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MEMORANDUM

DATE:	1/9/2024
TO:	Ed James
FROM:	Chelsea Cluff, P.E..
CC:	Tim Russell, P.E., WRS; Jonathan Lesperance, P.E.
SUBJECT:	Indian Hills General Improvement District 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 13 water purveyors within the Carson River Watershed for 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 well production, water quality, and water rights for the Indian Hills General Improvement District (IHGID) purveyor. Where deficiencies are noted or anticipated, potential mitigation measures will be provided for future consideration. Existing and future 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 period of record, will be made available to USGS, CWSD, and the water purveyor.

IHGID is located within Douglas County, Nevada and is located south of Carson City along Highway 395. IHGID has an estimated population of 6,000, according to the 2020 U.S. Census, and serves 1,810 connections. The service area covers approximately 540 acres. IHGID manages three (3) active municipal supply wells that supplement the water that comes from the Town of Minden through the Douglas County owned intertie. Minden pumps IHGID water rights from Minden wells. The IHGID water from Minden is capped by the regional agreements at 1,400 gpm. Due to being surrounded by Forest Service, wetland and river areas, and existing development, the potential for growth within the IHGID service area is limited. More significant growth within IHGID would require lands bill activity to allow the sale of Forest Service property to private owners. Due to this, the scenario of acquiring Forest Service land was assumed unlikely in the 30-year planning horizon and therefore not included in this report.

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2.0 Existing and Future Demands

2.1 Existing Production

The residents of IHGID are supplied with water from the Town of Minden, with support from three (3) IHGID-owned municipal wells. Over 90 percent of the public water supply comes from the Town of Minden. The IHGID well production was analyzed from January 2015 to December 2022. All three wells combined can produce 285,300 gpd. Of the three wells, Ridgeview #5 has the largest production per year at a total of 15.3 MG. For the breakdown of each well and the maximum pumping capacity see Table 1. The existing locations and associated permit numbers for each well are listed within Table 8 in the Supplemental Information.

Table 1: Well Pumping Capacity & Max Daily Production Capacity

Well Name	Well Pumping Capacity Production (gpm)	Max Daily Production Capacity (gpd) [1]	Annual Production Limits (MG)
No. School	93.8	89,100	32.85
So. School	93.8	89,100	32.85
Ridgeview #5	112.6	107,100	39.45
Total	300	285,300	105.15

Notes:
[1] Maximum daily production was estimated by using a sixteen (16) hour pumping cycle. The 16-hour pumping cycle is being used for the purpose of long-term drought and sustainability planning and does not actually reflect well capacity if pumping at 24 hours a day.

The three wells have a total annual production ranging from 20.2 to 48.5 million gallons, with the largest production year being 2021 (48.5 MG). However, a substantial portion of IHGID demands is supplied via Minden's water with a total annual delivery ranging from 17.7 to 19.3 MG. Overall, the production capacity of a system as identified in this report is the summer-time capacity since water demand increases five (5) to fifteen (15) times compared to winter-time demands. The maximum monthly production of IHGID's wells for all 5 years occurred between June – September with the maximum occurring in July 2020 (9.7 MG). The maximum monthly delivery from Minden for all five years occurred in August 2019 (38.7 MG). Water demands and production increase in the summer months due to higher temperatures and increased irrigation. From the maximum monthly production, the average day max month (ADMM) can be calculated by dividing the average max month by the number of days within a month (31). The ADMM was used along with the maximum pumping capacity to see the current deficiencies in the system. As seen within Figure 1, the current 5-Year ADMM is still below the maximum production capacity for the IHGID wells and Minden intertie. For a breakdown of production of the wells by month, reference Table 2, and Table 3. For the yearly production of all wells broken down by month and the Minden intertie consumption by month, reference Table 9 and Table 10 in the Supplemental Information section.

Table 2: Historical Monthly Well Production

Month	Monthly Well Production (Gallons)					
	2018	2019	2020	2021	2022	2018-2022 Average Max Month Daily Demand (ADMM)[1]
June	590,000	2,880,000	5,030,000	8,000,000	8,600,000	167,333
July	3,770,000	3,330,000	9,700,000	8,100,000	9,200,000	227,333
August	6,000,000	4,200,000	8,150,000	8,500,000	8,200,000	233,667
September	5,250,000	3,210,000	7,700,000	7,600,000	6,600,000	202,400

Notes:
[1] The ADMM is purely for the demand required from the three wells that supply a portion of the overall demand of IHGID.

= Maximum Month

Table 3: Historical Town of Minden Water Production

Month	Monthly Well Production (Gallons)					
	2018	2019	2020	2021	2022	2018-2022 Average Max Month Daily Demand (ADMM) [1]
June	29,139,000	27,240,000	28,930,000	27,327,000	29,051,000	944,580
July	34,426,000	33,359,000	30,250,000	31,551,000	19,861,000	964,174
August	34,245,000	38,650,000	29,374,000	30,504,000	37,068,000	1,095,748
September	28,816,000	23,352,000	24,205,000	24,900,000	26,369,000	850,947

Notes:
[1] The ADMM is purely for the demand required for the water supplied via the intertie agreement with Minden

= Maximum Month

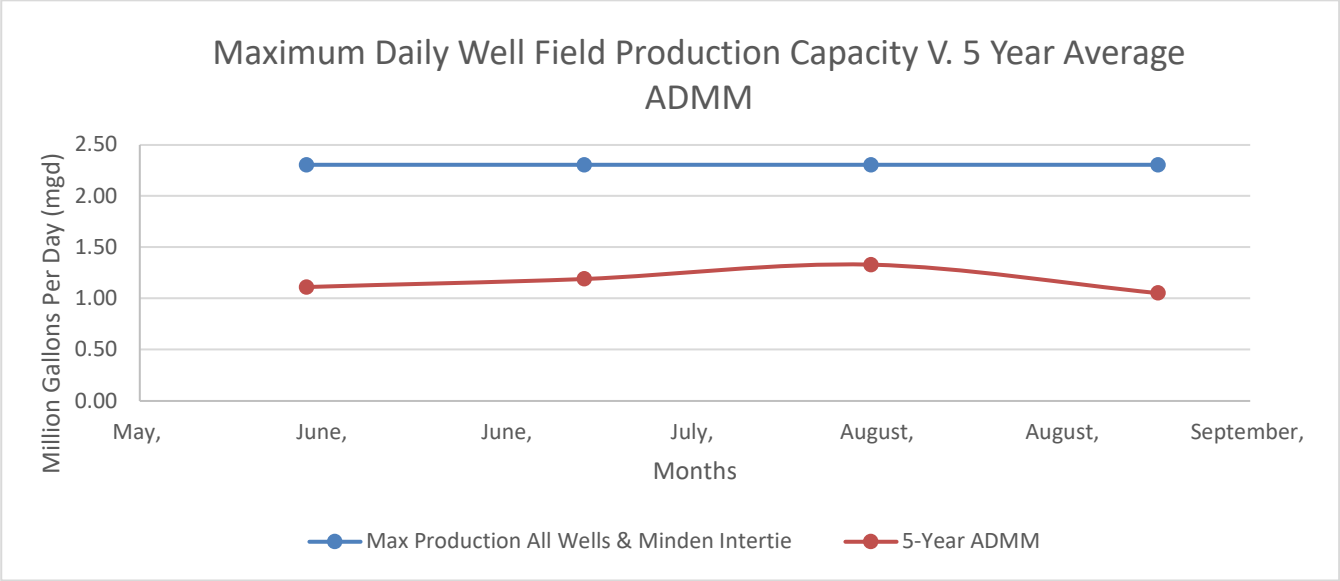


Figure 1: Maximum Water Capacity

2.2 Growth Projections and Future Projection

To estimate the growth in water production for IHGID, a planning period from 2021 through 2051 (30 years) was analyzed using a growth rate from the State Demographer for Douglas County. Due to the limited foreseen growth of the area because of space constraints, a lower growth rate was used than neighboring Douglas County purveyors (0.54% year over year). Figure 2 illustrates the annual well production required using the State Demographer growth rate over the 30-year planning horizon. Table 11, in the Supplemental Information, provides an in-depth breakdown of the growth rate over the 30-year planning horizon.

Due to the limited space for potential development, growth within IHGID is limited and was considered when assuming the growth analysis. However, this is a high-level estimate of production growth and should be evaluated frequently to ensure demands can be met within the IHGID service territory.

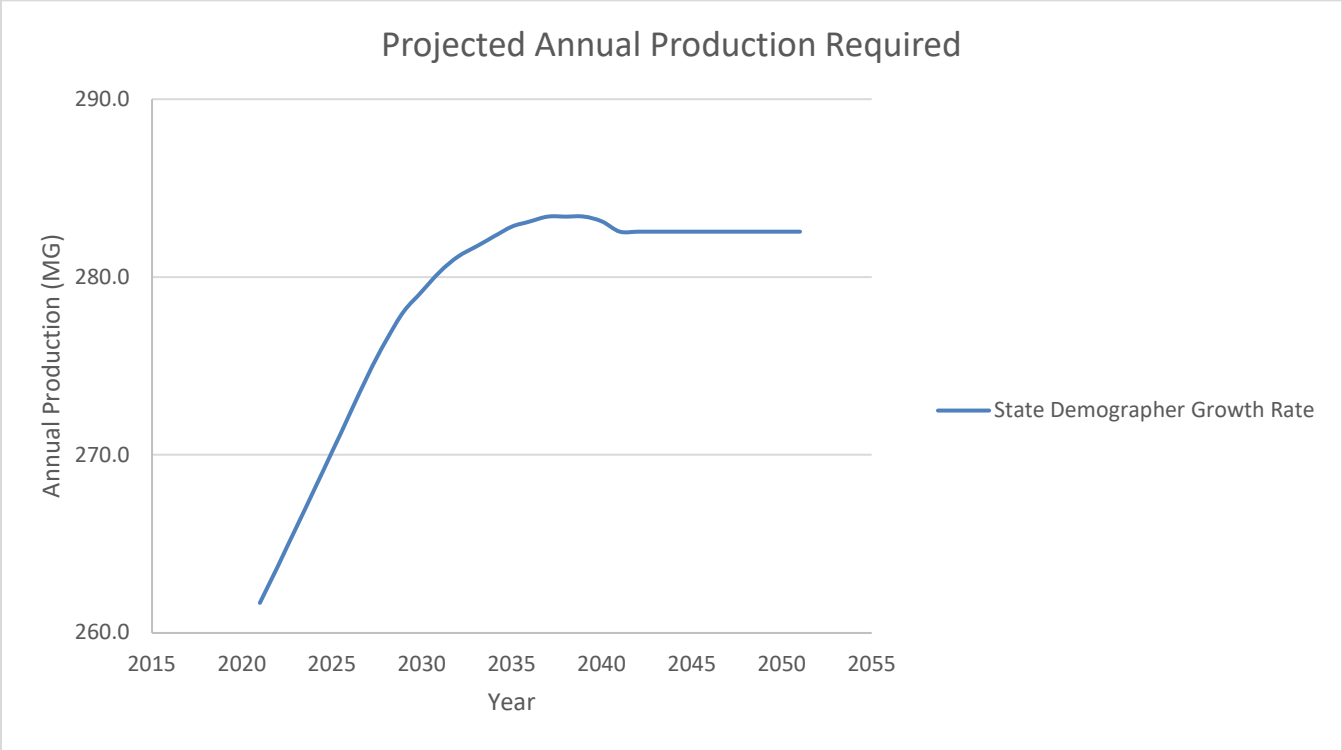


Figure 2: Projected Annual Production

2.3 Estimated Future Water Production

To estimate future water 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 IHGID. The calculated demand for IHGID in 2051 was approximately 283 MG. On Figure 3, the future estimated ADMM for the State Demographer growth rate is compared against current available production capacity. The State Demographer Growth projections are below the maximum well production capacity of the three wells and the Minden intertie agreement. An additional 420 gpm is available above the 2051 IHGID demands (1,980 gpm). For projected annual total production, see Table 11 in the Supplemental Information.

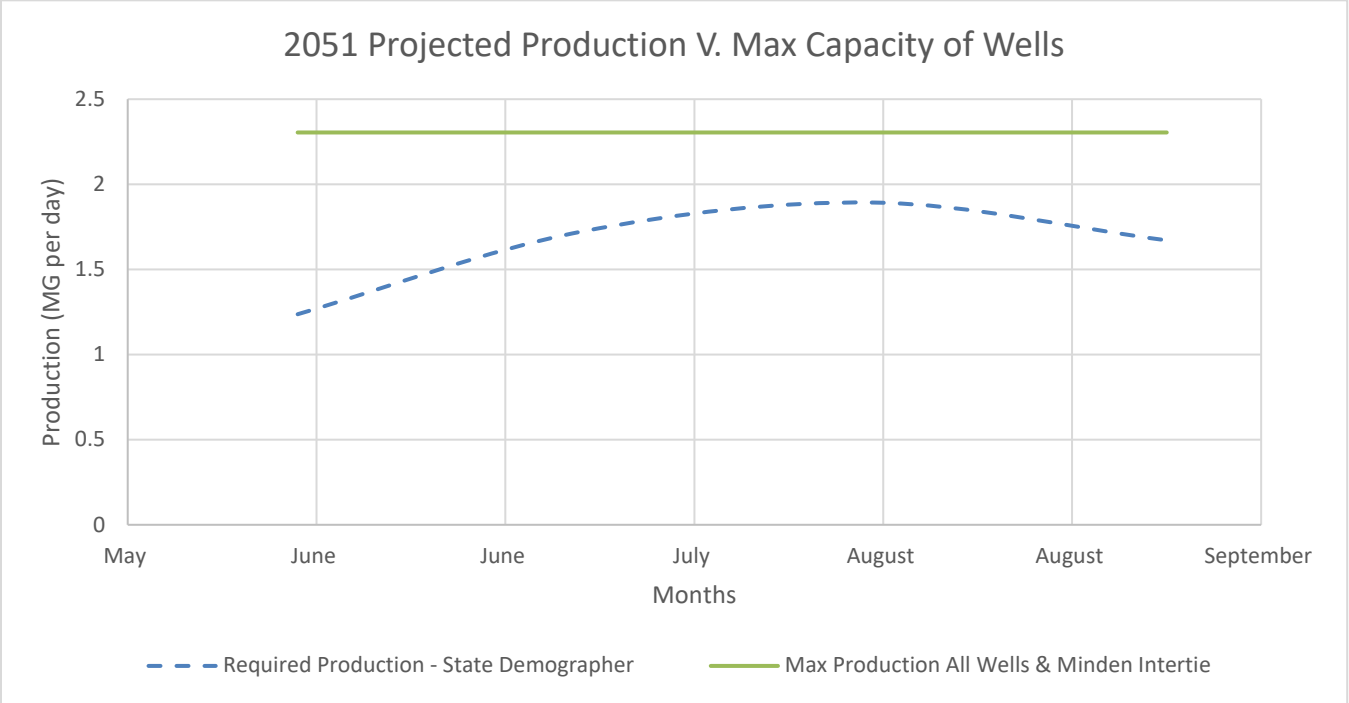


Figure 3: Projected 2051 Production V. Max Capacity of Wells

3.0 Water Quality

Water quality was analyzed using purveyor provided data from 2023. The data provided analyzes existing water quality for five (5) constituents: Total Dissolved Solids (TDS), Arsenic, Iron, Manganese, and Nitrogen. The North and South School wells were sampled together, and Ridgeview #5 was sampled separately. The Ridgeview #5 well has higher contaminant concentrations than the school wells. There are no contaminants that exceed the EPA limits for the IHGID wells. For individual constituent well concentrations, see Table 4. Since a large amount of water supplied to IHGID comes from Minden's wells, a summary of the water quality for Minden has been provided below.

Table 4: Contaminants Concentration for IHGID

Well	Contaminant	IHGID Average	MCL
	mg/L		
Nitrogen			
No. and So. School	1.8	3.25	10
Ridgeview #5	4.7		
Arsenic			
No. and So. School	0	0.0018	0.01
Ridgeview #5	0.0035		
TDS			
No. and So. School	210	290	1,000
Ridgeview #5	370		
Chloride			
No. and So. School	12	24	400
Ridgeview #5	36		
Sodium			
No. and So. School	32	41	200
Ridgeview #5	50		
Sulfate			
No. and So. School	0	17	500
Ridgeview #5	34		
Magnesium			
No. and So. School	4	10.50	150
Ridgeview #5	17		

Water quality was also analyzed for the Town of Minden using historical purveyor provided data from 1992 through 2013. The data provided analyzes existing water quality per well for arsenic. This data does not include water quality records for Well#6, Well#7, Well#9, Well#10, and Well#11. Three (3) wells (Well#8, Well#4 and Well#2) have had spot samples of arsenic concentrations above the maximum concentration limit (MCL) of 10 parts per billion (ppb). However, these spot samples are accounted to low activity at the well and as pumping continues arsenic levels appear to trend downward. The water distributed to residents of IHGID is a mixture of IHGID wells and Town of Minden water. The yearly concentrations for Town of Minden are shown in Table 5.

Table 5: Contaminants Concentration for Town of Minden

CONTAMINANT	MCL	Arsenic 10(ppb)
Well 1	2009	4
	2010	7
	2011	7
	2012	7
	2013	7
Well 2	2009	10
	2010	10
	2011	7
	2012	8
	2013	8
Well 3	2009	4
	2010	7
	2011	4
	2012	4
	2013	4
Well 4	2009	8
	2010	4
	2011	8
	2012	7
	2013	10
Well 5	2009	9
	2010	7
	2011	7
	2012	9
	2013	7
Well 8	2009	10
	2010	12
	2011	8
	2012	10
	2013	9

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4.0 Water Rights

IHGID has 25 water rights applications which includes three (3) active wells, the Town of Minden intertie, and six (6) inactive wells. The total combined duty of the water rights for the three active wells is 221 AF annually with a combined diversion rate of 740 gpm. The current annual production is 148.5 acre-feet per year (AFA). Projected production based on the State Demographer (IHGID growth rate) is 160 AF. Based on this projected total, the IHGID system has sufficient capacity for the 30-year planning period.

5.0 Summary

For the beginning of the planning period (2021), IHGID currently has adequate well production capacity (2.3 MG/day) to meet the demands of its community (1.33 MG/day) and negligible water quality issues impacting their system. Based on the planning horizon of 30-years (2021 to 2051) and the State Demographer growth rate used in the analysis, IHGID has sufficient water rights (221 AFA) to account for future growth in 2051 (160 AFA). As development continues and the population grows within IHGID, the future required well production capacity will be 1.89 MG/day and is below the current capacity of 2.30 MG/day from the three (3) active wells and the Minden Regional intertie. 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 6.

Table 6: Summarize Existing and Future Production

	Mgal/day	gal/min
Existing (2021) Water Supply Capacity[1]	2.30	2,400
Existing (2021) Water Demand	1.33	1,390
Existing (2021) Water Supply Deficit/Surplus	0.97	1,010
Future (2051) Water Demand[2]	1.89	1,980
Future (2051) Water Supply Deficit/Surplus[3]	0.41	420

[1] Existing water supply capacity includes production from the following wells: North School Well, South School Well, and Ridgeview #5 Well. This also includes water supply capacity from the intertie from Minden.
[2] The water demand in 2051 assumes the State Demographer 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). The deficit has been rounded up to provide a more conservative estimate.

5.1 Mitigation Options

The current (1.33 MG/day) demand and future demand in 2051 (1.89 MG/day) is below the maximum well capacities and Minden intertie (2.30 MG/day), as shown in Figure 1 and Figure 3. Based on the current data and methodology used for the analysis, IHGID's current water supply of three (3) wells and Minden intertie are sufficient for the projected growth in the service area and will not require additional wells to meet the projected water demand of 1,980 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 current analysis shows. 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

5.2 Modeling Options

The option that would be recommended for modeling purposes has been summarized below and in Table 7. The option uses the State Demographer's growth rate. A summary of the projected population growth per year over the 30-year planning horizon can be found in Table 11. This is not a recommendation to the purveyor and purely an assumed option for modeling purposes.

Option 1: Run existing wells at existing capacities.

Table 7: Modeling Options

Options	North School Well	South School Well	Ridgeview #5 Well	Total
Option #1 (gpm)	93.8	93.8	112.6	300
Notes: [1] Max well production was assumed that wells could run 16 hours of the day during the peak months of June through September.				

6.0 Supplemental Information

Table 8: Existing Well Locations and Depths

Parameter	North School	South School	Ridgeview #5
Well Depth (ft)	315	350	240
Screened Interval from (ft)	130	100	-
Screened Interval to (ft)	315	345	-
Latitude	39.09	39.09	39.09
Longitude	119.79	119.79	119.77
Elevation (ft)	4902	4897	4791

Table 9: Historical Total Monthly Well Production

	Monthly Well Production (Gallons)					
Month	**2018**	**2019**	**2020**	**2021**	**2022**	**2018-2022 Average**
January	473,000	400,000	470,000	1,020,000	1,100,000	692,600
February	452,000	343,000	640,000	400,000	1,000	367,200
March	604,000	390,000	430,000	250,000	0	334,800
April	390,000	510,000	1,330,000	450,000	0	536,000
May	481,000	1,140,000	2,960,000	7,400,000	4,217,000	3,239,600
June	590,000	2,880,000	5,030,000	8,000,000	8,600,000	5,020,000
July	3,770,000	3,330,000	9,700,000	8,100,000	9,200,000	6,820,000
August	6,000,000	4,200,000	8,150,000	8,500,000	8,200,000	7,010,000
September	5,250,000	3,210,000	7,700,000	7,600,000	6,600,000	6,072,000
October	3,260,000	2,860,000	5,700,000	2,500,000	1,800,000	3,224,000
November	425,000	450,000	1,300,000	2,400,000	500,000	1,015,000
December	364,000	500,000	1,300,000	1,900,000	600,000	932,800
Total	22,059,000	20,213,000	44,710,000	48,520,000	40,818,000	35,264,000
Average Day (gpd)	60,436	55,378	122,158	132,932	111,830	96,547
Max Month (gallons)	6,000,000	4,200,000	9,700,000	8,500,000	9,200,000	7,520,000
ADMM (gpd)	193,548	135,484	312,903	274,194	296,774	242,581

= Maximum Month

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Table 10: Historical Water from Town of Minden Intertie

Month	Monthly Production (Gallons)					
	2018	2019	2020	2021	2022	2018-2022 Average
January	9,905,000	10,537,000	8,635,000	9,005,000	8,802,000	9,376,800
February	7,035,000	9,989,000	8,713,000	8,349,000	9,175,000	8,652,200
March	7,278,000	10,828,000	8,401,000	9,436,000	10,463,000	9,281,200
April	12,215,000	16,437,000	17,071,000	20,950,000	19,905,000	17,315,600
May	20,107,000	29,259,000	29,217,000	24,455,000	25,114,000	25,630,400
June	29,139,000	27,240,000	28,930,000	27,327,000	29,051,000	28,337,400
July	34,426,000	33,359,000	30,250,000	31,551,000	19,861,000	29,889,400
August	34,245,000	38,650,000	29,374,000	30,504,000	37,068,000	33,968,200
September	28,816,000	23,352,000	24,205,000	24,900,000	26,369,000	25,528,400
October	16,975,000	14,340,000	16,769,000	12,828,000	19,844,000	16,151,200
November	12,062,000	9,833,000	10,002,000	7,205,000	8,818,000	9,584,000
December	9,422,000	7,898,000	8,123,000	6,657,000	9,614,000	8,342,800
Total	221,625,000	231,722,000	219,690,000	213,167,000	224,084,000	222,057,600
Average Day (gpd)	607,192	634,855	600,246	584,019	613,929	608,048
Max Month (gallons)	34,426,000	38,650,000	30,250,000	31,551,000	37,068,000	34,389,000
ADMM (gpd)	1,110,516	1,246,774	975,806	1,017,774	1,195,742	1,109,323

= Maximum Month

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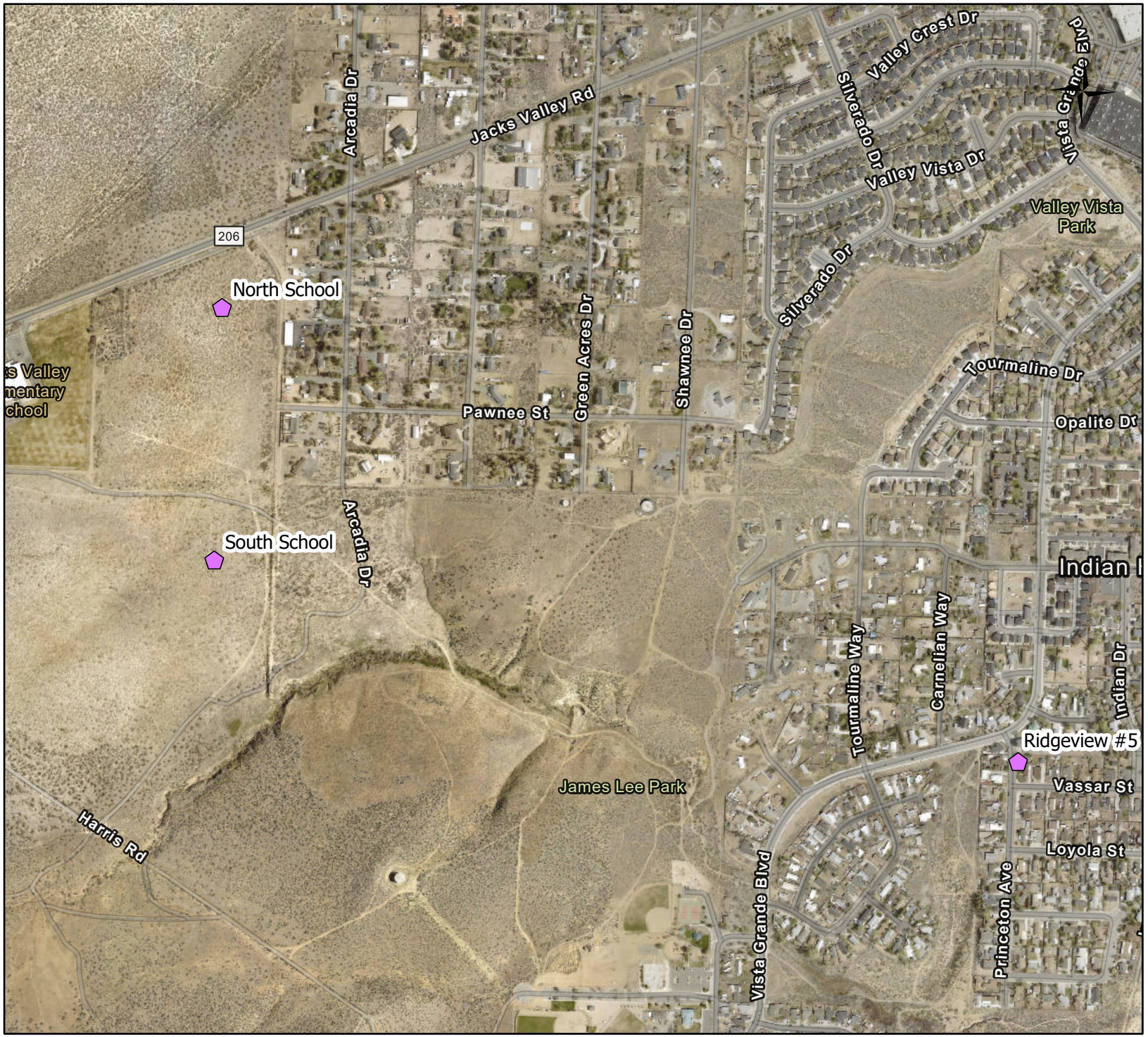
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Table 11: Future Water Production

Year	State Demographer Growth Rate	Projected Flow	
		Gallons	MG
2021	0.8%	261,687,000	261.7
2022	0.8%	263,780,000	263.8
2023	0.8%	265,890,000	265.9
2024	0.8%	268,017,000	268.0
2025	0.8%	270,161,000	270.2
2026	0.8%	272,322,000	272.3
2027	0.8%	274,501,000	274.5
2028	0.7%	276,423,000	276.4
2029	0.6%	278,082,000	278.1
2030	0.4%	279,194,000	279.2
2031	0.4%	280,311,000	280.3
2032	0.3%	281,152,000	281.2
2033	0.2%	281,714,000	281.7
2034	0.2%	282,277,000	282.3
2035	0.2%	282,842,000	282.8
2036	0.1%	283,125,000	283.1
2037	0.1%	283,408,000	283.4
2038	0.0%	283,408,000	283.4
2039	0.0%	283,408,000	283.4
2040	-0.1%	283,125,000	283.1
2041	-0.2%	282,559,000	282.6
2042	0.0%	282,559,000	282.6
2043	0.0%	282,559,000	282.6
2044	0.0%	282,559,000	282.6
2045	0.0%	282,559,000	282.6
2046	0.0%	282,559,000	282.6
2047	0.0%	282,559,000	282.6
2048	0.0%	282,559,000	282.6
2049	0.0%	282,559,000	282.6
2050	0.0%	282,559,000	282.6
2051	0.0%	282,559,000	282.6

Notes:
[1] Total Projected Production is based off the State Demographer growth rate described in Section 2.2 and is the total of all wells and the Minden intertie in gallons.



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WELL LOCATIONS
IHGID

CWSD

30-YEAR REGIONAL DROUGHT PLAN

1 OF 1

LEGEND

- IHGID Wells

Paper Size: 8.5" x 11"

0 500 1,000
Feet

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

Date:	1/9/2024
Project #:	10974.000
Revision:	2