City of Lincoln

2010 Urban Water Management Plan

FINAL
Adopted

July 12, 2011

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City of Lincoln

2010 Urban Water Management Plan

Prepared by

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CHAPTER 1. INTRODUCTION

The City of Lincoln (City) has prepared this Urban Water Management Plan (UWMP) to address the Urban Water Management Planning Act (UWMPA) requirements for urban water suppliers. The City carries out a broad range of responsibilities, including water planning and management, and retail supply of treated water. The City currently serves about 9,800 af/yr to a population of over 41,000 through approximately 15,000 residential connections and hundreds of non-residential connections.

This UWMP addresses the current and future state of the City's water supplies and demands and assesses the availability of supplies to meet future demands during normal, single-dry and multiple dry years. Verification that future demands will not exceed supplies and the security of supplies in dry year conditions is an important aspect of this UWMP.

The City receives surface water from the Placer County Water Agency (PCWA) and Nevada Irrigation District (NID), which is currently treated and delivered to the City by PCWA. PCWA and NID also deliver raw water directly to raw water customers in and around the City, but these demands are assessed in those purveyors' UWMPs.

In addition to surface water, the primary supply, the City owns and operates several groundwater wells, which supply about 10 percent of in the demand during normal years. These wells are able to supply more than 10 percent of the City's demand during shortage, summer peaks, and emergency outages.

Note To DWR

The City of Lincoln has written this UWMP primarily as a water resources planning tool and secondarily to satisfy the requirements of the UWMPA.

The body of the document presents and discusses data that DWR requests in its 2010 UWMP Guidebook.

To facilitate review by DWR for compliance with the UWMPA, data from the body of the document has been transferred into DWR Tables consistent with the organization of the tables in Section N of the 2010 UWMP Guidebook. These tables are in **Appendix A-1**.

Also, this UWMP has been reviewed for adequacy according to the UWMP Checklist as contained in Section I of the 2010 UWMP Guidebook. A completed checklist is included in **Appendix A-2**.

1.1 Urban Water Management Planning Act

The UWMPA requires every "urban water supplier" to prepare an UWMP.[1] An "urban water supplier" is a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually."[2] The City currently serves about 9,800 af/yr of treated water through numerous residential and non-residential connections – serving a population of over 41,000. Because the City's water service exceeds the threshold for preparation of an UWMP, the City is preparing its 2010 UWMP in compliance with the UWMPA.

1.2 Public Participation and Agency Coordination

The UWMPA requires a water purveyor to coordinate the preparation of its UWMP with other appropriate agencies in and around its service area. This includes other water suppliers that share a common source, water management agencies, and relevant public agencies. The City has prepared this UWMP in coordination with water utilities that provide water for the City. The City has also coordinated the preparation of this plan with other appropriate local government agencies, as listed in **Table 1-1**. Copies of the notification letters sent are included in **Appendix B-3**.

Table 1-1 – Public and Agency Coordination

Coordinating Agencies	Participated in developing the plan	Commented on the draft	Attended public meetings	Contacted for assistance	Sent copy of draft plan	Sent notice of intention to adopt
County of Placer						√
Placer County Water Agency	√					√
Nevada Irrigation District						√
South Sutter Water District						√
Sacramento Area Council of Governments						√
Public			√			√

1.3 Plan Adoption

Prior to adoption of its UWMP, the City conducted a public hearing regarding its UWMP on July 12, 2011. A draft of the UWMP was made available for public inspection on the

[1] California Water Code (CWC) § 10640
[2] CWC § 10617

City's website as well as at the City building. General notice of the public hearing was provided through publication of the hearing date and time in the Lincoln News Messenger on June 23, June 30, and July 7 of 2011.[3] As part of its public hearing, the City received community input regarding its implementation plan for complying with the water conservation requirements contained in CWC §10608.20 et seq., including the implementation plan's economic impacts.[4] Prior to adopting the 2010 UWMP, the city considered the comments received. The resolution adopting the 2010 UWMP is included as **Appendix B-1**. Also, at the public hearing, the City adopted the method for determining its urban water use target pursuant to CWC §10608.20(b).

The City of Lincoln adopted its 2010 UWMP on July 12, 2011. A copy of the adopted 2010 UWMP will be provided to Placer County and the California State Library, and posted onto the District's website by August 30, 2011.

1.4 Previous Reports

The City and PCWA have prepared several water planning reports in the past decade. These documents provide context for the analyses contained in the City's 2010 UWMP. The City relied upon PCWA's 2006 Integrated Water Resources Plan (2006 IWRP) and PCWA's public draft 2010 UWMP. The City also has prepared several documents including a 2050 General Plan, 2004 Master Reclamation Plan, and a 2008 Wastewater Treatment and Reclamation Facility Expansion Plan, and has participated in the 2007 Western Placer County Groundwater Management Plan and its related on-going efforts.

The City has prepared urban water management plans in 2002, and 2005. The 2005 Plan concluded that the City has sufficient surface water supplies in normal and multiple-dry year periods, and that water shortages could occur by 2030 in a year hydrologically similar to the driest year in recent history. Under similar conditions, PCWA would reduce surface water deliveries but the City would produce groundwater to make up for any possible shortage. Under a revised and updated demand and supply analysis for the 2050 General Plan, anticipated increases in PCWA deliveries, additional surface supplies from NID, and use of recycled water supplies provide adequate water supplies to meet expected demands in 2050.

PCWA's 2006 IWRP assesses build-out water demands in western Placer County, including service to new development projects in current general plans and identified specific plan subareas that are located in western Placer County. The 2006 IWRP also integrates a variety of water supplies managed by PCWA and other purveyors, including

[3] See **Appendix B-2** for copies of the published notices
[4] CWC § 10608.26

surface water, groundwater, and recycled water. In its comparison of demands and supplies throughout western Placer County, the 2006 IWRP concludes that there are adequate water supplies to meet demands throughout western Placer County in normal years, and that PCWA's dry-year shortage policies will allow it to effectively manage the projected supply shortages in single and multiple-dry year periods such that it is able to deliver treated surface water to the City of Lincoln consistent with its contract. As described in detail in the following sections, the City anticipates having a secure surface water supply for the majority of its demands and will continue to use groundwater to provide supplies during peak summer demand conditions, to manage periodic outages in surface water and to augment shortfalls in surface water during dry conditions.

1.5 Plan Organization

This UWMP is organized as follows:

- Chapter 2 provides a description of the City's service area, including climate, population, and water supply facilities.
- Chapter 3 describes the City's current and future water supplies and the reliability of the supplies.
- Chapter 4 details the water demands on the City's system, including the past and future estimated demands.
- Chapter 5 provides information regarding the City's water demand management measures.
- Chapter 6 discusses the City's water shortage contingency plan.
- Chapter 7 discusses current and future recycled water use in the City's retail service area.
- Chapter 8 compares the City's water supplies and demands in normal and dry years.
- The Appendices include background information and supporting documents.

CHAPTER 2. SERVICE AREA, DEMOGRAPHICS AND CLIMATE

The City of Lincoln owns and operates a public water system that provides treated water directly to customers in the City's service area. The City also delivers recycled water to agriculture near the City's waste water treatment plant and has plans to expand the recycled water delivery system to include landscaping, golf courses, and industrial customers within and outside of the City's service area. More details of the recycled water system can be found in **Chapter 7**.

Water is supplied from PCWA, NID, and from wells throughout the City. PCWA provides treated water on a wholesale basis to the City. The City service area includes customers in both PCWA and NID service areas. Currently, NID raw water is purchased by the City and is treated by PCWA's treatment facilities. The agreement between PCWA, NID, and the City allows the City's customers to receive NID treated water without using a separate supply system. Details of this agreement can be found in **Chapter 3**. Discussions and associated analysis and environmental documentation to construct a new NID treated water supply system are underway and are expected to allow the NID supplies to be provided directly to the City within the planning horizon of this UWMP.

2.1 The City of Lincoln Service Area

Figure 2-1 shows a diagram of the City's water system. As noted, the City provides water to a small set of customers that are outside of the existing City limits.

2.1.1 General Service Area Description

The City's water service boundary conforms to the City's Sphere of Influence (SOI). Though the City's water system is currently not coterminous with the SOI, the geographic extent of the distribution system will expand with the addition of new developments. The City overlaps both PCWA and NID raw water service areas with the majority of customers residing in the PCWA service area.

Figure 2-2 shows the geographic extent of the City's service area.

Figure 2-1 – Treated Water Distribution System

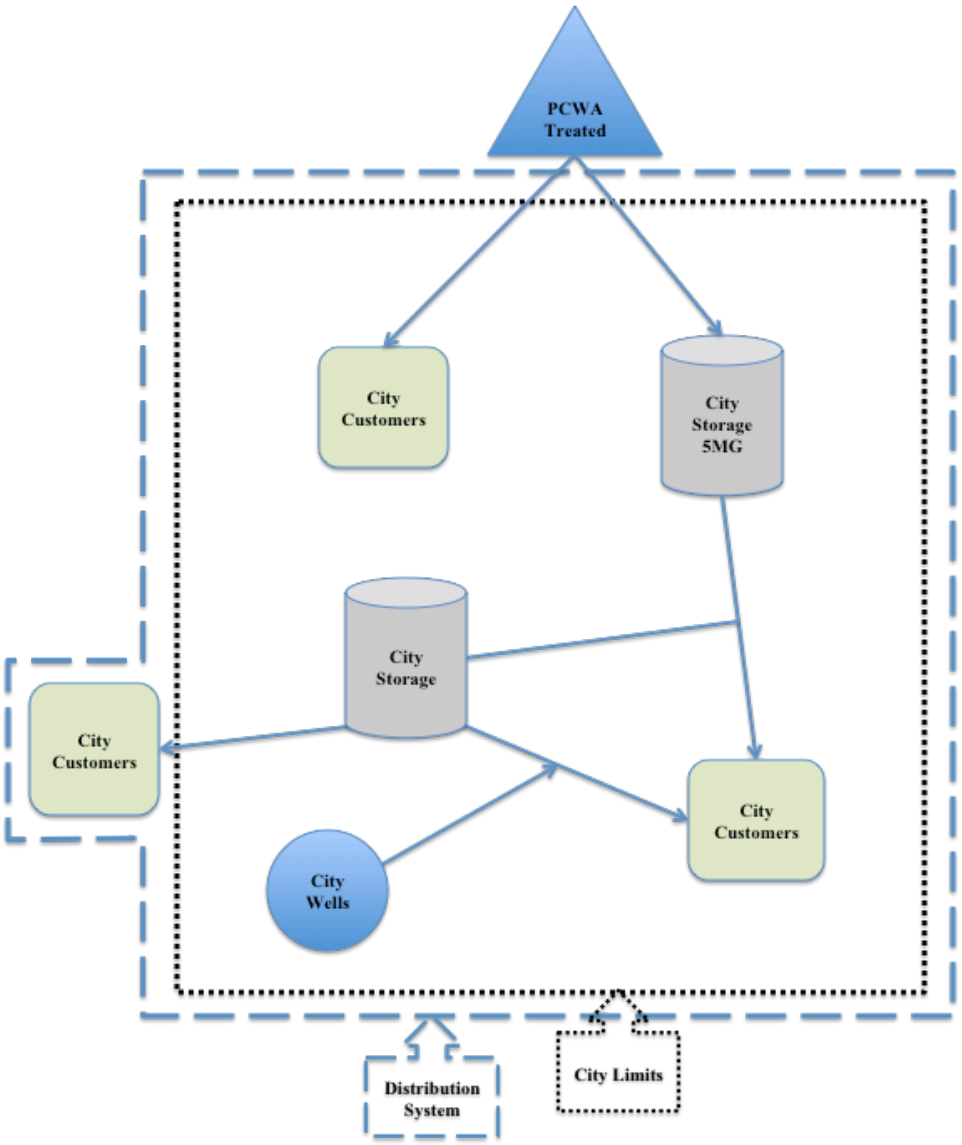
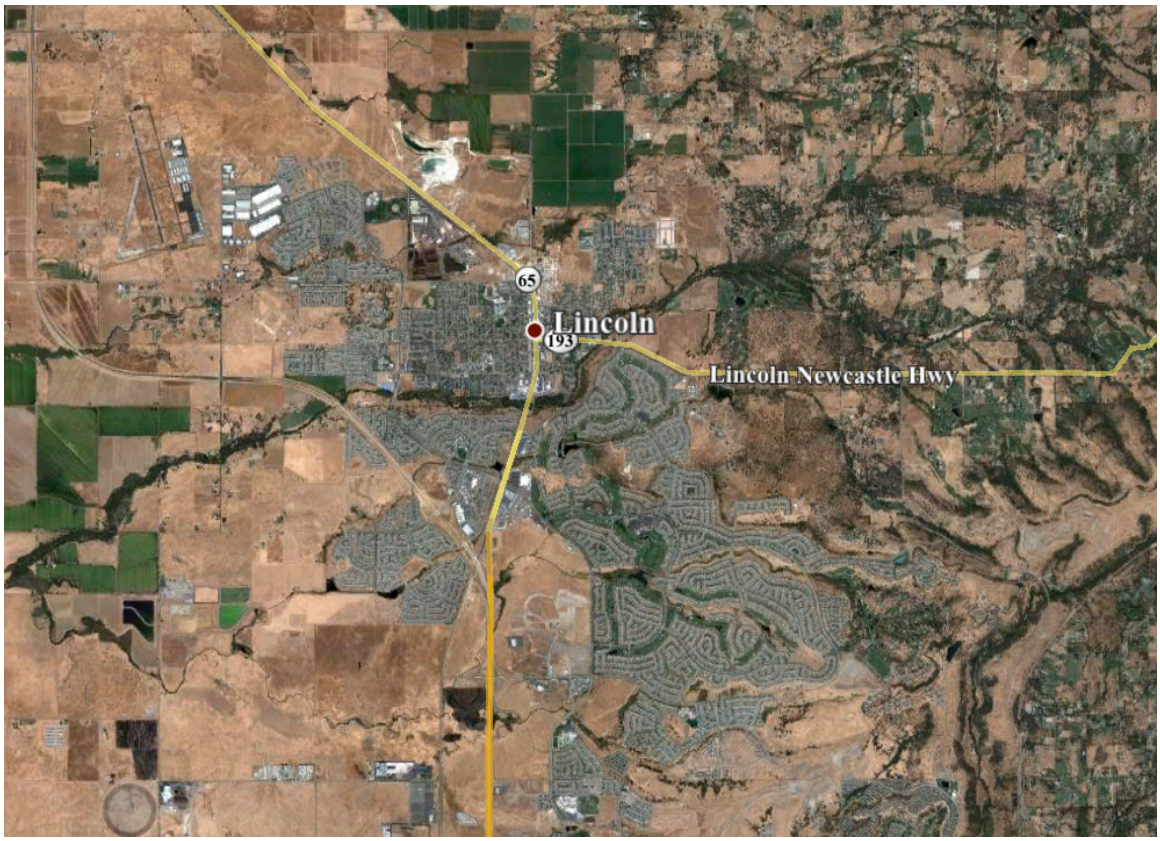


Figure 2-2 – The City of Lincoln Water Service Area



2.1.2 Climate

The climate in the City is typical to California's central valley with hot dry summers and cool wet winters. **Table 2-1** includes the average reference evapotranspiration (ETo), precipitation and temperature for the associated area. For purposes of documenting ETo, California Model Water Efficient Landscape Ordinance (MWELO) contains the reference ETo by month, as shown in **Table 2-1**. **Table 2-1** has an additional column for data from a local California Irrigation Management Information System (CIMIS) station. Local agencies are to use the MWELO ETo values as the standard for approval of landscape plans associated with specific development projects.[5] For the purpose of maintaining the most accurate values, Fair Oaks CIMIS station data is presented as a basis for comparison.

Temperature and precipitation numbers are from Western Regional Climate Center (WRCC) data stations. The nearest station to Lincoln was active in Rocklin from 1971 to

[5] Values in the MWELO, Appendix A match data from "Irrigation Scheduling" A Guide for Efficient On-Farm Water Management, University of California Division of Agriculture and Natural Resources, Publication 21454, published 1989.

2000. Temperature values are provided as monthly averages for high and low temperatures.

Table 2-1 – Average ETo, Rainfall, and Temperature

Roseville	Average Temperature, F	Average Rainfall, in	Appendix 4 Eto, in	CIMIS Average Eto, in
January	43.7	3.65	1.10	1.59
February	47.8	3.09	1.70	2.20
March	52.0	2.89	3.10	3.66
April	55.9	1.56	4.70	5.08
May	65.7	0.29	6.20	6.83
June	73.1	0.26	7.70	7.80
July	77.6	0.31	8.50	8.67
August	76.7	0.05	7.30	7.81
September	71.2	0.37	5.60	5.67
October	60.8	1.83	3.70	4.03
November	48.4	3.84	1.70	2.13
December	43.0	3.21	1.00	1.59
Annual	59.8	21.35	52.20	57.06

Note: ETo data from CIMIS station 131 Fair Oaks, 1997-present; Temperature and precipitation data from wrcc.dri.edu Rocklin station 047516 average 1971-2000

2.1.3 Service Area Demographics

The population served by the City includes a mix of users and user classes. This includes residential, as well as commercial, public, and industrial customers. A population estimate for the City was obtained from the Department of Finance (DOF).[6] The DOF estimate reflects a population for the customers located inside the existing city limits. In addition to the customers served inside the city limits, the City serves an estimated 30 people located outside of the city limits. The historic population for the City's service area is presented in **Table 2-2**.

Table 2-2 also includes a population projection through the year 2035. Notably, this population estimate of 73,499 persons is significantly less then estimates from just a couple of years ago. It should be noted that SACOG projected a 2035 population of 112,209 persons as recently as 2008. SACOG prepared this estimate when the City was experiencing a very high growth rate, as shown by the historic population numbers. The lower numbers presented in **Table 2-2** represent a more realistic growth rate for the City based on actual development plans. The numbers in **Table 2-2** are consistent with the City's build out population in its General Plan, but do suggest that the build out date will likely occur later than predicted just a few years ago.

[6] State of California, Department of Finance, E-4 *Historical Population Estimates for City, County and the State.*

Table 2-2 – Historic and Projected Population

Year	Population	Year	Population
2000	11,235	2010	41,141
2001	13,653	2015	46,059
2002	16,662	2020	51,237
2003	19,766	2025	58,642
2004	23,155	2030	66,043
2005	27,048	2035	73,499
2006	33,355		
2007	37,154		
2008	39,330		
2009	40,090		

Note: DOF Table E-4 and estimated population outside of the city calculated from housing growth projection.

2.1.4 Retail Service Area Expansion

The City of Lincoln grew rapidly in the last decade. The population increased from about 11,000 to 40,000 persons between 2000 and 2009.[7] This growth required significant expansion of the retail water distribution system. The infrastructure costs for service area expansions that are not covered in development agreements are paid for through the City's "connection fee" and its "water capacity & transmission" on an equivalent dwelling unit (EDU) basis. These fees are currently $5,132 and $12,618 respectively per EDU.[8]

To plan for development projects, the City enters into Development Agreements with those proposing new residential and non-residential projects. A Development Agreement typically requires a developer to construct, or provide funds for the construction of, the following water supply related facilities:

- Water storage facilities
- Municipal well construction
- Water transmission facilities
- Dedication to the City of water rights to groundwater underlying the project

Despite having a secure groundwater supply, the City is unlikely to supply water to a new isolated development by simply installing a well. The manageable size of the service area makes it efficient for the City to connect new developments to the City's primary distribution system while maintaining system wide water quality.

[7] State of California, Department of Finance, E-4 *Historical Population Estimates for City, County and the State, 1991-2000, with 1990 and 2000 Census Counts.* Sacramento, California, August 2007..
[8] Fees are slightly higher for some larger home sites.

2.1.5 Recycled Water System

See **Chapter 7** for more detail on the recycled water system for the City. The City plans to install a "purple pipe" system to bring recycled water to customers throughout new developments and to some existing developments. Since 2000, the City has required developers to install "purple pipe" systems to accommodate recycled water service. In 2000, the City did not have a source of adequately treated recycled water. The requirement therefore reflects forward planning by the City, which will help the City meet 2020 water conservation target because recycled water is excluded from total water use.

CHAPTER 3. WATER SUPPLY CONDITIONS

3.1 Introduction

This section details the City of Lincoln's (City) available water supplies and entitlements as currently used and as needed as development occurs within the City's service area and SOI. The City uses water from three sources, including Placer County Water Agency (PCWA) surface water supplies, Nevada Irrigation District (NID) surface supplies and City-produced groundwater. PCWA treated surface water is the City's primary supply source. NID surface water is currently supplied to the City according to an agreement that provides for the water to be delivered to the PCWA treatment facilities and ultimately delivered to the City with PCWA water supplies. The City supplements purchased surface water with groundwater from the City's municipal wells. The following information details the City's existing and planned water supplies, analyzes the reliability of these supplies, and identifies the extent of any water shortages.

3.2 Historic Water Supplies

The City's water supplies have historically included treated surface water from PCWA and NID, with groundwater used to manage curtailments in delivery, emergencies, and summer peak-day demands. **Table 3-1** indicates the City's water supply sources for the past five years, with the "surface water" values reflecting the combined supplies from NID and PCWA as treated and delivered by PCWA.

Table 3-1 – City of Lincoln Historic Water Supplies

Supply (AF)			
Year	**Groundwater**	**Surface Water**	**Total Supply**
2006	623	8,753	9,376
2007	924	9,396	10,320
2008	1,085	9,437	10,522
2009	836	9,319	10,155
2010	962	8,241	9,203

3.3 Existing Water Supplies and Entitlements

The City contracts with PCWA for delivery of treated surface water. The documents that collectively make up the City's contract with PCWA are included in **Appendix C-1**.[9] The City's contract with PCWA has been amended numerous times and is supplemented

[9] Documents attached in **Appendix C-1** include the 1998 contract and 1999, 2002, and 2005 contract supplements.

frequently as the City purchases additional entitlements from PCWA. The PCWA water supply contract currently entitles the City to the following:

- Maximum day Regulated Deliveries of **17,774,452** gallons per day;
- Maximum day Unregulated Deliveries of **726,972.5** gallons per day; and
- A water supply equivalent to an additional 408.5 equivalent dwelling units (EDUs) based on the City's contribution to the construction of the proposed Bickford pipeline from the proposed Bickford tank to the proposed metering station at the City's pond site pursuant to the Bickford Agreement (the Bickford Agreement is included in **Appendix C-2**).

The forgoing entitlements are set forth in the April 7, 2011 letter from PCWA included in **Appendix C-3**.

The treated water supply quantities delivered by PCWA to the City for the past five years are shown in **Table 3-2**.

Table 3-2 – Historic PCWA Water Supplies Delivered to the City of Lincoln (values do not include supplies from NID)

Year	Supply (AF)
2006	6,940
2007	7,736
2008	7,779
2009	7,724
2010	6,630

In September 2004, the City, PCWA and the NID entered into a temporary raw water sales agreement pursuant to which NID has supplied raw water to PCWA treatment facilities for delivery within the City's water service area. A copy of this agreement is included in **Appendix C-4**. According to City and NID records, NID provided approximately 1,813 acre-feet of water in 2006 as shown in **Table 3-3**.

Table 3-3 – Historic NID Water Supplies Delivered to the City of Lincoln

Year	Supply (AF)
2006	1,813
2007	1,660
2008	1,658
2009	1,595
2010	1,611

3.4 Projected Surface Water Supplies

The City primarily relies upon treated surface water from PCWA and NID to meet projected water demands throughout the existing City and, as detailed in the City's 2008

General Plan, anticipates these supplies to provide for demands in the SOI as well. The characteristics of these water supplies are detailed below.

3.4.1 Placer County Water Agency (PCWA)

The City will continue to rely upon treated surface water from PCWA as its primary source of water. The City's water supply entitlements that exist pursuant to its contract with PCWA are discussed in Section 3.3. The City anticipates receiving up to 34,000 acre-feet per year from PCWA to meet build-out water demands within the City's "service area," as defined in the 2008 General Plan, although this supply would not be required until well beyond the planning horizon contemplated in this UWMP.

PCWA has several surface water supplies available in western Placer County that it uses and anticipates using in the future to meet its current and future contractual obligations to deliver water to the City. These sources are described as follows:[10]

- ***PCWA Yuba/Bear River Supply (also referred to as PG&E Supply).*** PCWA's primary water supply for its Zone 1 service area (which includes the City) is delivered pursuant to a contract with PG&E, which provides for 100,400 acre-feet annually of Yuba/Bear River water from PG&E's Drum- Spaulding Hydroelectric Project (FERC Project No. 2310). The Drum-Spaulding Hydroelectric Project is a Federal Energy Regulatory Commission (FERC) licensed facility, which is owned by PG&E. PG&E provides wholesale water to PCWA for consumptive use in Placer County. PG&E is currently applying to the FERC for a new permit that would allow it to operate the Drum-Spaulding Hydroelectric Project. PCWA is closely monitoring PG&E's application process and has submitted comments as appropriate to ensure that PCWA can continue receiving water under its PG&E contract.

  Historically, this source of water has been highly reliable during normal years, as well as single-dry and multiple-dry year periods. For instance, between 1987 and 1992, the state experienced a five-year drought, during which many areas in the state had reduced water supplies. PCWA had a full Yuba/Bear River supply each year of the drought. Records indicate that 1977 is the only year in which PCWA had to impose drought restrictions on its customers due to reduced PG&E supply.

  PCWA's Zone 1 contract with PG&E will terminate in 2013, but PCWA expects the contract to be renewed after the expiration of the present term. While PG&E recognizes the fact that the price and other terms of the contract may change, it is

[10] The water supply information is as described in the Adopted 2008 General Plan Update.

not expecting a diminution in the available supply because any change in the available supply would operate as a change in the place of use and thereby injure consumptive water users receiving PG&E water in the PCWA service area.

There are no infrastructure limitations to the delivery of 100% of PCWA's supplies under its Zone 1 PG&E contract.

- ***PCWA Middle Fork Project/American River Supply.*** PCWA augments its Yuba/Bear River surface water supply with its Middle Fork Project water supply from the American River. The Middle Fork Project's storage capacity is 340,000 acre-feet. A water rights permit from the California State Water Resources Control Board allows the PCWA to divert up to 120,000 acre-feet per year for consumptive use. The permit provides that this water supply may be diverted from the American River at either Auburn or Folsom Reservoir. PCWA has performed extensive modeling of the Middle Fork Project system to determine its reliability under various hydrologic conditions dating back to 1921. Based on that analysis, PCWA has concluded that the Middle Fork Project can provide 120,000 acre-feet annually, even in dry years as severe as the 1976-1977 drought.[11]

  PCWA has developed and is planning several major water system improvements to carry American River water supplies to water users throughout western Placer County. These projects include:

  - American River Pump Station: The federal Bureau of Reclamation has constructed a $75 million diversion facility on the American River at Auburn, which PCWA currently uses to pump water under its Middle Fork Project water rights. The pump station was completed in June 2008. The American River Pump Station will supply up to 35,500 acre-feet annually to Placer County via the existing three mile-long Auburn Tunnel. If PCWA is ultimately able to divert more than 35,500 acre-feet annually from the American River because it is unable to reasonably divert water from the Sacramento River, it would likely seek an expansion that would allow as much as an additional 35,000 acre-feet annually to take advantage of its maximum "unused" supply (i.e., CVP Project) while still meeting its contractual obligations for service to Roseville, SJWD and SSWD.

  - Auburn Tunnel Pump Station: The Auburn Tunnel Pump Station is currently under construction at PCWA's Ophir Road site. The station will pump water to the surface of the 200-foot-deep Auburn Tunnel that runs

[11] PCWA 2005 UWMP, p. 4-3.

beneath the site. The project will also pump water to the Foothill WTP and into the Dutch Ravine Canal system, which runs to the Lincoln and Rocklin areas. The pumps would also supply PCWA's proposed water treatment plant in Ophir.

- Ophir Water Treatment Plant and Conveyance Pipelines: PCWA is currently in the design phase of the proposed state-of-the art Ophir Water Treatment Plant project located adjacent to the American River Pump Station. The Ophir Water Treatment Plant would treat a portion of the already approved 35,500 acre-foot-per-year American River supply diverted at the American River Pump Station. Initially, the facility would provide 30 million gallons of water a day. The plant could be expanded to handle as much as 120 million gallons of water daily. The plant's design is about 95 percent complete and a Final Environmental Impact Report has been certified for the project. The next phase is acquisition of various environmental permits that are required. Growth and land use policies in Placer County will determine the construction and expansion schedule of the plant.

  PCWA has indicated that to maximize use of the long-term water supply from the American River Pump Station at Auburn it will need to construct 16.8 miles of new 60-inch, and 6.3 miles of new 48-inch, treated water pipeline and connect it to PCWA's existing water distribution system.

- Foothill Raw Water Pipeline: A pipeline is proposed to run three miles from the Ophir Road site to the Foothill water treatment plant.[12] This will serve as a backup water supply to the Foothill water treatment plant. It also includes a connection to the Dutch Ravine Canal system and a new 18-inch treated water line to provide for local service and to connect to the existing one- million gallon Newcastle storage tank.

- ***Central Valley Project Supply***. PCWA has a Central Valley Project (CVP) water contract with the United States Bureau of Reclamation for delivery of no more than 35,000 af/yr.[13] The Amendatory Contract provides an indication of the reliability of the CVP water supply by stating that the average quantity of water made available to PCWA in the most recent five years was 31,000 af/yr. The current CVP contract expires in 2011. A Long Term Renewal Contract is awaiting formal approval by the United States Bureau of Reclamation. CVP

[12] PCWA Update, Volume 20, Number 1, Feb-March 2006.
[13] The most current version of the contract is the "Amendment to the Amendatory Contract," (Amendatory Contract) and is dated August 27, 2002.

water may be used for municipal and industrial purposes. PCWA's point of diversion for CVP water is Folsom Dam. Currently, the Amendatory Contract designates PCWA's Zone 1 as the service area for use of CVP water.

PCWA is authorized though its contract with Reclamation to take CVP contract water at Folsom Reservoir or other places that are agreed to by the affected parties. PCWA has initiated a planning process to divert water from the Sacramento River in order to be able to obtain the remainder of its Middle Fork Project supply and/or CVP water not delivered off of the American River. It is not certain when PCWA might construct a Sacramento River diversion facility.

PCWA does not plan to use any of its CVP contract entitlement prior to putting to use the full 120,000 acre-feet available to it annually from the American River pursuant to its water right permits.

At build-out, the City anticipates relying upon 34,000 acre-feet per year of water from PCWA as part of its water supply portfolio necessary to meet its municipal and industrial demands.[14] Although the City's contract with PCWA does not guarantee that this amount will be available, PCWA's August 2006 *Integrated Water Resources Plan* (PCWA IWRP)[15] and PCWA's 2010 *UWMP Public Draft* (May 2011) projects that it will supply the City with the 34,000 acre-feet of treated water per year anticipated at build-out as defined by the Adopted 2008 General Plan Update. Based on PCWA's representation of what will be available to the City at build-out and PCWA's water rights and contract entitlements, it is reasonably certain that 34,000 acre-feet per year in normal water years will be available from PCWA to meet water demands at build-out of the City's service area as defined by the Adopted 2008 General Plan Update.

Importantly, the City's projected build-out water supply from PCWA does not require PCWA to develop additional water supply sources. Rather, existing PCWA water rights and contracts will be sufficient to provide the City with its anticipated supplies.

3.4.1.1 Dry-Year Reliability

Table 3-4 shows projected PCWA water supplies during normal, single-dry and multiple dry years.

[14] Representing the current and future planned available water and Lincoln's current contract amount as presented in the April 7, 2011 Letter from PCWA found in **Appendix C-3**.
[15] The PCWA August 2006 Integrated Water Resources Plan can be viewed at the City of Lincoln Public Works Department.

Table 3-4 – Projected PCWA Water Supplies

Supply	Average/ Normal	Single Dry Year	Multiple Dry Water Years			
			Year 1	Year 2	Year 3	Year 4
	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr
Pacific Gas & Electric	100,400	50,200	75,300	75,300	75,300	75,300
Middle Fork [American River] Project	120,000	120,000	120,000	120,000	120,000	120,000
Central Valley Project	31,000	23,250	23,250	23,250	23,250	23,250
Total	251,400	193,450	218,550	218,550	218,550	218,550

The City's water supply contract with PCWA provides that water deliveries in dry water years may be reduced but does not specify how any shortages are allocated to the City. PCWA's most recent water supply planning documents are the *2010 Urban Water Management Plan* (2010 PCWA UWMP)[16] and the August 2006 PCWA IWRP. Figure 9-1 (Page 9-3 of the PCWA IWRP) illustrates projected shortages to Zone 1 customers during single-dry and multiple-dry years. Specifically, the 2006 PCWA IWRP provides that the City could potentially experience reductions in its anticipated 34,000 acre-feet of PCWA surface water supply but no reductions in supply are expected in the planning horizon of this UWMP, except in the potential event of a extended supply outage due to infrastructure failures.

3.4.2 Nevada Irrigation District (NID)

NID supplies irrigation, wholesale, and retail water to Nevada County and Placer County customers. Agricultural water use accounts for nearly 90 percent of the total demand on NID water supply. The remaining water supplied by NID is primarily delivered directly or through PCWA to single-family residential accounts. NID's service area covers Nevada County and a portion of Placer County. NID's mountain watersheds cover 70,000 acres and include the upper portions of the Middle Yuba River above Milton Diversion, Canyon Creek above Bowman Reservoir, and Deer Creek.

In anticipation of the City's Adopted 2008 General Plan Update, the City contracted with NID for delivery of a treated surface water supply. In October 2004, NID and PCWA entered into a temporary water sales agreement to provide raw water to PCWA for treatment and delivery of surface water to the NID service area within the City of Lincoln until NID has other means available to serve Lincoln's treated needs within NID's service area boundary (see **Appendix C-4**).

The City negotiated a Water Facilities/Planning Phase agreement with NID in 2004 to establish a conceptual framework for the design and construction of a new $235 million water treatment facility. The Water Facilities/Planning Phase agreement is included in

[16] PCWA is preparing a 2010 update to its 2005 UWMP and has released a public draft as of June 2011. The representation of the City's demand for 34,000 acre-feet per year from PCWA in the updated PCWA UWMP is consistent with the representation by PCWA.

Appendix C-5. The preferred location for the new plant is near NID's Valley View site located northeast of the City, as identified in the *Lincoln Area Water Treatment Plant Planning and Site Study* (2005). The proposed treatment facility would allow NID to serve treated water within the NID service area to customers in the Lincoln SOI.

3.4.2.1 NID Surface Water Supplies

NID's surface supplies consist of watershed runoff, carryover storage in surface reservoirs, recycled water and contract purchases. The NID *2010 Draft Urban Water Management Plan*[17] concludes that NID may experience supply deficiencies during single and multiple dry years throughout the 2015-2035 planning period. NID water supply sources are described as follows:

- ***Watershed Runoff.*** This supply consists of runoff from the Middle Yuba River above Milton Diversion, Canyon Creek above Bowman Reservoir, Texas Creek, Fall Creek and Deer Creek. The amount of runoff and the manner in which it may be used depends upon the amount of water contained in the snow pack and the rate at which the snow pack melts. The system of storage reservoirs and conduits used to transport water to NID's service area boundary is referred to as the Upper Division. Maximum capacity of conduits in the Upper Division limits the amount of runoff for consumptive purposes. The average watershed runoff supply is 229,124 acre-feet annually.

- ***Carryover Storage.*** Carryover storage is the amount of water left in reservoirs at the end of a normal irrigation system. NID has ten primary storage reservoirs with a maximum storage capacity of 280,390 acre-feet. The average of NID's carryover storage supply is 119,843 acre-feet. The carryover storage has only fallen below this average level a few years.

- ***Recycled Water***. NID's recycled water supply consists of effluent from municipal wastewater treatment plants that is captured and mixed with surface water. At present, this occurs below the Grass Valley, Nevada City, Auburn, and Placer County (at Joeger Road) treatment plants. With the exception of the small town of Smartsville, this water is not used as raw water supply for NID's treated water supply.

  In 2009, NID received 2,550 acre-feet of recycled water. The quantity of recycled water available is estimated to remain around 2,500 acre-feet. NID's 2010 *Draft Urban Water Management Plan* estimates that recycled water will comprise this same 2,500 acre-feet annually by the year 2035.

[17] Nevada Irrigation District 2010 Draft Urban Water Management Plan.

- ***Contract Purchases***. NID has a contract with PG&E for a maximum of 59,361 acre-feet during years of at least normal precipitation. This maximum amount is reduced to 23,591 acre-feet in dry years. In 1995, NID purchased only 7,356 acre-feet of surface water under the PG&E contract and only 8,936 acre-feet in the year 2000. NID's 2010 *Draft Urban Water Management Plan* estimates purchasing 8,000 acre-feet a year up through the year 2035. The contract expires in 2013 and a renegotiated contract could affect NID's overall water supply. According to NID's 2010 *Draft Urban Water Management Plan*, NID does not foresee any major changes over present operations once negotiations have concluded.

On February 4, 2004, the City and NID entered into a Memorandum of Understanding (MOU) to assess the feasibility of providing the City with a treated water supply. Among the numerous efforts undertaken pursuant to the MOU was completion of the *Lincoln Area Water Treatment Plant Planning and Site Study* (WTP Study) in August 2005. As described in the WTP Study, the treatment plant would be capable of meeting projected annual water demand of 17,500 acre-feet per year. Of this amount, approximately 70 percent would be allocated to the City, which is estimated to be approximately 12,000 acre-feet per year.

On July 4, 2007, the City and NID established a conceptual framework for the development of a treated water facility including a Framework for Collaboration. The Framework for Collaboration entered into between the City and NID is included in **Appendix C-6**. The City and NID contemplate moving forward under the following four definitive agreements:

1. Agreement on the respective service areas of NID and Lincoln;
2. Agreement regarding the planning required to install the water treatment plant and associated facilities, including environmental evaluation (adopted by NID Board and Lincoln City Council in 2007);
3. Agreement on terms and conditions of treated water service to be provided, at wholesale, by NID to Lincoln; and
4. Agreement on the financing and construction of said Project.

NID is currently working on completing the planning, design studies, and engineering details necessary to better define the project and its alternatives. Once this step is complete, NID plans to move forward with the environmental review process. NID had planned to start operating the plant by 2015. NID expects the planning, design, engineering, environmental review, and permitting to take many years. However, in the

interim, the existing agreement to route NID water through PCWA treatment facilities for delivery to the City will serve as the mechanism for NID to provide water to the City.

Similar to the City's water supply from PCWA, water supplies from NID would come from existing NID water rights and entitlements and do not require that additional water supply sources be developed by NID. Therefore, the City plans to continue receiving NID water supplies into the future.

3.4.2.2 Dry-Year Reliability

Although the Framework for Collaboration between the City and NID provides that any curtailments in water deliveries from NID would be shared equally between the City and NID's own domestic water customers using the same source water, NID's 2005 Urban Water Management Plan (2005 NID UWMP) projects that no reductions are likely during dry periods. The NID 2010 Draft UWMP predicts potential future shortages in dry years. The water transfer agreement between Lincoln, PCWA, and NID contains a provision that Lincoln would be limited to the same proportion of the contract as other NID customers. The 2005 NID UWMP includes the 12,000 acre-feet per year that the City is relying upon from NID to meet its water demands at build-out.[18] Of its total annual supply of 410,828 acre-feet projected at 2035, NID projects that it will have between 192,442 and 333,944 acre-feet during multiple dry water years and 183,113 acre-feet per year available during a single dry water year.

Despite potential decreases in supply, NID projects that its water demands will be 213,549 in 2035. This is over 30,000 acre-feet per year less than projected water supplies during a single dry water year or a 14% shortage when measures of demands. During multiple dry year periods, only the second of three years would suffer a shortage of about 10%.

3.5 Groundwater

The City overlies the northeastern section of the North American Groundwater sub-basin, which is designated by the California Department of Water Resources (DWR) as basin 5-21.64. The North American sub-basin lies in the eastern part of the Sacramento Groundwater Basin. The North American sub-basin comprises approximately 351,000 acres, of which 39 percent, or approximately 133,000 acres, are within Placer County's boundaries. Included within the sub-basin are sections of western Placer, south Sutter, and northern Sacramento Counties. The basin is bounded on the north by the Bear River, to the west by the Feather and Sacramento Rivers, and to the south by the American River. The eastern boundary can be represented by a line extending north-south from the

[18] This value of approximately 12,000 AF/Yr is confirmed by the September 2008 NID Regional Water Supply Project, Land Use and Water Demands Memorandum included in **Appendix C-7**.

Bear River to Folsom Lake about 2 miles east of the City of Lincoln. This eastern boundary also represents the approximate location of the edge of the alluvial basin from the Sierra Nevada (DWR Bulletin 118, 2004). The North American sub-basin's approximate total storage is 4.9 million acre-feet of water, assuming an aquifer thickness of 200 feet across the total 351,000 acres of the basin and a specific yield of 7 percent (DWR Bulletin 118, 2004).

3.5.1 Historic Groundwater Pumping by the City of Lincoln

Historic groundwater pumping by the City during the past five years is shown in **Table 3.5**. Delivery of surface water from PCWA has enabled the City to maintain a low reliance upon groundwater. From 2002 through 2006, groundwater has made up an average of 8 percent of the City's total potable water supply. The City's goal is to use groundwater to meet no more than 10 percent of its water demands during normal years.

Table 3-5 – City of Lincoln Historic Groundwater Pumping

Year	Groundwater Pumping (AF)
2006	623
2007	924
2008	1,085
2009	836
2010	962

3.5.2 Projected Groundwater Pumping by the City of Lincoln

Projected groundwater pumping by the City of Lincoln through 2035 is shown in **Table 3-6**. Groundwater pumping is based on the City's goal of limiting groundwater to 10 percent of demands during normal water years.

Table 3-6 – Projected Groundwater Pumping

Acre-feet				
2015	2020	2025	2030	2035
1,073	1,137	1,271	1,404	1,556

Groundwater pumping will depend on the growth rate experienced within the City's service area. At this time, development projects currently in the planning stages include: Village 1, Village 4B1-3, Village 6C, Village 9, and Villages 13-17 but additional growth may occur within the City before 2035.

3.5.3 The Western Placer County Groundwater Management Plan

In 2006, a Memorandum of Understanding was signed by Lincoln, PCWA and the City of Roseville to proceed with the West Placer County Groundwater Management Plan (WPCGMP) effort. The Basin Management Objectives are listed below:

- Management of the groundwater basin shall not have a significant adverse effect on groundwater quality;
- Manage groundwater elevations to ensure an adequate groundwater supply for backup, emergency, and peak demands without adversely impacting adjacent areas;
- Participate in State and Federal land surface subsidence monitoring programs;
- Protect against adverse impacts to surface water flows in creeks and rivers due to groundwater pumping; and
- Ensure groundwater recharge projects comply with State and federal regulations and protect beneficial uses of groundwater.

The City, working with PCWA and others, developed the WPCGMP.[19] This effort builds upon and expands the geographic coverage of the City's own GMP.[20] As documented in both the City's GMP and the WPCGMP, the groundwater conditions underlying the City and the SOI indicate currently and historically stable groundwater elevations and reliable water quality. A Memorandum of Agreement was signed by all parties in the fall of 2007 allowing implementation of the actions in the WPCGMP, which will continue to manage the basin in a sustainable manner.

The City is planning to install additional wells within the Lincoln SOI to be able to, when necessary in back-up and emergency situations, meet 75% of the average day demand at build out (approximately 34 mgd) with groundwater. The City is conducting ongoing groundwater investigations to help determine optimal well spacing and pumping schedules.

The City will continue its field and theoretical analyses over the next few years, developing a Lincoln area groundwater model and quantifying recharge and recoverable groundwater volumes. The City is currently in discussions with the Regional Water Authority, PCWA, the County of Placer and the City of Roseville regarding the sharing of groundwater data in the Western Placer County area, and developing a mutually beneficial Integrated Water Resources Management Program. The Integrated Water Resources Management Plan will address anticipated water use policies and goals regarding surface water, groundwater and reclaimed water in western Placer County.

The WPCGMP is designed to assist the City of Lincoln, City of Roseville, Placer County Water Agency (PCWA), and the California American Water Company (CAW) in an effort to maintain a safe, sustainable and high-quality groundwater resource within a zone

[19] Adoption by the City of Lincoln of the WPCGMP occurred in December 2007. The WPCGMP can be viewed at the City of Lincoln Public Works Department.
[20] The City of Lincoln November 2003 Groundwater Management Plan can be viewed at the City of Lincoln Public Works Department.

of the North American River Groundwater Sub-basin.[21] The WPCGMP has as its objective the maintenance of groundwater resources to meet backup, emergency, and peak demands without adversely affecting other groundwater uses within the WPCGMP area. Moreover, the purpose of the WPCGMP is to provide a framework to coordinate groundwater management activities through a set of basin management objectives and specific implementation actions.[22] The "WPCGMP Area," which is located in southwestern Placer County, is shown in **Figure 3-1**.[23]

3.5.4 Groundwater Conditions

In and around the City, groundwater level trends have been stable for the last 50 years. The WPCGMP concludes that groundwater elevations, as evidenced by these hydrographs, as well as an extensive data review, indicates that groundwater elevations are not significantly declining in the vicinity of the City. Further west of the City, near the Placer-Sutter County border, groundwater elevations have also been stable over the past 20 years, exhibiting seasonal variation between about 10 feet above mean sea level (msl) and 30 feet above msl. As noted by the hydrographs in **Figure 3-2** water surface elevation drops in a west, southwest direction, which follows the contours of the underlying strata. Data in **Figure 3-2** shows that groundwater levels are not dropping around the City and long-term trends in wells 11N06E16D001M and 12N06E06A001M show a slight upward trend.

[21] WPCGMP, p. ES-1.
[22] WPCGMP, p. 1-3.
[23] Figure 3-1 appears as Figure 1-1 in the WPCGMP.

Figure 3-1 – Western Placer County GMP Service Area

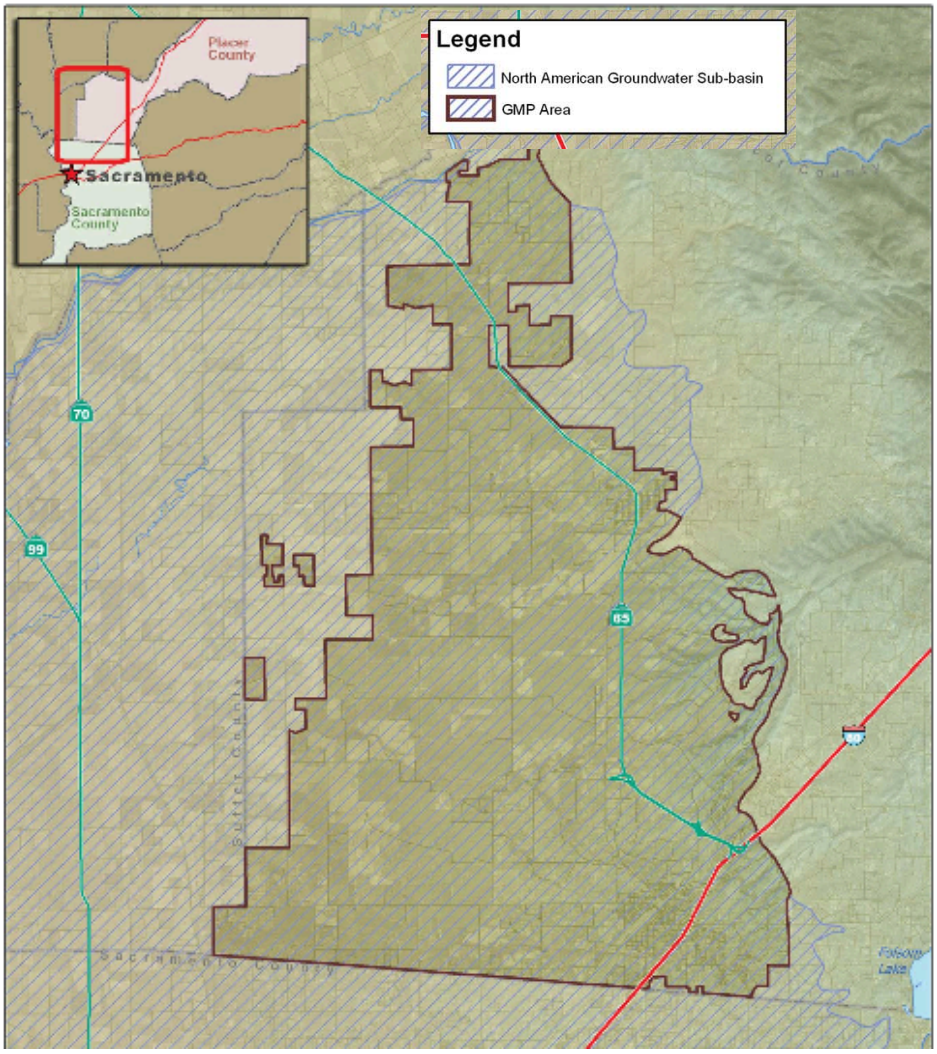
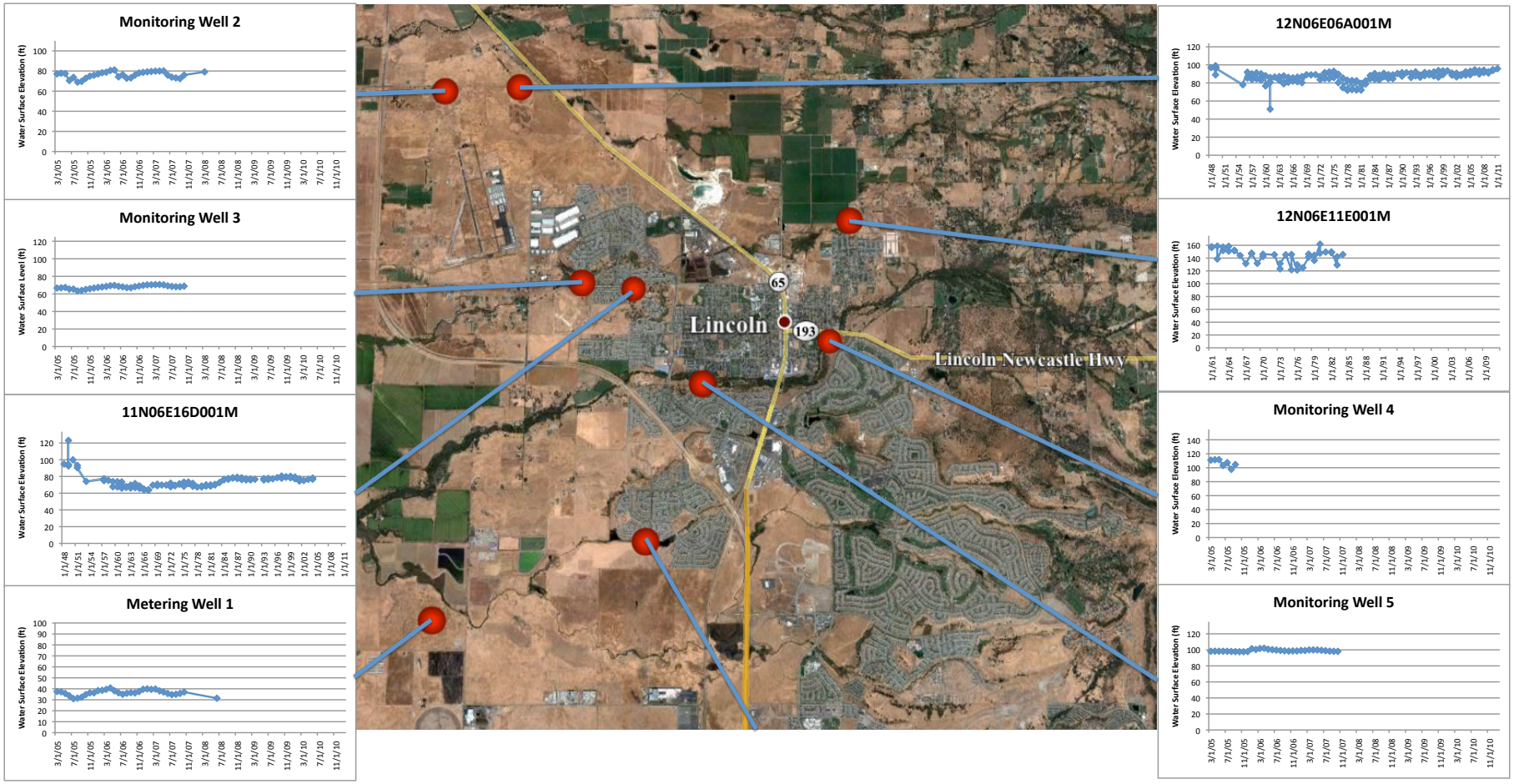


Figure 3-2 – Hydrographs



3.5.5 Groundwater Quality

Groundwater historically supplied by the City does have adequate quality typical of a basin with high concentrations of total dissolved solids and various minerals. However, higher quality surface water is preferred for potable requirements by most customers for aesthetic reasons, but groundwater does supplement this supply in normal water years. Potential issues with groundwater quality include possible decreases in quality with higher pumping rates as well as contamination from the Alpha Explosives site.

The Alpha Explosives is about 5 miles north-northwest of the city and is responsible for nitrate and perchlorate contamination of underlying groundwater in proximity to the site. The plume was reported in 1999 to have extended north and south of the site 600ft and west 1,300ft.[24] This plume movement westward follows the contour in water surface elevations in **Figure 3-2** and shows the likely path of the contaminants. With remediation and the path of the plume, it is not likely that this contamination will reach City wells. If City wells are found to have contamination, then the water would either be treated or designated for non-potable use. The City continues to closely monitor the on-going remediation activities.

3.6 Recycled Water

Chapter 7 provides a more detailed discussion of recycled water opportunities within and adjacent to the City's water service area.

The City's Wastewater Treatment and Reclamation Facility (WWTRF) became operational in 2004 for the purpose of treating wastewater generated within the City. The WWTRF is capable of producing recycled water that meets DHS requirements in Title 22 for unrestricted reuse. The 2008 WWTRF Expansion Plan contemplates the expansion of the capacity of the WWTRF to accommodate an increase in flow as the City of Lincoln's treated water demand increases in the coming years.[25]

While plant capacity will dictate the potential recycled water supply from the WWTRF, treated water demand and the wastewater generated from such demand will drive the quantity of water available for reuse after treatment. Because it is not certain at this time whether the City of Lincoln will partner with Placer County and/or the City of Auburn, the recycled water availability analysis that follows assumes the WWTRF is only treated wastewater generated by the City of Lincoln's treated water service customers.

[24] WPCGMP section 2, page 12
[25] This document can be viewed at the City of Lincoln's Public Works department.

The City of Lincoln has identified existing and potential recycled water users both within and outside of the City's water service area.[26] The City of Lincoln identifies three recycled water use categories, including Agricultural Irrigation (i.e., crops) Landscape Irrigation (i.e., parks, golf courses, road medians, highway landscaping) and Industrial/Commercial (i.e., cooling, washing, and other process uses) uses.

Recycled water from the WWTRF is currently used for agricultural irrigation at four sites near to the facility, with about 400 acres under cultivation.

The anticipated recycled water uses within the City have been projected to replace about 400 acre-feet per year of the City's potable water demand. This represents only a small portion of the total recycled water use in an around the city but the majority of that use will replace raw water not provided by the City. Potential recycled water users are divided into three phases depending on the date of anticipated recycled water service.

In 2004, the City completed a Reclamation Master Plan[27]. This Plan was followed by an Initial Study/Mitigated Negative Declaration for Phase 1 of the Reclaimed Water Distribution System[28]. Since 2000, the City has been installing purple pipe within the new developments that will use the reclaimed water produced by the City. The foundation of the recycled water calculations can be found in further detail in Chapter 7.

3.7 Desalinated Water

There are currently no plans to develop desalinated water supplies.

3.8 Transfer and Exchange Opportunities

The purpose of this section is to describe the opportunities for exchanges or transfers of water on a short-term or long-term basis. Water exchanges and transfers are an integral part of a comprehensive water management strategy. This section will break down the water exchange and transfer discussion into two sections: (1) Objectives; and (2) Mechanisms to meet those objectives. The District does not have any existing exchange or transfer agreements in place.

[26] City of Lincoln, Technical Memorandum 1, Recycled Water Users Description and Phasing, April 16, 2007 (Lincoln Recycled Water Tech. Memo 1).
[27] Completed by ECO:LOGIC, December 2004. This document can be viewed at the City of Lincoln Public Works Department.
[28] Completed by ECO:LOGIC, February 2006. This document can be viewed at the City of Lincoln Public Works Department.

3.5.1 Water Exchange and Transfer Objectives

The City is considering three primary objectives in assessing water exchange and transfer opportunities. The City considers these objectives as both a water provider that could make water available for other users as well as a water receiver in obtaining water supplies for certain beneficial purposes.

- The City would consider water transfer opportunities in the context of improved dry year reliability. There are several unknowns related to dry year reliability that may affect the City in the future including hydrological changes related to climate change, limits placed by PCWA or NID, groundwater contamination, and regulatory-induced shortage issues associated with existing water supplies. The City may pursue water transfers and exchanges to address these potential issues should they arise.

- The City may also pursue water transfers and exchanges in the interest of managing its water assets in order to provide local, regional and statewide benefits. Delta water supply issues, climate change, fisheries issues, and aging infrastructure may all impact numerous purveyors' water management planning activities. The City is initially evaluating opportunities to improve statewide, regional and local water planning objectives through water transfers and exchanges.

- The City may consider water transfers and exchanges as a viable water supply option for potential new growth within or without its existing boundaries that has not been contemplated in the planning horizon presented in this UWMP. Although the City does not intend to expand its service area or provide any permanent supplies outside its service area, in the event such a potential action were to happen or unforeseen significant increased industrial development occurs with the service area (due to high water using industries) the City may consider entering water exchange or transfer arrangements.

3.5.2 Mechanisms to Meet Objectives

There are a few mechanisms that may be used to meet the City's consideration of water transfer objectives, as described above. These include:

- The City is undertaking activities to meet water conservation objectives. These conservation activities include assessing infrastructure and end-user water conveyance and use. Water supplies conserved through the City's efforts may be retained by the City and potentially made available for alternative uses as provided under California Water Code Section 1011, and

- The City is actively engaged in conjunctive use activities and may evaluate expanding how it manages its surface water and groundwater supplies to make water supplies available for alternative uses. The City may pursue groundwater banking and storage

arrangements in the context of regional cooperation and WPCGMP water management activities. These banking and storage opportunities have been developed in order to flexibly and reliably manage the City's entire water supply portfolio for beneficial purposes within and without its service area.

3.9 Supplies and Supply Reliability

This section assesses the reliability of the water supplies discuss above. The UWMPA requires an assessment of supply reliability in a normal water year, a single-dry water year, and during a multiple-dry water year period. The City of Lincoln assesses supply reliability based on its experience and historic hydrologic records of precipitation and runoff in the American River watershed as well as assessments from wholesale suppliers.

3.9.1 Normal Year

The water supply in the City of Lincoln is 100 percent reliable in normal water years. PCWA and NID expect full deliveries in normal years to the City and the underlying groundwater basin will continue to support the anticipated demands placed upon it by the City.

3.9.2 Single Dry Year

The water supply in the City of Lincoln is 100 percent reliable in single dry water years. Any reduction in this would be due to emergency or infrastructure failure. Both PCWA and NID use the 1976-1977 drought to represent the single dry year condition and neither anticipate shortages that would result in reduced deliveries to the City that the City would not easily replace with increased groundwater pumping (in compliance with the WPCGMP objectives). NID notes the potential for slight shortage in single dry years but suggests that this can be averted with the implementation of conservation measures and other supplies.[29] Groundwater is also considered 100 percent reliable in single dry years and will supplement and shortfalls in surface water deliveries. Groundwater supplies will be maintained around the City's goal of 10 percent but may represent a greater percentage in a single dry year, consistent with historic use of the basin by the City and other overlying users.

3.9.3 Multiple Dry Year Period

The water supply in the City of Lincoln is 100 percent reliable in multiple dry water years. PCWA uses the dry year period of 1987-1992 and NID uses 1990-1992 to reflect a multiple dry-year period. The overlapping years of 1987-1990 shall be considered the dry years for the City. As with the single dry year conditions, both providers expect full deliveries for water customers. NID notes the potential for slight shortage in single dry

[29] 2010 Nevada Irrigation District, Draft UWMP

years but suggests that this can be averted with the implementation of conservation measures and other supplies.[30] Groundwater is also considered 100 percent reliable in multiple dry years and will supplement surface water deliveries. Consistent with anticipated actions in a single dry year, groundwater supplies will be maintained around the City's goal of 10 percent but may represent a greater percentage in a single dry year, consistent with historic use of the basin by the City and other overlying users..

3.9.4 Water Supply Projects and Programs

Current water deliveries from NID are wheeled through the PCWA treatment plant per the agreement in **Appendix C-4**. Plans exist between the City and NID to develop a treatment plant so that NID water can be provided directly from NID to the City's treated system. These plans are explained by the 2004 planning phase agreement[31] and 2007 MOU[32] between the City and NID. The project is currently in the planning phase with potential site studies completed for the treatment plant and associated water storage facilities. Due to the financial implications associated with the economic downturn, progress on the project has slowed. The City does not have an estimate of when the project construction will start of possible completion date. In the meantime, the agreement to move NID water through PCWA's facilities will continue to function as the method to continue delivering NID water to the City.

3.9.5 Summary of Supply Reliability

Based on the forgoing analysis, the reliability of the City of Lincoln's supplies is summarized in **Table 3-7** for build-out and contract values and in **Table 3-8** for yearly estimations of availability.

Table 3-7 – Summary of Water Supply Reliability at 2050 or beyond (City's anticipated Build-out)

Source	Normal Year		Single Dry Year		Multiple Dry Years	
	Reliability	Amount	Reliability	Amount	Reliability	Amount
PCWA Surface Water	100%	34,000	100%	34,000	100%	34,000
NID Surface Water	100%	12,000	86%	10,320	90%	10,800
City Ground Water	100%	4,600	100%	6,280	100%	5,800
Recycled Wter	100%	400	100%	400	100%	400
Total		51,000		51,000		51,000

Note: Recycled water supply numbers only represent estimated potable water offset currently served by the City.

Yearly availability in **Table 3-8** is lower than the summary values presented in **Table 3-7** to more accurately represent future agreements and infrastructure expansions as they occur.

[30] 2010 Nevada Irrigation District, Draft UWMP
[31] **Appendix C-5**
[32] **Appendix C-6**

Table 3-8 – Expected Water Availability by Source (Normal Year)

Supplys (AF/Yr)	2015	2020	2025	2030	2035
PCWA	8,500	8,695	9,176	9,706	10,316
NID	1,395	1,541	2,059	2,630	3,286
Groundwater	1,073	1,137	1,271	1,404	1,556
Recycled	0	0	200	300	400
Total	10,968	11,373	12,706	14,040	15,558

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CHAPTER 4. WATER DEMAND CONDITIONS

Understanding the quantities and characteristics of the demand for water, now and into the future, is essential to enable the City to adequately plan and manage its water supplies in the most effective manner. This section of the 2010 UWMP presents the current and future water demands for the City and describes their derivation. This section is organized as follows:

- Historic and Current Water Demands – This subsection presents data reflecting the historic and current water demand conditions for residential and non-residential customers in the City.
- Future Water Demands – This subsection presents the derivation of future demands for potable water within the City's service area, including land-use classifications, unit demand factors, and estimation of non-revenue water.
- Summary of Water Demands – This subsection presents a summary of the projected current and future water demands in five-year increments.
- Future Target Water Use – This subsection presents the calculation of baseline per-capita water use values, as required in §10608.16 et seq., and the resulting 2015 and 2020 water use targets.

4.1 Historic and Current Water Demands

Table 4-1 shows historic water demands within the City's service area for the past five years along with the sources of supply used to meet demands. As described in detail in Chapter 3, surface water supplies are obtained through agreements with both the Placer County Water Agency (PCWA) and the Nevada Irrigation District (NID). The City also operates groundwater wells to meet emergency and summer peaking demands.

Table 4-1 – City of Lincoln Historic Water Demand and Supply

Year	Population	Water Demand (AF)	Groundwater	Surface Water	Total Supply
2006	33,619	9,376	623	8,753	9,376
2007	37,455	10,320	924	9,396	10,320
2008	39,636	10,522	1,085	9,437	10,522
2009	40,532	10,155	836	9,319	10,155
2010	41,141	9,203	962	8,241	9,203

4.1.1 Current Demand Factors

This subsection describes the determination of unit demand factors for existing City customers. Demand factors are represented as the average demand in acre-feet per dwelling unit per year. Residential demand factors are broken into categories based on

the type of residence such as high density and low density, where high density represents apartments or condominiums and low density represents more traditional single-family homes. High density residences share common landscaped areas and have very little or no individual landscape demand, and also tend to have less people per dwelling unit than the lower-density dwelling units. These factors result in smaller per dwelling unit (DU) water demand. Low-density DU demands associate with more typical subdivisions where homes are on medium to large lots with individual landscaping and typically large turf areas. These DUs usually have more people per unit (e.g. housing a family) and, combined with outdoor landscaping, generally have greater per dwelling unit water demands.

Non-residential use is developed in a similar fashion to residential demand. Due to the variance between types of commercial connections, though, demands are developed as equivalent dwelling units (EDUs) or on a demand per acre basis[33].

To enable unit water demand to reflect the impact of external drivers affecting future indoor and outdoor use (see **Section 4.2)**, the factors are broken into the following residential subcategories: country estates, low density, medium density, high density, and mixed use. Existing indoor demand factors are based on the meter study conducted as part of this UWMP (see **Appendix B-5). Table 4-2** summarizes the study's findings.

Land use categories for future development are defined as: very low density, low density, medium density, and high density. Country estates shall be considered the same as a very low density development, while mixed use demands can be considered equivalent to high density demand factors. Future indoor residential land-use categories are estimated accordingly.

Table 4-2 – Current Demand Factors

Customer Type	Demand Factor	Units
Country Estates	0.85	AF/DU
Low Density Residential	0.46	AF/DU
Medium Density Residential	0.29	AF/DU
High Density Residential	0.22	AF/DU
Office/Light Industrial	2.8	AF/Acre
Retail/Commercial	2.8	AF/Acre
Public	3.1	AF/Acre

Note: High Water Use Industrial is not calculated using demand factors. Demand Factors do not include water lost in the delivery system and thus only reflect demand at the customer's meter.

[33] Non-residential use includes all commercial, industrial, institutional, and parkway demands. Since these demands vary with the types of commercial establishments and the specific industries, the EDU basis provides a useful method to reflect the average demand per acre.

4.2 Future Water Demands

4.2.1 Current and Future Mandates

External forces will drive the City to adopt policies that ensure future residential development achieves lower unit water demands than those seen historically in the City. Recently enacted State statutes and efficiency mandates will also drive the use of more efficient fixtures and products used in residential development. This subsection identifies and describes the key drivers that support use of unit demand factors that are lower than current values.

4.2.1.1 Water Conservation Objectives

On November 10, 2009, Governor Arnold Schwarzenegger signed SBX7 7, which now requires each urban water supplier to select one of four methods for determining water conservation targets for 2020.[34] This bill establishes a statewide goal of achieving a 20-percent reduction in urban per capita water use by 2020. As part of the statutes, the City must establish a water conservation target based on determination of historic baseline use. This determination is detailed in **Section 4.5**.

Achieving the City's 2020 conservation target will require reductions in per capita urban water use from current levels. This will require the City to continue and potentially increase water conservation measures in its existing service area, continue to reduce system deliver losses, and also require new service areas to use efficient indoor infrastructure and landscape features. A combination of new construction and adoption of conservation measures by existing customers will help the City meet its identified target use.

4.2.1.2 Indoor Infrastructure Requirements

In January 2010, the California Building Standards Commission adopted the statewide mandatory Green Building Standards Code (CAL Green Code) that requires the installation of water-efficient indoor infrastructure for all new projects beginning after January 1, 2011. CAL Green Code was incorporated as Part 11 into Title 24 of the California Code of Regulations.[35] The CAL Green Code applies to the planning, design, operation, construction, use and occupancy of every newly constructed building or structure. Thus, all future construction will need to satisfy the indoor water use infrastructure standards necessary to meet the CAL Green Code.

[34] California Water Code § 10608.20

[35] The CAL Green Code is Part 11 in Title 24. All references in this WSA will be to the Chapter and Section numbers that appear in the Draft document which may be obtained by visiting the California Building Standards Commission web site at: http://www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf

The CAL Green Code requires residential and non-residential water efficiency and conservation measures for new buildings and structures that will reduce the overall potable water use in the building by 20 percent. The 20 percent water savings can be achieved in one of the following ways: (1) installation of plumbing fixtures and fittings that meet the 20 percent reduced flow rate specified in the CAL Green Code, or (2) by demonstrating a 20 percent reduction in water use from the building "water use baseline."[36]

4.2.1.3 California Model Water Efficient Landscape Ordinance

In 2006, the California Legislature enacted, and the Governor signed, the Water Conservation in Landscaping Act, which required the Department of Water Resources to update the Model Water Efficient Landscape Ordinance (MWELO)[37]. On September 10, 2009, the Office of Administrative Law (OAL) approved the updated MWELO, which requires that a local agency adopt the provisions of the MWELO by January 1, 2010. Because the City is a "local agency" under the MWELO, it must require "project applicants" to prepare plans consistent with the requirements of MWELO for review and approval by the City. The City is in compliance with this state law and formally notified DWR of the City's adherence to the State's MWELO in a letter dated February 4, 2010.

The MWELO provisions are likely to have a significant effect on the landscape design and resulting outdoor water demand by requiring preparation of a Landscape Design Plan with a water budget that is 70 percent of reference evapotranspiration.[38] The provisions of the MWELO are applicable to new construction with a landscape area greater than 2,500 square feet.[39] The MWELO "highly recommends" use of a dedicated landscape meter on landscape areas smaller than 5,000 square feet, and requires weather-based irrigation controllers or soil-moisture based controllers or other self-adjusting irrigation controllers for irrigation scheduling in all irrigation systems.[40] The MWELO provides a

[36] See CAL Green Code. For Residential construction, Section 4.303.1 provides the residential water conservation standard and Table 4.303.2 identifies the infrastructure requirements to meet this standard. Table 4.303.1 and Worksheets WS-1 and WS-2 are to be used in calculating the baseline and the reduced water use if Option 2 is selected. For non-residential construction, Section 5.303.2.3 provides the water conservation standard as well as the baseline and reduced flow rate infrastructure standards. Note that Worksheets WS-1 and WS-2 incorporate both residential and non-residential fixtures, yet the water use is still to be analyzed by "building or structure" as specified in Chapter 1, Section 101.3.

[37] Gov. Code §§ 65591-65599

[38] California Code of Regulations (CCR), Tit. 23, Div. 2, Ch. 27, Sec. 492.4. The MWELO provides the local agency discretion to calculate the landscape water budget assuming a portion of landscape demand is met by precipitation, which would further reduce the outdoor water budget. For purposes of this UWMP, precipitation is not assumed to satisfy a portion of the outdoor landscape requirement because the determination of an appropriate effective precipitation factor is highly uncertain given the various landscape slopes, terrain composition, concurrent watering schedules, etc.

[39] CCR Tit. 23, Div. 2, Ch. 27, Sec. 490.1.

[40] CCR Tit. 23, Div. 2, Ch. 27, Sec. 492.7(a)(1)(A)-(B).

methodology to calculate total water use based upon a given plant factor and irrigation efficiency.[41] Finally, MWELO requires the landscape design plan to delineate hydrozones (based upon plant factor) and then assign a unique valve for each hydrozone (low, medium, high water use).[42]

It is difficult to predict the ultimate impact of the MWELO requirements on water demand. While the requirement is for development of a landscape design plan that uses plants and features that are estimated to use no more than 70 percent of ETo, some provision must be made for the inherent tendency to overwater even with irrigation controllers installed, piecemeal changes in landscape design, reductions in irrigation efficiency through product use, and limited resources for enforcement in the absence of dedicated irrigation meters.

For these reasons, future outdoor water use is assumed to be about 85 percent ETo over a long-term period. This value was selected based on a study that supports the assumption that customers tend to apply 16 percent more water to the landscape than it actually needs.[43] While weather-based irrigation controllers may reduce this number such that only about 2 percent more water is being applied than is needed, some consideration needs to be made for the factors described above that will impact water use, outside of a controlled study, even when using a weather-based irrigation controller. These factors will likely result in overuse somewhere between 2 percent and 16 percent. Given the uncertainty regarding these impacts, the "overuse" percentage of 16 percent was used to adjust the MWELO Landscape Plan requirement.

4.2.1.4 Metering and Volumetric Pricing

In 2003, the California Legislature enacted, and the Governor signed, legislation that set in motion the requirement for water purveyors to install meters on all service connections to residential and nonagricultural commercial buildings constructed prior to January 1, 1992 (all buildings constructed post-1992 were required to have a meter placed at construction).

The California Urban Water Conservation Council (CUWCC) recommends assuming a 20 percent water savings for accounts with meter retrofits and volumetric rates.[44] Twenty

[41] In calculating Estimated Total Water Use, the MWELO requires use of at least a 71% irrigation efficiency factor. Assuming 71% irrigation efficiency, the average plant factor must be 0.50. It would be possible to stay within the water budget if the average plant factor were higher than 0.50 by designing a system with an irrigation efficiency higher than 71%. Again the relationship between a Plant Factor (PF) and Irrigation Efficiency (IE) in the Applied Water formula is: AW=(ETo*PF)/IE.
[42] CCR Tit. 23, Div. 2, Ch. 27, Secs. 492.3(a)(2)(A) and 492.7(a)(2).
[43] http://www.irwd.com/Conservation/FinalETRpt[1].pdf.
[44] BMP 1.3, Memorandum of Understanding Regarding Urban Water Conservation in California, California Urban Water Conservation Council, December 10, 2008.

percent is an appropriate level of water savings when these measures are applied to existing residential accounts where no volumetric billing occurs. However, much of the City is newer development and the entire City service area is billed based on volume. Because of these factors, the new customers are assumed to not use 20 percent less than existing customers. Accordingly, the existing and future demand factors are not reduced due to this external driver.

4.2.1.5 California Urban Water Conservation Council and Water Forum Agreement Conservation Element Best Management Practices

The City of Lincoln is not a signatory to the CUWCC Best Management Practices (BMP) Memorandum of Understanding (MOU), nor is the City a signatory to the Water Forum Agreement (WFA). However PCWA, which supplies treated water to the City, is a signatory to the WFA and a signatory to the CUWCC.

In 2009, the WFA updated the WFA Conservation Element. Under that revised Element, signatories would replace their respective WFA water conservation plans with the CUWCC MOU, including the CUWCC BMPs. As PCWA acts as a wholesaler to the City, PCWA has no interaction with the retail customers in the City and will not impose any BMPs in the City.[45] However, the City does maintain a structured water conservation program that continues to implement demand management measures, as outlined in **Section 5**.

4.2.2 Indoor Residential Demand Factors

Based upon an analysis of 2010 monthly meter data for low and medium density residential dwelling units within the City, the historic combined unit demand factor was determined to be approximately 0.41 AF/DU/Yr, which at 2.4 people per house, equates to 55,666 gallons per capita per year. Because a vast majority of the existing customers are in homes built within the last decade, the current and future indoor unit demand factor is assumed to be nearly equivalent, even with the additional drivers such as the Cal Green Code.

The indoor demands for each dwelling unit category are estimated by subtracting the outdoor demands, from **Section 4.2.3**, from the total demands gathered from the meter study. **Table 4-3** presents the resulting estimated indoor unit demand factors.

[45] CUWCC MOU Section 3.1

Table 4-3 – Indoor Demand Factors

Dwelling Unit Type	Indoor Demand per DU gal/day	Indoor Yearly Demand AF
Country Estates	159	0.18
Low Density	171	0.19
Medium Density	152	0.17
High Density	163	0.18

The resulting indoor demand factors for residential units in the City all fall around the same value of about .18 AF/DU/Yr. This matches the values estimated from the meter study for post 1993 constructed houses. The variability in the results is due to the estimation of landscape area for each dwelling unit type.

4.2.3 Outdoor Demand Factors

Review of historic City data indicates a wide range of planning numbers for indoor and outdoor unit demand factors. The outdoor demand factor for the various land classifications in the City was calculated from meter study results. Looking at meter volumes for outdoor uses such as parks and then dividing by the acreage gave a range of demand factors. More details of this can be found in the meter study found in **Appendix B-5**.

Based on the analysis preformed in the meter study, there was a range of outdoor demands. These demands changed due to the type of use and the differences in climate year to year. The resulting average outdoor demand factors for 2010, a milder year, was 3.60 AF/Ac. This is consistent with previous assumptions for the area where the outdoor demand was estimated at 3.73 AF/Ac as 85% of ETo.

The primary driver that could significantly change both residential and non-residential outdoor water demands is the MWELO, as discussed in **Section 4.3.5**. In following MWELO methodologies, landscaping demand can by calculated as an estimate of reference ETo as described in **Section 4.3.3**. Using demand values estimated for MWELO, a demand per acre or square foot could be applied to the average lot size of each category and produce the outdoor demand for each residence type.

Using the outdoor unit demand factor of 3.73 af/ac/yr and associated landscape area for an average lot in the City, and estimate of current outdoor demands can be derived. Using this same number and the average lot size from the Village 1 land-use plan, which is a current example of future development in the City, an estimate of future outdoor demands is created. All lot sizes are calculated to use this number. For example, the country estates are expected to share this demand per-acre value but with greater proportions of the lot dedicated to landscape versus areas covered by hardscape and the structure's footprint. The medium density lots are also assumed to have similar per-acre

values, but with lesser proportions of the lot dedicated to landscaping. Thus the country estates and medium density lots will see per dwelling unit outdoor demand factors that are greater and less than, respectively, that of a low-density dwelling unit.

The estimate of low density lot area was made based upon the acreage and unit figures for the low density land use categories as well as an estimate of the area necessary for roads and right-of-ways. For the low density category, the planned unit density is an average of 5.5 units per acre (2,883 units/524.2 acres). Assuming 25 percent of the area in the category is for roads and rights of ways, then the lot size is approximately 6,000 square feet (sq-ft). To estimate the landscaped area on each lot, the City's Zoning Code was used as a reference. Assuming the lots are 6,000 sq-ft, they would likely have associated building standards similar to those in the City's R-1 category that requires minimum 6,000 sq-ft lots and maximum building coverage of 60 percent.[46] Required set backs would put the maximum lot coverage closer to 55 percent for a 60ft by 100ft lot.[47] However this still creates a 3,300 sq-ft home footprint that seems large for this type of lot where houses are commonly two stories and around 2,500 sq-ft in size. A more reasonable estimation would be a 2,000 sq-ft footprint. If 25 percent of the lot were used for hardscapes, then the remainder of the lot, as landscape area, would be approximately 40 percent or around 2,500 sq-ft. The same ratio of 40 percent is used for the country estates in Village 1.

For the high density category, the planned unit density is approximately 20 units/acre (579 units/29 acres). This reduces to an average of about 2,200 sq-ft per unit. This is just above the minimum lot requirements from the R-3 zoning requirements of just over 2,100 sq-ft of lot per unit for the minimum R-3 land area.[48] Using approximately 10 percent to account for roads and right of ways, then the average final lot size would be about 1,950 sq-ft. [49] It is common for this type of development to use as much of the land area as possible to maximize value so the 60 percent maximum is appropriate in this case. After taking 20 percent for hardscape the remainder, about 20 percent or 400 sq-ft, is left as landscape area. For the Multi-Unit Residential category, the landscaped area is only 10 percent of lot area because the combined commercial uses (in the Multi-Unit Nonresidential category) reduce landscaped areas with more area dedicated to hardscapes connecting the residential and commercial components.

[46] City of Lincoln Zoning Code, § 18.12.040 and 18.12.050.
[47] City of Lincoln Zoning Code, § 18.12.070.
[48] City of Lincoln Zoning Code, § 18.16.040 and 18.16.050.
[49] Because multi-family units tend to be accessed by main arterial roads and have limited interior roadways, 10% was selected as a reasonable figure across the multi-family categories. This accounts for those complexes accessed entirely by arterial roads and provides for some internal roadways in condominium type complexes.

Table 4-4 – Outdoor Demand Factors

Dwelling Unit Type	Average Lot Area (Acres)	Average Landscape (%)	Yearly Outdoor Demand (AF/Ac)	Outdoor Yearly Demand (AF/du)
Country Estates	0.45	40%	3.73	0.67
Low Density	0.18	40%	3.73	0.27
Medium Density	0.08	40%	3.73	0.12
High Density	0.05	20%	3.73	0.04

4.2.4 Non-Residential

4.2.4.1 Public Land Use Coverage Percentages

The Public sector water demand is evaluated on a land-area coverage basis. Each non-residential land-use is assigned an average coverage percentage for each non-residential land-use type – indoor, hardscape, and outdoor irrigation. Land-use coverage percentages were estimated based upon existing City land-use coverages as well as proposed Floor Area Ratios, which serve as an indicator of the "indoor" coverage percentage.[50] The following land use types are lumped into one category known as Public.

- *Parks:* For the Park categories, minimal area is devoted to indoor uses and hardscapes. While these figures will vary depending on the location and purpose of the park space, on average, about 5 percent is devoted to the indoor and hardscape categories and 95 percent of the park space is landscaped.[51] This estimate provides a conservatively high demand total for the Park category because the landscape category has a higher unit demand factor than the indoor and hardscape categories.

- *Schools:* For the School category, Landscape coverage remains at 50%, consistent with historic values. Values of indoor and hardscape are calculated at 25% each.[52]

- *City Property:* This type of property consists of the city owned buildings and land not including parks. The resulting estimate of 60% landscape and 20% for indoor and hardscape demands was developed. This assumes that landscaping makes up the majority of the land rather than assume that City property only includes city owned buildings.

[50] Because floor area may comprise building area on more than one story, the coverage percentage may be less than floor area, but without specific knowledge of the ultimate building design, the floor area serves as a reasonable approximation of the area that the building will cover.
[51] Tully & Young assessed park coverage by using Google Earth Pro to analyze existing parks.
[52] Based upon an electronic map survey conducted by Tully & Young using Google Earth Pro, indoor coverage was increased from the historic value of 10% to 25% and the hardscaped area is reduced accordingly to 25%.

All coverage percentages are provided in **Table 4-5**. The resulting calculation of total public demand factor is based on a weighted percentage of the various land types demand factors scaled by the respective acreage.

Table 4-5 – Public Coverage Percentages and Unit Demand Factors

Land Use	Acres	Use Class	Coverage %	Use Class Unit Demand (AF/Ac/Yr)	Land Use Unit Demand (AF/Ac/Yr)
Parks	119.6	Indoor	2%	0.48	0.0096
		Hardscape	3%	0	0
		Landscape	95%	3.73	3.54
		Total	100%		3.55
Schools	116.7	Indoor	25%	2.8	0.7
		Hardscape	25%	0	0
		Landscape	50%	3.73	1.87
		Total	100%		2.57
City Property	34	Indoor	20%	2.8	0.56
		Hardscape	20%	0	0
		Landscape	60%	3.73	2.24
		Total	100%		2.80
Total Public	270.3				**3.10**

Note: Unit Demands presented don't include water loss and represent demand at the meter. Acreages from May 28, 2011 email from Rod Campbell and Bruce Burnworth.

- The Landscape demand factor is based on MWELO calculations as discussed under the residential landscape demand.
- For the School category, the indoor demand factor is as presented in the 2008 General Plan calculated based on average daily demand.
- Indoor park use is estimated in the meter study memo and represents the small demand from bathrooms and drinking fountains in parks.
- City Property is considered a blend of indoor and outdoor demands based on the percentages of land use types in this category.

Unit demand factors are presented in **Table 4-5** in the "Use Class Unit Demand" and "Land Use Unit Demand" columns.

4.2.4.2 Commercial, Industrial, and Office Demand Factors

Demand factors for the Commercial, Industrial, and Office use classifications come from the City's 2008 General Plan. As described in the meter study memo, an analysis of the meters for these categories produced an estimate in the range of the general plan values. Due to the lack of a sizable difference, further investigation in the meter study was

focused on the residential land classifications, which represent the majority of the City's demand.

4.2.5 Anticipated Reduction in Current Unit Water Demand Factors

Current unit water demand factors represent the demands of existing development. Most of the city's residences are newer and build after efficient plumbing fixtures were required. There will be small increases in efficiency of current users. This increase in efficiency is from a numbers of sources including rebate programs for plumbing retrofits and appliances. Increases in efficiency occur outside of rebate programs through natural attrition. Remodels, appliance upgrades, and fixture style changes all contribute to efficiency increases due to retailers and manufactures focusing on sales to contractors who are required to use code compliant building materials. The trends in both current and future demands over time are presented in **Table 4-6.**

Table 4-6 – Change in Current Demand Factors Over Time

Existing Demands (AF/Yr)	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
Country Estates	0.85	0.83	0.81	0.79	0.77	0.77
Low Density	0.46	0.45	0.45	0.44	0.44	0.44
Medium Density	0.29	0.28	0.28	0.27	0.26	0.26
High Density	0.22	0.22	0.21	0.21	0.20	0.20
Industrial/Office	2.80	2.73	2.65	2.58	2.50	2.50
Commercial	2.80	2.73	2.65	2.58	2.50	2.50
Public	3.10	2.80	2.80	2.80	2.80	2.80
Future Demands (AF/Yr)	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
Country Estates	--	0.77	0.77	0.77	0.77	0.77
Low Density	--	0.44	0.44	0.44	0.44	0.44
Medium Density	--	0.26	0.26	0.26	0.26	0.26
High Density	--	0.20	0.20	0.20	0.20	0.20
Mixed Use	--	0.20	0.20	0.20	0.20	0.20
Industrial/Office	--	2.5	2.5	2.5	2.5	2.5
Commercial	--	2.5	2.5	2.5	2.5	2.5
Public	--	2.8	2.8	2.8	2.8	2.8

Note: Units are AF/Yr per DU for residential demands and AF/Yr per Acre for nonresidential. Values represented do not include system losses necessary to deliver the identified unit demand to the City's customers.

4.3 Projected Water Demands

4.3.1 Introduction

Water demand projections within the City's service area were developed for the 2010 UWMP. These numbers include current service areas as well as future planned developments within the SOI. The existing city demands are estimated to show a slight reduction due to natural attrition of customers switching to more efficient appliances and fixtures as well as on-going conservation efforts of the City.

4.3.2 Planned Construction

A number of developments are currently in planning and construction phases in the City. The general plan refers to the areas around the City as villages. Since the analysis preformed for the 2008 General Plan, the rate of growth has slowed due to economic conditions. A new construction growth rate has been developed and the City expects 12,500 additional dwelling units (DUs) by 2035. A summary of the expected growth is presented in **Table 4-7** as a running total of new DUs from 2010.

Table 4-7 – New Development for the City of Lincoln

	2015	2020	2025	2030	2035
Country Estate (DUs)	285	585	1014	1443	1875
Low Density (DUs)	1064	2184	3786	5387	7000
Medium Density (DUs)	342	702	1217	1732	2250
High Density (DUs)	209	429	744	1058	1375
Industrial/Office (Acres)	0	35	70	105	140
Commercial (Acres)	0	10	30	50	70

Note: These numbers represent a running total of new construction and include the development in each five-year period as well as the previous development.

4.3.3 The Future of Existing Demands

As discussed in **Section 4.3.5**, the changes in existing demands are likely to be small due to the newer age of most of the homes, however a slight drop in water demands for existing customers is expected.

4.3.4 Non-Revenue Water Demands

The demand factors presented earlier in this section represent the demand for water at each customer location. To fully represent the demand, the demands of non-revenue water also need to be included. Often, non-revenue water represents water that is lost due to system leaks, fire protection, construction water, unauthorized connections and inaccurate meters. In most instances, the predominant source of non-revenue water is

from system losses. For purposes of estimating future demand from new connections, the non-revenue water value is assumed to be 10 percent.[53]

4.3.5 Projected Water Demands for the City of Lincoln

These represent the most current demand estimates for the City. Projected water demands for the City of Lincoln are represented in **Table 4-8**.

Table 4-8 – Projected Water Demands for the City of Lincoln

Water Demand	2010	2015	2020	2025	2030	2035
Acre Feet	10,005	10,730	11,373	12,706	14,040	15,558

The water demand projections depicted in **Table 4-8** include existing uses as well as anticipated residential and non-residential land uses.

4.3.6 Low Income Household Water Demand

California Water Code (CWC) §10631.1 requires water suppliers to include a projection of water use by lower income households as defined by §50097.5 of the Health and Safety Code. The housing element of the Placer County General Plan provides the income distribution used for this analysis.[54] This housing element, adopted in 2009, uses 1999 data. The income limits for "lower income" are to come from Department of Housing and Policy Development. Only values for 2006 through 2010 are available so values were taken from 1999 US Department of Housing and Urban Development income limits. The 1999 Placer County "lower income" values for 2 person and 3 person households were $33,200 and $37,350 respectively.[55] As the City uses an estimate of between 2 and 3 people per household it is assumed that a dollar value between those two would be appropriate. While this could be calculated more accurately, the Placer County housing element has an income split at less than $35,000 yearly income. This split correlates to 28.1% for unincorporated portions of Placer County and 27% for incorporated areas of Placer County. The City makes up a sizable portion of the incorporated population of Placer County. For lack of more recent income distributions, this 27% is assumed to remain constant into the future. Using 27% of the projected population, a weighted average of demand factors from medium and low density housing units of 0.38 AF/Yr, and 2.4 people per housing unit, the current and future demand from "lower income" customers is presented in **Table 4-9**.

[53] The 10 percent value reflects the quantity of water supplied by the Lincoln distribution system, but not accounted for in customer meter quantities. For purposes of estimating this quantity when viewed from the customer meter looking back to the "beginning" of the water supply distribution system, a value of 11% is multiplied by the customer demands, then added to those demands to reflect a total projected demand.
[54] Placer County General Plan- Housing Element, pg 21, Table 8- Household Income Distribution
[55] www.huduser.org/portal/datasets/il/fmr99rev/index.html

Table 4-9 – Lower Income Demands

AF/Yr	2010	2015	2020	2025	2030	2035
Total Retail Treated	10,005	10,730	11,373	12,706	14,040	15,558
Lower Income	1,759	1,920	2,081	2,319	2,541	2,757
% of Treated	17.6%	17.9%	18.3%	18.3%	18.1%	17.7%

Note: Low Income demand factor adjusted to show linear reduction of 10% by 2030.

4.4 Future Target Water Use

Pursuant to CWC §10608.20 et seq., an urban retail water supplier must document baseline daily per capita water use, develop both an urban water use target and an interim water use target, and then document compliance daily per capita water use.[56] Documentation of compliance must include the bases for determining the estimates, including references to supporting data.

4.4.1 Baseline Daily Per Capita Water Use Analysis

"Baseline per capita daily water use" is an urban retail water supplier's estimate of its average gross water use, reported in gallons per capita per day and calculated over a continuous 10-year period ending no earlier than December 31, 2004, and no later than December 31, 2010.[57] "Gross water use" is defined as the total volume of water, whether treated or untreated, entering the distribution system of an urban retail water supplier, excluding recycled water, water in long-term storage, water conveyed to another urban water supplier, and possibly water delivered for agricultural use.[58] The City's distribution system is schematically detailed in **Figure 2-1**.

The City of Lincoln has estimated its "baseline per capita daily water use" by assessing the Public Water System Annual Reports to the California Department of Public Health for the period 1995-2010 as provided by the City Department of Public Services and historic population data obtained from the California Department of Finance for the same period.[59]

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[56] An "urban retail water supplier" is a water supplier that directly provides potable municipal water to more than 3,000 end users or that supplies more than 3,000 acre-feet of potable water annually. CWC 10608.12(p). The City of Lincoln supplies water directly to more than 3,000 end users.

[57] CWC § 10608.12(b)(1). This analysis currently only analyzes baseline daily per capita water use through 2009. At the point all relevant 2010 data is available, the calculations should be updated for purposes of inclusion in the 2010 UWMP. It is unlikely that use of the 2010 data will change the baseline daily per capita water calculations such that the City would select a new baseline period, but the 2010 data may be instructive when considering the existing per capita water use of the City's customers in the distribution system.

[58] CWC § 10608.12(g).

[59] "Base daily per capita water use" means "an urban retail water supplier's estimate of its average gross water use, reported in gallons per capita per day and calculated over a continuous 10-year period ending no

4.4.1.1 Distribution System

For this analysis, the City's "distribution system" includes the conveyance systems from PCWA's surface water treatment plants to the customers. It also includes all treatment and conveyance systems from the wells operated by the City. A graphical representation of the distribution system can be found in **Section 2** as **Figure 2-1**.

4.4.1.2 Gross Water Use

To calculate "gross water use," inflow data for the period 1995-2010 was totaled for the PCWA inflow totals plus well production and compared to the recorded sales at the customers' meters. Total water supplies entering the distribution system are provided in **Table 4-10**.

Table 4-10 – Water Entering the City's Distribution System

AF/Yr	1995	1996	1997	1998	1999	2000	2001	2002
City Wells	449	516	484	433	469	569	408	713
Surface Water	1302	1338	1678	1421	1783	2041	3326	4063
Total	1751	1854	2162	1854	2252	2610	3734	4776
AF/Yr	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
City Wells	543	298	515	623	924	1085	836	962
Surface Water	4845	7243	7828	8753	9396	9437	9319	8241
Total	5388	7541	8343	9376	10320	10522	10155	9203

The City has not used recycled water for anything more than agriculture around the treatment plant, therefore recycled water does not need to be excluded from the total volume of water entering the distribution system. More discussion of recycled water will be addressed in **Chapter 7**. Also, because the City's treated water distribution system storage is equal to approximately maximum day demand, and is intended to shed peaks and provide storage for short duration emergencies, there is not a significant change in the City's treated water storage volumes over the course of the year. Therefore, there is no adjustment made for water in long-term storage. Because the City does not serve treated water for agricultural purposes, there is no adjustment made for such deliveries as well. Gross water use for the City is provided in **Table 4-10** as the values included in the rows titled "Total."

4.4.1.3 Population Analysis

The Department of Water Resources has identified three acceptable methodologies for estimating population during the period 1995-2010 for purposes of calculating baseline daily per capita water use. Due to the City's distribution system matching the City limits,

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earlier than December 31, 2004, and no later than December 31, 2010. (CWC § 10608.12(b)(1)) "Gross water use" is defined as the total volume of water, whether treated or untreated, entering the distribution system of an urban retail water supplier, excluding recycled water, water in long-term storage, water conveyed to another urban water supplier, and possibly water delivered for agricultural use. (CWC § 10608.12(g))

the City was able to use an allowable method where the source of population data was the Department of Finance (DOF), which had yearly population estimates. All population-based calculations in this UWMP are estimated using DOF Table E-4 with 30 people added to account for the few services, which remain outside the city limits.

Table 4-11 – City of Lincoln Population

Year	Population
1995	8,333
1996	8,579
1997	8,901
1998	9,053
1999	9,635
2000	11,235
2001	13,659
2002	16,886
2003	20,035
2004	23,480
2005	27,433
2006	33,619
2007	37,455
2008	39,636
2009	40,532
2010	41,141

4.4.1.4 Baseline Water Use Calculation

Using the Gross Water Use data provided in **Table 4-10** and the population data provided in **Table 4-11**, annual daily per capita water use was calculated, and the results are summarized in **Table 4-12**.

Table 4-12 – The City of Lincoln Daily Per Capita Water Use

Year	Daily Per Capita Use (gpcd)
1995	188
1996	193
1997	217
1998	183
1999	209
2000	207
2001	244
2002	253
2003	240
2004	287
2005	272
2006	249
2007	246
2008	237
2009	224
2010	200

From these annual figures, the baseline daily per capita water use was calculated for the six 10-year time periods ending no earlier than December 31, 2004 and no later than December 31, 2009. The results are provided in **Table 4-13**. Based on a review of the results, the City will select the 2000-2009 baseline daily per capita water use as its baseline period. The per capita water use during this period averaged 246 gallons per capita per day.

Table 4-13 – The City of Lincoln Baseline Daily Per Capita Water Use

Period	gpdc
1995-2004	222
1996-2005	230
1997-2006	236
1998-2007	239
1999-2008	244
2000-2009	246
2001-2010	245

4.4.2 Water Use Target

Pursuant to CWC §10608.20(a), the City plans to adopt the following urban water use target: (1) 80% of its baseline per capita daily water use. The City must meet its urban

water use target by December 31, 2020, and its interim water use target by December 31, 2015.[60]

4.4.2.1 Method 1 Target Calculation

One method that may be used to determine the City's "water use target" is to estimate 80 percent of the City's baseline daily per capita water use.[61] Using this target, 80 percent of the City's baseline daily per capita water use is 197 gpcd. The City must also achieve an "interim water use target," which is the midpoint between its baseline daily per capita water use and its water use target.[62] Using the same water use target, the City's interim water use target is 222 gpcd. The City must achieve its water use target by December 31, 2020 and its interim water use target by December 31, 2015.[63]

Table 4-14 – Water Use Target and Interim Water Use Target

Baseline Period	2020 Compliance Year	2015 Compliance Year
	80% of Baseline	90% of Baseline
1995-2004	178	200
1996-2005	184	207
1997-2006	189	212
1998-2007	191	215
1999-2008	195	220
2000-2009	197	221
2001-2010	196	221

4.4.2.2 Method 4 Target Calculation

Alternatively, the City may adopt a target based on the methodology developed by the Department of Water Resources pursuant to CWC § 10608.20 (b)(4) (i.e., "Method 4"). DWR issued *Provisional Method 4 for Determining Water Use Targets* on February 16, 2011, which an urban water supplier selecting Method 4 must use to calculate its water use target. DWR developed the Method 4 Target Calculator to facilitate calculation of an urban water supplier's water use target. The Method 4 Target Calculator helps an urban water supplier calculate potential water savings in three unique sectors: (1) residential indoor; (2) commercial, industrial and institutional (CII), and (3) landscape water use, water loss and other unaccounted for water sectors. The combined potential savings from these sectors is subtracted from an urban water supplier's Base Daily Per Capita Water Use to develop its target.

[60] An urban retail water supplier's "interim urban water use target" is the midpoint between the urban retail water supplier's base daily per capita water use and the urban retail water supplier's urban water use target for 2020. (CWC § 10608.12(j)).
[61] CWC § 10608.20(b)(1).
[62] CWC § 10608.12(j).
[63] CWC § 10608.24(a)-(b).

There are two approaches for calculating potential residential indoor savings. An urban water supplier can use the default value of 15 gpcd, which was selected based on an analysis by DWR which found that an urban water supplier could achieve about this quantity of savings through implementation of toilet, showerhead, and clothes washer rebate and installation programs. Alternatively, an urban water supplier can calculate potential savings through implementation of rebate and installation programs by estimating the existing saturation rate for each type of appliance. Once estimated, the Target Method 4 Calculator projects potential additional installations necessary to achieve a target saturation rate and then estimates the associated water savings with achievement of the saturation rate. As for potential CII savings, the Target Method 4 Calculator assumes an urban water supplier can achieve a 10 percent water savings in the CII sector compared to CII use in the "mid-point" year of the 10-year period used to estimate its Base Daily Per Capita Water Use. In the landscaping and water loss sectors, the Target Method 4 Calculator projects potential savings by assuming an urban water supplier can achieve 21.6 percent savings from these sectors. The existing use in these sectors is calculated by subtracting indoor use (defaulted in the Method 4 Calculator to 70 gpcd) and mid-point CII use, measured in gpcd, from an urban water supplier's Base Daily Per Capita Water Use.

Based on the Target Method 4 Calculator, the City's water use target under Method 4 is estimated to be 202 gpcd. The assumed indoor savings is 15 gpcd because the City does not currently have a reliable indoor fixture and appliance saturation estimate for the mid-point year of the baseline period (2004), nor does it have sufficient rebate data for the Target Method 4 Calculator to estimate the 2004 saturation rate. The City also estimated potential savings in the CII sector based on a mid-point year (2004) population of 23,115 persons, and an estimate of the 2004 CII demand. Constraints in the availability and discrete representations of CII demands in the data maintained by the City limited the ability to more accurately estimate demand.

As for landscape irrigation and water loss savings potential, the Target Method 4 Calculator estimates that the City can save 25.5 gpcd, which is the product of multiplying the City's estimated per capita landscape and water loss demand of 118.1 gpcd by 21.6%.

Thus, total potential savings using the Target Method 4 Calculator is 47 gpcd. When subtracted from the Base Daily Per Capita Water Use of 249 gpcd, the 2020 water use target is 202 gpcd, and the 2015 interim water use target is 226 gpcd.

4.4.2.3 Selection of a Water Use Target

Based on the analysis of both Method 1 and 4 targets, the City will select the 2020 water use target estimated using Method 1. Give the small difference, but significant uncertainty in the Method 4 value, Method 1 provides the City with a reasonable target.

As DWR continues to refine the Method 4 Calculator, which DWR has indicated it will accomplish prior to the 2015 round of UWMPs, the City may revisit this decision.

4.4.2.4 Minimum Water Use Reduction Requirement

The City must also comply with a minimum water use reduction requirement.[64] The City's 2020 water use target is 197 gpcd. For each of the three five-year periods ending December 31, 2007, 2008 and 2009, 95% of average daily per capita water use was greater than 197 gpcd. Because the City's selected water use target is less than 95% of the average per capita water use for the three five-year periods ending December 31, 2007, 2008 and 2009, as shown in **Table 4-16**, the City will use 197 gpcd as its water use target.

Table 4-15 – 95% of 5-Yr. Baseline

5-Yr. Average Base Daily Per Capita Use		95% of Base Daily
Period	gpcd	gpcd
2003-2007	259	246
2004-2008	258	245
2005-2009	245	233
2006-2010	231	220

4.4.3 Compliance Daily Per Capita Water Use

The City is to report to DWR on its progress in meeting its urban water use targets as part of its UWMPs submitted pursuant to CWC § 10631.[65] Thus, the City will need to report on its progress in both its 2015 and 2020 UWMPs, which are to be submitted to DWR by December 31, 2015 and December 31, 2020 respectively. As part of the progress reports, the City should include its "compliance daily per capita water use," which is the gross water use during the final year of the reporting period, reported in gallons per capita per day.[66] Documentation of compliance must include the bases for determining the estimates, including references to supporting data.

[64] CWC § 10608.22 provides that "An urban retail water supplier's per capita daily water use reduction shall be no less than 5 percent of base daily per capita water use over a continuous five-year period ending no earlier than December 31, 2007 and no later than December 31, 2010."
[65] CWC § 10608.40.
[66] CWC § 10608.12(e).

CHAPTER 5. WATER DEMAND MANAGEMENT MEASURES

5.1 District Participation

The City of Lincoln implements a best management practices program to ensure efficient water use throughout its service area. CWC §10631 requires that an UWMP include a description of the urban water supplier's water demand management measures (DMM) implemented as part of a water purveyor's water use efficiency program. The fourteen DMMs are shown in **Table 5-1**[67]. CWC §10631 also provides that members of the California Urban Water Conservation Council (CUWCC) shall be deemed in compliance with the UWMPA demand management measure requirements by complying with all the provisions of the CUWCC MOU and by submitting the annual reports.[68] The City, however, is not a signatory to the CUWCC MOU and therefore must provide a detailed report of DMMs in this UWMP.

This section provides the City's description of DMMs being implementing, and those it has scheduled for implementation, as indicated in **Table 5-1**.

Table 5-1 – DMM Implementation Status

Demand Management Measure	UWMP Act DMM	Implemented
Water Survey Programs for Single-Family and Multi-Family Customers	A	X
Residential Plumbing Retrofit Kit	B	X
System Water Audits, Leak Detection, and Repair	C	X
Metering Retrofit and Commodity Rates	D	X
Large Landscape Conservation Programs and Incentives	E	X
High Efficiency Washing Machine Rebate Program	F	X
Public Information Programs	G	X
School Education Programs	H	X
Commercial, Industrial, and Institutional Water Conservation Programs	I	X
Wholesale Agency Programs	J	N/A
Conservation Pricing	K	X
Water Conservation Coordinator	L	X
Water Waste Prohibition	M	X
Residential Ultra-Low Flush Toilet Replacement Program	N	X

[67] CWC §10631(f)
[68] CWC § 10631(j).

5.2 Detailed Information on DMMs

The subsections below provide detailed information for each of the 14 DMMs being addressed by the City.

5.2.1 DMM A – Water Survey Programs for Single-Family and Multi-Family Customers

Description: The City began implementing this program in 2009 and, because it is successful, anticipates continuing the program indefinitely. Water surveys generally involve sending a qualified water auditor to customer locations to audit water use, including a survey of both indoor and outdoor components. The City attempts to provide water surveys to an average of 1.5 percent per year of current single-family accounts (approximately 200 accounts) and, depending on economic conditions in the City, budgets accordingly. An annual budget includes training and staff time, brochures, and purchase of showerheads, aerators, dye tablets, or water conservation kits and other auditing materials.

The City's water survey program currently includes the following:

- Marketing of the program through: public outreach, regional program participation, customer contact, surveys
- Survey details:
  - Check for leaks, including toilets and faucets.
  - Check showerhead flow rates, aerator flow rates, and offer to replace or recommend replacement, as necessary.
  - Check toilet flow rates and offer to install or recommend installation of displacement device or direct customer to ultra low flow toilet (ULFT) replacement program, as necessary; replace leaking toilet flapper, as necessary.
  - Check irrigation system and timers.
  - Review or develop customer irrigation schedule.
  - Check water meter.
- Conservation packet includes:
  - Residential water use literature
  - Water saving devices such as garden spray nozzle and low-flow shower nozzles

Methods to Evaluate Effectiveness: The City implements BMP B (see below) along with BMP A because of their similar focus. The effectiveness of the program is evaluated in comparison with the objective of number of accounts surveyed, as well as random analysis of customer's meter data before and after surveys.

5.2.2 DMM B – Residential Plumbing Retrofit

Description: This best management practice is generally implemented in connection with BMP A, but retrofit kits are also distributed by the City at public events, community and association meetings, and other venues where City staff can reach out to customers. Table 5-2 indicates the number of kits distributed over the past several years.

However, the City's residential customers overwhelmingly occupy houses constructed after 1993 (over 80%), with a large percentage constructed in just the last decade. As a result, the opportunities to replace high-water using toilets are limited to defined areas of the City constructed prior to 1993.

Table 5-2 – Retrofit Kits Distributed

Year	2006	2007	2008	2009	2010
# of devices distributed	0	0	0	100	100

Methods to Evaluate Effectiveness: Effectiveness will continue to be evaluated by considering acceptance of retrofit kits by existing customers. Given the high proportion of 3.5 and 1.6 gpf or less toilets already existing within the City, the opportunities for retrofit kits are very limited.

The information needed to evaluate the effectiveness of this DMM includes:

- The target population of pre-1992 single-family residences and multi-family units to be provided showerheads and other water saving devices.
- The number of showerhead retrofit kits distributed during previous reporting period.
- The number of device retrofits completed during the previous reporting period.
- The estimated percentage of pre-1992 single-family residences and multi- family units in service area fitted with low-flow showerheads.

5.2.3 DMM C – System Water Audits, Leak Detection and Repair

Description: The City monitors the percentage of unaccounted for water and repairs system leaks when found.

Table 5-3 – Unaccounted for Water, Surveys and Repairs

Task	2006	2007	2008	2009	2010
Unaccounted for water (acre-feet)	840	816	578	569	520
Miles of mains/lines surveyed	37	0	0	0	0
# of mainline repairs (as a result of surveys)	0	0	0	0	0
# of service line repairs (as a result of surveys)	5	0	0	0	0

Methods to Evaluate Effectiveness: City staff will continue to review production and consumption records to assure the unaccounted water losses are at or near compliance with AWWA standards.

5.2.4 DMM D – Metering with Commodity Rates

Description: The City is fully metered and all customers are billed based in part on the volume they received (using commodity rates).

Methods to Evaluate Effectiveness: The City will continue to evaluate the effectiveness of its meter and commodity rate program by monitoring its annual water production to assess long-term trends in water demand and make necessary adjustments to rates if targeted conservation savings for compliance with CWC §10608 are not being achieved.

5.2.5 DMM E – Large Landscape Conservation Programs

Description: Currently, the City offers large landscape water audits and system check-ups for property owners through coordinated efforts with RWA. A considerable portion of landscape-related customer outreach in the region is achieved through the Regional Water Authority. RWA conducts landscape workshops, an annual media campaign to notify residents to make seasonal adjustments to its irrigation schedules, and develops materials for member agencies. The City also advises customers of the need to seasonally adjust sprinkler timers and encourages the use of CIMIS station information to assist with wise landscaping water use.

Methods to Evaluate Effectiveness: Consumption review, water savings can be measured over time by comparing current use to historic use, annual account review is recommended

5.2.6 DMM F – High-Efficiency Washing Machine Rebate Programs

Description: The City is implementing this BMP. The City is evaluating program development and assessing the opportunities. However, as noted previously, over 80% of the households are post-1993 constructions with a large percentage of housing constructed only in the last decade – and targeting active adults and new homeowners. As a result, many of the customers already have high-efficiency washing machines, which limits the practical implementation of this BMP.

Methods to Evaluate Effectiveness: the City of Lincoln will monitor program success through number of rebates requested. Expansion of the program will be considered annually.

5.2.7 DMM G – Public Information Programs

Description: The City participates in the RWA's Regional Water Efficiency Program (RWEP). RWA has implemented a regional water conservation program for the past 10 years. The RWEP has been supported through member dues and federal and state grant funds.

The overall goal of the RWEP is to maximize customer participation in water conservation programs. Historically and for the foreseeable future, the regional public information and school education program elements include: school outreach materials and presentations, media advertising campaigns, commercial consumer outreach, promotional materials, community events and fairs, evapotranspiration data availability, a Web site, and allied organizations outreach.

Methods to Evaluate Effectiveness: The City of Lincoln will monitor effectiveness through regional feedback and local surveys

5.2.8 DMM H – School Education Programs

Description: The City participates in the Regional Water Authority's RWEP also provides a broad-based school education program. Specifically, the RWEP program has focused mainly on K-8 programs. RWEP has continued to use the legacy Sacramento Bee Newspapers in Education (NIE), now called Media in Education (MIE) program that originated back in the mid-1990s as part of the Sacramento Area Water Works Association (SAWWA) program in order to meet the baseline requirements for school education outreach. It includes an annual Water Conservation Pledge and Quiz Contest. It is estimated that a total of 33,932 students have been educated since inception.

The school education program is an ongoing effort that the City will continue to implement through coordination and membership in RWA.

Methods to Evaluate Effectiveness: the City of Lincoln will monitor and evaluate feedback at a local and regional level through surveys and networking with other municipalities

5.2.9 DMM I – Commercial, Industrial and Institutional Conservation

Implementation Description: City of Lincoln offers water use reviews and audits for its Commercial, Industrial and Institutional (CII) accounts and advises all commercial customers of the programs and encourages their participation and makes CII conservation materials available.

Implementation Schedule: Currently, city of Lincoln does not offer incentives and therefore the current program does not meet CUWCC implementation requirements designed for achievement of a 10% savings compared to baseline water use in 10 years. City of Lincoln plans to consider implementation of the DMM after budget analysis and cost effectiveness is evaluated. to meet the requirement. Initially, fund allocation for the CII survey/incentive program will be limited because the City of Lincoln will still be allocating funds to its meter retrofit/repair program.

Methods to Evaluate Effectiveness: City of Lincoln will evaluate this BMP's effectiveness by tracking CII water use compared to baseline CII water use. Effectiveness will also be tracked by consumption review and customer surveys

5.2.10 DMM J - Wholesale Agency Programs

The City does not provide wholesale water supplies and this DMM is therefore not applicable.

5.2.11 DMM K – Conservation Pricing

Description: The City currently bills for water based on conservation priced commodity rates. A base rate of $22.90 per month applies to the first 10,000 gallons for metered accounts ($2.29 per 1,000 gallons for the first 10,000 gallons). The next 10,000 gallons costs $3.53 per 1,000 gallons per month. The next 10,000 gallons costs $3.63 per 1,000 gallons per month., the overall pricing structure is designed to recover the cost of providing water service.

Methods to Evaluate Effectiveness: The City will continue to evaluate the effectiveness of its conservation pricing program by monitoring its annual water production to assess long-term trends in water demand and make necessary adjustments to rates if targeted conservation savings for compliance with CWC §10608 are not being achieved.

5.2.12 DMM L – Water Conservation Coordinator

Description: The City has designated a member of the water utilities division to administer and monitor conservation efforts. This staff member is a competent Water Conservation Practitioner. City of Lincoln also pulls assistance from the public service staff to perform leak detection/repair

Methods to Evaluate Effectiveness: the City of Lincoln has no method to quantify savings but believes that this program is in the public's interest at this time.

5.2.13 DMM M – Water Waste Prohibition

Implementation Description: The City incorporated water waste prohibitions into its Municipal Code at Article VI. Section 13.04.440 Gross Waste.

Methods to Evaluate Effectiveness: the City of Lincoln has no method to quantify the savings/effectiveness of this ordinance but believes this program is in the public's interest.

5.2.14 DMM N – Residential Ultra-Low-Flush Toilet Rebate Programs

The City's residential customers overwhelmingly occupy houses constructed after 1993 (over 80%), with a large percentage constructed in just the last decade. As a result, the opportunities to replace high-water using toilets are limited to defined areas of the City constructed prior to 1993. The does not provide a rebate program at this time, but continues to evaluate the potential effectiveness of such a program by periodically reviewing the water use records in some of the older neighborhoods within the City's service area.

Methods to Evaluate Effectiveness: Given the high proportion of 3.5 and 1.6 gpf or less toilets already existing within the City, the opportunities for a rebate program are very limited.

The information needed to evaluate the effectiveness of this DMM includes:

- The number of connections serving pre-1993 single-family residences and multi-family units
- The current average indoor use in older homes in comparison to the indoor use in newer communities within the City.

5.3 Benefit Analysis of Demand Management Measures

The Urban Water Management Planning Act requires a cost benefit analysis of any DMM not implemented or scheduled for implementation. All 14 DMMs are either currently implemented, scheduled for program development or implementation, or are not applicable. Consequently, no cost benefit analyses are necessary.

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CHAPTER 6. WATER SHORTAGE CONTINGENCY PLAN

The City has developed a Draft Water Shortage Resolution to adopt in the event of shortfalls in the water supply system and a Water Shortage Contingency Plan to address supply shortages. In the event of a catastrophic interruption of water supplies, the City would move to Stage 4 of its Water Shortage Contingency Plan. Additional efforts would be coordinated with PCWA, Placer County and the State Office of Emergency Services. The City would also increase its outreach and education efforts through the local media and education programs to focus attention on the water supply situation.

6.1 Water Shortage Contingency Resolution

The City has developed a Water Shortage Resolution that describes a mechanism to implement different Stages of Action during water supply shortage situations. Should a water supply shortage arise, the City Council will be able to react quickly to take the appropriate actions. A full copy of the Draft Water Shortage Resolution can be found in **Appendix B-4**.

6.2 Stages of Action and Reduction Goals

The City's Water Shortage Contingency Plan consists of four Stages of Action to address potential water supply reductions of up to 50 percent. Upon the declaration of a water shortage by the City Council, the appropriate stage can be implemented. The stages, outlined in **Table 6-1**, include voluntary and mandatory water demand management measures that may be implemented as appropriate to address the severity and anticipated duration of the water supply shortage. Stages of Action may be triggered by 1) current supply conditions, 2) future supply conditions or a 3) loss of supply due to natural or human induced disasters.

As an example of how the table can be used, if current water supplies were 85 –90 percent of normal, Stage 1 would be triggered. Stage 1 would also be triggered if future projected water supplies were estimated to be insufficient to provide 80 percent of normal deliveries for the next two years. Loss of water supply due to a natural or human induced disaster would trigger Stage 4.

Table 6-1 – Stages of Action and Water Supply Conditions

Water Shortage Stages and Triggering Mechanisms				
Stage of Action and Percent Reduction of Supply	Stage 1 Water Awareness Up to 15%	Stage 2 Water Alert 15 - 25%	Stage 3 Water Emergency 25 - 35%	Stage 4 Water Crisis 35 - 50%
Water Supply Condition				
Current Supply: Total supply is ___% of normal	85-90%	75 - 85%	65 - 75%	65%
Future Supply: Projected supply is insufficient to provide ___% of deliveries for the next two years	80%	75%	65%	50%
Disaster Loss				Disaster Loss

6.3 Mandatory Prohibitions on Water Waste

The Lincoln City Municipal Code contains provisions that prohibit certain wasteful water use practices including gross waste, allowing leaks from faucets and water closets, watering without a hose nozzle, and irrigating landscapes between the hours of five a.m. and ten p.m. A copy of the relevant section of the Code is included in Appendix H. Due to an error at the time of Code adoption, the hours for watering were inadvertently reversed and the Code section 13.04.430 states "Irrigation of lawns or gardens is restricted to the hours of five a.m. to ten p.m." The City is in the process of amending this section of the Code to correct this mistake and restrict watering except between the hours of ten p.m. to five a.m.

6.4 Penalties

The Lincoln City Municipal Code contains provisions for penalties to water customers that violate regulations and restrictions set forth in section 13.04.540 of the Municiple Code.

6.5 Reduction Methods

6.5.1 Stage One – Water Awareness

All water consumers are encouraged to be aware of water consumption and use water wisely. These measures are expected to result in up to 15 percent reduction in water use. Water consumption should be limited to a reasonable level necessary to maintain the public health, business operations, and landscaping.

Residents and businesses are asked to comply, on a voluntary basis, to limit landscape irrigation to a maximum of three (3) days per week, and adhere to the following landscape watering schedules; odd numbered addresses, limit watering to Tuesday, Thursday and Saturday; even numbered addresses limit watering to Wednesday, Friday and Sunday.

All water consumers are further encouraged to not waste water. The following uses of water constitute waste:

- The watering of landscapes in a manner or to an extent, which allows substantial amounts of water to run off the area being watered.
- The escape of water through breaks or leaks within the users system for any substantial period of time (12 hours after detection).

6.5.2 Stage Two - Water Alert

Each of the stage one water use regulations shall remain in full force and effect and be mandatory except as modified by this section. All water consumers shall comply with the following conservation measures to achieve between 15 and 25 percent reduction in normal water use:

- To help reduce evaporation and maintain healthy plants, water only between the hours of 10 p.m. and 5 a.m.
- Equip all hoses or filling apparatus for non-irrigation purposes with an automatic shutoff nozzle.
- Limit hosing of landscape surfaces except for health and safety purposes.
- Serve water only upon request to restaurant customers.

6.5.3 Stage Three, Water Emergency

Water consumers shall comply with the following conservation measures to achieve between 25 and 35 percent reduction in normal water use. Each of the stage one and two water use regulations shall remain in full force and effect and be mandatory except as modified by this section:

- Landscape watering shall be allowed on two (2) days per week. The Director of Public Works shall implement this provision through the establishment of an equitable landscape watering schedule to be set forth in the Resolution adopted by the City Council.
- The use of running water from a hose, pipe, or faucet for the purpose of cleaning buildings and paved, tile, wood, plastic or other surfaces is prohibited, except in the event the Director of Public Works, or his designee, determines that such use is the only feasible means of correcting a potential threat to health and safety.

- All restaurants that provide table service shall post, in a conspicuous place, a Notice of Drought Conditions, approved by the Director of Public Works, and shall not serve water except upon specific request by the customer.
- Boats and vehicles shall be washed only at commercial washing facilities equipped with water recycling equipment or by use of a bucket and hose equipped with a self-closing valve that requires operating positive pressure to activate the flow of water.
- All pools and spas shall be covered when not in use to reduce evaporative losses unless the Director of Public Works grants an exemption.
- Operators of hotels, motels, and other commercial establishments offering lodgings shall post in each room and at each site, a Notice of Drought Condition, approved by the Director of Public Works.
- The operation of and introduction of water into ornamental fountains is prohibited.
- Such other and further regulations as the City Council may determine, after a public hearing.

6.5.4 Stage Four - Water Crisis

Water consumers shall comply with the following conservation measures to achieve reductions between 35 and 50 percent reduction in normal water use. Each of the stage one, two and three water use regulations shall remain in full force and effect and be mandatory except as modified by this section:

- Irrigation of any yard, or other landscaped area containing lawn or turf grass areas is prohibited, except by hand held bucket.
- The introduction of water into swimming pools and spas is prohibited except to maintain the structural integrity of such facilities.
- Such other and further regulations as the City Council may determine after a public hearing.

6.6 Revenue and Expenditure Impacts

Reduction in revenues from water sales due to temporary water supply shortages should not have a significant impact on the City's ability to provide services. Some of the revenue loss would be offset by reduced costs to purchase treated water from PCWA.

6.7 Measures to Overcome Impacts

Although significant reductions in City revenues are not expected as a result of water supply shortages, rate increases could be used to offset decreased sales revenue if deemed necessary.

6.8 Reduction Measuring Mechanism

Treated surface water and groundwater deliveries are metered as the water flows into the City's distribution system. During various stages of alert, the frequency of measurement can be increased to better characterize demand and compare to reduction goals. This will allow the City to implement additional demand management measures if goals are not being met or relax some restrictions if demand goals are being exceeded.

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CHAPTER 7. RECYCLED WATER PLAN

The purpose of this section is to describe the current and future state of recycled water resources in the City's service area. The City owns and operates the Wastewater Treatment and Reclamation Facility (WWTRF) south west of the City. The WWTRF was designed to provide Title 22 compliant water to the region, where Title 22 of the California Code of Regulations defines the quality standards for recycled water and its use. This section provides explanation of the quantity of wastewater generated as well as the planned and potential uses of recycled water in the City's service area.

7.1 General Description of Wastewater Treatment Systems in the Surrounding Area

The City has participated with PCWA, Roseville, and Auburn as well as Placer County in the development of a Reclamation Master Plan. The Reclamation Master Plan is the guide created to address the treated water from the City's WWTRF. For more detail see the Reclamation Master Plan in **Appendix D-4**. The City's WWTRF provides wastewater treatment in the PCWA service area.

Table 7-1 – Recycled Water Plan Participating Agencies

Agency Name	Agency Type	Plan Development Input
City of Roseville	Water/Wastewater Agency	Provided recycled water supply/demand information
City of Lincoln	Water/Wastewater Agency	Provided recycled water supply/demand information
County of Placer	Planning Agency	Provided proposed development information
Placer Nevada Wastewater Authority	Wastewater Agency	Provided recycled water supply/demand information
City of Auburn	Wastewater Agency	Provided capacity information

Note: contents taken from 2005 PCWA UWMP

Wastewater Treatment Plants (WWTPs), such as the one in Applegate, are shutting down and piping their sewage into other treatment plants for more efficient and cost effective centralized treatment. The Applegate WWTP project will close and send its wastewater to Auburn's SMD #1 treatment plant.[69]

The cities of Lincoln and Roseville produce recycled water. Placer County and the City of Auburn WWTPs, however, do not produce water available for direct reuse, and it is unlikely that they will do so in the near future. The potential growth in development and demand for recycled water have two primary drivers: (1) the need to expand small WWTPs in Placer and Nevada counties based on future growth projections, and (2) the more stringent NPDES requirements which will require WWTP operators to institute

[69] Initial Study/Environmental Assessment, Applegate Wastewater Treatment Plant Closure and Pipeline Project, September 2008

more expensive treatment processes. The 1998 Placer County Evaluation of Regional Wastewater Treatment Options suggested using one regional treatment plant as a more efficient long-term solution. This resulted in the formation of Placer Nevada Wastewater Authority (PNWA). The PNWA has contemplated piping wastewater to a an expanded Lincoln WWTP, yet there is not currently an agreement in place among Lincoln, Placer County and Auburn to expand Lincoln's wastewater treatment plant. The regionalization of the wastewater system would allow for production of more recycled water but would not create any new recycled water supplies in the foothill regions.

7.2 Current Wastewater Use in the City of Lincoln Service Area

With the completion of the WWTRF in 2004, the City of Lincoln can treat an average dry weather flow (ADWF) of 2.6 million gallons per day (day) with a capacity of 4.2 mgd. The WWTRF produces Title 22 compliant effluent suitable for unrestricted use and reclamation. As identified in the 2008 WWTRF Expansion Plan, the City is contemplating future expansion in 2.1, 4.2, or 6.3 mgd, depending on the determined regional partnerships and geographic scope of influent directed to the WWTRF. Final capacity of the Lincoln plant could be as much as 25 mgd based on the current wastewater treatment technology used at the plant.

With completion of the WWTRF, the City was able to provide reclaimed water to agricultural demands on adjacent and neighboring lands. About 400 acres are currently provided with recycled water from the WWTRF facility. Treated effluent not provided to the current agricultural operations is discharged to Auburn Ravine, in compliance with the City's NPDES permit (see **Table 7-2**).

Table 7-2 – Historic discharge of treated effluent (acre-feet/yr)

Year	Discharged to Ravine	Delivered To Agriculture
2005	1827	264
2006	3078	419
2007	1628	508
2008	2072	666
2009	2380	591
2010	2824	272

The quantity of wastewater collected and treated in the future is dependent on the influent, which directly relates to the treated water demand projections within the City's water service area. **Table 7-3** includes the estimated quantity of wastewater collected and treated that would meet recycled water standards and would be available for potential

delivery to City or other identified customers.[70] These values do not reflect potentially larger quantities of reclaimed water, should expansions occur to accommodate a more regional approach to wastewater treatment.

Table 7-3 – Volume Collected and Treated Meeting Recycled Water Standards

Type of Wastewater	Current	2015	2020	2025	2030	2035
	(values in acre-feet/yr)					
Wastewater collected & treated in service area	4,002	5,365	5,686	6,353	7,020	7,779
Volume that meets recycled water standard	4,002	5,365	5,686	6,353	7,020	7,779

In the 2005 UWMP a projection was made for future recycled water use within the City's service boundary. This projection is compared with the actual use presented in **Table 7-4** to show the development of recycled water use planning.

Table 7-4 – Comparison of 2005's 2010 Projection and Actual 2010 Use (acre-feet/yr)

Use type	2010 actual use	2005 Projection for 2010
Agricultural irrigation	272	4700
Landscape irrigation	0	0
Commercial irrigation	0	0
Golf course irrigation	0	0
Wildlife habitat	0	0
Wetlands	0	0
Industrial reuse	0	0
Groundwater recharge	0	0
Seawater barrier	0	0
Geothermal/Energy	0	0
Indirect potable reuse	0	0
Total	272	4700

Note: Recycled water use in only expected in zone 1 and zone 5.

7.3 Projected Recycled Water Use

The 2008 WWTRF Expansion Plan contemplates the expansion of the capacity of the WWTRF to accommodate an increase in flow as the City of Lincoln's treated water demand increases in the coming years. The 2008 WWTRF Expansion Plan also

[70] The quantity of wastewater generated from the City of Lincoln is calculated based on an estimated average of 40 percent of the total current annual demand as influent to the WWTRF, but expanding to 50 percent of future annual demand as a result of estimated future demands reflecting a greater percentage of the total demand as indoor demand.

considers two expansion options that could accommodate the wastewater flows from the City of Auburn and/or Placer County as well. Currently, the City of Lincoln is discussing potential partnership arrangements with Placer County and the City of Auburn. Ultimately, if there is a partnership arrangement, the partner agencies will likely expand the WWTRF beyond the capacity that would be necessary if the City of Lincoln were to expand the WWTRF just to meet the wastewater treatment needs of its water service customers alone.

While plant capacity will dictate the potential recycled water supply from the WWTRF, treated water demand and the wastewater generated from such demand will drive the quantity of water available for reuse after treatment. Because it is not certain at this time whether the City of Lincoln will partner with Placer County and/or the City of Auburn, the recycled water availability analysis that follows assumes the WWTRF is only treated wastewater generated by the City of Lincoln's treated water service customers (see estimated future treated effluent quantities in **Table 7-3**).

The 2008 WWTRF Expansion Plan proposes an expansion increment of 2.1 mgd ADWF for the City of Lincoln only. This expansion should provide sufficient capacity for the City of Lincoln until approximately the year 2018. This estimate is based on flow projections related to growth in the City of Lincoln's treated water service area. The expansion would also accommodate sewer service to the Thunder Valley Indian Casino located just south of Lincoln. With a 2.1 mgd expansion, the new ADWF for the WWTRF would be 6.3 mgd. As of January, 2008, the WWTRF Expansion Plan recommended that expansion construction take place between 2009-2010 so that the WWTRF would be at 6.3 mgd ADWF by the end of 2011.[71] To date, the expansion has not occurred, and the City of Lincoln is awaiting resolution of its discussions with potential regional partners Placer County and the City of Auburn, as well as a return of the housing market that will drive the need for expanded wastewater treatment facilities.

As for recycled water demands, the City has identified existing and potential recycled water users in and around the SOI.[72] The City identifies three recycled water use categories, including Agricultural Irrigation (i.e., crops) Landscape Irrigation (i.e., parks, golf courses, road medians, highway landscaping) and Industrial/Commercial (i.e., cooling, washing, and other process uses) uses. As of 2007, about 400 acres were in the process of being irrigated with recycled water from the WWTRF. Lincoln Recycled Water Technical Memo 1 (Memo 1) estimates a potential annual demand for these customers of 1,676 af/yr. Potential recycled water users are divided into three phases

[71] WWTRF Expansion Plan, p. ES-23.
[72] City of Lincoln, Technical Memorandum 1, Recycled Water Users Description and Phasing, April 16, 2007 (Lincoln Recycled Water Tech. Memo 1).

depending on the data of anticipated recycled water service. Phase 1 users are planned for service on or before 2020.[73] Phase 2 users are planned for service on or before 2025. Phase 3 users are those with the potential for service after 2030.[74] If all users identified in Memo 1 demand recycled water, total demand could be as high as 6,822 af/yr. However, only a portion of these demands is within the City's service area, where use of recycled water would offset the need for potable water supplies. The potential quantity of water delivered within the City's service area, as shown in **Table 7-5**, reflects a combination of service to existing industrial uses and the park, school and medial landscaping already or planned to be plumbed with purple-pipe infrastructure.

Table 7-5 – Existing and Potential Recycled Water Use

	All Potential Uses		City Service Area Only
Recycled Water Service	**Mgal/Year**	**AF/Year**	**AF/Year**
Agricultural Irrigation	546	1,676	
Incremental Future Users			
Phase 1	179	549	200
Phase 2	218	669	100
Phase 3	1,280	3,928	100
TOTAL	2,223	6,822	400

An expansion of the WWTRF to 6.3 mgd ADWF would be able to generate a recycled water supply of about 7,000 af/yr. While this is more than the total demand for all planned City and surrounding area recycled water uses, the fact that most recycled water demands are for agricultural crops and landscape irrigation may result in a situation where there would not be enough treated wastewater in the summer to meet the recycled water demands, and potentially too much in the winter months for the identified demands in Lincoln Recycled Water Tech. Memo 1. Thus, during some months, potable or raw water would be necessary to make up the difference between the identified recycled water demand and the available recycled water supply.

To generate as much as 7,000 af/yr in treated wastewater, total treated water demand would need to be about 14,000 af/yr, assuming 50% of treated water demand results in wastewater influent flows. The City's projected water demand is slightly over 15,000 af/yr in 2035.

[73] Due to on-going economic constraints and a significant halt in new construction within the City, the originally projected phasing of recycled water facilities has been adjusted from the original estimated dates of 2007 through 2012 as outlined in the Lincoln Recycled Water Tech. Memo 1.
[74] The Lincoln Recycled Water Tech. Memo 1 indicates that the future phases do not include any new agricultural users, even though there is significant agricultural acreage in the City's limits.

7.4 Technical and Economic Feasibility of Recycled Water Use

Under current plans, recycled water use in Western Placer County is expected to grow. Treatment levels at the City of Lincoln and City of Roseville wastewater treatment plants produce tertiary treated wastewater suitable as an alternative for demands that are traditionally met with both treated and raw water supplies, including agricultural crop irrigation, landscape irrigation and industrial process uses.

The City's recycled water use is expected to grow as demands increase with anticipated development, the City may generate recycled water supplies that are available for use in the PCWA retail service area adjacent to the City.

As all of the water from the City's WWTRF will be of a quality that can be reused for designated purposes, the installation of transmission infrastructure will drive the ultimate delivery of treated wastewater to potential customers. There are plans for additional "purple pipe" systems that will feed areas west of the current City. These will be built in stages in relation to development activities. Extension of infrastructure beyond the City's boundaries to serve customers in PCWA's retail service area would require additional planning efforts not currently contemplated in the City's recycled water planning documents. There is the potential for use in PCWA areas replacing raw water deliveries, but no specific system of conveyance is yet planned.

7.5 Future Actions to Encourage Recycled Water Use

The City does have existing "purple pipe" systems to convey recycled water to meet several demands within their service area. Most of the newer neighborhoods have been built with purple pipe systems, in anticipation of the City completing the planned main transmission infrastructure to join the WWTRF to these neighborhoods. Once economic conditions improve, the City will continue forward with construction of these key portions of infrastructure. This construction will allow for the realization of the estimated in-City recycled water use shown in **Table 7-5**.

PCWA, an adjacent water purveyor, will also continue to seek opportunities to deliver recycled water to its retail customers in close proximity to the City's WWTRF as a way to improve supply reliability.

The City will use a number of strategies to encourage recycled water use as a way to offset their own water use and aid in achieving targeted per-capita demand reductions (see Chapter 4).

7.6 Total Planned Recycled Water Use

The recycled water planning documents that have been drafted during the past decade lay out a number of feasible plans for recycled water use within and outside of the City's water service area. While it is unlikely that all of these small planned parts will be built, a number of them are reasonable enough to assume their future development. **Table 7-6** shows the total potential use from all of the proposed uses. This table serves as the upper limit of possible recycled water consumption and would likely see future increases as other projects are added to the service area.

Table 7-6 – Total Potential Recycled Water Demand

	All Potential Uses		City Service Area Only	Total
Recycled Water Service	**Mgal/Year**	**AF/Year**	**AF/Year**	**AF/Year**
Agricultural Irrigation	546	1,676		1,676
Incremental Future Users				
Phase 1	179	549	200	749
Phase 2	218	669	100	769
Phase 3	1,280	3,928	100	4,028
TOTAL	2,223	6,822	400	7,222

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CHAPTER 8. SUPPLY & DEMAND INTEGRATION

The purpose of this chapter is to compare the total water supply sources available to the City of Lincoln with the total projected water use over the next 20 years, in five-year increments, for a normal water year, a single-dry water year, and multiple dry water years.

8.1 Normal Water Year Supply Demand Comparison

Under this water supply scenario, the City would anticipate full availability of its purchased supplies, as well as availability of groundwater to meet nominal peaking and other operational needs. Using the demand projections in **Table 4-7** the following comparison table was developed for a normal hydrologic year. As shown in **Table 8-1**, the City projects adequate water supplies through 2035 to meet the projected growth over the next twenty years in the City's water service area. The slight surplus in the current and 2015 conditions reflects the circumstances in the current purchased contract volumes from PCWA and the "normal year" goal of meeting 10 percent of the demand with groundwater. Because the City's contract with PCWA reflects about 8,500 acre-feet of annual demand (see Chapter 3), the actual quantity of water purchased from PCWA or pumped from the aquifer over the next few years would be limited to the actual demand. Since the City uses groundwater as a 10 percent buffer, the representation in this table demonstrates a "surplus," when in reality, the City would only pump water as needed to manage their water supply portfolio.

Table 8-1 – Supply and Demand Comparison (Normal Year)

Demand (af/yr)	Current	2015	2020	2025	2030	2035
Treated Demand	10,005	10,730	11,373	12,706	14,040	15,558
Total	10,005	10,730	11,373	12,706	14,040	15,558

Supply (af/yr)	Current	2015	2020	2025	2030	2035
PCWA Surface Water	8,500	8,500	8,695	9,176	9,706	10,316
NID Surface Water	1,395	1,395	1,541	2,059	2,630	3,286
Groundwater	962	1,073	1,137	1,271	1,404	1,556
Recycled Water	0	0	0	200	300	400
Total	10,857	10,968	11,373	12,706	14,040	15,558

Difference	852	238	0	0	0	0
Difference as % of Supply	8%	2%	0%	0%	0%	0%
Difference as % of Demand	9%	2%	0%	0%	0%	0%

8.2 Single Dry-Year Supply and Demand Comparison

In a single dry year condition, the City anticipates only a slight reduction in surface water supplies delivered by NID consistent with the projection in **Table 3-7**, but full supplies from PCWA. Based on the reliability analysis presented in Chapter 3, the City is projecting nearly full supplies available during single-dry year events.

As for the City's water demand in a single dry year condition, the City's treated water demand is increased to reflect the general expansion of the landscape irrigation season due to limited rainfall in a dry year. An adjustment factor of 5 percent is applied to the normal-year demands based on various analyses of the difference between maximum evapotranspiration (ETo) and average ETo over an average 5 to 10 year period.

As shown in **Table 8-2**, the City anticipates increasing groundwater pumping to offset the minimal reduction projected in NID surface deliveries. In these intermittent hydrologic conditions, the City anticipates exceeding the normal year goal of limiting groundwater pumping to 10 percent of normal demands. As shown in **Table 8-2**, groundwater pumping increases to about 17 percent of demand. This increase may also be mitigated by temporary conservation measures enacted as part of the City's Water Shortage Contingency Plan (see Chapter 6).

Table 8-2 – Supply and Demand Comparison (Single Driest-Year)

Demand (af/yr)	Current	2015	2020	2025	2030	2035
Treated Demand	10,505	11,266	11,942	13,342	14,742	16,336
Total	10,505	11,266	11,942	13,342	14,742	16,336

Supply (af/yr)	Current	2015	2020	2025	2030	2035
PCWA Surface Water	8,500	8,500	8,695	9,176	9,706	10,316
NID Surface Water	1,200	1,200	1,325	1,771	2,262	2,826
Groundwater	962	1,566	1,922	2,194	2,474	2,794
Recycled Water	0	0	0	200	300	400
Total	10,662	11,266	11,942	13,342	14,742	16,336

Difference	156	0	0	0	0	0
Difference as % of Supply	1%	0%	0%	0%	0%	0%
Difference as % of Demand	1%	0%	0%	0%	0%	0%

8.3 Multiple Dry Year Supply and Demand Comparison

Under this water supply scenario, the City anticipates many of the same conditions that were assumed for the single-dry year analysis, including: (1) slight reductions in NID supplies (see Chapter 3), and (2) increases in projected demands as represented in the driest-year scenario. However, to represent a multiple dry year period, a five-year water

supply projection is made for each 5-year reporting increment. Water supplies within each year of the five-year block follow a pattern of four dry years, followed by one normal year.

To reflect the demands in each of the intervening years in the five-year block, the following assumptions are made:

- The fifth year, a normal year, reflects the estimated demand for the next standard 5-year increment (e.g. the 2015, 2020, 2025, etc. demand from **Table 8-1**).
- Demand in the four prior years reflects a linear growth between each 5-year standard increment, but with the demand adjustments made to increase some demands.

This resulting analysis has been represented in **Table 8-3**. During each multiple dry year period projected in **Table 8-3**, the District anticipates a minor reduction in surface water supplies that will be offset with increased groundwater pumping and implementation of the Water Shortage Contingency Plan, as necessary. The shortfalls shown in each of the five-year incremental tables would be resolved by these actions, where groundwater pumping would increase for a few years to quantities above the 10 percent of demand goal.

Table 8-3 – Supply and Demand Comparison (Multiple Dry Years)

Demand (af/yr)	Current	2015	2020	2025	2030	2035
Treated Demand	10,505	11,266	11,942	13,342	14,742	16,336
Total	10,505	11,266	11,942	13,342	14,742	16,336

Supply (af/yr)	Current	2015	2020	2025	2030	2035
PCWA Surface Water	8,500	8,500	8,695	9,176	9,706	10,316
NID Surface Water	1,200	1,200	1,325	1,771	2,262	2,826
Groundwater	962	1,566	1,922	2,194	2,474	2,794
Recycled Water	0	0	0	200	300	400
Total	10,662	11,266	11,942	13,342	14,742	16,336

Difference	156	0	0	0	0	0
Difference as % of Supply	1%	0%	0%	0%	0%	0%
Difference as % of Demand	1%	0%	0%	0%	0%	0%

Part A: 2011 through 2015					
Demand (af/yr)	2011	2012	2013	2014	2015
Total	10,658	10,810	10,962	11,114	10,730
Supply (af/yr)	2011	2012	2013	2014	2015
Total	10,662	10,662	10,662	10,662	10,857
Difference	4	-148	-300	-452	127
Difference as % of Supply	0%	-1%	-3%	-4%	1%
Difference as % of Demand	0%	-1%	-3%	-4%	1%

Part B: 2016 through 2020					
Demand (af/yr)	**2016**	**2017**	**2018**	**2019**	**2020**
Total	11,401	11,536	11,671	11,806	11,373
Supply (af/yr)	**2016**	**2017**	**2018**	**2019**	**2020**
Total	11,266	11,266	11,266	11,266	11,373
Difference	-135	-270	-405	-540	0
Difference as % of Supply	-1%	-2%	-4%	-5%	0%
Difference as % of Demand	-1%	-2%	-3%	-5%	0%

Part C: 2021 through 2025					
Demand (af/yr)	**2021**	**2022**	**2023**	**2024**	**2025**
Total	12,222	12,502	12,782	13,062	12,706
Supply (af/yr)	**2021**	**2022**	**2023**	**2024**	**2025**
Total	11,942	11,942	11,942	11,942	12,706
Difference	-280	-560	-840	-1,120	0
Difference as % of Supply	-2%	-5%	-7%	-9%	0%
Difference as % of Demand	-2%	-4%	-7%	-9%	0%

Part D: 2026 through 2030					
Demand (af/yr)	**2026**	**2027**	**2028**	**2029**	**2030**
Total	13,622	13,902	14,182	14,462	14,040
Supply (af/yr)	**2026**	**2027**	**2028**	**2029**	**2030**
Total	13,342	13,342	13,342	13,342	14,040
Difference	-280	-560	-840	-1,120	0
Difference as % of Supply	-2%	-4%	-6%	-8%	0%
Difference as % of Demand	-2%	-4%	-6%	-8%	0%

Part E: 2031 through 2035					
Demand (af/yr)	**2031**	**2032**	**2033**	**2034**	**2035**
Total	15,061	15,380	15,698	16,017	15,558
Supply (af/yr)	**2031**	**2032**	**2033**	**2034**	**2035**
Total	14,742	14,742	14,742	14,742	15,558
Difference	-319	-638	-957	-1,275	0
Difference as % of Supply	-2%	-4%	-6%	-9%	0%
Difference as % of Demand	-2%	-4%	-6%	-8%	0%