary, improve the monitoring network. Currently no funding is in place to install additional monitoring wells in the basin to mitigate potential spatial data gaps. If determined to be necessary, and if funding becomes available (potentially through DWR grants), the Voluntary Cooperative will work to close data gaps by construction of dedicated CASGEM monitoring wells.

Well Construction Information Gaps:

The six proposed CASGEM monitoring wells are interpreted to be constructed in an unconfined alluvial aquifer. Well construction information for the proposed wells is available and has been provided for all proposed CASGEM monitoring wells. This effectively eliminates data gaps with respect to well construction information. If additional wells are added to the CASGEM network to close spatial data gaps, the Voluntary Cooperative would continue to provide full construction information for new CASGEM wells.

4 FIELD METHODS

The following guidelines describe the field procedures to be followed when measuring groundwater levels in monitoring wells for the CASGEM program. Following these guidelines will result in collection of representative groundwater level measurements that are repeatable and consistent among the monitoring wells included in the CASGEM program.

4.1 Well Coordinates

Well location coordinates for the selected CASGEM monitoring wells are submitted to the DWR in the CASGEM Online Submittal System. If changes to the Reference Point or ground surface elevations occur, or if additional wells are added to the CASGEM network, coordinates should be defined by a horizontal location and vertical elevation [DWR, 2010]. The horizontal location should be in decimal degrees with latitude and longitude referenced to the North American Datum of 1983 (NAD83). The vertical elevation should be in feet and referenced to the North American Vertical Datum of 1988 (NAVD88).

4.2 Reference Point and Land Surface Datum

The DWR specifies that the Reference Point can be determined by surveying to a benchmark, using a USGS 7.5' quadrangle map, using a digital elevation model (DEM), or using a global positioning system. Additionally, horizontal and vertical coordinates of the Reference Point, and the land-surface datum should be surveyed in accordance with the same coordinate system described above. Because the land-surface datum around a well is subject to change over time, DWR recommends re-measuring the distance between the Reference Point and land-surface datum every three to five years. Establishment of Reference Points for wells in the current monitoring network were professionally surveyed by GPS or by land surveys to obtain vertical control data. Future wells should follow a similar surveying procedure.

To ensure data comparability regarding water level measurements for the same well, a consistent datum or Reference Point location must be established. Therefore, the Reference Point should be marked on the top of the well casing, be as permanent as possible, be clearly visible, and easily located. A clearly labeled photograph of the Reference Point should be included in the well field notes, in addition to a clear description of the Reference Point location.

4.3 Static Water Level

The water level measurement should be confirmed to be representative of the regional static water level. If possible, it should not be affected by pumping in or near the monitored well. If the water level in the well to be measured is affected by pumping, measurement should be delayed until such time as the water level returns to a static level.

If this is not possible (for example, because some nearby well is heavily relied-upon for water supply), the occurrence of pumping should be noted on the field forms. If known, the time since the last pumping in the area should also be noted, even if the water level has rebounded to its static level.

4.4 Measuring Depth to Water

The DWR provides detailed guidelines for measuring water levels in wells for the CASGEM Program [DWR, 2010b]. An electric sounding tape will be used for completing water level measurements. The following step-by-step field procedures for sounding of water levels are consistent with the DWR Field Guidelines for CASGEM Water-Level Measurements. Blank field forms for use during field data collection are included as Appendix A. As previously described, well field forms should be accompanied by a photograph and description of the Reference Point to ensure consistency of measurements.

Before making a measurement:

1. Inspect the electric sounding tape and electrode probe before using it in the field. Check the tape for wear, kinks, frayed electrical connections and possible stretch; the cable jacket tends to be subject to wear and tear. Test that the battery and replacement batteries are fully charged.
2. Check the distance from the electrode probe's sensor to the nearest foot marker on the tape, to ensure that this distance puts the sensor at the zero foot point for the tape. If it does not, a correction must be applied to all depth-to-water measurements. Record this in an equipment log book and on the field form.
3. Prepare the field forms and place any previous measured water-level data for the well into the field folder.
4. After reaching the field site, evaluate and note the general well condition, and check that the Reference Point is clearly marked on the well and is accurately described in the well file or field folder. If a new Reference Point needs to be established, follow the procedures above. If the groundwater elevation in the well is not measureable or the measurement accuracy is questionable, note the reason.
5. Check the circuitry of the electric sounding tape before lowering the electrode probe into the well. To determine proper functioning of the tape mechanism, dip the electrode probe into tap water and observe whether the indicator needle, light, and/or beeper (collectively termed the "indicator" in this document) indicate a closed circuit. For an electric sounding tape with multiple indicators (sound and light, for instance), confirm that the indicators operate simultaneously. If they do not operate simultaneously, determine which is the most accurate and use that one.

6. Wipe off the electrode probe and the lower 5 to 10 feet of the tape with a disinfectant wipe or clean with diluted household chlorine bleach (20:1 water to bleach ratio), rinse with de-ionized or tap water, and dry.

Making a measurement:

1. If the water level was measured previously at the well, use the previous measurement(s) to estimate the length of tape that should be lowered into the well. Preferably, reference measurements that were obtained during the same season of the prior year.
2. Lower the electrode probe slowly into the well until the indicator shows that the circuit is closed and contact with the water surface is made. Avoid letting the tape rub across the top of the well casing. Place the tip or nail of the index finger on the insulated wire at the Reference Point and read the depth to water to the nearest 0.01 foot. Record this value in the column labeled “Tape at RP”, with the appropriate measurement method code and the date and time of the measurement.
3. Lift the electrode probe slowly up a few feet and make a second measurement by repeating step 2 and record the second measurement with the time in the row below the first measurement in Table 5. Make all readings using the same deflection point on the indicator scale, light intensity, or sound so that water levels will be consistent between measurements. If the second measurement does not agree with the first measurement within 0.02 of a foot (0.2 of a foot for production wells), make a third measurement, recording this measurement with the time in the row below the second measurement. If more than two readings are taken, record the average of all reasonable readings.

After making a measurement:

1. Wipe down the electrode probe and the section of the tape that was submerged in the well water, using a disinfectant wipe or clean with diluted household chlorine bleach (20:1 water to bleach ratio), and rinse thoroughly with de-ionized or tap water. Dry the tape and probe and rewind the tape onto the tape reel. Do not rewind or otherwise store a dirty or wet tape.

5 DATA REPORTING

Data collected for the CASGEM program should be submitted to the DWR via their online system at:

https://www.casgem.water.ca.gov/oss/(S(2v12aou15y0sdejhcblwe3uw))/default.aspx

DWR recommends that data be submitted as soon as possible after the measurements are collected, with annual deadlines of January 1st and July 1st. With the recommended monitoring in the fall (November) and spring (May), it is reasonable for the Voluntary Cooperative to collect all semi-annual measurements from the network of monitoring wells and process the data and upload them to the DWR web site within the two months.

In addition to submittal of the required semi-annual groundwater elevation monitoring data, it is recommended that available historical groundwater elevation data (collected prior to Fall 2011) be uploaded to the CASGEM online database. Historical data collected from a CASGEM monitoring well should be uploaded as a "voluntary" data submittal.

The following subsection discusses what information is required and recommended by DWR to be uploaded to the online system for the wells and the water level measurements.

5.1 Online Data Submittal

Data is submitted online using the web address provided above. The various data required or recommended for data submittal is listed in the following sections.

Information for the Voluntary Cooperative's Responsible Party

- The name, address, phone number, contact name, contact e-mail, and any other contact information for pertinent staff.
- The name, address, phone number, contact name, contact e-mail, and any other contact information of the respective Water District staff.

Information Required for Each Well

- Local well identification and/or State well number
- Reference Point elevation (feet, NAVD88)
- Reference Point description
- The elevation of the Land Surface Datum (feet, NAVD88)
- Method of determining elevation
- Accuracy of elevation method
- Well use

- Well status (active, inactive, or unknown)
- Well coordinates (decimal latitude/longitude, NAD83)
- Method of determining coordinates
- Accuracy of coordinate method
- Well Completion type
- Total well depth (feet)
- Top and bottom of screened intervals (up to 10 intervals)
- Well Completion Report number (if available)
- Groundwater basin of well (or sub-basin or portion)
- Written description of well location
- Any additional comments
- Designation if the proposed monitoring well is “CASGEM” or “Voluntary”
- County where the well is located

Information for Each Groundwater Elevation Data Point

- CASGEM Well ID Number
- The local or State well number provided by the Monitoring Entity
- The measurement date and time (PST/PDT with military time/24 hour format)
- The reference point elevation of the well (feet, NAVD88)
- The land surface datum elevation at the well (feet, NAVD88)
- The depth to water below the Reference Point (feet)
- The depth reading in feet at the Water Surface (WS)
- The method of measuring the depth to water (e.g. electric sounding tape, pressure transducer)
- The accuracy of the method of measuring the depth to water
- Measuring agency identification
- Measurement Identification (“CASGEM” or “Voluntary”)
- The Measurement Quality Codes
  - The “No Measurement” code, if applicable
  - The “Questionable Measurement” code, if applicable
- Any additional comments about measurement, if applicable

Measurement Quality

The “No Measurement” and “Questionable Measurement” codes are standard codes available on the online system. These codes will allow for the reporting of issues that potentially affect the quality of a measurement, such as pumping at a nearby well, obstructions present in the well casing, or the presence of oil on the water surface on the well.

6 REFERENCES

Anchor Environmental CA, L.P. (Anchor) et al, 2004. San Diego River Watershed Management Plan, Baseline Assessment Subtask 10.8, Prepared for San Diego River Watershed Workgroup. August 2004.

California Department of Water Resources (DWR), 2004. California's Groundwater; Bulletin 118; Basin 9-15; San Diego River Valley Groundwater Basin. February 2004.

California Department of Public Works (DPW), 1934. Estimate of Storage Capacity, Mission Valley and Upper San Diego River Groundwater Basins., Unumbered report. 16 p.

California Department of Water Resources (DWR), 2010a. California Statewide Groundwater Elevation Monitoring (CASGEM) Program Procedures for Monitoring Entity Reporting. December 2010.

California Department of Water Resources (DWR), 2010b. Groundwater Elevation Monitoring Guidelines. December 2010.

California Department of Water Resources, 1975. California's Groundwater. Bulletin 118.

Izbicki, J.A., 1985. Evaluation of the Mission, Santee, and Tijuana Hydrologic Subareas for Reclaimed Water Use, San Diego County, California. U.S. Geologic Survey Water Resources Investigations Report 85-4032.

Kennedy and Tan, 2005. Geology of the San Diego 30'x60' Quadrangle, California. 2005.

San Diego County Water Authority, 2001. Groundwater Management Planning Study Santee-El Monte Basin. Phase III Report. Prepared by Department of Geological Sciences, San Diego State University. January, 2001.

TABLE

Table 1
CASGEM Well Specifications
San Diego River Valley Basin
San Diego County, California

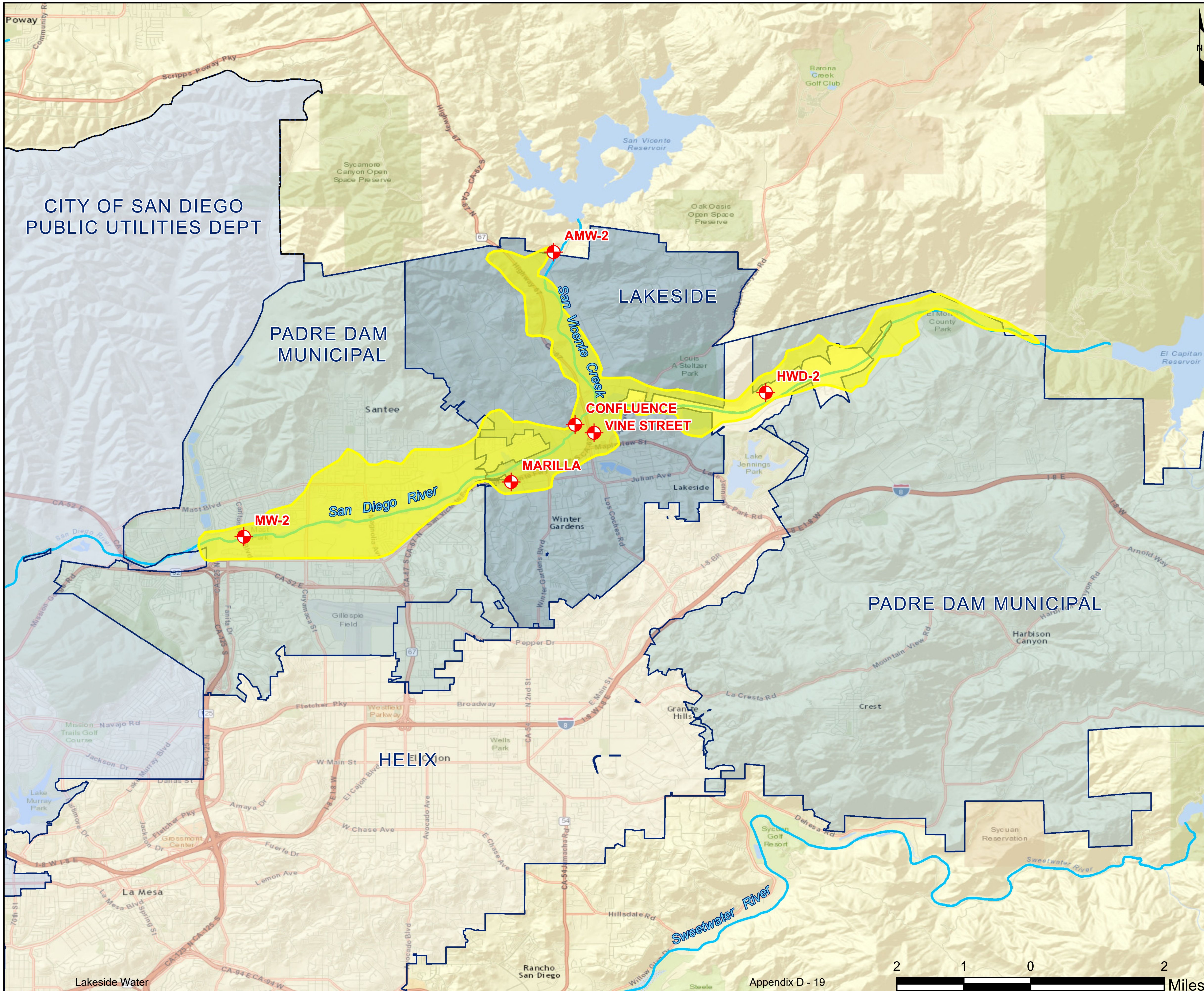
Geosyntec consultants

Local Well Name	State Well ID or Master Site Code	Water District	Groundwater Basin	Well Use	CASGEM Well Type	Well Completion Type	Well Status	Latitude	Longitude	Reference Point (RP) Elevation (NAVD88 ft)	Land Surface Elevation (NAVD88 ft)	Determination Method	Method Accuracy (ft)	Total Depth (ft)	Perforated Interval Depths (ft bgs)	Well Location Descriptions
MW-2	328442N1169971W001	Padre Dam	San Diego River Valley	Monitoring	CASGEM	Single Well	Active	32.84419663	-116.997148	329.12	327.00	Survey	0.01	36.3	14.5 - 34.5	9125 Carlton Hills Blvd; Mast Park parking lot - south side, near curb, separating the first and second sets of parking spots.
Marilla Well	328556N1169394W001	City of San Diego	San Diego River Valley	Monitoring	CASGEM	Single Well	Active	32.855608	-116.939431	378.34	376.43	GPS	0.1	35.0	15.0 - 35.0	Vacant lot north of Woodside Ave; east of Marilla Drive.
Confluence	329593N1169256W001	City of San Diego	San Diego River Valley	Monitoring	CASGEM	Single Well	Active	32.8675	-116.9256	393.21	390	GPS	0.1	38.0	18.0 - 38.0	Within Andersen Drilling yard.
Vine Street	328662N1169215W001	Lakeside	San Diego River Valley	Monitoring	CASGEM	Single Well	Active	32.866239	-116.921467	402	400	Google Earth	1.0	240.0	70-220	10435 Vine Street in Lakeside.
AMW-2	329054N1169302W001	SDCWA	San Diego River Valley	Monitoring	CASGEM	Single Well	Active	32.90537	-116.93024	451.2	450	GPS	0.1	70.0	30 - 60	3,000 ft southwest of San Vicente Dam, located in southeast corner of paved area surrounding administration building.
HWD-2	328749N1168843W001	Helix	San Diego River Valley	Monitoring	CASGEM	Single Well	Active	32.8749	-116.8843	447.24	446.29	GPS	0.1	65.0	5 - 65	South of Willow Road, approx. 0.5 miles east of Stelzer Co. Park; Santee El Monte Basin - 4,000 ft N/NE of Lake Jennings between Willow Rd and SD River

Notes:
ft bgs: feet below ground surface
--: Not Applicable

FIGURE

San Diego River Valley Basin CASGEM Well Network



CASGEM Wells

San Diego River Valley Basin

Water District

Helix

Padre Dam Municipal

Lakeside

City of San Diego Public Utilities Dept

San Diego River Valley Basin
Voluntary Cooperative Groundwater Monitoring Association

City of San Diego PUBLIC UTILITIES Water & Wastewater

Helix Water District

LAKESIDE WATER DISTRICT

PADRE DAM Municipal Water District

Figure 1
July 2015

APPENDIX A
FIELD FORMS

State of California | DEPARTMENT OF WATER RESOURCES | California Natural Resources Agency

WELL DATA

State Well No. ______________

Region ______________

OWNER	SITE ID
ADDRESS	WELL NAME
TENANT	OTHER NO.
ADDRESS	

TYPE OF WELL ☐ SPECIAL STUDIES ☐ MONTHLY ☐ SEMI ANNUAL ☐ WATER QUALITY

LOCATION COUNTY BASIN NO.

U.S.G.S. QUAD. QUAD NO.

1/4 1/4 SECTION TWP. RGE. ☐MD ☐SB ☐H BASE & MERIDIAN

COORDINATES (NAD83) LONGITUDE LATITUDE SOURCE

DESCRIPTION

REFERENCE POINT DESCRIPTION

WHICH IS FT. ABOVE ☐ BELOW ☐ LAND SURFACE DATUM GROUND ELEVATION FT.

REFERENCE POINT ELEVATION FT. DETERMINED FROM

WELL USE CONDITION DEPTH FT.

CASING, SIZE IN., PERFORATIONS

MEASUREMENTS BY ☐ DWR ☐ USGS ☐ USBR ☐ COUNTY ☐ IRR. DIST. ☐ WATER DIST. ☐ CONS. DIST. ☐ OTHER

GRAVEL PACK? ☐ YES ☐ NO	DEPTH TO TOP GR.	DEPTH TO BOT GR.
TYPE OF MATERIAL	PERM. RATING	THICKNESS
CHIEF AQUIFER	DEPTH TO TOP AQ.	DEPTH TO BOT. AQ.
SUPP. AQUIFER	DEPTH TO TOP AQ.	DEPTH TO BOT. AQ.

DRILLER DATE DRILLED LOG NUMBER (DWR 188)

WELL PUMP TYPE MAKE MODEL SERIAL NO.

WATER ANALYSIS MIN. SAN. H.M.

POWER SOURCE WATER LEVELS AVAILABLE? ☐ YES ☐ NO

H.P. MOTOR SERIAL NO PERIOD OF RECORD BEGIN END

ELEC. METER NO. TRANSFORMER NO. COLLECTING AGENCY

SIZE OF DISCHARGE PIPE IN.

YIELD G.P.M. PUMPING LEVEL FT. PROD. REC. PUMP TEST YIELD

SKETCH

N

REMARKS

RECORDED BY

DATE

DWR 429 (Rev. 7/10)

APPENDIX E

DWR SBX7-7 Tables

SB X7-7 Table 0: Units of Measure Used in 2020 UWMP* *(select one from the drop down list)*
Acre Feet
**The unit of measure must be consistent throughout the UWMP, as reported in Submittal Table 2-3.*
NOTES:

SB X7-7 Table 2: Method for 2020 Population Estimate	
Method Used to Determine 2020 Population (may check more than one)	
☐	**1. Department of Finance** (DOF) or **American Community Survey** (ACS)
☐	**2. Persons-per-Connection Method**
☑	**3. DWR Population Tool**
☐	**4. Other** DWR recommends pre-review
NOTES:	

SB X7-7 Table 3: 2020 Service Area Population	
2020 Compliance Year Population	
2020	31,016
NOTES: used DWR population too = 31,016 for 2020 but popluation is actually estimated at 35,000	

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s), Meter Error Adjustment
Complete one table for each source.

Name of Source	SDCWA connection		
This water source is *(check one)* **:**			
☐	The supplier's own water source		
☑	A purchased or imported source		
Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional* *(+/-)*	Corrected Volume Entering Distribution System
	2,879	-	2,879

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.* [2] ***Meter Error Adjustment*** *- See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s) Meter Error Adjustment
Complete one table for each source.

Name of Source	LWD Wells		
This water source is *(check one)* **:**			
☑	The supplier's own water source		
☐	A purchased or imported source		
Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional* *(+/-)*	Corrected Volume Entering Distribution System
	593		593

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.* [2] ***Meter Error Adjustment*** *- See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES:

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s), Meter Error Adjustment
Complete one table for each source.

Name of Source	Enter Name of Source 3		
This water source is *(check one)* **:**			
☐	The supplier's own water source		
☐	A purchased or imported source		
Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional* *(+/-)*	Corrected Volume Entering Distribution System
			0

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.* [2] ***Meter Error Adjustment*** *- See guidance in Methodology 1, Step 3 of Methodologies Document*

NOTES:

SB X7-7 Table 4-A: 2020 Volume Entering the Distribution System(s), Meter Error Adjustment
Complete one table for each source.

Name of Source	Enter Name of Source 4		
This water source is *(check one)* **:**			
☐	The supplier's own water source		
☐	A purchased or imported source		
Compliance Year 2020	Volume Entering Distribution System [1]	Meter Error Adjustment [2] *Optional* *(+/-)*	Corrected Volume Entering Distribution System
			0

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.* [2] ***Meter Error Adjustment*** *- See guidance in Methodology 1, Step 3 of Methodologies Document*

SB X7-7 Table 4: 2020 Gross Water Use							
Compliance Year 2020	2020 Volume Into Distribution System *This column will remain blank until SB X7-7 Table 4-A is completed.*	2020 Deductions					2020 Gross Water Use
		Exported Water *	Change in Dist. System Storage* (+/-)	Indirect Recycled Water *This column will remain blank until SB X7-7 Table 4-B is completed.*	Water Delivered for Agricultural Use*	Process Water *This column will remain blank until SB X7-7 Table 4-D is completed.*	
	3,472		(4)	-		-	**3,476**

* **Units of measure (AF, MG , or CCF)** must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.

NOTES:

SB X7-7 Table 4-B: 2020 Indirect Recycled Water Use Deduction *(For use only by agencies that are deducting indirect recycled water)*									
2020 Compliance Year	**2020 Surface Reservoir Augmentation**					**2020 Groundwater Recharge**			**Total Deductible Volume of Indirect Recycled Water Entering the Distribution System**
	Volume Discharged from Reservoir for Distribution System Delivery[1]	Percent Recycled Water	Recycled Water Delivered to Treatment Plant	Transmission/ Treatment Loss[1]	Recycled Volume Entering Distribution System from Surface Reservoir Augmentation	Recycled Water Pumped by Utility[1,2]	Transmission/ Treatment Losses[1]	Recycled Volume Entering Distribution System from Groundwater Recharge	
			-		-			-	-

[1] ***Units of measure (AF, MG , or CCF)*** *must remain consistent throughout the UWMP, as reported in SB X7-7 Table 0 and Submittal Table 2-3.* [2] *Suppliers will provide supplemental sheets to document the calculation for their input into "Recycled Water Pumped by Utility". The volume reported in this cell must be less than total groundwater pumped - See Methodology 1, Step 8, section 2.c.*

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C: 2020 Process Water Deduction Eligibility (For use only by agencies that are deducting process water) Choose Only One	
☐	**Criteria 1**- Industrial water use is equal to or greater than 12% of gross water use. Complete SB X7-7 Table 4-C.1
☐	**Criteria 2** - Industrial water use is equal to or greater than 15 GPCD. Complete SB X7-7 Table 4-C.2
☑	**Criteria 3** - Non-industrial use is equal to or less than 120 GPCD. Complete SB X7-7 Table 4-C.3
☐	**Criteria 4** - Disadvantaged Community. Complete SB x7-7 Table 4-C.4
NOTES:	

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C.1: 2020 Process Water Deduction Eligibility *(For use only by agencies that are deducting process water using Criteria 1)*

Criteria 1
Industrial water use is equal to or greater than 12% of gross water use

2020 Compliance Year	2020 Gross Water Use Without Process Water Deduction	2020 Industrial Water Use	Percent Industrial Water	**Eligible for Exclusion Y/N**
	3,476	312	9%	NO

NOTES:

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C.2: 2020 Process Water Deduction Eligibility *(For use only by agencies that are deducting process water using Criteria 2)*				
Criteria 2 Industrial water use is equal to or greater than 15 GPCD				
2020 Compliance Year	2020 Industrial Water Use	2020 Population	2020 Industrial GPCD	**Eligible for Exclusion Y/N**
		31,016	-	NO
NOTES:				

Data from this table will not be entered into WUEdata. Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C.3: 2020 Process Water Deduction Eligibility *(For use only by agencies that are deducting process water using Criteria 3)*

Criteria 3
Non-industrial use is equal to or less than 120 GPCD

2020 Compliance Year	2020 Gross Water Use Without Process Water Deduction *Fm SB X7-7 Table 4*	2020 Industrial Water Use	2020 Non-industrial Water Use	2020 Population *Fm SB X7-7 Table 3*	Non-Industrial GPCD	**Eligible for Exclusion Y/N**
	3,476	312	3,164	31,016	91	YES

NOTES:

Data from this table will not be entered into WUEdata.
Instead, the entire table will be uploaded to WUEdata as a separate upload in Excel format.

SB X7-7 Table 4-C.4: 2020 Process Water Deduction Eligibility ***(For use only by agencies that are deducting process water using Criteria 4)***

Criteria 4
Disadvantaged Community. A "Disadvantaged Community" (DAC) is a community with a median household income less than 80 percent of the statewide average.

SELECT ONE
"Disadvantaged Community" status was determined using one of the methods listed below:

1. IRWM DAC Mapping tool https://gis.water.ca.gov/app/dacs/

☐ If using the IRWM DAC Mapping Tool, include a screen shot from the tool showing that the service area is considered a DAC.

2. 2020 Median Income

☐

California Median Household Income*		Service Area Median Household Income	Percentage of Statewide Average	**Eligible for Exclusion? Y/N**
2020	**$75,235**		0%	YES

*California median household income 2015 -2019 as reported in US Census Bureau QuickFacts.

NOTES

SB X7-7 Table 5: 2020 Gallons Per Capita Per Day (GPCD)		
2020 Gross Water ***Fm SB X7-7 Table 4***	**2020 Population** ***Fm SB X7-7 Table 3***	**2020 GPCD**
3,476	31,016	**100**
NOTES:		

SB X7-7 Table 9: 2020 Compliance

Actual 2020 GPCD[1]	Optional Adjustments to 2020 GPCD					2020 Confirmed Target GPCD [1, 2]	**Did Supplier Achieve Targeted Reduction for 2020?**
	Enter "0" if Adjustment Not Used						
	Extraordinary Events[1]	Weather Normalization[1]	Economic Adjustment[1]	TOTAL Adjustments[1]	Adjusted 2020 GPCD [1] *(Adjusted if applicable)*		
100	-	-	-	-	100	149	**YES**

[1] *All values are reported in GPCD*

[2] ***2020 Confirmed Target GPCD*** *is taken from the Supplier's SB X7-7 Verification Form Table SB X7-7, 7-F.*

NOTES:

APPENDIX F

Board Adoption of the UWMP

RESOLUTION NO. 21-07

**RESOLUTION OF THE BOARD OF DIRECTORS
OF THE LAKESIDE WATER DISTRICT
ADOPTING THE URBAN WATER MANAGEMENT PLAN AND WATER SHORTAGE CONTINGENCY PLAN**

WHEREAS, The Urban Water Management Planning Act (Water Code Section 10610 et. seq.) requires every urban water supplier, as defined in the act, to prepare and adopt an urban management plan; and

WHEREAS, the Lakeside Water District is an urban water supplier within the meaning of the act; and

WHEREAS, in cooperation with the San Diego County Water Authority, the District has drafted such a plan, a public hearing thereon following publication within the jurisdiction of the District of a notice of the time and place of the hearing pursuant to section 6066 of the Government Code; and

WHEREAS, it is in the interest of the District to adopt an urban water management plan;

NOW, THERFORE, IT IS HEREBY RESOLVED, DETERMINED AND ORDERED by the Board of Directors of the Lakeside Water District as follows:

1. That the URBAN WATER MANAGEMENT PLAN and the WATER SHORTAGE CONTINGENCY PLAN FOR THE LAKESIDE WATER DISTRICT, 2020, be and it is approved and adopted as the plan required by the Urban Water Management Planning Act.

2. That the District shall implement its plan in accordance with the schedule set forth in the plan.

3. That the Secretary of the District be and he is authorized and directed to file with the Department of Water Resources of the State of California a copy of the District's plan no later than 30 days after its adoption.

PASSED AND ADOPTED at a regular adjourned meeting of the Board of Directors of the Lakeside Water District held on August 3, 2021, by the following vote to wit:

AYES: Hilliker, Jenkins, Johnson, Neumeister, Robak
NOES:
ABSENT:

Steve Robak, President
Board of Directors

Brett Sanders, Secretary
Lakeside Water District

APPENDIX G

District Rates and Fees

2.13-2(B) **District Water Billings including the Meter Charge and the Commodity Charge**

1. **Meter Charge**; is a standard bi-monthly charge which varies with the size of the meter. The charge is made to recover the cost of customer service, meter reading, repair and replacement of meters, services, valves, meter boxes, etc., by meters of various sizes.

a. All permanent meter installations shall be subject to the following base charges whether or not water is used:

as of 01/01/2021

Meter Size	Each Billing	CWA
5/8”	$ 13.80	$ 8.30
¾”	16.96	8.30
1”	23.23	13.35
1 ½”	33.93	25.10
2”	60.26	43.50
3”	99.76	80.30
4”	138.00	137.15
6”	169.40	250.85

For land outside the District all water service charges shall be doubled.

b. Billings covering a service period of one month or less shall be billed for one half the standard meter charge. Billings covering a service period of more than one month shall be billed the full standard meter charge.

2.13-2(B) (2) Commodity Charge is a unit charge for the amount of water used. This charge includes water purchases, treatment, pumping to reservoirs less than elevation 1003' mean sea level (msl), and other costs attributable directly to the amount of water used. (2x outside of District).

(a) **Commodity Charge** **as of 01/01/2021**

Lifeline Rate (First 12 units, excluding Commercial, Industrial and multi-family dwellings).

$4.56

Standard Rate (Usage over 12 units).

$4.65

2.13-2(C) **Service Charges**

1.	Start – Up Charge	$	20.00
2.	Charge for returned payments		25.00
3.	Red Tags (48 Hour Notice)		20.00
4.	Shut Off for Non-Payment		50.00
5.	Turn On after 4:00p.m.		75.00
6.	Charge for Special Reading		10.00
7.	Service Call Charge		15.00
8.	Cut Lock Charge		100.00
9.	Meter Re-Installation		60.00
10.	Additional “hold” charge (after red tag)		20.00

2.13-2(D) **Delinquent Accounts**

Delinquent accounts shall have a late payment charge added. If not paid on or before the due date, the account becomes past due and a late payment charge of 10% of the bill will be added. In the event the late payment charge is not included with payment of the past due bill, it will be added to the following bill. If not paid with the following bill, the account will be subject to turnoff.

2.13-2(E) Accounts which have not been paid by the due date on the delinquent bill will have a “red tag” hung on or near their house and a $20 charge will be added to the bill. The customer then has an additional 48 hours to pay their bill. If after the “red tag” has been hung and the customer requests additional time, there may be a $20 additional “hold” charge with a maximum of a five (5) day extension granted only once per six months. Accounts which have not been paid in full by the date on the “red tag” will be shut-off for non-payment. Accounts terminated for non-payment shall have a $50 turn-off charge added.

If the customer has not paid to have service reinstated, the meter should be checked once a week to make sure the service is still off and locked.

After three weeks, if the meter is still off and locked, with no contact from the customer, the meter should be removed and the curb stop locked. A deposit and reinstallation charge will be required before the meter can be replaced and service reestablished.

A lien will be filed for all charges which remain unpaid.

APPENDIX H

Notices to County

LAKESIDE WATER DISTRICT

May 18, 2021

County of San Diego
Attn: Bill Morgan
5510 Overland Avenue, Suite 410
San Diego, CA 92123

Regarding: Notice of Lakeside Water District's
2020 Urban Water Management Plan Preparation

Dear Bill Morgan,

In accordance with California Water Code Section 10621(b), this letter is to inform you that Lakeside Water District is updating its Urban Water Management Plan (UWMP). California State law requires urban water suppliers to update their UWMPs every five years and notify the cities and counties within their service area that a plan is being prepared. Lakeside Water District must adopt an updated UWMP and submit the adopted plan to the California Department of Water Resources.

The UWMP is required to contain a detailed evaluation of the supplies necessary to reliably meet demands over at least a 20-year period in both normal and dry years. In accordance with State law, Lakeside Water District will distribute a copy of its draft 2020 UWMP by posting it at www.LakesideWater.org for public review at least two weeks prior to holding a tentatively scheduled public hearing in **August 3rd, 2021, at 5:30pm**.

Please feel free to contact Jeanne Swaringen at (619) 443-3806, or Jeanne@LakesideWater.org, if you have any questions or would like additional information.

Sincerely,

Jeanne Swaringen

Jeanne Swaringen
Administrative Services Supervisor

10375 VINE STREET, LAKESIDE, CA 92040
(619) 443-3805 FAX (619) 443-3690

LAKESIDE WATER DISTRICT

May 18, 2021

County of San Diego
Attn: Kathleen Flannery
5510 Overland Avenue, Suite 310
San Diego, CA 92123

Regarding: Notice of Lakeside Water District's
2020 Urban Water Management Plan Preparation

Dear Kathleen Flannery,

In accordance with California Water Code Section 10621(b), this letter is to inform you that Lakeside Water District is updating its Urban Water Management Plan (UWMP). California State law requires urban water suppliers to update their UWMPs every five years and notify the cities and counties within their service area that a plan is being prepared. Lakeside Water District must adopt an updated UWMP and submit the adopted plan to the California Department of Water Resources.

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10375 VINE STREET, LAKESIDE, CA 92040
(619) 443-3805 FAX (619) 443-3690

LAKESIDE WATER DISTRICT

May 18, 2021

County of San Diego
Attn: Damon Davis
5510 Overland Avenue, Suite 310
San Diego, CA 92123

Regarding: Notice of Lakeside Water District's
2020 Urban Water Management Plan Preparation

Dear Damon Davis,

In accordance with California Water Code Section 10621(b), this letter is to inform you that Lakeside Water District is updating its Urban Water Management Plan (UWMP). California State law requires urban water suppliers to update their UWMPs every five years and notify the cities and counties within their service area that a plan is being prepared. Lakeside Water District must adopt an updated UWMP and submit the adopted plan to the California Department of Water Resources.

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10375 VINE STREET, LAKESIDE, CA 92040
(619) 443-3805 FAX (619) 443-3690

LAKESIDE WATER DISTRICT

June 1, 2021

County of San Diego
Attn: Bill Morgan
5510 Overland Avenue, Suite 410
San Diego, CA 92123

Regarding: Notice of Lakeside Water District's
2020 Urban Water Management Plan Preparation and
2020 Water Shortage Contingency Plan

Dear Bill Morgan,

This letter is a follow-up to a previous letter sent in May, which provided notification of Lakeside Water District's ongoing update of its Urban Water Management Plan (UWMP). In addition to the 2020 UWMP update, the district is also taking this opportunity to notify you that we are also considering updating our Water Shortage Contingency Plan (WSCP).

As indicated in the first notification letter, California state law requires urban water suppliers to update their UWMP and WSCP every five years and to notify the cities and counties within their service area that the plans are being prepared. The district must adopt and submit its 2020 UWMP and WSCP, which is part of the 2020 UWMP to the California Department of Water Resources.

The UWMP is required to contain a detailed evaluation of the supplies necessary to reliably meet demands over at least a 20-year period in both normal and dry years. The WSCP is required to include a detailed proposal for how a water supplier intends to act in the case of an actual water supply shortage. In accordance with State law, Lakeside Water District will distribute a copy of its draft 2020 UWMP by posting it at www.LakesideWater.org for public review at least two weeks prior to holding a tentatively scheduled public hearing in **August 3rd, 2021, at 5:30pm**.

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Administrative Services Supervisor

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(619) 443-3805 FAX (619) 443-3690

APPENDIX I

Public Notice

NOTICE OF PUBLIC HEARING OF THE BOARD OF DIRECTORS OF THE LAKESIDE WATER DISTRICT TO CONSIDER ADOPTION OF THE URBAN WATER MANAGEMENT PLAN AND WATER SHORTAGE CONTINGENCY PLAN

In accordance with Section 10642 of the Urban Water Management Planning Act of the California Water Code, notice is hereby given that Lakeside Water District will hold a Public Hearing on its Urban Water Management Plan and Water Shortage Contingency Plan. The purpose of the Hearing will be to receive public comment on the Plan, prior to its adoption. The Plan will be available for public review at www.lakesidewater.org or at the district office. The Public Hearing will be held at 5:30 p.m. on Tuesday, August 3, 2021, in the District's Board Room at 10375 Vine St., Lakeside CA 92040. For further information concerning the Plan or the Public Hearing, contact Brett Sanders, General Manager, or call 619-443-3805. Written comments will be received at the above address until 5:00 p.m. on, August 3, 2021.

The East County Californian on 5/28/21 FOR 2 WEEKS OR 2 PUBLICATIONS

And posted on the District's website at www.LakesideWater.org

APPENDIX J

UWMP Regional Coordination

Lakeside WD - Draft Baseline M&I and Agricultural Demand Forecast (AF)

	2025	2030	2035	2040	2045
Baseline M&I Demand Forecast	4,643	4,849	4,923	5,060	5,173
Baseline Total Agricultural Demand Forecast	-	-	-	-	-
Total	**4,643**	**4,849**	**4,923**	**5,060**	**5,173**

Lakeside WD - Draft Active and Passive Conservation Savings (AF) [1]

Conservation Savings	2025	2030	2035	2040	2045
Active Savings	189	158	158	161	153
Passive Savings	318	415	501	582	663
Total	**507**	**573**	**659**	**743**	**816**

Lakeside WD - Projected Verifiable Local Supplies (AF) [1]

Local Supply Source	2025	2030	2035	2040	2045
Surface Water	-	-	-	-	-
Groundwater	700	900	900	900	900
Recycled Water	-	-	-	-	-
Potable Reuse	-	-	-	-	-
Seawater Desalination	-	-	-	-	-
San Luis Rey Water Transfers	-	-	-	-	-
Total	**700**	**900**	**900**	**900**	**900**

1) Verifiable category based on Urban Water Management Plan criteria

Additional Planned Supplies

Local Supply Source	2025	2030	2035	2040	2045
Surface Water	-	-	-	-	-
Groundwater	-	-	-	-	-
Recycled Water	-	-	-	-	-
Potable Reuse	-	-	-	-	-
Seawater Desalination	-	-	-	-	-
San Luis Rey Water Transfers	-	-	-	-	-
Total	**-**	**-**	**-**	**-**	**-**

Conceptual Supplies

Local Supply Source	2025	2030	2035	2040	2045
Surface Water	-	-	-	-	-
Groundwater	-	-	-	-	-
Recycled Water	-	-	-	-	-
Potable Reuse	-	-	-	-	-
Seawater Desalination	-	-	-	-	-
San Luis Rey Water Transfers	-	-	-	-	-
Total	**-**	**-**	**-**	**-**	**-**

Lakeside WD - Forecast of Demand on the Water Authority (AF)

		2025	2030	2035	2040	2045
A	Baseline Demand Forecast [1]	4,643	4,849	4,923	5,060	5,173
B	Conservation	507	573	659	743	816
C=A-B	Net Total Water Demands	4,136	4,276	4,264	4,317	4,357
D	Member Agency Local Supplies	700	900	900	900	900
E=C-D	Demand on the Water Authority	3,436	3,376	3,364	3,417	3,457

Footnote:

1) Based on Feb 2021 projections

SANDAG Growth Forecast Variables for Lakeside WD [1]

	2025	2030	2035	2040	2045
Population	34,007	34,466	33,742	33,335	33,088
SF Housing Units	7,710	8,091	8,140	8,277	8,385
MF Housing Units	3,809	4,119	4,177	4,224	4,224
Total Non-Ag Employment Counts	8,309	8,926	9,667	10,375	10,926

1) Series 14 Growth Forecast (version 17)

APPENDIX K

San Diego County Water Authority Water Shortage Contingency Plan 2020

Our Region's Trusted Water Leader
San Diego County Water Authority

2020 Water Shortage Contingency Plan

San Diego County Water Authority

May 27, 2021

Water Shortage Contingency Plan

San Diego County Water Authority

Sandra L. Kerl, General Manager
Dan Denham, Deputy General Manager
Tish Berge, Assistant General Manager

This plan prepared under the direction of:

Kelley Gage, Director of Water Resources
Denise Vedder, Director of Public Affairs

Prepared by:

Jeff Stephenson, Water Resources Manager
Tim Bombardier, Principal Water Resources Specialist
Alexi Schnell, Water Resources Specialist

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LIST OF ACRONYMS AND ABBREVIATIONS

AAC	All-American Canal
AF	acre-feet
AF/YR	acre-feet per year
Board	Water Authority Board of Directors
CC	Coachella Canal
CII	Commercial, Industrial, and Institutional
CRA	Colorado River Aqueduct
CSP	Carryover Storage Project
CSPG	Carryover Storage Policy Guidelines
CVP	Central Valley Project
DMP	Drought Management Plan (2006)
DWR	Department of Water Resources
EO	Executive Order
EOC	Emergency Operations Center
ESP	Emergency Storage Project
EWDP	Emergency Water Delivery Plans
FY	Fiscal Year
GPCD	gallons per capita per day
IAWP	Interim Agricultural Water Program
ICP	Integrated Contingency Plan
IID	Imperial Irrigation District
Lewis Carlsbad Desalination Plant	Claude “Bud” Lewis Carlsbad Desalination Plant
MAAT	Member Agency Advisory Team
M&I	municipal and industrial
MCB Camp Pendleton	Marine Corps Base Camp Pendleton
MWD	Metropolitan Water District of Southern California
MGD	Million Gallons per Day
Model Drought Ordinance	Model Drought Response Conservation Program Ordinance
MHM Plan	Multi-Hazard Mitigation Plan for San Diego County, California
PSAWR	Permanent Special Agricultural Water Rate
QSA	Quantification Settlement Agreement
RSF	Rate Stabilization Fund
SANDAG	San Diego Association of Governments
SB	Senate Bill
SDCWA	San Diego County Water Authority
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
Transfer Agreement	Water Authority–IID Water Conservation and Transfer Agreement
UWMP	Urban Water Management Plan
Water Authority	San Diego County Water Authority
WSAP	Water Supply Allocation Plan
WSCP	Water Shortage Contingency Plan
WSDM	Water Surplus and Drought Management Plan
WSDRP	Water Shortage and Drought Response Plan
WTP	Water Treatment Plant

Section 1
Introduction

1.1 Introduction

The San Diego County Water Authority's (Water Authority) Board of Directors (Board) approved its Drought Management Plan (DMP) in 2006. The DMP outlined a series of orderly, progressive steps for the Water Authority and its member agencies to take during shortages to minimize impacts to the region's economy and quality of life. It also included an allocation methodology to equitably allocate water supplies to its member agencies. The DMP was activated just a year later, in 2007, in response to the Metropolitan Water District of Southern California (MWD) drawing water from storage to meet demands. It was deactivated in 2011, when supply conditions improved.

In 2008, the Board approved another drought management document, the Model Drought Response Conservation Program Ordinance (Model Drought Ordinance). The Model Drought Ordinance focuses on core water use restrictions and is intended to assist the member agencies when updating or drafting local drought response ordinances and to provide regional consistency in drought response levels and messaging to the public and media. Also in 2008, the Board adopted Resolution 2008-11 that established procedures to administer the supply allocation methodology contained in the DMP.

Using lessons from previous shortage periods, in 2012, the DMP's supply allocation methodology was updated and the DMP was renamed the Water Shortage and Drought Response Plan (WSDRP). In 2014, the WSDRP was activated due to critically dry weather in California and its impact on water supply conditions. The WSDRP was deactivated in 2016 when supply conditions improved. In each instance when the DMP and WSDRP were activated, a smooth transition into and out of water allocations for the member agencies was possible due to the advanced planning efforts of the Water Authority and its member agencies. Those planning efforts also resulted in a framework that allowed for regional consistency in public drought messaging.

To ensure that the Water Authority and its member agencies continued to proactively plan for future water supply shortages, the Water Authority revised its WSDRP and renamed it the Water Shortage Contingency Plan (WSCP) in August 2017. The plan was named the WSCP for consistency with the long-term framework contained in the April 2017 Final Report, *Making Water Conservation a California Way of Life, Implementing Executive Order B-37-16.* The long-term framework built on Executive Order (EO) B-37-16 and provided recommendations on implementation of long-term improvements to water supply management to support water conservation, including recommendations related to strengthening local drought resilience.

In 2018, recommendations included in EO B-37-16 related to strengthening local drought resilience were added to the Water Code with the passage of Senate Bill (SB) 606. In anticipation of that legislation, the Water Authority proactively included drought planning elements from EO B-37-16 in the WSCP that was adopted by the Water Authority Board in August 2017. Additional requirements added to the Water Code after the passage of SB 606 were incorporated into the WSCP as part of the process to prepare the Water Authority's 2020 UWMP.

It is important to note that because the allocation methodology was included in the WSCP adopted by the Water Authority Board in August 2017, no changes were made to the allocation methodology during the process to prepare the 2020 WSCP. In addition, in August 2017 there was uncertainty as to when the State Water Resources Control Board (SWRCB) would complete its rulemaking process regarding the addition of new permanent water waste prohibitions. Because of that uncertainty, the Model Drought Ordinance was not updated in August 2017. However, it was updated as part of the process to prepare the 2020 WSCP. See Section 6 and Appendix B for more information.

1.2 Reliability

The Water Authority's mission is to provide a safe and reliable supply of water to its member agencies serving the San Diego region. The Water Authority and its member agencies continue to make great strides to develop a more drought-resilient mix of water resources, thereby increasing the region's ability to manage and avoid shortage situations. In partnership with and support of its member agencies, the region continues to be a leader in water conservation and water use efficiency.

In 2012, the Water Authority entered into a Water Purchase Agreement to purchase supplies from the 50 million gallons per day (MGD) Claude "Bud" Lewis Carlsbad Desalination Plant (Lewis Carlsbad Desalination Plant). This project is the largest seawater desalination facility in North America and came on-line in December 2015. The Lewis Carlsbad Desalination Plant provides a long-term drought-resilient water supply for the San Diego region. The San Vicente Dam raise was completed in 2014, providing both additional emergency storage and carryover storage for the region. The carryover storage capacity is critical to having a drought-resilient resource mix. It allows the region to store water in years when supplies are available and utilize those supplies during times of shortage.

Deliveries of conserved agricultural transfer water from the Imperial Valley were 190,000 AF/YR in 2020, and will reach a maximum of 200,000 AF/YR in 2021. The Water Authority continues to take delivery of 77,700 AF/YR of conserved water from projects to line the All-American Canal (AAC) and Coachella Canal (CC). Locally, the Water Authority's member agencies continue to evaluate, plan and implement local supply development through recycled water, brackish groundwater recovery, and potable reuse. In the future, the additional increment of supply to reduce reliance on imported sources and ensure drought-resilient supplies is expected to come from these efforts.

Demand management, or water-use efficiency, is an important ongoing component of the Water Authority's long-term strategy to increase the reliability of the San Diego region's water supply through diversification of its water supply portfolio. Since 1991, in partnership with and support of its member agencies, the Water Authority's programs and initiatives cumulatively have conserved more than 1 million AF of water. The savings were achieved through various measures, including incentives for water-efficient devices, legislation, code changes, outreach campaigns, and programs.

In September 2020, the Water Authority Board adopted Ordinance No. 2020-04, that established its Permanent Special Agricultural Water Rate (PSAWR) Program effective January 1, 2021. The PSAWR Program is a water management program that provides additional water to the municipal and industrial (M&I) sector during water supply shortages. Eligible agricultural customers receive a cost benefit on their water rates and in return take a greater cutback during a supply shortage. Additional information on the PSAWR Program is in Section 4.3

While the region has plans to provide a high level of water reliability, there will always be some level of uncertainty associated with maintaining and developing local and imported supplies. Therefore, as a prudent measure, the Water Authority and its member agencies developed the comprehensive WSCP in the event that the region faces a water supply shortage.

1.3 Defining Drought

The definition of drought can vary depending on perspective. For the WSCP, the definition of drought is consistent with the definition used by the California Department of Water Resources (DWR). The DWR drought brochure, *Drought in California*, includes the following definition:

> "From a water use perspective, drought is best defined by its impacts to a particular class of water users in a particular location. Hydrologic conditions constituting a drought for water users in one location may not constitute a drought for water users in a different part of the state or with a different water supply." [1]

Based on this definition, water supply shortages in different regions of the state do not necessarily constitute a drought in the San Diego region.

1.4 Senate Bill 606

On May 9, 2016, Governor Brown issued EO B-37-16, which built on temporary statewide emergency water restrictions to establish longer-term water conservation measures, including permanent monthly water use reporting and new permanent water use standards that go beyond the 20% reduction in per capita urban water use required in SB X7-7. The executive order also permanently banned wasteful practices such as hosing off sidewalks, driveways and other hardscapes, and called for long-term improvements in local drought

[1] *Drought in California*, California Department of Water Resources, Natural Resources Agency, Fall 2015, p. 4.

preparation.

The directives in EO B-37-16 related to improvements in local drought preparation are Items 8 and 9. Item 8 required DWR to strengthen requirements for urban water shortage contingency plans to include adequate actions to respond to droughts that last at least five years, as well as more frequent and severe periods of drought. Item 9 required DWR to work with stakeholders to update the requirements for water shortage contingency plans. The executive order also directed the SWRCB to make adjustments to the emergency water conservation regulation in recognition of the differing water supply conditions across the state. This directive resulted in a change from the mandated conservation standard to a self-certification approach that recognized the unique supply conditions of each region/community.

In 2018, the California State Legislature enacted SB 606 and Assembly Bill 1668 in response to EO B-37-16. The provisions of these bills focused on improving drought planning and water conservation in the state. Of the two bills, SB 606 included provisions related to drought planning and strengthening local drought resilience. The WSCP meets the requirements of the Water Code.

1.5 Organization of the Water Shortage Contingency Plan

The WSCP is organized into the following 10 sections and appendices:

Section 1: Introduction, discusses the purpose of the WSCP and provides an overview of its content. SB 606, which requires urban water suppliers to adopt a stand-alone WSCP as part of their 2020 UWMP, is also discussed. An overview of the Water Authority's actions to increase the region's water supply reliability, as well as a discussion on defining drought, is included in the section.

Section 2: Plan Preparation and Re-Evaluation, provides information on preparation of the WSCP and background information on preparation of the 2006 DMP, which was updated in 2012 to become the WSDRP. The section outlines a procedure to evaluate implementation and make updates to the WSCP.

Section 3: Drought Response and Shortage Management Actions, includes a review of historic drought periods and the Water Authority's actions during those periods. The section also includes lessons learned from the events.

Section 4: Annual Water Supply and Demand Assessment, contains a discussion on the annual water supply and demand assessment, including the need to perform the assessment and the process. It provides details on the evaluation criteria to be used and basic supply and demand assumptions.

Section 5: Drought Response Actions and Levels, provides an overview of the six regional shortage response actions and levels, including the percent action required at each level and the water supply conditions that trigger the response levels. The section also discusses the potential scenarios that would trigger a certain shortage response level.

Section 6: Extraordinary Demand Reduction Measures, identifies a list of potential consumer water use restrictions and extraordinary measures to reduce demands during shortage events. These measures, along with the response level information discussed in Section 5, form the basis for Model Drought Ordinance. Section 6 also discusses potential measures that the member agencies and municipalities can take to conserve water.

Section 7: Municipal and Industrial Supply Allocation Methodology, provides a detailed description of the supply allocation methodology. The methodology provides the Water Authority a means to allocate its supplies to its member agencies in a water supply shortage situation. An example of the calculation procedure is included for illustrative purposes.

Section 8: Catastrophic Water Shortage, describes how the Water Authority manages catastrophic water shortages caused by an event such as an earthquake. The section includes a discussion on the Integrated Contingency Plan, Emergency Water Delivery Plans, and Emergency Storage Program.

Section 9: Communication Plan, describes the elements of the communication plan, including coordination, key audiences, and communication objectives. It also discusses strategies and tactics for each water supply shortage level.

Section 10: Implementation, summarizes the role of the Board to activate the plan and consider potential shortage response actions. It also includes a discussion on the role of the Member Agency Advisory Team during a water supply shortage event and how the Water Authority will manage reduced revenues due to implementation of demand reduction measures.

Appendix A: Carryover Storage Policy Guidelines

Appendix B: Model Drought Ordinance

Appendix C: Examples of Potential Customer Water Use Prohibitions

Appendix D: Multi-Jurisdictional Hazard Mitigation Plan

Appendix E: Water Authority Board Resolution No. 2021-__

Section 2
Plan Preparation and Re-Evaluation

Section 2 discusses the process to prepare the original 2006 DMP, the update process for the DMP's allocation methodology in 2012, preparation of the 2017 WSCP and its subsequent 2020 update as part of the Water Authority's 2020 UWMP, and the schedule to re-evaluate the WSCP in future years.

2.1 Drought Management Plan (2006)

In 2006, the DMP was prepared to identify the actions that the Water Authority and its member agencies would take if faced with drought conditions, and specifically, how supplies would be allocated. The process to draft the DMP was extensive and included multiple meetings with member agency staff and multiple presentations and reports to the Board. An overview of the process is detailed below.

2.1.1 Member Agency Technical Advisory Committee

Preparation and implementation of the DMP included input and support from the Water Authority's member agencies. Recognizing the importance of member agency involvement, the Water Authority formed a Technical Advisory Committee (TAC) to provide input on development of the DMP. The TAC met 10 times between March 2005 and February 2006, and included a representative from each of the member agencies. Key to the successful preparation of the plan was full involvement from all member agencies which ensured effective communication and understanding of member agencies' issues and concerns. To assist in the effort, a consultant team was hired to facilitate the TAC meetings and assist with technical details, such as the historic context of drought plans in Southern California and the development of the allocation model. The TAC members worked together successfully to develop the elements of the DMP.

2.1.2 Principles

Twenty-three principles were developed to provide guidance to the Water Authority and its member agencies to develop and implement the 2006 DMP. The principles were initially drafted based on results from a questionnaire that was completed by the TAC members. The principles were then revised and finalized based upon input received during a series of TAC meetings.

The principles used during development of the 2006 DMP are shown below and were grouped into the following five categories: 1) Overall Plan; 2) Communication Strategy; 3) Drought Supply Enhancement; 4) Drought Response Stages; and 5) Allocation Methodology.

Overall Plan

1. *The DMP will be developed in cooperation with the member agencies and include all aspects of drought planning – including steps to avoid rationing, drought response stages, allocation methodology, pricing, and communication strategy.*

Communication Strategy

2. *An on-going, coordinated and regional public outreach program shall be developed by the Water Authority that provides a clear and consistent message to the public regarding water supplies and specific conservation measures. The outreach program will also recognize and support member agency communication efforts that address specific retail level allocations.*

3. *A Drought Coordination Team, made up of one representative from each member agency, will be established to assist the Water Authority in implementation of the DMP. This includes items such as formulation and implementation of the public outreach program, timing of drought stages, selection of drought supply actions, and addressing potential issues surrounding implementation of the shortage allocation methodology.*

4. *The drought management plan should specify actions and timing of communications.*

Drought Supply Enhancement

5. *The Water Authority and its member agencies will work cooperatively to avoid and/or minimize rationing during droughts through supply enhancement and voluntary demand reduction measures.*

6. *Future Water Authority carryover storage supplies will be managed and utilized to assist in meeting M&I demands during drought periods. Member agencies will be encouraged to develop carryover storage.*

7. *The Water Authority will consider securing option and/or spot water transfers to meet the reliability goal set by the Board. The cost of this regional supply will be melded into the Water Authority's supply costs for all classes of service that benefit.*

8. *Subject to the Water Authority's wheeling policy, if a member agency purchases transfer water from a source other than the Water Authority, the full cost of the transfer, including, but not limited to, purchase costs, wheeling costs, and administrative costs, will be borne by said member agency.*

9. *Emergency Storage Project (ESP) supplies may be available when any member agency's non-interruptible firm demands drop below a 75% service level.*

10. *The quantities of supplies from the ESP to be removed from storage will be based on a minimum amount necessary to meet essential health, safety, and firefighting needs, and maximum amount based on the need to ensure adequate supplies remain for a catastrophic event (e.g. earthquake).*

Drought Response Stages

11. *Develop drought response stages, which at a minimum, accomplish the following:*
    - *Can be easily communicated to the public;*
    - *Flexible to handle unexpected changes in demand and supply conditions;*
    - *Includes percent reduction (voluntary or mandatory) per stage; and*
    - *Includes both supply enhancement and emergency demand reduction methods.*

12. *Targets for achieving the emergency demand reduction measures should take into account the region's already aggressive long-term water conservation program.*

13. *The decision on when, and in which sequence drought enhancement supplies will be utilized during different stages will include consideration of the following factors:*
    - *Location – Out-of-region supplies will be utilized in the earlier stages, prior to in-county storage, because these supplies are more vulnerable to implementation risks such as seismic events;*
    - *Cost – Priority will be given to maximizing supply reliability and at the same time using the most cost-effective supplies; and*
    - *Limitations – Potential restrictions on the use of drought enhancement supplies is a factor in determining supply availability (e.g. potential restrictions on ESP supplies).*

Allocation Methodology

14. *The allocation methodology will be equitable, easy to administer, contain financial penalties and pricing signals, and a communication strategy to ensure member agencies and the public are informed and understand the need to conserve.*

15. *In order to protect the economic health of the entire region, it is very important for the allocation methodology to avoid large, uneven retail impacts across the region. The methodology should include a minimum level of retail agency reliability to ensure equitable allocation among the member agencies.*

16. *With the exception of allocating water from the ESP, the Water Authority shall make no distinction among customers paying the same M&I rate (e.g. non-Interim Agricultural Water Program (IAWP) agriculture, residential, commercial, and industrial).*

17. *Additional IAWP cutbacks beyond the initial 30% faced by IAWP customers should be equally applied to both IAWP and M&I customers.*

18. *A member agency that has developed local projects and instituted conservation measures should not be penalized in the computation of allocations.*

19. *To help balance out the financial costs and risks associated with development of local resources, the shortage allocation methodology should provide an incentive to those member agencies that have developed local supplies.*

20. *The base-year, upon which allocations will be derived, will be based on historic demands. Adjustments to the base-year will be made for demographic changes, growth, local supplies, demand hardening, and supplies allocated under interruptible service programs.*

21. *A member agency's base-year will be adjusted to reflect the regional financial contribution from the Water Authority for development of local projects. The adjustment will take into account the risks associated with developing the local projects.*

22. *A member agency will not be able to market its unused allocation to other agencies within the Water Authority's service area at a cost higher than the Water Authority's charges for those supplies.*

23. *Penalty rates, along with other demand reduction measures, will be used by the Water Authority to encourage conservation during a drought.*

2.1.3 Report Approval

Water Authority staff, with consultant assistance, prepared an initial draft of the DMP based on results from the TAC member discussions on DMP elements. TAC members reviewed the draft report and their comments were incorporated. In February 2006, the TAC supported forwarding the report to the Board's Water Planning Committee for consideration. The DMP elements were presented to the Board through a series of meetings and workshops, with final approval of the DMP in May 2006.

2.2 Water Shortage and Drought Response Plan (2012)

The DMP was activated in 2007 and deactivated in 2011. During the activation period, MWD allocated supplies to its member agencies, including the Water Authority, from July 2009 to April 2011. In response to the allocation from MWD, the Water Authority activated the mandatory cutback stage of its DMP and allocated supplies to its member agencies.

An evaluation of the implementation of the Water Authority's allocation methodology revealed that there was consensus among Water Authority and member agency staff that the allocation methodology worked as envisioned and served as an effective, equitable means to allocate supplies. However, the evaluation also revealed that specific elements of the allocation methodology could be improved.

A series of member agency meetings were held to gain input and aid staff in the development of modifications to the allocation methodology. The first meeting was in May 2011. Additional meetings were postponed until MWD finalized adjustments to its Water Supply Allocation Plan (WSAP) in September 2011. Water Authority staff resumed meetings with member agency staff between October 2011 and March 2012. At the completion of the meetings a technical report was prepared by Water Authority staff to provide a detailed description of the modifications. The Board approved the updated allocation methodology in April 2012, and formally renamed the DMP as the WSDRP.

2.3 2017 Water Shortage Contingency Plan

The process to develop the 2017 WSCP began with a workshop-type meeting with the member agency managers in March 2017. It continued with monthly progress updates with the member agency managers and opportunities for the member agency managers to provide comments on the draft WSCP. In April 2017, a special meeting of the Board's Water Planning Committee was held to present proposed revisions to the WSDRP (which was later renamed the WSCP). The 2017 WSCP was approved by the Board in August 2017 as a stand-alone document.

The 2017 WSCP was a comprehensive shortage planning document that incorporated elements not previously included in the WSDRP. Those elements included information on catastrophic water shortage planning (Section 8), Board-approved guidelines to manage carryover storage, and an annual M&I reliability analysis (Section 4). The communication plan (Section 9) in the WSDRP was updated in the 2017 WSCP based on lessons learned from previous shortage periods. In addition, the 2017 WSCP incorporated elements from the state's long-term framework document, *Making Water Conservation a California Way of Life, Implementing Executive Order B-37-16*, which was released in April 2017. Because some elements of the state's long-term framework had yet to be fully implemented through a rulemaking process, including the drafting of the permanent water waste prohibitions, the Water Authority's Model Drought Ordinance was not be updated in the 2017 WSCP. The allocation methodology was updated in 2012, and therefore, it was not updated in the 2017 WSCP.

2.4 2020 Water Shortage Contingency Plan

In 2018, with the passage of SB 606, the Water Code was amended to include new requirements related to water shortage contingency planning (§10632). The 2017 WSCP was prepared in anticipation of these new requirements and as a result, only minimal, non-substantive updates were required during preparation of the 2020 WSCP. One of those new requirements is that water suppliers must prepare and adopt a WSCP as part of their UWMP, but that the WSCP must also be a stand-alone document so that a water supplier can update it without having to update its UWMP. The 2020 WSCP functions as a stand-alone document.

2.5 Plan Re-Evaluation

The WSCP will be re-evaluated at least every five years in coordination with the urban water management plan update, but the frequency of the re-evaluations could increase based on the needs of the Water Authority and its member agencies. Re-evaluations will be based on lessons learned, new statutory requirements, continued local supply development, or other factors.

Section 3
Historic Drought Response and Shortage Management Actions

The Water Authority has activated its drought planning document twice since 2006. The first time was during the period of 2007 to 2011. During that period, the WSDRP was known as the DMP and was activated in response to MWD withdrawing water from storage to meet demands. By 2012, the DMP had been renamed the WSDRP, and was activated in 2014 in response to the Governor's declaration of a state of emergency due to severe drought conditions, as well as in response to drought response actions being considered at MWD. In each instance, the advanced planning efforts of the Water Authority and its member agencies allowed for a smooth transition into and out of water allocations. Additional information on the drought management actions taken during the drought periods are discussed below.

3.1 Significant Drought and Shortage-Related Events (2007 to 2011)

2007

The 2007–2011 California drought marked the beginning of increased restrictions on State Water Project (SWP) pumping from the Bay-Delta due to environmental considerations. The Colorado River was in the midst of a prolonged multi-year drought that began in 2000. In April 2007, MWD notified its member agencies that it expected challenges in meeting demands due to insufficient imported water supplies from the SWP and the Colorado River. In order to meet demands, MWD announced that it would implement shortage-related actions consistent with its Water Surplus and Drought Management (WSDM) Plan, including a need to draw upon its storage to meet expected 2007 demands. MWD adopted its WSDM Plan in 1999 as guidance for managing regional water supplies during both surplus and shortage situations. MWD's announcement that it would need to draw upon its storage to meet demands triggered implementation of the Water Authority's WSDRP. The Water Authority began to implement a series of response measures identified in its WSDRP to reduce potential shortage impacts, starting with a call for voluntary conservation, and securing dry-year water transfers and storage programs for the region.

2009

As dry conditions persisted into 2009, the Water Authority and its member agencies intensified their drought response activities. In April 2009, for the first time in decades, MWD's Board voted to allocate urban water deliveries to its member agencies in fiscal year (FY) 2010. In turn, the Water Authority allocated water deliveries to its member agencies using the supply allocation methodology contained in the WSDRP. The Water Authority's long-term strategy to improve water supply reliability by diversifying the region's water supply portfolio helped offset some of the required cutbacks from MWD. In order to ensure deliveries remained under the allocation target, many agencies went from voluntary conservation to mandatory water use restrictions. Residences and businesses responded to the call for conservation, and urban water use fell throughout San Diego County. Although hydrologic conditions began to improve in 2010, storage reserves remained low, and allocations continued into FY 2011 to help restore storage reserves and prepare for a potential dry water year.

2011

Supply conditions continued to improve throughout the winter and into the spring 2011. Storage water began to rise to levels seen before the start of the 2007 drought. In April 2011, MWD terminated water allocations to its member agencies. Subsequently, the Water Authority discontinued allocations to its member agencies and deactivated the WSDRP in April 2011. With the drought over and deactivation of the WSDRP, the Water Authority, in coordination with its member agencies, conducted an evaluation of the WSDRP, including the allocation methodology, based on lessons learned through implementation during the 2007-2011 shortage period.

Table 3-1 contains a timeline of significant drought and shortage-related events during the drought period of 2007 to 2011.

Table 3-1
Timeline of Significant Drought and Shortage-Related Events
(2007 – 2011)

April 2007	MWD announced it will need to draw from storage supplies to meet expected 2007 demands, consistent with Water Surplus and Drought Management Plan.
May 2007	Water Authority moved into Drought Management Plan Stage 1, Voluntary Supply Management (triggered by MWD withdrawal of storage supplies to meet expected 2007 demands). US District Judge Wanger invalidated US Fish and Wildlife 2005 Delta smelt biological opinion and orders a new biological opinion to be developed.
October 2007	MWD announced plans to reduce agricultural deliveries to customers participating in Interim Agricultural Water Program by 30%, effective January 1, 2008, consistent with WSDM Plan.
December 2007	Water Authority Board declared implementation of Stage 2, Supply Enhancement, of the DMP. Judge Wanger issues an interim order to direct actions at the export facilities to protect Delta smelt until a new biological opinion is completed.

January 2008	MWD implemented 30% cutback to Interim Agricultural Water Program participants, consistent with MWD's WSDM Plan.
February 2008	MWD approved its Water Supply Allocation Plan (WSAP).
March 2008	Water Authority released Model Drought Ordinance for use by member agencies that outlined potential mandatory use restrictions for retail customers under four levels.
April 2008	Water Authority notified member agencies of Drought Response Level 1, Drought Watch (up to 10% voluntary conservation), under Model Drought Ordinance (Stage 2 of DMP continued). Judge Wanger invalidated National Marine Fisheries Service biological opinion related to operations of the Central Valley Project (CVP) and SWP.
June 2008	Governor Schwarzenegger proclaimed statewide emergency due to drought and issued Executive Order S-06-08, that directed DWR to respond to drought conditions through a variety of actions, including facilitating water transfers and increasing conservation and outreach.
December 2008	US Fish and Wildlife Service released revised biological opinion on Delta smelt.
February 2009	Governor Schwarzenegger declared a statewide drought emergency on February 27.
April 2009	MWD announced allocation of M&I deliveries to its member agencies, including estimated 13% cutback to San Diego region for FY 2010. Water Authority Board enacted DMP Stage 3, Mandatory Supply Cutbacks, and Drought Response Level 2 (Drought Alert, up to 20% mandatory conservation), in anticipation of 8% cutback to its member agencies in FY 2010. Water Authority Board authorized utilization of approximately 16,000 AF of dry-year transfers acquired in 2009.

June 2009	National Marine Fisheries Service released final biological opinion and concluded that CVP and SWP pumping operations should be changed to protect the winter and spring run Chinook salmon, Central Valley steelhead, North American green sturgeon, and southern resident killer whales.
May 2010	Water Authority Board voted to continue DMP Stage 3, Mandatory Cutbacks, and Drought Response Level 2.
March 2011	Governor Brown proclaimed an end to the state's drought.
April 2011	MWD terminated implementation of its WSAP and IAWP supply cutbacks. Water Authority discontinued M&I water supply allocations to member agencies, deactivated Water Shortage and Drought Response Plan (formerly DMP), suspended special agricultural water rate cutbacks, and declared an end to drought response levels contained in Model Drought Ordinance.

3.2 Significant Drought and Shortage-Related Events (2014 to 2017)

2014

In January 2014, Governor Brown proclaimed a state of emergency throughout California, calling for increased conservation across the state. In response to the governor's drought declaration and call for conservation, the Water Authority activated its WSDRP for the second time since its adoption in 2006, declaring in February 2014, a regional drought response Stage I, Voluntary Supply Management, and notifying the member agencies of a voluntary Drought Watch condition under the Model Drought Ordinance. The Water Authority recognized that voluntary measures to reduce water use would be instrumental in helping preserve critical water reserves should dry conditions continue.

As drought conditions intensified across the state, with smaller communities in the Central Valley at risk of significant water supply shortages, in April 2014, the governor directed the SWRCB to adopt emergency regulations to prevent "the waste and unreasonable use of water," calling for a voluntary 20% reduction in urban water use statewide. In July 2014, the SWRCB adopted an emergency regulation for urban water conservation aimed at reducing outdoor water use, which established prohibitions on water waste and identified actions local water agencies should take to reduce water demand in their service areas. Consistent with the governor's call for statewide conservation, in July 2014, the Water Authority increased the regional drought response to Stage II, Supply Enhancement, and Drought Alert under the regional Model Drought Ordinance, which includes mandatory water-use restrictions with a regional savings target of up to 20%.

2015

Dry conditions continued to worsen into a fourth year in the spring of 2015, as reflected by a record low level of snow water content in the northern Sierra Nevada of 5% of average for April 1, the date that usually marks the maximum accumulation of snowpack before it begins to melt. On April 1, 2015, the governor directed the SWRCB to impose restrictions on urban suppliers to achieve a statewide reduction in potable urban use of 25%. Following this direction, in May 2015, the SWRCB amended and readopted its emergency regulation to require a 25% reduction statewide in overall potable water use effective June 2015 through February 2016. The regulation included water conservation standards for retail urban water suppliers based on a reduction in water use that varied between 4 and 36% depending on residential gallons per capita per day (GPCD), compared with 2013 water-use levels. This marked the first time in California's history that conservation measures were mandated statewide to respond to drought conditions.

In April 2015, MWD's Board announced that it would implement its WSAP, calling for a 15% cutback in FY 2016 deliveries in its service area. In response to these cutbacks and the SWRCB emergency regulation, in May 2015, the Water Authority declared the Mandatory Supply Cutback stage under its WSDRP and approved member agency M&I and TSAWR supply allocations for FY 2016. The Water Authority member agencies also were required to limit outdoor irrigation of ornamental landscapes and turf with potable water to no more than two days per week.

An important element to drought response planning is determining the regional shortage level based on available supplies and projected demands. This analysis was conducted in 2015 for FY 2016, based on the supply allocation from MWD. The MWD supply allocation was combined with member agency dry-year local supplies, supplies from the Water Authority's Colorado River transfers of conserved water, and deliveries from the Lewis Carlsbad Desalination Plant. The total supplies available were calculated as 521,000 AF. Normal water demands were calculated for FY 2016 based on FY 2014 demands. The analysis showed a projected shortage of less than 1% for the region, which demonstrated that the planning and actions taken by the Water Authority and its member agencies are effective in managing severe multi-year droughts. Unfortunately, the SWRCB emergency regulation did not take into account the supplies water agencies had available during the drought and the required agency reduction levels did not reflect the supply reliability investments agencies had made to avoid or mitigate shortage due to drought.

Under the SWRCB's May 2015 emergency regulation, the Water Authority member agencies were required to reduce their monthly water use on a cumulative basis starting June 2015 through February 2016, by 12 to 36% compared to 2013 water-use levels, for a total aggregate region-wide reduction in water use of 20%. The San Diego region effectively reduced its cumulative potable water use by 21% from June 2015 through February 2016, outperforming the state's aggregate regional target of 20% during the initial phase of unprecedented state water-use mandates.

In November 2015, the governor issued EO B-36-15, extending the regulation until October 2016 and directing the SWRCB to consider modifications to the regulation. The Water Authority advocated for revisions to the regulation that take into account investments in drought resilient supplies.

2016

In February 2016, the SWRCB amended the emergency regulation to allow for adjustments to the conservation standards, including for new local drought-resilient supplies developed after 2013. In March 2016, the SWRCB certified supply from the Lewis Carlsbad Desalination Plant as drought-resilient, which lowered the range of member agencies' conservation standards to between 8% and 28%, with the regional aggregate water conservation goal reduced from 20% to approximately 13%. Under the regulations, a water supplier's conservation standard required at least an 8% reduction in water use, regardless of supply availability.

California's supply conditions improved somewhat during the winter of water year 2016, with an El Niño weather pattern bringing rain and snow to parched California. In March 2016, the Water Authority Board revised its regional drought management actions, rescinding its declaration of a regional Level 2 Drought Alert condition under the Model Drought Ordinance, recognizing that the SWRCB individual water supplies conservation standards are driving member agency-specific, rather than regional, water-use restrictions.

In May 2016, due to the improved supply conditions and sufficient supply availability, MWD terminated its member agency allocations. The Water Authority then ended allocations to its member agencies, consistent with the WSDRP. Also in May 2016, the SWRCB adopted an emergency regulation that replaced the prior percentage reduction-based water conservation standard with a localized "stress test" approach. The Water Authority and its member agencies advocated for the stress test approach since it took into account local supply investments and actual shortages being experienced within a community. Utilizing the conservative stress test criteria, the Water Authority and its member agencies demonstrated the availability of adequate supplies to meet demands for the years 2017, 2018, and 2019, should dry conditions continue.

2017

In January 2017, supported by the results of the self-certification stress test analysis and improved statewide water supply conditions that bolstered and enhanced the analysis, the Board adopted Resolution No. 2017-01, declaring an end to drought conditions in San Diego County.

Despite objections by the Water Authority and other water suppliers throughout the state, the SWRCB, in February 2017, re-adopted and extended the emergency regulation for another 270 days or until the Governor rescinded or modified the drought declaration. The action maintained the stress test approach and kept in place existing water use reporting requirements and prohibitions on wasteful water use practices. In April 2017, Governor

Brown issued Executive Order B-40-17, which lifted the drought emergency in all California counties except Fresno, Kings, Tulare, and Tuolumne. The action ended the statewide emergency drought proclamation put in place by the Governor in January 2014. Through establishment of its drought awareness effort, the Water Authority continued its messaging and outreach to residents and businesses to ensure an ongoing community commitment to water-use efficiency across the region.

Table 3-2 contains a timeline of key events during the statewide drought emergency declared by the Governor in January 2014 and ended in April 2017.

Table 3-2
Timeline of Significant Drought and Shortage-Related Events
(2014 – 2017)

January 2014	Governor Brown declared a state of emergency throughout California due to severe drought and called for increased voluntary conservation to reduce water use by 20%.
February 2014	Water Authority notified member agencies of a Level 1, Drought Watch condition, under the regional Model Drought Ordinance, and declared implementation of Stage I, Voluntary Supply Management, under WSDRP.
April 2014	Governor Brown issued a proclamation that the drought emergency continues in California and called for an increased statewide conservation.
July 2014	SWRCB adopted emergency regulation for statewide urban conservation. Water Authority notified member agencies of a Level 2, Drought Alert condition, under the regional Model Drought Ordinance, and declared implementation of Stage II, Supply Enhancement, under WSDRP.
December 2014	MWD revised its WSAP.
April 2015	Governor Brown issued Executive Order B-29-15, instituting emergency actions and mandatory water-use restrictions for California. MWD imposed Level 3 under its WSAP, effective July 2015, reducing MWD supplies by 15%.

May 2015	SWRCB issued additional requirements to its emergency regulation, including mandatory water-use reductions that ranged from 12 to 36% for Water Authority member agencies with an aggregate water conservation target of 20%. Water Authority declared implementation of Stage III, Mandatory Supply Cutback, under WSDRP, adopted Ordinance No. 2015-02, allocating M&I and TSAWR supplies to its member agencies and requiring member agencies to restrict irrigation of ornamental landscapes and turf with potable water to no more than two days a week.
November 2015	Governor Brown issued Executive Order B-36-15 calling for extensions of urban water use restriction through October 2016, should drought conditions persist through January 2016, and directs SWRCB to consider modifying restrictions.
February 2016	SWRCB extended the emergency regulation through October 2016, and provides for adjustments to conservation standard for significant investment in new, local, drought-resilient sources of potable supply, climate differences and growth.
March 2016	SWRCB certified supplies from the Lewis Carlsbad Desalination Plant are drought-resilient, reducing member agency conservation standards to a range of 8 to 28% with a regional aggregate water conservation target of 13%. Water Authority modified its shortage management actions, adopting Ordinance No. 2016-01 and rescinding Ordinance No. 2015-02. Actions include continuing to allocate supplies to its member agencies in FY 2016 under its WSRP Stage III, Mandatory Supply Cutback, but rescinding the July 2014 notification of a regional Level 2, Drought Alert condition.
May 2016	Governor Brown issued Executive Order B-37-16. MWD rescinded its member agency allocations. Water Authority modified its shortage management actions, rescinding Ordinance No. 2016-01, to end member agency allocations, and establish a drought awareness effort. SWRCB modified its emergency regulation from a mandated conservation standard to a self-certification approach, effective June 2016 through January 2017.
January 2017	Water Authority Board adopted Resolution No. 2017-01, declaring an end to drought conditions in San Diego County.
February 2017	SWRCB re-adopted and extended the emergency regulation for another 270 days or until the Governor rescinds or modifies the drought declaration.

April 2017	Governor Brown issued Executive Order B-40-17, which lifted the drought emergency in all California counties except Fresno, Kings, Tulare, and Tuolumne.

3.3 Lessons Learned

As noted at the beginning of Section 3, the Water Authority has activated its shortage management plan twice since 2006. The first time, in 2007 when it was named the DMP, was in response to MWD's withdrawal of storage to meet demands. The DMP was active for approximately four years and deactivated in 2011. The second time the shortage management plan was activated was in 2014 when it was named the WSDRP. The plan was activated in response to the Governor's declaration of a state of emergency due to severe drought conditions, as well as in response to drought response actions being considered at MWD. The WSDRP was deactivated in 2016. In both instances, the region was able to smoothly and successfully transition into and out of allocations. This is a reflection of the comprehensiveness of the documents and coordinated effort that went into preparation of the documents. Because activation of the previous two versions of the shortage management documents were successful, the WSCP retains the same allocation methodology and many of the same elements included in the DMP and WSDRP. However, the 2020 WSCP also includes new elements required under the Water Code as a result of the passage of SB 606.

In addition to the successful activation and deactivation of the DMP and WSDRP, the advanced planning and foresight shown by the Water Authority and its member agencies after the drought in the early 1990s prepared the region to withstand the recent drought conditions. In fact, the water supply diversification strategies implemented by the Water Authority and its member agencies, combined with more than 25 years of aggressive water use efficiency programs, ensured sufficient water supplies for the region during the 2014-2017 drought period. As a result of being prepared for drought conditions, the Water Authority's member agencies were not assigned a conservation standard under the state's "stress test" methodology which was used to calculate a water supplier's water conservation standard. The benefits of supply diversification and water use efficiency will continue to be promoted by the Water Authority and its member agencies as methods to mitigate the impacts from drought conditions.

In the area of communication, past droughts have shown that clear and effective communication between the Water Authority, its member agencies, the public, and other stakeholders is critical to successful management of drought conditions. There are challenges associated with maintaining clear and effective communication. In some instances, the diversity between the Water Authority's member agencies can limit the scope of region-wide messaging since the messaging by individual member agencies may differ. In addition, the region can be subject to messaging from MWD that is designed to target MWD's entire service area, rather than just the San Diego region. Furthermore, previous state-wide campaigns such as "Save Our Water" may also have led to public confusion since the severe drought conditions that exist in other regions of California did not exist in the San Diego region. Information on the WSCP's communication plan can be found in Section 9.

Section 4
Annual Water Supply and Demand Assessment

Beginning in the 1990s, the Water Authority and its member agencies started to develop a diverse portfolio of water supplies to mitigate against potential water supply shortages. These supplies include core supplies, such as seawater desalination, and supply augmentation projects, such as carryover storage. Despite the development of a diverse water supply portfolio, supply uncertainties may still exist at times, but are primarily associated with the availability of imported supplies from MWD. The supply risks are the result of factors such as climate change, drought, and regulatory permitting.

Water Code §10632(a) requires an annual water supply and demand assessment (annual assessment) be conducted to ensure that the Board, member agencies, the public, and state and local agencies are informed as to the region's water supply conditions and the likelihood of water shortages. By July 1 of each year, the results of the annual assessment, including information on an anticipated shortage, triggered shortage response actions, compliance and enforcement actions, and communication actions, must be submitted to DWR in the form of an annual water shortage assessment report. The water supply reliability assessment and the drought risk assessment conducted in the 2020 UWMP show no supply shortages. This section describes the decision making process and methodologies used to perform the annual assessment. The annual assessment focuses on the demand and supplies available to M&I customers. The availability of water supplies associated with the Water Authority's PSAWR Program is discussed in Section 4.3.

The annual assessment is conducted in steps to determine if a regional customer demand reduction is needed, and if so, identify the appropriate shortage response level and actions (discussed in Section 5). It is important to note that if it is determined that a regional shortage response level exists, the actual response level of each member agency may differ slightly depending on the availability of their local supplies. An overview of the basic steps of the annual assessment process are outlined below, and in more detail in Sections 4.1 through 4.4. The annual assessment covers the current year and one dry year.

1. Annual Water Supply and Demand Assessment
    a. Evaluate the Water Authority's core water supplies and member agency demands on the Water Authority to determine if there is a water supply shortfall. Consider locally applicable factors and infrastructure capabilities and constraints that could influence supply.
    b. Evaluate management and potential utilization of carryover storage reserves based on the Board's adopted CSPG (See Appendix A) and determine if additional supply augmentation is required to mitigate a potential water supply shortfall.
2. Calculation of Regional Shortage Level

a. If a water supply shortfall exists after the analysis of Water Authority supplies, calculate the regional shortage level considering total demands and both Water Authority and member agency supplies.

4.1 Assessment of Water Authority Supplies and Demands

This section describes the assessment to evaluate the Water Authority's M&I supplies and projected water demands. The assessment is used to determine if there is a shortfall in Water Authority supplies for the current year and one dry year. If the assessment identifies a shortfall in Water Authority supplies, the supplies available could be allocated based on the allocation methodology in Section 7.

4.1.1 Water Authority Core Water Supplies

The Water Authority's core water supplies that are considered as part of the annual assessment are described below. The core supplies include water supplies from the Lewis Carlsbad Desalination Plant, the Quantification Settlement Agreement (QSA), and MWD. The capabilities and constraints of the infrastructure to deliver the core water supplies are considered as part of the annual assessment.

Claude "Bud" Lewis Carlsbad Desalination Plant

The Lewis Carlsbad Desalination Plant, located at the Encina Power Station in Carlsbad, began commercial operation in December 2015, and provides a highly reliable local treated water supply of up to 56,000 AF/YR. Of the total Lewis Carlsbad Desalination Plant annual production of 48,000 to 56,000 AF/YR, 6,000 AF/YR is considered a member agency local supply.

Quantification Settlement Agreement

In 2003, as part of the execution of the QSA, the Water Authority contracted for 77,700 AF/YR of conserved water from projects to line the AAC and CC. The water is considered Priority 3(a) water and has a higher priority than that of several other water users on the Colorado River, including MWD. Also in 2003, the Water Authority and Imperial Irrigation District (IID) executed an amendment to a 1998 transfer agreement that makes Colorado River water that is voluntarily conserved by Imperial Valley farmers available to the Water Authority. The amendment modified certain aspects of the transfer agreement to be consistent with the terms and conditions of the QSA and related agreements. The volume of water annually available to the Water Authority through the transfer agreement reached its peak of 200,000 AF/YR in 2021.

Metropolitan Water District of Southern California

Under normal conditions, MWD is able to meet the Water Authority's supplemental water needs. However, during drought conditions, MWD may implement its WSAP and allocate water to its member agencies. Under MWD's WSDM Plan, MWD is scheduled to inform its member agencies, including the Water Authority, in April of any potential cutback for the coming fiscal year and if necessary, the agency's allocation. That information is factored into the Water Authority's annual assessment.

4.1.2 Member Agency Projected Water Demands on the Water Authority

Demand for water in the Water Authority's service area falls into two classes of service: M&I and PSAWR demand. The WSCP's annual assessment considers only M&I water use, which encompasses a wide range of water uses, including residential demand (water used for human consumption in the home, domestic purposes, and outdoor residential landscaping) and water used for commercial, industrial, and institutional (CII) purposes.

Short-term water use trends in the region are closely linked to the economy and weather. Over the last several decades, economic growth cycles stimulated local development, which in turn, produced an increase in water demand. However, various factors, including MWD supply allocations, implementation of member agency mandatory water-use restrictions, an extraordinary conservation ethic, and state-mandated emergency water regulations resulted in a decrease in water demand. To project M&I water demands on the Water Authority for the annual assessment, the Water Authority uses a short-term forecast model that considers multiple variables, including historic water demand patterns, weather, local economic index, and anticipated conservation levels. Demand on the Water Authority is also influenced by member agency local supply levels which may be influenced by weather and other factors.

4.1.3 Supply Augmentation

If a water supply shortfall is identified based on the assessment of core water supplies and projected water demands, the next step is to evaluate the use of stored water reserves from the Water Authority's Carryover Storage reserves or to pursue additional supply augmentation measures, such as dry-year transfers, to reduce or eliminate the shortfall. If a shortage doesn't exist, consistent with the CSPG, Water Authority staff will analyze how to most effectively manage storage supplies to avoid potential shortages in the future. The Water Authority's supply augmentation programs and projects are discussed below.

Water Authority Carryover Storage Reserves

To more effectively manage supplies and increase reliability during shortage periods, the Water Authority invested in carryover storage. With carryover storage capacity, the Water Authority can store water for use during times of drought, or to avoid or minimize the impact of supply shortages. Carryover storage provides the following three benefits to the region during a supply shortage:

1. *Enhanced reliability of the water supply* - During dry weather periods, increased regional demand for water may exceed available supplies, resulting in potential water shortages. Carryover storage provides a reliable and readily available source of water during periods of shortage.

2. *Increased system efficiency* - Carryover storage provides operational flexibility to serve above normal demands, such as those occurring during peak summer months or extended droughts, from locally stored water rather than by the over-sizing of the Water Authority's imported water transmission facilities.

3. *Improved management of water supplies* - Carryover storage allows the Water Authority to accept additional deliveries from its existing SWP- and Colorado River-derived sources during periods of greater availability, such as during wet years. This results in more water available locally during periods of shortage.

The Water Authority's carryover storage includes surface water storage in the San Vicente Reservoir. In December 2002, the Water Authority's Water Facilities Master Plan identified the need for approximately 100,000 AF of carryover storage to assist in maintaining a secure and reliable water supply for the region during shortage periods. The San Vicente Dam Raise CSP meets that need by providing approximately 100,000 AF of local storage capacity, thereby facilitating the reliable and efficient delivery of water to residents in the Water Authority's service area during times of shortages. Construction of the San Vicente Dam raise was completed in 2014. By June 2016, the carryover pool was filled to its target storage level of 100,000 AF, although storage levels may vary throughout the year due to operational needs.

The Water Authority's carryover storage also includes out-of-region groundwater storage in California's Central Valley. Following a Request for Proposal process in 2008, the Water Authority executed a groundwater banking agreement with Semitropic-Rosamond Water Bank Authority to store and recover water in its groundwater basins. The Water Authority also acquired storage rights in Semitropic's Original Water Bank through an acquisition of Vidler Water Company's storage rights. The Central Valley out-of-region groundwater agreements provide 70,000 AF of storage capacity, with more than 9,000 AF/YR of put capacity and more than 14,000 AF/YR of recovery capacity. These rights expire December 31, 2035, unless the agreements are renewed.

Utilization of Carryover Storage Supplies

In December 2016, the Board approved CSPG to provide policy guidance on how the Water Authority's carryover storage supplies should be managed during supply shortage events and normal (non-shortage) periods to help minimize or avoid potential cutbacks to member agencies during drought. The CSPG are included in Appendix A.

Water Authority's Dry-Year Transfer Program

To ensure adequate water supplies during drought conditions and periods of regulatory constraints, the Water Authority may consider securing water transfers as part of its WSCP. Considerations on whether to pursue transfers are based on a range of factors, such as source location, federal and state agency approvals, price, call period, and capacity in the SWP system.

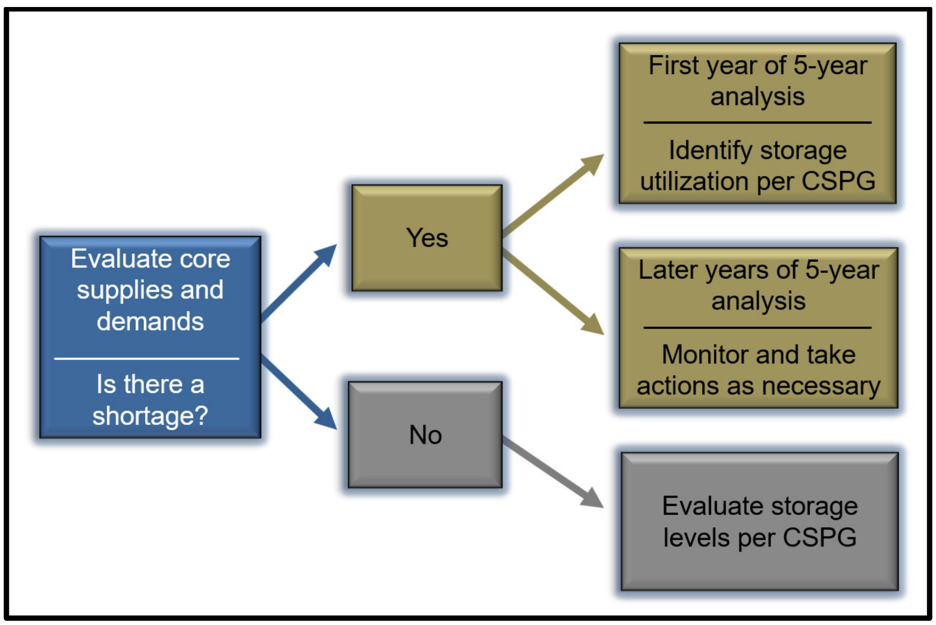
As an example, to lessen the impact of shortages during the 2007–2011 drought, in 2009, the Water Authority acquired 20,000 AF of water under a one-year transfer agreement with

Placer County Water Agency in Northern California to lessen the impact of water supply reductions on the San Diego region. The transfer eased the region's transition from voluntary conservation to mandatory water-use restrictions by keeping the regional water savings target for the year at a manageable level.

The Water Authority did not pursue transfers during the 2012 - 2017 drought for a number of reasons, including the ability of the Water Authority and its member agencies to manage the drought with the current available supplies. In addition, securing dry-year transfers with the SWRCB's May 2015 emergency regulation in place would not have alleviated the state-mandated cutback levels. Supply availability was not taken into account when the state established the reduction mandates.

Figure 4-1 provides an overview of the assessment process to evaluate the Water Authority's core supplies, demands on the Water Authority, and management of carryover supplies.

Figure 4-1
Assessment Process Overview



CSPG = Carryover Storage Policy Guidelines

4.2 Regional Reliability Assessment Calculation

If a regional water supply shortfall still exists after consideration of augmented supplies, the next step is to calculate a regional shortage level at the customer level in order to identify the appropriate M&I shortage response actions. The potential M&I shortage response actions are listed in Section 5. The regional shortage level is calculated by projecting total water demands within the Water Authority's service area and comparing these demands to the available Water Authority and member agency water supplies. As part of the assessment, the Water Authority will contact the member agencies to confirm and determine the appropriate local supply figures to use in the assessment. This includes supplies such as surface water, groundwater, potable reuse water, and non-potable recycled water. *It is important to note that this assessment calculates a regional shortage response level, but the actual shortage response level of each of the member agencies may differ depending on the amount of local supplies available to that member agency*.

4.3 Permanent Special Agricultural Water Rate Program

The Water Authority Board, in September 2020, approved the PSAWR Program and made it available to eligible customers effective January 1, 2021. As a condition of PSAWR Program participation, PSAWR deliveries to the member agencies are exempt from the Storage Charge calculation. In return, agricultural customers receive half the M&I level of service under the ESP and no deliveries under the CSP. The cutback to PSAWR deliveries during a shortage is equivalent to the cutback level from MWD. During the last drought, under the SWRCB May 2015 emergency regulation, urban commercial agriculture was exempt from the emergency conservation mandates, consistent with how the agricultural sector was treated throughout the state. Per PSAWR Program guidelines, program participants would still be required to cutback consistent with the Water Authority's cutback level from MWD.

4.4 Water Supply and Demand Assessment Timeline

To ensure an accurate annual assessment of regional water supply and demand conditions, up-to-date data on supply availability from both the Water Authority's member agencies and MWD is utilized. In addition, information on local and statewide hydrologic conditions, as well as other factors, is considered as part of the assessment.

The process to complete the assessment by July 1 of each year begins in April, with Water Authority staff coordinating with the member agencies to gather the necessary information to conduct the assessment. The information collected includes the member agencies' projections for production of local supplies, such as recycled water (potable and non-potable), groundwater, and surface water. Water Authority staff also monitors imported water supply conditions, including the status of QSA delivers and the potential for supply allocations from MWD. According to the schedule in MWD's WSDM plan, member agencies will generally be notified of any potential allocations in the April time frame when the outlook for imported supplies is known to a fairly high degree of certainty. Based on the results of the assessment, Water Authority staff may recommend an appropriate regional shortage response level for Board consideration to effectively manage the supply situation. It should be noted that this timeline serves as a guideline for preparing the annual assessment and could be modified based on circumstances relevant at that time.

Section 5
Regional Shortage Response Actions and Levels

Section 4 discussed the annual assessment that is used to determine the current regional supply situation for the San Diego region and if any shortage is anticipated. Based on the annual assessment, a water shortage level may need to be activated. If a water supply shortage is identified, this section provides information on the regional water shortage levels and response actions associated with the water supply situation. This section also discusses the water supply conditions that could trigger a specific regional water shortage level. Included is a description of the percent reduction required at each level and whether it is voluntary or mandatory.

5.1 Regional Shortage Levels and Response Actions

In times of potential water supply shortages, the Water Authority needs to take actions to try to reduce and eliminate the shortage. The Shortage Response Matrix provides guidance to the Board to select potential regional actions to lessen the existing or future severity of water supply shortages. The matrix includes a list of potential shortage response actions available to the Water Authority at each of the six levels. The six levels and percent reductions are consistent with the six levels required under SB 606. The Shortage Supply Matrix is shown as Figure 5-1. Each of the actions listed in the Shortage Supply Matrix could reduce the gap between supplies and demands from between 0% to 100% depending on the number of actions implemented and the size of the gap. For example, a 10% gap could be reduced entirely through a communications program that educates the public on the water supply situation. At the same time, that same 10% gap could be reduced by 5% using a limited communications program and another 5% by increasing funding for ongoing water use efficiency programs. Each situation is unique and how the Water Authority proceeds will be at the discretion of the Board.

Figure 5-1
Shortage Supply Matrix

Regional Water Shortage Levels[2]	Potential Water Authority M&I Shortage Response Actions[1]					
	Ongoing Water Use Efficiency	Communication Plan	Supply Augmentation: Storage Withdrawals	Supply Augmentation: Spot Transfers, Other	Call for Extraordinary Demand Reduction Measures	Member Agency M&I Supply Allocation
Normal Conditions	✓					
Level 1 Up to 10% (Voluntary)	✓	✓	✓			
Level 2 Up to 20% (Mandatory)	✓	✓	✓	✓	✓	✓
Level 3 Up to 30% (Mandatory)	✓	✓	✓	✓	✓	✓
Level 4 Up to 40% (Mandatory)	✓	✓	✓	✓	✓	✓
Level 5 Up to 50% (Mandatory)	✓	✓	✓	✓	✓	✓
Level 6 Above 50% (Mandatory)	✓	✓	✓	✓	✓	✓

[1] The matrix contains potential Water Authority regional actions. The member agencies can implement local jurisdiction regulations as necessary for their service areas.

[2] The response to a catastrophic emergency could occur under any response level. Potential Water Authority shortage response actions include activation of the Integrated Contingency Plan and allocation of Emergency Storage Program supplies.

The reduction levels are defined as "up to" or "above" a specified percentage to provide more flexibility for the member agencies to establish the appropriate local reduction level should their reduction not equate exactly to the regional number. As mentioned in Section 4, the regional percent reduction may differ slightly from a member agency's regional percent reduction depending on the amount of local supplies available to that member agency.

To determine the specific actions that should be taken at each level, the Water Authority and its member agencies will evaluate conditions specific to the timing, supply availability, and cost, along with other pertinent variables. Numerous variables can influence the supply reduction levels during a water supply shortage. These variables include, but are not limited to, SWP allocation, conditions on the Colorado River, Water Authority supplies, local storage, local demands, and timing. Member agencies will independently adopt retail-level actions to manage potential water supply shortages.

Depending on the situation, the Board may not implement each of the identified actions in a response level, but select only those that are appropriate. For example, at Level 2, the matrix lists six actions the Board could consider adopting, but based on local and statewide supply conditions, would only decide to implement four of the actions. In addition, the Board may adopt additional actions not listed in the matrix. This occurred during the 2014-2017 statewide drought, when the SWRCB instituted emergency conservation mandates for urban retail water suppliers statewide, regardless of local supply conditions (see Section 3). In the future, should the state mandate emergency conservation standards that would require the Water Authority to deviate from the process outlined in the WSCP, extensive collaboration would occur with the member agencies to develop recommended regional actions for Water Authority Board consideration.

The following is a brief description of each of the potential shortage response actions in the Shortage Response Matrix.

Ongoing Water Use Efficiency
The Water Authority and its member agencies continuously promote water use efficiency, regardless of water supply conditions. Water use efficiency measures target all sectors of water users. Over the last several years, the focus of water use efficiency efforts shifted from indoor to outdoor water conservation due to 25 years of indoor water conservation activities. Those activities included retrofits of indoor plumbing devices and audits to identify inefficient practices. More recent activities included landscape retrofits that are the result of market transformation efforts and outreach campaigns such as the Water Authority's "Live WaterSmart" campaign. Ongoing water use efficiency efforts will be coordinated with the Communication Plan and will take place throughout all regional response shortage levels.

Communication Plan
The Communication Plan will be in place prior to a water supply shortage and be initiated in Level 1 of the Shortage Response Matrix. Activation of the Communication Plan will continue through all subsequent levels of the matrix and be coordinated between the Water Authority and its member agencies. Refer to Section 9 for additional information on the Communication Plan.

Supply Augmentation
Supply augmentation can be initiated under Level 1, and can include storage withdrawals, spot transfers, and other actions. As discussed in Section 4, the Water Authority may withdraw water from its carryover supplies in accordance with the CSPG. At the Board's discretion, storage supplies may be withdrawn from the ESP to mitigate severe shortages. Supply augmentation also includes transfer option contracts for supplies from outside of the region. Transfer options are multi-year contracts that allow the Water Authority to obtain a specified quantity of water at a future date. The amount of water secured will depend on the supply shortage, availability of supply, and cost. A minimum payment for water is usually required in order to secure the transfer. This payment must be made even if the water is not needed. The Water Authority may also buy spot transfers from outside of the region. Spot transfers make water available for a limited duration (typically one year or less) through a contract entered into in the same year that the water is delivered. Additional information on supply augmentation is available in Section 4.

Call for Extraordinary Demand Reduction Measures
Extraordinary demand reduction measures are those measures that reduce water customers'

demand beyond the reductions that result from ongoing water use efficiency activities. They are measures that could be implemented when the regional water shortage response level reaches Level 2 and a mandatory reduction in water use of up to 20% is required. An example of an extraordinary demand reduction measure is restrictions on outdoor water use. Implementation of the specific demand reduction measures would occur at the member agency level. Please refer to Section 6 for additional information.

Member Agency Municipal & Industrial Supply Allocation
Implementation of the Water Authority's M&I supply allocation methodology would be considered when a mandatory reduction in water use is needed (Level 2). Information on the supply allocation methodology can be found in Section 7.

5.2 Potential Response Level Triggers

Response level triggers vary depending on whether the regional water shortage response stage is voluntary or mandatory. For the voluntary level, the scenarios that could trigger a response include the likelihood of potential core supply shortages in the near-term or a shortage in core supplies that could be mitigated through carryover storage reserves. For mandatory levels, a potential scenario that could trigger a response is inadequate Water Authority core supplies to meet demands and supply augmentation does not fully mitigate a core supply shortage. In addition, the response to a catastrophic emergency could occur under any response level. The potential scenarios are summarized in Figure 5-2.

Figure 5-2
Potential Response Level Triggers

Regional Water Shortage Response – M&I Demand Reduction Level		Scenarios (As Documented in Reliability Analysis)
Voluntary	Level 1 – Up to 10%	➢ Likelihood of potential core supply shortage in the near-term ➢ Shortage in core supplies, but mitigated through carryover storage reserves
Mandatory	Level 2 – Up to 20%	➢ Water Authority core supplies are not adequate to meet member agency demands ➢ Supply augmentation (i.e., utilize storage reserves and/or dry-year transfers)
	Level 3 – Up to 30%	
	Level 4 – Up to 40%	
	Level 5 – Up to 50%	
	Level 6 – Above 50%	
Catastrophic Emergency		➢ Occurs when a disaster, such as an earthquake or other emergency event, results in insufficient available water to meet the region's needs or eliminates access to imported water supplies

Section 6
Extraordinary Demand Reduction Measures

The main purpose of implementing extraordinary demand reduction measures during a supply shortage is to achieve a measurable reduction in water use to assist in managing a short-term supply shortfall. The shortage response matrix in Section 5 includes extraordinary demand reduction measures as a potential shortage response action. This section provides a brief discussion on demand reduction measures and the Water Authority's 2020 Model Drought Ordinance. It should be noted that the Water Authority, as a wholesale water supplier, does not implement demand reduction measures at the retail customer level, but can assist member agencies in communicating and educating the public regarding any potential measures.

6.1 Examples of Extraordinary Demand Reduction Measures

Demand reduction measures primarily consist of water conservation actions, but may include actions related to water use efficiency. The distinction between the two types of actions is that water conservation results in a reduction in water loss, waste, or use, whereas water use efficiency is the performance of ongoing water-related tasks with lesser amounts of water.[2] Appendix C includes a list of potential customer water use prohibitions that could be considered extraordinary demand reduction measures and used by the member agencies in their role as a retail water supplier.

6.2 Model Drought Ordinance

The Water Authority's Model Drought Ordinance focuses on core water use restrictions and is intended to assist the member agencies when updating local drought response ordinances and to provide regional consistency in drought response levels and messaging to the public and media. The use of the Model Drought Ordinance as a tool for member agencies helps provide consistency throughout the region which helps to reduce confusion among the public and media on the current response level and appropriate use restrictions.

Triggers that identify the actions required to initiate a certain drought response level are included in the Model Drought Ordinance, which takes into account the relationship between the Water Authority and its member agencies. A certain drought response level may apply when the Water Authority notifies its member agencies that a specific consumer demand reduction level is required. Factors that impact the demand reduction level include potential or actual cutbacks from MWD, the amount of member agency local supplies available, and the

[2] *Making Water Conservation a California Way of Life, Implementing Executive Order B-37-16*. Final Report, April 2017. Page 1-7.

ability of the Water Authority or its member agencies to secure supplemental supplies. Based on an action by the Board and notification from the Water Authority, the member agency would declare the appropriate response level and implement water-use restrictions consistent with the declared response level.

In identifying examples of potential water-use restrictions that could be included in the Model Drought Ordinance, staff identified core restrictions that were common to the existing member agency ordinances and successfully employed by other agencies outside the region. Appendix C provides a list of additional water use prohibitions.

Section 7
Municipal and Industrial Supply Allocation Methodology

7.1 Introduction

As outlined in the Shortage Supply Matrix discussed in Section 5.1, after the Board has exhausted available supply enhancement options and can no longer avoid cutbacks, implementation of an allocation methodology will occur. The challenge in developing the methodology was to meet the diverse needs of the member agencies in a fair and equitable manner. Each of the Water Authority's member agencies has a different demand profile and unique supply portfolio. Some agencies have abundant local supplies, while others are 100% reliant on water supplies purchased from the Water Authority. There are member agencies that serve primarily agricultural customers, while others serve only M&I customers.

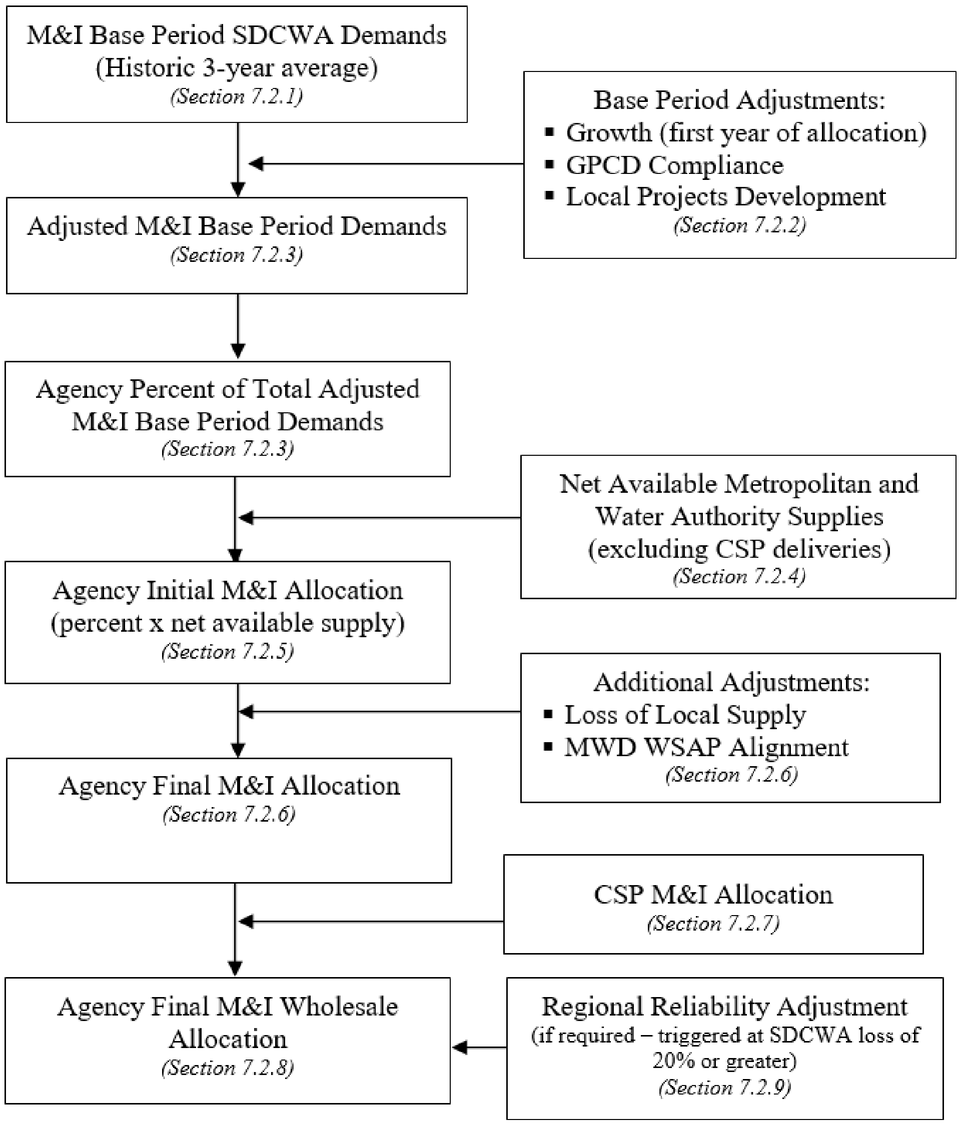
This section includes a description of the M&I supply allocation methodology developed through a collaborative effort between the Water Authority and its member agencies. The goal of the methodology is to provide an equitable means of apportioning the Water Authority's supplies during periods of supply shortages consistent with the TAC approved principles discussed in Section 2.1.3. Through the TAC meetings, Water Authority staff and designated member agency representatives have collectively agreed to the allocation methodology described in this section. It should be noted that agricultural customers in the voluntary PSAWR program have a separate allocation methodology. In exchange for a cost-benefit rate differential, PSAWR customers are subject to higher cutbacks set at the MWD percent reduction level.

In evaluating implementation of the Water Authority's allocation methodology during the FY 2010 and FY 2011 cutback period, Water Authority and member agency staff identified specific elements of the methodology for review and refinement. As part of this effort, it was noted that certain conditions had changed since adoption of the methodology in 2006. Specifically, the adoption of SB X7-7 in 2009, caused a paradigm shift in conservation tracking and prompted an evaluation of the manner in which the allocation methodology addressed demand hardening and conservation savings. A final area of review involved the relationship between the Water Authority's methodology and modifications to MWD's WSAP. Alignment between the two allocation plans was necessary when methodological inconsistencies result in unintended and inequitable impacts to the region or a single member agency. On April 26, 2012, the Board approved modifications to the allocation methodology that were developed through the member agency review and refinement process.

To provide an overview of the allocation methodology that includes the April 2012 modifications, a schematic has been prepared that shows principal steps in the process. As shown in Figure 7-1, the methodology begins with a determination of each agency's base period M&I demands. From this base, adjustments are added to account for agency's growth

growth in demand, local projects development, and compliance with water use efficiency requirements. The calculation results in an adjusted base period demand for each member agency. Next, the amount of supplies available from the Water Authority is determined. This includes the Water Authority's own supplies (excluding Carryover Storage) along with supplies available from MWD. Individual member agency's percent share of the total regional adjusted base period M&I demand is then calculated. The percentages are multiplied by Water Authority supplies available to derive an initial M&I allocation for each member agency. To calculate agencies' final M&I supply allocations, additional adjustments are subsequently made for allocation-year local supply loss and for MWD WSAP alignment, if needed. If the Board elects to utilize carryover storage, a separate allocation for this supply is performed and results in a final total wholesale allocation. In the unlikely event of severe imported supply shortages, a regional reliability adjustment will be applied to avoid large uneven retail impacts. Each box shown in Figure 7-1 contains a reference number to the corresponding subsection that describes the step in detail.

Figure 7-1
Supply Allocation Methodology



7.2 Description of M&I Allocation Methodology

To help describe the M&I allocation methodology and demonstrate the calculation procedures, the following example was developed. The example was prepared for illustration purposes only. For this sample analysis, demand and local supply data for five representative agencies was established to approximate a cross-section of characteristics unique to the region. Other agency attributes such as estimated growth, per capita use, and local supply availability were also based on local agency characteristics. Implementation of the allocation methodology would be considered when a mandatory reduction in water use is needed under Levels 2 through 6 of the Shortage Supply Matrix (see Section 5.1). For illustration purposes, an estimated 15% cutback in MWD supplies to the Water Authority was assumed.

7.2.1 Historic M&I Base Period M&I Demands on the Water Authority (Unadjusted)

A historic base period M&I demand is required to establish each agency's demands on the Water Authority prior to activation of the WSCP. Base period M&I demands are calculated using data from the three most recently completed consecutive fiscal years immediately preceding the year in which Board action is taken to activate the WSCP due to supply shortage conditions. Each of the three consecutive fiscal years will be years in which the WSCP has not been activated. Each agency's base period M&I demand is established by calculating its three-year average of demand on the Water Authority.

For illustrative purposes, Table 7-1 contains historic base period M&I demands for the sample agencies. In the event that consecutive multi-year allocations are required, base period demands (based on the three years prior to the activation of the WSCP) are to remain fixed for the duration of the allocation.

Table 7-1
Example
Historic Base Period M&I Demands on Water Authority (AF)

	Agency A	Agency B	Agency C	Agency D	Agency E
SDCWA M&I Demand (three-year average)	2,200	6,500	181,000	43,100	25,000

7.2.2 Adjustments

Adjustments applied to the base period were developed to equitably account for relevant factors in calculating each agency's allocation. Such factors include growth, compliance with water use efficiency requirements, local supply availability, and efforts taken by local agencies to develop reliable local projects such as recycled water, groundwater recovery, and seawater desalination. The adjustments are intended to acknowledge unique agency characteristics and provide an incentive for agencies to decrease their reliance on imported supplies over the long-term. The following is a summary of each adjustment:

Growth

Because the base period is fixed, a growth adjustment is applied to estimate the increase in demand due to growth from the base period to the allocation year. This adjustment is calculated using agency-level population estimates as a metric to approximate growth in demand. These population figures are based on San Diego Association of Governments (SANDAG) generated annual demographic totals. Each agency's demand increase is computed by multiplying its change in population by a per-capita water use efficiency factor (GPCD factor). The GPCD factor is an aggregate of member agencies' SB X7-7 GPCD targets from the Water Authority's UWMP and encompasses residential and CII demands. As an example, the 2010 UWMP contained an aggregated GPCD target of 174 GPCD for year 2015. The growth adjustment calculation is expressed as:

= (Change in Population) X (Aggregated Member Agency GPCD Target)

However, if an agency's actual base period GPCD is less than the aggregated GPCD target, the lower value will be utilized as the water use factor in the growth calculation. This is done to ensure that the growth adjustment reflects efficient water use levels in the member agency's service area.

In the event that an agency experiences minimal or no population increase, an alternate growth adjustment calculation is available. To qualify, the agency must have sustained a growth rate of less than 50% of the regional population growth rate. As previously stated, SANDAG data will be utilized to determine each agency's growth rate and the regional growth rate. Under the proposed adjustment, CII growth would be captured through CII meter installations that occurred after the base period. Additionally, residential growth in demands would be captured by applying a water-efficient residential GPCD to the minimal population increase. Agencies requesting this method for capturing growth are required to provide adequate documentation on CII meter installations and residential GPCD factors based on their individual SB X7-7 targets.

Finally, to ensure alignment with MWD's WSAP, when necessary, in subsequent years of a multi-year allocation period the growth adjustment amount received from MWD will be passed through to Water Authority member agencies based on each agency's proportional share of Water Authority-wide population growth. The reason the Water Authority growth adjustment from MWD is not passed through to agencies in the first year, is because the two agencies' base periods would likely be different, making the time frame between the base periods and allocation years inconsistent. To again address the concern of agencies with minimal population growth and large CII increase, an agency can request CII meter installations be used, in part, as a basis for proportioning the growth adjustment received from MWD. The same criteria and documentation would be required as discussed above. Table 7-2 illustrates the growth adjustment calculations for each sample agency. *It is important to note that should the State adopt water use efficiency requirements that supersede SB X7-7, the growth adjustment will be updated to align with these new requirements.*

Table 7-2
Growth Adjustment

Member Agency Population

Population	Agency A	Agency B	Agency C	Agency D	Agency E
Final Year of Base Period	12,197	31,784	789,627	220,970	116,782
Allocation Year	12,300	32,400	808,100	233,300	117,500
Change in Population	103	616	18,473	12,330	718

Governing GPCD Target

Agency	Base Period GPCD	Aggregated Agency SB X7-7 Target	Governing GPCD Target
A	176	174	174
B	186	174	174
C	200	174	174
D	165	174	165
E	187	174	174

Growth Adjustment

	Agency A	Agency B	Agency C	Agency D	Agency E
Governing GPCD Target	174	174	174	165	174
Population	103	616	18,473	12,330	718
Gallons (MG)	**6.5**	**39.1**	**1,173.2**	**742.6**	**45.6**
Adjustment (AF)	**20**	**120**	**3,600**	**2,280**	**140**

GPCD Compliance

With the state's adoption of the SB X7-7, retail agencies are currently required to implement water use efficiency measures that result in a 20% reduction in their per capita water use by the year 2020. In order to acknowledge the importance of meeting SB X7-7 targets, a water use efficiency adjustment is incorporated into the allocation methodology. The GPCD compliance adjustment applies only to agencies that fail to meet their SB X7-7 2020 targets, or estimated pre-2020 targets, over the Water Authority established allocation base period. Agencies not meeting their targets will have their SB X7-7 compliance shortfall deducted from their base period demand. Consistent with SB X7-7 guidelines, each agency's base period demand will be normalized for weather before comparison to its GPCD target.

However, to recognize agencies' efforts towards meeting their targets, an SB X7-7 target performance allowance is included as part of the adjustment. Under this allowance, an agency's base period demand would be reduced only if its GPCD exceedance is over 5% of its SB X7-7 target. GPCD compliance adjustments for the sample agencies are shown below in Table 7-3.

Table 7-3
GPCD Compliance Adjustment

	Agency A	Agency B	Agency C	Agency D	Agency E
Base Period GPCD (weather normalized)	176	186	200	165	187
SB X7-7 GPCD Target	178	174	210	170	180
Variance	**-2**	**12**	**-10**	**-5**	**7**
SB X7-7 Target 5% Exceedance Allowance	**N/A**	**183**	**N/A**	**N/A**	**189**
Adjustment (GPCD)	**0**	**3**	**0**	**0**	**0**
Adjustment (AF)	**0**	**117**	**0**	**0**	**0**

It is important to note that should the State adopt water use efficiency requirements that supersede SB X7-7, the growth adjustment will be updated to align with these new requirements.

Local Projects Development

The development of highly reliable in-region supplies, such as brackish groundwater recovery, recycled water, and seawater desalination result in a dual benefit. They add to the region's supply diversity and are a dependable source during shortages of imported water. An adjustment is made for the regional benefit of these annually reliable supplies. The adjustment recognizes both the investment made by the local agency and the regional financial contribution made by the Water Authority. Similar to the M&I base period calculation time frame, a three-year average of beneficial use from these reliable supplies is employed to calculate the adjustment. The Local Projects Development adjustment is 30% of the three-year average. In addition to the incentive from the adjustment, the member agency will be able to utilize 100% of their local project's supply that is available during a drought. Table 7-4 on the following page shows the Local Projects Adjustment.

Table 7-4
Local Projects Development Adjustment (AF)

Year	Agency A	Agency B	Agency C	Agency D	Agency E
1	65	0	4,900	1,310	1,850
2	64	0	4,950	1,350	2,100
3	66	0	5,150	1,340	2,050
Average	**65**	**0**	**5,000**	**1,333**	**2,000**
30% Credit	**20**	**0**	**1,500**	**400**	**600**

7.2.3 Adjusted M&I Base Period M&I Demands and Supply Allocation Percentages

An agency's adjusted M&I base period M&I demand is calculated by adding the applicable adjustments to their initial M&I base period demand. The adjusted M&I base period demand amount is then used to generate an agency's pro-rata percent share of the M&I adjusted base period demand. It is this percentage that is used to calculate an agency's initial imported supply allocation volume. Table 7-5 illustrates the calculation for the sample agencies.

Table 7-5
Adjusted M&I Base Period Demand and
Initial Supply Allocation Percentages (AF)

Agency	Base Period M&I Demand on SDCWA	Growth Adjustment	GPCD Compliance Adjustment	Local Projects Development Adjustment	Adjusted M&I Base Period M&I Demand	Pro-rata Share of Adjusted Base Period M&I Demand
A	2,200	20	0	20	2,240	0.80%
B	6,500	120	-117	0	6,503	2.40%
C	181,000	3,600	0	1,500	186,100	69.90%
D	43,100	2,280	0	400	45,780	17.20%
E	25,000	140	0	600	25,740	9.70%
				Total	**266,363**	

7.2.4 Water Authority Supply Availability and Net Cutback Percentages

The next step in the allocation methodology is to identify the M&I supplies available to meet member agency M&I demands during shortage events. Supplies are equal to the sum of water from MWD, the Water Authority's IID transfer water, conserved water from planned canal lining programs, and supplies from the Lewis Carlsbad Desalination Plant. These additional supplies developed by the Water Authority help to reduce demands on MWD, and therefore decrease the impact from reductions in MWD's supplies. This is demonstrated in the calculations shown in Table 7-6.

For this example, it is assumed that MWD's allocation results in a drought supply allotment equal to 85% of the Water Authority's M&I demand on MWD. In the example, Water Authority supplies are conservatively set at 20,000 AF/YR. Actual Water Authority supplies are significantly higher than 20,000 AF/YR and include supplies from the Lewis Carlsbad Desalination Plant and the QSA. Total M&I supply availability is computed by combining Water Authority supplies and MWD drought supplies (Table 7-6). As discussed in Section 7.2.6, the loss of local supply adjustment requires a portion of the available supply to be set aside to implement the adjustment, the loss of local supply volume is shown in Table 7-8.

Table 7-6
M&I Supply Availability - illustrative purposes (AF)

M&I Supply Availability	
Allocation-Year M&I Demand	273,360
SDCWA Supply	20,000
M&I Demand on MWD	253,360
MWD Cutback to M&I Supplies	15%
Net MWD M&I Supply Availability	215,356
Initial SDCWA M&I Supply Availability	235,356
Loss of Local Supply Adjustment Set Aside	4,700
Net SDCWA M&I Supply Availability	230,656

7.2.5 Member Agency Initial Allocation of Water Authority Supplies

The next step in the allocation methodology is to determine the initial member agency M&I level allocation of available M&I supplies. This is calculated by multiplying total M&I available supplies (excluding carryover storage) by each agency's percent share of the adjusted base period demand, as shown in the following equation:

= (Net Available Regional Imported Supply) X (Agency's Pro Rata Share of Base Period M&I Demand)

For the example, data from Tables 7-5 and 7-6 are used to calculate allocations for the sample agencies. The results are shown in Table 7-7.

Table 7-7
Initial Imported M&I Supply Allocation Volumes

Agency	Pro-rata Share of Adjusted M&I Base Period SDCWA M&I Demands	SDCWA Initial M&I Allocation Volume (AF)
A	0.8%	1,845.2
B	2.4%	5,536
C	69.9%	161,228
D	17.2%	39,673
E	9.7%	22,374
Total	**100.0%**	**230,656**

7.2.6 Additional Adjustments

Loss of Local Supply

Some agencies have invested heavily in local supply development, thereby reducing their reliance on imported water and providing other regional benefits such as surface water treatment capacity. The loss of local supply adjustment was developed to recognize the benefit of these historic supplies and not penalize agencies for diminished local supplies during an allocation year. The adjustment is calculated as the difference between an agency's average local supply used over the base period and its projected allocation-year local supply use. This difference is then reduced by the Water Authority cutback percentage from MWD. Loss of local supply during an allocation year, as used in this section, shall be deemed by the Water Authority to occur, or have occurred, where a member agency's locally produced source of water supply is lost or otherwise reduced as a result of drought/locally dry conditions, legislative and regulatory actions, court orders, water rights decrees and related settlements, the inability of the member agency claiming the adjustment to obtain contracted deliveries from a local water supplier , damage or loss of member agency infrastructure needed to produce, store, treat and convey local water supplies, or other circumstances where the member agency has lost the ability to utilize a local water supply through no fault of its own. The Loss of Local Supply Adjustment for the sample agencies is shown in Table 7-8.

Member agency developed local water supplies subject to adjustment under this provision include, but are not limited to, locally produced surface water, groundwater, desalinated ocean or brackish water, recycled water, captured stormwater or any other locally produced source of water that satisfies the potable or non-potable demands of a Water Authority member agency during the allocation year where a loss of local supply adjustment is sought. It is critical that the agency claiming a potential local supply loss adequately document the actual loss for the year end reconciliation when financial penalties for exceeding allocation targets are assessed.

While recycled, brackish groundwater, and seawater desalination supplies are eligible for the Loss of Local Supply Adjustment, doing so will preclude an agency from applying for the Local Projects Development Adjustment described in the Section 7.2.2 on this same supply.

Table 7-8
Loss of Local Supply Adjustment

Base Period Local Use

Year	Agency A	Agency B	Agency C	Agency D	Agency E
1	0	0	19,700	0	2,000
2	0	0	21,800	0	3,900
3	0	0	18,500	0	2,500
Average	**0**	**0**	**20,000**	**0**	**2,800**
Allocation Year Local Supply	**0**	**0**	**15,346**	**0**	**1,925**
Difference (less 15% MWD Cutback)	**0**	**0**	**3,956**	**0**	**744**

Metropolitan WSAP Alignment

The WSCP allocation methodology also contains adjustments necessary to align it with MWD's WSAP to ensure equitable supply allocations to Water Authority member agencies. In December of 2008, the Board approved alignment modifications that dealt with agencies adding planned local supplies and extraordinary increases in production during consecutive allocation years. The modifications were made because, due to increases in certain member agency local supplies, the Water Authority would have been allocated less water by MWD and the net effect on the Water Authority's allocation needs to be passed through to the member agency developing the local supply.

For agencies adding planned local supplies during consecutive allocation years, a pass through of the net effect on the Water Authority's allocation from MWD will be conveyed directly to the Water Authority member agencies adding these local supplies. The specific change in the amount of water allocated to the Water Authority by MWD because of the member agency's local supply will be identified and the member agency's allocation will be adjusted accordingly by that amount of volume. If more than one agency is involved in a single local supply project, each participating agency's Water Authority allocation will be adjusted on a pro rata basis relative to the participating agency's share of the water delivered by the local supply project.

Under the MWD WSAP, "extraordinary" increases in production are treated differently than planned local supplies. This allows the member agency to improve its reliability through unplanned actions that are solely in response to the drought. Extraordinary increases, such as short-term water transfers and overproduction (mining) of groundwater basins, are not included in an agency's allocation year local supplies. However, the full amount of the extraordinary local supply will be included in the calculation of an agency's Retail Impact Adjustment. Similar to planned local supplies, the change in the amount of water allocated to the Water Authority by MWD will be identified and the allocation of the member agency who implemented the extraordinary local supply will be adjusted accordingly by that volume of water.

The MWD Board subsequently approved additional modifications to its WSAP in September 2011. To maintain continued equitable allocation of supplies to member agencies, an additional adjustment pertaining to recycled water development is now made to the Water Authority's allocation methodology based on the WSAP modifications. The net effect on the Water Authority's allocation from the increased recycled water developed after the based period would be passed on to those member agencies that developed the recycled water supplies. This would be reflected as a reduction in their allocation from the Water Authority. While the agency's allocation from the Water Authority would be reduced, the agency would still be better off in regard to reliability then if they had not developed the recycled water supply.

7.2.7 Carryover Storage Program

Permanent Special Agricultural Water Rate

Under the PSAWR Program, participants are exempt from paying the Water Authority's storage charge and in return will not receive supplies from the CSP during shortages and limited supplies from the ESP.

Carryover Storage Adjustment

Under the PSAWR Program, no CSP supplies are available to PSAWR participants during supply augmentation which begins in Level 1 of the WSCP. A description of the methodology used to ensure CSP supplies are delivered solely to M&I customers is outlined below.

Utilizing CSP Deliveries during Supply Augmentation (Level 1)

In this scenario, the assumptions are that MWD is allocating supplies to its member agencies, but the cutback is minimal, and the Water Authority and its member agencies are able to avoid mandatory cutbacks to M&I customers through shortage management actions. These actions could include voluntary conservation measures and utilization of CSP deliveries. To ensure no CSP supplies are delivered to PSAWR Program participants, each member agency with PSAWR Program participants would be given a PSAWR Program supply allocation based on the MWD cutback level. The following basic steps will be taken to establish the PSAWR Program allocation of non-CSP supplies:

1. Establish PSAWR Program base year, most recently completed fiscal years prior to activation of the WSCP; and
2. Apply M&I cutback level to each agency's PSAWR Program base year to determine its PSAWR Program allocation.

Allocating CSP Supplies during Mandatory Cutback Levels (Levels 2-6)

At this stage, MWD and the Water Authority are both allocating supplies to their member agencies. The Water Authority is utilizing CSP supplies to lessen the cutback level from MWD to M&I customers. In establishing member agency allocations, it is critical that the allocations reflect only CSP deliveries to M&I customers. As a result, a separate calculation to determine the M&I allocation of CSP deliveries is required. The methodology employed is consistent with the approach used to allocate non-CSP supplies (i.e., MWD allocation and Water Authority QSA supplies), except that WSAP Alignment Adjustments are not necessary because they pertain to allocation of MWD supplies.

For this sample calculation, it is assumed that the Water Authority is in mandatory cutbacks and 10,000 AF of CSP storage is made available for distribution to M&I customers. The methodology used to allocate the 10,000 AF of CSP supplies is shown in Table 7-9. In this scenario, each agency's percent share of M&I demand is used to determine its proportional share of the available CSP supplies.

Table 7-9
CSP Allocation (AF)

Agency	M&I Base Period Demand	Pro-rata Share of M&I Demand	CSP Allocation (10,000 AF available storage)
A	2,240	0.8%	80
B	6,503	2.4%	240
C	186,100	69.9%	6,990
D	45,780	17.2%	1,720
E	25,740	9.7%	970
Total	**266,363**	**100.0%**	**10,000**

7.2.8 Member Agency Final Total M&I Allocation

The last step in the allocation process is to calculate each agency's total available M&I Water Authority M&I supplies. This is done by summing each agency's allocation of M&I supplies and adding in its share of M&I CSP allocation, as shown in the following equation:

= Supply Allocation + CSP Allocation (M&I)

For the example, Table 7-10 shows final M&I allocations for the sample agencies. Unless Water Authority supply cutbacks are severe, at or exceeding 20%, the calculation is now complete. If the cutback is severe, the methodology includes a regional reliability adjustment, which is discussed in Section 7.2.9 below.

Table 7-10
Final M&I Supply Allocation (AF)

Agency	SDCWA Initial M&I Allocation Volume	Loss of Local Supply Adjustment	MWD WSAP Alignment	CSP Allocation	Total M&I Allocation Volume
A	1,845	0	0	80	1,925
B	5,536	0	0	240	5,776
C	161,228	3,956	0	6,990	172,174
D	39,673	0	0	1,720	41,393
E	22,374	744	0	970	24,088
Total	**230,656**	**4,700**	**0**	**10,000**	**245,356**

7.2.9 Regional Reliability Adjustment (if required)

In accordance with Principle 15, which states, "*In order to protect the economic health of the entire region, it is very important for the allocation methodology to avoid large, uneven retail impacts across the region. The methodology should include a minimum level of retail agency reliability to ensure equitable allocation among the member agencies*," a regional reliability floor was established. The floor, if needed, is set at 5% below the region's total level of service and is triggered when the net cutback to total Water Authority supplies reaches or exceeds

20%. Taking into account the supply development by the Water Authority, its member agencies, and MWD, this level of cutback is very unlikely. The first step in determining the adjustment is calculation of the level of service for each member agency and region, which is shown below.

Level of Service

The level of service value is computed as the ratio of total supplies available to an agency, including allocated imported supplies and local resources, to projected demand during that same period. Thus, in order to calculate Level of Service estimates, projected member agency allocation-year demand and supply projections are necessary.

Table 7-11 contains estimated allocation-year demands and supplies used for this example. The second column titled, "M&I Demand on SDCWA", has been computed for this example by adding the demand increase associated with the growth adjustment and the estimated loss of local potable supply volume to the base period M&I demand. Estimated allocation year local supplies used to offset imported demands are provided by member agencies.

Table 7-11
Allocation-Year M&I Demand and Supply (AF)

Agency	M&I Demand on SDCWA	Total Local Supply	Total Demands
A	2,220	70	2,290
B	6,920	0	6,920
C	192,600	20,446	213,046
D	45,380	1,400	46,780
E	26,540	4,125	30,665
Total	**273,660**	**26,041**	**299,701**

Summing an agency's M&I allocation volume (Table 7-10) and projected allocation-year total local supplies (Table 7-11) results in their total supply during a cutback. This value is then divided by the projected total demand (Table 7-11) to generate the agency's estimated level of service. A summary of agency level allocations and resulting levels of service is shown in Table 7-12. The M&I level of service of the agencies' and region are utilized in severe cutback levels to calculate the regional reliability adjustment.

Table 7-12
M&I Allocation and Resulting Level of Service (AF)
15% Cutback to MWD Supply

Agency	Total Allocation Volume	Total Local Supply	Total Supply	Projected Total Demand	Level of Service
A	1,925	70	1,995	2,290	87%
B	5,776	0	5,776	6,920	83%
C	172,174	20,446	192,620	213,046	90%
D	41,393	1,400	42,793	46,780	91%
E	24,088	4,125	28,213	30,665	92%
Total	**245,356**	**26,041**	**271,397**	**299,701**	

Total Regional Level of Service - (271,397/299,701) = 91%

Regional Reliability Adjustment Calculation

The regional reliability floor effectively reallocates a portion of the Water Authority's supplies necessary to bring all agencies up to the minimum level of service. This floor is set at 5% below the region's total level of service and is triggered when the net cutback to total Water Authority supplies reaches or exceeds 20%. The volume of imported supplies required to meet this shortfall is provided by those agencies with a total level of service exceeding the region's total level of service. An agency's contribution is calculated by multiplying its pro-rata percent share of the aggregated exceedance volumes by the total level of service shortfall. However, an agency's contribution cannot exceed quantities that would lower its total level of service below the regional level of service.

Data from the previous example is used to illustrate the regional reliability floor adjustment procedure. In this scenario, the reduction in MWD's supply is elevated to 30%. As a result, the net cutback in Water Authority total supplies increases to 28%, which triggers the reliability adjustment. A detailed summary of the regional reliability floor calculation is shown in Table 7-13.

7.2.10 Data Reconciliation

Since allocations are based on estimated values, an assessment of each agency's actual demand and supply utilization during a cutback is necessary. Through this process, a final accounting of appropriate allocation volumes will be calculated. The reconciliation of certified and actual data will occur at the end of the allocation period or at the end of twelve months, whichever comes first. Agencies are required to certify the following information: total and PSAWR demands, base period GPCD, local potable use and recycled water use.

7.2.11 Future Updates to Allocation Methodology

It is anticipated that minor adjustments to the allocation methodology will be needed in response to long-term water conservation framework legislation that supersedes SB X7-7. These modifications will include, but may not be limited to, minor adjustments to the calculation methodology for the growth and GPCD compliance adjustments.

Table 7-13
Regional Reliability Floor (AF)
30% Cutback to MWD Supply

Available Supply: **192,652**

Regional Reliability

Regional Level of Service (233,393/299,701) = 78%

Regional Reliability Floor (-5%) 73%

Level of Service

Agency	SDCWA Initial Allocation Volume	Estimated Local Supplies	Loss of Local Supply Adjustment	CSP Allocation	Total Supply	Projected Total Demand	Level of Service
A	1,541	0	0	80	1,691	2,290	73.9%
B	4,624	0	0	240	4,864	6,920	70.3%
C	134,664	15,346	3,956	6,990	166,056	213,046	77.9%
D	33,136	0	0	1,720	36,256	46,780	77.5%
E	18,687	1,925	744	970	24,526	30,665	80.0%
Total	**192,652**	**17,271**	**4,700**	**10,000**	**233,393**	**299,701**	

Regional Reliability Floor Reallocation

Agency	Total M&I Floor Check	Total M&I Shortfall	Pro-rata Share of Total Shortfall	Exceedance of Regional Reliability Average	Exceedance Volume	Pro-rata Share of Exceedance	Exceedance Agency Contribution	Revised SDCWA Initial Allocation	Revised Total Supply	Revised Level of Service
A	0.0%	0	0.00%	0.00%	0	0.0%	0	1,541	1,691	73.9%
B	-2.7%	188	100.00%	0.00%	0	0.0%	0	4,812	5,052	73.0%
C	0.0%	0	0.00%	0.00%	0	0.0%	0	134,664	166,056	77.9%
D	0.0%	0	0.00%	0.00%	0	0.0%	0	33,136	36,256	77.5%
E	0.0%	0	0.00%	2.00%	607	100.0%	188	18,499	24,338	79.4%

Shortfall Calculation **Exceedance Calculation** **Reallocation**

7.3 Member Agency Transfers Secured Following Allocation Methodology

The Water Authority's member agencies have the option of purchasing water from an entity and using, among other facilities, the SWP, the Colorado River Aqueduct (CRA), MWD's distribution system, and the Water Authority's distribution system to wheel the water. In addition to the cost of the transfer water, the member agency would pay the applicable wheeling rates to utilize these facilities. This transfer water would not be considered a Water Authority supply or local supply when allocating Water Authority supplies under the methodology included in the WSCP. Rather, the transfer water would be "on top" of the allocation, and thus, not factored into the allocation methodology base period or be eligible for the local project development adjustment.

However, under the MWD WSAP, these transfer supplies would be considered an "extraordinary" increase in production as discussed in Section 7.2.6. With extraordinary increases, only the portion of the production equal to MWD's regional shortage is added to the base period local supply. The remainder of the supply is outside of the MWD WSAP and adds directly to the agency's supply. For example, during a 10% shortage, 10% of the extraordinary increase is added to the base period local supplies while 90% is not. It is through this addition to the base period local supplies that the Metropolitan allocation to the Water Authority is reduced.

Consistent with the Water Authority's alignment methodology, the net effect on the Water Authority's allocation from MWD will be directly passed through to member agencies with the extraordinary increases in production. The change in the amount of water allocated to the Water Authority by MWD will be identified and the member agency's allocation will be adjusted accordingly by that amount of water. If more than one agency is involved, each participating agency's Water Authority allocation will be adjusted on a pro-rata basis relative to the participating agency's share of the extraordinary local supply increase.

Water Authority staff will assist member agencies in entering into agreements with the wheeling entities. Additionally, the Water Authority may need to be a signatory to some of the wheeling agreements, such as an agreement with MWD. However, it will be the member agency's responsibility to find the transfer water, enter into an agreement with the selling entity, and comply with any other requirements (e.g. California Environmental Quality Act, National Environmental Policy Act). Any transfer water identified by the Water Authority during its search that it chooses not to purchase will also be available for purchase by its member agencies. The Water Authority will notify the member agency managers should transfers be available for purchase.

Section 8
Catastrophic Water Shortage

A catastrophic water shortage occurs when a disaster, such as an earthquake, results in insufficient available water to meet the region's needs or eliminates access to imported water supplies. This section describes the Water Authority's ICP, ESP, and Emergency Water Delivery Plans (EWDPs), all of which were developed to protect public health and safety and to prevent or limit economic damage that could occur from a severe shortage of water supplies. Additional information on these plans can be found on the Water Authority's website at www.sdcwa.org.

8.1 Integrated Contingency Plan

The ICP provides staff with the information necessary to respond to an emergency that causes severe damage to the Water Authority's water distribution system or impedes the Water Authority's ability to provide reliable water service to its member agencies. The ICP describes the situations and incidents that trigger the activation of the ICP and Emergency Operations Center (EOC). It also provides direction and strategies for responding to a crisis. The ICP includes:

- Authorities, policies, and procedures associated with emergency response activities.
- EOC activities, including activation and deactivation guidelines.
- Multi-agency and multi-jurisdictional coordination, particularly between the Water Authority, its member agencies, and MWD in accordance with Standardized Emergency Management System and National Incident Management System guidelines.
- Incident Command System management and organization and emergency staffing required to assist in mitigating any significant emergency or disaster.
- Mutual Aid Agreements and covenants that outline the terms and conditions under which mutual aid assistance will be provided.
- Hazard specific action plans and Incident Command System position checklists.

In addition, the ICP uses a step-by-step approach to emergency response planning by providing tools such as resource and information lists, personnel rosters, pertinent policies and procedures, and reference materials. The Water Authority provides input to the Unified San Diego County Emergency Services Organization's "Operational Area Emergency Plan," which, in turn, supports the ICP.

8.2 Emergency Storage Project

The ESP is a system of reservoirs, pipelines, pump stations, and other conveyance facilities intended to improve San Diego's regional water storage capacity and allow stored emergency water to be delivered to the Water Authority's member agencies within San Diego County during a prolonged regional interruption. The ESP facilities can be used to help deliver emergency water supply to member agencies during two- and six-month emergency events in which the region is either completely unable or partially able to receive imported water deliveries due to a disaster that renders their transmission system inoperable.

A regional emergency event is a catastrophic interruption of imported water supplies, or any other emergency situation in which the Water Authority has insufficient water available to supply at least 75% of the total demand of its service area, or any portion thereof. The Water Authority Board may also authorize that water stored for emergency use under the ESP be used in a prolonged drought or other water shortage situation.

The regional emergency water supply reservoirs (with their ESP capacity) are Olivenhain (18,000 AF), Lake Hodges (20,000 AF), and San Vicente (52,100 AF). The actual amount of ESP water to be delivered to a particular member agency during an emergency event will depend on many factors, including member agency demands, local supplies, parts of the ESP infrastructure and other Water Authority infrastructure in place, availability of supplies from MWD, and the actual duration of the emergency. Overall, the ESP was designed to create a regional storage capacity of 90,100 AF of water to meet emergency needs. Recent trends in regional water demand indicate that this volume of emergency storage will serve the region beyond 2045.

Completion of the Water Authority's Twin Oaks Valley Water Treatment Plant (WTP) in 2008 increased the ability to treat emergency water supplies delivered from Olivenhain and Lake Hodges Reservoirs. Prior to construction of the Twin Oaks Valley WTP, many member agencies that normally receive treated water from the Water Authority would have to be delivered untreated water in a two-month emergency event. The untreated water would have to be conveyed in treated water pipelines, resulting in the need for decontamination of the treated water pipelines prior to switching back to treated water deliveries. Additionally, the completion of the Lewis Carlsbad Desalination Plant allows the Water Authority to deliver treated water supply to member agencies during emergency events. This results in a commensurate decrease in emergency storage that needs to be maintained in ESP reservoirs.

8.3 Emergency Water Delivery Plans

EWDPs provide forecasts of Water Authority emergency water supply deliveries to its member agencies during two- and six-month emergency events, the same planning level events that formed the basis for the design of ESP facilities. These forecasts are referred to as EWDPs. Water supplies included in EWDP development are imported water supplies (for 6-month event only) and local supplies. Imported water supplies include Water Authority QSA transfers, spot transfers, out-of-region storage supplies, and MWD supplies. Local supplies include member agency local supplies and Water Authority in-region supplies. Member agency local supplies consist of recycled water, seawater desalination, groundwater, and water stored in surface reservoirs. The transfer of local supplies between member agencies is also considered. Water Authority in-region supplies consist of water produced at the Lewis

Carlsbad Desalination Plant and water stored in ESP surface reservoirs.

The following general procedure from the EWDPs shows the methodology to calculate the allocation of ESP supplies to member agencies in a prolonged outage situation without imported supplies:

- Define the water storage and conveyance facility infrastructure that would be in place at the time of the emergency event in order to estimate duration of emergency (that is, time needed to repair damaged pipelines and/or infrastructure);
- Determine the total demand of each member agency during the emergency, considering both M&I and agricultural demands;
- Determine the net demand of each member agency, considering the availability of recycled water supplies;
- Determine the local supplies available to each member agency, including: potable reuse, groundwater, surface water storage, and seawater desalination;
- Determine the amount of local water that could be transferred within City of San Diego service areas;
- Determine the amount of transfers between member agencies based on existing agreements;
- Determine the amount of Lewis Carlsbad Desalination Plant supplies that could be delivered to member agencies;
- Determine the amount of imported water supplies available to deliver to member agencies;
- Allocate ESP supplies in Olivenhain, Lake Hodges, and San Vicente Reservoirs to each member agency to achieve an initial level of service of 75%, considering other supplies available to each member agency as described above and taking into account limitations of delivery facilities;
- Determine reductions in deliveries to member agencies participating in the Water Authority's TSAWR program. The cutback rate for TSAWR customers is twice the rate imposed on Water Authority M&I customers, up to a 90% cutback. Reductions in deliveries that arise from such a cutback will be reallocated to commercial and industrial customers;
- Determine increases in member agency deliveries due to redistribution of the emergency water not delivered to member agencies as a result of the TSAWR program; and

- Determine net Water Authority deliveries to member agencies from all water supply sources available to the Water Authority, consisting of Lewis Carlsbad Desalination Plant supplies, imported water supplies, and ESP reservoir supplies.

8.4 Multi-Hazard Mitigation Plan

Water Code Section 10632.5 requires an urban water supplier to include within its UWMP a seismic risk assessment and mitigation plan to assess the vulnerability of each of the various facilities of a water system and mitigate those vulnerabilities. An urban water supplier may comply with this requirement by submitting a copy of the most recently adopted multihazard mitigation plan under the federal Disaster Mitigation Act of 2000 (Public Law 106-390) if the multihazard mitigation plan addresses seismic risk.

Appendix D includes a copy of the *Multi-Hazard Mitigation Plan for San Diego County, California* (MHM Plan). The MHM Plan was prepared with input from the Water Authority and under the federal Disaster Mitigation Act of 2000. Section 4.3.4 of the MHM Plan addresses seismic risk.

Section 9
Communication Plan

9.1 Introduction

The Water Authority and its 24 member agencies conduct communications and outreach about water supplies and water-use efficiency as an ongoing activity during normal supply conditions. However, clear and effective communications between water agencies, the public, public officials and other key stakeholders becomes even more important if supply conditions become abnormal and the Water Authority needs to activate its WSCP. Experience from previous droughts or other demand management periods, along with data from regional public opinion polls, indicate that when there is a need for urgent water conservation, people basically want to know the following:

1. What they need to do – specifically – to save water
2. How much water they need to save and for how long
3. Why they need to save water
4. What water agencies are doing to correct the supply problem or address the situation

While communicating these points may seem simple and straightforward on the surface, in practice the process can be challenging and complex for the Water Authority. The very diverse needs and characteristics of the Water Authority's member agencies alone puts limits on the scope of messages and tactics that can be applied to the entire region. To further complicate matters, state-imposed regulations on local water districts during droughts or supply shortages have the potential to dictate a wide range of water-saving targets – and thus a variety of needed behaviors – across the region. Experience also has shown it is possible for the state to mandate emergency water savings targets or measures when there is no actual shortage emergency in the region. Finally, if residents and businesses are asked to save water for an extended period of time, their resolve to comply and help water agencies achieve their respective water-use targets can be eroded by a number of factors ranging from impacts to water rates, negative effects to their lifestyle, equity issues or simple "drought fatigue."

These possibilities make it even more difficult for the Water Authority and its member agencies to communicate effectively, avoid confusion and maintain credibility. However, in previous droughts the Water Authority and its member agencies have been able to work together to overcome these obstacles and conduct effective, award-winning outreach campaigns. This section of the WSCP describes the basic communications plan needed to help the Water Authority successfully convey crucial information during all stages of the WSCP.

9.2 Coordination

For the reasons described in Section 9.1, it is vital for the Water Authority's communications to be closely coordinated with its member agencies. The Water Authority regularly interacts with its member agencies at several levels to ensure regional messaging and outreach efforts remain appropriate, effective and responsive to member agency needs. These levels include the Joint Public Information Council/Conservation Coordinators (staff level), the Member Agency Managers group (management level) and the Water Authority Board's Legislation and Public Outreach Committee (Board level). During droughts or other times of limited supply that activate the WSCP, the Water Authority will establish more frequent schedules of updates, reports or discussions at all levels to ensure Water Authority outreach messages and tactics stay in sync with the changing needs of member agencies and their customers. The schedule and timing of these updates may adjust periodically to reflect evolving water shortage conditions or other factors.

During droughts or other situations that create supply shortages, it's also common for entities outside the San Diego region, such as MWD, the Association of California Water Agencies and DWR, to engage in communication activities that extend into this area. Water Authority outreach staff will also engage in regular contact with these entities to help minimize the potential for their activities to cause local confusion, as well as seek opportunities to leverage these external resources to complement outreach already under way by the Water Authority and its member agencies.

To maximize internal coordination, the Water Authority will convene a "cabinet" of senior management and department executives from across the organization to discuss supply planning, operational, financial and communication issues related to the WSCP as needed.

9.3 Flexibility and Adaptability

The Water Authority's WSCP includes six distinct levels of potential shortage, along with "normal" conditions when no out-of-the-ordinary water-saving actions are called for. It also includes a "catastrophic" condition when extreme events prompt emergency-oriented water-saving measures to preserve supplies for health and safety. It's possible for the desired scope of water-saving actions or outcomes to vary widely at each level of the plan. For example, at Level 2 the communication messages, tactics and resources needed to reach a target of 12% would likely be very different than those needed to hit a target of 20%.

In addition, there are many potential communication strategies and tactics that can be deployed to help the Water Authority successfully implement each level of the WSCP. The precise mix of appropriate strategies and tactics is best determined based on a number of factors, including what WSCP level is activated, the specific supply or regulatory circumstances driving that activation, budget availability, seasonal conditions, and other factors.

Because of these potential variations, this communication plan doesn't dictate every strategy and tactic or the scale of resources that needs to be applied regionally at each level of the WSCP. Rather, this plan includes recommended strategies and tactics that generally match the needs associated with the escalating levels. This is intended to give the Water Authority's Board and management the flexibility to apply tailored communications approaches that best fit the specific goals of the Water Authority and its member agencies at any given point, and the agility to react quickly to any changes in conditions. An outline summarizing recommended actions at each level is at the end of this section of the communication plan in Table 9-1. Specific, customized campaign plans with budgets and timelines will be crafted by the Public Affairs Department when needed to reflect the unique circumstances of any demand management or water shortage situation.

9.4 Key Audiences

The Water Authority needs to communicate with many different stakeholders as part of the WSCP. The intensity of outreach will likely vary with the WSCP level that is active at any given time, but the key audiences for the communication plan are fairly consistent. In general, they include:

- Member agencies
- General public (water consumers)
- Public officials
- Homeowners
- Multi-family property owners/managers
- Commercial-industrial property managers
- Landscape contractors/suppliers
- Business/civic leaders
- High-visibility or high-water-use industries (restaurants, hotels, construction, etc.)
- Land-use agencies
- Environmental groups
- Community-based service organizations
- Non-English-speaking populations
- Temporary residents (tourists, college students, etc.)

While it's important to communicate with all of these groups, at times some of these audiences may require higher priority or specialized outreach. Public Affairs staff will coordinate closely with member agencies and solicit feedback from stakeholders as needed to ensure outreach efforts are reaching key audiences.

9.5 Communication Objectives

In general, the communication objectives during the various levels of the WSCP include the following:

- Motivate water users to increase conservation immediately in ways that are consistent with any voluntary or mandatory actions called for at the current level of the WSCP.
- Raise awareness and understanding of the drought, regulatory or other conditions affecting water supplies and the need for increased conservation.

- Minimize confusion and maintain credibility of water agencies and conservation messages with an appropriate tone that avoids "cry wolf" perception and non-compliance backlash.
- Make water users feel appreciated for existing accomplishments in improving their water-use efficiency, and for supporting regional and local investments in water supply reliability.
- Educate regional civic and business leaders, elected officials and the public that the region's water agencies have greatly improved the region's water supply reliability by promoting water-use efficiency programs, diversifying water supply sources and investing more than $3.5 billion in alternative supplies and major water infrastructure.
- Prepare the region for escalation (or de-escalation) of the WSCP based on trending supply conditions.
- Ensure all stakeholders believe they are being treated fairly in relationship to other stakeholders.
- Maintain communication effectiveness by soliciting or monitoring feedback from member agencies, key stakeholders and the general public to update or adapt messages or tactics.
- Exit WSCP implementation having demonstrated the effectiveness and value of conservation actions and water supply reliability investments in minimizing impacts to the region's economy and quality of life.

9.6 Standard Communications

During normal water supply conditions, the Water Authority will engage in standard communications and outreach activities. That means the Water Authority will promote water-use efficiency as a way of life in the San Diego region as part of its regular messaging delivered through the following channels:

- Media relations (pitches, interviews and news releases)
- Social media (Twitter, Facebook, YouTube, etc.)
- Websites (sdcwa.org and WaterSmartSD.org)
- E-newsletters
- Speaker's Bureau presentations
- Community events
- Citizens Water Academy
- Water News Network

During normal conditions, water efficiency will be promoted by sharing water-saving tips that are consistent with any permanent water-use restrictions in effect throughout the San Diego region (by statewide mandate or consensus of all member agencies). It will also be promoted by ongoing marketing of the Water Authority's array of regional water-use efficiency programs that are designed to help the member agencies achieve their long-term water management targets or goals, as well as promotion of other available water-savings tools and resources (for example, any available MWD-administered programs or SDG&E-funded

programs).

9.7 Level 1 Strategies and Tactics

This section lists a number of strategies the Water Authority has used to guide successful drought response campaigns in the past and should be considered during Level 1 of the WSCP (up to 10% voluntary conservation).

Recommended Strategies

- Engage member agencies in the development of a regional campaign theme that fits the call for increased conservation and can adapt to changing levels of the WSCP as necessary.
- Send clear, consistent and understandable messages encouraging increased voluntary conservation.
- Develop and maintain a steady stream of media relations activities and social media communications that explain the need to conserve and how to conserve, promote water-use efficiency programs and incentives, and/or give general support for water conservation. Schedule these efforts to provide timely support for water-use efficiency events, strategies and other programs.
- Enhance the level of conservation-oriented community outreach through greater frequency of outreach at community events and speaker's bureau presentations.
- Develop specific outreach efforts that target key industries or groups (hospitality, HOAs, building managers, etc.) to raise awareness of, and participation in, drought response actions and water-use efficiency programs.
- Recruit community and media partners who can expand the reach of drought response communications.
- Establish an online hub for:
    - Information on current status of regional WSCP and recommended water conservation practices
    - Link to www.WaterSmartSD.org, sdcwa.org or other appropriate website for more water conservation tips, rebates, tools and other resources
    - Updated information on statewide weather, water supply and/or regulatory conditions
    - Information on how the Water Authority and its 24 member agencies are successfully enhancing the region's water supply reliability through investments in water supply diversification and major infrastructure
    - Links to member agency websites for retail level information
- Regularly communicate with local, state and other elected officials in the region about the importance of achieving voluntary water conservation and encourage them to publicly promote such efforts to their constituents.

Recommended Tactics

- Member agency communications
    - Involve member agencies in development and implementation of communication plan through more frequent JPIC meetings and supplemental communications.
    - Provide regular campaign updates to member agency general managers and their designated staff, and Board members.
    - Provide campaign outreach materials (newsletter articles, graphics, bill stuffers, etc.) to member agencies for reproduction and distribution.
    - Encourage member agencies to promote consistent regional messaging and conservation programs to their customers and the public in their service areas.
- News conference or other event to announce/explain change in WSCP level
- Water Authority communications (ongoing)
    - Media relations
        - News releases, advisories, op-eds, etc.
        - Media opportunities (pitches, events, in-studio appearances, etc.)
        - Partnerships
    - Website messaging (sdcwa.org and/or WaterSmartSD.org)
        - Provide links to local agency webpages containing water-use restrictions or other drought instructions/resources for customers
        - Provide searchable directory of conservation rebates or programs by postal code or street address
        - Provide lists of easy, understandable water-saving tips
        - Provide links to water-savings programs
    - E-newsletters
    - Social media (Twitter, Facebook, YouTube, etc.)
- Community relations
    - Events (water-efficient plant fairs, classes, fairs, garden tours, etc.)
    - Speakers Bureau presentations
    - Community partnerships
        - Restaurants
        - Hotels/motels
        - Local breweries
        - San Diego Gas & Electric
        - Large employers (public and private)
        - Public agencies (Caltrans, San Diego County, etc.)
        - Shopping malls (Westfield, Simon Property Group)
        - High-traffic destinations (airport, theme parks, San Diego County Fair, etc.)
        - Regional gardens (Water Conservation Garden, San Diego Botanic Garden)
    - Ethnic outreach (presentations, community events, partnerships)

- Industry relations
  - Targeted outreach to high-water-use industries
- School education
  - Modify school assembly program content to include messages about need for increased voluntary conservation.
  - Provide other regional water and environmental education programs with key messages about need for increased conservation.

- Government relations outreach
  - Encourage elected officials to post links to regional campaign on their websites and promote water conservation tips and program availability at www.WaterSmartSD.org to constituents through newsletters and social media.
  - Provide conservation information and other support as necessary to government officials for their own media events, hearings, community meetings, etc.
- Advertising
  - Execute targeted advertising plans to enhance awareness of need for increased voluntary conservation or spur participation in specific programs or behaviors.
  - Coordinate campaign timing/placement with those of other water agencies to leverage available resources (City of San Diego, MWD, Department of Water Resources/Association of California Water Agencies).
  - Coordinate message tone and content to maximize consistency and minimize confusion; ensure external campaign messages are appropriate for San Diego region.
  - Complement ads with public service announcements on local government access channels
- Educational/promotional items that encourage conservation (dye tablets, self-closing hose nozzles, etc.)
- Testing and evaluation
  - Use public opinion polls and other opportunities to test messages and tactics and revise as needed to increase effectiveness.

9.8 Level 2 Strategies and Tactics

In the event of a more severe supply shortage or demand management period that requires entering Level 2 of the WSCP (up to 20% mandatory conservation), the Water Authority will continue to deploy or enhance Level 1 strategies and tactics as needed, and will consider supplemental strategies and tactics listed below.

Recommended Strategies

- Engage member agencies in the development of a more serious campaign message that reflects the need for compliance with mandatory water-use restrictions. Provide visuals and other supporting materials for the campaign to member agencies.
- Send clear, consistent and understandable messages regarding mandatory water-use restrictions in effect.
- Enhance media relations activities and social media communications related to water-use restrictions, conservation programs and drought conditions. Schedule these efforts to provide timely support for new campaign initiatives, conservation events and other programs.
- Leverage stakeholder groups' communication channels to help distribute updated information about restrictions and conservation as soon as possible; groups to include business organizations, civic organizations, service clubs, religious leaders, elected officials, along with key associations governing HOAs, building managers, landscape companies, etc.
- Expand efforts to recruit community and media partners who can expand the reach of drought response communications.
- Enhance the campaign's current level of grass-roots community outreach with strategies and tactics that encourage more community members to publicly show their support for the campaign (i.e., turn more homeowners, property managers, students, etc. into individual "community partners" promoting increased conservation in neighborhoods around the county)
- Expand drought outreach advertising; continue to coordinate communications and advertising messages and plans with the region's 24 member agencies, MWD, the state Department of Water Resources, and other agencies.
- Consider adjustments to water conservation resources and programs in ways that make finding and participating in key programs easier, or to facilitate short-term water savings. Support these efforts with events to provide information and resources to consumers or other stakeholders.

Recommended Tactics

- Member agency communications
    - Involve member agencies in planning and implementing more serious or urgent campaign messaging and activities.
    - Supplement regular JPIC meetings with more frequent communications (email updates, etc.) as needed.
- News conference or other event to announce/explain any change in WSCP level
    - Consider joint announcement with business/civic partners to enhance communitywide buy-in for water-savings actions.
- Water Authority communications (ongoing)
    - Websites
        - Add "pop-ups" with outreach campaign messages to sdcwa.org and WaterSmartSD.org.
    - E-newsletter

        - Ensure drought updates or conservation information are distributed at least twice monthly through WaterSource e-newsletter.
    - Social media
        - Expand community engagement on drought campaign through more involved social media activity (consider neighborhood-based outreach via Nextdoor or other means).
    - Regional water-waste reporting app
        - Enhance efforts to encourage customers to download and use it to report incidents of water waste directly to member agencies.
- Stakeholder outreach
    - Provide updated campaign messaging to business groups, service clubs, religious leaders, elected officials to distribute to their own audiences (via newsletter, email, etc.).
    - Accelerate outreach efforts to key associations governing HOAs, building managers, landscape companies, etc. to immediately raise awareness of and compliance with mandatory water use restrictions, as well as to update information on available conservation resources.
- Community Partnerships
    - Consider adding budget resources to attract more high-value community partnerships
- Government Relations
    - Supplement existing activities with in-person briefings to state and local officials on state of water supplies and water conservation campaign.
- Advertising
    - Execute mass-market regional advertising with involving radio, TV to enhance awareness of needed mandatory water-saving actions.
    - Continue to coordinate campaign timing/placement with those of other water agencies to leverage available resources (City of San Diego, MWD, Department of Water Resources/Association of California Water Agencies).
- Testing and evaluation
    - Use public opinion polls or other opportunities to test messages and tactics and revise them as needed to increase effectiveness.

9.9 Level 3-4 Strategies and Tactics

In the event of a more severe supply shortage or demand management period that requires entering Level 3 or 4 of the WSCP (up to 30% or 40% mandatory conservation, respectively), the Water Authority will continue to deploy or enhance Level 2 strategies and tactics as needed, and will consider supplemental strategies and tactics listed below.

Recommended Strategies

- Engage member agencies in the development of a more serious campaign message that reflects the need for higher level of extraordinary conservation. Provide visuals and other supporting materials for the campaign to member agencies.
- Send clear, consistent and understandable messages regarding mandatory water use restrictions in effect and escalating challenges affecting water supplies.
- Conduct specialized outreach to landscape industry and water users with large ornamental landscapes to achieve significant reductions in discretionary outdoor water use while minimizing long-term property damage.
- Initiate targeted outreach to major CII water users to help them identify, prepare for and, as much as possible, avoid negative impacts from extreme water conservation requirements.
- Evaluate the appropriateness of continuing to promote long-term water-use efficiency programs and tools amid worsening supply conditions/increasing restrictions.

Recommended Tactics

- Member agency communications
    - Involve member agencies in the planning and implementation of updated messages and campaign activities to raise awareness for more extreme water-saving actions and behaviors; provide updated communications materials to member agencies.
- News conference or other event to announce/explain any change in WSCP level
    - Invite local elected officials to participate to convey need for savings across the region.
- Water Authority communications (ongoing)
    - Promote compliance with specific, regionally applicable water-use restrictions.
    - Encourage users to check with local water agencies for additional rules or restrictions in effect for their area.
    - Provide instructions for triaging landscape resources during extreme shortage conditions (saving trees, etc.).
- Stakeholder outreach
    - Reinforce business groups, service clubs, religious leaders, elected officials to spread awareness of need for significant, collective water-saving actions to preserve our economy and quality of life.
    - Provide specialized technical assistance sessions or resources to help homeowners achieve immediate reductions in water use while minimizing landscape damage.
    - Consider providing specialized technical assistance to large landscape customers (HOAs, cities, schools, etc.) to help achieve large-scale reductions in discretionary outdoor water use.
    - Conduct specialized outreach to industries (hospitality, car washes, restaurants, etc.) or other large-scale water users (schools, park and rec

  - districts) that will likely experience impacts from emergency conservation to determine solutions for minimizing economic or quality of life impacts.
  - Add water conservation information/assistance resources to 211 emergency services directory.
- Advertising
  - Supplement mass-media campaign to enhance awareness of extreme water-saving actions as needed.
- Testing and evaluation
  - Use public opinion polls or other opportunities to test messages and tactics, and revise as needed to increase effectiveness.

9.10 Level 5-6 Strategies and Tactics

In the event of a situation that requires entering Level 5 or 6 of the WSCP (up to or greater than 50% mandatory conservation, respectively), the Water Authority will continue to deploy or enhance Level 3-4 strategies and tactics as needed, and will consider supplemental strategies and tactics listed below to reflect increased shortage conditions.

Recommended Strategies

- Engage member agencies in the development of campaign messages and tactics that raise awareness of the extreme shortage conditions facing the region and the likely need to focus water use on essential public health and safety needs.
- Send clear, consistent and understandable messages regarding what uses of water or levels of water use remain acceptable for residential, commercial and public water users.
- Emphasize the need for all residents and businesses to work together to help the region successfully weather the situation.
- Raise awareness of any urgent actions being taken by water agencies to improve water supply conditions; provide regular updates on those efforts.
- Suspend promotion of ongoing water-use efficiency programs to focus resources on promoting extreme/emergency conservation measures.
- Coordinate with regional emergency response agencies/services on messaging/additional outreach tactics if needed.

Recommended Tactics

- Member agency communications
  - Involve member agencies in the planning and implementation of updated messages and campaign activities to raise awareness for water-saving actions and behaviors; provide updated communications materials to member agencies.
- News conference or other event to announce/explain any change in WSCP level; consider joint event with emergency response/public health authorities

- Water Authority communications
  - Encourage users to check with local water agencies for additional rules or restrictions in effect for their area.
  - Promote all available resources to aid vulnerable populations.
  - Provide updates to media and other stakeholders on water supply conditions as often as possible (daily or as needed).
  - Evaluate need for "phone bank" or additional staff resources to handle public inquiries.
- Stakeholder outreach
  - Provide updated communications materials to business groups, service clubs, religious leaders, elected officials to raise immediate awareness for increased water-savings actions and available assistance resources.

9.11 Catastrophic Shortage Communications

In the event of a natural disaster, infrastructure failure or other situation that requires regional water use to be quickly prioritized for or limited to essential public health and safety needs, the Water Authority will immediately deploy or enhance appropriate communication strategies and tactics from WSCP Levels 1-6 as needed, and will consider strategies and tactics listed below to reflect the need for urgent, emergency-driven water conservation.

Recommended Strategies

- Engage member agencies in the development of campaign messages and tactics that raise awareness of the emergency conditions facing the region and the need to focus water use on essential public health and safety needs.
- Send clear, consistent and understandable messages regarding what uses of water or levels of water use remain acceptable for residential, commercial and public water users, and the expected duration of this restricted level of water use
- Emphasize the need for all residents and businesses to work together to help the region successfully weather the situation.
- Raise awareness of any urgent actions being taken by water agencies to improve water supply conditions; provide regular updates on those efforts.
- Suspend promotion of ongoing, long-term water-use efficiency programs and tools to focus resources on communicating need for immediate water conservation actions.
- Coordinate with local emergency response agencies/services on messaging and outreach tactics where possible.

Recommended Tactics

- Member agency communications
  - Involve member agencies in the planning and implementation of updated messages and campaign activities to raise awareness for emergency-level

water-saving actions and behaviors; provide updated communications materials to member agencies.

- News conference or other event to announce/explain change in WSCP level
    - Consider joint announcement with emergency response or public health agencies to reflect need for emergency-level water conservation.
- Water Authority communications
    - Provide specific instructions for acceptable water use during emergency conditions and how long conditions will likely be in effect.
    - Encourage users to check with local water agencies for additional rules or restrictions in effect for their area.
    - Promote all available resources to aid vulnerable populations.
    - Provide updates to media and other stakeholders on water supply conditions as often as possible (daily or as needed).
    - Consider deploying alternate home page on sdcwa.org to emphasize emergency-oriented water conservation actions.
- Stakeholder outreach
    - Provide updated communications materials to business groups, service clubs, religious leaders, elected officials to raise immediate awareness for emergency-level water-savings actions and available assistance resources.
    - Conduct specialized outreach to landscape and related industries with significant outdoor water use to urge immediate end to landscape water use (if required).
    - Coordinate dissemination of information regarding water-use restrictions to local law enforcement or other public agencies to help maximize widespread compliance with emergency mandates.

Table 9-1
General Communication Plan Outline

Normal Conditions	Level 1 Up to 10% Voluntary Conservation	Level 2 Up to 20% Mandatory Conservation	Levels 3-4 Up to 30% or 40% Mandatory Conservation	Levels 5-6 Up to 50% or >50% Mandatory Conservation
Standard outreach efforts in effect (media relations, social media, websites, speakers' bureau, etc.)	Update message platform to reflect conditions, Water Authority response, and needed actions from public	Update campaign and messages to generate immediate actions/behaviors by public	Update campaign and messages to raise awareness for more severe water-saving actions/behaviors by public	Update campaign and messages to reflect extreme or emergency condition and likely need to focus water use on health/safety needs
Promote ongoing WUE programs/tools/ partnerships designed to achieve long-term water management goals (SB X7-7 or other)	Announce status change to key stakeholders, general public (News release, social media, etc.)	Announce status change to key stakeholders, general public (News release, social media, etc.)	Announce status change to key stakeholders, general public (News release, social media, etc.)	Announce status change to key stakeholders, general public (News release, social media, etc.)
Standard coordination with member agencies (JPIC meets 6x a year)	Include increased conservation messages on sdcwa.org and in standard outreach efforts; provide regular condition updates to stakeholders/media	Supplement Level 1 activities with additional tactics (mass media ads, partnerships, events, Nextdoor messages, etc.) as needed; provide regular condition updates to stakeholders/media	Supplement Level 2 outreach with additional tactics (supplemental ads, etc.) as needed; provide regular updates to stakeholders/media on conditions	Supplement Level 3-4 outreach with additional tactics (phone bank/hotline, etc.) as needed; provide regular condition updates to stakeholders/media on conditions
Quarterly Board reports on public communication and water-use efficiency outreach activities	Enhance promotion of ongoing WUE programs/tools; deploy targeted advertising	Conduct issue briefings with elected officials, other key civic and business leaders	Conduct specialized outreach to reduce discretionary outdoor use while minimizing landscape damage	Suspend promotion of long-term WUE programs/ tools to focus on imminent needs
	Increase coordination with member agencies (JPIC meets monthly)	Continue promotion of ongoing WUE programs/tools	Promote available water assistance resources for vulnerable populations; specialized outreach to impacted industries	Continue enhanced coordination with member agencies as needed (daily or weekly briefings or email updates, etc.)
	Initiate regular Board reports on campaign efforts	Enhance coordination with member agencies as needed (weekly email updates, etc.)	Continue enhanced coordination with member agencies as needed	Analyze water use and other data to determine any appropriate supplemental actions
	Analyze water use and other data to determine any appropriate supplemental actions	Analyze water use and other data to determine any appropriate supplemental actions	Analyze water use and other data to determine any appropriate supplemental actions	

Catastrophic Communications
• Implementation of any appropriate strategies and tactics from Levels 1-6 • Shift to messages that reflect emergency condition and need to focus water use on health/safety needs • Potential joint news release/news event with public health officials or incident commanders to announce condition and explain needed actions • Ensure ongoing coordination with emergency response services with daily advisories or alerts, etc. as needed; provide regular condition updates to stakeholders/media Evaluate posting alternate, emergency-themed website home page

Section 10
Implementation

The WSCP contains actions the Water Authority will take to analyze and respond to shortage conditions. Board-approved policies and procedures are critical to ensure successful implementation of the WSCP. The Board's authority to implement the WSCP includes all facets of implementation, including the authority to activate the WSCP, approve regional shortage levels, and approve potential response actions and response level triggers. This section discusses the Board's role to approve shortage response actions and implement the allocation methodology, the role of the Member Agency Advisory Team (MAAT), and potential revenue impacts from fluctuating water sales.

10.1 Implementation of the Allocation Methodology

In 2021, the Board approved the WSCP with Resolution No. 2021-__ (Appendix E) to establish the policies and procedures to administer the M&I water supply allocation methodology. The methodology is contained in Section 7. The WSCP addresses the process for setting member agency allocations, including the policies and procedures to do the following:

- Establish a process to set member agency allocations over a 12-month period;
- Provide a timeline for coordinating data collection between the Water Authority and the member agencies for use in calculating allocations;
- Provide procedures whereby a member agency may request a change, or modification, to its Board approved allocation;
- Require the Water Authority General Manager and the MAAT to review all modification requests and provide recommendations;
- Provide for a pass through of any penalties levied by MWD on the Water Authority for exceeding its annual allocation; and
- Provide monthly reports to the MAAT and the Water Authority Board on water use compared to allocations for each member agency, once mandatory cutbacks are required.

10.1.1 Municipal and Industrial Water Supply Allocations

The following provisions govern the establishment and adoption of a water supply allocation whenever the Board determines it is necessary to allocate water as provided in the WSCP. This section applies to allocation of water for all uses except PSAWR uses which is discussed in Section 10.1.5.

a. *Water Supply Allocation Period*
An allocation period shall be for 12 months, from July 1 of a given year through the following June 30, unless otherwise specifically determined by the Board. If the

shortage of supply is related to cutbacks by MWD, it is the intention of the Board that the Water Authority's allocation period be consistent, to the extent feasible, with MWD's 2014 WSAP, or later update of such plan, adopted by MWD.

b. *Establish Water Supply Allocation*
The General Manager shall establish the recommended supply allocation for each member agency based on the Supply Allocation Methodology included in the WSCP. The three-year base period described in the WSCP shall be determined prior to commencement of the water allocation period and shall include the three most recent consecutive non-allocation fiscal years. Prior to activation of the WSCP, the General Manager shall coordinate with member agencies to obtain and analyze historic data such as, but not limited to, total water use, local water use, and projected local supply, in order to finalize the allocation data to be utilized by the Water Authority in calculating the supply allocation. This coordination shall occur during January through April of a year in which the General Manager determines an allocation may be necessary beginning July 1. During this coordination period, member agencies will have an opportunity to provide updated projections for local supply based upon changes in local supply conditions caused by winter runoff. Member agencies shall provide water use and other information upon request of the General Manager. The ICP, ESP or Emergency Water Delivery Plans shall govern allocations in response to an unanticipated or catastrophic event (See Section 8).

c. *Adopt Supply Allocation*
The General Manager's recommended allocation shall be submitted to the Water Planning and Environmental and Committee for recommendation to the Board. The determination by the Board of the allocation for each member agency shall be final, subject only to modification by the Board because of significant changes in Water Authority supply conditions or pursuant to Section 10.1.3.

10.1.2 Monthly Water Use Reporting

The General Manager shall provide monthly reports of each member agency's actual imported and local water use data compared to their allocation to the Water Planning and Environmental Committee, MAAT, and the Board. In order to provide an accurate accounting of member agencies' performance, member agencies shall provide monthly total water use data and other information in a timely manner upon request of the General Manager.

10.1.3 Modifications to Supply Allocations Due to Changes in Local Conditions

A member agency may request a modification to its approved allocation based upon new information justifying a recalculation of the allocation because of significant changes in local circumstances (e.g. surface water or local supply changes). Information shall not be considered new if it reasonably could have been made available before the initial establishment of the allocation. The General Manager may initiate a modification to a member agency's allocation at any time if the General Manager determines that information provided by the member agency was inaccurate or incomplete. Requests for modification that, alone or in the aggregate, total more than 10% of the requesting agency's allocation or greater than 500 AF within a single allocation period must be approved by the Board. All other modification requests are considered minor and may be approved by the General Manager after consultation with the MAAT.

10.1.4 Reconciliation

Within six months of the end of an allocation period, the General Manager shall conduct a final accounting of member agency deliveries during the allocation period compared with the member agency supply allocations, including any modifications provided in Section 10.1.3. As part of the reconciliation, member agencies shall provide actual local water use for the allocation period and other information upon request of the General Manager. Upon completion of the reconciliation, the General Manager shall notify each member agency of their performance in meeting their supply allocation.

10.1.5 Participants in the Permanent Special Agricultural Water Rate Program

As described in Section 4, PSAWR customer supply allocations are based on cutbacks from MWD. Supply allocations to PSAWR customers shall be established, monitored, and enforced based on MWD's WSAP M&I water supply reduction guidelines and the Water Authority's PSAWR guidelines. If the PSAWR Program is terminated, the Board may allocate water for agriculture according to the methodology provided in the WSCP.

10.2 Water Supply Conditions Report

Upon activation of the WSCP or at other times as requested by the Board, staff prepares monthly updates to the Board and MAAT on state and local water supply conditions. The updates include information on SWP deliveries, storage levels in major state reservoirs, and hydrologic conditions in the Sierra Nevada. The report also includes information on Colorado River hydrologic conditions and local conditions related to water storage levels, rainfall totals, average regional temperatures, and short-term weather outlooks.

10.3 Member Agency Advisory Team

The MAAT will be made up of the general managers of the Water Authority's member agencies or their representatives. The MAAT will focus on decisions related to actions included in the Shortage Response Matrix, including the Allocation Methodology. The intensity of the drought will determine how often the MAAT meets. It may meet infrequently if water is only being withdrawn from storage, or the meetings may be scheduled monthly and possibly more often if the allocation of water begins. Also, during the implementation of the

Shortage Supply Matrix actions, policy issues may arise where the Water Authority's General Manager may desire input from the member agencies before making a recommendation to the Board. The MAAT could be convened at this time to provide input. The policy decisions related to implementation of the matrix actions could include recommendations on:

1. What drought response action(s) to take to avoid allocations;
2. How much to spend to avoid allocations;
3. Modifications to supply allocations; and
4. Modifying a portion of the WSCP that is not working as expected.

The MAAT will also be the body to which a member agency may appeal should the Water Authority's General Manager deny an adjustment during allocations. Should the member agency want to appeal the MAAT's recommendation, it may then ask the Water Authority's Board for a review.

Additionally, the Water Authority's General Manager may wish to convene the advisory team to provide an update on supply conditions or conservation performance during a drought. This meeting may simply be for communication purposes or for further input to develop new programs to help avert the impacts of a drought.

10.4 Revenue Impacts

Activation of the WSCP will result in a reduction in water use and a corresponding reduction in water sales. To address the impact from a reduction in water sales, in FY 1990, the Water Authority created a Rate Stabilization Fund (RSF) to provide funds that would mitigate the need for rate increases in the event of an unexpected decline in water sales. In 2006 and again in 2018, the Board adopted new policies governing the RSF. Under the policy, the RSF has a "target" balance that is the equivalent of the estimated financial impact 2.5 years of wet weather (reduced sales). The new policy also established a maximum RSF balance equal to the financial impact of 3.5 years of wet weather. The policy matches the level of RSF funding with the risk (water sales volatility) that the fund is designed to mitigate. The RSF provides an important tool to mitigate water sales volatility and the impact that has on water rates.

On January 1, 2003, the Water Authority implemented a rate structure that substantially increased the percentage of water revenues generated from fixed charges. This increase replaced the previous variable "postage stamp" rate, which historically generated as much as 80% or more of total annual revenues, with two fixed charges, and one variable rate. The new fixed charges, Customer Service and Storage combined with the Infrastructure Access Charge, provide the Water Authority with enhanced revenue stability. Additionally, in March 2015, the Board adopted the new fixed Supply Reliability Charge. The Supply Reliability Charge recovers a portion of the Lewis Carlsbad Desalination Plant water purchase and IID water transfer supply costs. The fixed charges combined help to mitigate revenue volatility due to changes in either water demand or supply availability and support smooth and predictable rates and charges. As part of the Water Authority's annual rate setting process, the split between fixed and variable revenues is continuously assessed and adjusted to ensure appropriate cost-recovery.

Although the Water Authority maintains strong financial reserves, it is possible that additional loss of revenue associated with demand reduction or costs associated with supply enhancement could negatively affect the Water Authority's short-term financial situation. The Water Authority may compensate for increased costs or reduced water sales by adjusting water rates in succeeding years.

Appendix A

Carryover Storage Policy Guidelines

Carryover Storage Policy Guidelines

In December 2016, the Board approved CSP Guidelines to provide policy guidance on how the Water Authority's carryover storage supplies should be managed during supply shortage events and normal (non-shortage) periods to help minimize or avoid potential cutbacks to member agencies during drought. Under the WSCP, carryover supplies can be used under any of the six regional water shortage response levels. The CSP Guidelines are listed below.

Withdrawal of Carryover Supplies during Dry-Year Shortage Events

1. ***The trigger to evaluate utilization of carryover supplies during shortage events is when any of the Water Authority's supplies are cutback and supply is insufficient to meet projected demand***

   Should any of the Water Authority's supplies experience a cutback or reduction in deliveries, staff will evaluate the need to withdrawal supplies from carryover storage. This includes potential supply allocations from MWD, reduction in Colorado River transfers or decrease in deliveries from the Carlsbad Desalination Project.
2. ***Any evaluation will initially plan for carryover storage surface supplies to be utilized over five consecutive dry-years***

   Under the Urban Water Management Planning Act, agencies are currently required to evaluate supply reliability over three consecutive dry years. The basic planning assumption in the Water Authority's 2015 UWMP is that carryover storage be withdrawn over a three-year period in equal increments. As stated in the DWR 2013 California Water Plan Update: *"Climate change could extend California's drought periods and make them worse. Warming temperatures and changes in rainfall and runoff patterns may exacerbate the frequency and intensity of droughts."* Using the Sacramento River runoff index to measure annual hydrology within the state, the last three dry cycles have lasted six years (1987-1992), four years (2007-2010) and five years running for the current drought (2012-2016). Without above average runoff in year 2011, the state would have experienced a dry cycle lasting nine years. In identifying ways to improve shortage contingency planning throughout the state, Governor Brown's May 2016 Executive Order requires DWR to update plan requirements to include planning for at least a five-year drought. To ensure that the Water Authority and its member agencies are adequately planning for and responding to future droughts, withdrawal of carryover supplies will be evaluated under five consecutive dry-years of shortage.

3. ***The amount of carryover surface supplies used annually over the five-year period will be handled on a case-by-case basis, with a general guideline of withdrawing surface storage supplies evenly over the five-year period.***

As stated in the Water Authority's 2015 UWMP there are a number of factors to consider when determining the utilization of carryover supplies to reduce or eliminate shortages. The plan states that the storage take amount should be handled on a case-by-case basis, considering such items as, current demand trends, regional and local supply availability, hydrologic conditions, and storage supply available for withdrawal. There are other political issues that could also impact the operation of carryover storage supplies during a shortage event, such as state drought response regulations and activities. For these reasons, the carryover storage policy guidelines should be flexible to allow for the uncertainties and complexities associated with managing supplies during a drought.

As a starting point in the detailed analysis, the general rule will be that surface storage supplies be withdrawn evenly throughout the five-year period. This is a conservative and reliable drought management approach that helps avoid depletion of storage reserves in the early years and lessen severe cutbacks in subsequent years of the shortage event. It is important to note that this is just a general guideline to begin the analysis and actual withdrawals may differ from this rule, providing the Board with flexibility in responding to specific shortage situations.

At the end of five years, if carryover surface water supplies from San Vicente Reservoir are no longer available, deliveries could be made from the Central Valley Groundwater Bank and Emergency Storage Program storage reserves. Deliveries from the Groundwater Bank are made after carryover surface water supplies, because the costs associated with withdrawing supplies from groundwater bank are higher and there are no losses due to evaporation.

4. ***Supplies taken from carryover storage will be considered a regional supply to be combined with the Water Authority's supplies for delivery to the member agencies' municipal and industrial customers.***

Carryover storage supplies are combined with long-term Colorado River transfers and seawater desalination supplies in the Water Authority's system to provide additional regional reliability to each of the Water Authority's member agencies. When determining member agencies' M&I allocations during a shortage, the supplies available to allocate will total both the Water Authority's core supplies and dry-year supplies, such as carryover storage and potential dry-year transfers.

5. ***Carryover storage supplies will not be available to TSAWR customers***

In March 2015, the Water Authority Board approved extending the TSAWR program until December 31, 2020. As part of the program, TSAWR deliveries to the member agencies are exempt from the Storage Charge calculation. In return, agricultural customers receive half the municipal and industrial (M&I) level of service under the Emergency Storage Program and no delivery under the Carryover Storage Program

(CSP). The cutback to TSAWR deliveries during a shortage is equivalent to the cutback level from Metropolitan. In April 2012, the Board approved modifications to the Water Authority's Water Shortage and Drought Response Plan allocation methodology. This included a methodology to ensure that during shortages, CSP deliveries go just to M&I customers.

Evaluation of Carryover Storage Levels during Normal Periods

6. ***The necessary carryover storage levels maintained during normal periods will be evaluated following a shortage event when carryover supplies have been withdrawn and at least annually by May of each year.***

   It is important to often conduct an evaluation of carryover storage levels using updated information to ensure adequate reserves for potential dry-year shortages. If a prolonged shortage situation could be reasonably foreseen within the next two years, staff would work to ensure that carryover storage reserves are full going into a potential drought period. The analysis would be conducted consistent with these policy guidelines and be conducted at the following times:
   - After a shortage event to determine how much water, if any, should be put into storage to replenish reserve levels.
   - During normal periods, the evaluation will be conducted once a year by May when hydrologic conditions are more certain. As part of this annual evaluation, staff will also conduct a review of emergency storage reserves and provide the Board with an informational report that includes a discussion on both carryover and emergency storage reserves.
   - More frequently, if conditions warrant the evaluation.

7. ***Maintain a target volume of 70,000 AF and maximum volume of 100,000 AF in San Vicente carryover storage reserves during normal (non-shortage) periods to ensure the region is prepared for extended shortages due to drought.***

   For financial and supply planning purposes, a target volume is being proposed to ensure the region has stored water, or the ability to purchase additional water for storage, to manage shortage events. The target volume will be re-evaluated on a periodic basis to determine if the amount is appropriate taking into account current water demand trends and supply availability. The initial 70,000 AF target is based on a number of factors, including current regional water demand trends, available local, regional and imported water supplies and the recent shortage evaluation conducted for the region under the State Water Resources Control Board May 2016 Emergency Regulation.

Appendix B

Model Drought Ordinance

ORDINANCE NO. _______

AN ORDINANCE OF [AGENCY] ADOPTING A DROUGHT RESPONSE CONSERVATION PROGRAM

WHEREAS, article 10, section 2 of the California Constitution declares that waters of the State are to be put to beneficial use, that waste, unreasonable use, or unreasonable method of use of water be prevented, and that water be conserved for the public welfare; and

WHEREAS, conservation of current water supplies and minimization of the effects of water supply shortages that are the result of drought are essential to the public health, safety, and welfare; and

WHEREAS, regulation of the time of certain water use, manner of certain water use, design of rates, method of application of water for certain uses, installation and use of water-saving devices, provide an effective and immediately available means of conserving water; and

WHEREAS, California Water Code sections 375 et seq. authorize water suppliers to adopt and enforce a comprehensive water conservation program; and

WHEREAS, adoption and enforcement of a comprehensive water conservation program will allow the [AGENCY] to delay or avoid implementing measures such as water rationing or more restrictive water use regulations pursuant to a declared water shortage emergency as authorized by California Water Code sections 350 et seq.; and

WHEREAS, the San Diego County Water Authority has adopted an Urban Water Management Plan that includes water conservation as a necessary and effective component of the Water Authority's programs to provide a reliable supply of water to meet the needs of the Water Authority's 24 member public agencies, including the [AGENCY]. The Water Authority's Urban Water Management Plan also includes a contingency analysis of actions to be taken in response to water supply shortages. This ordinance is consistent with the Water Authority's Urban Water Management Plan; and

WHEREAS, as anticipated by its Urban Water Management Plan, the San Diego County Water Authority, in cooperation and consultation with its member public agencies, has adopted a Water Shortage Contingency Plan, which establishes a progressive program for responding to water supply limitations resulting from drought conditions. This ordinance is intended to be consistent with and to implement the Water Authority's Water Shortage Contingency Plan; and

WHEREAS, the Water Authority's Water Shortage Contingency Plan contains six regional water shortage levels containing regional actions to be taken to lessen or avoid supply shortages. This ordinance contains drought response levels that correspond with the Water Shortage Contingency Plan levels; and

WHEREAS, the [AGENCY], due to the geographic and climatic conditions within its territory and availability of water provided by the San Diego County Water Authority, may experience shortages due to drought conditions, regulatory restrictions enacted upon imported supplies, and other factors. The [AGENCY] has adopted an Urban Water Management Plan that includes water conservation as a necessary and effective component of its programs to provide a reliable supply of water to meet the needs of the public within its service territory. The [AGENCY's] Urban Water Management Plan also includes a contingency analysis of actions to be taken in response to water supply shortages. This ordinance is consistent with the Urban Water Management Plan adopted by the [AGENCY]; and

WHEREAS, the water conservation measures and progressive restrictions on water use and method of use identified by this ordinance provide certainty to water users and enable [AGENCY] to control water use, provide water supplies, and plan and implement water management measures in a fair and orderly manner for the benefit of the public; and

WHEREAS, this ordinance is intended to be consistent with the [AGENCY's] Water Shortage Contingency Plan.

NOW, THEREFORE, the [LEGISLATIVE BODY] of [AGENCY] does ordain as follows:

SECTION 1.0 DECLARATION OF NECESSITY AND INTENT

(a) This ordinance establishes water management requirements that are in addition to any permanent water waste prohibitions and are necessary to conserve water, enable effective water supply planning, assure reasonable and beneficial use of water, prevent waste of water, prevent unreasonable use of water, prevent unreasonable method of use of water within the [AGENCY] in order to assure adequate supplies of water to meet the needs of the public, and further the public health, safety, and welfare, recognizing that water is a scarce natural resource that requires careful management not only in times of drought, but at all times.

(b) This ordinance establishes regulations to be implemented during times of declared water shortages, or declared water shortage emergencies. It establishes six levels of drought response actions to be implemented in times of shortage, with increasing restrictions on water use in response to worsening drought conditions and decreasing available supplies.

(c) Level 1 condition drought response measures are voluntary and will be reinforced through local and regional public education and awareness measures that may be funded in part by [AGENCY]. During drought response condition Levels 2 through 6, all conservation measures and water-use restrictions become mandatory and become increasingly restrictive in order to attain escalating conservation goals.

(d) During a Drought Response Level 2 condition or higher, the water conservation measures and water use restrictions established by this ordinance are mandatory and violations are subject to criminal, civil, and administrative penalties and remedies specified in this ordinance and as provided in [AGENCY] Administrative or Municipal Code.

SECTION 2.0 DEFINITIONS

(a) The following words and phrases whenever used in this chapter shall have the meaning defined in this section:

1. "Grower" refers to those engaged in the growing or raising, in conformity with recognized practices of husbandry, for the purpose of commerce, trade, or industry, or for use by public educational or correctional institutions, of agricultural, horticultural or floricultural products, and produced: (1) for human consumption or for the market, or (2) for the feeding of fowl or livestock produced for human consumption or for the market, or (3) for the feeding of fowl or livestock for the purpose of obtaining their products for human consumption or for the market. "Grower" does not refer to customers who purchase water subject to the Water Authority's Permanent Special Agricultural Water Rate Program.

2. "Water Authority" means the San Diego County Water Authority.

3. "Metropolitan" means the Metropolitan Water District of Southern California.

4. "Permanent water use efficiency measures" means any permanent water use efficiency measure adopted by [AGENCY] Board of Directors.

5. "Person" means any natural person, corporation, public or private entity, public or private association, public or private agency, government agency or institution, school district, college, university, or any other user of water provided by the [AGENCY].

6. "WSCP" means the Water Authority's Water Shortage Contingency Plan or [AGENCY's] Water Shortage Contingency Plan, as specified, in existence on the effective date of this ordinance and as readopted or amended from time to time, or an equivalent plan of the Water Authority to manage or allocate supplies during shortages.

SECTION 3.0 APPLICATION

(a) The provisions of this ordinance apply to any person in the use of any water provided by the [AGENCY].

(b) This ordinance is intended solely to further the conservation of water. It is not intended to implement any provision of federal, State, or local statutes, ordinances, or regulations relating to protection of water quality or control of drainage or runoff. Refer to the local jurisdiction or Regional Water Quality Control Board for information on any stormwater ordinances and stormwater management plans.

(c) Nothing in this ordinance is intended to affect or limit the ability of the [AGENCY] to declare and respond to an emergency, including an emergency that affects the ability of the [AGENCY] to supply water.

(d) The provisions of this ordinance do not apply to use of water from private wells or to recycled water.

(e) Nothing in this ordinance shall apply to use of water that is subject to a special supply program, such as the Water Authority's Permanent Special Agricultural Water Rate Program. Violations of the conditions of special supply programs are subject to the penalties established under the applicable program. A person using water subject to a special supply program and other water provided by the [AGENCY] is subject to this ordinance in the use of the other water.

SECTION 4.0 CORRELATION BETWEEN WATER SHORTAGE CONTINGENCY PLAN AND DROUGHT RESPONSE LEVELS

(a) The correlation between the Water Authority's WSCP shortage levels and the [AGENCY'S] drought response levels identified in this ordinance is described herein. Under WSCP Shortage Level 1, the [AGENCY] would implement Drought Response Level 1 actions. Under WSCP Shortage Level 2, the [AGENCY] would implement Drought Response Level 1 and Level 2 actions. Under WSCP Shortage Levels 3, the [AGENCY] would implement Drought Response Level 1, Level 2, and Level 3 actions. Under WSCP Level 4, the [AGENCY] would implement Drought Response Level 1, Level 2, Level 3, and Level 4 actions. Under WSCP Level 5, the [AGENCY] would implement Drought Response Level 1, Level 2, Level 3, Level 4, and Level 5 actions. Under WSCP Level 6, the [AGENCY] would implement Drought Response Level 1, Level 2, Level 3, Level 4, Level 5, and Level 6 actions.

(b) The drought response levels identified in this ordinance correspond with the Water Authority WSCP as identified in the following table:

Drought Ordinance Response/WSCP Shortage Levels	Use Restrictions	Conservation Target
1	Voluntary	Up to 10%
2	Mandatory	Up to 20%
3	Mandatory	Up to 30%
4	Mandatory	Up to 40%
5	Mandatory	Up to 50%
6	Mandatory	Above 50%

SECTION 5.0 PERMANENT WATER EFFICIENCY MEASURES

(a) [AGENCY] adopted permanent water use efficiency measures and restrictions on [DATE]. Those measures and restrictions are the following:

1. [MEASURES AND RESTRICTIONS].

SECTION 6.0 DROUGHT RESPONSE LEVEL 1

(a) A Drought Response Level 1 condition applies when the Water Authority notifies its member agencies that due to drought or other supply reductions, there is a reasonable probability there will be supply shortages and that a consumer demand reduction of up to 10% is required in order to ensure that sufficient supplies will be available to meet anticipated demands. The General Manager shall declare the existence of a Drought Response Level 1 and take action to implement the Level 1 conservation practices identified in this ordinance.

(b) During a Drought Response Level 1 condition, [AGENCY] will increase its public education and outreach efforts to emphasize increased public awareness of the need to implement the following water conservation practices. [The same water conservation practices become mandatory if [AGENCY] declares a Level 2 Drought Alert condition]:

1. Stop washing down paved surfaces, including but not limited to sidewalks, driveways, parking lots, tennis courts, or patios, except when it is necessary to alleviate safety or sanitation hazards.

2. Stop water waste resulting from inefficient landscape irrigation, such as runoff, low head drainage, or overspray, etc. Similarly, stop water flows onto non-targeted areas, such as adjacent property, non-irrigated areas, hardscapes, roadways, or structures.

3. Irrigate residential and commercial landscape before 10 a.m. and after 6 p.m. only. Watering is permitted at any time when a drip/micro-irrigation system/equipment is used.

4. Use a hand-held hose equipped with a positive shut-off nozzle or bucket to water landscaped areas, including trees and shrubs located on residential and commercial properties that are not irrigated by a landscape irrigation system.

5. Irrigate nursery and commercial grower's products before 10 a.m. and after 6 p.m. only. Watering is permitted at any time with a hand-held hose equipped with a positive shut-off nozzle, a bucket, or when a drip/micro-irrigation system/equipment is used. Irrigation of nursery propagation beds is permitted at any time. Watering of livestock is permitted at any time.

6. Use re-circulated water to operate ornamental fountains.

7. Wash vehicles using a bucket and a hand-held hose with positive shut-off nozzle, mobile high pressure/low volume wash system, or at a commercial site that re-circulates (reclaims) water on-site. Avoid washing during hot conditions when additional water is required due to evaporation.

8. Serve and refill water in restaurants, bars, and other food service establishments only upon request.

9. Offer guests in hotels, motels, and other commercial lodging establishments the option of not laundering towels and linens daily.

10. Repair all water leaks within five (5) days of notification by the [AGENCY] unless other arrangements are made with the General Manager.

11. Use recycled or non-potable water for construction purposes when available and economically feasible.

(c) During a Drought Response Level 2 condition or higher, all persons shall be required to implement the conservation practices established in a Drought Response Level 1 condition.

SECTION 7.0 DROUGHT RESPONSE LEVEL 2

(a) A Drought Response Level 2 condition applies when the Water Authority notifies its member agencies that due to cutbacks caused by drought or other reduction in supplies, a consumer demand reduction of up to 20% is required in order to have sufficient supplies available to meet anticipated demands. The [AGENCY] Board of Directors shall declare the existence of a Drought Response Level 2 condition and implement the mandatory Level 2 conservation measures identified in this ordinance.

(b) All persons using [AGENCY] water shall comply with Level 1 water conservation practices during a Drought Response Level 2 condition, and shall also comply with the following additional conservation measures:

1. Limit residential and commercial landscape irrigation to no more than three (3) assigned days per week on a schedule established by the General Manager and posted by the [AGENCY]. This section shall not apply to commercial growers or nurseries.

2. Limit lawn watering and landscape irrigation using sprinklers to no more than ten (10) minutes per watering station per assigned day. This provision does not apply to landscape irrigation systems using water efficient devices, including but not limited to: weather based controllers, drip/micro-irrigation systems and stream rotor sprinklers.

3. Water landscaped areas, including trees and shrubs located on residential and commercial properties, and not irrigated by a landscape irrigation system governed by Section 7(b)(2), on the same schedule set forth in Section 7(b)(1) by using a bucket, hand-held hose with positive shut-off nozzle, or low-volume non-spray irrigation.

4. Repair all leaks within seventy-two (72) hours of notification by the [AGENCY] unless other arrangements are made with the General Manager.

5. Stop operating ornamental fountains or similar decorative water features unless recycled water is used.

SECTION 8.0 DROUGHT RESPONSE LEVEL 3 – DROUGHT CRITICAL CONDITION

(a) A Drought Response Level 3 condition applies when the Water Authority notifies its member agencies that due to increasing cutbacks caused by drought or other reduction of supplies, a consumer demand reduction of up to 30% is required in order to have sufficient supplies available to meet anticipated demands. The [AGENCY] Board of Directors shall declare the existence of a Drought Response Level 3 condition and implement the Level 3 conservation measures identified in this ordinance.

(b) All persons using [AGENCY] water shall comply with Level 1 and Level 2 water conservation practices during a Drought Response Level 3 condition and shall also comply with the following additional mandatory conservation measures:

1. Limit residential and commercial landscape irrigation to no more than two (2) assigned days per week on a schedule established by the General Manager and posted by the [AGENCY]. This section shall not apply to commercial growers or nurseries.

2. Water landscaped areas, including trees and shrubs located on residential and commercial properties, and not irrigated by a landscape irrigation system governed by section 7(b)(2), on the same schedule set forth in section 8(b)(1) by using a bucket, hand-held hose with a positive shut-off nozzle, or low-volume non-spray irrigation.

3. Stop washing vehicles except at commercial carwashes that re-circulate water, or by high pressure/low volume wash systems.

4. Repair all leaks within forty-eight (48) hours of notification by the [AGENCY] unless other arrangements are made with the General Manager.

(c) Upon the declaration of a Drought Response Level 3 condition, [AGENCY] will suspend consideration of annexations to its service area.

(d) The [AGENCY] may establish a water allocation for property served by the [AGENCY] using a method that does not penalize persons for the implementation of conservation methods or the installation of water saving devices. If the [AGENCY] establishes a water allocation it shall provide notice of the allocation by including it in the regular billing statement for the fee or charge or by any other mailing to the address to which the [AGENCY] customarily mails the billing statement for fees or charges for on-going water service. Following the effective date of the water allocation as established by the [AGENCY], any person that uses water in excess of the allocation shall be subject to a penalty in the amount of $___ for each billing unit of water in excess of the allocation. The penalty for excess water usage shall be cumulative to any other remedy or penalty that may be imposed for violation of this ordinance.

SECTION 9.0 DROUGHT RESPONSE LEVEL 4

(a) A Drought Response Level 4 condition applies when the Water Authority notifies its member agencies that due to increasing cutbacks caused by drought or other reduction of supplies, a consumer demand reduction of up to 40% is required in order to have sufficient supplies available to meet anticipated demands. The [AGENCY] Board of Directors shall declare the existence of a Drought Response Level 4 condition and implement the Level 4 conservation measures identified in this ordinance.

(b) All persons using [AGENCY] water shall comply with Level 1, Level 2, and Level 3 water conservation practices during a Drought Response Level 4 condition and shall also comply with the following additional mandatory conservation measures:

1. Stop filling or re-filling ornamental lakes or ponds, except to the extent needed to sustain aquatic life, provided that such animals are of significant value and have been actively managed within the water feature prior to declaration of a drought response level under this ordinance.

SECTION 10.0 DROUGHT RESPONSE LEVEL 5

(a) A Drought Response Level 5 condition applies when the Water Authority notifies its member agencies that due to increasing cutbacks caused by drought or other reduction of supplies, a consumer demand reduction of up to 50% is required in order to have sufficient supplies available to meet anticipated demands. The [AGENCY] Board of Directors shall declare the existence of a Drought Response Level 5 condition and implement the Level 5 conservation measures identified in this ordinance.

(b) All persons using [AGENCY] water shall comply with conservation measures required during Level 1, Level 2, Level 3, and Level 4 conditions and shall also comply with the following additional mandatory conservation measures:

1. Stop all landscape irrigation, except crops and landscape products of commercial growers and nurseries. This restriction shall not apply to the following categories of use unless the [AGENCY] has determined that recycled water is available and may be lawfully applied to the use.

A. Maintenance of trees and shrubs that are watered on the same schedule set forth in section 8(b)(1) by using a bucket, hand-held hose with a positive shut-off nozzle, or low-volume non-spray irrigation;

B. Maintenance of existing landscaping necessary for fire protection as specified by the Fire Marshal of the local fire protection agency having jurisdiction over the property to be irrigated;

C. Maintenance of existing landscaping for erosion control;

D. Maintenance of plant materials identified to be rare or essential to the well-being of rare animals;

E. Maintenance of landscaping within active public parks and playing fields, day care centers, school grounds, cemeteries, and golf course greens, provided that such irrigation does not exceed two (2) days per week according to the schedule established under section 8(b)(1);

F. Watering of livestock; and

G. Public works projects and actively irrigated environmental mitigation projects.

2. Repair all water leaks within twenty-four (24) hours of notification by the [AGENCY] unless other arrangements are made with the General Manager.

(c) The [AGENCY] may establish a water allocation for property served by the [AGENCY]. If the [AGENCY] establishes a water allocation it shall provide notice of the allocation by including it in the regular billing statement for the fee or charge or by any other mailing to the address to which the [AGENCY] customarily mails the billing statement for fees or charges for on-going water service. Following the effective date of the water allocation as established by the [AGENCY], any person that uses water in excess of the allocation shall be subject to a penalty in the amount of $___ for each billing unit of water in excess of the allocation. The penalty for excess water usage shall be cumulative to any other remedy or penalty that may be imposed for violation of this ordinance.

(d) Upon the declaration of a Drought Response Level 5 condition, no new potable water service shall be provided, no new temporary meters or permanent meters shall be provided, and no statements of immediate ability to serve or provide potable water service (such as, will serve letters, certificates, or letters of availability) shall be issued, except under the following circumstances:

1. A valid, unexpired building permit has been issued for the project; or

2. The project is necessary to protect the public's health, safety, and welfare; or

3. The applicant provides substantial evidence of an enforceable commitment that water demands for the project will be offset prior to the provision of a new water meter(s) to the satisfaction of [AGENCY].

This provision shall not be construed to preclude the resetting or turn-on of meters to provide continuation of water service or to restore service that has been interrupted for a period of one year or less.

SECTION 11.0 DROUGHT RESPONSE LEVEL 6

(a) A Drought Response Level 6 condition applies when the Water Authority Board of Directors declares a water shortage emergency pursuant to California Water Code Section 350 and notifies its member agencies that Level 6 requires a demand reduction of more than 50% in order for the [AGENCY] to have maximum supplies available to meet anticipated demands. The [AGENCY] shall declare a Drought Emergency in the manner and on the grounds provided in California Water Code section 350.

(b) All persons using [AGENCY] water shall comply with conservation measures required during Level 1, Level 2, Level 3, Level 4, and Level 5 conditions and shall also comply with the following additional mandatory conservation measures:

1. Stop all landscape irrigation, except crops and landscape products of commercial growers and nurseries. This restriction shall not apply to the following categories of use

unless the [AGENCY] has determined that recycled water is available and may be lawfully applied to the use.

A. Maintenance of existing landscaping necessary for fire protection as specified by the Fire Marshal of the local fire protection agency having jurisdiction over the property to be irrigated;

B. Maintenance of existing landscaping for erosion control;

C. Maintenance of plant materials identified to be rare or essential to the well-being of rare animals;

D. Watering of livestock; and

E. Public works projects and actively irrigated environmental mitigation projects.

SECTION 12.0 PROCEDURES FOR DETERMINATION AND NOTICATION OF DROUGHT RESPONSE LEVEL

(a) The existence of a Drought Response Level 1 condition may be declared by the General Manager upon a written determination of the existence of the facts and circumstances supporting the determination. A copy of the written determination shall be filed with the Clerk or Secretary of the [AGENCY] and provided to the [AGENCY] Board of Directors. The General Manager may publish a notice of the determination of existence of Drought Response Level 1 condition in one or more newspapers, including a newspaper of general circulation within the [AGENCY]. The [AGENCY] may also post notice of the condition on their website.

(b) The existence of Drought Response Level 2, Level 3, Level 4, or Level 5 conditions, may be declared by resolution of the [AGENCY] Board of Directors adopted at a regular or special public meeting held in accordance with State law. The mandatory conservation measures applicable to Drought Response Level 2, Level 3, Level 4, or Level 5 conditions, shall take effect on the tenth (10) day after the date the response level is declared. Within five (5) days following the declaration of the response level, the [AGENCY] shall publish a copy of the resolution in a newspaper used for publication of official notices. If the [AGENCY] establishes a water allocation, it shall provide notice of the allocation by including it in the regular billing statement for the fee or charge or by any other mailing to the address to which the [AGENCY] customarily mails the billing statement for fees or charges for on-going water service. Water allocation shall be effective on the fifth (5) day following the date of mailing or at such later date as specified in the notice.

(c) The existence of a Drought Response Level 6 condition may be declared in accordance with the procedures specified in California Water Code Sections 351 and

352. The mandatory conservation measures applicable to Drought Response Level 6 conditions shall take effect on the tenth (10) day after the date the response level is declared. Within five (5) days following the declaration of the response level, the [AGENCY] shall publish a copy of the resolution in a newspaper used for publication of official notices.

(d) The [AGENCY] Board of Directors may declare an end to a Drought Response Level by the adoption of a resolution at any regular or special meeting held in accordance with State law.

SECTION 13.0 HARDSHIP VARIANCE

(a) If, due to unique circumstances, a specific requirement of this ordinance would result in undue hardship to a person using agency water or to property upon which agency water is used, that is disproportionate to the impacts to [AGENCY] water users generally or to similar property or classes of water uses, then the person may apply for a variance to the requirements as provided in this section.

(b) The variance may be granted or conditionally granted, only upon a written finding of the existence of facts demonstrating an undue hardship to a person using agency water or to property upon with agency water is used, that is disproportionate to the impacts to [AGENCY] water users generally or to similar property or classes of water use due to specific and unique circumstances of the user or the user's property.

1. Application. Application for a variance shall be a form prescribed by [AGENCY] and shall be accompanied by a non-refundable processing fee in an amount set by resolution of the [AGENCY] Board of Directors.

2. Supporting Documentation. The application shall be accompanied by photographs, maps, drawings, and other information, including a written statement of the applicant.

3. Required Findings for Variance. An application for a variance shall be denied unless the approving authority finds, based on the information provided in the application, supporting documents, or such additional information as may be requested, and on water use information for the property as shown by the records of the [AGENCY], all of the following:

A. That the variance does not constitute a grant of special privilege inconsistent with the limitations upon other [AGENCY] customers.

B. That because of special circumstances applicable to the property or its use, the strict application of this ordinance would have a disproportionate impact on the property or use that exceeds the impacts to customers generally.

C. That the authorizing of such variance will not be of substantial detriment to adjacent properties, and will not materially affect the ability of the [AGENCY] to effectuate the purpose of this chapter and will not be detrimental to the public interest.

D. That the condition or situation of the subject property or the intended use of the property for which the variance is sought is not common, recurrent, or general in nature.

4. Approval Authority. The General Manager shall exercise approval authority and act upon any completed application no later than ten (10) days after submittal and may approve, conditionally approve, or deny the variance. The applicant requesting the variance shall be promptly notified in writing of any action taken. Unless specified otherwise at the time a variance is approved, the variance applies to the subject property during the term of the mandatory drought response.

5. Appeals to [AGENCY] Board of Directors. An applicant may appeal a decision or condition of the General Manager on a variance application to the [AGENCY] Board of Directors within ten (10) days of the decision upon written request for a hearing. The request shall state the grounds for the appeal. At a public meeting, the [AGENCY] Board of Directors shall act as the approval authority and review the appeal de novo by following the regular variance procedure. The decision of the [AGENCY] Board of Directors is final.

SECTION 14.0 VIOLATIONS AND PENALTIES

(a) Any person, who uses, causes to be used, or permits the use of water in violation of this ordinance is guilty of an offense punishable as provided herein.

(b) Each day that a violation of this ordinance occurs is a separate offense.

(c) Administrative fines may be levied for each violation of a provision of this ordinance as follows:

1. ____ dollars for a first violation.
2. ____ dollars for a second violation of any provision of this ordinance within one year.
3. ____ dollars for each additional violation of this ordinance within one year.

(d) Violation of a provision of this ordinance is subject to enforcement through installation of a flow-restricting device in the meter.

(e) Each violation of this ordinance may be prosecuted as a misdemeanor punishable by imprisonment in the county jail for not more than thirty (30) days or by a fine not exceeding $1,000, or by both as provided in Water Code Section 377.

(f) Willful violations of the mandatory conservation measures and water use restrictions as set forth in Section 11.0 and applicable during a Drought Response Level 6 condition may be enforced by discontinuing service to the property at which the violation occurs as provided by Water Code Section 356.

(g) All remedies provided for herein shall be cumulative and not exclusive.

SECTION 15.0 EFFECTIVE DATE

This ordinance is effective immediately upon adoption or as otherwise established by State law for [AGENCY].

Any part or provision of this Ordinance that is prohibited or that is held to be void or unenforceable shall be ineffective to the extent of such prohibition or unenforceability without invalidating the remaining provisions hereof.

PASSED, APPROVED AND ADOPTED this [DATE] by the following vote:

AYES;

NOES:

ABSTAIN:

ABSENT:

____
[President/Chair of Legislative Body]

Appendix C

Examples of Additional Customer Water Use Prohibitions

Examples of Additional Customer Water Use Prohibitions

The severity of water use prohibitions varies depending on the required reduction in water use. Below are examples of potential water use prohibitions that could be considered for inclusion in a retail water supplier's drought ordinance. The prohibitions are grouped into residential and non-residential categories.

Examples of Potential Residential Prohibitions

Landscape

- The application of potable water to landscapes in a manner that causes runoff onto adjacent property or impervious surfaces, including, but not limited to, walkways, roadways, parking lots, or structures, is prohibited.

- The irrigation of residential landscapes is prohibited between 10 a.m. and 6 p.m. Supervised testing or repairing of irrigation systems is exempt.

- The application of potable water to landscapes during and within 48 hours after measurable rainfall is prohibited.

- The use a hand-held hose that is not equipped with a positive shut-off nozzle to water landscaped areas is prohibited. The use of a bucket is exempt.

- The irrigation with potable water of landscapes outside of newly constructed homes and buildings in a manner inconsistent with regulations or other requirements established by the California Building Standards Commission and the Department of Housing and Community Development is prohibited.

- The weekly irrigation of landscapes in excess of the number of watering days assigned by the water supplier is prohibited.

- The use of sprinklers to irrigate landscape for more than ten minutes per watering station per day is prohibited. This prohibition does not apply to landscape irrigation systems using water efficient devices, including, but not limited to, weather-based controllers, drip/micro-irrigation systems, and stream rotor sprinklers.

- The irrigation of landscapes more than once per week during the months of November through May is prohibited.

- The use of irrigation to establish new landscapes is allowed at any time for up to two months if the landscape is water efficient and replaced turf or another high water use landscape, or if the new landscape is water efficient and is required for a landscape permit.

- Irrigation is allowed at any time as required by a landscape permit for erosion control, establishment, repair, renovation of public use fields for schools and parks, and for landscape following a disaster (up to two months with a hardship variance).

- Over-seeding of turf is prohibited.

- All landscape irrigation is prohibited, with the following exceptions for use:
    - Maintenance of trees and shrubs that are watered by using a bucket, hand-held hose with a positive shut-off nozzle, or low-volume non-spray irrigation.
    - Maintenance of existing landscaping necessary for fire protection as specified by the Fire Marshal of the local fire protection agency having jurisdiction over the property to be irrigated.
    - Maintenance of existing landscaping for erosion control.
    - Maintenance of plant materials identified to be rare or essential to the well-being of rare animals.
    - Watering of livestock.

<u>Power Washing</u>

- Power washing of exterior surfaces, such as siding, is prohibited.

- Power washing of impervious surfaces is prohibited, including, but not limited to, sidewalks, driveways, parking lots, tennis courts, or patios. Power washing to alleviate safety or sanitation hazards is exempt.

<u>Vehicle Washing</u>

- The use of a hose that dispenses potable water to wash vehicles, except where the hose is fitted with a positive shut-off nozzle, is prohibited.

- Washing vehicles is prohibited, except at commercial carwashes that recirculate (reuse) the water.

<u>Fountains/Decorative Water Features</u>

- The use of potable water in a fountain or other decorative water feature, except where the water is part of a recirculating system or to the extent needed for maintenance, is prohibited.

<u>Leak Detection and Repair</u>

- Repair all water leaks within 24 hours of notification by the water supplier unless other arrangements are made with the water supplier.

- Water service shall be shut-off if there are noticeable leaks on the customer's side of the meter.

Swimming Pools/Ponds

- Filling or refilling ornamental lakes or ponds is prohibited, except to the extent needed to sustain aquatic life, provided that such animals are of significant value and have been actively managed within the water feature prior to declaration of a drought response level under this ordinance.

- Pools and spas must be covered during non-use.

- Pool filling is prohibited.

- Draining swimming pools more than once every three years, except as necessary to complete structural repairs or to comply with public health standards, is prohibited.

Example of Potential Non-Residential Prohibitions

Landscape

- The application of potable water to landscapes in a manner that causes runoff onto adjacent property or impervious surfaces, including, but not limited to, walkways, roadways, parking lots, or structures, is prohibited.

- Irrigation of commercial landscapes is prohibited between 10 a.m. and 6 p.m. Public and private golf course greens and tees and professional sports fields are exempt and may be irrigated in order to maintain play areas and accommodate event schedules. Supervised testing or repairing of irrigation systems is allowed anytime with proper signage.

- Application of potable water to landscapes during and within 48 hours after measurable rainfall is prohibited.

- Use of a hand-held hose that is not equipped with a positive shut-off nozzle to water landscaped areas is prohibited. The use of a bucket to water landscaped areas is exempt.

- Irrigation of nursery and commercial grower's products is prohibited between 10 a.m. and 6 p.m. Watering with a hand-held hose equipped with a positive shut-off nozzle, a bucket, or when a drip/micro-irrigation system/equipment is used is exempt. Also exempt is irrigation of nursery propagation beds and watering of livestock.

- The irrigation with potable water of ornamental turf on public street medians is prohibited.

- The irrigation with potable water of landscapes outside of newly constructed homes and buildings in a manner inconsistent with regulations or other requirements established by the California Building Standards Commission and the Department of Housing and Community Development is prohibited.

- The weekly irrigation of landscapes in excess of the number of watering days assigned by the water supplier is prohibited. The irrigation of landscapes more than once per week during the months of November through May is prohibited. This prohibition shall not apply to commercial growers or nurseries.

- The use of sprinklers to irrigate landscape for more than ten minutes per watering station per day is prohibited. This prohibition does not apply to landscape irrigation systems using water efficient devices, including, but not limited to, weather-based controllers, drip/micro-irrigation systems, and stream rotor sprinklers.

- Landscaped areas, including trees and shrubs not irrigated by a landscape irrigation system, must be watered by using a bucket, hand-held hose with positive shut-off nozzle, or low-volume non-spray irrigation.

- All landscape irrigation is prohibited, with the following exceptions for use:
  - Water for crops and landscape products of commercial growers and nurseries.
  - Maintenance of trees and shrubs that are watered by using a bucket, hand-held hose with a positive shut-off nozzle, or low-volume non-spray irrigation.
  - Maintenance of existing landscaping necessary for fire protection as specified by the Fire Marshal of the local fire protection agency having jurisdiction over the property to be irrigated.
  - Maintenance of existing landscaping for erosion control.
  - Maintenance of landscaping within active public parks and playing fields, day-care centers, school grounds, cemeteries, and golf course greens.
  - Maintenance of plant materials identified to be rare or essential to the well-being of rare animals.
  - Public works projects and actively irrigated environmental mitigation projects.
  - Watering of livestock.

- The use of irrigation to establish new landscapes is allowed at any time for up to two months if the landscape is water efficient and replaced turf or another high water use landscape, or if the new landscape is water efficient and is required for a landscape permit.

- Irrigation is allowed at any time as required by a landscape permit for erosion control, establishment, repair, renovation of public use fields for schools and parks, and for landscape following a disaster (up to two months with a hardship variance).

- Over-seeding of turf is prohibited.

Power Washing

- Power washing of exterior surfaces, such as siding, is prohibited.

- Power washing of impervious surfaces is prohibited, including, but not limited to, sidewalks, driveways, parking lots, tennis courts, or patios. Power washing to alleviate safety or sanitation hazards is exempt.

Swimming Pools/Ponds

- Filling or refilling ornamental lakes or ponds is prohibited, except to the extent needed to sustain aquatic life, provided that such animals are of significant value and have been actively managed within the water feature prior to declaration of a drought response level under this ordinance.

- Pools and spas must be covered during non-use.

- Pool filling is prohibited.

- Draining swimming pools more than once every three years, except as necessary to complete structural repairs or to comply with public health standards, is prohibited.

Vehicle Washing

- The use of a hose that dispenses potable water to wash vehicles, except where the hose is fitted with a positive shut-off nozzle, is prohibited.

- Washing vehicles is prohibited, except at commercial carwashes that recirculate (reuse) the water.

- Non-recirculating systems in all new conveyor car wash systems are prohibited.

Fountains/Decorative Water Features

- The use of potable water in a fountain or other decorative water feature, except where the water is part of a recirculating system or to the extent needed for maintenance, is prohibited.

Cooling Systems

- Single-pass through cooling systems as part of new construction are prohibited.

Hotels/Motels/Restaurants

- Eating or drinking establishments, including, but not limited to restaurants, hotels, cafes, cafeterias, bars, or other public places where food or drink are served and/or purchased, are prohibited from serving drinking water unless requested.

- Hotels, motels, and other commercial lodging establishments shall provide guests with the option of choosing not to have towels and linens laundered daily. The hotel or motel shall prominently display notice of this option in each guestroom using clear and easily understood language.

Leak Repair

- Repair all water leaks within 24 hours of notification by the member agency unless other arrangements are made with the water supplier.

- Water service shall be shut-off if there are noticeable leaks on the customer's side of the meter.

Construction

- Recycled or non-potable water must be used for construction purposes when available.

- The use of unnecessary water for construction purposes is prohibited.

Water Service

- No new potable water service shall be provided, no new temporary meters or permanent meters shall be provided, and no statements of immediate ability to serve or provide potable water service (such as, will-serve letters, certificates or letters of availability) shall be issued, except under the following circumstances:
    - A valid, unexpired building permit has been issued for the project; or
    - The project is necessary to protect the public's health, safety, and welfare; or
    - The applicant provides substantial evidence of an enforceable commitment that water demands for the project will be offset prior to the provision of a new water meter(s) to the satisfaction of the water supplier.
    - This provision shall not be construed to prohibit the resetting or turn-on of meters to provide continuation of water service or to restore service that has been interrupted for a period of one year or less.

- Annexations to a water supplier's service area shall not be considered.
- The water supplier shall establish a water allocation for each parcel using a method that does not penalize persons for the implementation of conservation methods or the installation of water saving devices.
- Flushing sewers or hydrants with potable water is prohibited, except in cases of emergency or for essential operations.

Laundromats

- All laundromats shall have converted 100% of washers to high-efficiency washers by [date TBD].
- The installation of non-recirculating laundry systems is prohibited.

Appendix D

Multi-Hazard Mitigation Plan for San Diego County, California

MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN

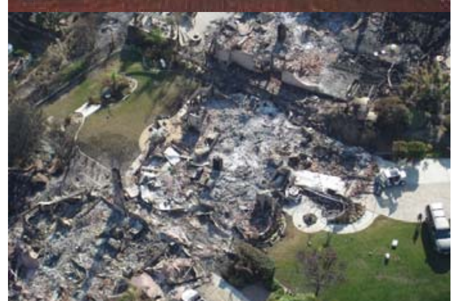
SAN DIEGO COUNTY, CALIFORNIA

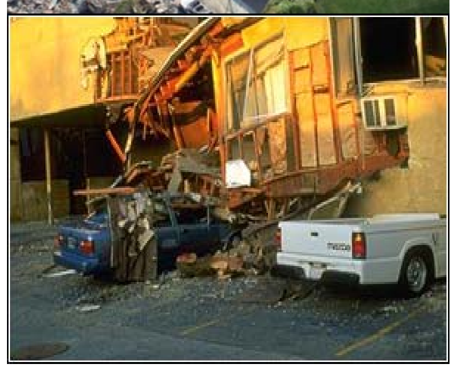
Participating Jurisdictions:

Carlsbad	National City
Chula Vista	Oceanside
Coronado	Poway
Del Mar	San Diego
El Cajon	San Marcos
Encinitas	Santee
Escondido	Solana Beach
Imperial Beach	Vista
La Mesa	County of San Diego
Lemon Grove	Alpine FPD

Rancho Santa Fe FPD
Padre Dam MWD

October 2017





Contents

INTRODUCTION

Across the United States, natural and manmade disasters have led to increasing levels of death, injury, property damage, and interruption of business and government services. The impact on families and individuals can be immense and damages to businesses can result in regional economic consequences. The time, money and effort to respond to and recover from these disasters divert public resources and attention from other important programs and problems. With four presidential disaster declarations, four gubernatorial proclamations and fifteen local proclamations of emergency since 1999 San Diego County, California recognizes the consequences of disasters and the need to reduce the impacts of natural and manmade hazards. The elected and appointed officials of the County also know that with careful selection, mitigation actions in the form of projects and programs can become long-term, cost effective means for reducing the impact of natural and manmade hazards.

This *Multi-Hazard Mitigation Plan for San Diego County, California (*the Plan*)*, was prepared with input from county residents, responsible officials, the San Diego County Water Authority, the Alpine and Rancho Santa Fe Fire Protection Districts, the Padre Dam Municipal Water District, the San Diego Foundation, ICLEI, the California Office of Emergency Services (Cal OES) and the Federal Emergency Management Agency (FEMA). The process to develop the Plan included over a year of coordination with representatives from all of the jurisdictions in the region. The Plan will guide the region toward greater disaster resilience in harmony with the character and needs of the community.

This section of the Plan includes an overview of the Plan, a discussion of the Plan's purpose and authority, and a description of the 18 incorporated cities and the unincorporated County within the San Diego region.

1.1 Plan Description/Purpose of Plan

Federal legislation has historically provided funding for disaster relief, recovery, and some hazard mitigation planning. The Disaster Mitigation Act of 2000 (DMA 2000) is the latest legislation to improve this planning process (Public Law 106-390). The new legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur. As such, DMA 2000 establishes a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP).

Section 322 of DMA 2000 specifically addresses mitigation planning at the state and local levels. It identifies new requirements that allow HMGP funds to be used for planning activities, and increases the amount of HMGP funds available to states that have developed a comprehensive, enhanced mitigation plan prior to a disaster. States and communities must have an approved mitigation plan in place prior to receiving post-disaster HMGP funds. Local and tribal mitigation plans must demonstrate that their proposed mitigation measures are based on a sound planning process that accounts for the risk to and the capabilities of the individual communities.

State governments have certain responsibilities for implementing Section 322, including:

- Preparing and submitting a standard or enhanced state mitigation plan;
- Reviewing and updating the state mitigation plan every three years;
- Providing technical assistance and training to local governments to assist them in applying for HMGP grants and in developing local mitigation plans; and
- Reviewing and approving local plans if the state is designated a managing state and has an approved enhanced plan.

The intent of DMA 2000 is to facilitate cooperation between state and local authorities, prompting them to work together. It encourages and rewards local and state pre-disaster planning and promotes sustainability as a strategy for disaster resilience. This enhanced planning network is intended to enable local and state governments to articulate accurate needs for mitigation, resulting in faster allocation of funding and more effective risk reduction projects.

FEMA prepared an Interim Final Rule, published in the Federal Register on February 26, 2002 (44 CFR Parts 201 and 206), which establishes planning and funding criteria for states and local communities.

The Plan has been prepared to meet FEMA requirements thus making the County and all participating jurisdictions and special districts eligible for funding and technical assistance from state and federal hazard mitigation programs.

1.2 Plan Purpose and Authority

In the early 1960s, the incorporated cities and the County of San Diego formed a Joint Powers Agreement which established the Unified San Diego County Emergency Services Organization (USDCESO) and the Unified Disaster Council (UDC) as the policy making group. The UDC, the San Diego County Board of Supervisors, City Councils and governing Boards for each participating municipality or special district will adopt the Plan once the State of California and FEMA have granted provisional approval. This Plan is intended to serve many purposes, including:

Enhance Public Awareness and Understanding – to help residents of the County better understand the natural and manmade hazards that threaten public health, safety, and welfare; economic vitality; and the operational capability of important institutions;

Create a Decision Tool for Management – to provide information that managers and leaders of local government, business and industry, community associations, and other key institutions and organizations need to take action to address vulnerabilities to future disasters;

Promote Compliance with State and Federal Program Requirements – to ensure that San Diego County and its incorporated cities can take full advantage of state and federal grant programs, policies, and regulations that encourage or mandate that local governments develop comprehensive hazard mitigation plans;

Enhance Local Policies for Hazard Mitigation Capability – to provide the policy basis for mitigation actions that should be promulgated by participating jurisdictions to create a more disaster-resistant future; and

Provide *Inter-Jurisdictional Coordination of Mitigation-Related Programming* – to ensure that proposals for mitigation initiatives are reviewed and coordinated among the participating jurisdictions within the County.

Achieve *Regulatory Compliance* – To qualify for certain forms of federal aid for pre- and post-disaster funding, local jurisdictions must comply with the federal DMA 2000 and its implementing regulations (44 CFR Section 201.6). DMA 2000 intends for hazard mitigation plans to remain relevant and current. Therefore, it requires that State hazard mitigation plans are updated every three years and local plans, including the San Diego Regional Plan, every five years. This means that the Multi-jurisdictional Hazard Mitigation Plan for San Diego uses a "five-year planning horizon". It is designed to carry the region through the next five years, after which its assumptions, goals, and objectives will be revisited and the plan resubmitted for approval.

1.3 Community Description

1.3.1 The County of San Diego

San Diego County, one of 58 counties in the State of California, was established on February 18, 1850, just after California became the 31st state. The County stretches 65 miles from north to south, and 86 miles from east to west, covering 4,261 square miles. Elevation ranges from sea level to about 6,500 feet. Orange and Riverside Counties border it to the north, the agricultural communities of Imperial County to the east, the Pacific Ocean to the west, and the State of Baja California, Mexico to the south. Geographically, the County is on the same approximate latitude as Dallas, Texas and Charleston, South Carolina.

San Diego County is comprised of 18 incorporated cities and 17 unincorporated communities. The county's total population in 2016 was approximately 3.2 million with a median age of 35 years (US 2010 Census Quickfacts). San Diego is the third most populous county in the state.

The following subsections provide an overview of the *Economy, Physical Features, Infrastructure,* and *Jurisdictional Summaries* for the County of San Diego.

1.3.1.1 Economy

San Diego offers a vibrant and diverse economy along with a strong and committed public/private partnership of local government and businesses dedicated to the creation and retention of quality jobs for its residents. Although slowed by the recession in 2008, the business climate continues to thrive due to the diversification of valuable assets such as world class research institutions; proximity to Mexico and the Pacific Rim; a well educated, highly productive work force; and an unmatched entrepreneurial spirit.

According to the U.S. Bureau of Economic Analysis (BEA), San Diego's Gross Regional Product (GRP)–an estimate of the total output of goods and services in the county–was $197.9 billion in 2013 San Diego's abundant and diverse supply of labor at competitive rates is one of the area's greatest assets. As of November 2014, the total civilian labor force was estimated at 1.33 million, which includes self-employed individuals and wage and salary employment. Unemployment for

November 2014 was 5.8% or 94,000 persons. This was slightly higher than the national rate of 5.5% but significantly lower than the state's rate of 7.1% (Source: State of California Employment Development Department).

There are several reasons for the strong labor supply in San Diego. The area's appealing climate and renowned quality of life are two main factors that attract a quality workforce. The excellent quality of life continues to be an important advantage for San Diego companies in attracting and retaining workers. In addition, local colleges and universities augment the region's steady influx of qualified labor. Each year San Diego's educational institutions graduate approximately 1,500 students with bachelors, masters and PhD degrees in electrical engineering, computer science, information systems, mechanical engineering and electronic technology. Over 2,500 students annually receive advanced degrees in business administration. There is also a pool of qualified workers from San Diego's business schools, which annually graduate over 1,000 students with administrative and data processing skills.

1.3.1.2 Employment

San Diego's diverse and thriving high-tech industry has become the fastest growing sector of employment and a large driving force behind the region's continued economic prosperity. San Diego's high-tech industry comprises over a tenth of the region's total economic output.

San Diego boasts the third largest concentration of biotech companies in the country with an estimated 700 firms. Currently there are over 34,500 people employed in San Diego's biotech industry. Life Science activity accounts for more than $14.2 billion in direct economic activity and $36.6 billion in total economic impact in San Diego (Source: BIOCOM 2013 Southern California Economic Impact Report). The general services industry is the second largest employment sector in the County, totaling nearly 51% of the county's industry employment. This sector includes business services, San Diego's tourism industry, health services and various business services, employing 671,600 workers. Government is the fourth largest employer with 236,200 jobs accounting for about 187% of total industry employment. (Source: California Employment Development Division).

1.3.1.3 Physical Features

The physical, social and economic development of the region has been influenced by its unique geography, which encompasses over 70 miles of coastline, broad valleys, lakes, forested mountains and the desert. The county can be divided into three basic geographic areas, all generally running in the north-south direction. The coastal plain extends from the ocean to inland areas for 20 to 25 miles. The foothills and mountains, rising in elevation to 6,500 feet, comprise the middle section of the county. The third area is the desert, extending from the mountains into Imperial County, 80 miles east of the coast. San Diegans can live in the mountains, work near the ocean, and take recreational day trips to the desert.

One of San Diego's greatest assets is its climate. With an average yearly temperature of 70 degrees, the local climate has mild winters, pleasant summers, and an abundance of sunshine and light rainfall.

San Diego County experiences climatic diversity due to its varied topography. Traveling inland, temperatures tend to be warmer in the summer and cooler in the winter. In the local mountains, the average daily highs are 77 degrees and lows are about 45 degrees. The mountains get a light snowfall several times a year. East of the mountains is the Anza Borrego Desert, where rainfall is minimal and the summers are hot. The dry, mild climate of San Diego County is conducive to productivity. Outdoor work and recreational activities are possible almost all year-round. In addition, storage and indoor work can be handled with minimum investment in heating and air conditioning, although extreme heat events have increased slightly in both frequency and severity.

1.3.1.4 Infrastructure

San Diego has a well-developed highway system. There are about 610 miles of state highways and 1,000 miles of regional arterials within the San Diego region. The county also encompasses more than 7,185 miles of maintained city streets and county roads. Roughly 11.6 million vehicle trips are made on the region's roadways daily, accounting for more than 68 million vehicle miles traveled daily.

Since 1980, San Diego's licensed drivers have increased 46%; likewise, auto registrations have increased 57%. Vehicle miles of travel (VMT) are up 86% since 1980. Unfortunately the increase in drivers, vehicles and VMT has not been matched by corresponding increases in freeway mileage (10%) or local street and road mileage (19%). Over the same time period, there has been a decrease in both reported fatal accidents and injury accidents.

All urbanized areas in the region and some rural areas are served by public transit. The San Diego Region is divided into two transit development boards: the San Diego Metropolitan Transit Development Board (MTDB), and the North County Transit Development Board (NCTD). San Diego Transit Corporation (SDTC), which operates transit service under MTDB, serves about two million people annually with routes that cover the cities of San Diego, Chula Vista, El Cajon, La Mesa and National City, as well as portions of San Diego County's unincorporated areas. SDTC routes also connect with other regional operators' routes. San Diego Trolley operates the light rail transit system under MTDB. The North County Transit District (NCTD) buses carry passengers in north San Diego County, including Del Mar, east to Escondido, north to Orange County and Riverside County, and north to Camp Pendleton. NCTD's bus fleet carries more than 11 million passengers every year. NCTD's bus system has 35 routes. In addition, NCTD runs special Express Buses for certain sporting and special events in San Diego.

San Diego Gas & Electric is a public utility that provides natural gas and electric service to 3 million consumers through 1.2 million electric meters and 720,000 natural gas meters in San Diego and southern Orange counties. SDG&E's service area encompasses 4,100 square miles, covering two counties and 25 cities. SDG&E is a subsidiary of Sempra Energy, a Fortune 500 energy services holding company based in San Diego. Virtually all of the petroleum products in the region are delivered via a pipeline system operated by Kinder Morgan Energy Partners.

The San Diego County Water Authority is a public agency serving the San Diego region as a wholesale supplier of water. The Water Authority works through its 24 member agencies to provide a safe, reliable water supply to support the region’s $171 billion economy and the quality of life of 3 million residents or 90 percent of the county's population. The 24 member agencies are comprised of six cities, five water districts, three irrigation districts, eight municipal water districts, one public utility district and one federal agency (military base) and cover a service area of 920,000 acres. In 2008, Metropolitan Water District of Southern California supplied 71% of the water while 29% came from local and other supplies. Metropolitan imports the water from two sources, the Colorado River and the state Water Project (Bay-Delta) in northern California. Traveling hundreds of miles over aqueduct systems that include pump stations, treatment plants and reservoirs, approximately 700,000 acre-feet of water is transported annually through the Water Authority's five pipelines and then distributed to the member agencies for delivery to the public. Residents place the highest demand on water, consuming roughly 59% of all water in San Diego County. Industrial/commercial use is the second largest consumer of water at 17%, followed by the public sector at 13% and agriculture at 12% of the total water demand.

1.3.2 Local Jurisdictions

1.3.2.1 Carlsbad (Population: 110,972)

Carlsbad is a coastal community located 35 miles north of downtown San Diego. It is bordered by Encinitas to the south, Vista and San Marcos to the east and Oceanside to the north. Carlsbad is home to world-class resorts such as the La Costa Resort and Spa and the Four Seasons Resort at Aviara, offering championship-level golf and tennis facilities. The newest addition to Carlsbad's commercial/recreational landscape is Legoland, which opened in the spring of 1999. The city of Carlsbad has a strong economy, much of which has come from industrial development. Callaway Golf, Cobra Golf, ISIS Pharmaceuticals, Mallinckrodt Medical, NTN Communications and Immune Response are just a few of the local companies located in Carlsbad. The area has nine elementary schools, two junior high schools, and three high schools. The school district ranks among the best in the county. Distinguished private and parochial schools also serve Carlsbad, including the internationally renowned Army Navy Academy.

1.3.2.2 Chula Vista (Population: 256,780)

Chula Vista is home to an estimated 44% of all businesses in the South Bay Region of San Diego County. Chula Vista is the second largest municipality in San Diego County, and the 21st largest of 450 California cities. Today Chula Vista is attracting such companies as Solar Turbines and Raytheon, a $20 billion global technology firm serving the defense industry. Chula Vista ranks among the nation's top ten governments in terms of employee productivity and local debt levels.

1.3.2.3 Coronado (Population: 23,500)

Coronado is a 13.5 square mile ocean village. The military bases of the Naval Air Station North Island and Naval Amphibious Base occupy 5.3 square miles. Coronado is connected to San Diego by a 2.3-mile bridge and to Imperial Beach (its neighbor to the south), by a six-mile scenic highway, the Silver Strand. It is primarily a bedroom community for San Diego executives, a haven for retired senior military officers and an internationally renowned tourist destination. This vibrant community welcomes more than two million visitors annually to soak up the sun and the sand while enjoying the lush surroundings and village appeal of Coronado. The city contains 14 hotels, amongst them are 3 world-class resorts including the Hotel Del Coronado and 67 highly acclaimed restaurants.

1.3.2.4 Del Mar (Population: 4,311)

Del Mar is the smallest city in the County with only 4,580 residents in the year 2014. Located 27 miles north of downtown San Diego, this coastal community is known for its affluence and comfortable standard of living. It is a beautiful wooded hillside area overlooking the ocean and has a resort-like atmosphere. The Del Mar Racetrack and Thoroughbred Club serve as Del Mar's most noted landmark. This racetrack is also the location for the annual San Diego County Fair. The City of Del Mar has 2.9 miles of shoreline that include the Del Mar City Beach and the Torrey Pines State Beach. There are two elementary schools, one junior high school and one high school in Del Mar, which is considered one of the region's best school districts.

1.3.2.5 El Cajon (Population: 102,211)

El Cajon is located 15 miles east of the City of San Diego. El Cajon is an inland valley surrounded by rolling hills and mountains. El Cajon's current population of 97,934 makes it the sixth most populated jurisdiction in the region. As one of the most eastern cities in the County, El Cajon has a warm and dry climate. El Cajon is a diverse residential, commercial, and industrial area, and serves as the main commerce center for several surrounding communities. Gillespie Field, a general aviation airport, is a major contributing factor to the city's vibrant industrial development. El Cajon includes a cross-section of housing types from lower cost mobile homes and apartments to moderately priced condominiums to higher cost single-family residences. There are 23 elementary schools, seven middle schools and four high schools.

1.3.2.6 Encinitas (Population: 61,588)

Encinitas is located along six miles of Pacific coastline in the northern half of San Diego County. Approximately 21 square miles, Encinitas is characterized by coastal beaches, cliffs, flat topped coastal areas, steep mesa bluffs and rolling hills. Incorporated in 1986, the City encompasses the communities of Old Encinitas, New Encinitas, Olivenhain, Leucadia and Cardiff-By-The-Sea. The Los Angeles/San Diego (LOSSAN) rail passes through the city, and other transit corridors traversing the city include El Camino Real and Coast Highway 101. Encinitas is bordered by Carlsbad to the north, Solana Beach to the south and the community of Rancho Santa Fe to the east.

1.3.2.7 Escondido (Population: 148,738)

Escondido has a reputation as a bedroom community due to the large percentage of residents who work outside of the city. Escondido is located 30 miles north of San Diego and is approximately 18 miles inland from the coast. It is the region's fifth most populated city. More than a decade ago, the people of Escondido conceived a vision of cultural excellence. Today, the $73.4 million California Center for the Arts stands as a product of this vision. Escondido has 18 elementary schools, nine of which are parochial schools, three middle schools and six high schools, three of which are parochial. There is a unique mix of agriculture, industrial firms, high-tech firms, recreational centers and parks, as well as residential areas. The area's largest shopping mall, the

North County Fair, houses 6 major retail stores and approximately 175 smaller stores. California State University, San Marcos and Palomar Community College are located within minutes of Escondido.

1.3.2.8 Imperial Beach (Population: 27,063)

Imperial Beach claims the distinction of being the "Most Southwesterly City - in the continental United States." The City is located in the Southwest corner of San Diego County, only five miles from the Mexican Border and 15 miles from downtown San Diego. With a population of 28,200, Imperial Beach occupies an area of 4.4 square miles. Imperial Beach offers some of the least expensive housing to be found west of the I-5. It is primarily a resort/recreation community with a vast beach area as well as a 12,000-foot pier for fishing. Some describe Imperial Beach as quaint, but mostly the town has a rare innocence and a relaxed atmosphere. Looking south just across the International border, Tijuana's famous "Bullring by the Sea," the Plaza De Monumental can be seen.

1.3.2.9 La Mesa (Population: 58,642)

La Mesa is centrally located 12 miles east of downtown San Diego. La Mesa is a suburban residential community as well as a commercial and trade center. The area is characterized by rolling hills and has a large number of hilltop home sites that take advantage of the beautiful views. La Mesa offers affordable housing within a wide range of prices, as well as high-end luxury homes atop Mt. Helix. La Mesa has an abundance of mixed-use condominiums for those who prefer a downtown village atmosphere. There is a positive balance between single-family housing and multi-family housing within La Mesa's city limits. One of the region's major retail facilities, Grossmont Center is located in the heart of the city adjacent to another major activity center, Grossmont Hospital. The La Mesa-Spring Valley Elementary School District provides 18 elementary schools and four junior high schools. There are two high schools in the area and Grossmont College, a two-year community college, is also located in La Mesa.

1.3.2.10 Lemon Grove Population: (26,141)

Lemon Grove lies eight miles east of downtown San Diego. Lemon Grove is the third smallest jurisdiction in the San Diego region based on population and geographic size. Initially the site of expansive lemon orchards, the city still remains a small town with a rural ambiance. Currently manufacturing and trade account for over one-third of the total employment in this area. A substantial proportion of the homes in Lemon Grove are single-family dwellings with the addition of several apartments and condominiums built over the last 20 years. There are five elementary schools and two junior high schools.

1.3.2.11 National City (Population: 59,578)

National City is one of the county's oldest incorporated areas. Just five miles south of San Diego, National City is the South Bay's center of industrial activity. The economy is based on manufacturing, shipbuilding and repair. The San Diego Naval Station, which overlaps San Diego and National City is the largest naval facility in the country. There are a great number of historical sites in National City and homes in the area are usually 50 years or older. Stately Victorians reflect the early part of the century when shipping and import/export magnates lived here. Served by National Elementary and Sweetwater High School districts, National City also offers several private schools for all grade levels. National City is best known for its Mile of Cars; the title describing its abundant auto dealerships. Two large shopping malls, Plaza Bonita and South Bay Plaza, are located in National City.

1.3.2.12 Oceanside (Population: 172,794)

Oceanside is centrally located between San Diego and Los Angeles. Located just 36 miles north of downtown San Diego, Oceanside is bordered by Camp Pendleton to the north, Carlsbad to the south, Vista to the east and the ocean to the west. The current population of 178,806 makes Oceanside the fourth largest jurisdiction in the County and the largest coastal community. Industrial real estate rates tend to be lower than the County average. There is an abundant supply of new housing and condominium developments, which tend to be more affordable than in other areas of Southern California coastal cities. With a near-perfect year-round climate and recognition as one of the most livable places in the nation, Oceanside offers both an incomparable lifestyle and abundant economic opportunity. Its extensive recreational facilities include 3.5 miles of sandy beaches, the Oceanside Harbor and the Oceanside Lagoon. There are 16 elementary schools, two parochial and two private, three middle schools and three high schools, as well as Mira Costa College and the United States International University.

1.3.2.13 Poway (Population: 49,417)

Poway is located 23 miles northeast of San Diego within the well-populated I-15 corridor. Poway is distinct because it is set into the foothills. Poway's main recreational facility is the 350-acre Lake Poway Park; the Lake also serves as a reservoir for the water supplied to San Diego by the Colorado River Aqueduct. The area has many recreational facilities, providing complete park sites, trails and fishing opportunities. Poway is also home to the Blue Sky Ecological Reserve, 700 acres of natural habitat with hiking, horseback riding and interpretive trails. The Poway Performing Arts Center is an 815 seat professional theater that began its eleventh season in 2001. The Poway Unified School District is excellent and has been consistently rated in the top tier. The district has four high schools, five middle schools and 19 elementary schools. There are eight private and parochial schools offering instruction from K-8 grades.

1.3.2.14 San Diego (Population 1,356,865)

The City of San Diego is the largest city in San Diego County, containing roughly half of the County's total population. With its current population of 1,336,865, the City of San Diego is the second largest city in the state. It is the region's economic hub, with well over half of the region's jobs and nearly three-quarters of the region's large employers. Thirteen of the region's 20 major colleges and universities are in the City of San Diego, as are six of the region's major retail centers. The City's visitor attractions are world-class and include Balboa Park, San Diego Zoo, Wild Animal Park, Sea World, Cabrillo National Monument and Old Town State Historic Park. The City of San Diego spans approximately 40 miles from its northern tip to the southern border. Including the shoreline around the bays and lagoons, the City of San Diego borders a majority of the region's shoreline, encompassing 93 of the region's 182 shoreline miles.

1.3.2.15 San Marcos (Population: 89,387)

San Marcos is located between Vista and Escondido, approximately 30 miles north of downtown San Diego. San Marcos is known for its resort climate, rural setting, central location and affordable housing prices. San Marcos has been the fasted growing jurisdiction in the region since 1956. It is home to two of the region's major educational facilities, Palomar Community College and California State University, San Marcos. The K-12 School District is an award winning district with over seven Schools of Distinction Awards to their credit.

1.3.2.16 Santee (Population: 56,105)

Santee lies 18 miles northeast of downtown San Diego and is bordered on the east and west by slopes and rugged mountains. The San Diego River runs through this community, which was once a dairy farming area. It is now a residential area that has experienced phenomenal growth since the 1970's. Since the expansion of the San Diego Trolley, Santee residents can ride the Trolley to Mission Valley, Downtown San Diego and as far as the U.S./Mexico Border. Elementary students attend one of 11 elementary schools, while high school students attend Santana or West Hills High School.

1.3.2.17 Solana Beach (Population: 13,236)

As one of the county's most attractive coastal communities, Solana Beach is known for its small-town atmosphere and pristine beaches. Incorporated in 1986, it has one of the highest median income levels in the County as well as an outstanding school system recognized with state and national awards of excellence. Lomas Santa Fe, located east of the freeway, is a master planned community, which features shopping, homes, and condominiums, two golf courses and the family oriented Lomas Santa Fe Country Club.

1.3.2.18 Vista (Population: 96,929)

Vista has been growing at twice the rate of the State of California and 50% faster than the rest of the San Diego area in the last decade. There are 10 elementary schools, four middle schools, and five high schools. More than 400 companies have located their businesses in the city since 1986.

1.3.2.19 Unincorporated County of San Diego (Population: 609,062)

The unincorporated County consists of approximately 34 Community Planning and Sub-regional Areas. Many of the communities in the Unincorporated County jurisdiction are located in the mountains, desert, North County, or on the border of Mexico. Rancho Santa Fe, an affluent residential and resort community, is one of the exceptions, located within the urban core area. The community of Julian is located in the central mountains along a principle travel route between the desert and Metropolitan San Diego, and is a common tourist destination. Alpine is located east of El Cajon on Interstate 8 and is considered a gateway to San Diego County's wilderness areas of mountains, forests, and deserts.

The Sub-regional Planning Areas are Central Mountain, County Islands, Mountain Empire, North County Metro, and North Mountain. Communities within the Central Mountain Sub-region are Cuyamaca, Descanso, Guatay, Pine Valley, and Mount Laguna. The County Islands Community Plan area consists of Mira Mesa, Greenwood, and Lincoln Acres. The North Mountain Sub-region is mostly rural and includes Santa Ysabel, Warner Springs, Palomar Mountain, Mesa Grande, Sunshine Summit, Ranchita and Oak Grove. The Mountain Empire Sub-region contains Tecate, Potrero, Boulevard, Campo, Jacumba, and the remainder of the plan area. The Community Planning Areas are Alpine, Bonsall, Borrego Springs, Boulevard, Crest/Dehesa/Granite Hills/Harbison Canyon, Cuyamaca, Descanso, Desert, Fallbrook, Hidden Meadows, Jacumba, Jamul/Dulzura, Julian, Lake Morena/Campo, Lakeside/Pepper Drive-Bostonia, Otay, Pala-Pauma, Palomar/North Mountain, Pendleton/Deluz, Pine Valley, Portrero, Rainbow, Ramona, San Dieguito (Rancho Santa Fe), Spring Valley, Sweetwater, Tecate, Twin Oaks, Valle De Oro, and Valley Center.

2.1 List of Participating and Non-Participating Jurisdictions

The incorporated cities that participated in the planning process are Carlsbad, Chula Vista, Coronado, Del Mar, El Cajon, Encinitas, Escondido, Imperial Beach, La Mesa, Lemon Grove, National City, Oceanside, Poway, San Diego (City), San Marcos, Santee, Solana Beach, Unincorporated (County), and Vista. There were no non-participating cities. The two Fire Protection District that participated in the revision of the plan were the Alpine Fire Protection District and the Rancho Santa Fe Fire Protection District. One municipal water district also participated, Padre Dam MWD. Representatives from all participating jurisdictions, local businesses, educational facilities, various public, private and non-profit agencies, and the general public provided input into the preparation of the Plan. Local jurisdictional representatives included but were not limited to fire chiefs/officials, police chiefs/officials, planners and other jurisdictional officials/staff.

2.2 Description of Each Jurisdiction's Participation in the Planning Process

A Hazard Mitigation Working Group (HMWG) was established to facilitate the development of the Plan. Representatives from each incorporated city, special district and the unincorporated county were designated by their jurisdiction as the HMWG member. Each HMWG member identified a Local Mitigation Planning Team for their jurisdiction that included decision-makers from police, fire, emergency services, community development/planning, transportation, economic development, public works and emergency response/services personnel, as appropriate. The jurisdiction-level Local Mitigation Planning Team assisted in identifying the specific hazards/risks that are of concern to each jurisdiction and to prioritize hazard mitigation measures. The HMWG members brought this information to HMWG meetings held regularly to provide jurisdiction-specific input to the multi-jurisdictional planning effort and to assure that all aspects of each jurisdiction's concerns were addressed. A list of the lead contacts for each participating jurisdiction is included in Section 3.2.

All HMWG members were provided an overview of hazard mitigation planning elements at the HMWG meetings. This training was designed after the FEMA State and Local Mitigation Planning How-to Guide worksheets, which led the HMWG members through the process of defining the jurisdiction's assets, vulnerabilities, capabilities, goals and objectives, and action items. The HMWG members were also given additional action items at each meeting to be completed by their Local Mitigation Planning Team. HMWG members also participated in the public workshops held to present the risk assessment, preliminary goals, objectives and actions. In addition, several HMWG members met with OES staff specifically to discuss hazard-related goals, objectives and actions. Preliminary goals, objectives and actions developed by jurisdiction staff were then reviewed with their respective City Council, City Manager and/or representatives for approval.

Throughout the planning process, the HMWG members were given maps of the profiled hazards as well as detailed jurisdiction-level maps that illustrated the profiled hazards and critical infrastructure. These maps were created using the data sources listed in Appendix B**.** These data sources contain the most recent data available for the San Diego region. A very large portion of this data was supplied by the regional GIS agency, SanGIS. The SanGIS data is updated periodically with the new data being provided by the local agencies and jurisdictions. This ensured that the data used was the most recent available for each participating jurisdiction. The HMWG members reviewed these maps and provided updates or changes to the critical facility or hazard layers. Data received from HMWG members were added to the hazard database and used in the modeling process described in the Risk Assessment portion of the Plan (Section 4). The data used in this revision of the plan is considered to be more accurate that that utilized in the original plan

All 18 incorporated cities and participating special districts provided OES with edits to critical facilities within their jurisdictions.

3.1 Description of Planning Committee Formation

The San Diego County Operational Area consists of the County of San Diego and the eighteen incorporated cities located within the county's borders. Planning for emergencies, training and exercises are all conducted on a regional basis. In 1961 the County and the cities formed a Joint Powers Agency (JPA) to facilitate regional planning, training, exercises and responses. This JPA is known as the Unified San Diego County Emergency Services Organization (USDCESO). Its governing body is the Unified Disaster Council (UDC). The membership of the UDC is defined in the JPA. Each city and the County have one representative. Representatives from the cities can be an elected official, the City Manager or from the municipal law enforcement or fire agency. The County is represented by the Chairperson of the County Board of Supervisors, who also serves as Chair of the UDC.

In addition there are 26 fire protection districts and 17 water districts within the San Diego Region. Each was offered the opportunity to participate in the development of this plan.

3.1.1 Invitation to Participate

The original development of the Hazard Mitigation Plan, as well as this current revision, was conducted under the auspices of the UDC. At the direction of the UDC, the San Diego County Office of Emergency Services (OES) acted as the lead agency in the revision of this plan. Thomas Amabile, the representative for the San Diego County OES, requested input from each jurisdiction in the county. Each municipality and special district was formally invited to attend a meeting to develop an approach to the planning process and to form the HMWG Committee (See Appendix A). These invitations were in the form of an email to each member jurisdiction. Invitations were also emailed to each Water District and Fire Protection District within the County. At the October 17, 2013 UDC meeting, it was again announced that the plan was reaching the five year mark and required updating. Each jurisdiction also confirmed their participation on the HMWG. In addition to the eighteen incorporated cities, OES provided an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, as well as business, academia and other private and non-profit interested to be involved in the planning process. Some of those parties are listed in Section 3.2 below. The committee was formed as a working group to undertake the planning process and meeting dates were set for all members of the committee and interested parties to attend. Local jurisdictional representatives included but were not limited to fire chiefs/officials, police chiefs/officials, planners and other jurisdictional officials/staff.

3.2 Name of Planning Committee and its Members

The HMWG is comprised of representatives from San Diego County (County), each of the 18 incorporated cities in the County four special districts and interested public agencies and citizens, as listed above in Section 2.1. The HMWG met regularly, and served as a forum for participating agencies to voice their opinions and concerns about the mitigation plan. Although several jurisdictions sent several representatives to the HMWG meetings, each jurisdiction selected a lead representative who acted as the liaison between their jurisdictional Local Mitigation Planning Team and the HMWG. Each local team, made up of other jurisdictional staff/officials met separately and provided additional local-level input to the leads for inclusion into the Plan. These lead representatives are:

Lead HMWG Representatives for Participating Jurisdictions:

- City of Carlsbad, David Harrison, Fire Department, Emergency Preparedness Manager
- City of Chula Vista, Marisa Balmer, Fire Department, Emergency Services Coordinator
- City of Coronado, Perry Peake, Fire Department, Battalion Chief
- City of Del Mar, Ashlee Stratakis, Fire Department, Program Analyst
- City of El Cajon, Rick Sitta, Fire Department, Deputy Chief
- City of Encinitas, Tom Gallup, Fire Department, Senior Program Analyst
- City of Escondido, Don Rawson, Fire Department, Emergency/Disaster Preparedness Manager
- City of Imperial Beach, Dean Roberts, Fire Department, Emergency Services Coordinator
- City of La Mesa, Greg McAlpine, Fire Dept, Deputy Chief
- City of Lemon Grove, Tim Smith, Fire Department, Deputy Chief
- City of National City, Walter Amadee, Fire Department, Management Analyst III
- City of Oceanside, Greg Vanvorhees, Fire Department, Fire Marshall
- City of Poway, Dane Cawthone, Fire Department, Division Chief
- City of San Diego, Jeff Pack, Office of Homeland Security, Sr. Homeland Security Coordinator
- City of San Diego, Eugene Ruzzini, Office of Homeland Security, Analyst
- City of San Marcos, Scott Hansen, Fire Department, Battalion Chief
- City of Santee, Richard Mattick, Fire Department, Assistant Chief
- City of Solana Beach, Ashlee Stratakis, Fire Department, Program Analyst
- City of Vista, Mike Easterling, Fire Department, Deputy Chief
- County of San Diego, Thomas Amabile, OES, Sr. Emergency Services Coordinator
- County of San Diego, Jason Batchelor, SD County Planning and Developmental Services, GIS Coordinator
- Alpine FPD, Bill Paskle, Fire Chief
- Padre Dam MWD, Larry Costello, Safety and Risk Manager
- Rancho Santa Fe FPD, Tony Michel, Fire Chief

Representatives of the following agencies/organizations were invited to attend all planning team meetings and provided both data and general input to and feedback on the plan:

- California Office of Emergency Services (Cal OES.), Joanne Phillips, Sr. Emergency Services Coordinator
- Emergency Preparedness and Disaster Medical Response, Donna Johnson, EMS Specialist
- San Diego County Hazardous Materials Division, Dave Cammall, Registered Environmental Health Specialist
- San Diego Department of Public Works, Gitanjali Shinde, Assistant Engineer

The California Office of Emergency Services participated on the regional planning committee. The representatives from San Diego County EMS, Hazardous Materials and Public Works participated on the County's local planning team.

Each participating jurisdiction had their own local planning team. Details on the membership of those teams can be found in the individual jurisdiction's portion of Section Five. Each local planning team met either before or after the regional team to discuss the topics of the regional meetings (listed in Section 3.3 below).

Finally, the Unified Disaster Council (UDC) received briefings regularly on the progress of the planning process. UDC meetings are open to the public, with agendas and notices posted according to California's Brown Act, with emailed invitations and reminders sent out one to two weeks prior to the meetings. Included on that email list are representatives from the following agencies:

- American Red Cross
- Chambers of Commerce
- Federal Agencies (USN, USMC, USCG, DHS)
- Hospitals
- Port of San Diego
- State Agencies (Cal OES, DMV, Caltrans)
- School Districts
- Universities and colleges
- Utilities (Power- SDG&E, Water – San Diego County Water Authority and Water Districts, Cable, telephone and internet – Cox Communications)

3.3 Hazard Mitigation Working Group Meetings

The Hazard Mitigation Working Group met regularly. The following is a list of meeting dates and results of meetings (see Appendix A for sign-in sheets, meeting agendas, and meeting minutes).

HMWG Meeting Dates/Results of Meeting:
HMWG Meeting 1: 2/11/2014 - Kickoff and Formation of HMWG
Climate Change Workshop 1: 3/4/2014
HMWG Meeting 2: 3/11/2014 - Overview of Planning Process/Assessing Risks
Climate Change Workshop 2: 6/10/2014
HMWG Meeting 3: 6/10/2014 - Overview of Planning Process/Profiling Hazards
HMWG Meeting 4: 9/16/2014 - Review Risk Assessment/Development of Mitigation Plan

The distribution of the draft and final plans was accomplished electronically. Other meetings included individual meetings with jurisdictions and meetings with GIS staff.

Not all members were able to attend all meetings. Follow-up phone calls and in person meetings were conducted with those who were not able attend to ensure they were kept current on the process.

3.4 Planning Process Milestones

The approach taken by San Diego County relied on sound planning concepts and a methodical process to identify County vulnerabilities and to propose the mitigation actions necessary to avoid or reduce those vulnerabilities. Each step in the planning process was built upon the previous, providing a high level of assurance that the mitigation actions proposed by the participants and the priorities of implementation are valid. Specific milestones in the process included:

Risk Assessment (June 2014 – September 2014) - The HMWG used the list of hazards from the current Multi-jurisdictional Hazard Mitigation Plan to determine if they were still applicable to the region and if there were any new threats identified that should be added to the plan. Specific geographic areas subject to the impacts of the identified hazards were mapped using a Geographic Information System (GIS). The HMWG had access to updated information and resources regarding hazard identification and risk estimation. This included hazard specific maps, such as floodplain delineation maps, earthquake shake potential maps, and wildfire threat maps; GIS-based analyses of hazard areas; the locations of infrastructure, critical facilities, and other properties located within each jurisdiction and participating special district; and an estimate of potential losses or exposure to losses from each hazard.

The HMWG also conducted a methodical, qualitative examination of the vulnerability of important facilities, systems, and neighborhoods to the impacts of future disasters. GIS data and modeling results were used to identify specific vulnerabilities that could be addressed by specific mitigation actions. The HMWG also reviewed the history of disasters in the County and assessed the need for specific mitigation actions based on the type and location of damage caused by past events. The process used during the completion of the initial plan and first update was utilized for this update.

Finally, the assessment of community vulnerabilities included a review of current codes, plans, policies, programs, and regulations used by local jurisdictions to determine whether existing provisions and requirements adequately address the hazards that pose the greatest risk to the community. Again, this was a similar process to that used in the original plan and first update.

Goals, Objectives and Alternative Mitigation Actions (August, 2014- October, 2014) – Based on this understanding of the hazards faced by the County, the goals and objectives identified in the current plan were reviewed to see what had been completed and could be removed and which were not able to be completed due to funding or other roadblocks. Members then added those goals, objectives or actions as required for the completion of the update. This was done by the members working with their local planning groups and in a series of one-on-one meetings with OES staff.

Mitigation Plan and Implementation Strategy (October 2014 - February, 2015) – Each jurisdiction reviewed their priorities for action from among their goals, objectives and actions, developing a specific implementation strategy including details about the organizations responsible for carrying out the actions, their estimated cost, possible funding sources, and timelines for implementation.

Work Group Meetings (February, 2014 – December, 2014) - As listed in Section 3.3 a series of HMWG meetings were held in which the HMWG considered the probability of a hazard occurring in an area and its impact on public health and safety, property, the economy, and the environment, and the mitigation actions that would be necessary to minimize impacts from the identified hazards. These meetings were held every month or two (depending on the progress made) starting February 2014 and continued through September 2014. The meetings evolved as the planning process progressed, and were designed to aid the jurisdictions in completing worksheets that helped define hazards within their jurisdictions, their existing capabilities and mitigation goals and action items for the Mitigation Plan.

Climate Change Workshops and Stakeholder Meeting (March, 2014-September 2014) – A series of workshops to discuss the impact climate change is having on the regions natural hazards were conducted to educate local planners and community members. Topics discussed included sea level rise, drought, changes to precipitation patterns and extreme weather, as well as their current and potential future impacts. The information presented in these workshops were incorporated into the risk assessment process as well in the development of mitigation goals and objectives.

3.5 Public Involvement

A detailed survey was posted on the websites of all participating jurisdictions. It was active from the beginning of March 2014 to the end of July 2014. There were 532 responses to the survey. The survey questions and respondents answers are found in Appendix D.

A Hazard Mitigation Plan Web Page, as part of the San Diego County Office of Emergency Services website was developed to provide the public with information. Items posted on the web site included the current plan, and draft updates, by jurisdiction or agency.

Public involvement was valuable in the development of the Plan. The areas of concern provided by the survey responses were used by each jurisdiction while developing mitigation objectives and actions.

3.6 Existing Plans or Studies Reviewed

HMWG team members and their corresponding Local Mitigation Planning Teams prior to and during the planning process reviewed several plans, studies, and guides. These plans included FEMA documents, emergency services documents as well as county and local general plans, community plans, local codes and ordinances, and other similar documents. These included:

San Diego County/Cities General Plans

Various Local Community Plans

Various Local Codes and Ordinances

FEMA Local Mitigation Handbook March 2013

FEMA Mitigation Ideas January 25, 2013

Integrating Hazard Mitigation and Climate Adaptation Planning – ICLEI February 2014

Climate Change Impacts in the United States – U.S. Government Printing Office 2014

Local Mitigation Plan Review Tool

California State Hazard Mitigation Plan 2013

Unified San Diego County Emergency Services Organization Operational Area Emergency Plan dated September 2010

4.1 Overview of the Risk Assessment Process

Risk Assessment requires the collection and analysis of hazard-related data in order to enable local jurisdictions to identify and prioritize appropriate mitigation actions that will reduce losses from potential hazards. The FEMA Local Mitigation Handbook March 2013 identifies nine tasks to the hazard mitigation planning process, including: 1) determining the planning area and resources, which requires establishing the planning area and those jurisdictions to be included in the planning process 2) building the planning team, which involves identifying local team members, engaging local leadership, getting buy-in and documentation of the process, 3) creating an outreach strategy, to ensure public participation 4) reviewing community capabilities, which involves assessing what resources are in place, such as the National Flood Insurance Program, to help mitigate the hazards, 5) conducting the risk assessment which profiles the hazards, 6) developing a mitigation strategy to minimize the impacts of the hazards, 7) keeping the plan current, 8) reviewing and adopting the plan and 9) creating a safe and resilient community . Tasks 1, 2 3 and 4 were described in Section Three. The remaining tasks are described below.

When the revision process began in 2014 a complete review of the hazards identified in the original plan and first update was conducted to determine if they were still valid and should be kept as a target for mitigation measures or removed from the list. We also reassessed those hazards that were not considered for mitigation actions in 2010 to determine if that decision was still applicable or if they should be moved to the active list. Finally, we examined potential or emerging hazards, including climate change, to see if any should be included on the active list.

The data used was the most recent data available from SanGIS and the participating jurisdictions. This data changed the model results in some cases raising the risks and reducing it in others. The overall result was a more accurate picture of the risks facing the region. An example of this is the data for dam failure. The 2010 plan shows an exposed population of is 241,767, with the exposure for residential buildings at \$23,054,569. The 2014 data shows the exposed population has increased to 432,664, with exposure for residential buildings increasing to \$40,141,337.

While many of the mitigation measures listed in the original plan and revision were accomplished, the risk of the hazard did not significantly diminish. This is easily seen in both the wildfire and earthquake hazards. While mitigation measures have been put in place (such as the update of the fire code and vegetation management measures) wildfire remains, and will continue to be, the greatest risk to the San Diego region. The HMG reviewed all events since 2010 (wildfires, etc.) and all were profiled accurately in the original plan. The review of the other hazards showed that the updated data was consistent with previous growth in the region. Any significant changes to the hazard profiles were the result of the incorporation of climate change into this plan.

4.1.1 Risk Assessment

Risk Assessment is the process of identifying the potential impacts of hazards that threaten an area including both natural and man-made events. A natural event causes a hazard when it harms people or property. Such events would include floods, earthquakes, tornadoes, tsunami, coastal storms, landslides, and wildfires that strike populated areas. Man-made hazard events are caused by human activity and include technological hazards and terrorism. Technological hazards are generally accidental and/or have unintended consequences (for example, an accidental hazardous materials release). Terrorism is defined by the *Code* *of Federal Regulations* as "…unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives." Natural hazards that have harmed the County in the past are likely to happen in the future; consequently, the process of risk assessment includes determining whether or not the hazard has occurred previously. Approaches to collecting historical hazard data include researching newspapers and other records, conducting a planning document and report literature review in all relevant hazard subject areas, gathering hazard-related GIS data, and engaging in conversation with relevant experts from the community. In addition, a variety of sources were used to determine the full range of all potential hazards within San Diego County. Even though a particular hazard may not have occurred in recent history in San Diego County, it is important during the hazard identification stage to consider all hazards that may potentially affect the study area.

4.1.2 Profiling (Describing) Hazards

Hazard profiling entails describing the physical characteristics of hazards such as their magnitude, duration, past occurrences and probability. This stage of the hazard mitigation planning process involves creating base maps of the study area and then collecting and mapping hazard event profile information obtained from various federal, state, and local government agencies. Building upon the original hazard profiles, OES used the existing hazard data tables (created for the original Hazard Mitigation Plan and revision) and updated them using current data. The revised hazard data was mapped to determine the geographic extent of the hazards in each jurisdiction in the County. The level of risk associated with each hazard in each jurisdiction was also estimated and assigned a risk level of high, medium or low depending on several factors unique to that particular hazard. The hazards looked at were both natural and man-made.

Probability of future events are described in the plan as:

- Highly Likely – Occurs at intervals of 1 – 10 years
- Likely - Occurs at intervals of 10 - 50 years
- Somewhat Likely - Occurs at intervals greater than every 50 years

4.1.3 Identifying Assets

The next step of the risk assessment process entails identifying which assets in each jurisdiction will be affected by each hazard type. Assets include the built environment (any type of structure or critical facility such as hospitals, schools, museums, apartment buildings, and public infrastructure), people, economic factors, future development and the natural environment. The inventory of existing and proposed assets within the County was updated. The assets were then mapped to show their locations and to determine their vulnerability to each hazard type. The HMWG also considered proposed structures, including planned and approved developments, based upon a review of the General Plan Land Use Element for the County and the cities.

4.1.4 Analyze Risk

Analyzing risk involves evaluating vulnerable assets, describing potential impacts and estimating losses for each hazard. Vulnerability describes the degree to which an asset is susceptible to damage from a hazard. Vulnerability depends on an asset's construction, contents and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. Often, indirect effects can be much more widespread and damaging than direct effects. Risk analysis predicts the extent of injury and damage that may result from a hazard event of a given intensity in a given area. It identifies the effects of natural and man-made hazard events by estimating the relative exposure of existing and future population, land development, and infrastructure to hazardous conditions. The analysis helps set mitigation priorities by allowing local jurisdictions to focus attention on areas most likely to be damaged or most likely to require early emergency response during a hazard event.

4.1.5 Repetitive Loss

Disaster records were reviewed for repetitive losses. No repetitive losses were found for Coastal storms, erosion and Tsunamis, Dam Failures, Earthquakes, landslides, wildfire or liquefaction. The City of Lemon Grove had one address involved in a series of repetitive structure fires caused by arson. A list of repetitive losses by jurisdiction is below (Repetitive loss due to flooding is found in Section 4.3.5.3):

Alpine FPD	0	National City	0
Carlsbad	1 Structure Fire	Oceanside	0
Chula Vista	0	Poway	0
Coronado	0	Padre Dam MWD	0
Del Mar	3 Storm /Erosion	San Diego	0
El Cajon	0	San Marcos	0
Encinitas	0	Santee	0
Escondido	0	Solana Beach	0
Imperial Beach	0 Flood	Vista	0
La Mesa	0	County of San Diego	0 Flood
Lemon Grove	1 Structure Fire	Rancho Santa Fe FPD	0

4.1.6 Exposure Analysis

Exposure analysis identifies the existing and future assets located in an identified hazard area. It can quantify the number, type and value of structures, critical facilities, and infrastructure located in those areas, as well as assets exposed to multiple hazards. It can also be used to quantify the number of future structures and infrastructure possible in hazard prone areas based on zoning and building codes.

4.2 Hazard Identification and Screening

4.2.1 List of Hazards Prevalent in the Jurisdiction

The HMWG reviewed the hazards identified in the original Hazard Mitigation Plan and evaluated each to see if they still posed a risk to the region. In addition, the hazards listed in the How-to Guide were also reviewed to determine if they should be added to the list of hazards to include in the plan revision. All hazards identified by FEMA in the How-To-Guides were reviewed. They include: avalanche, coastal storm, coastal erosion, dam failure, drought/water supply, earthquake, expansive soils, extreme heat, flooding, hailstorm, house/building fire, land subsidence, landslide, liquefaction, severe winter storm, tornado, tsunami, wildfire, windstorm, and volcano. Although not required by the FEMA *Disaster Mitigation Act of 2000*, manmade hazards such as hazardous materials release, nuclear materials release, and terrorism were also reviewed by the HMWG.

Climate change was not included as a hazard. However, the impact of climate change on the identified hazards was included in the evaluation of the hazards and their impacts.

4.2.2 Hazard Identification Process

As summarized above, hazard identification is the process of identifying all hazards that threaten an area, including both natural and man-made events. In the hazard identification stage, The HMWG determined hazards that potentially threaten San Diego County. The hazard screening process involved narrowing the all-inclusive list of hazards to those most threatening to the San Diego region. The screening effort required extensive input from a variety of HMWG members, including representatives from City governments, County agencies, special districts, fire agencies and law enforcement agencies, the California Office of Emergency Services, local businesses, community groups, the 2010 Unified San Diego County Emergency Services Organization Operational Area Emergency Plan, and the general public.

OES, with assistance of GIS experts from the County of San Diego's Planning and Development Services used information from FEMA and other nationally and locally available databases to map the County's hazards, infrastructure, critical facilities, and land uses. This mapping effort was utilized in the hazard screening process to determine which hazards would present the greatest risk to the County of San Diego and to each jurisdiction within the County.

It was also determined that the coastal storm, erosion, and tsunami hazards should be profiled together because the same communities in the County have the potential to be affected by all three hazards. In the development of the initial plan, the HMWG indicated that based on the fact that the majority of the development in San Diego is relatively recent (within the last 60 years), an urban type of fire that destroys multiple city blocks is not likely to occur alone, without a wildfire in the urban/wild-land interface occurring first. Therefore, it was determined that house/building fire and wildfire should be addressed as one hazard category in the plan. This current revised plan continues to discuss structure fire and wildfire together. Similarly, the original plan and first revision addressed earthquake and liquefaction as one category because liquefaction does not occur unless an adequate level of ground shaking from an earthquake occurs first. With the decommissioning of the San Onofre Nuclear Generating Station it was decided to incorporate nuclear materials release (resulting from an accident) under hazardous materials release.

The final list of hazards to be profiled for San Diego County was determined as Wildfire/Structure Fire, Flood, Coastal Storms/Erosion/Tsunami, Earthquake/Liquefaction, Rain-Induced Landslide, Dam Failure, Drought, Hazardous Materials Incidents, and Terrorism.

Table 4.2-1 shows a summary of the hazard identification results for San Diego County.

Table 4.2-1
Summary of Hazard Identification Results

Hazard	Data Collected for Hazard Identification	Justification for Inclusion
Coastal Storms, Erosion and Tsunami	• Historical Coastlines (NOAA) • Shoreline Erosion Assessment (SANDAG) • Maximum Tsunami Run up Projections (USCA OES) • FEMA FIRM Maps • FEMA Hazards website • Coastal Zone Boundary (CALTRANS) • Tsunamis and their Occurrence along the San Diego County Coast (report, Westinghouse Ocean Research Laboratory) • Tsunami (article, Scientific American) • Storms in San Diego County (publication of San Diego County Dept. of Sanitation and Flood Control)	• Coastal storms prompted 11 Proclaimed States of Emergency from 1950-2017 • Coastline stabilization measures have been implemented at various times in the past (erosion) • Extensive development along the coast
Dam Failure	• FEMA-HAZUS • Dam Inundation Data (SanGIS) • San Diego County Water Authority (SDCWA) (Olivenhain Dam) • FEMA FIRM maps • Topography (SANDAG) • FEMA Hazards website	• Dam failure • 58 dams exist throughout San Diego County • Many dams over 30 years old • Increased downstream development
Drought	• California Department of Water Resources • San Diego County Water Authority	• Statewide multiple year droughts have occurred numerous times since 1976 • Regional water storage reserves are at the lowest point since 2008
Earthquake	• USGS • CGS • URS • CISN • SanGIS • SANDAG • FEMA-HAZUS 99 • FEMA Hazards website	• Several active fault zones pass through San Diego County

Hazard	Data Collected for Hazard Identification	Justification for Inclusion
Floods	• FEMA FIRM Maps • Topography • Base flood elevations (FEMA) • Historical flood records • San Diego County Water Authority • San Diego County Dept. of Sanitation and Flood Control • FEMA Hazards website	• Much of San Diego County is located within the 100-year floodplain • Flash floods and other flood events occur regularly during rainstorms due to terrain and hydrology of San Diego County • There have been multiple Proclaimed States of Emergency between 1950-2016 for floods in San Diego County
Hazardous Materials Release	• County of San Diego Dept. of Environmental Health, Hazardous Materials Division	• San Diego County has several facilities that handle or process hazardous materials • Heightened security concerns since September 2001
Landslide	• USGS • CGS • Tan Map Series • Steep slope data (SANDAG) • Soil Series Data (SANDAG) • FEMA-HAZUS • FEMA Hazards website • NEH	• Steep slopes within earthquake zones characterize San Diego County, which creates landslide risk. • There have been 2 Proclaimed States of Emergency for landslides in San Diego County
Liquefaction	• Soil-Slip Susceptibility (USGS) • FEMA-HAZUS MH • FEMA Hazards website	• Steep slopes or alluvial deposit soils in low-lying areas are susceptible to liquefaction during earthquakes or heavy rains. San Diego County terrain has both of these characteristics and lies within several active earthquake zones
Nuclear Materials Release	• San Onofre Nuclear Generating Station (SONGS) and Department of Defense	• The potential exists for an accidental release to occur at San Onofre or from nuclear ships in San Diego Bay • Heightened security concerns since September 2001
Terrorism	• County of San Diego Environmental Health Department Hazardous Materials Division	• The federal and state governments have advised every jurisdiction to consider the terrorism hazard • Heightened security concerns since September 2001
Wildfire/ Structure Fire	• CDF-FRAP • USFS • CDFG • Topography • Local Fire Agencies • Historical fire records • FEMA Hazards website	• San Diego County experiences wildfires on a regular basis • 9 States of Emergency were declared for wildfires between 1950-2016 • Terrain and climate of San Diego • Santa Ana Winds

A matrix of all data collected, including source, original projection, scale and data limitations is included in Attachment B. Maps were generated depicting the potential hazards throughout the county and distributed to the jurisdictions. Data and methods that were ultimately used to determine risk levels and probability of occurrence for each hazard are described in detail in the hazard profiling sections.

Hazards are categorized in this plan as being highly likely (occurring every 1-10 years), likely (occurring every 10-50 years) or somewhat likely (occurring at intervals greater than 50 years).

4.2.3 Hazard Identification Sources

Once the hazards of concern for San Diego County were determined, the available data was collected, using sources including the Internet, direct communication with various agencies, discussions with in-house URS experts, and historical records. Specific sources included the United States Geological Survey (USGS), California Geological Survey (CGS), Federal Emergency Management Agency (FEMA) HAZUS, FEMA Flood Insurance Rate Maps (FIRM), United States Forest Service (USFS), California Department of Forestry – Fire and Resource Assessment Program (CDF-FRAP), National Oceanographic and Atmospheric Administration (NOAA), San Diego Geographic Information Source (SanGIS), San Diego Association of Governments (SANDAG), San Diego County Flood Control District, Southern California Earthquake Data Center (SCEDC), California Seismic Safety Commission (CSSC), California Integrated Seismic Network (CISN), California Department of Fish and Game (CDFG), Drought Outlook websites, and input gathered from local jurisdictions districts and agencies. When necessary, agencies were contacted to ensure the most updated data was obtained and used. Historical landmark locations throughout the County were obtained from the National Register and from the San Diego Historical Resources Board.

Table 4.2-1 also depicts data sources researched and utilized by hazard, as well as brief justifications for inclusion of each hazard of concern in the San Diego region. See Appendix B for a Data Matrix of all sources used to gather initial hazard information.

4.2.4 Non-Profiled Hazards

During the initial evaluation the HMWG determined that those hazards that were not included in the original plan's profiling step because they were not prevalent hazards within the County, were found to pose only minor or very minor threats to the County compared to the other hazards had not changed and would not be included in the revision. The following table gives a brief description of those hazards and the reason for their exclusion from the list.

Table 4.2-2
Summary of Hazards Excluded from Hazard Profiling

Hazard	Description	Reason for Exclusion
Avalanche	A mass of snow moving down a slope. There are two basic elements to a slide; a steep, snow-covered slope and a trigger	Snowfall in County mountains not significant; poses very minor threat compared to other hazards
Expansive soils	Expansive soils shrink when dry and swell when wet. This movement can exert enough pressure to crack sidewalks, driveways, basement floors, pipelines and even foundations	Presents a minor threat to limited portions of the County
Hailstorm	Can occur during thunderstorms that bring heavy rains, strong winds, hail, lightning and tornadoes	Occurs during severe thunderstorms; most likely to occur in the central and southern states; no historical record of this hazard in the region.
Land subsidence	Occurs when large amounts of ground water have been withdrawn from certain types of	Soils in the County are mostly granitic. Presents a minor threat to limited parts of the county. No historical record

Hazard	Description	Reason for Exclusion
	rocks, such as fine-grained sediments. The rock compacts because the water is partly responsible for holding the ground up. When the water is withdrawn, the rocks fall in on themselves.	of this hazard in the region.
Tornado	A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm (or sometimes as a result of a hurricane) and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado is a result of the high wind velocity and wind-blown debris.	Less than one tornado event occurs in the entire State of California in any given year; poses very minor threat compared to other hazards. No historical record of this hazard in the region.
Volcano	A volcano is a mountain that is built up by an accumulation of lava, ash flows, and airborne ash and dust. When pressure from gases and the molten rock within the volcano becomes strong enough to cause an explosion, eruptions occur	No active volcanoes in San Diego County. No historical record of this hazard in the region.
Windstorm	A storm with winds that have reached a constant speed of 74 miles per hour or more	Maximum sustained wind speed recorded in the region is less than 60 miles per hour and would not be expected to cause major damage or injury (see Figure 4.3.1)

4.3 Hazard Profiles

A hazard profile is a description of the physical characteristics of a hazard and a determination of various hazard descriptors, including magnitude, duration, frequency, probability, and extent. The hazard data that were collected in the hazard identification process were mapped to determine the geographic extent of the hazards in each jurisdiction in the County and the level of risk associated with each hazard. Most hazards were given a risk level of high, medium or low depending on several factors unique to the hazard. The hazards identified and profiled for San Diego County, as well as the data used to profile each hazard are presented in this section. The hazards are presented in alphabetical order; and this does not signify level of importance to the HMWG. Because Nuclear Materials Release, Hazardous Materials Release and Terrorism hazards are sensitive issues and release of information could pose further unnecessary threat, the HMWG decided that each of these hazards would be discussed separately in a “For Official Use Only” Appendix and would be exempt from public distribution and disclosure by Section 6254 (99) of the California Government Code (See separately bound Attachment A).

4.3.1 Emerging Risk – Climate Change

According to the Intergovernmental Panel on Climate Change (IPCC), warming of the climate system is unequivocal, as is now evident from observations of increased global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.[1] The overwhelming majority of

[1] IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

climate scientists agree that human activities, especially burning of fossil fuels, are responsible for most of the global warming observed.[2]

Climate change is already affecting California and the San Diego region. Sea levels measured at a station in La Jolla have risen at a rate of 6 inches over the last century.[3] Flooding and erosion in coastal areas is already occurring even at existing sea levels and damaging some coastal areas during storms and extreme high tides.[4] California has also seen an increase in average temperatures of about 1.5F since 1985, more extreme heat events, and decreasing spring snowmelt from the Sierra Nevada as more precipitation falls as rain instead of snow.[5] Eighty-four percent of San Diego County residents believe that climate change is happening.[6]

The climate is projected to continue to change over this century and beyond.[7] Climate change is not a hazard in and of itself, but rather is a factor that could affect the location, extent, probability of occurrence, and magnitude of climate-related hazards. This risk assessment goes on to discuss climate change as a factor affecting extreme heat, coastal storms/erosion, wildfire, flooding, and drought/water supply. The climate change factor is increasing risk for some natural hazards, and this assessment includes information about how risk will change into the future. By assessing ongoing changes in risk—in addition to the traditional practice of risk assessment based on observed hazard events—this plan's hazard mitigation strategies can better reduce risk from hazards expected going forward. The following section provides a summary of projections for temperatures, sea level rise, and precipitation, provided by Dr. Daniel Cayan and his team at Scripps Institution of Oceanography.[8]

4.3.1.1 Annual Average Temperature

According to the National Climate Assessment, the Southwestern United States has already heated up markedly. The period since 1950 has been hotter than any other comparably long period in the last 600 years and the decade from 2000 to 2010 was the hottest in the 110-year instrumental record.[9] Global climate

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[2] Ibid.

[3] California Environmental Protection Agency and Office of Environmental Health Hazard Assessment, 2013. "Indicators of Climate Change in California."

[4] Walsh, J., D. Wuebbles, K. Hayhoe, J. Kossin, K. Kunkel, G. Stephens, P. Thorne, R. Vose, M. Wehner, J. Willis, D. Anderson, S. Doney, R. Feely, P. Hennon, V. Kharin, T. Knutson, F. Landerer, T. Lenton, J. Kennedy, and R. Somerville, 2014: Ch. 2: Our Changing Climate. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 19-67. doi:10.7930/J0KW5CXT.

[5] Ibid.

[6] Climate Education Partners, 2014. "San Diego, 2050 Is Calling. How Will We Answer?"

[7] Walsh, J., D. Wuebbles, K. Hayhoe, J. Kossin, K. Kunkel, G. Stephens, P. Thorne, R. Vose, M. Wehner, J. Willis, D. Anderson, S. Doney, R. Feely, P. Hennon, V. Kharin, T. Knutson, F. Landerer, T. Lenton, J. Kennedy, and R. Somerville, 2014: Ch. 2: Our Changing Climate. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 19-67. doi:10.7930/J0KW5CXT.

[8] Higbee, Melissa, Daniel Cayan, Sam Iacobellis, Mary Tyree (2014). Report from San Diego Hazard Mitigation Plan Update Training Workshop #1: Climate Change and Hazards in San Diego. ICLEI-Local Governments for Sustainability. Accessed July 7, 2014. http://www.icleiusa.org/library/documents/training-workshop-report/view

[9] Garfin, G., G. Franco, H. Blanco, A. Comrie, P. Gonzalez, T. Piechota, R. Smyth, and R. Waskom, 2014: Ch. 20: Southwest. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 462-486. doi:10.7930/J08G8HMN.

models project that ***San Diego will likely warm 2-3 °F by 2050*** under the relatively low GHG emissions scenario (RCP 4.5). Greater warming can be expected in inland areas than along the coast. Under the higher emissions scenario (RCP 8.5), the warming trend becomes significantly more pronounced after 2050. This tendency occurs in coastal and inland areas.

4.3.1.2 Heat Waves

For this analysis, the definition of a heat wave is the occurrence of the 98th percentile maximum temperature calculated from the historical period of 1970-2000 for at least one day. For coastal areas, a heat wave is defined as at least one day with the temperature reaching 83 °F or higher. For inland areas, a heat wave is at least one day with the temperature reaching 116 degrees °F or higher.

By this definition, heat waves occur about 2 times per year in San Diego's present climate. However, ***heat waves are projected to increase in frequency and intensity*** (higher maximum temperatures) over the 21st century. By mid-century, the San Diego region could see heat waves occurring 12-16 times per year. ***Heat waves are also projected to increase in duration*** (number of days). In the current climate, heat waves last 2 days on average. By mid-century, heat waves are projected to last 3-4 days on average.

4.3.1.3 Sea Level Rise

Sea levels measured at a station in La Jolla have risen at a rate of 6 inches over the last century.[10] The table below shows the ranges of sea level rise that the California Coastal Commission[11] recommends local jurisdictions plan for based on the National Research Council's (NRC) report on Sea Level Rise in California, Oregon and Washington: Past Present and Future.[12] ***San Diego is projected to experience up to two feet of sea level rise by mid-century.***

NRC Average Sea Level Rise Projections for South of Cape Mendocino

Time Period	Range	Central Estimate
2000-2030	4 to 30 cm (.13 to .98 ft)	14.7 ± 5.0 cm
2000-2050	12 to 61 cm (.39 to 2.0 ft)	28.4 ± 9.2 cm
2000-2100	42 to 167 cm (1.38 to 5.48 ft)	91.9 ± 24.9 cm

4.3.1.4 High Sea Level Events

It's not only important to consider increases in average sea level, but also consider other fluctuations that will occur on top of the increase in the average, such as high astronomical tides, wind, waves, and storm surge. These fluctuations produce high sea level events.

This analysis of high sea levels uses a model that includes sea level rise, weather, and tidal-related fluctuations in sea level. This analysis defines a high sea level as the 99.99th percentile hourly sea level

[10] California Environmental Protection Agency and Office of Environmental Health Hazard Assessment, 2013. "Indicators of Climate Change in California."

[11] California Coastal Commission Draft Sea Level Rise Policy Guidance (2013) http://www.coastal.ca.gov/climate/slr/guidance/CCC_Draft_SLR_Guidance_PR_10142013.pdf

[12] Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future (2012). http://www.nap.edu/catalog.php?record_id=13389

calculated for the period 1970-1999.The analysis sums the total number of hours in a year that the sea level is at or above this threshold.

The chart below illustrates how as the annual mean sea level increases, ***San Diego's shoreline will see increasingly more hours of high sea levels as the century progresses.*** In the present climate, San Diego experiences one hour of high sea levels per year on average. By the 2030 period, high sea levels occur 12 hours per year on average. By mid-century, this increases to 62 hours per year. These high sea levels put more natural ecosystems (beaches, cliffs, wetlands) and man-made infrastructure at risk of exposure to flooding and wave action.

High Sea Levels Trend Chart:

4.3.2 Sea Level Rise, Coastal Storms, Erosion and Tsunami

4.3.2.1 Nature of Hazard

These four hazards were mapped and profiled as a group because many of the factors and risks involved are similar and limited to the coastal areas. Coastal storms can cause increases in tidal elevations (called storm surge), wind speed, and erosion. The most dangerous and damaging feature of a coastal storm is storm surge. Storm surges are large waves of ocean water that sweep across coastlines where a storm makes landfall. Storm surges can inundate coastal areas, wash out dunes, and cause backwater flooding. If a storm surge occurs at the same time as high tide, the water height will be even greater.

With up to two feet of sea level rise projected by 2050, low-lying areas could become inundated more frequently and with increasingly higher water levels. In addition, storm related flooding may reach father inland and occur more often[13]. Beaches and cliffs could also see increased erosion as they are exposed to more hours of high sea levels and wave action.[14] The NOAA Sea Level Rise Viewer allows for planers to predict the impact of sea level rise over the next several decades. It can be found at https://coast.noaa.gov/digitalcoast/tools/slr.

According to the Sea Level Rise Adaptation Strategy for the San Diego Bay, the sectors most vulnerable to sea level rise are storm water, wastewater, shoreline parks, transportation facilities, commercial buildings, and ecosystems. Low-lying communities, such as Imperial Beach, Coronado, Mission Beach, and parts of La Jolla Shores, Del Mar, and Oceanside may be particularly vulnerable to sea level rise.[15] In addition, some of San Diego's military installations and the region controlled by the Port of San Diego may also be affected.[16] According to the County of San Diego Local Coastal Program Land Use Plan, (dated February 2017), fewer than one percent of the residents of San Diego County reside in areas at risk of inundation from a 55-inch rise in sea level by 2100. Based on that information, sea level rise is considered (on a scale of low, medium, high, very high) a low hazard for the region.

Coastal erosion is the wearing away of coastal land. It is commonly used to describe the horizontal retreat of the shoreline along the ocean, and is considered a function of larger processes of shoreline change, which include erosion and accretion. Erosion results when more sediment is lost along a particular shoreline than is re-deposited by the water body, and is measured as a rate with respect to either a linear retreat or volumetric loss. Erosion rates are not uniform and vary over time at any single location. Various locations along the Coast of San Diego County are highly susceptible to erosion. Erosion prevention and repair measures such as installation of seawalls and reinforcement of cliffs have been required in different locations along the San Diego coast in the past. The risk of coastal erosion in San Diego County is considered medium.

- A tsunami is a series of long waves generated in the ocean by a sudden displacement of a large volume of water. Underwater earthquakes, landslides, volcanic eruptions, meteoric impacts, or onshore slope failures can cause this displacement. Tsunami waves can travel at speeds averaging 450 to 600 miles per hour. As a tsunami nears the coastline, its speed diminishes, its wavelength decreases, and its height increases greatly. After a major earthquake or other tsunami-inducing activity occurs, a tsunami could reach the shore within a few minutes. One coastal community may experience no damaging waves while another may experience very destructive waves. Some low-lying areas could experience severe inland inundation of water and deposition of debris more than 3,000 feet inland. Historically the impact of Tsunamis on the San Diego coastline has been low, but inundation maps developed by the California Office of Emergency Services and the California Geologic Survey show the potential for moderate damage along low-lying areas. The California Geologic Survey has developed Tsunami Inundation maps that can be found at http://www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/Inundation_Maps.

[13] San Diego's Changing Climate: A Regional Wake-Up Call. A Summary of the Focus 2050 Study Presented by The San Diego Foundation
[14] Ibid.
[15] Ibid.
[16] Ibid.

4.3.2.2 Disaster History

There were eleven (11) Proclaimed States of Emergency for Weather/Storms in San Diego County between 1950 and 2017. In January and February 1983, the strongest-ever El Nino-driven coastal storms caused over 116 million dollars in beach and coastal damage. Thirty-three homes were destroyed and 3900 homes and businesses were damaged. Other coastal storms that caused notable damage were during the El Nino winters of 1977-1978 and 1997-1998 and 2003-2004. Other Proclamations occurred in December 2010. July 2015, and February 2017. The City of San Diego proclaimed for winter storms in 2013.

Coastal erosion is an ongoing process that is difficult to measure, but can be seen in various areas along the coastline of San Diego County. Unstable cliffs at Beacon's Beach in Encinitas caused a landslide that killed a woman sitting on the beach in January 2000. In 1942, the Self-Realization Fellowship building fell into the ocean because of erosion and slope failure caused by groundwater oversaturated the cliffs it was built on.

Wave heights and run-up elevations from tsunami along the San Diego Coast have historically fallen within the normal range of the tides (Joy 1968). The largest tsunami effect recorded in San Diego since 1950 was May 22, 1960, which had a maximum wave height 2.1 feet (NOAA, 1993). In this event, 80 meters of dock were destroyed and a barge sunk in Quivera Basin. Other tsunamis felt in San Diego County occurred on November 5, 1952, with a wave height of 2.3 feet and caused by an earthquake in Kamchatka; March 9, 1957, with a wave height of 1.5 feet; May 22, 1960, at 2.1 feet; March 27, 1964 with a wave height of 3.7 feet, September 29, 2009 with a wave height of 0.5 feet, February 2010 with a wave height of 0.6 meters, and in June, 2011 with wave height of 2 feet.. It should be noted that damage does not necessarily occur in direct relationship to wave height, illustrated by the fact that the damages caused by the 2.1-foot wave height in 1960 were worse than damages caused by several other tsunamis with higher wave heights.

4.3.2.3 Location and Extent/Probability of Occurrence and Magnitude

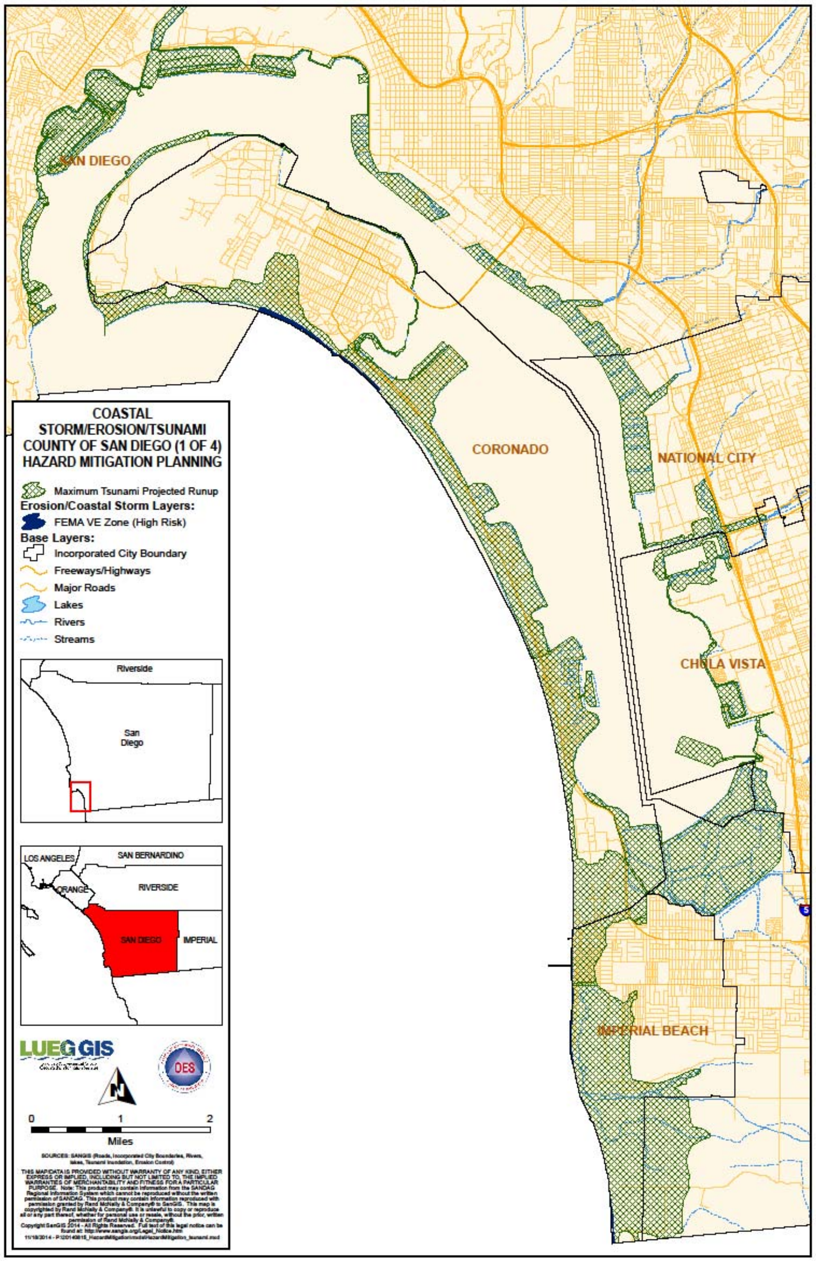
Figure 4.3.1 displays the location and extent of coastal storm/coastal erosion/tsunami hazard areas for the County of San Diego. As shown in this figure, the highest risk zones in San Diego County are located within the coastal zone of San Diego County. Coastal storm hazards are most likely during El Nino events. As shown on Figure 4.3.1, maximum wind speeds along the coast are not expected to exceed 60 miles per hour, resulting in only minor wind-speed related damage. Coastal erosion risk is highest where geologically unstable cliffs become over-saturated by irrigation or rainwater. The greatest type of tsunami risk is material damage to small watercraft, harbors, and some waterfront structures (Joy 1968), with flooding along the coast as shown in the run-up projections on Figure 4.3.1.

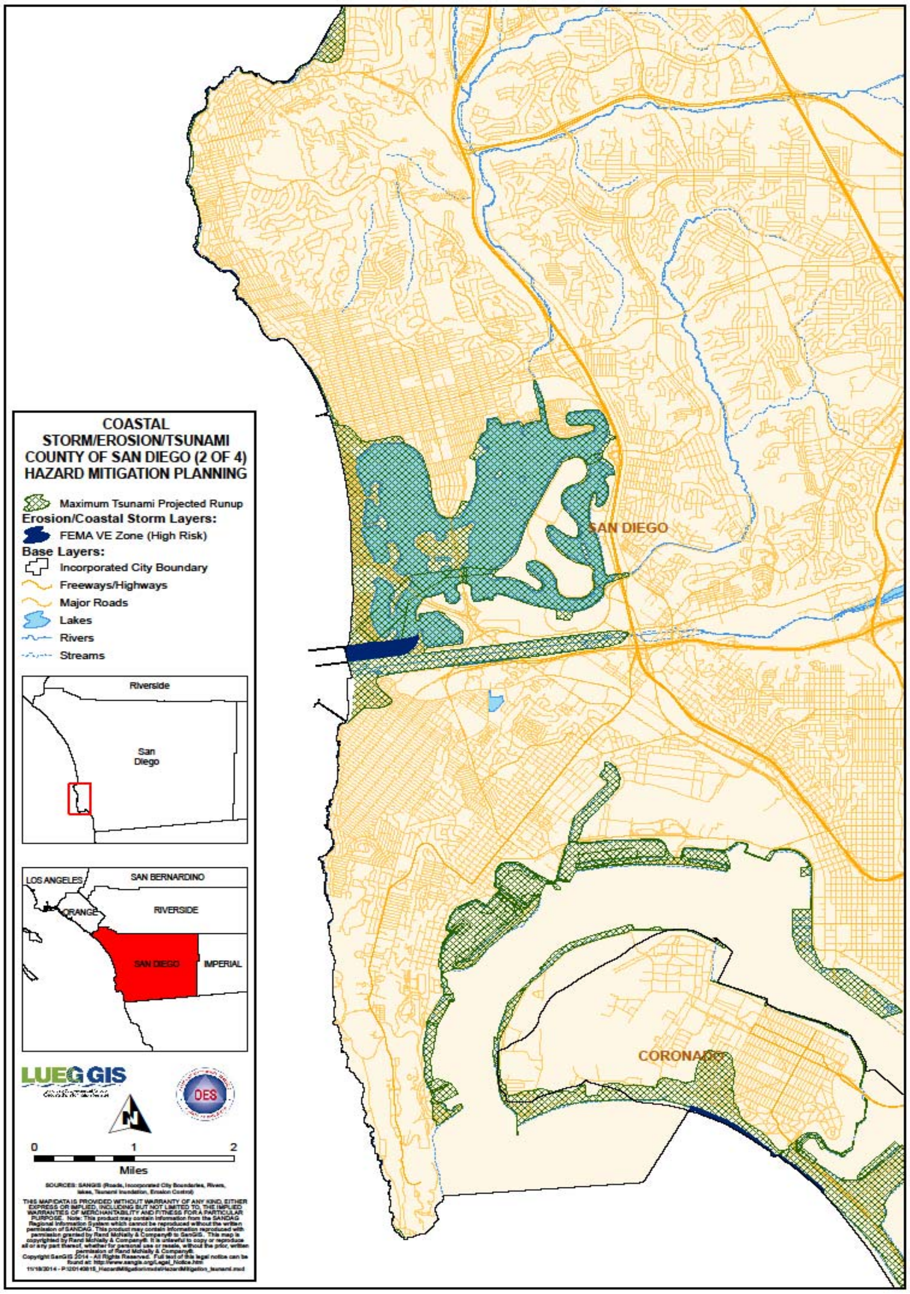
As stated above, the risk of damage from seal level rise is considered somewhat likely with the risk of damage from coastal erosion considered to be likely and from tsunami highly likely.

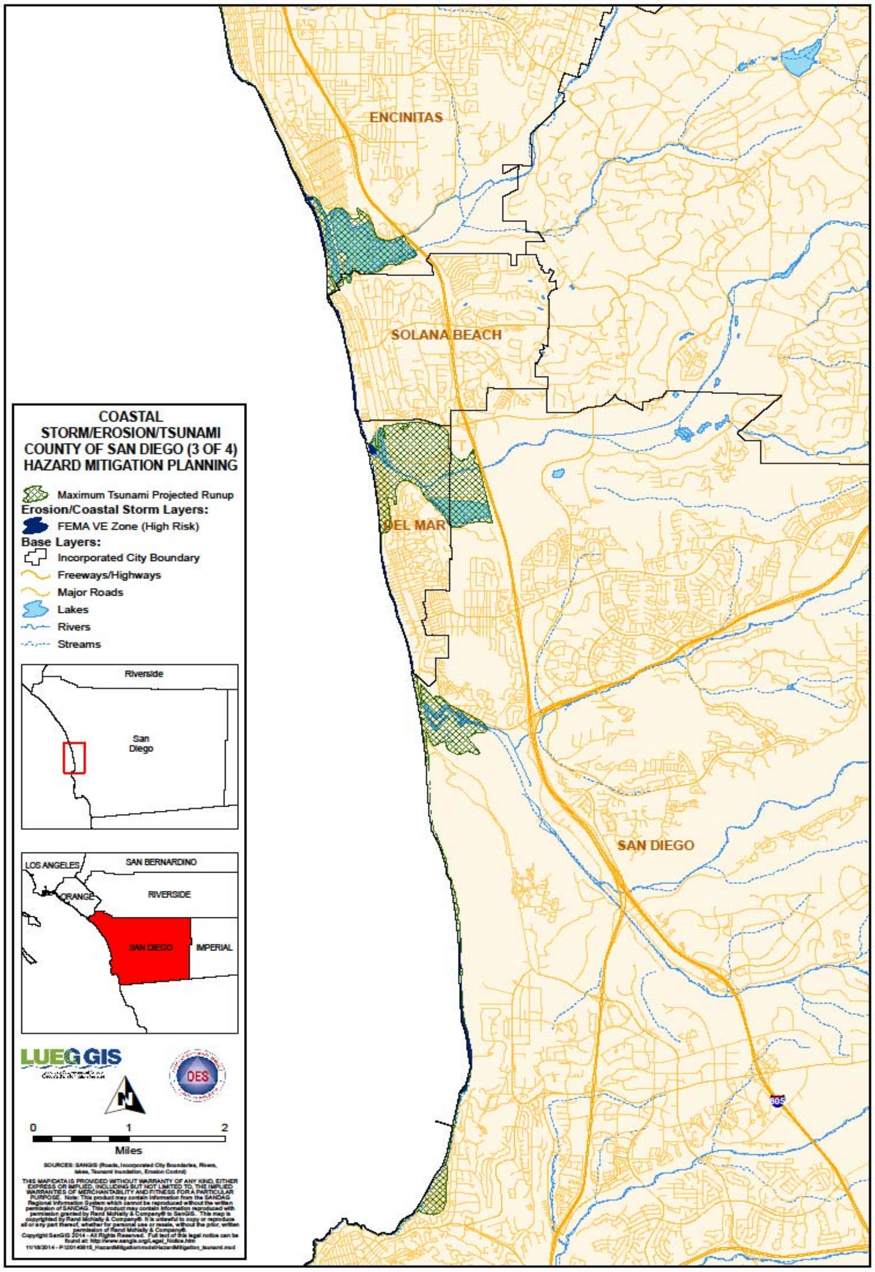
Data used to profile this group of hazards included the digitized flood zones from the FEMA FIRM Flood maps, NOAA historical shoreline data, and Caltrans' coastal zone boundary for the coastal storm/erosion hazard (refer to Appendix B for complete data matrix). Maximum tsunami run up projections modeled by the University of Southern California and distributed by the California Office of Emergency Services were used for identifying tsunami hazard. The tsunami model was the result of a combination of inundation modeling and onsite surveys and shows maximum projected inundation levels from tsunamis along the entire coast of San Diego County. NOAA historical tsunami effects data were also used, which showed locations where tsunami effects have been felt, and when available, details describing size and location of earthquakes that caused the tsunamis. *The Shoreline Erosion Assessment and Atlas of the San Diego Region Volumes I and II* (SANDAG, 1992) were reviewed for the shoreline erosion category. This publication shows erosion risk levels of high, moderate and low for the entire coastline of San Diego County.

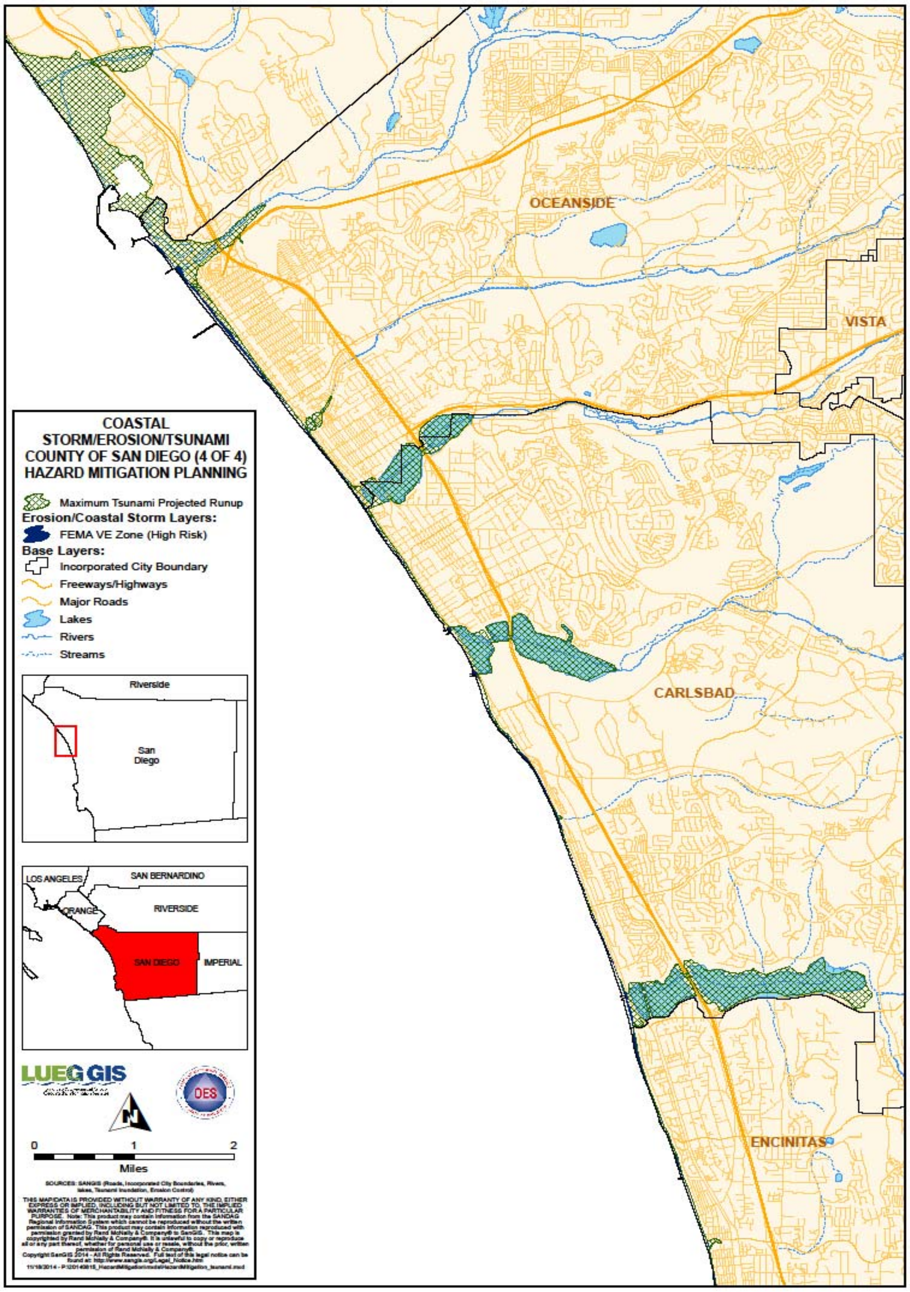
For modeling purposes, the VE Zone of the FEMA FIRM map series was used as the high hazard value for coastal storms and coastal erosion. The VE Zone is defined by FEMA as the coastal area subject to a velocity hazard (wave action). Coastal storm and erosion risk were determined to be high if areas were found within the VE zone of the FEMA FIRM maps. Tsunami hazard risk levels were determined to be high if an area was within the maximum projected tsunami run-up and inundation area.

Figure 4.3.1


COASTAL
STORM/EROSION/TSUNAMI
COUNTY OF SAN DIEGO (1 OF 4)
HAZARD MITIGATION PLANNING
Maximum Tsunami Projected Runup
Erosion/Coastal Storm Layers:
FEMA VE Zone (High Risk)
Base Layers:
Incorporated City Boundary
Freeways/Highways
Major Roads
Lakes
Rivers
Streams
SAN DIEGO
CORONADO
NATIONAL CITY
CHULA VISTA
IMPERIAL BEACH
Riverside
San Diego
LOS ANGELES
SAN BERNARDINO
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
LUEG GIS
DES
0
1
2
Miles


COASTAL
STORM/EROSION/TSUNAMI
COUNTY OF SAN DIEGO (2 OF 4)
HAZARD MITIGATION PLANNING
Maximum Tsunami Projected Runup
Erosion/Coastal Storm Layers:
FEMA VE Zone (High Risk)
Base Layers:
Incorporated City Boundary
Freeways/Highways
Major Roads
Lakes
Rivers
Streams
Riverside
San Diego
LOS ANGELES
SAN BERNARDINO
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
LUEG GIS
OES
0
1
2
Miles
SAN DIEGO
CORONADO


COASTAL
STORM/EROSION/TSUNAMI
COUNTY OF SAN DIEGO (3 OF 4)
HAZARD MITIGATION PLANNING
Maximum Tsunami Projected Runup
Erosion/Coastal Storm Layers:
FEMA VE Zone (High Risk)
Base Layers:
Incorporated City Boundary
Freeways/Highways
Major Roads
Lakes
Rivers
Streams
ENCINITAS
SOLANA BEACH
DEL MAR
SAN DIEGO
Riverside
San Diego
LOS ANGELES
SAN BERNARDINO
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
LUEG GIS
DES
0
1
2
Miles
805


OCEANSIDE
VISTA
CARLSBAD
ENCINITAS
COASTAL
STORM/EROSION/TSUNAMI
COUNTY OF SAN DIEGO (4 OF 4)
HAZARD MITIGATION PLANNING
Maximum Tsunami Projected Runup
Erosion/Coastal Storm Layers:
FEMA VE Zone (High Risk)
Base Layers:
Incorporated City Boundary
Freeways/Highways
Major Roads
Lakes
Rivers
Streams
Riverside
San Diego
LOS ANGELES
SAN BERNARDINO
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
LUEG GIS
OES
0
1
2
Miles

4.3.3 Dam Failure

4.3.3.1 Nature of Hazard

Dam failures can result in severe flood events. When a dam fails, a large quantity of water is suddenly released with a great potential to cause human casualties, economic loss, lifeline disruption, and environmental damage. A dam failure is usually the result of age, poor design, or structural damage caused by a major event such as an earthquake or flood.

4.3.3.2 Disaster History

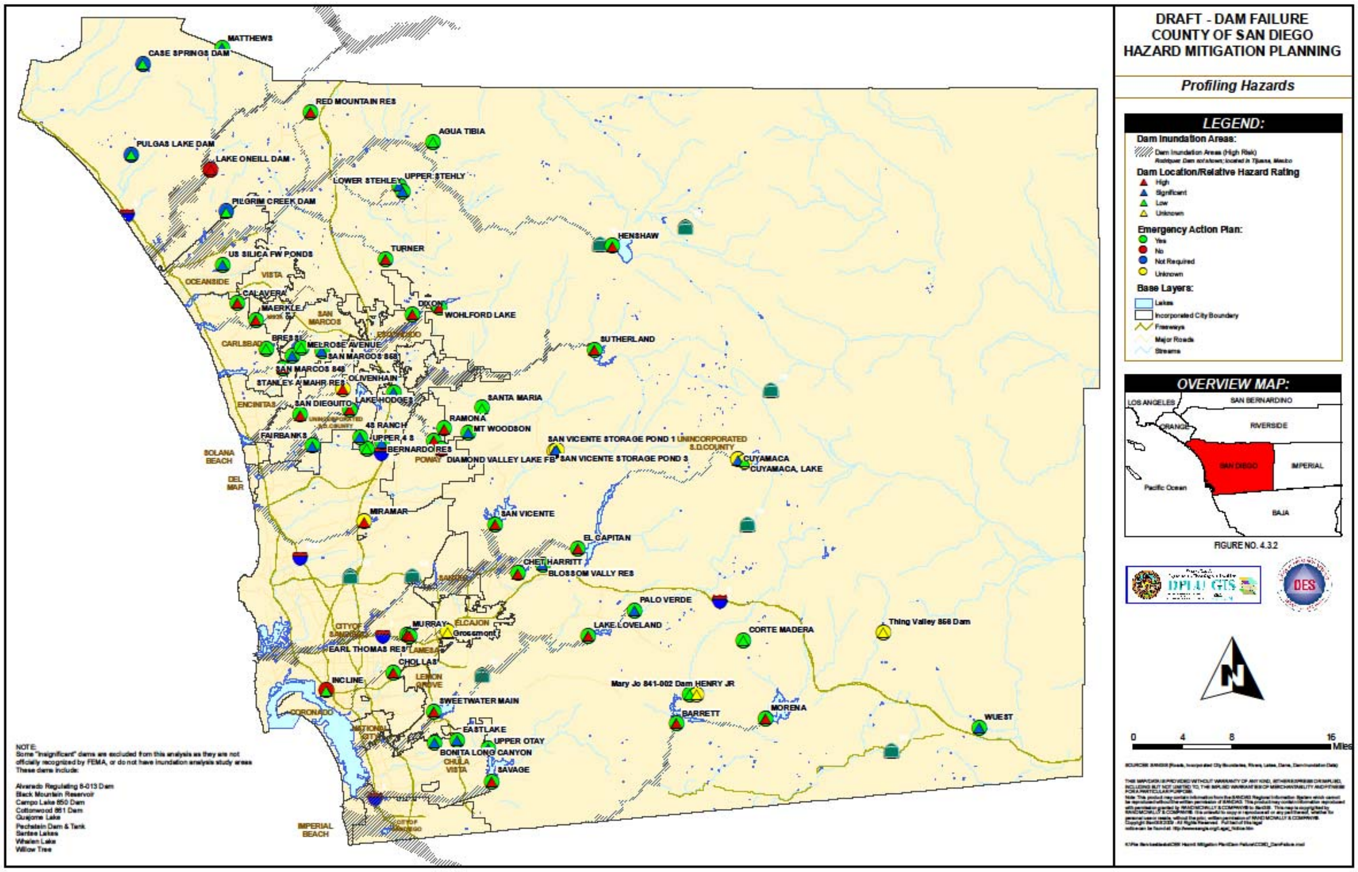
Two major dam failures have been recorded in San Diego County. The Hatfield Flood of 1916 caused the failure of the Sweetwater and Lower Otay Dams, resulting in 22 deaths. Most of those deaths were attributed to the failure of Lower Otay Dam (County of San Diego Sanitation and Flood Control, 2002).

4.3.3.3 Location and Extent/Probability of Occurrence and Magnitude

Figure 4.3.2 displays the location and extent of dam failure hazard areas for the County of San Diego. Dam failures are rated as one of the major "low-probability, high-loss" events.

Dam inundation map data were used to profile dam failure risk levels (refer to Appendix B for complete data matrix). These maps were created by agencies that own and operate dams. OES obtained this data from SanGIS, a local GIS data repository. The dam inundation map layers show areas that would be flooded in the event of a dam failure. If an area lies within a dam inundation zone, it was considered at high risk. A dam is characterized as high hazard if it stores more than 1,000 acre-feet of water, is higher than 150 feet tall, has potential for downstream property damage, and potential for downstream evacuation. Ratings are set by FEMA and confirmed with site visits by engineers. A simple way to define high risk of dam failure is if failure of the dam is likely to result in loss of human life. Most dams in the County are greater than 50 years old and are characterized by increased hazard potential due to downstream development and increased risk due to structural deterioration in inadequate spillway capacity (Unified San Diego County Emergency Services Organization Operational Area Emergency Plan, 2014). The potential for dam failure is considered to be somewhat likely.

Figure 4.3.2


DRAFT - DAM FAILURE
COUNTY OF SAN DIEGO
HAZARD MITIGATION PLANNING
Profiling Hazards
LEGEND:
Dam Inundation Areas:
Dam Inundation Areas (High Risk)
Dam Location/Relative Hazard Rating
High
Significant
Low
Unknown
Emergency Action Plan:
Yes
No
Not Required
Unknown
Base Layers:
Lakes
Incorporated City Boundary
Freeways
Major Roads
Streams
OVERVIEW MAP:
LOS ANGELES
SAN BERNARDINO
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
Pacific Ocean
BAJA
FIGURE NO. 4.3.2
DES
0 4 8 16 Miles
MATTHEWS
CASE SPRINGS DAM
RED MOUNTAIN RES
AGUA TIBIA
PULGAS LAKE DAM
LAKE ONEILL DAM
LOWER STEHLEY
UPPER STEHLY
PILGRIM CREEK DAM
HENSHAW
TURNER
US SILICA FW PONDS
OCEANSIDE
VISTA
CALAVERA
MAERKLE
SAN MARCOS
DIXON
WOHLFORD LAKE
CARLSBAD
BRESSI
MELROSE AVENUE
SAN MARCOS 868
SUTHERLAND
SAN MARCOS 848
OLIVENHAIN
STANLEY A MAHR RES
LAKE HODGES
SANTA MARIA
ENCINITAS
SAN DIEGUITO
RAMONA
4S RANCH
MT WOODSON
FAIRBANKS
UPPER 4 S
SAN VICENTE STORAGE POND 1
UNINCORPORATED S.D.COUNTY
BERNARDO RES
SOLANA BEACH
POWAY
DIAMOND VALLEY LAKE FB
SAN VICENTE STORAGE POND 3
CUYAMACA
CUYAMACA, LAKE
DEL MAR
MIRAMAR
SAN VICENTE
EL CAPITAN
CHET HARRITT
BLOSSOM VALLY RES
PALO VERDE
MURRAY
EL CAJON
Grossmont
LAKE LOVELAND
CORTE MADERA
Thing Valley 858 Dam
EARL THOMAS RES
LA MESA
CHOLLAS
INCLINE
LEMON GROVE
Mary Jo 841-002 Dam
HENRY JR
SWEETWATER MAIN
CORONADO
BARRETT
MORENA
NATIONAL CITY
EASTLAKE
WUEST
UPPER OTAY
BONITA LONG CANYON
CHULA VISTA
SAVAGE
IMPERIAL BEACH
NOTE:
Some "insignificant" dams are excluded from this analysis as they are not officially recognized by FEMA, or do not have inundation analysis study areas
These dams include:
Alvarado Regulating 8-013 Dam
Black Mountain Reservoir
Campo Lake 850 Dam
Cottonwood 861 Dam
Guajome Lake
Pechstein Dam & Tank
Santee Lakes
Whalen Lake
Willow Tree

4.3.4 Earthquake

4.3.4.1 Nature of Hazard

An earthquake is a sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of the Earth's tectonic plates. The effects of an earthquake can be felt far beyond the site of its occurrence. They usually occur without warning and, after just a few seconds, can cause massive damage and extensive casualties. Common effects of earthquakes are ground motion and shaking, surface fault ruptures, and ground failure. Ground motion is the vibration or shaking of the ground during an earthquake. When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter. Soft soils can further amplify ground motions. The severity of these effects is dependent on the amount of energy released from the fault or epicenter. One way to express an earthquake's severity is to compare its acceleration to the normal acceleration due to gravity. The acceleration due to gravity is often called "g". A 100% g earthquake is very severe. More damage tends to occur from earthquakes when ground acceleration is rapid. Peak ground acceleration (PGA) is a measure of the strength of ground movement. PGA measures the rate in change of motion relative to the established rate of acceleration due to gravity (980 cm/sec/sec). PGA is used to project the risk of damage from future earthquakes by showing earthquake ground motions that have a specified probability (10%, 5%, or 2%) of being exceeded in 50 years. These ground motion values are used for reference in construction design for earthquake resistance. The ground motion values can also be used to assess relative hazard between sites, when making economic and safety decisions.

Another tool used to describe earthquake intensity is the Richter scale. The Richter scale was devised as a means of rating earthquake strength and is an indirect measure of seismic energy released. The scale is logarithmic with each one-point increase corresponding to a 10-fold increase in the amplitude of the seismic shock waves generated by the earthquake. In terms of actual energy released, however, each one-point increase on the Richter scale corresponds to about a 32-fold increase in energy released. Therefore, a magnitude (M) 7 earthquake is 100 times (10 X 10) more powerful than a M5 earthquake and releases 1,024 times (32 X 32) the energy. An earthquake generates different types of seismic shock waves that travel outward from the focus or point of rupture on a fault. Seismic waves that travel through the earth's crust are called body waves and are divided into primary (P) and secondary (S) waves. Because P waves move faster (1.7 times) than S waves they arrive at the seismograph first. By measuring the time delay between arrival of the P and S waves and knowing the distance to the epicenter, seismologists can compute the Richter scale magnitude for the earthquake.

The Modified Mercalli Scale (MMI) is another means for rating earthquakes, but one that attempts to quantify intensity of ground shaking. Intensity under this scale is a function of distance from the epicenter (the closer to the epicenter the greater the intensity), ground acceleration, duration of ground shaking, and degree of structural damage. This rates the level of severity of an earthquake by the amount of damage and perceived shaking (Table 4.3-1).

Table 4.3-1
Modified Mercalli Intensity Scale

MMI Value	Description of Shaking Severity	Summary Damage Description Used on 1995 Maps	Full Description
I.			Not felt
II.			Felt by persons at rest, on upper floors, or favorably placed.
III.			Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.
IV.			Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motorcars rock. Windows, dishes, doors rattle. In the upper range of IV, wooden walls and frame creak.
V.	Light	Pictures Move	Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clock stop, start, change rate.
VI.	Moderate	Objects Fall	Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked.
VII.	Strong	Nonstructural Damage	Difficult to stand. Noticed by drivers of motorcars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roofline. Fall of plaster, loose bricks, stones, tiles, cornices. Some cracks in masonry C. Small slides and caving in along sand or gravel banks. Concrete irrigation ditches damaged.
VIII.	Very Strong	Moderate Damage	Steering of motorcars affected. Damage to masonry C, partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, and elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Cracks in wet ground and on steep slopes.
IX.	Very Violent	Extreme Damage	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land.
X.			Rails bent greatly. Underground pipelines completely out of services.
XI.			Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into air.

Several major active faults exist in San Diego County, including the Rose Canyon, La Nacion, Elsinore, San Jacinto, Coronado Bank and San Clemente Fault Zones. The Rose Canyon Fault Zone is part of the Newport-Inglewood fault zone, which originates to the north in Los Angeles, and the Vallecitos and San Miguel Fault Systems to the south in Baja California (see Figure 4.3.3). The Rose Canyon Fault extends inland from La Jolla Cove, south through Rose Canyon, along the east side of Mission Bay, and out into San Diego Bay. The Rose Canyon Fault is considered to be the greatest potential threat to San Diego as a region, due to its proximity to areas of high population. The La Nacion Fault Zone is located near National City and Chula Vista. The Elsinore Fault Zone is a branch of the San Andreas Fault System. It originates near downtown Los Angeles, and enters San Diego County through the communities of Rainbow and Pala; it then travels in a southeasterly direction through Lake Henshaw, Santa Ysabel, Julian; then down into Anza-Borrego Desert State Park at Agua Caliente Springs, ending at Ocotillo, approximately 40 miles east of downtown. The San Jacinto Fault is also a branch of the San Andreas Fault System. This fault branches off from the major fault as it passes through the San Bernardino Mountains. Traveling southeasterly, the fault passes through Clark Valley, Borrego Springs, Ocotillo Wells, and then east toward El Centro in Imperial County. This fault is the most active large fault within County of San Diego. The Coronado Bank fault is located about 10 miles offshore. The San Clemente Fault lies about 40 miles off La Jolla and is the largest offshore fault at 110 miles or more in length (Unified San Diego County Emergency Services Organization Operational Area Emergency Plan, 2014).

4.3.4.2 Disaster History

Historic documents record that a very strong earthquake struck San Diego on May 27, 1862, damaging buildings in Old Town and opening up cracks in the earth near the San Diego River mouth. This destructive earthquake was centered on either the Rose Canyon or Coronado Bank faults and descriptions of damage suggest that it had a magnitude of about 6.0 (M6). The strongest recently recorded earthquake in San Diego County was a M5.3 earthquake that occurred on July 13, 1986 on the Coronado Bank Fault, 25 miles west of Solana Beach. In recent years there have been several moderate earthquakes recorded within the Rose Canyon Fault Zone as it passes beneath the City of San Diego. Three temblors shook the city on 17 June 1985 (M3.9, 4.0, 3.9) and a stronger quake occurred on 28 October 1986 (M4.7) (Demere, SDNHM website 2003). The most recent significant earthquake activity occurred on June 15, 2004 with a M5.3 on the San Diego Trough Fault Zone approximately 50 miles SW of San Diego. It was reported as an IV on the MMI (Southern California Seismic Network).

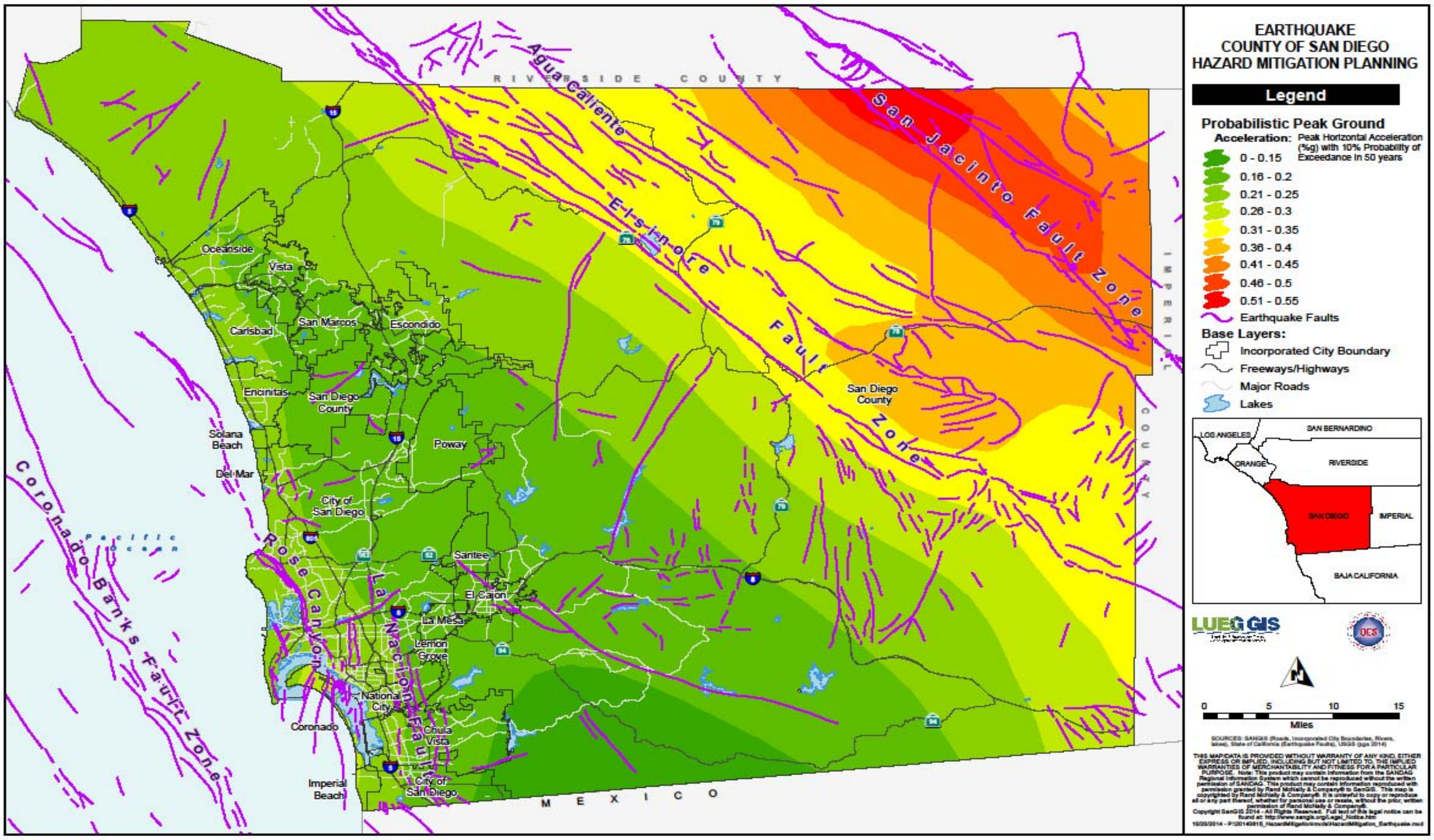
4.3.4.3 Location and Extent/Probability of Occurrence and Magnitude

Figure 4.3.3 displays the location and extent of the profiled earthquake hazard areas for San Diego County. This is based on a USGS earthquake model that shows probabilistic peak ground acceleration for every location in San Diego County. Since 1984, earthquake activity in San Diego County has increased twofold over the preceding 50 years (Demere, SDNHM website 2003). All buildings that have been built in recent decades must adhere to building codes that require them to be able to withstand earthquake magnitudes that create a PGA of 0.4 or greater. Ongoing field and laboratory studies suggest the following maximum likely magnitudes for local faults: San Jacinto (M6.4 to 7.3), Elsinore (M6.5 to 7.3), Rose Canyon (M6.2 to 7.0), La Nacion (M6.2 to 6.6), Coronado Bank (M6.0 to 7.7), and San Clemente (M6.6 to 7.7) (Demere, SDNHM website 2003).

Data used to profile earthquake hazard included probabilistic PGA data from the United States Geological Survey (USGS) and a Scenario Earthquake Shake map for Rose Canyon from the California Integrated Seismic Network (CISN) (refer to Attachment A for complete data matrix). From these data, the HMWG determined that risk level for earthquake is determined to be high if an area lies within a 0.3 or greater PGA designation. Earthquakes were modeled using HAZUS-MH, which uses base information to derive probabilistic peak ground accelerations much like the PGA map from USGS that was used for the profiling process.

The potential for an earthquake in the San Diego region is considered somewhat likely.

Figure 4.3.3


EARTHQUAKE
COUNTY OF SAN DIEGO
HAZARD MITIGATION PLANNING
Legend
Probabilistic Peak Ground Acceleration: Peak Horizontal Acceleration (%g) with 10% Probability of Exceedance in 50 years
0 - 0.15
0.16 - 0.2
0.21 - 0.25
0.26 - 0.3
0.31 - 0.35
0.36 - 0.4
0.41 - 0.45
0.46 - 0.5
0.51 - 0.55
Earthquake Faults
Base Layers:
Incorporated City Boundary
Freeways/Highways
Major Roads
Lakes
RIVERSIDE COUNTY
IMPERIAL COUNTY
MEXICO
Pacific Ocean
San Jacinto Fault Zone
Elsinore Fault Zone
Agua Caliente
Coronado Banks Fault Zone
Rose Canyon
La Nacion Fault
Oceanside
Vista
Carlsbad
San Marcos
Escondido
Encinitas
San Diego County
Solana Beach
Del Mar
Poway
City of San Diego
Santee
El Cajon
La Mesa
Lemon Grove
National City
Chula Vista
Coronado
Imperial Beach
LOS ANGELES
SAN BERNARDINO
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
BAJA CALIFORNIA
LUEG GIS
Miles
0 5 10 15

4.3.5 Flood

4.3.5.1 Nature of Hazard

A flood occurs when excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto a river's bank or to adjacent floodplains. Floodplains are lowlands adjacent to rivers, lakes, and oceans that are subject to recurring floods. Most injury and death from flood occurs when people are swept away by flood currents, and property damage typically occurs as a result of inundation by sediment-filled water. Average annual precipitation in San Diego County ranges from 10 inches on the coast to approximately 45 inches on the highest point of the Peninsular Mountain Range that transects the county, and 3 inches in the desert east of the mountains.

Several factors determine the severity of floods, including rainfall intensity and duration. A large amount of rainfall over a short time span can result in flash flood conditions. A sudden thunderstorm or heavy rain, dam failure, or sudden spills can cause flash flooding. The National Weather Service's definition of a flash flood is a flood occurring in a watershed where the time of travel of the peak of flow from one end of the watershed to the other is less than six hours. There are no watersheds in San Diego County that have a longer response time than six hours. In this county, flash floods range from the stereotypical wall of water to a gradually rising stream. The central and eastern portions of San Diego County are most susceptible to flash floods where mountain canyons, dry creek beds, and high deserts are the prevailing terrain.

4.3.5.2 Disaster History

From 1770 until 1952, 29 floods were recorded in San Diego County. Between 1950 and 1997, flooding prompted 10 Proclaimed States of Emergency in the County of San Diego. Several very large floods have caused significant damage in the County of San Diego in the past. The Hatfield Flood of 1916 destroyed the Sweetwater and Lower Otay Dams, and caused 22 deaths and $4.5 million in damages. The flood of 1927 caused $117,000 in damages, and washed out the Old Town railroad bridge (Bainbridge, 1997). The floods of 1937 and 1938 caused approximately $600,000 in damages. (County of San Diego Sanitation and Flood Control, 1996). In the 1980 floods, the San Diego River at Mission Valley peaked at 27,000 cubic feet per second (cfs) and caused $120 million in damage (Bainbridge, 1997).

Table 4.3-2 displays a history of flooding in San Diego County, as well as loss associated with each flood event.

Date	Loss Estimation	Source of Estimate	Comments
1862	Not available	County of San Diego Sanitation and Flood Control	6 weeks of rain
1891	Not available	County of San Diego Sanitation and Flood Control	33 inches in 60 hours
1916	$4.5 million	County of San Diego Sanitation and Flood Control	Destroyed 2 dams, 22 deaths
1927	$117,000	County of San Diego Sanitation and Flood Control	Washed out railroad bridge Old Town
1937 & 1938	$600,000	County of San Diego Sanitation and Flood Control	N/A
1965	Not available	San Diego Union	6 killed
1969	Not available	San Diego Union	All of State declared disaster area
1979	$2,766,268	County OES	Cities of La Mesa, Lemon Grove, National City, San Marcos, San Diego and unincorporated areas
1980	$120 million	County of San Diego Sanitation and Flood Control; Earth Times	San Diego river topped out in Mission Valley
Oct-87	$640,500	State OES	N/A
1995	$Tens of Millions	County OES	San Diego County Declared Disaster Area
2003	Not Available	County OES	Storm floods areas impacted by the 2003 firestorm.
Sept 2004	Not Available	San Diego Union-Tribune	Series of storms caused localized flooding
Oct 2004	Not Available	San Diego Union-Tribune	Flash-flood in Borrego Springs
Jan-Mar 2005	Not Available	Cal EMA (formerly State OES)	San Diego County Declared Disaster Area
Jan 2017	$14.5 million (estimated)	County OES	San Diego County Declared Disaster Area

Table 4.3-2
Historical Records of Large Floods in San Diego County

4.3.5.3 Location and Extent/Probability of Occurrence and Magnitude

In regions such as San Diego, without extended periods of below-freezing temperatures, floods usually occur during the season of highest precipitations or during heavy rainfalls after long dry spells. The areas surrounding the river valleys in all of San Diego County are susceptible to flooding because of the wide, flat floodplains surrounding the riverbeds, and the numerous structures that are built in the floodplains. One unusual characteristic of San Diego's hydrology is that it has a high level of variability in its runoff. The western watershed of the County of San Diego extends about 80 miles north from the Mexican border and approximately 45 miles east of the Pacific Ocean. From west to east, there are about 10 miles of rolling, broken coastal plain, 10 to 15 miles of foothill ranges with elevations of 600 to 1,700 feet; and approximately 20 miles of mountain country where elevations range from 3,000 to 6,000 feet. This western watershed constitutes about 75% of the County, with the remaining 25% mainly desert country. There are over 3,600 miles of rivers and streams which threaten residents and over 200,000 acres of flood-prone property. Seven principle streams originate or traverse through the unincorporated area. From north to south they are the Santa Margarita, San Luis Rey, San Dieguito, San Diego, Sweetwater, Otay, and Tijuana Rivers (Unified San Diego County Emergency Services Organization Operational Area Emergency Plan, 2006).

FEMA FIRM data was used to determine hazard risk for floods in the County of San Diego. FEMA defines flood risk primarily by a 100-year flood zone, which is applied to those areas with a 1% chance, on average, of flooding in any given year. Any area that lies within the FEMA-designated 100-year floodplain is designated as high risk. Any area found in the 500-year floodplain is designated at low risk. Base flood elevations (BFE) were also used in the HAZUS-MH modeling process. A BFE is the elevation of the water surface resulting from a flood that has a 1% chance of occurring in any given year (i.e. the height of the base flood).

Figure 4.3.4 displays the location and extent of flood hazard areas for the County of San Diego. As shown in this figure, high hazard (100-year floodway) zones in San Diego County are generally concentrated within the coastal areas, including bays, coastal inlets and estuaries. Major watershed areas connecting the local mountain range to the coastal region, where flash floods are more common, show several 100-year flood hazard areas.

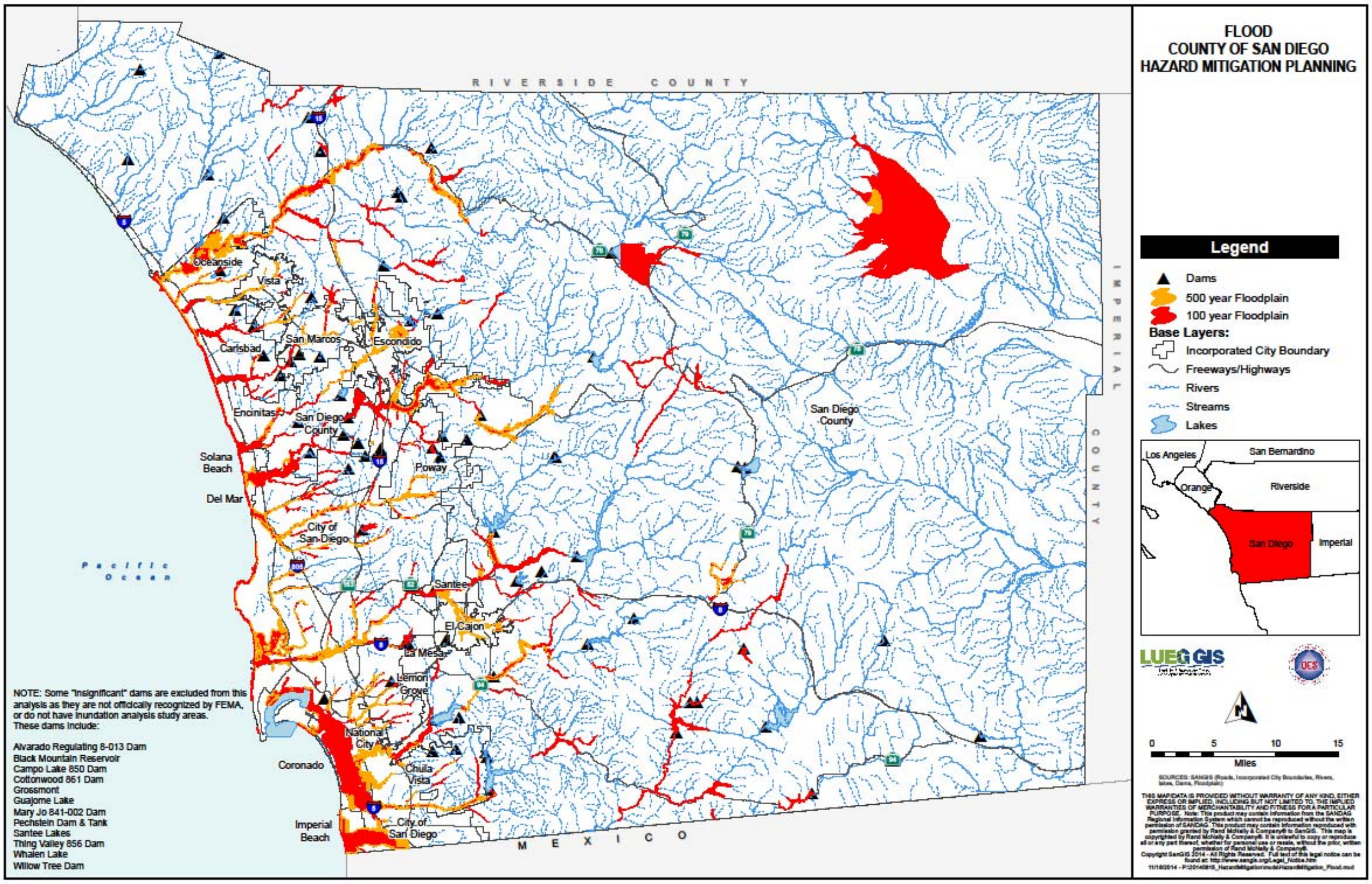
Based on FEMA Records the San Diego region has not suffered severe repetitive loss (residential properties that have at least four NFIP payments over $5,000 each with the cumulative claim exceeding $20,000 or at least two separate claims payments with the cumulative amount exceeding the market value of the building) since 1974. There have been numerous repetitive losses (losses of at least $1,000 each). These losses are provided in the table below:

Table 4.3-3
Repetitive Loss Due to Floods in San Diego County

Jurisdiction	Number of Repetitive Losses	Jurisdiction	Number of Repetitive Losses	Jurisdiction	Number of Repetitive Losses
Carlsbad	1	Chula Vista	2	Coronado	0
Del Mar	13	El Cajon	4	Encinitas	2
Escondido	2	Imperial Beach	4	La Mesa	2
Lemon Grove	0	National City	2	Oceanside	15
Poway	7	San Diego	35	San Marcos	1
Santee	1	Solana Beach	6	Vista	2
County of San Diego	14				

Based on the historical record, the likelihood of flooding in the San Diego region is highly likely.

Figure 4.3.4


FLOOD
COUNTY OF SAN DIEGO
HAZARD MITIGATION PLANNING
RIVERSIDE COUNTY
IMPERIAL COUNTY
MEXICO
Pacific Ocean
Oceanside
Vista
Carlsbad
San Marcos
Escondido
Encinitas
San Diego County
Solana Beach
Del Mar
Poway
City of San Diego
Santee
El Cajon
La Mesa
Lemon Grove
National City
Chula Vista
Coronado
Imperial Beach
City of San Diego
San Diego County
NOTE: Some "insignificant" dams are excluded from this analysis as they are not officically recognized by FEMA, or do not have inundation analysis study areas.
These dams include:
Alvarado Regulating 8-013 Dam
Black Mountain Reservoir
Campo Lake 850 Dam
Cottonwood 861 Dam
Grossmont
Guajome Lake
Mary Jo 841-002 Dam
Pechstein Dam & Tank
Santee Lakes
Thing Valley 856 Dam
Whalen Lake
Willow Tree Dam
Legend
Dams
500 year Floodplain
100 year Floodplain
Base Layers:
Incorporated City Boundary
Freeways/Highways
Rivers
Streams
Lakes
Los Angeles
San Bernardino
Orange
Riverside
San Diego
Imperial
LUEG GIS
OES
0
5
10
15
Miles

4.3.6 Rain-Induced Landslide

4.3.6.1 Nature of Hazard

Landslides occur when masses of rock, earth, or debris move down a slope, including rock falls, deep failure of slopes, and shallow debris flows. Landslides are influenced by human activity (mining and construction of buildings, railroads, and highways) and natural factors (geology, precipitation, and topography). Frequently they accompany other natural hazards such as floods, earthquakes, and volcanic eruptions. Although landslides sometimes occur during earthquake activity, earthquakes are rarely their primary cause. The most common cause of a landslide is an increase in the down slope gravitational stress applied to slope materials (oversteepening). This may be produced either by natural processes or by man's activities. Undercutting of a valley wall by stream erosion or of a sea cliff by wave erosion are ways in which slopes may be naturally oversteeped. Other ways include excessive rainfall or irrigation on a cliff or slope. Another type of soil failure is slope wash, the erosion of slopes by surface-water runoff. The intensity of slope wash is dependent on the discharge and velocity of surface runoff and on the resistance of surface materials to erosion. Surface runoff and velocity is greatly increased in urban and suburban areas due to the presence of roads, parking lots, and buildings, which have zero filtration capacities and provide generally smooth surfaces that do not slow down runoff.

Mudflows are another type of soil failure, and are defined as flows or rivers of liquid mud down a hillside. They occur when water accumulates under the ground, usually following long and heavy rainfalls. If there is no brush, tree, or ground cover to hold the soil, mud will form and flow down-slope.

4.3.6.2 Disaster History

Landslides and landslide prone sedimentary formations are present throughout the coastal plain of western San Diego County. Landslides also occur in the granitic mountains of East San Diego County, although they are less prevalent. Ancient landslides are those with subdued topographic expressions that suggest movements at least several hundred and possibly several thousands of years before present. Many of these landslides are thought to have occurred under much wetter climatic conditions than at present. Recent landslides are those with fresh or sharp geomorphic expressions suggestive of active (ongoing) movement or movement within the past several decades. Reactivations of existing landslides can be triggered by disturbances such as heavy rainfall, seismic shaking and/or grading. Many recent landslides are thought to be reactivations of ancient landslides.

Areas where significant landslides have occurred are: the Otay Mesa area, Oceanside, Mt. Soledad in La Jolla, Sorrento Valley, in the vicinity of Rancho Bernardo and Rancho Penasquitos, along the sides of Mission Gorge (San Carlos and Tierrasanta), western Santee, the Fletcher Hills area of western El Cajon, western Camp Pendleton, and the east side of Point Loma. Some of the more significant historical coastal bluff landslides have occurred along north La Jolla (Black's Beach), Torrey Pines, Del Mar, and Encinitas. Landslides tend to be more widespread in these areas where the underlying sedimentary formations contain weak claystone beds that are more susceptible to sliding.

Remedial grading and other mitigation measures have stabilized many but not all landslides in urban areas and other developments within San Diego County. Published geologic maps and other sources of information pertaining to landslide occurrence may not differentiate between known or suspected landslides. Moreover, published landslide maps (such as those used to compile the landslide areas for this effort) are not always updated or revised to reflect landslides that have been stabilized, or in some cases completely removed. The landslide maps for this study have been compiled for planning and emergency responses preparedness, and the compilation sources may not reflect current or existing conditions.

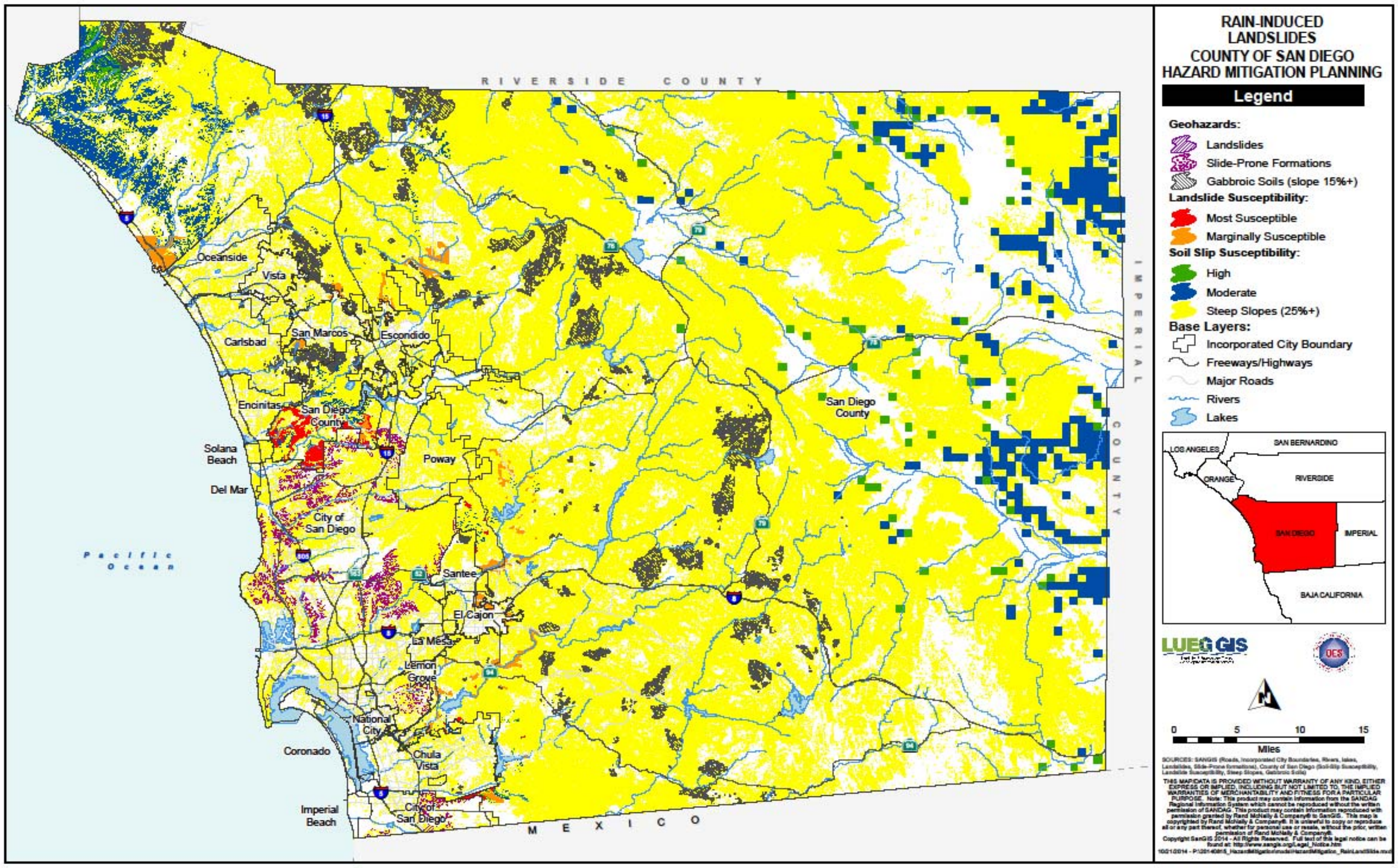
4.3.6.3 Location and Extent/Probability of Occurrence and Magnitude

Data used to determine landslide risk were steep slope (greater than 25%), soil series data (SANDAG, based on USGS 1970s series), and soil-slip susceptibility from USGS. Because landslide data in GIS format was not available for the entire county, a model was run using USGS soils and steep slope data to determine landslide risk areas for the entire County. Tan Landslide Susceptibility Maps that depict steep slope areas, landslide formations, and landslide susceptible areas based on a combination of slope, soils and geologic instability were also used in the analysis.

As shown in Figure 4.3.5, the location and extent of landslide hazard areas are generally concentrated along canyons near the coastal areas with steep slopes. The western portion of the county shows the soil-slip susceptibility data, while the eastern portion of the county shows the results of the model used to determine landslide risk for areas that were not included in the soil-slip susceptibility model. Housing development on marginal lands and in unstable but highly desirable coastal areas has increased the threat from landslides throughout San Diego County.

Based on historical occurrences the potential for a rain-induced landslide is considered likely.

Figure 4.3.5


RAIN-INDUCED LANDSLIDES
COUNTY OF SAN DIEGO
HAZARD MITIGATION PLANNING
Legend
Geohazards:
Landslides
Slide-Prone Formations
Gabbroic Soils (slope 15%+)
Landslide Susceptibility:
Most Susceptible
Marginally Susceptible
Soil Slip Susceptibility:
High
Moderate
Steep Slopes (25%+)
Base Layers:
Incorporated City Boundary
Freeways/Highways
Major Roads
Rivers
Lakes
RIVERSIDE COUNTY
IMPERIAL COUNTY
MEXICO
Pacific Ocean
Oceanside
Vista
Carlsbad
San Marcos
Escondido
Encinitas
San Diego County
Solana Beach
Del Mar
Poway
City of San Diego
Santee
El Cajon
La Mesa
Lemon Grove
National City
Coronado
Chula Vista
Imperial Beach
City of San Diego
San Diego County
LOS ANGELES
SAN BERNARDINO
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
BAJA CALIFORNIA
LUEG GIS
0 5 10 15
Miles

4.3.7 Liquefaction

4.3.7.1 Nature of Hazard

Liquefaction is the phenomenon that occurs when ground shaking causes loose soils to lose strength and act like viscous fluid. Liquefaction causes two types of ground failure: lateral spread and loss of bearing strength. Lateral spreads develop on gentle slopes and entails the sidelong movement of large masses of soil as an underlying layer liquefies. Loss of bearing strength results when the soil supporting structures liquefies and causes structures to collapse.

4.3.7.2 Disaster History

Liquefaction is not known to have occurred historically in San Diego County, although liquefaction has occurred in the Imperial Valley in response to large earthquakes (Magnitude 6 or greater) originating in that area. Although San Diego is one of several major California cities in seismically active regions, ground failures or damage to structures has not occurred as a consequence of liquefaction. Historically, seismic shaking levels have not been sufficient to trigger liquefaction. Paleoseismic indicators of liquefaction have been recognized locally, and several pre-instrumental (prior to common use of seismographs) earthquakes could have been severe enough to cause at least some liquefaction.

4.3.7.3 Location and Extent/Probability of Occurrence and Magnitude

Recognizing active faults in the region, and the presence of geologically young, unconsolidated sediments and hydraulic fills, the potential for liquefaction to occur has been long recognized in the San Diego area. The regions of San Diego Bay and vicinity are thought to be especially vulnerable. The potential exists in areas of loose soils and/or shallow groundwater in earthquake fault zones throughout the County. Figure 4.3.6 displays the location and extent of areas with a risk of liquefaction.

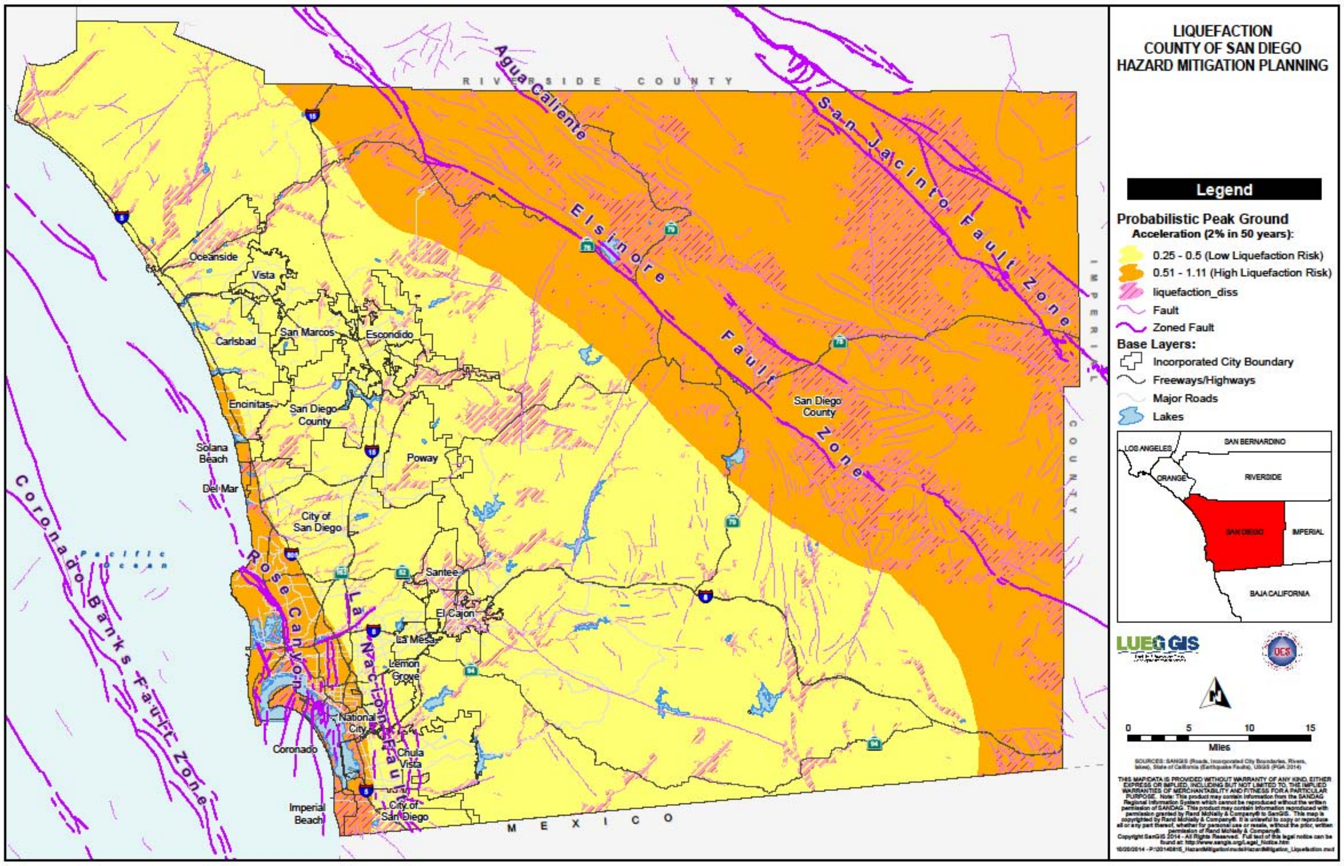
Data used to profile liquefaction hazard included probabilistic PGA data from the United States Geological Survey (USGS) and a Scenario Earthquake Shake map for Rose Canyon from the California Integrated Seismic Network (CISN), along with existing liquefaction hazard areas from local maps (refer to Attachment A for complete data matrix). Liquefaction hazards were modeled as collateral damages of earthquakes using HAZUS-MH, which uses base information and NEHRP soils data to derive probabilistic peak ground accelerations much like the PGA map from USGS. Soils were considered because liquefaction risk may be amplified depending on the type of soil found in a given area. The National Earthquake Hazards Reduction Program (NEHRP) rates soils from hard to soft, and give the soils ratings from Type A through Type E, with the hardest soils being Type A, and the softest soils rated at Type E. Liquefaction risk was considered high if there were soft soils (Types D or E) present within an active fault zone. Liquefaction risk was considered low if the PGA risk value was less than 0.3, and hard soils were present (Types A-C). For example, an area may lie in a PGA zone of 0.2, which would be a low liquefaction risk in hard soils identified by the NEHRP. However, if that same PGA value is found within a soft soil such as Type D or E, a PGA of 0.2, when multiplied by 1.4 or 1.7 (amplification values for type D and E soil, shown below), would become a PGA value of at least 0.28 to 0.3. This would increase the liquefaction risk to high. Areas where soil types D or E are located are illustrated in Figure 4.3.6.

The potential for liquefaction in San Diego is considered somewhat likely.

Soil Amplification Factors

	Soil Type				
PGA	A	B	C	D	E
0.1	0.80	1.00	1.20	1.60	2.50
0.2	0.80	1.00	1.20	1.40	1.70
0.3	0.80	1.00	1.10	1.20	1.20
0.4	0.80	1.00	1.00	1.10	0.90
0.5	0.80	1.00	1.00	1.00	0.80

Figure 4.3.6


LIQUEFACTION
COUNTY OF SAN DIEGO
HAZARD MITIGATION PLANNING
Legend
Probabilistic Peak Ground Acceleration (2% in 50 years):
0.25 - 0.5 (Low Liquefaction Risk)
0.51 - 1.11 (High Liquefaction Risk)
liquefaction_diss
Fault
Zoned Fault
Base Layers:
Incorporated City Boundary
Freeways/Highways
Major Roads
Lakes
RIVERSIDE COUNTY
IMPERIAL COUNTY
MEXICO
Agua Caliente
San Jacinto Fault Zone
Elsinore Fault Zone
Coronado Banks Fault Zone
Rose Canyon
La Nacion Fault
Pacific Ocean
Oceanside
Vista
Carlsbad
San Marcos
Escondido
Encinitas
San Diego County
Solana Beach
Del Mar
Poway
City of San Diego
Santee
El Cajon
La Mesa
Lemon Grove
National City
Coronado
Chula Vista
Imperial Beach
City of San Diego
San Diego County
LOS ANGELES
SAN BERNARDINO
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
BAJA CALIFORNIA
0 5 10 15
Miles

4.3.8 Structure/Wildfire Fire

4.3.8.1 Nature of Hazard

A structural fire hazard is one where there is a risk of a fire starting in an urban setting and spreading uncontrollably from one building to another across several city blocks, or within hi-rise buildings.

A wildfire is an uncontrolled fire spreading through vegetative fuels and exposing or possibly consuming structures. They often begin unnoticed and spread quickly. Naturally occurring and non-native species of grasses, brush, and trees fuel wildfires. A wildland fire is a wildfire in an area in which development is essentially nonexistent, except for roads, railroads, power lines and similar facilities. An Urban-Wildland/Urban Interface fire is a wildfire in a geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels. Significant development in San Diego County is located along canyon ridges at the wildland/urban interface. Areas that have experienced prolonged droughts or are excessively dry are at risk of wildfires.

People start more than 80 percent of wildfires, usually as debris burns, arson, or carelessness. Lightning strikes are the next leading cause of wildfires. Wildfire behavior is based on three primary factors: fuel, topography, and weather. The type, and amount of fuel, as well as its burning qualities and level of moisture affect wildfire potential and behavior. The continuity of fuels, expressed in both horizontal and vertical components is also a determinant of wildfire potential and behavior. Topography is important because it affects the movement of air (and thus the fire) over the ground surface. The slope and shape of terrain can change the speed at which the fire travels, and the ability of firefighters to reach and extinguish the fire. Weather affects the probability of wildfire and has a significant effect on its behavior. Temperature, humidity and wind (both short and long term) affect the severity and duration of wildfires.

San Diego County's topography consists of a semi-arid coastal plain and rolling highlands which, when fueled by shrub overgrowth, occasional Santa Ana winds and high temperatures, creates an ever-present threat of wildland fire. Extreme weather conditions such as high temperature, low humidity, and/or winds of extraordinary force may cause an ordinary fire to expand into one of massive proportions.

Large fires would have several indirect effects beyond those that a smaller, more localized fire would create. These may include air quality and health issues, road closures, business closures, and others that increase the potential losses that can occur from this hazard. Modeling for a larger type of fire would be difficult, but the consequences of the three largest San Diego fires this century (October, 203, October 2007 and May 2014) should be used as a guide for fire planning and mitigation.

4.3.8.2 Disaster History

Table 4.3-3 lists the most recent major wildfires in San Diego County. Wildland fires prompted five (5) Proclaimed States of Emergency, and Urban/Intermix Fires prompted four (4) Proclaimed States of Emergency in the County of San Diego between 950-2014. In October of 2003 the second-worse wild-land fire in the history of San Diego County destroyed 332,766 acres of land, 3,239 structures and 17 deaths at a cost of $450M. San Diego County's worst wildfire occurred in October 2007. At the height of the firestorm there were seven fires burning within the County. The fires destroyed 369,000 acres (13% of the County), 2,670 structures, 239 vehicles, and two commercial properties. There were 10 civilian deaths, 23 civilian injuries and 10 firefighter injuries. The cost of fire exceeded $1.5 billion. San Diego County's third worst wildfire in history, known as the Laguna Fire, destroyed thousands of acres in the backcountry in September of 1970. The fire resulted in the loss or destruction of 383 homes and 1,200 other structures

($5.7 million); 225,000 acres of trees and other watershed ($30 million); small dams ($3 million); and bridges and roads ($600,000). The total dollar cost of the Laguna Fire was approximately $40 million. The Bernardo, Poinsettia and Cocos Fires of May, 2014 burned 26,000 acres, destroyed 65 homes and damaged 19 others.

Table 4.3-3
Major Wildfires in San Diego County
Larger than 5,000 acres

Fire	Date	Acres Burned	Structures Destroyed	Structures Damaged	Deaths
Conejos Fire	July 1950	62,000	Not Available	Not Available	0
Laguna Fire	October 1970	190,000	382	Not Available	5
Harmony Fire (Carlsbad, Elfin Forest, San Marcos)	October 1996	8,600	122	142	1
La Jolla Fire (Palomar Mtn)	September 1999	7,800	2	2	1
Viejas Fire	January 2001	10,353	23	6	0
Gavilan Fire (Fallbrook)	February 2002	6,000	43	13	0
Pines Fire (Julian, Ranchita)	July 2002	61,690	45	121	0
Cedar Fire	October 2003	280,278	5,171	63	14
Paradise Fire	October 2003	57,000	415	15	2
Otay Fire	October 2003	46,291	6	0	0
Roblar (Pendleton)	October 2003	8,592	0	0	0
Mataguay Fire*	July 2004	8,867	2	0	0
Horse Fire*	July 2006	16,681	Not Available	Not Available	0
Witch Creek Fire*	October 2007	197,990	1,125	77	2
Harris Fire*	October 2007	90,440	255	12	5
Poomacha Fire*	October 2007	49,410	139	Not Available	0
Ammo Fire*	October 2007	21,004	Not Available	Not Available	0
Rice Fire*	October 2007	9,472	208	Not Available	0
Bernardo, Poinsettia & Cocos Fires	May 2014	26,000	65	19	0

* Information gathered from the California Department of Forestry and Fire Protection website

4.3.8.3 Location and Extent/Probability of Occurrence and Magnitude

The wildfire risk maps use the most recent USGS Fire Regime data. Data for Regimes II and IV were utilized to develop the risk tables for the participating jurisdictions. Additional wildland fire hazard maps are available at http://www.fire.ca.gov/fire_prevention/fhsz_maps_sandiego. Perimeter maps for the three most significant wildfire events of the past 15 years, the 2003 and 2007 Firestorms and the 2014 North County wildfires, are below.

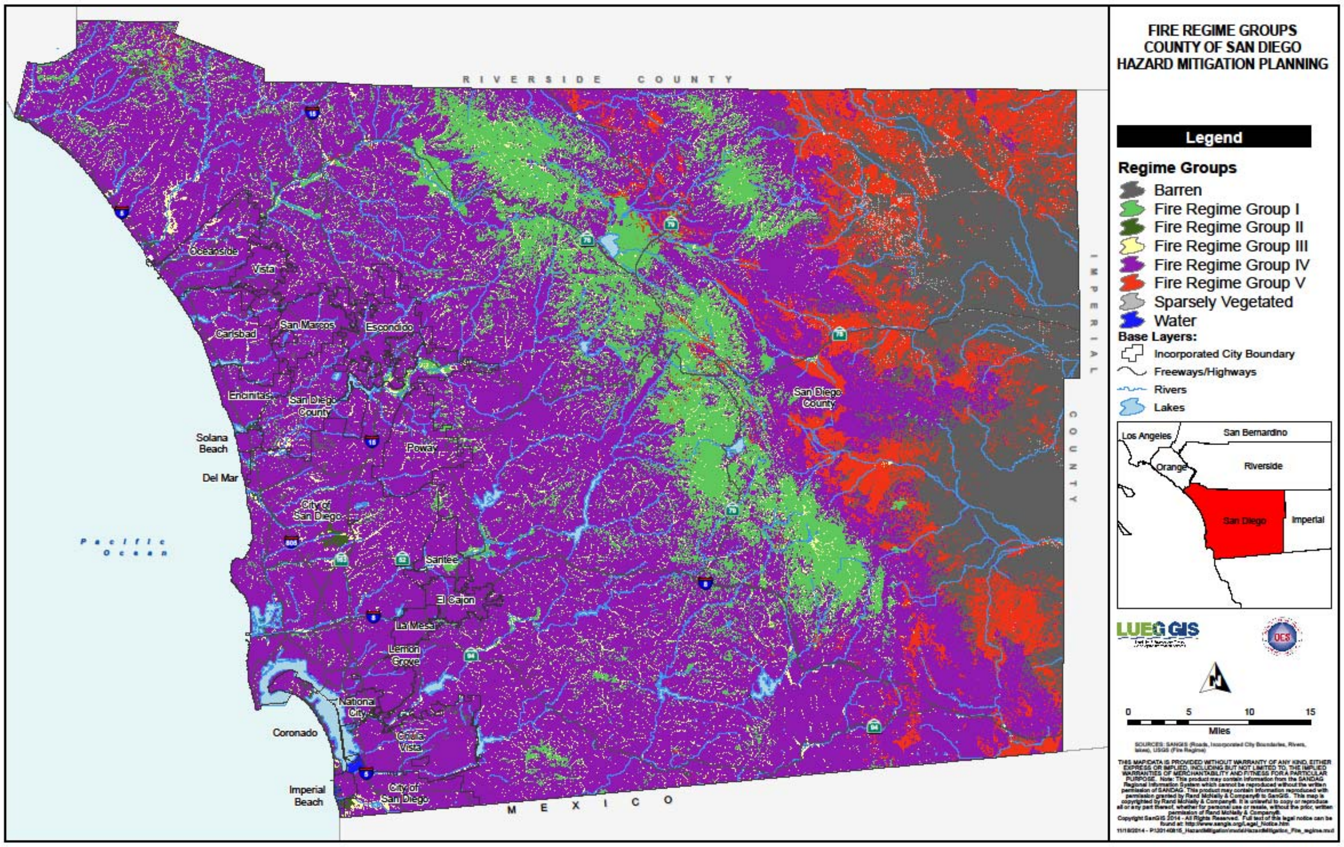
Under current climate conditions, the wildfire threat to property, lives, and ecosystems in the San Diego region is very high. With hotter temperatures and possibly fewer rainy days in the coming decades, vegetation could become drier. As a result, it is likely that San Diego region will see an increase in the frequency and intensity of fires, making the region more vulnerable to devastating fires like the ones seen in 2003 and 2007.[17] The fire season could also become longer and less predictable, making firefighting efforts more costly.[18] Using the scale described in Section 4.2.3 the potential for a wildfire in the San Diego region is considered highly likely.

Building density is also a factor in potential building loss during a wildfire. A recent study in the Ecological Society of America's publication *Ecological Applications*[19] indicates that the area of the building clusters, the number of buildings in the cluster and building dispersion all contribute to the potential for building loss. While all three factors had a positive influence on the number of structures lost, larger building structures were most strongly associated with building loss. The likeliest reason being that more buildings are exposed. Two other top factors were the number of buildings in the cluster and the distance to the nearest building. In the mediterranean California model the closer the buildings were to each other the less likely they were to be affected.

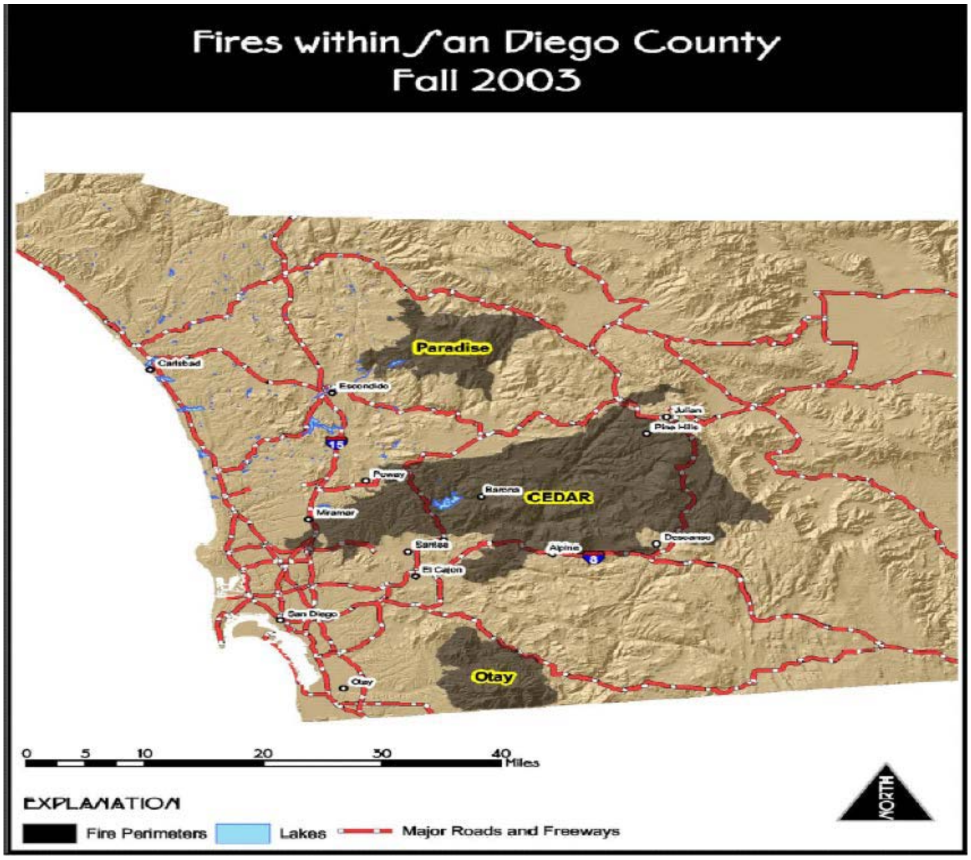
An increase in wildfire also impacts public health. Fire-related injuries and death are likely to increase as wildfires occur more frequently.[20] Wildfires can also be a significant contributor to air pollution. Wildfire smoke contains numerous toxic and hazardous pollutants that are dangerous to breath and can worsen lung disease and other respiratory conditions.[21]

[17] San Diego's Changing Climate: A Regional Wake-Up Call. A Summary of the Focus 2050 Study Presented by The San Diego Foundation.
[18] Ibid.
[19] Alexander, Patricia M., et. al. (2016). Factors related to Building Loss Due to Wildfires in the Conterminous United States. *Ecological Applications, 0(0),* 1-16.
[20] Ibid.
[21] Ibid.

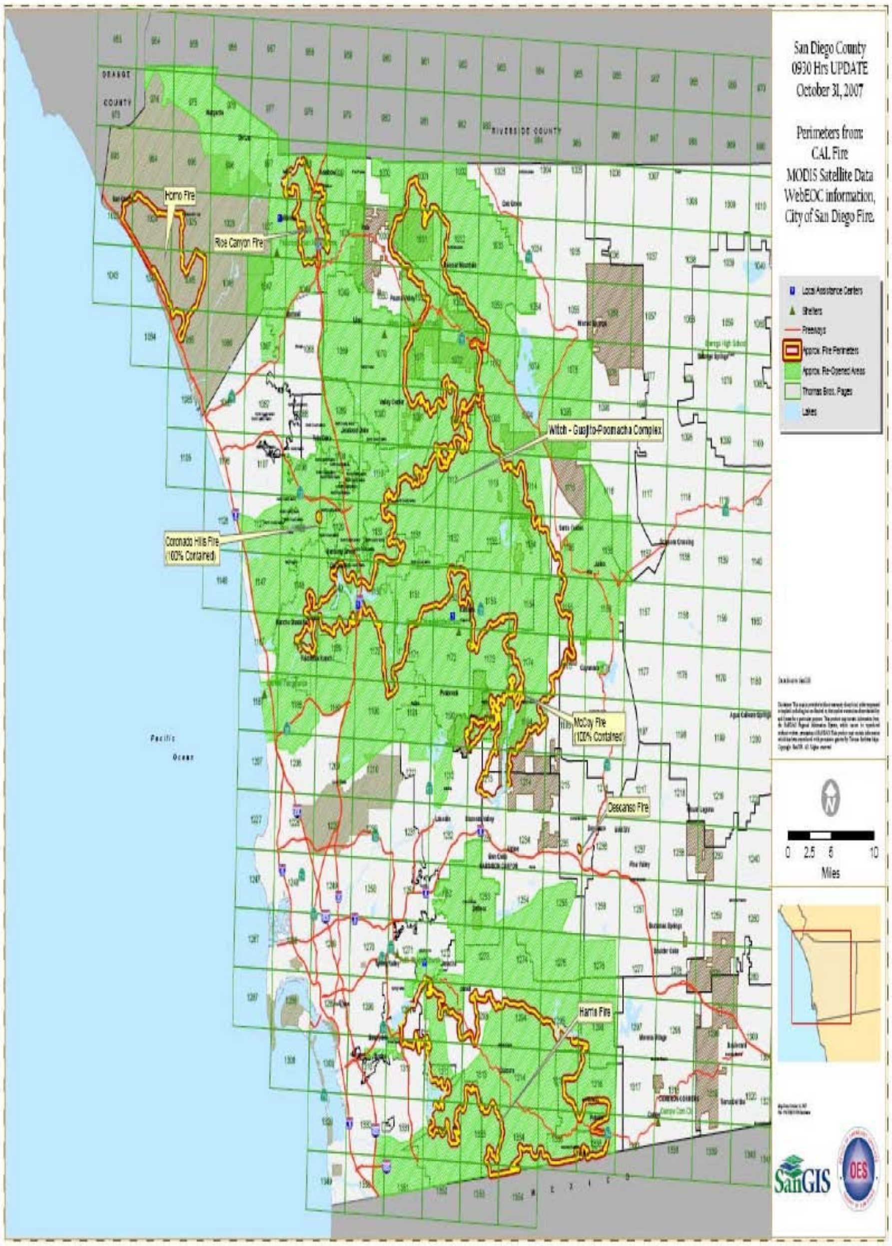
Figure 4.3.7

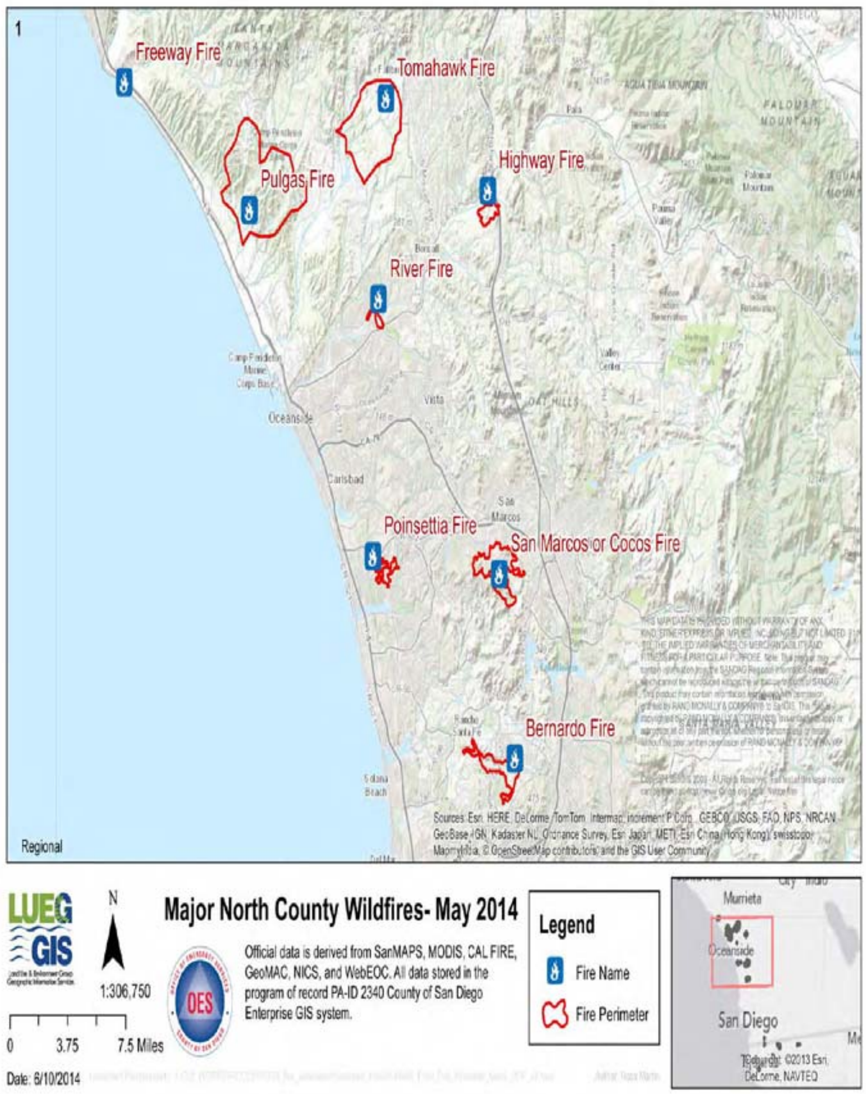

FIRE REGIME GROUPS
COUNTY OF SAN DIEGO
HAZARD MITIGATION PLANNING
Legend
Regime Groups
Barren
Fire Regime Group I
Fire Regime Group II
Fire Regime Group III
Fire Regime Group IV
Fire Regime Group V
Sparsely Vegetated
Water
Base Layers:
Incorporated City Boundary
Freeways/Highways
Rivers
Lakes
RIVERSIDE COUNTY
IMPERIAL COUNTY
MEXICO
Pacific Ocean
Oceanside
Vista
Carlsbad
San Marcos
Escondido
Encinitas
San Diego County
Solana Beach
Del Mar
Poway
City of San Diego
Santee
El Cajon
La Mesa
Lemon Grove
National City
Coronado
Chula Vista
Imperial Beach
City of San Diego
San Diego County
Los Angeles
San Bernardino
Orange
Riverside
San Diego
Imperial
LUEG GIS
0
5
10
15
Miles

2003 Wildfire Perimeter Map



October 31, 2007 Wildfire Perimeter Map





2014 North County Wildfires Perimeter Map

4.3.9 Extreme Heat

4.3.9.1 Nature of the Hazard

Although extreme heat does not cause structural damage like floods, fires, and earthquakes, heat waves claim many lives due to heat exhaustion and heat stroke. According to a California Energy Commission Study, from 1994 to 2009, heat waves have claimed more lives in California than all declared disaster events combined.[22] Despite this history, not a single heat emergency was formally proclaimed at the state level or as a federal disaster between 1960 and 2008. The author of an account of a heat wave which killed 739 people in Chicago in July 1995 suggests that the hidden nature of social vulnerability combined with the inconspicuous nature of heat events (unlike floods, fires, and earthquakes) prevent them from being declared as legitimate disasters.[23] However, the California State Hazard Mitigation Plan considers extreme heat a legitimate disaster type.[24]

Extreme heat is exacerbated by the "urban heat island effect", whereby impervious surfaces, such as concrete and asphalt, absorb heat and result in greater warming in urban areas compared to rural areas. Urban heat islands exacerbate the public health impacts that heat waves have upon the more vulnerable populations.[25] San Diego County has among the highest percentages of impervious surfaces in the states, increasing the potential impacts of heat islands.[26] In fact, Southern California's urban centers are warming more rapidly than other parts of the state.[27]

Extreme heat events put vulnerable populations, such as the elderly, children, chronically ill, and people who work outside at risk of heat-related illnesses and even death. Extreme heat events highlight the importance of thoughtful social vulnerability analysis.[28] For example, socially isolated elderly persons are especially vulnerable. People who live in urban areas with high impervious surface coverage and no access to air conditioning are also especially vulnerable. In California, San Diego County ranks second, behind Los Angeles, in absolute numbers of the elderly and children less than five years of age. These two populations are most likely to suffer from heat-related illnesses and heat events.[29]

Extreme heat also has secondary impacts, such as power outages and poor air quality. Heat events, and the increased use of air conditioning, can lead to power outages, which makes the events even more

[22] Messner, Steven, Sandra C. Miranda, Karen Green, Charles Phillips, Joseph Dudley, Dan Cayan, Emily Young. Climate Change Related Impacts in the San Diego Region by 2050. PIER Research Report, CEC-500-2009-027-D, Sacramento, CA: California Energy Commission. 2009.
[23] Klinenberg, Eric. *Heat Wave: A Social Autopsy of Disaster in Chicago*, The University of Chicago, 2002
[24] Governor's Office of Emergency Services (2013) California Multi-Hazard Mitigation Plan
[25] Ibid.
[26] English et al. (2007). Executive Summary, Heat-Related Illness and Mortality Information for the Public Health Network in California
[27] Ibid.
[28] Governor's Office of Emergency Services (2013) California Multi-Hazard Mitigation Plan
[29] English et al. (2007). Executive Summary, Heat-Related Illness and Mortality Information for the Public Health Network in California

dangerous.[30] Hotter temperatures may also lead to poorer air quality because ozone formation, a component of smog, increases with higher temperatures.[31]

4.3.9.2 Disaster History

Following the events of 2006 when there was a prolonged period of extreme heat across the state of California, San Diego County developed an Excess Heat Preparedness and Response Plan.[32]

According to the Spatial Hazard Events and Losses Database for the United States (SHELDUS) there have been four extreme heat events in San Diego in the past 18 years resulting in 4 heat related fatalities and 28 heat related injuries.

4.3.9.3 Location and Extent/Probability of Occurrence and Magnitude

San Diego is facing an increase in the frequency, duration, and strength of heat waves in the coming decades. While greater warming is expected in inland areas, residents of coastal areas are vulnerable when the temperature spikes, because they are less accustomed to the heat and they are less likely to have air conditioning. Research also indicates that heat waves are likely to become more humid in the future and with nighttime temperatures staying high, further stressing public health.[33] Extreme warm temperatures in the San Diego region mostly occur in July and August, but as climate warming takes hold, the occurrences of these events will likely begin in June and could continue to take place into September.[34]

The potential for extreme heat event is considered highly likely.

[30] Ibid.

31 USGCRP (2009). *Global Climate Change Impacts in the United States* . Karl, T.R., J.M. Melillo, and T.C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA.

[32] Messner, Steven, Sandra C. Miranda, Karen Green, Charles Phillips, Joseph Dudley, Dan Cayan, Emily Young. Climate Change Related Impacts in the San Diego Region by 2050. PIER Research Report, CEC-500-2009-027-D, Sacramento, CA: California Energy Commission. 2009.

[33] Gershunov, A., and K. Guirguis (2012), California heat waves in the present and future, Geophysical Research Letters., 39, L18710

[34] Messner, Steven, Sandra C. Miranda, Karen Green, Charles Phillips, Joseph Dudley, Dan Cayan, Emily Young. Climate Change Related Impacts in the San Diego Region by 2050. PIER Research Report, CEC-500-2009-027-D, Sacramento, CA: California Energy Commission. 2009.

4.3.10 Drought/Water Supply

4.3.10.1 Location and Extent/Probability of Occurrence and Magnitude

Climate Change and Drought/Water Supply

Warming temperatures statewide could result in reduced water supply for the San Diego region. The State Water Project and Colorado River provide 75% to 95% of the water supply for the San Diego region, depending on the year.[35] Both of these water supplies originate in mountain snowpack. Over the past 50 years across most of the Southwest, there has been less late-winter precipitation falling as snow, earlier snowmelt, and earlier arrival of most of the year's streamflow.[36] Projections of further warming will result in reduced snowpack, which could translate into reduced water supply for the San Diego region's cities, agriculture, and ecosystems.[37] In fact, studies indicate that San Diego's sources of water could shrink by 20 percent or more by 2050.[38] An additional threat to water supply is the vulnerability of the levees protecting the California Delta, which feeds the State Water Project.[39] According to the California Adaptation Planning Guide, jurisdictions in the San Diego region must carefully consider the vulnerability of their water supply.[40]

At the same time that the San Diego region's water supply is likely to decrease, water demand is expected to increase approximately 29% by 2050 due to economic growth and population pressures.[41] Local water managers also report that higher temperatures could lead to increased demand for water for irrigation. Water shortages could become more frequent and more severe in the future, straining the local economy. The potential for drought in San Diego is highly likely.

Off-setting this slightly is the desalinization plant in Carlsbad. The plant, designed to produce 50 million gallons per day, is estimated to provide 8% of the regions water resources by 2020.

A U.S. Drought Monitor, using the Palmer Drought Severity Index, can be found at http://droughtmonitor.unl.edu/

4.3.10.2 History of Drought in San Diego

The depression ear drought of 1929-1934 was the worst drought in California's history. Its impact was felt statewide. At that time San Diego was self-sufficient relying on local water supplies. The region would not begin to import water until 1947.

The drought of 1987-1992 was extremely severe and resulted in the Metropolitan Water District ordered a 50% reduction in water use. The San Diego County Water Authority actually considered banning outdoor water use. The rains of "Miracle March" in 1991 replenished rivers, reservoirs and the Sierra snowpack.

[35] Ibid.
[36] Garfin, G., G. Franco, H. Blanco, A. Comrie, P. Gonzalez, T. Piechota, R. Smyth, and R. Waskom, 2014: Ch. 20: Southwest. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 462-486. doi:10.7930/J08G8HMN.
[37] California Adaptation Planning Guide, Understanding Regional Characteristics (2012)
[38] San Diego's Changing Climate: A Regional Wake-Up Call. A Summary of the Focus 2050 Study Presented by The San Diego Foundation.
[39] California Adaptation Planning Guide, Understanding Regional Characteristics (2012)
[40] Ibid.
[41] San Diego's Changing Climate: A Regional Wake-Up Call. A Summary of the Focus 2050 Study Presented by The San Diego Foundation

Another drought occurred in 2007 and lasted until 2011. The latest drought that began in 2012 just ended in 2017 following a series of winter storms that brought heavy rainfall to the state.

4.3.11 Manmade Hazards

4.3.11.1 Nature of Hazard

Manmade hazards are distinct from natural hazards in that they result directly from the actions of people. Two types of manmade hazards can be identified: technological hazards and terrorism. Technological hazards refer to incidents that can arise from human activities such as the manufacture, storage, transport, and use of hazardous materials, which include toxic chemicals, radioactive materials, and infectious substances. Technological hazards are assumed to be accidental and their consequences unintended. Terrorism, on the other hand, encompasses intentional, criminal, and malicious acts involving weapons of mass destruction (WMDs) or conventional weapons. WMDs can involve the deployment of biological, chemical, nuclear, and radiological weapons. Conventional weapons and techniques include the use of arson, incendiary explosives, armed attacks, intentional hazardous materials release, and cyber-terrorism (attack via computer).

Hazardous Materials

Technological hazards involving hazardous material releases can occur at facilities (fixed site) or along transportation routes (off-site). They can occur as a result of human carelessness, technological failure, intentional acts, and natural hazards. When caused by natural hazards, these incidents are known as secondary hazards, whereas intentional acts are terrorism. Hazardous materials releases, depending on the substance involved and type of release, can directly cause injuries and death and contaminate air, water, and soils. While the probability of a major release at any particular facility or at any point along a known transportation corridor is relatively low, the consequences of releases of these materials can be very serious.

Some hazardous materials present a radiation risk. Radiation is any form of energy propagated as rays, waves or energetic particles that travel through the air or a material medium. Radioactive materials are composed of atoms that are unstable. An unstable atom gives off its excess energy until it becomes stable. The energy emitted is radiation. The process by which an atom changes from an unstable state to a more stable state by emitting radiation is called radioactive decay or radioactivity.

Radiological materials have many uses in San Diego County including:

- by doctors to detect and treat serious diseases,
- by educational institutions and companies for research,
- by the military to power large ships and submarines.

With the shutdown of SONGS, radiological materials are no longer used to generate commercial electric power within San Diego County. However, the stored spent fuel that remains on site does pose a hazard.

Radioactive materials, if handled improperly, or radiation accidentally released into the environment, can be dangerous because of the harmful effects of certain types of radiation on the body. The longer a person is exposed to radiation and the closer the person is to the radiation, the greater the risk. Although radiation cannot be detected by the senses (sight, smell, etc.), it is easily detected by scientists with sophisticated instruments that can detect even the smallest levels of radiation. Under extreme circumstances an accident or intentional explosion involving radiological materials can cause very serious problems. Consequences may include death, severe health risks to the public, damage to the environment, and extraordinary loss of, or damage to, property.

Terrorism

Following a number of serious international and domestic terrorist incidents during the 1990's and early 2000's, citizens across the United States have paid increased attention to the potential for deliberate, harmful terrorist actions by individuals or groups with political, social, cultural, and religious motives. There is no single, universally accepted definition of terrorism, and it can be interpreted in a variety of ways. However, terrorism is defined in the Code of Federal Regulations as "…the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives" (28 CFR, Section 0.85). The Federal Bureau of Investigation (FBI) further characterizes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. However, the origin of the terrorist or person causing the hazard is far less relevant to mitigation planning than the hazard itself and its consequences. Terrorists utilize a wide variety of agents and delivery systems.

4.3.11.2 Disaster History

Hazardous Material Releases

Hazardous materials can include toxic chemicals, radioactive materials, infectious substances, and hazardous wastes. The State of California defines a hazardous material as a substance that is toxic, ignitable or flammable, or reactive and/or corrosive. An extremely hazardous material is defined as a substance that shows high acute or chronic toxicity, carcinogenicity, bio-accumulative properties, persistence in the environment, or is water reactive (California Code of Regulations, Title 22). "Hazardous waste," a subset of hazardous materials, is material that is to be abandoned, discarded, or recycled, and includes chemical, radioactive, and biohazardous waste (including medical waste). An accidental hazardous material release can occur wherever hazardous materials are manufactured, stored, transported, or used. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas.

Numerous facilities in San Diego County generate hazardous wastes in addition to storing and using large numbers of hazardous materials. There are a total of 12,747 sites with permits to store and maintain chemical, biological and radiological agents, and explosives in the County. Although the scale is usually small, emergencies involving the release of these substances can occur daily at both these fixed sites and on the County's streets and roadways. The major transit corridors of Interstates 5 and 805 have been the locations of the majority of incidents the Hazardous Incident Response Team (HIRT) has responded to in recent years.

Facilities that use, manufacture, or store hazardous materials in California must comply with several state and federal regulations. The Superfund Amendments and Reauthorization Act (SARA Title III), which was enacted in 1986 as a legislative response to airborne releases of methylisocyanate at Union Carbide plants in Bhopal, India and in Institute, West Virginia. SARA Title III, also known as the Emergency Planning and Community-Right-To-Know Act (EPCRA), directs businesses that handle, store or manufacture hazardous materials in specified amounts to develop emergency response plans and report releases of toxic chemicals. Additionally, Section 312 of Title III requires businesses to submit an annual inventory report of hazardous materials to a state-administering agency. The California legislature passed Assembly Bill 2185 in 1987, incorporating the provisions of SARA Title III into a state program. The community right-to-know requirements keep communities abreast of the presence and release of hazardous wastes at individual facilities.

Table 4.3-4 shows a breakdown by jurisdiction of facilities in the County with permits to store and maintain chemical, biological and radiological agents, and explosives. Facilities with EPA ID Numbers are facilities that generate hazardous waste.

Table 4.3-4
Licensed Hazardous Material Sites by Jurisdiction

Jurisdiction	Facilities with County Environmental Health Hazardous Material Permits	Sites with Toxic/Radiologic Hazardous Materials or Large and Complex Sites	Sites with Flammable hazardous Materials
Carlsbad	409	4	0
Chula Vista	805	5	0
Coronado	77	0	0
Del Mar	47	0	0
El Cajon	679	2	0
Encinitas	290	0	0
Escondido	790	7	0
Imperial Beach	36	0	0
La Mesa	305	1	0
Lemon Grove	111	0	0
National City	369	2	0
Oceanside	523	2	0
Poway	311	0	0
San Diego	5,458	15	2
San Marcos	431	2	0
Santee	227	1	0
Solana Beach	63	0	0
Unincorporated	1,192	9	0
Vista	522	1	0
USMCB Camp Pendleton	102	0	0
TOTAL	**12,747**	**55**	**2**

Hazardous materials spills and releases in San Diego County have occurred as a result of clandestine drug manufacturing; spills from commercial, military and recreational vessels on the region's waterways; traffic accidents; sewer breaks and overflows; and various accidents/incidents related to the manufacture, use, and storage of hazardous materials by County industrial, commercial and government facilities. Although the following emergency response history for San Diego County chronicles various hazardous materials releases, the incidents do not necessarily indicate the degree of exposure to the public.

There were 504 responses to a hazardous materials release within San Diego County in 2014. Table 4.3-5 lists the numbers buy jurisdiction.

Table 4.3-5
County of San Diego Environmental Health Department
Hazardous Materials Division HIRT Responses in 2014

City	Number of Hazardous Materials Releases
Carlsbad	18
Chula Vista	28
Coronado	1
Del Mar	2
El Cajon	26
Encinitas	9
Escondido	22
Imperial Beach	7
La Mesa	8
Lemon Grove	5
National City	15
Oceanside	16
Poway	8
San Diego	220
San Marcos	7
Santee	12
Solana Beach	0
Unincorporated	86
Vista	14
TOTAL RESPONSES IN 2014	**504**

There has not been significant exposure to the public in San Diego County due to manmade releases of chemical or biological agents, although there have been several smaller-scale incidents. Chemical spills and releases from transportation and industrial accidents have resulted in short-term chemical exposure to individuals in the vicinity of the release. San Diego beaches are routinely closed because of sewage spills and storm run-off. Bacterial levels can increase significantly in ocean and bay waters, especially near storm drain, river, and lagoon outlets, during and after rainstorms. Elevated bacterial levels may continue for a period of up to 3 days depending upon the intensity of rainfall and volume of runoff.

Waters contaminated by urban runoff may contain human pathogens (bacteria, viruses, or protozoa) that can cause illnesses.

San Diego experienced its first significant E. coli bacteria outbreak in 10 years after patrons ate tainted food at local area restaurants in 2003. In 1992 and 1993 a similar outbreak occurred in San Diego County, which resulted in the death of a child after he ate tainted food from a Carlsbad fast-food restaurant. Additionally, in the early 1980s a hepatitis outbreak associated with poor food handling techniques resulting in the closure of a major restaurant in Mission Valley and the implementation of a food-handler certification program by the San Diego County Health Department.

The only known release of radiological agents in the County was the result of an accident at San Onofre Nuclear Generating Station (SONGS). In 1981, an accidental "ignition" of hydrogen gases in a holding tank of the San Onofre Nuclear Generating Station (SONGS) caused an explosion - which bent the bolts of an inspection hatch on the tank, allowing radioactive gases in the tank to escape into a radioactive waste room. From there, the radioactive material was released into the atmosphere. The plant was shut down for several weeks following the event (W.I.S.E. Vol.3 No.4 p.18). This incident occurred during the plant's operation of its Unit 1 generator, which has since been decommissioned. No serious injuries occurred.

On February 3, 2001 another accident occurred at SONGS when a circuit breaker fault caused a fire that resulted in a loss of offsite power. Published reports suggest that rolling blackouts during the same week in California were partially due to the shutdown of the SONGS reactors in response to the 3-hour fire. Although no radiation was released and no nuclear safety issues were involved, the federal Nuclear Regulatory Commission sent a Special Inspection Team to the plant site to investigate the accident.

Terrorism

While San Diego County has not experienced any high profile attacks by groups or individuals associated with international terrorist organizations, the region has been the site of several incidents with domestic origins. Most notable is the August 1, 2003 arson attack on a mixed-use housing and office development under construction in the University City neighborhood. The blaze, which officials estimate caused around $50 million in damage, was allegedly set by the Earth Liberation Front, a radical environmentalist group.

San Diego has been linked to the 9-11 attacks in New York City and on the Pentagon; two of the confirmed hijackers of the commercial aircraft used in the attacks took flight school lessons while living in San Diego.

San Diego County has received numerous bomb threats to schools, government buildings, religious sites, and commercial facilities over the years. While the majority of bomb threats are hoaxes, authorities have been required to mobilize resources and activate emergency procedures on a fairly regular basis in response.

Other Manmade Disasters

On September 25th, 1978 San Diego was the scene of one of the worst air disasters in the United States. A mid-air collision between a Cessna 172 and a Pacific Southwest Airlines (PSA) Boeing 727 caused both planes to crash into the North Park neighborhood below. A total of 144 lives were lost including 7 people on the ground. More than 20 residences were damaged or destroyed.

In 1984, a gunman opened fire in a San Ysidro McDonald's restaurant, killing 21 people. This event was not considered an act of terrorism as no political or social objectives were associated with this event.

4.3.11.3 Location and Extent/Probability of Occurrence and Magnitude

Information related to the probability and magnitude of manmade hazards is considered sensitive homeland security related information. Consequently, this information is provided in a separate confidential document (Attachment C). The potential for a man-made event is highly likely.

4.4 Vulnerability Assessment

Vulnerability describes how exposed or susceptible to damage an asset is, and depends on an asset's construction, contents and the economic value of its functions. This vulnerability analysis predicts the extent of injury and damage that may result from a hazard event of a given intensity in a given area on the existing and future built environment. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. Indirect effects can be much more widespread and damaging than direct effects. For example, damage to a major utility line could result in significant inconveniences and business disruption that would far exceed the cost of repairing the utility line.

4.4.1 Asset Inventory

Hazards that occur in San Diego County can impact critical facilities located in the County. A critical facility is defined as a facility in either the public or private sector that provides essential products and services to the general public, is otherwise necessary to preserve the welfare and quality of life in the County, or fulfills important public safety, emergency response, and/or disaster recovery functions. Figure 4.4-1 shows the critical facilities identified for the County. The critical facilities identified in San Diego County include 57 hospitals and other health care facilities; 289 emergency operations facilities, fire stations, and police stations; 1,057 schools, 3,732 hazardous material sites, 7 transportation systems that include 46 airport facilities, 1,985 bridges, 23 bus and 40 rail facilities; 68 marinas and port facilities, and 1,040 kilometers of highways; utility systems that include 21 electric power facilities, natural gas facilities, crude and refined oil facilities, 13 potable and waste water facilities, and 672 communications facilities and utilities; 56 dams, 124 government office/civic centers, jails, prisons, military facilities, religious facilities, and post offices (Figure 4.4.1).

GIS, HAZUS-MH, and other modeling tools were used to map the critical facilities in the county and to determine which would most likely be affected by each of the profiled hazards. San Diego County covers 4,264 square miles with several different climate patterns and types of terrain, which allows for several hazards to affect several different parts of the county and several jurisdictions at once or separately. The hazards addressed are described in Section 4.3.

4.4.2 Estimating Potential Exposure and Losses, and Future Development Trends

GIS modeling was used to estimate exposure to population, critical facilities, infrastructure, and residential/commercial properties, from coastal storms/erosion, tsunami, structure fire/wildfire, dam failure, landslide, and manmade hazards. The specific methods and results of all analyses are presented below. The results are shown as potential exposure in thousands of dollars, and as the worst-case scenario. For infrastructure, which has been identified as highways, railways and energy pipelines, the length of exposure/impact is given in kilometers. Exposure characterizes the value of structures within the hazard zone, and is shown as estimated exposure based on the overlay of the hazard on the critical facilities, infrastructure, and other structures, which are given an assumed cost of replacement for each type of structure exposed. These replacement costs are estimated using a building square footage inventory purchased from Dun and Bradstreet. The square footage information was classified based on Standard Industrial Code (SIC) and provided at a 2002 census-tract resolution. The loss or exposure value is then determined with the assumption that the given structure is totally destroyed (worst case scenario), which is not always the case in hazard events. This assumption was valuable in the planning process, so that the total potential damage value was identified when determining capabilities and mitigation measures for each jurisdiction. Table 4.4-1 provides abbreviations and average replacement costs used for critical facilities and infrastructure listed in all subsequent exposure/loss tables. Table 4.4-2 provides the total inventory and exposure estimates for the critical facilities and infrastructure by jurisdiction. Table 4.4-3 shows the estimated exposure inventory for infrastructure by jurisdiction. Table 4.4-4 provides an inventory of the maximum population and building exposure by jurisdiction.

In addition to estimating potential exposure for structures, at-risk populations were also identified per hazard area. At-risk populations were defined as low-income, disabled and/or elderly and were based upon the 2000 census information.

Loss was estimated for earthquake and flood hazards in the County, in addition to exposure. Loss is that portion of the exposure that is expected to be lost to a hazard, and is estimated by referencing frequency and severity of previous hazards. Hazard risk assessment methodologies embedded in HAZUS, FEMA's loss estimation software, were applied to earthquake and flood hazards in San Diego County. HAZUS (a loss estimation software) integrates with GIS to provide estimates for the potential impact of earthquake and flood hazards by using a common, systematic framework for evaluation. This software contains economic and structural data on infrastructure and critical facilities, including replacement value costs with 2006 square footage and valuation parameters to use in loss estimation assumptions. This approach provides estimates for the potential impact by using a common, systematic framework for evaluation. The HAZUS risk assessment methodology is parametric, in that distinct hazard and inventory parameters (e.g. ground shaking and building types) were modeled to determine the impact (damages and losses) on the built environment. The HAZUS-MH models were used to estimate losses from earthquake and flood hazards to critical facilities, infrastructure, and residential/commercial properties, as well as economic losses on several return period events and annualized levels. Loss estimates used available data, and the methodologies applied resulted in an approximation of risk. The economic loss results are presented as the Annualized Loss (AL) for the earthquake hazard. AL addresses the two key components of risk: the probability of the hazard occurring in the study area and the consequences of the hazard, largely a function of building construction type and quality, and of the intensity of the hazard event. By annualizing estimated exposure values, the AL takes into account historic patterns of frequent smaller events with infrequent but larger events to provide a balanced presentation of the risk. These estimates should be used to understand relative risk from hazards and potential losses. Uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications that are necessary for a comprehensive analysis (such as incomplete inventories, demographics, or economic parameters).

Figure 4.4.1

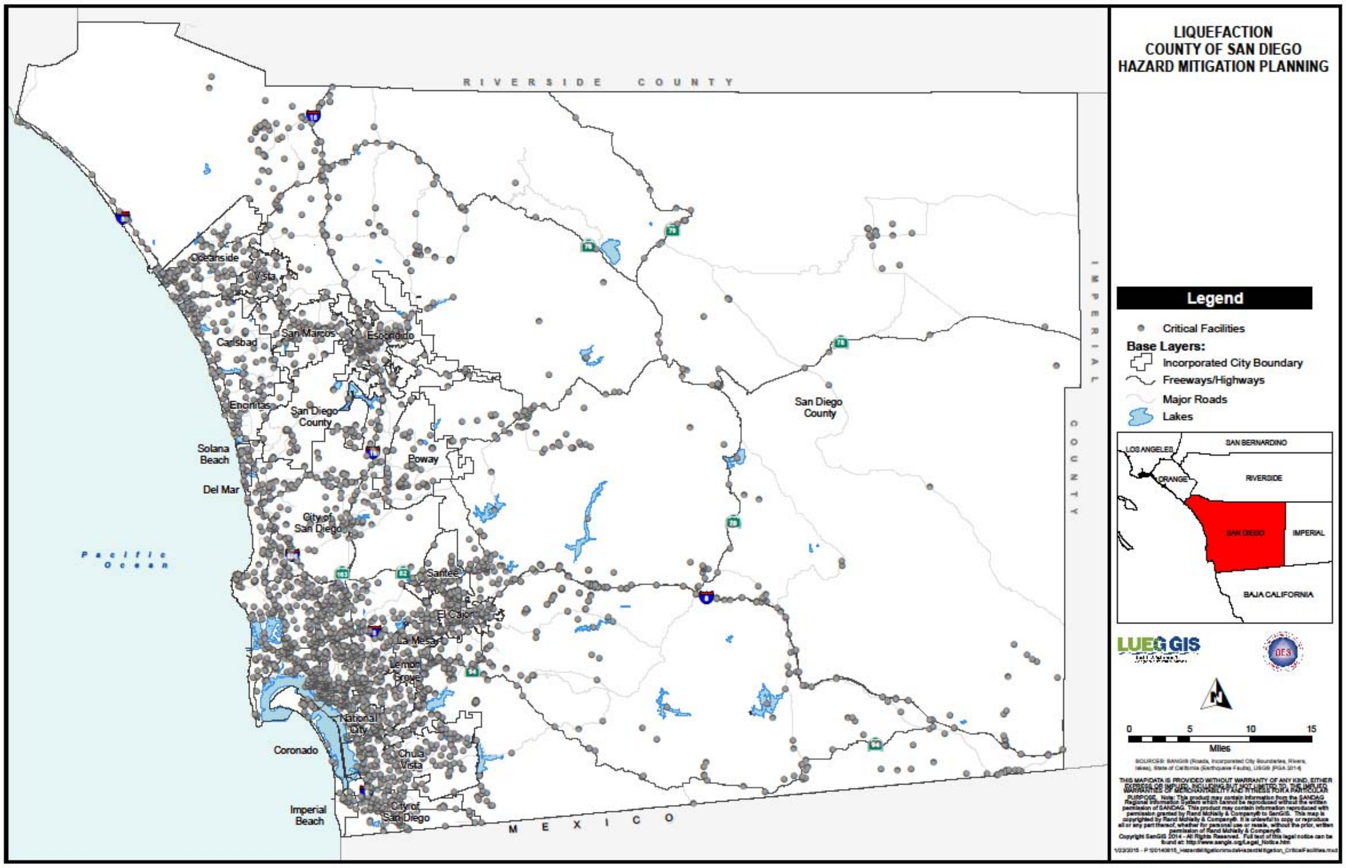

LIQUEFACTION
COUNTY OF SAN DIEGO
HAZARD MITIGATION PLANNING
Legend
Critical Facilities
Base Layers:
Incorporated City Boundary
Freeways/Highways
Major Roads
Lakes
RIVERSIDE COUNTY
IMPERIAL COUNTY
MEXICO
Pacific Ocean
Oceanside
Vista
San Marcos
Escondido
Carlsbad
Encinitas
San Diego County
Solana Beach
Del Mar
Poway
City of San Diego
Santee
El Cajon
La Mesa
Lemon Grove
National City
Coronado
Chula Vista
Imperial Beach
City of San Diego
San Diego County
LOS ANGELES
SAN BERNARDINO
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
BAJA CALIFORNIA
LUEG GIS
Miles

Table 4.4-1
Abbreviations and Costs Used for Critical Facilities and Infrastructure

Abr.	Name	Building Type (where applicable)	Average Replacement Cost
AIR	Airport facilities	s1l	200,000,000
BRDG	Bridges	n/a	191,600
BUS	Bus facilities	c1l	2,000,000
COM	Communication facilities and Utilities	c1l	2,000,000
ELEC	Electric Power facility	c1l	10,000,000
EMER	Emergency Centers, Fire Stations and Police Stations	c1l	2,000,000
GOVT	Government Office/Civic Center	c1l	2,000,000
HOSP	Hospitals/Care facilities	s1m	100,000,000
INFR	Kilometers of Infrastructure. Includes:		
	Oil/Gas Pipelines (OG)	n/a	300
	Railroad Tracks (RR)	n/a	860
	Highway (HWY)	n/a	3,860
PORT	Port facilities	c1l	20,000,000
POT	Potable and Waste Water facilities	c1l	100,000,000
RAIL	Rail facilities	c1l	2,000,000
SCH	Schools	rm1l	1,000,000

Table 4.4-2
Inventory of Critical Facilities and Infrastructure and Exposure Value by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	RAIL	SCH	TOTAL
Carlsbad	Number	1	33	0	2	1	7	5	2	153	0	2	0	33	**239**
	Exposure (x$1000)	200,000	6,323	0	4,000	10,000	14,000	10,000	200,000	247	0	200,000	0	33,000	**677,570**
Chula Vista	Number	0	44	2	2	1	13	9	7	119	1	1	0	75	**274**
	Exposure (x$1000)	0	8,430	4,000	4,000	10,000	26,000	18,000	700,000	255	20,000	100,000	0	75,000	**965,686**
Coronado	Number	0	2	0	1	0	3	4	1	28	0	0	0	9	**48**
	Exposure (x$1000)	0	383	0	2,000	0	6,000	8,000	100,000	51	0	0	0	9,000	**125,434**
Del Mar	Number	0	5	0	0	0	1	2	0	14	0	0	0	2	**24**
	Exposure (x$1000)	0	958	0	0	0	2,000	4,000	0	10	0	0	0	2,000	**8,968**
El Cajon	Number	1	37	1	2	1	8	7	6	64	0	0	0	47	**174**
	Exposure (x$1000)	200,000	7,089	2,000	4,000	10,000	16,000	14,000	600,000	161	0	0	0	47,000	**900,250**
Encinitas	Number	0	16	0	1	0	6	3	3	85	0	1	7	25	**147**
	Exposure (x$1000)	0	3,066	0	2,000	0	12,000	6,000	300,000	145	0	100,000	14,000	25,000	**462,211**
Escondido	Number	0	74	1	4	0	8	8	8	83	0	1	1	46	**234**
	Exposure (x$1000)	0	14,178	2,000	8,000	0	16,000	16,000	800,000	211	0	100,000	2,000	46,000	**1,004,389**
Imperial Beach	Number	0	1	0	0	0	2	2	2	4	0	0	0	8	**19**
	Exposure (x$1000)	0	192	0	0	0	4,000	4,000	200,000	2	0	0	0	8,000	**216,194**
La Mesa	Number	0	36	0	1	0	4	4	2	53	0	0	0	25	**125**
	Exposure (x$1000)	0	6,898	0	2,000	0	8,000	8,000	200,000	113	0	0	0	25,000	**250,011**
Lemon Grove	Number	0	8	0	0	0	2	3	0	24	0	0	0	10	**47**
	Exposure (x$1000)	0	1,533	0	0	0	4,000	6,000	0	60	0	0	0	10,000	**21,593**
National City	Number	0	47	1	1	2	4	4	7	37	5	1	3	20	**132**
	Exposure (x$1000)	0	9,005	2,000	2,000	20,000	8,000	8,000	700,000	88	100,000	100,000	6,000	20,000	**975,093**
Oceanside	Number	1	43	2	4	0	10	12	11	124	0	1	8	43	**259**
	Exposure (x$1000)	200,000	8,239	4,000	8,000	0	20,000	24,000	1,100,000	250	0	100,000	16,000	43,000	**1,523,489**
Poway	Number	0	45	1	0	0	4	2	1	34	0	0	0	25	**112**
	Exposure (x$1000)	0	8,622	2,000	0	0	8,000	4,000	100,000	98	0	0	0	25,000	**147,720**
San Diego (City)	Number	4	498	12	33	9	89	98	50	959	62	2	5	361	**2,182**
	Exposure (x$1000)	800,000	95,417	24,000	66,000	90,000	178,000	196,000	5,000,000	2,168	1,240,000	200,000	10,000	361,000	**8,262,585**
San Marcos	Number	0	12	0	2	0	8	3	2	59	0	0	2	28	**116**
	Exposure (x$1000)	0	2,299	0	4,000	0	16,000	6,000	200,000	149	0	0	4,000	28,000	**260,448**
Santee	Number	0	15	1	4	0	4	3	0	33	0	1	0	15	**76**
	Exposure (x$1000)	0	2,874	2,000	8,000	0	8,000	6,000	0	72	0	100,000	0	15,000	**141,946**
Solana Beach	Number	0	5	0	0	0	1	2	0	28	0	0	1	9	**46**
	Exposure (x$1000)	0	958	0	0	0	2,000	4,000	0	46	0	0	2,000	9,000	**18,004**
Unincorporated - Rural	Number	33	227	2	44	3	100	3	15	1,334	0	0	0	86	**1,847**
	Exposure (x$1000)	6,600,000	43,493	4,000	88,000	30,000	200,000	6,000	1,500,000	4,402	0	0	0	86,000	**8,561,895**
Unincorporated - Urban Core	Number	0	117	0	12	0	40	7	10	320.3	0	1	2	115	**624**
	Exposure (x$1000)	0	22417.2	0	24000	0	80000	14000	1000000	597.25	0	100000	4000	115000	**1,360,014**
Vista	Number	0	12	0	0	0	9	4	3	53	0	0	10	40	**131**
	Exposure (x$1000)	0	2,299	0	0	0	18,000	8,000	300,000	101	0	0	20,000	40,000	**388,400**
Total Number		**40**	**1,277**	**23**	**113**	**17**	**323**	**185**	**130**	**12,749**	**68**	**11**	**39**	**1,022**	**15,997**
Total Exposure (x$1000)		**8,000,000**	**244,673**	**46,000**	**226,000**	**170,000**	**646,000**	**370,000**	**13,000,000**	**42,540**	**1,360,000**	**1,100,000**	**78,000**	**1,022,000**	**26,305,213**

Table 4.4-3
Inventory of Exposure for Infrastructure

Jurisdiction	Data	HWY	Replacen	RR	Total
Carlsbad	Number	55	87	11	**153**
	Exposure (x$1000)	212	26	9	**247**
Chula Vista	Number	61	52	6	**119**
	Exposure (x$1000)	234	15	6	**255**
Coronado	Number	12	16	0	**28**
	Exposure (x$1000)	46	5	0	**51**
Del Mar	Number	1	8	5	**14**
	Exposure (x$1000)	3	3	4	**10**
El Cajon	Number	39	19	7	**64**
	Oil/Gas Pipeplines	150	6	6	**161**
Encinitas	Railroad Tracks	32	43	10	**85**
	Exposure (x$1000)	124	13	8	**145**
Escondido	Number	52	27	3	**83**
	Exposure (x$1000)	200	8	3	**211**
Imperial Beach	Number	0	4	0	**4**
	Exposure (x$1000)	1	1	0	**2**
La Mesa	Number	26	16	12	**53**
	Exposure (x$1000)	99	5	10	**113**
Lemon Grove	Number	14	6	4	**24**
	Exposure (x$1000)	54	2	4	**60**
National City	Number	21	12	4	**37**
	Exposure (x$1000)	81	4	4	**88**
Oceanside	Number	57	49	18	**124**
	Exposure (x$1000)	220	15	15	**250**
Poway	Number	25	9	0	**34**
	Exposure (x$1000)	95	3	0	**98**
San Diego (City)	Number	514	354	92	**959**
	Exposure (x$1000)	1,983	106	79	**2,168**
San Marcos	Number	35	15	9	**59**
	Exposure (x$1000)	136	4	8	**149**
Santee	Number	17	15	1	**33**
	Exposure (x$1000)	67	4	1	**72**
Solana Beach	Number	10	15	3	**28**
	Exposure (x$1000)	40	4	2	**46**
Unicorporated - Rural	Number	1,107	117	110	**1,334**
	Exposure (x$1000)	4,272	35	94	**4,402**
Unicorporated - Urban Core	Number	136	152	33	**320**
	Exposure (x$1000)	523	46	28	**597**
Vista	Number	23	24	7	**53**
	Exposure (x$1000)	88	7	6	**101**
Total Number		**10,777**	**1,352**	**620**	**12,749**
Total Exposure (x$1000)		**41,601**	**405**	**533**	**42,540**

Table 4.4-4
Inventory of the Maximum Population and Building Exposure by Jurisdiction

		Residential Buildings at Risk		Commercial Buildings at Risk	
Jurisdiction	**Exposed Population**	**Building Count**	**Potential Exposure (x$1000)**	**Building Count**	**Potential Exposure (x$1000)**
Carlsbad	104,707	43,723	$12,308,025	1,559	$6,986,970
Chula Vista	232,095	77,457	$21,804,146	2,184	$9,788,033
Coronado	23,009	9,541	$2,685,792	470	$2,106,399
Del Mar	4,591	2,537	$714,166	220	$985,974
El Cajon	98,205	35,656	$10,037,164	1,360	$6,095,112
Encinitas	64,145	24,848	$6,994,712	1,268	$5,682,796
Escondido	143,071	47,044	$13,242,886	1,835	$8,223,920
Imperial Beach	28,243	9,859	$2,775,309	346	$1,550,668
La Mesa	56,880	25,333	$7,131,240	952	$4,266,578
Lemon Grove	25,650	8,824	$2,483,956	365	$1,635,821
National City	56,522	15,776	$4,440,944	892	$3,997,676
Oceanside	179,626	64,642	$18,196,723	1,964	$8,802,059
Poway	51,126	16,339	$4,599,429	732	$3,280,604
San Diego (City)	1,354,013	510,740	$143,773,310	18,862	$84,533,825
San Marcos	83,149	27,726	$7,804,869	812	$3,639,140
Santee	56,848	19,681	$5,540,202	582	$2,608,349
Solana Beach	13,547	6,512	$1,833,128	322	$1,443,107
Unincorporated - Rural	168,254	60,561	$17,047,922	2,177	$9,756,661
Unincorporated - Urban Core	333,626	108,042	$30,413,823	3,560	$15,954,852
Vista	96,100	30,707	$8,644,021	1,163	$5,212,217
Total	**3,173,407**	**1,145,548**	**$322,471,762**	**41,625**	**$186,550,763**

4.4.2.1 Coastal Storm/Erosion

FEMA FIRM flood hazard data compiled and digitized in 1997 was used to profile the coastal storm/erosion hazard. Specifically, the FEMA FIRM VE zone was used in the hazard modeling process in HAZUS-MH. As discussed earlier, the VE Zone is defined by FEMA as the coastal area subject to a velocity hazard (wave action). The identified vulnerable assets were superimposed on the identified hazard areas, resulting in three risk/exposure estimates: 1) the aggregated exposure and building count (both dollar exposure and population) at the census block level for residential and commercial occupancies, 2) lifeline infrastructure and 3) the critical infrastructure at risk (schools, hospitals, airports, bridges, and other facilities of critical nature). These results were then aggregated and presented by hazard risk level per jurisdiction.

Table 4.4-5 provides a breakdown of potential coastal storm/coastal erosion exposure by jurisdiction. No losses to critical facilities and infrastructure are expected from these hazards. Approximately 4,600 people may be at risk from coastal storm/coastal erosion hazards in San Diego County. In addition, special populations at risk that may be impacted by coastal storm/coastal erosion in San Diego County include: 331 low-income households and 813 elderly persons.

Table 4.4-5
Potential Exposure from Coastal Storm/Erosion Hazard by Jurisdiction

		Residential Buildings at Risk		Commercial Buildings at Risk	
Jurisdiction	**Exposed Population**	**Building Count**	**Potential Exposure (x$1000)**	**Building Count**	**Potential Exposure (x$1000)**
Carlsbad	14	8	$2,252	0	$0
Chula Vista	0	0	$0	0	$0
Coronado	580	261	$73,472	1	$4,482
Del Mar	17	10	$2,815	0	$0
El Cajon	0	0	$0	0	$0
Encinitas	94	42	$11,823	0	$0
Escondido	0	0	$0	0	$0
Imperial Beach	157	64	$18,016	0	$0
La Mesa	0	0	$0	0	$0
Lemon Grove	0	0	$0	0	$0
National City	0	0	$0	0	$0
Oceanside	76	54	$15,201	3	$13,445
Poway	0	0	$0	0	$0
San Diego (City)	199	128	$36,032	1	$4,482
San Marcos	0	0	$0	0	$0
Santee	0	0	$0	0	$0
Solana Beach	402	167	$47,011	2	$8,963
Unincorporated - Rural	0	0	$0	0	$0
Unincorporated - Urban Core	0	0	$0	0	$0
Vista	0	0	$0	0	$0
Total	**1,539**	**734**	**$206,621**	**7**	**$31,372**

4.4.2.2 Tsunami

Tsunami maximum run-up projections were modeled for the entire San Diego County coastline in 2000 by the University of Southern California, and distributed by the CA Office of Emergency Services. The model was a result of a combination of inundation modeling and onsite surveys to show maximum predicted inundation levels due to tsunami. This was a scenario model, which uses a given earthquake intensity and location to determine resulting tsunami effects. The identified vulnerable assets were superimposed on top of this information, resulting in three risk/exposure estimates: 1) the aggregated exposure and building count (both dollar exposure and population) at the census block level for residential and commercial occupancies, 2) the aggregated population at risk at the census block level, and 3) the critical infrastructure at risk (schools, hospitals, airports, bridges, and other facilities of critical nature). These results were then aggregated and presented by hazard risk level per jurisdiction.

Table 4.4-6 provides a breakdown of potential exposure by jurisdiction, and Table 4.4-7 provides a breakdown of potential exposure to infrastructure and critical facility by jurisdiction. Approximately 37,000 people may be at risk from the tsunami hazard in San Diego County. In addition, special populations at risk that may be impacted by tsunami in San Diego County include: 2,558 low income households and 3,655 elderly persons.

Table 4.4-6
Potential Exposure from Tsunami Hazard by Jurisdiction

		Residential Buildings at Risk		Commercial Buildings at Risk	
Jurisdiction	**Exposed Population**	**Building Count**	**Potential Exposure (x$1000)**	**Building Count**	**Potential Exposure (x$1000)**
Carlsbad	1,165	535	$150,603	23	$103,079
Chula Vista	83	26	$7,319	1	$4,482
Coronado	8,523	3,367	$947,811	98	$439,207
Del Mar	1,023	542	$152,573	35	$156,860
El Cajon	0	0	$0	0	$0
Encinitas	388	178	$50,107	9	$40,335
Escondido	0	0	$0	0	$0
Imperial Beach	5,225	2,138	$601,847	97	$434,725
La Mesa	0	0	$0	0	$0
Lemon Grove	0	0	$0	0	$0
National City	1,306	0	$0	5	$22,409
Oceanside	2,108	1,059	$298,109	46	$206,158
Poway	0	0	$0	0	$0
San Diego (City)	10,294	6,490	$1,826,935	393	$1,761,308
San Marcos	0	0	$0	0	$0
Santee	0	0	$0	0	$0
Solana Beach	324	135	$38,003	3	$13,445
Unincorporated - Rural	5,154	95	$26,743	0	$0
Unincorporated - Urban Core	35	11	$3,097	1	$4,482
Vista	0	0	$0	0	$0
Total	**35,628**	**14,576**	**$4,103,144**	**711**	**$3,186,489**

Table 4.4-7
Potential Exposure to Critical Facilities and Infrastructure from Tsunami Hazard by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	WWTR	RAIL	SCH	Total
Carlsbad	Number	0	2	0	0	0	0	0	0	4	0	0	0	0	0	**6**
	Exposure (x$1000)	0	383	0	0	0	0	0	0	3	0	0	0	0	0	**386**
Chula Vista	Number	0	1	0	0	0	0	0	0	0	1	0	0	0	0	**2**
	Exposure (x$1000)	0	192	0	0	0	0	0	0	0	20,000	0	0	0	0	**20,192**
Coronado	Number	0	1	0	0	0	1	2	0	18	0	0	0	0	1	**23**
	Exposure (x$1000)	0	192	0	0	0	2,000	4,000	0	36	0	0	0	0	1,000	**7,227**
Del Mar	Number	0	2	0	0	0	1	0	0	3	0	0	0	0	0	**6**
	Exposure (x$1000)	0	383	0	0	0	2,000	0	0	2	0	0	0	0	0	**2,385**
El Cajon	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Encinitas	Number	0	1	0	0	0	0	0	0	3	0	1	0	0	0	**5**
	Exposure (x$1000)	0	192	0	0	0	0	0	0	1	0	100,000	0	0	0	**100,193**
Escondido	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Imperial Beach	Number	0	0	0	0	0	0	0	0	1	0	0	0	0	1	**2**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	1	0	0	0	0	1,000	**1,001**
La Mesa	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lemon Grove	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
National City	Number	0	2	0	0	0	0	0	0	0	3	0	0	0	0	**5**
	Exposure (x$1000)	0	383	0	0	0	0	0	0	1	60,000	0	0	0	0	**60,384**
Oceanside	Number	0	3	0	0	0	0	0	0	2	0	0	0	0	0	**5**
	Exposure (x$1000)	0	575	0	0	0	0	0	0	3	0	0	0	0	0	**578**
Poway	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
San Diego (City)	Number	0	7	0	0	0	0	1	1	10	49	0	0	0	0	**68**
	Exposure (x$1000)	0	1,341	0	0	0	0	2,000	100,000	5	980,000	0	0	0	0	**1,083,347**
San Marcos	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Santee	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Solana Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated Rural	Number	0	4	0	0	0	0	0	0	1	0	0	0	0	0	**5**
	Exposure (x$1000)	0	766	0	0	0	0	0	0	1	0	0	0	0	0	**768**
Unincorporated Urban Core	Number	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	0	0	0	0	0	**1**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	2	0	0	0	0	0	**2**
Vista	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total Number		**0**	**23**	**0**	**0**	**0**	**2**	**3**	**1**	**42**	**53**	**1**	**0**	**0**	**2**	**127**
Total Exposure (x$1000)		**0**	**4,407**	**0**	**0**	**0**	**4,000**	**6,000**	**100,000**	**55**	**1,060,000**	**100,000**	**0**	**0**	**2,000**	**1,276,462**

Refer to Table 4.4-1 for abbreviation definition

4.4.2.3 Dam Failure

Dam inundation zones, compiled by FEMA or the National Inventory of Dams throughout San Diego County, and purchased through SanGIS, show areas that would be flooded if each dam failed. The San Diego County Water Authority provided the San Vicente Dam and Olivenhain Dam inundation maps. Olivenhain Dam is the newest dam in San Diego County, and had not yet been filled at the time of preparation of this report. Inundation areas for Olivenhain Dam however were identified and modeled as high risk. The identified vulnerable assets were superimposed on top of this information, resulting in three risk/exposure estimates: 1) the aggregated exposure and building count (both dollar exposure and population) at the census block level for residential and commercial occupancies, 2) the aggregated population at risk at the census block level, and 3) the critical infrastructure at risk (schools, hospitals, airports, bridges, and other facilities of critical nature). These results were then aggregated and presented by hazard risk level per jurisdiction.

Table 4.4-8 provides a breakdown of potential exposure by jurisdiction, and Table 4.4-9 provides a breakdown of potential exposure to infrastructure and critical facility by jurisdiction. Approximately 368,000 people are at risk from the dam failure hazard. In addition, special populations at risk that may be impacted by the dam failure hazard in San Diego County include 13,689 low-income households and 24,316 elderly persons.

Table 4.4.8
Potential Exposure from Dam Failure Hazard by Jurisdiction

		Residential Buildings at Risk		Commercial Buildings at Risk	
Jurisdiction	**Exposed Population**	**Building Count**	**Potential Exposure (x$1000)**	**Building Count**	**Potential Exposure (x$1000)**
Carlsbad	4,113	1,951	$549,207	49	$219,603
Chula Vista	8,635	2,973	$836,900	190	$851,523
Coronado	0	0	$0	0	$0
Del Mar	1,139	612	$172,278	47	$210,640
El Cajon	0	0	$0	0	$0
Encinitas	1,204	425	$119,638	35	$156,860
Escondido	47,700	14,323	$4,031,925	766	$3,432,982
Imperial Beach	5,526	1,880	$529,220	42	$188,231
La Mesa	1,701	731	$205,777	19	$85,152
Lemon Grove	0	0	$0	0	$0
National City	1,998	496	$139,624	184	$824,633
Oceanside	33,755	11,437	$3,219,516	285	$1,277,285
Poway	47	16	$4,504	1	$4,482
San Diego (City)	75,686	28,036	$7,892,134	1,206	$5,404,930
San Marcos	2,481	829	$233,364	59	$264,420
Santee	20,815	6,968	$1,961,492	267	$1,196,614
Solana Beach	40	17	$4,786	2	$8,963
Unincorporated - Rural	14,512	3,686	$1,037,609	135	$605,030
Unincorporated - Urban Core	21,862	7,304	$2,056,076	277	$1,241,431
Vista	553	215	$60,523	16	$71,707
Total	**241,767**	**81,899**	**$23,054,569**	**3,580**	**$16,044,486**

Table 4.4-9
Potential Exposure to Critical Facilities and Infrastructure from Dam Failure Hazard by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	WWTR	RAIL	SCH	Total
Carlsbad	Number	0	4	0	0	0	0	0	0	7	0	0	0	0	1	**12**
	Exposure (x$1000)	0	766	0	0	0	0	0	0	9	0	0	0	0	1,000	**1,775**
Chula Vista	Number	0	16	0	0	1	1	1	2	23	0	0	0	0	1	**45**
	Exposure (x$1000)	0	3,066	0	0	10,000	2,000	2,000	200,000	60	0	0	0	0	1,000	**218,126**
Coronado	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Del Mar	Number	0	3	0	0	0	1	0	0	9	0	0	0	0	0	**13**
	Exposure (x$1000)	0	575	0	0	0	2,000	0	0	5	0	0	0	0	0	**2,579**
El Cajon	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Encinitas	Number	0	5	0	0	0	0	0	0	19	0	1	0	0	3	**28**
	Exposure (x$1000)	0	958	0	0	0	0	0	0	13	0	100,000	0	0	3,000	**103,971**
Escondido	Number	0	33	1	1	0	4	8	6	48	0	0	1	1	15	**118**
	Exposure (x$1000)	0	6,323	2,000	2,000	0	8,000	16,000	600,000	149	0	0	100,000	2,000	15,000	**751,472**
Imperial Beach	Number	0	1	0	0	0	0	1	0	3	0	0	0	0	1	**6**
	Exposure (x$1000)	0	192	0	0	0	0	2,000	0	1	0	0	0	0	1,000	**3,192**
La Mesa	Number	0	2	0	0	0	0	0	0	9	0	0	0	0	0	**11**
	Exposure (x$1000)	0	383	0	0	0	0	0	0	12	0	0	0	0	0	**395**
Lemon Grove	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
National City	Number	0	26	0	0	0	0	1	0	22	1	0	0	1	2	**53**
	Exposure (x$1000)	0	4,982	0	0	0	0	2,000	0	63	20,000	0	0	2,000	2,000	**31,044**
Oceanside	Number	1	17	0	1	0	3	2	0	25	0	0	0	0	7	**56**
	Exposure (x$1000)	200,000	3,257	0	2,000	0	6,000	4,000	0	62	0	0	0	0	7,000	**222,319**
Poway	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
San Diego (City)	Number	0	120	0	1	1	8	12	2	286	0	1	0	1	12	**444**
	Exposure (x$1000)	0	22,992	0	2,000	10,000	16,000	24,000	200,000	605	0	100,000	0	2,000	12,000	**389,597**
San Marcos	Number	0	1	0	0	0	0	0	0	3	0	0	0	0	2	**6**
	Exposure (x$1000)	0	192	0	0	0	0	0	0	4	0	0	0	0	2,000	**2,196**
Santee	Number	0	12	1	3	0	4	2	0	67	0	1	0	0	6	**96**
	Exposure (x$1000)	0	2,299	2,000	6,000	0	8,000	4,000	0	130	0	100,000	0	0	6,000	**128,429**
Solana Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated Rural	Number	1	42	0	1	0	5	0	0	68	0	0	1	0	5	**123**
	Exposure (x$1000)	200,000	8,047	0	2,000	0	10,000	0	0	211	0	0	100,000	0	5,000	**325,258**
Unincorporated Urban Core	Number	0	22	0	0	0	6	2	2	76	0	0	0	0	15	**123**
	Exposure (x$1000)	0	4,215	0	0	0	12,000	4,000	200,000	140	0	0	0	0	15,000	**235,356**
Vista	Number	0	2	0	0	0	1	0	0	1	0	0	0	0	0	**4**
	Exposure (x$1000)	0	383	0	0	0	2,000	0	0	0	0	0	0	0	0	**2,384**
Total Number		**2**	**306**	**2**	**7**	**2**	**33**	**29**	**12**	**664**	**1**	**3**	**2**	**3**	**70**	**1,136**
Total Exposure (x$1000)		**400,000**	**58,630**	**4,000**	**14,000**	**20,000**	**66,000**	**58,000**	**1,200,000**	**1,465**	**20,000**	**300,000**	**200,000**	**6,000**	**70,000**	**2,418,094**

Refer to Table 4.4-1 for abbreviation definition

4.4.2.4 Earthquake, Liquefaction and Earthquake-Induced Landslides

The data used in the earthquake hazard assessment were: 100-, 250-, 500-, 750-, 1000-, 1500-, 2000-, and 2500- year return period USGS probabilistic hazards. Soil conditions for San Diego County as developed by USGS were also used, which allowed for a better reflection of amplification of ground shaking that may occur. The HAZUS software model, which was developed for FEMA by the National Institute of Building Services as a tool to determine earthquake loss estimates, was used to model earthquake and flood for this assessment. This software program integrates with a GIS to facilitate the manipulation of data on building stock, population, and the regional economy with hazard models. PBS&J updated this model in 2003 to HAZUS-MH (Multiple Hazard), which can model earthquake and flood, along with collateral issues associated with each model, such as liquefaction and landslide with earthquakes. This software was not released prior to the beginning of the planning process; however, PBS&J performed vulnerability and loss estimation models for earthquakes and flood for this project using the newer model.

Additionally, the earthquake risk assessment explored the potential for collateral hazards such as liquefaction and earthquake-induced landslides. Three cases were examined, one case with shaking only, a second case with liquefaction potential, and a third with earthquake-induced landslides. Once the model was complete, the identified vulnerable assets were superimposed on top of this information, resulting in three risk/loss estimates: 1) the aggregated exposure and building count (both dollar exposure and population) at the census block level for residential and commercial occupancies, 2) the aggregated population at risk at the census block level, and 3) the critical infrastructure at risk (schools, hospitals, airports, bridges, and other facilities of critical nature). These results were then aggregated and presented by hazard risk level per jurisdiction. Results for residential and commercial properties were generated as annualized losses, which average all eight of the modeled return periods (100-year through 2500-year events). For critical facility losses it was helpful to look at 100- and 500-year return periods to plan for an event that is more likely to occur in the near-term. In the near term, a 500-year earthquake would cause increased shaking, liquefaction and landslide, which would be expected to increase loss numbers. Exposure for annualized earthquake included buildings and population in the entire county because a severe or worst case scenario earthquake could affect any structure in the County. Furthermore, the annualized earthquake loss table also shows potential collateral exposure and losses from liquefaction and landslide separately; this is the additional loss from earthquake due to liquefaction or landslide caused by earthquakes and should be added to the shaking-only loss values to get the correct value. (The collateral liquefaction and landslide loss results for critical facilities were included with earthquake in Tables 4.4-11 and 4.4-12, to plan for an event that is more likely to occur in the near-term as discussed above).

Table 4.4-10 provides a breakdown of potential exposure and losses due to annualized earthquake events by jurisdiction. Tables 4.4-11 and 4.4-12 provide a breakdown of infrastructure and critical facility losses from 100-year and 500-year earthquakes, respectively. Approximately 2,800,000 people may be at risk from the annualized earthquake and earthquake-induced liquefaction hazards. In addition, special populations at risk that may be impacted by the earthquake hazard in San Diego County include 13,689 low-income households and 24,316 elderly persons.

Table 4.4-10
Potential Exposure and Losses from Annualized Earthquake Hazard by Jurisdiction

		Residential Buildings at Risk					Commercial Buildings at Risk				
Jurisdiction	**Exposed Population**	Building Count	**Potential Loss from **Shaking** (x$1000)	**Potential Additional Loss from **Liquefaction** (x$1000)	**Potential Additional Loss from **Landslide** (x$1000)	Potential Exposure (x$1000)	Building Count	**Potential Loss from **Shaking** (x$1000)	**Potential Additional Loss from **Liquefaction** (x$1000)	**Potential Additional Loss from **Landslide** (x$1000)	Potential Exposure (x$1000)
Carlsbad	104,707	43,723	2,649	0	524	12,308,025	1,559	998	0	352	6,986,970
Chula Vista	232,095	77,457	3,086	332	586	21,804,146	2,184	772	50	262	9,788,033
Coronado	23,009	9,541	1,309	156	208	2,685,792	470	224	0	75	2,106,399
Del Mar	4,591	2,537	235	0	46	714,166	220	110	0	27	985,974
El Cajon	98,205	35,656	1,739	0	319	10,037,164	1,360	726	0	218	6,095,112
Encinitas	64,145	24,848	1,962	0	536	6,994,712	1,268	659	0	209	5,682,796
Escondido	143,071	47,044	2,743	0	399	13,242,886	1,835	1,149	0	339	8,223,920
Imperial Beach	28,243	9,859	680	149	94	2,775,309	346	87	8	34	1,550,668
La Mesa	56,880	25,333	1,026	0	121	7,131,240	952	318	0	82	4,266,578
Lemon Grove	25,650	8,824	454	0	56	2,483,956	365	95	0	32	1,635,821
National City	56,522	15,776	874	56	203	4,440,944	892	420	0	132	3,997,676
Oceanside	179,626	64,642	4,336	646	1,156	18,196,723	1,964	849	34	293	8,802,059
Poway	51,126	16,339	776	0	141	4,599,429	732	257	0	82	3,280,604
San Diego (City)	1,354,013	510,740	32,046	1,648	8,721	143,773,310	18,862	12,428	725	4,231	84,533,825
San Marcos	83,149	27,726	934	0	113	7,804,869	812	518	0	153	3,639,140
Santee	56,848	19,681	1,076	0	279	5,540,202	582	252	0	108	2,608,349
Solana Beach	13,547	6,512	573	62	108	1,833,128	322	312	15	84	1,443,107
Unincorporated-Rural	168,254	60,561	886	0	152	17,047,922	2,177	149	0	43	9,756,661
Unincorporated-Urban Core	333,626	108,042	8,963	1	2,113	30,413,823	3,560	1,123	0	329	15,954,852
Vista	96,100	30,707	1,597	0	251	8,644,021	1,163	411	0	116	5,212,217
Total	**3,173,407**	**1,145,548**	**$67,943**	**$3,050**	**$16,126**	**$322,471,762**	**$41,625**	**$21,860**	**$832**	**$7,202**	**$186,550,763**

Table 4.4-11
Potential Exposure to Critical Facilities and Infrastructure from 100-Year Earthquake Hazard by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	WWTR	RAIL	SCH	TOTAL
Carlsbad	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Chula Vista	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Coronado	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Del Mar	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
El Cajon	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Encinitas	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Escondido	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Imperial Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
La Mesa	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lemon Grove	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
National City	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Oceanside	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Poway	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
San Diego (City)	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
San Marcos	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Santee	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Solana Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated -	Number	15	30	1	19	0	26	0	8	437	0	0	1	0	28	**565**
Rural	Exposure (x$1000)	3,000,000	5,748	2,000	38,000	0	52,000	0	800,000	1,647	0	0	100,000	0	28,000	**4,027,395**
Unincorporated -	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Urban Core	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Vista	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total Number		**15**	**30**	**1**	**19**	**0**	**26**	**0**	**8**	**437**	**0**	**0**	**1**	**0**	**28**	**565**
Total Exposure (x$1000)		**3,000,000**	**5,748**	**2,000**	**38,000**	**0**	**52,000**	**0**	**800,000**	**1,647**	**0**	**0**	**100,000**	**0**	**28,000**	**4,027,395**

Table 4.4-12
Potential Exposure to Critical Facilities and Infrastructure from 500-Year Earthquake Hazard by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	WWTR	RAIL	SCH	TOTAL
Carlsbad	Number	1	33	0	2	1	7	5	2	153	0	2	0	0	33	**239**
	Exposure (x$1000)	200,000	6,323	0	4,000	10,000	14,000	10,000	200,000	247	0	200,000	0	0	33,000	**677,570**
Chula Vista	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Coronado	Number	0	1	0	1	0	2	4	1	19	0	0	0	0	9	**37**
	Exposure (x$1000)	0	192	0	2,000	0	4,000	8,000	100,000	30	0	0	0	0	9,000	**123,222**
Del Mar	Number	0	5	0	0	0	1	2	0	14	0	0	0	0	2	**24**
	Exposure (x$1000)	0	958	0	0	0	2,000	4,000	0	10	0	0	0	0	2,000	**8,968**
El Cajon	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Encinitas	Number	0	16	0	1	0	6	3	3	85	0	1	0	7	25	**147**
	Exposure (x$1000)	0	3,066	0	2,000	0	12,000	6,000	300,000	145	0	100,000	0	14,000	25,000	**462,211**
Escondido	Number	0	71	1	4	0	8	8	8	83	0	1	1	1	46	**232**
	Exposure (x$1000)	0	13,604	2,000	8,000	0	16,000	16,000	800,000	211	0	100,000	100,000	2,000	46,000	**1,103,815**
Imperial Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
La Mesa	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lemon Grove	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
National City	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Oceanside	Number	1	43	2	4	0	10	12	11	124	0	1	0	8	43	**259**
	Exposure (x$1000)	200,000	8,239	4,000	8,000	0	20,000	24,000	1,100,000	250	0	100,000	0	16,000	43,000	**1,523,489**
Poway	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
San Diego (City)	Number	2	115	3	15	4	24	35	4	239	47	1	0	5	68	**562**
	Exposure (x$1000)	400,000	22,034	6,000	30,000	40,000	48,000	70,000	400,000	421	940,000	100,000	0	10,000	68,000	**2,134,455**
San Marcos	Number	0	12	0	2	0	8	3	2	59	0	0	0	2	28	**116**
	Exposure (x$1000)	0	2,299	0	4,000	0	16,000	6,000	200,000	149	0	0	0	4,000	28,000	**260,448**
Santee	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Solana Beach	Number	0	5	0	0	0	1	2	0	28	0	0	0	1	9	**46**
	Exposure (x$1000)	0	958	0	0	0	2,000	4,000	0	47	0	0	0	2,000	9,000	**18,005**
Unincorporated -	Number	30	188	2	31	2	76	1	12	1,145	0	0	4	0	63	**1,554**
Rural	Exposure (x$1000)	6,000,000	36,021	4,000	62,000	20,000	152,000	2,000	1,200,000	3,818	0	0	400,000	0	63,000	**7,942,838**
Unincorporated -	Number	0	39	0	9	0	20	3	6	165	0	1	0	2	45	**290**
Urban Core	Exposure (x$1000)	0	7472.4	0	18000	0	40000	6000	600000	252	0	100000	0	4000	45000	**820,725**
Vista	Number	0	12	0	0	0	9	4	3	53	0	0	0	10	40	**131**
	Exposure (x$1000)	0	2,299	0	0	0	18,000	8,000	300,000	101	0	0	0	20,000	40,000	**388,400**
Total Number		**34**	**540**	**8**	**69**	**7**	**172**	**82**	**52**	**2,167**	**47**	**7**	**5**	**36**	**411**	**3,637**
Total Exposure (x$1000)		**6,800,000**	**103,464**	**16,000**	**138,000**	**70,000**	**344,000**	**164,000**	**5,200,000**	**5,681**	**940,000**	**700,000**	**500,000**	**72,000**	**411,000**	**15,464,145**

4.4.2.5 Flood

Digitized 100-year and 500-year flood maps with base flood elevation (BFE) from the FEMA FIRM program for most of the areas were utilized for this project. Census blocks with non-zero population and non-zero dollar exposure that intersect with these polygons were used in the analysis. For the areas that did not include BFE information, a base flood elevation was estimated for the final purpose of computing the flood depth at different locations of the region as follows:

- Transect lines across the flood polygon (perpendicular to the flow direction) were created using an approximation method for Zone A flood polygons. Zone A is the FEMA FIRM Zone that is defined as the 100-year base flood.
- A point file was extracted from the line (Begin node, End node and center point). The Zonal operation in the GIS tool Spatial Analyst (with the point file and a digital elevation model [DEM]) was used to estimate the ground elevation in the intersection of the line with the flood polygon borders. The average value of the End and Begin point of the line was calculated. This value was assumed as the base flood elevation for each transect.

A surface model (triangulated irregular network, or TIN) was derived from the original transect with the derived BFE value and the flood polygon. This TIN file approximated a continuous and variable flood elevation along the flood polygon. A grid file was then derived from the TIN file with the same extent and pixel resolution of the DEM (30-meter resolution). The difference of the flood elevation grid file and the DEM was calculated to produce an approximate flood depth for the whole study area. HAZUS-MH based damage functions, in a raster format, were created for each of the occupancies present in the census blocks. A customized Visual Basic (VBA) script was written to assign the ratio of damage expected (function of computed flood depth) for each type of occupancy based on the HAZUS-MH damage functions. HAZUS-MH exposure values ($) in raster format were created using Spatial Analyst. Since not all areas in the census blocks are completely within the flood area, the exposure at risk was weighted and estimated accordingly based on the number of pixels in flood area. Losses were then estimated through multiplication of damage ratio with the exposure at risk for each block. Losses were then approximated based on 100- and 500-year losses (high and low hazards).

Table 4.4-13 provides a breakdown of potential exposure and losses by jurisdiction for 100-year flood, and Table 4.4-14 provides a breakdown of infrastructure and critical facility losses for 100-year flood by jurisdiction. Table 4.4-15 provides a breakdown of potential exposure and losses by jurisdiction from 500-year flood, and Table 4.4-16 provides a breakdown of potential infrastructure and critical facility losses by jurisdiction. The loss tables also provide a breakdown of loss ratios for commercial and residential properties by jurisdiction. These loss ratios are determined by dividing the loss values by the exposure values for each jurisdiction, and give a perspective of the potential losses for each jurisdiction for this hazard. For example, a loss ratio value of 0.4 in El Cajon would mean that 40% of the exposed buildings in El Cajon would be lost due to a 100- or 500-year flood.

Approximately 134,000 people may be at risk from the 100-year flood hazard. In addition, special populations at risk that may be impacted by the 100-year flood hazard in San Diego County include 8,424 low-income households and 15,144 elderly persons. Approximately 215,000 people are at risk from the 500-year flood hazard. In addition, special populations at risk that may be impacted by the 500-year flood hazard in San Diego County include 13,689 low-income households and 24,316 elderly persons.

4.4.2.5.1 Participation in the National Flood Insurance Program

Most jurisdictions within San Diego County participate in the National Flood Insurance program. Specific details for each participating jurisdiction are listed below.

City of Carlsbad

The City of Carlsbad has participated in the National Flood Insurance Program since 1974. Participation in the NFIP allows FEMA to authorize the sale of flood insurance (up to program limits) for businesses and residents within the appropriate flood risk zones. FEMA provides Flood Insurance Rate Maps (FIRM) delineating base flood elevations and flood risk zones and provides requirements to be adopted by the City. Their maps were updated in 2012.

City of Chula Vista

The City of Chula Vista participates in the National Flood Insurance Program, allowing FEMA to authorize the sale of flood insurance (up to program limits) for businesses and residents within the appropriate flood risk zones. FEMA provides Flood Insurance Rate Maps delineating base flood elevations and flood risk zones and provides requirements to be adopted by the City. The Chula Vista Municipal Code has been amended to include the language required by FEMA.

City of Coronado

The City of Coronado participates in the National Flood Insurance Program, allowing FEMA to authorize the sale of flood insurance (up to program limits) for businesses and residents within the appropriate flood risk zones. FEMA provides Flood Insurance Rate Maps (FIRM) delineating base flood elevations and flood risk zones and provides requirements to be adopted by the City.

City of Del Mar

The City of Del Mar participates in the National Flood Insurance Program, allowing FEMA to authorize the sale of flood insurance (up to program limits) for businesses and residents within the appropriate flood risk zones. FEMA provides Flood Insurance Rate Maps (FIRM) identifying base flood elevations and flood risk zones and provides requirements. All FEMA requirements have been adopted by the City.

City of El Cajon

The City of El Cajon is a participant in FEMA's National Flood Insurance Program (NFIP). This program provides flood insurance for structures located within the floodplain areas in the City and as designated by FEMA. The City of El Cajon manages the permitting of any proposed developments and improvements within the floodplain areas per the FEMA guidelines and requirements and keeps up to date copies of the Flood Insurance Rate Maps (FIRM). These maps are used to assist constituents in answering their questions regarding the 100-year flood elevations and boundaries within the floodplain areas.

City of Encinitas

Encinitas participates in the National Flood Insurance Program (NFIP) and is required to adopt and enforce floodplain ordinances that meet FEMA's requirements. In return the NFIP makes federally backed flood insurance available in areas that are prone to flooding (have at least 1% chance of flooding annually). Without Federally backed insurance for flooding, homeowners either can't find flood insurance or the rate is very high. The NFIP is a Federal program administered by FEMA that provides flood insurance, floodplain management, and flood hazard mapping. The City of Encinitas Engineering Department manages the permitting of any proposed developments and improvements within the floodplain areas per the FEMA guidelines and requirements and keeps up to date copies of the Flood Insurance Rate Maps (FIRM). These maps are used to address questions regarding the 100-year flood elevations and boundaries within the floodplain areas. Encinitas received updated maps last year. Any proposed changes to these maps are processed by the City through FEMA. The Floodplain Management Regulations in Chapter 23.40 of the Encinitas Municipal Code meet or exceed FEMA guidelines and requirements.

City of Escondido

The City of Escondido does not participate in the National Flood Insurance Program (NFIP). As part of their property insurance policy the City does purchase flood coverage. The City has a $30,000,000 limit with a deductible of either $250,000 or $100,000 depending upon the specific flood zone.

City of Imperial Beach

The City of Imperial Beach participates in the NFIP. The staff member with the key role in the program is the Floodplain Administrator. The Administrator determines if a proposed structure would be situated within an area of special flood hazard (usually a 100-year floodplain or floodway) as shown on the FEMA Flood Insurance Rate Map (FIRM). They are usually along the oceanfront, bay-front, or river valley. It is rare if the City receives a building permit application to build within a floodplain. When that occurs, the Administrator requires the finish floor elevation to be above the base flood elevation. In addition there would be a requirement for the applicant's engineer to submit a hydrology study that would show the proposed structure would not raise the base flood elevation. The requirements in the City of Imperial beach follow the rules, regulations and guidelines of the National Flood Insurance Program.

City of La Mesa

The City of La Mesa is a participant in FEMA's National Flood Insurance Program (NFIP). This program provides flood insurance for structures located within the floodplain areas in the City and as designated by FEMA. The City of La Mesa manages the permitting of any proposed developments and improvements within the floodplain areas per the FEMA guidelines and requirements and keeps up to date copies of the Flood Insurance Rate Maps (FIRM). These maps are used to assist constituents in answering their questions regarding the 100-year flood elevations and boundaries within the floodplain areas.

City of Lemon Grove

The City of Lemon Grove is a participant in FEMA's National Flood Insurance Program (NFIP). This program provides flood insurance for structures located within the floodplain areas in the City and as designated by FEMA. The City of Lemon Grove manages the permitting of any proposed developments and improvements within the floodplain areas per the FEMA guidelines and requirements and keeps up to date copies of the Flood Insurance Rate Maps (FIRM). These maps are used to assist constituents in answering their questions regarding the 100-year flood elevations and boundaries within the floodplain areas.

City of National City

The City of National City is a participant in FEMA's National Flood Insurance Program (NFIP). This program provides flood insurance for structures located within the floodplain areas in the city and as designated by FEMA. The City of National City manages the permitting of any proposed developments and improvements within the floodplain areas per the FEMA guidelines and requirements, State of

California Department of Water Resources Model Floodplain. Management Ordinance and the City of National City Floodplain Ordinance, and keeps up to date copies of the Flood Insurance Rate Maps (FIRM). These maps are used to assist constituents in answering their questions regarding the 100-year flood elevations and boundaries within the floodplain areas. Any proposed changes to these maps are processed by the City through FEMA.

City of Oceanside

The City of Oceanside participates in FEMA's National Flood Insurance Program. The program is monitored through our City Engineering Department which manages the permitting of developments and improvements in the floodplain areas. These areas are identified by Flood Maps that are updated by FEMA. The City has been part of this program since 1991 with our last assessment in 1996.

City of Poway

The City of Poway participates in the National Flood insurance Program (NFIP). Participation in the NFIP is required to provide our citizens with Federally-subsidized flood insurance. The City's responsibility, as a NFIP participant, is to adopt a floodplain ordinance regulate development in the 100 year floodplain. Any development in the floodplain requires a Floodplain Development permit issued by the City. They estimate there are over 900 residential structures located in the 100-year floodplain. The City of Poway also participates in the Community Rating System (CRS) program which provides our citizens with a 10% reduction in their flood insurance premiums. The amount of reduction is based on our floodplain management activities that are over and above the minimum required by FEMA.

City of San Diego

The City of San Diego is a participant in FEMA's National Flood Insurance Program (NFIP). This program provides flood insurance for structures located within the floodplain areas in the city and as designated by FEMA. The City of San Diego manages the permitting of any proposed developments and improvements within the floodplain areas per the FEMA guidelines and requirements and keeps up to date copies of the Flood Insurance Rate Maps (FIRM). These maps are used to assist constituents in answering their questions regarding the 100-year flood elevations and boundaries within the floodplain areas. Any proposed changes to these maps are processed by the City through FEMA.

City of San Marcos

The City of San Marcos is a participant in FEMA's National Flood Insurance Program (NFIP). This program provides flood insurance for structures located within the floodplain areas in the city and as designated by FEMA. The City of San Marcos has adopted a floodplain management ordinance in accordance with the FEMA's rules and regulations. The City manages the permitting of any proposed developments and improvements within the floodplain areas per the guidelines and requirements provided in said ordinance and keeps up to date copies of the Flood Insurance Rate Maps (FIRM). These maps are used to assist constituents in answering their questions regarding the 100-year flood elevations and boundaries within the floodplain areas. Any proposed changes to these maps are processed by the City through FEMA.

City of Santee

The City of Santee is a participant in FEMA's National Flood Insurance Program (NFIP). This program provides flood insurance for structures located within the floodplain areas in the city and as designated by

FEMA. The City of Santee manages the permitting of any proposed developments and improvements within the floodplain areas per the City's Flood Damage Prevention Ordinance that meets or exceeds FEMA guidelines and requirements. The City of Santee keeps up to date copies of the Flood Insurance Rate Maps (FIRM) that are used to assist constituents in answering their questions regarding the 100-year flood elevations and boundaries within the floodplain areas. Any proposed changes to these maps are processed by the City through FEMA.

City of Solana Beach
The City of Solana Beach is a participant in FEMA's National Flood Insurance Program (NFIP). This program provides flood insurance for structures located within the floodplain areas in the city and as designated by FEMA. The City also has a Municipal Code (Chapter 17.80; FLOOD DAMAGE PREVENTION OVERLAY ZONE). This ordinance references the Federal Flood Insurance Rate Maps. The City of Solana Beach is currently working with FEMA to ensure their program remains current.

City of Vista
The City of Vista is a participant in FEMA's National Flood Insurance Program (NFIP). This program provides flood insurance for structures located within the floodplain areas in the city and as designated by FEMA. The City of Vista manages the permitting of any proposed developments and improvements within the floodplain areas per the City's Flood Damage Prevention Ordinance that meets or exceeds FEMA guidelines and requirements. The City of Vista keeps up to date copies of the Flood Insurance Rate Maps (FIRM) that are used to assist constituents in answering their questions regarding the 100-year flood elevations and boundaries within the floodplain areas. Any proposed changes to these maps are processed by the City through FEMA.

County of San Diego
The County of San Diego participates in the National Flood Insurance Program (NFIP) managed by the Federal Emergency Management Agency (FEMA). To qualify for flood insurance, new construction and substantial improvement to structures located in the Special Flood Hazard Area (SFHA) within the County must meet minimum standards established by the NFIP. Additionally, FEMA’s Community Rating System (CRS) program enables communities to earn credits for tasks and activities above and beyond minimum NFIP standards. The County has been a participating member under the CRS since September 2007, and has twice successfully reduced insurance premiums in San Diego by five percent. To ensure that the County’s Flood Damage Prevention Ordinance reflects the most current standards set forth by the NFIP and to implement higher regulations for development of new or substantially improved structures located within the SFHA, the County’s DPW Flood Control Engineering Group has begun the process of updating the Flood Damage Prevention Ordinance.

Fire Protection Districts and Municipal Water Districts
Special districts do not directly participate in the National Flood Insurance Program. Residents of the Fire protection Districts or Water Agencies participate in the NFIP through the process set up by the jurisdiction (City or County) they reside in.

Table 4.4-13
Potential Exposure and Losses from 100-Year Flood Hazard by Jurisdiction

		Residential Buildings at Risk		Commercial Buildings at Risk	
Jurisdiction	**Exposed Population**	**Building Count**	**Potential Exposure (x$1000)**	**Building Count**	**Potential Exposure (x$1000)**
Carlsbad	6,906	3,045	$857,168	102	$457,133
Chula Vista	5,947	2,395	$674,193	153	$685,700
Coronado	2,853	1,227	$345,401	30	$134,451
Del Mar	813	435	$122,453	42	$188,231
El Cajon	1,870	657	$184,946	36	$161,341
Encinitas	653	234	$65,871	22	$98,597
Escondido	8,367	2,599	$731,619	101	$452,652
Imperial Beach	1,206	408	$114,852	14	$62,744
La Mesa	0	0	$0	0	$0
Lemon Grove	105	34	$9,571	2	$8,963
National City	2,854	893	$251,380	118	$528,841
Oceanside	19,007	6,715	$1,890,273	217	$972,529
Poway	2,518	814	$229,141	47	$210,640
San Diego (City	36,042	12,191	$3,431,767	523	$2,343,929
San Marcos	2,377	794	$223,511	70	$313,719
Santee	1,873	572	$161,018	46	$206,158
Solana Beach	1,124	574	$161,581	13	$58,262
Unincorporated - Rural	7,276	3,661	$1,030,572	137	$613,993
Unincorporated - Urban Core	10,125	3,358	$945,277	195	$873,932
Vista	1,988	635	$178,753	94	$421,280
Total	**113,904**	**41,241**	**$11,609,342**	**1,962**	**$8,793,095**

Table 4.4-14
Potential Exposure to Critical Facilities and Infrastructure
from 100-Year Flood Hazard by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	WWTR	RAIL	SCH	Total
Carlsbad	Number	0	6	0	0	0	0	0	0	20	0	0	0	0	1	**27**
	Exposure (x$1000)	0	1,150	0	0	0	0	0	0	20	0	0	0	0	1,000	**2,169**
Chula Vista	Number	0	12	0	0	0	1	1	1	13	0	0	0	0	1	**29**
	Exposure (x$1000)	0	2,299	0	0	0	2,000	2,000	100,000	25	0	0	0	0	1,000	**107,324**
Coronado	Number	0	1	0	0	0	0	1	0	2	0	0	0	0	0	**4**
	Exposure (x$1000)	0	192	0	0	0	0	2,000	0	7	0	0	0	0	0	**2,198**
Del Mar	Number	0	3	0	0	0	0	0	0	4	0	0	0	0	0	**7**
	Exposure (x$1000)	0	575	0	0	0	0	0	0	3	0	0	0	0	0	**578**
El Cajon	Number	0	2	0	0	0	0	0	0	3	0	0	0	0	5	**10**
	Exposure (x$1000)	0	383	0	0	0	0	0	0	4	0	0	0	0	5,000	**5,387**
Encinitas	Number	0	4	0	0	0	0	0	0	5	0	1	0	0	0	**10**
	Exposure (x$1000)	0	766	0	0	0	0	0	0	4	0	100,000	0	0	0	**100,771**
Escondido	Number	0	4	0	0	0	0	0	0	6	0	0	0	0	5	**15**
	Exposure (x$1000)	0	766	0	0	0	0	0	0	15	0	0	0	0	5,000	**5,781**
Imperial Beach	Number	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**1**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
La Mesa	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lemon Grove	Number	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**1**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	3	0	0	0	0	0	**3**
National City	Number	0	8	0	0	0	0	1	0	9	1	0	0	0	1	**20**
	Exposure (x$1000)	0	1,533	0	0	0	0	2,000	0	24	20,000	0	0	0	1,000	**24,557**
Oceanside	Number	1	17	0	1	0	2	3	0	28	0	0	0	0	5	**57**
	Exposure (x$1000)	200,000	3,257	0	2,000	0	4,000	6,000	0	53	0	0	0	0	5,000	**220,310**
Poway	Number	0	7	0	0	0	1	0	0	1	0	0	0	0	0	**9**
	Exposure (x$1000)	0	1,341	0	0	0	2,000	0	0	2	0	0	0	0	0	**3,343**
San Diego (City)	Number	0	74	1	3	0	0	2	1	66	49	0	0	1	3	**200**
	Exposure (x$1000)	0	14,178	2,000	6,000	0	0	4,000	100,000	99	980,000	0	0	2,000	3,000	**1,111,278**
San Marcos	Number	0	3	0	0	0	0	0	2	6	0	0	0	0	2	**13**
	Exposure (x$1000)	0	575	0	0	0	0	0	200,000	14	0	0	0	0	2,000	**202,589**
Santee	Number	0	9	0	0	0	0	0	0	3	0	0	0	0	0	**12**
	Exposure (x$1000)	0	1,724	0	0	0	0	0	0	1	0	0	0	0	0	**1,726**
Solana Beach	Number	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**1**
	Exposure (x$1000)	0	192	0	0	0	0	0	0	0	0	0	0	0	0	**192**
Unincorporated Rural	Number	3	36	0	1	0	4	0	0	51	0	0	0	0	12	**107**
	Exposure (x$1000)	600,000	6,898	0	2,000	0	8,000	0	0	175	0	0	0	0	12,000	**629,073**
Unincorporated Urban Core	Number	0	14	0	0	0	1	1	0	18	0	0	0	0	0	**34**
	Exposure (x$1000)	0	2,682	0	0	0	2,000	2,000	0	50	0	0	0	0	0	**6,733**
Vista	Number	0	0	0	0	0	1	1	0	2	0	0	0	1	0	**5**
	Exposure (x$1000)	0	0	0	0	0	2,000	2,000	0	5	0	0	0	2,000	0	**6,005**
Total Number		**4**	**201**	**1**	**5**	**0**	**10**	**10**	**4**	**239**	**50**	**1**	**0**	**2**	**35**	**562**
Total Exposure (x$1000)		**800,000**	**38,512**	**2,000**	**10,000**	**0**	**20,000**	**20,000**	**400,000**	**504**	**1,000,000**	**100,000**	**0**	**4,000**	**35,000**	**2,430,016**

Refer to Table 4.4-1 for abbreviation definition

Table 4.4-15
Potential Exposure and Losses from 500-Year Flood Hazard by Jurisdiction

		Residential Buildings at Risk		Commercial Buildings at Risk	
Jurisdiction	**Exposed Population**	**Building Count**	**Potential Exposure (x$1000)**	**Building Count**	**Potential Exposure (x$1000)**
Carlsbad	6,996	3,086	$868,709	104	$466,097
Chula Vista	25,564	9,180	$2,584,170	405	$1,815,089
Coronado	3,868	1,715	$482,773	46	$206,158
Del Mar	1,062	567	$159,611	47	$210,640
El Cajon	17,608	6,457	$1,817,646	278	$1,245,913
Encinitas	678	243	$68,405	23	$103,079
Escondido	32,516	9,994	$2,813,311	336	$1,505,851
Imperial Beach	3,408	1,178	$331,607	35	$156,860
La Mesa	0	0	$0	0	$0
Lemon Grove	131	41	$11,542	2	$8,963
National City	8,584	2,735	$769,903	259	$1,160,760
Oceanside	37,323	12,878	$3,625,157	368	$1,649,266
Poway	4,690	1,540	$433,510	79	$354,054
San Diego (City	85,289	28,438	$8,005,297	1,126	$5,046,394
San Marcos	2,609	875	$246,313	77	$345,091
Santee	2,994	967	$272,211	60	$268,902
Solana Beach	1,250	648	$182,412	16	$71,707
Unincorporated - Rural	8,950	4,426	$1,245,919	151	$676,737
Unincorporated - Urban Core	11,357	3,785	$1,065,478	213	$954,602
Vista	4,639	1,553	$437,170	144	$645,365
Total	**259,516**	**90,306**	**$25,421,139**	**3,769**	**$16,891,527**

Table 4.4-16
Potential Exposure to Critical Facilities and Infrastructure from 500-Year Flood Hazard by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	WWTR	RAIL	SCH	Total
Carlsbad	Number	0	6	0	0	0	0	0	0	20	0	0	0	0	1	**27**
	Exposure (x$1000)	0	1,150	0	0	0	0	0	0	20	0	0	0	0	1,000	**2,169**
Chula Vista	Number	0	18	0	0	1	1	1	1	30	1	0	0	0	3	**56**
	Exposure (x$1000)	0	3,449	0	0	10,000	2,000	2,000	100,000	48	20,000	0	0	0	3,000	**140,497**
Coronado	Number	0	1	0	0	0	0	1	0	2	0	0	0	0	0	**4**
	Exposure (x$1000)	0	192	0	0	0	0	2,000	0	7	0	0	0	0	0	**2,198**
Del Mar	Number	0	3	0	0	0	1	0	0	4	0	0	0	0	0	**8**
	Exposure (x$1000)	0	575	0	0	0	2,000	0	0	4	0	0	0	0	0	**2,578**
El Cajon	Number	0	13	1	0	1	2	3	3	9	0	0	0	0	8	**40**
	Exposure (x$1000)	0	2,491	2,000	0	10,000	4,000	6,000	300,000	19	0	0	0	0	8,000	**332,510**
Encinitas	Number	0	4	0	0	0	0	0	0	6	0	1	0	0	0	**11**
	Exposure (x$1000)	0	766	0	0	0	0	0	0	5	0	100,000	0	0	0	**100,771**
Escondido	Number	0	20	0	0	0	2	5	2	14	0	0	0	0	11	**54**
	Exposure (x$1000)	0	3,832	0	0	0	4,000	10,000	200,000	31	0	0	0	0	11,000	**228,863**
Imperial Beach	Number	0	0	0	0	0	0	0	0	2	0	0	0	0	0	**2**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**1**
La Mesa	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lemon Grove	Number	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**1**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	4	0	0	0	0	0	**4**
National City	Number	0	12	0	0	0	1	2	0	11	1	0	0	0	2	**29**
	Exposure (x$1000)	0	2,299	0	0	0	2,000	4,000	0	27	20,000	0	0	0	2,000	**30,327**
Oceanside	Number	1	21	0	2	0	4	4	1	37	0	0	0	1	6	**77**
	Exposure (x$1000)	200,000	4,024	0	4,000	0	8,000	8,000	100,000	77	0	0	0	2,000	6,000	**332,100**
Poway	Number	0	8	0	0	0	1	0	0	1	0	0	0	0	1	**11**
	Exposure (x$1000)	0	1,533	0	0	0	2,000	0	0	3	0	0	0	0	1,000	**4,535**
San Diego (City)	Number	0	119	2	3	0	2	8	3	122	49	1	0	1	5	**315**
	Exposure (x$1000)	0	22,800	4,000	6,000	0	4,000	16,000	300,000	229	980,000	100,000	0	2,000	5,000	**1,440,030**
San Marcos	Number	0	4	0	0	0	0	0	2	6	0	0	0	0	2	**14**
	Exposure (x$1000)	0	766	0	0	0	0	0	200,000	14	0	0	0	0	2,000	**202,781**
Santee	Number	0	9	0	2	0	0	1	0	5	0	0	0	0	0	**17**
	Exposure (x$1000)	0	1,724	0	4,000	0	0	2,000	0	4	0	0	0	0	0	**7,729**
Solana Beach	Number	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**1**
	Exposure (x$1000)	0	192	0	0	0	0	0	0	0	0	0	0	0	0	**192**
Unincorporated Rural	Number	3	39	0	1	0	4	1	0	56	0	0	0	0	13	**117**
	Exposure (x$1000)	600,000	7,472	0	2,000	0	8,000	2,000	0	193	0	0	0	0	13,000	**632,665**
Unincorporated Urban Core	Number	0	15	0	0	0	1	1	0	20	0	0	0	0	1	**38**
	Exposure (x$1000)	0	2,874	0	0	0	2,000	2,000	0	58	0	0	0	0	1,000	**7,932**
Vista	Number	0	1	0	0	0	2	2	0	4	0	0	0	1	4	**14**
	Exposure (x$1000)	0	192	0	0	0	4,000	4,000	0	10	0	0	0	2,000	4,000	**14,202**
Total Number		**4**	**294**	**3**	**8**	**2**	**21**	**29**	**12**	**349**	**51**	**2**	**0**	**3**	**57**	**835**
Total Exposure (x$1000)		**800,000**	**56,330**	**6,000**	**16,000**	**20,000**	**42,000**	**58,000**	**1,200,000**	**753**	**1,020,000**	**200,000**	**0**	**6,000**	**57,000**	**3,482,083**

Refer to Table 4.4-1 for abbreviation definition

4.4.2.6 Rain-Induced Landslide

Steep slope and soils data from SANDAG, as well as data from the State of California, U.S. Geological Survey and HAZUS for all of San Diego County were combined and modeled to determine areas susceptible to rain-induced landslides. Soils that are prone to movement were determined from the database, and combined with areas that have greater than 25% slope, which are prone to sliding. The combination of these two factors gives a general idea of landslide susceptibility. Localized hard copy maps developed by Tan were also reviewed. The TAN landslide susceptibility modeling takes into account more information, such as past landslides, landslide-prone formations, and steep slope. The identified vulnerable assets were superimposed on top of this information, resulting in three risk/exposure estimates: 1) the aggregated exposure and building count (both dollar exposure and population) at the census block level for residential and commercial occupancies, 2) the aggregated population at risk at the census block level, and 3) the critical infrastructure at risk (schools, hospitals, airports, bridges, and other facilities of critical nature). These results were then aggregated and presented by hazard risk level per jurisdiction.

Table 4.4-17 provides a breakdown of potential exposure for high-risk rain-induced landslide hazard by jurisdiction, and Table 4.4-18 provides a breakdown of infrastructure and critical facility exposure for high risk. Table 4.4-19 provides a breakdown of potential exposure for moderate risk rain-induced landslide by jurisdiction, and Table 4.4-20 provides a breakdown of potential infrastructure and critical facility exposure for moderate risk. Approximately 505,000 people may be at risk from the rain-induced landslide hazard. In addition, special populations at risk that may be impacted by the rain-induced landslide hazard in San Diego County include 22,346 low-income households and 57,564 elderly persons.

Table 4.4-17
Potential Exposure from Rain-Induced Landslide Hazard (High Risk) by Jurisdiction

		Residential Buildings at Risk		Commercial Buildings at Risk	
Jurisdiction	**Exposed Population**	**Building Count**	**Potential Exposure (x$1000)**	**Building Count**	**Potential Exposure (x$1000)**
Carlsbad	455	204	$57,426	2	$8,963
Chula Vista	0	0	$0	0	$0
Coronado	0	0	$0	0	$0
Del Mar	0	0	$0	0	$0
El Cajon	35	22	$6,193	0	$0
Encinitas	24	7	$1,971	0	$0
Escondido	751	295	$83,043	2	$8,963
Imperial Beach	0	0	$0	0	$0
La Mesa	0	0	$0	0	$0
Lemon Grove	2	0	$0	0	$0
National City	0	0	$0	0	$0
Oceanside	0	0	$0	0	$0
Poway	2	0	$0	0	$0
San Diego (City)	137,095	48,049	$13,525,794	1,072	$4,804,382
San Marcos	1,441	457	$128,646	4	$17,927
Santee	35	12	$3,378	0	$0
Solana Beach	0	0	$0	0	$0
Unincorporated - Rural	9,130	3,573	$1,005,800	93	$416,798
Unincorporated - Urban Core	1,509	314	$88,391	4	$17,927
Vista	92	32	$9,008	1	$4,482
Total	**150,571**	**52,965**	**$14,909,648**	**1,178**	**$5,279,443**

Table 4.4-18

Potential Exposure to Critical Facilities and Infrastructure from Rain-Induced Landslide Hazard (High Risk) by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	WWTR	RAIL	SCH	Total
Carlsbad	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Chula Vista	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Coronado	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Del Mar	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
El Cajon	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Encinitas	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Escondido	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Imperial Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
La Mesa	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lemon Grove	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
National City	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Oceanside	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Poway	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
San Diego (City)	Number	0	17	0	10	0	6	4	0	93	0	0	0	0	22	**152**
	Exposure (x$1000)	0	3,257	0	20,000	0	12,000	8,000	0	221	0	0	0	0	22,000	**65,478**
San Marcos	Number	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**1**
	Exposure (x$1000)	0	0	0	0	0	2,000	0	0	0	0	0	0	0	0	**2,000**
Santee	Number	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**1**
	Exposure (x$1000)	0	0	0	2,000	0	0	0	0	0	0	0	0	0	0	**2,000**
Solana Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated	Number	0	3	0	2	0	3	1	0	26	0	0	0	0	0	**35**
Rural	Exposure (x$1000)	0	575	0	4,000	0	6,000	2,000	0	82	0	0	0	0	0	**12,657**
Unincorporated	Number	0	0	0	0	0	0	0	0	2	0	0	0	0	8	**10**
Urban Core	Exposure (x$1000)	0	0	0	0	0	0	0	0	3	0	0	0	0	8,000	**8,003**
Vista	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total Number		**0**	**20**	**0**	**13**	**0**	**10**	**5**	**0**	**121**	**0**	**0**	**0**	**0**	**30**	**199**
Total Exposure (x$1000)		**0**	**3,832**	**0**	**26,000**	**0**	**20,000**	**10,000**	**0**	**306**	**0**	**0**	**0**	**0**	**30,000**	**90,138**

Refer to Table 4.4-1 for abbreviation definition

Table 4.4-19
Potential Exposure to Rain-Induced Landslide Hazard (Moderate Risk) by Jurisdiction

		Residential Buildings at Risk		Commercial Buildings at Risk	
Jurisdiction	**Exposed Population**	**Building Count**	**Potential Exposure (x$1000)**	**Building Count**	**Potential Exposure (x$1000)**
Carlsbad	57	30	$8,445	0	$0
Chula Vista	2	1	$282	1	$4,482
Coronado	0	0	$0	0	$0
Del Mar	0	0	$0	0	$0
El Cajon	39	13	$3,660	1	$4,482
Encinitas	6	1	$282	0	$0
Escondido	171	71	$19,987	2	$8,963
Imperial Beach	0	0	$0	0	$0
La Mesa	0	0	$0	0	$0
Lemon Grove	0	0	$0	0	$0
National City	7	2	$563	0	$0
Oceanside	0	0	$0	0	$0
Poway	0	0	$0	0	$0
San Diego (City)	10	3	$845	0	$0
San Marcos	970	286	$80,509	0	$0
Santee	0	0	$0	0	$0
Solana Beach	0	0	$0	0	$0
Unincorporated - Rural	23,197	4,188	$1,178,922	89	$398,871
Unincorporated - Urban Core	35,499	11,039	$3,107,479	389	$1,743,381
Vista	11	2	$563	0	$0
Total	**59,969**	**15,636**	**$4,401,534**	**482**	**$2,160,179**

Table 4.4-20
Potential Exposure to Critical Facilities and Infrastructure from Rain-Induced Landslide Hazard (Moderate Risk) by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	WWTR	RAIL	SCH	Total
Carlsbad	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Chula Vista	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Coronado	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Del Mar	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
El Cajon	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Encinitas	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Escondido	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Imperial Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
La Mesa	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lemon Grove	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
National City	Number	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**1**
	Exposure (x$1000)	0	192	0	0	0	0	0	0	0	0	0	0	0	0	**192**
Oceanside	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Poway	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
San Diego (City)	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
San Marcos	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Santee	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Solana Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated Rural	Number	1	20	0	0	0	3	0	0	39	0	0	0	0	4	**67**
	Exposure (x$1000)	200,000	3,832	0	0	0	6,000	0	0	108	0	0	0	0	4,000	**213,940**
Unincorporated Urban Core	Number	0	29	0	0	0	8	2	1	36	0	0	0	2	12	**90**
	Exposure (x$1000)	0	5,556	0	0	0	16,000	4,000	100,000	71	0	0	0	4,000	12,000	**141,628**
Vista	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total Number		**1**	**50**	**0**	**0**	**0**	**11**	**2**	**1**	**75**	**0**	**0**	**0**	**2**	**16**	**158**
Total Exposure (x$1000)		**200,000**	**9,580**	**0**	**0**	**0**	**22,000**	**4,000**	**100,000**	**179**	**0**	**0**	**0**	**4,000**	**16,000**	**355,759**

4.4.2.7 Wildfire/Structure Fire

Wildfire loss estimates were determined using the USGS LANDFIRE model because data for the CDF-FRAP model was being revised and would not be available for this revision. The LANDFIRE model provides five different Fire Regimes. In the model, fire threat is a combination of factors including; 1) historical fire regime and fire regime condition class, 2) existing vegetation, and 3) topography. These factors were combined to create five fire regime classes ranging from little or no threat to extreme. The regime classes are:

Fire Regime I -	0-35 year frequency and low to mixed severity
Fire Regime II -	0-35 year frequency and high severity
Fire regime III -	35-100+ year frequency and mixed severity
Fire Regime IV -	35-100 + year frequency and high severity
Fire Regime V -	200+ year frequency and high severity

The model uses spatial data in the ARC Grid format which includes existing vegetation types, historical vegetation data, and fire behavior fuel models. It also incorporates natural and human-caused changes. Fuel is considered to be any material that can burn and is further defined as live and dead biomass. Fuel loading is the dry weight of a fuel component per unit area, typically kilogram per square meter. Other factors such as surface-to-volume ratio, packing ratio and heat content are also considered[42].

LANDFIRE uses the Fuel Characterization Classification System (FCCS) developed by Sandberg and others (2001) which summarizes fuel loading using canopy, shrub, surface and ground fuel stratifications. It also uses a fuel loading model developed specifically for LANDFIRE. This uses a broad classification of fuel beds based on fuel loading that accounts for variability of loading within fuel components[43].

Wildfire can create a multi-hazard effect, where areas that are burned by wildfire suddenly have greater flooding risks because the vegetation that prevented erosion is now gone. Watershed from streams and rivers will change and floodplain mapping may need to be updated. Also, air quality issues during a large-scale fire would cause further economic losses than only the structural losses described below. Road closures and business closures due to large-scale fires would also increase the economic losses shown below. Areas burned during the 2007 firestorm that are susceptible to flooding or debris flow as a result of a significant rain event have been mapped and these maps have been provided to the appropriate jurisdictions.

Tables 4.4-21 and 4.4-22 provide a breakdown of potential exposure to Fire Regimes II and IV. These two regimes provide the greatest risk to the San Diego region.

[42] Keane, Robert F., Tracey Frescino, Matthew C. Reeves, and Jennifer L. Long, Mapping Wildland Fuel Across Large Regions for the LANDFIRE prototype Project, USDA Forest Service Gen. Tech. Rep. RMRS-GTR-175. 2006

[43] Ibid.

Table 4.4-21 Potential Exposure from Extreme Wildfire Hazard by Jurisdiction

FIRE REGIME GROUPS II AND IV - POPULATION

Jurisdiction	Exposed Population	Residential Buildings at Risk		Commercial Buildings at Risk		TOTAL Buildings at Risk
		Building Count	Exposure (x$1,000)	Square Footage	Exposure (x$1,000)	Exposure (x$1,000)
Carlsbad	99,892	43,157	12,148,696	29,541	10,339,342	22,488,038
Chula Vista	227,269	72,446	20,393,549	24,923	8,722,910	29,116,459
Coronado	22,740	9,263	2,607,535	3,372	1,180,036	3,787,571
Del Mar	3,791	2,288	644,072	2,055	719,363	1,363,435
El Cajon	96,248	32,872	9,253,468	18,121	6,342,347	15,595,815
Encinitas	57,529	23,980	6,750,370	15,107	5,287,475	12,037,845
Escondido	134,425	43,388	12,213,722	20,384	7,134,378	19,348,100
Imperial Beach	25,831	9,466	2,664,679	1,477	517,032	3,181,711
La Mesa	56,037	24,608	6,927,152	10,150	3,552,605	10,479,757
Lemon Grove	25,538	8,689	2,445,954	2,777	971,934	3,417,887
National City	57,267	15,144	4,263,036	9,300	3,255,165	7,518,201
Oceanside	157,029	60,356	16,990,214	17,827	6,239,477	23,229,691
Poway	43,624	15,054	4,237,701	12,366	4,328,138	8,565,839
San Diego (City)	1,244,722	486,276	136,886,694	262,238	91,783,418	228,670,112
San Marcos	79,610	25,994	7,317,311	14,638	5,123,300	12,440,611
Santee	45,353	16,283	4,583,665	5,307	1,857,498	6,441,162
Solana Beach	12,004	5,986	1,685,059	5,292	1,852,269	3,537,328
Vista	89,520	29,418	8,281,167	18,919	6,621,623	14,902,790
Unincorporated-Rural	88,262	27,785	7,821,478	12,481	4,368,416	12,189,894
Unincorporated-Urban	335,301	111,685	31,439,328	29,983	10,494,099	41,933,427
Padre Dam MWD	83,399	30,088	8,469,772	11,692	4,092,373	12,562,145
Valley Center MWD	22,390	7,410	2,085,915	3,023	1,058,187	3,144,102
Alpine FPD	12,885	4,814	1,355,141	1,355	474,178	1,829,319
Rancho Santa Fe FPD	24,260	10,052	2,829,638	4,463	1,562,217	4,391,855
San Miguel FPD	114,949	39,482	11,114,183	9,036	3,162,580	14,276,763
TOTAL[1]	2,901,990	1,064,138	299,554,847	516,259	180,690,824	480,245,671

[1]Total includes municipalities and unincorporated area only; FPDs and MWDs are excluded from the total to avoid multiple counting of items.

Table 4.4-22
Potential Exposure from Very High Wildfire Hazard by Jurisdiction

		Residential Buildings at Risk		Commercial Buildings at Risk	
Jurisdiction	**Exposed Population**	**Building Count**	**Potential Exposure (x$1000)**	**Building Count**	**Potential Exposure (x$1000)**
Carlsbad	3,219	1,294	$364,261	33	$147,896
Chula Vista	9,048	2,795	$786,793	3	$13,445
Coronado	19	0	$0	0	$0
Del Mar	7	5	$1,408	0	$0
El Cajon	97	36	$10,134	2	$8,963
Encinitas	1,267	424	$119,356	14	$62,744
Escondido	846	328	$92,332	14	$62,744
Imperial Beach	65	0	$0	0	$0
La Mesa	0	0	$0	0	$0
Lemon Grove	188	79	$22,239	1	$4,482
National City	0	0	$0	0	$0
Oceanside	1,402	470	$132,305	7	$31,372
Poway	937	305	$85,858	17	$76,189
San Diego (City)	20,153	6,990	$1,967,685	208	$932,194
San Marcos	2,236	818	$230,267	8	$35,854
Santee	222	89	$25,054	3	$13,445
Solana Beach	76	33	$9,290	1	$4,482
Unincorporated - Rural	47,816	18,209	$5,125,834	658	$2,948,959
Unincorporated - Urban Core	41,461	10,036	$2,825,134	180	$806,706
Vista	654	217	$61,086	7	$31,372
Total	**129,713**	**42,128**	**$11,859,032**	**1,156**	**$5,180,845**

Table 4.4-23
Potential Exposure from High Wildfire Hazard by Jurisdiction

		Residential Buildings at Risk		Commercial Buildings at Risk	
Jurisdiction	**Exposed Population**	**Building Count**	**Potential Exposure (x$1000)**	**Building Count**	**Potential Exposure (x$1000)**
Carlsbad	9,255	4,298	$1,209,887	72	$322,682
Chula Vista	3,840	1,224	$344,556	18	$80,671
Coronado	0	0	$0	0	$0
Del Mar	16	9	$2,534	1	$4,482
El Cajon	118	42	$11,823	3	$13,445
Encinitas	1,159	419	$117,949	18	$80,671
Escondido	1,660	654	$184,101	17	$76,189
Imperial Beach	37	7	$1,971	0	$0
La Mesa	404	177	$49,826	1	$4,482
Lemon Grove	0	0	$0	0	$0
National City	9	2	$563	5	$22,409
Oceanside	2,795	849	$238,994	21	$94,116
Poway	3,069	976	$274,744	55	$246,494
San Diego (City)	30,997	10,710	$3,014,865	280	$1,254,876
San Marcos	11,312	3,578	$1,007,207	30	$134,451
Santee	2,658	938	$264,047	18	$80,671
Solana Beach	50	22	$6,193	1	$4,482
Unincorporated - Rural	8,518	3,197	$899,956	108	$484,024
Unincorporated - Urban Core	8,068	2,504	$704,876	76	$340,609
Vista	792	277	$77,976	12	$53,780
Total	**84,757**	**29,883**	**$8,412,065**	**736**	**$3,298,531**

Table 4.4-24
Potential Exposure from Moderate Wildfire Hazard by Jurisdiction

		Residential Buildings at Risk		Commercial Buildings at Risk	
Jurisdiction	**Exposed Population**	**Building Count**	**Potential Exposure (x$1000)**	**Building Count**	**Potential Exposure (x$1000)**
Carlsbad	76,454	31,464	$8,857,116	1,229	$5,508,009
Chula Vista	169,128	57,512	$16,189,628	1,963	$8,797,577
Coronado	18,868	8,097	$2,279,306	428	$1,918,168
Del Mar	3,332	1,836	$516,834	178	$797,743
El Cajon	97,629	35,464	$9,983,116	1,348	$6,041,332
Encinitas	55,064	21,388	$6,020,722	1,103	$4,943,315
Escondido	134,126	43,671	$12,293,387	1,745	$7,820,567
Imperial Beach	26,346	9,139	$2,572,629	310	$1,389,327
La Mesa	56,195	25,030	$7,045,945	946	$4,239,688
Lemon Grove	25,058	8,606	$2,422,589	361	$1,617,894
National City	55,054	15,749	$4,433,344	881	$3,948,378
Oceanside	161,361	58,273	$16,403,850	1,824	$8,174,621
Poway	43,815	14,007	$3,942,971	610	$2,733,837
San Diego (City)	1,251,231	473,008	$133,151,752	17,500	$78,429,750
San Marcos	60,659	20,218	$5,691,367	735	$3,294,050
Santee	50,473	17,705	$4,983,958	535	$2,397,710
Solana Beach	11,413	5,585	$1,572,178	303	$1,357,955
Unincorporated - Rural	71,028	24,474	$6,889,431	792	$3,549,506
Unincorporated - Urban Core	255,909	86,104	$24,238,276	2,970	$13,310,649
Vista	90,913	28,908	$8,137,602	1,106	$4,956,760
Total	**2,714,056**	**986,238**	**$277,625,997**	**36,867**	**$165,226,834**

Table 4.4-25
Potential Exposure from Wildfire (Moderate, High, Very High, Extreme Combined) Hazard by Jurisdiction

		Residential Buildings at Risk		Commercial Buildings at Risk	
Jurisdiction	**Exposed Population**	**Building Count**	**Potential Exposure (x$1000)**	**Building Count**	**Potential Exposure (x$1000)**
Carlsbad	88,928	37,056	$10,431,264	1,334	$5,978,588
Chula Vista	182,033	61,536	$17,322,384	1,984	$8,891,693
Coronado	18,887	8,097	$2,279,306	428	$1,918,168
Del Mar	3,355	1,850	$520,775	179	$802,224
El Cajon	97,844	35,542	$10,005,073	1,353	$6,063,740
Encinitas	57,495	22,232	$6,258,308	1,135	$5,086,730
Escondido	136,697	44,680	$12,577,420	1,776	$7,959,499
Imperial Beach	26,448	9,146	$2,574,599	310	$1,389,327
La Mesa	56,599	25,207	$7,095,771	947	$4,244,170
Lemon Grove	25,246	8,685	$2,444,828	362	$1,622,375
National City	55,063	15,751	$4,433,907	886	$3,970,786
Oceanside	165,558	59,592	$16,775,148	1,852	$8,300,108
Poway	47,823	15,289	$4,303,854	682	$3,056,519
San Diego (City)	1,302,402	490,708	$138,134,302	17,989	$80,621,301
San Marcos	74,207	24,614	$6,928,841	773	$3,464,354
Santee	53,353	18,732	$5,273,058	556	$2,491,825
Solana Beach	11,539	5,640	$1,587,660	305	$1,366,919
Unincorporated - Rural	140,648	51,134	$14,394,221	1,745	$7,820,567
Unincorporated - Urban Core	307,689	99,272	$27,945,068	3,249	$14,561,043
Vista	92,372	29,407	$8,278,071	1,125	$5,041,913
Total	**2,944,186**	**1,064,170**	**$299,563,855**	**38,970**	**$174,651,849**

Table 4.4-26
Potential Exposure to Critical Facilities and Infrastructures from Extreme Wildfire Hazard by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	WWTR	RAIL	SCH	Total
Carlsbad	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Chula Vista	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Coronado	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Del Mar	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
El Cajon	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Encinitas	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Escondido	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**1**
Imperial Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
La Mesa	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lemon Grove	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
National City	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Oceanside	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Poway	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
San Diego (City)	Number	0	0	0	0	0	0	0	0	5	0	0	0	0	0	**5**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	6	0	0	0	0	0	**6**
San Marcos	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Santee	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Solana Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated Rural	Number	2	22	1	14	0	5	0	0	114	0	0	0	0	2	**160**
	Exposure (x$1000)	400,000	4,215	2,000	28,000	0	10,000	0	0	415	0	0	0	0	2,000	**446,630**
Unincorporated Urban Core	Number	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**1**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	4	0	0	0	0	0	**4**
Vista	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total Number		**2**	**22**	**1**	**14**	**0**	**5**	**0**	**0**	**120**	**0**	**0**	**0**	**0**	**2**	**166**
Total Exposure (x$1000)		**400,000**	**4,215**	**2,000**	**28,000**	**0**	**10,000**	**0**	**0**	**426**	**0**	**0**	**0**	**0**	**2,000**	**446,641**

Refer to Table 4.4-1 for abbreviation definition

Table 4.4-27
Potential Exposure to Critical Facilities and Infrastructures from Very High Wildfire Hazard by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	RAIL	SCH	Total
Carlsbad	Number	0	1	0	0	0	0	1	1	2	0	0	0	2	7
	Exposure (x$1000)	0	192	0	0	0	0	2,000	100,000	3	0	0	0	2,000	104,195
Chula Vista	Number	0	0	0	0	0	0	0	0	3	0	0	0	1	4
	Exposure (x$1000)	0	0	0	0	0	0	0	0	1	0	0	0	1,000	1,001
Coronado	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Del Mar	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
El Cajon	Number	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	Exposure (x$1000)	0	0	0	0	0	0	0	0	3	0	0	0	0	3
Encinitas	Number	0	1	0	0	0	0	0	0	1	0	0	0	0	2
	Exposure (x$1000)	0	192	0	0	0	0	0	0	1	0	0	0	0	193
Escondido	Number	0	1	0	0	0	0	0	0	2	0	0	0	0	3
	Exposure (x$1000)	0	192	0	0	0	0	0	0	4	0	0	0	0	196
Imperial Beach	Number	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
La Mesa	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lemon Grove	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
National City	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oceanside	Number	0	0	0	0	0	0	0	0	2	0	0	0	0	2
	Exposure (x$1000)	0	0	0	0	0	0	0	0	4	0	0	0	0	4
Poway	Number	0	0	0	0	0	0	0	0	3	0	0	0	1	4
	Exposure (x$1000)	0	0	0	0	0	0	0	0	8	0	0	0	1,000	1,008
San Diego (City)	Number	0	8	0	2	0	0	1	0	58	0	0	0	3	72
	Exposure (x$1000)	0	1,533	0	4,000	0	0	2,000	0	134	0	0	0	3,000	10,667
San Marcos	Number	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	Exposure (x$1000)	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Santee	Number	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	Exposure (x$1000)	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Solana Beach	Number	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	Exposure (x$1000)	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Unincorporated - Rural	Number	13	105	2	34	0	50	0	5	665	0	0	0	23	897
	Exposure (x$1000)	2,600,000	20,118	4,000	68,000	0	100,000	0	500,000	2,173	0	0	0	23,000	3,317,291
Unincorporated - Urban Core	Number	0	9	0	0	0	6	1	2	75	0	0	0	6	99
	Exposure (x$1000)	0	1,724	0	0	0	12,000	2,000	200,000	82	0	0	0	6,000	221,806
Vista	Number	0	0	0	0	0	0	0	0	1	0	0	0	1	2
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	1,000	1,000
Total Number		**13**	**125**	**2**	**36**	**0**	**56**	**3**	**8**	815	**0**	**0**	**0**	**37**	**1,095**
Total Exposure (x$1000)		**2,600,000**	**23,950**	**4,000**	**72,000**	**0**	**112,000**	**6,000**	**800,000**	2,417	**0**	**0**	**0**	**37,000**	**3,657,367**

Refer to Table 4.4-1 for abbreviation definition

Table 4.4-28
Potential Exposure to Critical Facilities and Infrastructures from High Wildfire Hazard by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	WWTR	RAIL	SCH	Total
Carlsbad	Number	0	0	0	0	0	0	0	0	19	0	0	0	0	3	**22**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	27	0	0	0	0	3,000	**3,027**
Chula Vista	Number	0	1	0	0	0	0	0	0	2	0	0	0	0	1	**4**
	Exposure (x$1000)	0	192	0	0	0	0	0	0	4	0	0	0	0	1,000	**1,195**
Coronado	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Del Mar	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
El Cajon	Number	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**1**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	3	0	0	0	0	0	**3**
Encinitas	Number	0	3	0	0	0	0	0	0	3	0	1	0	0	0	**7**
	Exposure (x$1000)	0	575	0	0	0	0	0	0	1	0	100,000	0	0	0	**100,576**
Escondido	Number	0	0	0	1	0	0	0	0	7	0	0	0	0	0	**8**
	Exposure (x$1000)	0	0	0	2,000	0	0	0	0	5	0	0	0	0	0	**2,005**
Imperial Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
La Mesa	Number	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**1**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Lemon Grove	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
National City	Number	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**1**
	Exposure (x$1000)	0	192	0	0	0	0	0	0	0	0	0	0	0	0	**192**
Oceanside	Number	0	1	0	0	0	0	1	0	8	0	0	0	0	0	**10**
	Exposure (x$1000)	0	192	0	0	0	0	2,000	0	16	0	0	0	0	0	**2,208**
Poway	Number	0	2	0	0	0	0	0	0	7	0	0	0	0	1	**10**
	Exposure (x$1000)	0	383	0	0	0	0	0	0	22	0	0	0	0	1,000	**1,405**
San Diego (City)	Number	0	13	0	3	0	0	0	0	51	0	0	0	0	8	**75**
	Exposure (x$1000)	0	2,491	0	6,000	0	0	0	0	92	0	0	0	0	8,000	**16,582**
San Marcos	Number	0	1	0	2	0	1	0	0	2	0	0	0	0	0	**6**
	Exposure (x$1000)	0	192	0	4,000	0	2,000	0	0	4	0	0	0	0	0	**6,196**
Santee	Number	0	0	0	1	0	0	0	0	2	0	0	0	0	0	**3**
	Exposure (x$1000)	0	0	0	2,000	0	0	0	0	5	0	0	0	0	0	**2,005**
Solana Beach	Number	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Exposure (x$1000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Unincorporated Rural	Number	4	17	0	2	0	3	1	0	136	0	0	0	0	2	**165**
	Exposure (x$1000)	800,000	3,257	0	4,000	0	6,000	2,000	0	446	0	0	0	0	2,000	**817,703**
Unincorporated Urban Core	Number	0	6	0	0	0	1	0	2	16	0	0	1	0	0	**26**
	Exposure (x$1000)	0	1,150	0	0	0	2,000	0	200,000	21	0	0	100,000	0	0	**303,171**
Vista	Number	0	0	0	0	0	1	0	0	2	0	0	0	0	1	**4**
	Exposure (x$1000)	0	0	0	0	0	2,000	0	0	1	0	0	0	0	1,000	**3,001**
Total Number		**4**	**45**	**0**	**9**	**0**	**6**	**2**	**2**	**255**	**0**	**1**	**1**	**0**	**16**	**341**
Total Exposure (x$1000)		**800,000**	**8,622**	**0**	**18,000**	**0**	**12,000**	**4,000**	**200,000**	**648**	**0**	**100,000**	**100,000**	**0**	**16,000**	**1,259,270**

Refer to Table 4.4-1 for abbreviation definition

Table 4.4-29
Potential Exposure to Critical Facilities and Infrastructures from Moderate Wildfire Hazard by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	WWTR	RAIL	SCH	Total
Carlsbad	Number	1	19	0	2	1	7	4	1	89	0	1	0	0	18	**143**
	Exposure (x$1000)	200,000	3,640	0	4,000	10,000	14,000	8,000	100,000	153	0	100,000	0	0	18,000	**457,793**
Chula Vista	Number	0	39	2	2	1	11	8	7	85	0	1	0	0	59	**215**
	Exposure (x$1000)	0	7,472	4,000	4,000	10,000	22,000	16,000	700,000	165	0	100,000	0	0	59,000	**922,638**
Coronado	Number	0	1	0	1	0	3	4	1	12	0	0	0	0	9	**31**
	Exposure (x$1000)	0	192	0	2,000	0	6,000	8,000	100,000	12	0	0	0	0	9,000	**125,204**
Del Mar	Number	0	5	0	0	0	1	2	0	10	0	0	0	0	2	**20**
	Exposure (x$1000)	0	958	0	0	0	2,000	4,000	0	7	0	0	0	0	2,000	**8,965**
El Cajon	Number	1	37	1	2	1	8	7	6	61	0	0	0	0	47	**171**
	Exposure (x$1000)	200,000	7,089	2,000	4,000	10,000	16,000	14,000	600,000	153	0	0	0	0	47,000	**900,242**
Encinitas	Number	0	11	0	1	0	6	3	3	72	0	0	0	7	23	**126**
	Exposure (x$1000)	0	2,108	0	2,000	0	12,000	6,000	300,000	127	0	0	0	14,000	23,000	**359,235**
Escondido	Number	0	67	1	1	0	6	8	8	68	0	1	0	1	43	**204**
	Exposure (x$1000)	0	12,837	2,000	2,000	0	12,000	16,000	800,000	187	0	100,000	0	2,000	43,000	**990,024**
Imperial Beach	Number	0	1	0	0	0	2	2	2	3	0	0	0	0	8	**18**
	Exposure (x$1000)	0	192	0	0	0	4,000	4,000	200,000	2	0	0	0	0	8,000	**216,194**
La Mesa	Number	0	36	0	1	0	4	4	2	52	0	0	0	0	25	**124**
	Exposure (x$1000)	0	6,898	0	2,000	0	8,000	8,000	200,000	112	0	0	0	0	25,000	**250,010**
Lemon Grove	Number	0	8	0	0	0	2	3	0	23	0	0	0	0	10	**46**
	Exposure (x$1000)	0	1,533	0	0	0	4,000	6,000	0	58	0	0	0	0	10,000	**21,591**
National City	Number	0	46	1	1	2	4	4	7	37	0	1	0	2	20	**125**
	Exposure (x$1000)	0	8,814	2,000	2,000	20,000	8,000	8,000	700,000	87	0	100,000	0	4,000	20,000	**872,901**
Oceanside	Number	1	37	2	4	0	10	9	11	103	0	1	0	7	37	**222**
	Exposure (x$1000)	200,000	7,089	4,000	8,000	0	20,000	18,000	1,100,000	206	0	100,000	0	14,000	37,000	**1,508,295**
Poway	Number	0	40	1	0	0	3	1	1	22	0	0	1	0	22	**91**
	Exposure (x$1000)	0	7,664	2,000	0	0	6,000	2,000	100,000	60	0	0	100,000	0	22,000	**239,724**
San Diego (City)	Number	4	445	12	22	8	85	95	49	750	3	2	2	5	339	**1,821**
	Exposure (x$1000)	800,000	85,262	24,000	44,000	80,000	170,000	190,000	4,900,000	1,686	60,000	200,000	200,000	10,000	339,000	**7,103,948**
San Marcos	Number	0	11	0	0	0	7	3	2	54	0	0	0	2	20	**99**
	Exposure (x$1000)	0	2,108	0	0	0	14,000	6,000	200,000	136	0	0	0	4,000	20,000	**246,244**
Santee	Number	0	14	1	1	0	3	2	0	27	0	1	0	0	15	**64**
	Exposure (x$1000)	0	2,682	2,000	2,000	0	6,000	4,000	0	60	0	100,000	0	0	15,000	**131,742**
Solana Beach	Number	0	5	0	0	0	1	1	0	27	0	0	0	1	9	**44**
	Exposure (x$1000)	0	958	0	0	0	2,000	2,000	0	44	0	0	0	2,000	9,000	**16,002**
Unincorporated Rural	Number	13	72	0	5	3	35	2	5	383	0	0	1	0	38	**557**
	Exposure (x$1000)	2,600,000	13,795	0	10,000	30,000	70,000	4,000	500,000	1,289	0	0	100,000	0	38,000	**3,367,085**
Unincorporated Urban Core	Number	0	96	0	1	0	30	7	6	194	0	1	1	2	100	**438**
	Exposure (x$1000)	0	18,394	0	2,000	0	60,000	14,000	600,000	415	0	100,000	100,000	4,000	100,000	**998,808**
Vista	Number	0	12	0	0	0	8	4	3	48	0	0	0	9	38	**122**
	Exposure (x$1000)	0	2,299	0	0	0	16,000	8,000	300,000	95	0	0	0	18,000	38,000	**382,394**
Total Number		**20**	**1,002**	**21**	**44**	**16**	**236**	**173**	**114**	**2,118**	**3**	**9**	**5**	**36**	**882**	**4,679**
Total Exposure (x$1000)		**4,000,000**	**191,983**	**42,000**	**88,000**	**160,000**	**472,000**	**346,000**	**11,400,000**	**5,056**	**60,000**	**900,000**	**500,000**	**72,000**	**882,000**	**19,119,039**

Refer to Table 4.4-1 for abbreviation definition

Table 4.4-30
Potential Exposure to Critical Facilities and Infrastructures from
(Moderate, High, Very High, Extreme Combined) Wildfire Hazard by Jurisdiction

Jurisdiction	Data	AIR	BRDG	BUS	COM	ELEC	EMER	GOVT	HOSP	INFR	PORT	POT	WWTR	RAIL	SCH	Total
Carlsbad	Number	1	20	0	2	1	7	5	2	110	0	1	0	0	23	**172**
	Exposure (x$1000)	200,000	3,832	0	4,000	10,000	14,000	10,000	200,000	183	0	100,000	0	0	23,000	**565,015**
Chula Vista	Number	0	40	2	2	1	11	8	7	95	0	1	0	0	61	**228**
	Exposure (x$1000)	0	7,664	4,000	4,000	10,000	22,000	16,000	700,000	185	0	100,000	0	0	61,000	**924,849**
Coronado	Number	0	1	0	1	0	3	4	1	12	0	0	0	0	9	**31**
	Exposure (x$1000)	0	192	0	2,000	0	6,000	8,000	100,000	13	0	0	0	0	9,000	**125,204**
Del Mar	Number	0	5	0	0	0	1	2	0	10	0	0	0	0	2	**20**
	Exposure (x$1000)	0	958	0	0	0	2,000	4,000	0	7	0	0	0	0	2,000	**8,965**
El Cajon	Number	1	37	1	2	1	8	7	6	63	0	0	0	0	47	**173**
	Exposure (x$1000)	200,000	7,089	2,000	4,000	10,000	16,000	14,000	600,000	159	0	0	0	0	47,000	**900,248**
Encinitas	Number	0	15	0	1	0	6	3	3	76	0	1	0	6	25	**136**
	Exposure (x$1000)	0	2,874	0	2,000	0	12,000	6,000	300,000	130	0	100,000	0	12,000	25,000	**460,004**
Escondido	Number	0	68	1	2	0	6	8	8	76	0	1	1	1	43	**214**
	Exposure (x$1000)	0	13,029	2,000	4,000	0	12,000	16,000	800,000	197	0	100,000	100,000	2,000	43,000	**1,092,226**
Imperial Beach	Number	0	1	0	0	0	2	2	2	4	0	0	0	0	8	**19**
	Exposure (x$1000)	0	192	0	0	0	4,000	4,000	200,000	2	0	0	0	0	8,000	**216,194**
La Mesa	Number	0	36	0	1	0	4	4	2	53	0	0	0	0	25	**125**
	Exposure (x$1000)	0	6,898	0	2,000	0	8,000	8,000	200,000	113	0	0	0	0	25,000	**250,010**
Lemon Grove	Number	0	8	0	0	0	2	3	0	23	0	0	0	0	10	**46**
	Exposure (x$1000)	0	1,533	0	0	0	4,000	6,000	0	58	0	0	0	0	10,000	**21,591**
National City	Number	0	47	1	1	2	4	4	7	37	0	1	0	2	20	**126**
	Exposure (x$1000)	0	9,005	2,000	2,000	20,000	8,000	8,000	700,000	87	0	100,000	0	4,000	20,000	**873,093**
Oceanside	Number	1	38	2	4	0	10	10	11	112	0	1	0	7	37	**233**
	Exposure (x$1000)	200,000	7,281	4,000	8,000	0	20,000	20,000	1,100,000	226	0	100,000	0	14,000	37,000	**1,510,506**
Poway	Number	0	42	1	0	0	3	1	1	31	0	0	1	0	24	**103**
	Exposure (x$1000)	0	8,047	2,000	0	0	6,000	2,000	100,000	89	0	0	100,000	0	24,000	**242,137**
San Diego	Number	4	466	12	27	8	85	96	49	859	3	2	3	5	350	**1,966**
(City)	Exposure (x$1000)	800,000	89,286	24,000	54,000	80,000	170,000	192,000	4,900,000	1,912	60,000	200,000	300,000	10,000	350,000	**7,231,198**
San Marcos	Number	0	12	0	2	0	8	3	2	56	0	0	0	2	20	**105**
	Exposure (x$1000)	0	2,299	0	4,000	0	16,000	6,000	200,000	142	0	0	0	4,000	20,000	**252,441**
Santee	Number	0	14	1	2	0	3	2	0	30	0	1	0	0	15	**68**
	Exposure (x$1000)	0	2,682	2,000	4,000	0	6,000	4,000	0	65	0	100,000	0	0	15,000	**133,748**
Solana Beach	Number	0	5	0	0	0	1	1	0	28	0	0	0	1	9	**45**
	Exposure (x$1000)	0	958	0	0	0	2,000	2,000	0	46	0	0	0	2,000	9,000	**16,004**
Unincorporated	Number	30	194	2	41	3	88	3	10	1,184	0	0	3	0	63	**1,618**
Rural	Exposure (x$1000)	6,000,000	37,170	4,000	82,000	30,000	176,000	6,000	1,000,000	3,908	0	0	300,000	0	63,000	**7,702,078**
Unincorporated	Number	0	111	0	1	0	37	8	10	285	0	1	2	2	106	**561**
Urban Core	Exposure (x$1000)	0	21,268	0	2,000	0	74,000	16,000	1,000,000	518	0	100,000	200,000	4,000	106,000	**1,523,785**
Vista	Number	0	12	0	0	0	9	4	3	50	0	0	0	9	40	**127**
	Exposure (x$1000)	0	2,299	0	0	0	18,000	8,000	300,000	96	0	0	0	18,000	40,000	**386,395**
Total Number		**37**	**1,172**	**23**	**89**	**16**	**298**	**178**	**124**	**3,192**	**3**	**10**	**10**	**35**	**937**	**6,114**
Total Exposure (x$1000)		**7,400,000**	**224,555**	**46,000**	**178,000**	**160,000**	**596,000**	**356,000**	**12,400,000**	**8,136**	**60,000**	**1,000,000**	**1,000,000**	**70,000**	**937,000**	**24,435,691**

Refer to Table 4.4-1 for abbreviation definition

4.4.2.8 Manmade Hazards

Vulnerability assessment information for manmade hazards is considered sensitive homeland security information and is provided in a separate confidential document (Attachment A).

4.5 Multi-Jurisdictional Assessment

It should be noted that individual risk assessment maps were completed for each of the 18 participating incorporated cities as well as the unincorporated County. Hazard profile maps were created at a local (1:2,000) scale, complete with land use information, critical facility information, infrastructure and hazard areas for each of the 19 jurisdictions. Jurisdictional HMWG leads were presented copies of these maps to provide to their Local Mitigation Planning teams. The local teams utilized these maps to help identify their jurisdictional Goals, Objectives, and Mitigation Measures. Several of the local goals, objectives, and action items identified in the proceeding section (Section 5) relate directly to these risk assessment maps. Due to concern of sensitivity of information depicted on these localized maps, only the County-scale maps are included in the Plan.

4.5.1 Analysis of Land Use

San Diego County covers 4,264 square miles and is located in the southernmost corner of the state, bordering Mexico and the Pacific Ocean. There are 18 jurisdictions in the County with a total of over 888 thousand households in the region and a total population of 2,813,833 (2000 Census Bureau data). Existing land use data (Figure 4.5.1) was utilized in the hazard profiling process. Forecast land use information for 2030 from the Regional Economic Development Information system (REDI) was evaluated in analyzing future development trends. Existing land use consists of mainly residential, commercial and industrial in the western (urban core) portion of the county. The eastern area (unincorporated rural) is spotted with residential surrounded by park and 'not in use' areas. The forecast land use describes residential land use becoming the most predominant land use in the urban core of the county and expanding largely into the eastern portion of the county. In the eastern portion of the county, Native American Reservations and parks will make up the rest of the land use designations.

Within the county, there are 18 incorporated jurisdictions and the County jurisdiction, all of which contributed to the risk assessment analyses for the San Diego County Hazard Mitigation Plan. Wildfire and flood were identified as the most significant risks to the County, however, all hazards are addressed in the Mitigation Plan. Each jurisdiction has unique hazard situations that require additional or unique mitigation measures. The loss estimates are summarized above in tables that show potential total exposure and/or losses for each jurisdiction. The Mitigation Strategy (Section 5) approaches each jurisdiction separately.

4.5.2 Analysis of Development Trends

The San Diego Association of Governments (SANDAG) is a regional planning body whose membership includes all 18 incorporated cities and the County of San Diego. SANDAG plays a key role in regional coordination efforts. In 2004 the SANDAG Board of Directors adopted a Regional Comprehensive Plan (RCP) that provides a strategic framework for the San Diego Region. It encourages cities and the county to increase residential and employment concentrations in areas with the best existing and future transit connections, and to preserve important open spaces "Smart Growth"). City general plans are being aligned with the RCP as they are revised.

Many of the jurisdictions in San Diego County are close to being "built-out" under their general plans. A few representative examples will illustrate the trends throughout the region:

- The City of San Diego has less than four percent (4%) of its land available for development. For the City of San Diego this means that the focus is now on how to reinvest in existing communities (City of San Diego General Plan, March 2008). The City's General Plan takes hazard mitigation into consideration in the Public Facilities, Services and Safety Element by discussing disaster preparedness (preparation for natural and man-made disasters as well as preparations for restoration of municipal services) and seismic safety.
- The City of Poway's Plan calls for the preservation of open space and the maintenance of the City's rural character. (Poway Comprehensive Plan: General Plan). Accordingly, future development "in Poway should be concentrated in parts of the City other than the rural hillside areas and existing open space should be protected." This is intended to limit growth to the "enhancement of existing developed and developing areas."
- The City of National City has only 0.8% (113 acres) of land vacant and available for development. It has adopted the SANDAG Smart Growth concept. Additional opportunities for future development may include a change to an existing use within a built-up area, rebuilding sites with more intense uses or building on under-utilized sites. (City of National City General Plan, Chapter 2 Land Use).
- The City of Chula Vista also subscribes to the SANDAG Smart Growth concept. Chula Vista was one of the fastest growing cities in the State during the 1990s and the early initial years of the 21st century. This growth occurred mostly in the eastern portion of the City on large, vacant tracts of land. Western Chula Vista is for the most part already developed. Chula Vista's emphasis is shifting from the development of vacant lands in the eastern portion of the City to revitalizing the already developed areas. "Redevelopment will play a prominent role in the City's evolution" (City of Chula Vista General Plan, Chapter Five, Land Use Element).
- The City of Encinitas still contains a number of underdeveloped or undeveloped areas that can accommodate additional homes or businesses. It is the intent of the City to achieve a balanced and functional mix of development consistent with the long-range goals, objectives and values of the City (City of Encinitas General Plan April, 2013). Among the things the City seeks to accomplish with this plan the "reduction of loss of life, injury, and property damage that might result from flooding, seismic hazards and other natural and man-made hazards that need to be
- The County of San Diego will manage growth in the unincorporated areas through the use of zoning regulations, building codes and the permit process (San Diego County General Plan). Hazard mitigation measures to minimize landslides, flooding, and other natural and man-made hazards are found in the plan. The 2010 Multi-Jurisdictional Hazard Mitigation Plan has been included into the General Plan by reference.

The result of this is that much of the new development in the near term will occur in the unincorporated portion of San Diego County. In the near future development trends will shift towards the redevelopment of urban cores. Hazards mapped in these areas include wildfire, flood, earthquake, and dam failure. The two most prevalent hazards related to development trends appear to be the increasing density in downtown San Diego near the Rose Canyon Fault Zone (earthquake and liquefaction hazard) and the expansion of the urban/wildland interface by new development throughout the county, but especially in east and south county (wildfire hazard). It should also be noted that high-rise residential and commercial development has increased significantly in the downtown San Diego and Golden Triangle areas and these developments present a potential new type of structural fire hazard risk.

The population is estimated to increase to approximately 4.4 million by 2050 (SANDAG, 2010). The forecast land use describes residential land use becoming the most predominant land use in the urban core of the county and expanding largely into the eastern portion of the county.

The original plan predicted that near term development (that development that would occur over the course of the four year life of the plan) would be concentrated mostly in the unincorporated urban core and the southeastern portion of San Diego County in and around the City of Chula Vista. For the first few years this prediction appeared to be accurate. Beginning in 2008, the economic downturn resulted in a significant slow-down within the region in terms of growth and caused a very large downturn in median home prices. It is estimated that the downturn resulted in a $4 billion loss to San Diego County as a result of the change it caused in consumer spending habits. The median price of a home in San Diego County dropped from approximately $600,000 in 2006 to approximately $400,000 in 2012. The current median price of home is $488,000 up approximately since 2014.

2008 saw the unemployment rate rise to 7.6% in San Diego with the loss of 56,500 jobs by January of 2009. This was the worst job loss in San Diego since 1974. In 2008 there were fewer than 3000 residential building permits issued. The normal average is 14,000. By April of 2009 the total number of unemployed in San Diego had reached 135,000, for and unemployment rate of 8.6%. (National Association of Counties "A Snapshot of Large, Urban Counties" April, 2009). Current unemployment rate for the San Diego region is 4.6%, down from 5.1% in August 2015. Since September 2014 there has been an increase of 46,900 nonfarm jobs in San Diego.

4.5.2.1 Data Limitations

It should be noted that the analysis presented here is based upon "best available data". See Appendix B for a complete listing of sources and their unique data limitations (if any). Data used in updates to this plan should be reassessed upon each review period to incorporate new or more accurate data if/when possible.

5.1 Overview

After each participating jurisdiction reviewed the Risk Assessment (Section 4), jurisdictional leads met with their individual Local Planning Groups (LPG) to identify appropriate jurisdictional-level goals, objectives, and mitigation action items. This section of the Plan incorporates 1) mitigation goals and objectives, 2) mitigation actions and priorities, 3) an implementation plan, and 4) documentation of the mitigation planning process for each of the twenty one (21) participating jurisdictions. Each of these steps is described as follows.

5.1.1 Develop Mitigation Goals and Objectives

Each jurisdiction reviewed hazard profile and loss estimation information presented in Section 4 and utilized this as a basis for developing mitigation goals and objectives. Mitigation goals are defined as general guidelines explaining what each jurisdiction wants to achieve in terms of hazard and loss prevention. Goal statements are typically long-range, policy-oriented statements representing jurisdiction-wide visions. Objectives are statements that detail how each jurisdiction's goals will be achieved, and typically define strategies or implementation steps to attain identified goals. Other important inputs to the development of jurisdiction-level goals and objectives include performing reviews of existing local plans, policy documents, and regulations for consistency and complementary goals, as well as soliciting input from the public.

5.1.2 Identify and Prioritize Mitigation Actions

Mitigation actions that address the goals and objectives developed in the previous step were identified, evaluated, and prioritized. These actions form the core of the mitigation plan. Jurisdictions conducted a capabilities assessment, reviewing existing local plans, policies and regulations for any other capabilities relevant to hazard mitigation planning. An analysis of their capability to carry out these implementation measures with an eye toward hazard and loss prevention was conducted. The capabilities assessment required an inventory of each jurisdiction's legal, administrative, fiscal and technical capacities to support hazard mitigation planning. After completion of the capabilities assessment, each jurisdiction evaluated and prioritized their proposed mitigations.

As part of this process, each city and the County reviewed the actions detailed in the 2010 plan to see if they were completed, had been dropped due to issues such as lack of political support or lack of funding or were on-going and should be continued in the new plan. The status of each jurisdiction's action items is detailed in Appendix C. Also considered were changes in development, mitigation efforts and priorities.

Each participant used their local planning group to evaluate alternative mitigation actions by considering the implications of each action item. One potential method available to the cities to accomplish this was the STAPLEE method. The STAPLEE criteria are a tool used to assist communities in deciding which actions to include in their implementation strategy. The criteria are designed to account for a wide range of factors that affect the appropriateness of an action. STAPLEE considers the following criteria:

- **Social**: Community acceptance, public support, adverse effects on population segments, health/welfare/safety impacts, and financial effects
- **Technical**: Technical feasibility, long term effectiveness, and secondary impacts
- **Administrative**: Staff, funding, and maintenance capabilities
- **Political**: Political support, local champion, and public support
- **Legal**: State authority, existing local authority, and potential opposition
- **Economic**: Benefits, costs, and availability of outside funding
- **Environmental**: impact on environment and endangered species, local regulations and California Environmental Quality Act (CEQA)/National Environmental Policy Act (NEPA) considerations.

Local planning groups are comprised of individuals from the various jurisdictional departments brining their experience and knowledge of the region, the jurisdiction and local constraints to assist in the evaluation of the hazards and the development of mitigations strategies, goals and objectives. Individual LPG membership is discussed in each jurisdictions section of this chapter.

Each jurisdiction also considered the following: ease of implementation; multi-objective actions; time for implementation and post-disaster mitigation feasibility. Utilizing the above information, each community ranked the possible action items on a prioritization scale of high, medium, and low. A High ranking indicated that the hazard has a high probability of occurrence and/or a severe impact on the community. The Medium ranking indicated a moderate potential for occurrence or impact. Those hazards with a low probability of occurrence but with a potentially high impact were also ranked as medium. The Low ranking indicates that the potential for the event to occur is remote and/or the impact of the event is minimal to the community. Only those hazards that received a high or moderate ranking were considered in the mitigation planning process.

Many of these hazards were ranked differently by individual jurisdictions. For example, tsunamis received a relatively high ranking among coastal jurisdictions while inland jurisdictions did not consider them for mitigation action. All jurisdictions rated wildfire high (based on the firestorms of 2003 and 2007). Flooding and Earthquake (based on the known faults within the County) were also rated high by all participants. Table 5.X-1 *Summary of Potential Hazard-Related Exposure/Loss* formed the initial ranking basis for the individual participants. The hazards selected by each jurisdiction for mitigation actions are included in their section of this Chapter. In all cases the actions selected are prioritized based on the benefit of the action compared to the cost (in terms of funding, staff time, time to complete) of conducting that action. Those actions that will provide the most benefits in the least amount of time with available resources were selected as the highest priorities. That is not to say the other actions are not considered important. It merely indicates that we set out to complete what we could with current resources. The other actions will be completed as additional resources become available.

There were nine Goals established by the HMWG. They are listed below (in the order of importance assigned by the jurisdictions):

1. Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to geologic hazards (includes Earthquakes, landslides, liquefaction, etc.).

2. Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to structure fire/wildfire.

3. Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to flooding/dam failure.

4. Increase public understanding and support for effective hazard mitigation.

5. Improve hazard mitigation coordination and communication with federal, State, local and tribal governments.

6. Promote disaster resistant existing and future development.

7. Build and support local capacity and commitment to continuously become less vulnerable to hazards.

8. Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to coastal erosion/coastal bluff failure/storm surge/Tsunami.

9. Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to severe weather.

Each jurisdiction then identified and prioritized actions. They listed those with the highest short to medium term priorities. Not all jurisdictions included all the goals. Some jurisdictions included unique goals (such as minimizing losses by prompt resumption of City operations and restoration of City services). Others split the goals into multiple ones (i.e., some have a separate earthquake goal as opposed to a geologic hazard goal). An implementation schedule, funding source and coordinating individual or agency are identified for each prioritized action item.

Each jurisdiction prepared a strategy for implementing the mitigation actions identified in the previous step. The implementation strategies identify who is responsible for which action, what kind of funding mechanisms and other resources are available or will be pursued, and when the strategies will be completed.

In combination, the goals, objectives, actions and implementation strategies form the body of each jurisdiction's Plan. The following subsections present individual Plans for each of the 19 jurisdictions as well as the Fire Protection District.

5.2 Regional Considerations

The Risk Assessment (Section 4) indicates that each participating jurisdiction is susceptible to a variety of potentially serious hazards in the region. This had been recognized and formally addressed as early as the 1960s. At that time all of the cities and the County formed a Joint Powers Agreement which established the Unified San Diego County Emergency Services Organization (Organization) and the Unified Disaster Council (UDC) which is the policy making group of the Organization. It also created the Office of Disaster Preparedness (now OES), which is staff to the Organization.

The Organization's approach to emergency planning has been comprehensive, i.e., planned for and prepared to respond to all hazards: natural disasters, man-made emergencies, and war-related emergencies, utilizing the State of California's Standardized Emergency Management System

(SEMS), the National Incident Management System (NIMS) as well as a coordinated Incident Command System. OES is the agency charged with developing and maintaining the San Diego County Operational Area Emergency Plan, which is considered a preparedness document.

The Disaster Mitigation Act of 2000 requires that in addition to having emergency response and emergency preparedness documents, regions should develop and maintain a document outlining measures that can be taken before a hazard event occurs that would help minimize the damage to life and property. The UDC assigned OES the role of coordinating the development of the Plan as a multi-jurisdictional plan.

The Plan includes specific goals, objectives, and mitigation action items each of the participating jurisdictions developed that will help minimize the effects of the specified hazards that potentially affect their jurisdiction. Some overall goals and objectives shared some commonalities (including promoting disaster-resistant future development; increasing public understanding, support, and demand for effective hazard mitigation; building and supporting local capacity and commitment to continuously becoming less vulnerable to hazards; and improving coordination and communication with federal, state, local and tribal governments). However, the specific hazards and degree of risk vary greatly between the different jurisdictions; and the mix of other goals and objectives, and most action items are unique to each jurisdiction. Consequently, the goals, objectives and action items in this Plan are presented by individual jurisdiction and special district.

It is also envisioned that these mitigation actions will be implement on a jurisdiction-by-jurisdiction basis. However, UDC and OES will provide general oversight to this process to help reduce duplication of efforts between jurisdictions as appropriate, and to spearhead coordination of initiatives and action items that could be accomplished more efficiently on a regional level.

5.21 County of San Diego

The Unincorporated portion of the County of San Diego (County) reviewed a set of jurisdictional-level hazard maps including detailed critical facility information and localized potential hazard exposure/loss estimates to help identify the top hazards threatening their jurisdiction. In addition, LPGs were supplied with exposure/loss estimates for the County summarized in Tables 5.21-1a and 5.21-1b. See Section 4.0 for additional details.

Table 5.21-1a
Summary of Potential Hazard-Related Exposure/Loss in the County (Urban)

		Residential		Commercial		Critical Facilities	
Hazard Type	Exposed Population	Number of Residential Buildings	Potential Exposure/ Loss for Residential Buildings (x$1,000)	Number of Commercial Buildings	Potential Exposure/ Loss for Commercial Buildings (x$1,000)	Number of Critical Facilities	Potential Exposure for Critical Facilities (x$1,000)
Coastal Storm / Erosion	0	0	0	0	0	0	0
Sea Level Rise	0	0	0	0	0	0	0
Dam Failure	21,862	7,304	2,056,076	277	1,241,431	123	235,356
Earthquake (Annualized Loss - Includes shaking, liquefaction and landslide components)	333,626*	108,042*	8,963*	3,560*	15,954,852*	290*	820,725*
Flood (Loss)							
100 Year	10,125	3,358	945,277	195	873,932	34	6,733
500 Year	11,357	3,785	1,065,478	213	954,602	38	7,932
Rain-Induced Landslide							
High Risk	1,509	314	88,391	4	17,927	10	8,003
Moderate Risk	35,499	11,039	3,107,479	389	1,743,381	12	141,628
Tsunami	35	11	3,097	1	4,482	1	2
Wildfire / Structure Fire							
Fire Regime II & IV	335,301	111,685	31,439,328	29,983	10,494,099	561	1,523,785

* Represents 250-year earthquake value under three earthquake scenarios (shake only, shake and liquefaction, and shake and landslide).

Table 5.21-1b
Summary of Potential Hazard-Related Exposure/Loss in the County (Rural)

		Residential		Commercial		Critical Facilities	
Hazard Type	Exposed Population	Number of Residential Buildings	Potential Exposure/ Loss for Residential Buildings (x$1,000)	Number of Commercial Buildings	Potential Exposure/ Loss for Commercial Buildings (x$1,000)	Number of Critical Facilities	Potential Exposure for Critical Facilities (x$1,000)
Coastal Storm / Erosion	0	0	0	0	0	0	0
Dam Failure	14,512	3,686	1,037,609	135	605,030	123	325,258
Earthquake (Annualized Loss - Includes shaking, liquefaction and landslide components)	168,254*	60,561*	17,047,922*	2,177*	9,756,661*	1,554*	7,942,838*
Flood (Loss)							
100 Year	7,276	3,661	1,030,572	137	613,993	107	629,073
500 Year	8,950	4,426	1,245,919	151	676,737	117	632,685
Rain-Induced Landslide							
High Risk	9,130	3,573	1,005,800	93	416,798	35	12,657
Moderate Risk	23,197	4,188	1,178,922	89	398,871	67	213,940
Tsunami	5,154	95	26,743	0	0	5	768
Wildfire / Structure Fire							
Fire Regime II & IV	88,262	27,785	7,821,478	12,481	4,368,416	1,618	7,702,078

* Represents 500-year earthquake value under three earthquake scenarios (shake only, shake and liquefaction, and shake and landslide).

After reviewing the localized hazard maps and exposure/loss table above, the following hazards were identified by the County LPG as their top five.

- **Fire**
- **Hazardous Materials Release**
- **Flood**
- **Earthquake**
- **Manmade Hazards**

5.21.1 Capabilities Assessment

The LPG identified current capabilities available for implementing hazard mitigation activities. The Capability Assessment (Assessment) portion of the jurisdictional mitigation plan identifies administrative, technical, legal and fiscal capabilities. This includes a summary of departments and their responsibilities associated to hazard mitigation planning as well as codes, ordinances, and plans already in place associated to hazard mitigation planning. The second part of the Assessment provides the County's fiscal capabilities that may be applicable to providing financial resources to implement identified mitigation action items.

5.21.2 Existing Institutions, Plans, Policies and Ordinances

The following is a summary of existing departments in the County and their responsibilities related to hazard mitigation planning and implementation, as well as existing planning documents and regulations related to mitigation efforts within the community. The administrative and technical capabilities of the County, as shown in Table 5.21-2, provides an identification of the staff, personnel, and department resources available to implement the actions identified in the mitigation section of the Plan. Specific resources reviewed include those involving technical personnel such as planners/engineers with knowledge of land development and land management practices, engineers trained in construction practices related to building and infrastructure, planners and engineers with an understanding of natural or manmade hazards, floodplain managers, surveyors, personnel with GIS skills and scientists familiar with hazards in the community.

- San Diego County Planning Development Services

  Maintain and protect public health, safety and well-being. Preserve and enhance the quality of life for County residents by maintaining a comprehensive general plan and zoning ordinance, implementing habitat conservation programs, ensuring regulatory conformance and performing comprehensive community outreach.

  Advanced Planning Division: Provides land use and environmental review, maintains a comprehensive general plan and zoning ordinance, issues land use and building permits, and enforces building and zoning regulations. It is also responsible for long-range planning through development and implementation of a comprehensive County General Plan.

  Building Division: Review site and building plans for compliance with all applicable codes.

Code Compliance Division: Enforces building, grading, zoning, brushing and clearing, junk, graffiti, signs, abandoned vehicle complaints and noise control.

Land Development Division: Provides engineering and review services for construction and development projects throughout the unincorporated areas of San Diego County.

Project Planning Division: reviews "discretionary" projects. Those are projects that builders and homeowners cannot do "by right," but which may be approved by PDS's director, the Zoning Administrator, the Planning Commission or the Board of Supervisors if the projects meet certain conditions. Discretionary projects include lot splits, major subdivisions and conditionally-permitted uses. They also process applicants' requests for General Plan Amendments and Zoning changes.

- San Diego County Department of Public Works

Preserve, enhance and promote quality of life and public safety through the responsible development of reliable and sustainable infrastructure and services.

Land Development Division: Provides engineering and review services for construction and development **projects throughout the unincorporated areas of San Diego County. Services such as Stormwater, Flood** Control, Map Processing, Cartography, Surveys, the Geographic and Land Information Systems and dealing with land development issues are the daily job of this division. The division processes more than 5,000 permits each year.

Transportation Division: Roads Section is the most visible part of DPW, responding to requests for services ranging from pothole repair to tree trimming. Traffic Engineering provides traffic management and determines the need for stop signs and traffic lights. Route Locations updates the County's General Plan Circulation Element, provides transportation planning support and more. County Airports include eight unique facilities scattered throughout the area. McClellan-Palomar Airport provides commercial service to Los Angeles and Phoenix; Ramona Airport is home to the busiest aerial firefighting base in the USA; and, the County Sheriff's air force, ASTREA, is based at Gillespie Field.

Engineering Services Division: The division includes Wastewater, Flood Control, Design Engineering, Environmental Services, Construction Engineering, Materials Lab, Project Management and Flood Control Engineering and Hydrology. The Director of Public Works has assigned the Deputy Director of Engineering Services as the County Engineer and Flood Control Commissioner.

Management Services Division: This division provides a variety of services to department employees and the public. It includes Personnel, Financial Services, Communications, Recycling, Inactive Landfills and Management Support. Special Districts serve small areas in unincorporated areas providing a variety of services to residents in rural areas.

- San Diego County Housing & Community Development

Improve the quality of life in our communities – helping needy families find safe, decent and affordable housing and partnering with property owners to increase the supply and availability of affordable housing. The Department provides many valuable services to both property owners and tenants and strives to create more livable neighborhoods that residents are proud to call home.

Key service programs include: improving neighborhoods by assisting low-income residents, increasing the supply of affordable, save housing and rehabilitating both business and residential properties in San Diego County. They serve the communities of: Chula Vista, Coronado, Del Mar, El Cajon, Escondido, Imperial Beach, Lemon Grove, Poway, San Marcos, Santee, Solana Beach, Vista, and the unincorporated areas of San Diego County.

The Community Development Block Grant Program (CDBG) provides funding to agencies or businesses that provide a benefit to low and moderate income persons, prevent or eliminate slums and blight, or meet needs having a particular urgency.
In addition to funding housing and shelter programs, the County also allocates grant funds toward various community improvements in the Urban County area. These include Developer Incentive programs, Housing Opportunity for Persons with AIDS and the Emergency Solutions Grant program. Participating cities, community residents, nonprofit organizations and other county departments may submit grant proposals.

- County of San Diego Emergency Medical Services (EMS)

Mission: To ensure that all residents of and visitors to San Diego County receive timely and high quality emergency medical services, specialty care, prevention services, disaster preparedness and response. Emergency Medical Services (EMS) is a branch of the Health and Human Services Agency's Public Health Services. It is the 'local EMS agency' (LEMSA) as defined in California law.

Part of San Diego County EMS is the Disaster Medical Health Emergency Preparedness unit. This unit coordinates with emergency management agencies, community organizations, medical providers, prehospital provider agencies (fire/EMS), hospitals, clinics, skilled nursing facilities, businesses and other partners in developing public health and disaster preparedness by dissemination of risk assessments, trainings and public health guidance.

- County of San Diego Office of Emergency Services

The Office of Emergency Services (OES) coordinates the overall county response to disasters. OES is responsible for alerting and notifying appropriate agencies when disaster strikes; coordinating all agencies that respond; ensuring resources are available and mobilized in times of disaster; developing plans and procedures for response to and recovery from disasters; and developing and providing preparedness materials for the public.

Function**:** To protect life and property within the San Diego County Operational Area in the event of a major emergency or disaster by: 1) Alerting and notifying appropriate agencies when disaster strikes; 2) Coordinating all Agencies that respond; 3) Ensuring resources are available and mobilized in times of disaster; 4) Developing plans and procedures for response to and recovery from disasters and 5) Developing and providing preparedness materials for the public.

- County of San Diego Sheriff's Department

The San Diego County Sheriff's Department is the chief law enforcement agency in San Diego County. The department is comprised of approximately 4,000 employees, both sworn officers and professional support staff. The department provides general law enforcement, detention and court services for the people of San Diego County in a service area of approximately 4,200 square miles. In addition, the department provides specialized regional services to the entire county, including the incorporated cities and the unincorporated areas of the county.

The San Diego County Sheriff's Department provides contract law enforcement services for the cities of Del Mar, Encinitas, Imperial Beach, Lemon Grove, Poway, San Marcos, Santee, Solana Beach and Vista. In these cities the Sheriff's Department serves as their police department, providing a full range of law enforcement services including patrol, traffic and investigative services.

In the unincorporated (non-city) areas, the Sheriff's Department provides generalized patrol and investigative services. The California Highway Patrol has the primary jurisdiction for traffic services in unincorporated areas.

The San Diego County Sheriff's Department operates seven detention facilities. Male arrestees are booked at the San Diego Central Jail and Vista Detention Facility, while female arrestees are booked at the Las Colinas and Vista Detention Facilities. The remaining jails house inmates in the care of the Sheriff.

- California Department of Forestry and Fire Protection

CalFIRE is an emergency response and resource protection department that responds to more than 5,600 wildland fires that burn over 172,000 acres in the State each year. In addition, department personnel respond to more than 350,000 other emergency calls, including structure fires, automobile accidents, medical aid, swift water rescues, civil disturbance, search and rescue, floods, and earthquakes. CalFIRE is the State's largest fire protection organization, whose fire protection team includes extensive ground forces, supported by a variety of fire-fighting equipment. CalFIRE has joined with Federal and local agencies to form a statewide mutual aid system. This system insures a rapid response of emergency equipment by being able to draw on all available resources regardless of jurisdiction. CalFIRE is responsible for wildland fire protection within the District's State Responsibility Areas, even though the Fire District is the first responder to an incident.

Table 5.21-2
County of San Diego: Administrative and Technical Capacity

Staff/Personnel Resources	Y/N	Department/Agency and Position
A. Planner(s) or engineer(s) with knowledge of land development and land management practices	Y	Department of Planning & Land Use (DPLU)/ Lead Planner
B. Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	Y	DPLU/Building Inspectors
C. Planners or Engineer(s) with an understanding of natural and/or manmade hazards	Y	
D. Floodplain manager	Y	
E. Surveyors	Y	DPLU & Department of Public Works (DPW)/ Surveyor, Lead
F. Staff with education or expertise to assess the community's vulnerability to hazards	Y	
G. Personnel skilled in GIS and/or HAZUS	Y	DPLU GIS Manger and DPW GIS Manager
H. Scientists familiar with the hazards of the community	Y	County Science Advisory Board
I. Emergency manager	Y	Office of Emergency Services / Emergency Services Coordinator
J. Grant writers	N	Departments determine their own level of service.

The legal and regulatory capabilities of the County are shown in Table 5.21-3, which presents the existing ordinances and codes that affect the physical or built environment of the County. Examples of legal and/or regulatory capabilities can include: the County's building codes, zoning ordinances, subdivision ordnances, special purpose ordinances, growth management ordinances, site plan review, general plans, capital improvement plans, economic development plans, emergency response plans, and real estate disclosure plans.

Table 5.21-3
County of San Diego: Legal and Regulatory Capability

Regulatory Tools (ordinances, codes, plans)	Local Authority (Y/N)	Does State Prohibit (Y/N)
A. Building code	Y	N
B. Zoning ordinance	Y	N
C. Subdivision ordinance or regulations	Y	N
D. Special purpose ordinances (floodplain management, storm water management, hillside or steep slope ordinances, wildfire ordinances, hazard setback requirements)	Y	N
E. Growth management ordinances (also called "smart growth" or anti-sprawl programs)	Y	N
F. Site plan review requirements	Y	N
G. General or comprehensive plan	Y	N
H. A capital improvements plan	Y	N
I. An economic development plan	Y	
J. An emergency response plan	Y	N
K. A post-disaster recovery plan	Y	
L. A post-disaster recovery ordinance	N	
M. Real estate disclosure requirements	Y	N

5.21.3 Fiscal Resources

Table 5.21-4 shows specific financial and budgetary tools available to the County such as community development block grants; capital improvements project funding; authority to levy taxes for specific purposes; fees for water, sewer, gas, or electric services; impact fees for homebuyers or developers for new development; ability to incur debt through general obligations bonds; and withholding spending in hazard-prone areas.

Table 5.21-4
County of San Diego: Fiscal Capability

Financial Resources	Accessible or Eligible to Use (Yes/No)
A. Community Development Block Grants (CDBG)	Yes
B. Capital improvements project funding	Yes
C. Authority to levy taxes for specific purposes	Yes
D. Fees for water, sewer, gas, or electric service	Yes
E. Impact fees for homebuyers or developers for new developments/homes	Yes
F. Incur debt through general obligation bonds	Yes
G. Incur debt through special tax and revenue bonds	Yes
H. Yes Incur debt through private activity bonds	Yes
I. Withhold spending in hazard-prone areas	Yes

5.21.4 Goals, Objectives and Actions

Listed below are the County's specific hazard mitigation goals, objectives and related potential actions. For each goal, one or more objectives have been identified that provide strategies to attain the goal. Where appropriate, the County has identified a range of specific actions to achieve the objective and goal.

The goals and objectives were developed by considering the risk assessment findings, localized hazard identification and loss/exposure estimates, and an analysis of the jurisdiction's current capabilities assessment. These preliminary goals, objectives and actions were developed to represent a vision of long-term hazard reduction or enhancement of capabilities. To help in further development of these goals and objectives, the LPG compiled and reviewed current jurisdictional sources including the County's planning documents, codes, and ordinances. In addition, County representatives met with consultant staff and/or OES to specifically discuss these hazard-related goals, objectives and actions as they related to the overall Plan. Representatives of numerous County departments involved in hazard mitigation planning, including Fire, Police, and Public Works provided input to the County LPG. The County LPG members were:

- Tom Amabile, County OES
- Dave Cammal, DEH
- Jason Batchelor, Planning and Development Services
- Gitanjali Shinde, DPW
- Lisa Prus, San Diego County Water Authority
- Donna Johnson, HHSA, EMS

Once developed, County staff submitted the plan to Governor's Office of Emergency Services and FEMA for approval. Once approved the plan will be taken to the Unified Disaster Council and then to the San Diego County Board of Supervisors for adoption.

A public survey was posted on all participating agencies websites from March through July 2014. Over 500 responses were received. The survey results are in Appendix D. An email address was also provided on the webpage to allow the public to submit questions and/or suggestions. This email address was checked daily.

The following sections present the hazard-related goals, objectives and actions as prepared by the County's LPG in conjunction with the Hazard Mitigation Working Group, locally elected officials and residents.

5.21.4.1 Goals

The County of San Diego has developed the following 13 Goals for their Hazard Mitigation Plan (See Attachment A for Goals 12, and 13).

Goal 1. Promote Disaster-resistant future development.

Goal 2. Increase public understanding and support for effective hazard mitigation.

Goal 3. Build and support local capacity and commitment to become less vulnerable to hazards.

Goal 4. Enhance hazard mitigation coordination and communication with federal, state, local and tribal governments.

"Reduce the possibility of damage and losses to existing assets, particularly people, critical facilities/infrastructure, and County-owned facilities, due to":

Goal 5. Dam Failure

Goal 6. Earthquakes and Liquefaction

Goal 7. Coastal Storm/Erosion/Tsunami

Goal 8. Landslides

Goal 9. Floods

Goal 10. Structural Fire/Wildfire

Goal 11. Extreme Weather and Drought

Goal 12. Manmade Hazards

Goal 13. Hazardous Materials Release

5.21.4.2 Objectives and Actions

The County of San Diego developed the following broad list of objectives and actions to assist in the implementation of each of their 11 identified goals. The County of San Diego developed objectives to assist in achieving their hazard mitigation goals. For each of these objectives, specific actions were developed that would assist in their implementation. A discussion of the prioritization and implementation of the action items is provided in Section 5.21.5.

Goal 1: Promote disaster-resistant future development.		New, Existing or Both
Objective 1.A: Facilitate the development or updating of general plans and zoning ordinances to limit development in hazard areas.		
Action 1.A.1	Update General Plan as necessary.	Both
Action 1.A.2	Attract and retain qualified, professional and experienced staff.	Both
Action 1.A.3	Continue to identify high hazard areas using GIS.	Both
Objective 1.B: Facilitate the adoption of building codes that protect existing assets and restrict new development in hazard areas.		
Action 1.B.1	Review Codes as necessary.	New
Objective 1.C: Facilitate consistent enforcement of general plans, zoning ordinances, and building codes.		
Action 1.C.1	Staff enforcement personnel to a level to ensure compliance.	Both
Action 1.C.2	Develop and coordinate permits for all agencies.	Both
Action 1.C.3	Continue to utilize multi-agency permitting and enforcement team.	Both
Objective 1.D: Limit future development in hazardous areas		
Action 1.D.1	Development should be in harmony with existing topography.	Both
Action 1.D.2	Development patterns should respect environmental characteristics.	New
Action 1.D.3	Clustering should be encouraged.	New
Action 1.D.4	Development should be limited in areas of known geologic hazards.	New
Action 1.D.5	Development in floodplains shall be limited to protect lives and property.	New
Action 1.D.6	High fire hazard areas shall have adequate access for emergency vehicles.	Both
Objective 1.E: Address identified data limitations regarding the lack of information about new development and build-out potential in hazard areas.		
Action 1.E.1	Continue to utilize Geographic Information Systems (GIS) capabilities to identify hazards.	Both
Action 1.E.2	Continue to develop and update data sets that are necessary to test hazard scenarios and mitigation tools.	Both
Objective 1.F: Increase public understanding, support and demand for hazard mitigation for new developments.		
Action 1.F.1	Continue to gain public acceptance for avoidance policies in high hazard areas.	Both
Action 1.F.2	Continue public education efforts to publicize and adopt the appropriate hazard mitigation measures.	Both
Action 1.F.3	Help create demand for hazard resistant construction and site planning.	Both

Goal 2: Increase public understanding and support for effective hazard mitigation.		New, Existing or Both
Objective 2.A: Educate the public to increase awareness of hazards and opportunities for mitigation actions.		
Action 2.A.1	Publicize and encourage the adoption of appropriate hazard mitigation actions.	Both
Action 2.A.2	Continue to provide information to the public on the County website.	Both
Action 2.A.3	Heighten public awareness of hazards by using the County Communications Office.	Both
Action 2.A.4	Gain public acceptance for avoidance policies in high hazard areas.	Both
Action 2.A.5	Identify hazard specific issues and needs.	Both
Action 2.A.6	Help create demand for hazard resistant construction and site planning.	Both
Action 2.A.7	Promote partnerships between the state, counties, local and tribal governments to identify, prioritize and implement mitigation actions.	Both
Action 2.A.8	Promote County's "Know Your Hazards" app.	Both
Objective 2.B: Promote partnerships between the state, counties, local and tribal governments to identify, prioritize, and implement mitigation actions.		
Action 2.B.1	Develop, maintain and improve lasting partnerships.	Both
Action 2.B.2	Support the County Fire Safe Council.	Both
Action 2.B.3	Promote cooperative vegetation Management Programs that incorporate hazard mitigation.	Both
Objective 2.C: Promote hazard mitigation in the business community.		
Action 2.C.1	Increase awareness and knowledge of hazard mitigation principles and practices.	Both
Action 2.C.2	Encourage businesses to develop and implement hazard mitigation actions.	Both
Action 2.C.3	Identify hazard-specific issues and needs.	Both
Objective 2.D: Monitor and publicize the effectiveness of mitigation actions implemented countywide.		
Action 2.D.1	Continue to use the County website to publicize mitigation actions.	Both
Action 2.D.2	Continue to create marketing campaigns.	Both
Action 2.D.3	Continue to determine mitigation messages to convey.	Both
Action 2.D.4	Continue to establish budget and identify funding sources for mitigation outreach.	Both
Action 2.D.5	Continue to develop and distribute brochures, CDs and other publications.	Both
Objective 2.E: Provide education on hazardous conditions.		
Action 2.E.1	Continue to support public and private sector symposiums.	Both
Action 2.E.2	Coordinate production of brochures, informational packets and other handouts.	Both
Action 2.E.3	Develop partnerships with the media on hazard mitigation.	Both

Goal 3: Build and support local capacity and commitment to become less vulnerable to hazards.		**New, Existing or Both**
Objective 3.A: Increase awareness and knowledge of hazard mitigation principles and practice among local officials.		
Action 3.A.1	Use County Communications Office/County News Center to promote mitigation actions.	Both
Action 3.A.2	Conduct meetings with key elected officials to determine local issues and concerns.	Both
Action 3.A.3	Continuously demonstrate the importance of pre-disaster mitigation planning to the Board of Supervisors and other public officials.	Both
Objective 3.B: Develop hazard mitigation plan and provide technical assistance to implement plan.		
Action 3.B.1	Coordinate the update of the multi-jurisdictional plan.	Both
Action 3.B.2	Continue to have the County Working Group update and monitor the plan.	Both
Objective 3.C: Limit growth and development in hazardous areas.		
Action 3.C.1	Update GIS mapping to identify hazardous areas.	Both
Action 3.C.2	Continue to enforce trespassing regulations in high-risk areas.	Both
Action 3.C.3	Update General Plan and zoning regulations to reflect hazardous areas.	Both
Action 3.C.4	Support transfer of development rights in hazard prone areas.	Both
Objective 3.D: Management of wildland vegetative communities to promote less hazardous conditions.		
Action 3.D.1	Continue to use GIS to inventory by type and vegetation age class.	Both
Action 3.D.2	Continue to define target class ranges.	Both
Action 3.D.3	Continue to develop partnerships within the communities to fix age class ranges.	Both
Objective 3.E: Improve the County's ability to manage in pre and post-disaster scenarios as well as respond effectively during the event.		
Action 3.E.1	Train multiple staff members for each position in the Op Area EOC	Both

Goal 4: Enhance hazard mitigation coordination and communication with federal, state, local and tribal governments.		New, Existing or Both
Objective 4.A: Establish and maintain closer working relationships with state agencies, local and tribal governments.		
Action 4.A.1	Continue the program of multi-jurisdictional/multi-functional training and exercises to enhance hazard mitigation.	Both
Action 4.A.2	Leverage resources and expertise that will further hazard mitigation efforts.	Both
Action 4.A.3	Update the multi-jurisdictional/multi-hazard mitigation plan to include tribal governments and special districts.	Both
Action 4.A.4	Maintain multi-jurisdictional/multi-functional training and exercises to enhance hazard mitigation.	Both
Objective 4.B: Encourage other organizations to incorporate hazard mitigation activities.		
Action 4.B.1	Continue to encourage tribal governments to become part of the HIRT JPA.	Both
Action 4.B.2	Establish and maintain lasting partnerships.	Both
Action 4.B.3	Continue to streamline policies to eliminate conflicts and duplication of effort.	Both
Objective 4.C: Improve the County's capability and efficiency at administering pre- and post-disaster mitigation.		
Action 4.C.1	Maintain consistency with the State in administering recovery programs.	Both
Action 4.C.2	Continue to work to establish a requirement that all hazard mitigation projects submitted to the State must be reviewed by the County.	Both
Action 4.C.3	Continue to improve coordination with the State Hazard Mitigation Office in dealing with local issues.	Both
Objective 4.D: Support a coordinated permitting activities process.		
Action 4.D.1	Develop notification procedures for all permits that support affected agencies.	Both
Action 4.D.2	Continue to streamline policies to eliminate conflicts and duplication of effort.	Both
Action 4.D.3	Continue to exchange resources and work with local and regional partners.	Both
Objective 4.E: Coordinate recovery activities while restoring and maintaining public services.		
Action 4.E.1	Maintain two damage assessment teams.	Both
Action 4.E.2	Maintain activation and reporting procedures for the damage assessment teams.	Both

Goal 5: Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to dam failure.		New, Existing or Both
Objective 5. A: Develop a comprehensive approach to reducing the possibility of damage and losses due to dam failure		
Action 5.A.1	Update dam inundation plans, at a minimum every ten years.	Both
Action 5.A.2	Continue to participate in community awareness meetings	Both
Action 5.A.3	Continue to develop and distribute printed publications to the communities concerning hazards.	Both
Objective 5.B: Protect existing assets with the highest relative vulnerability to the effects of a dam failure.		
Action 5.B.1	Continue to identify hazard-prone structures.	Existing
Action 5.B.2	Continue to construct barriers around structures.	Both
Action 5.B.3	Encourage structural retrofitting.	Existing
Objective 5.C: Coordinate with and support existing efforts to mitigate dam failure (e.g., US Army Corps of Engineers, US Bureau of Reclamation, and California Department of Water Resources).		
Action 5.C.1	Continue to revise development ordinances to mitigate effects of development on wetland areas.	Both
Action 5.C.2	Incorporate and maintain valuable wetlands in open space preservation programs.	Both
Action 5.C.3	Review and revise, as necessary, sediment and erosion control regulations.	Both
Objective 5.D: Protect floodplains from inappropriate development.		
Action 5.D.1	Strengthen existing development regulations to discourage land uses and activities that create hazards.	New
Action 5.D.2	Plan and zone for open space, recreational, agricultural, or other low-intensity uses within floodway fringes.	New

Goal 6: Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to earthquakes and liquefaction.		New, Existing or Both
Objective 6.A: Develop a comprehensive approach to reducing the possibility of damage and losses due to earthquakes.		
Action 6.A.1	Update Building Codes to reflect current earthquake standards.	Both
Action 6.A.2	Continue to participate in community awareness meetings.	Both
Action 6.A.3	Continue to develop and distribute printed publications to the communities concerning hazards.	Both

Goal 6: Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to earthquakes and liquefaction.		**New, Existing or Both**
Objective 6.B: Protect existing assets with the highest relative vulnerability to the effects of earthquakes.		
Action 6.B.1	Continue to identify hazard-prone structures through GIS modeling.	Both
Action 6.B.2	Ensure new construction critical facilities are designed to function after a major earthquake.	New
Action 6.B.3	Continue to study ground motion, landslide, and liquefaction.	Both
Objective 6.C: Coordinate with and support existing efforts to mitigate earthquake hazards.		
Action 6.C.1	Identify projects for pre-disaster mitigation funding.	Both
Action 6.C.2	Continue to implement an ongoing public seismic risk assessment program.	Both
Action 6.C.3	Continue to collaborate with Federal, State and local agencies' mapping efforts.	Both

Objective 6.D: Address identified data limitations regarding the lack of information about the relative vulnerability of assets from earthquakes.		
Action 6.D.1	Continue to assess countywide utility infrastructure with regard to earthquake risk.	Both
Action 6.D.2	Develop and implement an incentive program for seismic retrofits.	Existing
Action 6.D.3	Continue to encourage the public to prepare and maintain a 3-day preparedness kit for home and work.	Both
Objective 6.E: Protect existing assets with the highest relative vulnerability to the effects of liquefaction.		
Action 6.E.1	Identify hazard-prone structures through GIS modeling.	Existing
Action 6.E.2	Build critical facilities that function after a major earthquake.	New
Action 6.E.3	Study ground motion, landslide and liquefaction.	Both

Goal 7: Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to coastal storm/erosion/tsunami.		**New, Existing or Both**
Objective 7.A: Develop a comprehensive approach to reducing the possibility of damage and losses due to coastal storms/erosion.		
Action 7.A.1	Continue to coordinate with coastal cities to develop a comprehensive plan.	Both
Action 7.A.2	Participate in community awareness meetings.	Both
Action 7.A.3	Develop and distribute printed publications to the communities concerning hazards.	Both

Goal 7: Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to coastal storm/erosion/tsunami.		**New, Existing or Both**
Objective 7.B: Protect existing assets with the highest relative vulnerability to the effects of coastal storms/erosion.		
Action 7.B.1	Retrofit structures to strengthen resistance to damage.	Existing
Action 7.B.2	Continue to encourage the public to prepare and maintain a 3-day preparedness kit for home and work.	Both
Action 7.B.3	Seek pre-disaster mitigation funding for coastal erosion projects.	Both
Objective 7.C: Coordinate with and support existing efforts to mitigate severe coastal storms/erosion.		
Action 7.C.1	Continue to review and update plans that would include coordination with cities, special districts and county departments.	Both
Action 7.C.2	Continue to streamline policies to eliminate conflicts and duplication of effort.	Both
Action 7.C.3	Continue to develop and publish evacuation procedures to the public.	Both
Objective 7.D: Address identified data limitations regarding the lack of information about the relative vulnerability of assets from coastal storms/erosion.		
Action 7.D.1	Using GIS continue to identify hazard-prone structures.	Both
Action 7.D.2	Continue to incorporate information and recommendations from coastal cities into the hazard mitigation plan.	Both

Goal 8: Reduce the possibility of damage and losses to existing assets, including people, critical facilities /infrastructure, and public facilities due to landslide.		**New, Existing or Both**
Objective 8.A: Develop a comprehensive approach to reducing the possibility of damage and losses due to landslide.		
Action 8.A.1	Continue to identify potential areas based upon historical data.	Both
Action 8.A.2	Continue to participate in community awareness meetings.	Both
Action 8. A.3	Continue to develop and distribute printed publications to the communities concerning hazards.	Both
Objective 8.B: Protect existing assets with the highest relative vulnerability to the effects of landslide.		
Action 8.B.1	Study and improve storm drains for landslide prone areas.	Both
Action 8.B.2	Develop, adopt and enforce effective building codes and standards.	New
Action 8.B.3	Seek pre-disaster mitigation funding for landsides prevention projects.	Both
Objective 8.C: Coordinate with and support existing efforts to mitigate landslide.		
Action 8.C.1	Continue to review and update plans that would include coordination with cities, special districts and county departments.	Both

Goal 8: Reduce the possibility of damage and losses to existing assets, including people, critical facilities /infrastructure, and public facilities due to landslide.		**New, Existing or Both**
Action 8.C.2	Continue to streamline policies to eliminate conflicts and duplication of effort.	Both
Action 8.C.3	Develop and publish evacuation procedures to the public.	Both
Objective 8.D: Address identified data limitations regarding the lack of information about the relative vulnerability of assets from landslide.		
Action 8.D.1	Identify hazard-prone structures through GIS modeling.	Both
Action 8.D.2	Implement hazard awareness program.	Both

Goal 9: Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to floods.		**New, Existing or Both**
Objective 9.A: Develop a comprehensive approach to reducing the possibility of damage and losses due to floods.		
Action 9.A.1	Continue to review and compare existing flood control standards, zoning and building requirements.	Both
Action 9.A.2	Identify flood-prone areas by using GIS.	Both
Action 9.A.3	Adopt policies that discourage growth in flood-prone areas.	Both
Objective 9.B: Protect existing assets with the highest relative vulnerability to the effects of floods within the 100-year floodplain.		
Action 9.B.1	Assure adequate funding to restore damaged facilities to 100-year flood design.	Both
Action 9.B.2	Update storm water system plans and improve storm water facilities in high-risk areas.	Both
Action 9.B.3	Plan for evacuation in case of major hazard event.	Both
Objective 9.C: Coordinate with and support existing efforts to mitigate floods (e.g., US Army Corps of Engineers, US Bureau of Reclamation, and California Department of Water Resources).		
Action 9.C.1	Develop a flood control strategy that ensures coordination with Federal, State and local agencies.	Both
Action 9.C.2	Improve hazard warning and response planning.	Both
Objective 9.D: Minimize repetitive losses caused by flooding.		
Action 9.D.1	Identify those communities that have recurring losses.	Both
Action 9.D.2	Develop project proposals to reduce flooding and improve control in flood prone areas.	Both
Action 9.D.3	Acquire properties, when feasible, on floodway to prevent development.	Both

Goal 9: Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to floods.		New, Existing or Both
Objective 9.D: Minimize repetitive losses caused by flooding.		
Action 9.D.4	Seek pre-disaster mitigation funding.	Both
Objective 9.E: Address perceived data limitations regarding the lack of information about the relative vulnerability of assets from flooding.		
Action 9.E.1	Continue to encourage the public to prepare and maintain a 3-day preparedness kit for home and work.	Both
Action 9.E.2	Increase participation and improve compliance with the National Flood Insurance Program (NFIP).	Both
Action 9.E.3	Develop and implement hazard awareness program.	Both

Goal 10: Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to structural fire/wildfire.		New, Existing or Both
Objective 10.A: Develop a comprehensive approach to reducing the possibility of damage and losses due to structural fire/wildfire.		
Action 10.A.1	Update the County Consolidated Fire Code as necessary.	Both
Action 10.A.2	Develop model Weed Abatement and Fuel Modification Ordinances.	Both
Action 10.A.3	Utilize GIS as an information tool.	Both
Action 10.A.4	Coordinate with and support existing efforts to mitigate structural fire/wildfire.	Both
Action 10.A.5	Continue to develop partnerships for a countywide vegetation management program.	Both
Objective 10.B: Protect existing assets with the highest relative vulnerability to the effects of structural fire/wildfire.		
Action 10.B.1	Enforce standardized Defensible Space Clearance distances.	Both
Action 10.B.2	Work with community-based groups to pilot chipping programs.	Both
Action 10.B.3	Continue to research options to provide low cost insurance to cover landowners who allow prescribed burning on their lands.	Both
Objective 10.C: Coordinate with and support existing efforts to mitigate structural fire/wildfire.		
Action 10.C.1	Establish a continuing wildland fire technical working group.	Both
Action 10.C.2	Continue to develop partnerships for a countywide vegetation management program.	Both

Goal 10: Reduce the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to <u>structural fire/wildfire</u>.		**New, Existing or Both**
Objective 10.C: Coordinate with and support existing efforts to mitigate structural fire/wildfire.		
Action 10.C.3	Report annually to the Board of Supervisors on the progress of fire mitigation strategies.	Both
Objective 10.D: Address identified data limitations regarding the lack of information about the relative vulnerability of assets from structural fire/wildfire.		
Action 10.D.1	Identify Urban/wildland fire interface areas.	Both
Action 10.D.2	Use GIS to map fire risk areas.	Both
Action 10.D.3	Implement public education program to address fire dangers and corrective measures.	Both

Goal 11: Reduce the possibility of damage and losses to existing assets, including people, critical facilities /infrastructure, and public facilities due to <u>extreme weather and drought.</u>		**New, Existing or Both**
Objective 11.A: Educate the community about drought, its potential impacts and individual mitigation techniques that they can engage in to help prevent drought or reduce the impact of drought.		
Action 11.A.1	Encourage residents to adopt drought tolerant landscaping or xeriscape practices.	Both
Action 11.A.2	Promote use of reclaimed water for all landscaping efforts.	Both
Action 11.A.3	Support groundwater recycling efforts.	Both
Objective 11.B: Protect vulnerable populations from the effects of extreme heat		
Action 11.B.1	Support regional efforts to prepare for excessive heat events	Both
Action 11.A.2	Participate in "Excessive Heat Emergency Awareness" events and exercise heat emergency plans as established by HHSA, AIS, EMS, and PHS.	Both
Action 11.A.3	Continue to provide "Cool Zones" during excessive heat events.	Both

5.21.5 Prioritization and Implementation of Action Items

Once the comprehensive list of jurisdictional goals, objectives, and action items listed above was developed, the proposed mitigation actions were prioritized using STAPLEE criteria. This step resulted in a list of acceptable and realistic actions that address the hazards identified in each jurisdiction. This prioritized list of action items was formed by the LPG.

The prioritized actions below reflect progress in local mitigation efforts as well as changes in development.

The Disaster Mitigation Action of 2000 (at 44 CFR Parts 201 and 206) requires the development of an action plan that not only includes prioritized actions but one that includes information on how the prioritized actions will be implemented. Implementation consists of identifying who is responsible for which action, what kind of funding mechanisms and other resources are available or will be pursued, and when the action will be completed.

The top 11 prioritized mitigation actions as well as an implementation strategy for each are:

Action Item #1: Update Operational Area Emergency Operational Plan and associated Annexes
Coordinating Individual/Organization: The Office of Emergency Services (OES) will work with the 18 incorporated cities and participating special districts to revise and update the Plan
Potential Funding Source: FEMA Grants/ General Funds for County and Cities.
Implementation Timeline: January 2019 – January 2020

Action Item #2: Develop and maintain public education and outreach programs related to actions residents can take to mitigate hazards they may face. (Annual defensible space education/outreach; terrorism prevention; erosion control, etc.)
Coordinating Individual/Organization: OES and County Communications Office (CCO)
Potential Funding Source: General Fund/Federal or State Grants
Implementation Timeline: January 2018 – January 2023

Action Item #3: Review the County Consolidated Fire Code annually and update as necessary
Coordinating Individual/Organization: Planning and Developmental Services and County Fire Authority
Potential Funding Source: General Fund/Federal or State Grants
Implementation Timeline: January 2018 - January 2023

Action Item #4: Streamline policies to eliminate conflicts and duplication of effort in regional planning efforts by coordinating emergency management activities with regional stakeholders by facilitating meetings on a regular basis with regional emergency managers, campus emergency managers, DOD partners, Voluntary Agencies Active in Disaster, and faith-based partners.
Coordinating Individual/Organization: OES, County Departments, local military, healthcare agencies and the 18 incorporated cities
Potential Funding Source: General Fund/Federal or State grants
Implementation Timeline: January 2018 – January 2023

Action Item #5: Publicize and encourage the adoption of appropriate hazard mitigation actions throughout the region
Coordinating Individual/Organization: OES/PDS/County Fire Authority/CCO/County Technology Office (CTO)
Potential Funding Source: General Fund/Federal or State grants.
Implementation Timeline: January 2018 – January 2023

Action Item #6: Review Building Codes to reflect current earthquake standards annually and update as necessary
Coordinating Individual/Organization: Planning and Developmental Services
Potential Funding Source: General Fund/Federal or State Grants.

Implementation Timeline: January 2018 – January 2023

Action Item #7: Support public and private sector symposiums that emphasize hazard mitigation planning

Coordinating Individual/Organization: OES/County Departments/Cities/Private Sector
Potential Funding Source: General Fund/Federal or State Grants
Implementation Timeline: January 2018 – January 2023

Action Item #8: Maintain multi-jurisdictional/multi-functional training and annual exercises to enhance hazard mitigation

Coordinating Individual/Organization: OES/County Departments/All 18 Cities/appropriate Private Sector Agencies
Potential Funding Source: Grant Funded
Implementation Timeline: January 2018 – January 2023

Action Item #9: Review and update annually regional emergency plans, Concept of Operation plans, protocols, and standard operational processes.

Coordinating Individual/Organization: OES/appropriate county Departments/All 18 Cities/Special Districts
Potential Funding Source: General Fund/Federal or State grants.
Implementation Timeline: January 2018 – January 2023

Action Item #10: Encourage the public to prepare and maintain a 3-day preparedness kit for home and work through outreach events, social media, paid media and earned media.

Coordinating Individual/Organization: OES/CCO/CTO
Potential Funding Source: General Fund/Federal or State grants
Implementation Timeline: January 2018 – January 2023

Action Item #11: Develop a Climate Action Plan.

Coordinating Individual/Organization: Land Use and Environment Group/OES
Potential Funding Source: General Fund/Federal or State grants
Implementation Timeline: January 2018 – January 2023

This section of the Plan describes the formal process that will ensure that the Plan remains an active and relevant document. The plan maintenance process includes a schedule for monitoring and evaluating the Plan annually and producing a plan revision every five years. This section describes how the county and cities will integrate public participation throughout the plan maintenance process. Finally, this section includes an explanation of how jurisdictions intend to incorporate the mitigation strategies outlined in this plan into existing planning mechanisms such as the County Comprehensive Land Use Plan, Capital Improvement Plans, and Building Codes.

6.1 Monitoring, Evaluating and Updating the Plan

6.1.1 Plan Monitoring

The HMWG participants will be responsible for monitoring the plan annually for updates to jurisdictional goals, objectives, and action items. If needed, these participants will coordinate through the County OES to integrate these updates into the Plan. County OES will be responsible for monitoring the overall Plan for updates on an annual basis.

6.1.2 Plan Evaluation

The Plan is evaluated by County OES and by each participating jurisdiction annually to determine the effectiveness of programs, and to reflect changes in land development or programs that may affect mitigation priorities. This includes re-evaluation by HMWG leads (or their select jurisdictional representative) based upon the initial STAPPLEE criteria used to draft goals, objectives, and action items for each jurisdiction. County OES and city representatives also review the goals and action items to determine their relevance to changing situations in the county, as well as changes in State or Federal regulations and policy. County OES and jurisdictional representatives review the risk assessment portion of the Plan to determine if this information should be updated or modified, given any new available data. The coordinating organizations responsible for the various action items will report on the status of their projects, the success of various implementation processes, difficulties encountered, success of coordination efforts, and which strategies should be revised. Any updates or changes necessary will be forwarded to County OES for inclusion in further updates to the Plan. The HMWG and each Local Mitigation Planning Team meet annually to discuss the status of the Plan.

6.1.3 Plan Updates

Since the plan's original adoption in 2005 the HMWG has participated in an annual review. This process was continued after the adoption of the 2010 plan. The review details all mitigation actions that were deferred, begun, continued or completed during that calendar year. In the past five years there has been considerable progress made with the successful completion of the vast majority of the action items developed by the participating jurisdictions. Appendix C details the status of the action items from the 2010 plan.

This review process has been effective in identifying gaps and shortfalls in funding, support, and other resources. It has also allowed for the re-prioritization of specific actions as circumstances change. It allows each participating jurisdiction to maintain the plan as a living document. This review process has enabled the HMWG to improve the document by eliminating actions that have been completed, adding new actions that have been identified since the plans adoption and reprioritizing other actions to reflect new priorities and/or constraints. The negative side of this review process is that it is time consuming, pulling staff away from their day-to-day responsibilities.

County OES will continue to be the responsible agency for updates to the Plan. All HMWG participants will continue to be responsible to provide OES with jurisdictional-level updates to the Plan annually or when/if necessary as described above. Every five years the plan will be updated and submitted to Cal OES and FEMA for review.

6.1.4 Implementation through Existing Programs

County and local jurisdictions have implemented many of the recommended action items through existing programs and procedures. Participants use the Plan as a baseline of information on the natural hazards impacting their jurisdictions. They have also been able to refer to existing institutions, plans, policies and ordinances defined for each jurisdiction in Section 5 of the Plan (e.g., General Plan, Comprehensive Plan). Participants are incorporating the Hazard Mitigation Plan into their General Plans and/or Comprehensive Plans as those plans come up for review and revision.

6.1.5 Continued Public Involvement

The 2010 was posted on the Hazard Mitigation page of the San Diego County Office of Emergency Services webpage. The public was encouraged to comment on the plan online. Once approved, the revised plan will be posted on the hazard mitigation page of the County website. A dedicated email address is provided to the public to provide comments on the plan.

In addition, at the beginning of the revision process a survey was posted on all participating jurisdiction's webpages to determine the best way to meet the needs and desires of the community. The survey results are in Appendix D.

The participating jurisdictions and special districts continue to be dedicated to involving the public directly in the review process and updates of the Plan. A maintenance committee made up of a representative from County OES and a representative from each participating jurisdiction is responsible for monitoring, evaluating, and updating the Plan as described above. During all phases of plan maintenance the public will have the opportunity to provide feedback.

A copy of the Plan is available for review on the County OES website. Participating jurisdictions also have links from their website to the Plan. In addition, hard copies of the plan are catalogued and kept at all of the appropriate agencies in the county. The existence and location of these copies is also posted on the county website. To facilitate public comments, the site contains an email address for the public's use which is monitored on a daily basis by County OES. Any questions or comments received on this website are forwarded to the appropriate member(s) of the HMWG for their review and response. County OES also tracks these public comments on the plan.

A press release requesting public comments is also issued for each update, and after each evaluation. We are also using social media (Facebook, Twitter, etc.) to notify the public of any changes they should be aware of. These notifications direct people to the website where the public can review proposed changes. Coupled with the dedicated email address for comments, this provides the public a simple and easily accessible to allow them to express their concerns, opinions, or ideas about any updates/changes that are proposed to the Plan. The County OES will continue to be responsible for publicize any changes to the Plan and maintaining public involvement.

SECTION 7 REFERENCES

ABAG Dam Failure Inundation Hazards Guide, http://www.abag.ca.gov/bayarea/eqmaps/damfailure/dfguide.html

Bainbridge, David 1997. The Flood Next Time. The San Diego Earth Times Web Page: http://www.sdearthtimes.com/et1097/et1097s1.html

California Department of Boating and Waterways and SANDAG, 1994. Shoreline Erosion Assessment and Atlas of the San Diego Region, Volumes I and II. Edited by Reinhard E. Flick, PhD.

California Earthquake History 1769-Present Earthquake.usgs.gov/regional/sca/ca_eqs.php

City of Fort Collins Dam Failure Webpage, http://www.ci.fort-collins.co.us/oem/dam-failure.php

California Coastal Commission Draft Sea Level Rise Policy Guidance (2013) http://www.coastal.ca.gov/climate/slr/guidance/CCC_Draft_SLR_Guidance_PR_10142013.pdf

California Department of Conservation, Division of Mines and Geology 1990. Planning Scenario for a Major Earthquake, San Diego-Tijuana Metropolitan Area. Special Publication 100.

California Department of Water Resources, Dam Safety, http://www.water.ca.gov/damsaefty/docs/fault.pdf

California Environmental Protection Agency and Office of Environmental Health Hazard Assessment, 2013. "Indicators of Climate Change in California."

Climate Education Partners, 2014. "San Diego, 2050 Is Calling. How Will We Answer?"
County of San Diego, Department of Sanitation and Flood Control. Storms in San Diego County.

FEMA 2002. State and Local Mitigation Planning How-to Guide. September 2002, FEMA 386-1.

FEMA 1999. HAZUS 99 Earthquake Loss Estimation Methodology User Manual-ArcView. Developed by FEMA through arrangements with National Institute of Building Sciences.

Frankel, Arthur, Mueller, Charles, Barnhard, Theodore, Perkins, David, Leyendecker, E.V., Dickman, Nancy, Hanson, Stanley, and Hopper, Margaret, 1997, Seismic-hazard maps for the conterminous United States, Map C - Horizontal Peak Acceleration with 2% probability of exceedance in 50 years, U.S. Geological Survey Open-File Report 97-131-C. http://geohazards.cr.usgs.gov/eq/html/data.html

Garfin, G., G. Franco, H. Blanco, A. Comrie, P. Gonzalez, T. Piechota, R. Smyth, and R. Waskom, 2014: Ch. 20: Southwest. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 462-486. doi:10.7930/J08G8HMN.

Governor's Office of Emergency Services 2003. Interim Hazard Mitigation Planning Guidance for California Local Governments. Prepared for the DRC April 21-23, 2003.

Hawk, R.N., and Christiansen, T.P., 1991, City of San Diego Ordinances and Regulations with Respect to Geotechnical and Geological Hazards, in Environmental Perils, San Diego Region, Abbott, P.L., and Elliott, W.J., editors, San Diego Association of Geologists

Higbee, Melissa, Daniel Cayan, Sam Iacobellis, Mary Tyree (2014). Report from San Diego Hazard Mitigation Plan Update Training Workshop #1: Climate Change and Hazards in San Diego. ICLEI-Local Governments for Sustainability. Accessed July 7, 2014. http://www.icleiusa.org/library/documents/training-workshop-report/view

Institute for Business and Life Safety, Tampa FL, July 2008 Mega Fires: The Case for Mitigation, The Witch Creek Fire, October 21-31, 2007

IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Leighton & Associates, 1983, Seismic Safety Study for the City of San Diego, City of San Diego General Plan

Journal of San Diego History 2002. Dry Rivers, Dammed Rivers and Floods: An Early History of the Struggle Between Droughts and Floods in San Diego. Winter 2002, Volume 48, Number 1. http://www.sandiegohistory.org/journal/2002-1/hill.htm

National Association of Counties April 2009. "A Snapshot of the Impact of the Recession on Large, Urban Counties".

Office of Emergency Services 2014. Unified San Diego County Emergency Services Organization Operational Area Emergency Plan.

San Diego's Changing Climate: A Regional Wake-Up Call. A Summary of the Focus 2050 Study Presented by The San Diego Foundation

San Diego Natural History Museum Web Page 2003. Faults and Earthquakes in San Diego County. Thomas A. Demere, Ph.D: Curator of Paleontology. http://www.sdnhm.org/research/paleontology/sdfaults.html

Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future (2012). http://www.nap.edu/catalog.php?record_id=13389

South Carolina Emergency Management Division. South Carolina Emergency Operations Plan Appendix 4 South Carolina Dam Failure and Preparedness Plan. February 2009

Stroh, Robert C. editor., 2001: Coastal processes and Engineering Geology of San Diego, California, San Diego Association of Geologists, Sunbelt Publications

U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration 1993. Tsunamis affecting the West Coast of the United States 1806-1992. KGRD 29.

Walsh, J., D. Wuebbles, K. Hayhoe, J. Kossin, K. Kunkel, G. Stephens, P. Thorne, R. Vose, M. Wehner, J. Willis, D. Anderson, S. Doney, R. Feely, P. Hennon, V. Kharin, T. Knutson, F. Landerer, T. Lenton, J. Kennedy, and R. Somerville, 2014: Ch. 2: Our Changing Climate. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 19-67. doi:10.7930/J0KW5CXT.

APPENDIX A: HAZARD MITIGATION WORKING GROUP MEETING AGENDAS AND SUMMARIES

Group Meeting #1: Wednesday February 11, 2014, 9:00 AM

Meeting Summary

Tom Amabile (TA) gave an introduction that discussed the working group goals. The group went around and identified themselves and their agencies. The audience consisted of representatives from the 18 incorporated cities, the County of San Diego and various local water agencies as well as from several fire protection districts. Special Districts represented were:

- Alpine Fire Protection District
- Lakeside Fire Protection District
- Padre Dam Municipal Water District
- Rancho Santa Fe Fire Protection District
- San Diego County Water Authority
- Sweetwater Authority
- Valley Center Water District
- Vista Irrigation District

TA gave a PowerPoint™ presentation discussing the goals of the San Diego County Multi-Jurisdiction Multi-Hazard Mitigation Plan (Plan), the objectives of DMA 2000, the hazard mitigation planning process and the steps involved in developing the Plan achieving the goals.
The presentation included a discussion of the methodology that will be used to revise the Plan for San Diego County. It was stressed that participation from special districts, especially fire protection districts and water districts was strongly encouraged and welcome.

As explained in the PowerPoint presentation the goals of the hazard mitigation planning process consists of:

1. Identifying
    a. Risk of loss of life and property damage due to man-made and natural disasters
    b. Options for mitigation to lower or eliminate those risks
    c. Available resources and capabilities to implement mitigation actions
    d. Risks to San Diego County:
        i. Coastal storms/erosion
        ii. Dam Failure
        iii. Drought
        iv. Earthquakes
        v. Flooding
        vi. Hazardous Materials\
        vii. Landslides
        viii. Terrorism
        ix. Tsunamis

x. Wildfires

2. Planning Process

   a. Basic Steps
      i. Establish planning area
         a. Identify partnerships
            i. Regional organizations
            ii. Local governments
            iii. Special Districts
            iv. Tribal governments
      ii. Build the planning team
         a. Identify Team Members
            i. Board of Supervisors/City Councils
            ii. Code Enforcement
            iii. Community Development
            iv. Fire
            v. Law Enforcement
            vi. Emergency Management
            vii. Floodplain Administrators
            viii. GIS
            ix. Public Information
            x. Public Works
            xi. Special Districts
            xii. Stormwater Management
            xiii. Special Districts
            xiv. Transportation
         b. Each participating jurisdiction will have a local planning team
            i. Focus on issues specific to that jurisdiction
            ii. One or two members will also be part of the regional planning team
         c. Responsibilities include:
            i. Attend meetings
            ii. Collect data
            iii. Make decisions on the planning process and content
            iv. Submit required worksheets
            v. Review plan drafts
            vi. Assist with coordination of public involvement and plan adoption
      iii. Create an outreach strategy
         a. Three tiers
            i. Planning Team
            ii. Stakeholders

iii. General Public
b. Successful Outreach
i. Informs and educates
ii. Invites interested parties tro contribute
iii. Identifies conflicts
iv. Incorporated different perspectives
v. Provides data and information that improves the final plan
vi. Ensures transparency and builds trust
vii. Maximizes opportunities
c. Outreach Methods
i. Community Events
ii. News articles
iii. Presentations to local governments
iv. Questionnaires/Surveys
v. Public forums
vi. Social media
vii. Community specific meetings
viii. Website
d. Document the process
iv. Review community capabilities
a. Existing authorities, polices, programs and resources
b. Core Capabilities
i. Planning
ii. Public information and warning
iii. Operational coordination
iv. Community resilience
v. Long-term vulnerability reduction
vi. Risk and disaster resilience assessment
vii. Threats and hazards identification
c. National Flood Insurance Program
d. Community Capabilities
i. Plans
ii. Studies
iii. Reports
iv. Technical Information
v. For each jurisdiciton
v. Conduct risk assessment
a. Describe hazards
b. Identify community assets
i. People
ii. Economic
iii. Built Environment
iv. Cultural resources

v. Future development
vi. Natural Environment

c. Analyze Risk
i. Exposure Analysis
ii. Historical Analysis
iii. Scenario Analysis
iv. GIS Hazard Mapping

d. Summarize vulnerability

vi. Develop a mitigation strategy
a. Goals –What we want to achieve
b. Actions – Specific projects and activities to meet those goals\
c. Action Plan – Describes how mitigation actions will be implemented
d. Develop the Plan
i. Finalize goals and objectives
ii. Identify mitigation measures
iii. Evaluate mitigation measures
iv. Prioritize mitigation measures
e. Document the plan

vii. Keep the plan current

viii. Adopt the plan

ix. Create a safe and resilient community
a. Focus on quality, not quantity
b. Develop strong messaging
c. Encourage local champions
d. Identify funding and assistance

The presentation also entailed an explanation of the benefits and requirements of participating in the Hazard Mitigation Plan process. The special districts were told that this was an excellent time for them to become engaged with the hazard mitigation planning process. Because the plan was set for revision, they could become part of the process and have their plans incorporated into the multi-jurisdictional plan by simply participating and developing a plan. TA went on to describe the benefits of having a plan, specifically the ability to apply for hazard mitigation grants. He explained that the grant process was competitive and having a hazard mitigation plan did not guarantee a grant award.

The schedule of work group meeting was discussed. The work group will meet monthly to begin with. The next meeting date was schedule for March 5, 2014. At that meeting all participating jurisdictions (cities, county and special districts) will begin the actual process of updating and revising the multi-jurisdictional hazard mitigation plan.

Group Meeting #2: Thursday May 28, 2009, 10:00 AM
A G E N D A

Introductions
Schedule
GIS's Role in the Planning Process
Planning Process – Where Are We Now?
GIS – Assessing Risks – Step 1/Identify Hazards
What's Next?
Next Meeting – Time and Location
June 25, 2009 0900 – 1200
OES

Tom Amabile (TA) gave an introduction that discussed the working group goals. The group went around and identified themselves and their agencies. The audience consisted of representatives from the incorporated cities, the County of San Diego, various local water agencies and fire protection districts. Agencies represented at the meeting were:

City of Poway
City of El Cajon
City of La Mesa
City of Lemon Grove
City of San Diego
City of San Marcos
City of Vista
Alpine FPD
Lakeside FPD
Rancho Santa Fe FPD
San Miquel FPD
Padre Dam MWD
San Diego County Water Authority
Sweetwater Authority
Valley Center MWD
Vista Irrigation District

GIS' Role in the Planning Process

Geographic Information System (GIS) is essential for hazard mitigation planning. It can incorporate multiple and diverse data sources and provide an easily understood visual presentation of even the most complex data. GIS provides a modeling capability, allowing us to ask "What If" questions. Finally, it allows the data to be easily disseminated in the form of tables, maps, charts, etc.

It works by putting the available data in layers that can then be rectified and so they will overlay and allow queries to be run.

We need to identify all available data sources. There is a listing of sources in Appendix B of the current Hazmit plan. Please review them and if you have additional appropriate data files that are not currently being used for this project, please let Tom Amabile know so they can be incorporated in to the HAZUS modeling that will be done. If there are data layers identified that are no longer valid, please let Tom know that was well.

Planning Process

We have organized our resources by establishing a planning team, and are working towards assessing community support and engaging the public. Currently, we are assessing our risk. This is accomplished by identifying hazards and profiling them to assess likely hood of occurrence and potential severity. We can eliminate hazards with a low risk (little chance of occurrence or for damage from the event), those with little potential for mitigation and those that already have mitigation efforts underway.

We will look at events that have resulted in a Local Proclamation of Emergency, a Gubernatorial Proclamation or a Presidential Declaration. They will be categorized by:

Type
Date
Location
Expenditures
Damages
Description

We will also look at undeclared events looking for the same data above. Once that is complete we can inventory assets to determine their vulnerability to these hazards and identify potential loses.

Once that is complete we will develop the mitigation plan. To do this we will identify goals and objectives, establish and prioritize mitigation measures, prepare an implementation strategy and document the plan.

The final step will be to implement the plan. That will require adoption of the approved plan by all participating jurisdictions and implementation of plan recommendations. Each year we will evaluate the results and modify the recommendations to reflect completed tasks adding new tasks to the prioritized list as appropriate.

It is anticipated that we will begin the next revision of the complete plan in 2019.

Assessing Risk

Hazards currently addressed in the plan are:

Earthquakes
Wildfires
Flooding
Landslide
Drought
Tsunami
Hazardous materials
Coastal storm/erosion
Dam failure
Terrorism

Potential additions to the 2015 plan are:

Drought/Water Supply
Extreme Heat
Other extreme weather events

A discussion of the identified hazards and potential new hazards took place. The consensus was that we would merge liquefaction with earthquake and merge radioactive materials release with hazardous materials release. There will also be a new hazard listed to encompass potential impacts from climate change that was identified as "Extreme Weather/Drought".

OES is finishing up a survey on Survey Monkey that will released to the public by the end of March and will be available to them for six weeks (FEMA requires a minimum response time of four weeks). This will be the start of the Public Outreach effort. We will conduct the survey upfront, before making/finalizing the plan, so ideas/comments from the public can be incorporated into the planning process and the draft plan. Each jurisdiction is requested to provide a link to the survey on their website, to allow for as much public outreach as possible. The County of San Diego will issue a press release to notify the public and encourages each jurisdiction to do the same. The County's press release will be made available to all participating jurisdictions.

What's Next?

It is expected that each jurisdiction will, with the assistance of their local hazmit working group, begin to focus on aspects specific to their jurisdiction. Part of this process will be "Ground-truthing," I.e., each individual jurisdiction must confirm the data being used is accurate and acceptable to them.

Part of this process will be to profile the hazards. While the County's GIS staff will model this, each city/special district will need to review the results to ensure they are appropriate for that jurisdiction.

Homework

Everyone is requested to:

Review the data matrix in Appendix B
Review the hazard maps
Review FEMA Local Mitigation Planning Handbook (on the CD provided last meeting. It is also available on line at:
http://www.fema.gov/media-library/assets/documents/31598?id=7209
Complete the 4 Worksheets form the handbook

Group Meeting #3: June 24, 2014,
AGENDA

Introductions
Schedule
Mitigation Strategy
Goals,- Consistent with hazards identified
Goals from 2010 Plan
Actions
Local Plans and regulations
Structure/Infrastructure projects
Natural Systems protection
Education & Awareness programs
Preparedness Actions
Mitigating Actions
Action Prioritization

Implementation
Incorporate into existing plans & Policies
Integrate with other community objectives, using existing mechanisms.
Think pre and post-disaster mitigation

Updating Mitigation Strategy
Evaluate implementation progress
Explain changes in priorities

Communicating Mitigation Action Plan to the Public

What's Next ?
Run HAZUS analysis
Develop Maps and Tables

Begin development of mitigation strategy
Homework
Review goals and objectives in 2010 plan
Begin update local goals, objectives and actions.

Next Meeting – August 26, 2014 10 AM

Meeting Summary

Tom Amabile gave an introduction that discussed the working group goals. Members went around the room and introduced themselves.

Tom Amabile reviewed the time-line for the project. He then reviewed the goals, objects and actions that will be listed in the plan;
Goals are guidelines that explain what you want to achieve. They must be consistent with the hazards identified.
Objectives connect actions to the goals, and
Actions are specific measurable projects and activities that help achieve the goal.
Mitigation actions which include changes to local plans and regulations, structure/infrastructure projects, natural systems protection and education and awareness programs.
Preparedness actions to reduce or eliminate long-term risk and lessen the need for preparedness and/or response resources in the future. These actions include mutual aid agreements, purchasing communications equipment and developing mass notification capabilities.

The **Action Plan** describes how mitigation actions will be prioritized and implemented.

Goals and Objectives identified in the current plan were presented. They are:

Reduce the possibility of damage and losses to existing assets due to geologic hazards
Reduce the possibility of damage and losses to existing assets due to structure fire/wildfire
Reduce the possibility of losses to existing assets due to flooding/dam failure
Increase public understanding and support for effective hazard mitigation
Improve hazard mitigation coordination and communication with federal, State, local and tribal governments
Reduce the possibility of damage and losses to existing assets due to geologic hazards
Reduce the possibility of damage and losses to existing assets due to structure fire/wildfire
Reduce the possibility of losses to existing assets due to flooding/dam failure
Increase public understanding and support for effective hazard mitigation
Improve hazard mitigation coordination and communication with federal, State, local and tribal governments

There was discussion regarding changing or modifying these goals and objectives. Each participating jurisdiction is free to modify them to meet their needs.

The process for identifying mitigation actions was discussed. It includes:
Review of the risk assessment

Capabilities assessment
Evaluation and prioritization of mitigation actions
Implementation
Updating mitigation strategy
Communicating the action plan to key officials and the public

Action Items

OES/County:

Run HAZUS analysis
Develop maps and tables.

All jurisdictions:

Begin development of Mitigation Strategy.

All other meetings between individual jurisdictions were conducted via telephone or in person between the city/special district and OES.

Group Meeting #4: September 16, 2014,

A G E N D A

Introductions
Schedule
Survey results
Review of Hazards
Review of Over-arching Mitigation Goals
Development of Additional Goals
Homework Assignment
What's Next?

Meeting Summary
Tom Amabile gave an introduction that discussed the working group goals. Members went around the room and introduced themselves.

Tom Amabile reviewed the time-line for the project.
The results of the on-line survey were discussed:
534 people responded to the survey.

Carlsbad -	44	National City -	2
Coronado -	1	Oceanside -	14
Chula Vista -	31	Poway -	28
Del Mar -	28	San Diego -	69

El Cajon -	13	San Marcos -	76
Encinitas -	17	Santee -	13
Escondido -	5	Solana Beach -	109
Imperial Beach -	0	Vista -	29
La Mesa -	9	Unincorporated -	41
Lemon Grove -	4	Other -	1

75% were unaware a regional HazMit plan exists
61% had been impacted by a disaster
86% said they were concerned about being impacted.
Biggest hazards:
Wildfire/Structure Fire – 41%
Earthquake - 31%
Drought – 8%
Climate Change – 4%
Coastal Storm/Erosion – 3%
Next biggest hazards:
Earthquake – 33%
Wildfire/Structure Fire – 17%
Drought – 16%
Terrorism – 3%
Climate Change – 3%
6.87 % live or have a business in a flood plain
9.23 % have flood insurance, 10.17 % aren't sure if they do or not
If they don't have flood insurance it is because
Not in flood plain – 58%
Home/business elevated or protected – 19%
Never floods – 4%
Too expensive – 5%
3 Most common steps local government can take
Increase awareness
Conduct more exercises/drills
Add resources (more fire assets, helicopters, CERT, etc.)
Other concerns
Getting emergency information
Government needs to be eco-friendly
Rated six categories on level of importance:

Category	Importance		
	Very	Somewhat	Not
Prevention	76%	21%	2%
Property Protection	55%	39%	6%
Public Awareness	77%	21%	2%

Nat. Resources	65%	29%	6%
Emerg. Services	88%	11%	1%
Structural Projects	54%	38%	8%

Review of Hazards

Tom Amabile reviewed the hazards in the revised plan:
Coastal Storm/Erosion/Tsunami/Sea Level Rise
8 local proclamations of emergencies
Coastline heavily developed/populated
Prone to erosion
Sea level rise predicted to be between 3 and 12 inches by 2030.
Dam Failure
Over 30 significant dams in the County
Most over 35 years old
Increased downstream development
Drought
Not originally in plan (reliance on imported water reduces our risk from local drought)
State-wide drought puts us at risk
Floods
Large portions of the County within 100 year flood plain
2 proclaimed emergencies in last 15 years
Moderate rainfall results in urban/flash floods on routine basis
Hazardous Materials
Over 100 licensed sites within the region
Regional HazMat team responds to hundreds of calls each year.
Landslide
Landslide prone areas found throughout the county
Most recent damaging landslide was 2007 in La Jolla. 111 homes evacuated, 40 found to be uninhabitable due to ground instability and 7 suffered significant damage.
Terrorism
Every major metropolitan area is susceptible to a terrorist event
Wildfire/Structure Fire
Occur frequently – significant wildfires breakout routinely
5 proclaimed emergencies due to wildfire between 2003 and 2014
Drought increases the risk due to low fuel moisture.

Hazards Not in the Plan
Avalanche
Hailstorm
Nuclear Materials Release (removed due to SONGS decommissioning)
Severe Winter Storms
Volcano

Windstorm

Existing Objectives:
Reduce vulnerability to:
Geologic hazards (earthquake, landslides, liquefaction, etc.)
Wildfires/structure fires
Flooding/dam failure
Coastal erosion/coastal bluff failure/storm surge/tsunami/sea level rise
Severe Weather (including extreme heat)
Increase public support for hazard mitigation
Improve hazard mitigation coordination between all levels of government
Promote disaster resistant existing and future development
Build and support local capacity
Need to develop a goal for drought

Homework
Review current goals and objectives for your jurisdiction
Delete completed items
Add new items
Identify 5 to 10 priority action items
Start Date
Agency/department responsible
Cost/Funding source
Estimated completion date
Short description of the project
Please provide to Tom by 10/15/14

Next Meeting date to be determined.

Multi-juirisdiction Hazard Mitigation Plan Update
2014
Working Group Meeting # 1

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Multi-juirisdiction Hazard Mitigation Plan Update
2014
Working Group Meeting # 1

Februrary 11, 2014

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Multi-juirisdiction Hazard Mitigation Plan Update
2014
Working Group Meeting # 2

3/11/2014

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Multi-jurisdiction Hazard Mitigation Plan Update
2014
Working Group Meeting # 2

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Multi-juirisdiction Hazard Mitigation Plan Update
2014
Working Group Meeting # 3

6/24/2014

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Multi-juirisdiction Hazard Mitigation Plan Update
2014
Working Group Meeting # 3

6/24/2014

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Multi-juirisdiction Hazard Mitigation Plan Update
2014
Working Group Meeting # 4

11/18/2014

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Multi-juirisdiction Hazard Mitigation Plan Update
2014
Working Group Meeting # 4

6/24/2014

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APPENDIX B: DATA MATRIX

NAME	SOURCES	QUERY (IF ANY)	NOTES (INCL. CREDITS)
Coastal Storm/Erosion	HYD_FLOODPL	FLD_ZONE = 'VE'	Federal Emergency Management Agency (FEMA)
Tsunami	HYD_TSUNAMI_INUNDATION_AREA		California Emergency Management Agency (CalEMA), University of Southern California (USC) and California Geological Survey (CGS)
Dam Failure	HYD_DAM_INUNDATION		California Office of Emergency Services and County of San Diego
100-Year Earthquake	HAZUS, USGS		Federal Emergency Management Agency (FEMA; HAZUS); soil from U.S. Geological Survey VS30 data - http://earthquake.usgs.gov/hazards/apps/vs30/custom.php
500-Year Earthquake	HAZUS, USGS		Federal Emergency Management Agency (FEMA; HAZUS); soil from U.S. Geological Survey VS30 data - http://earthquake.usgs.gov/hazards/apps/vs30/custom.php
Rose Canyon M6.9 Scenario	USGS		U.S. Geological Survey
100-Year Flood	HYD_FLOODPL	FLOOD_PLAI = 'FP100' OR FLOOD_PLAI = 'FW100'	Federal Emergency Management Agency (FEMA)
500-Year Flood	HYD_FLOODPL	FLOOD_PLAI = 'FP500'	Federal Emergency Management Agency (FEMA)
Rain-Induced Landslide (High Risk)	GEO_LANDSLIDE_CN	soil_slip_risk = 'High' OR state_landslide_cat = 'Most Susceptible' OR GABRO_SLOPE = 'YES'	State of California, U.S. Geological Survey, Federal Emergency Management Agency (FEMA; HAZUS) and County of San Diego
Rain-Induced Landslide (Moderate Risk)	GEO_LANDSLIDE_CN	(soil_slip_risk = 'Moderate' OR state_landslide_cat = 'Marginally Susceptible') AND GABRO_SLOPE = ''	State of California, U.S. Geological Survey, Federal Emergency Management Agency (FEMA; HAZUS) and County of San Diego
Fire Regime Group II	LANDFIRE	<= 35 Year Fire Return Interval, Replacement Severity	U.S. Department of Agriculture Forest Service and U.S. Department of the Interior
Fire Regime Group IV	LANDFIRE	35 - 200 Year Fire Return Interval, Replacement Severity	U.S. Department of Agriculture Forest Service and U.S. Department of the Interior
Extreme Heat	Cal-Adapt	Maximum temperature - MONTHLY - August 2020 - A2 GFDL	California Energy Commission (CEC) - http://cal-adapt.org/
Sea Level Rise (Coastal Flooding)	Areas inundated by unimpeded Pacific coastal flooding under a scenario of 1.4-meter (55-inch) sea-level rise		Pacific Institute -- http://www2.pacinst.org/
Sea Level Rise (MHHW)	Area inundated by mean higher high water (MHHW) under 1.4-meter (55-inch) sea-level rise scenario		Pacific Institute -- http://www2.pacinst.org/

APPENDIX C: IMPLEMENTATION STATUS

County of San Diego

Priority	Action Item Number	Description	Status
1.	3.B.1	Update Operational Area Plan.	Completed.
2.	2.D.4	Continue to develop and maintain public education and outreach programs.	Completed. On-going.
3.	10.A.1	Update the County Consolidated Fire Code every three years.	On-going.
4.	4.B.3	Continue to streamline policies to eliminate conflicts and duplication of efforts.	On-going.
5.	2.A1	Publicize and encourage the adoption of appropriate hazard mitigation actions.	Completed. On-going.
6.	6.A.1	Update Building Codes to reflect current earthquake standards.	Completed. On-going
7.	2.E.1	Support public and private sector symposiums.	On-going.
8.	4.A.4	Maintain multi-jurisdictional/multi-functional training and exercises to enhance hazard mitigation.	Completed. On-going
9.	4.A.3	Continue to review and update plans that would include coordination with cities, special districts and County departments.	Completed, on-going.
10.	Attach A 1.E.1	Continue to encourage the public to prepare and maintain a 3-day preparedness kit for home and work.	Completed, on-going.

APPENDIX D: SURVEY RESULTS FOR SD MULTIJURISDICTIONAL HAZARD MITIGATION PLAN REVISION

There were 532 respondents for this survey. Of those people:

- 271 chose to provide their name
- 267 provided their e-mail
- 222 provided their phone number

All of the 532 Respondents provided the cities or communities in which they live and work. Although there were respondents from all areas of the county:

- The majority of people stated they live and/or work in the northern part of the county (Example: Solana Beach, Del Mar, Carlsbad, Encinitas, etc.)
- Western and Central San Diego (Example: City of San Diego, Point Loma, etc.) had many respondents, but much less than North County
- There was only a handful of Respondents who claimed to be from the South Bay and Eastern area of the county (Example: Chula Vista, Bonita, Lakeside, Lemon Grove, etc.).

Almost everyone stated they were responding to this survey as a Resident. (524 Answered; 8 Skipped)

- 96.56% (506 Responders) responded as a Resident.
- 2.67% (14 Responders) responded as a Community Organization.
- 0.57% (3 Responders) responded as a Local Business.
- 0.19% (1 Responders) responded as a Non-profit Organization.

According to the responses to question 4, "Are you aware of the San Diego Multijurisdictional Hazard Mitigation Plan developed in 2004 and revised in 2010?" (529 Answered; 3 Skipped)

- 25.52% YES
- 74.48% NO.

When asked, "Have you ever experienced or been impacted by a disaster?" (529 Answered; 3 Skipped)

- 4.54% answered YES
- 38.94% answered NO.
- 56.52% answered YES and explained what the disaster was. Of those people who provided details, earthquakes and having to evacuate their homes due to wild fires was the most common answer.

Question 6 asked, "How concerned are you about the possibility of your community being impacted by a disaster?" (527 Answered; 5 Skipped)

- 18.41% are Extremely Concerned
- 31.31% are Very Concerned

- 35.86% are Moderately concerned
- 13.09% are only Slightly concerned
- 1.33% are Not at all concerned

Question 7 asked people to select the one hazard they think is the highest threat to their neighborhood. (523 Answered; 9 Skipped):

- 41.49% - Structure/Wild Land Fires
- 31.17% - Earthquake
- 8.03% - Drought
- 5.54% - Other (Examples: too much government regulation, Tornadoes, Power outage)
- 3.63% - Climate change
- 2.87% - Coastal Storms/Erosion
- 1.34% - Tsunami
- 1.15% - Extreme heat
- 0.96% - Pandemic
- 0.96% - Landslide
- 0.76% - Severe Winter Storm
- 0.76% - Terrorism
- 0.38% - Extreme Wind
- 0.19% - Nuclear accident
- 0.19% - Hazardous Materials Incident
- 0.19% - Dam Failure
- 0.19% - Flood
- 0.19 % - Oil or Gas line failure
- 0.00% - Liquefaction.

Question 8 had people choose the hazard they think is the second highest threat to their neighborhood. (513 Answered; 19 Skipped):

- 32.55% - Earthquake
- 16.96% - Structure/Wild Land Fire
- 16.37% - Drought
- 3.70% - Other
- 3.31% - Terrorism
- 3.31% - Climate Change
- 3.12% - Coastal Storms/Erosion
- 2.73% - Extreme Heat
- 2.73% - Severe Winter Storm
- 2.53% - Landslide
- 2.53% - Pandemic
- 2.14% - Extreme Wind

- 1.95% - Oil or Gasoline Failure
- 1.95 – Tsunami
- 1.56% - Flood
- 0.78% - Hazardous Materials Incident
- 0.78% - Dam Failure
- 0.58% - Nuclear Accident
- 0.39% - Liquefaction

In reference to the question, “Is your home or business located in a flood plain?” (524 Answered; 8 Skipped)

- 6.87% of people have a home or business that is located in a floodplain
- 93.13% said they do not have a home or business in a flood plain

The following question asked, “Do you have flood insurance?” (531 Answered; 1 Skipped)

- 9.23% of people said they do have flood insurance
- 60.80% said they do not have flood insurance
- 10.17% of people said they do not know if they have flood insurance

When asked people why they do not have flood insurance (469 Answered; 63 Skipped)

- 58.21% said they do not have flood insurance because their home or business is not located in a flood plain
- 18.76% of people do not have flood insurance because their home/business is elevated or otherwise protected
- 4.26% claim it is not necessary because it never floods
- 4.90% said flood insurance is too expensive
- 3.10% said they have never really considered getting flood insurance
- 5.76% have “other reasons”. The majority of people who chose other as their answer explained they do not have flood insurance because they rent or because flood insurance is too expensive.

When asked, “Have you taken any actions to make your home, business or neighborhood more resistant to hazards?”(526 Answered; 6 Skipped)

- 60.27% of people who answered said they have taken actions to make their home, business, or neighborhood more resistant to hazards
- 39.73% have not taken any action

The following question asked if they are interested in making their home, business or neighborhood more resistant to hazards (523 Answered; 9 Skipped)

- 85.09% of people are interested in making their home, business, or neighborhood more resistant to hazards
- 14.91% are not interested

When people were asked what the most effective way to receive information about how to make their home, business, or neighborhood more resistant to hazards (520 Answered; 12 Skipped):

- 52.12% said email
- 13.08% answered internet
- 8.85% answered Mail
- 7.88% said Television
- 7.88% Public workshops
- 4.81% selected Social Media
- 3.65% said Newspaper
- 1.73% said Radio

The follow up question was, "Do you require assistance in receiving information?" (528 Answered; 4 Skipped)

- 97.92% Do not require assistance in receiving information
- 2.08% Require assistance

Question 16 asks people to give their opinion in reference to what are some steps the local government could take to reduce or eliminate the risk of future hazard damages in their neighborhood. (405 Answered; 127 Skipped)

- The 3 most common answers people gave were: Increase public emergency awareness/education, conduct more mock disaster drills, and increase emergency resources and equipment (more fire depts., helicopters, C.E.R.T., etc.).
- Other steps which were suggested were: improve AlertSanDiego.org, monitor people's water usage and inspect homes for safe property practices, and for the cities and county to better maintain land/forestry.

When asked if there are any other issues regarding the reduction of risk and loss associated with hazards or disasters in the community that are important, many people continue to comment about how they are not well informed on how to react in the event of an emergency or disaster (234 Answered; 298 Skipped):

- People feel there is not an effective means to disseminate emergency information.
- Another common topic in people's response to this question is their concern as to what the cities/county is doing to be eco-friendly.

The final question asks people, in their opinion, to rate the level of importance of the six broad categories of community-wide activities. (529 Answered; 3 Skipped)

1. Prevention – Administrative or regulatory actions that influence the way land is developed and buildings are constructed. (Example – Planning and zoning building codes, etc.)
   a. Very Important: 76.15%
   b. Somewhat Important: 21.56%
   c. Not Important: 2.29%

2. Property Protection – Actions that involve the modification of existing buildings or structures to protect them from a hazard area (Example – Retrofits, relocation, acquisition, etc.)
    a. Very Important: 55.05%
    b. Somewhat Important: 39.43%
    c. Not Important: 5.52%
3. Public Education and Awareness – Actions to inform and educate residents, elected officials and property owners about the hazards and potential ways to mitigate them (Example – Outreach, real estate disclosure, school-age and adult education.
    a. Very Important: 76.57%
    b. Somewhat Important: 21.71%
    c. Not Important: 1.71%
4. Natural Resources Protection – Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems (Examples – Erosion control, stream restoration, etc.)
    a. Very Important: 64.63%
    b. Somewhat Important: 29.25%
    c. Not Important: 6.12%
5. Emergency Services – Actions that protect people and property during and immediately after a disaster or hazard event (Example – Warning systems, protection of official facilities, etc.)
    a. Very Important: 88.80%
    b. Somewhat Important: 10.63%
    c. Not Important: 0.57%
6. Structural Projects – Actions that involve the construction of structures to reduce the impact of a hazard (Example – Dams, floodwalls, seawalls, etc.)
    a. Very Important: 53.82%
    b. Somewhat Important: 37.98%
    c. Not Important: 8.21%

RESOLUTION NO. 2021-___

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE SAN DIEGO COUNTY WATER AUTHORITY APPROVING AND ADOPTING THE 2020 URBAN WATER MANAGEMENT PLAN, WATER SHORTAGE CONTINGENCY PLAN, AND APPENDIX M ADDENDUM TO THE 2015 URBAN WATER MANAGEMENT PLAN

WHEREAS, California Water Code Section 10610 *et seq*., known as the Urban Water Management Planning Act (Planning Act), requires urban water suppliers to prepare and adopt an Urban Water Management Plan (UWMP) and Water Shortage Contingency Plan (WSCP) every five years on or before July 1, in years ending in six and one; and

WHEREAS, California Water Code Section 10652 exempts the preparation and adoption of UWMPs and amendments to UWMPs from the California Environmental Quality Act; and

WHEREAS, the deadline for adoption of the 2020 UWMP and WSCP is July 1, 2021; and

WHEREAS, the Planning Act specifies the requirements and procedures for adopting such UWMPs and WSCPs; and

WHEREAS, pursuant to the Planning Act, the Water Authority prepared a draft 2020 UWMP and draft WSCP in consultation with the Water Authority's member agencies to support long-term water resources planning in areas that include water demand forecasting, identification of local and imported supplies, and water shortage contingency planning; and

WHEREAS, California Water Code Section 85000 *et seq*., known as the Sacramento-San Joaquin Delta Reform Act of 2009 (Delta Reform Act), states the policy of the State of California is to reduce reliance on the Delta (as defined) in meeting California's future water supply needs, and that each region of the state that depends on water from the Delta must improve its regional self-reliance for water through investments in water use efficiency, water recycling, advanced water technologies, local and regional water supply projects, and improved regional coordination of local and regional water supply efforts; and

WHEREAS, the Water Authority is a water supplier that is likely to participate in or carry out a proposed covered action (as defined), or may receive Delta water from a proposed covered action, and, therefore, have included the information necessary to demonstrate reduced reliance on the Delta in compliance with California Code of Regulations, Title 23, Section 5003(c)(1)(C) in the Water Authority's 2020 UWMP at Appendix J and in the Amendment to the Water Authority's 2015 UWMP at Appendix M; and

WHEREAS, the Water Authority, at least 60 days before the public hearing on the draft 2020 UWMP, draft WSCP, and draft Appendix M, notified each of the cities within the Water Authority's service area and the County of San Diego that the Water Authority would be reviewing the documents and considering amendments or changes; and

WHEREAS, the draft 2020 UWMP, draft WSCP, draft Appendix M were made available for public review and comment commencing March 8, 2021, and ending on May 6, 2021; and

WHEREAS, notices of the March 25, 2021 public hearing to receive comments on the draft 2020 UWMP, draft WSCP, and draft Appendix M were published in accordance with applicable law; and

WHEREAS, the proceedings of the March 25, 2021 public hearing were recorded in the meeting minutes; and

WHEREAS, information on how to access an electronic copy of the draft 2020 UWMP, draft WSCP, and draft Appendix M was distributed to Water Authority member agencies, interested parties, as well as to each of the cities within the Water Authority's service area and the County of San Diego; and

WHEREAS, the final 2020 UWMP, final WSCP, and final Appendix M, incorporating changes to the draft 2020 UWMP, draft WSCP, and draft Appendix M as a result of certain comments, were available electronically to the Water Authority Board of Directors on May __, 2021, prior to the May 27, 2021, Board meeting; and

WHEREAS, the Water Authority Board of Directors, upon recommendation of the General Manager, and the information presented to it at a Board meeting on May 27, 2021, has determined that the final 2020 UWMP, final WSCP, and final Appendix M, dated May 27, 2021, and on file with the Clerk of the Board is consistent with the Planning Act and/or Delta Reform Act and are accurate representations of the water resources documents for the Water Authority;

NOW THEREFORE, the Board of Directors of the San Diego County Water Authority resolves as follows:

1. The foregoing recitals are true and correct, have been duly performed in conformity with the Planning Act and other applicable law, and constitute the findings and determinations of the Board.

2. The final 2020 UWMP, dated May 27, 2021, on file with the Clerk of the Board, is approved and adopted.

3. The final WSCP, dated May 27, 2021, on file with the Clerk of the Board, is approved and adopted.

4. The final Appendix M, dated May 27, 2021, on file with the Clerk of the Board, is approved and adopted.

5. The General Manager is hereby directed to:

a. Submit the 2020 UWMP, WSCP, and Appendix M to the California Department of Water Resources within 30 days of adoption and not later than July 1, 2021;
b. Submit a copy of the 2020 UWMP, WSCP, and Appendix M to the California State Library, each Water Authority member agency, the County of San Diego, and each city within which the Water Authority provides water supplies not later than 30 days after adoption;
c. Make the 2020 UWMP, WSCP, and Appendix M available for public review through the Water Authority's website as soon as practical after adoption; and
d. Implement the 2020 UWMP, WSCP, and Appendix M consistent with the Water Authority's Administrative Code, adopted Operations and Capital Improvement Plan Budgets, adopted Water Facilities Master Plan, other applicable law, and other formal action of the Board.

6. The General Manager is further directed to periodically review the 2020 UWMP, WSCP, and Appendix M in accordance with applicable law and recommend to the Board amendments to the documents as may be appropriate as a result of such review.

7. Should any provision of this adopting Resolution or the application thereof to any person or circumstance be deemed invalid, that invalidity shall not affect other provisions or applications of this Resolution which can be given effect without the invalid provision or application thereof, and to this end the provisions of this Resolution are severable.

8. This resolution is effective upon adoption.

PASSED, APPROVED AND ADOPTED this 27th day of May 2021, by the following vote:

AYES:

NOES:

ABSTAIN:

ABSENT:

____
Gary Croucher, Chairman
Board of Directors

ATTEST:

____
Jerry Butkiewicz, Secretary
Board of Directors

APPENDIX L

Lakeside Water District
Water Shortage Contingency Plan
2020

10.1 WATER SHORTAGE CONTINGENCY PLAN

~~Drought Response Conservation Program~~

10.1-1 DECLARATION OF NECESSITY AND INTENT

(a) This policy establishes water management requirements necessary to conserve water, enable effective water supply planning, assure reasonable and beneficial use of water, prevent waste of water, prevent unreasonable use of water, prevent unreasonable method of use of water within the Lakeside Water District in order to assure adequate supplies of water to meet the needs of the public, and further the public health, safety, and welfare, recognizing that water is a scarce natural resource that requires careful management not only in times of drought, but at all times.

(b) This policy establishes regulations to be implemented during times of declared water shortages, or declared water shortage emergencies. It establishes six ~~four~~ levels of ~~drought response actions~~ demand reduction targets in compliance with CA Water Code 10632 to be implemented in times of shortage, with increasing restrictions on water use in response to worsening ~~drought~~ conditions and decreasing available supplies. The San Diego County Water Authority (CWA) is the regional supplier. Reference CWA Water Shortage Contingency Plan for analysis of supply, demand, reliability, growth, and further analysis.

(c) As per California State law and Executive Order B-~~40-17~~ 37-16, and the States goal to "Make Water Conservation a California Way of Life", certain provisions of conservation are in effect at all times. Recognizing the severe effects of the 2012 to 2017 prolonged drought, the following prohibitions remain in effect during non-shortage ~~drought~~ periods.

1. No outdoor watering during a rain event or within 48 hours after measurable rainfall.
2. No watering down a sidewalk with a hose instead of using a broom or a brush except to alleviate safety or sanitary conditions.
3. No washing of automobiles with hoses not equipped with a shut-off nozzle.
4. No overwatering a landscape in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots, or structures.
5. Home owners associations (HOAs) and local governments may not penalize homeowners for certain outdoor conservation practices during a declared ~~drought~~ shortage.
6. No use of a non-recirculated potable water in fountain or other decorative water feature.
7. No serving of drinking water other than upon request in eating or drinking establishments, including but not limited to restaurants, hotels, cafes, cafeterias, bars, or other public places where food or drink are served and/or purchased
8. No irrigation with potable water of ornamental turf on public street medians
9. No irrigation with portable water of landscapes outside of newly constructed homes and buildings in a manner inconsistent with regulations or other requirements established by the California Building Standards Commission and The Department of Housing and Community Development.

(d) Level 1 ~~drought response~~ measures are voluntary and will be reinforced through local and regional public education and awareness measures that may be funded in part by Lakeside Water District. During ~~drought response~~ Levels 2 through ~~4~~ 6, all conservation measures and water-use restrictions are mandatory and become increasingly restrictive in order to attain escalating conservation goals.

(e) During a ~~drought response~~ Level 2 condition or higher, the water conservation measures and water use restrictions established by this policy are mandatory and violations are subject to criminal, civil, and administrative penalties and remedies specified in this policy and as provided in Lakeside Water District Administrative or Municipal Code.

10.1-2 DEFINITIONS

(a) The following words and phrases whenever used in this chapter shall have the meaning defined in this section:

1. "Grower" refers to those engaged in the growing or raising, in conformity with recognized practices of husbandry, for the purpose of commerce, trade, or industry, or for use by public educational or correctional institutions, of agricultural, horticultural or floricultural products, and produced: (1) for human consumption or for the market, or (2) for the feeding of fowl or livestock produced for human consumption or for the market, or (3) for the feeding of fowl or livestock for the purpose of obtaining their products for human consumption or for the market. "Grower" does not refer to customers who purchase water subject to the Metropolitan Interim Agricultural Water Program or the Water Authority Special Agricultural Rate programs.

2. "Water Authority" means the San Diego County Water Authority.

~~3. "DMP" means the Water Authority's Drought Management Plan in existence on the effective date of this policy and as readopted or amended from time to time, or an equivalent plan of the Water Authority to manage or allocate supplies during shortages.~~

3. "Metropolitan" means the Metropolitan Water District of Southern California.

4. "Person" means any natural person, corporation, public or private entity, public or private association, public or private agency, government agency or institution, school district, college, university, or any other user of water provided by the Lakeside Water District.

10.1-3 APPLICATION

(a) The provisions of this policy apply to any person in the use of any water provided by the Lakeside Water District.

(b) This policy is intended solely to further the conservation of water. It is not intended to implement any provision of federal, State, or local statutes, policy, or regulations relating to protection of water quality or control of drainage or runoff. Refer to the local jurisdiction or Regional Water Quality Control Board for information on any storm water policy and storm water management plans.

(c) Nothing in this policy is intended to affect or limit the ability of the Lakeside Water District to declare and respond to an emergency, including an emergency that affects the ability of the Lakeside Water District to supply water.

(d) The provisions of this policy do not apply to use of water from private wells or to recycled water.

(e) Nothing in this policy shall apply to use of water that is subject to a special supply program, such as the Metropolitan Interim Agricultural Water Program or the Water Authority Special Agricultural Rate programs. Violations of the conditions of special supply programs are subject to the penalties established under the applicable program. A person using water subject to a special supply program and other water provided by the Lakeside Water District is subject to this policy in the use of the other water.

10.1-4 LEVEL 1 – Demand Reduction Up to 10%
~~Drought Response Level 1 – Drought Water Condition~~

(a) ~~A Level 1 condition is also referred to as a "Drought Watch" condition.~~ A Level 1 condition applies when the Water Authority notifies its member agencies that due to ~~drought or other~~ supply reductions, there is a reasonable probability there will be supply shortages and that a consumer demand reduction of up to 10 percent is requested in order to ensure that sufficient supplies will be available to meet anticipated demands. The General Manager or designee shall declare the existence of ~~a Drought Response~~ Level 1 and take action to implement the Level 1 conservation practices identified in this policy.

(b) During a Level 1 ~~Drought Watch~~ condition, Lakeside Water District will increase its public education and outreach efforts to emphasize increased public awareness of the need to implement the following water conservation practices. [The same water conservation practices become mandatory if Lakeside Water District declares a Level 2 ~~Drought Alert~~ condition]:

1. Do not irrigate between 10 a.m. and 6 p.m.

2. Three (3) day a week watering is recommended if landscape is mature and healthy.

3. Irrigate nursery and commercial grower's products before 10 a.m. and after 6 p.m. only. Watering is permitted at any time with a hand-held hose equipped with a positive shut-off nozzle, a bucket, or when a drip/micro-irrigation system/equipment is used. Irrigation of nursery propagation beds is permitted at any time. Watering of livestock is permitted at any time.

4. Repair all water leaks within ~~three~~ five (~~3~~5) days of notification by the Lakeside Water District unless other arrangements are made with the General Manager or designee.

5. Use recycled or non-potable water for construction purposes when available.

(c) During a ~~Drought Response~~ Level 2 condition or higher, all persons shall be required to implement the conservation practices established in a ~~Drought Response~~ Level 1 condition.

10.1-5 LEVEL 2 – Demand Reduction Up to 20%
~~Drought Response Level 2 – Drought Alert Condition~~

(a) ~~A Drought Response Level 2 condition is also referred to as a "Drought Alert" condition~~. A Level 2 condition applies when the Water Authority notifies its member agencies that due to cutbacks ~~caused by drought or other reduction~~ in supplies, a consumer demand reduction of up to 20 percent is required in order to have sufficient supplies available to meet anticipated demands. The Lakeside Water District Board of Directors shall declare the existence of a ~~Drought Response~~ Level 2 condition and implement the mandatory Level 2 conservation measures identified in this policy.

(b) All persons using Lakeside Water District water shall comply with Level 1 ~~Drought Watch~~ water conservation practices during a Level 2 ~~drought alert~~ and shall also comply with the following additional conservation measures:

1. Limit residential and commercial landscape irrigation to no more than three (3) days per week. This section shall not apply to commercial growers or nurseries.

2. Limit lawn watering and landscape irrigation using sprinklers to no more than ten (10) minutes per watering station per day. This provision does not apply to landscape irrigation systems using water efficient devices, including but not limited to: weather based controllers, drip/micro-irrigation systems and stream rotor sprinklers.

3. Water landscaped areas, including trees and shrubs located on residential and commercial properties, and not irrigated by a landscape irrigation system governed by section 5 (b) (1), on the same schedule set forth in section 5 (b) (1) by using a bucket, hand-held hose with positive shut-off nozzle, or low-volume non-spray irrigation.

4. Repair all leaks within five (5) days ~~seventy-two (72) hours~~ of notification by the Lakeside Water District unless other arrangements are made with the General Manager or designee.

5. Stop operating ornamental fountains or similar decorative water features unless recirculated water is used.

~~6. No outdoor watering of turf or ornamental landscapes during and up to 48 hours following measurable precipitation.~~

10.1-6 LEVEL 3 – Demand Reduction Up to 30%
~~DROUGHT RESPONSE Level 3 – Drought Critical Condition~~

(a) ~~A Drought Response Level 3 condition is also referred to as a "Drought Critical" condition~~. A Level 3 condition applies when the Water Authority notifies its member agencies that due to increasing cutbacks caused by ~~drought or other~~ reduction of supplies, a consumer demand reduction of up to ~~40~~ 30 percent is required in order to have sufficient supplies available to meet anticipated demands. The Lakeside Water District Board of Directors shall declare the existence of a ~~Drought Response~~ Level 3 condition and implement the Level 3 conservation measures identified in this policy.

(b) All persons using Lakeside Water District water shall comply with Level 1 ~~Drought Watch~~ and Level 2 ~~Drought Alert~~ water conservation practices during a Level 3 ~~Drought Critical~~ condition and shall also comply with the following additional mandatory conservation measures:

1. Limit residential and commercial landscape irrigation to no more than two (2) assigned days per week on a schedule established by the General Manager or designee and posted by the Lakeside Water District. During the months of November through

May, landscape irrigation is limited to no more than once per week on a schedule established by the General Manager or designee and posted by the Lakeside Water District. This section shall not apply to commercial growers or nurseries.

2. Water landscaped areas, including trees and shrubs located on residential and commercial properties, and not irrigated by a landscape irrigation system governed by section 6 (b) (1), on the same schedule set forth in section 6 (b) (1) by using a bucket, hand-held hose with a positive shut-off nozzle, or low-volume non-spray irrigation.

3. Stop filling or re-filling ornamental lakes or ponds, except to the extent needed to sustain aquatic life, provided that such animals are of significant value and have been actively managed within the water feature prior to declaration of a ~~drought response~~ shortage level under this policy.

4. Stop washing vehicles except at commercial carwashes that re-circulate water, or by high pressure/low volume wash systems.

5. Repair all leaks within three (3) days ~~forty-eight (48) hours~~ of notification by the Lakeside Water District unless other arrangements are made with the General Manager or designee.

(c) Upon the declaration of a ~~Drought Response~~ Level 3 condition, no new potable water service shall be provided, no new temporary meters or permanent meters shall be provided, and no statements of immediate ability to serve or provide potable water service (such as, will serve letters, certificates, or letters of availability) shall be issued, except under the following circumstances:

1. A valid, unexpired building permit has been issued for the project; or
2. The project is necessary to protect the public's health, safety, and welfare; or
3. The applicant provides substantial evidence of an enforceable commitment that water demands for the project will be offset prior to the provision of a new water connection to the satisfaction of Lakeside Water District.

This provision shall not be construed to preclude the resetting or turn-on of meters to provide continuation of water service or to restore service that has been interrupted for a period of one year or less.

Upon the declaration of a ~~Drought Response~~ Level 3 condition, Lakeside Water District will suspend consideration of annexations to its service area.

(d) The Lakeside Water District may establish a water allocation for property served by the Lakeside Water District. If the Lakeside Water District establishes a water allocation it shall provide notice of the allocation by including it in the regular billing statement for the fee or charge or by any other mailing to the address to which the Lakeside Water District customarily mails the billing statement for fees or charges for on-going water service. Following the effective date of the water allocation as established by the Lakeside Water District, any person that uses water in excess of the allocation shall be subject to a penalty in the amount of $___for each billing unit of water in excess of the allocation. The penalty for excess water usage shall be cumulative to any other remedy or penalty that may be imposed for violation of this policy.

10.1-7 LEVEL 4 – Demand Reduction Up to 40%
~~Drought Response Level 4 – Drought Emergency Condition~~

(a) ~~A Drought Response Level 4 condition is also referred to as a "Drought Emergency" condition~~. A Level 4 condition applies when the Water Authority Board of Directors declares a water shortage emergency pursuant to California Water Code section 350 and notifies its member agencies that Level 4 requires a demand reduction of up to ~~more than~~ 40 percent in order for the Lakeside Water District to have maximum supplies available to meet anticipated demands. The Lakeside Water District shall declare a Level 4 Demand Reduction up to 40% ~~Drought Emergency~~ in the manner and on the grounds provided in California Water Code section 350.

(b) All persons using Lakeside Water District water shall comply with conservation measures required during Level 1 ~~Drought Watch~~, Level 2 ~~Drought Alert~~, and Level 3 ~~Drought Critical~~ conditions and shall also comply with the following additional mandatory conservation measures:

1. Stop all landscape irrigation, except crops and landscape products of commercial growers and nurseries. This restriction shall not apply to the following categories.

    A. Maintenance of trees and shrubs that are watered on the same schedule set forth in section 6 (b) (1) by using a bucket, hand-held hose with a positive shut-off nozzle, or low-volume non-spray irrigation;

    B. Maintenance of existing landscaping necessary for fire protection as specified by the Fire Marshal of the local fire protection agency having jurisdiction over the property to be irrigated;

    C. Maintenance of existing landscaping for erosion control;

    D. Maintenance of plant materials identified to be rare or essential to the wellbeing of rare animals;

    E. Maintenance of landscaping within active public parks and playing fields, day care centers, school grounds, cemeteries, and golf course greens, provided that such irrigation does not exceed two (2) days per week according to the schedule established under section 6 (b) (1);

    F. Watering of livestock; and

    G. Public works projects and actively irrigated environmental mitigation projects.

2. Repair all water leaks within ~~twenty-four (24~~) forty-eight (48) hours of notification by the Lakeside Water District unless other arrangements are made with the General Manager or designee.

(c) The Lakeside Water District may establish a water allocation for property served by the Lakeside Water District. If the Lakeside Water District establishes a water allocation it shall provide notice of the allocation by including it in the regular billing statement for the fee or charge or by any other mailing to the address to which the Lakeside Water District customarily mails the billing statement for fees or charges for on-going water service. Following the effective date of the water allocation as established by the Lakeside Water District, any person that uses water in excess of the allocation shall be subject to a penalty in the amount of $___for each billing unit of water in excess of the allocation. The penalty for excess water usage shall be cumulative to any other remedy or penalty that may be imposed for violation of this policy.

~~10.1-8 CORRELATION BETWEEN DROUGHT MANAGEMENT PLAN AND DROUGHT RESPONSE LEVELS~~

~~THIS SECTION REMOVED BY BOARD ACTION 8-6-2016~~

10.1-8 LEVEL 5 – Demand Reduction Up to 50% **(ALL NEW LEVEL 5-6)**

(a) A Level 5 condition applies when the Water Authority Board of Directors declares a water shortage emergency pursuant to California Water Code section 350 and notifies its member agencies that Level 4 requires a demand reduction of up to 50 percent in order for the Lakeside Water District to have maximum supplies available to meet anticipated demands. The Lakeside Water District shall declare a Level 5 demand reduction up to 50% in the manner and on the grounds provided in California Water Code section 350.

(b) All persons using Lakeside Water District water shall comply with conservation measures required during Level 1, Level 2, Level 3 and Level 4 conditions and shall also comply with the following additional mandatory conservation measures:

1. Stop all landscape irrigation, except crops and landscape products of commercial growers and nurseries. This restriction shall not apply to the following categories.

   A. Maintenance of trees and shrubs that are watered on the same schedule set forth in section 6 (b) (1) by using a bucket, hand-held hose with a positive shut-off nozzle, or low-volume non-spray irrigation;

   B. Maintenance of existing landscaping necessary for fire protection as specified by the Fire Marshal of the local fire protection agency having jurisdiction over the property to be irrigated;

   C. Maintenance of existing landscaping for erosion control;

   D. Maintenance of plant materials identified to be rare or essential to the wellbeing of rare animals;

   E. Maintenance of landscaping within active public parks and playing fields, day care centers, school grounds, cemeteries, and golf course greens, provided that such irrigation does not exceed two (2) days per week according to the schedule established under section 6 (b) (1);

   F. Watering of livestock; and

   G. Public works projects and actively irrigated environmental mitigation projects.

2. Repair all water leaks within twenty-four (24) hours of notification by the Lakeside Water District unless other arrangements are made with the General Manager or designee.

(d) The Lakeside Water District may establish a water allocation for property served by the Lakeside Water District. If the Lakeside Water District establishes a water allocation it shall provide notice of the allocation by including it in the regular billing statement for the fee or charge or by any other mailing to the address to which the Lakeside Water District customarily mails the billing statement for fees or charges for on-going water service. Following the effective date of the water allocation as established by the Lakeside Water District, any person that uses water in excess of the allocation shall be subject to a penalty in the amount of $___for each billing unit of water in excess of the allocation. The penalty for excess water usage shall be cumulative to any other remedy or penalty that may be imposed for violation of this policy.

10.1-9 LEVEL 6 – Demand Reduction Over 50%

(a) A Level 6 condition applies when the Water Authority Board of Directors declares a water shortage emergency pursuant to California Water Code section 350 and notifies its member agencies that Level 6 requires a demand reduction of more-than 50 percent in order for the Lakeside Water District to have maximum supplies available to meet anticipated demands. The Lakeside Water District shall declare a Level 5 demand reduction over 50% in the manner and on the grounds provided in California Water Code section 350.

(b) All persons using Lakeside Water District water shall comply with conservation measures required during all previous shortage levels and shall also comply with the following additional mandatory conservation measures:

1. Stop all landscape irrigation, except crops and landscape products of commercial growers and nurseries. This restriction shall not apply to the following categories.

    A. Maintenance of trees and shrubs that are watered on the same schedule set forth in section 6 (b) (1) by using a bucket, hand-held hose with a positive shut-off nozzle, or low-volume non-spray irrigation;

    B. Maintenance of existing landscaping necessary for fire protection as specified by the Fire Marshal of the local fire protection agency having jurisdiction over the property to be irrigated;

    C. Maintenance of existing landscaping for erosion control;

    D. Maintenance of plant materials identified to be rare or essential to the wellbeing of rare animals;

    E. Maintenance of landscaping within active public parks and playing fields, day care centers, school grounds, cemeteries, and golf course greens, provided that such irrigation does not exceed two (2) days per week according to the schedule established under section 6 (b) (1);

    F. Watering of livestock; and

    G. Public works projects and actively irrigated environmental mitigation projects.

2. Repair all water leaks within twenty-four (24) hours of notification by the Lakeside Water District unless other arrangements are made with the General Manager or designee.

(e) The Lakeside Water District may establish a water allocation for property served by the Lakeside Water District. If the Lakeside Water District establishes a water allocation it shall provide notice of the allocation by including it in the regular billing statement for the fee or charge or by any other mailing to the address to which the Lakeside Water District customarily mails the billing statement for fees or charges for on-going water service. Following the effective date of the water allocation as established by the Lakeside Water District, any person that uses water in excess of the allocation shall be subject to a penalty in the amount of $___for each billing unit of water in excess of the allocation. The penalty for excess water usage shall be cumulative to any other remedy or penalty that may be imposed for violation of this policy.

~~10.1-9~~ 10.1-10 PROCEDURES FOR DETERMINATION AND NOTIFICATION OF ~~DROUGHT~~ RESPONSE LEVEL

(a) The existence of a ~~Drought Response~~ Level 1 condition may be declared by the General Manager or designee upon a written determination of the existence of the facts and circumstances supporting the determination. A copy of the written determination shall be filed with the Clerk or Secretary of the Lakeside Water District and provided to the Lakeside Water District Board of Directors. The General Manager or designee may publish a notice of the determination of existence of ~~Drought Response~~ Level 1 condition in one or more newspapers, including a newspaper of general circulation within the Lakeside Water District. The Lakeside Water District may also post notice of the condition on their website.

(b) The existence of ~~Drought Response~~ Level 2 or Level 3 conditions may be declared by policy of the Lakeside Water District Board of Directors adopted at a regular or special public meeting held in accordance with State law. The mandatory conservation measures applicable to ~~Drought Response~~ Level 2 or Level 3 conditions shall take effect on the tenth (10) day after the date the response level is declared. Within five (5) days following the declaration of the response level, the Lakeside Water District shall publish a notice of declared shortage level in a newspaper used for publication of official notices.

(c) The existence of a ~~Drought Response~~ Level 4, 5 and 6 condition may be declared in accordance with the procedures specified in California Water Code sections 351 and 352. The mandatory conservation measures applicable to ~~Drought Response~~ Level 4 - 6 conditions shall take effect on the tenth (10) day after the date the response level is declared. Within five (5) days following the declaration of the response level, the Lakeside Water District shall publish a notice of declared ~~drought~~ response level in a newspaper used for publication of official notices. If the Lakeside Water District establishes a water allocation, it shall provide notice of the allocation by including it in the regular billing statement for the fee or charge or by any other mailing to the address to which the Lakeside Water District customarily mails the billing statement for fees or charges for on-going water service. Water allocation shall be effective on the fifth (5) day following the date of mailing or at such later date as specified in the notice.

(d) The Lakeside Water District Board of Directors may declare an end to a ~~Drought Response~~ Shortage Level by the adoption of a policy at any regular or special meeting held in accordance with State law.

~~10.1-10~~ 10.1-11 HARDSHIP VARIANCE / APPEALS

(a) If, due to unique circumstances, a specific requirement of this policy would result in undue hardship to a person using agency water or to property upon which agency water is used, that is disproportionate to the impacts to Lakeside Water District water users generally or to similar property or classes of water uses, then the person may apply for a variance to the requirements as provided in this section.

(b) The variance may be granted or conditionally granted, only upon a written finding of the existence of facts demonstrating an undue hardship to a person using agency water or to property upon which agency water is used, that is disproportionate to the impacts to Lakeside Water District water users generally or to similar property or classes of water use due to specific and unique circumstances of the user or the user's property.

1. Application. Application for a variance shall be in writing and may be required to be accompanied by a non-refundable processing fee in an amount to cover administrative expenses. Applications must be received prior to a bill or fine becoming delinquent.

2. Supporting Documentation. The application shall be accompanied by photographs, maps, drawings, and other information, including a written statement of the applicant.

3. Required Findings for Variance. An application for a variance shall be denied unless the approving authority finds, based on the information provided in the application, supporting documents, or such additional information as may be requested, and on water use information for the property as shown by the records of the Lakeside Water District, all of the following:

A. That the variance does not constitute a grant of special privilege inconsistent with the limitations upon other Lakeside Water District customers.

B. That because of special circumstances applicable to the property or its use, the strict application of this policy would have a disproportionate impact on the property or use that exceeds the impacts to customers generally.

C. That the authorizing of such variance will not be of substantial detriment to adjacent properties, and will not materially affect the ability of the Lakeside Water District to effectuate the purpose of this chapter and will not be detrimental to the public interest.

D. That the condition or situation of the subject property or the intended use of the property for which the variance is sought is not common, recurrent or general in nature.

4. Approval Authority. The Water Conservation Coordinator or designee shall exercise approval authority and act upon any completed application no later than 10 days after

submittal and may approve, conditionally approve, or deny the variance. The applicant requesting the variance shall be promptly notified in writing of any action taken. Unless specified otherwise at the time a variance is approved, the variance applies to the subject property during the term of the mandatory ~~drought response~~ water shortage.

5. Appeals to the General Manager. An applicant may appeal a decision or condition of the Water Conservation Coordinator or designee on a variance application to the General Manager or designee on a variance application within 10 days of the decision upon written request for a hearing. The request shall state the grounds for the appeal.

6. Appeals to the Appeals Committee. An applicant may appeal a decision or condition of the General Manager or designee on a variance application to the Appeals Committee, consisting of two members of the Board of Directors within 10 days of the decision upon written request for a hearing. The request shall state the ground for the appeal. The request shall be accompanied by a non-refundable processing fee in the amount of $100 to cover administrative expenses.

7. Appeals to Lakeside Water District Board of Directors. An applicant may appeal a decision or condition of the Appeals Committee on a variance application to the Lakeside Water District Board of Directors within 10 days of the decision upon written request for a hearing. The request shall state the grounds for the appeal. At a public meeting, the Lakeside Water District Board of Directors shall act as the approval authority and review the appeal de novo by following the regular variance procedure. The decision of the Lakeside Water District Board of Directors is final.

~~10.1-11~~**10.1-12** VIOLATIONS AND PENALTIES

(a) Any person, who uses, causes to be used, or permits the use of water in violation of this policy is guilty of an offense punishable as provided herein.

(b) Each day that a violation of this policy occurs is a separate offense.

(c) Administrative fines may be levied for each violation of a provision of this policy as follows:

1. A warning for a first violation.
2. One hundred dollars for a second violation.
3. Two hundred dollars for a third violation of any provision of this policy within one year.
4. Five hundred dollars for each additional violation of this policy within one year.

(d) Violation of a provision of this policy is subject to enforcement through installation of a flow-restricting device in the meter.

(e) Each violation of this policy may be prosecuted as a misdemeanor punishable by imprisonment in the county jail for not more than thirty (30) days or by a fine not exceeding $1,000, or by both as provided in Water Code section 377.

(f) Willful violations of the mandatory conservation measures and water use restrictions as set forth in Section 7.0 and applicable during a Level 4 ~~Drought Emergency~~ condition may be enforced by discontinuing service to the property at which the violation occurs as provided by Water Code section 356.

(g) All remedies provided for herein shall be cumulative and not exclusive.

APPENDIX M

UWMP SUBMITTAL

Jeanne Swaringen

From: DO-NOT-REPLY <donotreply@ecointeractive.com>
Sent: Wednesday, August 4, 2021 10:56 AM
To: Jeanne Swaringen
Subject: WUEdata - UWMP Submittal Confirmation

This serves as confirmation that the following UWMP was electronically submitted to DWR:

Water Supplier Name: Lakeside Water District
Submitted by: Jeanne Swaringen
Email Address: jeanne@lakesidewater.org
Submitted Date: 8/4/2021 10:55:54 AM
Confirmation Number: 5484861075

Click the link below to view the submitted plan on WUEdata:

View Submitted UWMP on WUEdata

DWR staff reviews plans in the order they are received. Upon the completion of the review, DWR will send a status letter to the people you listed on the contact sheet. This will contain the results of the review. The DWR reviwer may contact you if they have questions.

If you have any questions or would like to discuss the review of 2020 Urban Water Management Plan, please contact us at (916) 651-0740 or (UWMPHelp@water.ca.gov).
Send a request to UWMPHelp@water.ca.gov if you require an expedited review.

Email auto-generated by WUEdata on 8/4/2021

Errata Sheet for Minor Corrections to
Lakeside Water District 2020 Urban Water Management Plan (UWMP)

This errata sheet logs minor content errors that were identified after final adoption of the *Lakeside Water District* 2020 UWMP. DWR has determined that these corrections are minor and do not require the UWMP to be amended.

These data errors have been corrected in the Department of Water Resources (DWR) UWMP database at https://wuedata.water.ca.gov/secure/

This errata sheet has been filed with the UWMP in all locations where it is made publicly available, including the California State Library. Errata may be submitted to State Library via email to cslgps@library.ca.gov

Name and agency of the person filing errata sheet: Jeanne Swaringen

#	Description of Correction	Location	Rationale	Date Error Corrected
1	Population methodology change from DWR Population tool to SDCWA Population.	SBX7-7 Tables 2, 3, 5, & 9.	To be consistent throughout the plan.	August 25, 2022
2	Correct the 2020 Target of 142 GPCD.	Table 5-2 & SBX7-7 Table 9	Correct the 2020 Target of 142 GPCD.	August 25, 2022

SB X7-7 Compliance Table 2: Method for Population Estimates

Method Use to Determine Population *(may check more than one)*	
☐	**1. Department of Finance (DOF) or American Community Survey (ACS)**
☐	**2. Persons-per-Connection Method**
☐	**3. DWR Population Tool**
☑	**4. Other** *DWR recommends pre-review*
NOTES	**SDCWA**

SB X7-7 Compliance Table 3: Service Area Population

2020 Compliance Year Population	
2020	34,000
NOTES	**SDCWA**

SB X7-7 Compliance Table 5: Gallons Per Capita Per Day (GPCD)

2020 Population *From SB X7-7 Compliance Table 3*	2020 Gross Water Use *From SB X7-7 Compliance Table 4* (AF)	2020 GPCD
34,000	3,476	91
NOTES		

SB X7-7 Compliance Table 9: 2020 Compliance

2020 Actual GPCD[1]	Optional Adjustments for 2020 GPCD						
	Enter "0" for adjustments not used			TOTAL Adjustments[1]	Adjusted 2020 GPCD[1] *(Adjusted if applicable)*	2020 Confirmed Target GPCD[1,2]	Did Supplier Achieve Targeted Reduction for 2020?
	Extraordinary Events[1]	Weather Normalization[1]	Economic Adjustment[1]				
91	0	0	0	0	91	142	YES

Table 5-2 R: 2020 Compliance Summary, From SB X7-7 2020 Compliance Form

Does supplier have more than one SB X7-7 2020 Compliance Form?[1]:	N			
2020 GPCD				
Actual 2020 GPCD[2]	2020 Total Adjustments[2]	Adjusted 2020 GPCD[2] (Adjusted if applicable)	2020 Confirmed Target GPCD2	Did Supplier Achieve Targeted Reduction for 2020?
91	0	0	142	Y