LUMOS & ASSOCIATES

MEMORANDUM

DATE:	4/29/2024
TO:	Ed James
FROM:	Chelsea Cluff, P.E.
CC:	Tim Russell, P.E., WRS; Jonathan Lesperance, P.E.
SUBJECT:	Douglas County Purveyor Data

1.0 Background Information

Lumos & Associates (Lumos) was contracted by the Carson Water Subconservancy District (CWSD) to assist the United States Geological Survey (USGS) with the data collection and analysis of the projected water use by 13 water purveyors within the Carson River Watershed as part of the Carson River Watershed 30-Year Regional Drought and Water Sustainability Plan. The intended purpose of this document is to identify potential deficiencies in water supply (both quantity and/or quality) over a 30-year planning horizon with a focus on existing and future municipal water production, water quality, and water rights for the Douglas County purveyor. Where deficiencies are noted or anticipated, potential mitigation measures will be provided for future consideration. Existing well pumping rates, future well pumping rates, and well locations will be provided to USGS for use in modeling groundwater and surface water impacts across the watershed. Tabulated data, including monthly production for each well over the current 5-year (2018-2022) period of record, will be made available to USGS, CWSD, and the water purveyor.

Douglas County manages the operations and maintenance of eight (8) water systems for the Douglas County community within the Carson Valley. The systems include North County, Clear Creek, West Valley/Montana, East Valley, Foothill, Sierra Estates, and the Fairgrounds. The Fairgrounds, Foothills, and Sierra Estates are three (3) independent systems and not connected to the others. The North County, Clear Creek, West Valley, East Valley, and Clear Creek systems are all intertied and water can be moved between them. The Douglas County system includes thirteen existing active municipal supply wells that services 4,270 connections, of which 3,820 of these are residential. They also have an intertie with Minden that supplies water to the East Valley system. Douglas County is south of Carson County and includes 728 square miles of area, which includes portions of the Tahoe basin which are not included in this analysis.

2.0 Existing and Future Production

2.1 Existing Production

The Douglas County system within the Carson Watershed is broken into eight (8) systems which obtain municipal water from 13 groundwater wells and the intertie with Minden. Five of which are interconnected: North Valley, East Valley, West Valley/Montana, and Clear Creek. Water can move freely between them therefore the capacity analysis has analyzed them together. The remaining three systems (Foothills, Fairgrounds, and Sierra County Estates) are independent of each other and will be analyzed separately through the report.

North Valley, East Valley, West Valley, Clear Creek, Montana and Regional Intertie

The combined North Valley, East Valley, Clear Creek, Montana, and Regional Intertie system supplies water via six (6) active wells. Monthly total well production varies from 0.75 million gallons per month (MG/month) to 2.7 MG/month for the North County system, 1.15 to 8.5 MG/month for the Montana system, 0.97 to 4.5 MG/month for the West Valley system. The East Valley system receives an average of 33 MG/month from the Minden Regional Intertie, which is then distributed to North County and then West Valley. The highest producer is the North County Well 2 at 300 gallons per minute (gpm) for North County, Montana Well 3 at 450 gpm for Montana, and Walley's Well at 430 gpm for West Valley.

Overall, the production capacity of a system, as identified in this report, is the summer-time capacity since water demand increases six (6) to ten (10) times in the summer when compared to winter-time demands. Therefore, the capacity analysis is focused on the high production months. The maximum monthly production for all five (5) years analyzed occurred between June and August with the overall highest production month being July of 2018 at 113.6 MG for North County, East Valley, West Valley, Clear Creek, Montana, and the Minden Regional Intertie. For a breakdown of each well with pumping capacity, and max daily production capacity see Table 1. The existing locations and associated permit numbers for each well are listed within Table 9 in the Supplemental Information section.

Table 1: Well Pumping Capacity & Max Daily Production Capacity for North Valley, East Valley, West Valley, Clear Creek, Montana, and Minden Regional Intertie

System Name	Well name	Well Pumping Capacity (gpm) [1]	Max Daily Production Capacity (gpd) [2]
North County	North County Well 1 [3]	80	76,800
	North County Well 2	300	288,000
	Minden Intertie	500	480,000
	TOTAL	880	844,800
Montana	Montana Well 2	85	81,600
	Montana Well 3	450	432,000
	TOTAL	535	513,600
West Valley	Genoa Lakes Well 2 [4]	280	268,800
	Walley's Well	430	412,800
	Minden Intertie	500	480,000
	TOTAL	1,210	1,161,600
East Valley	Minden Intertie	1,600	1,536,000
	TOTAL	1,600	1,536,000
	SYSTEM TOTAL	4,225	4,055,200

Notes:
[1] Well pumping capacity was analyzed using the 2023 Carson Valley Water Master Plan.
[2] Maximum daily production was estimated by using a sixteen (16) hour pumping cycle, the 16-hour pumping cycle is only being used for the purpose of drought and sustainability planning and does not actually reflect well capacity if pumping at 24 hours a day.
[3] North County Well 1 is typically not pumped due to arsenic concentrations above the Federal Maximum Contaminant (MCL) Level. When required, Douglas County operates this well in accordance with the State approved blending protocol to ensure municipal water supplied to service connections is under the MCL and complies with all Federal and state drinking water requirements.
[4] Genoa Lakes Well 2 is an induction well.

Sierra County Estates

The Sierra County Estates (SCE) System supplies water via two (2) active wells. Monthly total well production varies from 0.5 to 1.2 MG/month for the Sierra County Estates system. The highest producer is Well 1 at 300 gpm for the Sierra County Estates system. Combined, the two wells have a total pumping capacity of 450 gpm and a max daily production of 432,000 gpd, assuming a sixteen (16) hour a day pumping cycle. For a breakdown of each well with pumping capacity, and max daily production capacity see Table 2. The existing locations and associated permit numbers for each well are listed within Table 9 in the Supplemental Information section.

Overall, the production capacity of a system, as identified in this report, is the summer-time capacity since water demand increases six (6) to ten (10) times in the summer when compared to winter-time demands. Therefore, the capacity analysis is focused on the high production months. The maximum monthly production for all five (5) years analyzed occurred between June and August with the overall highest production month being July of 2022 at 3.9 million gallons (MG) for Sierra County Estates.

Table 2: Well Pumping Capacity & Max Daily Production Capacity for Sierra County Estates

System Name	Well name	Well Pumping Capacity (gpm) [1]	Max Daily Production Capacity (gpd) [2]
Sierra County Estates	SCE Well 1	300	288,000
	SCE Well 2	150	144,000
	TOTAL	450	432,000

Notes:
[1] Well pumping capacity was analyzed using the 2023 Carson Valley Water Master Plan.
[2] Maximum daily production was estimated by using a sixteen (16) hour pumping cycle, the 16-hour pumping cycle is only being used for the purpose of drought and sustainability planning and does not actually reflect well capacity if pumping at 24 hours a day.

Foothills

The Foothills System supplies water via three (3) active municipal wells: Job's Peak Well 1 and 2 and the Sheridan Well #3. Monthly total well production 1.05 to 1.4 MG/month for the Foothill system. The highest producer is Job's Peak Well 1 at 130 gpm for the Foothill system. Combined, the three wells have a total pumping capacity of 330 gpm and a max daily production of 316,800 gpd, assuming a sixteen (16) hour a day pumping cycle. For a breakdown of each well with pumping capacity, and max daily production capacity see Table 3 The existing locations and associated permit numbers for each well are listed within Table 9 in the Supplemental Information section.

Overall, the production capacity of a system, as identified in this report, is the summer-time capacity since water demand increases six (6) to ten (10) times in the summer when compared to winter-time demands. Therefore, the capacity analysis is focused on the high production months. The maximum monthly production for all five (5) years analyzed occurred between June and August with the overall highest production month being July of 2018 at 8.3 MG for the Foothills system.

Table 3: Well Pumping Capacity & Max Daily Production Capacity for Foothills

System Name	Well name	Well Pumping Capacity (gpm) [1]	Max Daily Production Capacity (gpd) [2]
Foothills	Job's Peak Well 1	130	124,800
	Job's Peak Well 2	100	96,000
	Sheridan Well 3	100	96,000
	TOTAL	330	316,800

Notes:
[1] Well pumping capacity was analyzed using the 2023 Carson Valley Water Master Plan.
[2] Maximum daily production was estimated by using a sixteen (16) hour pumping cycle, the 16-hour pumping cycle is only being used for the purpose of drought and sustainability planning and does not actually reflect well capacity if pumping at 24 hours a day.

Fairgrounds

The Fairgrounds System is supplied water via two (2) active municipal wells, one of which is often not pumped due to nitrate concentrations per community request. Monthly total well production varies from 0.005 to 0.9 MG/month for the Fairgrounds system. The highest producer is Well 2 at 200 gpm for the Fairgrounds system. Combined, the two wells have a total pumping capacity of 270 gpm and a max daily production of 259,200 gpd, assuming a sixteen (16) hour a day pumping cycle. For a breakdown of each well with pumping capacity, and max daily production capacity see Table 4. The existing locations and associated permit numbers for each well are listed within Table 9 in the Supplemental Information section.

Overall, the production capacity of a system, as identified in this report, is the summer-time capacity since water demand increases six (6) to ten (10) times in the summer when compared to winter-time demands. Therefore, the capacity analysis is focused on the high production months. The maximum monthly production for all five (5) years analyzed occurred between June and August with the overall highest production month being August of 2021 at 2.25 MG for the Fairgrounds.

Table 4: Well Pumping Capacity & Max Daily Production Capacity for Fairgrounds

System Name	Well name	Well Pumping Capacity (gpm) [1]	Max Daily Production Capacity (gpd) [2]
Fairgrounds	Fairgrounds Well 1 [3]	70	67,200
	Fairgrounds Well 2	200	192,000
	TOTAL	270	259,200

Notes:
[1] Well pumping capacity was analyzed using the 2023 Carson Valley Water Master Plan.
[2] Maximum daily production was estimated by using a sixteen (16) hour pumping cycle, the 16-hour pumping cycle is only being used for the purpose of drought and sustainability planning and does not actually reflect well capacity if pumping at 24 hours a day.
[3] Fairgrounds Well 1 is typically not pumped due to nitrate concentrations per community request.

The maximum monthly production was used to calculate the average day max month (ADMM) by dividing the absolute maximum month for each year throughout the five years of data and dividing by the number of days within that month. The ADMM was used along with the maximum pumping capacity (based on a 16 hour a day pumping cycle) to evaluate production deficiencies in the system. Figure 1 illustrates the difference in summer demand versus capacity by illustrating the average five-year ADMM to the available production capacity. The available production capacity is broken down into two scenarios: with all wells operating and without Fairgrounds Well #1 and North County Well#1 to account for current minimal use due to high arsenic or nitrate levels. As seen within Figure 1, Figure 2, Figure 3, and Figure 4, the current maximum well production exceeds the ADMM for peak summer months in all scenarios. For a breakdown of the production of all the wells through the summer period see Table 5, and for the yearly production of all wells broken down by month, reference Table 10 in the Supplemental Information section.

Table 5: Historical Total Monthly Well Production

Month	Monthly Well Production (gallons): North County, East Valley, West Valley, Clear Creek, Montana, and Minden Regional Intertie					
	2018	2019	2020	2021	2022	2018-2022 Average
Jun	92,885,000	95,023,500	81,903,000	91,520,000	87,079,000	89,682,100
Jul	113,601,000	105,334,000	92,477,000	103,484,000	96,618,500	102,302,900
Aug	93,807,000	100,653,000	94,507,000	88,390,000	91,018,000	93,675,000
Sep	102,728,000	88,292,500	66,870,000	69,692,000	80,569,000	81,630,300
Month	**Monthly Well Production (gallons): Sierra County Estates**					
	2018	2019	2020	2021	2022	2018-2022 Average
Jun	2,957,000	3,100,000	3,014,000	3,072,000	3,116,000	3,051,800
Jul	3,692,000	3,453,000	3,812,000	3,548,000	3,951,000	3,691,200
Aug	3,549,000	3,489,000	3,350,000	3,647,000	3,050,000	3,417,000
Sep	2,744,000	2,514,000	2,906,000	3,192,000	2,790,000	2,829,200
Month	**Monthly Well Production (gallons): Foothills**					
	2018	2019	2020	2021	2022	2018-2022 Average
Jun	5,980,000	6,974,000	5,633,000	6,165,000	6,261,000	6,202,600
Jul	7,713,000	7,576,000	6,626,000	6,806,000	7,242,000	7,192,600
Aug	8,309,000	7,440,000	6,664,000	6,896,000	6,167,000	7,095,200
Sep	6,237,000	6,251,000	5,883,000	7,705,000	5,868,000	6,388,800
Month	**Monthly Well Production (gallons): Fairgrounds**					
	2018	2019	2020	2021	2022	2018-2022 Average
Jun	1,722,000	1,546,000	1,537,720	1,543,800	1,534,960	1,576,896
Jul	2,057,000	1,667,000	2,242,880	1,649,000	1,894,600	1,902,096
Aug	1,814,000	1,819,000	1,795,000	2,254,104	1,640,880	1,864,597
Sep	1,471,000	1,297,000	1,598,160	1,463,000	1,422,960	1,450,424

= Maximum Month

Carson Office

308 N Curry, Suite 200, Carson City, NV 89703

Tel. 775.883.7077 / Fax. 775.827.6112

www.lumosinc.com

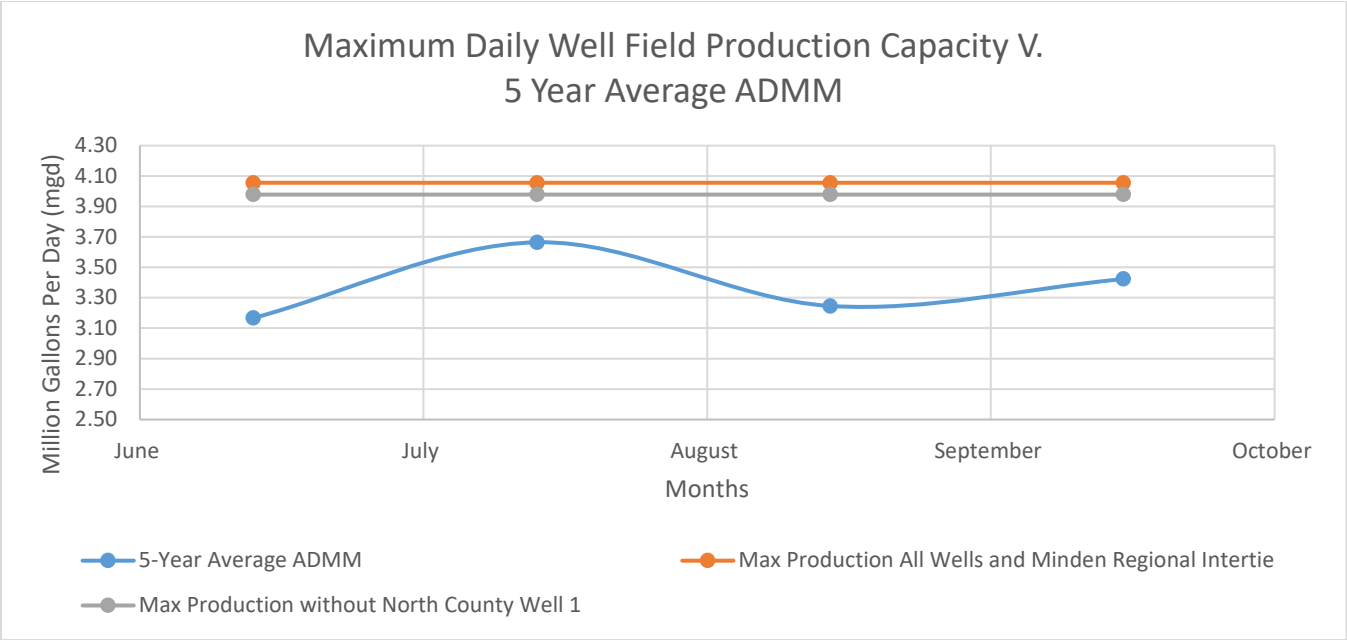


Figure 1: Maximum Well Field Production Capacity V. 5 Year Average ADMM for North Valley, East Valley, West Valley, Clear Creek, Montana, and Minden Regional Intertie

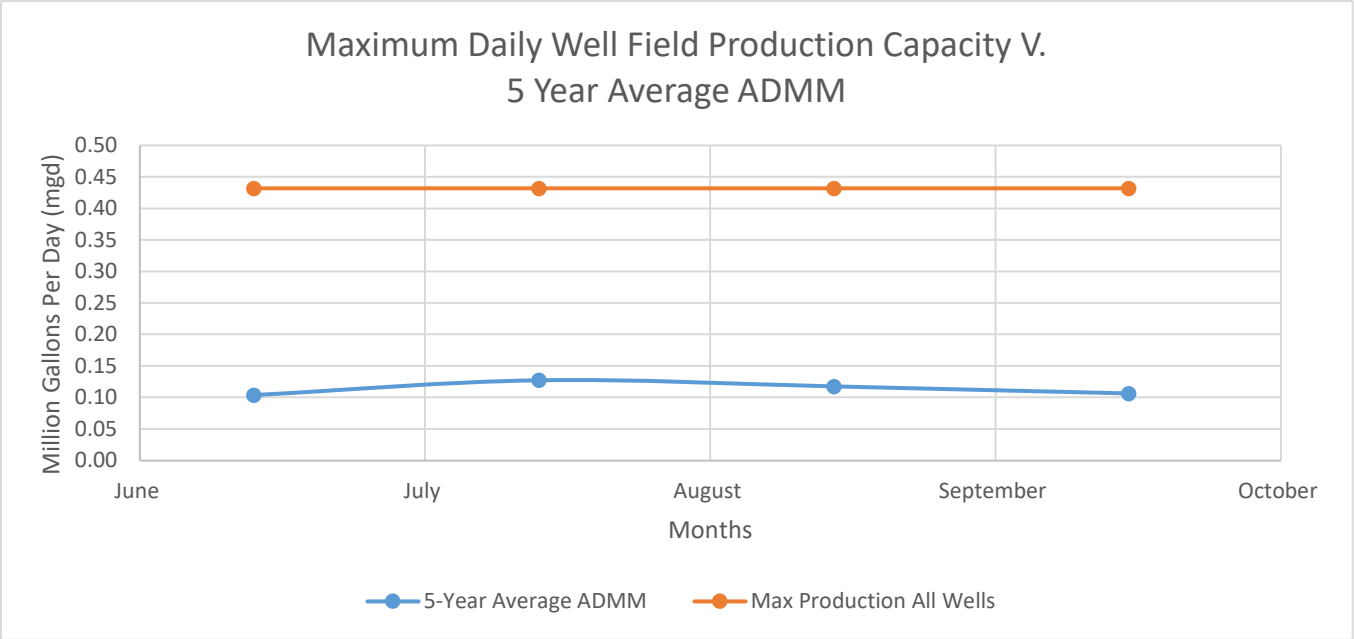


Figure 2: Maximum Well Field Production Capacity V. 5 Year Average ADMM for Sierra County Estates

Carson Office

308 N Curry, Suite 200, Carson City, NV 89703

Tel. 775.883.7077 / Fax. 775.827.6112

www.lumosinc.com

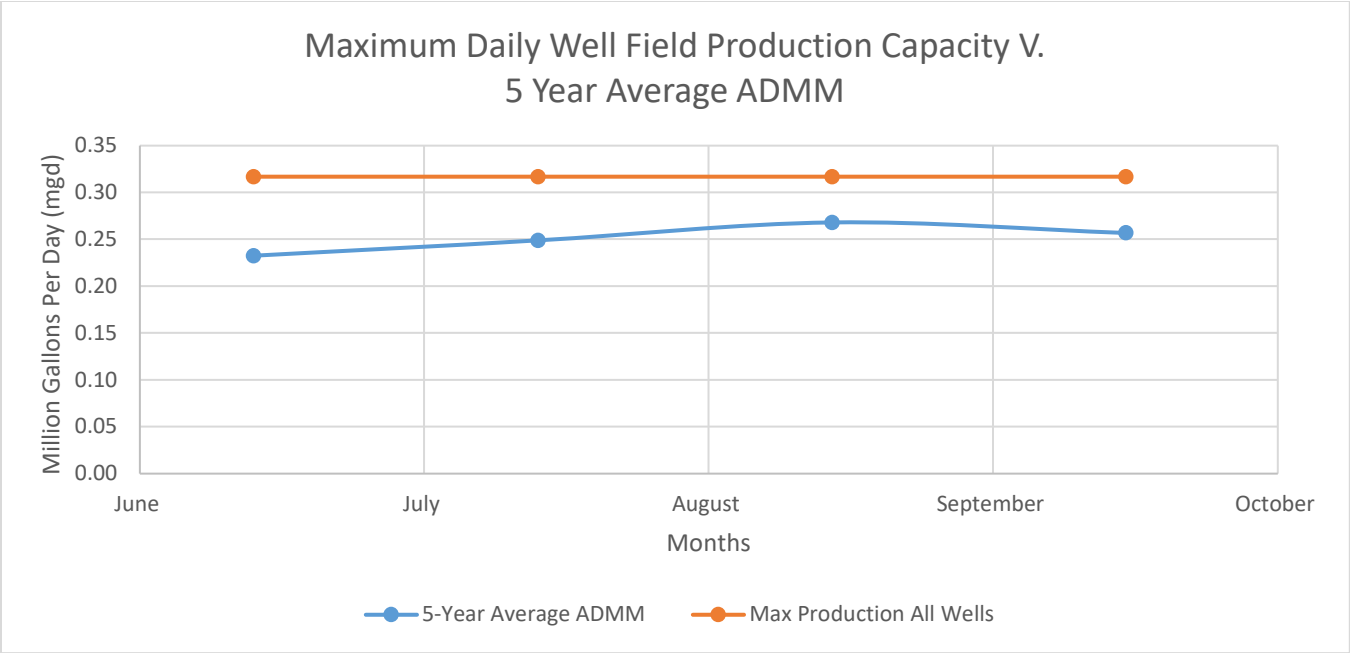


Figure 3: Maximum Well Field Production Capacity V. 5 Year Average ADMM for Foothills

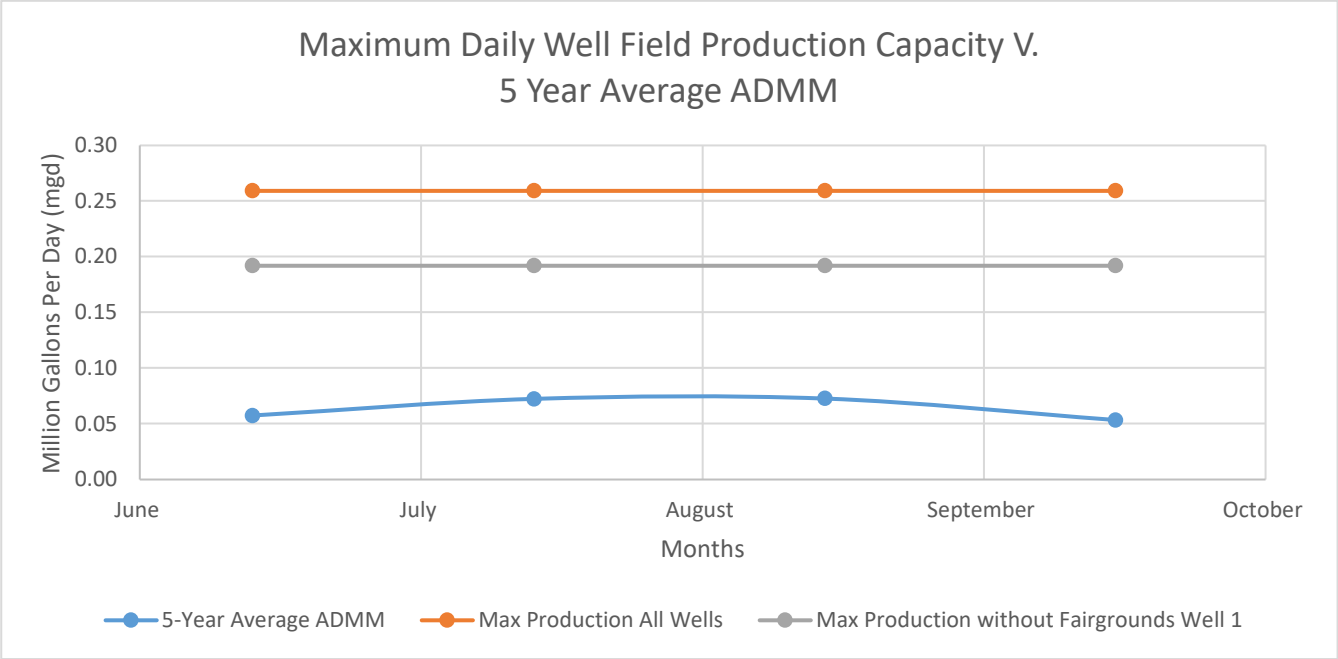


Figure 4: Maximum Well Field Production Capacity V. 5 Year Average ADMM for Fairgrounds

Carson Office

308 N Curry, Suite 200, Carson City, NV 89703

Tel. 775.883.7077 / Fax. 775.827.6112

www.lumosinc.com

2.2 Growth Projections

To estimate the growth in water production for each system, a planning period from 2021 through 2051 (30 years) was analyzed using a growth rate specified for each system. North County, East Valley, West Valley, Clear Creek, and Montana use a growth rate of 0.54%. The 0.54% growth rate is based on population data from 2010 to the current date (2023) and was provided by Douglas County for the whole planning area. Sierra County Estates, Foothill, and Fairgrounds use individual growth rates determined by the remaining lots to reach full buildout by 2051 – 0.3%, 0.6%, and 0% respectively. Sierra County Estates growth rate is based off 23 total lots to be built and 21 currently built – leading to a 0.3% growth rate for the system. The Foothill system comprises of two subdivisions – Sheridan Acres and Job's Peak. Sheridan Acres has already reached buildout of 101 lots, whereas Job's Peak has 85 lots built of the 122 total lots resulting in a 0.6% growth rate. The fairground system has reached substantial completion and therefore has a growth rate of 0.0%. Figure 5 and Figure 6 illustrate the annual well production required using the Douglas County and buildout growth rate over the 30-year planning horizon. It is unknown if developable land (receiving area), planned developments, and land use classifications were taken into consideration in the growth analysis as this is a county provided estimate of production growth.

Table 11, in the Supplemental Information section, provides an in-depth breakdown of the growth rates provided by Douglas County over the 30-year planning horizon.

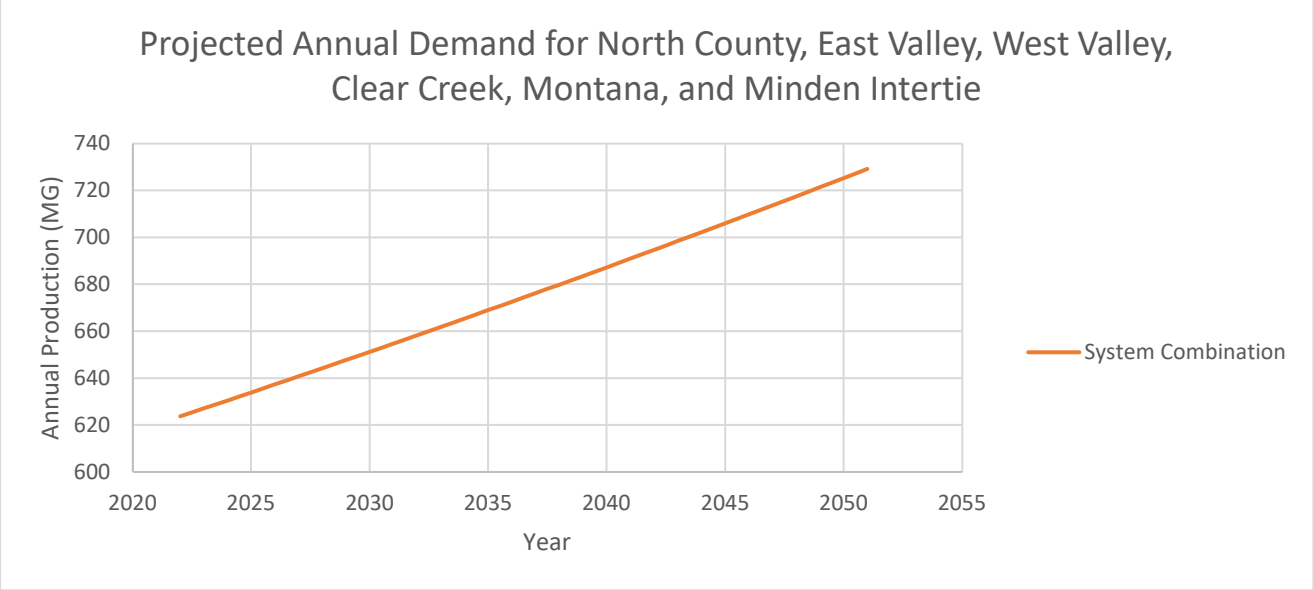


Figure 5: Projected Annual Production for North County, East Valley, West Valley, Clear Creek, Montana, and Minden Regional Intertie

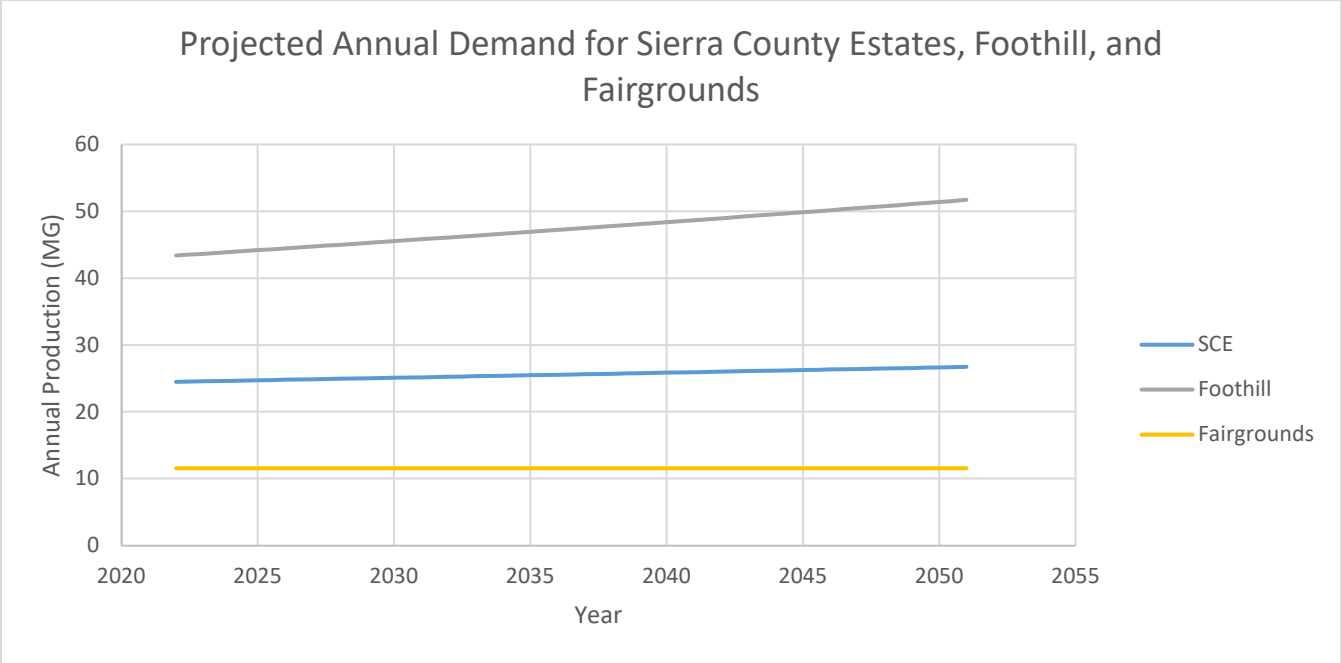


Figure 6: Projected Annual Production for Sierra County Estates, Foothills, and Fairgrounds

Carson Office

308 N Curry, Suite 200, Carson City, NV 89703

Tel. 775.883.7077 / Fax. 775.827.6112

www.lumosinc.com

2.3 Estimated Future Demand v. Existing Available Production

North Valley, East Valley, West Valley, Clear Creek, and Montana

To estimate future well production necessary to meet anticipated water demand, the growth projection discussed in Section 2.2 was used to project the maximum daily demand required for North Valley, East Valley, West Valley, Clear Creek, and Montana systems. The calculated yearly demand for these five (5) systems in 2051 was approximately 733.2 MG based off Douglas County's growth rate, as described in Section 2.2. To get the monthly future demand in 2051 for each of the high production months (June through September), the estimated annual future demand for 2051 was multiplied by the 5-year average percentage of the high production months. The five-year average percentage was found by taking the monthly total and dividing it by the total annual production for each year between 2018 to 2022 and then averaging across all five years. In Figure 7, the estimated demand in 2051 according to the Douglas County growth rate is compared to the anticipated production.

The scenarios analyzed, as discussed in Section 2.2, are production with all wells functioning and production without North County Well#1. For the production scenarios, it is estimated that there will be enough production to meet the estimated demands in 2051 generated by the Douglas County growth rate. Therefore, current well production (even without reliable use of North County Well#1) will be sufficient to meet the anticipated demands in 2051 assuming the growth rate defined by Douglas County remains accurate. For projected annual total production, see Table 12 in the Supplemental Information section.

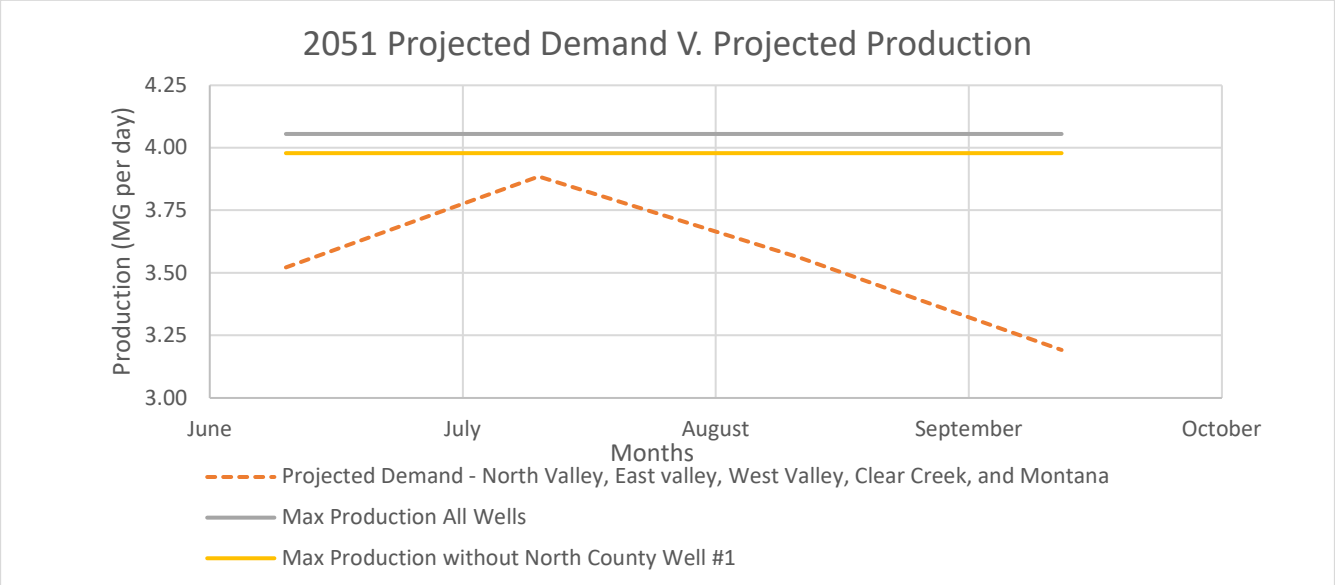


Figure 7: Projected 2051 Demand V. Projected Production for North Valley, East Valley, West Valley, Clear Creek, and Montana

Sierra County Estates

To estimate future well production necessary to meet anticipated water demand, the growth projection discussed in Section 2.2 was used to project the maximum daily demand required for Sierra County Estates. The calculated yearly demand for this system in 2051 was approximately 26.8 MG based off the potential buildout growth rate, as described in Section 2.2 To get the monthly future demand in 2051 for each of the high production months (June through September), the estimated annual future demand for 2051 was multiplied by the 5-year average percentage of the high production months. The five-year average percentage was found by taking the monthly total and dividing it by the total annual production for each year between 2018 to 2022 and then averaging across all five years. In Figure 8, the estimated demand in 2051 according to the buildout growth rate is compared to the anticipated production.

For the production scenario with all wells operating within the Sierra County Estates System, it is estimated that there will be enough production to meet the estimated demands in 2051 generated by the buildout growth rate. Therefore, current well production will be sufficient to meet the anticipated demands in 2051 assuming the growth rates defined by the buildout potential remain accurate. For projected annual total production, see Table 12 in the Supplemental Information section.

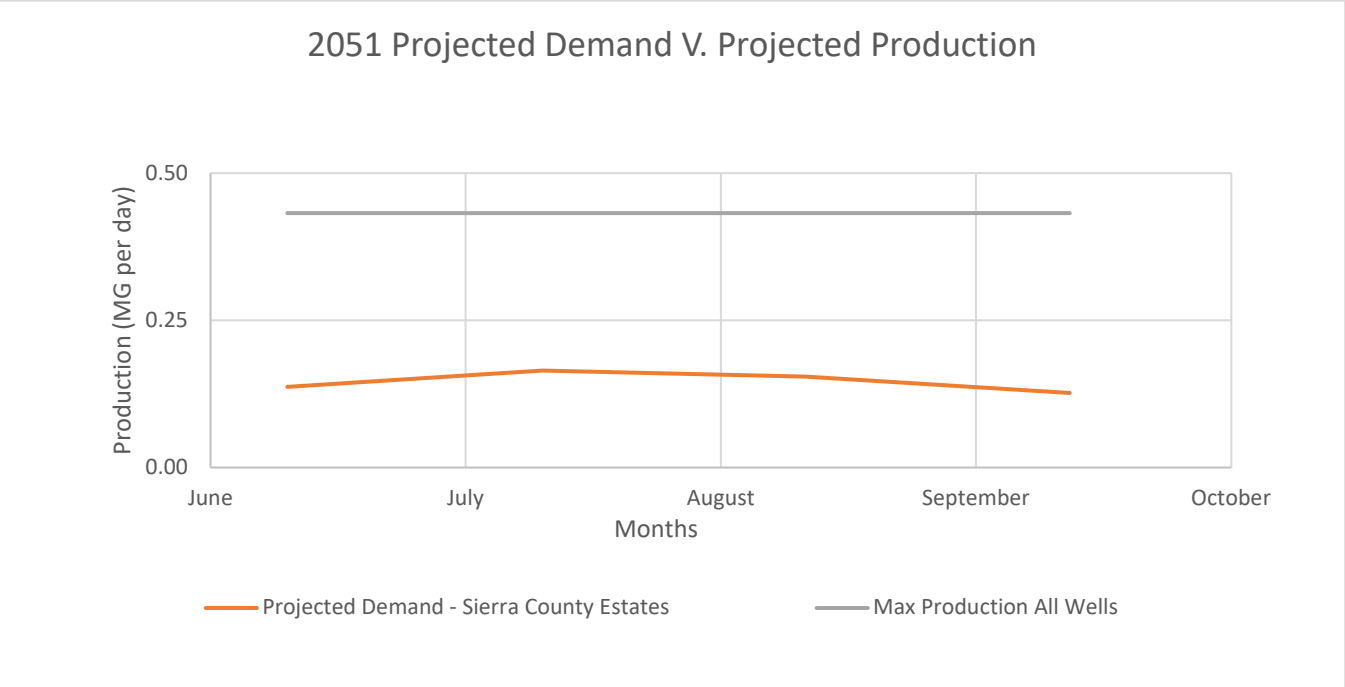


Figure 8: Projected 2051 Demand V. Projected Production for Sierra County Estates

Carson Office

308 N Curry, Suite 200, Carson City, NV 89703

Tel. 775.883.7077 / Fax. 775.827.6112

www.lumosinc.com

Foothills

To estimate future well production necessary to meet anticipated water demand, the growth projection discussed in Section 2.2 was used to project the maximum daily demand required for the Foothills. The calculated yearly demand for this system in 2051 was approximately 52 MG based off the potential buildout growth rate, as described in Section 2.2. To get the monthly future demand in 2051 for each of the high production months (June through September), the estimated annual future demand for 2051 was multiplied by the 5-year average percentage of the high production months. The five-year average percentage was found by taking the monthly total and dividing it by the total annual production for each year between 2018 to 2022 and then averaging across all five years. In Figure 9, the estimated demand in 2051 according to the Buildout growth rate is compared to the anticipated production.

For the production scenario with all wells operating within the Foothill System, it is estimated that there will be enough production to meet the estimated demands in 2051 generated by the Buildout growth rate. Therefore, current well production will be sufficient to meet the anticipated demands in 2051 assuming the growth rates defined by the potential buildout are accurate. For projected annual total production, see Table 12 in the Supplemental Information section.

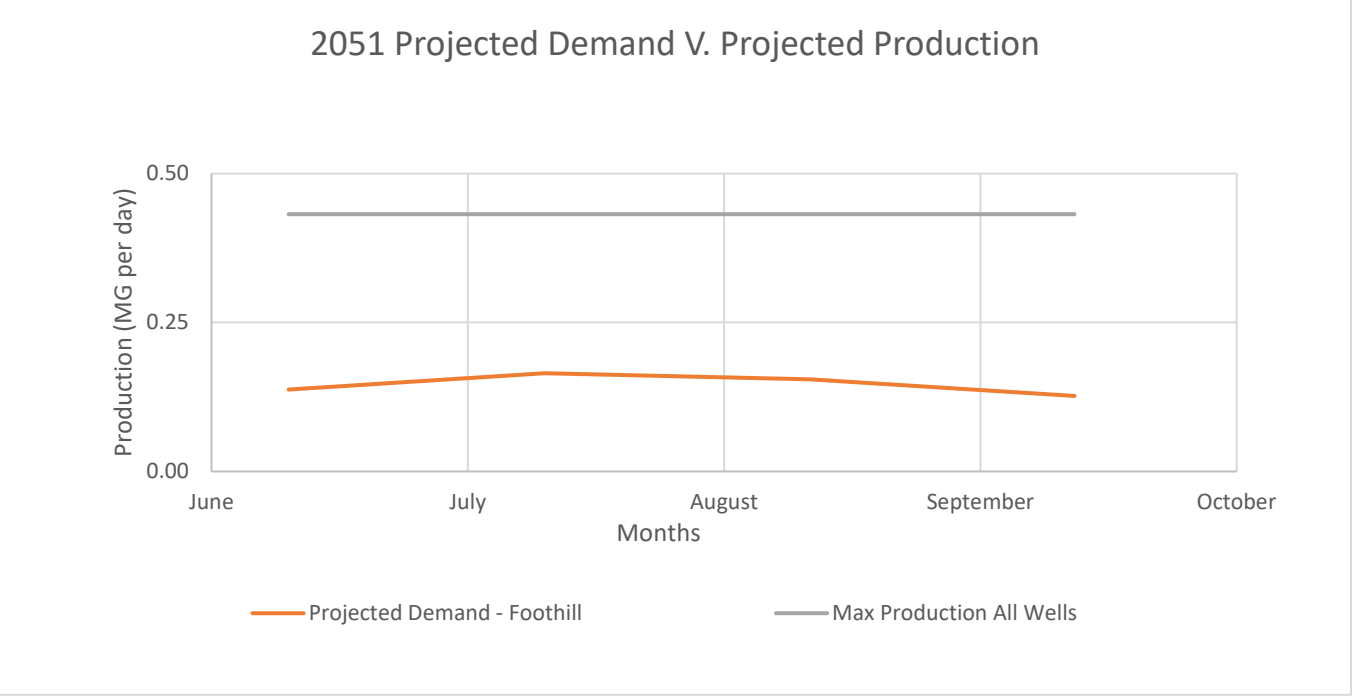


Figure 9: Projected 2051 Demand V. Projected Production for Foothills

Carson Office

308 N Curry, Suite 200, Carson City, NV 89703

Tel. 775.883.7077 / Fax. 775.827.6112

www.lumosinc.com

Fairgrounds

To estimate future well production necessary to meet anticipated water demand, the growth projection discussed in Section 2.2 was used to project the maximum daily demand required for Fairgrounds. The calculated yearly demand for this system in 2051 was approximately 11.6 MG based off the potential buildout growth rate, as described in Section 2.2. To get the monthly future demand in 2051 for each of the high production months (June through September), the estimated annual future demand for 2051 was multiplied by the 5-year average percentage of the high production months. The five-year average percentage was found by taking the monthly total and dividing it by the total annual production for each year between 2018 to 2022 and then averaging across all five years. In Figure 10, the estimated demand in 2051 according to the Buildout growth rate is compared to the anticipated production.

The scenarios analyzed, as discussed in Section 2.2, are production with all wells functioning and production without Fairgrounds Well#1. For the production scenarios, it is estimated that there will be enough production to meet the estimated demands in 2051 generated by the Buildout growth rate. Therefore, current well production (even without reliable use of Fairgrounds Well#1) will be sufficient to meet the anticipated demands in 2051 assuming the growth rates defined by the potential buildout are accurate. For projected annual total production, see Table 12 in the Supplemental Information section.

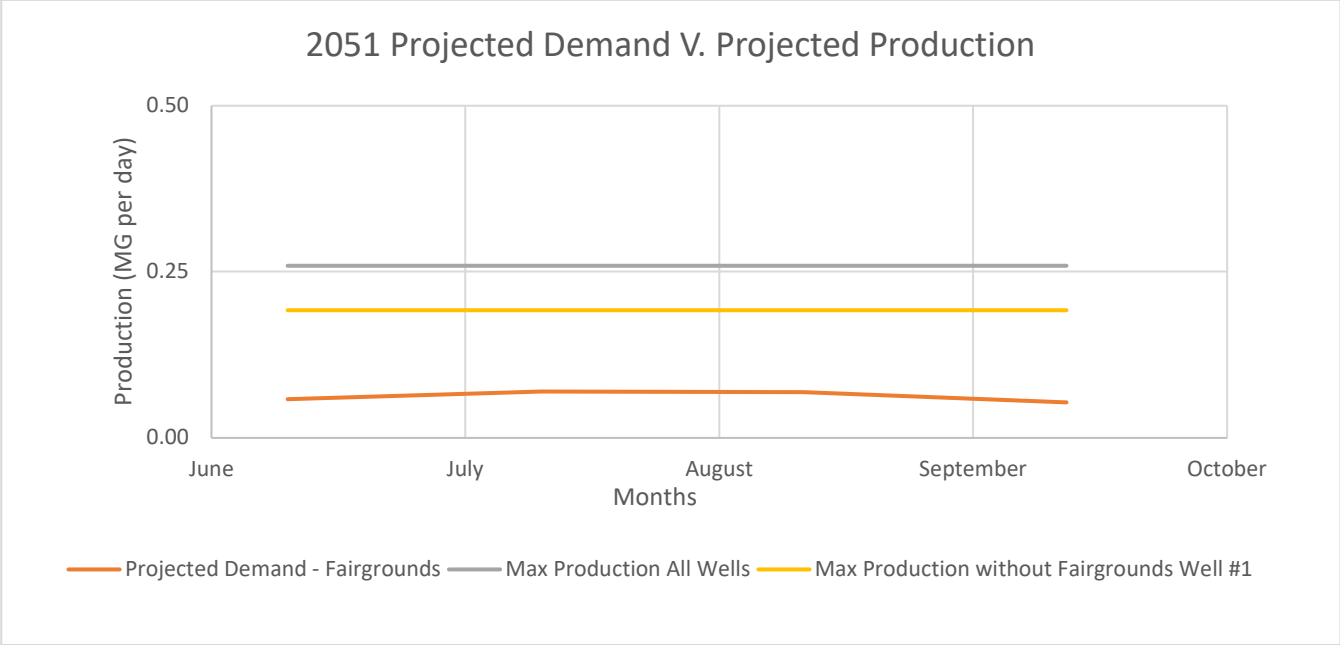


Figure 10: Projected 2051 Demand V. Projected Production for Fairgrounds

Carson Office

308 N Curry, Suite 200, Carson City, NV 89703

Tel. 775.883.7077 / Fax. 775.827.6112

www.lumosinc.com

3.0 Water Quality

Water quality was analyzed using purveyor provided data from 2020 through 2022. The data provided analyzes existing water quality per well for six (6) constituents: Total Dissolved Solids (TDS), Arsenic, Iron, Manganese, and Nitrogen. The maximum contaminant level (MCL) and secondary maximum contaminant level (SMCL) for each constituent is provided in Table 3 as well. One well (North County Well 1) has had spot samples of arsenic concentrations above the maximum concentration limit (MCL) of 10 parts per billions (ppb) and their use has been limited to times of peak demand. During these times of peak demand, water from the North County Well 1 requires adequate blending with water from the other Douglas County wells to reduce the arsenic level below 10 ppb, in accordance with the State approved blending protocol to ensure water quality compliance. The only other contaminant flagged for being near the limit is a reoccurrence of Nitrogen in Fairgrounds Well #1 with 4.5 parts per million (ppm), which is below the limit of 10 ppm. Although, the Fairgrounds Well #1 does not exceed the limit it was noted within the 2023 Water Masterplan by Farr West Engineering that the production is limited per the request of community residents. Overall, it is recommended to continue the monitoring of the North County Well #1 and Fairground Well #1. The remaining Douglas County wells have low or non-detectable contaminant levels for the monitored contaminants. The yearly concentrations are shown in Table 3.

Table 6: Contaminants Concentration

System Name	Well Name	CONTAM.	TDS	Arsenic	Iron	Mang.	Nitr.
		MCL/SMCL	500 (mg/L)	10 (ppb)	0.3 (ppm)	0.1 (ppm)	10 (ppm)
Montana	Montana Well 2	2022	160	----	<.05	0.006	----
	Montana Well 3	2021	----	----	----	----	2
		2022	210	----	<.05	<0.001	----
North County	North County Well 1	2022	----	12	----	----	1.6
	North County Well 2	2022	----	3	----	----	----
West Valley	Genoa Lakes Well 2	2020	120	<2	<0.05	<0.002	0.36
		2021	----	----	----	----	0.44
		2022	----	----	----	----	----
	Walley's Well	2021	170	6	<0.05	<0.001	<0.5
		2022	----	----	----	----	----
Sierra County Estates	SCE Well 1	2022	----	<1	0.06	----	1.6
	SCE Well 2	2021	----	----	0.75	----	0.94
		2022	----	----	<0.05	----	----

System Name	Well Name	CONTAM. MCL/SMCL	TDS 500 (mg/L)	Arsenic 10 (ppb)	Iron 0.3 (ppm)	Mang. 0.1 (ppm)	Nitr. 10 (ppm)
Foothills	Job's Peak Well 1	2020	54	<2	<0.05	0.04	----
		2021	----	<1	----	----	0.09
		2022	----	----	----	----	<0.05
	Job's Peak Well 2	2022	----	<0.001	----	----	<0.05
	Sheridan Well 3	2022	----	<0.001	----	----	0.08
Fairgrounds	Fairgrounds Well 1	2020	250	----	<0.05	<0.002	4.5
		2021	----	----	----	----	-----
		2022	----	----	----	----	----
	Fairgrounds Well 2	2020	----	----	----	----	1.5
		2021	----	----	----	----	----
		2022	----	----	----	----	----

4.0 Water Rights

Douglas County has 23 certificated and 51 permitted water rights attributed to thirteen municipal wells. The total combined duty of those water rights is 3024 acre-feet (AF). The current annual production for the year (2022) is 1908 acre-feet per year (AFA) for the North County, East Valley, West Valley, Clear Creek, and Montana systems. Projected demand based on 0.54% (Douglas County growth rate) in 2051 is 2,243 AFA. The current annual production for the year (2022) is 75 acre-feet per year (AFA) for the Sierra County Estates system. Projected demand based on the potential buildout growth rate in 2051 is 82 AFA. The current annual production for the year (2022) is 132 acre-feet per year (AFA) for the Foothill system. Projected demand based on the buildout growth rate in 2051 is 159 AFA. The current annual production for the year (2022) is 35 acre-feet per year (AFA) for the Fairgrounds system. Projected demand based on the potential buildout growth rate in 2051 is 35 AFA. The Minden Regional Intertie accounts for 8 AFA. Based on this conservative projected future demand, the Douglas County system has sufficient water rights over the 30-year planning period.

5.0 Summary

North County, East Valley, West Valley, Clear Creek, and Montana

For the beginning of the planning period (2021), The North County, East Valey, West Valley, Clear Creek, and Montana systems currently have adequate well production capacity (4.06 MG/day with North County Well #1, 3.98 without) to meet the demands of its community (3.66 MG/day) and negligible water quality issues impacting their system. Based on the planning horizon of 30-years (2021 to 2051) and the growth rates (0.54%) used in the analysis, Douglas County has sufficient water rights (2568 AFA) to account for future growth in 2051 (2,243 AFA). As development continues and the population grows within the systems, the future required well production capacity will be 3.88 MG/day still below the current capacity of 4.06 MG/day with North County Well #1 and below the current capacity of 3.98 MG/day without North County Well #1. However, it is critical to reanalyze future water supply to ensure demands can be met in case growth is higher than 0.54% year over year.

Sierra County Estates

For the beginning of the planning period (2021), the Sierra County Estates system currently has adequate well production capacity (0.43 MG/day) to meet the demands of its community (0.13 MG/day) and negligible water quality issues impacting their system. Based on the planning horizon of 30-years (2021 to 2051) and the Buildout growth rate used in the analysis, Sierra County Estates has sufficient water rights (71 AFA) to account for future growth in 2051 (82 AFA). As development continues and the population grows within their district, the future required well production capacity will be 0.16 MG/day still below the current capacity of 0.43 MG/day. However, it is critical to reanalyze future water supply to ensure demands can be met in case growth is higher than anticipated.

Foothills

For the beginning of the planning period (2021), the Foothill system currently has adequate well production capacity (0.32 MG/day) to meet the demands of its community (0.27 MG/day) and negligible water quality issues impacting their system. Based on the planning horizon of 30-years (2021 to 2051) and the Buildout growth rate used in the analysis, Foothills has sufficient water rights (311 AFA) to account for future growth in 2051 (159 AFA). As development continues and the population grows within their district, the future required well production capacity will be 0.32 MG/day still within the current capacity of 0.32 MG/day. However, it is critical to reanalyze future water supply to ensure demands can be met in case growth is higher than anticipated.

Fairgrounds

For the beginning of the planning period (2021), the Fairgrounds system currently has adequate well production capacity (0.26 MG/day with Fairgrounds Well #1, 0.19 MG/day without) to meet the demands of its community (0.07 MG/day) and negligible water quality issues impacting their system. Based on the planning horizon of 30-years (2021 to 2051) and the Buildout growth rate used in the analysis, Fairgrounds has sufficient water rights (78 AFA) to account for future growth in 2051 (35 AFA). As development continues and the population grows within their district, the future required well production capacity will be 0.08 MG/day still below the current capacity of 0.26 MG/day with Fairgrounds Well #1 and below the current capacity of 0.19 MG/day without Fairgrounds Well #1. However, it is critical to reanalyze future water supply to ensure demands can be met in case growth is higher than anticipated.

For an in-depth look at all considerations and groundwater modeling scenarios, see Section 5.1 and Section 5.2. For a more detailed breakdown of projected well production required capacity and the surplus, see Table 7.

Table 7: Summarized Existing & Future Production

North County, East Valley, West Valley, Clear Creek, and Montana				
	With North County Well #1		Without North County Well #1	
	Mgal/day	gal/min	Mgal/day	gal/min
Existing (2021) Water Supply Capacity[1]	4.06	4,230	3.98	4,145
Existing (2021) Water Demand	3.66	3,820	3.66	3,820
Existing (2021) Water Supply Deficit/Surplus	0.40	410	0.32	325
Future (2051) Water Demand[2]	3.88	4,050	3.88	4,050
Future (2051) Water Supply Deficit/Surplus[3]	0.18	180	0.10	95
Sierra County Estates				
	Mgal/day	gal/min		
Existing (2021) Water Supply Capacity[4]	0.43	450		
Existing (2021) Water Demand	0.13	140		
Existing (2021) Water Supply Deficit/Surplus	0.30	310		
Future (2051) Water Demand[5]	0.16	170		
Future (2051) Water Supply Deficit/Surplus[3]	0.27	280		
Foothills				
	Mgal/day	gal/min		
Existing (2021) Water Supply Capacity[6]	0.32	330		
Existing (2021) Water Demand	0.27	280		
Existing (2021) Water Supply Deficit/Surplus	0.05	50		
Future (2051) Water Demand[5]	0.32	330		
Future (2051) Water Supply Deficit/Surplus[3]	0.00	0		
Fairgrounds				
	With Fairgrounds Well #1		Without Fairgrounds Well #1	
	Mgal/day	gal/min	Mgal/day	gal/min
Existing (2021) Water Supply Capacity[7]	0.26	270	0.19	200
Existing (2021) Water Demand	0.07	80	0.07	80
Existing (2021) Water Supply Deficit/Surplus	0.19	190	0.12	120
Future (2051) Water Demand[5]	0.08	90	0.08	90
Future (2051) Water Supply Deficit/Surplus[3]	0.18	180	0.11	110

Notes:
[1] Existing water supply capacity includes production from the following wells: North County Wells #1 and #2, Montana Wells #2 and #3, Genoa Lakes Well 2, and West Walley's Well.
[2] The water demand in 2051 assumes the Douglas County growth rate, as discussed in Section 2.2.
[3] The deficit/surplus calculation assumes no additional well development between 2021 and 2051 to analyze the additional well capacity needed to meet future demands. A negative number represents a water production deficit (and the need for additional water production) and a positive number represents a water production surplus (no additional water production necessary to meet future water demands).
[4] Existing water supply capacity includes production from the following wells: Sierra County Estates Well #1 and #2
[5] The water demand in 2051 assumes the Buildout growth rates, as discussed in Section 2.2.
[6] Existing water supply capacity includes production from the following wells: Job's Peak Wells #1 and #2R and Sheridan Well #3.
[7] Existing water supply capacity includes production from the following wells: Fairgrounds Wells #1 and #2

5.1 Future Water Supply Considerations

North County, East Valley, West Valley, Clear Creek, and Montana

The current (3.66 MG/day) and future demands in 2051 (3.88 MG/day) are below the maximum well capacities (4.06 MG/day with North County Well #1, 3.98 MG/day without), as shown in Figure 1 and Figure 7. Based on the current data and methodology used for the analysis, Douglas County's current water supply is sufficient for the projected growth in the service area and will not require additional wells to meet the projected water demand of 4,050 gpm.

Sierra County Estates

The current (0.13 MG/day) and future demands in 2051 (0.16 MG/day) are below the maximum well capacities (0.43 MG/day) as shown in Figure 2 and Figure 8. Based on the current data and methodology used for the analysis, Douglas County's current water supply is sufficient for the projected growth in the service area and will not require additional wells to meet the projected water demand of 170 gpm.

Foothills

The current (0.27 MG/day) and future demands in 2051 (0.32 MG/day) are within the maximum well capacities (0.32 MG/day), as shown in Figure 3 and Figure 9. Based on the current data and methodology used for the analysis, Douglas County's current water supply is sufficient for the projected growth in the service area and will not require additional wells to meet the projected water demand of 330 gpm.

Fairgrounds

The current (0.07 MG/day) and future demands in 2051 (0.08 MG/day) are below the maximum well capacities (0.26 MG/day with Fairgrounds Well #1, 0.19 MG/day without), as shown in Figure 4 and Figure 10. Based on the current data and methodology used for the analysis, Douglas County's current water supply is sufficient for the projected growth in the service area and will not require additional wells to meet the projected water demand of 90 gpm.

It is important to note that population growth in an area is dependent on many different factors that are not always able to be anticipated in a future growth analysis. Therefore, the population and expected community growth should be continually monitored in case an unanticipated population boom drives the water demand to be higher than the capacity of the existing water supply. For this reason, it is encouraged that all purveyors look at the benefits of water conservation.

1. Water Conservation
    - Pros: Reduce overall demand and production needs, inexpensive
    - Cons: Consumer buy in, does not fully accommodate long-term growth, loss of revenue
2. Arsenic Treatment Plant
    - Pros: Uses existing infrastructure, known capacity and production ability
    - Cons: Highest anticipated O&M costs, managing waste by-product

5.2 Modeling Options

The base condition that would be recommended for modeling purposes has been summarized below and in Table 8. This is not a recommendation to the purveyor and purely an assumed option for modeling purposes. The base condition uses the growth rate that was provided by Douglas County (0.54%) for the North County, East Valley, West Valley, Clear Creek, and Montana systems. The buildout growth rates were used for the Sierra County Estates, Foothills, and Fairgrounds systems. A summary of the projected production and the corresponding growth per year over the 30-year planning horizon can be found in Table 11.

Base Condition: Run existing wells with existing capacities for all active wells until July 2025. At the end of July 2025 an electrical upgrade should be completed on Wally's Well increasing capacity from 430 gpm to 800 gpm. An arsenic treatment plant is also expected to be brought online 10 years from the data of this report (2034), which will bring the South Airport Well #1 to a capacity of 1,300 gpm.

Table 8: Proposed Required Well Capacities in 2051

Option	North County		Montana		West Valley		Sierra County Estates	
	Well 1 [3]	Well 2	Well 2	Well 3	GENOA LAKES WELL 2	Walley's Well [3]	SCE WELL 1	SCE WELL 2
Base	80	300	85	450	280	800	300	150

Option	Foothills			Fairgrounds		East Valley		
	JOB'S PEAK WELL 1	JOB'S PEAK WELL 2R	SHERIDAN WELL 3	Well 1	Well 2	Minden Regional Intertie	South Airport Well	Total
Base	130	100	100	0	200	2,600	1,300	6,875

Notes:

[1] Max well production was assumed that wells could run 16 hours of the day during the peak months of June through September.

[2] Proposed well capacity is based on Douglas County provided growth rate of 0.54% for the North County, East Valley, West Valley, and Montana systems. Proposed well capacity is based on buildout provided growth rates for the Sierra County Estates, Foothills, and Fairgrounds systems.

[3] South Airport Well and Walley's Well will increase capacity between the planning period of 2021 and 2051 due to the completion of an Arsenic Treatment Plant and electrical upgrades, respectively.

6.0 Supplemental Information

Table 9: Existing Well Locations & Depths

Parameter	North County		Montana		West Valley	
	WELL 1	WELL 2	WELL 2	WELL 3	GENOA LAKES WELL 2	WALLEYS WELL
Well Depth (ft)	322	350	463	463	170	499
Screened Interval from (ft)	120	134	110	110	115	----
Screened Interval to (ft)	280	335	340	340	165	----
Latitude	39.11	39.11	39.04	39.04	39.02	38.98
Longitude	119.77	119.76	119.82	119.82	119.84	119.83
Surface Elevation (ft)	4838	4727	4779	4779	4727	4677
Permit Number	78948	70489	--	--	--	--

Parameter	Sierra County Estates		Foothills			Fairgrounds	
	SCE WELL 1	SCE WELL 2	JOB'S PEAK WELL 1	JOB'S PEAK WELL 2R	SHERIDAN WELL 3	WELL 1	WELL 2
Well Depth (ft)	107	700	400	240	225	380	450
Screened Interval from (ft)	85	55	95	80	105	141	100
Screened Interval to (ft)	102	425	285	220	25	380	450
Latitude	38.91	38.9	38.91	38.9	39.91	38.9	38.93
Longitude	119.83	119.84	119.85	119.84	119.83	119.68	119.7
Surface Elevation (ft)	4834	5426	5559	5426	4838	4994	4898
Permit Number	--	--	--	78129T	--	--	--

Parameter	East Valley
	South Airport Well
Well Depth (ft)	430
Screened Interval from (ft)	150
Screened Interval to (ft)	405
Latitude	38.99
Longitude	119.75
Surface Elevation (ft)	4,714
Permit Number	41205

Notes:
[1] All longitudes are negative [-]

Table 10: Historical Total Monthly Well Production

Month	Monthly Well Production (gallons): COMBINATION: N COUNTY, E VALLEY, W VALLEY, CLEAR CREEK, MONTANA, MINDEN INTERTIE					
	2018	2019	2020	2021	2022	2018-2022 Average
Jan	14,519,500	15,155,500	16,353,500	16,681,000	18,306,000	16,203,100
Feb	15,608,000	13,987,000	19,253,500	13,152,000	16,799,500	15,760,000
Mar	16,682,500	17,116,500	19,188,000	15,100,000	25,064,500	18,630,300
Apr	40,789,000	40,300,500	43,283,000	51,140,000	43,468,500	43,796,200
May	72,646,500	68,400,000	88,135,000	72,313,000	74,417,000	75,182,300
Jun	92,885,000	95,023,500	81,903,000	91,520,000	87,079,000	89,682,100
Jul	113,601,000	105,334,000	92,477,000	103,484,000	96,618,500	102,302,900
Aug	93,807,000	100,653,000	94,507,000	88,390,000	91,018,000	93,675,000
Sep	102,728,000	88,292,500	66,870,000	69,692,000	80,569,000	81,630,300
Oct	53,057,500	51,398,000	59,773,000	42,586,500	58,779,500	53,118,900
Nov	21,207,000	21,220,000	8,352,000	16,694,000	16,435,500	16,781,700
Dec	15,103,500	16,148,500	15,360,000	16,729,000	15,220,000	15,712,200
Total	652,634,500	633,029,000	605,455,000	597,481,500	623,775,000	622,475,000
Average Day (gpd)	1,788,040	1,734,326	1,658,781	1,632,463	1,708,973	1,705,411
Max Month (gallons)	113,601,000	105,334,000	94,507,000	103,484,000	96,618,500	102,302,900
ADMM (gpd)	3,664,548	3,397,871	3,048,613	3,338,194	3,116,726	3,300,094
Month	**Monthly Well Production (gallons): SIERRA COUNTY ESTATES**					
	2018	2019	2020	2021	2022	2018-2022 Average
Jan	145,000	138,000	110,000	180,000	194,000	153,400
Feb	212,000	151,000	144,000	128,000	152,000	157,400
Mar	250,000	154,000	147,000	172,000	344,000	213,400
Apr	812,000	1,459,000	1,154,000	1,490,000	1,404,000	1,263,800
May	2,371,000	2,233,000	2,869,000	2,664,000	2,293,000	2,486,000
Jun	2,957,000	3,100,000	3,014,000	3,072,000	3,116,000	3,051,800
Jul	3,692,000	3,453,000	3,812,000	3,548,000	3,951,000	3,691,200
Aug	3,549,000	3,489,000	3,350,000	3,647,000	3,050,000	3,417,000
Sep	2,744,000	2,514,000	2,906,000	3,192,000	2,790,000	2,829,200
Oct	1,964,000	1,095,000	1,945,000	695,000	1,556,000	1,451,000
Nov	261,000	171,000	216,000	219,000	2,827,800	738,960
Dec	159,000	104,000	151,000	205,000	2,833,240	690,448
Total	19,116,000	18,061,000	19,818,000	19,212,000	24,511,040	20,143,608
Average Day (gpd)	52,373	49,482	54,296	52,492	67,154	55,188
Max Month (gallons)	3,692,000	3,489,000	3,812,000	3,647,000	3,951,000	3,691,200
ADMM (gpd)	119,097	112,548	122,968	117,645	127,452	119,071

Carson Office

308 N Curry, Suite 200, Carson City, NV 89703

Tel. 775.883.7077 / Fax. 775.827.6112

www.lumosinc.com

Month	Monthly Well Production (gallons): FOOTHILLS					
	2018	2019	2020	2021	2022	2018-2022 Average
Jan	1,319,000	1,829,000	986,000	1,023,000	1,303,000	1,292,000
Feb	1,108,000	1,927,000	1,313,000	901,000	876,000	1,225,000
Mar	1,159,000	2,141,000	1,115,000	1,543,000	1,277,000	1,447,000
Apr	2,271,000	3,183,000	2,406,000	4,749,000	2,530,000	3,027,800
May	4,767,000	5,409,000	5,340,000	5,463,000	5,744,000	5,344,600
Jun	5,980,000	6,974,000	5,633,000	6,165,000	6,261,000	6,202,600
Jul	7,713,000	7,576,000	6,626,000	6,806,000	7,242,000	7,192,600
Aug	8,309,000	7,440,000	6,664,000	6,896,000	6,167,000	7,095,200
Sep	6,237,000	6,251,000	5,883,000	7,705,000	5,868,000	6,388,800
Oct	4,652,000	4,013,000	4,058,000	2,120,000	4,158,000	3,800,200
Nov	2,000,000	2,768,000	1,398,000	1,067,000	974,000	1,641,400
Dec	1,822,000	3,161,000	894,000	902,000	999,000	1,555,600
Total	47,337,000	52,672,000	42,316,000	45,340,000	43,399,000	46,212,800
Average Day (gpd)	129,690	144,307	115,934	123,880	118,901	126,610
Max Month (gallons)	8,309,000	7,576,000	6,664,000	7,705,000	7,242,000	7,192,600
ADMM (gpd)	268,032	244,387	214,968	248,548	233,613	232,019
Month	**Monthly Well Production (gallons): FAIRGROUNDS**					
	2018	**2019**	**2020**	**2021**	**2022**	**2018-2022 Average**
Jan	295,000	239,520	225,080	324,440	314,840	279,776
Feb	253,000	285,240	291,000	322,440	303,600	291,056
Mar	248,000	390,600	245,240	349,720	518,680	350,448
Apr	782,000	1,035,000	612,440	973,160	877,880	856,096
May	1,004,000	1,388,000	1,296,080	1,282,000	1,381,880	1,270,392
Jun	1,722,000	1,546,000	1,537,720	1,543,800	1,534,960	1,576,896
Jul	2,057,000	1,667,000	2,242,880	1,649,000	1,894,600	1,902,096
Aug	1,814,000	1,819,000	1,795,000	2,254,104	1,640,880	1,864,597
Sep	1,471,000	1,297,000	1,598,160	1,463,000	1,422,960	1,450,424
Oct	834,000	729,360	959,240	822,000	1,093,120	887,544
Nov	313,000	423,080	535,080	279,680	286,000	367,368
Dec	273,950	185,160	264,720	272,000	318,800	262,926
Total	11,066,950	11,004,960	11,602,640	11,535,344	11,588,200	11,359,619
Average Day (gpd)	30,320	30,151	31,788	31,517	31,748	31,122
Max Month (gallons)	2,057,000	1,819,000	2,242,880	2,254,104	1,894,600	1,902,096
ADMM (gpd)	66,355	58,677	72,351	72,713	61,116	61,358

= Maximum Month

Carson Office

308 N Curry, Suite 200, Carson City, NV 89703

Tel. 775.883.7077 / Fax. 775.827.6112

www.lumosinc.com

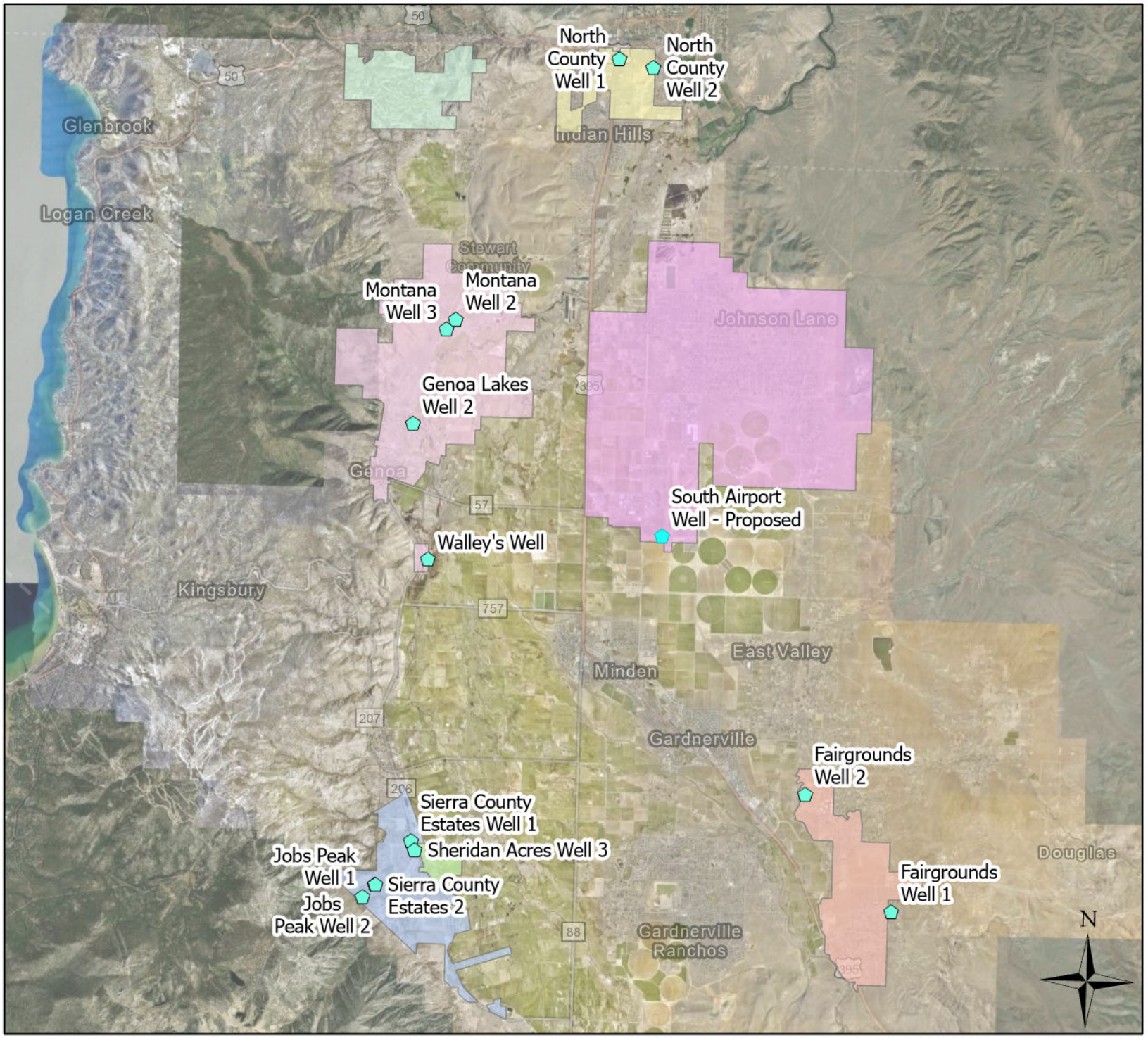
Table 11: Projected Growth Rates for Douglas County

Year	SCE Growth Rate [1] [2]	Foothills Growth Rate [1] [2]	Fairgrounds Growth Rate [1] [2]	Douglas County Growth Rate [1] [3]
2021 (base)	--	--	--	--
2022	0.3%	0.6%	0.0%	0.54%
2023	0.3%	0.6%	0.0%	0.54%
2024	0.3%	0.6%	0.0%	0.54%
2025	0.3%	0.6%	0.0%	0.54%
2026	0.3%	0.6%	0.0%	0.54%
2027	0.3%	0.6%	0.0%	0.54%
2028	0.3%	0.6%	0.0%	0.54%
2029	0.3%	0.6%	0.0%	0.54%
2030	0.3%	0.6%	0.0%	0.54%
2031	0.3%	0.6%	0.0%	0.54%
2032	0.3%	0.6%	0.0%	0.54%
2033	0.3%	0.6%	0.0%	0.54%
2034	0.3%	0.6%	0.0%	0.54%
2035	0.3%	0.6%	0.0%	0.54%
2036	0.3%	0.6%	0.0%	0.54%
2037	0.3%	0.6%	0.0%	0.54%
2038	0.3%	0.6%	0.0%	0.54%
2039	0.3%	0.6%	0.0%	0.54%
2040	0.3%	0.6%	0.0%	0.54%
2041	0.3%	0.6%	0.0%	0.54%
2042	0.3%	0.6%	0.0%	0.54%
2043	0.3%	0.6%	0.0%	0.54%
2044	0.3%	0.6%	0.0%	0.54%
2045	0.3%	0.6%	0.0%	0.54%
2046	0.3%	0.6%	0.0%	0.54%
2047	0.3%	0.6%	0.0%	0.54%
2048	0.3%	0.6%	0.0%	0.54%
2049	0.3%	0.6%	0.0%	0.54%
2050	0.3%	0.6%	0.0%	0.54%
2051	0.3%	0.6%	0.0%	0.54%

Notes:
[1] The percent change for 2041 was extended through 2051 to estimate populations through the planning period.
[2] The buildout Growth Rate was used for the Sierra County Estates, Foothills, and Fairground systems.
[3] The Douglas County growth rate was used for the North County, East Valley, West Valley, Clear Creek, and Montana systems.

Table 12: Future Well Production

Year	Future Production (MG)			
	North County, East Valley, West Valley, Clear Creek, and Montana	Sierra County Estates	Foothills	Fairgrounds
2021 (base)	624	25	43	12
2022	627	25	44	12
2023	631	25	44	12
2024	634	25	44	12
2025	637	25	44	12
2026	641	25	45	12
2027	644	25	45	12
2028	648	25	45	12
2029	651	25	46	12
2030	655	25	46	12
2031	658	25	46	12
2032	662	25	46	12
2033	665	25	47	12
2034	669	25	47	12
2035	673	26	47	12
2036	676	26	48	12
2037	680	26	48	12
2038	684	26	48	12
2039	687	26	48	12
2040	691	26	49	12
2041	695	26	49	12
2042	698	26	49	12
2043	702	26	50	12
2044	706	26	50	12
2045	710	26	50	12
2046	714	26	50	12
2047	718	26	51	12
2048	721	27	51	12
2049	725	27	51	12
2050	729	27	52	12
2051	733	27	52	12



Path: L:\LAProj\10974.000 - CWSD 30 Year Regional Drought Plan\3-Design\CWSD\CWSD\CWSD.aprx

LUMOS & ASSOCIATES
308 N. CURRY ST., STE 200 CARSON CITY, NV 89703
TEL: 775.883.7077
WWW.LUMOSINC.COM

(c)LUMOS & ASSOCIATES, INC.: THIS DRAWING IS THE PROPERTY OF LUMOS & ASSOCIATES, INC... USE OR REPRODUCTION OF THIS DRAWING, IN WHOLE OR IN PART, WITHOUT THE WRITTEN PERMISSION OF LUMOS & ASSOCIATES, INC. IS STRICTLY PROHIBITED. THIS DRAWING IN NOT TO BE USED FOR ANY PROJECT OTHER THAN THE PROJECT FOR WHICH IT WAS PREPARED.

WELL LOCATIONS
DOUGLAS COUNTY

CWSD

30-YEAR REGIONAL DROUGHT PLAN

1 OF 1

LEGEND

- Douglas County Wells

Water Service Area

- Clear Creek
- East Valley
- Fairgrounds
- Foothill
- North County
- Sheridan Acres
- West Valley

Paper Size: 8.5" x 11"

0 1.5 3
Miles

Projection: Transverse Mercator
Grid: NAD 1983 UTM Zone 11N
Datum: North American 1983
Created by: dmarinrios

Date:	4/23/2024
Project #:	10974.000
Revision:	2