CHAPTER 7. WATER SUPPLY RELIABILITY

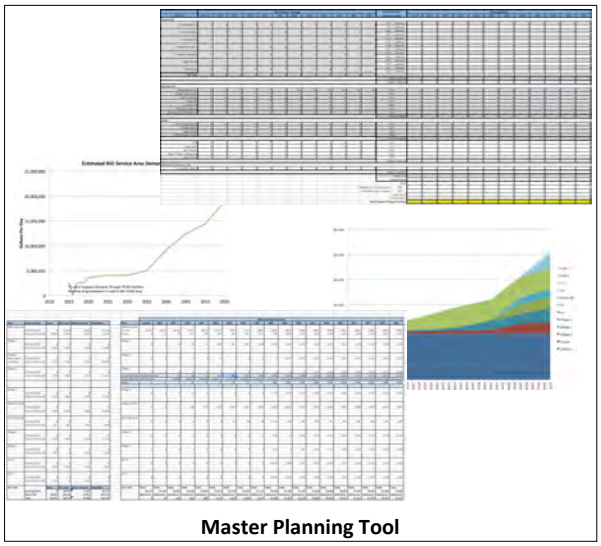
7.1 Introduction

The meaning of water supply reliability is often misconstrued. For instance, the 2015 Urban Water Management Plan update required water purveyors to demonstrate that annual water supplies are sufficient to meet annual water demands under normal and dry hydrological conditions. This annual assessment of water supply reliability is misleading. A water system's reliability must be assessed not only on an annual basis, but also on a monthly and even daily basis. Moreover, reliability is not just a function of annual physical supply availability but also nuanced details of water rights and contracts, regulatory and contractual issues, and water system infrastructure limitations. This Chapter addresses the meaning of water supply reliability and explains the City of Lincoln's analysis of water supply reliability as applied in this Water Master Plan.

7.2 Defining Reliability

The word "reliability" means "to be able to be trusted to do or provide what is needed."[1] Accordingly, in the context of a water purveyor, "water supply reliability" requires a water purveyor to consistently deliver water to its customers and that the water system is dependable to continually deliver additional water supplies to the purveyor's customers into the future. One of the City of Lincoln's primary management goals is to develop a water system that has long-term reliability.

The City's water supply reliability can be disaggregated into its three meaningful parts. First, as described in **Chapter 4** and the **Master Demand Spreadsheet Tool**, the City must accurately calculate its current and future demands. Second, as described in **Chapter 5**, the City must fully understand its water supplies and the risks associated with those water supplies under the State's changing water conditions. Last, as shown in **Chapters 3**, **9**, **10** and **11**, the City must use its knowledge of both demand and supply to construct and manage a water delivery system capable of



Master Planning Tool

[1] http://www.merriam-webster.com/dictionary/reliable

handling changed conditions. Thorough vetting and integration of these components creates a reliable water system.

Ensuring water supply reliability also requires incorporating risk management principles into water resources planning. In its most general form, risk management is the:

> *Identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of risk events and maximize the realization of opportunities.*[2]

In short, risk management weighs the threats and advantages in deciding a course of action. Thus, weighing the threats and advantages of (a) current and future demand calculations, (b) the supply dependability of the City's water asset portfolio, and (c) the stability and utility of the City's existing and planned water supply infrastructure system are the critical elements needed to assess the City's water supply reliability risks and adequately mitigate those risks with actions.

Financial investing is an instructive analogy that illuminates the risk management discussion. In managing a financial investment portfolio, risk management dictates understanding ones current and future needs ("demands"), possessing a diverse asset portfolio to protect against a sudden financial loss associated with a single financial asset ("supplies"), and making sure one is invested in the appropriate financial vehicles to deliver the return on investment to meet future needs ("infrastructure"). Continually monitoring all three components in relation to one's financial objectives ("reliability"), and making adjustments as conditions change, produces a sound financial portfolio.

As further described in the sections below, each water supply reliability component has subparts that require in-depth analysis to draw a reliability conclusion. For instance, demand calculations must consider land-use based and per capita water usage as well as trends in population growth, conservation regulations, and housing constructs. Similarly, the supply assessment requires understanding water rights, California's changing hydrological and regulatory framework, as well as asset redundancy and usability. Last, infrastructure requires analyzing existing system weaknesses, assessing system redundancies, and maximizing long-term structural investments. All of these details are contemplated in the sections below.

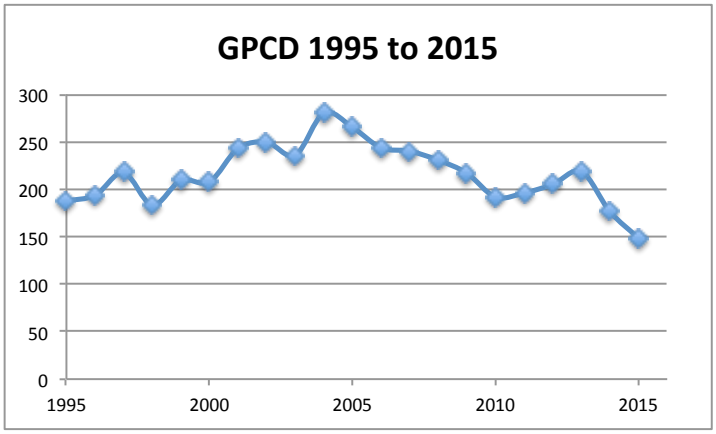
[2] https://en.wikipedia.org/wiki/Risk_management

7.3 Demand Reliability

Calculating demand requires the City to review its current water use, assess the demographic and regulatory factors influencing that use, and then project those findings into predicted future demands. These calculations are complex and require detailed and synthesized analytical rigor. As shown in **Chapter 4** and the **Master Demand Spreadsheet Tool**, demand is calculated based upon the land use classification associated with a water use. These calculations have both spatial and temporal components. For example, it is intuitive that a residential lot with a larger landscaped area likely uses more water for irrigation than does a smaller residential lot with a smaller landscaped area. Thus, in the demand calculations, the spatial element of how water is used on a particular lot size is categorized accordingly. Similarly, water use over time changes. For instance, water use in a residential landscape changes over the course of the year as little or no outdoor irrigation is applied during the winter months while summer month water application is high. To add complexity, demands for similar lot sizes will change over time due to regulatory factors, such as the recent updates to the Model Water Efficient Landscape Ordinance (MWELO) that significantly constrain the use of turf in residential construction – and eliminate it altogether for uses such as street medians.[3] In addition, a City's total volume of water use grows over time as the City's population expands and water consumption grows accordingly. Each of these particulars is captured in **Chapter 4** and further detailed in the **Master Demand Spreadsheet Tool**.

The current water demand for the City is derived from the **Master Demand Spreadsheet Tool** and amalgamated in the City's 2015 Urban Water Management Plan. In that plan, the City reports demand based upon its customer population and gross water use. The current demand is represented as 10,174 acre-feet per year.[4]

Ensuring that the demand assessment and forecast is reliable requires accurately analyzing relevant existing information. As is outlined in **Chapter 4**, the team conducted two different meter studies in 2011 and 2015 in order to assess the water consumption data from existing residential



[3] See Chapter 4 for further discussion of the MWELO.
[4] The value represents "normalized" conditions when analyzing customer demand for several recent years and adjusting for voluntary conservation in 2014 and state-mandated conservation 2015 in response to drought conditions.

and commercial units. As noted in that chapter, the team concluded that the City's overall demands were less than the demand estimates that had previously been predicted as part of the 2008 General Plan. Moreover, the team analyzed the regulatory changes applicable to land-use patterns, including items like the 2015 changes in the MWELO.

The MWELO impacts the overall water demand applicable to each newly constructed house. Specifically, MWELO regulates the percentage of a residential lot that may be irrigated with water as well as the targeted evapotranspiration rates of those irrigated acreages. Thus, the team assessed these new demand components in the context of the meter study and the number of future residential lots to assess the City's future demand. Importantly, the team mitigated this demand analysis by building into the calculation conservative water demand factors that would insulate the demand calculation in the case of unforeseen variables. For instance, even though a housing type may be required to install certain landscape forms under the new MWELO, it is possible that a homeowner removes that landscape and installs a more water intensive landscape in the future. Thus, assuming that the MWELO provides a perfect future formula for calculating demand is misguided. As such, the WMP uses conservative assumptions in assessing demand in order to ensure that the calculations may be relied upon for future planning.

In addition to the housing types and irrigated acreages assessed in the demand calculations, the team also assessed the City's overall growth rate. As discussed in several City Council workshops, the City's growth rates have been sporadic. In the period from 1890 to 1940, the City's population doubled from approximately 1,000 people to just over 2,000 people. But in the period from 1990 to 2000, the City's population swelled from 7,500 people to over 40,000 people. These sporadic growth rates make assessing the precise annual demand for water difficult. As such, the team assessed reasonable Placer County growth rates and discussed the pros and cons of using rapid growth rates and slow growth rates in assessing long-term water demand. As such, in an effort to minimize risk, the City is using a 3% compounded growth rate to substantiate its annual water demand projections.

This overall demand calculation is important because it informs the volume of supply that will be needed in order to meet the City's long-term demand. In other words, if the predicted irrigated landscape acreage or population growth rate are inaccurate, then the volume of water supplied to the City may be either insufficient or excessive at certain time frames in the predicted future conditions. The City's built-in risk management calculations allow it to provide a conservative estimate of need and recalculate annual

water demand on a regular basis.[5] The demand calculations in this WMP allow the City to plan for a water supply that is likely potentially larger than the City will need.[6]

The next important components of demand analyses are the calculations of maximum day demand and peak hour demand. The maximum day demand (MDD) is defined as the single day in a year that the maximum amount of water will move through an identified location in the City's water system. The peak hour demand (PHD) is the single hour within that maximum day that the most water will move through an identified location in the City's water system. These two numbers are extremely important to understand because they inform not only the necessary volume of water supply to meet those peaking demands, but also the sizing of the infrastructure needed to deliver the supplies to meet the demands.

As noted in **Chapter 4**, the City's current MDD is approximately 16.8 million gallons and its peak hour (PHD) is nearly double that figure. Importantly, in assessing these peaking demands, legally required fire flow pressures must also be maintained that do not surpass engineering-based water flow rates through the City's infrastructure system. As such, the demand calculations must assess the water amounts needed in order to deliver adequate water volumes at a particular quality while maintaining appropriate system pressures. Importantly, these demand calculations must be extremely accurate in order to make sure that in the non-theoretical situation, the water delivery system can supply what is needed. As described in **Chapters 3** and **9**, the system models incorporate these demand calculations in order to ensure reliable assessments and practical model testing – through fire flow pressure testing – in order to ensure that the system can meet predicted demands.

In summary, reliably calculating demand is more than merely capturing meter observations. The demand calculations must accurately represent annual, monthly and daily volumes, flow rates, pressures, peaking factors, and growth rates in order for the City to acquire adequate water supplies and to design infrastructure to meet its customers' needs.

7.4 Supply Reliability

A reliable water supply requires that the volumes of water that are necessary to meet the water system demands are available when needed. The physical water supply reliability

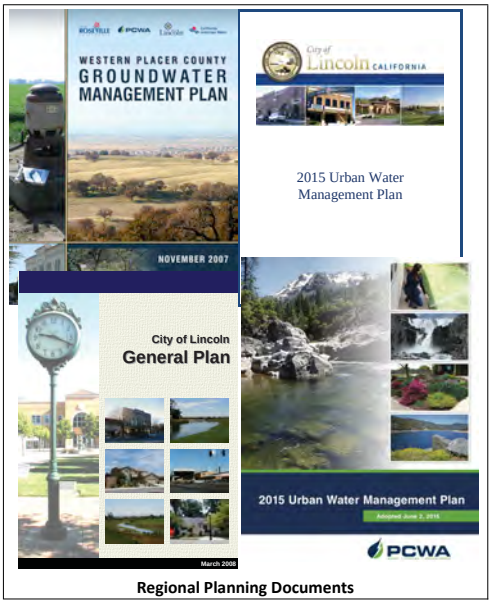
[5] The City's Master Demand Spreadsheet Tool is a detailed mathematical model that will allow the City to calculate at any single point in time the predicted demands in the City as growth occurs in time.
[6] It is important to note that other specific demand items – like water intensive industrial and commercial uses – are also considered in these demand calculations. Companies like micro-breweries that have potable water supplies as a basis of their manufacturing processes must be accounted for in developing long-term demand projections.

is distinguishable from the water supply deliveries discussed below in **Section 7.5**, System Reliability. A water supply assessment requires evaluating the underlying water rights, incorporating California's changing hydrological and regulatory framework into the understanding of those rights, as well as analyzing water asset redundancy and usability under various hydrological, contractual, and regulatory conditions. **Chapter 5** includes extensive discussion on all aspects of the City's water supplies. The purpose of this section is to explain the reliability of the City's water supplies.

As noted in **Section 7.3**, a reliable financial portfolio has a diverse set of financial assets. Similarly, a reliable water supply portfolio should include multiple water sources derived from multiple locations. As noted in **Chapter 5**, the City of Lincoln has the following water sources in its water supply portfolio:

- PCWA treated water under a water supply contract;
- NID treated water under a temporary water service contract;
- Groundwater through overlying and appropriative water rights;
- PCWA raw water through a raw water service contract;
- NID raw water through raw water service contracts; and
- Recycled water derived from the City's Waste Water Treatment and Reclamation Facility.

Each of these water assets in the City's water supply portfolio is subject to fundamental water rights laws. Moreover, each asset is subject to operational management decisions – like diversion to storage facilities – derived from the wholesale water providers. Last, the supplies are subject to hydrological changes and regulatory criteria that modify the utility of each asset under different conditions. When combined, these criteria constitute the reliability determinations that exist in the City's contracts for water supply.



Regional Planning Documents

For example, NID possesses numerous pre-1914 appropriative water rights, several contracts with Pacific Gas & Electric Company for water supply deliveries, and additional SWRCB issued appropriative water rights. NID also maintains nearly 400,000 acre-feet of water storage capabilities in its system that allows it to capture

and serve water to the City. In other words, NID relies upon a number of water sources and management efforts in order to meet its obligations to its customers, including the City. Thus, the significant diversity of NID's water supply portfolio and its management decisions comprise the reliability determination when analyzed as part of the City's water supply portfolio.

In addition to these basic considerations, the project team considered NID's obligations to all of its existing and future customers. The majority of NID's current consumptive-use customers are agricultural users. In time, as these irrigated acreages convert to urban uses, the actual consumptive use (the demands) decline – as urban consumption is generally less on a per-acre basis than nearly all forms of irrigated agriculture. Thus, the long-term demand for NID's water supply will likely decrease.

General longevity of NID's water supplies in the context of issues like climate change – described in **Chapter 1** – are also considered. NID's large water storage capabilities and its plans to develop more water storage, insulate its water supplies from potential reduction derived from the impacts of climate change – more precipitation falling as rain rather than snow and earlier watershed runoff events.

Last, in this NID example, the project team considered the vulnerability of the NID temporary water service agreement with the City. As noted in **Chapter 5**, that agreement can be unilaterally terminated by NID at any time. Thus, on its face, the City's NID water supply is vulnerable to termination. However, NID notes in the Agreement that the development of the Regional Water Supply Project (RWSP) will produce a permanent supply of water to the City. Since the City continues to pursue the RWSP, there is no reason to conclude that the water supply is unreliable.

City Well

Physical water supply reliability requires not only an independent analysis of each wholesale water providers' water assets, but also an assessment of the City's collective water assets. For instance, if NID's water supply to the City were suddenly curtailed – whether by emergency outage or natural phenomena – the City needs to have redundant supplies to meet its needs. As such, the team assessed the City's ability to draw from its other water assets in order to satisfy the water demands. This system redundancy assessment – the ability to pull water from other sources within a water supply portfolio – is a critical aspect of understanding physical water supply reliability.

The City would have essentially four options to meet a major outage in the event its NID water supplies became unavailable. First, it could draw more surface water from Placer County Water Agency. Second, it could pump more groundwater and deliver that water into the City's water system (see **Chapter 6**). Third, it could activate the City's Water Shortage Contingency Plan and reduce demands so that available supplies from its other sources could meet its essential needs. And last, the City could deliver some of its non-potable water supplies to offset potable demands – allowing the potable water supplies to only meet potable water demands (like drinking water). The City's ability to pull surface water from multiple watersheds – the American River and the Yuba/Bear Rivers watersheds – as well as draw upon groundwater resources creates supply redundancy in its sources. This redundancy in water sources makes the City's physical supply availability in all year types and even emergency conditions highly reliable.

This Water Master Plan provides an extensive analysis of the City's overall annual water supply as well as the underlying rights and entitlements, regulatory issues, and wholesale system operational issues that make up the City's annual supply. The City is in the fortunate position to only acquire the volume of supply it needs on a daily basis to meet its demands. Thus, the City used only 7,629 acre-feet of water in 2015 (a drought year) even though an adjusted normal year demand in 2015 (as described in **Section 7.3**) would have been in excess of 10,000 acre-feet. This calculation adjustment is important in helping the City project future supplies accurately and ensuring the City accurately determines if the future supply projections are sufficient to meet the projected demand.

In addition to annual volume, reliable supply is also assessed based upon the ability to meet maximum day and peak hour demands. The City's PCWA contract water entitlement quantifies delivery based upon maximum day measurements. And nearly all of the water right's underlying the City's contracts with PCWA and NID contain express conditions regarding the maximum water diversions that can be utilized to capture the supply. Taken together, all aspects of a supply source, including location of the supply, available diversion rate, and total annual volume available inform the assessment of water supply reliability.

Tables 7-1 through **7-3** below show the City of Lincoln's aggregated water supply reliability in normal years, a single dry year, and multiple dry years based upon annual physical supply availability.

These tables generally depict the City's annual demands and thus the annual supplies that will be needed to meet those demands. The tables do not depict the sources that constitute those water supplies nor the vulnerabilities in those sources or the redundancies in the system. Accordingly, the City can substantiate the reliability of the identified volume of supplies by examining the detailed analysis provided in this WMP.

Table 7-1 – Supply and Demand Comparison (Normal Year)

(acre-feet/yr)	2020	2025	2030	2035	2040	BO
Supplies	12,291	13,478	15,296	17,113	20,336	35,986
Demands	12,291	13,478	15,296	17,113	20,336	35,986
Difference	0	0	0	0	0	0

Table 7-2 – Supply and Demand Comparison (Single Dry Year)

(acre-feet/yr)	2020	2025	2030	2035	2040	BO
Supplies	12,905	14,152	15,908	17,627	20,947	37,066
Demands	12,905	14,152	15,908	17,627	20,947	37,066
Difference	0	0	0	0	0	0

Table 7-3 – Supply and Demand Comparison (Multi-Dry Years)

	(acre-feet/yr)	2020	2025	2030	2035	2040	BO
Year 1	Supplies	12,905	14,152	15,908	17,627	20,947	37,066
	Demands	12,905	14,152	15,908	17,627	20,947	37,066
	Difference	0	0	0	0	0	0
	(acre-feet/yr)	2020	2025	2030	2035	2040	BO
Year 2	Supplies	11,615	12,737	14,317	15,864	18,852	33,359
	Demands	11,615	12,737	14,317	15,864	18,852	33,359
	Difference	0	0	0	0	0	0
	(acre-feet/yr)	2020	2025	2030	2035	2040	BO
Year 3	Supplies	10,324	11,322	12,726	14,101	16,757	29,652
	Demands	10,324	11,322	12,726	14,101	16,757	29,652
	Difference	0	0	0	0	0	0

7.5 System Reliability

As discussed in **Sections 7.3** and **7.4** above, the threshold for determining supply reliability is that the volumes of supply are adequate to meet the City's customer demands. However, in addition to those two factors, the City must also have a water delivery system with sufficiently sized and disseminated infrastructure to transport water from the supply sources to the end users. Accomplishing this objective requires that the City's water infrastructure be designed to (1) deliver water of sufficient volume and pressure to all areas in the City and SOI; (2) address peaking issues that arise during the maximum day and peak hour with adequate fire flow protection; and (3) handle outages through system redundancy allowing access to multiple physical water supplies. The City's current system design minimally meets these threshold requirements but the future system design, as shown in **Chapter 9**, is much more robust.

As discussed **Section 5**, the variety of the City's potable water sources is derived from different purveyors (including the City) that are geographically dispersed. The City's current delivery system, however, limits this natural source water dispersion by directing

all surface sources through PCWA's treatment and delivery systems. In addition, the City adds groundwater derived from its well system to meet peaking needs in limited areas within the City's infrastructure. Thus, although the City can adequately meet its current demands with this infrastructure system, there are vulnerabilities that may significantly tax the water system as demands continue to grow.

Specifically, as noted in **Chapter 3**, the City utilizes water pumps on the PCWA regulated flow ledger to deliver water to a portion of the Catta Verdera development.(upper zone) If this pump system were to fail, the City would have no other viable means of delivering water to this area.[7] Thus, the City has sought to remedy this problem with a specific project – the Phase III water pipeline project (describe in **Chapter 11**) – that would allow more water to be delivered to the City's upper system. This water would be derived from PCWA's unregulated flow ledger and delivered by gravity to these high elevation lots. This infrastructure redundancy would reduce the pumping burden on the lower system and create infrastructure reliability for these high elevation lots in case one system were to fail. To date, the existing system has proven to be reliable because there has not been a system outage.

As the City grows, additional system vulnerabilities need to be corrected in order to meet the City's reliability objectives. For example – as noted in **Chapter 9** – there are still areas in the City that use pipes that were installed as early as 1929. These pipes are not meant to handle the pressures and flow velocities that are needed to meet the City's build-out capacity objectives. Moreover, connecting new pipes constructed with new materials to aging pipes from 1929 is generally an inferior engineering practice. As such, the ongoing Facilities Replacement Program (**Chapter 10**) and Capital Improvement Program (**Chapter 11**) seek to ensure that these system vulnerabilities are rectified over time to meet the infrastructure reliability objectives. Moreover, even in areas within the City with more modern infrastructure, systems could be undersized to meet the long-term build-out objectives for water deliveries. These system vulnerabilities must also be rectified to preserve water system reliability.

The City's long-term system reliability plans will significantly reduce infrastructure vulnerabilities. For instance, the City's development of multiple surface water delivery points from both PCWA and NID through multiple treatment facilities creates water supply and infrastructure redundancy in the City's surface water system. In addition, the strategic placement of water storage tanks and groundwater wells further protect the City from unforeseen outages either from source water or infrastructure failures. These system reliability plans – including looped infrastructure and large backbone delivery

[7] In some discussions, the City has considered emergency water deliveries through fire hoses that would be laid on the land surface that would push water higher up into the City's water system.

lines – allow the City to continue water service in difficult, and even emergency, conditions. All of these model representations are described in detail in **Chapter 9** and the specific CIP projects are described in **Chapter 11**.

7.6 Financial Reliability

In conjunction with demand, supply, and system reliability as discussed in **Sections 7.3, 7.4, and 7.5**, the City must also ensure financial reliability. Successful management of the City's water supplies and system requires financial support for continued maintenance and growth. Sources for revenue including developer fees, connection charges, customer rates, state bond funding, grant funding, and additional surcharges are critical to safeguarding the City's future water supply reliability. As discussed in **Chapter 3**, the City will expand far beyond its existing boundaries and its infrastructure must be adequate to deliver water to every corner while meeting its legal water-delivery requirements. A full financial assessment is beyond the scope of this analysis. Nevertheless, it is critical for the City to maintian financial reliability to ensure it has sufficient monetary assets to support its planned projects and maintain its current supplies.

7.7 Conclusion

Water supply reliability is a complex analysis that requires an ability to predict the future water demand, address the minutia of water rights and contracts, and evaluate infrastructure systems for adequate water delivery. The City has conservatively estimated its water demands and emphasized redundant water supplies and infrastructure systems in its short-term and long-term water planning. Conservative demand estimates are based upon carefully assessed meter studies and practically analyzed regulatory criteria that impact water demand estimates. Moreover, conservative growth estimates that have been evaluated based on regional trends and recorded in the **Master Demand Spreadsheet Tool** can be easily updated to reflect actual observations in the future. These demand assessments provide the foundation for supply augmentation efforts and infrastructure development projects.

The City has planned a redundant physical water supply system by developing six sources of water. Although all of these sources cannot be used for potable deliveries at this time, the ability to offset non-potable demands may allow secured potable supplies to be used more efficiently and cost-effectively. The City's robust water supply portfolio insulates it from outages caused by the failure of one or more of those supplies to materialize for any particular reason. And although there are vulnerabilities in each of the six supplies, actions can be taken to shore-up those supplies as the City continues to

grow and engage on water related issues.[8] As such, the City's physical water supplies are reliable.

Last, the City's infrastructure must be able to deliver the secured supplies to meet current and future demands. The current system configuration has some delivery vulnerabilities that are being addressed through continued modeling work and fire flow testing. The long-term system design, however, would allow the City to deliver water that originates from numerous water sources to meet customer demands throughout the City's system while still providing adequate pressures when the system is under stress. This long-term infrastructure planning renders the City's water system infrastructure reliable.

[8] **Chapter 8** identifies the key areas for the City's long-term strategic engagement.

SECTION 8. STRATEGIC WATER ISSUES

8.1 Introduction

This chapter of the Water Master Plan addresses the strategic water management issues facing the City of Lincoln. The issues facing the City vary in their complexity and geographic scope. In some cases, issues are entirely local and involve specific identifiable actions that are easily discerned. But in other instances, issues are complex with statewide and even global significance that require management actions aimed at mitigating the local risk. All of the issues described in the following sections, however, are relevant to the City's short-term and long-term water management efforts. The following discussion identifies critical City water resource protection challenges with recommended actions, explains the broader water management issues and various forums where the issues are being discussed, and recommends how the City can prioritize and engage in the most critical issues both now and in the future.

A number of water management challenges are facing the City – both internally and externally. It is clear that the management of the City's water assets has become exponentially more complicated since the adoption of the 2008 General Plan. Indeed, the worsening four-year drought crisis has illuminated the lack of statewide water planning, highlighted the growing insurgency of federal and state regulatory agencies into local and regional issues, and underscored the City's water asset and water conveyance vulnerabilities. Critical to the management of the City's water assets is the continued diligence in perfecting the City groundwater rights, recycled water rights and surface water entitlements, and protecting the ability to provide a balanced water supply during wet and dry years to meet customer demands.

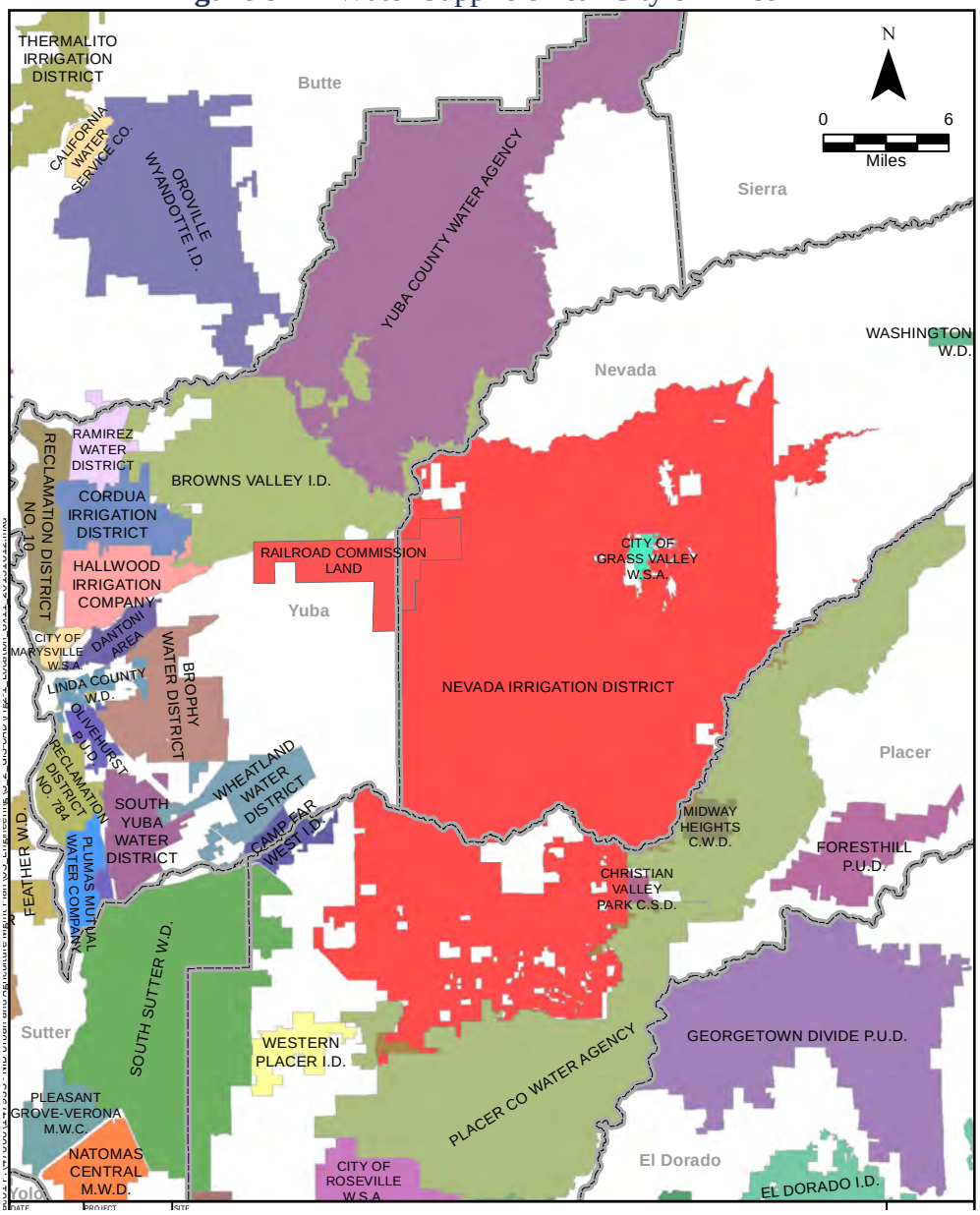
Additionally, the City must be prepared to control a dynamic assortment of issues that continue to evolve in light of the State's limited water resources. This control begins by forming an adaptive issue management structure that enables swift issue identification, clear issue prioritization, and effective issue engagement strategies. This section outlines an engagement framework and recommends the short-term and long-term management actions for the City's Management and staff.

8.2 Intensifying Competition for Water

Perhaps the biggest challenge facing the City is the intensifying competition for water statewide. Fresh water for agriculture and municipal use is an increasingly limited resource, and ongoing ecosystem management challenges, including preservation of endangered and threatened fisheries, create an ongoing and persistent need to balance

the uses of this finite resource. As a result, there are numerous competing interests that could affect the City's water resources and it is important to understand the context and challenges these interests pose in the coming years as illustrated by **Figure 8-1**.

Figure 8-1 – Water Suppliers near City of Lincoln[1]



Like other California municipalities, the City faces elements of change that permeate and underlie the related specific issues that are further described later in this chapter.

[1] NID 2015 UWMP at p. 20.

Specifically, the competition for limited water resources is tied to many of the following issues:

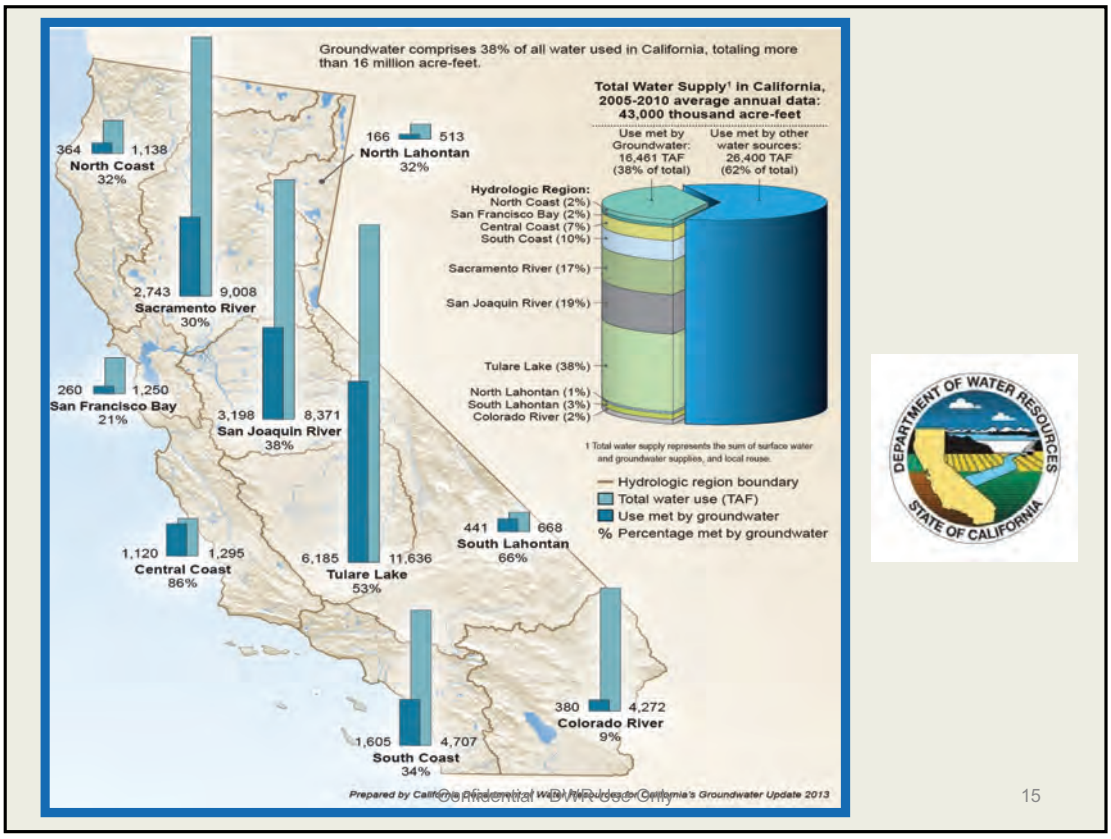
- California's hydrology is changing and fluctuating due to climate change and expanded water use.
- California's population continues to swiftly grow adding pressure to limited water resources and outdated storage and conveyance systems.
- California's water is needed to satiate growing urban, industrial, agricultural and environmental demands.
- California's and the Federal Government's Legislators and Regulatory Agencies are expanding their involvement in local water management issues.
- California's groundwater basins are rapidly depleting and some basins are undergoing significant contamination events.

All of these elements of change generate actions and projects that drive the exponential expansion of smaller issues that impact the City's water management. For instance, as a response to hydrological uncertainty and increased urban and industrial demand, southern California water export interests have reopened the debate on north of Delta water diversions (formerly the peripheral canal discussion and now coined the "Delta Fix") that require the City's attention and engagement. The increased attention on the State's changing natural and demographic circumstances create new forums where water issues are debated and new issues for those forums to debate. These forums and issues will be examined more closely throughout the remaining sections in this chapter.

8.2.1 California's Changing Hydrology

California's hydrology is in a state of flux. Specifically, climate change predictions, measured land and sea surface temperature increases, and observed trends in snowpack storage and stream runoff indicate that changes are occurring in California's hydrological systems. California's Department of Water Resources has observed less natural storage in snowpack (California's largest system of storage) due to warmer temperatures that cause earlier snowmelt and larger runoff events. In other words, the existing measured trends indicated that even if precipitation amounts in California remain fairly static in the face of a changing climate, the reduced natural storage and earlier runoff events appear to be reducing water supply reliability throughout the State. **Figure 8-2** provides an illustration of the complicated makeup of California's surface water supply alone. The existing storage and conveyance systems – most of which were built in the 1970s – are inadequate to handle these sorts of changes and still provide water supply reliability to all Californians.

Figure 8-2 – Total Water Surface Supplies[2]



Changes to California's hydrology, however, are not new. The dendrochronological record shows that the State has undergone 50 to 90 year wet and dry cycles over the last 10,000 years and has been plagued by extreme droughts lasting over 10 years in this same time period.[3] California's current water supply and conveyance systems were designed to handle hydrological uncertainties with a much shorter duration. In other words, California's storage and conveyance systems were designed to complement natural storage in the form of snow pack. As such, these systems are not sufficient to handle water supply for acute droughts lasting 5 years or more, or for climatic trends resulting in reduced annual precipitation and early runoff.

In short, California's hydrology is changing and the City will need to develop and implement new strategies to manage its assets to protect its ratepayers from negative impacts resulting from these changes.

[2] Sustainable Groundwater of California seminar through Law Seminars International on 6/16/16.
[3] Professor Ingram, UC Berkeley 2014.

8.2.2 Population Growth

California's population continues to expand, putting further pressure on the allocation of its limited water resources. In 2015, California's population was estimated at 39 million people.[4] This number should be compared against the entire population of Canada with a total population approximating 36 million people.[5] By 2050, the United States Census Bureau predicts that California's population will swell beyond 50 million people. Providing safe and reliable water supplies to meet this increased human demand in light of climate and hydrological trends will be a huge challenge over the next 35 years.

8.2.3 Expanding Water Demands

The demand for water in California goes beyond meeting only the needs of people in urban environments. Water demands are expanding across numerous sectors of California's economy as well as in various environmental stewardship and conservation locations. For instance, there is growth in water demand in nearly every economic sector to meet:

- agricultural needs, such as expanding permanent crops that require water application in all year types and have limitations on the quality of water used;
- industrial development, like oil production, where water is needed in the extraction and processing of subsurface carbon products; and
- commercial product development, like water-rich soy sauce, where water is the primary ingredient in the marketable food product.

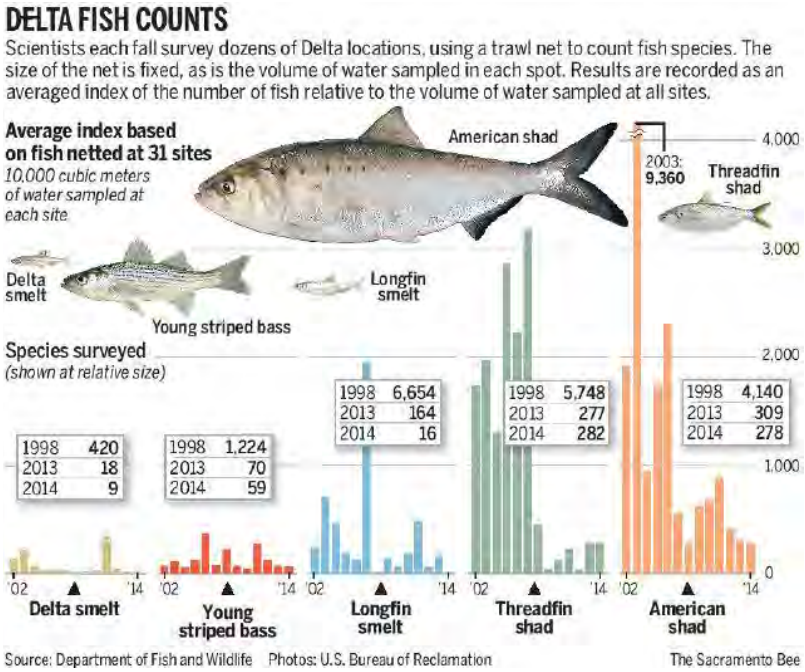
All of these economic areas – agricultural, industrial and commercial are changing the distribution and value of the State's water assets. This economic growth parallels the urban population expansion and all require new sources of water in both normal and dry years.

Similarly, there is tremendous growth in environmental water demands. In California, there are 34 species and subspecies of fish that are listed as either threatened or endangered by the State of California or the federal government. This includes the "famous" delta smelt as seen in **Figure 8-3**. Other avian and terrestrial species also rely on water supplies, and trends indicate that the regulatory agencies will connect water resources with these non-aquatic species as well. Similarly, water quality requirements in California's Delta and in upstream systems (like the cold water pool below Shasta Reservoir) further expand the demand for water resources throughout the State's

[4] http://www.census.gov/quickfacts/table/PST045215/06
[5] http://www.statcan.gc.ca/daily-quotidien/150617/dq150617c-eng.htm

environmental setting. This trend of dedicating water resources to environmental purposes continues to expand as the relationship between water and healthy ecosystems becomes further understood.

Figure 8-3 – Delta Smelt



8.2.4 Government Engagement

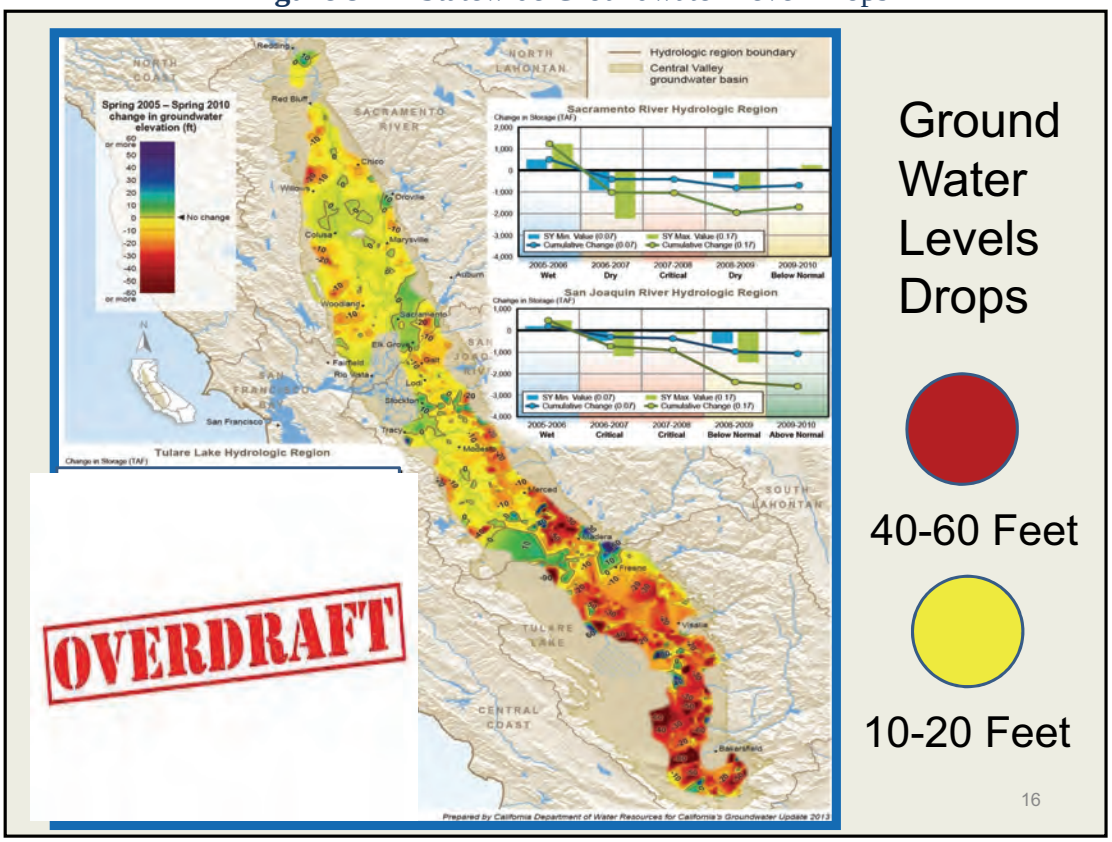
Both the federal and state governments continue to expand their jurisdiction into water resource management. The expansion is occurring in historically regulated sectors – like surface water management – but is also moving into historically unregulated sectors – like groundwater. The regulatory engagement expansion is arising from not only traditional water regulatory agencies, such as the SWRCB and the United States Bureau of Reclamation (USBR), but also is greatly expanding in non-traditional water regulatory agencies, like California's Department of Fish and Wildlife (DFW). For example, DFW requires a streambed alteration permit for any change to any diversion facility on a natural watercourse. Such a permit can greatly expand and complicate changes to traditional water diversions derived from a pre-existing water system. The regulatory regime not only needs to meet the diversion and conveyance requirements of the SWRCB, but also the regulatory objectives of DFW – which can completely modify a planned and engineered system (see the promulgation of fish screens on Sacramento River diversion facilities). This expanded reach into the water sector from new federal and state regulatory agencies will continue in California as more water is needed to meet specific regulatory objectives.

In addition to the state and federal growth in regulation, there is also regulatory growth at the local and regional levels. There are literally thousands of local agencies, special districts, municipalities, counties, joint powers authorities, and private companies in California that regulate water. In addition, as water becomes a preeminent factor in land use issues and environmental enhancement, the number of local agencies impacting water governance will grow, further complicating the regulatory burdens permeating water management in California. For instance, Placer County and Sutter County – two primarily land-use based agencies – are beginning to assert themselves in water issues where they have historically remained silent. In short, the City can expect expanded government and regulatory activity in the area of water resource management.

8.2.5 Groundwater Depletion

Groundwater depletion and contamination issues are rapidly emerging into the forefront of California's water management consciousness. **Figure 8-4** illustrates the statewide problem of groundwater depletion. There are 515 identified groundwater basins and sub-basins (collectively "basins") in California. Each of these basins has its own set of water supply and quality issues, water demands to satisfy, and regulatory systems governing the resource. In some areas, groundwater is heavily regulated through sophisticated plans, hydrogeological analyses, and integrated local and regional governance. In other areas, groundwater is wholly unregulated and massive depletions are occurring at alarming rates causing wells to run dry and land subsidence. In response to these wholly unregulated areas and areas that have ineffective management structures, the California legislature – in 2014 – enacted a sweeping set of groundwater laws and regulations called the Sustainable Groundwater Management Act (SGMA). The SGMA is described in detail in **Chapter 6** of this Water Master Plan.

Figure 8-4 – Statewide Groundwater Level Drops[6]



Groundwater contamination is also implicating the reliability of groundwater resources. Local contamination in the Placer County and Sacramento County areas, caused by industrial development, has resulted in a far-reaching regulatory structure requiring clean up and mitigation. Other longer-term contamination issues – like nitrogen fixation in the soils and water systems of the Central Valley – have traditionally been unregulated. In some areas of the Central Valley, the groundwater contamination situation has required a complete cessation in water use for human consumption. As the scientific understanding of water quality issues associated with human activity and development become better understood, the implications to groundwater cleanup and use will likely expand, impacting water resource management for urban areas throughout California.

8.2.6 Groundwater Contamination

The Placer County region has been addressing groundwater contamination in numerous locations in the City for decades. There are nearly 40 identified potential groundwater contamination sites in or near Lincoln's Sphere of Influence, including a former federal

[6] Sustainable Groundwater of California seminar through Law Seminars International on 6/16/16.

Titan Missile Site, Alpha Explosives Site, and numerous underground storage tank issues. These issues have required continual assessment over the course of the last 30 years. The status of the groundwater contamination and site remediation is not within the purview of this analysis. However, further assessment of the status of regional clean up activities is warranted in order to ensure that threats to groundwater assets are avoided and eradicated.

8.2.7 Water Use Efficiency

The City maintains an existing comprehensive water use efficiency program. The City participated in the State Water Resources Control Board (SWRCB) water conservation efforts in the 2015 drought and has taken active steps in reducing consumption in housing developments throughout its service area. The City participates in water fixture rebate retrofit programs, large landscape water budget developments, and commodity rate metering. The City also employs a public outreach and education program as well as many other best management practices to improve water use efficiency. The City will continue to comply with the Water Conservation Act of 2009 and is following the water efficiency efforts required by State government.

The City's 2011 meter study indicated approximately an 11 percent unaccounted for water, and further analysis in 2015 suggests the City's unaccounted for water is less than 10% in 2013, 2014 and 2015. Ten percent (10%) or less unaccounted for water is generally considered within acceptable limits. The most recent analysis, detailed in **Chapter 4**, is the first time the City has been in a position to quantify water consumption to determine the amount of unaccounted for water. Water that is quantified as "unaccounted for use" may include some or all of the following:

- Meter inaccuracy
- Unpermitted construction water
- Water system flushing
- Leaks in water mains, valves, and fire hydrants
- Leaks in services prior to the meter
- Emergency water for fire prevention or other hydrant activity

The most recent State water planning legislation includes a greater focus on quantifying leak and unaccounted for water. DWR working with the American Water Works Association (AWWA), prepared the Water Conservation Guidebook No. 5 focusing a leak audit on the following key steps:

- Quantify water sources
- Quantify water use
- Evaluate meter accuracy
- Calibrate meters
- Conduct leak survey
- Sonic Survey of all valves

The City has a leak detection program. The City should consider revamping its leak detection program to ensure consistency with the Urban Water Management Planning Act amendments as well as engage in thorough protocols to evaluate system vulnerabilities and unaccounted for water. Losses due to leaks tend to be constant whereas losses due to meters tend to be proportionately larger during the peak use period. The City could enhance the leak survey by evaluating winter minimum demand readings, conducting fire hydrant testing, and incorporating specific evaluation criteria into its new modeling system.

The California Water Conservation Act of 2009 requires a 20 percent reduction in per capita local agency water use by 2020. The City's plan for compliance with this mandate and current level of participation in the various Best Management Practices (BMPs) is documented in the 2015 Urban Water Management Plan (UWMP). While the City will maintain a robust conservation program into the future, the benefits of continued coordination with the Regional Water Authority on Demand Management Measures is necessary to meet the conservation requirement mandates and mechanisms to achieve them.

8.2.8 Source Water Quality

The City has two of the best quality surface water supply sources in the State of California: the American River watershed and the Yuba/Bear Rivers watershed (**Figure 8-5**). The American River watershed is low in dissolved solids, has very few upstream urban discharges above Placer County Water Agency's (PCWA) diversion, and is considered "generally excellent" in the 2013 American River Watershed Sanitary Survey.

All regulated drinking water parameters fall below maximum contaminant level standards. The Yuba/Bear Rivers also has very few upstream urban discharges and is derived from snowy-mountain run off that lie above urban centers. Nevada Irrigation District's (NID) diversions and storage allow runoff sediments to fall from the water, therein allowing better quality water deliveries through their conveyance system.

Figure 8-5 – Yuba-Bear Watershed Sources

8.3 Regional Forums and Programs

Throughout the broader Sacramento watershed, there are numerous forums that participate in developing and advocating water planning and management issues. These forums generally serve the City's needs by advocating positions on policy and legal issues and defending intrusions into local and regional water management and water

rights issues. In short, these entities' objectives are aimed at protecting the region's water supplies. However, the importance of water resources in California has exponentially grown and, in line with this growth, the forums that discuss water issues have expanded and diversified. The purpose of this subsection is to: (1) describe the regional water

groups that the City should be monitoring, (2) outline the programs and issues that each forum is coordinating, and (3) assess the City's engagement opportunities in these forums in order to maximize the effectiveness of implementing the City's water management strategies.

8.3.1 Water Forum and Water Forum Agreement

In 1993, the City of Sacramento and Sacramento County created the Water Forum to address concerns over both water supply reliability and environmental degradation in the Sacramento Region and the Lower American River (LAR). Specifically, the region was experiencing a prolonged drought and surface and groundwater conditions were becoming critical. Moreover, there was an increasing awareness of the environmental conditions along the LAR and that further deterioration of the LAR might lead to permanent environmental problems. The LAR supports 43 species of fish, including federally protected species – fall run Chinook salmon and Central Valley steelhead.

The Water Forum Agreement (WFA) is a signed document that seeks to meet specific objectives in the American River watershed. The Agreement is a package of linked elements with two, co-equal objectives: to provide a reliable and safe water supply for the region's economic health and planned development to the year 2030; and preserve the fishery, wildlife, recreational, and aesthetic values of the Lower American River. In order to meet these co-equal objectives, the Water Forum Agreement incorporates seven key elements: increased surface water diversions; actions to meet customer needs while reducing diversion impacts in drier years; support for improved pattern of fishery flow releases from Folsom Reservoir; Lower American River habitat management; water conservation; groundwater management; and Water Forum Successor Effort.

The City of Lincoln is not a signatory to the Water Forum Agreement or a member of the Water Forum (although it participates in the Regional Water Authority – (described below)), so the Agreement is only applicable through its impact on surrounding entities – in particular, Placer County Water Agency. PCWA has specific obligations under the Agreement and its subsequent Purveyor Specific Agreement (PSA) that may impact PCWA's ability to build surface water diversion facilities and deliver surface water to the City of Lincoln. PCWA's PSA requires it to reduce diversions from the American River less than the total allocation available on under its water right permits in order to make water available for use in the LAR. PCWA, however, is able to capture foregone water at

the mouth of the American River and transfer that water to other agencies. The WFA and PCWA's PSA have a direct bearing on the City's use of surface water from the American River as well as the longevity of its groundwater assets because a source the City relies upon is limited by the WFA and the WFA's PSA implementation.

8.3.2 Regional Water Authority

The Regional Water Authority (RWA) is a joint powers authority formed in 2001 to promote collaboration on water management and water supply reliability programs in the greater Sacramento, Placer, and El Dorado County region. It is an outgrowth of the Water Forum that was developed to allow regional agencies to collectively implement the provisions of the Water Forum Agreement.

RWA represents 24 water suppliers and associated agencies in the greater Sacramento Area. The mission of RWA is to serve and represent the regional water supply interest and to assist Members in protecting and enhancing the reliability, availability, affordability, and quality of water resources. A nine-member Executive Committee is elected annually to guide RWA. Recently, RWA has changed objectives and morphed into a broader advocacy forum and water management group that includes non-Water Forum members. In September 2013, RWA Board unanimously adopted the updated Goals and Objectives for the RWA Strategic Plan. The four goals are: Planning Goal, Implementation Goal, Information/Education Goal, and Advocacy Goal.

The Planning Goal seeks to develop a regional water reliability plan to identify the most promising regional opportunities to improve water supply reliability; evaluate and respond to external impacts on the region's water supplies and operations; and create an Implementation Plan for the Planning Goal and update it annually. RWA has initiated the regional water reliability planning effort.

The Implementation Goal seeks to promote implementation of the American River Basin Integrated Regional Water Management Plan; support a lower American River Flow Management Standard that is consistent with the Water Forum coequal goals; support implementation of water transfers among agencies intra-and interregional that are beneficial for the region; support programs to benefit from economies of scale in purchasing; fully implement the regional mutual aid program template for equipment, manpower, and water supply; promote improvements in water use efficiency in the region to meet future water needs; and create an Implementation Plan for the implementation goal and update it annually.

The Information and Education Goal seeks to educate and inform members and other interested parties on water management issues affecting the region; raise RWA profile

and credibility to external audiences through a focused public outreach effort; develop and maintain strong partnerships to advance RWA member interests; develop a comprehensive public outreach and education program among members to create and implement a consistent message for RWA and the region; and create an Implementation Plan for the Information/Education Goal and update it annually.

The Advocacy Goal seeks to engage state and federal legislators representing the region and legislators on relevant committees to discuss an agenda for legislative action that represents a collective RWA member vision on items of regional importance; and evaluate, comment, and advocate on statewide water regulatory issues that may impact the region and its water supply reliability.

8.3.2.1 Restructure of Joint Powers Authority

In October of 2013, the RWA members amended its Joint Powers Authority in order to be a more effective entity in furthering its membership's objectives. Specifically, RWA modified its voting structure so as to allow the membership to take positions on various issues without the memberships' unanimous consent. This change in voting structure is likely to elevate RWA's effectiveness in advocating and analyzing water issues throughout California's legislative and regulatory processes.

8.3.2.2 RWA Integrated Regional Water Management Plan

In April of 2004, sixteen of RWA's members and associate members elected to embark on the development of an Integrated Regional Water Management Plan (IRWMP) on behalf of the entire RWA membership. RWA's IRWMP's addresses complex water resource management challenges by identifying water supply and infrastructure issues and finding regional cooperative solutions and financing mechanisms to resolve the challenges.

RWA's IRWMP provides the following benefits:

- Establishes a common vision and goals and a stronger regional understanding of water resources issues and potential solutions.
- Creates opportunities to identify projects that align with the vision and goals.
- Creates opportunities to develop multi-partner projects with better economics of scale and more potential funding sources.
- Establishes a framework to monitor and evaluate the region's progress toward meeting its goals.
- Establishes an adaptive process to address tomorrow's water resources challenges.

The City has been active in identifying issues and developing solutions as part of the IRWMP process. The IRWMP process in California legislative and regulatory law is becoming the paramount planning forum that allows regional agencies to obtain state funding from legislative enactments and proposition initiatives. Continuing participation in RWA's IRWMP process is critical to meet the City's long-term water management objectives.

To further these objectives, a comprehensive update to the IRWMP was adopted in July 2013 that furthered the ongoing effort to promote regional sustainable water resources. This update greatly expanded beyond the original efforts in the 2006 IRWMP to incorporate new stakeholder-derived issues and concerns. In addition to the 2006 goals, a vision statement was added to the IRWMP effort. The vision states "The American River Basin Region will responsibly manage water resources to provide lasting health to our community, economy, and environment." A list of primary goals was incorporated into the document to help guide and inform actions made within the IWRMP. The goals serve to help all the stakeholders realize the vision by:

1. Providing reliable and sustainable water resources, sufficient to meet the existing and future needs of the region.

2. Protecting and enhancing the quality of surface water and groundwater.

3. Protecting and enhancing the environmental resources of the watersheds within the region.

4. Protecting the people, property, and environmental resources of the region from damaging flooding.

5. Promoting community stewardship of our region's water resources.

The new vision and goals help inform stakeholders in deciding the appropriate actions to execute that affect the American River Basin. The 2013 update provides adaptive management practices and informs participating entities about strategy, implementation of projects and system flexibility. Additional information on the following topics have also been included:

- Updates to all basic water-related, environmental, and socioeconomic data
- Development of vision and goals, principles, objectives, and strategies for meeting water resource management needs
- A summary of regional climate change vulnerabilities and adaptation measures

- Addressing issues associated with a reliable and safe water supply for disadvantaged communities
- Documentation of increasingly extensive stakeholder outreach, including the development of a Web-based interface to ensure ongoing collaboration and communication beyond plan adoption
- A comprehensively updated project prioritization method and project list
- Updated details on financing and implementation

Overall, the 2013 update has expanded the IWRMP while still adhering to the original plan's framework and guiding principles of sustainable resource management and integration.

8.3.3 Association of California Water Agencies (ACWA)

The Association of California Water Agencies (ACWA) is the largest coalition of public water agencies in the country. Originally created in 1910, its nearly 450 public agency members collectively are responsible for 90 percent of the water delivered to cities, farms and businesses in California. ACWA has a primary mission to assist its members in promoting the development, management and reasonable beneficial use of water in an environmentally balanced manner.

ACWA identifies issues of concern to the water community and the general public. The association accumulates and communicates the best available scientific and technical information to the public and policy makers; facilitates consensus building; develops reasonable goals and objectives for water resources management; advocates sound legislation; and fosters cooperation among all interest groups concerned with stewardship of the state's water resources. In addition to its public agency members, ACWA has numerous affiliate members that include mutual water companies as well as other non-profit and non-public water suppliers. Hundreds of firms and corporations with an interest in water also belong to ACWA as associate members. A 33-member Board of Directors governs the association. The membership is organized into 10 geographic regions, which play an active role in setting the association's policy agenda (**Figure 8-6**).

Figure 8-6 – ACWA Geographic Regions

The size of ACWA has made it difficult to be an effective advocate of statewide water policies that benefit all of its members. In 2009, ACWA took political actions that were adamantly against the needs of its northern California membership. These actions nearly resulted in a mass exodus of northern California interests from ACWA's membership as distrust permeated the Association's leadership ranks. Instead, ACWA's board policies were modified to prevent factional dominance.

In 2014, ACWA was active in helping facilitate the Governor's Water Action Plan, groundwater legislation, and potential modifications to the Water Bond. Again, in 2014, ACWA leadership took actions that were counter to the needs of the RWA regional interest. In 2015, ACWA lobbied on behalf of the State's water purveyors asserting that the Governor's conservation targets were overreaching. The effort was not productive and the drastic conservation requirements were implemented and most acutely felt in the RWA region. And as California moves into the next legislative session, ACWA will need to address its position on the Delta Fix – Governor Brown's primary water supply and infrastructure objective – further discussed in **Section 8.4.2** below. The City should consider developing an ACWA membership in order to track important water issues among the state's water purveyors, develop new relationships with water interests outside the regional boundaries, and understand legislative and regulatory actions impacting the City's water assets.

8.3.4 Western Placer County Groundwater Management Plan

The 2007 Western Placer County Groundwater Management Plan (WPCGMP) is designed to assist the City of Lincoln, City of Roseville, Placer County Water Agency

(PCWA), and the California American Water Company (Cal-Am) in an effort to maintain a safe, sustainable and high-quality groundwater resource within a zone of the North American River Groundwater Subbasin. 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 WPCGMP provides a framework to coordinate groundwater management activities through a set of basin management objectives and specific implementation actions that were agreed to by all of the participants. In 2013, the partnership completed the Western Placer County Sustainable Yield effort that is designed to understand the usage, storage capacity and sustainable yield of the aquifers, and to develop management strategies to protect and enhance the partnership's groundwater assets.

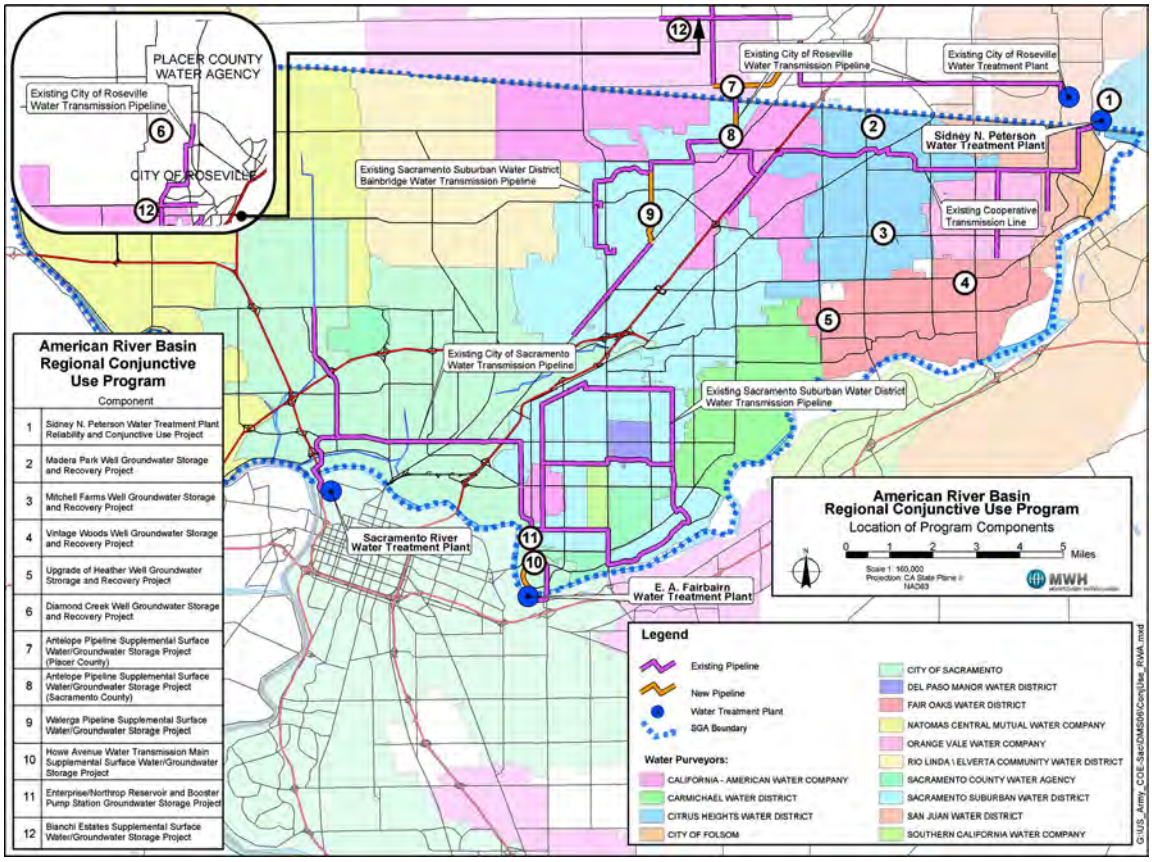
The City is an active participant in the WPCGMP effort. The focus of this group at this time is to develop and implement compliance activities related to the Sustainable Groundwater Management Act (detailed in **Chapter 6**). These activities will require not only collaboration with the WPCGMP partners, but also Placer County, Sutter County

and members of the Sacramento Groundwater Authority (SGA). SGA is a JPA formed to manage groundwater in the Sacramento County portion of the North American Subbasin and has applied to become a GSA under the 2014 SGMA Legislative package.

8.3.5 American River Basin Regional Conjunctive Use Project

SGA and RWA are conjointly working to develop a groundwater banking program. For SGA this effort grew out of their primary goals and conjuctive use focus. SGA and RWA are further promoting conjunctive use throughout the region and with their respective stakeholders related to the North Area Basin – a basin with excess storage capacity estimated at 2 million acre-feet. The program area is bound on the east by Folsom Lake, on the south by the American River, on the west by the Sacramento River and by the Bear River to the north. A map of the planned project can be seen in **Figure 8-7.**

Figure 8-7 – American River Basin Regional Conjunctive Use Project[7]



The program aims to maximize surface water use in normal and wet years, while in dry years surface water use would be conserved to help serve in stream environmental purposes. Specifically, SGA anticipates the water banking program to be based on direct and in-lieu recharge during wet years when groundwater is not as needed with ample surface water supplies. Then in dry years, participating members will increase groundwater pumping and decrease their surface water use, allowing that water to satisfy environmental needs such as in-stream flows, water quality and fishery habitat. Although this program is not fully developed, SGA has 16 water purveyors seeking participation. Last, SGA intends to work with outside entities interested in banking water in the North Basin region. The program seeks to improve groundwater storage and banking by improving regional water supply infrastructure.

8.3.6 Legal Defense and Political Organizations

There are numerous legal defense and political organizations that work within the American River and Yuba/Bear Rivers watershed region. Only two of these

[7] Regional Water Authority Map of American River Basin Regional Conjunctive Use Project

organizations are described in this section. The primary purpose of these types of organizations is to defray costs associated with legal representation and advocacy. The organizations that affect the American River and Yuba/Bear Rivers basins are as follows:

- Sacramento Valley Water Users Joint Defense Agreement – The Sacramento Valley Water Users Joint Defense Agreement was established in the 1990s to handle issues associated with the development and implementation of the Bay Delta Water Quality Control Plan. This Agreement has been signed by numerous water agencies in the American River Watershed.

- American River Watershed Joint Defense Agreement – Recognizing that some water issues are isolated in priority to the American River region, a group of American River water diverters established this joint defense agreement to defray costs associated with battling these issues.

The primary issues that these legal defense entities will face include: (1) the Delta Water Fix; (2) the Bay Delta Water Quality Control Plan Update; and (3) the Lower American River flow standard. All of these issues impact the water users within this region and may affect long-term reliability. Specifically, more stringent regulatory actions related to water rights and water supplies may affect long-term supply reliability even if the hydrology of the region stabilizes. As such, these entities may be used to legally challenge certain laws, rulings, or regulations that affect water supply reliability on behalf of regional stakeholders.

8.4 Regional and Statewide Issues Affecting Water Assets

California is replete with water-related issues. The complexity and sophistication of the various issues as well as the diverse forums in which these issues are discussed make tracking each of them very difficult. The purpose of this section is to describe the most pertinent regional and statewide water issues facing the City and to assess the City's best opportunities to engage and influence these issues.

8.4.1 Bay Delta Water Quality Control Plan Update

The Bay Delta Water Quality Control Plan (WQCP) is the responsibility of the State Water Resources Control Board (SWRCB). The SWRCB updates the WQCP every 3 years, with the intent of protecting the beneficial uses of water within the Bay-Delta and its tributaries as well as the water quality issues associated with managing the states' waters to meet these beneficial uses. The last Bay-Delta WQCP update was completed in 2006 and is currently undergoing revision.

The recent update process started in 2009 and is a multi-phase effort to review both water quality and stream flow rates for Delta tributaries to meet Delta outflow requirements. The most recent approved amendments were issued in Spring 2016 with SWRCB hearing on the planned changes to the WQCP scheduled for "Fall 2016." Phase 1 is currently under development and is providing recommended flow regimes for future management of tributaries to the San Joaquin River. In this Phase, it is becoming increasingly clear that upstream water rights will be modified in some way to meet recommended flow criteria downstream. The Phase 2 effort will focus on the Sacramento River Water Quality Control Plan component and the necessary flows to meet Delta water quality needs. Then, in Phase 3 Water Rights, the State will determine how to address flow recommendations in the context of the Sacramento region's water rights. By the time this phase of the effort is moving forward, the flow regimes in the San Joaquin, Sacramento, and other Delta tributaries will be fixed. As such, the City should monitor Phases 1, 2 and 3 of the WQCP update in order to understand the tactics and implementation goals of the SWRCB. The findings in Phase 1 will be telling of SWRCB's application of those goals and objectives in Phases 2 and 3.

The specific threats to the City posed by the WQCP Update relate to the City's surface water entitlements that are derived from water rights in the American River and Yuba/Bear Rivers watersheds. The WQCP Update could radically change the volumes of water available for diversion under various water rights for potable uses. Moreover, the WQCP may also include mandated discharges under the City's NPDES permit that may end up as permanent. Under current conditions, Delta water quality requirements are the sole responsibility of the federal and state projects. In other words, if there is insufficient water in the system to meet the needs of the Delta, then the projects must provide that water from stored supplies. But this oversimplification does not adequately address the prevailing thinking on the water issues at the state regulatory level.

The SWRCB wants to vastly increase the flow regimes on river systems tributary to the Delta. This increased flow regime is not necessarily going to be the responsibility of the project purveyors. Where natural flows need to be increased on Delta watershed tributaries, junior water right holders' water rights may be jeopardized. Or, in another potential scenario, the SWRCB may attempt to utilize principles under the Public Trust Doctrine to reduce both junior and senior water rights in order to meet additional flow needs. Either scenario impacts the City's water assets. Accordingly, paying very close attention to the Bay Delta WQCP proceedings as well as working with regional stakeholders to develop and propose water supply solutions that meet the primary objectives of the WQCP update is paramount.

8.4.2 California WaterFix and California EcoRestore

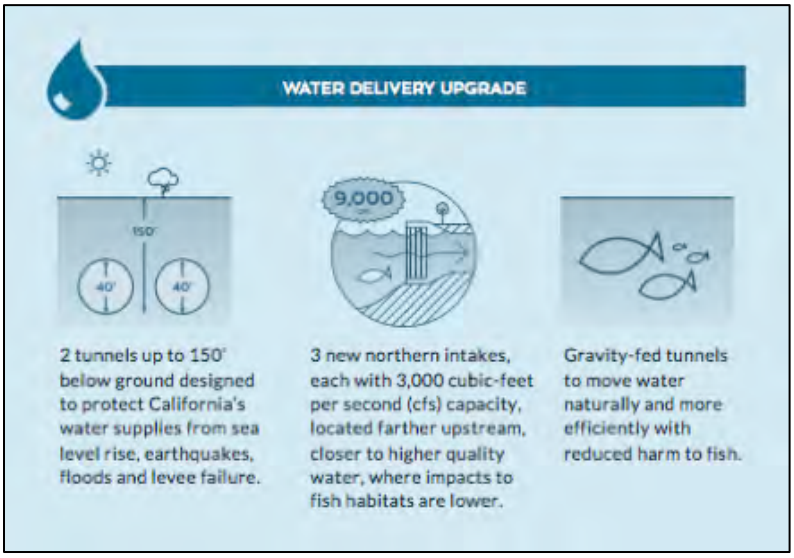
The Bay Delta Conservation Plan (BDCP) was recently changed to reflect public comments and fulfill the requirement of the 2009 Delta Reform Act. State and Federal agencies are proposing a new sub-alternative – Alternative 4A – which would replace Alternative 4 (the proposed BDCP) as the State's proposed project. Alternative 4A reflects the State's proposal to separate the conveyance facility and habitat restoration measures into two separate efforts: California WaterFix and California EcoRestore.

The California WaterFix would seek to improve water conveyance to water exporters by building facilities that meet export needs. Specifically, the WaterFix would build two tunnels in the north delta that are approximately 150 feet underground with three separate intakes, see **Figure 8-8**. Each intake will be capable of diverting approximately 3,000 cubic feet per second for a total of 4.9 million acre-feet annually to the export communities. The WaterFix is an effort to improve California's infrastructure for delta-watershed export communities. Minimum limits will be placed on the water flow to ensure hydrologic conditions do not prevent fish populations from gaining beneficial use from the water.

The California WaterFix would also include habitat restoration. California WaterFix will include approximately 2,300 acres of habitat restoration to mitigate for the construction and operation of the new water facilities. These costs will be paid for exclusively by water agencies benefiting from the project. Through 2020, the WaterFix will pursue more than 30,000 acres of critical Delta restoration under the California EcoRestore program, and pursuant to pre-existing regulatory requirements and various enhancements to improve the overall health of the Delta. Proposition 1 funds and other state public dollars will be directed exclusively for public benefits unassociated with any regulatory

compliance responsibilities. The cost to fix California's primary water delivery system is estimated at $14.9 billion – or about $5 a month for urban water users – and will be paid for by public water agencies that rely on the supplies.

Figure 8-8 – WaterFix Proposed Tunnels



California EcoRestore (EcoRestore) will accelerate and implement a comprehensive suite of habitat restoration actions to support the long-term health of the Sacramento-San Joaquin Delta's (Delta) native fish and wildlife species. Through 2020, EcoRestore will pursue environmental enhancements in the Delta through existing regulatory structures and other identified enhancements. EcoRestore looks to enhance as much as 30,000 acres of land in and around the Delta through this effort. EcoRestore will be funded through Proposition 1 funds and other state funds that are directed exclusively at public benefits.

The City should work with RWA executive management to get a full understanding of the implications of the WaterFix project and EcoRestore project to affect regional water supply reliability.

8.4.3 Delta Plan

The Delta Plan is a planning document that addresses environmental and water quality requirements in the legal Delta. The Delta Plan is governed by the Delta Stewardship Council (DSC) and requires updating and modification as conditions change. While the Delta Plan does not in itself make changes to system operations or management, it is enforceable and works as the overarching guidance document for many of the plans and policies being developed to manage the Delta going forward.

The Delta Plan incorporates a requirement to establish delta outflow objectives. Delta outflow objectives can only be satisfied by assessing water rights and supplies in the entire Delta watershed system – from the headwaters of the San Joaquin and Sacramento

Rivers to their confluence in the Delta. Although the Delta Plan does not grant jurisdictional authority to the DSC beyond the boundaries of the legal delta, it is ambiguous as to the DSC's authority in managing resources beyond the Delta that have a lasting impact in the Delta. In this way, it is unclear whether the Delta Plan grants DSC the authority to manipulate water assets outside the legal Delta and should be closely monitored by Sacramento area water interests. There is little doubt, however, that the DSC will recommend specific actions to the SWRCB in order to modify delta outflow objectives.

The Delta Plan also calls for a Delta Water Master who has been appointed to help implement the Delta Plan. The Water Master is charged with ensuring that the water diversions and uses in the delta are legal. Specifically, not only is the Water Master tasked with stopping illegal diversions of water, but he is also charged with assessing the reasonable and beneficial use of water in the Delta for irrigation, urban and industrial uses. The Water Master does not have authority to manage water assets outside the legal Delta but the implications of a Water Master with this limited range of water management may not meet the Delta Plan objectives. Accordingly, the City should be monitoring the Delta Plan and its implementation through participation in the RWA.

8.4.4 Climate Change

Climate change resulting in increased hydrologic uncertainty, more pervasive and longer-lasting droughts, and decreased snow pack in the Sierra's could also influence operations and further increase competition for water supply when it is available. For example, hydrologic modeling of Folsom Dam Operations conducted for the California WaterFix and EcoRestore concluded that Folsom Dam will reach dead pool storage levels approximately once every 10 years, in part due to climate change projections. Dead pool storage is the level at which no additional river releases out of Folsom Reservoir are possible. Similarly, Nevada Irrigation District (NID) has initiated efforts to plan, design, and construct an additional reservoir in order to mitigate the effects of climate change on its water management system. In short, it is looking to build a reservoir that is capable of capturing more runoff falling as rain since snowpack may be reduced in climate change conditions.

The City's existing water assets, however, rely upon the ability of the upstream diverters to capture and deliver water under those diverters' water rights. PCWA and NID manage significant watersheds and have large reservoirs to capture water under their water rights. However, the potential for change in the ability to capture these supplies – and thus the reliability of these supplies – still exists if the climate change implications manifest as predicted. These predictions are noted below.

First, with warming regional temperatures, precipitation will fall more as rain than as snow. Rain does not accumulate in snowpack (the largest source of storage in California) and tends to rapidly melt existing snowpack. As such, the change in precipitation form can impact the natural flow of the source-water watersheds by lessening the amount of snowpack in the system.

Second, climatologists predict that in many areas there will be less precipitation due to climate change. If this prediction manifests, the amount of water available for diversion in the source water systems will be less – like a perennial drought.

Last, with warming regional temperatures, the timing and pattern of runoff from the snowpack will also likely change. Here, the time period to melt the snowpack will be shortened as the temperatures surrounding the snowpack rise. This means that there will be earlier snowmelts in the Sierra watershed. Earlier snowmelts mean that the natural flow of the river systems will be higher in the prevailing runoff months but will last for a shorter period throughout the dry periods in the summer. As such, water diversions of the natural flow in summer may be significantly decreased.

The regulatory issues predicted with climate change are perhaps more dire. As described in the previous example, the regulatory issues in the Delta may be greatly exacerbated with climate change requiring longer and more substantial releases of water from existing reservoir systems. Simply put – if sea level rises as predicted, then more water will be needed to meet the delta water quality requirements as promulgated by the SWRCB. Accordingly, there is growing concern that climate change could exacerbate hydrological and regulatory droughts and directly impact the City's water assets.

8.4.5 State Water Resources Control Board Authority

The State Water Resources Control Board (SWRCB) has expansive jurisdiction over water supplies in California. As described in earlier sections, the State retains ownership of all water in California and water purveyors merely possess the right to use the water. SWRCB has been charged with managing water rights in California and has expanded its ability to carry out this mandate by expanding its reach into surface and groundwater resources.

For instance, in managing surface water resources, the SWRCB has declared that it holds the waters of the State in trust for the people for Public Trust uses. In California Supreme Court case law, the Public Trust Doctrine takes priority over all other uses of water in the State – in other words, a pre-emptive senior water right that was not recognized until the 1980s. The SWRCB seeks to use this California Supreme Court doctrine priority to further acquire water resources to protect public trust uses.

On the groundwater side (besides the SGMA described in **Chapter 6**), the SWRCB has long been isolated from groundwater jurisdiction. Although it has made political requests to obtain the authority to regulate groundwater, it has generally been thwarted. However, SWRCB has used its regulatory authority to enter the groundwater management arena. The first foray was to establish hydrological connectivity between certain surface water and groundwater sources. In this instance, the SWRCB reasoned that where groundwater was feeding surface water systems, surface water purveyors had relied on these supplies to fulfill the balance of their surface water rights. As such, some groundwater has been subject to SWRCB's jurisdiction.

More recently, the California Legislature is requiring regions to engage in groundwater planning which may give the SWRCB more authority to enforce new planning regulations. Moreover, in Siskiyou County, a trial court has recently ruled that the Public Trust Doctrine applies to groundwater resources. This case will likely be appealed but the implications to groundwater management could be staggering.

Last, the Governor's latest Emergency Drought Declaration and the driest conditions since the 1976-1977 drought have prompted the State Water Resources Control Board to take dramatic action to protect the Public Trust State water resources. Severe drought conditions have caused the SWRCB to implement water rights curtailments in the American River and Yuba/Bear Rivers watersheds as well as implement drastic water demand curtailment orders. These actions are unprecedented in California.

The SWRCB's Order mandating water use restrictions in local jurisdictions was particularly problematic for the City of Lincoln – requiring a 36% reduction in 2015. Under the order, wasting water is subject to a $500 per day fine on individual water wasters (e.g. washing down sidewalks, washing cars without a shutoff nozzle, or allowing irrigation to run off property). Cities must also activate their dry year water plans and ordinances including outdoor water use restrictions. As the SWRCB continues to aggressively pursue assurance of curtailment and water conservation compliance, it is critical that the City take measured actions to assure reliable water supplies by diversifying its water supply portfolio and aggressively protecting the assets currently within that portfolio.

8.4.6 Water Conservation and Water Use Efficiency

The Water Conservation Act of 2009, also known as SBX7-7 signed by Governor Schwarzenegger implemented new requirements and restrictions on the use of water

throughout the State of California. One of the major tenants of the new law is the requirement for Urban Water Suppliers (including the City) to achieve a 20 percent

statewide water use reduction on a per capita basis by 2020. The primary reporting and accountability mechanism for tracking progress and compliance towards meeting the conservation targets is via the Urban Water Management Plan water resource planning documents. The City completed and submitted its 2015 UWMP which includes the 2015 interim update and 2020 SBX7-7 compliance target.

The City has met the 2015 compliance target and is currently on track to meet the 2020 compliance target. An important element of water conservation for the City is preservation of its water rights and entitlements despite the potential decrease in overall water use. In order to accomplish this, the City is advised to account for water demand reduction savings by recording and reporting those savings under Water Code sections 1010 and 1011 to further protect water assets.

8.4.7 California Water Bond

In 2009, Californians adopted a California Water Bond as part of a comprehensive package of legislative reforms geared towards repairing California's struggling water delivery systems and ecosystems. These reforms were aimed at establishing a new paradigm in California as it related to water diversions, the Delta ecosystem, and long-term water supply reliability throughout the state.

A second Water Bond, Proposition 1, was put to the voters for approval in November 2014. It passed overwhelmingly. The Water Bond provides for $7.545 billion in expenditures (including repurposing $425 million of unspent funds). The key expenditures are for safe drinking water ($520 million) water supply reliability and integrated regional water management projects ($310 million); watershed protection ($1.495 billion); statewide water system operational improvements and storage ($2.7 billion); conservation and watershed recycling ($1.785 billion); groundwater protection and water quality ($900 million); water recycling ($725 million); and statewide flood management ($395 million). In some instances under this provision, the funding is continuously appropriated. The City should monitor the bond situation both through RWA and its participation in the legislative advocacy program within this group.

8.4.8 PCWA Permit Renewal Process

Placer County Water Agency is currently seeking to renew its American River water right permits – Permit 18356 and 18358 – with priority dates of 1958. For post-1914 appropriative water rights issued by the State Water Resources Control Board, a permit renewal is an effort to continue to validate the utility of the issued water right. The SWRCB water right process has three stages – application stage, permit stage, and

license stage. The application stage is the initial filing where the applicant demonstrates the need for water, the availability of water on the system, and the plan and ability to put the water to beneficial uses. When the SWRCB agrees with the applicant, it issues a water right permit that outlines specific conditions and timelines that the applicant needs to meet in order to "legally perfect" the water right and obtain a license.

PCWA's permits have specific terms about diverting volumes of water and applying those waters to beneficial use by a specific time. PCWA did not meet the timelines that were outlined in its water right permits and is now engaging the SWRCB to extend those timelines. Historically, these time extensions have been casually granted by the SWRCB. However, more recently, SWRCB has been extremely fickle about extending timelines and, in some cases in the American River region, has terminated the water right in its entirety.

PCWA's permit renewal process is important for the City of Lincoln because the water supply contained in those permits constitute the water supplies that will be diverted into the Ophir water treatment plant once it is constructed. If the supplies are somehow diminished or never perfected, the City's investments in PCWA infrastructure may be suspect. Accordingly, the City should monitor PCWA's permit renewal process and support PCWA's efforts to utilize the water assets derived from its permits in the Placer County region.

8.5 Strategic Engagement Recommendations

The analysis in this section has focused on the key issues affecting the City's water assets. California's water management system is fluid – regulatory issues continue to appear and then evolve over time with some fading away and others becoming more important. The purpose of this section is to outline the list of issues and prioritize City actions related to those issues so that the City may take appropriate steps to protect its water assets and secure long-term supply reliability. These issues will change over time and should be revisited annually to determine their relevance and prioritization.

8.5.1 High Priority Issues and City Actions

Regional Water Authority – The City should continue to be a leading entity in RWA. The evolution of that entity from implementation of the WFA to a regional advocacy and IRWMP implementation program direct impacts the City's long-term water asset management strategy.

WPCGMP – The City should take a leadership role in the WPCGMP as that entity is developing the western Placer County region's efforts in complying with the 2014 groundwater legislation described below.

Bay Delta Water Quality Control Plan Update – The City should engage with regional stakeholders on the WQCP Update. This effort could implicate the City's water assets directly and permanently. RWA should work diligently to be in front of this issue with City support.

2014 Groundwater Legislation and Regulation – The City should work to influence the 2014 groundwater legislation implementation. The stakes to the City's groundwater assets are high and, as described in **Chapter 6**, the creation of a Groundwater Sustainability Agency (GSA) and Groundwater Sustainability Plan (GSP) will have lasting implications to the City.

Regional Groundwater Use and Quality – The City should be constantly vigilant about groundwater use and quality in the North American Subbasin. Monitoring within the City is paramount but assessing plume migration, water rights issues, and associated uses within and without all of Placer County should also be closely monitored.

SWRCB Authority – The City should be addressing the expansion of SWRCB authority of surface water and groundwater. The demand reduction order in 2015 indicates that the SWRCB believes in top down management of water supplies and demands. And SWRCB's incursion into groundwater regulation should be carefully monitored. Moreover, the City should be particularly interested in the application of the public trust doctrine to the North Basin groundwater resources.

Water Conservation and Water Use Efficiency – The City should continue to implement its water conservation and water efficiency measures. Importantly, the City should document the water savings under Water Code sections 1010 and 1011 and assert control over the conserved water assets for City benefit.

8.5.2 Medium Priority Issues and City Actions

City Groundwater Banking – The City should continue to develop and refine its conjunctive use efforts. The City should work one-on-one with neighboring agencies to gather support for developing groundwater banking protocols and incorporating those protocols into any GSA or GSP affecting the North American Subbasin. The City should be working with RWA and SGA in the context of those entities current development of groundwater banking programs.

Water Forum – The City should work with PCWA to monitor implementation of the WFA and PCWA's PSA. The City's leadership position within RWA may provide political support to PCWA's efforts and provide for a more active role for the City in supporting the WFA. The LAR may be an important component to afford particular attention.

WaterFix and EcoRestore Programs – The City should continue to monitor the WaterFix and EcoRestore Programs and understand the implications of the construction of the tunnels on City's water assets. The City should work with RWA and encourage RWA staff to prepare regular reports on this effort. The City should consider joining regional litigation efforts through participating agencies in order to further support the City's interests in regional supply reliability.

Climate Change – The City should monitor scientific studies on climate change and the impacts of climate change to the American River and Yuba/Bear Rivers watersheds. The City may seek to work with RWA to commission an assessment of such impacts.

8.5.3 Low Priority Issues and City Actions

Delta Plan – The City should work with RWA staff to obtain regular updates on the Delta Stewardship Council and the implementation of the Delta Plan. The City should monitor legislative efforts aimed at expanding the authority of the DSC and the influence of the Delta Plan to upstream watersheds.

ACWA – The City should consider joining ACWA in order to better position itself as a leader in water asset management issues. The City's projected buildout population coupled with the development of the regional water treatment facility necessitate broader participation in statewide water management activities.