Hydrology Report - Well Supply Area of Influence

Subject Property:

Bell Hill

Property Location:

1496 Bell Hill Rd

Kelseyville, CA 95451

APN 017-002-02

Prepared by:

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INTRODUCTION

The purpose of this study is to determine the area of influence due to the use of an existing well for proposed commercial cannabis project. Development encompasses a total of 70,560 SF of commercial cannabis canopy area plus 168,680 SF of cultivation area at 1496 Bell Hill Rd, Kelseyville CA on Lake County APN 017-002-02.

Ancillary facilities include eight greenhouses, four immature plant greenhouses, one processing facility, one Drying Building, and various water storage tanks. Infrastructure will be built over a multi-year schedule in accordance with County guidelines for this property. Processing buildings will contain cannabis processing activities such as drying, trimming, curing, and packaging. There are no offsite residences within 200 feet of the proposed cultivation area.

This report estimates the amount of water available and recharge rate during a drought year from the existing well. In addition, this report estimates the zone of influence to the surrounding area to make sure that the proposed well use will not conflict with existing wells in the area.

WELL

The parcel has two existing wells although they do not show up on California Department of Water Resources (DWR) map application. Only one well will be used for this project, it is anecdotally called Well #1 for reference. This well is located to the west of the proposed development on the parcel.
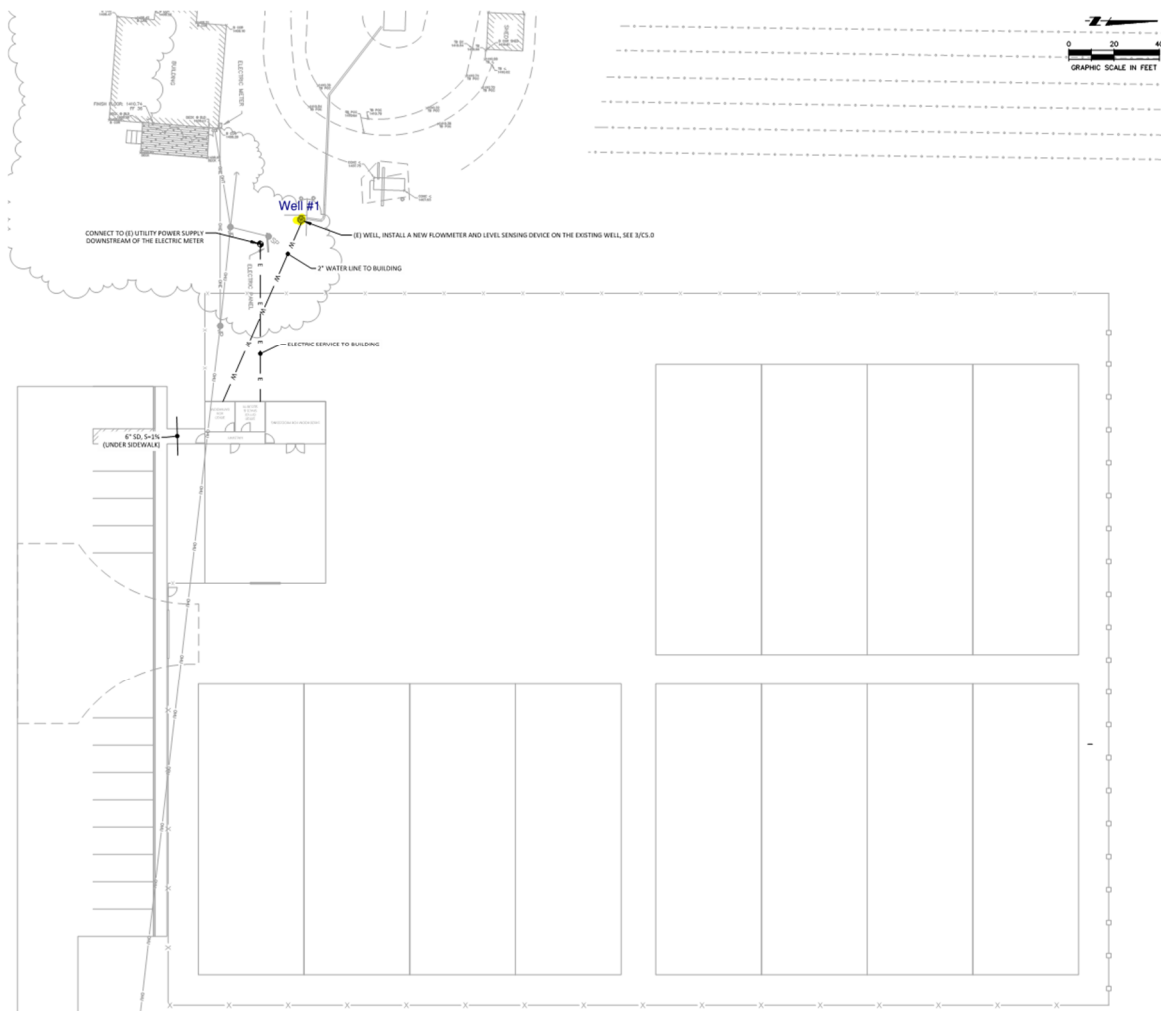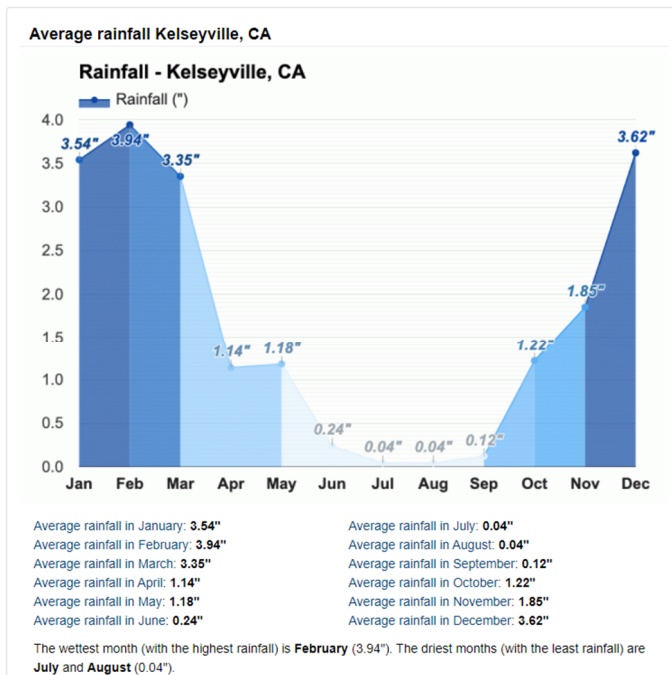

Well #1 yield test completed in 2020 showed that the capacity of the well is 680 gpm.

BASIS OF CALCULATION

The precise long-term yield of all wells cannot be estimated with extreme precision due to the inherent uncertainty with the aquifer, losses due to evaporations, and the amount of rainfall that percolates through the ground. Therefore, conservative estimates and assumptions are used in this report.

This study is based on the following information and assumptions:

1. Calculations for confined aquifers
2. Well Yield Test
3. 20.28 inches average annual rainfall
4. Aquifer is assumed to be uniform throughout the area of well influence
5. Peak monthly water usage is 152,385 gallons (see Appendix B)

Average rainfall Kelseyville, CA

Average rainfall in January: **3.54"**
Average rainfall in February: **3.94"**
Average rainfall in March: **3.35"**
Average rainfall in April: **1.14"**
Average rainfall in May: **1.18"**
Average rainfall in June: **0.24"**
Average rainfall in July: **0.04"**
Average rainfall in August: **0.04"**
Average rainfall in September: **0.12"**
Average rainfall in October: **1.22"**
Average rainfall in November: **1.85"**
Average rainfall in December: **3.62"**

The wettest month (with the highest rainfall) is **February** (3.94"). The driest months (with the least rainfall) are **July** and **August** (0.04").

CALCULATE DAILY AVERAGE WATER USE FLOWRATE

As shown in the facility monthly water use estimates (see Appendix B):

Monthly Water Use Estimates											
Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
48,785	48,785	48,785	87,649	126,476	139,431	152,385	152,385	152,385	126,476	77,252	48,785

Utilizing the peak month water usage, the daily average flowrate is:

$$Q = 152{,}385 \frac{gal}{month} \div 30 \frac{days}{month} \div 1440 \frac{min}{day}$$

Q = 3.52 gpm

Note this calculated average use flowrate demand from the well is several orders of magnitude smaller than the yield test pump rate (680 gpm) observed in the 2020 pump test (Appendix B).

CALCULATE ESTIMATED SPECIFIC CAPACITY

The well yield test showed a drawdown of 30 ft at a pumped flowrate of 680 gpm over the course of several hours.

$$S_c = \frac{Q}{s} = 680 \text{ gpm} \div 30 \text{ ft}$$

S_c = 226.7 gpm/ft

CALCULATE TRANSMISSIVITY

Utilizing the Theis (1935) nonequilibrium equation:

$$S_c = \frac{4\pi T}{\ln\left(\frac{2.25 T t p}{r_w^2 S}\right)}$$

Because this equation cannot be explicitly solved for transmissivity, it must be solved graphically or iteratively. Utilizing a spreadsheet for iterative analysis yields:

T = 185.3 gpd/ft

CALCULATE RADIUS OF INFLUENCE

Utilizing the Cooper and Jacob (1946) equation for drawdown for computing the radius of influence for confined aquifers with a short period of pumping:

$$R = \sqrt{\frac{2.25 T t}{S}}$$

$$R = \sqrt{\frac{2.25 * 185.3\frac{gpd}{ft} * 1\,day}{0.01}}$$

R = 204.2 ft

       R = Radius of Influence (ft)

       t = time (days), assume one day for calculation purposes

       T = transmissivity (gpd/ft)

       S = water storage capacity (unitless), assume 0.01 for calculation purposes

WELLS IN SURROUNDING AREA

Data from existing wells in the area was obtain through the California Department of Water Resources online portal. As seen in the attached site map (Appendix A), the neighboring wells are outside of this zone of influence.

AQUIFER RECHARGE

The proposed project has an estimated total annual estimated water usage of 1,099,624 gallons per the project management plan, see Appendix B.

Utilizing an average annual precipitation value of 20.28 inches per year, recharge potential from rainfall is calculated as follows:

Basis of calculation

Project Total Area = 239,240 SF (5.49 acres)

Rainfall (average) = 20.28 in/yr

Rainfall percolating into soil reaching aquifer = 50% to account for evaporation and other losses

Recharge Volume = Area x Rainfall x Percolation Percentage

$$V_{avg} = 239{,}240 \; ft^2 * 20.28 \frac{in}{yr} * 50\% * \frac{ft}{12 \; in} * 7.48 \frac{gal}{ft^3} = 1{,}515{,}140 \text{ gal/yr}$$

The estimated recharge rate is much higher than the estimated facility annual water use (1,099,624 gal/yr).

It is important to note that the lot size is 72.8 acres which is significantly larger than the facility coverage area used above for recharge capacity analysis. It is an agricultural area with minimal impervious areas on the lot and rainfall percolating on the property will recharge the local aquifer.

CONCLUSION

As demonstrated above, the project has adequate water supply for the proposed uses and the radius of influence is smaller than the distance to neighboring wells. The average flowrate demand is minimal compared with the theoretical well yield demonstrated by the well pump testing.

Appendix A

Well Location Map

8/18/2021

Well Completion Report Map Application

WCR Number	Legacy Log Number	Well Location	City	Permit Number	Record Type	Planned Use/Former Use	Decimal Latitude	Decimal Longitude	APN	Date Work Ended	Total Completed Depth	Top Of Perforated Interval	Bottom of Perforated Interval	Casing Diameter	Static Water Level	Well Yield	Well Yield Unit of Measure
WCR2016-001627	992440	1650 Bell Hill RD	Kelseyville	WE4624	WellCompletion/New/Production or Monitoring/NA	Water Supply Irrigation - Agriculture	38.962781	-122.883354	007-009-08	10/20/2015	206	189	196	12	55		
WCR2016-001629	992439	1650 Bell Hill RD	Kelseyville	WE4624	WellCompletion/Drill and Destroy/NA/NA	Destruction Test Well	38.960888	-122.8830949	007-009-08	9/29/2015					115		
WCR2017-012062	E0347708	1505 BELL HILL RD	KELSEYVILLE	None	WellCompletion/New/Production or Monitoring/NA	Water Supply Domestic	38.959058	-122.883408	7010210	7/9/2017	110	30	110	5	16	25	GPM
WCR1971-001652	59261			None	WellCompletion/New/Production or Monitoring/NA	Water Supply Irrigation - Agriculture	38.9609839	-122.8854917		4/30/1971	99						
WCR2016-001605	952151	6860 Boggs LN	Kelseyville	WE4627	WellCompletion/New/Production or Monitoring/NA	Water Supply Domestic	38.956164	-122.883543	007-010-49	11/8/2015	110	90	110	4	27	50	GPM

Find address or place

Harvey Dr

Bell Hill Rd

(E) Well #1

Project site
1496 Bell Hill Rd

WCR2016-001627

204' radius zone of
influence from well

1/3 mile radius from
project site

WCR1971-001652

WCR2016-001629

WCR2017-012062

WCR2016-001605

600ft

Esri Community Maps Contributors, Lake County, CA, BuildingFootprintUSA, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, Bureau

Enclosure B

Well Yield Test
Water Use Estimates

Well #1

WELL TEST REPORT

JOB _Mike Burkson_ SIZE TURBINE _40hp_

LOCATION _1496 Bell hill rd. kelseyville_ SETTING _Unknown_

WELL DEPTH _Unknown_ CASING SIZE _10in liner_ STATIC LEVEL _92 Ft_

DATE STARTED _9-15-2020_ DATE COMPLETED _9-15-2020_

DATE	TIME		OPERATOR	G.P.M.	DRAWDOWN	WATER COLOR
	A.M.	P.M.				
9-15-2020	8:00			680	92 Ft	Clear
	8:30			680	122 Ft	
	9:00			680	122 Ft	
	10:00			680	122 Ft	
	10:30			680	122 Ft	
	11:00			680	122 Ft	
	11:30			680	122 Ft	
		12:00	End run time	680	122 Ft	↓
		12:00	Start recovery	0		
		12:30		0	96	
		1:00		0	95	
		1:30		0	95	
		2:00		0	95	
		2:30		0	94	
		3:00		0	94	
		3:30		0	94	
		4:00		0	94	
9-16-2020	9:00			0	92 Ft	

COMMENTS:

Well #1

At this time we feel this well is capable of (gpm)

Note: All result are subject to change depending on time of year and weather conditions.

Water Use Management Plan

Purpose

This Water Use Management Plan is designed to conserve Lake County's water resources and to ensure that the proposed cultivation operation's water use practices are in compliance with applicable County, State, and Federal regulations at all times. This Water Use Management Plan focuses on designing a water efficient delivery system and irrigation practices, and the appropriate and accurate monitoring and reporting of water use practices. The Water Use Plan aims to provide details for all the sources of water on the property, how it will be used and its amount of use.

A. Water Sources and Irrigation

Water is provided to North Coast Select's proposed cultivation operation from a groundwater well, located at Latitude 38.96160 (N), -122.88720 (W) (via google maps imagery). The Well Completion Report is included in the submittal of this management plan. The well located at the center of the property will pump water to the thirty-two 2,500-gallon (one steel/fiber glass) water tanks. Water will then be delivered to the cannabis plants using highly efficient drip irrigation. Water lines are a combination of PVC piping, black poly tubing, and drip lines. The water storage tanks will be equipped with float valves to prevent overflow and runoff of irrigation water when full. Additionally, safety valves will be equipped to supply lines in case the flow of water needs to be stopped in an emergency situation. A meter compliant with Title 23, Division 3, Chapter 2.7 of the California Code of Regulations will be installed and attached to the water system in order to record continuous data that will be maintained for a 5-year duration minimum. All records will be made available to all interested state and county departments upon request. The monitoring of the well will begin 3 months prior to the use of the well for cultivation.

The 2 meters to be installed on the well will be:

- A totalizing well meter that continuously measures the total water output. The consultant for the project has recommended the use of the GPI G2 Series meter depending on the well configuration. Please see attached product sheet on the final page of the management plan.
- A continuously recording water level monitor. The consultant for the project has recommended the use of the Well Watch 670. Please see attached Product sheet for more details. Please see attached product sheet on the final page of the management plan.

*If the professional installation company recommends different meters, the new well meter specifications will be supplied to water resources.

B. Projected Water Use

Due to the federally illegal status of cannabis, the industry is far behind other crops in water use studies. While few exist, it is probable that the resulting water use numbers from these studies are only accurate to a certain degree, particularly as water use is extremely dependent upon the natural conditions of the location where cultivation is taking place. According to Bauer et al. (2015), a study of water use in Northern California determined cannabis plants used approximately 22.7 liters per day, which translates to roughly 5.99 gallons per day. It has also been documented through CalCannabis's Final Programmatic Environmental Impact Report that outdoor cannabis uses between 25-35 inches per year, based on Hammon et al. (2015). The PEIR also stated that it is comparable to other crops such as corn, tomatoes, alfalfa, and hops. However, projecting cannabis water use in line with that of tomatoes (20 inches per year) would likely be the absolute minimum as the few water use studies published have been more in line with 25-35 inches per year.

It is almost a certainty that water use will differ between projects, based on soil type, irrigation method, and growing method, among other factors, however, through well monitoring these estimates can be replaced with much more robust numbers in the future. For the purposes of this Water Use Management Plan, the following table below will display water use estimates based on range of probable outcomes starting at 20 inches (a probable best case scenario) up to 35 inches (a probable worst case scenario) of water per year and a total canopy area of 70,560 ft^2. The average (27.5 inches) being the projected water use total for this project until further data is captured.

Total Project Water Use Estimates*	
Inches	Gallons
20-25 (best case scenario)	879,699 - - - 1,099,624
25-30 (likely scenario)	1,099,624- - - 1,319,549
30-35 (worst case scenario)	1,319,549- - - 1,539,474
Estimated Water Use Total for Project*	
25 Inches is estimated	*1,099,624**

Monthly Water Use Estimates											
Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
48,785	48,785	48,785	87,649	126,476	139,431	152,385	152,385	152,385	126,476	77,252	48,785

*Estimates based on data from available published studies and are unlikely to reflect the true water use of this project. Actual water use could be lower or higher depending on conditions and methods of irrigation. By utilizing micro drip irrigation, water use is more likely to be lower than the estimated water use total.

Methodology:
Approximately 27,154 gallons of water equals one inch of water per year for one acre (USGS). To achieve the total amount of gallons, the gallons per inch per acre was multiplied by the number of inches. A foot being 12 inches, therefore, one-acre foot of water would be approximately 325,850 gallons of water, with 27.5 inches yielding a value of 746,740 gallons per acre for outdoor. Due to the cultivation being grown inside of greenhouses where the temperature can be regulated more easily, it is anticipated that this project will likely be closer to the 25 inches.

C. **Water Conservation**

In accordance with the State Water Quality Control Board Cannabis General Order, the project will implement the following BMPs and mitigation techniques to help conserve water over the duration of the project.

- A visual monitoring inspection program will be implemented to check the following, at a minimum frequency of before each rain event.

  - All water conveyance areas and storm water drainage areas to identify any spills, leaks, or uncontrolled pollutant sources.

- Will use drip lines for water delivery to the plants in order to efficiently and effectively irrigate.

- The areas inside the cultivation area without ground cover will be applied with mulch to conserve soil moisture within the grow area.

- An inline water meter will be installed on the dripline supply line as well as the water storage tanks in order to accurately determine where and how much water is being used. Staff will record and log all data in order to be reviewed annually to see the projects water use.