

# CHAPTER 3

## Water Demand Analysis

This chapter describes the City’s historical and current water use, as well as the City’s future water demands. The future water demands are based on water use factors and planned future development discussed with the City’s planning department. Future water demands will be used to evaluate the future water production required, the adequacy of the City’s available water supplies, and the capacity of the City’s water system to reliably deliver water to its customers.

The following sections of this chapter present the City’s historical and current water demands and future water demands:

- Historical Water Production and Use
- Historical Peak Water Use
- Existing and General Plan Land Use and Growth Projections
- Water Use Factors
- Future Water Demands and Required Water Production

### 3.1 HISTORICAL WATER PRODUCTION AND USE

The following sections summarize the historical water production for the City’s water service area.

#### 3.1.1 Historical Annual Water Production

As described in Chapter 2, the City’s water supplies come from a combination of surface water and groundwater sources consisting of water purchased from PCWA, water purchased from NID, and pumped groundwater from City-owned wells. Table 3-1 summarizes historical annual water production for the City between 2012 and 2023. The 10-year average surface water percentage of total production is 95 percent, and the 10-year average groundwater percentage of total production is 5 percent. These ratios align with the City’s existing conjunctive use goal of relying on groundwater for 10 percent of its water demands and surface water for the remaining 90 percent, as stated in Chapter 2.

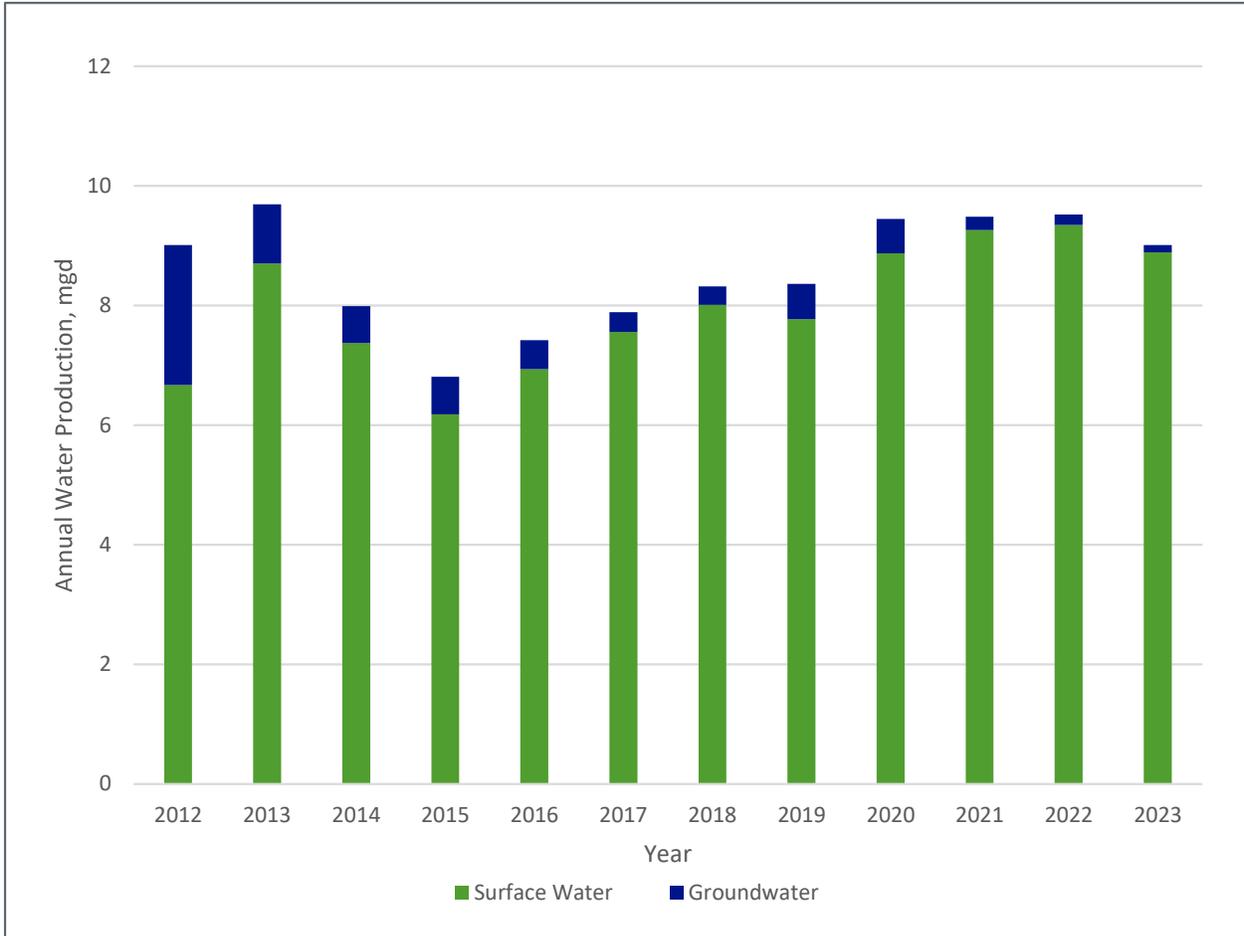
Figure 3-1 displays the annual water production, in mgd from 2012 to 2023. The highest annual water production occurred in 2022, with a total of approximately 9.5 mgd. The lowest annual water production occurred in 2015, with a total of approximately 6.8 mgd, which was during the height of a severe drought. Since 2015, production data shows a steady increase in production through 2020 which can be contributed to a post drought rebound in water use as well as new customers being added to the system. Figure 3-1 also shows that water production between 2020 and 2023 has remained fairly constant despite the City’s continued growth. The fairly steady water production could be contributed to the City’s continued emphasis on water conservation, expanded use of recycled water where possible, and improvements to infrastructure to reduce non-revenue water losses.

**Table 3-1. Historical Annual Water Production**

| Year                               | Surface Water, MG | Groundwater, MG | Total, MG    | Surface Water Percent of Total | Groundwater Percent of Total |
|------------------------------------|-------------------|-----------------|--------------|--------------------------------|------------------------------|
| 2012                               | 2,434             | 854             | 3,288        | 74                             | 26                           |
| 2013                               | 3,175             | 363             | 3,538        | 90                             | 10                           |
| 2014                               | 2,691             | 225             | 2,916        | 92                             | 8                            |
| 2015                               | 2,256             | 230             | 2,486        | 91                             | 9                            |
| 2016                               | 2,531             | 177             | 2,708        | 93                             | 7                            |
| 2017                               | 2,758             | 120             | 2,878        | 96                             | 4                            |
| 2018                               | 2,924             | 112             | 3,036        | 96                             | 4                            |
| 2019                               | 2,837             | 215             | 3,052        | 93                             | 7                            |
| 2020                               | 3,238             | 209             | 3,447        | 94                             | 6                            |
| 2021                               | 3,379             | 83              | 3,462        | 98                             | 2                            |
| 2022                               | 3,410             | 65              | 3,475        | 98                             | 2                            |
| 2023                               | 3,244             | 45              | 3,289        | 99                             | 1                            |
| <b>5-Year Average (2019-2023)</b>  | <b>3,222</b>      | <b>123</b>      | <b>3,345</b> | <b>96%</b>                     | <b>4%</b>                    |
| <b>10-Year Average (2014-2023)</b> | <b>2,927</b>      | <b>148</b>      | <b>3,075</b> | <b>95%</b>                     | <b>5%</b>                    |

*Source: Surface water and groundwater production spreadsheets provided by the City, April 2024.*

MG = Million Gallons per Year



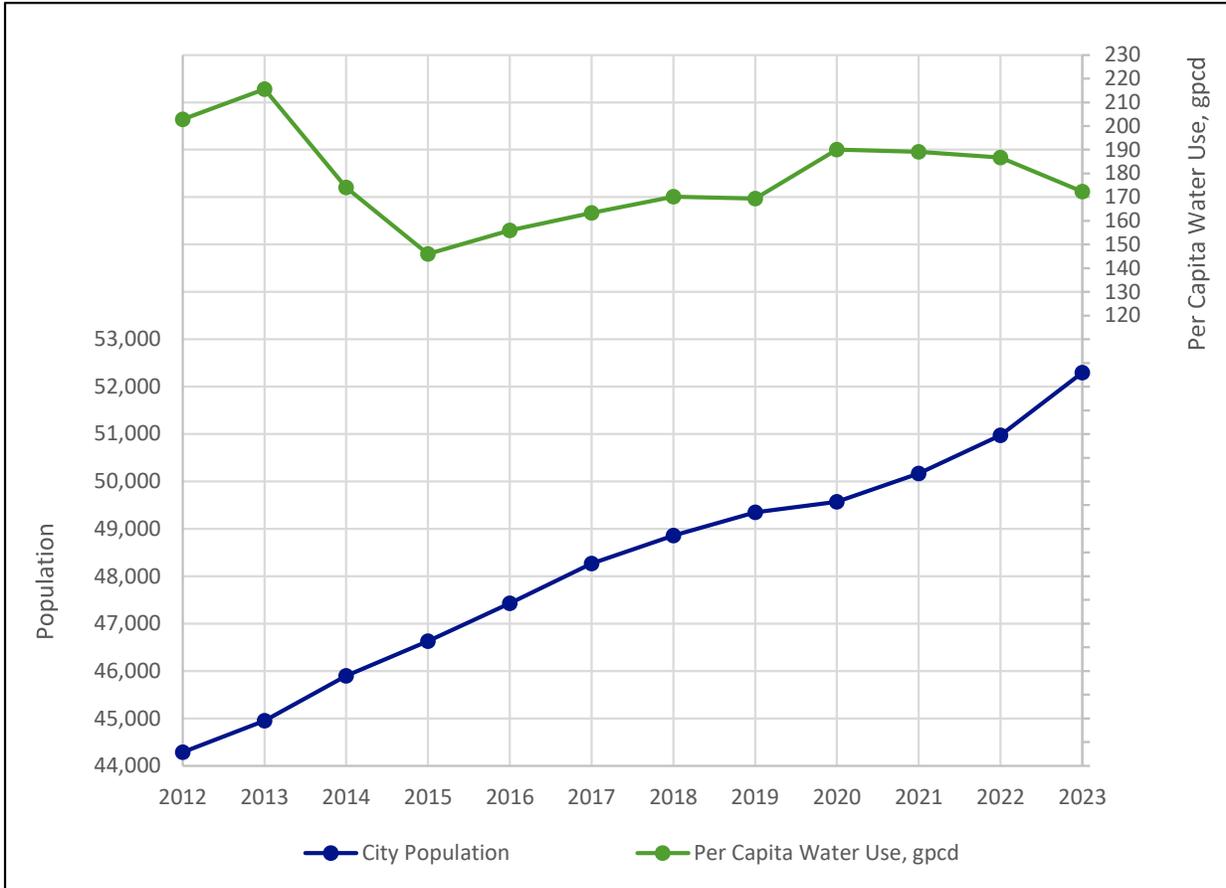
**Figure 3-1. Historical Annual Water Production**

### 3.1.2 Per Capita Water Use

Historical per capita water use for the City’s water service area from 2012 to 2023 is presented in Table 3-2 and on Figure 3-2. The per capita water use is based on total water production for the City’s water service area (representing all water uses including all residential and non-residential uses) divided by the City’s water service area population. Since 2020, the City’s per capita water use has continued to decrease as the population has increased.

| <b>Table 3-2. Historical Production, Population, and Per Capita Water Use</b> |                                                    |                                 |                             |
|-------------------------------------------------------------------------------|----------------------------------------------------|---------------------------------|-----------------------------|
| <b>Year</b>                                                                   | <b>Average Daily Production, mgd<sup>(a)</sup></b> | <b>Population<sup>(b)</sup></b> | <b>Per Capita Use, gpcd</b> |
| 2012                                                                          | 9.0                                                | 44,286                          | 203                         |
| 2013                                                                          | 9.7                                                | 44,954                          | 216                         |
| 2014                                                                          | 8.0                                                | 45,899                          | 174                         |
| 2015                                                                          | 6.8                                                | 46,627                          | 146                         |
| 2016                                                                          | 7.4                                                | 47,427                          | 156                         |
| 2017                                                                          | 7.9                                                | 48,268                          | 163                         |
| 2018                                                                          | 8.3                                                | 48,860                          | 170                         |
| 2019                                                                          | 8.4                                                | 49,348                          | 169                         |
| 2020                                                                          | 9.4                                                | 49,573                          | 190                         |
| 2021                                                                          | 9.5                                                | 50,165                          | 189                         |
| 2022                                                                          | 9.5                                                | 50,977                          | 187                         |
| 2023                                                                          | 9.0                                                | 52,296                          | 172                         |

(a) Production based on surface and groundwater spreadsheets provided by the City, April 2024.  
 (b) Source: Population estimates from State of California Department of Finance Tables E-4 Historical Population Estimates for Cities, Counties, and the State, September 2024.  
 mgd = million gallons per day; gpcd = gallons per capita per day



**Figure 3-2. Comparison of Historical Per Capita Demand and Population**

### 3.1.3 Historical Water Consumption

Water production is a measure of water produced at various supply facilities. Water consumption is a measure of water delivered to customers. The City tracks water consumption through customer meter records. As of 2023, the City had approximately 23,454 metered water use connections that serve various customer types. Table 3-3 summarizes the number of accounts by customer type. As shown in Table 3-3, the predominant customer type in the City’s water service area is residential, which accounts for approximately 97 percent of the total number of water meters.

| <b>Table 3-3. City Customer Types as of December 2023<sup>(a)</sup></b>                                                                                                                                                     |                           |                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------|
| <b>Customer Type</b>                                                                                                                                                                                                        | <b>Number of Accounts</b> | <b>Percent of Total Accounts</b> |
| <b>Residential</b>                                                                                                                                                                                                          |                           |                                  |
| Single Family                                                                                                                                                                                                               | 22,685                    | 96.7                             |
| Multi Family                                                                                                                                                                                                                | 94                        | 0.4                              |
| <b>Residential Subtotal</b>                                                                                                                                                                                                 | <b>22,779</b>             | <b>97.1%</b>                     |
| <b>Non-Residential</b>                                                                                                                                                                                                      |                           |                                  |
| Non-residential <sup>(b)</sup>                                                                                                                                                                                              | 415                       | 1.8                              |
| Industrial                                                                                                                                                                                                                  | 5                         | 0.02                             |
| Landscape/Irrigation                                                                                                                                                                                                        | 255                       | 1.0                              |
| <b>Non-Residential Subtotal</b>                                                                                                                                                                                             | <b>675</b>                | <b>2.9%</b>                      |
| <b>Total</b>                                                                                                                                                                                                                | <b>23,454</b>             | <b>100%</b>                      |
| (a) Source: Data are from <i>2023 Water Consumption by Class.xls</i> , provided by the City in May 2024.<br>(b) Non-residential accounts include commercial, office, institutional, and public/quasi-public land use types. |                           |                                  |

Table 3-4 summarizes the City’s water consumption by customer type in 2023. Although residential customers account for approximately 97 percent of the total accounts, they only account for 83 percent of the total consumption. Dedicated irrigation accounts (e.g., landscape median, parks, etc.) make up approximately 10 percent of the total consumption but only 3 percent of total accounts.

**Table 3-4. Consumption by Customer Types as of December 2023<sup>(a)</sup>**

| Customer Type                   | Total Annual Consumption, MG | Percent of Total Annual Consumption |
|---------------------------------|------------------------------|-------------------------------------|
| <b>Residential</b>              |                              |                                     |
| Single Family                   | 2,481                        | 80.7                                |
| Multi Family                    | 70                           | 2.3                                 |
| <b>Residential Subtotal</b>     | <b>2,551</b>                 | <b>82.9%</b>                        |
| <b>Non-Residential</b>          |                              |                                     |
| Non-residential <sup>(b)</sup>  | 198                          | 6.4                                 |
| Industrial                      | 22                           | 0.7                                 |
| Landscape/Irrigation            | 305                          | 9.9                                 |
| <b>Non-Residential Subtotal</b> | <b>578</b>                   | <b>17.1%</b>                        |
| <b>Total</b>                    | <b>3,076</b>                 | <b>100%</b>                         |

(a) Source: Data are from 2023 Water Consumption by Class.xls, provided by the City in May 2024.

(b) Non-residential accounts include commercial, office, institutional, and public/quasi-public land use type.

### 3.1.4 Non-Revenue Water

Non-revenue water (NRW) is the difference between the quantity of water produced and the quantity of water consumed and/or metered. Consumption (i.e., customer water use) typically does not equal the total production because of unmeasured system losses. Water utilities strive to minimize the amount of NRW; however, it is difficult to eliminate entirely. The most common reasons for NRW are due to system losses such as leakage, errors in measurement, unmetered usage, and errors in systematic data as discussed in detail below:

- **Leaks:** Leaks are frequently the largest component of NRW and includes losses from distribution and transmission mains and customer service laterals up to the meter. The amount of leakage varies from system to system, but there is a general correlation between the age of a system and the amount of NRW. Other factors affecting leaks include system pressure (i.e., the higher the pressure, the higher the leakage), frequency of main and service pipe breaks, and the extent of leak detection and control policies.
- **Errors in Measurement:** Flow measurements are not always exact, and thus metered customer usage may contain inaccuracies. For example, some flow meters under register actual usage at low flow rates, especially as they age.
- **Unmetered Usage:** The City may have unauthorized and unmetered connections or other types of unmetered water use. Not all unmetered usage is due to water theft; fire hydrants, blow-offs, and other maintenance appurtenances that are exercised are typically not metered.
- **Errors in Systematic Data:** Systematic data errors can contribute to NRW when inaccuracies occur in how water data is collected, recorded, or interpreted. These errors may include misread flow meter data, incorrect recording of meter readings, and/or incorrect meter locations.

An estimate of NRW is required for water system planning to project future water production needs, as a system will always have some amount of water loss. NRW ranging from 5 to 10 percent is typical for many water utilities.

California Water Code Section 10608.34 required the State Water Resources Control Board (SWRCB) to develop water loss performance standards for urban retail water suppliers. Executive Orders B-37-16 and B-40-17 directed the SWRCB and DWR to minimize water waste through system leaks. Water loss performance standards were developed through a rulemaking process that became effective in 2023.<sup>1</sup> The Water Loss Control regulation requires urban retail water suppliers, like the City, to complete questionnaires administered by the SWRCB and to meet water loss standards by 2028 (or by 2031 in some cases), using water audit data submitted for 2025, 2026, or 2027.

Table 3-5 summarizes the non-revenue water for the City’s system from 2019 through 2023 by comparing water production to water consumption. Based on the average water consumption versus water production, the average NRW is approximately 9.8 percent. The NRW has consistently decreased over the five-year period which reflects the City’s proactive approach to system rehabilitation of maintenance or replacement of aging infrastructure. As described in subsequent sections, NRW will be accounted for when projecting the future water production required for future conditions and will be assumed to be 10 percent.

| <b>Table 3-5. Non-Revenue Water</b>                                                                       |                                     |                                      |                              |                                       |
|-----------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------------|------------------------------|---------------------------------------|
| <b>Year</b>                                                                                               | <b>Production, MG<sup>(a)</sup></b> | <b>Consumption, MG<sup>(b)</sup></b> | <b>NRW, MG<sup>(c)</sup></b> | <b>NRW as a Percent of Production</b> |
| 2019                                                                                                      | 3,052                               | 2,679                                | 373                          | 12.2                                  |
| 2020                                                                                                      | 3,447                               | 3,049                                | 398                          | 11.5                                  |
| 2021                                                                                                      | 3,462                               | 3,107                                | 355                          | 10.3                                  |
| 2022                                                                                                      | 3,475                               | 3,176                                | 299                          | 8.6                                   |
| 2023                                                                                                      | 3,289                               | 3,076                                | 213                          | 6.5                                   |
| <b>5-Year Average Percent of Production that is Non-Revenue Water</b>                                     |                                     |                                      |                              | <b>9.8%</b>                           |
| (a) Production based on surface and groundwater production spreadsheets provided by the City, April 2024. |                                     |                                      |                              |                                       |
| (b) Consumption based on <i>Water ConsumedByClass.xls</i> spreadsheets provided by the City, May 2024.    |                                     |                                      |                              |                                       |
| (c) NRW is equal to production minus authorized consumption.                                              |                                     |                                      |                              |                                       |

### 3.2 HISTORICAL PEAK WATER USE

Water system facilities are generally sized to meet peak demand conditions. For facility sizing (e.g., supply, pumping and storage), the peaking conditions of most concern are typically maximum day plus fire flow demand or peak hour demand. This section reviews historical peak water use for the City’s water service area and includes discussion of the maximum day demand, peak hour demand, and hourly variations of demand during the maximum demand day.

<sup>1</sup> Source: [Water Loss Control | California State Water Resources Control Board](#)

### 3.2.1 Maximum Day and Peak Hour Demand

Table 3-6 summarizes the historical maximum day peaking factors for the City from 2014 through 2023, which are most representative of recent water use trends. As shown in Table 3-6, the maximum day demand has varied between 1.6 to 1.9 times the average day demand and the average historical maximum day peaking factor is 1.8 times average day demand.

| Year           | Average Day Demand (ADD), mgd | Maximum Day Demand (MDD), mgd | Maximum Day Peaking Factor (MDD/ADD) |
|----------------|-------------------------------|-------------------------------|--------------------------------------|
| 2014           | 8.0                           | 14.2                          | 1.8                                  |
| 2015           | 6.8                           | 11.2                          | 1.6                                  |
| 2016           | 7.4                           | 16.4                          | 2.2                                  |
| 2017           | 8.2                           | 14.0                          | 1.7                                  |
| 2018           | 8.4                           | 14.2                          | 1.7                                  |
| 2019           | 8.4                           | 15.3                          | 1.8                                  |
| 2020           | 9.4                           | 15.5                          | 1.7                                  |
| 2021           | 9.5                           | 15.3                          | 1.6                                  |
| 2022           | 9.5                           | 15.1                          | 1.6                                  |
| 2023           | 9.0                           | 16.9                          | 1.9                                  |
| <b>Average</b> | <b>8.5</b>                    | <b>14.8</b>                   | <b>1.8</b>                           |

To develop a peak hour peaking factor, West Yost reviewed peak days of City provided SCADA data from 2023 to identify historical peak hour demands. This data was provided to West Yost as part of the hydraulic model calibration, the peak hour peaking factor was calculated based on the diurnal development for the City’s pressure zone groups. While each of the pressure zone groups have a specific peak hour peaking factor, it was determined that a single peaking factor for the maximum day would be used for facilities sizing. The recommended peaking factors are summarized in the following section.

### 3.2.2 Recommended Demand Peaking Factors

Table 3-7 summarizes the recommended peaking factors for this WMPU. These peaking factors will be subsequently used to evaluate and size storage and pumping facilities, as well as define water supply needs and capacity requirements. For planning purposes, the maximum day peaking factor for the City is recommended to be 1.9 which is slightly higher than the 10-year average to be conservative. The factor also represents a decrease from the average day to maximum day factor developed in the City’s 2017 WMP of 2.0. The reduction in the maximum day peaking factor reflects recent trends in water use, with increased water conservation and reductions in NRW loss.

The peak hour factor developed in the City’s 2017 WMP was 2.0 times MDD (4.0 times ADD) for the City’s entire system. Although the peak hour factor varies across each of the City’s pressure zone groups, a single peak hour factor is recommended for the City’s entire system. The recommended peak hour factor developed for this WMPU is 2.2 times MDD (3.8 times ADD), as shown in Table 3-7.

**Table 3-7. Summary of Recommended Main Zone Maximum Day and Peak Hour Peaking Factors**

| Maximum Day Demand Peaking Factor (MDD/ADD)                                 | Peak Hour Demand Peaking Factor (PHD/MDD) |
|-----------------------------------------------------------------------------|-------------------------------------------|
| 1.9                                                                         | 2.2                                       |
| MDD = maximum day demand; ADD = average day demand; PHD = peak hour demand. |                                           |

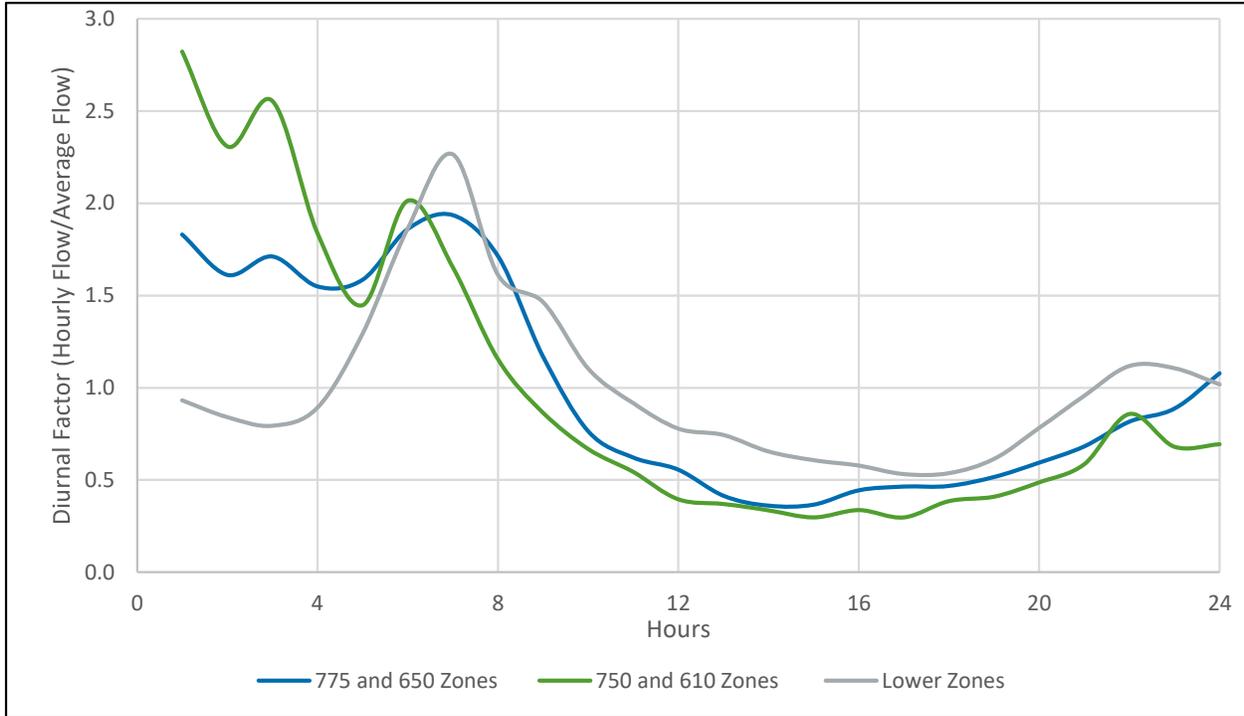
### 3.2.3 Diurnal Curve Development

The MDD (including the peak hour) and minimum day demand diurnal curves were developed by reviewing SCADA data for summer and winter 2023 conditions. The minimum day demand diurnal curves represent seasonal winter demands (typically December through February), and MDD diurnal curves represent seasonal summer demands (typically June through August).

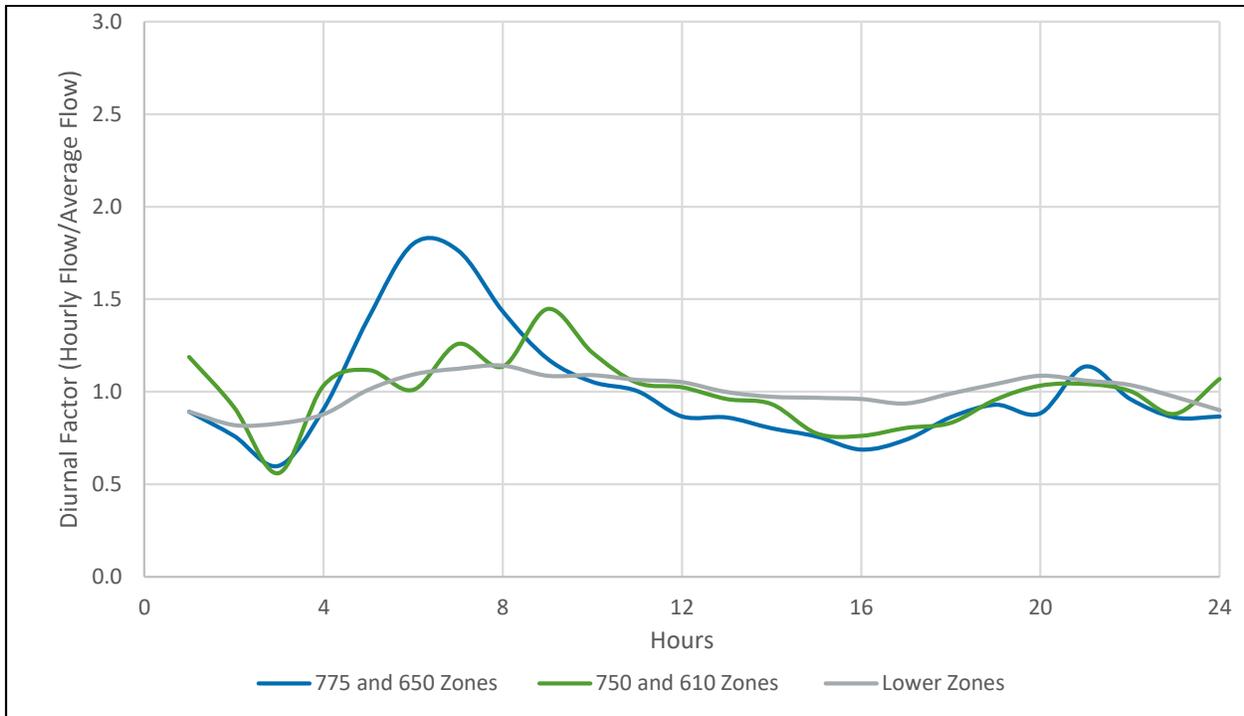
The City has SCADA coverage in the system that allows the development of multiple diurnal curves that group connected zones. Hourly patterns were developed for three zone groups for both winter and summer demands. The results of the 2023 diurnal curves were compared to the curves developed using 2021 data and found to be very similar in patterns.

Figure 3-3 shows the diurnal patterns developed for summer demand conditions. These diurnal patterns differ from the diurnal patterns developed for the model calibration (see Chapter 6), as patterns used for that effort are specific to the day the model was calibrated to. Diurnal patterns shown on Figure 3-3 are based on the hourly averages during the peak week of 2023 which occurred during the week of July 16 to 22. Diurnal patterns shown on Figure 3-3 were used for the existing and future distribution system evaluations, described in Chapters 7 and 8.

Figure 3-4 shows the diurnal patterns developed for winter demand conditions. Diurnal patterns shown on Figure 3-4 are based on the hourly averages during the minimum week of 2023 which occurred during the week of February 22 to 28. As expected, the minimum day demand diurnals have a flatter curve than the MDD diurnals as outdoor water irrigation use is typically minimal in the winter months.



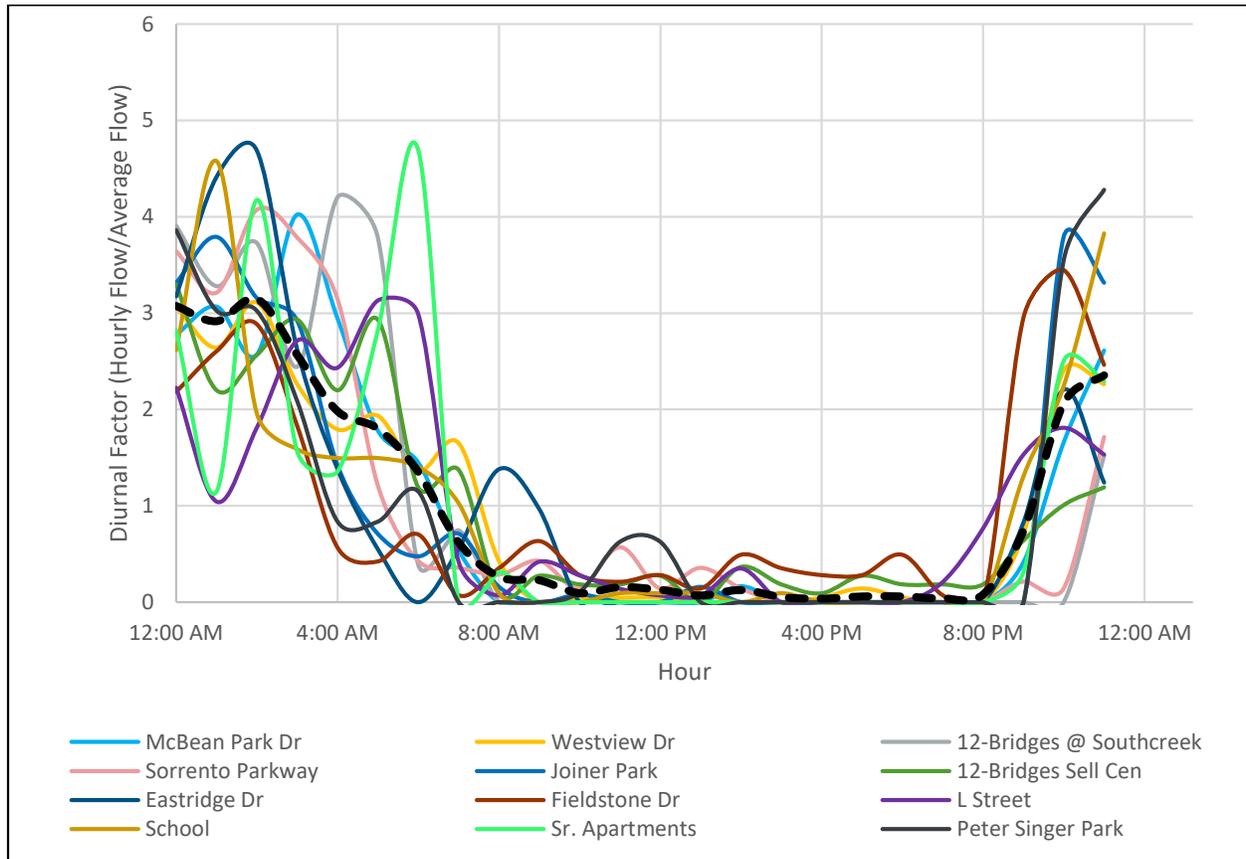
**Figure 3-3. Grouped Zones Maximum Day Demand Diurnal Curves**



**Figure 3-4. Grouped Zones Minimum Day Demand Diurnal Curves**

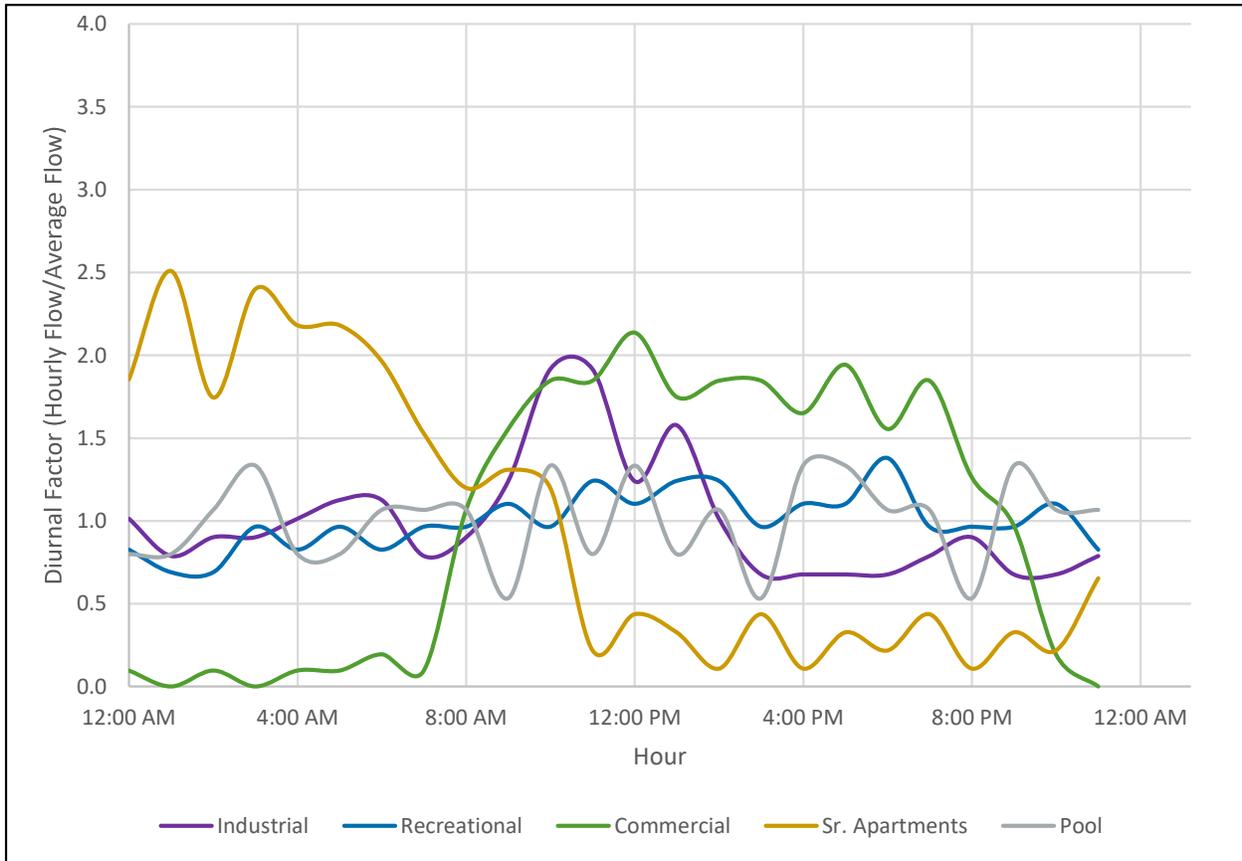
The City provided hourly consumption data for its 17 largest water users collected through Advanced Metering Infrastructure (AMI) which allowed diurnals to be created for these accounts. The diurnals developed for these large water users show very different patterns from the diurnals developed for the zone groups discussed above.

Of the data provided, 12 of the 17 meters represent irrigation meters. The diurnal curves developed for each of these meters are shown on Figure 3-5 for a maximum summertime demand period during 2023. As expected, most of the consumption occurs overnight between the hours of 9 PM to 7 AM, which is consistent with when irrigation often occurs. An average of the irrigation diurnals was developed to provide a general irrigation diurnal to use for the future system evaluations.



**Figure 3-5. Irrigation Meters Maximum Day Demand Diurnal Curves**

The five other large consumption meter data provided represents a mix of uses: industrial, recreational, commercial car wash, senior apartments, and a public pool. As shown on Figure 3-6, the industrial, recreational, and pool all show fairly constant demands occurring throughout the day with a morning peak for the industrial account. The senior apartment account shows high demands prior to about 10 AM which may be in part due to irrigation occurring during the evening hours. The commercial car wash account shows consumption occurs during business hours as expected. Due to the variety of how water is consumed by these individual large water users, the developed diurnals are only applied to these specific users.



**Figure 3-6. Large Users Maximum Day Demand Diurnal Curves**

### 3.3 EXISTING AND FUTURE LAND USE AND GROWTH PROJECTIONS

The following sections discuss the existing and projected future land use for the City’s water service area.

#### 3.3.1 Existing Land Use

The City’s existing land use consists mostly of low density single family residential developments in addition to commercial, office, industrial, parks, and schools as shown on Figure 3-7. Residential uses are located throughout the City’s service area. Generally, the eastern portion of the existing city has several traditional single family residential communities along Twelve Bridges Drive and Del Webb Boulevard. Along the most eastern edge of City Limits, the developments are low density/country estates which tend to include large multi-story homes on large lots with extensive landscaping.

The City’s commercial and mixed uses are found throughout the City with a concentrated commercial corridor along Lincoln Boulevard which includes the historic downtown part of the City. The City also includes a significant industrial land use in the northern and northwestern part of the City. The industrial users include Sierra Pacific Industries, Gladding McBean Manufacturer, and the Lincoln Regional Airport.

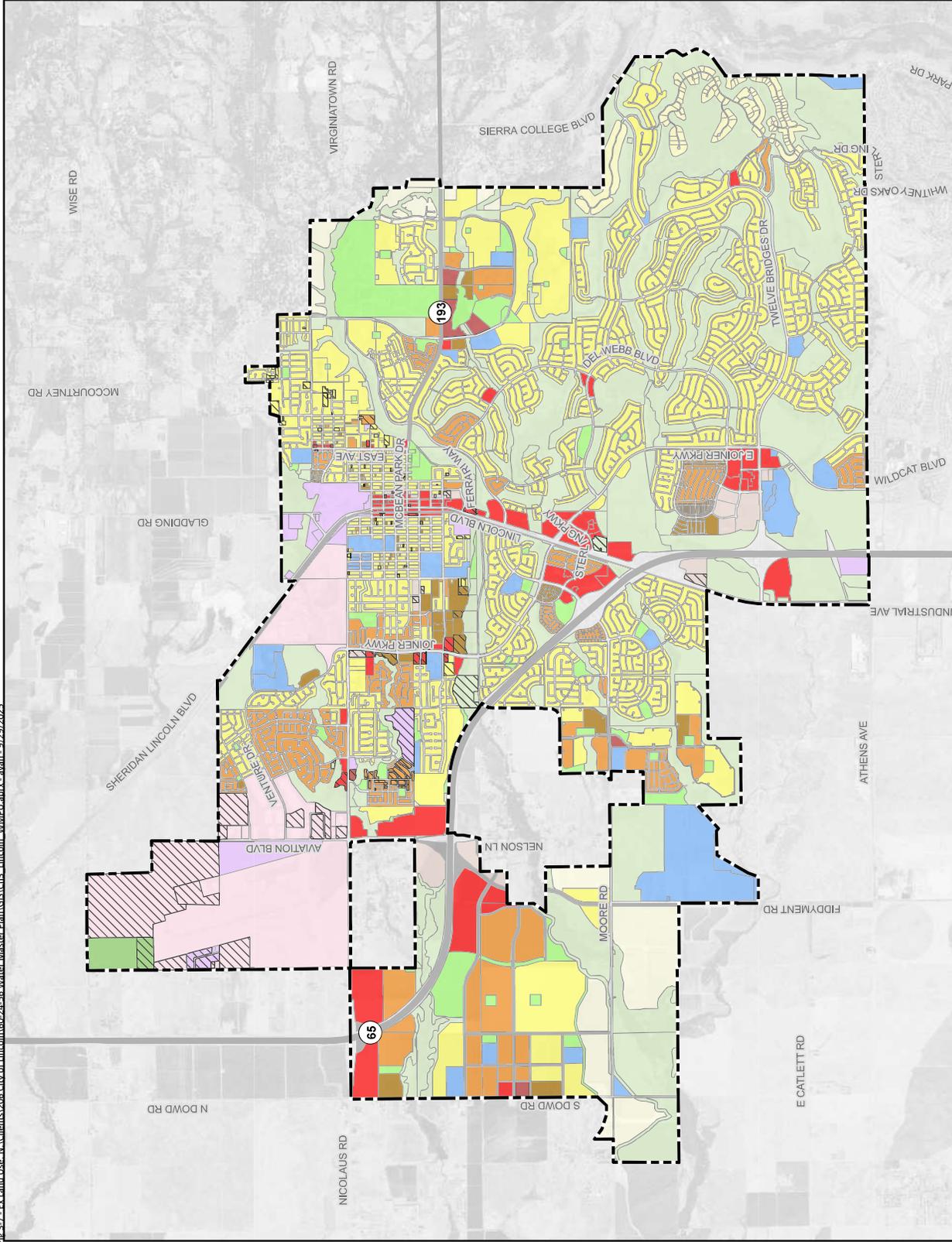
City Limit

Zoning

-  Country Estates
-  Low Density Estates
-  Low Density Residential
-  Medium Density Residential
-  High Density Residential
-  Mixed Use
-  Commercial
-  Business and Professional
-  Industrial
-  Industrial Planned Development
-  Public Facilities
-  Parks and Recreation
-  Open Space
-  Agricultural
-  Right-of-Way
-  Vacant Activity

Notes:

1. GIS zoning and land use shapefiles provided by the City of Lincoln in 2025.
2. Parcels with land use activity of Vacant are shown for locations within the City Limits which are not part of a Specific Plan.
3. Future land uses within Villages and Special Use Districts are planned and not shown as Vacant.

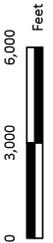
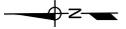


Prepared by:



Prepared for:

City of Lincoln  
Water Master Plan Update



Existing and  
Planned Land Use  
Figure 3-7

### **3.3.2 Projected Future Land Use**

This section includes a discussion of the City’s future land use and the estimated timing on when development will occur. The General Plan 2050 (GP) serves as a long-term policy guide for the City’s growth and is the basis for the future growth projections used for facility planning along with input from the City’s Community Development Department. The development of the future growth areas were classified in 5-year increments through a 20-year period with any remaining area assumed to be developed at buildout.

#### **3.3.2.1 Overview of the City’s General Plan 2050**

Future growth and land uses are defined in the City’s GP, which summarizes anticipated development within the City’s SOI. The SOI encompasses both incorporated and unincorporated areas and were defined in the GP as the probable ultimate boundary and service area of the City. Infill is expected to occur on vacant parcels within the City’s existing City Limit boundary. Additionally, the GP categorized larger undeveloped areas into two designations: Village or Special Use District (SUD) which are described below and shown on Figure 3-8.

##### **3.3.2.1.1 Infill**

The GP identified the need to develop the vacant infill parcels within the existing City Limits. Implementation measures to encourage the development of vacant and underutilized parcels, including parcels in the downtown area of the City, were included as part of the GP. One measure to help achieve the infill development was the addition of a mixed use category to encourage combining a residential use with a business or commercial use (either horizontally or vertically). In 2024, the City has started a Downtown Master Plan (DMP) + Objective Design and Development Standards (ODDS) project to improve the downtown area of the City, which will include facilitating mixed use and housing options in the downtown area.

##### **3.3.2.1.2 Villages**

The GP designated seven areas as a Village (identified as V-1 through V-7). The village concept encompasses major new development areas which include a mix of housing types and a village center. In addition, each village will be characterized by extensive bicycle and pedestrian trails and open space to interconnect the village areas along with the developed portions of the City.

Village 1 is located in the eastern part of the City and is actively being developed. The City anticipates substantial completion of Village 1 within a 10-year timeframe.

Village 5 and Village 7 are located in the western part of the City Limits and SOI. Both villages have active development plans being processed with the City for portions that have recently been annexed within the City Limit boundary. Construction for both villages are anticipated to begin within a 5-year timeframe. Village 7 covers a smaller area and is expected to be substantially complete within a 15-year timeframe while Village 5 is anticipated to be completed within a 20-year timeframe.

Villages 2, 3, and 4 are located in the northern part of the SOI outside of the existing City Limits and Village 6 is located in the southwest part of the SOI. These areas are anticipated to start development beyond the 20-year timeframe and are therefore included as part of buildout.

#### 3.3.2.1.3 Special Use Districts

The GP designated three areas as SUDs (identified as SUD-A, SUD-B, and SUD-C). Land uses within the SUDs are limited by restrictions established by the County of Placer’s Airport Land Use Compatibility Plan and the proximity of the State Route 65 Bypass. At this time, only SUD-B is actively proceeding with development plans and is anticipated to begin construction within a 5-year timeframe and be completed within a 15-year timeframe. Both SUD-A and SUD-C are within the SOI but outside the existing City Limits and are not anticipated to have development occur over the next 20 years and are considered part of the buildout.

#### 3.3.2.2 Projected Future Land Use

The exact amount of development that will occur through GP buildout is based on many factors, including changes in the regional real estate and labor markets, and individual property owners’ decisions. For the purposes of this WMPU, the future land use projections defined are assumed based on the City’s current pace of development.

The future growth was classified in 5-year increments for a 20-year period based on input from the City’s Community Development Department. All remaining areas in the GP SOI are assumed to occur at buildout. It is not expected that all areas in the SOI will be fully developed within the 20-year period based on the current pace of development.

Based on discussions with City staff, additional assumptions used to estimate development in this WMPU include:

- Infill is assumed to be parcels within the existing City Limits with a land use activity code of “Vacant” in the City’s GIS land use file, but do not include parcels in a Specific Plan or General Development Plan.
- Infill is assumed to be completed at a constant rate through buildout.
- Village 1 has active construction occurring and is anticipated to be substantially completed within 10 years.
- SUD-B is anticipated to begin development in the next 5 years and be substantially completed within 15 years.
- Villages 5 and 7 are anticipated to begin development in the next 5 to 10 years and be substantially completed within 15 to 20 years.
- Villages 2, 3, 4, and 6 and SUD-A and -C are assumed to develop in buildout (beyond 20 years).
- Available Specific Plans and/or General Development Plans were referenced to capture the most recent land use assumptions.
- Residential dwelling unit densities (i.e., dwelling units per acre) are assumed to be the average of the dwelling unit density ranges provided in the GP<sup>2</sup> unless other specific densities were provided.
- No development occurs outside of the SOI.

---

<sup>2</sup> Mintier & Associates. March 2008. City of Lincoln General Plan, Table 4-1

**Table 3-8. Future Incremental Land Use Projections By Development Areas**

| Development/ Land Use          | 5-Year       |              | 10-Year      |              | 15-Year      |            | 20-Year      |            | Buildout       |              | Total          |              |
|--------------------------------|--------------|--------------|--------------|--------------|--------------|------------|--------------|------------|----------------|--------------|----------------|--------------|
|                                | Acres        | DU           | Acres        | DU           | Acres        | DU         | Acres        | DU         | Acres          | DU           | Acres          | DU           |
| <b>Vacant Infill Parcels</b>   |              |              |              |              |              |            |              |            |                |              |                |              |
| Low Density Residential        | 6.3          | 28           | 6.3          | 28           | 6.3          | 28         | 6.3          | 28         | 6.3            | 28           | 31.3           | 139          |
| Medium Density Residential     | 5.0          | 48           | 5.0          | 48           | 5.0          | 48         | 5.0          | 48         | 5.0            | 48           | 25.2           | 238          |
| High Density Residential       | 4.0          | 66           | 4.0          | 66           | 4.0          | 66         | 4.0          | 66         | 4.0            | 66           | 19.9           | 328          |
| Mixed Use                      | 0.5          | -            | 0.5          | -            | 0.5          | -          | 0.5          | -          | 0.5            | -            | 2.7            | -            |
| Commercial                     | 6.5          | -            | 6.5          | -            | 6.5          | -          | 6.5          | -          | 6.5            | -            | 32.5           | -            |
| Business Professional          | 3.2          | -            | 3.2          | -            | 3.2          | -          | 3.2          | -          | 3.2            | -            | 16.0           | -            |
| Industrial                     | 99.6         | -            | 99.6         | -            | 99.6         | -          | 99.6         | -          | 99.6           | -            | 498.2          | -            |
| Open Space                     | 9.6          | -            | 9.6          | -            | 9.6          | -          | 9.6          | -          | 9.6            | -            | 47.9           | -            |
| <b>Subtotal</b>                | <b>134.7</b> | <b>141</b>   | <b>134.7</b> | <b>141</b>   | <b>134.7</b> | <b>141</b> | <b>134.7</b> | <b>141</b> | <b>134.7</b>   | <b>141</b>   | <b>673.7</b>   | <b>705</b>   |
| <b>Deer Crossing</b>           |              |              |              |              |              |            |              |            |                |              |                |              |
| Commercial                     | 3.6          | -            | -            | -            | -            | -          | -            | -          | -              | -            | 3.6            | -            |
| <b>Ferrari Pavillion</b>       |              |              |              |              |              |            |              |            |                |              |                |              |
| Commercial                     | 12.0         | -            | -            | -            | -            | -          | -            | -          | -              | -            | 12.0           | -            |
| <b>Joiner Ranch East</b>       |              |              |              |              |              |            |              |            |                |              |                |              |
| Medium Density Residential     | 25.5         | 198          | -            | -            | -            | -          | -            | -          | -              | -            | 25.5           | 198          |
| <b>Bella Breeze</b>            |              |              |              |              |              |            |              |            |                |              |                |              |
| Commercial                     | -            | -            | 13.4         | -            | -            | -          | 13.4         | -          | -              | -            | 26.7           | -            |
| <b>Lincoln 270</b>             |              |              |              |              |              |            |              |            |                |              |                |              |
| Business Professional          | -            | -            | 79.9         | -            | -            | -          | -            | -          | -              | -            | 79.9           | -            |
| Commercial                     | -            | -            | 58.1         | -            | -            | -          | -            | -          | -              | -            | 58.1           | -            |
| Industrial                     | -            | -            | 37.8         | -            | -            | -          | -            | -          | -              | -            | 37.8           | -            |
| Open Space                     | -            | -            | 102.1        | -            | -            | -          | -            | -          | -              | -            | 102.1          | -            |
| ROW                            | -            | -            | 1.4          | -            | -            | -          | -            | -          | -              | -            | 1.4            | -            |
| <b>Subtotal</b>                | <b>-</b>     | <b>-</b>     | <b>279.3</b> | <b>-</b>     | <b>-</b>     | <b>-</b>   | <b>-</b>     | <b>-</b>   | <b>-</b>       | <b>-</b>     | <b>279.3</b>   | <b>-</b>     |
| <b>Lincoln Place</b>           |              |              |              |              |              |            |              |            |                |              |                |              |
| Low Density Residential        | 5.3          | 21           | -            | -            | -            | -          | -            | -          | -              | -            | 5.3            | 21           |
| Medium Density Residential     | 7.6          | 80           | -            | -            | -            | -          | -            | -          | -              | -            | 7.6            | 80           |
| Open Space                     | 3.7          | -            | -            | -            | -            | -          | -            | -          | -              | -            | 3.7            | -            |
| <b>Subtotal</b>                | <b>16.6</b>  | <b>101</b>   | <b>-</b>     | <b>-</b>     | <b>-</b>     | <b>-</b>   | <b>-</b>     | <b>-</b>   | <b>-</b>       | <b>-</b>     | <b>16.6</b>    | <b>101</b>   |
| <b>Village 1<sup>(a)</sup></b> |              |              |              |              |              |            |              |            |                |              |                |              |
| Country Estates                | 72.2         | 154          | 51.9         | 119          | 58.0         | 129        | 10.2         | 23         | -              | -            | 192.3          | 425          |
| Low Density Residential        | 354.4        | 1,542        | 239.8        | 1,184        | -            | -          | -            | -          | -              | -            | 594.2          | 2,726        |
| Medium Density Residential     | 28.0         | 179          | 72.1         | 682          | -            | -          | -            | -          | -              | -            | 100.1          | 861          |
| High Density Residential       | -            | -            | 17.9         | 421          | -            | -          | -            | -          | -              | -            | 17.9           | 421          |
| Mixed Use                      | -            | -            | 39.0         | -            | -            | -          | -            | -          | -              | -            | 39.0           | -            |
| Parks                          | 22.1         | -            | 75.6         | -            | 1.0          | -          | -            | -          | -              | -            | 98.7           | -            |
| Open Space                     | 210.1        | -            | 138.9        | -            | 61.3         | -          | 9.3          | -          | -              | -            | 419.7          | -            |
| ROW                            | 15.1         | -            | 15.1         | -            | 15.1         | -          | 15.1         | -          | -              | -            | 60.4           | -            |
| <b>Subtotal</b>                | <b>701.9</b> | <b>1,875</b> | <b>650.3</b> | <b>2,407</b> | <b>135.4</b> | <b>129</b> | <b>34.6</b>  | <b>23</b>  | <b>-</b>       | <b>-</b>     | <b>1,522.3</b> | <b>4,434</b> |
| <b>Village 2</b>               |              |              |              |              |              |            |              |            |                |              |                |              |
| Country Estates                | -            | -            | -            | -            | -            | -          | -            | -          | 164.4          | 321          | 164.4          | 321          |
| Low Density Residential        | -            | -            | -            | -            | -            | -          | -            | -          | 575.5          | 2,561        | 575.5          | 2,561        |
| Medium Density Residential     | -            | -            | -            | -            | -            | -          | -            | -          | 57.5           | 544          | 57.5           | 544          |
| High Density Residential       | -            | -            | -            | -            | -            | -          | -            | -          | 24.7           | 469          | 24.7           | 469          |
| Mixed Use                      | -            | -            | -            | -            | -            | -          | -            | -          | 80.6           | -            | 80.6           | -            |
| Parks                          | -            | -            | -            | -            | -            | -          | -            | -          | 80.6           | -            | 80.6           | -            |
| Open Space                     | -            | -            | -            | -            | -            | -          | -            | -          | 564.2          | -            | 564.2          | -            |
| ROW                            | -            | -            | -            | -            | -            | -          | -            | -          | 64.5           | -            | 64.5           | -            |
| <b>Subtotal</b>                | <b>-</b>     | <b>-</b>     | <b>-</b>     | <b>-</b>     | <b>-</b>     | <b>-</b>   | <b>-</b>     | <b>-</b>   | <b>1,612.0</b> | <b>3,895</b> | <b>1,612.0</b> | <b>3,895</b> |
| <b>Village 3</b>               |              |              |              |              |              |            |              |            |                |              |                |              |
| Country Estates                | -            | -            | -            | -            | -            | -          | -            | -          | 263.2          | 513          | 263.2          | 513          |
| Low Density Residential        | -            | -            | -            | -            | -            | -          | -            | -          | 579.0          | 2,576        | 579.0          | 2,576        |
| Medium Density Residential     | -            | -            | -            | -            | -            | -          | -            | -          | 157.9          | 1,492        | 157.9          | 1,492        |
| High Density Residential       | -            | -            | -            | -            | -            | -          | -            | -          | 52.6           | 1,000        | 52.6           | 1,000        |
| Mixed Use                      | -            | -            | -            | -            | -            | -          | -            | -          | 103.2          | -            | 103.2          | -            |
| Parks                          | -            | -            | -            | -            | -            | -          | -            | -          | 103.2          | -            | 103.2          | -            |
| Open Space                     | -            | -            | -            | -            | -            | -          | -            | -          | 722.4          | -            | 722.4          | -            |
| ROW                            | -            | -            | -            | -            | -            | -          | -            | -          | 82.6           | -            | 82.6           | -            |
| <b>Subtotal</b>                | <b>-</b>     | <b>-</b>     | <b>-</b>     | <b>-</b>     | <b>-</b>     | <b>-</b>   | <b>-</b>     | <b>-</b>   | <b>2,064.0</b> | <b>5,581</b> | <b>2,064.0</b> | <b>5,581</b> |
| <b>Village 4</b>               |              |              |              |              |              |            |              |            |                |              |                |              |
| Country Estates                | -            | -            | -            | -            | -            | -          | -            | -          | 330.1          | 644          | 330.1          | 644          |
| Low Density Residential        | -            | -            | -            | -            | -            | -          | -            | -          | 660.2          | 2,938        | 660.2          | 2,938        |
| Medium Density Residential     | -            | -            | -            | -            | -            | -          | -            | -          | 264.1          | 2,496        | 264.1          | 2,496        |
| High Density Residential       | -            | -            | -            | -            | -            | -          | -            | -          | 66.0           | 1,254        | 66.0           | 1,254        |
| Mixed Use                      | -            | -            | -            | -            | -            | -          | -            | -          | 129.5          | -            | 129.5          | -            |
| Parks                          | -            | -            | -            | -            | -            | -          | -            | -          | 129.5          | -            | 129.5          | -            |
| Open Space                     | -            | -            | -            | -            | -            | -          | -            | -          | 906.2          | -            | 906.2          | -            |
| ROW                            | -            | -            | -            | -            | -            | -          | -            | -          | 103.6          | -            | 103.6          | -            |
| <b>Subtotal</b>                | <b>-</b>     | <b>-</b>     | <b>-</b>     | <b>-</b>     | <b>-</b>     | <b>-</b>   | <b>-</b>     | <b>-</b>   | <b>2,589.0</b> | <b>7,332</b> | <b>2,589.0</b> | <b>7,332</b> |

**Table 3-8. Future Incremental Land Use Projections By Development Areas**

| Development/ Land Use      | 5-Year         |              | 10-Year        |              | 15-Year        |              | 20-Year        |              | Buildout        |               | Total           |               |
|----------------------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|-----------------|---------------|-----------------|---------------|
|                            | Acres          | DU           | Acres          | DU           | Acres          | DU           | Acres          | DU           | Acres           | DU            | Acres           | DU            |
| <b>Village 5</b>           |                |              |                |              |                |              |                |              |                 |               |                 |               |
| Country Estates            | -              | -            | 149.2          | 184          | 298.4          | 368          | 261.6          | 674.3        | -               | -             | 709.2           | 1,227         |
| Low Density Residential    | -              | 153.0        | 113.1          | 380          | 226.3          | 1,065        | 230.7          | 1,091.9      | -               | -             | 570.1           | 2,690         |
| Medium Density Residential | -              | 269.0        | 141.8          | 669          | 283.5          | 1,875        | 16.3           | 16.8         | -               | -             | 441.6           | 2,830         |
| High Density Residential   | -              | 78.0         | 13.0           | 195          | 26.0           | 547          | 29.7           | 621.1        | -               | -             | 68.7            | 1,441         |
| Mixed Use                  | -              | -            | 12.3           | -            | 24.7           | -            | 4.4            | -            | -               | -             | 41.4            | -             |
| Commercial                 | -              | -            | 65.1           | -            | 130.3          | -            | 0.9            | -            | -               | -             | 196.3           | -             |
| Business Professional      | -              | -            | 21.7           | -            | 43.3           | -            | 94.9           | -            | -               | -             | 159.9           | -             |
| Parks                      | -              | -            | 45.7           | -            | 91.4           | -            | 31.6           | -            | -               | -             | 168.7           | -             |
| Open Space                 | -              | -            | 231.0          | -            | 462.0          | -            | 697.2          | -            | -               | -             | 1,390.2         | -             |
| Public                     | -              | -            | 17.4           | -            | 34.8           | -            | 66.0           | -            | -               | -             | 118.2           | -             |
| ROW                        | -              | -            | 50.1           | -            | 100.2          | -            | 214.3          | -            | -               | -             | 364.6           | -             |
| <b>Subtotal</b>            | -              | <b>500</b>   | <b>860.4</b>   | <b>1,428</b> | <b>1,720.9</b> | <b>3,856</b> | <b>1,647.6</b> | <b>2,404</b> | -               | -             | <b>4,228.9</b>  | <b>8,188</b>  |
| <b>Village 6</b>           |                |              |                |              |                |              |                |              |                 |               |                 |               |
| Country Estates            | -              | -            | -              | -            | -              | -            | -              | -            | 129.7           | 253           | 129.7           | 253           |
| Low Density Residential    | -              | -            | -              | -            | -              | -            | -              | -            | 700.6           | 3,118         | 700.6           | 3,118         |
| Medium Density Residential | -              | -            | -              | -            | -              | -            | -              | -            | 363.3           | 3,433         | 363.3           | 3,433         |
| High Density Residential   | -              | -            | -              | -            | -              | -            | -              | -            | 103.8           | 1,972         | 103.8           | 1,972         |
| Mixed Use                  | -              | -            | -              | -            | -              | -            | -              | -            | 127.2           | -             | 127.2           | -             |
| Parks                      | -              | -            | -              | -            | -              | -            | -              | -            | 127.2           | -             | 127.2           | -             |
| Open Space                 | -              | -            | -              | -            | -              | -            | -              | -            | 890.4           | -             | 890.4           | -             |
| ROW                        | -              | -            | -              | -            | -              | -            | -              | -            | 101.8           | -             | 101.8           | -             |
| <b>Subtotal</b>            | -              | -            | -              | -            | -              | -            | -              | -            | <b>2,544.0</b>  | <b>8,776</b>  | <b>2,544.0</b>  | <b>8,776</b>  |
| <b>Village 7</b>           |                |              |                |              |                |              |                |              |                 |               |                 |               |
| Low Density Residential    | 25.1           | 147          | 84.0           | 470          | 68.1           | 399          | -              | -            | 19.9            | 164           | 197.1           | 1,181         |
| Medium Density Residential | 57.6           | 539          | 60.9           | 595          | 33.6           | 314          | -              | -            | 6.3             | 81            | 158.4           | 1,529         |
| High Density Residential   | -              | -            | 17.2           | 334          | 12.4           | 241          | -              | -            | -               | -             | 29.6            | 575           |
| Mixed Use                  | 4.9            | -            | -              | -            | -              | -            | -              | -            | -               | -             | 4.9             | -             |
| Parks                      | 34.1           | -            | 27.3           | -            | 15.8           | -            | -              | -            | 12.5            | -             | 89.7            | -             |
| Public                     | 11.6           | -            | -              | -            | -              | -            | -              | -            | -               | -             | 11.6            | -             |
| Open Space                 | 120.2          | -            | 64.8           | -            | -              | -            | -              | -            | -               | -             | 185.0           | -             |
| ROW                        | 7.1            | -            | 11.9           | -            | 7.1            | -            | -              | -            | 1.1             | -             | 27.1            | -             |
| <b>Subtotal</b>            | <b>260.6</b>   | <b>686</b>   | <b>266.1</b>   | <b>1,399</b> | <b>137.0</b>   | <b>955</b>   | -              | -            | <b>39.8</b>     | <b>245</b>    | <b>703.4</b>    | <b>3,285</b>  |
| <b>SUD-A</b>               |                |              |                |              |                |              |                |              |                 |               |                 |               |
| Commercial                 | -              | -            | -              | -            | -              | -            | -              | -            | 1,814.4         | -             | 1,814.4         | -             |
| ROW                        | -              | -            | -              | -            | -              | -            | -              | -            | 201.6           | -             | 201.6           | -             |
| <b>Subtotal</b>            | -              | -            | -              | -            | -              | -            | -              | -            | <b>2,016.0</b>  | -             | <b>2,016.0</b>  | -             |
| <b>SUD-B</b>               |                |              |                |              |                |              |                |              |                 |               |                 |               |
| Commercial                 | -              | -            | 35.1           | -            | 34.7           | -            | -              | -            | -               | -             | 69.8            | -             |
| Low Density Residential    | 64.2           | 336          | 20.1           | 85           | -              | -            | -              | -            | -               | -             | 84.3            | 421           |
| Parks                      | 4.0            | -            | 0.6            | -            | -              | -            | -              | -            | -               | -             | 4.6             | -             |
| Open Space                 | 6.7            | -            | 16.1           | -            | -              | -            | -              | -            | -               | -             | 22.8            | -             |
| ROW                        | -              | -            | 16.9           | -            | -              | -            | -              | -            | -               | -             | 16.9            | -             |
| <b>Subtotal</b>            | <b>74.9</b>    | <b>336</b>   | <b>88.8</b>    | <b>85</b>    | <b>34.7</b>    | -            | -              | -            | -               | -             | <b>198.4</b>    | <b>421</b>    |
| <b>SUD-C</b>               |                |              |                |              |                |              |                |              |                 |               |                 |               |
| Commercial                 | -              | -            | -              | -            | -              | -            | -              | -            | 926.1           | -             | 926.1           | -             |
| ROW                        | -              | -            | -              | -            | -              | -            | -              | -            | 102.9           | -             | 102.9           | -             |
| <b>Subtotal</b>            | -              | -            | -              | -            | -              | -            | -              | -            | <b>1,029.0</b>  | -             | <b>1,029.0</b>  | -             |
| <b>Total</b>               | <b>1,229.8</b> | <b>3,838</b> | <b>2,293.1</b> | <b>5,460</b> | <b>2,162.7</b> | <b>5,081</b> | <b>1,830.3</b> | <b>2,568</b> | <b>12,028.5</b> | <b>25,970</b> | <b>19,544.4</b> | <b>42,916</b> |

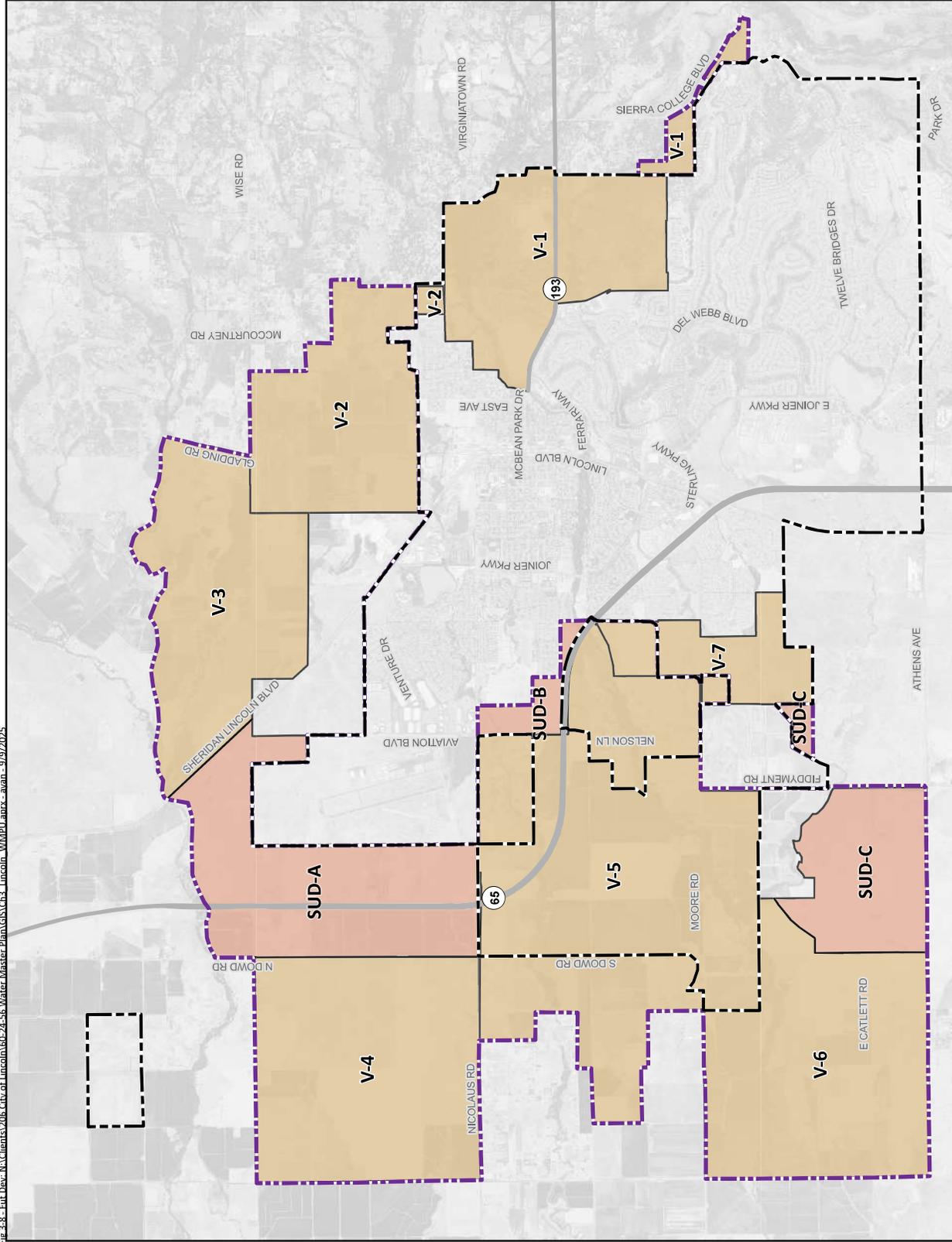
(a) Buildout includes planned development within City Limits and SOI identified in General Plan 2050.  
 (b) Projected timing of development based on discussions with the City's Community Development Department.  
 DU = Dwelling Units

Table 3-8 summarizes the future incremental land use by planned development and infill based on the timing provided by the City. The table identifies the land use type, projected dwelling units and/or acreage, and development timing (i.e., 5-year, 10-year, 15-year, 20-year, or buildout). It should be noted that the Village 1 area is actively under construction for the Esplanade at Turkey Creek and Turkey Creek Estates Developments. Approximately 40 percent of Esplanade and 15 percent of the Turkey Creek Estates residential homes have been constructed. The dwelling units for Village 1 shown in Table 3-8 have been reduced to reflect the remaining units for Esplanade and Turkey Creek Estates.

Table 3-9 summarizes the future cumulative planned development by land use designation. It is projected that approximately 16,947 new residential dwelling units will be added in the next 20 years and 42,916 new dwelling units will be added by buildout of the SOI. It is also projected that approximately 4,280 acres of non-residential land uses will be added in the next 20 years and 11,774 acres will be added by buildout of the SOI. Approximately 54 percent of the buildout non-residential area is composed of open space and right-of-way land use which is not planned to be irrigated.

| <b>Table 3-9. Summary of Future Cumulative Land Use Projections</b>                                                 |               |                |                |                |                               |
|---------------------------------------------------------------------------------------------------------------------|---------------|----------------|----------------|----------------|-------------------------------|
| <b>Future Land Use Designation</b>                                                                                  | <b>5-Year</b> | <b>10-Year</b> | <b>15-Year</b> | <b>20-Year</b> | <b>Buildout<sup>(a)</sup></b> |
| <b>Residential, DU</b>                                                                                              |               |                |                |                |                               |
| Country / Low Density Estates <sup>(b)</sup>                                                                        | 154           | 457            | 955            | 1,652          | 3,383                         |
| Low Density Residential                                                                                             | 2,074         | 4,374          | 5,867          | 6,987          | 18,372                        |
| Medium Density Residential                                                                                          | 1,044         | 3,306          | 5,543          | 5,608          | 13,701                        |
| High Density Residential                                                                                            | 66            | 1,160          | 2,013          | 2,700          | 7,460                         |
| <b>Total Residential</b>                                                                                            | <b>3,338</b>  | <b>9,297</b>   | <b>14,378</b>  | <b>16,947</b>  | <b>42,916</b>                 |
| <b>Non-Residential, Acres</b>                                                                                       |               |                |                |                |                               |
| Mixed Use                                                                                                           | 5             | 57             | 83             | 87             | 528                           |
| Commercial                                                                                                          | 22            | 200            | 372            | 393            | 3,140                         |
| Business Professional                                                                                               | 3             | 108            | 154            | 253            | 256                           |
| Industrial                                                                                                          | 100           | 237            | 337            | 436            | 536                           |
| Public                                                                                                              | 12            | 29             | 64             | 130            | 130                           |
| Parks                                                                                                               | 60            | 209            | 318            | 349            | 802                           |
| Open Space                                                                                                          | 350           | 913            | 1,446          | 2,162          | 5,255                         |
| ROW                                                                                                                 | 22            | 118            | 240            | 470            | 1,127                         |
| <b>Total Non-Residential</b>                                                                                        | <b>574</b>    | <b>1,871</b>   | <b>3,014</b>   | <b>4,280</b>   | <b>11,774</b>                 |
| (a) Buildout includes planned developments within City Limits and SOI identified in General Plan 2050 (March 2008). |               |                |                |                |                               |
| (b) Projected timing of developments based on discussions with the City's Community Development Department.         |               |                |                |                |                               |
| DU = Dwelling Units                                                                                                 |               |                |                |                |                               |

-  City Limit
-  Sphere Of Influence
-  Village Boundary
-  Special Use District



Notes:  
 1. GIS zoning and land use shapefiles provided by the City of Lincoln in 2025.

Prepared by:

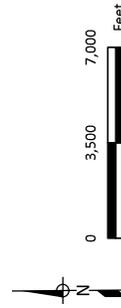


Prepared for:



City of Lincoln  
 Water Master Plan Update

Future Development Areas  
 Figure 3-8



## **3.4 WATER USE FACTORS**

Since 2019, the COVID pandemic occurred which altered how people work, with many continuing to work remotely from home at least part of the time. In addition, customers have continued to conserve water. These changes have had an impact on water consumption trends within the City’s service area.

The City’s meter consumption data from 2023 was used to develop the updated water use factors which are documented in a technical memorandum included as Appendix B.

### **3.4.1 Water Use Factor Development Methodology**

Unit water demand factors were developed using 2023 meter data and existing land use information in GIS format. The meter information was filtered to exclude meters which did not represent potable water consumption (i.e., reclaim water, hydrant water, and null). In addition, accounts without a full year’s worth of meter reads were excluded from the analysis. The City’s meter consumption data was spatially joined to the GIS parcels and land use. Some records were manually linked if the meter was located outside of its respective parcel. The unit water demand factor for each land use designation was calculated by dividing the total metered water consumption by the associated dwelling units or the parcel area per land use for residential and non-residential land uses respectively.

The parcel area calculation did not include streets, and therefore, resulted in “net” unit water use factors. The “net” unit water use factors were adjusted to account for streets so they could be applied to the gross acreage information provided by City staff for future development.<sup>3</sup> The following sections describe the updated unit water use factors by land use designation.

### **3.4.2 Residential Land Uses**

Unit water use factor categories were determined by comparing the existing land use to the General Plan land use designations. Land use with similar usage characteristics were grouped into a single water use factor category (i.e., low density estates and country estates). Residential water use factors were developed in units of acre-feet per dwelling unit per year (af/du/yr).

### **3.4.3 Non-Residential Land Uses**

Non-residential land uses were grouped together based on the similarity of their characteristics (i.e., neighborhood commercial and community commercial). The non-residential water use factors are in units of acre-feet per acre per year (af/ac/yr).

During the development of the non-residential water use factors, existing large industrial users, such as Sierra Pacific Industries, were excluded from the industrial water use factor since they are not representative of future industrial developments planned in the City’s General Plan.

---

<sup>3</sup> The gross acreage within the existing City limits is 15,425 acres, and the net acreage within the City limits assigned to an existing or planned land use is 13,798 acres. Therefore, a factor of 1.12 was used to convert from net acreage to gross acreage.

### 3.4.4 Recommended Water Use Factors

Table 3-10 summarizes the recommended unit water use factors for the City to use for future water system planning.

| <b>Table 3-10. Recommended Unit Water Demand Factors</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                      |                       |          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------------|----------|
| Water Use Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | General Plan Land Use Designation(s) | Unit Water Use Factor |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                      | af/du/yr              | af/ac/yr |
| <b>Residential</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                      |                       |          |
| Low Density Estates                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Low Density Estates                  | 1.46                  | --       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Country Estates                      |                       |          |
| Low Density Residential                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Low Density Residential              | 0.39                  | --       |
| Medium Density Residential                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Medium Density Residential           | 0.30                  | --       |
| High Density Residential                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | High Density Residential             | 0.18                  | --       |
| <b>Non-Residential</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                      |                       |          |
| Commercial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Neighborhood Commercial              | --                    | 1.45     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Community Commercial                 | --                    |          |
| Business and Professional                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Business and Professional            | --                    | 1.15     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Employment Center                    | --                    |          |
| Mixed Use <sup>(a)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Mixed Use                            | --                    | 2.00     |
| Industrial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Industrial                           | --                    | 0.47     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Light Industrial                     | --                    |          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Industrial Planned Development       | --                    |          |
| Public Facilities <sup>(b)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Public Facilities                    | --                    | 1.80     |
| Parks and Recreation <sup>(b)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Parks and Recreation                 | --                    | 3.55     |
| <p>(a) The City did not have any Mixed Use consumption during the 2023 year, therefore, it is recommended for the City to continue using the Mixed Use unit water use factor of 2.00 af/ac/yr developed in 2021 as provided in Table 3-10.</p> <p>(b) The calculated Public Facilities and Parks and Recreation water use factors were significantly lower than the 2021 unit water use factors of 1.80 af/ac/yr and 3.55 af/ac/yr, respectively. To be conservative, it is recommended for the City to continue using the Public Facilities and Parks and Recreation unit use factors developed in 2021 as provided in Table 3-10.</p> |                                      |                       |          |

## 3.5 FUTURE WATER DEMANDS AND REQUIRED WATER PRODUCTION

Water demands were projected for the GP SOI using the recommended water use factors applied to the future proposed developments. Future water production requirements were then estimated by adding the future water demand projections, which include NRW of 10 percent, to the existing baseline production.

### 3.5.1 Existing Baseline Demand

The average annual water production for the City’s water service area in 2023 was used to establish the existing baseline production. The average annual water production in 2023 was 9.0 mgd.

### 3.5.2 Projected Future Water Demands

Water demands in 5-year increments over the next 20-years and the buildout water system were developed by applying the water use factors to the proposed land uses shown in Table 3-8. Table 3-11 summarizes the projected incremental average daily water demand for each development that represent new demands in the system.

| Development Name             | 5-Year     | 10-Year    | 15-Year    | 20-Year    | Buildout    |
|------------------------------|------------|------------|------------|------------|-------------|
| Vacant – Infill              | 0.1        | 0.1        | 0.1        | 0.1        | 0.1         |
| Deer Crossing                | 0.01       | -          | -          | -          | -           |
| Ferrari Pavilion             | 0.02       | -          | -          | -          | -           |
| Joiner Ranch East            | 0.1        | -          | -          | -          | -           |
| Bella Breeze (Commercial)    | -          | 0.1        | -          | 0.1        | -           |
| Lincoln Place and Lincoln 14 | 0.03       | -          | -          | -          | -           |
| Lincoln 270                  | -          | 0.2        | -          | -          | -           |
| Village 1                    | 0.9        | 1.2        | 0.2        | 0.03       | -           |
| Village 2                    | -          | -          | -          | -          | 2.0         |
| Village 3                    | -          | -          | -          | -          | 2.9         |
| Village 4                    | -          | -          | -          | -          | 3.7         |
| Village 5                    | 0.2        | 1.0        | 2.2        | 1.8        | -           |
| Village 6                    | -          | -          | -          | -          | 3.6         |
| Village 7                    | 0.4        | 0.5        | 0.3        | -          | 0.1         |
| SUD-A                        | -          | -          | -          | -          | 2.6         |
| SUD-B                        | 0.1        | 0.1        | 0.05       | -          | -           |
| SUD-C                        | -          | -          | -          | -          | 1.3         |
| <b>Total</b>                 | <b>1.9</b> | <b>3.1</b> | <b>2.9</b> | <b>2.0</b> | <b>16.4</b> |

(a) Village 1, Village 5, Village 7, Lincoln 270, and SUD-B have active specific plans. The remaining villages do not have active specific plans but are anticipated to include a mix of land uses described in the General Plan 2050 (March 2008).

(b) SUD-A and SUD-C do not have active specific plans but are anticipated to be Commercial land use described in the General Plan 2050 (March 2008).

(c) Projected ADD includes non-revenue water of 10 percent.

mgd = million gallons per day

### 3.5.3 Projected Water Production Requirements

Table 3-12 summarizes the total projected water production requirements by the 5-year increments used to develop demands. Based on the projected land use development timing, the ADD will approximately be 18.9 mgd and a total MDD of 35.7 mgd by the 20-year timeframe. The buildout water system will have a total ADD of 35.3 mgd and a total MDD of 66.9 mgd.

**Table 3-12. Projected Water Production Requirements<sup>(a)</sup>**

| Phase                   | ADD, mgd | MDD, mgd <sup>(b)</sup> |
|-------------------------|----------|-------------------------|
| Existing <sup>(c)</sup> | 9.0      | 16.9                    |
| 5-Year                  | 10.9     | 20.5                    |
| 10-Year                 | 14.0     | 26.4                    |
| 15-Year                 | 16.9     | 31.9                    |
| 20-Year                 | 18.9     | 35.7                    |
| Buildout                | 35.3     | 66.9                    |

(a) Projected demands include non-revenue water of 10 percent.  
(b) Average day to MDD factor equals 1.9.  
(c) Existing demands based on 2023 demands in Table 3-2.  
mgd = million gallons per day

# CHAPTER 4

## Water Supply Analysis

This chapter provides an overview of the City's water supplies which include both surface water supplies and groundwater supplies. The availability and reliability of the City's water supplies are evaluated in the City's 2020 UWMP, which was incorporated into this WMPU. In addition, this chapter includes an integrated supply plan, which is intended to provide recommendations on how to meet the projected future demands (refer to Chapter 3) through a combination of groundwater and surface water supplies.

Key sections of this chapter include:

- Water Supply Overview
- Surface Water Supply
- Groundwater Supply
- Water Supply Plan

### 4.1 WATER SUPPLY OVERVIEW

The City's existing water supply portfolio consists of the following sources:

- **Surface water purchased from PCWA.** Surface water is diverted from the American, Yuba, and Bear Rivers, and various tributaries and creeks in West Placer County, and is treated by PCWA at the Foothill Water Treatment Plant before delivery to the City via one PCWA transmission pipeline at two metering stations.
- **Surface water purchased from NID.** Surface water is diverted from the Yuba, Bear, and Deer Creek watershed and is conveyed through PCWA's facilities where it is treated by PCWA at the Foothill Water Treatment Plant before delivery to the City via one PCWA transmission pipeline at two metering stations.
- **Groundwater.** Groundwater is pumped from City owned and operated wells from the underlying NASb.

In future years, the City will continue to rely on these sources to meet the projected demands. Additional production capacity from all sources will be required and is discussed in more detail in the subsequent sections.

### 4.2 SURFACE WATER SUPPLY

The City does not use any self-supplied surface water. All surface water used by the City is purchased from PCWA and NID as described in this section. The surface water supply is conveyed through PCWA facilities. The PCWA conveyance infrastructure includes the 42-inch diameter Penryn-Lincoln-Sunset pipeline which conveys supply to the points of delivery for the City. The surface water supply enters the City's system at two metering stations. Each metering station has one regulated and one unregulated connection. The regulated connections provide metered flow into the City's distribution system via the City's two 5 MG tanks (the Conspiracy Point Tank No. 1 and the Verdera Tank No. 3). The regulated connections control the rate of flow into the City's main service area to limit flow fluctuations. The unregulated connections provide metered flow into the City's higher elevation pressure zones. Since there are no storage tanks located in the higher elevation pressure zones, the flow is unregulated and based on customer demand patterns.

It is important to note PCWA and NID deliver untreated surface water directly to several customers within the City’s service area. This water is delivered under contracts between the supplier (PCWA or NID) and the end user. This water does not enter the City’s distribution system and the City does not bill these customers for untreated surface water use. Therefore, raw PCWA or NID water use is not included in this WMPU.

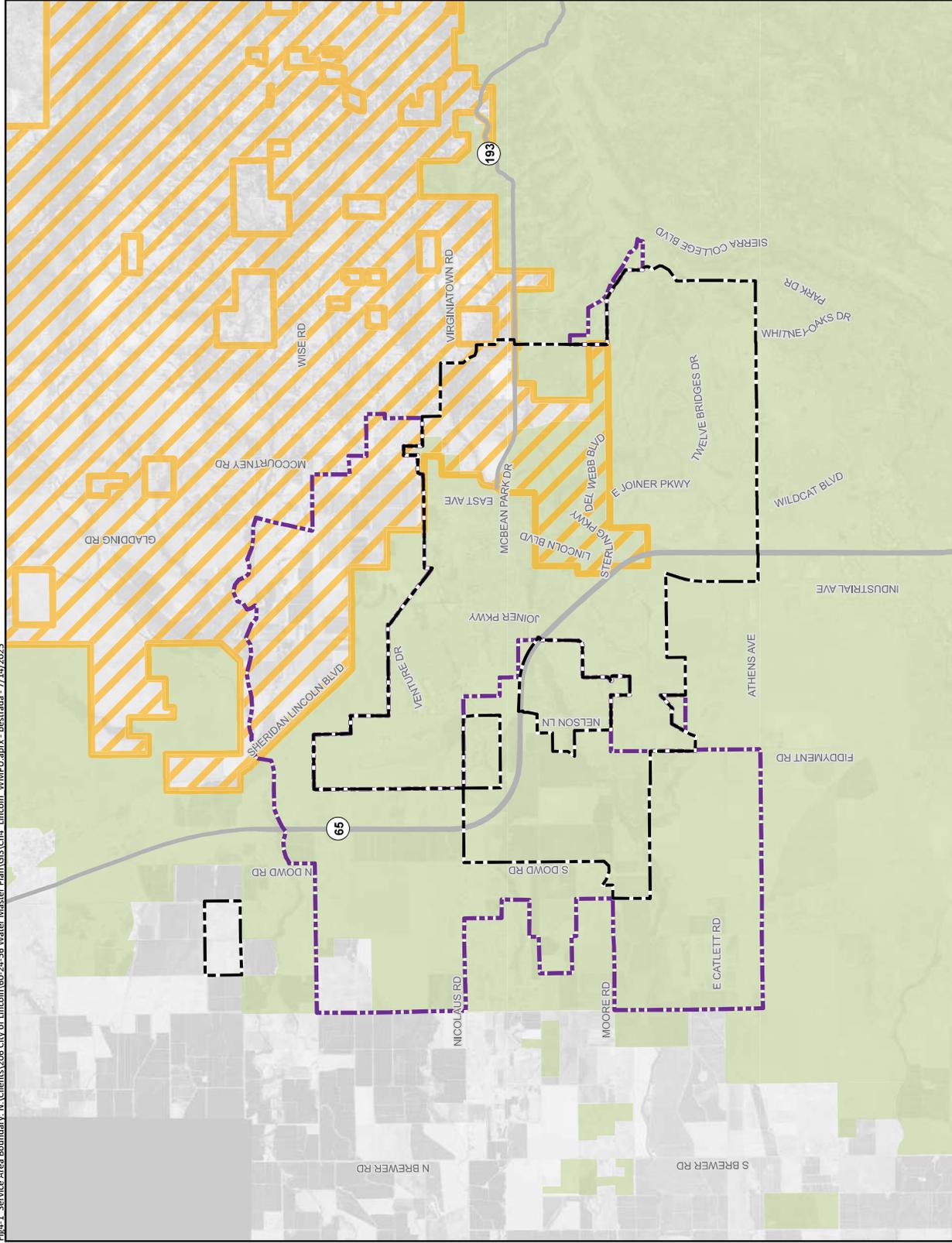
### **4.2.1 Placer County Water Agency**

PCWA was created in 1957 by a special act of the California Legislature and is the primary water resource agency for Placer County. The boundaries of PCWA are coterminous with the boundaries of Placer County. PCWA serves more than 41,000 retail treated water connections, provides wholesale water (treated and/or untreated) to California American Water, the Cities of Lincoln and Roseville, San Juan Water District, and several smaller historical community systems. It also provides raw water supply to private customers for irrigation and other non-potable uses. PCWA’s water supplies are primarily delivered to customers within its Western Water System.

The areas served by PCWA’s Western Water System extend from the community of Alta in the east, westward down the Interstate 80 corridor to the Sutter, Sacramento, and Nevada county lines in the west, south and north; respectively. The Western Water System is comprised of four distinct administrative zones, named Zones 1, 2, 3 and 5. Each of these zones was formed as PCWA’s service area grew at distinct times. However, a new Zone 6 was formed in 2017 to include these other zones and to consolidate administrative rules across all pre-existing zones in the Western Water System. PCWA’s Zone 6 covers its entire Western Water System service area and includes the majority of the City’s existing limits and SOI (see Figure 4-1).

As discussed in Chapter 2, the City entered a water supply contract with PCWA for delivery of treated surface water in 2012 with a maximum delivery entitlement of 18.5 mgd. In 2021, the City’s PCWA maximum delivery entitlement was increased to 18.9 mgd per Facilities Agreement No. 2521. In 2023, the City adopted Resolution 2023-109 which approves a funding agreement between the City and PCWA for the construction of Ophir Water Treatment Plant and additional treated water capacity. PCWA has been planning construction of Ophir Water Treatment Plant for more than a decade to meet the growing needs of treated water in the western side of Placer County. To serve the needs of PCWA and the City, PCWA must construct the first phase of Ophir Water Treatment creating an additional capacity of 10 mgd. The additional treated water capacity is expected to be available to the City starting in Quarter 3 2030. Per the agreement, the City’s Partner Capacity cannot exceed 5 mgd and was planned to initiate in 2030 with 0.46 mgd and increase at an estimated 0.46 mgd each year, reaching full capacity in approximately 10 years. Any additional capacity would be made available upon the completion of Phase 2 of the Ophir Water Treatment Plant which is estimated for another 10 mgd. Water supply agreements with PCWA are included in Appendix A.

Fig4-1. Service Area Boundary. N:\Clients\206 City of Lincoln\60-24-56 Water Master Plan\GIS\Ch4. Lincoln\_WMPU.aprx - bestrada - 7/14/2025



Notes:  
 1. City boundaries shown based on GIS data provided by the City in 2025.

Prepared by:



Prepared for:

City of Lincoln  
 Water Master Plan Update



Service Area Boundary  
 Figure 4-1



The reliability of the water supply delivery to the City is grounded in the underlying water rights and contracts held by PCWA. These water rights and contracts for PCWA’s surface water supplies include the following:

- Middle Fork Project (MFP) Water – Water stored in the Middle Fork Project along the North Fork American River under water rights permits 13856 and 13858;
- Central Valley Project (CVP) Water – CVP water supply from the American River under CVP Contract 14-060200-5082A with the United States Bureau of Reclamation;
- Pacific Gas & Electric (PG&E) Water – Water purchased from PG&E from the Yuba River and Bear River under the 1982 Zone 3 Contract Purchase Agreement and the Water Supply Agreement, signed in February 2015; and
- Pre-1914 Appropriations Water – Water diverted from various small creeks and their tributaries in western Placer County, for the purpose of irrigation, under appropriate water rights S000959, S000967, S010397, and S010398. Terms associated with water supply permits and contracts dictate the volume of supplies and applicable place of use.

Table 4-1 outlines the allotted maximum supply from each surface water source. These supplies are more fully described in PCWA’s 2020 UWMP.

| Supply                        | Source                                               | Water Right or Contracted Volume                                                                                              |
|-------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Middle Fork Project           | American River                                       | 120,000 AFY                                                                                                                   |
| CVP Contract                  | American River                                       | 35,000 AFY                                                                                                                    |
| PG&E Agreements               | Yuba and Bear Rivers                                 | 125,400 AFY                                                                                                                   |
| Pre-1914 Appropriative Rights | Various tributaries and creeks in West Placer County | S000959 – 40 cubic feet per second<br>All other pre-1914 rights not currently exercised<br>Total estimated yield of 3,400 AFY |

*Source: Table 6-2 from City’s 2020 Urban Water Management Plan.*

AFY = Acre Feet Per Year

It should be noted that during the preparation of PCWA’s 2020 UWMP, PCWA coordinated with the City for the City’s water demand projections. As discussed in Chapter 4 of the PCWA 2020 UWMP, the City provided a 20-year demand forecast but did not provide a buildout forecast; therefore, PCWA used the City’s 2017 WMP, which anticipates the City’s total potential buildout water use to be around 35,986 AFY (32 mgd).<sup>1</sup> The PCWA 2020 UWMP further states that “while some of this demand may be met with other Lincoln water assets under some circumstances, Lincoln primarily plans for this demand to be served by PCWA supplies” (PCWA 2020 UWMP).

However, at the time of this WMPU, no agreements are in place between the City and PCWA to increase the City’s maximum delivery entitlement to the approximate 32 mgd identified in the PCWA 2020 UWMP.

<sup>1</sup> Water Systems Consulting, Inc. June 2021. *Placer County Water Agency 2020 Urban Water Management Plan*. Section 4.2.1.3 Western Area Treated Wholesale Water Use.

Additional agreements between the City and PCWA, as well as potential modifications and/or expansions to PCWA metering stations, would be required to provide this additional supply capacity. Therefore, for planning purposes of this WMPU, future PCWA supply assumptions are based on the existing agreements in effect at the time of preparation, as described above in this section.

As demonstrated in Chapter 4 of the PCWA 2020 UWMP, the City and PCWA will continue to coordinate as the City develops, ensuring that surface water supply infrastructure is funded, planned, and constructed to promote regional water supply affordability, sustainability, resilience, and reliability.

### **4.2.2 Nevada Irrigation District**

NID is a California special district providing treated water and raw/irrigation water to its nearly 25,000 customers within portions of Nevada, Placer and Yuba counties. NID was created in 1921 by authorization of the Nevada County Board of Supervisors under the California Irrigation District Act of 1897, covering a 202,000 acre area within the county. In 1926, a select group of residents in Placer County chose to join NID, adding another 66,500 acres to the district service area (see Figure 4-1).

NID treated water service areas are located in and around Grass Valley, Nevada City, Banner Mountain, Glenbrook Basin, Loma Rica, Alta Sierra, Lake of the Pines, Penn Valley, Lake Wildwood, Smartsville and North Auburn. Additionally, per NID's 2015 Agricultural Water Management Plan (AWMP), NID currently serves approximately 5,200 agricultural customers (raw water customers) representing a reported area of 32,323 acres located primarily at the lower end (lower elevation) of the NID system. Agricultural water use accounts for more than 90 percent of the total demand on NID's water supply.

NID surface water is also supplied to some Placer County residential customers; primarily delivered indirectly through PCWA's treatment and distribution system. The City entered the Temporary Agreement between the City, PCWA, and NID in 2004. The Temporary Agreement entitles the City to receive NID raw water supply to serve City customers within NID's service area in 2004, but it does not specify an amount of water to be supplied by NID to the City. The water supply agreement with NID is included in Appendix A.

NID water supplies are primarily surface water supplies derived from watershed run-off from the Yuba, Bear, and Deer Creek watershed and consists of two primary supply sources as follows:

- Pre-1914 Appropriations – NID holds 25 pre-1914 water rights for direct diversion and storage of water, including three riparian rights
- Post-1914 Appropriations – NID holds 28 post-1914 appropriative water rights for direct diversion and storage of water

Terms contained within NID water right permits and contracts dictate the volume of supplies and applicable place of use. In addition to annual watershed runoff, NID's surface water supplies also may include water purchased from PG&E and carryover storage left within its reservoirs from year to year. Table 4-2 provides a summary of NID surface water supplies as documented in NID's 2020 UWMP.

**Table 4-2. NID Surface Water Supply Summary**

| Supply            | Source                               | Average Year Volume |
|-------------------|--------------------------------------|---------------------|
| Watershed Runoff  | Yuba, Bear and Deer Creek Watersheds | 233,000 AFY         |
| PG&E Agreement    | Yuba, Bear and Deer Creek Watersheds | 7,500 AFY           |
| Carryover Storage | NID Reservoirs                       | 144,000 AFY         |
| <b>Total</b>      |                                      | <b>384,500 AFY</b>  |

*Source: Table 6-3 from City's 2020 Urban Water Management Plan.*

Per the Temporary Agreement, NID agreed to sell PCWA raw water that would be delivered to PCWA’s treatment plants. PCWA would treat and deliver equivalent quantities of water to the City, less losses, for distribution for the City’s customers that are within the boundaries of NID. Although the water supply agreement between NID and the City is still active, the City is currently not using any NID supply. NID raw supply cost has exceeded the cost of PCWA’s alternative water supplies, thus PCWA has not been purchasing raw water from NID. However, the City recognizes the value of the Pre-1914 water rights and endeavors to retain access to the water supply whether directly or indirectly through PCWA. The City, PCWA, and NID plan to revisit the Temporary Agreement for an update within the next five years.

### 4.3 GROUNDWATER SUPPLY

As discussed in Chapter 2, the City has five groundwater wells located in the western portion of the City. The City uses these wells in conjunction with its surface water supplies during normal and wet years to meet peak summer demands and provide water supply resiliency when PCWA supplies are limited. Use of the groundwater wells may increase during dry years when available surface water supplies may be limited.

The City’s current annual demands are met by approximately 90 percent surface water and the remaining 10 percent through groundwater.<sup>2</sup> The City has responsibly managed its water supply by relying primarily on surface water, supplemented with groundwater as needed, to meet demand and operational requirements. In the future, the City may increase or decrease groundwater use (above or below 10 percent) through conjunctive use strategies to optimize system performance while protecting the aquifer. This section describes the history and management strategies of the groundwater subbasin underlying the City, as well as the volume of groundwater pumped by the City.

#### 4.3.1 Groundwater Basin Description

The groundwater basin underlying the City is the NASb of the Sacramento Valley Groundwater Basin (5-21.64). The NASb is defined by the unconsolidated sedimentary deposits that are bounded by the Bear River on the north; the Feather and Sacramento Rivers on the west; the American River on the south; and the edge of the alluvial basin, where little or no groundwater flows into or out of the groundwater basin from the rock of the Sierra Nevada, on the east. Figure 4-2 shows the extent of the NASb.

The various geologic formations that constitute the water-bearing deposits underlying the NASb are described in the 2003 Update to the California DWR Bulletin 118. These formations include an unconfined aquifer system consisting of alluvial material occupying the upper 200 to 300 feet below ground surface,

<sup>2</sup> State Water Resources Control Board. October 2023. *2023 Compliance Inspection Report of City of Lincoln Public Water System.*

and a semi-confined aquifer system consisting of fragmented volcanic rocks below the alluvium. The upper aquifer system consists of the Modesto, Riverbank, Turlock Lake, Victor, Fair Oaks, and Laguna Formations, along with Arroyo Seco and South Fork Gravels; the lower aquifer consists primarily of the Mehrten Formation.

The NASb is not an adjudicated basin and is not listed as critically overdrafted by DWR in the 2019 Groundwater Management Act 2019 Basin Prioritization. Furthermore, the subbasin has not been described in overdraft in DWR Bulletin 118, nor has Bulletin 118 projected the basin to become overdrafted with the current management of the subbasin.

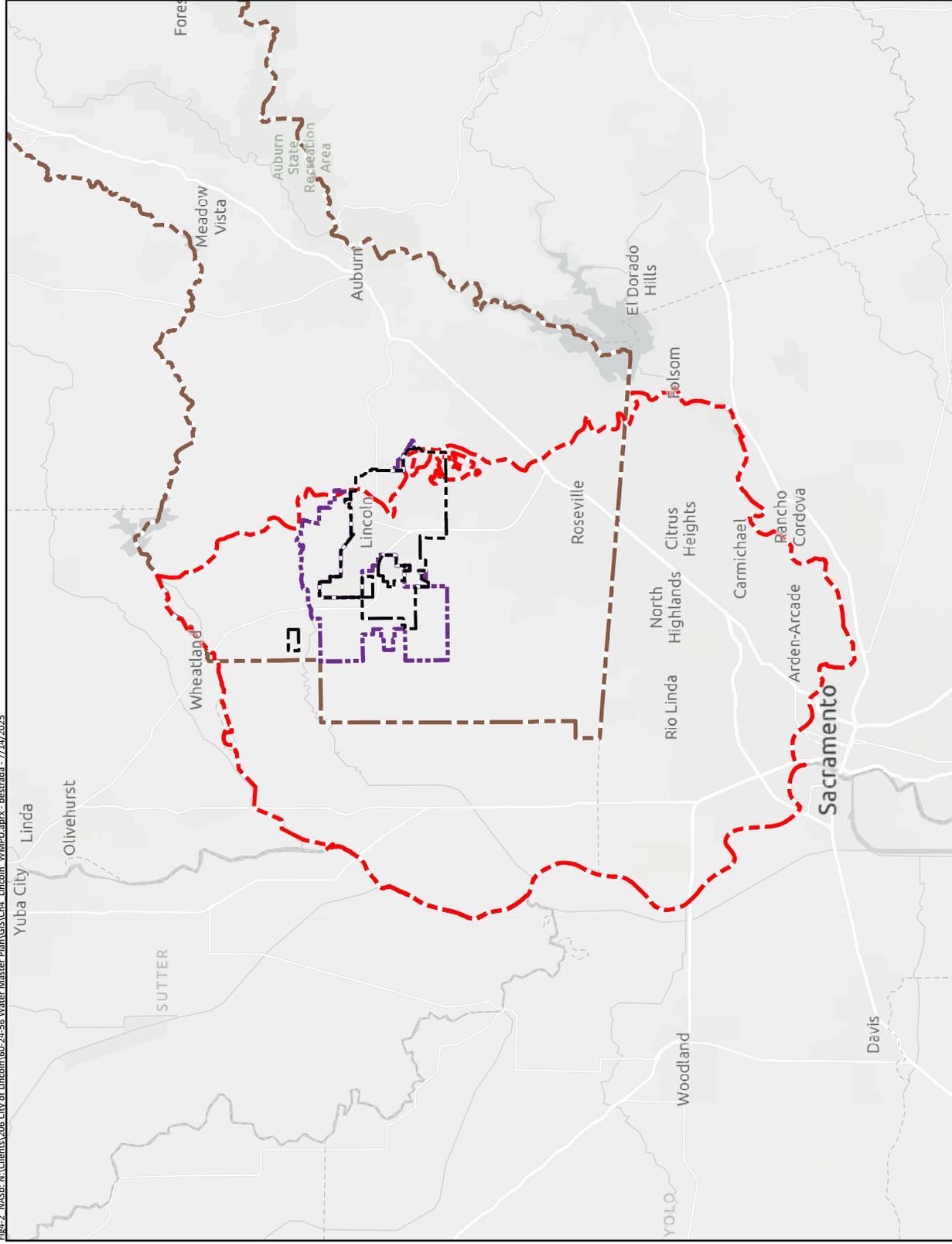
#### **4.3.1.1 Groundwater Basin Conditions**

The NASb can be divided into three areas (Eastern, Central, and Western) based on differences in groundwater conditions.<sup>3</sup> The City is located within Eastern Area which extends from the Placer County limits in the north to the City of Citrus Heights in the south. Due to the availability of surface water as a supply source for urban areas in the Eastern Area, groundwater levels are generally stable. In 2012, an aquifer water level depression was identified near the City which currently still exists. The depression varies in depth seasonally by about 5 to 10 feet.<sup>4</sup> Land subsidence is negligible and sea water intrusion is unlikely to occur in all areas of the NASb. The City, as a member of the Western Placer Groundwater Sustainability Agency, is closely monitoring groundwater levels to maintain sustainable conjunctive-use practices and protect aquifer health as described in more detail in the following section.

---

<sup>3</sup> GEI Consultants. December 2021. *North American Subbasin Groundwater Sustainability Plan*. Section 5: Groundwater Conditions.

<sup>4</sup> GEI Consultants. December 2021. *North American Subbasin Groundwater Sustainability Plan*. Section 5.2.3 Eastern Area.



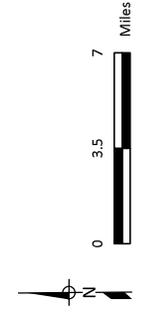
Notes:  
 1. City boundaries shown based on GIS data provided by the City in 2025.

**Sacramento Valley  
 Groundwater Basin  
 North American Subbasin  
 Figure 4-2**

Prepared for:  
**City of Lincoln**  
 Water Master Plan Update



Prepared by:



Generally, the quality of groundwater in the NASb is suitable for nearly all uses, with the exception of contamination plumes and localized quality issues.<sup>5</sup> In the Eastern Area, boron and total dissolved solids (TDS) levels were elevated in some locations near Sheridan, the City, and the City of Roseville.<sup>6</sup> However, the TDS levels in the Eastern Area are generally stable or decreasing. Nitrate concentrations are trending upward in many areas of the NASb but remain below the maximum contaminant level (MCL) for drinking water standards.

#### 4.3.1.2 Groundwater Management

The management of NASb groundwater resources is discussed below.

##### 4.3.1.2.1 Western Placer County Groundwater Management Plan

In 2007, the City adopted the Western Placer County Groundwater Management Plan (WPCGMP). The WPCGMP was developed to assist the City of Roseville, the City of Lincoln, PCWA, and California American Water in maintaining a safe, sustainable, and high-quality groundwater resource within a portion of the NASb. The WPCGMP provided a framework to coordinate groundwater management activities through a set of basin management objectives and specific implementation actions. The recommended sustainable yield for the entire NASb is 400,000 acre-feet per year (AFY), 95,000 AFY of which was assigned to Placer County water users in the WPCGMP.

##### 4.3.1.2.2 Sustainable Groundwater Management Act

In September 2014, the California Legislature passed the SGMA, which required local agencies to form a GSA and adopt and implement a GSP to achieve the sustainable management of groundwater basins over a 20-year time frame. The SGMA also required any agencies within medium and high priority basins to prepare GSPs by January 2022. The NASb was ranked as a high priority basin, and therefore, required the preparation of the NASb GSP, further discussed in the section below.

##### 4.3.1.2.3 North American Subbasin Groundwater Sustainability Plan

Since the NASb underlies portions of three counties (Placer, Sacramento, and Sutter), management of the basin is a collaborative effort of the following five GSAs:

- Reclamation District 1001 GSA
- Sacramento Groundwater Authority GSA
- South Sutter Water District GSA
- Sutter County GSA
- West Placer GSA

The City is a member of the West Placer GSA which also includes the City of Roseville, Placer County, PCWA, NID, and California American Water. In compliance with the SGMA, the five GSAs collaborated to develop the NASb GSP which was completed in December 2021 and approved by the State in July 2023. The focus of the NASb GSP is to identify required actions to maintain a safe, sustainable and high-quality

---

<sup>5</sup> GEI Consultants. December 2021. *North American Subbasin Groundwater Sustainability Plan*. Section 5.8: Groundwater Quality.

<sup>6</sup> GEI Consultants. December 2021. *North American Subbasin Groundwater Sustainability Plan*. Section 5.8.1 Occurrence of Commonly Evaluated Constituents in Groundwater.

groundwater resource that can meet backup, emergency, and peak water demands without adversely affecting other groundwater uses within the NASb area or within adjacent groundwater basins.

Section 6 of the NASb discusses the development of water budgets for historical, current, and future (including and excluding climate change) conditions of the NASb. Table 4-3 summarizes the average annual estimated change in groundwater storage under each of these conditions. As shown in Table 4-3, the NASb has a surplus of groundwater storage for all conditions except for the future condition with climate change. With climate change, the NASb is estimated to have a future storage deficit of about 3,500 AFY. The total sustainable yield of the NASb was estimated to be 336,000 AFY and the NASb is currently under its estimated sustainable yield by more than 10 percent.<sup>7</sup>

| Groundwater Model Baseline Condition                                                     | Average Annual Groundwater Storage Change, acre-feet |
|------------------------------------------------------------------------------------------|------------------------------------------------------|
| Historical (Water Years 2009 through 2018)                                               | 31,000                                               |
| Current (Water Years 1970 through 2019)                                                  | 14,900                                               |
| Projected Future Demands over 50 years (using 1970 - 2019 hydrology)                     | 5,400                                                |
| Projected Future Demands over 50 years with Climate Change (using 1970 - 2019 hydrology) | (3,500)                                              |

*Source: From Table ES-1 of the 2021 North American Subbasin Groundwater Sustainability Plan.*

Section 9 of the NASb GSP identifies two projects and five management actions to help reach the NASb sustainability goal.<sup>8</sup> The only project that directly involves the City is the Regional Conjunctive Use Expansion Project. As summarized from Section 9.2 of the NASb GSP, the Regional Conjunctive Use Expansion Project will provide additional surface water during wet years to reduce existing demand on groundwater through the reoperation of existing water treatment and distribution facilities. Agencies expected to participate by altering their groundwater extraction patterns to increase conjunctive use include California American Water, Citrus Heights Water District, City of Lincoln, City of Sacramento, Golden State Water Company, Rio Linda/Elverta Community Water District, Sacramento County Water Agency, and Sacramento Suburban Water District.

The following descriptions of the five management actions are taken directly from Section ES 9 of the NASb GSP.<sup>9</sup>

1. Continue development of the Sacramento Regional Water Bank, which will expand conjunctive use to further ensure basin sustainability.

<sup>7</sup> GEI Consultants. December 2021. *North American Subbasin Groundwater Sustainability Plan*. Section 6 Water Budgets.

<sup>8</sup> GEI Consultants. December 2021. *North American Subbasin Groundwater Sustainability Plan*. Section 9 Projects and Management Programs.

<sup>9</sup> GEI Consultants. December 2021. *North American Subbasin Groundwater Sustainability Plan*. Section ES 9 Projects and Management Actions.

2. Explore potential revisions to Placer, Sacramento, and Sutter counties' and the City of Roseville's well permitting programs to assess whether the permitting ordinances can be improved to be more protective of domestic wells, groundwater dependent ecosystems (GDEs) and interconnected surface water, along with reducing potential impacts to designated representative wells.
3. Proactively coordinate with land use agencies on their development of plans and approvals of new developments, to improve communications with the agencies and inform them of findings of the NASb GSP, annual report findings, and whether groundwater can be relied upon for future growth without causing undesirable results.
4. Improve data collection and communication with domestic and other shallow well owners to protect these beneficial users of groundwater in the NASb.
5. Continue monitoring and assessment of the NASb's GDEs to better understand these ecosystems to help protect them.

### **4.3.2 Historical Groundwater Use**

Historically, the City relied upon significant quantities of groundwater to meet demands but has since transitioned to proactive conjunctive use practices including acquiring surface water from PCWA and NID. The City uses groundwater during periods where treated surface water through PCWA's system is less available, and to manage summer maximum day and peak hour water demands. For the foreseeable future, availability of surface water supplies from PCWA will continue to be utilized as the City's primary water supply, and the City will continue to invest in its groundwater supplies to increase water supply resiliency and meet peak demands including fire protection while continuing to explore water supply alternatives.

As discussed in Chapter 3, average annual groundwater use over the last 5 years was approximately 123 MG, or 4 percent of City potable water supplies. In normal and wet years, the City primarily uses groundwater to supplement PCWA surface water supply during peak demand periods. In dry years, City groundwater use may increase to offset reductions in and/or limitations of available surface water supply. Therefore, the City's future supply criteria include development of adequate groundwater capacity to meet up to 50 percent of a maximum day demand to improve supply redundancy and reliability. As the City continues to grow, the City will endeavor to explore feasible opportunities to increase surface water supplies from PCWA and/or perfect the NID raw water supply for beneficial use and additional water supply resiliency potentially providing further diversification of its water supply portfolio.

## **4.4 WATER SUPPLY PLAN**

This section compares available supplies with projected water demands (summarizing supply capacity and demand assumptions used for the analysis) and presents a recommended supply plan, so that the City can reliably meet the projected future demands. Appendix C provides a system servicing plan with a more detailed comparison of projected demands and supply recommendations based on the phased planned growth.

### **4.4.1 Existing Supply Production Capacity**

The City's water supplies are introduced into the City's water distribution system via two metering stations from PCWA and five groundwater wells. Table 4-4 summarizes the existing capacity available through water rights agreements with PCWA and groundwater.

| <b>Table 4-4. Existing Supply Capacity for the City of Lincoln</b>                       |                    |
|------------------------------------------------------------------------------------------|--------------------|
| Supply Source                                                                            | Capacity, mgd      |
| Surface Water                                                                            | 19.0               |
| Groundwater Total (Firm) <sup>(a)</sup>                                                  | 8.1 (5.9)          |
| <b>Total (Firm)</b>                                                                      | <b>27.1 (24.9)</b> |
| <small>(a) Firm groundwater capacity assumes the largest well is out of service.</small> |                    |

Based on the existing capacity of supply sources, the City has adequate supplies to meet the existing maximum day demand of 16.9 mgd.

### **4.4.2 Potential Future Supply Sources**

As discussed in Chapter 3, the City is experiencing rapid growth, and the planned developments result in increased demands which will require new water resources be developed. The City’s ultimate plan is to continue to rely on surface water for 90 percent of the annual demand but also develop enough groundwater supply to meet 50 percent of maximum day demand for planning purposes. However, it should be noted the City does recognize alternative additional surface water supplies, to the extent feasible, would complement and potentially offset the magnitude of future reliance on groundwater.

To meet future demands and improve supply reliability, the City is exploring other supply sources, including:

- Aquifer Storage and Recovery Wells
- Groundwater Recharge
- Recycled Water

#### **4.4.2.1 Aquifer Storage and Recovery Wells**

To meet future demands, the construction of new groundwater wells is necessary. To mitigate potential impacts on the groundwater basin, the City intends to equip a strategic subset of future wells with aquifer storage and recovery (ASR) capability.

ASR is a water management strategy that involves the injection of treated surface water into a suitable aquifer during times when surplus water is available, typically winter months when demands are low. The stored water can then be recovered and used for potable supply during periods of high demand, such as the summer or for emergency conditions.

#### **4.4.2.2 Groundwater Recharge**

In addition to ASR, the City is working with other agencies that rely on NASb to develop potential groundwater recharge to help ensure a sustainable groundwater basin for all users. The West Placer Groundwater Sustainability Agency (WPGSA) has been leading the effort to regionally determine recharge projects that will benefit groundwater users of the basin which includes the City.

WPGSA completed a groundwater recharge site feasibility study in 2023<sup>10</sup>. The study helped to identify multiple sites throughout western Placer County that would be suitable for groundwater recharge and develop criteria to rank the priority of potential projects. Locations identified include potential sites within the City’s existing city limits as well as the sphere of influence. Since potential sites have now been identified, the next step is to perform field investigation and testing to further evaluate whether implementation of recharge is viable.

#### **4.4.2.3 Recycled Water**

Wastewater flows from the City are treated at the Lincoln-Sewer Maintenance District 1 Wastewater Authority (LiSWA) wastewater treatment and reclamation facility (WWTRF). The WWTRF produces Title 22 recycled water that is used for agricultural use at reclamation areas outside the existing City limits and for irrigation and industrial use within the City’s limits.

The City is interested in expanding the municipal use of recycled water. As part of the on-going Village 5 planning, a reclaimed water system is being considered to serve irrigation demands. Backbone recycled water pipeline infrastructure is included in Village 5 master planning and needs to be reconciled with the City’s Reclaimed Water Master Plan completed in 2019.<sup>11</sup>

For this WMPU, it is assumed that future parks and landscape corridors will be irrigated with potable water and not recycled water. Therefore, if the City does develop recycled water for irrigation in new developments, the future potable water demands could potentially be partially offset by the recycled water.

#### **4.4.3 Projected Water Demands**

Chapter 3 summarizes demand projections for the City’s system (refer to Table 3-11). Unit water use factors, developed from historical water use data, were used to estimate the future water use. Maximum day demands were calculated as 1.9 times the average daily demand, using the peaking factor adopted for this update. Maximum day demand is estimated at 35.7 mgd in the 20-year planning timeframe and 66.9 mgd by buildout of the entire sphere of influence.

---

<sup>10</sup> GEI Consultants. March 2023. *Groundwater Recharge Site Feasibility Evaluations West Placer County, California*

<sup>11</sup> Stantec. December 2019. *City of Lincoln - Reclamation Master Plan*

#### **4.4.4 Comparison of Supply Production Capacity and Demands**

Figure 4-3 compares historical and projected water demands with the City’s surface water and firm groundwater production capacities. As discussed in Section 4.2.1, future PCWA supply assumptions are based on the existing agreements in effect at the time of preparation of this WMPU. As the figure shows, when the City’s annual average demand reaches approximately 32 mgd, the surface water supplies from PCWA’s existing facilities may not be capable of supplying 90 percent of the demand and the City may require increased usage of groundwater to help support the average annual demands.

Also, based on the City’s criteria of developing adequate groundwater capacity to meet 50 percent of maximum day demands, the City will need to explore all potential alternatives such as constructing new interconnections with adjacent water systems, new treatment plant capacity, new groundwater well capacity, and leverage reclaimed water supplies to offset and mitigate potable water demand. Without alternatives, the City will need to construct a new well approximately every 4 to 5 years assuming a capacity of 1.7 mgd (1,200 gpm) per well.

The City will continue to pursue a conjunctive use strategy that maximizes available surface water supplies and supplements them with groundwater to meet future demands while concurrently exploring all available water supply alternatives. The City will also evaluate opportunities for groundwater use, including recharge and ASR, to ensure that impacts to the groundwater basin remain sustainable.

**Figure 4-3. Projected Supply and Demand Comparison**

