REALM
Engineering
1767 Market Street, Suite C, Redding, CA 96001

# *HYDROLOGY REPORT*

## *140 SODA BAY ROAD, LAKEPORT, CA*

***MAY 20, 2022***

## Contents

## INTRODUCTION

The purpose of this Hydrology Study/Report is to provide adequate information regarding the water usage for a proposed cannabis cultivation operation and its impacts to surrounding areas. This report was written to meet the requirements of an Urgency Ordinance requiring land use applicants to provide enhanced water analysis during a declared drought emergency, approved by the Lake County Board of Supervisors on July 27th, 2021 **(Attachment A – Urgency Ordinance No. 3106)**.

## PROJECT DESCRIPTION

Anthony and Matsuki Perkins are seeking a Major Use Permit from the County of Lake for a proposed commercial cannabis cultivation, manufacturing, and distribution operation at 140 Soda Bay Road near Lakeport, California on Lake County APNs 008-001-08 & 09 (Project Property). The Perkins' proposed commercial cannabis cultivation, manufacturing, and distribution operation would be composed of thirty 3,000 $ft^2$ greenhouses, a 6,000 $ft^2$ Processing and Non-Volatile Manufacturing Facility/Building, and a 2,400 $ft^2$ Distribution Facility/Building. The proposed greenhouses and Processing and Non-Volatile Manufacturing Facility/Building would be located in the central portion of the Project Property on APN 008-001-08, and the proposed Distribution Facility/Building would be located near Soda Bay Road in the southwestern portion of the Project Property on APN 008-001-09 **(Attachment B: Existing & Proposed Conditions Site Plans)**.

The 44-acre Agriculture and Service Commercial-zoned Project Property is situated between Clear Lake and Soda Bay Road, and approximately 1,500 feet east of the City of Lakeport. The Project Property is accessed via Soda Bay Road and a private gravel and native soil surfaced access road off of Soda Bay Road. Current and past land uses of the Project Property are/were intensive agriculture (vineyard and industrial hemp cultivation). The Project Parcel has been improved with two groundwater wells, a 24-acre vineyard, and a water storage reservoir.

The Project Property is located within the Manning Creek-Frontal Clear Lake Watershed (HUC12) and the Big Valley Groundwater Basin[1]. Topography of the Project Property is flat, with elevations ranging between 1,335 and 1,365 feet above mean sea level. Soils of the Project Property are identified as Cole variant clay loam, Still loam, and Still gravelly loam by the NRCS Web Soil Survey, and characterized as well-drained gravelly and clay loams derived from alluvium. The United States Geological Survey Map of the Ukiah Quadrangle defines the area in the vicinity of the Project Property as Alluvium.

Manning Creek, a perennial Class I watercourse, flows from east to west through the southern portion of the Project Property, then from south to north along the western boundary of the Project Property. An unnamed intermittent Class II watercourse forms in the northeast corner of the Project Property, and flows north into Clear Lake. An existing manmade off-stream water storage reservoir in the northwest corner of the Project Property is/will be used to store water for the existing onsite vineyard and proposed cannabis cultivation operation. All cannabis cultivation, manufacturing, and distribution activities would occur more than 150 feet from the surface water bodies outlined above.

The cultivation of cannabis would occur within thirty proposed 3,000 $ft^2$ steel-framed greenhouse structures with 6 mil polyethylene film coverings and polycarbonate covered end walls, equipped with LED horticultural lights and mechanical light deprivation systems. The growing medium of

the proposed cultivation operation will be an imported organic soil mixture in garden beds and nursery pots, with drip and micro-spray irrigation systems (to conserve water resources). Two 10' x 90' (900 $ft^2$) mixed-light canopy areas would be established within twenty-four of the proposed greenhouse structures, for a total combined mixed-light canopy area of 43,200 $ft^2$ (two 900 $ft^2$ canopy areas per flowering greenhouse × 24 flowering greenhouses = 43,200 $ft^2$ of mixed-light cannabis canopy). Six of the proposed greenhouse structures would contain only immature cannabis plants, including clones, seedlings, and mothers. The cultivation season for the proposed commercial cannabis cultivation, manufacturing, and distribution operation would begin in March and end in December of each year.

Two-thirds of the proposed 6,000 $ft^2$ Processing and Non-Volatile Manufacturing Facility/Building (4,000 $ft^2$) would be used for the purposes of processing (drying, curing, and trimming), packaging, and storing cannabis cultivated on the Project Property. The rest of the proposed Processing and Non-Volatile Manufacturing Facility/Building (2,000 $ft^2$) would be used for cannabis manufacturing activities, including $CO_2$ and solventless extraction. An existing onsite groundwater well located at Latitude: 39.01579° and Longitude: -122.90209° will serve as the primary water source for cultivation, processing, and manufacturing activities, with the other existing onsite groundwater well serving as a secondary/backup water source (should it be needed). Cannabis distribution activities, such as packaging, labeling, and storage, would occur within the proposed 2,400 $ft^2$ Distribution Facility/Building. Water for cannabis distribution activities would come from a Public Water District via a new/proposed water utility service connection.


***Figure 1 – Site Location Map***

## WATER USAGE

According to the Perkins, an existing onsite groundwater well located at Latitude: 39.01579° and Longitude: -122.90209 ("Well B" on the Existing & Proposed Conditions Site Plans) will serve as the primary water source for cannabis cultivation, processing, and manufacturing activities, with the existing onsite groundwater well located at Latitude: 39.01739° and Longitude: -122.90538° ("Well A" on the Existing & Proposed Conditions Site Plans) serving as a secondary/backup water source. Cannabis distribution activities, such as packaging, labeling, and storage, would occur within the proposed 2,400 $ft^2$ Distribution Facility/Building. Water for cannabis distribution activities conducted within the proposed Distribution Facility/Building, would come from a Public Water District via a new/proposed water utility service connection.

### Vineyard Water Usage

There is an established 24-acre vineyard on the Project Property. The Perkins have not monitored water usage of their vineyard, but their vineyard manager has indicated that vineyard cultivation and irrigation practices typical for the area are implemented to manage the existing onsite vineyard. A study published in 2014 by the University of California Cooperative Extension[2] indicates that vineyards within the Big Valley use approximately 0.9 acre-feet (10.81 acre inches) of water per year per acre of vineyard for irrigation (~0.4 acre-feet) and frost protection (~0.5 acre-feet). Using this data, we can estimate the current annual water usage requirement for the existing onsite vineyard to be 21.6 acre-feet (24 acres x 0.9 acre-feet = 21.6 acre-feet). "Well A" and the existing onsite water storage reservoir are used to provide water for frost protection, while "Well B" is used to provide irrigation water.

The Perkins have indicated that after approval of a Major Use Permit for cannabis cultivation, they would remove irrigation infrastructure and begin dry farming the existing onsite vineyard. Infrastructure for frost protection would be preserved and used as necessary. Therefore, we can estimate the annual water use requirement for the existing onsite vineyard following approval of a Major Use Permit for cannabis cultivation to be 12 acre-feet (24 acres x 0.5 acre-feet = 12 acre-feet).

### Cultivation Water Usage

Cannabis has often been characterized as a high-water-use plant. Bauer et al. (2015)[3] and Carah et al (2015)[4] estimate that cannabis plants can consume up to approximately 6 gallons per plant per day, whereas grapes consume approximately 3.5 gallons per plant per day in the North Coast region of California. Other authors, however, have reported that water use requirement for cannabis plants are similar to those of other agricultural crops, such as corn and hops, with an estimated water use requirement of 25-35 inches per year (Hammon et al. 2015[5]). According to a recent study published in the Journal of Environmental Management (Dillis et al. 2020[6]), outdoor and mixed-light cannabis cultivation uses the most water during the month of August, with an estimated water use of approximately 58,704 gallons per acre during the month of August.

The proposed commercial cannabis cultivation, manufacturing, and distribution operation would utilize thirty 3,000 $ft^2$ greenhouses for cultivation, with a combined total of 90,000 $ft^2$ of mixed-light cultivation area. According to the Perkins' Property Management Plan, cannabis cultivation would occur between March and December of each year, and the growing medium of the proposed cannabis cultivation areas will be an organic soilless growing medium (composed mostly of

composted forest material) in garden beds and nursery pots. Based on our experience, we estimate that the annual water use requirement for cultivation would be approximately 6.2 acre-feet (2,020,000 gallons), or ~3 acre-feet per acre of mixed-light cultivation area.

## Cannabis Processing, Distribution, and Manufacturing Water Usage

We understand that water usage for processing and distribution activities is limited to employee water usage, outlined below. According to the Perkins, non-volatile cannabis manufacturing activities (extraction and infusion) would require less than 1,000 gallons per day on average, and manufacturing activities would occur no more than four days a week. Therefore, we estimate that the annual water use requirement for manufacturing would be less than 208,000 gallons (52 weeks/year x 4 days/week x 1,000 gallons/day = 208,000 gallons/year).

## Employee Water Usage

We understand that the proposed commercial cannabis cultivation, manufacturing, and distribution operation would require two full-time cultivation managers, two full-time cultivation employees, a full-time manufacturing manager, a full-time distribution manager, and multiple seasonal employees. For the purpose of this assessment, we estimate that the project will require six year-round employees and an average of six seasonal employees during the cultivation season (March through December). To estimate employee water usage, we used the Napa County Water Availability Guidance Document[7] estimate of 15 gallons of water per day per employee.

Full-Time Employees = 6 employees x 15 gallons/day x 365 days/year = 32,850 gallons/year
Seasonal Employees = 6 employees x 15 gallons/day x 300 days/year = 27,000 gallons/year
Total Employee Water Usage = 32,850 gallons + 27,000 gallons = 59,850 gallons/year

The following table presents the expected water use for the commercial cannabis cultivation, manufacturing, and distribution operation in gallons by month.

| Use | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gallons | | | | | | | | | | | | |
| Cultivation | 0 | 0 | 64,000 | 130,000 | 198,000 | 260,000 | 260,000 | 260,000 | 260,000 | 260,000 | 198,000 | 130,000 | 2,020,000 |
| Manufacturing | 17,334 | 17,333 | 17,334 | 17,333 | 17,333 | 17,333 | 17,333 | 17,333 | 17,334 | 17,333 | 17,334 | 17,333 | 208,000 |
| Full Time Employees | 2,737 | 2,738 | 2,737 | 2,738 | 2,737 | 2,738 | 2,737 | 2,738 | 2,737 | 2,738 | 2,737 | 2,738 | 32,850 |
| Seasonal Employees | 0 | 0 | 2,700 | 2,700 | 2,700 | 2,700 | 2,700 | 2,700 | 2,700 | 2,700 | 2,700 | 2,700 | 27,000 |
| Total Usage | 20,071 | 20,071 | 86,771 | 152,771 | 220,770 | 282,771 | 282,770 | 282,771 | 282,771 | 282,771 | 220,771 | 152,771 | **2,287,850** |

***Table 1 – Total Project Water Usage***

Based on the water use estimates above, we estimate that the proposed commercial cannabis cultivation, manufacturing, and distribution operation would have a total annual water use requirement of approximately 7 acre-feet (approximately 2,287,850 gallons), with a maximum daily water use requirement of approximately 9,426 gallons, and an average daily water use requirement of approximately 6,268 gallons.

## WATER AVAILABILITY

According to the Perkins, an existing onsite groundwater well located at Latitude: 39.01579° and Longitude: -122.90209° ("Well B") will serve as the primary water source for cultivation, processing, and manufacturing activities, with the other existing onsite groundwater well ("Well A") serving as a secondary/backup water source (should it be needed). "Well B" was drilled in 1974 through clay and gravel to a depth of 100 feet, and completed at a depth of 88 feet **(Attachment C – Onsite Well Completion & Pump Test Reports)**. Information from the Well Completion Report for the primary well/water source indicates that it was screened between 72 and 82 feet below ground surface (bgs), and that the aquifer is composed of gravel.

On February 2nd, 2022, Stevenson Water Treatment & Distribution Systems, Inc. (License No.: 1025430) conducted a 6-hour pump test of "Well B" (Project Well). During the 6-hour pump test, "Well B" was pumped at 266 gpm, and the water level within the well was measured at 1-minute, 5-minute, 20-minute, and 30-minute intervals **(Attachment C - Onsite Well Completion and Test Reports)**. Approximately 95,760 gallons of water were pumped from the well during the 6-hour pump test, and the water level in the onsite well dropped from 8 to 34.1 feet bgs. The water level in the well recovered to 8 feet bgs within 17 hours after pumping for the test ceased (100% recovery). Using data from the 6-hour pump test, we can calculate a Specific Capacity of 10.2 gpm/foot of drawdown (i.e., 266 gpm / 26.1 feet) for the onsite groundwater well.

The peak anticipated daily demand for water of the proposed commercial cannabis cultivation, manufacturing, and distribution operation is approximately 9,426 gallons per day, with an average water demand of approximately 6,268 gallons per day. Based on data from the 6-hour pump test, it appears that primary well/water source could consistently produce 266 gpm. At 266 gpm, the onsite groundwater well could meet the average daily water demand of the proposed cultivation operation in less than 24 minutes and the peak anticipated daily demand in less than 36 minutes. Based on the estimated water usage rates, the measured pumping rates, and the existing water storage capacity, the site appears to have the water necessary to meet the irrigation water demands of the proposed cultivation operation without creating aquifer overdraft.

## AQUIFER/GROUNDWATER RECHARGE

The Project Property is located at the northwestern edge of the Big Valley Groundwater Basin. Hydrogeology in the Big Valley Groundwater Basin is comprised of two distinct areas: the younger alluvial and basin deposits in the north, and raised uplands comprised of the Kelseyville Formation in the south. The two areas are separated by the Big Valley Fault, which uplifted the Kelseyville Formation and created the uplands in the south[8]. Much of the northern portion of the Big Valley Groundwater Basin is directly underlain by alluvial deposits ranging from 10 to 126 feet thick. The deposits are likely to be stream deposits, consisting of gravel, sand, and silt, forming the "A1 Aquifer"[8]. The Project Well ("Well B") appears to receive groundwater from the "A1 Aquifer" based on its location between Highway 29 and Clearlake[9] and information provided in its well completion report **(Attachment C – Onsite Well Completion & Pump Test Reports)**.

The majority of recharge to groundwater in the "A1 Aquifer" is from infiltration of surface flow from creeks, with additional recharge from the percolation of rainfall and applied early season frost control spraying and mid-late season irrigation[8]. Groundwater levels within the Big Valley

Groundwater Basin fluctuate and trend downwards during drought periods, but there is sufficient recharge in average and above-average water years to fully recharge the basin. The southern portion of the basin experiences larger fluctuations and drawdowns in groundwater levels, while groundwater levels within the northern portion remain mostly stable. The California Department of Water Resources (DWR) estimates the storage capacity of the Big Valley Basin to be 105,000 acre-feet, with usable groundwater storage of approximately 60,000 acre-feet[8]. Total water use within the basin is estimated to be approximately 12,944 acre-feet per year, and despite seasonal and climate-influenced short-term fluctuations, groundwater levels in the Big Valley Basin remained stable during the last three decades[8].

In 2014, California passed the Sustainable Groundwater Management Act, authorizing local groundwater sustainability agencies to develop groundwater sustainability plans for a subset of California's alluvial aquifers. The Big Valley Basin was identified as a medium-priority basin by the California Department of Water Resources based on components such as population and groundwater use, and therefore is subject to the Sustainable Groundwater Management Act. The Big Valley Basin Groundwater Sustainability Plan (5-015) was developed by the Lake County Watershed Protection District and adopted in January of 2022. The goal of the Big Valley Basin Groundwater Sustainability Plan is the sustainable management of the groundwater resources of the Big Valley Basin for the long-term community, environmental, and economical benefits of existing and future residents and businesses in the Basin. The Big Valley Basin is currently considered to be in a sustainable condition[10].

Although the majority of recharge to groundwater under the Project Property is most likely derived from infiltration of surface flow from Manning and Thompson Creeks, we can estimate the amount of recharge from percolation of rainfall using the following calculations. The annual precipitation available for recharge onsite can initially be estimated using the following data and equation:

> 44.3-acre Project Property x 2.8 feet (average annual precipitation for Lakeport, CA[11]) =
> 124 acre-feet/year

The Project Property is nearly flat and covered in well drained gravelly and clay loam soils. Therefore, we estimate that the long-term average precipitation that recharges groundwater within the entire site is 15%. With this data and the precipitation data presented above, we can estimate the groundwater recharge from percolation using the following equation:

> 124 acre-feet/year (annual precipitation onsite) x 0.15 (long term average recharge) =
> 18.6 acre-feet/year

The estimated average annual recharge to groundwater from percolation of rainfall across the Project Property alone (18.6 acre-feet/year) is greater than the estimated annual water usage of the proposed commercial cannabis cultivation, manufacturing, and distribution operation (7 acre-feet). However, the major of groundwater recharge to the aquifer under the Project Property is most likely derived from infiltration of surface flow from Manning and Thompson Creeks, but we do not have the ability to accurately estimate recharge from surface flow with available data.

## POTENTIAL IMPACTS TO STREAMS & NEIGHBORING WELLS

Urgency Ordinance 3106 requires analysis of the "Cumulative impact of water use to surrounding areas due to project" implementation. To do this, we must first identify surrounding areas and uses that could be impacted from the project's well pumping/water usage. As outlined in previous sections of this report, water for the proposed cultivation operation would come from an existing onsite groundwater well ("Well B"), and the proposed commercial cannabis cultivation, manufacturing, and distribution operation would have an annual water use requirement of approximately 7 acre-feet (2,287,850 gallons) per year. Water for the existing onsite vineyard would come from another onsite groundwater well ("Well A") and onsite off-stream water storage reservoir, with an annual water use requirement of approximately 12 acre-feet for frost protection.

To evaluate potential well pumping impacts to surrounding areas and uses, the potential lateral extent of pumping from the Project Well ("Well B") was estimated. "Well A" has been used for frost protection for the existing onsite vineyard for over a decade. Therefore, impacts from "Well A" are not considered a concern to this assessment, as no change would occur as a result of project implementation. Using general relationships discussed in Groundwater and Wells, Second Edition (Driscoll 1986[12]), we estimated the lateral pumping influence using information from the 6-hour pump test performed by Stevenson Water Treatment & Distribution Systems, Inc. (License No.: 1025430) on February 2nd, 2022. An approximate relationship between specific capacity calculated from the pump test and aquifer transmissivity was used to obtain aquifer characteristics and estimate a potential radius of pumping influence. Transmissivity was estimated for an unconfined aquifer, using the relationship of Specific Capacity (yield/drawdown) multiplied by the coefficient of 1,500. To develop the slope of the drawdown curve from the project well, the value of $\Delta s$ (drawdown over on log graph cycle) was calculated for a distance-drawdown relationship, where $T = 528Q/\Delta s$ (Driscoll 1986, equation 9.11[12]). The analysis is shown on the attached semi-log plot (**Attachment D – Radius of Influence Analysis)**.

The specific capacity for the project well was calculated to be 10.2 gpm/foot drawdown (266 gpm/26.1 feet drawdown) from the 6-hour pump test. Using this data and the general relationships outlined above, we calculated a zone of pumping influence extending approximately 800 feet from the project well. The calculated 800-foot radius of pumping influence is shown in **Figure 2 – Zone of Pumping Influence Diagram**, on the next page. Manning Creek flows within approximately 1,000 feet west and south of the Project Well, and an unnamed Class II intermittent watercourse (NHD/DFG Water ID 116955028) forms approximately 950 northeast of the Project Well. Clear Lake is located over 3,000 feet north of the Project Well. The nearest known neighboring groundwater well is located over 950 feet southeast of the Project Well. Since there are no streams, wetlands, lakes, or groundwater wells within 800 feet of the Project Well, we do not anticipate any direct impacts to surface water bodies or neighboring wells as a result of pumping of the Project Well for the proposed commercial cannabis cultivation, manufacturing, and distribution operation.

Additionally, the Project Well is currently used to irrigate the existing onsite vineyard, which has an estimated annual water use requirement of approximately 9.6 acre-feet. As previously discussed in this report, the Perkins have indicated that after approval of a Major Use Permit for cannabis cultivation, they will remove irrigation infrastructure and begin dry farming the existing onsite vineyard. The proposed commercial cannabis cultivation, manufacturing, and distribution operation would have an estimated annual water use requirement of approximately 7 acre-feet. The overall reduction in water pumped from the Project Well would reduce impacts to the aquifer from which the Project Well receives groundwater.


*Figure 2 – Zone of Pumping Influence Diagram*

## DROUGHT MANAGEMENT PLAN

The Urgency Ordinance approved by the Lake County Board of Supervisors on July 27th, 2021 (Ordinance No. 3106) requires applicants to provide a plan depicting how the applicants plan to reduce water use during a declared drought emergency. As outlined in previous sections of this report, the proposed commercial cannabis cultivation, manufacturing, and distribution operation would have an estimated annual water use requirement of approximately 7 acre-feet (2,287,850 gallons), and an existing onsite groundwater well located at Latitude: 39.01579° and Longitude: -122.90209° (“Well B” / Project Well) will serve as the primary water source for cultivation, processing, and manufacturing activities, with a new/proposed water utility service connection for distribution activities.

Per the Water Conservation and Use requirements outlined in the State Water Resources Control Board's Cannabis General Order, the Perkins shall implement the following Best Practical Treatment and Control (BPTC) measures to conserve water resources:

- Regularly inspect the entire water delivery system for leaks and immediately repair any leaky faucets, pipes, connectors, or other leaks;
- Apply weed-free mulch in cultivation areas that do not have ground cover to conserve soil moisture and minimize evaporative loss;
- Implement water conserving irrigation methods (drip or trickle and micro-spray irrigation);
- Maintain daily records of all water used for irrigation of cannabis. Daily records will be calculated by using a measuring device (inline water meter) installed on the main irrigation supply line between the water storage area and cultivation area(s);
- Install float valves on all water storage tanks to keep them from overflowing onto the ground.

With the Water Conservation and Use requirements outlined above, the proposed cultivation operation would efficiently use water resources at all times. Additionally, Article 27 Section 27.11 of the Lake County Zoning Ordinance requires commercial cannabis cultivators using water from a groundwater well to install a water level monitor on their water supply well, and to regularly record readings from the continuous water level monitor. Well water level monitoring and reporting shall be performed as follows:

**Seasonal Static Water Level Monitoring**
Seasonal monitoring of well water levels provides information regarding long-term groundwater elevation trends. The water level in the onsite groundwater well shall be measured and recorded prior to the start of the cultivation season (March/April), and once in the fall (November) after the cultivation season has ended. Data reported to the Lake County Community Development Department as part of the Project's annual reporting requirements shall include a hydrograph plot of all seasonal water level measurements for the onsite groundwater well.

**Water Level Monitoring During Extraction**
The purpose of monitoring the water level in a well during extraction is to evaluate the performance of the well to determine the effect of the pumping rate on the water source during each cultivation season. This information can be used to determine the capacity and yield of the onsite groundwater well for determining pump rates and the need for water storage. The frequency of water level monitoring will depend on the source, the source's capacity, and the pumping rate. It is recommended that initially the water level be monitored twice per week or more, and that the frequency be adjusted as needed depending on the impact the pumping rate has on the well water level. Data reported to the Lake County Community Development Department as part of the Project's annual reporting requirements shall include a hydrograph plot of the water level readings during the cultivation season.

In addition to the monitoring and reporting described above, the Project's annual report shall include an analysis of the water level monitoring data, demonstrating whether or not use of the onsite groundwater well is causing significant drawdown and/or impacts to the surrounding area and what measures were taken to reduce impacts. If there are impacts, a revised Water Management Plan shall be prepared and submitted to the Lake County Community Development Department, for review and approval, demonstrating how the project will mitigate the impacts in the future.

**DROUGHT EMERGENCY RESPONSE**

When a drought emergency has been declared for the area of the proposed cultivation operation, the Perkins may implement the following additional measures, as needed or appropriate to the site, to reduce water use and ensure both success of the cultivation operation and decreased impacts to surrounding areas:

- Install moisture meters to monitor how much water is in the soil at the root level and reduce watering to only what is needed to avoid excess;
- Cover the soil and drip lines with removable plastic mulch to reduce evaporation;
- Irrigate only in the early morning hours or before sunset;
- Cover plants with shaded meshes during peak summer heat to reduce plant stress and water needs;
- Add soil amendments/ingredients to growing medium that retains water in a way to conserve water and aid plant growth/health. Soil amendments/ingredients such as peat moss, coco coir, compost, perlite, and vermiculite retain water and provide a good environment for cannabis to grow.

Additionally, to ensure both success and decreased impacts to the surrounding areas, the Perkins will reduce their water usage by as much as 20 percent during the second half of the year, by not replanting a portion of their mixed-light cultivation area(s) during periods of drought. To achieve this reduction in water use, the Perkins will not replant six of their flowering greenhouses after June 30th, when a drought emergency has been declared for their region. This reduction would occur during the hottest and driest months, when water usage for the proposed cultivation operation would be at its highest (July, August, and September). The peak anticipated daily demand for water of the proposed cultivation operation is ~9,426 gallons per day (when not under a declared drought emergency). Leaving six flowering greenhouses fallow during a drought emergency would reduce the peak anticipated daily demand for water of the proposed cultivation operation by as much as 1,734 gallons per day during the hottest driest months, when irrigation water withdrawals from the aquifers of the Big Valley Groundwater Basin are at their greatest (July, August, and September).

## CONCLUSIONS

An existing onsite groundwater well located at Latitude: 39.01579° and Longitude: -122.90209° ("Well B" / Project Well) will serve as the primary water source for the proposed commercial cannabis cultivation, manufacturing, and distribution operation, with another existing onsite groundwater well ("Well A") and onsite off-stream water storage reservoir serving as the primary water source for frost protection for the existing onsite vineyard. "Well B" was drilled in 1974 through clay and gravel to a depth of 100 feet, and screened between 72 and 82 feet below ground surface (bgs) in an aquifer composed of gravel. On February 2nd, 2022, Stevenson Water Treatment & Distribution Systems, Inc. (License No.: 1025430) conducted a 6-hour pump test of the Project Well. Approximately 95,760 gallons of water were pumped from the well during the 6-hour pump test, and the water level in the onsite well dropped from 8 to 34.1 feet bgs. The water level in the well recovered to 8 feet bgs within 17 hours after pumping for the test ceased (100% recovery). Using data from the 6-hour pump test, a Specific Capacity of 10.2 gpm/foot of drawdown was calculated for the onsite groundwater well.

The proposed commercial cannabis cultivation, manufacturing, and distribution operation has an estimated total annual water use requirement of approximately 7 acre-feet (approximately 2,287,850 gallons), with a maximum daily water use requirement of approximately 9,426 gallons, and an average daily water use requirement of approximately 6,268 gallons. Based on data from the 6-hour pump test, it appears that Project Well could easily meet the water demands of the proposed commercial cannabis cultivation, manufacturing, and distribution operation with less than an hour of pumping each day. The calculated a zone of pumping influence extends as far as 800 feet from the Project Well. There are no streams, wetlands, lakes, or groundwater wells within 800 feet of the Project Well. Therefore, direct impacts to surface water bodies or neighboring wells as a result of pumping of the Project Well for the proposed commercial cannabis cultivation, manufacturing, and distribution operation are not anticipated.

The Project Well appears to receive water from an alluvial aquifer identified as the "A1 Aquifer". The majority of recharge to groundwater in the "A1 Aquifer" is from infiltration of surface flow from creeks, with additional recharge from the percolation of rainfall and applied early season frost control spraying and mid-late season irrigation. Groundwater levels within the Big Valley Groundwater Basin fluctuate and trend downwards during drought periods, but there is sufficient recharge in average and above-average water years to fully recharge the basin. The California Department of Water Resources (DWR) estimates the storage capacity of the Big Valley Basin to be 105,000 acre-feet, with usable groundwater storage of approximately 60,000 acre-feet. Total water use within the basin is estimated to be approximately 12,944 acre-feet per year. Despite seasonal and climate-influenced short-term fluctuations, groundwater levels in the Big Valley Basin remained stable during the last three decades, and the Big Valley Basin is currently considered to be in a sustainable condition[10].

The Perkins intend to reduce their water usage by as much as 20 percent during the second half of the year during periods of drought. To achieve this reduction in water use, the Perkins will not replant six of the proposed flowering greenhouses after June 30th, when a drought emergency has been declared for their region. This reduction would occur during the hottest and driest months, when water usage for the proposed cultivation operation would be at its highest (July, August, and September). Leaving six flowering greenhouses fallow during a drought emergency would reduce the peak anticipated daily demand for water of the proposed cultivation operation by as much as 1,734 gallons per day during the hottest driest months, when irrigation water withdrawals from the aquifers of the Big Valley Groundwater Basin are at their greatest (July, August, and September).

## LIMITATIONS

Realm Engineering is not responsible for the independent conclusions, opinions or recommendations made by others based on the records review, site inspection, field exploration, and interpretations presented in this report.

Groundwater systems of Lake County are typically complex, and available data rarely allows for more than general assessment of groundwater conditions and delineation of aquifers. Hydrologic interpretations are based on Well Completion Reports made available to us through the California Department of Water Resources, available geologic maps and hydrological studies and professional judgment. This analysis is based on limited available data and relies significantly on interpretation of data from disparate sources of disparate quality.

It should be noted that hydrological assessments are inherently limited in the sense that conclusions are drawn and recommendations developed from information obtained from limited research and site evaluation. Additionally, the passage of time may result in a change in the environmental characteristics at this site and surrounding properties. This report does not warrant against future operations or conditions.

This report is for the exclusive use of Anthony and Matsuki Perkins, their affiliates, designates and assignees, and no other party shall have any right to rely on any service provided by Realm Engineering without prior written consent.

Please feel free to contact me with any questions that you may have regarding this Hydrology Study/Report.

Sincerely,
Jason Vine, P.E. 67800


Realm Engineering
1767 Market Street, Suite C
Redding, CA 96001
530-526-7493
info@realm-engineering.com

## REFERENCES


[1]Lake County Watershed Protection District, Lake County Groundwater Management Plan, 2006

[2]McGourty, G., Keiffer, R., Zoller, B. 2014. Vineyard Water Use in Lake County, California. University of California Agriculture and Natural Resources

[3]Bauer, S., Olson, J., Cockrill, A., et al. 2015. Impacts of surface water diversions for marijuana cultivation on aquatic habitat in four northwestern California watersheds. PLOS ONE, 10(9): e0137935

[4]Carah, J.K., Howard, J.K., Thompson, S.E., *et al.* 2015. High time for conservation: adding the environment to the debate on marijuana liberalization. Bioscience, 65, pp.822-829

[5]Hammon, B., Rizza, J. and Dean, D. 2015. Current impacts of outdoor growth of cannabis in Colorado. Colorado State University Extension, Fact Sheet No. 0.308

[6]Dillis, C.R., Grantham, T.E., Mcintee, C., McFadin, B., Grady, K.V. 2020. Water storage and irrigation practices for cannabis drive seasonal patterns of water extraction and use in Northern California. Journal of Environmental Management, Volume 272, 15 October 2020, 110955

[7]Water Availability Analysis (WAA) Guidance Document, Napa County, Adopted May 12, 2015

[8]Lake County Water Inventory and Analysis, Lake County Watershed Protection District, March 2006

[9]Big Valley Ground Water Recharge Investigation Update, Christensen Associates, Inc., May 2003

[10]Groundwater Sustainability Plan for Big Valley Basin (5-015), Lake County Water Resources Department, January 2022

[11] Scotts Creek Watershed Assessment, Scotts Creek Watershed Council, February 2010

[12]Driscoll, Fletcher G., 1986, Groundwater and Wells, Second Edition, Johnson Division, St. Paul Minnesota, 1089p.

# ATTACHEMENT A

# URGENCY ORDINANCE NO. 3106

**BOARD OF SUPERVISORS, COUNTY OF LAKE, STATE OF CALIFORNIA**

**ORDINANCE NO. 3106**

**AN URGENCY ORDINANCE REQUIRING LAND USE APPLICANTS TO PROVIDE ENHANCED WATER ANALYSIS DURING A DECLARED DROUGHT EMERGENCY**

**WHEREAS**, the Sheriff, acting as the OES Director of Lake County, declared a local emergency due to drought conditions on May 6, 2021; and

**WHEREAS**, the Lake County Board of Supervisors approved the ratification of the declaration of a local emergency due to drought conditions on May 11, 2021; and

**WHEREAS**, the Board of Supervisors wish to ensure continued access to drinking water from private wells or from water purveyors throughout the county; and

**WHEREAS**, the Board of Supervisors wish to ensure that all current agricultural activities and projects find success during this declared drought emergency; and

**WHEREAS**, the Board of Supervisors of the County of Lake finds that additional information is critical to ensuring that the Planning Commission approves projects based on evidence of water use and water impacts and the analysis of the impacts to the surrounding areas.

**NOW THEREFORE**, the Board of Supervisors of the County of Lake hereby ordains as follows:

**Section One:** Due to the exceptional drought that we are experiencing and the declaration of a drought emergency, any land use approvals are required to provide adequate information regarding water usage for the project being considered and its impacts to surrounding areas. All projects that require a CEQA analysis of water use must include these additional items:

A. Hydrology report prepared by a California licensed civil engineer, hydro-geologist, hydrologist, or geologist experienced in water resources
    a. Approximate amount of water available for the project's identified water source
    b. Approximate recharge rate for the project's identified water source
    c. Cumulative impact of water use to surrounding areas due to project
B. Drought Management Plan
    a. Provide a plan depicting how the applicants plan to reduce water use during a declared drought emergency, to ensure both success and decreased impacts to the surrounding areas

**Section Two:** This urgency ordinance, if approved, shall take effect on all future Planning Commission considerations until the declared drought emergency has expired or if the Board of Supervisors revokes the ordinance.

**Section Three:** It can be seen with certainty that there is no possibility that this urgency Ordinance may have a significant effect on the environment.

**Section Four:** All ordinances or parts of ordinances or resolutions or parts of resolutions in conflict herewith are hereby repealed to the extent of such conflict and no further.

**Section Five:** This ordinance shall go into effect immediately, and before the expiration of fifteen days after its passage, it shall be published at least once in a newspaper of general circulation printed and published in the County of Lake.

**Section Six:** This Ordinance is adopted as an urgency Ordinance pursuant to the provisions of Government Code sections 25123 and 25131 and shall be effective immediately upon adoption. Based on the declaration of purpose and facts constituting the urgency set forth above in Section One of this Ordinance, the Board of Supervisors finds and determines that the adoption of this Ordinance as an urgency Ordinance is necessary for the immediate preservation of the public peace, health and safety to address critical groundwater conditions in Lake County.

The Foregoing Ordinance was introduced before the Board of Supervisors on the 27th day of July, 2021, and passed by the following vote on the 27th day of July, 2021.

AYES: Supervisors Simon, Crandell, Scott, Pyska, and Sabatier

NOES: None

ABSENT OR NOT VOTING: None

COUNTY OF LAKE

Chair, Board of Supervisors

ATTEST: CAROL J. HUCHINGSON
Clerk of the Board of Supervisors

By: _____
Deputy

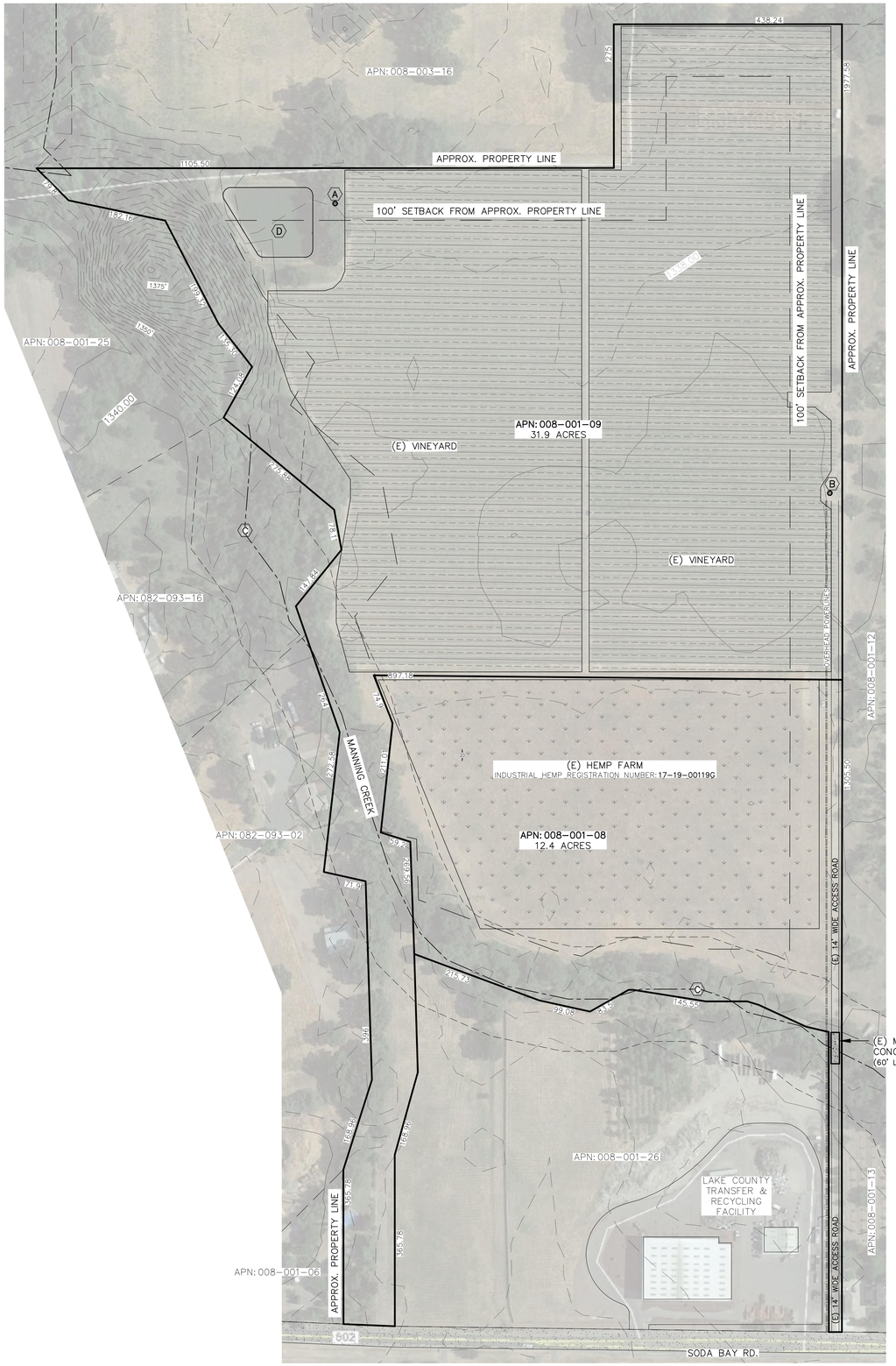
APPROVED AS TO FORM:

ANITA L. GRANT
County Counsel

By: _____

# ATTACHEMENT B

# EXISTING AND PROPOSED CONDITIONS SITE PLANS

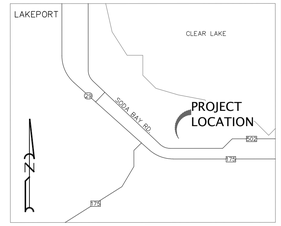



EXISTING CONDITIONS
SITE PLAN

GRAPHIC SCALE

120 0 60 120

( IN FEET )
1 inch = 120 ft.




VICINITY MAP
NO SCALE

140 SODA BAY RD.
LAKEPORT, CA 95433
LAKE COUNTY
APN's: 008-001-08 & 09

LEGEND:

| | |
|---|---|
| 1530 | CONTOUR ELEVATION |
| | FENCE |
| | ASPHALT |
| | GRAVEL |
| | CREEK / SWALE |
| APN | ASSESSOR'S PARCEL NUMBER |
| APPROX | APPROXIMATELY |
| DWY | DRIVEWAY |
| (E) | EXISTING |
| (P) | PROPOSED |
| RD | ROAD |
| SF | SQUARE FEET |

NOTES:

1. CONTOUR INTERVAL IS 5'

(A) (E) GROUNDWATER WELL
LAT: 39.01739°
LONG: -122.90538
BENEFICIAL USE: IRRIGATION

(B) (E) GROUNDWATER WELL
LAT: 39.01579°
LONG: -122.90209°
BENEFICIAL USE: DRINKING WATER

(C) INTERMITTENT CLASS II WATERCOURSE WITH 100' SETBACK (MANNING CREEK - NHD/DFG WATER ID: 116955052)

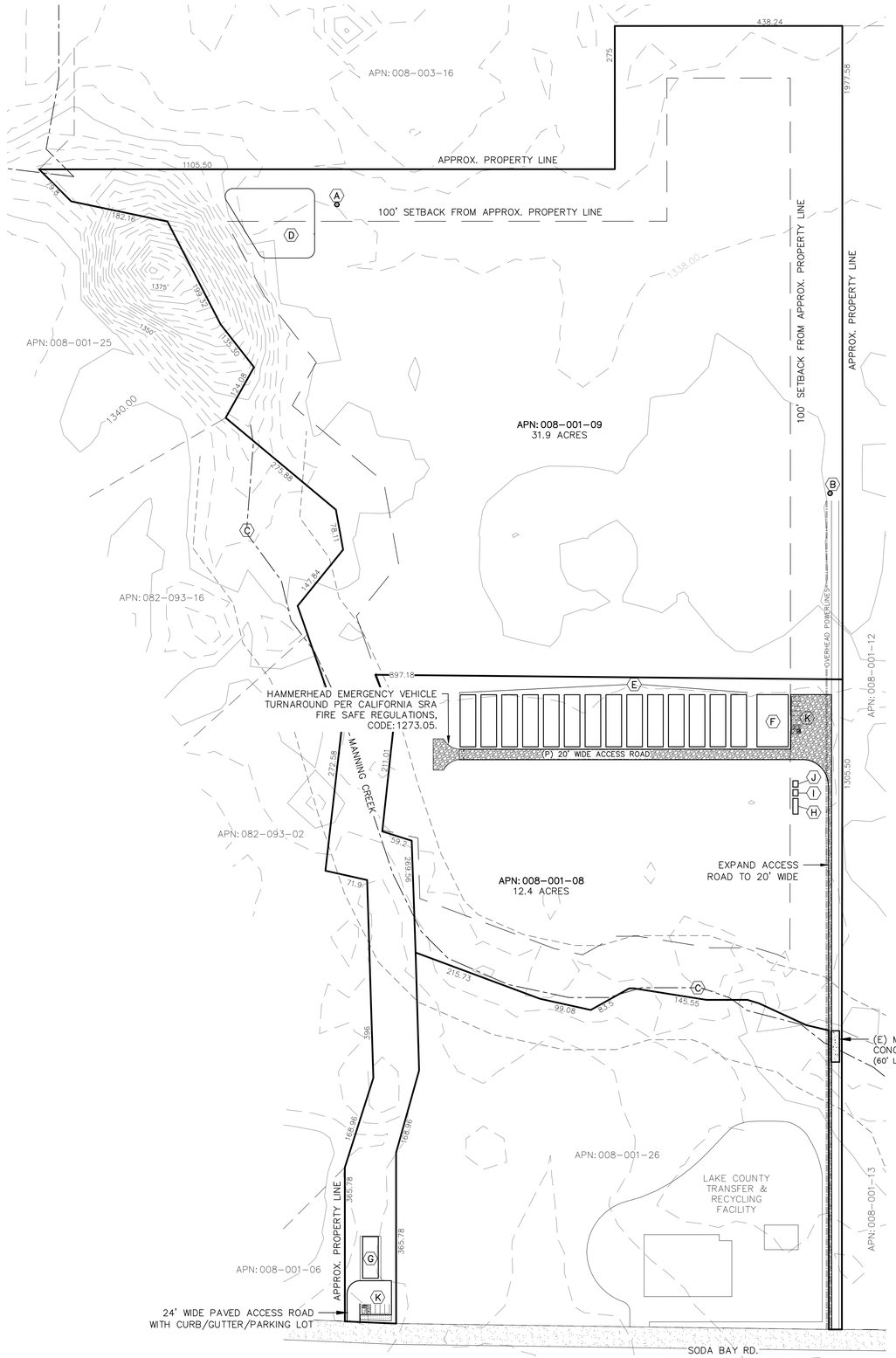
(D) WATER STORAGE RESERVOIR

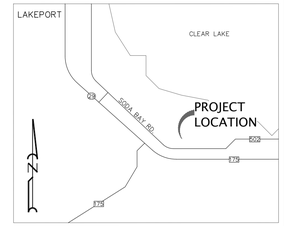
Revisions:
---

EXISTING CONDITIONS SITE PLAN

ANTHONY & MATSUKI PERKINS
140 SODA BAY RD
LAKEPORT, CA 95453
LAKE COUNTY
APN's: 008-001-08 & 09

PLOTTED BY: ---
DATE PLOTTED: 5/12/21
SCALE OF DRAWING: SEE PLAN
JOB NUMBER:
CADD FILE:
SHEET: 1




VICINITY MAP
NO SCALE

140 SODA BAY RD.
LAKEPORT, CA 95433
LAKE COUNTY
APN's: 008-001-08 & 09

LEGEND:

| | |
|---|---|
| 1530 | CONTOUR ELEVATION |
| | FENCE |
| | ASPHALT |
| | GRAVEL |
| | CREEK / SWALE |
| APN | ASSESSOR'S PARCEL NUMBER |
| APPROX | APPROXIMATELY |
| DWY | DRIVEWAY |
| (E) | EXISTING |
| (P) | PROPOSED |
| RD | ROAD |
| SF | SQUARE FEET |

NOTES:

1. CONTOUR INTERVAL IS 5'

(A) (E) GROUNDWATER WELL
LAT: 39.01739°
LONG: -122.90538
BENEFICIAL USE: IRRIGATION

(B) (E) GROUNDWATER WELL
LAT: 39.01579°
LONG: -122.90209°
BENEFICIAL USE: DRINKING WATER

(C) INTERMITTENT CLASS II WATERCOURSE WITH 100' SETBACK (MANNING CREEK - NHD/DFG WATER ID: 116955052)

(D) WATER STORAGE RESERVOIR

(E) (P) FOURTEEN - 30'x100' (3,000 SF) GREENHOUSES

(F) (P) 60'x100' (6,000 SF) PROCESSING AND NON-VOLATILE MANUFACTURING FACILITY/BUILDING

(G) (P) 30'X80' (2,400 SF) DISTRIBUTION FACILITY

(H) (P) 10'x30' COMPOST AREA

(I) (P) 10'x12' PESTICIDES & AGRICULTURAL CHEMICALS STORAGE AREA

(J) (P) DESIGNATED REFUSE AREA

(K) (P) PARKING / A.D.A.

PROPOSED CONDITIONS
SITE PLAN - PHASE I

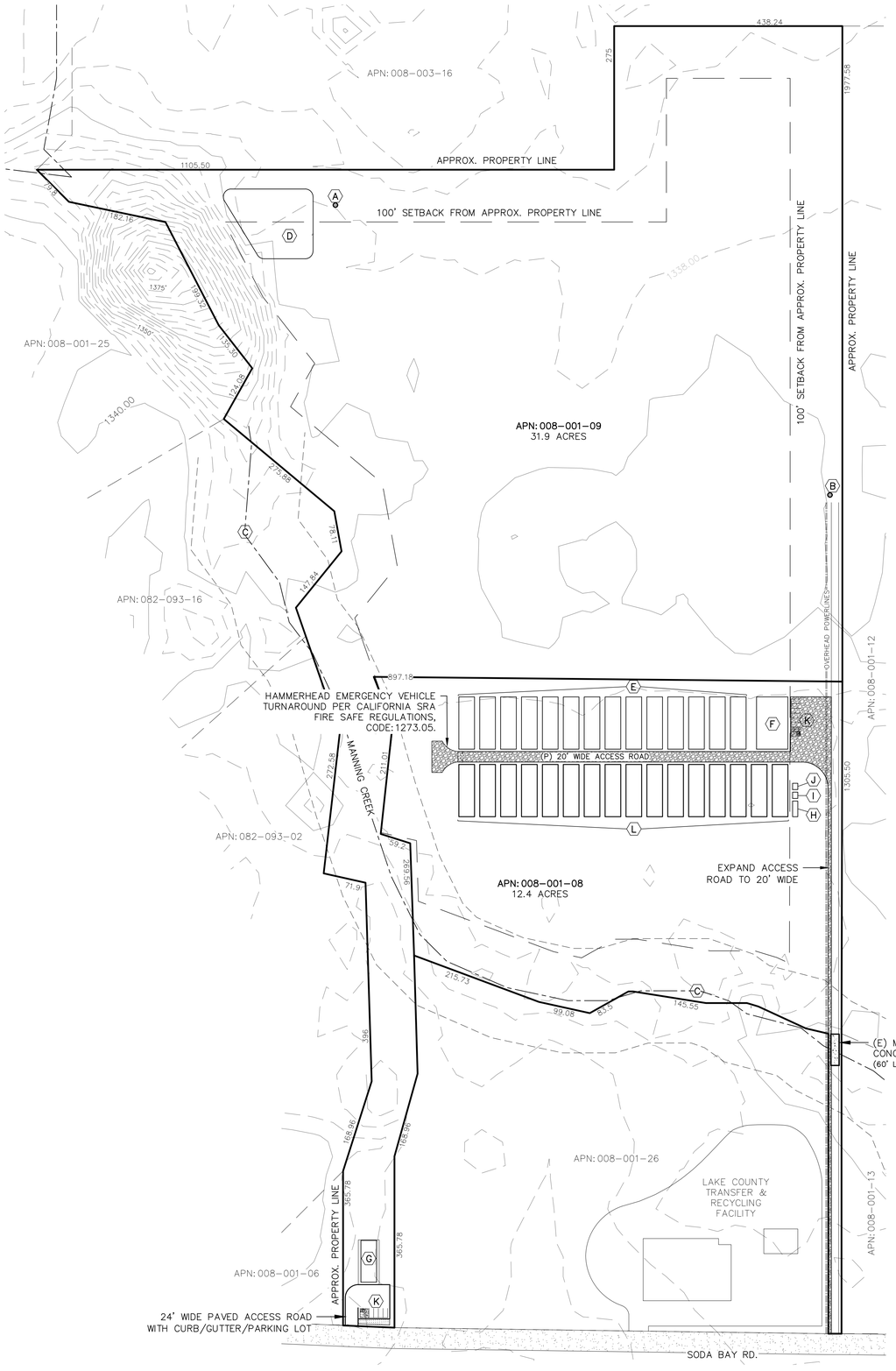
GRAPHIC SCALE
120 0 60 120
( IN FEET )
1 inch = 120 ft.

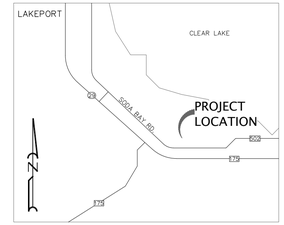
Revisions:
---

PROPOSED CONDITIONS SITE PLAN - PHASE I

ANTHONY & MATSUKI PERKINS
140 SODA BAY RD
LAKEPORT, CA 95453
LAKE COUNTY
APN's: 008-001-08 & 09

PLOTTED BY: ---
DATE PLOTTED: 5/28/21
SCALE OF DRAWING: SEE PLAN
JOB NUMBER:
CADD FILE:
SHEET: 1




140 SODA BAY RD.
LAKEPORT, CA 95433
LAKE COUNTY
APN's: 008-001-08 & 09

LEGEND:

| | |
|---|---|
| 1530 | CONTOUR ELEVATION |
| | FENCE |
| | ASPHALT |
| | GRAVEL |
| | CREEK / SWALE |
| APN | ASSESSOR'S PARCEL NUMBER |
| APPROX | APPROXIMATELY |
| DWY | DRIVEWAY |
| (E) | EXISTING |
| (P) | PROPOSED |
| RD | ROAD |
| SF | SQUARE FEET |

NOTES:

1. CONTOUR INTERVAL IS 2'

(A) (E) GROUNDWATER WELL
LAT: 39.01739°
LONG: -122.90538
BENEFICIAL USE: IRRIGATION

(B) (E) GROUNDWATER WELL
LAT: 39.01579°
LONG: -122.90209°
BENEFICIAL USE: DRINKING WATER

(C) INTERMITTENT CLASS II WATERCOURSE WITH 100' SETBACK (MANNING CREEK - NHD/DFG WATER ID: 116955052)

(D) WATER STORAGE RESERVOIR

(E) (E) FOURTEEN - 30'x100' (3,000 SF) GREENHOUSES

(F) (E) 60'x100' (6,000 SF) PROCESSING AND NON-VOLATILE MANUFACTURING FACILITY/BUILDING

(G) (E) 30'x80' (2,400 SF) DISTRIBUTION FACILITY

(H) (E) 10'x30' COMPOST AREA

(I) (E) 10'x12' PESTICIDES & AGRICULTURAL CHEMICALS STORAGE AREA

(J) (E) DESIGNATED REFUSE AREA

(K) (E) PARKING / A.D.A.

(L) (P) SIXTEEN - 30'X100' (3,000 SF) GREENHOUSES

PROPOSED CONDITIONS
SITE PLAN - PHASE II

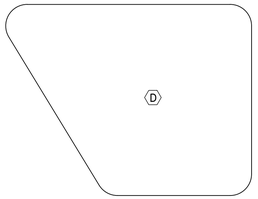
GRAPHIC SCALE
120 0 60 120
( IN FEET )
1 inch = 120 ft.

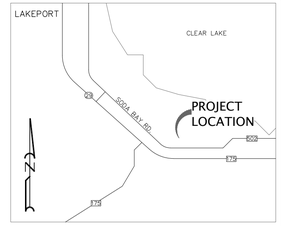
Revisions:
---

PROPOSED CONDITIONS SITE PLAN - PHASE II

ANTHONY & MATSUKI PERKINS
140 SODA BAY RD
LAKEPORT, CA 95453
LAKE COUNTY
APN's: 008-001-08 & 09

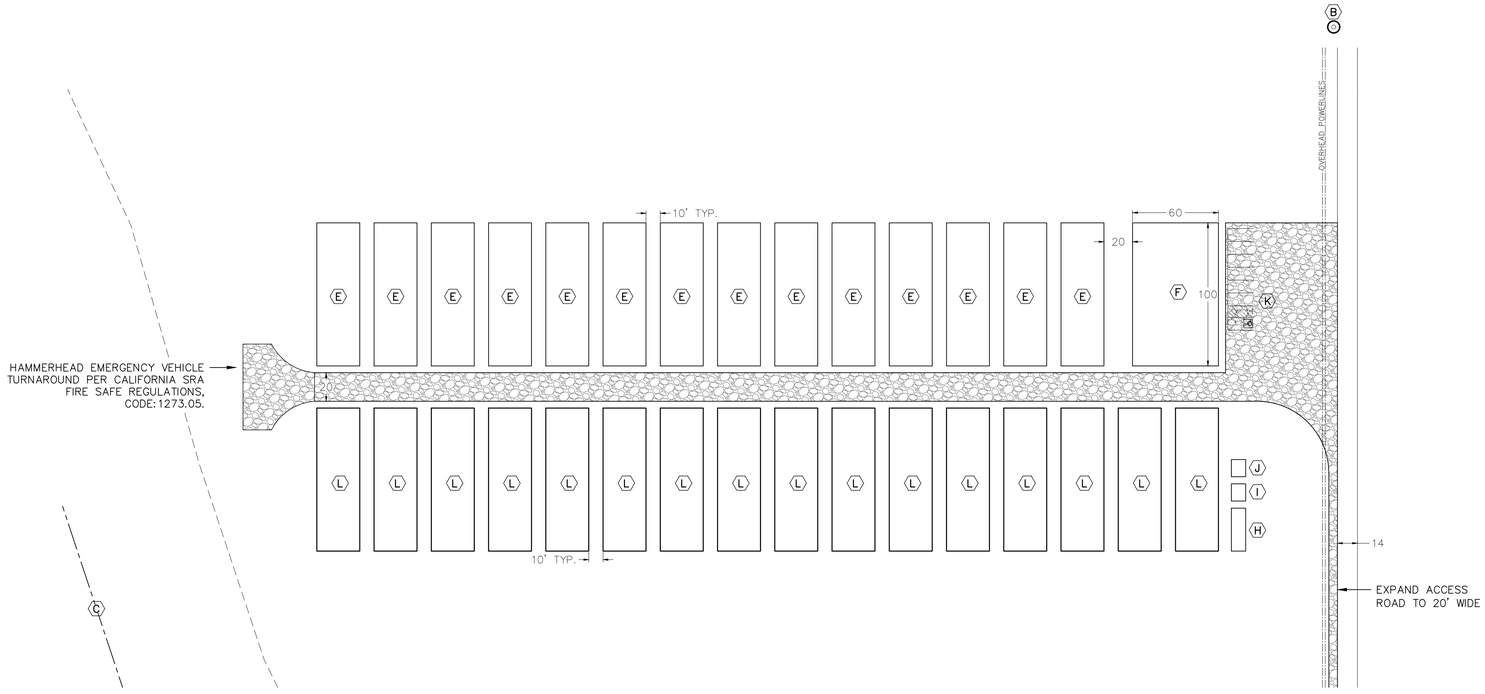
PLOTTED BY:
DATE PLOTTED: 5/28/21
SCALE OF DRAWING: SEE PLAN
JOB NUMBER:
CADD FILE:
SHEET: 1




VICINITY MAP
NO SCALE

140 SODA BAY RD.
LAKEPORT, CA 95433
LAKE COUNTY
APN's: 008-001-08 & 09




LEGEND:

| | |
|---|---|
| 1530 | CONTOUR ELEVATION |
| | FENCE |
| | ASPHALT |
| | GRAVEL |
| | CREEK / SWALE |
| APN | ASSESSOR'S PARCEL NUMBER |
| APPROX | APPROXIMATELY |
| DWY | DRIVEWAY |
| (E) | EXISTING |
| (P) | PROPOSED |
| RD | ROAD |
| SF | SQUARE FEET |

(A) (E) GROUNDWATER WELL
LAT: 39.01739°
LONG: −122.90538
BENEFICIAL USE: IRRIGATION

(B) (E) GROUNDWATER WELL
LAT: 39.01579°
LONG: −122.90209°
BENEFICIAL USE: DRINKING WATER

(C) INTERMITTENT CLASS II WATERCOURSE WITH 100' SETBACK (MANNING CREEK – NHD/DFG WATER ID: 116955052)

(D) WATER STORAGE RESERVOIR

(E) (E) FOURTEEN – 30'x100' (3,000 SF) GREENHOUSES

(F) (E) 60'x100' (6,000 SF) PROCESSING AND NON–VOLATILE MANUFACTURING FACILITY/BUILDING

(G) (E) 30'x80' (2,400 SF) DISTRIBUTION FACILITY

(H) (E) 10'x30' COMPOST AREA

(I) (E) 10'x12' PESTICIDES & AGRICULTURAL CHEMICALS STORAGE AREA

(J) (E) DESIGNATED REFUSE AREA

(K) (E) PARKING / A.D.A.

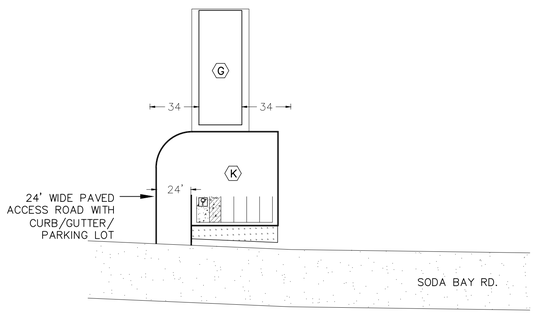
(L) (P) SIXTEEN – 30'X100' (3,000 SF) GREENHOUSES

## CULTIVATION SITE PLAN WITH CANOPY

GRAPHIC SCALE

50 0 25 50

( IN FEET )
1 inch = 50 ft.




Revisions:
---

CULTIVATION SITE PLAN WITH CANOPY

ANTHONY & MATSUKI PERKINS
140 SODA BAY RD
LAKEPORT, CA 95453
LAKE COUNTY
APN's: 008-001-08 & 09

PLOTTED BY: ---
DATE PLOTTED: 5/28/21
SCALE OF DRAWING: SEE PLAN
JOB NUMBER:
CADD FILE:
SHEET: 1

# ATTACHEMENT C

# ONSITE WELL COMPLETION AND PERFORMANCE TEST REPORTS

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

# WATER WELL DRILLERS REPORT

Do Not Fill In

№ 128707

State Well No. CONFIDENTIAL LOG

Other Wells Water Code Sec. 13752

## (2) LOCATION OF WELL:

County Lake Owner's number, if any

Township, Range, and Section 14N, 7W, 31

Distance from cities, roads, railroads, etc. 1/4 mile N Soda Bay ROAD ON E. Side of PROPERTY

## (3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

*If destruction, describe material and procedure in Item 11.*

## (4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

## (5) EQUIPMENT:

Rotary ☐
Cable ☒
Other ☐

## (6) CASING INSTALLED:

STEEL: OTHER:
SINGLE ☒ DOUBLE ☐

| From ft. | To ft. | Diam. | ~~Gage~~ or Wall |
|---|---|---|---|
| 0 | 72 | 12 IN | .250 |
| 82 | 88 | 12 IN | .250 |

If gravel packed

| Diameter of Bore | From ft. | To ft. |
|---|---|---|
| | | |

Size of shoe or well ring:

Size of gravel:

Describe joint Butt weld

## (7) PERFORATIONS OR SCREEN:*

Type of perforation or name of screen

| From ft. | To ft. | Perf. per row | Rows per ft. | Size in. x in. |
|---|---|---|---|---|
| 72 | 82 | | | |

## (8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☒ No ☐ To what depth 10 ft.

Were any strata sealed against pollution? Yes ☐ No ☒ If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing Neat Cement

## (9) WATER LEVELS:

Depth at which water was first found, if known 15 ft.

Standing level before perforating, if known ft.

Standing level after perforating and developing 25 ft.

## (10) WELL TESTS: Bail Test

Was pump test made? Yes ☐ No ☒ If yes, by whom?

Yield: 385 gal./min. with 90 ft. drawdown after 1 hrs.

Temperature of water COOL Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

## (11) WELL LOG:

Total depth 100 ft. Depth of completed well 88 ft.

Formation: *Describe by color, character, size of material, and structure*

| | | |
|---|---|---|
| 0 - 9 | Soil | ft. |
| 9 - 12 | Sticky Blue Clay | |
| 12 - 40 | Sandy Blue Clay | |
| 40 - 52 | Blue Clay + Gravel | |
| 52 - 72 | Sticky Blue Clay | |
| 72 - 78 | Cemented Gravel - Blue | |
| 78 - 78½ | Volcanic Gravel | |
| 78½ - 82 | Blue Gravel | |
| 82 - 100 | Blue Clay - Sandy | |

* 10 Ft. Johnson Watermark 304 Stainless Steel Screen 200 Slot

CONFIDENTIAL LOG
Water Code Sec. 13752

Work started 10-11 19 74, Completed 10-18 19 74

## WELL DRILLER'S STATEMENT:

*This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.*

NAME Willits Drilling
(Person, firm, or corporation) (*Typed or printed*)

Address 100 South Street
Willits, CA 95490

[SIGNED] [signature] (Well Driller)

License No. 304165 Dated 10-19, 19 74

SKETCH LOCATION OF WELL ON REVERSE SIDE



67139-780 8-72 30M TRIP ⓘT OSP

permit SONOMA

County of Sonoma
Permit & Resource Management Department

## CERTIFICATION OF WATER YIELD IN WATER SCARCE AREAS

**WLS-010**

Permit Sonoma shall be notified 24 hours in advance of this test

Water Yield Number _____ Well Permit Number _____

1. Individual performing test: Richard Larsen of Stevenson Water Treatment & Distribtuion Systems Inc
2. Type of license/registration, number and expiration date: C61/D21
3. Location of well: see coordinates
4. Address: 270 Soda Bay Road Lakeport, CA 95453 APN: _____
5. Type and model of test pump: 20 HP Trubine
6. Test pump setting depth: Turbine Bowls @ 70'
7. Maximum reported yield for this pump type at this setting: unknown
8. Type of discharge measurement method: Flowmeter
9. Type and model of flow meter (or provide an accurate description of weir or orifice plate): Seametrics AG-300
10. Geographic coordinates (Plane Coordinate Method or distance from fixed landmarks): 39°00'56.93"N 122°54'07.53"W
11. Estimated elevation of well head: 1340' + 1' above grade
12. Initial static water level (include measuring points such as top of casing, surface seal, access port): 8' from Top of Casing
13. Date & time of initial static water level measurement: 2/2/22 9:15am AM/PM
    a. Discharge Rate: 266 GPM
    b. Dynamic Water Level: 8'
    c. Specific Capacity: 10.23 GPM per foot
    d. Pump Test duration: 6 hrs
14. Immediately after the test take the following measurements:
    a. Dynamic water level: 34'1"
    b. Final discharge rate: 266 GPM
15. Post - Test Measurement:
    a. Dynamic water level: 34'1"
    b. Static water level: 8'
    c. Percentage of recovery of final static level: 100

Testing performed by (signature): _____ Date: 2/2/22

Company Stevenson Water Treatment & Distribtuion Systems Inc. Phone Number: 707-889-6194

Specialist Richard Larsen Date 2/2/22

Approved ☐ Denied ☐

**WELL PUMP TEST DATA RECORDATION** ADDRESS:

| Date | Time | Interval | SWL | GPM | Comments |
|---|---|---|---|---|---|
| 2/2/22 | 9:16 | 1 Min | 24' | 270 | |
| | 9:17 | 1 Min | 27' | 268 | |
| | 9:18 | 1 Min | 29' | 266 | |
| | 9:19 | 1 Min | 30.5' | 266 | |
| | 9:20 | 1 Min | 31.5' | 266 | |
| | | | | | |
| | 9:25 | 5 Mins | 32.6' | 266 | |
| | 9:30 | 5 Mins | 33.1' | 266 | |
| | 9:35 | 5 Mins | 33.5' | 266 | |
| | 9:40 | 5 Mins | 33.6' | 266 | |
| | 9:45 | 5 Mins | 33.6' | 266 | |
| | 9:50 | 5 Mins | 33.6' | 266 | |
| | 9:55 | 5 Mins | 33.7' | 266 | |
| | 10:00 | 5 Mins | 33.7' | 266 | |
| | 10:05 | 5 Mins | 33.7' | 266 | |
| | 10:10 | 5 Mins | 33.7' | 266 | |
| | 10:15 | 5 Mins | 33.8' | 266 | |
| | 10:20 | 5 Mins | 33.8' | 266 | |
| | | | | | |
| | 10:40 | 20 Mins | 33.8' | 266 | |
| | 11:00 | 20 Mins | 33.9' | 266 | |
| | 11:20 | 20 Mins | 33.9' | 266 | |
| | | | | | |
| | 11:50 | 30 Mins | 33.9' | 266 | |
| | 12:20 | 30 Mins | 34' | 266 | |
| | 12:50 | 30 Mins | 34' | 266 | |
| | 1:20 | 30 Mins | 34' | 266 | |
| | 1:50 | 30 Mins | 34.1' | 266 | |
| | 2:20 | 30 Mins | 34.1' | 266 | |
| | 2:50 | 30 Mins | 34.1' | 266 | |
| | 3:20 | 30 Mins | 34.1' | 266 | |
| | 3:50 | 30 Mins | 34.1' | 266 | |
| | | 30 Mins | | | |
| | | 30 Mins | | | |
| | | 30 Mins | | | |
| | | 30 Mins | | | |
| | | 30 Mins | | | |
| | | 30 Mins | | | |
| | | 30 Mins | | | |
| | | 30 Mins | | | |
| | | 30 Mins | | | |
| | | 30 Mins | | | |
| | | 30 Mins | | | |
| | | | | | |
| | | 72 Hrs. or | | | |

## CALCULATION OF WELL RECOVERY

### (Worksheet example taken from Permit Sonoma Number 9-2-28)

1. Determine the water level draw down by subtracting the initial static water level measurement from the stabilized pumping level. Record this result as the well draw down.

2. Next determine the water level recovery by subtracting the post test (within 72 hours) static water level from the stabilized dynamic pumping level. Record this result as the well recovery.

3. Next determine the percent recovery of the well. Divide the water level recovery by the water level draw down and multiply by 100. Record this result as the percent well recovery.

Example:

| | | | |
|---|---|---|---|
| a. | Initial static water level: | (measured value) | 8' |
| b. | Post test static water level*: | (measured value) | 8' |
| b.1. | Time (hours) of measurement: | (within 72 hours) | 17hrs. |
| c. | Stabilized pumping level**: | (measured value) | 34' |
| d. | Draw down: | (calculate by subtracting A from C) | 26' |
| e. | Recovery: | (calculate by subtracting B from C) | 26' |
| f. | Percent recovery: | (calculate by dividing E by D and multiplying result by 100) | 100% |

Well percent recovery (F) must be 90% or greater within a 72 hour period.

* The static water level after 72 hours or less post pump test.

** Kleinfelder refers to this as the dynamic pumping level.

# ATTACHEMENT D

# RADIUS OF INFLUENCE ANALYSIS

# Radius of Influence Analysis

Well Radius (from Well Completion Report) = 12 inches (1 foot)

Specific Capacity (using data from 2/2/2022 6-hour Pump Test)
266 gpm (yield) / 26.1 feet (drawdown) = 10.2 gpm/foot of drawdown
Specific Capacity (SC) = 10.2

Modified Jacob's equation from Driscoll Appendix 16-D (Driscoll 1986[9])
Transmissivity Unconfined Aquifer T = SC x 1500 = 15,300 gpft/day

Distance Drawdown Equation Driscoll 9.11 (Driscoll 1986[9]) T=528Q/ Δs
Δs = 528Q/T
Unconfined Aquifer Δs = 528 x 266 gpm / 15,300 = 9.2 over one log cycle

From Distance Drawdown Graph (below)
Approximate Radius of Pumping Influence = 800 feet