



Hydrology Report to Determine Area of Influence for Cultivation Irrigation Wells

for

Vann Ranch

Cultivation Project Location:

APN: 002-021-(04,15,16 & 17)
15365, 15263, 15095 & 15187 Elk Mountain Road
Upper Lake, CA 95485

Well Location:

APN: 002-021-(17 & 23)
15187 & 15525 Elk Mountain Road
Upper Lake, CA 95485

September 29, 2021

Prepared for:

Lake County
Community Development Department
255 North Forbes Street
Lakeport, CA 95453





INTRODUCTION

The purpose of this study is to provide adequate information of the water usage and the impacts to the surrounding area for a proposed commercial cannabis cultivation site. The site is proposing a maximum 193,800 sq.ft. (4.45 acres) of commercial cannabis canopy area.

The parcels on which the project and wells are located is owned by Vann Ranch and managed by Omar Malfavon.

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 radius of influence to the surrounding area and estimates the cumulative impacts where interference is with existing wells.

The report comes as a result from the County of Lake urgency ordinance requiring land use applicants to provide enhanced water analysis during a declared drought emergency. Ordinance no. 3106.

STUDY LIMITATIONS

The yield of wells cannot be estimated with precision because of the uncertainty with the aquifer and the amount of rain percentage 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.

- Cooper – Jacob well equation
- Well Completion Reports obtained from Lake County EHD and CA Dept. of Water Resources Database
- Well Yield Test and Drillers Reports
- Rainfall for a drought year is 20% of annual precipitation
- Aquifer is uniform throughout the wells area of influence



WELL

Well #1, #2, and #3 are the wells that will be used for irrigating the proposed cultivation project. A radius of influence was calculated for all three wells. A 1000 ft radius was placed around the radius of influence of the three wells. Typically, we run calculations for any wells that fall within any of the 1000 ft radii, but for this project there were none. See Well Area of Influence Map in Appendix B.1. Wells included in calculations are wells #1 - #3. See the Surrounding Area Map in Appendix B.2 for the 1000 ft radius. Locations of other wells outside the 1000 ft radius are depicted with coordinates on the Surrounding Area Map in Appendix B.2. All wells were located using information gathered from the County of Lake Environmental Health Department and the CA Department of Water Resources. See well descriptions below.

WELL #1

- Southern vicinity of APN: 002-021-23.
- See Appendix A for well drillers report and Appendix B for well maps.
- Total drill depth of 300 feet.
- The capacity of the well is at least 50 gpm.
- Use: "Vann Ranch" Commercial Cannabis Irrigation

WELL #2

- Northeast vicinity of APN: 002-021-17.
- See Appendix A for well drillers report and Appendix B for well maps.
- Total drill depth of 260 feet.
- The capacity of the well is at least 10 gpm.
- Use: "Vann Ranch" Commercial Cannabis Irrigation

WELL #3

- Southwest vicinity of APN: 002-021-17.
- See Appendix A for well drillers report and Appendix B for well maps.
- Total drill depth of 200 feet.
- The capacity of the well is at least 15 gpm.
- Use: "Vann Ranch" Commercial Cannabis Irrigation

See Appendix A for Well Completion/Drillers Reports.



WELL RADIUS OF INFLUENCE

The well radius of influence (cumulative impact) is estimated by the Cooper-Jacob equation:

$$R_{(well)} = \sqrt{\frac{2.24584Tt}{S}}$$

Where,

- $R_{(well)}$ = Radius of Influence (m)
- t = time (days)
- T = transmissivity (m² / day)
- S = water storage capacity (%) unitless

$$T = K * b$$

Where,

- K = 2.0 E-4 m/s for Basalt porosity
- b = (Total Drill Depth of Well) - (pump depth below clay layer in Well Driller's Report in Appendix A)
- t = 1 day = 86,400 sec
- S = 0.15

Therefore;

- $R_{(1)}$ => 142 m = 465 feet
- $R_{(2)}$ => 130 m = 427 feet
- $R_{(3)}$ => 105 m = 345 feet

There is no intersection between radius of influence for any of the wells. See Well Area of Influence Map in Appendix B.1.



WATER USAGE

The proposed project has a total canopy area of 4.45 acres (193,800 sf) with four Storage Containers for 15 employees during grow season and 30 employees during harvest season. These values were used for calculating the total water usage in gallons per year. See calculations below.

WATER USAGE FOR WELL #1

The total water usage of the canopy area is estimated by the square footage of the canopy multiplied by the ft/year needed for a single cannabis plant. The ft/yr is estimated to be similar to a tomato plant, which is 20in/year or 1.66 ft/year.

$$W_{\text{Irrigation}} = A * (\text{ft/yr})$$

$$W_{\text{Irrigation}} = (4.45 \text{ acres}) * (43,560 \text{ sf/acres}) * (1.66 \text{ ft/year}) * (7.48 \text{ gal/cf})$$

$$W_{\text{Irrigation}} = 2,406,897 \text{ gal/year}$$

$$W_{\text{Processing Building (Harvest)}} = (30 \text{ employees}) * (15 \text{ gals/employee/day}) * (0.7 \text{ days/week used}) * (91 \text{ days/year}) = 28,665 \text{ gal/year}$$

$$W_{\text{Processing Building (Non-Harvest)}} = (15 \text{ employees}) * (15 \text{ gals/employee/day}) * (0.7 \text{ days/week used}) * (274 \text{ days/year}) = 43,155 \text{ gal/year}$$

$$W_{\text{Processing Building}} = 28,665 + 43,155 = 71,820 \text{ gal/year}$$

$$\begin{aligned} \text{Total Water Usage} &= W_{\text{Irrigation}} + W_{\text{Processing Building}} \\ &= 2,406,897 \text{ gal/year} + 71,820 \text{ gal/year} \\ &= 2,478,717 \text{ gal/year} \end{aligned}$$



AQUIFER RECHARGE

The proposed project has an estimated total annual water usage of 2,478,717 gallons per year.

The calculations of Aquifer Recharge are based on the tributary area to the radius of influence of Well #1, #2, and #3. Per Well Recharge Area Map shown in Appendix B.3, the total recharge area is 9,199,249 sf (Area A = 3,776,342 sf, Area B = 1,593,809 sf, Area C = 3,829,098 sf).

Given: Annual Precipitation, $P = 40$ inches per year, assume a drought year is 20% of the annual precipitation, yields 8" (0.667 ft) of rainfall. (Note: Rainfall of 2021 was 9" per NOAA for Lake County)

Volume of water for recharge = Area x Drought Precipitation x Coefficient of Seepage.

$$V = (3,776,342 \text{ sf} + 1,593,809 \text{ sf} + 3,829,098 \text{ sf}) \times (0.667 \text{ ft/yr}) \times (7.48 \text{ gal/cf}) \times (0.7)$$

$$V = 32,127,567 \text{ gal/year}$$

$32,127,567 > 2,478,717$ therefore the wells are adequate to handle the 4.45 acres of cultivation in a drought year.

CONCLUSION

Per our calculations and assumptions, the project does have a more than adequate water supply for at least double the proposed irrigation use. Even in a drought year, our estimates show that the wells have the capacity to handle more than double the proposed water irrigation needs of the project, without impacting the surrounding neighbor's wells.

DISCLAIMER

Our calculations are based on data that has been made available to Vanderwall Engineering through state and county records as of 9/29/2021. All supporting data has been provided in this report. There is no way to guarantee future conditions. If new supporting data is provided, calculations would need to be redone to take into account for said data.



Appendix

A. Well Completion & Test Results

B. Maps

- B1. Well Area of Influence Map
- B2. Surrounding Aerial Map
- B3. Well Recharge Area

Appendix

A

State of California
Well Completion Report
 Form DWR 188 In Review 9/30/2020
 WCR2020-011955

WELL #1

Owner's Well Number _____ Date Work Began 08/03/2020 Date Work Ended 08/06/2020
 Local Permit Agency Lake County Health Services Department - Environmental Health Division
 Secondary Permit Agency _____ Permit Number WE-5386 Permit Date 06/08/2020

Well Owner (must remain confidential pursuant to Water Code 13752)			
Name	<u>MIDDLE CREEK RANCH LLC,</u>		
Mailing Address	<u>P.O. Box 474</u>		
City	<u>Upper Lake</u>	State	<u>Ca</u> Zip <u>95485</u>

Planned Use and Activity	
Activity	<u>New Well</u>
Planned Use	<u>Water Supply Irrigation - Agriculture</u>

Well Location					
Address <u>15525 Elk Mountain RD</u>			APN <u>002-021-23</u>		
City	<u>Upper Lake</u>	Zip	<u>95485</u>	County	<u>Lake</u>
Latitude <u>39 15 27.04 N</u>		Longitude <u>-122 57 45.25 W</u>		Township	<u>16 N</u>
Deg. Min. Sec.		Deg. Min. Sec.		Range	<u>10 W</u>
Dec. Lat. <u>39.2575111</u>		Dec. Long. <u>-122.9625694</u>		Section	<u>10</u>
Vertical Datum _____		Horizontal Datum <u>WGS84</u>		Baseline Meridian	<u>Mount Diablo</u>
Location Accuracy <u>20 Ft</u>		Location Determination Method _____		Ground Surface Elevation	_____
				Elevation Accuracy	_____
				Elevation Determination Method	_____

Borehole Information	
Orientation	<u>Vertical</u> Specify _____
Drilling Method	<u>Direct Rotary</u> Drilling Fluid <u>Air</u>
Total Depth of Boring	<u>300</u> Feet
Total Depth of Completed Well	<u>253</u> Feet

Water Level and Yield of Completed Well	
Depth to first water _____ (Feet below surface)	
Depth to Static _____	
Water Level	<u>50</u> (Feet) Date Measured <u>08/06/2020</u>
Estimated Yield*	<u>50</u> (GPM) Test Type <u>Air Lift</u>
Test Length	<u>1</u> (Hours) Total Drawdown <u>190</u> (feet)
*May not be representative of a well's long term yield.	

Geologic Log - Free Form		
Depth from Surface Feet to Feet		Description
0	25	Soil and gravel
25	45	Soft clay
45	300	Sandstone

Casings

Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
1	0	93	Blank	PVC	OD: 6.625 in. SDR: 21 Thickness: 0.316 in.	0.316	6.625			
1	93	253	Screen	PVC	OD: 6.625 in. SDR: 21 Thickness: 0.316 in.	0.316	6.625	Milled Slots	0.032	

Annular Material

Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	52	Bentonite	High Solids		Surface Seal
52	253	Filter Pack	Other Gravel Pack	1/4	Pea Gravel
253	300	Other Fill	See description.		Native backfill

Other Observations:

Borehole Specifications		
Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	300	12.25

Certification Statement			
I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief			
Name	WEEKS DRILLING AND PUMP CO		
	Person, Firm or Corporation		
	PO BOX 176	SEBASTOPOL	CA 94573-
	Address	City	State Zip
Signed	<i>electronic signature received</i>	09/01/2020	177681
	C-57 Licensed Water Well Contractor	Date Signed	C-57 License Number

Attachments
002-021-23 Final Map.pdf - Location Map

DWR Use Only			
CSG #	State Well Number	Site Code	Local Well Number
_ _ _ _	_ _ _ _	_ _ _ _	_ _ _ _
N			W
Latitude Deg/Min/Sec			Longitude Deg/Min/Sec
TRS:			
APN:			

State of California
Well Completion Report
 Form DWR 188 In Review 9/30/2020
 WCR2020-003720

WELL #2

Owner's Well Number WW1 Date Work Began 02/24/2020 Date Work Ended 03/02/2020
 Local Permit Agency Lake County Health Services Department - Environmental Health Division
 Secondary Permit Agency _____ Permit Number WE-5253 Permit Date 10/09/2019

Well Owner (must remain confidential pursuant to Water Code 13752)			
Name	<u>MIDDLE CREEK RANCH LLC,</u>		
Mailing Address	<u>P.O. Box 474</u>		
City	<u>Upper Lake</u>	State	<u>Ca</u> Zip <u>95485</u>

Planned Use and Activity	
Activity	<u>New Well</u>
Planned Use	<u>Water Supply Irrigation - Agriculture</u>

Well Location									
Address <u>15187 Elk Mountain RD</u>					APN <u>002-021-17</u>				
City <u>Upper Lake</u>		Zip <u>95485</u>		County <u>Lake</u>		Township <u>16 N</u>			
Latitude <u>39</u> <u>15</u> <u>12.9599</u> <u>N</u>			Longitude <u>-122</u> <u>57</u> <u>31.8599</u> <u>W</u>			Range <u>10 W</u>			
Deg. Min. Sec.			Deg. Min. Sec.			Section <u>10</u>			
Dec. Lat. <u>39.2536</u>					Dec. Long. <u>-122.95885</u>				
Vertical Datum _____					Horizontal Datum <u>WGS84</u>				
Location Accuracy <u>20 Ft</u>					Location Determination Method _____				
					Baseline Meridian <u>Mount Diablo</u>				
					Ground Surface Elevation _____				
					Elevation Accuracy _____				
					Elevation Determination Method _____				

Borehole Information	
Orientation	<u>Vertical</u> Specify _____
Drilling Method	<u>Direct Rotary</u> Drilling Fluid <u>Air</u>
Total Depth of Boring	<u>260</u> Feet
Total Depth of Completed Well	<u>230</u> Feet

Water Level and Yield of Completed Well	
Depth to first water _____ (Feet below surface)	
Depth to Static _____	
Water Level	<u>41</u> (Feet) Date Measured <u>02/28/2020</u>
Estimated Yield*	<u>10</u> (GPM) Test Type <u>Air Lift</u>
Test Length	<u>2</u> (Hours) Total Drawdown <u>99</u> (feet)
*May not be representative of a well's long term yield.	

Geologic Log - Free Form		
Depth from Surface	Feet to Feet	Description
0	20	Soil, gravels
20	45	Soft sand and clay
45	73	Shale
73	251	Sandstone with ribbons of shale
251	260	Shale

Casings										
Casing #	Depth from Surface Feet to Feet		Casing Type	Material	Casings Specificatons	Wall Thickness (inches)	Outside Diameter (inches)	Screen Type	Slot Size if any (inches)	Description
	1	0								
1	130	170	Screen	PVC	OD: 5.563 in. SDR: 21 Thickness: 0.265 in.	0.265	5.563	Milled Slots	0.032	
1	170	190	Blank	PVC	OD: 5.563 in. SDR: 21 Thickness: 0.265 in.	0.265	5.563			
1	190	210	Screen	PVC	OD: 5.563 in. SDR: 21 Thickness: 0.265 in.	0.265	5.563	Milled Slots	0.032	
1	210	230	Blank	PVC	OD: 5.563 in. SDR: 21 Thickness: 0.265 in.	0.265	5.563			

Annular Material					
Depth from Surface Feet to Feet		Fill	Fill Type Details	Filter Pack Size	Description
0	52	Bentonite	High Solids		Surface Seal
52	230	Filter Pack	Other Gravel Pack	1/4	Gravel
230	260	Other Fill	See description.		Native backfill

Other Observations:

Borehole Specifications		
Depth from Surface Feet to Feet		Borehole Diameter (inches)
0	50	11
50	260	7.875

Certification Statement				
I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief				
Name	WEEKS DRILLING AND PUMP CO			
	Person, Firm or Corporation			
	PO BOX 176	SEBASTOPOL	CA	94573-
	Address	City	State	Zip
Signed	<i>electronic signature received</i>	03/18/2020	177681	
	C-57 Licensed Water Well Contractor	Date Signed	C-57 License Number	

Attachments
002-021-17t.pdf - Location Map

DWR Use Only							
CSG #	State Well Number			Site Code	Local Well Number		
				N			W
Latitude Deg/Min/Sec				Longitude Deg/Min/Sec			
TRS:							
APN:							

State of California
Well Completion Report
 Form DWR 188 In Review 4/7/2020
 WCR2020-003719

WELL #3

Owner's Well Number WW2 Date Work Began 03/02/2020 Date Work Ended 03/05/2020
 Local Permit Agency Lake County Health Services Department - Environmental Health Division
 Secondary Permit Agency _____ Permit Number WE-5325 Permit Date 03/12/2020

Well Owner (must remain confidential pursuant to Water Code 13752)			
Name	<u>MIDDLE CREEK RANCH LLC,</u>		
Mailing Address	<u>P.O. Box 474</u>		
City	<u>Upper Lake</u>	State	<u>Ca</u> Zip <u>95485</u>

Planned Use and Activity	
Activity	<u>New Well</u>
Planned Use	<u>Water Supply Irrigation - Agriculture</u>

Well Location					
Address <u>15187 Elk Mountain RD</u>			APN <u>002-021-17</u>		
City	<u>Upper Lake</u>	Zip	<u>95485</u>	County	<u>Lake</u>
Latitude <u>39</u> <u>15</u> <u>5.77</u> N		Longitude <u>-122</u> <u>57</u> <u>48.8</u> W		Township <u>16 N</u>	
Deg. Min. Sec.		Deg. Min. Sec.		Range <u>10 W</u>	
Dec. Lat. <u>39.2516028</u>			Dec. Long. <u>-122.9635556</u>		
Vertical Datum _____			Horizontal Datum <u>WGS84</u>		
Location Accuracy <u>20 Ft</u>			Location Determination Method _____		
			Section <u>10</u>		
			Baseline Meridian <u>Mount Diablo</u>		
			Ground Surface Elevation _____		
			Elevation Accuracy _____		
			Elevation Determination Method _____		

Borehole Information	
Orientation	<u>Vertical</u> Specify _____
Drilling Method	<u>Direct Rotary</u> Drilling Fluid <u>Bentonite</u>
Total Depth of Boring	<u>200</u> Feet
Total Depth of Completed Well	<u>196</u> Feet

Water Level and Yield of Completed Well	
Depth to first water	_____ (Feet below surface)
Depth to Static	_____
Water Level	<u>43</u> (Feet) Date Measured <u>03/05/2020</u>
Estimated Yield*	<u>15</u> (GPM) Test Type <u>Air Lift</u>
Test Length	<u>3</u> (Hours) Total Drawdown <u>146</u> (feet)
*May not be representative of a well's long term yield.	

Geologic Log - Free Form		
Depth from Surface Feet to Feet		Description
0	20	Soil, gravels
20	60	Soft gravels and clay
60	175	Fractured sandstone
175	200	Shale

Appendix

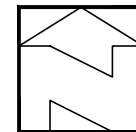
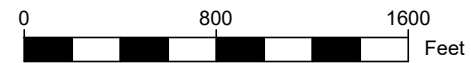
B

Well Area of Influence Map

APPENDIX B.1



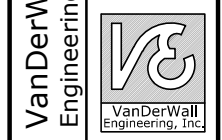
25' MINOR AND 100' MAJOR CONTOUR INTERVAL



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DEVELOPMENT DEPT.
COUNTY OF LAKE
LAKEPORT, CA

PO BOX 431
KELSEYVILLE, CA 95451
707-279-4887

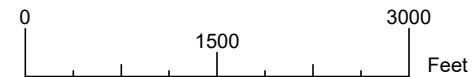
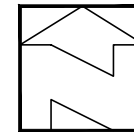
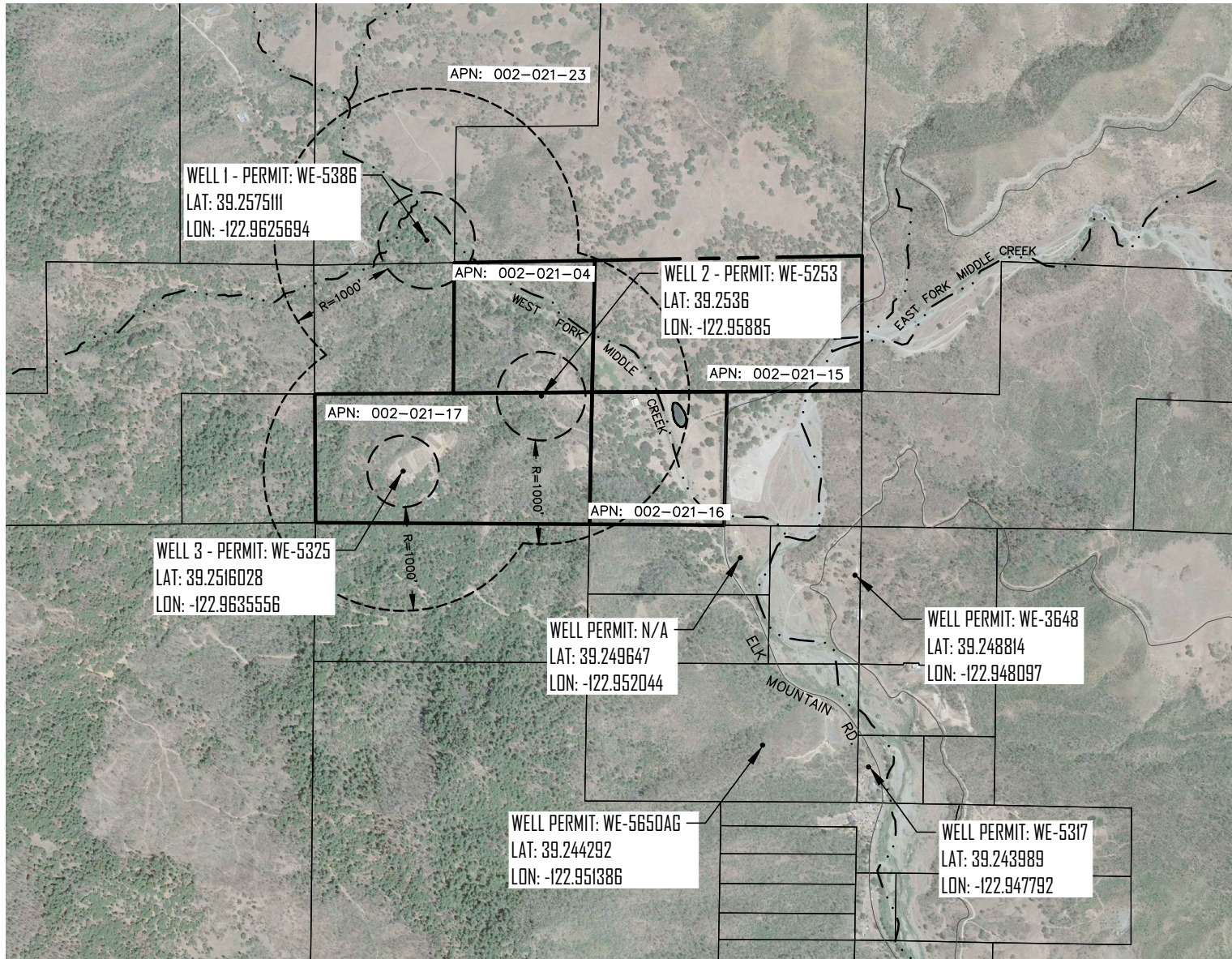
WELL AREA OF INFLUENCE MAP
APNs: 002-021-04, 15, 16, 17, 23
15365, 15095, 15187, 15525
ELK MOUNTAIN ROAD
UPPER LAKE, CALIFORNIA



VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING.	
0 1 1/2"	
DATE	SEPT 2021
PROJ	21-58
DWG	
APPENDIX	B.1

Surrounding Area Map

APPENDIX B.2

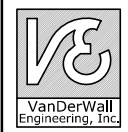


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COUNTY OF LAKE
LAKEPORT, CA

PO BOX 431
KELSEYVILLE, CA 95451
707-279-4887

VanDerWall
Engineering, Inc.

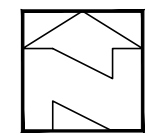
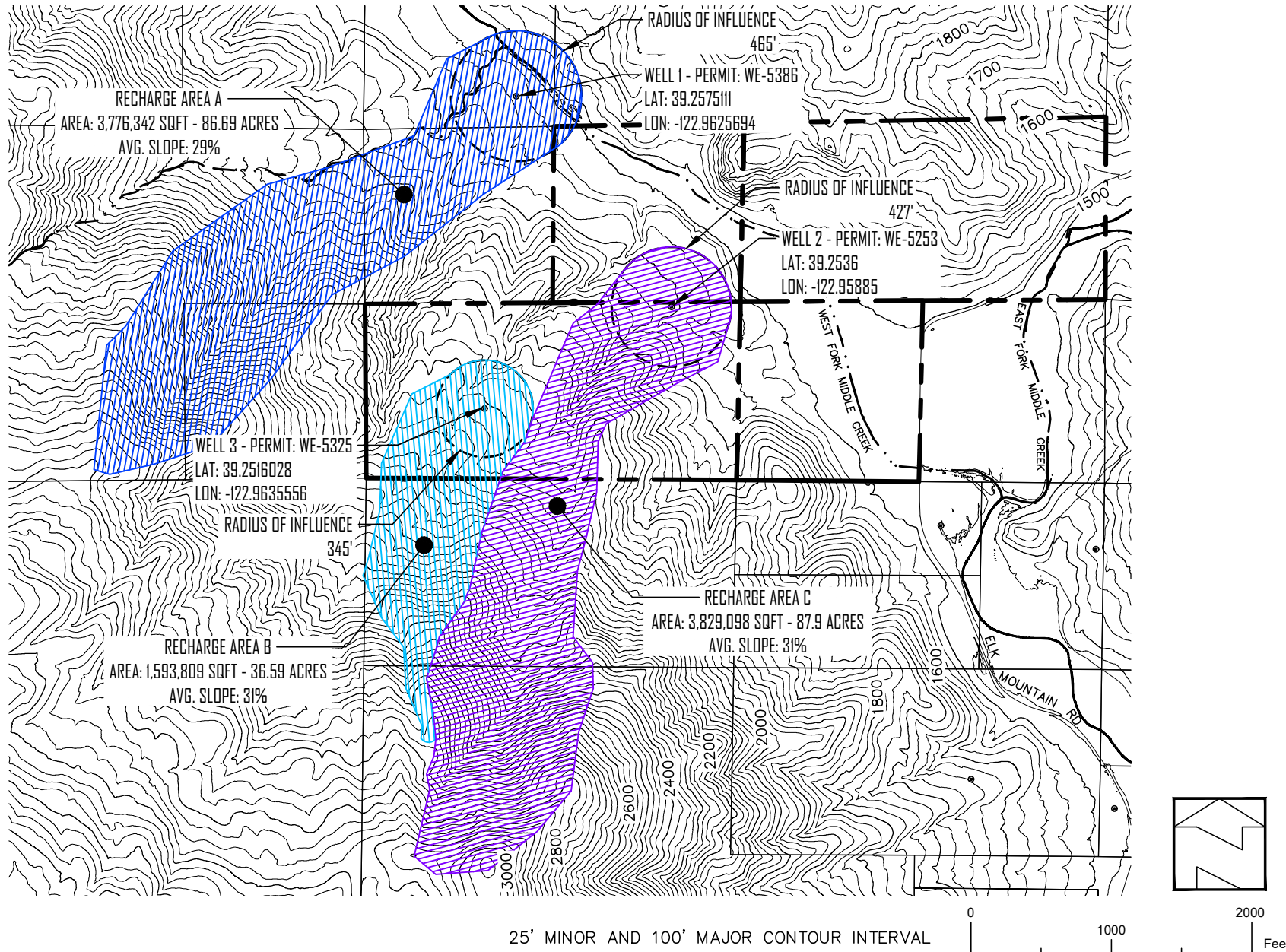
SURROUNDING AREA MAP
APNs: 002-021-04, 15, 16, 17, 23
15365, 15095, 15187, 15525
ELK MOUNTAIN ROAD
UPPER LAKE, CALIFORNIA



VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING.	
DATE	SEPT 2021
PROJ	21-58
DWG	
APPENDIX	B.2

Well Recharge Area Map

APPENDIX B.3



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 LAKE COUNTY COMMUNITY DEVELOPMENT DEPT.
 COUNTY OF LAKE
 LAKEPORT, CA

PO BOX 431
 KELSEVILLE, CA 95451
 707-779-4887

VanDerWall Engineering, Inc.
WELL RECHARGE AREA MAP
 APNs: 002-021-04, 15, 16, 17, 23
 15365, 15095, 15187, 15525
 ELK MOUNTAIN ROAD
 UPPER LAKE, CALIFORNIA

VERIFY SCALE
 BAR IS ONE INCH ON ORIGINAL DRAWING.
 0 1 1/2"

DATE: SEPT 2021
 PROJ: 21-58
 DWG:
 APPENDIX B.3