2010 – 2030
Water Resource Plan
Draft October 2009

TRUCKEE MEADOWS WATER AUTHORITY

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Abbreviations

AF	Acre-Feet, an acre-foot is equal to 325,851 gallons
AFA	Acre-Feet Annually or acre-feet per annum
ASL	Above Sea Level
ASR	Aquifer Storage and Recovery
BBER	Bureau of Business and Economic Research, University of Nevada Reno
BCC	Washoe County Board of County Commissioners
Board	Board of Directors for Truckee Meadows Water Authority
cfs	cubic feet per second
CIP	Capital Improvement Program
CTP	Chalk Bluff Water Treatment Plant
DRI	Desert Research Institute
FSA	Future Service Area
EPA	Environmental Protection Agency (U.S.)
EPDTS	Entry Points to the Distribution System
GIS	Geographic Information System
GTP	Glendale Water Treatment Plant
gdp	gross domestic product
gpcd	gallons per capita per day
gpm	gallons per minute
ISA	Interim Storage Agreement, 1994
JPA	Joint Powers Authority
µg/l	micrograms per liter or parts per billion (ppb)
MGD	Million Gallons per Day
M&I	Municipal and Industrial
NDEP	Nevada Division of Environmental Protection
NDWR	Nevada Division of Water Resources
NRS	Nevada Revised Statutes
NTU	Nephelometric Turbidity Unit
PCE	tetrachloroethylene, a volatile organic compound
PLPT	Pyramid Lake Paiute Tribe
POSW	Privately-Owned Stored Water, as defined in Truckee River Agreement

PSA	Preliminary Settlement Agreement
RAA	Running Annual Average
RPC	Regional Planning Commission
RSW	City of Reno, City of Sparks, and Washoe County
RWPC	Regional Water Planning Commission of Washoe County
SDWA	Safe Drinking Water Act
Sierra	Sierra Pacific Power Company
sq. ft.	Square Feet
STMFP	South Truckee Meadows Facility Plan, August 2002
SWE	Snow Water Equivalent
TCID	Truckee-Carson Irrigation District
tds	total dissolved solids
TMWA	Truckee Meadows Water Authority
TRA	Truckee River Agreement, 1935
TROA	Truckee River Operating Agreement, required under PL 101-618
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation or BOR (defined above)
WCWCD	Washoe County Water Conservation District
WDWR	Washoe County Department of Water Resources
WCHD	Washoe County Health District
2005 RMWP	2004-2025 Comprehensive Regional Water Management Plan, Washoe County, January 2005
2005 WRP	2005-2025 Truckee Meadows Water Resource Plan, Truckee Meadows Water Authority, March 2003

Key Findings and Recommendations

1.1 2010-2030 Water Resource Plan

***Findings**:*

TMWA's prior 2005-2025 Water Resource Plan: (1) laid the foundation for an understanding of the region's water supply system; (2) summarized the history of municipal water supply in the Truckee Meadows up to and including the formation of TMWA; (3) confirmed the use of Truckee River flows during the historical 1987-1994 drought period as the basis for prudent water supply planning for the Truckee Meadows; and (4), provided ongoing analysis of future water supply options to meet the region's development needs. This 2030 WRP reviews local events since the 2025 WRP and examines what, if any, those events have affected Truckee Meadows water resources and TMWA's plans and/or management strategies. Specific need for this plan relates to a number of key events that have occurred over the past 6 to 7 years which include: (1) legislative directives that modified regional water resource planning for the Truckee Meadows and led to the creation of the Western Regional Water Commission ("WRWC") which needs TMWA's latest water resource strategies adopted and available to be incorporated into its comprehensive water plan that is due January 1, 2011; (2) economic changes of the past few years at the national, state and local level that have affected the growth activity and patterns for the Truckee Meadows resulting in a need to examine current population trends and their potential impact on water demands and resource requirements; (3) the five Mandatory Signatory Parties (TMWA, Pyramid Lake Paiute Tribe, California, Nevada, and the United States) and seven other parties signed the Truckee River Operating Agreement ("TROA") on September 6, 2008; and (4), retrofit of more than 98 percent of the original 44,651 flat-rate water services that were required to be retrofit with water meters as part of the 1989 Negotiated River Settlement.

Recommendation:

The Board continue to review and potentially revise its water resource management strategies through its planning efforts, as presented in documents such as this 2010-2030 Water Resource Plan, in response to changing economic, institutional, and operating conditions.

1.2 Consolidation of TMWA and WDWR Water Operations

***Findings**:*

In response to the WRWC legislative directive to evaluate the potential consolidation of water purveyors in the Truckee Meadows, Preliminary Assessment Reports prepared by TMWA and Washoe County Department of Water Resources ("WDWR") staffs for WRWC generally indicate that operational and resource management efficiencies may be achieved through consolidation, that rate structures of the two agencies are sufficiently similar that migration to one set of customer rates would not result in inequities to either

customer base, and that no insurmountable financial or labor issues are anticipated. The timeline for completing an inter-local agreement is late 2009 after which due diligence efforts will begin to further identify and/or clarify any potential legal obligations/ constraints, complete financial analyses to determine the costs/benefits to the respective utility's customers, create an operating model of the combined systems to develop optimum production schedules and estimate related costs, and work out transition issues. Unless severe challenges to consolidation arise, the process will proceed toward complete consolidation which is a function of WDWR's ability to defease or refinance approximately $40 million of outstanding debt sometime in the future.

Recommendation:

The Board continue its participation with the process to fully evaluate and develop agreements leading to the consolidation of WDWR's water utility operations into TMWA.

1.3 Truckee River Operating Agreement

Findings:

The Truckee River Operating Agreement ("TROA") was signed by the five Mandatory Signatory Parties on September 6, 2008 whereby PLPT, the United States, California and Nevada set the stage for resolving river operation uncertainties; the parties are moving together to implement and make TROA effective. When TROA is effective a framework will be established which provides flexibility for river operations to allow parties to exchange water to accommodate emerging issues without injuring the water rights on which they rely and perhaps avoid future regulatory uncertainties surrounding the use of the Truckee River.

Recommendation:

The Board continue to support the efforts to implement TROA.

2.1 Sustainability of Source Water Supplies - Climate Change

Findings:

Climate change and drought are the most significant weather variables with potential to change the quantity and quality of raw water supplies, particularly surface water supplies. While the weather pattern consistently provides precipitation during the winter and spring months, the type of precipitation (snow versus rain), amount of precipitation, water content of snow, and speed of snowmelt are variable from year to year. TMWA manages the uncertainty of its raw water sources through storage in upstream reservoirs, conjunctive use of surface and groundwater supplies, and continually assessing the threats to water supply reliability from weather. Studies completed by DRI indicate that while the potential for climate change to alter the timing, type of, and quantity of

precipitation should continue to be monitored, it should not be artificially imposed as a constraint on current and future water supplies for this 20-year plan at this time.

Recommendation:

The Board (1) find that artificial restrictions on the management or implementation of water resources due to climate change are not warranted at this time and (2) continue to monitor and test for changes in climate in future planning efforts.

2.2 Sustainability of Source Water Supplies – Drought Cycles

Findings:

In its 2025 WRP TMWA worked with UNR to develop a stochastic model to analyze drought frequencies, similar to statistical analysis used to estimate flood frequencies. It was found that the likelihood of a 8-, 9- or 10-year drought event occurring is extremely rare with frequencies ranging from 1 in 230 years, 1 in 375 years, and 1 in 650 years, respectively. The 2000 to 2005 Drought did not change the probabilities previously estimated therefore this plan retains the Board adopted drought planning recommendation from the 2025 WRP.

Recommendation:

The Board continue to use for planning purposes the worst drought cycle of hydrologic record (1987 to 1994) for the Truckee River.

2.3 Sustainability of Source Water Supplies - Source Water Contamination

Findings:

While there is a risk to surface water reliability from turbidity and toxic spill events, research conducted in 1996 and again in 2007 by UNR on behalf of TMWA has shown no recorded contamination event from rail or highway transportation. The recent study also suggests that the area of highest risk is downstream of TMWA's treatment facilities in the City of Sparks where there is a rail yard and a large number of warehouses and shipping companies that load/unload trucks and rail cars. TMWA's Source Water Protection Program (including its Wellhead Protection Plan) is designed to preserve and enhance available water supplies and to address known and potential threats to water quality. TMWA has sufficient well capacity and distribution storage to meet reduced customer demands during a water quality emergency, and has emergency plans in place in the event of extended off-river emergencies. TMWA coordinates with other regional water entities to identify and engage in integration practices that are beneficial in terms of increasing the supply and/or quality of water supplies at minimum economic costs to ensure the delivery of water through the 20-year planning horizon and beyond.

Recommendation:

The Board continue to (1) implement and modify when appropriate its source water protection strategies in cooperation with local entities; (2) at a minimum, maintain the

ability to meet daily indoor water use with its wells, and for river outages lasting up to 7 days during a peak summer maintain the ability to meet average daily water using its wells, treated water storage, and enhanced conservation measures.

3.1 Water Rights Availability

Findings:

A review of available Truckee River water rights shows a sufficient number of water rights exist to meet future-average-year-TMWA-water-service demands through the 2010 to 2030 planning horizon. However, acquiring and transferring many of these water rights, which are fractionated and have ownership problems, will require additional time and expense before the right can be put to use. Over the past decades, demands for Truckee Meadows water rights have increased in response to a highly competitive development market, difficulties in finding willing sellers of significant quantities of water rights, and competing environmental and lower river uses of water rights for such things as Fernley water supply or enhancing water quality both in the Lower Truckee River and groundwater aquifers. TMWA will work with Reno, Sparks, Washoe County and Pyramid Lake Paiute Tribe to find opportunities that satisfy TMWA's operating requirements and enhance Truckee River flows below Vista to improve lower river water quality. Since the number of Truckee Meadows water rights is limited, close coordination of the various river interests must occur to avoid undo stress on the water rights market.

Recommendation:

The Board accept for planning purposes that the estimated number of mainstem Truckee River water resources is sufficient to support TROA implementation and future development within TWMA's service areas.

3.2 Current Water Resources

Findings:

TMWA has over 142,000 acre-feet of decreed, storage, and irrigation rights to generate water supplies for customer demands. TMWA uses its Privately Owned Stored Water ("POSW") in conjunction with the Interim Storage Agreement and a portion of its groundwater for drought reserves. To ensure an adequate supply of water for all customers, TMWA's Rule 7 requires that applicants for new water service dedicate sufficient water rights to meet the demand of their development. Applicants for new service can buy water rights on the open market and dedicate sufficient, acceptable water rights to TMWA or, if the applicant chooses to acquire from TMWA, the applicant pays for a will-serve commitment based on TMWA's costs incurred to acquire and process the necessary water rights. The primary water rights that applicants for new water service dedicate to TMWA are mainstem Truckee River water rights. Although the number of remaining Truckee River mainstem irrigation water rights available for conversion to M&I use continues to decrease, analysis shows over 50,000 acre-feet of Truckee River

mainstem rights are potentially available for future dedication to TMWA to support future will-serve commitments, and this amount is more than enough to meet TMWA's future water rights requirements through the planning horizon.

Recommendation:

The Board continue to acquire water rights to meet future water demands pursuant to its Rule 7.

3.3 Yield of Conjunctive Management of Water Resources

Findings:

TMWA's current resources and continued dedication of river rights will allow TMWA to meet a demand of 119,000 acre-feet under TROA implementation or 113,000 acre-feet without TROA based on the historic drought from 1987 to 1994; this drought, the most severe on record. Without TROA a 9-year drought design will support a demand of 110,000 acre-feet. Use of a more stringent drought cycle design, without data to support it, ultimately reduces the use of available resources and burdens the region with the costly requirement to replace the lost-committable resource. Using the 9-year drought design preserves the opportunity for the local community to continue to develop in an orderly fashion without necessitating unreasonable and unnecessary interruptions during the next few years before TROA is implemented, which is projected to meet demands of 119,000 acre-feet annually.

Recommendation:

The Board (1) until TROA is implemented, recognize that although demands could expand through the continued conversion of irrigation water rights to municipal to 113,000 acre-feet annually using an 8-year drought period use but manage demands to 110,000 acre-feet based on a 9-year drought period and (2) continue review of the performance of this standard based on factors such as demand growth, hydrologic cycles, climate changes, etc. and update the Board should future conditions change.

4.1 Population Projection

Findings:

TMWA's population forecast shows that population within TMWA's retail area and the wholesale areas will increase by slightly more than 95,000 people, from 371,000 people in 2010 to approximately 466,000 by 2030. This represents a 25 percent increase over the estimated 2010 population. The population estimates may change over time as the pace of development within the region or its sub-area varies and as the region moves towards greater intensification of land use. TMWA's forecast results compare favorably to the State Demographer's near-term projections.

Recommendation:

The Board accept TMWA's population forecast as a reasonable estimate of future population growth to be used by TMWA for planning purposes in its planning areas.

4.2 Water Demand Forecast

Findings:

Water demands within TMWA's service areas have decreased over time resulting in slower water demand growth in TMWA's extended forecast. Based on the review of current growth and economic trends in the region, future water demand is anticipated to grow in the central Truckee Meadows but at a slower pace than historically seen. As it relates to current uses of or projected need for water resources, whether TMWA and WDWR consolidate or not, the projected water demand in the respective service areas are not expected to change for two primary reasons: (1) the effective rates customers pay for service is comparable between the two purveyors and (2) both purveyors use TMWA's Rule 7 for estimating resource requirements and dedication of resources for new development.

The water demand forecast indicates that from 2010 to 2030 demand will increase by 26% or 20,000 acre-feet, from a 2010 estimate of approximately 77,000 acre-feet. The projected 2030 demand of approximately 97,000 acre-feet is well within the maximum 119,000 acre-feet demand annually under TROA.

Recommendation:

The Board accept for planning purposes that the water demand projects are reasonable estimates for use in TWMA's planning areas.

4.3 Water Production Facilities Forecast

Findings:

Production facilities are planned to meet peak day water demand under two conditions. In "normal" years TMWA seeks to maximize the availability of surface water so more surface capacity is needed and used while groundwater pumping is minimized. Conversely, in Drought Situations TMWA seeks to maximize groundwater pumping so more well capacity is needed and used while reduced Truckee River flows prevent full utilization of available surface capacity. The projected demands indicate that "normal" year peak day demands increase from 136.8 MGD in 2010 to 171.9 MGD in 2030. Based on current capacities -- 108.0 MGD surface treatment and 63.0 MGD groundwater – TMWA can meet the "normal" year peak day demand in 2030 with existing facilities, however, during Drought Situations there is insufficient groundwater capacity which must increase by 23.7 MGD, from 63.0 MGD to 85.7 MGD, in order to meet projected 2030 Drought Situation peak-day requirements. A review of TMWA's 2005-2025 Water

Facility Plan will determine if any change in facilities and/or their timing is warranted as a result of the 2030 peak day forecast.

Recommendation:

The Board accept for facility planning purposes in TMWA's planning areas the peak day forecast as a reasonable estimate of future peak day water.

5.1 Water Demand Management

Findings:

TMWA's Water Demand Management Programs include measures to enhance efficient use of water, reduce or eliminate water waste, and save water. Some specifics include change-out of old meters, leak repair, water theft prevention, landscape design/retrofit assistance, numerous education materials, Assigned-Day Watering, watering prohibited during the heat of the day, water audits, and Drought Situation responses. Combined, these measures are designed to achieve 10 percent water savings annually as part of the conservation goal agreed to in the 1996 Water Conservation Agreement between RSW, TMWA, PLPT and the United States. Continued levels of spending will be in accordance with that agreement. TMWA works with the WRWC in developing conservation plans for the region, and cooperates with WRWC in implementing its conservation programs. The water conservation activities embodied in this 2030 WRP satisfy Article 5(i) of the JPA and the Nevada Division of Water Resources requirements that public water systems have a water conservation plan as set forth in NRS 540.131 through 540.151.

TMWA is required to follow twice-a-week watering per the terms of the 1996 Conservation Agreement as part of the Preliminary Settlement Agreement until such time at least 90 percent of its flat-rate-residential services were metered; that goal has been met and surpassed. TMWA has retrofit its flat-rate residential services enabling TMWA's Board of Directors to modify the current Assigned-Day Watering schedule. In 2010, as TMWA completes its conversion to a fully-metered and volumetric-billing water system, it is anticipated that Assigned-Day Watering will transition from mandatory twice-per-week watering to a program of three-times-per-week watering. No watering on Monday will be retained to ensure time and flexibility for system recovery. The revised Assigned-Day Watering is summarized here:

	MON	TUE	WED	THR	FRI	SAT	SUN
All "EVEN" addressed services	No	Yes		Yes		Yes	
All "ODD" addressed services	No		Yes		Yes		Yes

Along with the Assigned-Day revision and to discourage watering during the hottest, and typically the windiest part of the day, the restriction on time-of-day watering will expand to 12:00 P.M. to 6:00 P.M. from its current time restriction of 1:00 P.M. and 5:00 P.M. applicable for the weeks between Memorial Day and Labor Day.

To improve customer understanding between climatologically induced droughts and water supply TMWA has developed and will implement as part of this 2030 WRP a

simpler way to explain the impact of a Drought Situation on available water supplies. The new classification system is presented in Chapter 5 along with changes in existing conservation measures that take place through the course of a Drought Situation year. This revision replaces the four-stage drought classification with a three-stage supply classification. In non-Drought Situations, "Supplies are Normal". In Drought Situations, "Supplies are Adequate" as long as Floriston rates are available through Labor Day; if Floriston Rates are not available through Labor Day "Supplies are Impacted". This revised system will improve TMWA's ability to create more meaningful, easier to understand information campaigns that relate needed reductions in customer use to during Drought Situations.

Recommendation:

The Board (1) accept and adopt the Water Conservation Plan outlined in this 2030 WRP; (2) recommend the WRWC adopt for planning purposes the Drought Situation supply response classification system; (3) submit the updated plan to the State of Nevada Division of Water Resources in fulfillment of NRS 540.131-540.151; and (4) direct staff to modify TMWA's Rule 2 to reflect changes in Assigned-Day Watering once implemented.

6.1 Future Water Resources

Findings:

The selection of the next water supply project is strictly a function of a project's yield, ease of implementation, sustainability, and financial feasibility accompanies with existing regional economic conditions and market forces that would or would not favor the development of a future water supply project. It may be that in the future as new technology becomes available or the political, regulatory or public opinion changes, new projects may be developed or projects previously thought infeasible may become feasible. In addition to TROA moving toward implementation, the North Valley's Importation Project was completed in 2008 and is available to supply 8,000 acre-feet annually to Lemmon Valley.

TMWA is an active supporter and participant in the TROA process. TMWA will continue toward TROA implementation because of the numerous benefits it provides. In addition to working towards implementation of TROA, TMWA will also pursue other resource development projects that do not conflict with TROA requirements and will be necessary in order to meet future water demands.

Recommendation:

The Board continue to (1) support the efforts to implement TROA and (2) investigate, evaluate, and negotiate, where appropriate, other potential water supply projects consistent with and/or in addition to TROA.

Chapter 1 Introduction

TMWA developed and adopted its 2005-2025 Water Resource Plan ("2025 WRP") in March 2003. The Board reviewed its water resource plan strategy in 2007 and concluded that no deviation from the 2025 WRP was warranted at that time. The purpose or need for this 2010-2030 Water Resource Plan ("2030 WRP") is to review, update, develop and/or modify TMWA's water resource planning and management strategies due to a number of key events that have occurred over the past 6 to 7 years which include:

- Economic changes of the past few years at the national, state and local level have affected the growth activity and patterns for the Truckee Meadows resulting in a need to examine current population trends and their potential impact on demands and resource requirements. Projected changes in demands can affect TMWA's water facility and capital improvement plans which, in turn, can affect the funding of those plans and rates charged to customers and fees paid by developers.
- Legislative directives modified regional water resource planning for the Truckee Meadows and lead to the creation of the Western Regional Water Commission ("WRWC"). TMWA is a major contributor to the potable water management element within the 2010-2030 Comprehensive Regional Water Management Plan ("2030 RWMP") which must be completed and adopted by the WRWC before January 2011. That timeline requires TMWA to have its latest water resource strategies adopted and available to be incorporated into the 2030 RWMP sometime in the Spring of 2010.

  A subset of directives to the WRWC was to evaluate the effectiveness of combining water purveyors within the Truckee Meadows. In late 2008 and continuing in 2009 TMWA and Washoe County Department of Water Resources ("WDWR") began the process to evaluate consolidation of the two utilities. Initial findings on the integrated management of water resources and operations of the two utilities were favorable.
- The context of TMWA's water resource planning has changed as a result of the five Mandatory Signatory Parties (TMWA, Pyramid Lake Paiute Tribe, California, Nevada, and the United States) and seven other parties signing the Truckee River Operating Agreement ("TROA") on September 6, 2008. This is one of many milestones toward changing the way the Truckee River and its reservoirs will be managed once the agreement is implemented.
- Since TMWA's predecessor began the Meter Retrofit Program in 1995, TMWA has retrofit with water meters over 98 percent of the original 44,651 flat-rate water services that were required to be retrofit as part of the 1989 Negotiated River Settlement, which provides the opportunity to review and update TMWA's demand-side management plans and programs.

Other events since the 2025 WRP have complicated water resource planning necessary to accommodate the region's growth in future years. This Introduction frames the more significant challenges to the future development of water resources for the Truckee Meadows region and sets the context for this water resource plan. This 2030 WRP relies and builds upon the

information developed and contained in prior TMWA and various regional planning efforts. This plan will examine and analyze the water resource options available to TMWA to meet the water demands of its current and future customers. To ensure that resource planning, facilities planning, and financial planning are up-to-date and well coordinated, TMWA's coordinated approach addresses the water-resource, and ultimately the facility challenges facing the utility and the region in order to develop workable strategies that are cost effective while protecting the financial integrity of TMWA. A visual presentation of the functional relationships of this coordinated approach is shown below in Figure 1. This 2030 WRP begins the process for this coordinated effort.

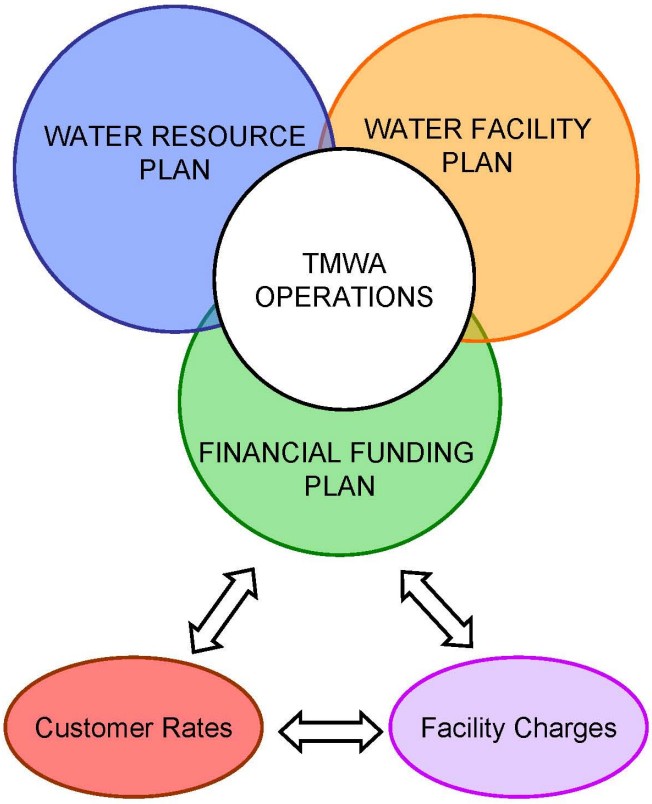

Figure 1: TMWA Planning Process

The information contained within this report is used to determine what, if any, changes are needed to TMWA's other key planning documents and determine any impacts to customer rates. This cycle of review and updating is a continuous process necessary to respond to changing economic and environmental factors that affect the Truckee Meadows region.

Background of Water Resource Planning for the Truckee Meadows

As shown in Figure 2, the Truckee River system extends from Lake Tahoe to Pyramid Lake. The river is fed by run-off from melting mountain snow carried by numerous creeks, streams and lakes. This snowpack-dependent, highly-variable river is diverted to meet the water supply needs of agriculture, municipal, recreation, wildlife, and the environment.

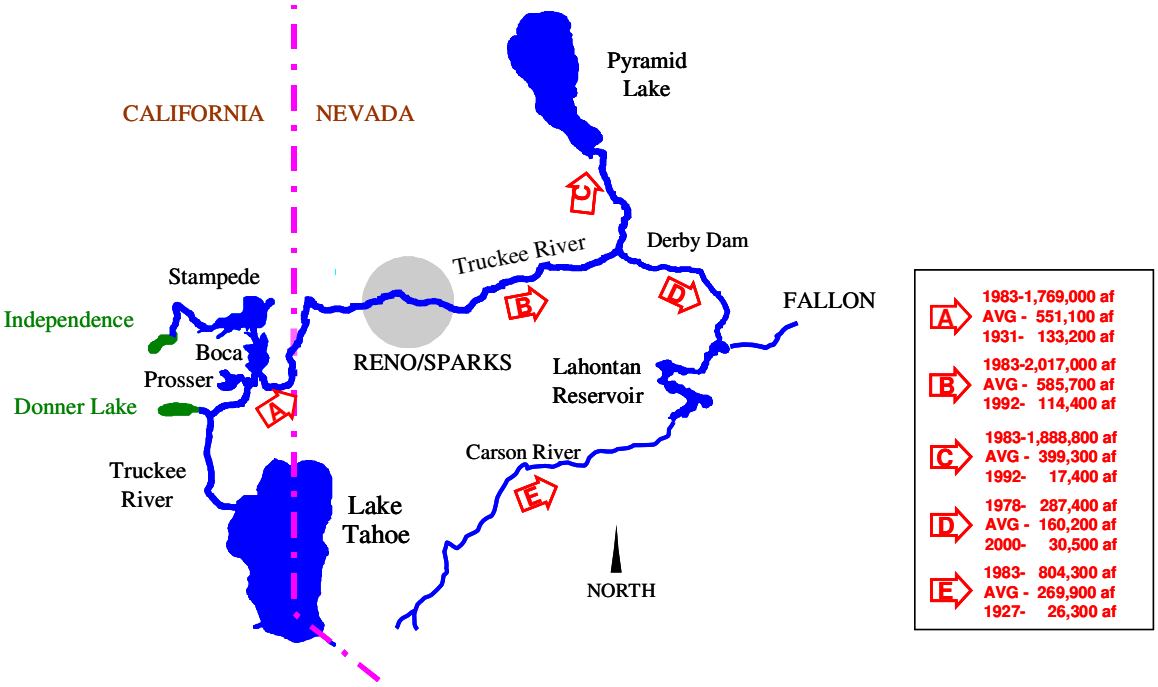

Figure 2: Truckee River System with Highest, Lowest and Averaged Recorded Flows

TMWA's water supply, both current and future, is primarily dependent on maximizing the resources available from the Truckee River, mostly mainstem[1] Truckee River water rights. This strategy has been followed by the purveyor since its inception in the 1800's due to the availability of the river, the association of hydroelectric diversions and diversions for municipal

[1] When used in this plan, the term "mainstem Truckee River resources (or water rights)" refers to those decreed irrigation water rights to divert the waters of the Truckee River directly from the river as opposed to diversion of water from tributaries to the Truckee River.

purposes, the quality of the supply, and the historic investment in surface water treatment facilities.

Typically, TMWA has met over 85 percent of its customer demands using Truckee River resources with 15 or less percent reliance on groundwater resources. In Drought Situations[2] the Truckee River may supply only 70 percent of water to meet TMWA demands with 30 percent reliance on groundwater resources and releases of TMWA's stored water in upstream reservoirs. Because of the uncertainty and variability of annual meteorology and its resulting snowpack and spring run-off to the Truckee River system, TMWA's resource planning and management of its resources are designed to mitigate the weather uncertainty with minimal impact to customers.

Formal evaluation of the Truckee Meadows water supplies was conducted by TMWA's predecessor, Sierra Pacific Power Company ("Sierra"), as early as 1929. Sierra planned for and managed its water resources to meet the growth requirements for the greater Reno and Sparks metropolitan areas. Prior to significant population increases beginning in the late 1960's (see Figure 3), water resource planning was not as complex an issue as the utility was able to rely on the combination of its decreed water rights, the conversion of irrigation lands with their associated water rights to municipal use, and upstream storage. However, continued rapid and consistent growth in population within the Truckee Meadows challenged the region's ability to engage new water supplies and optimize the management of existing water supplies.

[2] A "Drought Situation" means a situation under which it is determined each year by April 15 either there will not be sufficient run-off to maintain Floriston Rates through October 31, or the projected amount of water stored in Lake Tahoe (including. Lake Tahoe Floriston Rate water in other reservoirs as if it were in Lake Tahoe) used to support Floriston Rates would result in an elevation of Lake Tahoe less than 6223.5 feet Lake Tahoe Datum elevation on or before the following November 15.

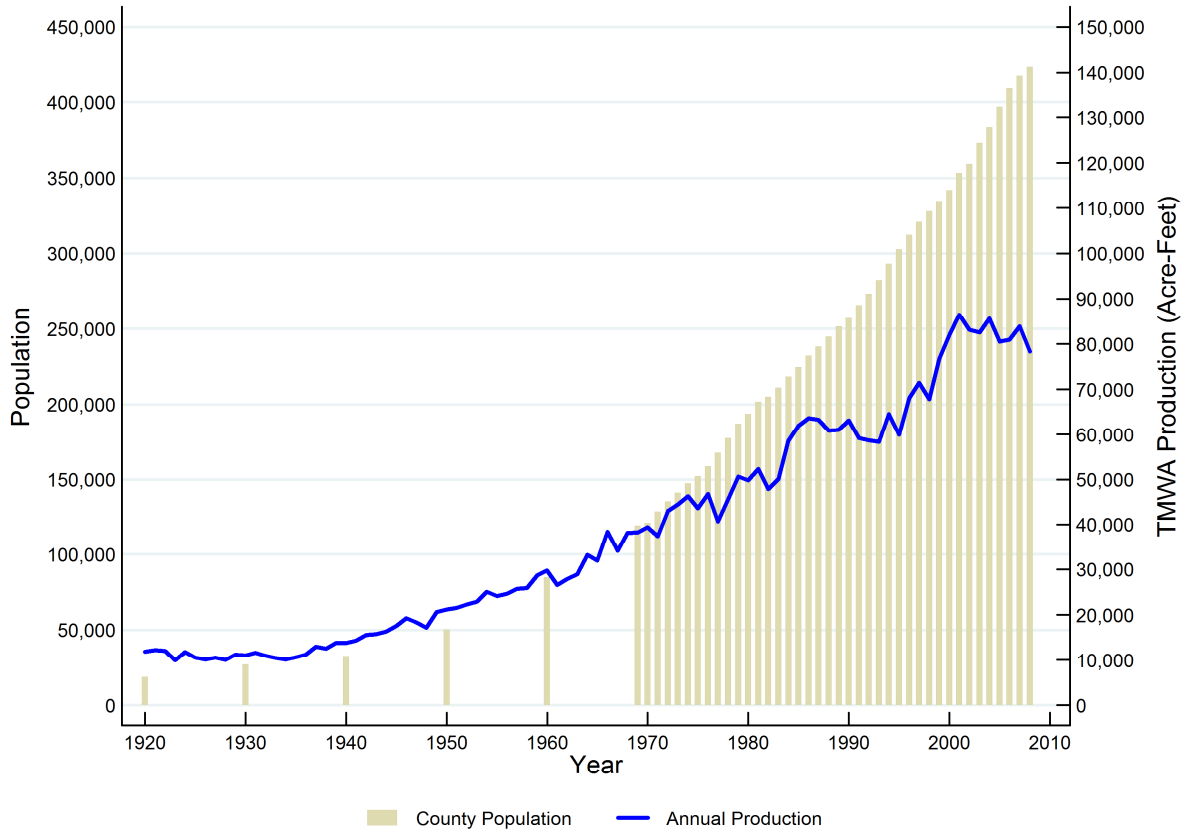

Figure 3: Historic Water Consumption and Washoe County Population

Throughout the history of water delivery in the Truckee Meadows, growth in water demands have been managed by the water purveyor by converting agricultural water rights and augmenting those river supplies with privately owned storage water ("POSW")[3] in Independence Lake and Donner Lake during dry years. The groundwater development program commences in the late 1960's to help balance growing demands within the region's widespread and multi-elevation distribution system, and to avoid problems with winter time ditch operations.

Planning for future water resources in the area required more concerted efforts beginning in the late 1970's due to accelerated growth in and around the Truckee Meadows, as well as extensive litigation over the water rights of the Pyramid Lake Paiute Tribe ("PLPT") and the Endangered Species Act which delayed and ultimately prohibited the implementation of Stampede Reservoir as a drought supply option. Sierra filed water resource plans for its service territory with the Public Utility Commission of Nevada ("PUCN") in 1986, 1988 and 1994.

[3] Privately Owned Stored Water means water *stored* in lakes or reservoirs pursuant to the water rights of TMWA in Independence and Donner Lakes.

Regional water plans by the Regional Water Planning and Advisory Board of Washoe County and subsequently by the Regional Water Planning Commission ("RWPC") were published in 1990, 1997 and 2005. The RWPC also approved water resource plans for Spanish Springs in May 2004 and the South Truckee Meadows Facilities Plan ("STMFP") in August 2002. A draft facility and resource-related plan for Lemmon Valley was released by RWPC in October 2002 and subsequently updated in 2007.

The RWPC's 2025 RWMP was finalized and released in January 2005. The 2005 RWMP reviewed and summarized the current status of water resources (ground and surface water), water quality and wastewater, flood control/storm drainage, watershed management, and water conservation as these issues affect the hydrographic basins within the RWPC planning area. The 2005 RWMP was subsequently amended in 2006 and 2009.

While TMWA contributes to these regional planning efforts, its primary planning focus has been to ensure a consistent supply of water for its customers who comprise approximately 84[4] percent of the population of Washoe County residing in and around the cities of Reno and Sparks. TMWA's water resource plans focus on how to supply water during drought and non-drought periods in those hydrographic basins where it supplies water, principally the central Truckee Meadows, Sun Valley, Spanish Springs (both within its retail and wholesale service areas), west Lemmon Valley, and the Truckee Canyon (Verdi/Mogul). In 2003, TMWA adopted its 2025 WRP. Between 2004 and 2006, there was a flurry of events -- change in value of water rights, accelerated housing starts, near completion of the meter retrofit program, a drought between 2000 to 2005, continued discussion on the effects of global warming on water supplies, changing Regional Planning land use designation, and legislative investigation into water resource development trends in Washoe County -- that stimulated a review by TMWA's Board in 2007 of TMWA's 2025 WRP to determine what, if any, impacts may alter TMWA's resource planning directions. The primary conclusion in 2007 was that although there had been substantial shifts in land use, future population locations and planned densities, and changes in water rights value since 2005, the projected demands in the long-term were not significantly different from those of the 2025 WRP, and thus no deviation from the Board's 2025 WRP planning actions was warranted at that time.

This resource plan relies on and is dependent on prior regional and TMWA planning efforts. While TMWA's water resource mix and management has not changed since 2005, events and trends that have occurred during the past five years, and noteworthy changes affecting future water resource decisions are discussed in the next section of this introduction.

Factors Affecting Truckee Meadows Water Resources

TMWA's prior 2025 WRP (1) laid the foundation for an understanding of the region's water supply system; (2) provided the history of municipal water supply in the Truckee Meadows up to and including the formation of TMWA as the largest municipal water purveyor

[4] Approximately 73% of the County population resides in TMWA's retail area and 11% resides in the wholesale areas.

in Northern Nevada; (3) confirmed the use of Truckee River flows during the historical 1987-1994 drought period as the basis for prudent water supply planning for the Truckee Meadows; and (4), provided ongoing analysis of future water supply options to meet the region's development needs. This 2030 WRP analyzes changes since the 2025 WRP and examines what, if any, impacts of major trends affecting Truckee Meadows water resources will affect TMWA's plans and/or management practices.

Economic Conditions and Water Rights

This 2030 WRP comes at a unique time for the greater Truckee Meadows region. Prior to 2003, the number of will-serve commitments issued by TMWA for retail and wholesale water service averaged between 1,000 to 1,500 acre-feet per year; by 2004 and 2005 the number of will-serve commitments had more than doubled. The region experienced eight years worth of development in a four year period (2003-2006) followed by a precipitous drop in development activity beginning late 2006 (see Figure 4).

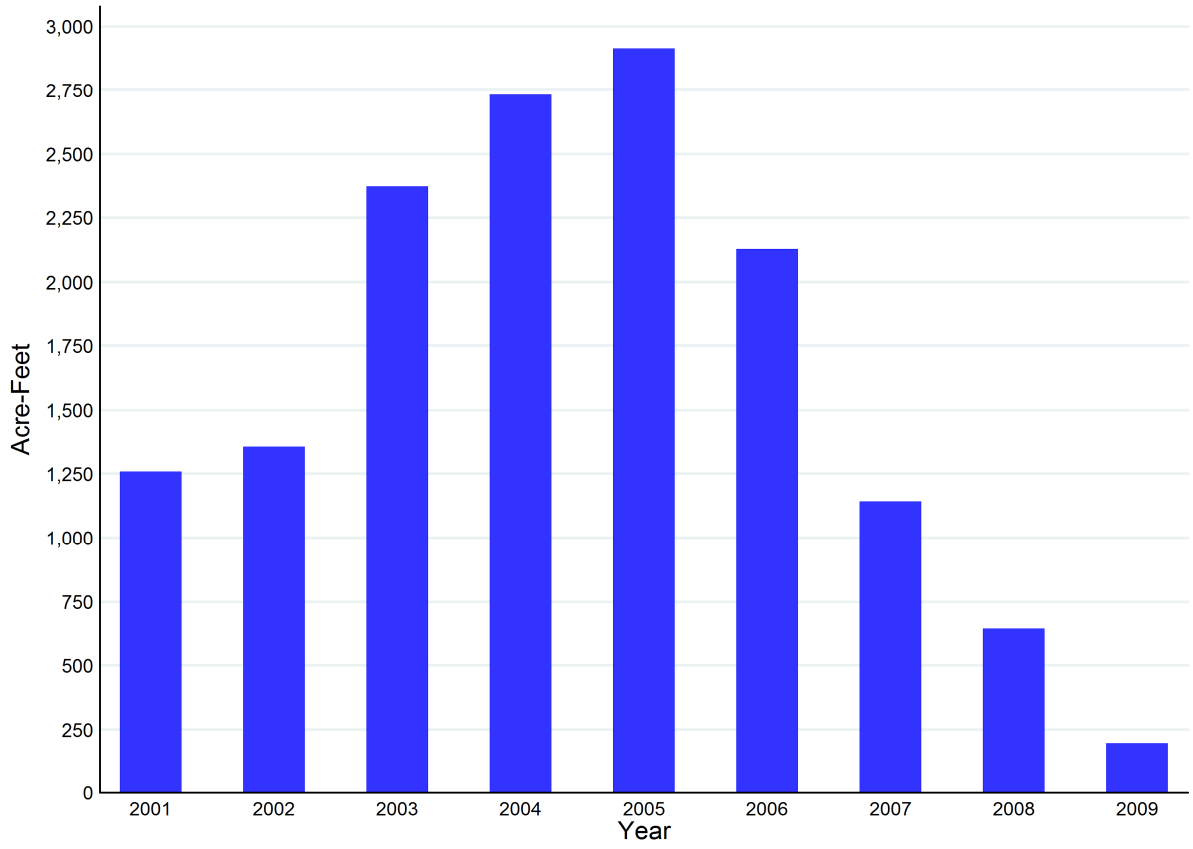

Figure 4: Annual Will-Serve Commitments Issued by TMWA 2001 -2009

With the increase in growth the amount of developable land necessary to house the region's population has decreased over the past 25 years in the hydrographic basins where TMWA provides water service. Figure 5 shows that since 1980 approximately 96,000 acres were

developed, which is about the same number of acres that had been developed from the time the first settlements appeared in the Reno/Sparks area in the mid-1800's. The reduced supply of developable land during the time period reflected in the graph is just one factor that contributed to increases in real estate prices experienced since the late 1990's through 2006.

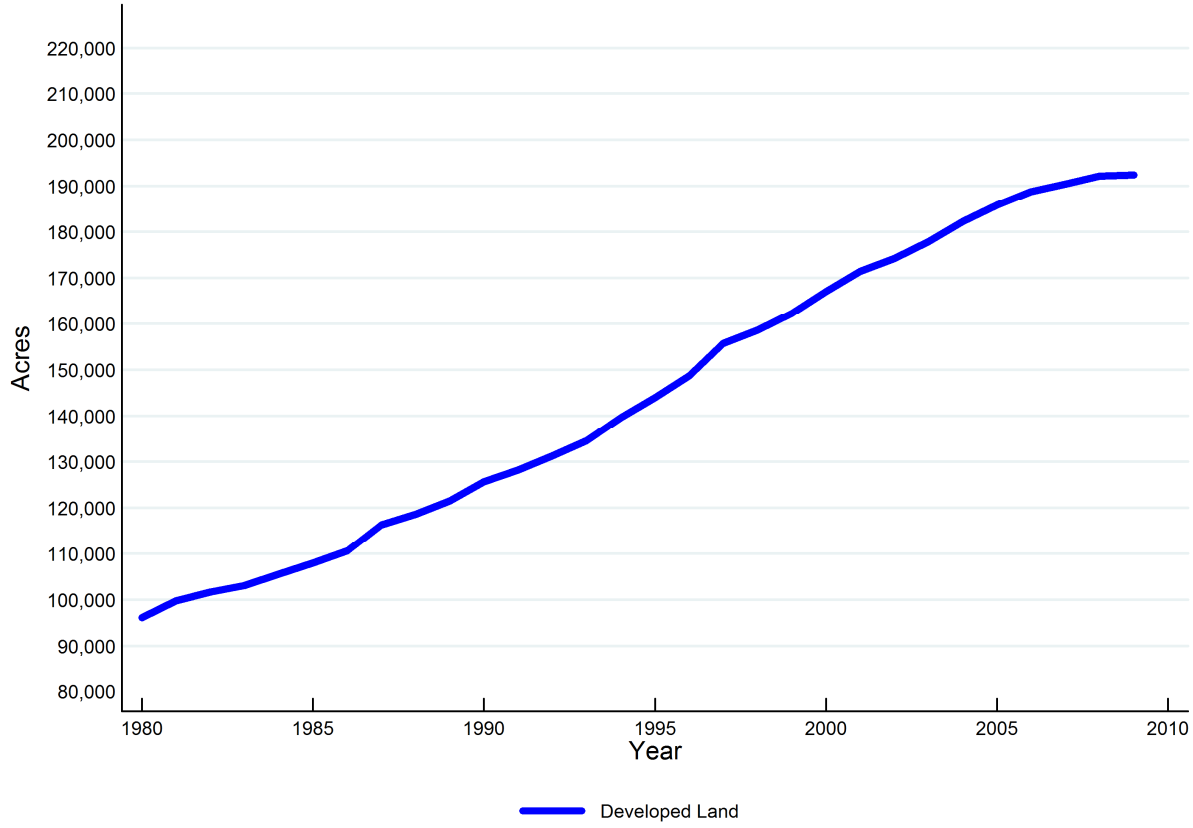

Figure 5: Development of Land in Washoe County by Year Since 1980

This 2003-2006 period of unprecedented growth exerted upward pressure on the price of housing as well as the price of water rights. The greatest increase in housing prices occurred between 2003 and 2005. Figure 6 shows that between 2000 and 2005, the median sales price of existing homes increased 103 percent, from $155,000 to $315,000. Some of the reasons cited for this rapid price increase in housing prices related to (a) relatively low home prices compared to California and other western markets; (b) historically low mortgage rates and access to mortgage loans in existence during that time; (c) high consumer confidence and spending at the national level; (d) a strong national economy; (e) an influx of national home builders to the region selling new homes at higher than average prices; (f) a surge in immigration and demand for new housing in the region; (g) a stable and favorable business climate compared to other regions in the west; and (h) increasing costs of raw materials for new construction brought about by high demands. At present the median price of existing single family homes is approximately $170,000. When the economy began to falter in Nevada beginning in late 2006, development of any significance declined substantially.

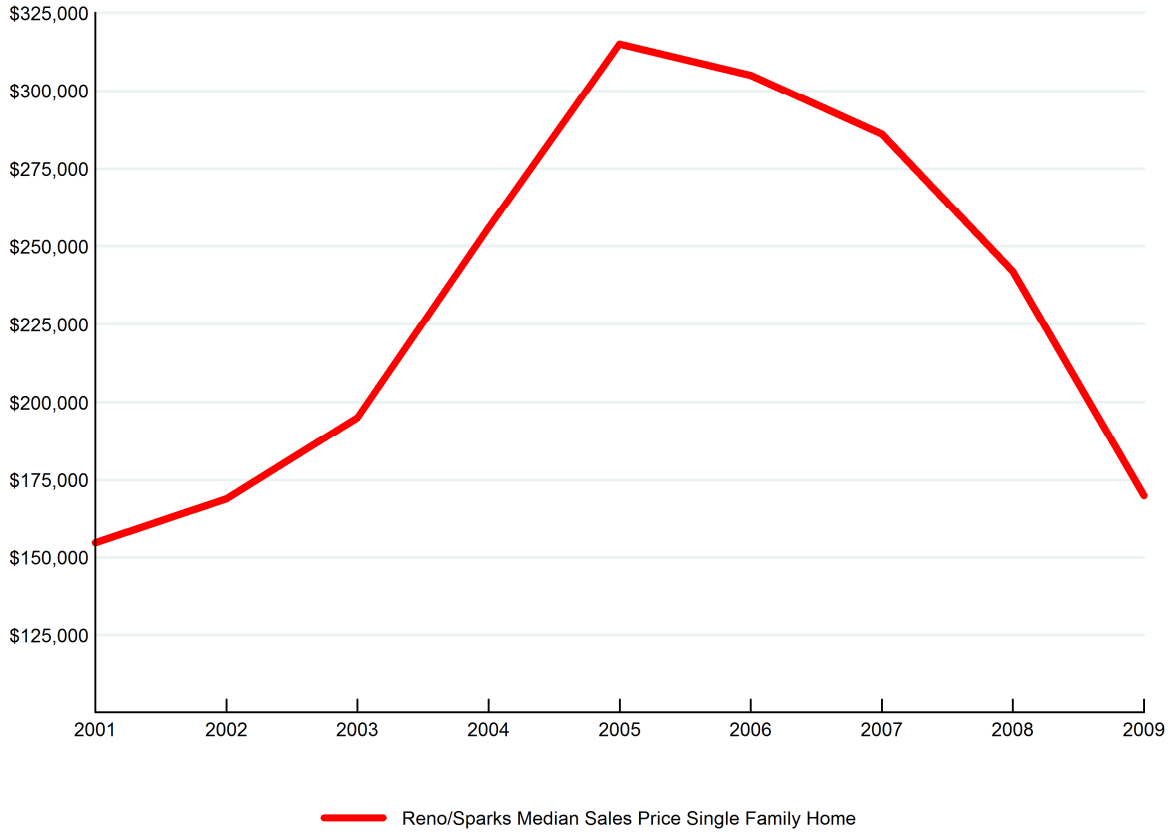

Figure 6: Changes in Median Price of Existing Single Family Homes

Unemployment was at a record low of 3.9% in the spring of 2006 statewide and is now at a record high of 12.4% in August 2009. The Reno MSA[5] unemployment rate tracks very closely to the statewide rate, and is currently 12.4%. The total number of people employed in the Reno MSA has decreased from 215,600 in 2007 to 200,300 in August 2009[6] . In addition to record unemployment, Nevada continues to rank in the top five states for the highest home foreclosure rate[7]. According to the Nevada Department of Employment, Training and Rehabilitation in August 2009, "Nevada is in the midst of the longest, deepest recession since World War II, and recent labor market trends show no sign of improvement."

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[5] Reno Metropolitan Statistical Area ("MSA") includes employment from Washoe and Storey Counties.

[6] Source: Nevada Labor Force Summary Data, Department of Employment, Training and Rehabilitation. Research and Analysis Bureau. www.nevadaworkforce.com.

[7] Source: RealtyTrac.com.

The long-term effects of these fundamental changes to the region's economy are incorporated into TMWA's population and water demand forecasts discussed in Chapter 4.

The economic factors described above have had a direct impact on the water rights market, including water rights associated with the Truckee River system which is TMWA's primary source of new water resources. The water rights market experienced a major disruption in the first quarter of 2005. The activities of the various sellers and buyers in the market radically changed the cost of acquiring a water right which led to a temporary reduction in the availability of water for all water rights buyers, including TMWA. Throughout 2005 developers and other buyers of water rights were willing to pay prices as high as $60,000 per acre-foot at a time when the market price earlier in the year were averaging between $4,000 to $8,000 per acre-foot. The demand for water rights in the Truckee Meadows competed with other demands for Truckee River water rights. These other demands include rights purchased for historic agricultural uses or to improve lower-river water-quality affected by wastewater treatment plant effluent discharges to the Truckee River, M&I demands for Truckee water rights in the Fernley area, and other in-stream flows uses (e.g., fisheries, wildlife). These competing interests along with the cost and time needed to determine a water right's ownership contributed to limited available supply and higher water rights prices.

The effects of these trends are compared to the increase in median home prices in Figure 7. The graph shows that although an increase in the cost of water rights as measured by TMWA's average annual price of Rule 7 water resource inventory generally lagged the rapid increase in housing price; the magnitude of the price change was unprecedented.

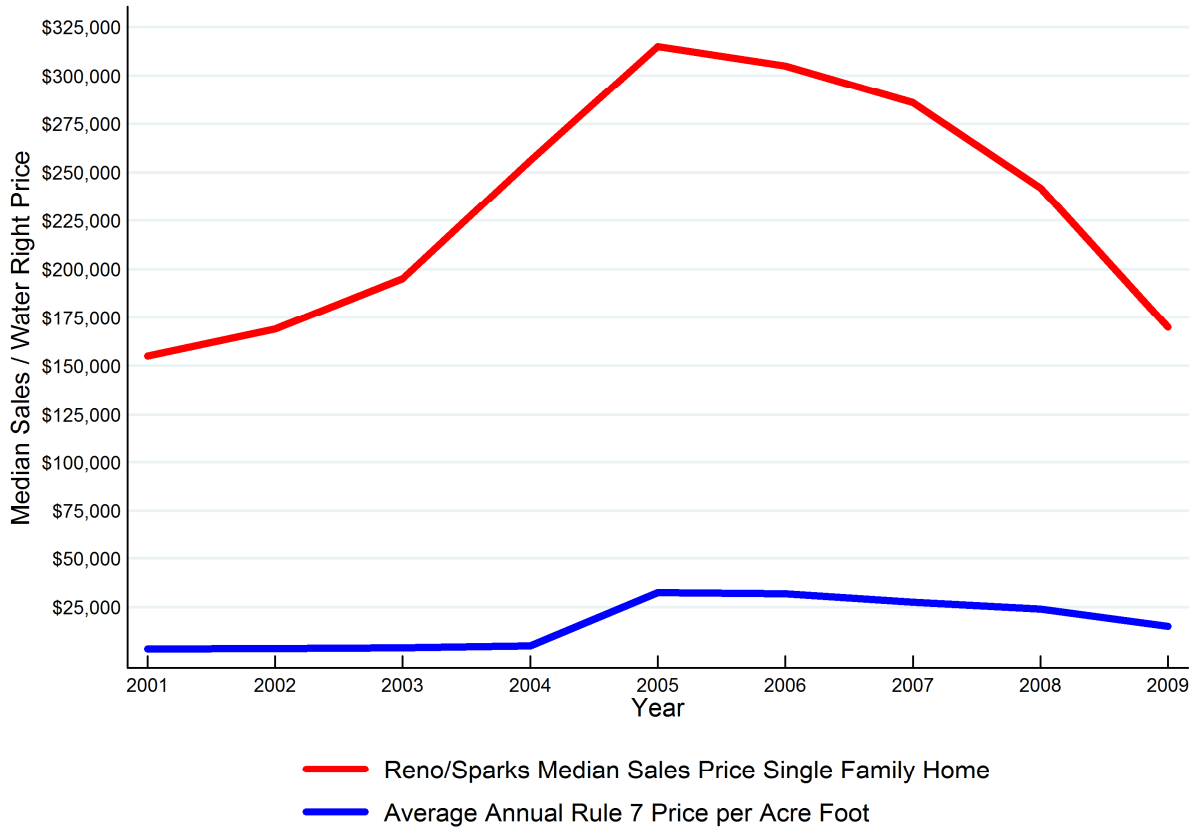

Figure 7: Changes in Median Price of Existing Homes and TMWA's Annual Rule 7 Price

Figure 8 shows this price shift in closer detail using the average month-end price of TMWA's Rule 7.

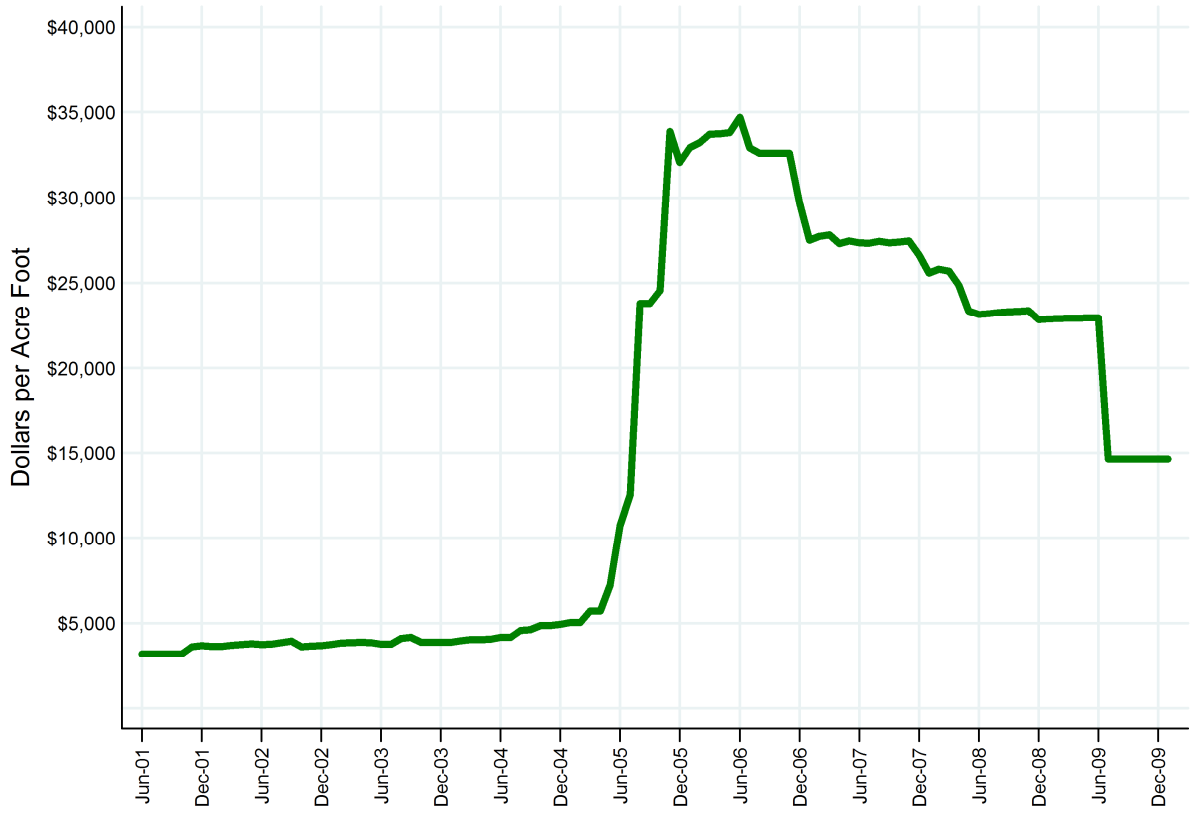

Figure 8: Month-End Rule 7 Price

The Orr Ditch Decree, issued in 1944, established the number of water rights associated with the Truckee River and all its tributaries by reach, by priority, by owner, and by quantity. It is important to note that although surface water rights can be subdivided and/or converted from one use to another, for example from agriculture to municipal use, the overall total number of surface water rights available from the Truckee River has not changed from the amount defined in the Decree. Having a sufficient number of water rights is essential to TMWA issuing new will-serve commitments. New development cannot proceed before demonstrating that adequate water resources exist to serve a project. At present, will-serve commitments can only be issued when, and if, water resources are available to service the estimated demand of a particular project and drought supplies can support the expansion of new demand. The needed water resources can either be purchased on the open market by an applicant for new water service and dedicated to a water purveyor or purchased directly from TMWA. Those purchasing will-serve commitments directly from TMWA are required to reimburse the utility for the costs it incurred in acquiring, processing and carrying the necessary water rights. This process for ensuring

adequate resources to meet demand was originally instituted by Sierra through their "Rule 17" approved by the PUCN in 1982.[8] Although somewhat modified under TMWA's "Rule 7", this process continues to be used to ensure new development provides sufficient resources for growth within TMWA's retail and wholesale areas.

The primary water rights that applicants for new water service dedicate to TMWA are mainstem Truckee River water rights. Although the number of remaining Truckee River mainstem irrigation water rights available for conversion to M&I use continues to decrease, analysis in Chapter 3 will show over 50,000 acre-feet of Truckee River mainstem rights is potentially available for future dedication to TMWA to support future will-serve commitments, and this amount is more than enough to meet TMWA's future water rights requirements through the planning horizon.

Figure 9 shows where buildable acres[9] are located with respect to water purveyors' service areas which can potential be served by Truckee River resources, both mainstem and/or tributary rights. Depending on the use of the land, commercial versus residential, and the resulting densities assigned to the land, the amount of water resources needed to meet this demand will vary. TMWA estimates an additional 20,000 acre-feet of water demand will be generated by 2030, requiring about 26,000 acre-feet of water resources. This is within the potentially available 50,000 acre-feet of water rights mentioned above, and is sufficient to meet projected growth in water demand and land use over the 2030 WRP planning horizon.

[8]In 1979, as the result of an extensive study by Sierra, the Washoe Council of Governments was informed of water supply problems resulting from the inability of the community to acquire use of Stampede Reservoir for municipal and industrial purposes. The State Engineer subsequently ordered that will-serve commitments for subdivisions could not be issued until a water budget showed that sufficient water was available for new projects. To address this situation, Sierra sought approval of "Rule 17" with the Public Utility Commission of Nevada (PUCN) in 1981. The PUCN issued its order on February 8, 1982 which created the Rule 17 process.

[9] Consistent with prior planning assumptions, buildable acreage excludes land with slopes greater than 30 percent and U.S. Forest Service lands (primarily to the west and southwest foothills of the Truckee Meadows).Although, over the years Federal lands have transferred to private use it cannot be predicted with certainty at this time where or the amount of Federal lands that may be transferred in the future for development purposes; it is a function of the region's economic and resulting growth plans of the local governments.

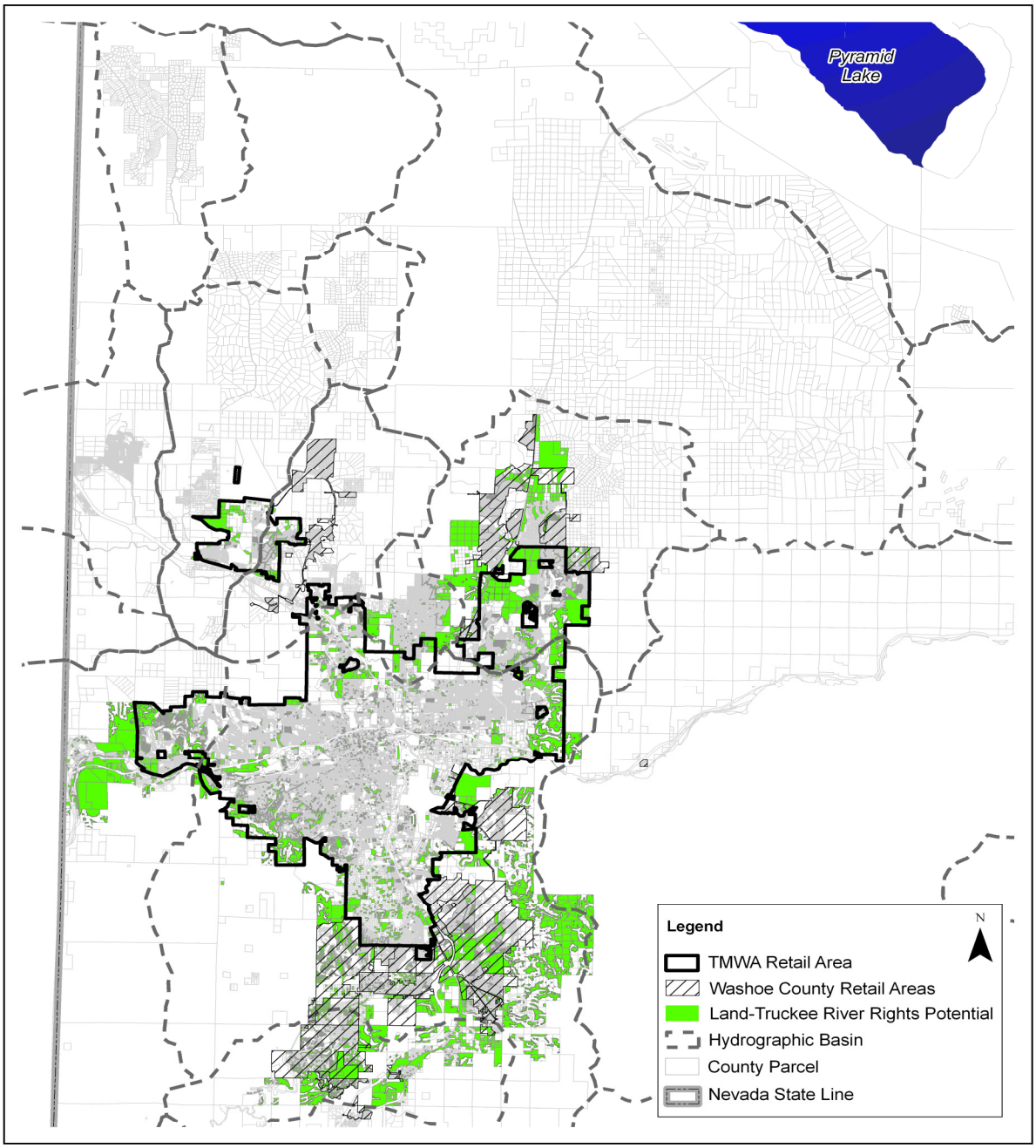

Figure 9: Buildable Acres in TMWA with Potential to Use Truckee River Resources

TMWA, pursuant to Board of Directors' actions, continues to maintain an inventory of water resources it has acquired from willing sellers at negotiated prices. In previous years, when

there were fewer buyers and less demand for water rights, TMWA (like its predecessor Sierra) was very successful in acquiring water rights. Today, the water rights market is characterized by an increased number of buyers and a decreased number of individuals willing to sell water rights unless the seller achieves a high price for their water right. This characterization, coupled with the fact that many recent buyers have been willing to pay much higher prices than past or current market trends would have predicted, resulted in a 500 percent run-up in TMWA's Rule 7 price over a 6-month period in 2005. But market corrections are occurring, consistent with the recent decline in housing starts in the region and associated decreased demand for water rights, aligning the price of water rights closer to market conditions.

Discussions of demands are found in Chapter 4, while availability of water rights to meet TMWA's service area demands is found in Chapter 3.

State Legislative Changes

Introduced in the 2007 Nevada Legislative Session, Senate Bill ("SB") 487 proposed to create a new regional water resources entity in Washoe County. The bill was sponsored by the Interim Legislative Subcommittee created in 2005 by Senate Continuing Resolution 26. SB 487 created a new regional water entity in Washoe County to be effective April 1, 2008. Pursuant to this legislation, the cities of Reno and Sparks, the South Truckee Meadows General Improvement District, the Sun Valley General Improvement District, the Truckee Meadows Water Authority, and Washoe County, formed a Joint Powers Authority to operate the Western Regional Water Authority ("WRWC"). This new entity is charged with coordinating resource management among the existing water purveyors in southern Washoe County. This includes planning for, developing, and managing new and existing water resources for the region (excluding Gerlach and Incline Village). SB 487 included a change of oversight and restructuring of the Regional Water Planning Commission ("RWPC") into the Northern Nevada Water Planning Commission ("NNWPC"). The WRWC began functioning and assumed oversight of the NNWPC in April 2008.

Section 41(1) of Western Regional Water Commission Act requires the WRWC to "..develop, and as necessary recommend revisions to, a Comprehensive Plan for the planning area covering the supply of municipal and industrial water, quality of water, sanitary sewerage, treatment of sewage, drainage of storm waters and control of floods. The initial Comprehensive Plan must be developed on or before January 1, 2011." That planning effort is in the early stages of developing the plan outline and calendar. The goal is to complete the regional water management plan for the years 2010 to 2030 sometime in Fall 2010. Since TMWA is a major contributor to the potable water management elements of that plan, adoption by TMWA's Board of this 2010-2030 WRP is necessary in Spring 2010 in order that it findings may be incorporated into the regional water management plan.

Water Purveyor Integration/Consolidation

For the last several years, serious consideration has been given by the TMWA's Board of Directors and Washoe County's Board of Commissioners ("BCC") to the possible integration of some or all functions of TMWA and WDWR. Formal direction was given to the WRWC to incorporate into its 2030 Comprehensive Water Plan an "[e]valuation and recommendations regarding the consolidation of public purveyors in the planning area, which must include

costsand benefits of consolidation, the feasibility of various consolidation options, analysis of water supplies, operations, facilities, human resources, assets, liabilities, bond covenants, and legal and financial impediments to consolidation and methods, if any, for addressing any such impediments." Western Regional Water Commission Act, Section 42(9).

In furtherance of this directive, at its September 12, 2008 meeting, the WRWC asked staffs from TMWA and WDWR to "conduct a focused financial analysis to assess the feasibility of some form of utility integration using their joint bond counsel and financial advisors…".[10] At the December 2008 WRWC meeting the Phase One Financial Report was presented which consisted of a bond analysis addressing certain limitations and restrictions resulting from existing debt and what opportunities were available for refunding or refinancing existing debt. This analysis demonstrated that consolidating WDWR into TMWA by defeasing WDWR debt would be financially feasible within a reasonable time-frame, but that the converse – defeasing TMWA's debt – would not be a financially advantageous alternative. Since the presentation of that report, the respective staffs of TMWA and WDWR have met on numerous occasions to analyze the feasibility of whether the integration/consolidation of certain functions of the two entities was possible and, if so, whether efficiencies and benefits to the community would result.

In addition to presentations and discussion of Phase 1 financial analysis work in December 2008, WRWC received preliminary assessments reports ("PARs") for System Planning and Engineering at its March 13, 2009 meeting, and Operations and Water Resources at its July 10, 2009 meeting. Each of these PARs analyzed the potential opportunities for improving efficiency, customer service, and reliability, as well as reducing long term operating and/or capital costs through some form of integration of WDWR and TMWA. The PARs were prepared by interagency teams of employees who are familiar with the topics and were asked to base their analyses on the assumption that the TMWA and WDWR water systems were operated as one rather than two systems. The PARs are included in Appendix A.

The System Planning and Engineering PAR concluded that integrated planning and operation of water system facilities could improve reliability, water quality and service levels for customers; and potentially result in decreased operating and/or capital costs as compared to stand-alone water systems, particularly in the South Truckee Meadows. Operational cost savings might be realized through a reduction in annual pumping costs by shutting down wells in the winter months to avoid electric costs and increasing deliveries of treated surface water from Chalk Bluff.

The Operations PAR identified existing functions performed by each utility. Each of the operations functions was evaluated to determine if there were opportunities for improved

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[10] The Western Regional Water Commission Act requires analysis of consolidation of all "public purveyors" within the planning area. No analysis has yet been conducted of the Sun Valley GID and South Truckee Meadows GID operations. It is generally felt that these entities function in a semi-autonomous fashion and that significant efficiencies in operations or resource management are unlikely to be achieved by consolidating their functions with a consolidated TMWA/DWR entity. However, some additional analysis of this question will be necessary to satisfy the requirements of the Act.

efficiency, synergy, or other quantifiable benefits. Benefits identified are in the form of improving system reliability, water quality, and service levels to our customers through integration of staffs and joint operations in the following areas:

- Water Treatment Operations
- Distribution Maintenance
- Water Quality/Laboratory Operations
- Treatment Operations Maintenance
- Customer (Field and Meter) Services
- Facilities Location
- Backflow
- Field Inspection Services/Construction Management/Inspection
- Buildings and Grounds Maintenance, Fleet Maintenance, and Materials Management

The Integrated Resource Management PAR concluded that integration efforts could produce one or more of the following benefits in each of the study areas:

- Improve aquifer supplies
- Improve aquifer water quality conditions
- Create resource reallocation opportunities
- Potential to reduce certain operating costs
- Potential to avoid certain capital costs and/or facility costs
- Create conjunctive opportunities

The findings of the PARs generally indicate that the majority of benefits from a consolidation, without clear delineation of financial impacts to be borne by either TMWA or WDWR customers, accrue to WDWR. These reports have generally indicated that operational and resource management efficiencies may be achieved through consolidation, that rate structures of the two agencies were sufficiently close that migration to one set of customer rates would not result in inequities to either customer base, and that no insurmountable labor issues are anticipated.

To facilitate the consolidation review, the WRWC appointed a Subcommittee on Integration/Consolidation in July 2009, which conducted two meetings with staff to consider certain aspects of consolidation. At its August 6, 2009 the WRWC-Subcommittee meeting concluded that the integration/consolidation process should proceed and that the full WRWC Board make a formal recommendation to the governing bodies of both utilities to develop an inter-local agreement to implement integration of the two agencies leading to full consolidation. The respective governing bodies took action in September 2009 to direct staffs to proceed with the development of an inter-local agreement ("ILA") to advance the integration/consolidation of WDWR water functions into TMWA. The timeline for completing the ILA is late 2009 after which due diligence efforts will begin to further identify and/or clarify any potential legal obligations/constraints, complete financial analyses to determine the costs/benefits to the respective utility's customers, create an operating model of the combined systems to develop optimum production schedules and estimate related costs, and work out transition issues. Unless severe challenges to consolidation arise, the process will proceed toward complete consolidation

subject to Washoe County's ability to defease, refinance, or renegotiate its outstanding debt sometime in the future which is required prior to full consolidation.

From the aspect of treating and delivering potable water to customers, the consolidation of TMWA and WDWR is expected to enhance efficiencies related to the operation of water production and distribution systems, this would include the likelihood of improved, unified conservation messaging along with enforcement. As it relates to current uses of or projected need for water resources, the consolidation of TMWA and WDWR should allow the expanded use of surface water and reduced use of groundwater thereby improving aquifer conditions in the various basins where TMWA and WDWR provide water service. There is minimal expectation that water usage will change by customers of the two utilities under a combined basis since the rates customers pay for service are comparable.

On a forward-looking basis, since WDWR uses TMWA's Rule 7 for estimating resource requirements for new development projects, future uses and dedication of resources would have similar outcomes whether consolidation occurs or not. Although the results of resource and facility planning conducted by WDWR for their current, respective service areas may change slightly under a combined operation, those changes would not significantly affect the projected use of resources for this planning effort.

Historic Uncertainties – the Truckee River Settlement and the Truckee River Operating Agreement ("TROA")

In order to fully understand the Truckee River Settlement it is important to take a look back at the history of uncertainty with respect to the uses and users of the water of the Truckee River. This uncertainty is more difficult to see today than it was in the early 1990s, because, since that time, much of the litigation has been put on hold and most parties with interests in the waters of the Truckee River have been successful in negotiating solutions to their issues. But, prior to the late 1980's, when negotiations had been largely unsuccessful, this community was in gridlock and was unable to rationally plan for its future. Prior to Senator Reid and Congresswoman Barbara Vucanovich taking on the project, there were two major unsuccessful attempts to get legislation through Congress and Sierra had made presentations to the Washoe Council of Governments stating it would be out of water and the community unable to grow unless many of these uncertainties were resolved.

Some of the uncertainties included: (1) whether the Truckee River reservoirs can be operated to accommodate the needs of the endangered and threatened species instead of providing water to water right holders; (2) the amount of water which California was entitled to use relative to the amount of water available for Nevada; (3) how would California agencies charged with managing wildlife issues implement their regulation programs such as increasing minimum releases or in-stream flows, and would those efforts cause our reservoirs to be depleted leaving more water unavailable in a drought; (4) how would a 60 year old court decree, dominated by agricultural uses, adapt to changing uses or conversion of water uses from irrigation to municipal; (5) how would pending litigation be resolved; (6) how would Tribal claims to water be resolved and whether their claim to higher priority water rights would affect Truckee Meadows water rights; and (7) what impacts would all these unsettled issues have on the utility's ability to maintain existing water supplies, grow its water supplies and provide for the communities' future demand for water.

Eventually, in 1989, Sierra and PLPT were able to sign an agreement known as the Preliminary Settlement Agreement ("PSA"). The intent of the agreement was to settle numerous issues (some mentioned above), claims and counter-claims between these two parties and lay the foundation for a larger settlement to Truckee River issues that would include the five Mandatory Signatory Parties (United States, California, Nevada, Sierra (now TMWA), and PLPT) and other parties willing to participate.

In 1990, Congress passed and the President signed into law Public Law 101-618, the *Truckee-Carson-Pyramid Lake Water Rights Settlement Act* ("Settlement Act"). The Settlement Act, which incorporated and ratified the terms of the PSA; provided for the negotiation of a new operating agreement on the Truckee River; and preserved and protected the rights of all Orr Ditch water rights holders. The bill had provisions regarding other issues some of which were related to the settlement, such as economic development funds for PLPT; and some not related, such as the Fallon Tribe Settlement and the Newlands project reclamation reform provisions. Section 205(a) of PL101-618 directed the Secretary of the Interior to negotiate an agreement for the operation of Truckee River reservoirs. This agreement has become known as the Truckee River Operating Agreement ("TROA").

Negotiations on TROA began in the 1990's leading to the final agreement in September of 2008. When implemented, TROA will allow for a congressionally authorized interstate allocation of water and change the operations of the Truckee River system to accommodate multiple beneficial uses for drought supply, endangered and threatened fish species, water quality, California water use, and storage. In addition, operations will enhance riparian habitat, reestablish river canopy, enhance reservoir releases, improve recreational pools in the reservoirs, and improve the process for emergency drawdown procedures for Lake Tahoe.

TROA was signed by the Mandatory Signatory Parties (TMWA, Pyramid Lake Paiute Tribe, California, Nevada, and the United States) and seven other parties on September 6, 2008. A number of conditions must be met before TROA can be implemented. Some of these have been satisfied since TROA's execution, other remain to be accomplished. These include:

- Publication of TROA in the Federal Register occurred on December 5, 2008 and its promulgation as a regulation occurred on January 5, 2009. The Truckee-Carson Irrigation District ("TCID"), Churchill County and the City of Fallon have initiated litigation in United States District Court challenging the regulation, including a challenge to the adequacy of the Final Environmental Impact Statement for the Operating Agreement. TCID, Fallon and Churchill County dismissed their lawsuit under CEQA and the time to bring that action has since run out.
- Modification of the Orr Ditch Decree to accommodate changes required by the Operating Agreement (submitted to the court in *United States v. Orr Water Ditch Company, et al*. for approval of modifications to the Orr Ditch Decree on November 17, 2008). The motion has been opposed by TCID, Churchill County and City of Fallon. Service of process on water right holders is to be completed by mid December with a full hearing on the merits projected for some time next year.
- The United States and the Truckee Meadows Water Authority submitted a joint motion to the court in *United States v. Truckee River General Electric Company* to modify the Truckee River General Electric Decree on November 20, 2008. The

Court entered an order modifying the Decree on December 22, 2008 without objection from TCID Fallon or Churchill County. Now TCID has indicated that it intends to move to have this order vacated, but has not yet done so.

- Change petitions (filed in 2004) are pending approval by the California State Water Resources Control Board to change the water rights for Boca, Prosser Creek and Stampede Reservoirs, and for Independence Lake. A hearing date is expected in June 2010.
- Applications (filed in 2006 and 2007) are pending hearing and approval by the Nevada State Engineer to change the water rights in Nevada to allow Truckee Meadows Water Authority to hold the consumptive use component of certain of its water rights in storage. The hearing is scheduled for December 2009. In addition, changes to the Water Authority's water rights to generate single purpose hydroelectric power may also need to be approved; those change applications have been filed with the Nevada State Engineer, but no hearing date has yet been established.
- The Nevada State Engineer's ruling on unappropriated Truckee River water (granting the unappropriated Truckee River water to PLPT), State Engineer Ruling No. 4683, must be final, and the Orr Ditch Court must have made a determination that the Truckee River in Nevada is fully appropriated and closed to new appropriations. On March 30, 2009, the final appeal was dismissed, and Ruling No. 4683 is now final. However, the State Engineer's denial of an earlier TCID application for unappropriated Truckee River water is still pending in the Third Judicial District Court in and for the County of Churchill. It is anticipated that any decision by that court will also be appealed to the Nevada Supreme Court.
- *Pyramid Lake Paiute Tribe v. California*, Civil S-181-378-RAR-RCB, and *United States v. Truckee-Carson Irrigation District*, Civil No. 4-2987-RCB, cases pending in federal courts in California and Nevada, respectively, must be finally resolved. The *United States v. Truckee-Carson Irrigation District* case was dismissed with prejudice on August 10, 2009. Work is underway to have the remaining action dismissed with prejudice.

Additional accomplishments of the TROA parties or TMWA toward implementing PL 101-618 and TROA include the following: United States Bureau of Reclamation ("USBR") and TMWA executed a storage contract in 2008 and the referendum vote by PLPT held in 2008 was successful. TMWA has also completed the retrofit of its single family flat-rate services with meters. TMWA and the Mandatory Signatory Parties continue to work toward implementing TROA. Many or most of these accomplishments have or will be appealed by TCID, Fallon, Churchill County, or other parties. The effectiveness of TROA is conditioned upon all of these appeals being exhausted. It cannot be known with certainty when court rulings, regulatory or appeal processes will be complete.

TROA is now a signed document and binds PLPT, the United States, California and Nevada to move forward together to implement and make TROA effective. There are and always will be regulatory uncertainties surrounding the use the Truckee River. When TROA becomes

effective there will be a new, more flexible framework for river operations which will provide parties additional opportunity to accommodate issues as they emerge. However, because TROA is not yet in place other water supply options to provide the drought reserves (if TROA implementation is delayed or halted) are discussed in Chapter 6.

Summary

Water resource planning for the Truckee Meadows has become increasingly more complex in recent years and will continue to be more challenging to accommodate the region's growth in future years in spite of an implemented TROA. This chapter framed the most challenging issues facing the future development of water resources for the Truckee Meadows. This 2030 WRP relies and builds upon the information developed and contained in prior TMWA and various regional planning efforts. This 2030 WRP plan will examine and analyze the water resource options available to TMWA to meet the water demands of its current and future customers. The plan is set forth as follows:

- "Key Findings and Recommendations" summarizes the significant findings of the 2030 WRP and makes recommendation for further Board actions.
- Chapter 1, "Introduction", discusses some of the key trends and challenges that have shaped or are projected to shape the future of the Truckee Meadows region and the availability of water resources.
- Chapter 2, "Source Water Reliability", presents discussion of quality of surface and ground sources, source-loss risk analysis, and protection/response plans.
- Chapter 3, "Water Resources Management and Production", describes what water resources and water rights are currently available or used by TMWA and how those resources are conjunctively managed to annually produce a sufficient amount of water to meet TMWA's water service demands.
- Chapter 4, "Water Demand and Peak Day Projections", presents forecasts of population, water demands, and peak day demands for both non-drought- and drought-situation years.
- Chapter 5, "Water Demand Management", describes several conservation programs and measures that TMWA is employing to reduce annual water use and minimize water waste, revision to TMWA's Assigned-Day Watering schedule, and update to classification of conservation activities during Drought Situations.
- Chapter 6, "Future Water Resources", identifies potential future water resources.
- Chapter 7, "Conclusion", compiles the issues outlined in the plan with some suggested direction for the future of water resources for the greater Truckee Meadows region.

References

2005-2025 Water Resource Plan, Truckee Meadows Water Authority, March 2003.

2004-2025 Regional Water Management Plan, Regional Water Planning Commission, 2005.

Chapter 2 Source Water Reliability

This chapter explores the reliability of TMWA's primary water sources in terms of both quantity and quality for continued municipal purposes. The discussion explores weather related factors, such as climate change and drought cycles, that can affect the availability of TMWA's resources, and water quality issues that can affect the long-term sustainability of the available water supply resources. However, the most imminent threats to the reliability of the water supply are weather and source supply contamination, both of which may affect the quantity and quality of available water supplies.

Weather

Weather is the primary determinant in establishing water supply for the Truckee Meadows. Precipitation replenishes the reservoirs and aquifers from which raw water is used and recycled. While the weather pattern consistently provides precipitation during the winter and spring months, the type of precipitation (snow versus rain), water content of snow, and speed of snowmelt are variable from year to year. TMWA manages uncertainty of water supply through storage of water in upstream reservoirs, conjunctive use of surface and groundwater supplies and continually assesses the threats to water supply reliability from weather. The key concerns with ensuring a continued adequate water supply are climate change and drought.

Climate Change

In 2006 and in 2009 (see Appendix B), TMWA partnered with the Desert Research Institute ("DRI") to research the possibility of climate change and global warming affecting the Truckee Meadows' water supplies. The results of the research show:

- historic data is the best data available for future planning at this point in time;
- scientific evidence remains inconclusive as to effect on the Truckee Meadows;
- the high variability in data and findings makes it difficult to detect long-term trends that may be due to climate change as a factor affecting regional water resources; and
- continued monitoring of research on this topic is warranted.

Specifically, DRI analyzed climate and hydrologic data in the Truckee Meadows region in order to reveal potential signs of environmental change that may be consistent and coincident with global warming. The analyses included investigations of temperature, precipitation, snow water equivalent, streamflow volume and timing, and reservoir volumes for the Lake Tahoe and Truckee River hydrographic basins. Linear regression analyses were used to identify the following trends:

- Temperature data revealed a slight trend towards increased minimum and maximum temperatures at most gages. However, a few stations showed trends towards decreased temperatures and year-to-year variability was quite high at all stations.
- Annual precipitation showed very high variability with an overall trend towards slightly reduced winter precipitation.

- Snow water equivalent ("SWE") showed very high variability with some stations reporting a trend towards increased snowpack and others showing reduced snowpack trends.
- The SWE trends were highly correlated with instrument elevation, where high elevation stations observed increased SWE and the low elevation stations observed reduced SWE.
- Mean annual streamflow data varied widely between water years.
- Long-term streamflow volume and timing trends were investigated through linear regressions of the cumulative streamflow volumes. The records revealed no consistent trends in streamflow volume or timing for the period of record.
- Cumulative-volume-linear-regression analyses were also used to investigate trends in reservoir volumes. The reservoir volumes displayed an obvious dependence on precipitation, as periods of drought strongly influenced reservoir volumes.

In order to investigate correlations between hydrologic variables and possible modifications in hydrologic processes, the following double-mass analyses were conducted:

- Relationships between streamflow and precipitation were studied at four paired stations. The results confirmed the expected high degree of correlation between these variables. The functions between precipitation and streamflow remained consistent throughout the records, indicating no observed modifications in large scale precipitation-runoff-streamflow processes at un-dammed gages.
- Double mass analysis of precipitation and reservoir volumes further demonstrated the high degree of correlation between these variables.
- Analyses of SWE and streamflow data revealed a slight deviation from historical trends over the past four water years.
- No consistent departures from long term patterns were observed between streamflow and reservoir volumes.
- Patterns between SWE and reservoir volumes remained consistent throughout the period of record.

As a result of these analyses, DRI concluded that no significant changes were found in the climatic and hydrologic variables over the period of record. Temporal trends in temperature, winter precipitation, and SWE were observed at some stations. However, very high year-to-year variability was observed for all stations and parameters.

Droughts

Consecutive years of low precipitation in the Lake Tahoe and Truckee River basins produce dry conditions and drought cycles for the Truckee Meadows. The length of a drought cycle is solely a function of climatic conditions over a period of years. A good indicator of an impending dry year is snowpack accumulation. Measured on April 1 of each year, the snowpack is used to forecast river flows through the year. Figure 10 shows snowpack for the Truckee River basin over the past 24 years. Annual snowpack accumulation in the Tahoe and Truckee River

basins is the foundation for estimating the amount of water that will run-off and contribute to river flows during the year. In years of less than average snowpack, the risk increases as to whether or not there is a continuing drought cycle with less than average river flows.

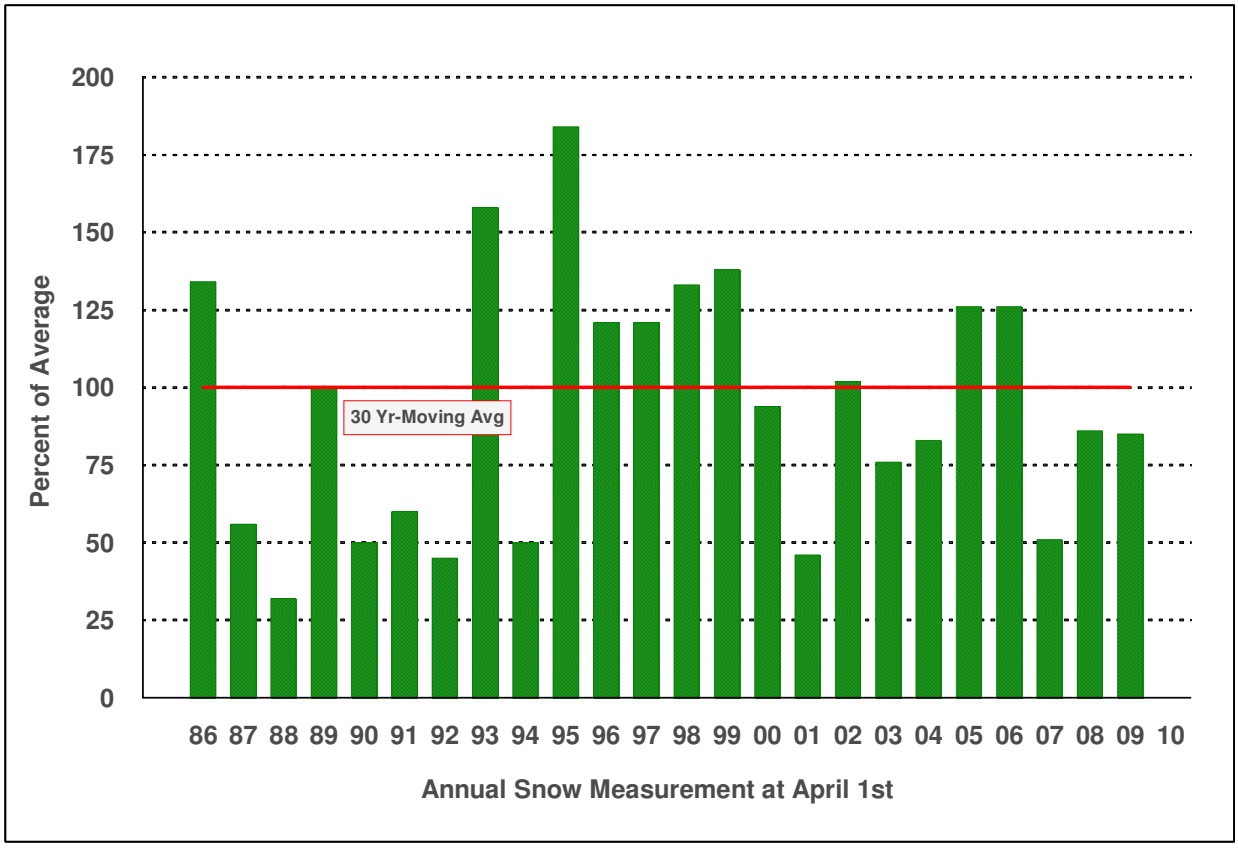

Figure 10: Snowpack for the Truckee River Basin

The most recent drought cycle in the Truckee Meadows occurred from 2000 to 2005. As shown in Figure 10, snowpack within the Truckee River basin was below average in 2000 and continued that pattern again in 2001. While there was an improvement over 2001 in the amount of snowpack and runoff in 2002-2004, it was not enough to end the drought. Although TMWA did not need to utilize any POSW to meet customer demands during these five years, the reduced water availability made it difficult to sustain the required Floriston Rates in December 2002 and again from late 2003 into early 2004. In September 2004 Floriston Rate storage was exhausted and normal-river flows were not met again until the end of February 2005 which ended up being a 125 percent of average snowpack year in the Truckee River Basin. Due to heavy precipitation and flooding in late December 2005/early January 2006 the elevation of Lake Tahoe rose significantly. In fact, almost 11 inches of precipitation was recorded at the USGS Farad gauging station over a two week period (Dec 21, 2005 to Jan 3, 2006). An above average snowpack was recorded again (126 percent of average) in the Truckee River Basin in 2006. As a result, Lake Tahoe and all Truckee River Basin reservoirs filled as a result of the streamflow runoff that was

produced the following spring. Those two consecutive above average snowpack years (2005 and 2006 respectively) effectively ended the five year drought cycle.

The severity of the 2000-2005 Drought as compared to prior droughts is illustrated by Lake Tahoe elevations in Figure 11. Month-end elevations of Lake Tahoe during the 1928 to 1935 Drought, the 1987 to 1994 Drought, and the 2000-2005 Drought are compared. On November 30, 1992, Tahoe reached an historic low elevation of 6220.2, or 2.8 feet below its rim. As shown, the graph also illustrates that reservoir operations cause reservoir depletions to extend over a period of 5 to 6 years, whereas the reservoirs can refill completely with a year of non-drought year precipitation or wintertime flooding (e.g., 2005-2006).

The 1987 to 1994 Drought is still the most severe drought on record. Figure 11 shows that the Truckee River system is finishing the third year of an ongoing climatological drought cycle. It cannot be known whether the cycle will end with the 2009/2010 winter snowpack or continue on. Snowpack in the Truckee Basin was 51, 86, and 85 percent of average for the years percent of average in 2007, 2008, and 2009, respectively. In December of 2008 Floriston Rate storage ran out, and in 2009 Floriston Rates are expected to run out by the end of October with Lake Tahoe at its natural rim and Boca Reservoir down to its minimum pool elevation.

As is typically the case, it took three consecutive dry years for Lake Tahoe to fall to its rim prior to November. By definition, the region in 2009 is in a Drought Situation but the loss of river flows will come after the prime irrigation season with no impact to TMWA's POSW or need to increase groundwater production. Should the 2009/2010 winter produce below average precipitation for a fourth year, the region will most likely be in a Drought Situation which could present an operational challenge for TMWA during Summer 2010.

Important observations to be drawn from reviewing the historical Truckee River hydrology and drought periods include:

- Water levels in all reservoirs are gradually depleted but refill rapidly following a drought, usually in a two to three year period.
- Truckee River supplies are available the majority of the year, whether climatological induced drought or non-drought year conditions persist.
- Donner and Independence Lakes typically fill each spring.
- Truckee River water supply provided by normal operation for Floriston Rates can diminish early in the summer of dry years.

Chapter 3 discusses the conjunctive management by TMWA of its available water resources -- annual river supplies, Privately Owned Stored Water in upstream lakes and reservoirs, credit water stored in Boca and Stampede Reservoirs per the Interim Storage Agreement, additional groundwater pumping, and artificial recharge – in order to meet customer demands through the worst drought on record.

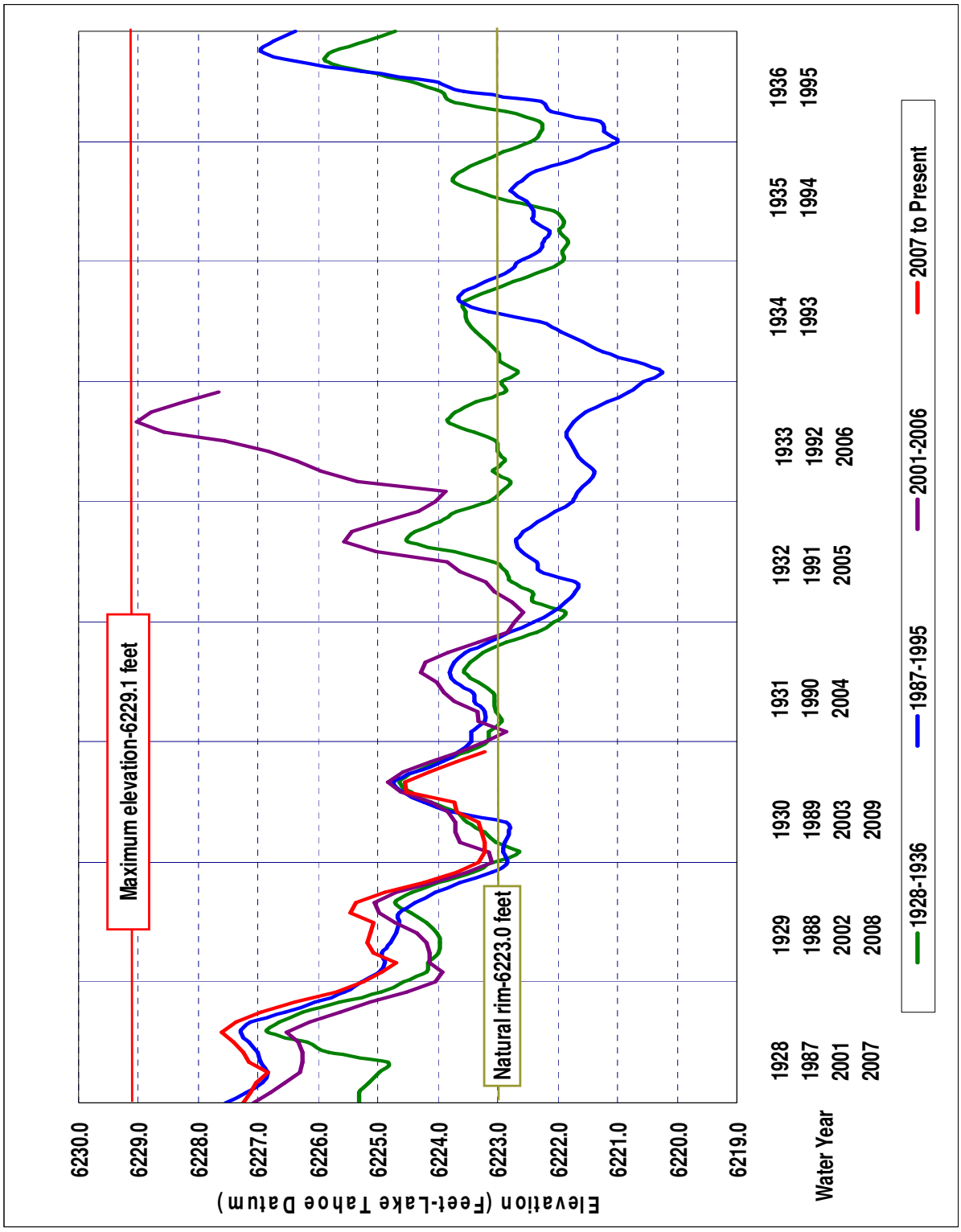

Figure 11: Lake Tahoe Elevations during Drought Cycles

Climate change and drought are the most significant weather variables with potential to change the quantity and quality of the water supply. Studies completed by DRI indicate that while potential for climate change to alter the timing, type of, and quantity of precipitation should continue to be monitored, it should not be artificially imposed as a constraint on current and future water supplies for this 20-year plan at this time. Drought cycles on the other hand have established historical patterns, with the most severe drought on record lasting eight years. TMWA plans for drought cycles by utilizing a combination of natural river flows, groundwater pumping, POSW releases, and extraction of accumulated groundwater injections. Operation of TMWA's water production facilities to meet demands during drought cycles is discussed in detail in Chapter 3.

Source Water Contamination

This section begins with an overview of TMWA's water quality and identified potential risks of water supply contamination, and summarizes TMWA's Source Water Protection Program.

As detailed within the *2008 Water Quality Report* found in Appendix C, TMWA continues to provide high quality water that meets or exceeds all US Safe Drinking Water Act standards. In addition, TMWA's water meets and, in most cases, significantly exceeds, all US Environmental Protection Agency ("USEPA") and Nevada State Health standards. On average, more than 1,000 laboratory tests are performed each month on over 180 samples taken from various locations in Reno and Sparks to ensure that TMWA's water meets all standards. In addition, TMWA takes samples from several locations in the distribution system on a monthly basis to continually demonstrate full compliance with the new arsenic standard put into effect in January 2006 by the USEPA.

TMWA Source Water Quality Assurance Program

TMWA's water quality goal is the delivery of high quality potable water to its customers at a reasonable price. In order to achieve and maintain this goal, TMWA utilizes a water quality assurance program. TMWA utilizes the following components in its water quality assurance program:

- Protection of Source Water Quality: TMWA has a fully integrated and coordinated source water quality program designed to protect or improve the quality of TMWA's surface water and groundwater supplies.
- Potable Water Treatment: TMWA utilizes modern-surface-water-treatment facilities for its raw-surface-water supplies and complies with all Federal and State drinking water regulations.
- Maintenance of Distribution System Water Quality: TMWA utilizes a highly skilled staff of scientists, engineers, and operators who continually monitor water quality in the distribution system.
- Cross Connection Control: TMWA has an extensive and fully engaged backflow prevention and cross-connection control program. The purpose of the program is to

prevent backflow of pollutants or contaminants from customer plumbing systems into TMWA's distribution system.

The water quality of the Truckee River is normally excellent. Surface water is of exceptional quality because base flows are composed of Sierra Nevada Mountain snowpack runoff and seepage or spring flow. Typical water quality data are shown in Table 1. Mineral concentrations are very low, and turbidity levels are typically less than five nephelometric turbidity units ("NTU"). However, water in the Truckee River can have higher turbidity because of storm runoff and/or algae growth associated with low flows and warm temperatures in summer.

Table 1: Typical Mineral Concentrations of Surface Water

Constituent	Minimum	Average	Maximum
Total dissolved solids, mg/l	34	86	132
Total suspended solids, mg/l	1	13	20,000*
PH	6.8	7.7	9.6
Temperature, C	0.5	0.0	20.0

* High turbidity events only, such as the July 1992 flash flood on Gray Creek.

The reliability of this source is governed by the ability of TMWA's surface-water-treatment facilities to treat Truckee River water during possible events of high turbidity and chemical or biological contamination. Three types of contamination events are identified:

- Turbidity events[11] – low frequency events that are flushed by river flows within hours.
- Non-persistent toxic spills – spills of substances that would be flushed by river flows, usually within an 8 hour period.
- Persistent toxic spills - spills lasting more than 2-4 days that do not flush through the river channel.

Higher than average turbidity events can occur in the Truckee River during periods of floods, storm runoff and/or algae growth associated with low flows and warm temperatures in summer. Turbidity at conventional filtration plants is removed through chemical stabilization (coagulation and flocculation), followed by sedimentation and filtration. All surface water is treated at CTP or GTP before distribution. The modern treatment facilities at CTP and GTP have

[11] The term "turbid" or "turbidity" is applied to waters containing suspended matter that interferes with the passage of light through water.

greatly reduced the water supply risks associated with turbidity events. Both CTP and GTP are designed to operate during intermittent turbidity events as high as 4,100 NTU lasting 5-10 days, but, it is more practical to shut the plants down and let the turbid water pass by to avoid significant clean-up efforts and costs at the treatment plants. Should a turbidity event that exceeds TMWA's ability to treat the water to required standards occur, it is possible to operate the system with only wells to supply an average day demand, more than sufficient to meet current indoor or winter daily demands of approximately 35 MGD.

Few toxic spills have occurred on the Truckee River and none were of major proportion. The most recent event was a sewage spill near Truckee, California which occurred in the spring of 1991, resulting in the shutdown of Glendale Treatment Plant operations for a day. Major toxic spills that would render the Truckee River unusable have not been recorded. However, toxic spills into rivers throughout the United States do occur, some of which have rendered water supplies unusable for an extended period of time. In the event of an incident on the Truckee River the contaminant might be diluted and washed downstream within a day depending on the flow rate in the river at the time. TMWA might be able increase river flows through release of its stored water. These steps are likely to mitigate any contaminant that does not readily absorb into the river bed.

Past resource plans and a recent review of United States Department of Transportation data, resulted in the identification of several types of hazardous materials which are commonly carried through the Truckee River Watershed. They include:

Ammonia perchlorate	Hydrogen sulfide	White phosphorous
Anhydrous Ammonia	Nitro cellulose (wet)	Propargyl alcohol
Chlorine	Propane	Sulfuric Acid
Cyanide	Petroleum naphtha	Sodium hydroxide
Hydrochloric acid	Phosphoric acid	

These chemicals represent ingredients used in the formation of products ranging from rocket fuel to pesticides. Although most are extremely toxic it is likely that all would be flushed past TMWA's treatment plant intakes within one day. Chemicals that would likely adhere to the river bed include manufactured pesticides, herbicides, and fungicides. Each chemical would require a specific response depending on location, duration, and other factors of the water quality emergency. In the event of a spill, it is currently possible to operate using distribution storage and wells while the water quality emergency is being assessed.

In 2007 research was completed at the University of Nevada, Reno on behalf of TMWA (see Appendix D), to quantify the risk of a spill to the Truckee River using data that was previously not available. The analysis has shown no recorded contamination event from rail or highway transportation. The data also suggests that accidents tend to occur more frequently during the loading and unloading of trucks and rail cars. This suggests that the area of highest risk is downstream of TMWA's treatment facilities in the City of Sparks where there is a rail yard and a large number of warehouses and shipping companies.

Also completed by the University of Nevada, Reno in 2008 was a risk analysis and assessment accompanied by the development of a contaminant transport model of the Truckee River from Tahoe City to the Glendale Treatment Plant. The results of this research are provided in Appendix E and include travel times for various classes of chemicals at different flow rates.

The model is used to quantify the time periods required for the river to flush clear a spill from different possible locations.

While a toxic spill into the Truckee River is clearly a concern, this is an extremely rare event and such an event has not occurred to this date. However, depending upon the time of year, TMWA is able to operate without the river for a period of hours to days using system distribution storage and its production wells. A detailed plan cannot be developed for a major emergency on the Truckee River that would anticipate all possible combinations of circumstances requiring emergency actions. Variables include location, size, and type of spill; time of year; levels of reservoirs and streams; customer demands; and other factors. The supply of water available from TMWA's 32 production wells enables TMWA to meet demands for average indoor water use throughout the year. In addition to relying on its wells, other steps to reduce water use during an extreme event and/or extended river outage could include:

- Call for voluntary, then mandatory water conservation, including watering restrictions (e.g., once per week during summer months), reduced laundry at commercial properties, use of paper plates in restaurants, no use of potable water for non-potable purposes, and other measures.
- Engage all wells on the TMWA system for full operation subject to Health Department approval. This would include the use of wells that do not meet drinking water standards.
- Modify flows in the Truckee River to either flush, dilute, or isolate the contaminant.
- Utilize extraordinary treatment processes in the pre-treatment section of the water plants. An example of this might be neutralizing pH through chemical additions in the pre-settling basin or addition of granular-activated carbon to filters. The likelihood of these steps being successful will depend on the type of contaminant and its concentration.
- Where possible, utilize and expand emergency interconnections with other water systems.
- Acquire the use of all water in local irrigation ponds, recreational lakes, etc., to the extent that water can be conveyed to the TMWA's treatment plants through ditches or other means.
- Use isolated portions of the storm drain system and ditch system for conveying water from unusual source locations to the water treatment plants. This might include installing sandbag check dams in certain ditches, along with low head pumps, in order to move water up-gradient in a ditch to a treatment plant. For example, the creeks in the South Truckee Meadows might be conveyed to the Glendale Treatment Plant by collecting the water in Steamboat Creek, pumping it into Pioneer Ditch, and thence through step pumping to Glendale.
- Temporarily pump the discharge from the Sparks Marina to the Glendale Water Treatment Plant.
- When TROA is in effect utilize the emergency worse than worst case water supply to flush the river of contaminants.

Besides the types of spill events described above, there may be other events that interfere with the availability of Truckee River water. In April 2008 an earthquake triggered a rock slide destroying a 200-ft section of flume along the Highland Ditch in the Mogul area. This incapacitated the primary raw water supply for CTP just as customer demands were increasing with the onset of springtime temperatures. Raw water supply to CTP was quickly restored (that same day) via the Orr Ditch Pump Station ("ODPS") at a limited capacity of about 60 MGD, but more supply was required. The GTP was brought on-line early in order to help meet those increasing customer demands. Within a few weeks a temporary pumping station along the river was also set up to provide enough raw water in order for CTP to resume operating at its full capacity of 83 MGD. By July the damaged section of flume was bypassed with a 54-inch aboveground high density polyethylene pipe and gravity flow from the river to CTP was restored at a limited capacity of about 26 MGD. The ODPS was used to supplement the additional 57 MGD or so that the CTP required to operate at full capacity. The earthquake event has fast-tracked the Mogul Bypass Project which was in TMWA's Capital Improvement Plan for 2014. The project will bypass or re-route a substantial portion of the Highland Ditch around and south of the Mogul area, replacing a series of aging wooden flumes and earthen-lined sections with approximately 8,400-ft of 69-inch steel pipe placed underground.

Though it cannot be predicted when a river interruption event will occur or what the nature of an event will be, TMWA plans for and practices scenarios to manage-through emergency events. The more extraordinary measures that can be engaged are believed to only apply in an extreme, worse-than-historic event that would occur in the peak of the summertime irrigation with contamination occurring between Boca and the diversion point of the Steamboat Ditch. Most combinations of scenarios as to time, place, and nature of event are manageable with existing production facilities and management options without such drastic measures. It must be emphasized that these are broad guidelines only. They are not intended as a definitive instruction list as to the response which should be taken in any given emergency situation. The event, if it occurs, must be evaluated on its specific conditions, and a response plan devised accordingly.

Source Water Protection Program

Surface Water. With the exception of a small appropriated water right from Hunter Creek, all of TMWA's surface water rights used for municipal water supply come from the Truckee River. Attitudes have changed over the years and today the Truckee River, its tributaries, and watershed are recognized as a pristine, high quality water source that must be maintained and protected. Several governmental agencies[12] are charged with protecting the

[12] The Tahoe Regional Planning Agency, or TRPA, is a bi-state planning agency authorized by Federal Government. Its goal is to ensure that anthropogenic activities, including new development, do not degrade the quality of Lake Tahoe, its tributaries, or watershed. Standards are strictly enforced by TRPA to minimize sediment and nutrient loading to the Lake, and TMWA certainly benefits from this enforcement and its programs. In California, the Lahontan Regional Water Quality Control Board enforces water quality standards on the Truckee River and tributaries outside of the Tahoe Basin. This Board derives its authority from the federal government and the Clean Water Act. The Nevada Division of Environment Protection ("NDEP"), under authority derived by the

Truckee River and its watershed. All of the local agencies derive their authority from the Clean Water Act and the Environmental Protection Agency.

In support of Truckee River source water protection and TMWA's reliance on the Truckee River for most of its water supply, the Truckee River Fund ("The Fund") was established by TMWA in 2005. The Fund is used to support projects that protect and enhance water quality or resources of the Truckee River, or its watershed. In addition, the Fund provides TMWA a vehicle for not only responding to the numerous requests from outside groups and organizations that are involved in promoting and improving the health of the Truckee River system and watershed, but a means to encourage matching funds for the projects. Participation in these projects benefits the primary water source for the community and, in the long-run, TMWA customers. The Fund's Advisory Committee reviews potential new projects once a request for proposal is submitted to the committee.

To-date the Fund has approved and funded 46 diverse projects that further the goals of the Fund. Examples include river riparian cleanup and restoration, planning and construction of Pioneer Dam, Independence Lake Forest and Wildfire Management Plan, and many others completed or underway listed at www.truckeeriverfund.org.

Groundwater. Groundwater protection is an important element of the water quality assurance program. The need to protect source waters gathered momentum in the 1990's when TMWA's predecessor, Sierra, implemented groundwater treatment at a number of wells which had become contaminated from solvents ("PCE") used in dry cleaning operations. The well map in Figure 12 depicts rough outlines of the extent and nature of some of the current threats to groundwater TMWA, WDWR, Reno and Sparks, Washoe County, and NDEP are monitoring and managing.

Clean Water Act, has a mission to preserve and enhance the environment of the state in order to protect public health, sustain healthy ecosystems, and contribute to a vibrant economy.

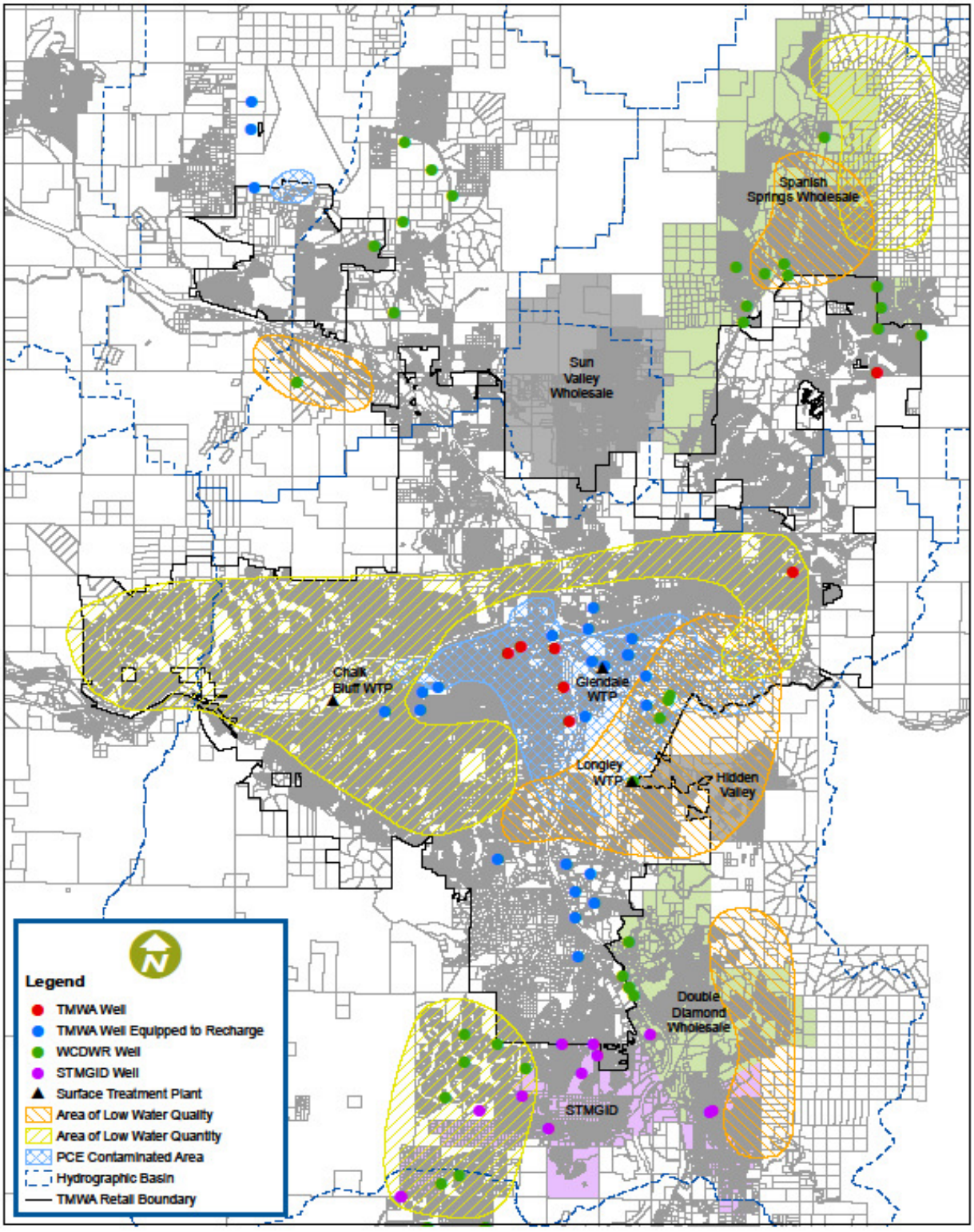

Figure 12: Production and Recharge Wells and Areas of Water Quality Concern

Shortly after treatment was implemented, local governmental entities created the "Central Truckee Meadows Remediation District" to provide administration to the PCE clean-up effort and to collect funds necessary for the construction, operation and maintenance of the treatment facilities. Groundwater protection has received even more emphasis with the recent implementation of TMWA's Wellhead Protection Plan ("WHPP"). The plan, recently endorsed by the Nevada Division of Environmental Protection, outlines a comprehensive action plan to protect TMWA's aquifer from further sources of contamination. Key components of the Wellhead Protection Plan are the delineation of capture zones by production wells coupled with a current inventory of Potential Contaminant Sources ("PCS's"). This information provides the baseline data by which TMWA can develop and implement groundwater protection strategies, including educational outreach.

TMWA's current overall groundwater protection action plan (which incorporates specific wellhead protection items) is fully integrated with other local agencies and includes the following elements:

- Water Quality Monitoring. TMWA has over 65 monitoring wells located within the Truckee Meadows, West Lemmon Valley and Spanish Springs hydrographic basins. Of the 65 monitoring wells, 16 are privately owned by the Central Truckee Meadows Remediation District ("CTMRD"). The remaining wells were drilled by TMWA. TMWA monitors water levels in these wells on a monthly basis and CTMRD samples for inorganic and organic constituents in the central Truckee Meadows on a quarterly basis. The results of this testing, along with sampling and testing of TMWA production wells, allows TMWA to be proactive in joint groundwater remediation efforts and to prudently plan the location of future wells and groundwater treatment facilities.
- Reno-Sparks PCE Contamination. TMWA works and communicates closely with the CTMRD concerning PCE removal and treatment at TMWA wells and is also proactive in the up-to-date delineation of PCE Plumes. The plumes in the central Truckee Meadows are shown in Figure 12. The plume contours were developed as part of TMWA's WHPP.
- In 1987, testing of TMWA's wells identified the presence of an organic solvent known as perchloroethylene and tetrachloroethylene ("PCE"). This solvent has been used since the 1930's in a variety of commercial/industrial operations such as commercial dry cleaning, paint manufacturing, and auto repair. The PCE contamination occurs in several plumes located along the current and historical commercial/industrial corridors along old U.S. 40 (Fourth Street/B Street/Prater Way), Virginia Street, and Keitzke Lane. Mitigation of the PCE plumes is managed by the CTMRD program which has paid for three air-stripping-treatment facilities that remove PCE from five of TMWA's 32 wells: Keitzke Lane, Mill Street, High Street, Morrill Avenue, and Corbett School. The CTMRD program has achieved success in plume capture and containment resulting from the implementation of a prescriptive pumping schedule of the TMWA wells fitted with PCE treatment equipment. The PCE plumes do not appear to be moving or growing.

- Sparks Solvent/Fuel Site Remediation. TMWA is an active team participant in monitoring the clean-up effort of this groundwater contamination site. Mitigation efforts are supervised under NDEP Permit UNEV-97207. TMWA's concern is the quality assurance of the clean-up operation with containment such that existing and future production wells are not compromised by movement of solvent/petroleum based plumes. Figure 12 depicts the extent of the existing contaminant plume.
- Stead Solvent Site Remediation. TMWA is an active team participant in the monitoring of the clean-up of solvent groundwater pollution in on the southern boundary of the Stead Airport in the West Lemmon Valley hydrographic basin. TMWA's goal is to ensure that clean-up and containment efforts are performed in such a way that nearby TMWA production wells are not compromised by movement of the solvent based plume. Clean-up of TCE related material since 1999 at the Stead Solvent Site has successfully reduced the spread of the contaminant plume. All cleanup plans are developed and supervised under the direction of NDEP.
- Leaky Underground Storage Tanks. As part of its WHPP implementation efforts, TMWA has identified seven leaking underground storage tanks in relatively close proximity to TMWA production wells. All thirteen sites are being remediated under the supervision of NDEP and the Washoe County District Health Department. As part of the remediation process, TMWA receives and evaluates quarterly reports concerning remediation of these sites, closely monitors water quality of nearby production wells, and provides input to regulatory/enforcement agencies as necessary.
- Arsenic Compliance Plan. TMWA's compliance plan is based on three USEPA accepted methods of mitigation: (1) blending higher arsenic concentration source water with lower arsenic concentration source water, (2) minimizing use of higher-arsenic-concentration-source water throughout the year to achieve a running annual average ("RAA") of less than 10-ppb at the Entry Points to the Distribution System ("EPTDS"), and, (3) treatment.

  As a result of TMWA's cost effective arsenic compliance plan, it received an award in February 2007 from the Nevada Division of Environmental Protection ("NDEP") and the USEPA. The NDEP Drinking Water State Revolving Fund awards recognize the most innovative projects that effectively use state revolving funds to protect public health, comply with the Safe Drinking Water Act, and rank high on a public health benefits priority list.

The arsenic concentration in treated Truckee River water is typically below 2 ppb, and the arsenic concentration in the wells varies from below 10-ppb to as high as 88 ppb. Attaining allowable arsenic levels (the maximum contaminant level ("MCL") for arsenic of 10 parts per billion (ppb)) from groundwater sources is an issue for TMWA's well operations. At 10 ppb, 11 of TMWA's 32 production wells are affected. Four of the wells that exceed the 10 ppb MCL (Greg, Pezzi, Poplar #1, and Terminal) are piped to Glendale Treatment Plant ("GTP") for treatment and/or blending with treated surface water. Two of the five PCE wells (Mill and Corbett) are also piped to GTP. The other three PCE wells (High Street, Morrill, and Kietzke) may be piped to GTP in the future while two other wells (View Street and Poplar #2) may

require special mitigation for arsenic. Because of TMWA's ability to maximize Truckee River water and minimize groundwater use to the summer months, USEPA recognizes the annual running average of TMWA's water supplies to attain drinking water standards.

Table 2 summarizes data on 13 of TMWA's 32 production wells with arsenic above or near 10 ppb and the mitigation action taken at each well in order to ensure compliance with drinking water standards.

Table 2: TMWA Wells Affected by Arsenic and Compliance Actions

	Well Name		Average Arsenic Value (ppb)	Treat at Glendale	Sample at EPTDS*	RAA** (ppb)
1	Terminal Way	1	88	X		1.84
2	Poplar No. 1	1	85	X		1.84
3	Pezzi	1	72	X		1.84
4	Mill Street	1	37	X		1.84
5	Greg Street	1	19	X		1.84
6	Corbett	1	17	X		1.84
7	Morrill Avenue		12		X	4.42
8	Silver Lake		10		X	4.61
9	High Street		9		X	4.42
10	Kietzke Lane		9		X	4.71
11	Sparks Avenue		9		X	4.87
12	Poplar No. 2		7		X	3.97
13	View Street	2	5		X	2.38

1. Well output blended and treated with surface water at Glendale Treatment Plant

2. The historical arsenic concentration has been as high as 13 ppb; however extensive artificial recharge activities (underground blending) result in a current wellhead concentration of approximately 5 ppb

* EPTDS - Entry Point To Distribution System

** RAA - Running Annual Average, average of four quarterly As testing results

Summary

This chapter has described major factors affecting TMWA's primary water supplies and finds that:

1. Weather and source supply contamination are of greatest concern in assessing the quantity and quality of water supplies available for continued municipal uses.
2. Changes in management of or any restriction to implementation of water resources due to climate change are not warranted at this time.
3. Low precipitation years that lead to low snowpack accumulations affect the amount of water available to the Truckee River system; Lake Tahoe elevations provide an indication of the severity and duration of historic drought cycles.
4. Drought cycles have established patterns, typically taking three years of consecutive dry winters to cause Lake Tahoe to fall to its rim; however, all the reservoirs may be replenished quickly with one or two wet winters.
5. Drought cycles occur in the Truckee Meadows and have ranged in duration from a few years to 8 years with intervening "wet" and "dry" year within the drought cycle.
6. TMWA's source water is of very high quality, meeting and exceeding all required standards. A Water Quality Assurance program has been implemented to ensure this high standard continues to be met in the future.
7. While there is a risk to source water reliability from turbidity and toxic spill events, TMWA has sufficient well capacity and distribution storage to meet reduced customer demands during a water quality emergency; additional actions are available to TMWA in the event of extended off-river emergencies. An earthquake event in 2008 tested TMWA's emergency response plan to loss in water supply and demonstrated TMWA's ability to respond by having trained staff and available alternate water supplies.
8. TMWA has a Source Water Protection Program in place designed to preserve and enhance available water supplies and to address known and potential threats to water quality.
9. TMWA coordinates with other regional water entities to identify and engage in integration practices that are beneficial in terms of increasing the supply and/or quality of water supplies at minimum economic costs to ensure the delivery of water through the 20-year planning horizon and beyond.

Chapter 3 Water Resource Management and Production

This chapter examines the relationship between water resources, including all reservoir storage rights, Truckee River surface water rights and ground water rights, and TMWA's surface and groundwater production facilities. Information contained in this chapter builds upon, and in some instances reiterates, the review of water rights, water production facilities, and water service demands provided in the 2025 WRP. The conjunctive management of TMWA's various rights with its production facilities makes it possible for TMWA to meet its service demands in drought and non-drought years as discussed in this chapter.

Water Rights

Identification of sustainable water resources for 20-year planning purposes requires consideration of both the legal and practical availability[13] of water rights that can be converted from irrigation to M&I uses. Sustainability, in the context of water resource planning, may be defined as the ability of a water resource to meet present needs while, over the life of the water resource taking advantage of opportunities for future generations to optimize potential future economic, social and environmental benefits. Water resources accepted by TMWA for will-serve commitments must meet these criteria.

Surface and groundwater rights are generally established in Nevada by the appropriation system administered by the State Engineer. TMWA coordinates with and often relies on the State Engineer to determine the sustainable yield of water supplies. For example, the State Engineer makes an assessment of the perennial yield[14] based upon the best available science before allowing appropriation of groundwater from a hydrographic basin. TMWA also relies on its Rule 7 to govern the acquisition and dedication of water resources prior to the issuance of a will-serve commitment. TMWA may acquire through dedication or purchase rights in the future as the need for surface water resources arises, but before accepting a water right for a will-serve commitment, TMWA considers a water right's source, priority, quantity, dry-year supply, yield, permitability, unencumbered ownership, and the long-term ability to provide water. In this manner, TMWA ensures that future resources can be sustained in perpetuity.

Most surface water rights, such as rights to the waters of the Truckee River and its tributaries, have also been adjudicated through court decrees. The Orr Ditch Decree, issued in 1944, established the number of water rights by reach, by priority, by owner, and by quantity associated with the Truckee River and all its tributaries. It is important to note that although water rights can be subdivided and/or converted from one use to another, for example agriculture

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[13] Availability is a function of factors such as economic, hydrologic, environmental, financial, or legal factors that may constrain and pose opportunity for resource development.

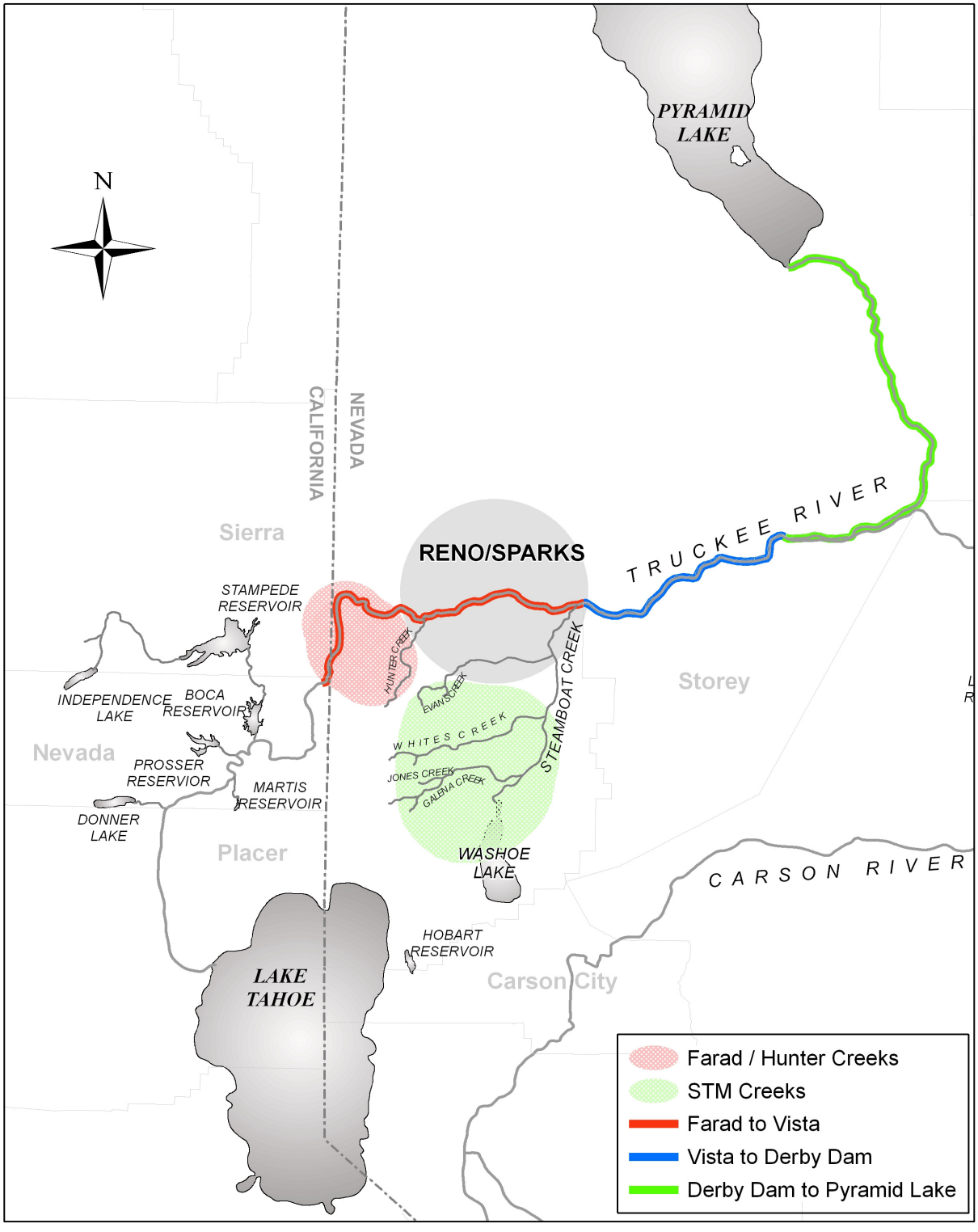
[14] Perennial yield is defined as "the amount of usable water of a groundwater reservoir that can be withdrawn and consumed economically each year for an indefinite period of time. It cannot exceed the sum of the Natural Recharge, the Artificial (or Induced) Recharge and the Incidental Recharge without causing depletion of the ground water reservoir. Also referred to as Safe Yield. http://water.nv.gov/WaterPlanning/dict-1/ww-dictionary.pdf

to municipal use, the overall total number of surface water rights available from the Truckee River will not change from the amount of water rights defined in the Decree.[15] In addition to the Orr Ditch Decree, the Truckee River is governed by several operating agreements, which will be superseded by the TROA when it is fully implemented. TROA was negotiated over the course of several decades and was subject to an extensive environmental review. TROA is designed to provide long-term sustainable water operations for the multiple stake-holders on the Truckee River system through the continued use of converted irrigation rights to M&I purposes. This is crucial since TMWA derives approximately 85 percent of its M&I water from the Truckee River and its tributaries. The Truckee Meadows is fortunate in having significant capacity for storage in upstream reservoirs and in Lake Tahoe to integrate with other resources to maximize the yield of the Truckee River. TROA further enhances the ability to maximize storage for drought supplies.

Figure 13 identifies the various reaches and more accessible "creek areas" of the Truckee River. The water rights within each reach or creek have varying priorities and yields that impact the ability to build a sufficient, consistent supply. For example, the Derby Dam to Pyramid Lake reach is of keen interest to PLPT and the Cities because during critical years, when flows are low, the water quality of the river as influenced by discharge of the treated effluent in the river at Vista can impact in-stream habitat. Transfer of direct diversion irrigation water rights to this reach could be used to mitigate lower-river, low-flow conditions.

TMWA's accumulation of Orr Ditch Decree irrigation rights was begun by TMWA's predecessor Sierra in the 1900's. Figure 14 compares the accumulation of TMWA's water rights (irrigation, groundwater, and Decree rights) over time to the annual production of water. The graph shows that until the 1960's, the demands of customers could be satisfied using the utility's base decree rights along with storage from Donner and Independence Lakes. As demands increased, more irrigation rights were acquired. In addition, groundwater resources began to be developed in the late 1950's and 1960's because the utility was limited in the amount of surface water it could treat, particularly to meet winter demands due to icing of the river and ditches. Adding wells was a less expensive alternative than adding surface water treatment plants in order to have production capacity to meet a growing summer peak demand. This strategy was heavily employed in the 1980's and 1990's in order to ensure peak-production capacity throughout the distribution system which was expanding further and further away from the centralized surface water treatment plants adjacent to the Truckee River.

[15] The State Engineer granted Permit No. 4683 which granted PLPT right to all unappropriated water (e.g., flood waters) over and above Orr Ditch rights.



Map Document: (W:\projects\water_resources\River_System_general\projects\mxd\RiverSystem_reaches.mxd)

Figure 13: Primary Tributaries and Reaches of the Truckee River

This operational strategy changed dramatically in 1994 with the advent of year-round operation of Phase I of Chalk Bluff Water Treatment Plant (Phase II was completed in 1996 and Phase III completed in 2004). The Glendale Treatment Plant, originally completed in 1976, underwent significant upgrades in 1996 to comply with Safe Drinking Water Act; it, too, can operate year-round if needed. Given Chalk Bluff's ability to operate as the baseload surface water plant for both winter and summer demands, TMWA can utilize more of its surface water resources thereby preserving groundwater for use during the heavy summer demand months of July through September. This strategy allows better management of resources for drought and non-drought conditions and increases summer peaking capacity. Coupled with the continued acquisition and conversion of water rights from agricultural to municipal/industrial ("M&I"), this strategy has enabled TMWA to meet a larger drought year demand and thereby allowed the utility the continued ability to issue will-serve commitments.

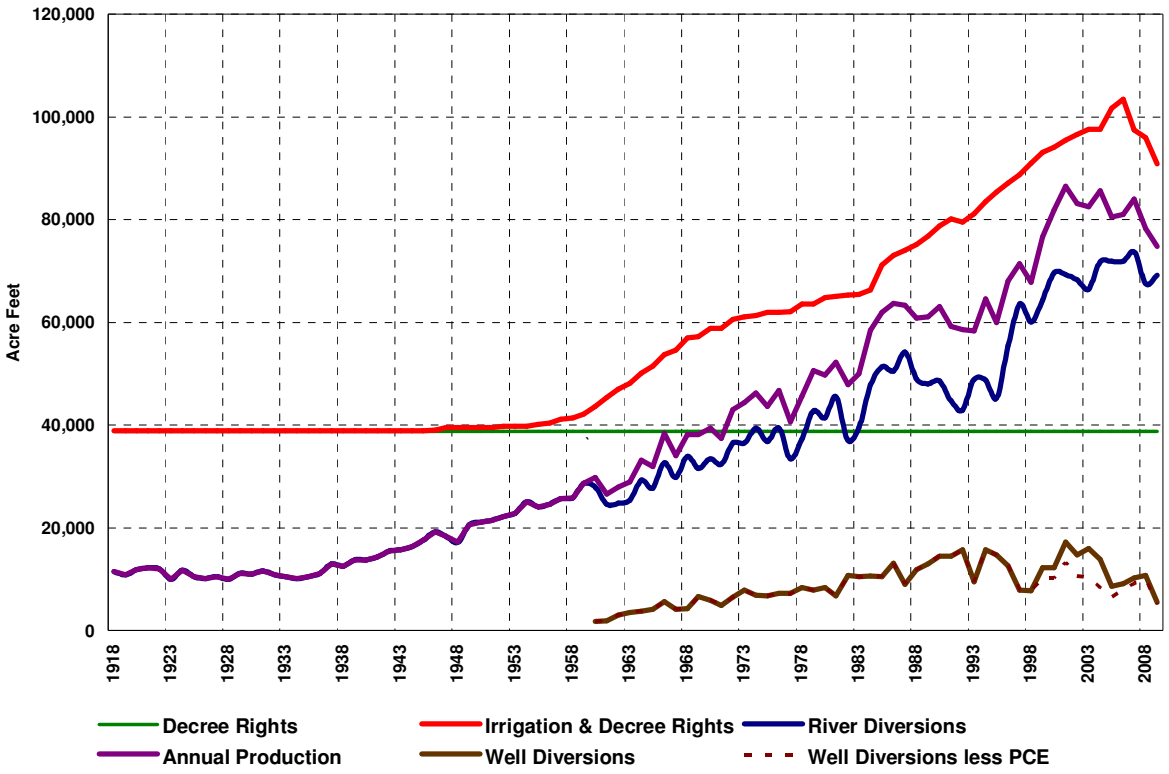


Figure 14: Historic Water Diversions, Production, and Acquisitions of Water Rights

After acquisition of a water right, TMWA ensures applications to change the points of diversion, place of use, and manner of use are filed with the Nevada State Engineer. TMWA's primary diversion points for surface water include the Highland Ditch and the Orr Ditch Pump Station for the Chalk Bluff Treatment Plant and the Glendale Diversion Dam for the Glendale Treatment Plant.

In addition to its decreed municipal water rights, TMWA has acquired and converted to M&I use over 64,500 acre-feet of irrigation rights. These transferred irrigation rights, are used in

conjunction with TMWA's other groundwater and storage rights to create its water supply. The priorities of the acquired rights vary from very early priority, e.g., 1861, to later priorities of the early 1900's. TMWA has over 142,900 acre-feet of decreed, groundwater, storage, and irrigation rights sufficient to generate water to serve approximately 101,000 acre-feet of commitments as of June 2009.

Decreed rights	
Truckee (40 cfs)	28,959
Hunter Creek (13.6 cfs)	9,847
	38,806
Storage Rights	
Independence Lake	17,500
Donner Lake (1/2 interest)	4,750
	22,250
Groundwater Rights	
Truckee Meadows Basin[16]	16,010
Lemmon Valley West Basin	883
Spanish Springs Basin	410
	17,303
Mainstem Truckee River Irrigation Rights	64,541
	142,900

To ensure an adequate supply of water, TMWA's "Rule 7" requires that applicants for new water service dedicate sufficient water rights to service their development. Applicants for new service can buy water rights in the open market and dedicate sufficient, acceptable water rights to the utility or, if the applicant chooses to acquire from TMWA, the applicant pays for a will-serve commitment based on TMWA's costs incurred in acquiring and processing the necessary water rights.

Table 3 summarizes the number of acre-feet of water rights that were assigned in the Orr Ditch Decree to each river reach as well as the tributary creeks, and identifies the ownership of significant blocks of those water rights.

[16] TMWA's groundwater diversion rights total 41,811 acre-feet annually, which rights are limited to average year pumping of 16,010 acre-feet annually, but during Drought Situations an additional 6,000 acre-feet can be pumped pursuant to State Engineer Order 1161.

Table 3: Orr Ditch Decree Water Rights by Reach by Major Owner

Reach	Orr Decree (af)	Pyramid Lake Paiute Tribe (af)	TMWA (af)	Washoe County (af)	Reno/Sparks & County Streets (af)	Tracy Power Plant (af)	Available Water Rights* (af)
Farad to Vista	149,638	0	85,071	15,352	3,409	0	45,806
Vista to Derby	2,488	461	462	364	0	0	1,201
Derby to Pyramid	35,898	25,997	2,968	79	0	2,700	4,154
Subtotal	188,024	26,458	88,501	15,795	3,409	2,700	51,161
Farad to Highland Creeks	10,815	0	9,901	112	56	0	746
South Truckee Meadows Creeks**	25,561	0	892	5,003	207	0	19,459
Subtotal	36,376	0	10,793	5,115	262	0	20,206
TOTALS	224,400	26,458	99,294	20,910	3,672	2,700	71,367

*The summation of water rights present in this table is not complete as to the identification of all the parties of interest to a Truckee River water right, nor an indication of the willingness of a party of interest to a Truckee River water right to sell that interest.

**Does not include Brown, Ophir, or Franktown Creeks, waste and drain rights or Alexander Lake.

Although it appears a significant block of water rights is available for future will-serve commitments, recent trends in the water rights market introduced in Chapter 1 have impacted the ability to acquire water rights. The water rights market is a classic free market environment for private property. Like any other market where the quantity of goods sold takes place between willing sellers and willing buyers, these exchanges are governed by the expectation of sellers attempting to maximize their return and the willingness of buyers to pay the market clearing price for the commodity. The process is complicated by the fact that water rights in the state of Nevada, including Truckee River rights, are private property bought and sold in a free, open market. The fact that TMWA is just one participant attempting to acquire a commodity in the free, open market exposes TWMA, and TMWA's customers, to the same risks as other participants. The lingering impacts as a result of the 2003 to 2005 housing bubble in the Truckee Meadows and the subsequent negative consequences of the 2007 Recession will continue to affect the availability and price of a Truckee Meadows water rights, and TMWA's ability to acquire water rights. In addition to the economic pressures, other issues affecting water resources that may be available for dedication to TMWA or acquired through the purchase by the utility include:

1. *Ownership*. Prior to 1979 the utility was solely responsible for the acquisition of water resources. However, since that time, water rights have been dedicated by

project sponsors to the utility to meet a project's demand, or the utility purchased small quantities of water rights via Rule 7 and then subsequently sold will-serve commitments to meet the project's demand. Ownership[17] of a water right is ultimately transferred to the utility through recordation of a deed with the County Recorder.

TMWA has an obligation to protect its customers' interests and resources by accepting only transferable, usable water. Title to a water right is evidenced by a deed recorded at the County Recorder. This may be a deed of the real property including the water rights as appurtenances, or a deed for only the water rights. When TMWA accepts a water right and issues a will-serve commitment, it becomes obligated to provide water service to new projects in perpetuity. Although TMWA takes great care to ensure that it receives clear title to water rights offered for dedication and avoid potential conflicts in title and subsequent encumbrance of TMWA's resources, recording of ownership of water rights in Nevada has historically been somewhat haphazard, and it is sometimes difficult to obtain a complete and accurate chain of title. Such factors will limit TMWA's ability to accept certain water rights.

Another complication with ownership of available Truckee River water rights between Farad and Pyramid Lake (the rights TMWA accepts for service) is finding the owner. Based on Federal Water Master records, mainstem water rights and Truckee Meadows creek rights are fractionated in more than 41,000 pieces spread over more than 32,500 individual parcels, ranging in size from hundredths of an acre-foot on up. The complexities associated with fractionated water rights may require tremendous amounts of time and effort to research the information with respect to which water rights a seller owns and may be willing to sell.

2. *Use*. Clear title does not necessarily imply the utility has the ability to "use" the water right. The State Engineer is required by State law to ensure that any change of use of a water right does not negatively affect other existing uses, including existing domestic wells, and is not detrimental to the public interest. This analysis takes place after the State Engineer has received an application from the developer or utility telling the State Engineer that the utility owns the water right and wants to change the use of the water, usually from agricultural to M&I use. This process may take place after TMWA has issued a will-serve commitment.

   The change application process is intended to consider the propriety of changing the point of diversion, place of use, or manner of use of a water right, but does not adjudicate conflicting claims to title. The State Engineer reviews the abstract of title and all other transfer documents relating to the actual water right referenced in the application. If the State Engineer is satisfied that the utility owns the water right and

[17] The exception to this applies to water rights dedicated for service between 1985 through 1996 during which time the rights were dedicated to Reno, Sparks or Washoe County in accord with an Internal Revenue Service ruling. Through water treatment or lease agreements, the utility is able to use those rights for the purpose for which they were dedicated.

all the acre-feet associated with the water rights, he issues a permit. It is important to recognize that the State Engineer's review is substantive and not simply ministerial, and the process is necessarily time consuming.

There are instances when the State Engineer finds fault with the ownership claim or with the amount of acre-feet in the application. When this happens, the utility must resolve the ownership question or correct the amount of acre-feet, because, in most cases with old water rights, applications, or permits, the acquisition by the utility was incorrect or the original grantee is gone.

3. *Yield*. The third issue facing the acquisition and use of water rights is how much water the water right will actually produce during a drought period. Prior to a water right being accepted as to its ownership and use, the "yield" of the right must be known.

   The current mix of resources (storage rights, groundwater rights, and surface rights) managed under TROA can support a yield (or demand) of approximately 119,000 acre-feet annually with TROA or 113,000 acre-feet annually without TROA simply through the continued addition of Truckee River irrigation water rights. A greater yield is achieved by increasing drought reserve resources or adding other resources not reliant on TROA. If water rights dedicated to the utility subsequently fail the ownership or use tests, overall resource yield can be negatively impacted. This could impact TMWA's ability to meet its service obligations and must be carefully evaluated before water rights are accepted for service.

There are a myriad of issues surrounding the ongoing development, acquisition, and management of water rights in the Truckee Meadows. With constrained amounts of river supplies resulting at times from climatological drought conditions, TMWA continuously works to maximize the yield it receives from its existing water rights--decreed, converted irrigation, storage, and groundwater--to generate a water supply that will meet the current and future needs of its customers. Over the years TMWA has acquired a sufficient number of water rights to meet current customer demands as well as maintaining rights available for new will-serve commitments through its Rule 7 processes. TMWA is fortunate to have rules in place to protect current customers and provide opportunity for new development to receive water service. TMWA will continue to have a role in optimizing the water resources available to it to meet future water supply requirements subject to existing constraints on the water rights market.

Water Production and Facilities[18]

Table 4 presents water production by source since 1990. The wells typically supply between 10 to 15 percent of total water production during non-Drought Situations, but during Drought Situations groundwater production has ranged between 20 and 30 percent of total water production. The facilities employed to produce water for TMWA's customers is described in this section.

Chalk Bluff Treatment Plant ("CTP")

CTP is TMWA's largest surface water treatment plant, capable of producing approximately 83 MGD of finished treated water. CTP was constructed in phases: Phase I completed in 1994, Phase II completed in 1996, and Phase III completed in 2004. The CTP treats raw water via a conventional water treatment process through settling of heavy solids, screening, flocculation and sedimentation, filtration, and chlorination. The plant is designed for modular expansions to an ultimate treatment capacity of 120 MGD. The next expansion of 15 MGD (nominal treatment capacity) will be accomplished primarily through the addition of mechanical equipment, such as filters and flocculation bays, to existing structures.

The plant sits on Chalk Bluff overlooking the Truckee River on the west side of Reno. Untreated (raw) water is delivered to the plant by gravity via the Highland Ditch or by pumps with 68 MGD capacity via the Orr Ditch Pump Station ("ODPS"). ODPS is located 1,000 feet due south of the plant on the river. The pumping station was built in conjunction with the construction of CTP and was expanded to a capacity of 68 MGD in 2008. The ODPS has been used to supplement supply to the Chalk Bluff plant at times of the year when the Highland Ditch cannot provide 100 percent of the raw water required to keep the plant at full load (typically June-September), or when the ditch is taken out of service for scheduled maintenance or repairs. Due to ice formation for a brief period of time in the winter months, the ditch is also taken out of service in favor of the ODPS.

The Highland Ditch has a nominal capacity of 55 MGD, and is approximately 7.3 miles in length from the diversion dam to CTP. The ditch conveys raw water to the Chalk Bluff plant through a series of earthen and concrete-lined open channel sections, including flumes, siphons and highway and railroad crossings.

[18] Though not used in the production of treated water, TMWA operates four hydroelectric power-generating facilities located on the Truckee River above Reno. These hydroelectric plants are valuable assets, because of the historic diversion rights associated with hydroelectric generation, and the clean, renewable hydroelectric energy that they (3 operating plants since Farad has been inoperable since the Flood of 1997) generate offsets up to 50% of TMWA's annual electrical power costs.

Table 4: Annual Water Production (units in acre-feet)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
SURFACE PLANTS																			
1 Glendale	11,987	11,389	12,775	13,508	13,666	12,098	14,021	11,726	10,066	13,704	13,234	10,925	13,087	12,438	12,360	10,095	10,012	7,899	8,678
2 Chalk Bluff					12,134	17,662	38,425	51,827	50,011	50,675	56,423	58,333	55,231	54,082	59,424	61,767	61,856	65,814	58,830
3 Highland	19,221	16,513	15,999	17,005	12,494	11,899	3,047												
4 Hunter Creek	10,977	10,559	11,051	14,636	9,372	3,607													
5 Idlewild	6,397	6,277	3,138	3,723	1,143														
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6 Subtotals	48,582	44,738	42,963	48,871	48,808	45,265	55,492	63,553	60,076	64,379	69,656	69,257	68,318	66,520	71,784	71,862	71,869	73,713	67,508
WELLS																			
7 Mill Street	1,651	1,370	1,596	1,035	1,679	17	0	8	0	601	850	1,224	1,196	331	1,395	724	917	685	770
8 High Street	1,081	1,340	716	16	86	132	1,287	840	551	1,319	722	1,600	1,596	1,861	1,372	645	1,052	1,107	859
9 Kietzke Lane	1,142	848	1,150	629	1,676	557	0	0	247	1,072	1,045	1,450	1,480	2,511	2,256	1,068	1,446	1,411	1,458
10 Morrill Avenue	1,213	1,171	539	20	69	0	1,113	1,422	1,385	855	840	1,351	1,419	1,616	1,201	782	887	899	822
11 So. Virginia	1,063	1,018	784	527	483	388	452	475	243	269	264	303	210	164	163	25	114	16	91
12 Fourth Street	1,184	1,033	974	292	721	867	738	559	389	602	432	784	309	398	204	139	182	228	76
13 Peckham Lane	441	488	620	261	218	201	0	0	0	0	19	0	0	0	0	0	0	0	0
14 View Street	1,321	1,483	1,691	943	1,841	1,719	1,199	521	396	660	481	669	328	197	259	176	177	183	515
15 Poplar #2	1,684	1,071	903	373	594	506	341	502	341	660	590	720	393	302	205	183	195	388	881
16 Greg Street	1,417	875	819	640	685	1,024	879	525	587	736	735	857	612	480	276	265	2	44	164
17 Delucchi Lane	390	355	292	219	0	51	106	152	125	157	89	122	111	79	72	31	33	0	287
18 Sparks	833	428	355	157	106	77	77	76	71	108	132	174	71	82	0	33	22	94	288
19 Poplar #1	0	0	277	526	828	1,166	669	328	253	379	949	682	342	454	64	283	0	56	207
20 Pezzi	31	21	264	178	488	685	235	19	14	113	454	375	207	259	0	73	0	26	77
21 Terminal Way	39	58	212	67	556	412	303	129	134	20	274	439	286	435	5	276	0	37	133
22 Lakeside Drive	555	632	560	166	188	192	276	358	171	262	137	182	86	134	75	51	88	124	160
23 Holcomb Lane	486	623	150	23	200	111	169	193	425	184	21	137	139	90	184	118	117	12	129
24 Patriot	24	531	986	847	853	679	553	323	292	408	197	280	255	190	170	230	211	89	227
25 21st Street	0	549	954	728	1,124	1,189	822	474	390	615	710	757	664	450	337	273	305	277	76
26 Reno High	0	567	1,854	1,757	1,997	2,226	1,481	293	366	758	429	707	437	533	1,376	749	147	132	352
27 El Rancho	0	0	0	88	522	361	485	257	798	335	297	185	232	230	79	27	86	71	87
28 Corbett	0	0	0	0	454	81	0	0	155	682	590	1,068	1,039	1,365	1,343	458	590	462	463
29 Swope	0	0	0	0	358	803	298	69	81	121	66	115	62	85	35	1	0	19	61
30 Hunter Lake	0	0	0	0	0	1,273	1,148	334	327	836	463	762	1,209	1,419	545	19	168	170	423
31 Glen Hare	0	0	0	0	0	0	0	0	0	0	376	407	295	246	76	335	448	12	111
32 Galetti	0	0	0	0	0	0	0	0	0	0	526	857	783	631	384	354	390	1,566	225
33 Longley	0	0	0	0	0	0	0	0	0	0	213	375	358	547	874	651	668	659	593
34 Sierra Plaza	0	0	0	0	0	0	0	0	0	0	0	0	159	349	436	101	163	338	222
35 Mendive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	58	0	0	13
36 Silver Knolls	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	251	126
37 Air Guard	0	0	0	0	0	0	0	0	0	188	159	412	236	212	112	146	191	183	3
38 Silver Lake	0	0	0	0	0	0	0	0	0	308	228	246	308	311	372	370	421	642	650
39 Hawkins Ct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	231
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40 Subtotals	14,557	14,461	15,696	9,490	15,728	14,718	12,629	7,857	7,744	12,249	12,290	17,239	14,821	15,960	13,875	8,642	9,021	10,184	10,780
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41 TOTALS	63,139	59,199	58,658	58,362	64,536	59,983	68,121	71,410	67,821	76,628	81,946	86,496	83,139	82,480	85,659	80,504	80,890	83,897	78,288
	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====
% Surface Water	77%	76%	73%	84%	76%	75%	81%	89%	89%	84%	85%	80%	82%	81%	84%	89%	89%	88%	86%
% Groundwater	23%	24%	27%	16%	24%	25%	19%	11%	11%	16%	15%	20%	18%	19%	16%	11%	11%	12%	14%
Retail GPCD	269	247	243	238	255	228	250	261	245	264	266	269	255	243	248	225	219	222	204

When completed, the Highland Canal Master Plan Project will increase the carrying capacity of the Highland Ditch from 55 MGD to 95 MGD. Remaining projects include the Mogul Bypass Siphon, the replacement of two additional sections of flume and installation of a parallel siphon in Chalk Canyon just west of the CTP which are expected to complete in early 2010. At that time TMWA will realize significant savings in power costs as the Highland Ditch will supply via gravity 100 percent of the raw water requirements to the CTP and the ODPS will only be used to supplement raw water supplies on a limited basis.

Glendale Treatment Plant ("GTP")

GTP is the smaller of TMWA's surface water treatment plants and is located in Sparks just east of the Grand Sierra Resort. The plant borders the north side of the Truckee River and diverts raw water from the river about 500 feet upstream of the plant. The plant was originally built in 1976 and upgraded in 1996. It employs the same treatment processes as CTP and also is authorized to filter at the same filtration rate as CTP. Although the plant is rated at 37.5 MGD, plant output is currently limited to 25 MGD because of the influent constraint of raw water diversion and the discharge restrictions from GTP to the distribution system.

The Glendale diversion project and other distribution improvements planned within the next two years will address these limitations by providing the ability to divert increased amounts of water from the river, especially during drought years, and increasing effluent capacity into the distribution system. These improvement projects in conjunction with groundwater blending and other improvements in the distribution systems will enable water production from GTP to be increased to take full advantage of GTP's rated treatment capacity. The increased production will include an estimated net 37.5 MGD from surface water plus 6.8 MGD from groundwater[19] from six wells that are pumped to GTP where it is blended with surface water and treated for arsenic for distribution throughout the water system. Expansion of the finished water pumping capacity will also reduce dependence on Chalk Bluff and provide increased flexibility to operate the Mill and Corbett wells on a year-round basis.

The current capacities of the two surface water treatments plants are summarized here.

	Design Capacity	Net Production Capacity	Planned Capacity
Chalk Bluff	90.0 MGD	83.0 MGD	120.0 MGD
Glendale	37.5 MGD	25.0 MGD	45.0 MGD

[19] GTP can treat water from the Mill, Corbett, Greg, Terminal, Pezzi, and Poplar #1 wells. The combined output of those wells is about 16 MGD, which in drought years is used to augment the reduced Truckee River flows into GTP. In non-drought years, when Truckee River water is available and its use is maximized, groundwater use from these wells is reduced.

Production Wells

TMWA has 32 production wells used to meet the demands of its customers. Twenty eight (28) of these production wells are located in the Truckee Meadows basin[20], three production wells in the west Lemmon Valley basin, and one production well is located in the Spanish Springs basin. Capacities for these wells are noted in Table 5. The wells are spread throughout the distribution system and the majority of wells pump water directly into the distribution system after chlorination. However, water from five wells (Morrill, Kietzke, High, Mill and Corbett) undergoes air-stripping treatment for PCE removal, and water from six wells (Mill, Corbett, Greg, Terminal, Pezzi and Poplar #1) is pumped to GTP for arsenic removal. TMWA's production wells have an overall rated capacity of approximately 63.0 MGD and are primarily used in the summer to handle peak water demands.

Over time, wells can lose production or deteriorate in water quality. Factors contributing to these declines may include chemical reactions between the well water and well formation and casing leading to corrosive action that clogs the well's screens, or by biological microorganisms that change the chemical and/or hydrogeologic characteristics of the water in the well. When the production rate or water quality of a well is affected negatively, TMWA begins an analysis to determine the cause of the decline and then take actions to rehabilitate the well so that the well production and water quality can be improved. Although well abandonment and drilling of a new well can mitigate the loss of well production, it is considered a last resort due the expense to replace a well.

As shown in Table 5 19 of TMWA's 32 production wells are more than thirty years old. TMWA has over the years carried out well rehabilitation on 18 wells, some of them two or three times (see Table 6). TMWA's approach to its well rehabilitation program has involved use of a combination of industry established methods along with specific monitoring and testing steps suitable for each well. Various reasons have prompted the rehabilitation at each well as shown in Table 6. Where extensive rehabilitation work was performed, the well's productive capacity was improved and/or restored. Fortunately, TMWA's wells have not had water quality deterioration problems except for production of sand at 5 wells.

[20] Additionally, the Peckham Lane Well and the Stanford Way Well are used for non-potable purposes (e.g., construction uses) due to high arsenic and other water quality issues.

Table 5: Production Well Capacities

	Well Name	In-Service Year	Rated Capacity [MGD]	Cumulative Rated Capacity [MGD]
Truckee Meadows Groundwater Basin				
1	Mill St.	1960	2.6	2.6
2	High St.	1961	2.2	4.8
3	Kietzke Ln.	1972	3.3	8.1
4	Morrill Ave.	1963	2.0	10.1
5	S. Virginia	1969	1.5	11.6
6	Fourth St.	1971	2.2	13.8
7	View St.	1969	2.4	16.2
8	Poplar # 2	1967	2.2	18.4
9	Greg St.	1967	2.0	20.4
10	Delucchi Lane	1972	0.8	21.2
11	Sparks Ave.	1967	0.9	22.1
12	Poplar # 1	1963	2.3	24.4
13	Pezzi	1974	1.3	25.7
14	Terminal	1961	1.7	27.4
15	Lakeside	1985	0.9	28.3
16	Holcomb	1988	1.0	29.3
17	Huffaker	1990	1.8	31.1
18	21st St.	1991	2.0	33.1
19	Reno High	1991	3.3	36.4
20	El Rancho	1992	1.2	37.6
21	Corbett	1993	2.1	39.7
22	Swope	1993	0.9	40.6
23	Hunter Lake	1995	3.3	43.9
24	Glen Hare	1999	1.7	45.6
25	Galletti Way	2000	2.3	47.9
26	Longley Lane	2000	2.2	50.1
27	Sierra Plaza	2002	2.0	52.1
28	Mendive	2005	0.3	52.4
West Lemmon Valley Groundwater Basin				
29	Air Guard	1968	1.6	54.0
30	Silver Lake	2005	3.2	57.2
31	Silver Knolls	2006	1.7	58.9
Spanish Springs Groundwater Basin				
32	Hawkings Ct.	2008	4.1	63.0

TMWA continues to monitor its wells with a view to detecting those that need rehabilitation and set up a routine well rehabilitation program. The rule of the thumb for doing rehabilitation work on a well is if it loses 20% to 25% of its design production rate. The rehabilitation program will save TMWA from drilling replacement wells, especially in view of the diminishing well sites within TMWA's services areas that can provide sufficient, high quality production capacity at minimal capital outlay.

Table 6: Summary of Well Rehabilitation Activities

Well	Rehab Date	Reason	Video	Line Brush	Rotary Brush	High Pressure Water Jetting	Single swabbing	Double Swabbing, Pumping, airlifting, bail	Acid Treatment	Patch	Spinner Flow Survey	Directional charge blasting	Flow Rate, gpm Before	After
			Treatments											
Truckee Meadows Groundwater Basin														
1 Morrill Avenue	Nov-08	Clean and check well condition	X	X			X	X					1,430	1,685
2 High Street	Oct-08	Clean and check well condition	X	X			X	X					1,680	1,900
3 Poplar #1	Oct-08	Clean and check well condition	X	X			X	X	X		X		1,750	2,900
4 Swope School	Dec-06	Producing sand	X	X			X	X		X	X			
5 Greg Street	Apr-05	Change pump	X	X			X	X			X			
6 Corbett School	Jan-05	Change pump	X	X				X			X			
7 Sparks Avenue	May-04	CTMRD request to patch well	X	X				X		X				
3 Nichols Blvd	Dec-03	Clean and check well condition	X	X			X	X			X			
8 El Rancho Drive	Oct-03	Drawing air	X	X			X	X						
5 Mill Street	Mar-03	Loss of production	X	X	X	X		X	X		X	X	1,400	2,500
9 Sparks Avenue	Nov-02	Loss of production	X	X	X			X	X		X		500	700
10 View Street	Nov-02	Loss of production	X		X			X			X		1,600	2,450
11 Poplar #2	Sep-02	Pump failure	X	X		X	X	X	X		X			
12 El Rancho Drive	Jul-01	Producing sand	X	X			X	X	X	X				
13 Holcomb Lane	Nov-00	Producing sand	X	X			X	X	X	X			450	700
14 Peckham Lane	Apr-00	Clean and check well condition		X				X						
Lemmon Valley Groundwater Basin														
15 Army Airguard	Mar-09	Drawing air	X	X				X					900	1,100
16 Red Rock	Jun-03	Clean and chek well condition	X	X				X			X			275
17 Silver Knolls	May-03	Clean and chek well condition	X	X				X		X	X			1,000
18 Army Airguard	Feb-03	Producing sand	X	X				X						
16 Old Silver Lake	Dec-02	Producing sand	X	X			X	X						
15 Silver Knolls	May-01	Clean and chek well condition	X	X				X						
17 Red Rock	May-01	Clean and chek well condition	X	X				X						
18 Army Airguard	May-00	Clean and check well condition		X				X						
15 Old Silver Lake	May-00	Clean and check well condition		X				X						

Conjunctive Operation of Surface and Groundwater Resources

The CTP and GTP make it possible for TMWA to operate a surface water treatment plant year-round thereby eliminating the need for winter groundwater pumping. TMWA manages its plants to maximize surface water production and limit or compress its groundwater pumping to help meet peak summer and early fall customer demands. This conjunctive operation of surface and groundwater supplies allows TMWA to increase its pumping during higher summer demands and beyond the summer months when necessitated by lack of river supplies during extreme dry years. This operational procedure also reduces facility use and overall cost of water production and creates the opportunity to aggressively pursue an aquifer storage and recovery program ("ASR") as described in Chapter 6.

The benefits of conjunctive management of TMWA's surface water and groundwater resources were recognized and resulted in the issuance by the State Engineer of "Groundwater Management Order 1161" ("the Order") on May 15, 2000. The order resolved several issues with respect to TMWA's ability to exercise its groundwater permits and provides the opportunity for improving the Truckee Meadows aquifer by: reducing over the long-term, the average-annual pumping of the Truckee Meadows aquifer; building up a credit of underground banked surface water for later extractions during droughts; and allowing up to 22,000 acre-feet[21] to be pumped for three consecutive years if sufficient credit has been accumulated during non-drought periods.

In the winter season, many of the wells are used to inject or recharge treated surface water into the groundwater aquifer for storage (see Table 7), water quality mitigation for marginal arsenic concentration wells, and future drought year use. The injection of treated water through TMWA's aquifer storage and recovery program ("ASR") has increased since the pilot program began in 1993. TMWA's ASR program has grown from storage of 81 acre-feet of treated surface water in 1993 to over 19,800 acre-feet by the end of 2008. The total amount of water injected in the Truckee Meadows hydrographic basin's aquifer since 1993 is 14,571 acre-feet, while 1,665 acre-feet since 2000 has been injected into the west Lemmon Valley hydrographic basin.

[21] When TROA goes into effect an average year pumping of 15,900 acre-feet will count against the 119,000 acre-foot demand of TROA. The ability to pump in excess of this amount as indicated here will not count against, and be in addition to the TROA water supply.

Table 7: Aquifer Storage and Recovery History (units in acre-feet)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Jun-09	Total, AF
Truckee Meadows Groundwater Basin																		
1 Lakeside Drive	3	9	116	132	111	377	194	246	258	218	292	194	192	213	148	270	154	3,126
2 Hunter Lake							196	290	332	175	246	34	22	0		122	197	1,614
3 View Street						173	327	486	433	260	353	598	264	202	179	291	68	3,633
4 Reno High							61	190	216	142	173	26	50	213	182	256	144	1,652
5 Poplar #1					22													22
6 Poplar #2								68	46	70	9	44	37	2				277
7 Kietzke Lane	26																	26
8 Morrill Avenue	27																	27
9 Forth Street	25							39	452	309	152	139	82	113	90	160	107	1,667
10 Glen Hare								36	117	62	99	15	9	0		62	46	445
11 Greg Street								76	135	137	177	164	41	0				731
12 Terminal Way								2										2
13 El Rancho								121	216	178	255	139	97	103	62	119	22	1,313
14 Holcomb Lane								21	39	187	123	72	17	137		40	32	667
15 21 st Street								61	202	193	259	172	108	151	108	154	84	1,490
16 Galletti Way								81	239	234	262	218	119	175	149	225	138	1,840
17 Longley Lane									10	14								24
18 Sparks Avenue																19	11	30
	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
19 Subtotal	81	9	116	132	133	550	778	1,717	2,693	2,177	2,401	1,815	1,037	1,308	918	1,718	1,003	18,587
West Lemmon Valley Groundwater Basin																		
20 Army Air Guard									242	205	180	157	137	163	136	118	32	1,370
21 Silver Lake								32	149	88	83	84	93	146	136	172	113	1096
22 Silver Knolls																32	0	32
	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
23 Subtotal								32	391	293	263	241	230	309	272	322	145	2,498
Spanish Springs Groundwater Basin																		
24 Hawkings Court																	229	229
	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
25 Subtotal																	229	229
	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
TOTALS	81	9	116	132	133	550	778	1,749	3,084	2,470	2,664	2,056	1,267	1,617	1,190	2,040	1,377	21,314
	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====

TMWA's injection of treated water is governed by quantity permits issued by Nevada Division of Water Resources ("NDWR"), and quality permits issued by Nevada Department of Environmental Protection ("NDEP"). Permit R-016 was approved by the State Engineer in 2001; this permit consolidated the Truckee Meadows wells that were used under 1992 permits R-010 and R-013, which were subsequently cancelled into R-016. Recharge of 7,000 acre-feet annually is permitted under R-016. Coincident with issuance of R-016, on October 16, 2001 NDEP reissued Permit No. UNEV92200 authorizing TMWA to inject treated water into twenty-three wells within the Truckee Meadows hydrographic basin No. 87. Both permits have been revised and were reauthorized in 2006. Reports are issued every January and July to both agencies summarizing injection activities including water quality.[22]

ASR is one element of TMWA's integrated management strategy to augment drought reserve supplies for later use during a Drought Situation. ASR, together with TMWA's POSW and credit water releases and increased groundwater pumping, create opportunity to maximize to and expand service commitments while meeting critical-year-water-supply requirements during drought cycles; this is a primary purpose of water resource planning for the Truckee Meadows. Between now and when TROA takes effect recharged water can be stored using any of unexercised water rights and the water supply created will enhance pre-TROA drought needs. After TROA takes effect the drought needs will be met with TROA drought supplies and only those water rights which need not be stored under TROA will be available for recharge purposes. The ASR drought reserve development can then be utilized to support demands above TROA's 119,000 acre-foot supply.

The water supply provided by below average precipitation and intervening years of above average precipitation during a drought cycle is shown in Figure 15. Figure 15 shows a 16-year history of daily river flows (the "blue area") measured at Farad compared to TMWA's daily diversion of surface water (the "green area") and groundwater and POSW (the "red area"). When the "red area" extents beyond the peak irrigation season, TMWA must increase its groundwater production and/or begin releases of its POSW. In the summer months of the driest years groundwater and/or POSW is used be meet demands when river supplies are not available. The reader should note, however, that in all years the river is able to meet a large portion of TMWA's water production requirements.

Lake Tahoe is the largest storage reservoir on the Truckee River system; 95 percent of the water stored upstream and carried-over to the next year to be used to provide normal river flows can be captured in the lake. The top 6.1 feet of the lake is used as a storage reservoir. River flows, or Floriston Rates[23], are almost entirely dependent upon Lake Tahoe's elevation at any point in time throughout the year. When the elevation of the lake approaches its natural rim (elevation 6223.00-ft. Lake Tahoe datum), Floriston Rates drop off shortly thereafter. If these rates of flow fall off during the typical summertime demand season, it will impact TMWA's

[22] Appendix F contains the most recent (July 2009) copy of the semi-annual report filed with NDEP and NDWR.

[23] Floriston Rates are the minimum required rates of the flow in the Truckee River that must cross the California/Nevada state line daily.

water production operations. Since typically 85 percent of TMWA's raw water is derived from the Truckee River it is easy to see why Lake Tahoe is the best barometer regarding the health of our region's water supply. Depending on the projected elevation of Lake Tahoe determined by April 15 each year for the remainder of the year, appropriate demand-management measures described in Chapter 5 may need to be implemented depending on the projected impact to TWMA's drought reserves.

Availability of Truckee River water, TWMA's primary water supply, can be negatively impacted during low precipitation years which lead to Drought Situations. By extracting as much groundwater as possible in the critical months of a drought year, the reliance on surface water released from POSW in those months is reduced which: (1) delays or potentially avoids the use of limited reservoir storage, (2) improves drought year supply capability, and, (3) increases the yield of TMWA's combined resources.

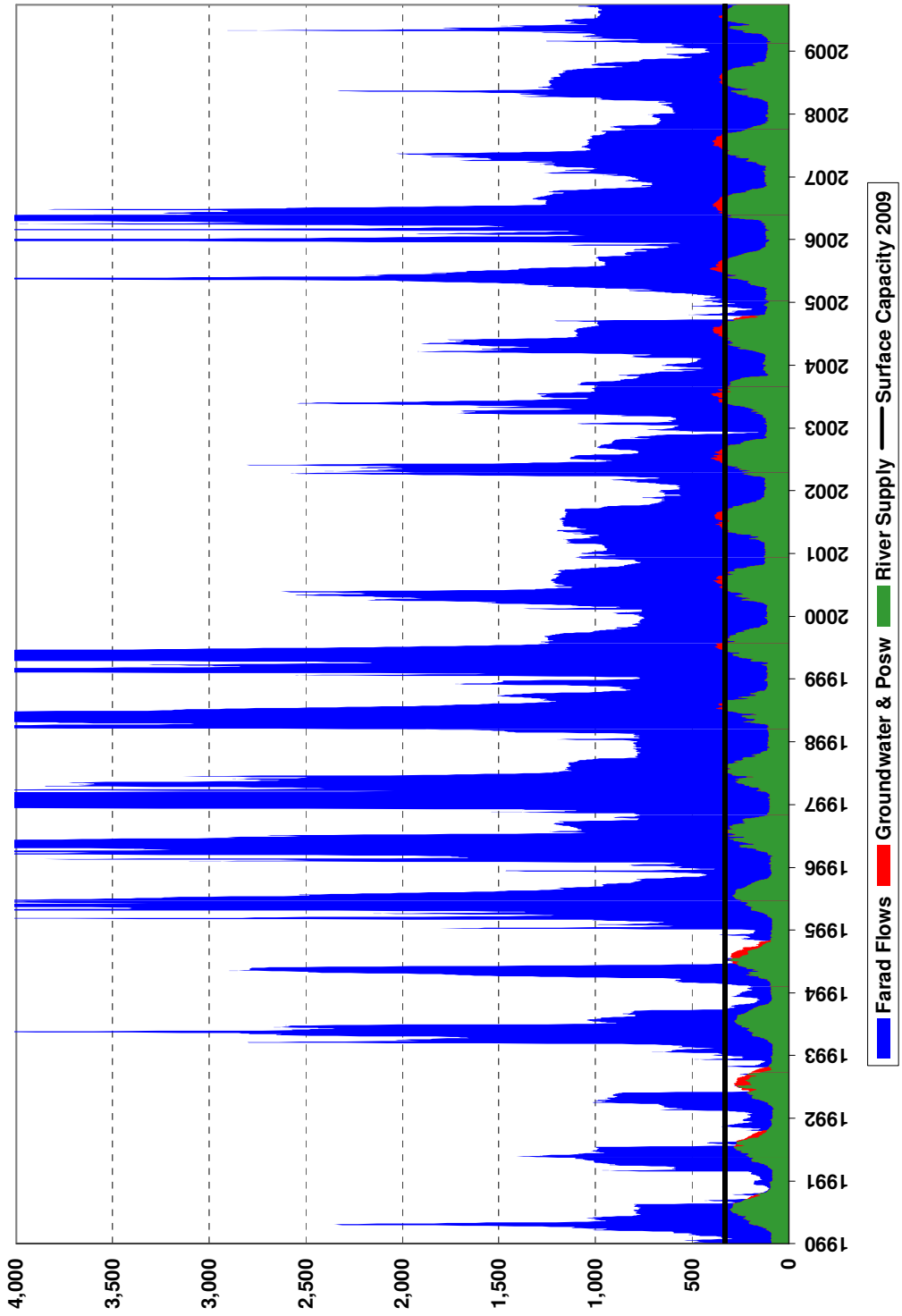

Figure 15: 1990 to 2006 Daily Water Sources

Under current operations river water is diverted up to the capacity of the surface water treatment plants; after this point the peak water demand is met using groundwater. During the summer months of drought years, groundwater, TMWA's pondage rights in Boca Reservoir (800 acre-feet), water stored in Federal reservoirs under the Interim Storage Agreement, Independence Lake (17,500 acre-feet), and Donner Lake (4,750 acre-feet) are used to augment the water supply needed to meet customer demands. Independence Lake is TMWA's largest drought backup water supply. The Independence Lake storage level reflects the severity of necessary actions during a drought because it is the last drought supply used, and because storage is re-filled in all but the driest years.

Although the resource management schemes vary between non-Drought and Drought Situation, experiences during prior droughts demonstrate the region's ability to manage its water resources during these dry periods. A comparison of non-Drought and Drought Situations operating strategies highlights the differences in resources management required in order to optimize available resources. The two resulting management scenarios ultimately determine the type of production facilities necessary to produce potable supplies; which facilities are discussed in Chapter 4. The non-Drought and Drought Situation resource management strategies include:

Non-Drought Situation:

- Maximize surface water diversions every month. Surface water production is the first supply to use.
- Limit groundwater use (attempting to pump an average of less than 15,950 acre-feet annually) to the critical months: July, August, and September, and eliminate its use as early as possible in October. No groundwater should be used in April, and if possible, delay its use until May or June preferably.
- Reserve TMWA POSW and credit stored water during the year.
- Artificial recharge, when required for operational purposes, should occur as early in October as possible and continue through April to store water underground for future use.
- Maximize establishment of POSW and credit water.

Drought Situation:

- Maximize surface water diversions every month while available. Surface water production is the first supply to use. This may include bringing the Glendale Water Treatment Plant on-line earlier in the spring and implementing artificial recharge operations early in the fall.
- Maximize opportunities to store water upstream including requesting early filling of reservoirs.
- Maximize groundwater use during the months of June through October results in reduction of the use of POSW and any other TMWA storage in surface reservoirs.
- Enhance water conservation measures as appropriate to reduce customer use.

- To the extent possible, meet remaining demand with groundwater use (up to 22,000 acre-feet annually in the Truckee Meadows). Some groundwater supplies will need to be reserved to meet peaking demands later in the year.
- Some POSW or credit water may be required to meet summer peak day demands in extended droughts, but this use should be delayed and minimized if possible to the months of June through October.
- Under TROA as the drought progresses, move water out of Tahoe as soon as practicable.

The 1987-1994 Drought was the most severe drought on record and now serves as the benchmark for water resource planning criteria.[24]. Hydrologic analyses confirmed TMWA's previous work of designing its resources to withstand the worst drought of hydrologic record of the Truckee River: 1987 to 1994. The model demonstrates that drought year cycles are rare events, similar to flood events. The analyses establish that appropriate drought design criterion should reflect conditions that impact the ability of TMWA to divert surface water and require TMWA to use its upstream reserves: the only time this happens is during the irrigation months and only during consecutive dry summer months. The effect of one summer month when Floriston Rates are not met does not necessarily impact upstream reserves; only consecutive months without meeting Floriston Rates during the irrigation season can significantly impact upstream reserves. The results presented in the 2025 WRP remain valid as the 1987 to 1994 Drought remains the most severe drought on record.

Drought cycles of 8-, 9- or 10-year are rare occurrences with frequencies of 1 in 230 years, 1 in 375 years, and 1 in 650 years, respectively. A 10-year drought would be so rare that using it as the design standard would impose an unrealistic burden on the region's resources. As a comparison, the 100-year flood is twice as likely as the 8-year drought. Four 100-year flood events, including the flood of 1997, appeared in the record of data used. Over this same period there were two eight-year drought events. It was found that the 10-year drought frequency is approximately 1 in 650 years; a 100-year flood is 6.5 times more likely than the 10 year drought! Based on comparable methods to flood planning and the statistical methods developed for this plan, planning for the 8-year event with today's resources is more than adequate to meet expected drought frequencies; under this scenario, TMWA's resources will support demands up to 113,000 acre-feet. Based on the 1987-1994 plus a repeat of 1987 hydrology drought planning criterion, TMWA has the ability to continue to acquire irrigation rights and extend its water service demands to 110,000 acre-feet.

Figure 16 illustrates drought reserves under the 8-year drought design (1987 to 1994) at 113,000 acre-feet of demand without TROA implementation. The figure shows annual declines in all reservoir storage is due to annual Fall releases required for dam safety reasons to ensure

[24] A complete description of this model and accompanying analyses were presented in Appendix J of the 2025 WRP.

there is sufficient flood storage capacity to capture excess runoff from winter storms in Donner Lake, drawdown of Independence by TMWA for reservoir operations, and credit storage drawdowns reflecting turnover of water stored in Stampede or Boca reservoirs for fish purposes. For comparison purposes, Figure 17 shows the estimated use of drought reserves under the 8-year drought design at 119,000 acre-feet of demand with TROA implementation.

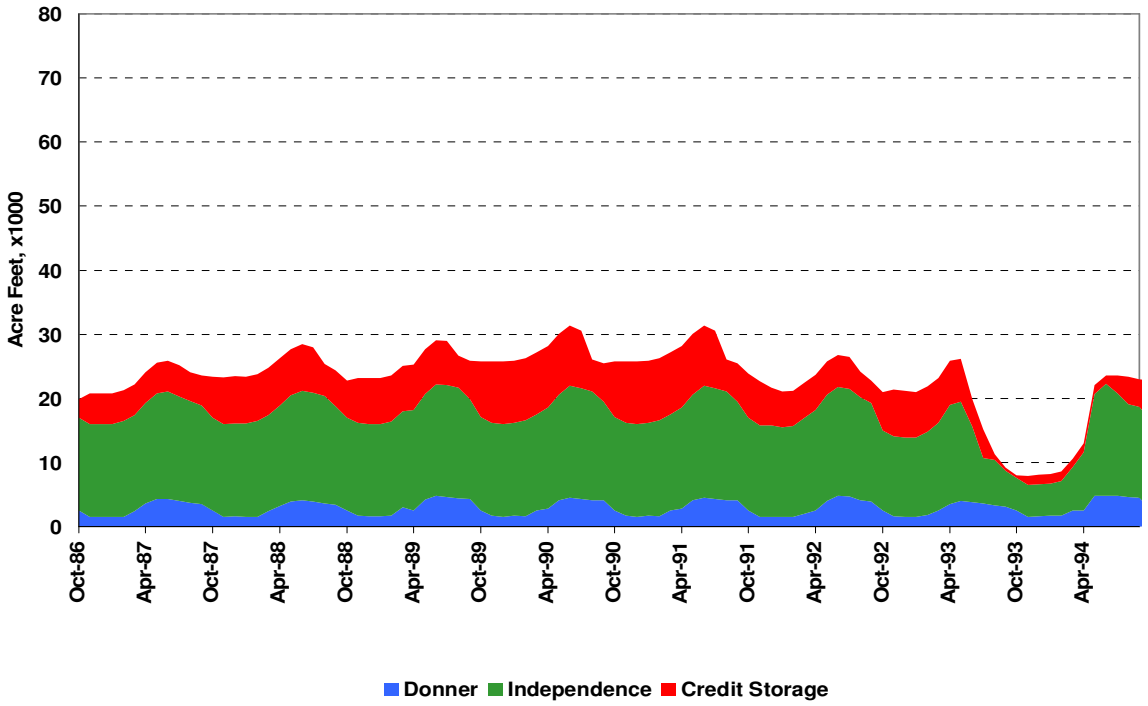

Figure 16: Remaining Drought Reserves During the Actual Hydrology of the 8-Year Drought Design with TMWA Demand of Yields 113,000 Acre-Feet

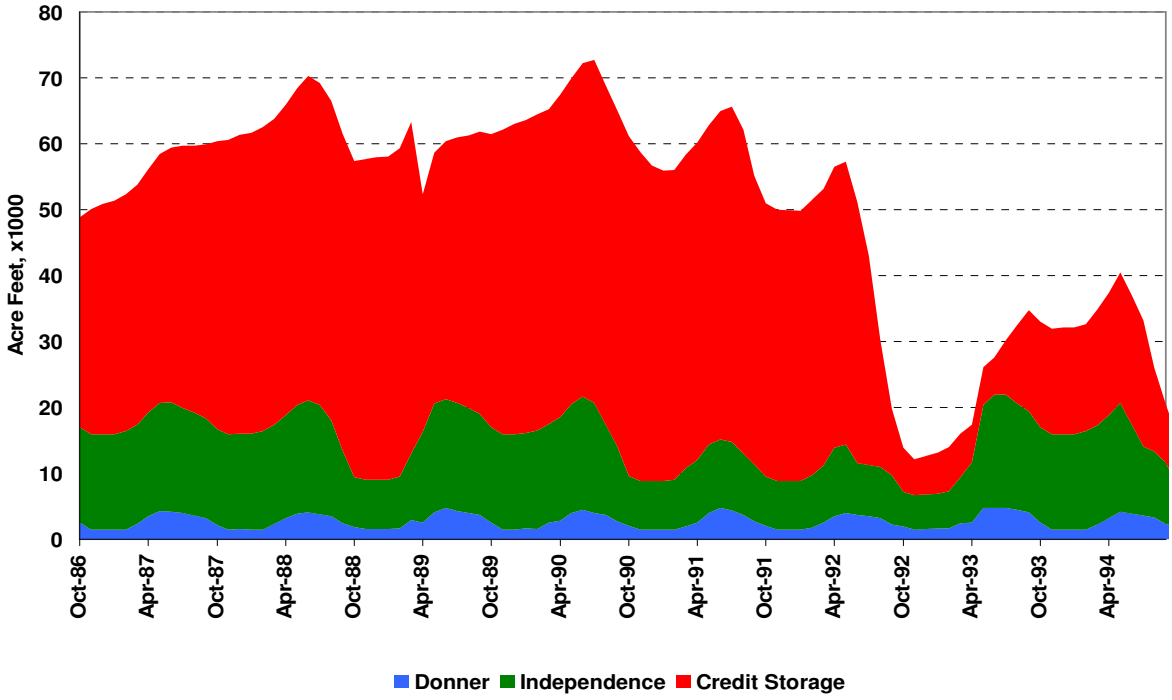

Figure 17: Remaining Drought Reserves During the Actual Hydrology of the 8-Year Drought Design with TMWA Demand of 119,000 Acre-Feet

Summary

This chapter has described TMWA's existing water rights and water production facilities. The key points of the analysis derived from conjunctively managing surface rights, groundwater rights, and water production facilities are:

1. Sustainability of water deliveries for the 20-year planning period and beyond is continually assessed both by TMWA and in coordination with other regional water purveyors to identify and engage in integration practices that are beneficial in terms of increasing the supply and/or quality of water supplies at minimum economic cost.
2. Subject to water-rights-market conditions, Truckee River water resources can sustain 119,000 acre-feet of demand under TROA.
3. Subject to water-rights-market conditions, there are sufficient Truckee River water rights to meet the TMWA's current and future demands through the planning horizon.
4. Current water rights include:
    - "40 cfs" right (28,959 acre-feet)
    - Hunter Creek (9,847 acre-feet)
    - Independence Lake (17,500 acre-feet)

- Half of Donner Lake storage (4,750 acre-feet)
- The Interim Storage Agreement for storage in Stampede and Boca (up to 14,000 AF) until TROA is implemented
- The Truckee Meadows Groundwater Banking Order (allows variable pumping up to 22,000 acre-feet in a drought-year, and 15,950 acre-feet average year pumping)
- Approximately 64,541 acre-feet of acquired irrigation rights.

5. Current production capacities are:

Chalk Bluff	83.0 MGD
Glendale	25.0 MGD
Subtotal Surface	108.0 MGD
Groundwater	63.0 MGD
Total	171.0 MGD

6. An earthquake event in 2008 tested TMWA's emergency response plan to loss in water supply and demonstrated TMWA's ability to respond by having trained staff and available alternate water supplies.
7. Drought year cycles are rare events, similar to flood events. The estimated drought frequencies are:

8-year	1 in 230 years
9-year	1 in 375 years
10-year	1 in 650 years

8. Drought yield of TMWA's existing resources is a function of available resources and drought-year design. By continuing to acquire Truckee River irrigation rights, yield studies conclude TMWA has the ability to continue to extend its water service demands to 113,000 acre-feet with an 8-year drought design, which includes additional drought-year conservation needed during the peak irrigation season (June through October) of 7,800 acre-feet, or 7% of average year demand. Or, 119,000 acre-feet with an 8-year drought design once TROA is implemented, which includes additional drought-year conservation needed during the peak irrigation season (June through October) over and above the annual savings of about 12,000 acre-feet, or 10% of average year demand.

References

2005-2025 Water Resource Plan, Truckee Meadows Water Authority, March 2003.

2005-2025 Water Facility Plan, Truckee Meadows Water Authority, Dec 2005.

Chapter 4 Water Demand and Peak Day Projections

Water demand was projected through the year 2030 to ensure that TMWA will have the necessary water resources and facilities to serve its service area population. Projected water demand is based on projected population and water service connections through the planning period. Projected water demand has five main components: (1) Residential demand, (2) Commercial demand, (3) Irrigation demand, (4) Wholesale demand, and (5) System losses. Each of these components is projected using established historic water demand factors. The projections include estimates of land use consumption, growth in dwelling units and commercial buildings, and were developed in a three-step modeling process as follows:

1. Future population is forecast.
2. The number of dwelling units and land use are forecast as a function of population.
3. The number of commercial properties is forecast as a function of dwelling units.

In addition to the total annual water demand projections, an analysis and projection of peak day demand is presented for facility capacity planning purposes.

Water Demand Factors

The total demand for water is dependent on three general demands or uses. First, the residential desire to consume water for internal household consumption. Second, the commercial need to consume water as an input to produce goods and service in the local economy. For example, a hotel requires water as part to service of providing hotel rooms whereas a restaurant uses water for cooking and cleaning. Each business has a demand for water that is dependent of the type of business and the building that it occupies. Third, residential and commercial users desire to consume water for irrigation purposes. The quantity of water used for irrigation purposes depends on the type of landscaping that is being maintained and the weather. During periods of warm or hot temperatures irrigation increases as the landscape requires more water and during periods of cooler temperatures and/or rain, less water is required.

Residential demand is characterized by the number of people living in the community and the type of dwelling units. As the number of persons increase one can expect an increase in dwelling units and thus an increase in the residential demand for water. As people live in a community, they create the need for jobs and the demand for goods and services. The commercial demand for water is dependent on the population, the health of the economy, and types of commercial enterprises. Most separate irrigation water services are installed at commercial property complexes or multi-family complexes, as such the number of irrigation services can be projected as a function of multi-family services and commercial services.

The core variables that are used to project water demand are population, economic health, and land use / building patterns.

Population and Economy

Population growth and employment are an inter-related time series. In general, the population of a community grows faster during periods of low unemployment as the prospects of

new jobs are good[25] (i.e., unemployment rates below 6%) and grows slower during periods of higher unemployment. Employment is the primary variable affecting population growth as evidenced by historic events in Nevada.

Employment statistics for the State of Nevada have been collected since 1976. Figure 18 show how employment and population are related for the State of Nevada. During the 1970's through 1987, Nevada saw relatively slow population growth as the unemployment rate was consistently above 6%. Starting about 1988, population grew at a faster rate as the unemployment rate was generally below 6%, and in some years fell to record lows of less than 4% unemployment. When the unemployment rate increased in 2006 and continued to increase rapidly to what are now record highs, population growth slowed to almost no growth in 2008.

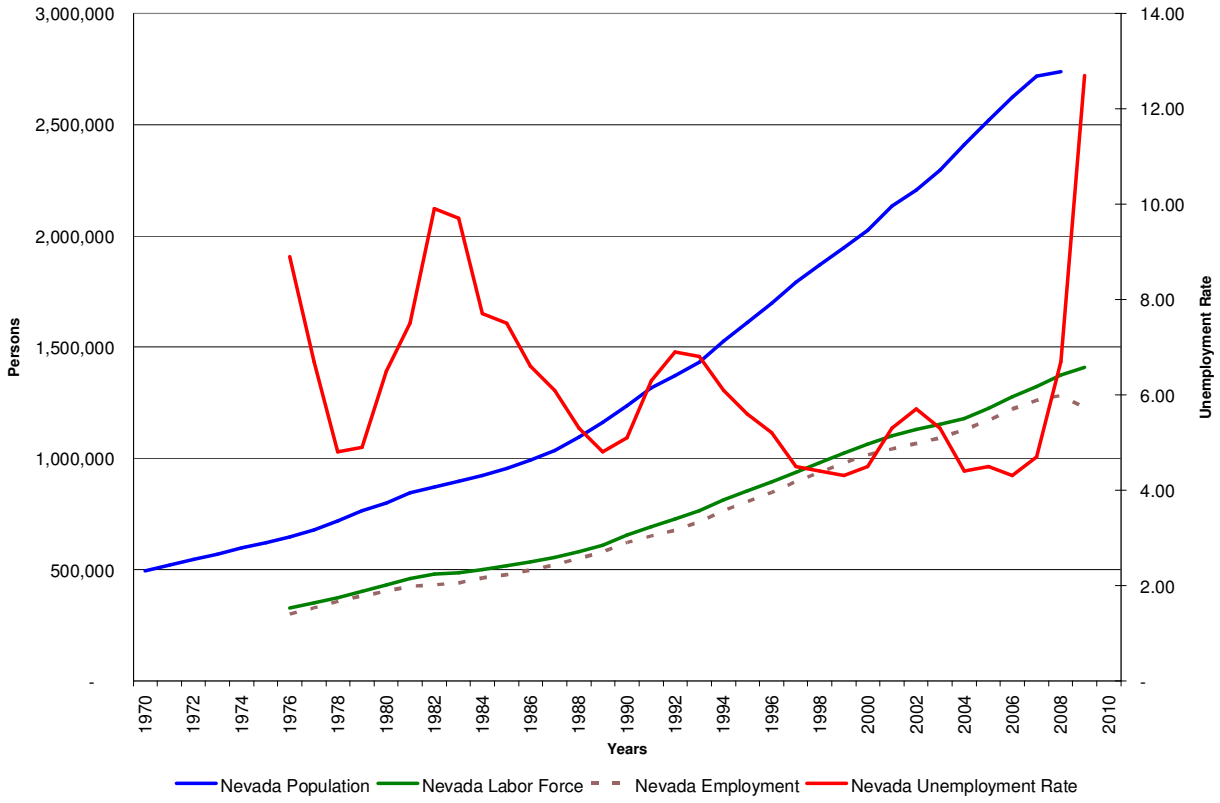

Figure 18: Nevada Population, Employment, and Unemployment 1970 to 2009

The employment trends in Washoe County are very similar to the State-wide trends shown above. Washoe County employment statistics from 1990 to 2009 are available from the Bureau of Labor Statistics. Figure 19 shows how the County experienced relatively stable population growth and low unemployment rates during the 1990's through 2006. Since late

[25] In most regions an unemployment rate of 5% is considered full employment.

2006, Washoe County has seen record unemployment rates and a flattening of the labor force that will translate into a period of slow population growth or a period of population contraction as people leave the region in search of jobs.

The sudden change in economic conditions implies that TMWA's prior employment population model has limited ability to provide a meaningful population projection. This combined with a change in labor reporting statistics required development of an alternative methodology for projecting population that is not directly dependent on employment.

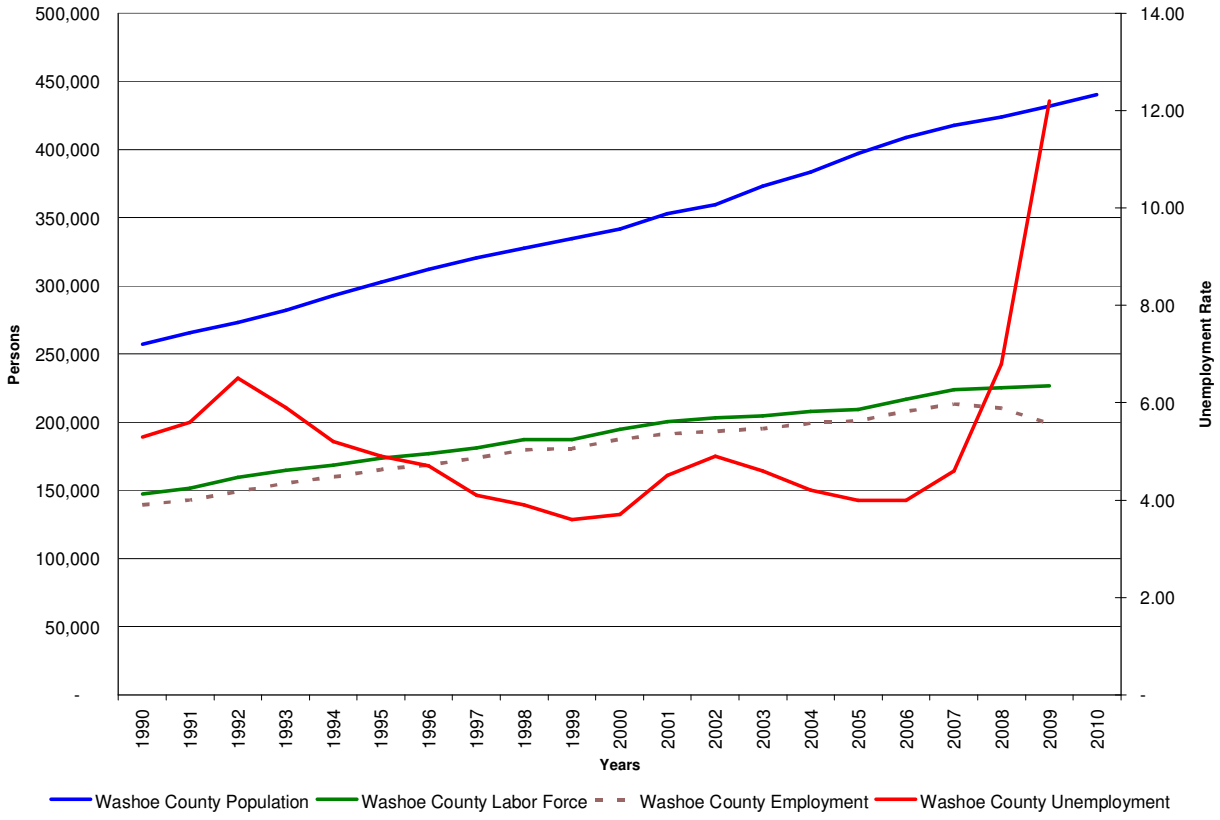

Figure 19: Washoe County Population, Labor force, Employment and Unemployment Rates

In developing a population projection, an important consideration is length of time period to be projected and available sources of data. This 2030 WRP requires a projection through the year 2030. The most recent population estimate is for 2008, thus a model is required to project for 22 years. Ideally, the source data series should be at least 22 years and cover similar economic conditions. The recent changes in labor reporting limits the usefulness of available historic employment data. Also, as described above the current economic conditions are not reflected in the available employment history.

Annual population estimates for Washoe County are available for the years 1950 to 2008. This meets the need of a long time series. This time series covers the recessions of the 1970's and 1980's and the periods of high growth seen in recent years.

Appendix G describes the population model development process and compares alternative population projection models. A summary of the selected population model, the logistic curve model, and its statistical properties, is provided below.

Logistic Curve Model

Many extrapolation methods that can be used to project population are not constrained by any limits on growth. This implies that population growth (or decline) can go on forever and in many cases, this is not a reasonable assumption. The logistic curve, one of the best-known growth curves in demography, solves the resource constraint problem by including an explicit ceiling on population. It is a symmetric sigmoid shape (S-shape) curve that has an initial period of slow growth, followed by increasing growth rates, followed by declining growth rates that eventually approach zero as population size levels off at its upper limit. The idea of limits on growth is intuitively plausible and is consistent with many theories of population growth, geographic impediments such as public lands and unbuildable terrain, growth constraints created by water resources and government policies, and in-fill of existing vacant residential sites. The population model developed for Washoe County is called a Keyfitz (1968) curve and is described as:

$$Y = \alpha \Big/ \left(1 + \beta_1 e^{-\beta_2 t}\right)$$

where "*Y*" is population, "*t*" is time, "α" is an estimated the population ceiling, "β_1" and "β_2" are parameters that define the shape of the logistic curve.

The estimated population is:

$\text{Population}_t = 676{,}985/(1 + 12.93262 * e^{-0.0513267 * t}) + 7{,}464$

Where t is time in years starting at t = 1 for 1950 and 7,464 is a model calibration factor.

This model's results fit the data with R^2 = 99%, and all parameters in this model are statistically significant. It is the lower bound on population ceiling of three models and was selected because the economy is still in a deepening recession.

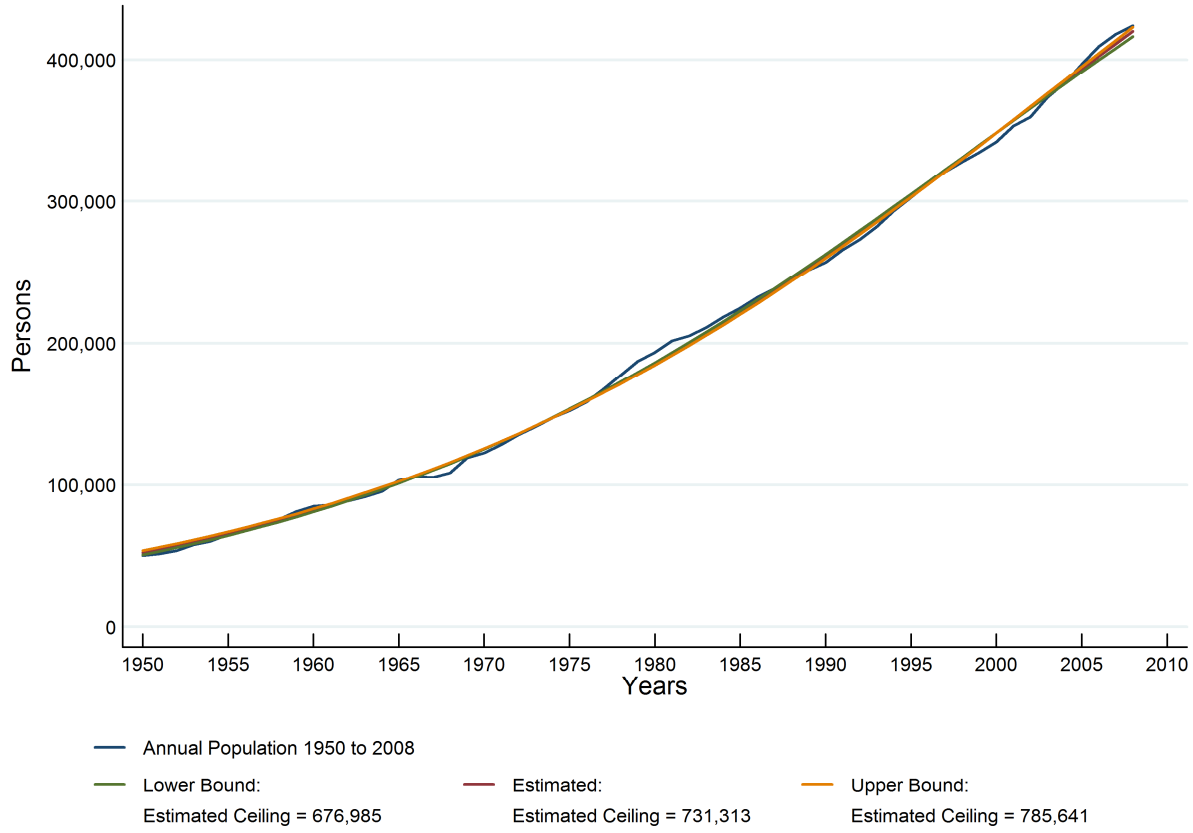

Figure 20: Population Logistic Curve Models Results

The results of all three logistic models are shown Figure 20. All three models fit the data equally well and each estimate has a R^2 = 99%. Figure 21 compares the models with the State Demographer projection and shows all three models provide essentially the same projection through the year 2015.

The State Demographer's population projection is one of two other population projection produced locally for planning; the other projection is the Washoe County Consensus Forecast. The consensus forecast was last published by Washoe County in 2008 based on data that excludes the current economic recession, therefore the consensus forecast needs to be updated before it can be used in this planning context.

The Demographer's projections are based on the REMI model and were last published in the fall of 2008. The REMI model is based on economic data since 2001 and thus has a limited ability to project population during this recession but is based on detailed local employment and economic data and can be compared with the logistic model. As shown in Figure 21, through the year 2020 there is no statistical difference between the logistic curves and the State Demographer's projection ("SDP"). For the years 2020 to 2030 the SDP trends towards the lower bound model. Since there is no statistical difference between the logistic curve and the SDP, (the SDP is contained entirely within the 95% confidence interval), the logistic curve

model using the lower bound of population ceiling is used as the population model for this 2030 WRP.

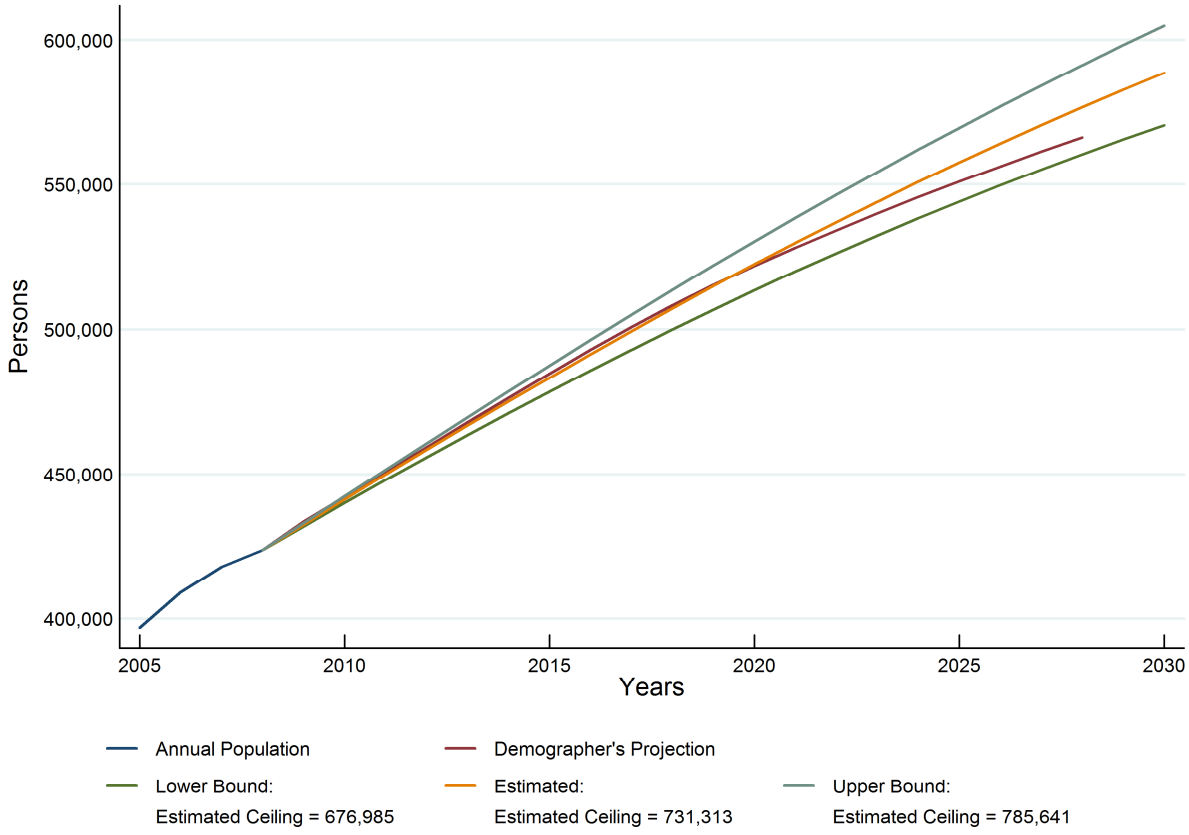

Figure 21: Logistic Lower, Estimated, Upper Bound and Demographer's Projections

Figure 22 shows the population projected out to year 2050 and compares the general trend with the SDP and the historic data used to estimate the model. The projected county population is expected to level out over time consistent with a logistic curve growth model.

Table 8 provides the Washoe County projections for 2010 to 2030 to be used as the basis for the water demand projection. Washoe County is projected to gain a total of 130,430 persons. This represents a 29.6% increase in population with an annual average increase of 1.33%.

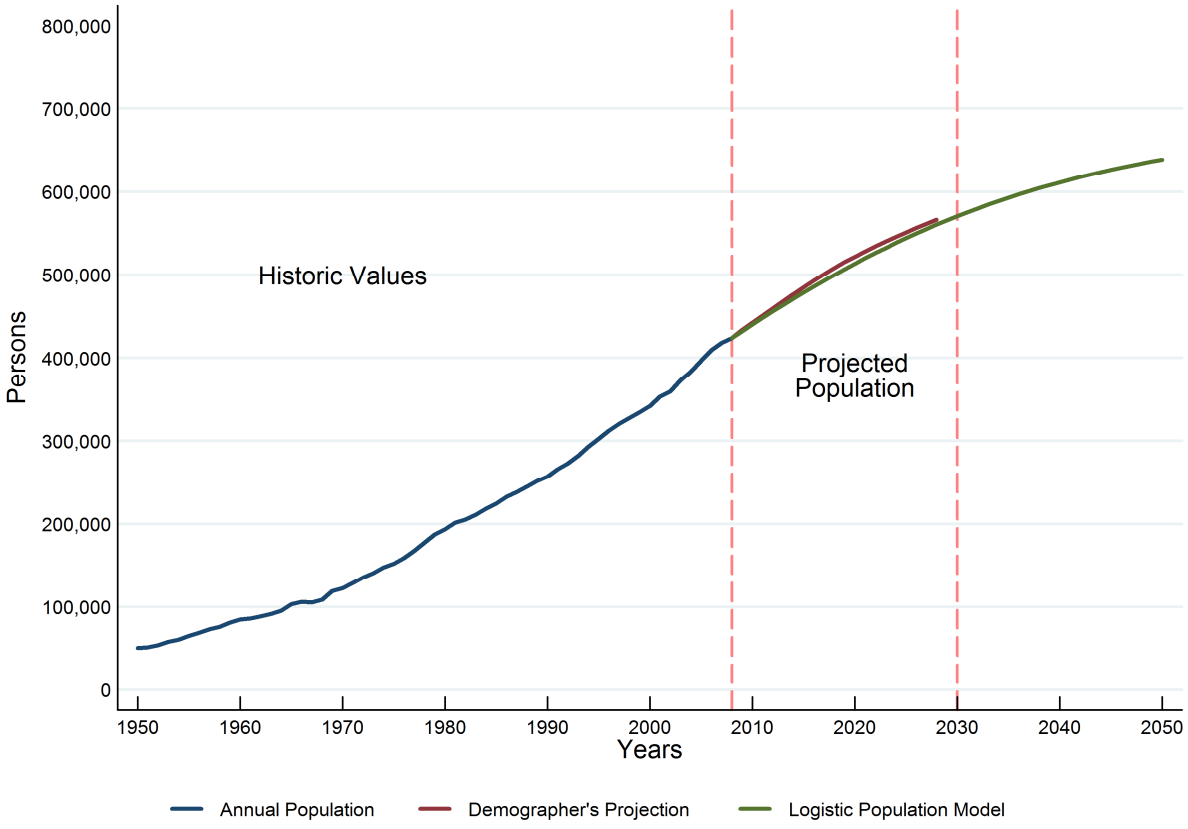

Figure 22: Population Projection Results

Table 8: Population Projections 2010 to 2030

Year	County	Percent Change	TMWA Retail	Total Wholesale	Balance of County
2010	440,081	1.87%	322,647	48,563	68,937
2011	448,038	1.81%	327,446	49,730	70,851
2012	455,872	1.75%	332,233	50,851	72,841
2013	463,577	1.69%	336,897	51,903	74,812
2014	471,146	1.63%	341,489	52,898	76,672
2015	478,572	1.58%	346,213	53,887	78,495
2016	485,851	1.52%	350,614	54,912	80,358
2017	492,977	1.47%	354,873	55,939	82,161
2018	499,946	1.41%	358,972	56,936	83,940
2019	506,754	1.36%	363,029	57,942	85,769
2020	513,398	1.31%	367,009	58,870	87,474
2021	519,876	1.26%	370,861	59,811	89,193
2022	526,185	1.21%	374,578	60,761	90,916
2023	532,324	1.17%	378,104	61,662	92,582
2024	538,291	1.12%	381,407	62,570	94,306
2025	544,088	1.08%	384,589	63,424	95,981
2026	549,713	1.03%	387,802	64,255	97,692
2027	555,166	0.99%	390,743	65,056	99,411
2028	560,450	0.95%	393,567	65,809	101,078
2029	565,564	0.91%	396,300	66,562	102,799
2030	570,511	0.87%	398,816	67,281	104,507
Total Change	130,430		76,169	18,718	35,570
Percent Change	29.64%	1.33%	23.61%	38.54%	51.60%

The disaggregation of population between TMWA's retail and wholesale areas and the balance of the county is a function of the location of dwelling units. An analysis of land use and distribution of the buildings in the different utility service areas and hydrographic basins provide the base data for projecting dwellings, commercial buildings, and the general consumption of land.

Data Construction and Trends

The Washoe County population is projected using a time series from 1950 to 2008. Since no formal similar time series for land use or building construction in Washoe County exists, it was constructed using information embedded in the County Assessor's data files. The County Assessor is the only source of detailed land use and building inventory for the entire county. A July 2009 snapshot of the assessor's data was downloaded from Washoe County's website for use in developing the projection of land consumption and building structures. The data provides a very detailed snapshot of what is known about each parcel and buildings that currently exist on each parcel. This database, when combined with a GIS parcel boundary database provides sufficient information for developing building(s) and dwelling unit history that can be used as part of the water demand projections.

Using a GIS application, each parcel was attributed with a utility service area, and hydrographic basin. In this manner the database was used to model Washoe County land use, dwelling unit history, profile and distribution, and the distribution and development of commercial buildings. Figure 23 shows the constructed historic data from 1950 to 2009, historic population and the general trend in persons-per-dwelling units. The persons-per-dwelling units are used to disaggregate the population into utility service areas and hydrographic basins. The construction of the persons-per-dwelling units time series was possible because of the long life of buildings. The statistical models of dwellings and building presented below uses data from 1979 to 2009 due to a stable statistical relationship between number of dwellings to growth in population in that period.

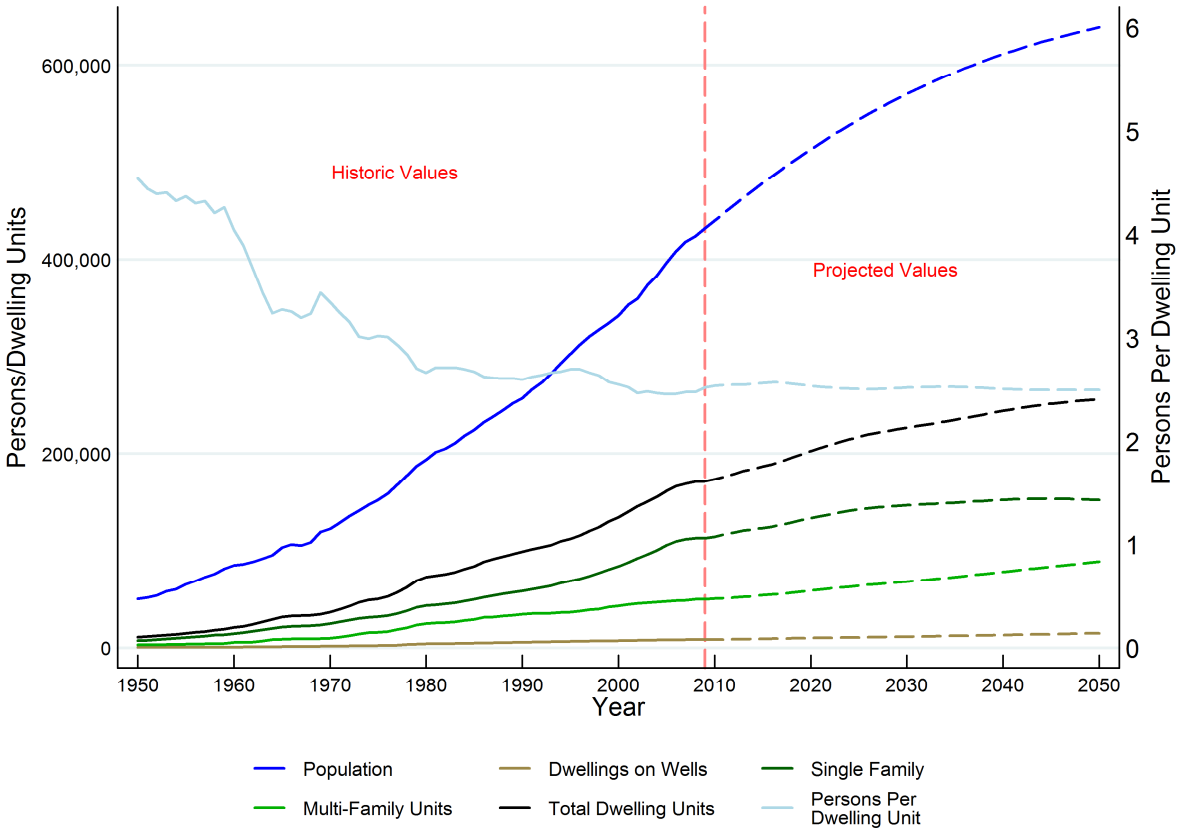

Figure 23: Washoe County Population, Dwelling Data and Projected Values

The Assessor's building data is reclassified into four classes that map to TMWA's customer classes. Dwelling units on domestic wells, while not served by any utility, are accounted for in the projection. Single family dwelling units (generally single family homes, townhouses, or condos) are serviced under the TMWA residential metered water service ("RMWS") rate class. Multi-Family dwelling units are apartments, duplexes, and any multi-family structure that would be billed on TMWA's multi-family metered water service ("MMWS") rate. Last is the commercial building group which includes any non-residential

buildings that would receive water on the general metered water service ("GMWS") rate. Figure 23, Figure 24, and Figure 25 show the data used for the models and the projected units.

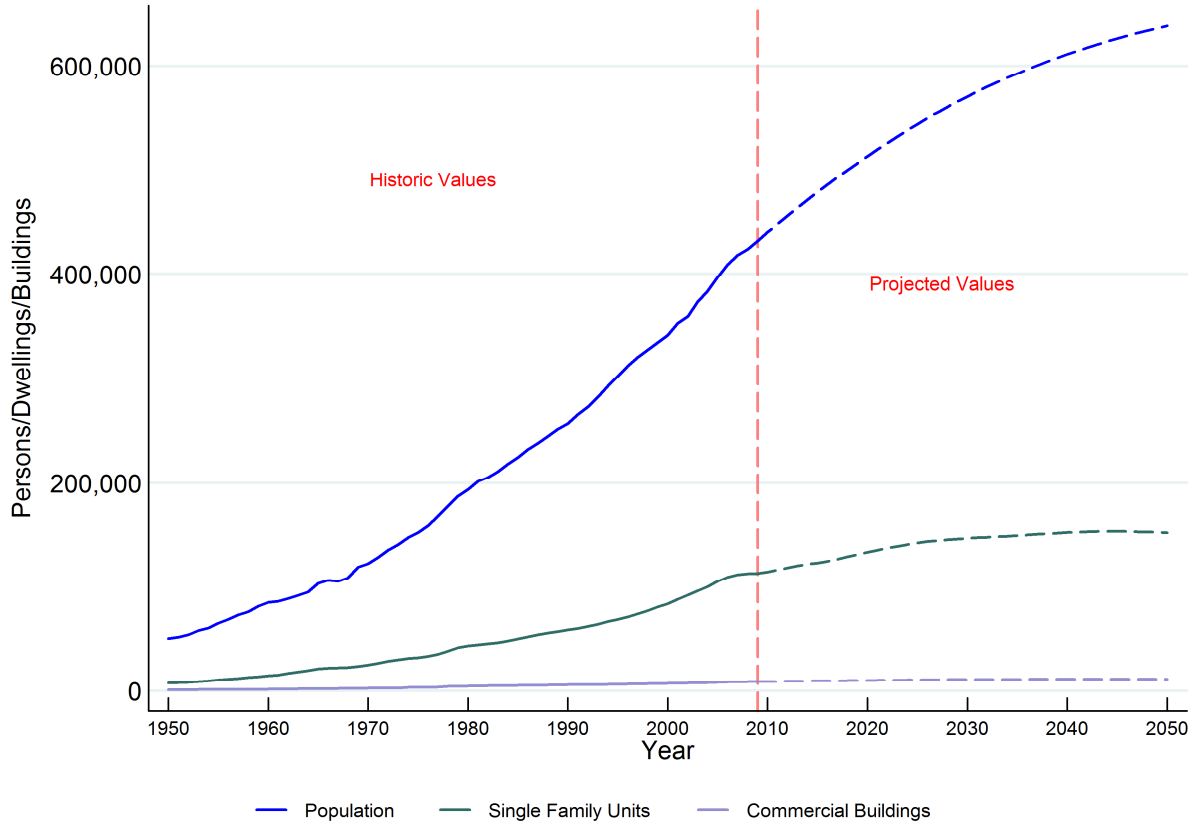

Figure 24: Washoe County Commercial Buildings Data and Projections

As a component of the model for dwelling units, Figure 25 shows the development of land over time and the projected amount of land that is projected to be developed through 2050.

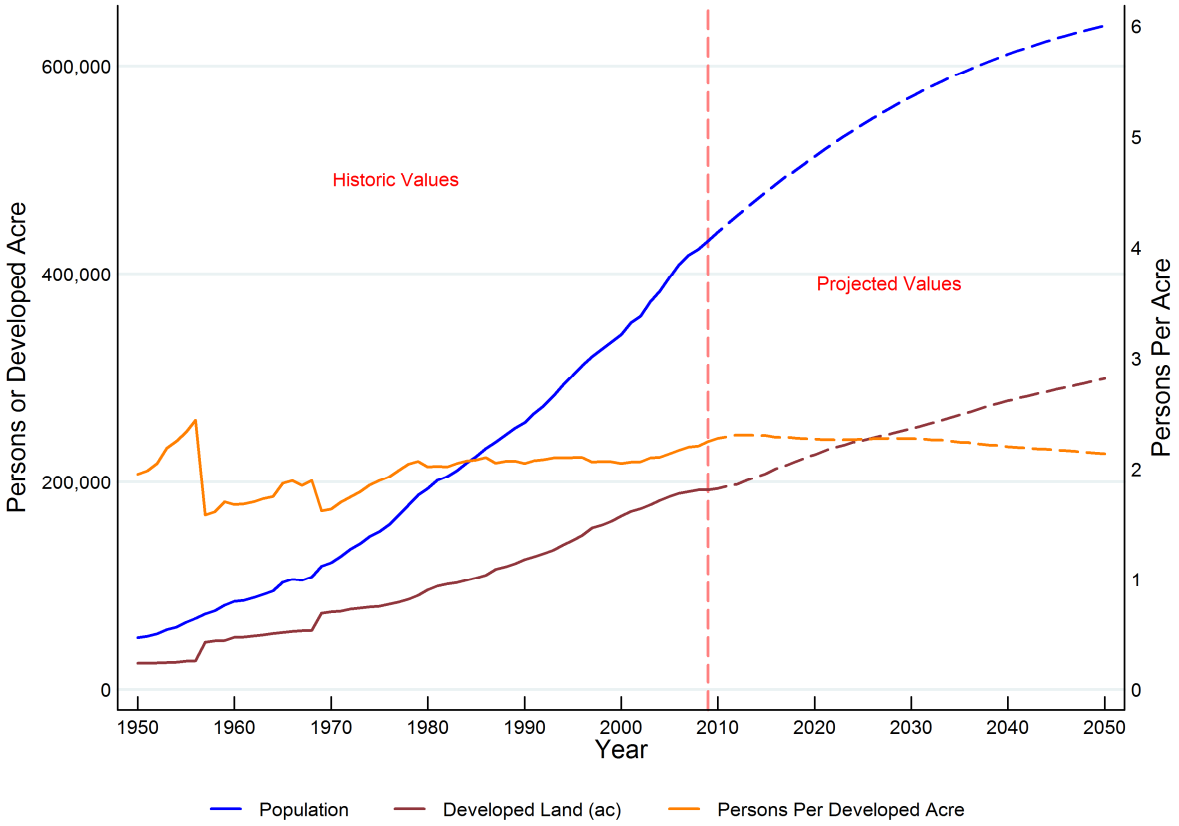

Figure 25: Washoe County Land Development Data and Projection

Statistical Analysis

Residential housing is the largest use of land, thus the development of land was best explained by residential housing units rather than commercial buildings. Figure 25 shows the projected development of land and the resulting persons per developed acre. The stock of single family and multi-family dwelling units in a given year is related to prior changes in population, number of new units constructed and current inventory of dwelling units. The stock of commercial buildings is related to prior economic activity including the number of single family units built in prior years.

Population is an exogenous variable to the housing model. When population projections change then the housing projections will change in response to the new population. The number of single family dwelling units is treated as an exogenous variable to the commercial building model in the same manner that population is exogenous to housing. The results of this three-step modeling process, using a vector autoregression model ("VAR") is shown with the data in Figure 23, Figure 24 and Figure 25. The three classes of dwelling units are inter-related and dependent on past values of each class along with population. A VAR is a common statistical method for modeling multiple variables that are related through time; the full statistical analysis is presented in Appendix H.

This model estimated the relationship between dwellings on wells, single family dwellings, multi-family units and developed land with population from the population model as the second step. The third and final step is estimating the relationship between commercial buildings and single family dwelling units. To summarize, the process models:

1. Population and projected dwelling units.
2. Housing and land development using vector autoregression and population.
3. Commercial buildings using vector autoregression and single family dwelling units and projections.

The persons per dwelling units and persons per developed acre are used as a measure of model quality. The population densities display how well the models are meeting the needs of the projected population. If the model is performing well at modeling the past trend then the there should be little change in the trends in the densities.

Persons per dwelling unit has remained stable since 1980 and the resulting projected dwelling units maintain the mix of units that will meet the future population needs. The persons-per-dwelling-unit is also used as the means to allocate county population to county sub-areas based on projected new dwelling units in a sub-area.

County Sub-Area Projections

The county projection is disaggregated into sub-areas listed here.

Utility Service Areas	
ID Code	Name
TR	TMWA Retail Area
RC	TMWA Combined Wholesale
WC	Rest of Washoe County
SV	Sun Valley
DD	Double Diamond
SS	Spanish Springs

Hydrographic Basins	
ID Code	Name
085	Spanish Springs
086	Sun Valley
087	Truckee Meadows
091	Truckee Canyon Segment
092	Lemon Valley
000	All Other Basins in County

Sub-area projections are derived from the County total projection using a ratio share analysis that allows for trends in the area shares over time, while requiring the sum of the shares to always equal 1. This ensures that in any projection year the sum of the sub-areas will always equal the County total.

Figure 26 and Figure 27 show the disaggregation of population, units and commercial buildings for TMWA retail area and wholesale service areas. It is these values that form the basis for the water demand projections.

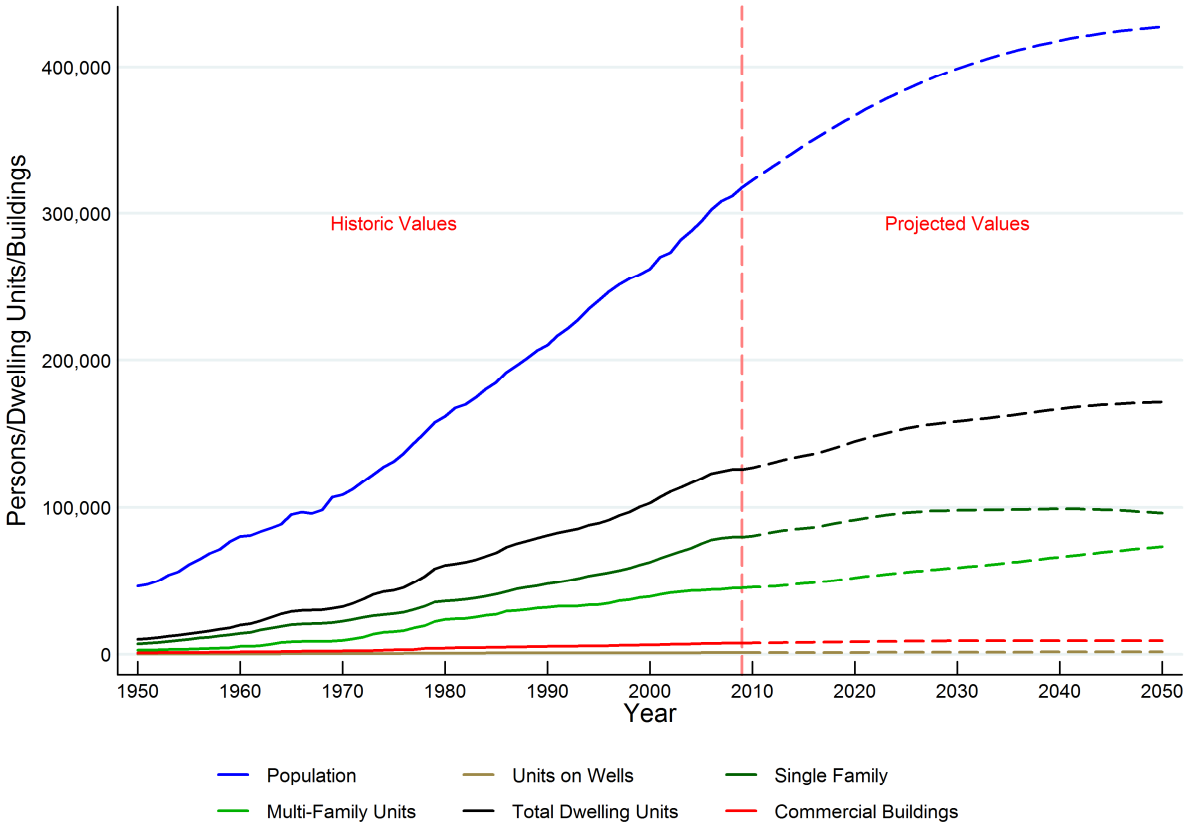

Figure 26: Dwelling Units and Commercial Building in TMWA's Retail Service Area

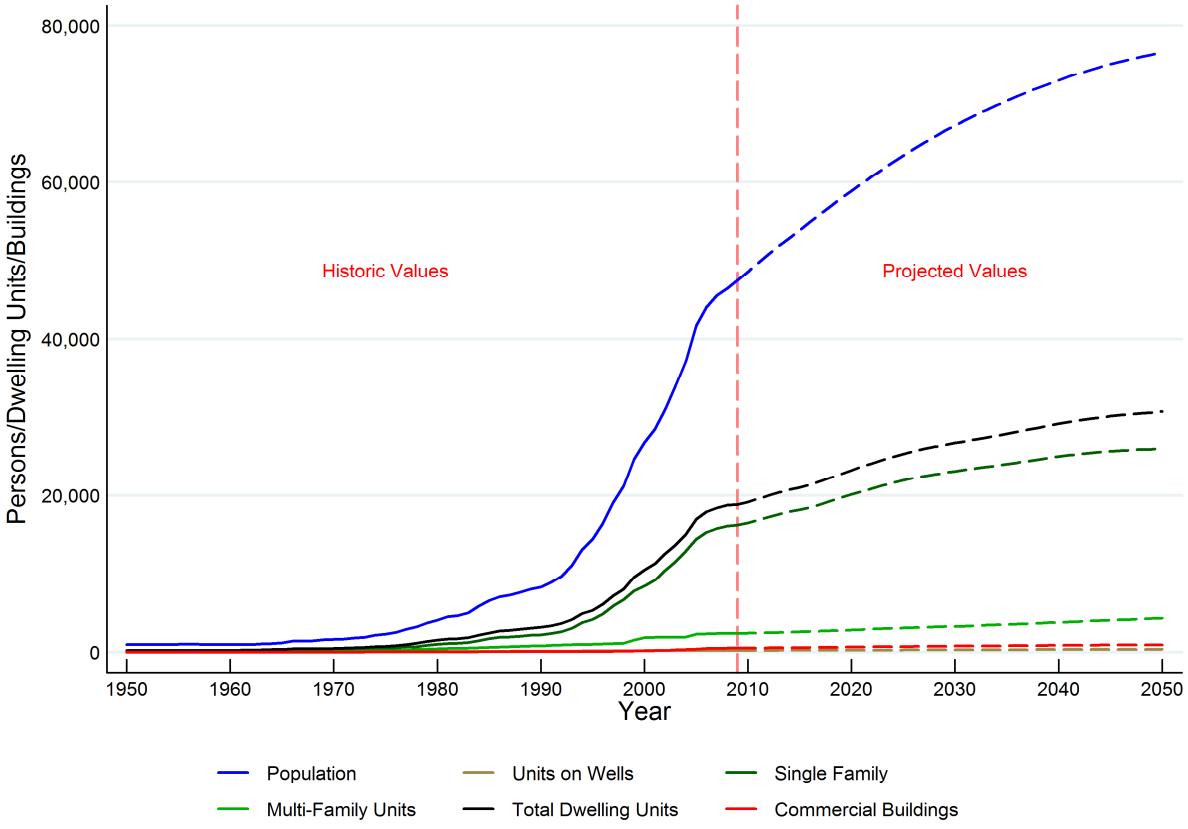

Figure 27: Dwelling Units and Commercial Buildings in TMWA's Wholesale Service Areas

Water Demand Projections

The Assessor's data does not match TMWA's billing records due to differences in how the data is recorded and used by each party. Not every parcel and building is served by TMWA and some buildings or properties may have more than one water service. To translate the dwelling and building projections into water services an adjustment factor is applied to each water service class.

Using active water service counts for June of each year from 2003 to 2009 a ratio of active water services to dwelling units or buildings was computed (Table 9). The results of this analysis are that:

- RMWS services have numbered 96.45% of single family unit counts,
- MMWS services must be converted to water services by dividing 10.23 units per service.
- GMWS services have numbered 73.89% of commercial building counts.

Table 9: Active Water Service Ratios Per Year

Year	Average Multi-Family Dwelling Units per Service	Ratio of Active RMWS	Ratio of Active Multi-Family Units	Ratio of Active GMWS Services
2003	10.71	.9684	1.0391	.7162
2004	10.49	.9634	1.0581	.7413
2005	10.05	.9572	1.0667	.7427
2006	10.19	.9720	1.0459	.7284
2007	10.08	.9711	1.0675	.7380
2008	10.10	.9639	1.0497	.7450
2009	10.02	.9558	1.0603	.7610
Average Ratio	10.23	.9645	1.0553	.7389

The metered irrigation water service ("MIS") do not have a direct counter part in the Assessor's data and therefore, could not be projected using the same model. However, most irrigation water services are attached to multi-family complexes or commercial properties. A regression analysis of MIS services as a function of MMWS and GMWS resulted in a model that projects the number of irrigation services. The projection of MIS services is shown in Table 10.

Using the active water service ratios and the MIS regression, projected total active water services are displayed in Table 10. These service counts are combined with the average water use per service (Table 14) to create the water demand forecast presented below.

Table 10: Projected Active Retail Water Services

Year	Single Family Base	Single Family New	Total Single Family	Multi-Family Units	Multi-Family Services	General Metered Service	Metered Irrigation Service	Total Services
2010	76,890	806	77,696	48,143	4,720	5,733	2,612	90,761
2011	76,890	2,083	78,973	48,408	4,746	5,780	2,662	92,161
2012	76,890	3,231	80,121	48,846	4,789	5,839	2,731	93,480
2013	76,890	4,352	81,242	49,526	4,855	5,904	2,817	94,818
2014	76,890	5,102	81,992	50,201	4,922	5,960	2,898	95,772
2015	76,890	5,724	82,614	50,955	4,996	6,014	2,981	96,605
2016	76,890	6,536	83,426	51,526	5,052	6,062	3,049	97,589
2017	76,890	7,622	84,512	52,187	5,116	6,113	3,124	98,865
2018	76,890	8,970	85,860	53,072	5,203	6,175	3,220	100,458
2019	76,890	10,213	87,103	53,898	5,284	6,240	3,315	101,942
2020	76,890	11,365	88,255	54,932	5,385	6,311	3,426	103,377
2021	76,890	12,506	89,396	55,883	5,479	6,380	3,532	104,787
2022	76,890	13,494	90,384	56,652	5,554	6,445	3,624	106,007
2023	76,890	14,461	91,351	57,501	5,637	6,508	3,718	107,214
2024	76,890	15,370	92,260	58,198	5,706	6,567	3,802	108,335
2025	76,890	16,090	92,980	58,931	5,778	6,619	3,883	109,260
2026	76,890	16,661	93,551	59,710	5,854	6,667	3,962	110,034
2027	76,890	17,039	93,929	60,325	5,914	6,704	4,024	110,571
2028	76,890	17,309	94,199	61,006	5,981	6,735	4,086	111,001
2029	76,890	17,536	94,426	61,627	6,042	6,760	4,139	111,367
2030	76,890	17,663	94,553	62,196	6,098	6,778	4,185	111,614

Table 11: Average Water Use Per Service (x1,000 gallons)

Year	RMWS	RMWS Base	RFWS	SUFR	MMWS	GMWS	MIS
2003	156.76	167.82	205.62	97.23	432.32	696.72	1,050.09
2004	156.02	179.29	271.51	74.93	445.07	762.79	1,054.98
2005	143.01	162.88	270.00	82.95	409.78	824.57	1,043.45
2006	137.74	159..20	313.35	86.36	455.66	696.91	956.35
2007	150.37	168.59	331.82	73.50	440.38	682.93	1,047.21
2008	143.59	162.87	347.07	81.99	428.78	587.20	947.96
Average	146.94	166.61	271.54	84.28	435.00	707.22	1,013.15

The weighted average water use per service is multiplied by the projected number of water services to produce the annual projected water demand. The weighted average 2003-2008 water use per service is used as a way to compensate for variation in the weather conditions and number of active water services per year. The RMWS Base average use per service includes all existing RMWS, RFWS, and SUFR water services and is used as the base water use per service per year for current services. For new RMWS services the average of 147 thousand gallons is used. Table 12 shows the projected retail water sales and Figure 28 provides a graphical view of

the projected trends. Of note is the slow down of growth that starts after 2035. This is directly related to the slowing of population growth in these later years.

Table 12 includes projection for the individual wholesale areas. Each wholesale water service is projected from published facility plans or existing wholesale contracts, such as Sun Valley GID's updated facility plan in late 2007. Spanish Springs demands were extrapolated from historic water use. South Truckee Meadows demand was extrapolated to the year 2016 where the quantity demanded equals the current contract limit of 3,600 acre-feet per year.

Table 12: Projected Retail Water Use by Class Through 2030[26]

Year	RMWS	MMWS	GMWS	MIS	Total Retail	Sun Valley	Spanish Springs	South Truckee Meadows	Total Wholesale	Total Deliveries	System Loss	Total Production
2010	39,679	6,301	12,443	8,121	66,544	2,090	964	2,932	5,986	72,530	4,630	77,160
2011	40,255	6,336	12,545	8,277	67,413	2,130	1,018	3,088	6,236	73,649	4,701	78,350
2012	40,773	6,393	12,673	8,491	68,330	2,171	1,066	3,227	6,464	74,794	4,774	79,568
2013	41,278	6,483	12,814	8,759	69,332	2,212	1,109	3,351	6,672	76,004	4,851	80,855
2014	41,617	6,571	12,936	9,011	70,135	2,252	1,148	3,463	6,863	76,998	4,915	81,913
2015	41,897	6,668	13,053	9,269	70,889	2,293	1,183	3,565	7,041	77,930	4,974	82,904
2016	42,263	6,744	13,157	9,480	71,644	2,333	1,216	3,600	7,149	78,793	5,029	83,822
2017	42,753	6,830	13,268	9,713	72,564	2,374	1,246	3,600	7,220	79,784	5,093	84,877
2018	43,361	6,946	13,402	10,012	73,721	2,415	1,274	3,600	7,289	81,010	5,171	86,181
2019	43,922	7,054	13,543	10,307	74,826	2,455	1,301	3,600	7,356	82,182	5,246	87,428
2020	44,441	7,189	13,697	10,652	75,979	2,496	1,325	3,600	7,421	83,400	5,323	88,723
2021	44,956	7,314	13,847	10,982	77,099	2,536	1,349	3,600	7,485	84,584	5,399	89,983
2022	45,401	7,415	13,988	11,268	78,072	2,577	1,371	3,600	7,548	85,620	5,465	91,085
2023	45,837	7,527	14,125	11,560	79,047	2,618	1,392	3,600	7,610	86,657	5,531	92,188
2024	46,247	7,616	14,253	11,821	79,938	2,658	1,411	3,600	7,669	87,607	5,592	93,199
2025	46,572	7,712	14,366	12,073	80,725	2,699	1,430	3,600	7,729	88,454	5,646	94,100
2026	46,829	7,815	14,470	12,319	81,433	2,740	1,449	3,600	7,789	89,222	5,695	94,917
2027	47,000	7,895	14,550	12,512	81,957	2,780	1,466	3,600	7,846	89,803	5,732	95,535
2028	47,122	7,985	14,618	12,704	82,429	2,821	1,483	3,600	7,904	90,333	5,766	96,099
2029	47,224	8,066	14,672	12,869	82,831	2,861	1,498	3,600	7,959	90,790	5,795	96,585
2030	47,281	8,141	14,711	13,012	83,145	2,902	1,514	3,600	8,016	91,161	5,819	96,980

[26] System losses are estimated at 6 percent based on review of production and to metered consumption.

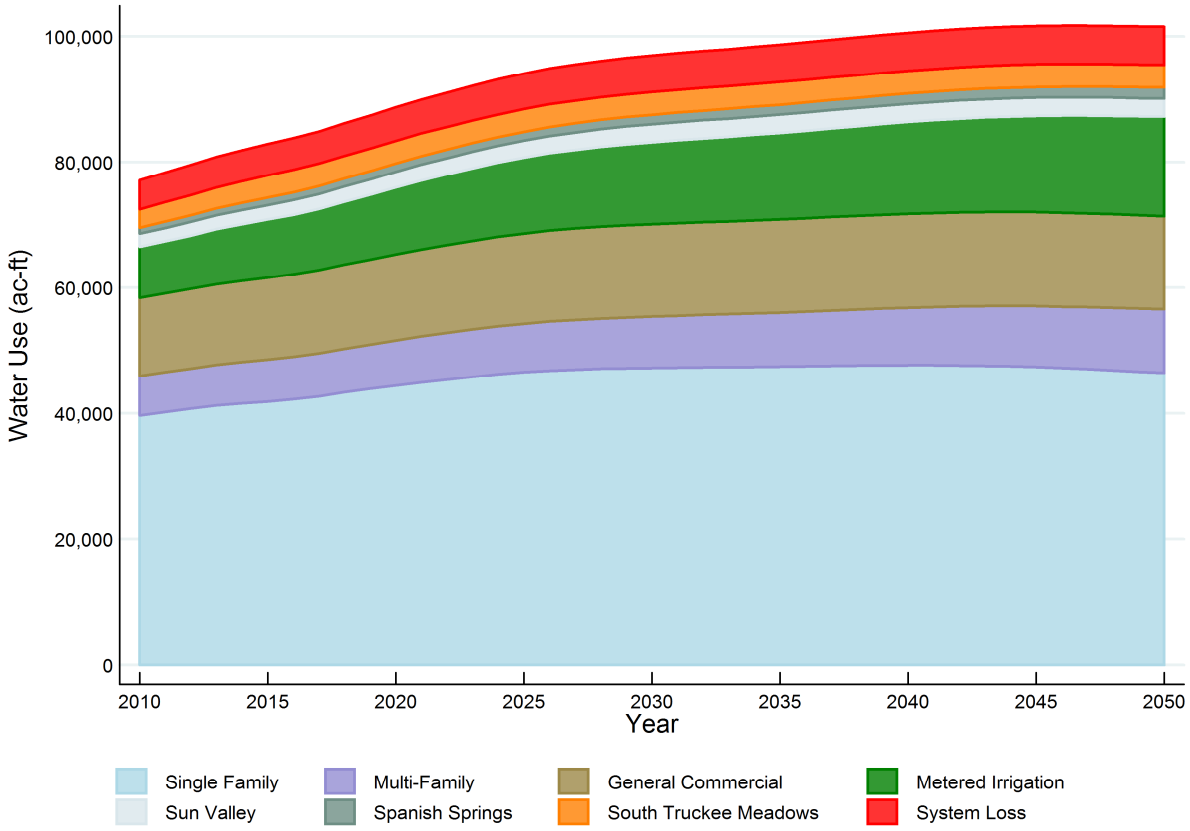

Figure 28: Projected Retail Water Use by Class Through 2050

Peak Day Projections

TMWA conjunctively manages its surface and groundwater production facilities, to satisfy the production requirements for both drought year and non-drought year conditions. Chapter 3 presented an overview of conjunctive management. Here, the facility planning goals are delineated further.

Production facilities are planned to meet two conditions. In "normal" years TMWA seeks to maximize the availability of surface water so more surface capacity is needed and used while groundwater pumping is minimized. Conversely, in Drought Situations TMWA seeks to maximize groundwater pumping so more well capacity is needed and used because reduced Truckee River flows prevent full utilization of available surface water production capacity. The projected demands indicate that "normal" year peak day demands increase from 136.8 MGD in 2010 to 171.9 MGD in 2030. Based on currently capacities -- 108.0 MGD surface treatment and 63.0 MGD groundwater – TMWA can meet the "normal" year peak day demand in 2030. However, during Drought Situations there is sufficient surface water supply is limited and groundwater capacity must increase 23.7 MGD, from 63.0 MGD to 85.7 MGD, in order to

maximize the use of TMWA's groundwater resources to meet 2030 Drought Situation peak-day requirements.

While drought years or other weather occurrences may see actual peak days varying from the non-drought year projections, the projections reflect the long-term trend in consumption, and the level of consumption to which system capacity must be able to respond. Projected peak day consumption during drought years is estimated to be non-drought year peak day consumption reduced by 5 percent. Historical data shows that peak day consumption has been reduced between 2 percent and 11 percent from prior year consumption when the Truckee Meadows has been experiencing drought. The projected rated surface water treatment and groundwater well production requirements are shown in Table 13.

Table 13: Projected Peak Day and Production Facilities Requirements

	Estimated Production	Non-Drought Year, Peak Day Consumption	Drought Year, Peak Day Consumption	Production Faciltities Requirements		
				Surface	Ground	Combined
	Acre-Ft	MGD	MGD	MGD	MGD	MGD
2010	77,160	136.8	129.9	108.0	63.0	171.0
2011	78,350	138.9	131.9	108.0	64.7	172.7
2012	79,568	141.0	134.0	108.0	66.3	174.3
2013	80,855	143.3	136.1	108.0	68.0	176.0
2014	81,913	145.2	137.9	108.0	69.7	177.7
2015	82,904	146.9	139.6	108.0	71.3	179.3
2016	83,822	148.6	141.1	108.0	73.0	181.0
2017	84,877	150.4	142.9	108.0	74.7	182.7
2018	86,181	152.7	145.1	108.0	76.3	184.3
2019	87,428	155.0	147.2	108.0	78.0	186.0
2020	88,723	157.2	149.4	108.0	79.7	187.7
2021	89,983	159.5	151.5	108.0	81.4	189.4
2022	91,085	161.4	153.4	108.0	83.0	191.0
2023	92,188	163.4	155.2	108.0	84.7	192.7
2024	93,199	165.2	156.9	108.0	85.7	193.7
2025	94,100	166.8	158.4	108.0	85.7	193.7
2026	94,917	168.2	159.8	108.0	85.7	193.7
2027	95,535	169.3	160.9	108.0	85.7	193.7
2028	96,099	170.3	161.8	108.0	85.7	193.7
2029	96,585	171.2	162.6	108.0	85.7	193.7
2030	96,980	171.9	163.3	108.0	85.7	193.7

Total production capability shown is greater than projected peak day consumption, be it groundwater in non-drought years or surface water in drought years. This cannot be avoided since water supplies dictate which facilities will be utilized in any given year. The projections shown here, however, reflect the minimum amount of production capacity required to maximize the yield of TMWA resources (as constrained by both the drought and non-drought scenarios).

The reader should note that existing surface capacity is sufficient to meet the 20-year planning horizon projection.

TMWA's 2005-2025 Water Facility Plan will need review to determine if changes in any facilities and/or their timing are warranted as a result of the current 2030 peak day forecast.

Summary

This chapter included TMWA's population forecast, water demand forecast, factors impacting the demand forecast, and peak day projections. The results are summarized:

1. A long term population projection through 2050 is developed using historic county population estimates from 1950 to 2008.
2. In the near term the economy is expected to be the constraint on population growth. Through the year 2030 the County is expected to see an average annual growth of 1.33% and a total population increase of 130,430 persons.
3. New water services are projected using historic building trends derived from Washoe County Assessor's data and a relationship between water services and County building inventories.
4. Using recent trends in average water use per service for 2003 to 2008 combined with projected new water services, water demand is projected through 2030.
5. Extrapolation of building trends and water demands show a plateau in water demand starting in 2035. Total water demand in 2030 is projected to be about 97,000 acre-feet.
6. Over 111,000 active water services are projected for the year 2030.
7. Peak day for 2030 is projected to be 171.9 MGD for non-drought year.
8. In developing the water demand forecast, TMWA's population forecast was found to be similar to State Demographer 2008 projection for Washoe County.
9. The projected peak day demands are a reasonable estimate to be used for planning future facilities. Just as managing the water resources in conjunctive manner produces the maximum committable yield of those resources, projected peak days under drought and non-drought conditions seek to maximize the use of surface and groundwater resources. In doing so the capital investment in additional production facilities is minimized.

Chapter 5 Water Demand Management

Water demand management is one of the key building blocks of integrated resource planning. It has been defined as the development and implementation of strategies, policies, measures or other initiatives aimed at influencing demand, so as to achieve efficient and sustainable use of the scarce water resource (Savenije and van der Zaag, 2002).

TMWA takes its role as steward of the region's water resources seriously. Whether through its commitment to sustainability of the region's ground and surface water sources, or as a result of regulation, TMWA's goal is to promote the wise and efficient use of water resources and the prevention of water waste through its water demand management programs.

Unlike many communities that utilize demand management programs to conserve water that can be reallocated to serve new growth, in essence creating a new water supply, TMWA can assure its customers that conserved water is used for their benefit as drought and emergency reserves or to benefit the health of the Truckee River system. Unused water rights associated with commercial or wholesale customers can be reallocated. Demand management programs reap many benefits, the most obvious of which are:

- Delayed need for future facilities or deferred timing of those facilities, and the cost associated with those facilities,
- Increased drought protection for the community as conserved water can be stored in upstream reservoirs
- Environmental benefits as a result of increased river flows (benefits riparian habitat and wildlife)
- Less water consumed means less energy required to produce and deliver water to customers as well as less energy consumed to process wastewater.

TMWA's water demand management programs must fulfill certain specific provisions, including water conservation requirements per the Joint Powers Agreement ("JPA"), which formed TMWA, the Nevada Revised Statutes ("NRS"), TROA, and regional planning, each of which are detailed below.

JPA Conservation Objectives. Article 5(i) of the JPA that formed TMWA requires the utility to "prepare, update and oversee the implementation of a water conservation plan for the use of municipal, industrial, and domestic water supplies within the retail service area of the Authority and to carry out the former Sierra Pacific role with regard to the Water Conservation Agreements with Members."

NRS Conservation Objectives. In addition to Article 5(i), TMWA is required to meet NRS 540.131 through 540.151, which calls for a conservation program that provides:

a) Methods of public education to (1) increase public awareness of the limited supply of water in the State and the need to conserve water, and (2) encourage reduction in the size of lawns and encourage the use of plants that are adapted to arid and semiarid climates;

b) Specific conservation measures required to meet the needs of the service area, including, but not limited to, any conservation measures required by law;

c) Management of water to (1) identify and reduce leakage in water facilities, inaccuracies in water meters and high pressure in water supplies, and (2) increase the use of treated effluent;

d) A contingency plan for drought conditions that ensures a supply of potable water;

e) A schedule for carrying out the plan; and

f) Measures to evaluate the effectiveness of the plan.

Truckee River Operating Agreement Along with other parties, TMWA is responsible to implement the water conservation element of TROA. The TROA Water Conservation Agreement was signed in July 1996 by PLPT, Sierra, Reno, Sparks, and Washoe County and signed off by the other TROA parties under the terms of the TROA agreement. Section 29(e) of the PSA stipulates that as a result of the agreement, the signatories will not make further determination whether such design criteria (10%) is met in ensuing drought situation years and agreement sets forth the parties' intent that because that agreement provides for normal year and drought year conservation that there will not be any further determination of whether the 10 percent design criteria has been met. TMWA submits reports annually to the signatory parties showing that the specific requirements are met.

The agreement requires TMWA to spend a minimum of $150,000 per year for landscape efficiency programs. The amount is in addition to $50,000 per year for public education and $100,000 per year for water waste prevention and water-saving device giveaways. TMWA has consistently spent in excess of $500,000 per year on water conservation consultants, devices, educational materials for school programs, Assigned-Day Watering communications, and a myriad of other educational materials dedicated to responsible water use.

The WRWC and its NNWPC are charged with overseeing and coordinating water resource planning and management in Washoe County including responsible water use planning. A priority of the NNWPC and WRWC work plans is to develop a new responsible water use plan for the region, replacing that which they inherited as part of the RWMP.

As the largest water purveyor in Washoe County, serving approximately 85% of the region's municipal water customers, TMWA is a key player in developing the region's responsible water use mission and will be integral in implementing programs that support that mission. It is highly likely, at least in the near-future, that TMWA's programs will continue to serve as the cornerstone of the region's efforts. TMWA will continue to be fully engaged in the regional dialogue on responsible water use and will implement programs for its customers that benefit the region and regional water use goals.

Since 1979, the community has evolved toward a metered water system by first metering all commercial and irrigation services. A formal program to retrofit of all TMWA's remaining flat-rate residential services began in earnest in June 1995. As of this plan, TMWA has completed the meter conversions on the original 42,000 single family residential water services that required retrofit when the program started in 1995. Finishing the retrofit program was a condition of NRS and a requirement of the Preliminary Settlement Agreement; this is a significant accomplishment toward implementing the Water Conservation Agreement that is part of TROA.

TMWA's water demand management strategy is comprised of many programs grouped under three headings:

System Management

Public Education

Other Demand Management Measures

The specific programs, the target audiences, and the primary benefit to TMWA of each program are summarized in Table 14.

Table 14: Water Demand Management Programs

	Primary Benefit	Target Audience
A. System Management		
Coordination of Treated Effluent Use	3, 4	Irrigation
Leaks and System Repairs	1, 4	All users
Meter Replacement	1	All users
Non-Potable Water Service	3, 4	Irrigation
System Pressure Standards	1, 4	All users
Unauthorized Use of Water	1, 4	Construction
B Public Education		
Assigned-Day Watering	1, 2, 3, 4	All users
Distribution of Water Savings Devises & Information	1, 2	Residential
Education Programs for Kids	2	Children
Homeowner Workshops	1, 2	Residential
Landscape Retrofit	1, 3	Irrigation & residential
Water Audits	1, 2	Residential & business
Water Waste Prevention	1	All users
C. Other Measures		
Codes and Ordinances	1	All users
Program Management and Droughts	1, 2, 3, 4	All users
Program Management and Emergency Supply Conditions	1, 2, 3, 4	All users
Water Management Programs	1, 3	Large water users
Water Rates	1, 4	All users

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1 - Reduces water waste
2 - Education
3 - Peak day savings
4 - Minimize operation and maintenance to distribution facilities

System Management

Coordination of Treated Effluent Use with Local Agencies. Providing service connections with effluent leaves capacity for new municipal demand that requires treated water, enabling existing potable water resources to go further. TMWA cooperates with Reno, Sparks and Washoe County to ensure that the use of treated effluent is being applied for irrigation purposes at suitable sites where the infrastructure is, or is planned to be, installed. TMWA's rules require that new service applicants submit verification whether or not the site applying for municipal, treated water is designated to be or is within feasible range to be serviced by effluent water. If the project meets the effluent provider criteria for service, treated effluent will be provided for irrigation purposes instead of potable water from TMWA. Replacement water rights are provided as required by TROA.

Leaks and System Repairs. TMWA is aggressive with repairs of water main breaks and leaks. Of primary concern is assessing public safety and safety of work crews, minimal interruption to public and private services, as well as minimizing overtime expenditures. If water leaks are not large, not causing a safety problem, and are reported outside normal working hours, field supervisors will determine the urgency of the needed repairs and schedule repair work accordingly.

When the source of the leak is determined and the appropriate underground locations of other utilities are completed, the crew will excavate the leak site and make repairs. In the case of a leaking poly-butylene pipe, the crew will usually replace the entire service, as this type of pipe has proven particularly prone to repeated leaks. All leaks are reported and entered into a database. Since its inception in 2001, TMWA has replaced over 263,000 feet of main, and repaired 1,581 specific leaks.

Meter Replacement. TMWA has implemented an effective meter replacement program which targets the elimination of water waste by replacing meters within 15 years of their installation date to ensure they remain accurate since the internal working of the meter wear out. TMWA spends approximately $5.7 million annually on meter replacements. As meters are replaced, additional water savings may be achieved with this measure since improvements are made to the system when leaks in older facilities are found and repaired when the meter is replaced.

Non-Potable Service TMWA has a Non-Potable Service ("NPS") tariff to provide sources of untreated water to sites that can use untreated Truckee River water or poor quality ground water for non-potable applications with minimal capital investment. Non-potable water service is available at a reduced rate, providing incentive for qualified customers to switch to this service. The service reduces TMWA peak day demand and lowers system capacity needs. Irrigation and construction sites utilizing this NPS conserve potable water enabling existing water resources to go further.

Specific facility needs for each service connection are identified in the service agreements between TMWA and the customer receiving non-potable service. The recipient of the service demonstrates each site's ability to tolerate the interruptible nature of the service (due to system or drought requirements) and/or the potential to switch between treated and untreated water.

System Pressure Standard. Pursuant to NAC 445A TMWA engineering design criteria plan for a max-day-demand-residual pressure of 40 be maintained at the customer's service connection. Pressures exceeding 125 PSI may increase the possibility of main breaks or accelerate the development of leaks, both on TMWA and the customer facilities. Excessive pressure results in more water delivered through the tap since flow rate is proportional to pressure. This can result in such forms of water waste as sprinkler overspray, faucet splashing and higher leakage flow rates.

Unauthorized Use of Treated Water Use of water without dedicated water rights, or for temporary purposes without TMWA's permission, is illegal. Examples of unauthorized use may include when there are two active service lines to one premise with one service that is not being billed, an illegal tap off a fire main, or an unauthorized hook-up to a fire hydrant. TMWA's rules and tariffs are designed to cover all costs to the utility in cases of illegal service taps, damage to TMWA facilities, and/or theft of water. Use of fire hydrants as a water source is also illegal under City ordinances except for City vehicles. TMWA monitors its system to locate and correct unauthorized water use on an ongoing basis.

Public Education

TMWA is deeply committed to public education about conservation and responsible water use. Because water use during the irrigation season is four times higher than during the winter months, much of TMWA's public education focuses on the efficient use of water on the landscape.

Assigned-Day Watering. Since 1987, TMWA has sponsored an advertising campaign for Assigned-Day Watering during the summer months, and for a fall cool-down period during the autumn months. It began as a voluntary program to spread the use of water more evenly throughout the week and reduce total weekly and daily water production used for landscape irrigation. The program calls for watering deeper and less often, and assigns days of the week when customers may water.

In 1996, the program became mandatory twice-per-week watering until such time that TMWA's flat-rate services were retrofit with meters. Outdoor watering is limited to a customer's assigned days (based on address) and watering between 1:00 p.m. and 5:00 p.m. is prohibited. TMWA continues to implement Assigned-Day Watering to help manage the delivery of water throughout the distribution system. Currently, this method enables residential services to water on Wednesday and Saturday, for even addresses, or Thursday and Sunday, for odd addresses. Commercial properties are assigned Tuesday and Friday for outdoor watering. Monday is used as a day for system recovery with no customer watering on this day.

TMWA was required to utilize twice-a-week watering, per the terms of the 1996 Conservation Agreement as part of the Preliminary Settlement Agreement, until such time at least 90 percent of its flat-rate, services residential were metered. As discussed earlier in this chapter, TMWA's predecessor, and subsequently TMWA, embarked on a meter retrofit program in June 1995 to meet this goal. TMWA has now retrofit its flat-rate residential services to meters

thereby enabling TMWA's Board of Directors to modify the current watering schedule if appropriate.

Prior to changing the current watering schedule, however, TMWA staff assessed the impact of potential changes on TMWA's system and pressure zones. As a first step, and in an effort to gain better understanding of system-wide, average daily summer usage and assigned day water usage, TMWA began in 2004 testing alternate day watering schemes in three different neighborhoods. This was followed by a daily water demand study conducted between June 2, 2006 through August 15, 2006. Follow-up studies during the summers of 2007 and 2008 tracked peak day usage system-wide and focused on targeted specific pressure zones and neighborhoods (see Appendix I). This micro-level data, when combined with the system-wide water demand data, enabled TMWA to thoroughly assess the impacts of a modified watering schedule on all parts of its system and in particular, measure the impact on water service to customers, if any, during peak times. Those studies indicate that (1) more than one-half of all customers currently water more than twice-week; (2) a change from two-day-a-week to three-day-a-week watering is not expected to increase peak day water, it may actually decrease peak day use; and (3), total water use during the peak week is not expected to change. Thus, revising the Assigned-Day Watering schedule will not impact existing facilities or their operation.

All of the measures outlined in this chapter comprise TMWA's plan for conservation in every year through 2030 regardless of whether it is a Drought or non-Drought Situation. However, TMWA increases conservation efforts during droughts. The goal during droughts is to further reduce water use in the event successive drought years are experienced. Since the current Assigned-Day Watering schedule effectively keeps the community on a Stage Two drought alert, any future modifications to the current watering schedule should be made simultaneously with changes to the current response plan to Drought Situations. In addition, any proposed revisions to the drought plan would be conditioned upon the installation of water meters on all old and new residences within TMWA's service area, excluding existing unmetered apartments and condominium units or complexes which have all outdoor irrigation metered. Once this condition is satisfied, all services would be switched to and paying a metered rate for water service. In 2010, as TMWA completes its conversion to a fully-metered and volumetric-billing water system, it is anticipated that the Assigned-Day Watering will transition from mandatory twice-per-week watering to a program of three-times-per-week watering. No watering on Monday will be retained to ensure time and flexibility for system recovery. The revised water days schedule and restrictions on times of the day under Assigned-Day Watering is summarized here:

	MON	TUE	WED	THR	FRI	SAT	SUN
All "EVEN" addressed services	No	Yes		Yes		Yes	
All "ODD" addressed services	No		Yes		Yes		Yes

Along with the Assigned-Day revision and to discourage watering during the hottest, and typically the windiest part of the day, the restriction on time-of-day watering will expand to 12:00 P.M. to 6:00 P.M. from its current time restriction of 1:00 P.M. and 5:00 P.M. for the days between Memorial Day and Labor Day.

Distribution of Water-Saving Devices and Information. TMWA utilizes every opportunity to promote responsible water use by attending public events and distributing information. Organizations can request that TMWA present conservation advice to a specific

audience. TMWA's residential water guide provides water savings tips for indoor and outdoor water use, as well as some general usage information about TMWA services, leak detection and repair, and how to read your water meter.

Doorhangers are left whenever a TMWA conservation consultant has visited a home or business to remind customers of their watering times. Bill inserts remind customers of both summer and winter habits that can conserve water. TMWA also uses its billing system to print conservation messages and facts directly on customer's bills. A conservation section at TMWA's Web site (www.tmh2o.com) that provides indoor and outdoor water conservation facts and tips, and videos and animations that describe our water system and how we manage it for municipal purposes.

A key part of TMWA's educational messaging centers on understanding our region's water resources. TMWA's website (www.tmh2o.com) includes information on our water supply and how its managed. A key resource, launched in 2009, is the Truckee River Flows and Storage website at www.tmwastorage.com. This site includes a module that specifically tracks water storage in the largest reservoir on the Truckee River system, Lake Tahoe.

TMWA's "How Do You Save?" web site is a fun, interactive Internet site that allows visitors to post their tips for how to use water responsibly, view tips posted by others, and email tips of use to others. The site is located at www.howdoyousave.org.

Further, local weatherpersons act as liaisons between TMWA and the community by featuring information on the water supply, conservation, and Assigned-Day Watering during their weather forecasts.

Educational Programs for School Kids. TMWA provides EPA teaching materials for grade schools that meet the Nevada standards for science curriculum. Children are introduced to a subject and build their knowledge base with each grade that they progress through. Teachers are able to download the materials directly from the Internet, through TMWA Academy (www.tmwaacademy.com). The TMWA Academy Web site was created especially for teachers and students in the Truckee Meadows. It provides lesson plans and information for all grade levels of students and teachers on water in northern Nevada.

TMWA sponsors an annual poster contest that enables children from throughout the community to develop slogans and pictures highlighting the need for conservation. Winning poster art submissions are made into book covers and/or bookmarks which are distributed in cooperation with Washoe County School District. Throughout the year, TMWA staff members attend kids' fairs, give classroom and after-school presentations, and host water system and treatment plant tours for school kids.

TMWA continues to solicit input from its customers through its Standing Advisory Committee, an oversight committee made up of individuals representing all customer classes. TMWA also regularly engages with green industry representatives and landscape professionals in the area to ensure the effectiveness of water conservation programs and to assess partnership opportunities.

Homeowner Workshops. TMWA regularly partners with Washoe County to offer a 'Common Sense Gardening Series' at Rancho San Rafael, a regional park with an extensive arboretum. The arboretum contains examples of low water-use plants and native plants. TMWA

is co-sponsoring seminars that address design, operation and maintenance of irrigation systems, and related matters.

Landscape Retrofit Program. The landscape retrofit program encompasses promotion of water-efficient and climate-compatible landscapes in our high desert environment. TMWA has a well-known publication titled Water-Efficient Landscaping in the Truckee Meadows with ideas for yard designs, irrigation layout, plant selection, and maintenance. The online, interactive version of the landscape guide allows users to search for plants that meet desired criteria such as low water use, sun exposure, bloom time, native species, and more.

In partnership with local nurseries and NevadaHome magazine, TMWA coordinates an annual Water Efficient Landscape Awards Program that recognizes homeowners and professionals who have designed and installed water-efficient landscapes. Also, as part of its landscape retrofit program, TMWA has worked with area schools on large-area turf replacement.

In 2008, TMWA, in conjunction with other agencies and professionals engaged in urban forestry and landscape improvement programs, created the Truckee Meadows Community Forestry Coalition ("Community Forestry Coalition"). The purpose of the Community Forestry Coalition is to promote a sustainable community forest in and around the Truckee Meadows, recognizing the benefits of both public and private trees. Trees provide substantial environmental, economic and aesthetic benefits to the community; however, tree care needs, especially watering requirements, are not obvious to the average resident. Local arborists are concerned that growth in the area and the conversion to a fully-metered water system has resulted in tree losses throughout the community.

TMWA's involvement in the Community Forestry Coalition reflects its interest in implementing Best Landscape Practices ("BLPs") that achieve water-efficient landscapes. In 2009, the Community Forestry Coalition developed an educational Web site for tree care geared toward residents of the Truckee Meadows (www.communityforestry.org). The site articulates the values and benefits of the region's trees and serves as an educational resource for urban-forestry related programs and regulations. It also provides easy-to-follow tree care practices for homeowners. By year's end TMWA will update its landscape guide to include an updated list of climate-compatible trees as well as tree care practices with particular emphasis on practices that improve the water efficiency of trees in the landscape.

As part of the Community Forestry Coalition, TMWA participates in the annual Backyard Tree Care Workshop put on for homeowners each year.

Water Audits/Water Usage Review. In 2003 TMWA piloted a residential water audit program. The program was expanded to include commercial customers in 2005. As of December 2008, more than 7,000 customer reviews were completed (see Table 15). TMWA's Water Usage Review Program is co-sponsored by TMWA and the Northern Nevada Water Planning Commission.

Table 15: Water Usage Review by Year and Type

	Residential Reviews	Commercial Reviews	Total Reviews	Cumulative Total
2008	2,196	265	2,461	7,052
2007	1,804	221	2,025	4,591
2006	661	70	731	2,566
2005	771	123	894	1,835
2004	431	66	497	941
2003	402	42	444	444

Customer response to TMWA's Water Usage Review Program is extremely positive. Participating customers are typically keen to print conservation messages and facts directly on customer's bills. TMWA features a conservation section at its website (www.tmh2o.com) that provides indoor and outdoor water conservation facts and tips, and videos and animations that describe our water system and how we manage it for municipal purposes. While the majority of water usage reviews are initiated by a customer concern about a high bill, TMWA monitors spikes in water use to proactively assist customers achieve balance between water savings and healthy landscaping.

Water Waste Prevention. TMWA has permanent full time water use consultants as well as hires temporary, seasonal consultants during the summer months to consult with customers about leaks and water waste, provide outdoor watering advice to customers, and help high bill customers reduce their water consumption. TMWA's water conservation consultants investigate water waste complaints and provide tips to customers that help curb water usage.

In 2004 TMWA enhanced its rules by adding penalties which are billed directly to a customer for water waste violations and for watering on non-assigned days or times. These rules provide for a one-time warning followed by an increasing penalty of up to $75 per occurrence for repeat violations.

Other Conservation Measures

Codes and Ordinances TMWA is working with local agencies to require landscape designs that make sense in our high desert environment. The Cities of Reno and Sparks, and Washoe County (April 2002, July 2002, and March 2002 respectively) have enhanced ordinances that support TMWA's conservation efforts and allow enforcement of penalties to water wasters. The ordinances give TMWA's Board of Directors authority to recommend to the local governments that a water emergency be declared with associated watering restrictions. A copy of the waste water and water emergency ordinances are contained in the 2025 WRP Appendix.

Demand-Side Program Management and Droughts. During droughts affecting the Truckee River watersheds the TMWA's customers are expected to reduce water use. Depending on the severity of the drought and the amount TMWA's drought reserve water supplies (i.e.,

Independence Lake, Donner Lake, and extra groundwater pumping drought reserves) that may be drawn upon during a Drought Situation, the aforementioned conservation measures may be modified to achieve targeted and/or necessary water reductions to preserve TMWA's drought reserve water supplies. Similar to past drought responses in previous water plans, the need to change customer uses in response to a Drought Situation may vary during the year.

Currently and under TROA, the determination of a Drought Situation takes place in April. That determination indicates the amount of water available for the Truckee River system and provides an early indication as to when river flows will no longer support Floriston Rates (which is always associated with Lake Tahoe elevations at or near the rim). TMWA's and the region's current water plans link conservation actions during droughts to the loss of Floriston Rates. When Lake Tahoe's elevation is projected in April to be greater than 6225.5 feet by November 15 it means that at a minimum, normal Truckee River flows are expected to be available for the rest of the year and into the following year. No shortages or interruptions in Truckee River flows are anticipated over the course of the year. When Lake Tahoe's elevation is projected to be between 6225.5 and 6223.50 feet by November 15 it means that the region has experienced one or more consecutive, below average snowpacks and correspondingly below normal streamflow runoff seasons, and that the elevation of the lake is declining year over year. Carry-over storage used to meet Floriston Rates is being depleted. Normal Truckee River flows are expected to be maintained through the summer and fall months and TMWA's reserve water supplies are not expected to be used and water production operations will not be negatively impacted. TMWA is closely monitoring the Truckee River water supplies as far as reservoir storage is concerned because historical data suggests that shortages or interruptions in Truckee River flow could occur sometime within the current year and the next year, particularly with a below average snowpack season. Finally, when the projected amount of Floriston Rate water stored in Lake Tahoe (including Floriston Rate water stored in other reservoirs as if it were in Lake Tahoe) on or before the following November 15 will be equivalent to an elevation less than 6223.50 feet Lake Tahoe datum, carry-over storage used to make Floriston Rates is likely to be exhausted by the end of the year; the elevation of the lake is expected to be at or below its natural rim; Truckee River flows are expected to fall off before the end of the year; and TMWA operations, either from a hydro power generation perspective and/or community water availability will be impacted. The elevation of Lake Tahoe and subsequent Truckee River flows could fall off significantly earlier than normal creating operational challenges for TMWA; forcing TMWA to use its additional groundwater pumping and/or back-up drought supplies (POSW stored in upstream reservoirs) in order to meet the demands of its water customers prior to November.

During droughts it is important to explain to customers (1) climatological conditions that have lead to reduced precipitation, reduced snowpack accumulations, and resulting lower Truckee River supplies; (2) the need to use water more efficiently; and (3) the degree to which TMWA water supplies will be affected. It is difficult for customers to understand why "less-than-normal" river flow conditions may or may not have an effect on TMWA water supplies. TMWA's conjunctive management of all its available water supplies (which include diversion of natural river flows, groundwater, artificial recharge, and POSW in upstream reservoirs) in a dry year usually avoids or minimizes any impacts on customers' uses.

The current response plan is based on declaring one of four Drought Stages: (1) No Drought; (2) Drought Watch; (3) Drought Alert; and (4) Drought Emergency. The current process is a climatological based declaration of a drought year and does not clearly link the drought level to available water supplies (both natural river flows and TWMA's drought reserve water supplies). This is very problematic from a public education perspective since under the current system the region is always in a "drought" stage with little connection between the drought stage and available water supplies, and leaves little room to reduce water use when severe actions may be needed. To improve customer understanding between climatologically induced droughts and water supply TMWA has developed and will implement as part of this 2030 WRP a simpler way to explain the impact of Drought Situations on available water supplies. The new classification system is presented in Table 16 along with changes in existing conservation measures that take place through the course of a Drought Situation year. This revision replaces the four-stage drought classification with a three-stage supply classification.

Using 2009 as an example demonstrates how this revised system would work. On April 15, 2009 a Drought Situation, Floriston Rates were expected to drop-off in October, and Tahoe would be at its rim on or before November 15, 2009. The condition was "Supplies are Adequate" because normal river flows were available past Labor Day, the loss of Floriston Rates did not occur until October, and there was no need to pump additional groundwater or release any POSW. Thus water supplies through the summer were "adequate" as were the implementation of TMWA's demand-side management programs.

Should the 2009/2010 winter produce a water year in 2010 similar to or less than 2009, another Drought Situation would be declared and the response most likely would be "Supplies are Impacted" because Floriston Rates would be projected to drop-off before Labor Day the and additional conservation actions may be necessary to avoid or delay use of TMWA's drought reserves.

This revised classification system will improve TMWA's ability to create more meaningful, easier to understand information campaigns that relate needed reductions in customer use to available water supplies.

Table 16: Demand-Side Program Management in Response to Drought Situations

	Non-Drought Situation	|------------------------*Drought Situation*----------------------|	
	Supplies are Normal	Supplies are Adequate (River Flows Drop-Off After Labor Day)	Supplies are Impacted (River Flows Drop-Off Before Labor Day)
-----------------a-----------------	------------b-----------	------------c------------	------------d------------
A *Assigned Day Watering*			
Monday	No water day	No water day	No water day
Even addresses:	Tuesday, Thursday and Saturday	Tuesday, Thursday and Saturday	Tuesday, Thursday and Saturday
Odd addresses:	Wednesday, Friday, and Sunday	Wednesday, Friday, and Sunday	Wednesday, Friday, and Sunday
B *Water Day Time Restrictions*			
Between Memorial Day and Labor Day	12 to 6 PM	12 to 6 PM	11 AM to 7 PM
C *Public Education & Advertising*	Standard programs	Standard programs	Increased programs
D *Water Waste Prevention*	Standard enforcement	Standard enforcement	Increased enforcement
E *Other Actions*			
Though not inclusive, these enhancements could be deployed depending on the severity of the circumstances and the potential impact to supplies			Expand water day time restrictions Reduce the number of watering days Set daily watering allotments Drought rates

NOTE: The use of the term "supplies" refers to (1) Truckee River water available from natural flows which are supported by releases from Federally operated reservoirs to support Floriston Rates and (2) TMWA's Privately Owned Stored Water held in Independence and Donner Lakes and Federal reservoirs.

Demand-Side Program Management and Emergency Supply Conditions. Natural disasters and other events can interrupt TMWA's available water supplies: these include floods, extreme low precipitation years, earthquakes, equipment failure, or distribution leaks. Sometimes the events are localized within the distribution system and sometimes the whole community can be affected. Chapter 2 characterized the nature and some of the potential risks to Truckee River water supplies. Chapter 3 described actions taken after the April 2008 earthquake. Other examples of events that have affected available river supplies include (1) a thunderstorm in July 1992 that caused a mudslide that sent a slug of muddy water into the Truckee River via Grey Creek and caused a shut-down of CTP; (2) in 1997 GTP was under water from the flood that year; and (3) in 1992 Floriston Rates dropped-off in June causing TMWA to use its POSW. All these types of events can affect TMWA's ability to produce water to minor or significant levels. When necessary during emergency events, the community is asked for and responds favorably to increased and more aggressive conservation messages and calls for water use reductions. Besides the progressive steps to be used under a Drought Situation, TMWA can call for mandatory water conservation, including watering restrictions (e.g., no outside watering or once per week during summer months), reduced laundry at commercial properties, use of paper plates in restaurants, no use of potable water for non-potable purposes, heavy fines for water wasters, drought rates, or other measures.

TMWA's goal is to minimize customer disruption when emergencies arise. TMWA personnel train for and practice responding to various emergency situations, which action has shown success during emergencies as water supply interruptions have been mitigated as swiftly and as cost effectively as possible. Increased conservation by TMWA customers during emergencies is just one element of successfully managing water supply interruptions.

Water Management Programs The Washoe County School District ("WCSD") is one of TMWA's largest municipal customers. TMWA prepared a Water Management Program for the School District to help them reduce water use on their sites, lowering their water bill, and reducing peak day demand for TMWA. For example, TMWA has worked with the WCSD to implement non-potable watering solutions at Reno High. Similar water management programs may be prepared for other large municipal customers in the future depending on interest.

A three-year evapotranspiration ("ET") Controller study was conducted from 2003 to 2006 at 20 commercial properties. Combined, the properties had over two million square feet, or 47 acres, of turf that was irrigated with the use of ET Controllers. The goal of the study was to better understand potential water use reductions gained through using ET Controllers when they were constrained to watering on only their assigned day. To measure water savings as a result of the installation of ET Controllers, a base level of water usage for each site was established by averaging its water usage between May to October in 2000, 2001, and 2002. Water usage for May to October of each study year was then compared to this base level.

Data shows that the total water savings for the 2003-2006 study properties, measured as the deviation from at each site from its base period water usage and using an average approach, was 15.4 million gallons. Data indicates that approximately 22.9 million gallons were saved over the 3-year study duration. (See Table 17 and Table 18) Additionally, the study confirmed that all the individual commercial sites that used the ET Controllers as intended benefited from water savings during the study period. However, not all sites benefited proportionately the same in each of the study years. The few sites that applied more water in relation to their established

base level either had system leaks, changes in ET Controller settings, or changes in landscaping during the study timeframe.

Table 17: Summary Results of 2003 ET Controller Study Sites

Site	PERCENT SAVINGS OVER HISTORICAL AVERAGE				THOUSANDS OF GALLONS SAVINGS REPORTING PERIOD MAY - OCTOBER			
	2003	2004	2005	Total	2003	2004	2005	Total
2003 Controller Group								
Vistas HOA	10%	11%	3%	**2%**	2,145	2,309	536	4,989
Coit Plaza	23%	9%	23%	**11%**	280	113	274	666
Greg Center- Bldg. A	8%	13%	3%	**7%**	164	259	67	489
Greg Center- Bldg. B	18%	21%	11%	**13%**	226	269	137	631
Greg Center- Bldg. C	43%	23%	14%	**22%**	416	223	138	778
Greg Center- Bldg. D	44%	19%	26%	**21%**	166	72	99	338
Manogue - Church	2%	10%	26%	**4%**	23	125	307	454
Manogue - Post Office	32%	13%	45%	**15%**	322	130	444	897
McCarran Landing	35%	49%	56%	**28%**	704	978	1,134	2,817
Redfield Promenade	18%	7%	33%	**8%**	735	293	1,339	2,366
Sierra Marketplace Office	29%	24%	17%	**18%**	411	344	245	999
TOTAL (THOUSANDS OF GALLONS)				**3%**	**5,591**	**5,113**	**4,719**	**15,423**

Table 18: Summary Results of 2004 ET Controller Study Sites

Site	PERCENT SAVINGS OVER HISTORICAL AVERAGE				THOUSANDS OF GALLONS SAVINGS REPORTING PERIOD MAY - OCTOBER			
	2004	2005	2006	Total	2004	2005	2006	Total
2004 Controller Group								
4840 Mill St	18%	26%	26%	**23%**	85	125	126	**335**
1301 Corporate Blvd	55%	49%	-30%	**25%**	267	240	(146)	**361**
3001 Skyline Blvd	18%	34%	26%	**26%**	66	125	96	**286**
1150 Corporate Blvd	42%	61%	65%	**56%**	364	523	559	**1,445**
4865 Longley Ln	35%	45%	-48%	**37%**	121	153	(165)	**109**
Northgate Village HOA	25%	20%	17%	**21%**	1,477	1,221	1,013	**3,712**
Cimarron HOA [R]	6%	-2%	-4%	**-7%**	447	(122)	(264)	**62**
Mill Creek HOA [R]	1%	5%	3%	**3%**	56	239	126	**421**
The Fairways HOA [R]	31%	0%	11%	**14%**	1,110	(13)	381	**1,478**
Lakeridge Shores HOA [R]	15%	21%	28%	**21%**	3,391	4,725	6,556	**14,673**
TOTAL (THOUSANDS OF GALLONS)				**16%**	**7,383**	**7,215**	**8,280**	**22,878**

Since completion of the Commercial ET Controller Study, TMWA has monitored developments in the smart controller field, including applications to the residential market. The National Association of Homebuilders and Builders Association of Northern Nevada standards call for smart controllers as part of all new development. States including California and Texas have recently adopted energy-saving legislation mandating all controllers sold in the state be smart controllers by 2010. Nevada is still unsure; however, Las Vegas is already headed in that direction.

Some of the key benefits of smart controllers include:

- They are recognized as more water efficient than non-smart controllers.
- They can help remedy the problem of overwatering.
- There are smart controllers that allow for the application of fertilizers and other soil amendments while the landscape is being watered.
- Some of the more common controller brands (e.g., Hunter) have a smart controller upgrade that converts the existing timer to a smart controller.

TMWA will evaluate the implementation of a residential smart controller rebate program.

Water Rates Metered customer rates are assessed using an inverted block structure with three tiers as described in Table 19 effective since June 2009.

Table 19: Metered Rate Structure.

	Tier 1	Tier 2	Tier 3
Single family residential	$ 1.63 per 1,000 gals 0 - 6,000 gals	$ 2.64 per 1,000 gals 6,001 - 25,000 gals	$ 3.05 per 1,000 gals 25,001 + gals
Multiple unit residential (per unit)	$ 1.63 per 1,000 gals 0 – 4,000 gals	$ 2.64 per 1,000 gals 4,001 + gals	
Commercial (tiers are defined by size of meter)	$ 1.63 per 1,000 gals	$ 2.64 per 1,000 gals	$ 3.05 per 1,000 gals

TMWA will continue to use a tiered rate structure for all non-irrigation service volumetric billing. Irrigation services pay under a seasonal rate structure. During the peak summer months of June through September, the rate per 1,000 gallons of flow is higher than during the off-peak months to encourage new plantings during cooler months.

Summary

TMWA has a comprehensive and extensive demand-side management program. As water supply conditions oscillate between normal and below normal snowpacks, TMWA and its customers are able to respond to the degree and duration of conservation warranted by supply conditions. TMWA will continually assess the benefits from these measures and may modify programs to reflect new practices and technologies. Success of a program is evaluated differently depending on the type of program, and may be measured by customer participation, water saved, estimated reduction of peak day usage, visibly improved water management practices, and number of children receiving water conservation education. This chapter has focused on TMWA's water demand management activities and how vital they are to system management, specifically sustainability of the water supplies, and finds that:

1. TMWA's water demand management programs meet the water conservation requirements of the JPA, NRS 540.313 through 540.151, and TROA.
2. TMWA will continue to be fully engaged in the regional dialogue on responsible water use and will implement programs for its customers that benefit the region and regional water use goals.
3. TMWA's water demand management programs pursue measures to efficiently use its available water resources by addressing water waste, system deficiencies (e.g., leaks, meter change out, pressure changes, etc.), public education and relations, watering schedules, and drought/emergency conditions. See Table 14 for details.

4. TMWA will continually assess the benefits of implemented programs and may modify programs to reflect new practices and technologies. Success of a program is evaluated differently depending on the type of program, level of participation, water saved, estimated reduction of peak day usage, visibly improved water management practices, or other measures.
5. Innovative ways treated influence demand will continue to be assessed, including expanded uses of effluent.
6. In conjunction with all services having a water meter, Assigned-Day Watering will change from 2 days-a-week to 3-days a week.
7. TMWA's management of its demand-side programs during Drought Situations progressively addresses the need to reduce water use as water supplies are impacted.
8. Demand-side management may be necessary in response to natural disasters and other events that have potential to interrupt TMWA's available water supplies.

Chapter 6 Future Water Resources

This 2030 WRP has demonstrated that TMWA currently and for the foreseeable future will continue to rely on the conversion of Truckee River water rights from irrigation to M&I use to meet projected growth. Pending the implementation of TROA which provides the ability to further utilize Truckee River water rights to meet demands up to 119,000 acre-feet annually, TMWA will continue to rely on the Interim Storage Contract (which will be superseded by TROA) in conjunction with the conversion of irrigation rights, optimize its recharge and conjunctive use opportunities, and if need be, begin to use some of the 8,000 acre-feet available from the North Valleys Importation Project should TMWA need resources to meet expansion of service in Lemmon Valley.

There are a number of water importation projects being pursued by private developers who are willing to bring these water supplies to the region. Also, the water supplies provided by TROA, ASR and conjunctive use can be timed either near term or into the future without losing the opportunity to pursue those projects. These water supplies are analyzed from the standpoint of long term water quantity and water quality because if the projects are not sustainable in perpetuity TMWA and its customers would be required to make up for such lack of water or water quality. However, to the extent these private developers find their projects to be environmentally permitable, cost effective and worth the financial risk they may take, TMWA would integrate these projects into its water resource supply mix and would accept will serve commitments against these supplies before other supplies are fully allocated.

Previous water resource plans identified various water supply projects that could be implemented to meet projected demands. Those projects still deemed potentially viable have been reiterated and updated for this chapter. In addition, new projects that may also be viable have been included. For this discussion it is assumed that future water resource projects will be implemented in the most economical fashion by the appropriate entity with the ability to assume the risk and invest the time and effort for permitting, design, construction, and financing of a water supply project - a function that TMWA does not currently perform.

Critical to any new water supply project is its yield or ability to provide water in a drought year, especially those projects that rely on the conversion of Truckee River irrigation rights to municipal use. The yield of a water right varies depending upon whether it is a wet or dry year. In dry years, the yield may be greatly reduced. To implement a reliable Truckee River water-right-dependent project two requirements must be met: 1) an adequate amount of existing irrigation water rights must be converted to municipal use, and 2) an adequate source of supply must exist from those rights during drought periods. Since groundwater rights are available for use at the same yield in both drought and non-drought years, projects that rely primarily on groundwater, such as groundwater importation projects, do not require additional drought supply contingencies.

The following is a list of potential water supply projects that TMWA and/or other purveyors may be able to use to expand future supply. Table 20 is based on data currently available and is by no means exclusive to any new combination or future configuration of how water resources could be integrated. All of the projects listed are available to the region; however, it is important to note that TMWA is not the project sponsor nor responsible for implementation for these projects, and may not be the direct beneficiary of the project's water supply. For example, three importation projects do not directly increase TMWA's water supply

yield but nevertheless are included since they would supply a portion of the regionally projected demands. Two of these projects are for Lemmon Valley and the third, Aqua Trac, is planned to supply water for the Fernley area, although there has been some suggestion that it may also provide water supplies to northern Spanish Springs.

Table 20: Potential Water Supply Projects.

Project	Estimated Yield	Irrigation Rights Required
	----a----	----b----
Groundwater		
Aqua Trac, LLP	80,000+	
High Rock Holdings & Juniper Hills Partners, LLC	10,000 - 14,000	
Intermountain Water Project	2,000 - 3,000	na
North Valleys Importation	8,000	
Red Rock Valley Ranch, LLC	1,300	
Sonterra	7,200	na
Surface Water		
Aquifer Storage and Recovery	8,000	8,000
Negotiated Settlement (TROA)	119,000	36,000
South Truckee Meadows Surface Treatment Plant*	6,700	8,000-12,000

Groundwater Projects

There are several importation projects being proposed and/or pursued in hydrographic surrounding basins immediately adjacent to the Truckee Meadows. Some of these projects are proposed to provide water supplies for the North Valleys and possibly Cold Springs. Other projects propose to export water from northern Washoe County to other communities in Nevada; however, it is possible that some of these supplies could be used to meet water needs in southern Washoe County. For example, Aqua Trac is in the preliminary planning and design stages to bring additional water supplies to Fernley, but the project has been suggested as a possible supply to northern Spanish Springs. Table 21 presents the estimated yields and the number of water rights appropriated for each of the hydrographic basins where potential groundwater importation projects are being proposed.

Table 21: Summary of Estimated Yield and Water Rights from Importation Basins

	Hydrographic Basin	Estimated Annual Yield	Active Municipal Rights	Active Irrigation Rights	Other Active Rights	Total Rights	Maximum Proposed Importation Quantity	
97	Honey Lake Valley	13,000	22,440	1,790	250	24,480	8,000	
99	Red Rock Valley	1,000	6	1,589	10	1,605	1,300	
78	Granite Springs Valley	4,500	4	5,149	217	5,370	80,000	
95	Dry Valley	1,000	4,445	26	-	4,471	3,000	
22	San Emidio	2,500	1,175	6,155	2,120	9,451	7,200	*
24	Hualapai Flat	6,700	9	29,506	6,954	36,470	14,000	

* Request for 7,200 af includes groundwater in both San Emidio and Hualapai Flat basins

Units are acre feet

Source: state engineer's water rights database; August & September 2007

Each importation project has a different place of use. North Valley Importation Project, sponsored by Vidler Water Company, and the Intermountain Water Project, and Red Rock Valley Importation projects propose to provide a water supply for Lemmon Valley and possibly Cold Springs. Aqua Trac was first introduced in 2004 and is in the preliminary planning and design stages to bring additional water supplies to Fernley, but has been suggested as a supply to northern Spanish Springs. Figure 29 shows the proposed pipeline routes of the various importation projects.

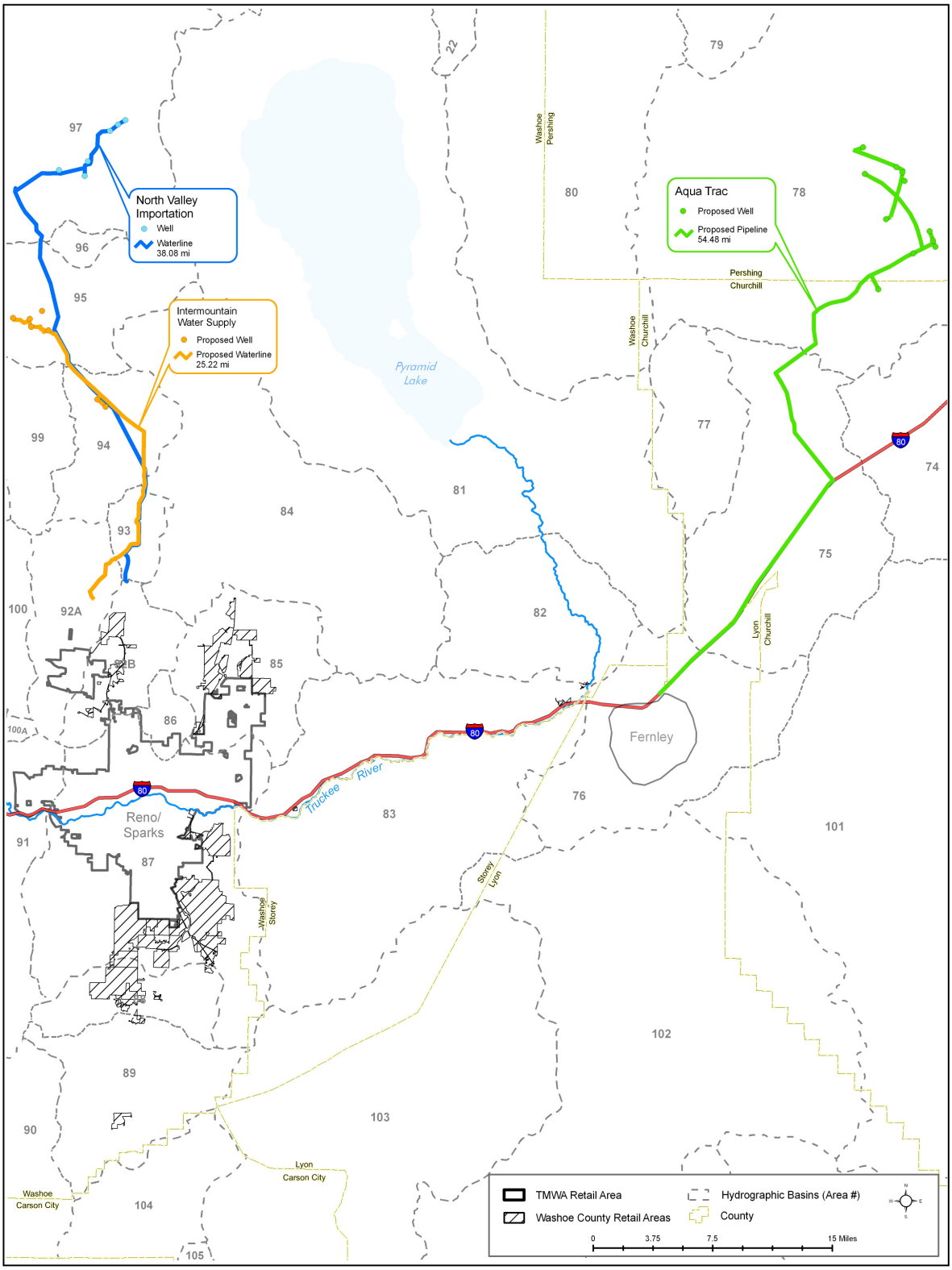

Figure 29: Proposed Importation Projects

Table 22 summarizes the status of proposed water importation projects in hydrographic basins outside of the Truckee Meadows. The descriptions that follow provide additional information on the projects. NVIP has been constructed and its water supply is available today while the balance of the projects is still in the preliminary development stages or permitting and therefore detailed information is limited. All of the projects listed are available to the region; however, it is important to note that private sponsors are responsible for implementation of these projects.

Table 22: Summary of Known Water Importation Projects

Project Name	Basin of Origin	Proposed Groundwater Quantity (af)	State Engineer Approval	Project Status	Approximate pipeline length
North Valleys Importation	Honey Lake Valley	8,000	Approved	Under construction	30 mi to North Valleys
Red Rock Valley Ranch, LLC	Red Rock	1,300	Pending a ruling	Pending, state & federal approvals	10 - 15 mi to the North Valleys
Aqua Trac, LLP	Granite Springs	80,000+	Applications to transfer denied 9/07	Pending, state & federal approvals	80 - 100 mi To Truckee Meadows
Intermountain	Dry Valley	2,000 - 3,000	Approved	Approved EIS	20 miles to North valleys
Sonterra	San Emidio & Hualapai Flat	7,200	Pre-hearing	Pending, state & federal approvals	100+ mi to Fernley / other
High Rock Holdings & Juniper Hills Partners, LLC	Hualapai Flat	10,000 - 14,000 *	Pre-hearing	Pending, state & federal approvals	100+ mi to Fernley / other

* includes groundwater and surface water importation

North Valley Importation Project ("NVIP"). The North Valley Importation Project is sponsored by Vidler Water Company ("Vidler"). The project was constructed and dedicated to Washoe County in July 2008; WDWR is responsible for the operation and maintenance of the project. NVIP is permitted to import 8,000 acre-feet of groundwater from the Honey Lake Valley Basin to Lemmon Valley. The project includes a well field, pump station, substation, and 28-mile transmission line.

After completing its Environmental Impact Statement, obtaining a Record of Decision from the US Department of the Interior, receiving approval from the State Engineer, receiving a

special use permit from Washoe County, and building a portion of the project, negotiations between PLPT and Vidler broke down and PLPT sued to halt construction citing potential negative impacts to PLPT's underground water rights. In June 2007, a settlement was reached between the parties in which Vidler Water Company agreed to limit the pumping and to pay PLPT $7.2 million and deed PLPT several thousand acres of real estate valued at $500,000. In addition, the parties agreed that in exchange for PLPT's agreement to not oppose additional permitting on the project, Vidler will pay them 12 percent of the gross sales price for water rights in excess of 8,000 acre-feet.

Intermountain Water Project ("IWP"). Sponsored by Intermountain Water Supply, Inc., the Intermountain Water Project proposes to import groundwater from Dry Valley and Bedell Flat to the North Valleys. A total of about 2,500 acre-feet per year is proposed for importation via 24 miles of water pipelines. Water delivered by the IWP will be available for use and distribution by either Washoe County or TMWA. The project will be constructed in up to three phases in order to match the demand for water in the North Valleys. Up to 1,500 acre-feet per year will be delivered in Stage One, with an additional 500 acre-feet per year each delivered in Stages Two and Three.

IWP has completed an EIS, and a Record of Decision that identified the Preferred Alternative has been issued by the US Department of the Interior. In addition, water use and inter-basin transfer rights for pumping in Dry Valley have been secured. The State Engineer has also approved a water right totaling 144 acre-feet per year for the IWP for Bedell Flat. At the time the Record of Decision was issued, an appeal and new water rights application were submitted by Intermountain Water Supply, the IWP sponsor, to the State Engineer for the remaining 356 acre-feet per year in Bedell Flat.

Red Rock Valley Importation ("Red Rock"). The Red Rock project proposes to bring between 1,000 to 1,300 acre-feet of water from the Red Rock groundwater basin to the north end of west-Lemmon Valley. TMWA entered into a purchase agreement with Red Rock subject to satisfying certain conditions of supply (e.g., 1,000 acre-foot minimum State Engineer permit) and facility construction. In January 2008 the State Engineer issued a permit for 855 acre-feet with conditions that allow the project to expand up to 1,273 acre-feet. TMWA has continued to work with Red Rock since it had contracted for first right of refusal should the project be built and able to deliver water.

Through 2008 Red Rock's project sponsors progressed with design and planning which lead to filing an application for a Special Use Permit with Washoe County in December 2008. The Board of Adjustment denied the application at its March 4, 2009 meeting and the BCC also denied an appeal in May 2009. Red Rock sued the BCC and anticipates a hearing sometime in late 2009.

Aqua Trac. In 2005 and 2006, Aqua Trac made numerous applications to appropriate water from Granite Springs hydrographic basin in amounts totaling over 90,000 acre-feet annually. In 2006, the project sponsors submitted a Right of Way Application to the U.S. Bureau of Land Management ("BLM Application"). Aqua Trac proposes to bring up to 20,000 acre-feet of water to Fernley. The BLM Application indicates that up to 11 wells may be developed along with 28-miles of 48-inch and 11 miles of 16-inch buried pipeline, two or three 2.5 million gallons storage tanks, and associated service roads and electrical support systems proposed as part of the project. The groundwater would be transported via a pipeline from the Granite

Springs Valley in Pershing County. If constructed, the imported water could be used to supplement municipal supplies in Fernley, Pyramid Lake tribal communities, and potentially to Spanish Springs Valley. A preliminary cost estimate for the well field and 26 mile pipeline is not known as of with this writing.

There are issues regarding the amount of sustainable water yield from groundwater sources in Kumiva Valley, Granite Springs Valley, and Winnemucca Lake Valley. Published US Geological Survey estimates show a much lower annual groundwater yield in each Valley than the project sponsor believes can be proven to the State Engineer. Further study is being conducted to better assess the sustainable yield, and the ultimate decision will be made by the State Engineer. Feasibility is dependent upon the findings of these studies, the outcome of the BLM Application, and the cost to construct the project.

On September 17, 2007 the State Engineer signed Ruling 5782 in which all Aqua Trac applications to appropriate the underground waters of Granite Springs hydrographic basin were denied based on: (1) insufficient water in the basins to support the application; (2) lack of identification of an amount of water to be used by a specific project or user; (3) no contracts in place with a water purveyor or other entity to put the water to beneficial use; and (4) no actual project identified to be constructed to use the water. It is not known at this writing what Aqua Trac's next steps will be nor the status of its BLM application.

Sonterra et. al. In June and July 2007, Sonterra Development filed the first batch of applications with the State Engineer to transfer at least 20,000 acre-feet of water per year from the Black Rock Desert area near Gerlach (in Washoe County) to Storey and Lyon Counties (specifically, Silver Springs, Stage Coach and Dayton). The groundwater rights together with a small surface water component proposed for export are primarily existing irrigation rights used for farming. All the applications associated with this exportation have now been protested by Washoe County based on: (1) availability of a long term sustainable resource beyond the already established yield estimates; (2) whether the applicant has justified the need to import the water from another basin as required under N.R.S. 533.370.6(a).; and (3), the State Engineer's consideration of demand for the resource within the County of origin.

Surface Water Projects

Aquifer Storage and Recovery ("ASR"). TMWA defines aquifer storage and recovery as the injection of treated surface water into the underground aquifer for later withdrawal. Chapter 3 provided a background of TMWA's recharge activities in the Truckee Meadows, Lemmon Valley, and Spanish Springs. ASR can increase the natural supply of groundwater by storing surface water underground when excess supply and treatment capacity exist, and by mitigating groundwater contamination. TMWA has equipped its production wells to allow for treated water to flow back into the wells under pressure during winter time operations.

Under TROA, TMWA can pump an average of 15,950 acre-feet annually which is included in the 119,000 acre-foot of demand TROA supplies. TMWA can pump groundwater in excess of 15,900 acre-feet annually with or without combining with other water rights as long as those other water rights do not rely on storage under the TROA. After TROA takes effect, new groundwater projects in excess of this 15,950 acre-feet can be pumped separately or paired with water rights that do not rely on TROA storage and will not be counted against TROA's 119,000

acre-foot demand. The greater the ability for groundwater drought-year pumping the greater surface water rights that can be supported thereby expanding the demands that can be made by adding more surface water rights.

This project would be in addition to the current Groundwater Management Order discussed in Chapter 3. TMWA will increase the amount recharged by 1,000 acre-feet per year in the non-drought years using groundwater rights not assigned to TROA or through acquisition of additional groundwater rights. This level of recharge will allow for an extraction of 4,500 acre-feet in drought years and this management of surface water and groundwater will support new service demands of 8,000 acre-feet.

To implement this resource, an additional 8,000 acre-feet of irrigation rights at an approximate cost of $200 million (8,000 times $25,000) must be dedicated to TMWA. TMWA projects 13 new wells capable of delivering a total of 13 MGD will be needed. Each well is estimated to cost $720,000 each; total capital cost for these wells would be $9.4 million. To facilitate the increase in recharge during non-drought-years, 14 MGD of surface water treatment would be required. The total project cost is estimated at $37.4 million in 2009 dollars.

Implementation of this project will require the location of at least 13 new well sites with good groundwater quality, otherwise a small treatment plant to treat this groundwater would be required with associated additional costs in the order of $42-56 million. This project would also require the approval of the State Engineer.

An additional ASR opportunity may exist with using WDWR well facilities in Spanish Springs for recharge; there may be sufficient capacity that could be used during drought years to extract additional groundwater. Assuming that all water rights owned by Washoe County in this area are fully committed to serve their present or future customers and to implement this project prior to TROA taking effect, TMWA would provide 1,400 acre-feet of recharge water annually to the wells in Spanish Springs. The yield is calculated by assuming that Spanish Springs would be served by Truckee River water eight months of the year and their full groundwater rights would be utilized during the four summer months for peaking in Drought Situations. No additional well capacity would be required to operate in this manner; however, additional injection, booster and/or pressure reducing facilities may be necessary. Prior to TROA taking effect TMWA may use any of its water rights for ASR. After TROA takes effect it will be necessary to ensure that the obligations to store water rights under TROA are fulfilled before water rights are utilized to support this project. The amount of water rights available to this project will be utilized to calculate how many surface water rights this recharge concept would support. The project would not count against TROA's 119,000 acre-foot demand limit.

Negotiated Settlement and the Truckee River Operating Agreement ("TROA"). The Negotiated Settlement ("Settlement") of the Truckee River will provide drought reserves for the Truckee Meadows as well as quiet much of the controversy surrounding the operations of the Truckee River system to provide our current water supplies. The Preliminary Settlement Agreement signed May of 1989 between Sierra Pacific Power Company and PLPT was a successful first step to begin solving many Truckee River issues. That agreement, assumed by TMWA, will allow TMWA to store its changed irrigation water rights and POSW in federal reservoirs for drought use in exchange for waiver of its hydroelectric water rights when TROA takes effect. Water rights currently owned by TMWA would be stored in the excess space in the federal reservoirs for use during droughts cycles. Some storage under TROA is firm storage

which does not evaporate of suffer losses unless it is the only water in the reservoir. Some storage is non-firm storage which spills when the reservoir fills and, in non-drought years, such storage in excess of certain base amounts is turned over to the US and PLPT to be used for recovery of endangered species and support of the fishery in the lower Truckee River. This settlement resource will support an annual demand of 119,000 acre-feet and, in addition, provide for additional drought reserves in the case of a worse than worst case drought. In 1990, Public Law 101-618 was passed that provides for the interstate allocation of water between California and Nevada on the Carson River, the Lake Tahoe basin, and the Truckee River basin subject to the finalization of TROA. The interstate allocation is an important resolution between the two states and gives TMWA the assurance of what water will continue to flow over the state line and into Nevada. TROA provides TMWA customers with certainty regarding the operation of the system and additional drought supplies for existing as well as new customers. The agreement creates benefits for those who do sign, and non-injury to the water rights of those who do not sign.

PL 101-618 also provided for an interim agreement to bridge the Truckee Meadows drought supply until TROA could take effect. This agreement will be superseded by the final TROA agreement. Some of the water rights that will need to be provided under TROA have already been provided and relied upon for new service commitments under the interim agreement.

Since the Settlement Act became law numerous additional benefits have been negotiated into TROA including new types of credit water that have been added to the categories set forth in the PSA; these include Water Quality Credit Water, California M&I Credit Water, California Joint Program Credit Water, California Environmental Credit Water, Additional California Environmental Credit Water, Fernley Municipal Credit Water, Newlands Project Credit Water and Other Credit Water. Additionally Minimum and Enhanced Reservoir Releases have been negotiated with guidelines for Preferred Instream Flows and Recreational Pools. There is a habitat restoration fund and Mandatory Exchanges for Donner Lake storage so that California can better meet their chosen instream flows and recreation pools in Donner Lake. Also a complex set of rules for exchange of water has been added.

TROA, signed September 6, 2008, was the culmination of 17 years of difficult negotiation of a new agreement for the operation of the federal reservoirs and TMWA's share of Donner Lake and Independence Lake. In order for the TROA to become effective, five mandatory signatory parties signed it: TMWA, State of Nevada, State of California, U.S., and PLPT.[27] As its name implies, the Truckee River Negotiated Settlement is a negotiated agreement among many parties. The Truckee Meadows community both gains and gives up something as part of the Settlement. TMWA and its customers are major participants to making the Settlement a reality and its customers are among the beneficiaries. Since TMWA's water customers are the taxpayers and sewer customers of Reno, Sparks, and Washoe County, many of the Settlement's benefits

[27] These other parties to also signed TROA: Carson/Truckee Water Conservancy District; City of Reno; City of Sparks; Sierra Valley Water Company; City of Fernley; Washoe County; North Tahoe Public Utility District; Truckee Donner Public Utility District; and Washoe County Water Conservation District.

overlap across jurisdictional lines in the Truckee Meadows. Many of the benefits have not and cannot be quantified for the purposes of the analysis as a resource but have been and will continue to be taken into account by the community in its support for the Settlement. In addition, since both states benefit from the interstate allocation of the Truckee and Carson Rivers and from the Tahoe Basin, there are other parties in the two states who indirectly benefit from the Settlement even without having participated.

Benefits and requirements of the Settlement are summarized below:

- Interim drought storage for the TMWA customers until Settlement becomes effective.
- Permanent drought storage for TMWA customers including emergency drought supplies during toxic spill conditions and worse than worst case droughts.
- Certainty associated with the Interstate Allocation of the Truckee and Carson Rivers as well as the Tahoe Basin between California and Nevada.
- Certainty regarding the continued operation of the reservoirs to support existing water rights.
- Improved flexibility of river operations to accommodate changing circumstances, policies and values while protecting historic water rights from injury.
- Improved timing of river flows for the threatened and endangered fish species in Pyramid Lake.
- Provides for enhanced minimum reservoir releases and protects from claims that would harm TMWA's water rights.
- Provides for increased recreational pools in the reservoirs.
- Provides for improved riparian habitat.
- Provides for improved water quality enhancement through flow augmentation and retiming of flow.
- Provides for reduced litigation and continued cooperation.
- Provides for water storage for California municipal and industrial use as well as environmental uses.
- Sets minimum bypass flows for the hydroelectric plants and protects from claims to the contrary and compensates for revenue reductions resulting from hydroelectric generation rather than demanding reduction in generation with no compensation.
- Provides for consistent dispute resolution.
- Provides reasonable and consistent rules for treated effluent reuse.

Although the development costs of TROA have been higher than predicted, it is probable that litigation costs would have exceeded the cost of negotiation. Most certainly the costs of uncertainty to the community would have grown as the issues in litigation grew. As shown by TMWA's conservation activities, the interim storage agreement, the Water Quality Settlement, the Tahoe-Truckee Sanitation Agency water quality settlement, PLPT's setting of water quality standards, and increased operations flexibility, the river system is already the beneficiary of

increased communication and cooperation, and solutions are being found regularly to areas of previous impasses.

Having been signed several steps need to occur before the agreement can be implemented. These include:

- Publication of TROA in the Federal Register (December 5, 2008) and its promulgation as a regulation (final on January 5, 2009). TCID, Churchill County and the City of Fallon have initiated litigation in the United States District Court challenging the regulation, including a challenge to the adequacy of the Final Environmental Impact Statement for the Operating Agreement.
- Modify the Orr Ditch Decree to accommodate changes required by the Operating Agreement (submitted to the court in United States v. Orr Water Ditch Company, et al. for approval of modifications to the Orr Ditch Decree on November 17, 2008). The motion has been opposed by TCID, Churchill County and City of Fallon. The court has not taken action on the motion.
- The United States and TMWA submitted a joint motion to the court in United States v. Truckee River General Electric Company to modify the Truckee River General Electric Decree on November 20, 2008. The Court entered an order modifying the Decree on December 22, 2008. TCID has stated that it intends to move to have this order vacated, but has not yet done so.
- Change petitions (filed in 2004) are pending approval by the California State Water Resources Control Board of petitions to change the water rights for Boca Reservoir, Prosser Creek Reservoir and Stampede Reservoir, and for Independence Lake. A hearing date has not been established.
- Applications (filed in 2006 and 2007) are pending hearing and approval by the Nevada State Engineer to change to water rights in Nevada to allow TMWA to hold the consumptive use component of certain of its water rights in storage. Hearing is scheduled for December 2009. In addition, changes to the Water Authority's water rights to generate single purpose hydroelectric power may also need to be approved; those change applications have been filed with the Nevada State Engineer, but no hearing date has yet been established.
- The Nevada State Engineer's ruling on unappropriated Truckee River water (granting the unappropriated Truckee River water to PLPT), State Engineer Ruling No. 4683, must be final, and the Orr Ditch Court must have made a determination that the Truckee River in Nevada is fully appropriated and closed to new appropriations. On March 30, 2009, the final appeal was dismissed, and Ruling No. 4683 is now final. However, the State Engineer's denial of an earlier TCID application for unappropriated Truckee River water is still pending in the Third Judicial District Court in and for the County of Churchill. It is anticipated that any decision by that court will also be appealed to the Nevada Supreme Court.
- Pyramid Lake Paiute Tribe v. California, Civil S-181-378-RAR-RCB, and United States v. Truckee-Carson Irrigation District, Civil No. 4-2987-RCB, cases pending in federal courts in California and Nevada, respectively, must be finally resolved. The United States v. Truckee-Carson Irrigation District case was dismissed with prejudice

on August 10, 2009. Work is underway to have the remaining action dismissed with prejudice.

Upon TROA implementation, the Interim Storage Contract is superseded by the Settlement operation. To take advantage of TROA's 119,000 acre-foot supply, the following Truckee Meadows water rights are estimated for this project (the estimates here are those submitted for the TROA EIS/EIR process):

Water rights for municipal demands	42,340
Water rights for water quality	6,700
Total	49,040

Reflecting back to Table 3, the reader should be aware that the projected total of rights for the Settlement approximately equals the recoverable amount of direct diversion water rights available between Farad and Vista. However, if the tributary water rights are added into the equation and there is close cooperation and coordination between the water quality purposes and the water supply purposes, there are enough water rights.

The projected cost of implementing TROA will be borne by developers and is a function of the number water rights converted to M&I use times prevailing market prices.

South Truckee Meadows Surface Treatment Plant. The implementation of a project to fully utilize tributary creek supplies in the south Truckee Meadows does not directly increase TMWA's water supply but does meet the growing demands in the southern portion of the Truckee Meadows. The construction of a surface water treatment plant in the South Truckee Meadows would develop and conjunctively use the tributary creek rights -principally Whites, Thomas, Galena and Steamboat creeks - with existing groundwater and wholesale water service from WDWR's retail service area. Adopted in 2002, the South Truckee Meadows Water and Wastewater Facility Plan identified the need for new water and sewer infrastructure within the south Truckee Meadows. It also identified a water supply plan for meeting estimated build-out water demands in this area of over 15,000 AFA based on 6,900 AFA groundwater, 6,700 AFA creeks rights, and 1,800 AFA wholesale from TMWA (mainstem Truckee River rights).

The plan calls for the construction of two water treatment facilities, built over time, which can ultimately deliver up to 9 MGD of water. The lower water treatment facility would be located within the vicinity of Mt. Rose Highway and US 395. It would utilize water previously used for irrigation from Thomas and Whites Creeks. It would also have the capability to treat groundwater pumped to the facility from existing and new wells for arsenic mitigation. The water treatment facility would be constructed in phases, with the first phase originally planned to be constructed by 2008 and supplying 4 MGD, expandable to 6 MGD. The site is secured for the facility.

The South Truckee Meadows Water Treatment Facility will enhance existing water supplies by more efficiently managing existing groundwater resources, using secondary groundwater resources, and utilizing creek rights not previously used for M&I. The anticipated overall project cost is $50 million. This includes predevelopment as well as construction costs. The lower facility will yield an additional 6 MGD and the upper facility will yield an additional 4 MGD. Construction is on hold pending need for the plant(s).

Conceptual Projects

The following project descriptions come from various water supply plans but that have never made it past the concept stage. They are included to provide ideas for future water supply possibilities; little is known of the status of these projects, but economics may someday stimulate renewed interest.

Dixie Valley Ground Water Importation. This supply alternative proposes to develop ground water in Dixie Valley and transport it via a pipeline over the Stillwater Range to Lahontan Valley. The water could support growth in the Fallon area, provide irrigation water, or augment supplies in the Lahontan Valley wetlands. Water from Dixie Valley utilized in the Lahontan Valley could displace the use of Truckee River water. Water rights thereby freed-up on the Truckee River could be transferred upstream.

Humboldt Basin Ground Water Importation. The Humboldt Basin Ground Water Importation project, better known as the Gabbs Hay Company plan, proposed to develop groundwater sources in Pershing and Humboldt Counties to enhance beneficial uses for wildlife projects in Toulon, Fernley, and Fallon areas, water for future growth in western Pershing County, displace Newlands Project water rights essentially freeing those rights to be utilized upstream, specifically by Truckee Meadows municipal-industrial users, or connect approximately 130 miles of gathering and transmission pipelines to deliver water to Sparks. Preliminary estimates are to produce 20,000 to 30,000 acre-feet, which is permitted, and/or certificated.

Long Valley, California, Ground Water Recharge and Importation. Long Valley, California is located north of Reno and west of Bordertown, Nevada. The owners of Evans Ranch, Inc, have filed applications with various California governing agencies to recover an estimated 3,300 acre-feet of surplus surface water from the Long Valley Creek system and use this water to recharge ground water supplies in the valley. The surface water would replace ground water which would be withdrawn and transported for use in the lower (Nevada) portion of Evans Ranch and/or quasi-municipal uses in developing areas in Washoe County, Nevada.

Silver State Importation Project. Silver State Importation Project ("SSIP"), also called the Washoe County Ground Water Importation Project, is a proposal to develop ground water sources in 19 hydrographic basins in central and northern Washoe County for importation into the Truckee Meadows. The plan was originally created to provide drought year water supplies for the Truckee Meadows served by TMWA and year-round supplies to Lemmon Valley, Spanish Springs Valley, Cold Spring Valley, Warm Springs Valley, and adjacent areas. SSIP was proposed to proceed in five stages over a 50-year period. The final project includes 372 miles of buried steel pipeline ranging in size from 14 to 60 inches, 8 pumping stations, 42 production wells, and underground terminal storage.

Purchase TCID's Share of Donner Lake Storage. The right to the water stored in Donner Lake (9,500 acre-feet) near Truckee is owned as tenants in common by TMWA and TCID. Since the 1988 WRP several attempts have been made to purchase TCID's half of Donner Lake water but without success.

With TROA or if operated in conjunction with the ISA the estimated annual yield of purchasing TCID's half of Donner Lake water is approximately 2,400 acre-feet/yr. The reason the yield of Donner is lower than one-half of the actual volume of water that can be stored in the

lake (9,500/2=4,750) is due to the facts that (1) there is a summertime lake level elevation requirement that restricts when and how much water can be released from the lake and (2) the physical outlet of the lake prevents complete release of the stored water (unless it were to be pumped out). The yield of Donner project is only available when used in conjunction with the ISA or TROA; as a standalone project the elevation and flood releases restrict the ability to use the water on an annual M&I schedule. Costs associated with the Donner Lake storage option include acquiring TCID's share of the reservoir plus associated treatment cost. There is expected to be little, if any, environmental impact from this project since the operation of Donner Lake would not change significantly.

Sierra Valley Water Rights. Since the late 1800s, a diversion ditch has carried up to 60 cfs of water for agricultural use from the Little Truckee River above Stampede Reservoir out of the Truckee Basin to Sierra Valley, California, in the Feather River basin. The Little Truckee River diversions are inversely proportional to the Sierra Valley natural runoff, i.e., the lower the available flows in the native Sierra Valley streams, the higher the diversions from the Little Truckee River. Thus, these rights have a higher drought yield than a normal year yield, but the ability to store these rights would be required.

Summary

This chapter presents the status of various ground and surface water projects. The majority of them have been reviewed and analyzed in various water resource plans over the past 20 years. The projects discussed here are not all inclusive, but are projects that have been studied in the past or continue to be considered potentially viable. The selection of the next water supply project is strictly a function of project's yield, ease of implementation, sustainability, and financial feasibility as determined by existing regional economic conditions and market forces that would or would not favor the development of a future water supply project. It may be that in the future as new technology becomes available or the political, regulatory or public opinion changes, new projects may be developed or projects previously thought infeasible may become feasible. Specific conclusions are:

1. TROA was signed September 6, 2008 and TMWA is actively pursuing completion of the remaining contingencies to implement this project.
2. TROA will provide 119,000 acre-feet of demand annually, sufficient to meet the projected demands through the planning horizon.
3. The North Valleys Importation Project with a place of use in Lemmon Valley was completed in 2008, is operational, and will yield 8,000 acre-feet annually.
4. The South Truckee Meadows Surface Treatment Plant design is complete and when built will conjunctively use 6,900 acre-feet of groundwater and 6,700 acre-feet of tributary creek water.
5. There are several importation projects for the Lemmon Valley area that are in various stages of permitting and/or design. Construction of these projects is subject to positive changes in economic conditions leading to increased demand for water supplies in Lemmon Valley.
6. Over the years, numerous projects have been proposed but remain unbuilt due to lack of financing, permitting, conceptual design, institutional or regulatory constraints, etc.

Chapter 7 Conclusions

The context of this water resource plan differs from previous planning efforts. Previous efforts concentrated on estimating future demands in order to determine and select between least-cost water-supply-development scenarios. For years the utility, and the region, focused its efforts on securing a long-term water supply comparing smaller, incremental supply projects to the larger river settlement project: the Truckee River Operating Agreement. Growth in the community was the primary driver and consumer of water resources in the Truckee Meadows. After nearly 20 years of negotiating, the final agreement was signed on September 6, 2008 and TMWA is diligently working through the remaining contingencies in order to implement TROA. That is not to say work on other supply projects is discontinued. On the contrary, TMWA continues to track progress on various projects as it looks beyond TROA and the projected water needs of the region.

Another contextual change for this water plan relates to the immediate and lingering effects of the economic slowdown in the region. Studies are indicating there will be little growth in the Truckee Meadows in the near-term. This change is significant for an area that was absorbing 3,000 to 4,000 residential units per year and projections are now under 1,000 units for at least the next 2 years[28]. Until (1) financing conditions improve nationally and locally for the Truckee Meadows business environment; (2) businesses are added to the region that can absorb the growing number of unemployed persons (currently the unemployment rate in Washoe County is estimated above 12 percent); and (3), the surplus number of existing vacant water services along with the large number of vacant lots (latest estimates approach 8,000 lots) with resources already dedicated but waiting for the structure to be built can be absorbed, TMWA's water production is projected not to exceed the highest production of approximately 86,000 acre-feet that occurred in 2001 until sometime in the next 7 to 9 years. The results of this situation will therefore not stress the management of TMWA's existing resources nor create a need to acquire new water resources for quite some time. It is interesting to note that by the time demands begin to grow, the legal challenges to TROA should have been exhausted allowing the full utilization of TROA and providing a water supply to meet the region's water supply needs through this 2030 WRP planning horizon and for many years thereafter.

Analysis has shown that between 2003 and 2006 the region experienced eight years' worth of historical development. During that time, twice the number of water resources was consumed for development within the region. This rapid period of growth and its associated consumption of land and water right resources highlighted the fact that the Truckee Meadows and its surrounding hydrographic basins faced some water resources challenges that affected future development within the region. But, as noted above the abrupt change in the local economy essentially halted that growth trend. The population model used for this plan which accounts for absorption of available land forecasts that population will increase at a decreasing rate of growth between 2010 and 2030 and beyond. The estimated water demand to support the

[28] Construction Report, Washoe County, 2nd Quarter 2009, Center for Regional Studies, College of Business, University of Nevada, Reno, Sep 2009, produced for Associated General Contractors.

projected population can be serviced and managed with existing resources through the planning horizon.

At this time, Truckee River irrigation rights continue to be the major source of water supplies for TMWA. Through continued conversion and commitment to M&I use the number of available Truckee River water rights available will meet the projected growth through the planning horizon. Note is made of the fact that the water rights market is becoming more competitive as there are other demands for these water rights such as M&I use in the Fernley area or for use as dilution or timing flows for water quality enhancement in the Lower Truckee River. Other factors discussed that are affecting the future acquisition of water rights in an open market environment include issues of ownership, finding willing sellers of the water rights, and the price of water rights. The factors affecting the price of Truckee River water rights was evidenced by TMWA's Rule 7 price which grew from approximately $5,000 an acre-foot in 2005 to over $32,000 an acre-foot in 2006; but has now settled back to between $6,000 to $12,000 an acre-foot in 2009. The lingering impacts as a result of significant price variation for water rights will continue to affect the availability and price of a Truckee Meadows water right.

In 2030, water will be delivered by TMWA to an estimated 400,000 persons living in he retail area and approximately 67,000 persons living in the wholesale areas. The 2030 water demand projected for this plan is approximately 97,000 acre-feet. Water demands will grow approximately 19,000 acre-feet, from approximately 78,000 acre-feet of water delivered for consumption in 2009. Approximately 172 MGD of combined surface treatment and groundwater wells will be needed to meet peak day consumption requirements in 2030. By replacing the diversion works and effluent pumps at Glendale and building Chalk Bluff Phase 4 along with the development of the groundwater water treatment facility in Sparks, these production targets can be achieved. The timing of construction for these facilities was presented in TMWA's 2005-2025 Water Facility Plan, and may be updated as a result of this plan.

Significant to water resource planning is the selection of a drought period to estimate the yield of TMWA's resources during Drought Situations. In years when sufficient precipitation occurs, there is no need for TMWA to pump significant amounts from its wells or release any of its privately owned stored water since the Truckee River can supply the majority of water to meet customer demands. TMWA manages its resources to take maximum advantage of Truckee River flows while minimizing use of its reserve supplies during non-Drought Situation years. Planning for the critical-year in a drought cycle therefore determines the maximum amount of water demands TMWA plans for. This plan showed that TMWA's current resources and continued dedication of river rights will allow TMWA to meet a demand of 119,000 acre-feet under TROA implementation or 113,000 acre-feet without TROA based on the historic drought from 1987 to 1994; this drought, the most severe on record, is used for the 8-year drought design criterion. Without TROA a 9-year drought design will support a demand of 110,000 acre-feet. Use of a more stringent drought cycle design, without data to support it, ultimately reduces the use of available resources and burdens the region with the costly requirement to replace the lost-committable resource. Using the 9-year drought design also preserves the opportunity for the local community to continue to develop in an orderly fashion without necessitating unreasonable and unnecessary interruptions during the next few years before TROA is implemented, which is projected to meet demands of 119,000 acre-feet annually.

Another significant change in the context of water planning for the Truckee Meadows is the fulfillment by TMWA to retrofit its flat-rate services in its retail service area. Completion of

this project, coupled with water savings from TMWA's demand-side management programs has reduced annual use per service which change has been captured in the data analyses of water use incorporated into the demand forecast in Chapter 4. Prior to meter retrofit completion, the Truckee Meadows has been required by ordinance to stay with the mandatory two-day-a-week that was introduced in 1986/1987. At that time, two-day-a-week, assigned-day watering was deployed to address peak day production facility limitations. Over time those limitations have been addressed through winter time operation of surface water plants, the addition of more well capacity, and ability to store POSW in federally owned/operated reservoirs. Four years of data collection and analyses of summer time irrigation habits of TMWA's retail customers has confirmed that revising the Assigned-Day Watering to allow three days-a-week will not impact peak day or overall water production during the peak irrigation months of July or August. Assigned-Day Watering will transition mandatory twice-per-week watering to a program of three-times-per-week watering and no watering on Monday will be retained to ensure time and flexibility for system recovery. Included with this water day revision is the expansion of no afternoon watering times to 12:00 P.M. and 6:00 P.M. from 1:00 and 5:00 p.m. to discourage watering during the hottest and usually windiest part of the day.

In conjunction with changing Assigned-Day Watering is a revision to the process of managing conservation and TMWA's demand management programs in response to Drought Situations. The current process is a climatological based declaration of a drought year but does not clearly link the drought level to available water supplies, both natural river flows and TWMA's drought reserve water supplies, and what actions from customers are necessary during the course of a Drought Situation year. This is very problematic from a public education perspective since the region is currently always in a "drought" stage with little connection between the drought stage and available water supplies, and leaves little room to reduce water use without severe actions. The new system replaces the four-stage drought classification with a three-stage supply classification, is easier understood, and will improve TMWA's ability to create more meaningful, easier to understand information campaigns that relate needed reductions in customer use to available water supplies.

Although TMWA can continue to convert Truckee River water rights and provide for new development based on its current pool of resources, TMWA is very active in ensuring the implementation of TROA. Projects awaiting resolution of TROA implementation – groundwater importation, aquifer storage and recovery, local reservoirs, etc – will remain under further investigation as to cost and feasibility. These activities are vital in order to have the next viable water resource available when demands dictate its need. In addition to securing the successful implementation of TROA, other projects that do not conflict with TROA requirements are included in this review. In reviewing the prior water plans, the number of water supply projects available for future development has decreased from a high of 20 projects to eight. The reduction in supply projects is a result of changes in conditions necessary to facilitate developing the supply project. For example, the loss in the number of potential reservoir sites is due to housing developments that have been built in the proposed reservoir site (e.g., Mogul Canyon west of Reno and Canoe Hill in the eastern foothills of Spanish Springs). At the same time, however, new projects have emerged, such as Aqua Trac and High Rock Holdings & Juniper Hills Partners, LLC, which may be available to the basins surrounding the Truckee Meadows. The estimated supply from future water supply projects has also decreased over the past 20 years, from a high of 73,000 acre-feet under the TROA supply scenario in 1994/1995 planning period to the current estimate of 44,000 acre-feet from all projects including TROA supplies. These

changes are due to reductions in the number of potential supply projects as noted above and/or as a result of changes in the scope of the project. For example, the North Valleys Importation Project (subsequently purchased by Vidler Corporation) originally sought a permitted yield of 13,000 AFA but is now permitted for 8,000 AFA. Although there has been a decline in the number of potential water supply projects and the decline in the quantity available from these water supply projects, the conclusion to draw is that future water supply development for areas beyond TMWA's retail and wholesale areas will reach further into northern Washoe County or into surrounding counties, and ultimately be very costly to implement.

Introduced in the 2007 Nevada Legislative Session, SB 487 proposed to create a new regional water resources entity in Washoe County. Pursuant SB 487 the cities of Reno and Sparks, the South Truckee Meadows General Improvement District, the Sun Valley General Improvement District, the Truckee Meadows Water Authority, and Washoe County formed Joint Powers Authority to operate the Western Regional Water Authority in 2008. SB 487 included a change of oversight and restructuring of the Regional Water Planning Commission into the Northern Nevada Water Planning Commission. This new entity is charged with coordinating resource management among the existing water purveyors in southern Washoe County. The WRWC began functioning and assumed oversight of the NNWPC in April 2008. The WRWC is required to produce a comprehensive regional water plan on or before January 1, 2011. That planning effort for the years 2010 to 2030 is in the early stages of developing the plan outline and calendar with a goal to finish sometime in Fall 2010. Since TMWA is a major contributor to the potable water management elements of that plan, adoption by TMWA's Board of this 2010-2030 WRP is necessary in Spring 2010 in order to incorporate its findings.

One of the last topics of significance for the context of this 2030 WRP is consideration of the possible integration of some or all functions of WDWR into TMWA. SB 487 directs the WRWC to incorporate an analysis of this topic into its 2011 Comprehensive Plan. The investigation began in Fall 2008 with favorable analyses presented to WRWC throughout 2009. Unless severe challenges to consolidation arise, the process is proceeding toward complete consolidation subject to various requirements to defeasing WDWR bonds, protecting the financial integrity of TMWA, and several other issues (transfer of employees, operating WDWR facilities, etc). From the aspect of treating and delivering potable water to customers, the consolidation of TMWA and WDWR is expected to enhance efficiencies related to the operation of water production and distribution systems. As it relates to current uses of or projected need for water resources, the consolidation of TMWA and WDWR should allow the expanded use of surface water and reduced use of groundwater thereby improving aquifer conditions in the various basins where TMWA and WDWR provide water service. There is minimal expectation that water usage will change by customers of the two utilities under a combined basis since the rates customers pay for service are comparable. On a forward looking basis, since WDWR uses TMWA's Rule 7 for estimating resource requirements for new development projects, future uses and dedication of resources would have similar outcomes whether consolidation occurs or not. Although the results of resource and facility planning conducted by WDWR for their current, respective service areas may change slightly under a combined operation, those changes would not significantly affect the projected demands or acquisition of resources for this planning effort.