July 8, 2022
To the office of Bruce McPherson, Santa Cruz County Supervisor, 5th district

From: The Old Mount Protectors – a group of dedicated, long-time Santa Cruz mountain residents and neighbors opposed to the establishment of a commercial cannabis grow operation at 375 Old Mount Road, Felton, CA - in the heart of their isolated rural community.

MAJOR CONCERNS FROM NEIGHBORS OF THE PROPOSED CANNABIS GROW OPERATION at 375 Old Mount Road, Felton, CA. 95018

CEQA Studies and Reports

1) CEQA REVIEW IS REQUIRED: This proposed application should not be exempted from CEQA, which was designed to protect environments exactly like the one in question here. This cornerstone environmental protection law requires studies and reports for when a proposed project *may* have impacts on the environment. Given this application's potential impact on water supply – one of the most critical environmental issue in our county – as well as other impacts gives ample reason to make sure the County and citizens fully understand its potential impact. The Zoning Administrator's approval of a CEQA exemption for this project is not only non-sensical given the historic drought and questions about water use, but is contrary to law. The reasons are detailed in the separate letter (attached) that was already filed with our appeal by our attorneys, Wittwer Parkin.

Excessive Water Use Given Drought-Devastated Region

2) TOO MUCH DRAIN ON WATER: The proposed project, by the most conservative estimates, will use an additional 240,000 gallons of water, condensed during a 6-month growing season, making it the equivalent of a half-million gallon usage anually. We think even this is an underestimate, given the scientific literature and the growing plans described to us by the applicants (three 8-10 week grow cycles with 10,000 plants in each cycle.) In addition, water will be consumed by 5 full time workers, 10 workers for the three harvests, and required hedge row irrigation. This is an addition to the applicants' family of 6 living on

the property. Our already heavily-impacted water table and local, regional and county water systems and natural environment, cannot accommodate an additional hundreds of thousands of gallons during the driest time of the year.

3) IMPACT ON OUR SUPPLY: We all have already seen the impacts of the drought on our wells and water quality, even without this added drain. Neighbors have had to have water trucked for the first time, have seen major increases in sediment and reduction in water quality, and our wells are already producing at fractions of what they did even a few years ago. This new large extraction of groundwater poses severe risk to many of us losing our water supply. The water from this site also flows down into Zayante Creek, which feeds the water supply for areas of San Lorenzo Valley and the County.
4) INADEQUATE WELL - The well at 375 Old Mount itself shows that there is not enough water for this operation. The well report submitted by the applicant would be inadequate for an application for a typical residential use – which is usually for fewer than 6 people. It shows just barely the 3 gallons per minute that the residential regulations would require. But that report is 2-and-a-half years old (i.e., 2-and-a-half years of further drought), was only a one-hour report (not the required 24 hours), and describes the well as a "low yield well" that runs dry quickly. The well initially produced 15 gpm but only 187 gallons over an hour, which means it probably ran dry in less than 12-and-a-half minutes. Meanwhile, to produce 240,000 gallons, at its best, this well would need to run continuously for approximately 2 months to produce the minimally-stated water required for this operation (not including household, worker or other irrigation use). That's a full one-third of the time during the 6-month grow season. The Planning Department has indicated that they are not required or allowed to require an adequate well test for a cannabis grow. However, this ignores the fact that CEQA review is an independent basis to examine the impact of the project on water supply and groundwater, and that CEQA requires the implementation of feasible mitigations and alternatives for significant environmental impacts.
5) FIRE: Besides providing life-sustaining hydration to the neighbors, plants and animals surrounding this proposed cannabis site, the water supply has another desperately-needed role in protecting our homes and

communities – Fire Protection. Any threat to our and the County's water supply threatens our ability to fight off the inevitable fires coming.

Security

Fence in disrepair; Sheriff response time not realistic; No M.O.U. on security issues related to shared gate

6) The owners of the proposed commercial cannabis property assured neighbors that the security plan allegedly presented to the Zoning Administrator and local sheriff's office consisted of "military type security" and ""As soon as someone crossed that line the sheriff will be here". Sheriff response time to this neighborhood is a minimum of 25 minutes at best and defying all speed laws due to physical distance from Felton sheriff's office to this site. This is not an adequate timetable to protect the lives and property surrounding the site. The area is surrounded by forest, and anyone could easily disappear into the undeveloped area before any law enforcement arrived. This could potentially trigger an expensive manhunt, as well as create a terrifying situation for the larger community of isolated mountain homes and families.

7) Fencing causes significant impacts to wildlife and the impact of fencing must be examined. Nevertheless, fences are used for security purposes at cannabis cultivation site. The existing fence surrounding the proposed cannabis grow property is in disrepair and does not maintain a height of even 4' in many areas. The dilapidated condition of the fence was not addressed by the Zoning representative nor the security representative during the March 5, 2022 Zoning Administrator public hearing. The repair and improvement of the fence was not added as a condition of approval.

8) The access gate to both the long-established Green Earth Zayante Vineyard property and the proposed commercial cannabis property is by a shared electric gate. The owners of Green Earth Zayante Vineyards (420 Old Mount Road) installed this gate in the 1980's and the electricity to run it is connected to the 420 Old Mount Road property and not the 375 Old Mount Road property (where the cannabis grow is proposed).

The shared status of the gate was not addressed by the Zoning Administrator nor the security representative. The resolution as to who was to be responsible to maintain the obligations of the security plan affecting the shared gate was not listed as a condition of approval. It appears that the Zoning Administrator and the sheriff are not aware that this is a shared access gate as no one has contacted the owners of 420 Old Mount Road as to their new responsibilities related to proposed new security measures. It is unrealistic to expect the neighbors to participate and enforce operating and maintaining the access gate according to the new unknown security rules of the proposed commercial cannabis grow operation.

Destruction of Roads by Trucks

9) IMPACT TO NEWLY-RESTORED ROAD: It is our understanding that this operation will require the ingress and egress of multiple heavy refrigerator trucks to come on site several times a year to collect the harvest. The proposal is that the trucks will remain on site for a few days to be filled with the freshly harvested cannabis and then trucked elsewhere for processing. The cannabis is to be frozen on site to preserve quality, thus requiring the use of refrigerator trucks. We need to clarify how big these trucks are in length and weight when fully loaded. Zayante Road has a length and weight restriction on trucks and there is concern regarding the impact of extra traffic and regular heavy trucks on a road that was recently repaved at great cost to the County and designated as an alternate escape route in advent of the need for emergency evacuations.

10) HERE COME THE WATER TRUCKS!: While the cannabis regulations prohibit the applicant from using water trucks to support the cannabis grow, we are concerned that water trucks will be used. Given the points above in #4, it's clear that there's not enough water produced by the well at this site, so they are likely to need an external water source. Would the applicant be able to truck in water and say that's for residential, not cannabis use? Will the applicant, after investing millions of dollars into this grow operation, feel the need to skirt the regulations

and try to truck in water anyway? If the County ignores the inadequate water supply, is it just instigating an enforcement situation when the applicant will need to truck in water. Even if none of that comes to pass, because of the drain on the water table that the cannabis grow will cause, *other* homes on these roads will need to truck in water – the drought has already compelled this for many. It doesn't matter whether the water trucks are heading to 375 Old Mount or somewhere else nearby. This operation will lead to heavy water trucks on our roads.

Odor

11) Sam LaForti, the County Cannabis Licensing Manager, disputed any concern voiced by neighbors for the negative effect of air borne phenolics (terpenes) emitted by ripening cannabis plants on the long-established heritage vineyard adjacent to the proposed grow. There are numerous volatile aromatic "terpenes" identified in cannabis known to travel great distances that are easily detected by humans and potentially absorbed by grapes. It is likely that these same terpenes can negatively affect the delicate flavor of wine grapes. The Cannabis representative disputed this theory by misquoting a research paper that links those terpenes of eucalyptus oil emitted from Eucalyptus trees to negative flavors of wine grape quality. The blatantly untrue statement and misrepresentation of the facts he stated that disputed the established fact that volatile terpenes emitted by Eucalyptus trees negatively impact wine grape flavor leads one to question the veracity other "facts" stated by the representative defending cannabis grows.

Abuse of Co-Location Rules

12) By creating two separate LLCs, the proposed cannabis operators seek to exploit the County cannabis regulations, which allow co-located entities to grow twice as much cannabis on a single parcel. However, the Supervisors certainly didn't mean for the regulations to allow one family to grow double the crop through legal slight-of-hand. The project should be denied because this is not a collated grow. Instead, it is one family attempting to skirt the square foot limit of 10,000 square feet.

Thank you for your consideration of these issues so central to the well-being, security and way of life of our isolated and rural community in the heart of the Santa Cruz Mountains.

Gratefully,

Josh Leichter
On behalf of The Old Mount Protectors

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July 7, 2022

Santa Cruz County Planning Commission,
c/o Santa Cruz County Planning Department,
701 Ocean St, Room 400,
Santa Cruz, CA, 95060

RE: Commercial Development Permit Application #211083
375 Old Mount Rd,
Felton, CA, 95018

Dear Members of the Planning Commission,

I have been retained by Aaron Madani, Masood Madani and Sarah Madani, owners of 375 Old Mount Rd, Felton, CA, 95018, to represent them in requesting you deny the appeal of Permit Application #211083, which was approved by Zoning Administrator Jocelyn Drake on March 4, 2022, and was subsequently appealed by the group "Old Mount Protectors." Contrary to the reasons set forth in the appeal, the Zoning Administrator was correct in her determination that the applied for permit should be approved, and that the project was correctly determined to be exempt from environmental review under the California Environmental Quality Act (CEQA). This determination is consistent with planning department and Zoning Administrator findings in numerous other similar applications that the project is CEQA except, as it qualifies for both Class 1 and Class 4 exemptions respectively.

In addition, in their appeal, appellant repeatedly cites sources that are clearly inaccurate and outdated. These sources do not provide an accurate depiction of current cannabis cultivation practices due to having been authored prior to the passage of California's Medical and Adult Use of Cannabis Regulation and Safety Act (MAUCRSA), which went into effect January 1, 2018, and Santa Cruz County Code Sections 7.128 and 13.10.650, all of which place strict regulations on water usage and the use of pesticides and rodenticides. These regulations had not been authored or passed at the time of the writing of the 2015 article *"High to for Conservation"* from the Journal *Bioscience,* which Appellant frequenty sites and bases many of their arguments off. At the time that the *Bioscience* article was written, no regulations had been established regarding the use of irrigation water, pesticides and rodenticides for cannabis cultivation. In addition, much of the cannabis cultivation discussed in the article, particularly in regard to pesticides and rodenticide usage, is stated in the article as being in reference to "semi-legal and black market context," (Appellant's Exhibit A, *Bioscience* article, page 2) which, was not subject to any form of regulation whatsoever. Subsequently, very strict regulations were put in place under MAUCRSA and SCCC 7.128 and SCCC 13.10.650, and which the Applicants would be required to meet. Due to these regulatory changes, the information provided by appellant is incorrect and irrelevant, and the

commissions decision making should be based on more recent and accurate studies. As is explained below, due to the use of and reliance on information contained in the outdated 2015 *Bioscience* article which the Appellant's appeal cites, Appellant has given an estimate of water usage of the proposed cannabis cultivation that is deceptively inaccurate, with their estimate being more than twelve (12) times the amount that is projected based on more recent and accurate statistical data.

A. The Zoning Administrator's Determination that the Project Qualifies for a Class 1 Categorical ("Existing Facilities") Exemption under C.C.R. Title 14, Section 15301 Was Correct.

A Project that "*consists of the operation, repair, maintenance, permitting, leasing, licensing or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination*" qualify for a Class 1 Categorial Exemption under 14 CCR 15301.

Here, the Project consists of outdoor cultivation of 20,000 square feet of cannabis on a 31.5 acre AG (Agriculture) zoned parcel. This parcel has long contained a vineyard containing approximately four (4) acres of wine grapes. The addition of 20,000 square feet of cannabis cultivation represents an increase of only approximately eleven percent (11%) of the existing agricultural use on the property and will occupy only approximately 1.5% of the overall parcel. As stated in the Staff Report (attached Exhibit F), the Project will use a pre-existing well, septic system, driveway, land, and electrical service. The Appellant heavily emphasizes that the project will involve the use of what they term "hoop-houses." These structures are properly termed within County Code Section 12.10.315(A)(11) as "Agricultural Shade Structures." SCCC 12.10.315 exempts these structures from requiring building permits because these structures are temporary and can easily be put up or removed as needed. They are not permanent structures. One of the conditions of the use permit is that the structures will be required to taken down and removed during the rainy season to prevent any issues related to water runoff. The only significant alteration will be the installation of a fence, which will surround the cannabis cultivation area (not the entire property). All other aspects of the proposed cultivation site will use existing infrastructure or temporary, seasonal structures.

Given that the sole modification related to the project is the installation of a fence immediately surrounding the cultivation are, this project qualifies for a Class 1 Categorical Exemption due to it's use of existing facilities.

B. The Zoning Administrator's Determination that the Project Qualifies for a Class 4 Categorical ("Minor Alterations to Land") Exemption under C.C.R. Title 14, Section 15304 Was Correct.

Class 4 Categorical Exemptions under 14 CCR 15304 apply to any project which *"consists of minor public or private alterations in the condition of land, water, and/or vegetation which do not involve removal of healthy, mature, scenic trees except for forestry or agricultural purposes."*

Here, the Project consists solely of outdoor cultivation of cannabis in an already cleared, open field. The project requires no clearing of trees or vegetation whatsoever, with the only permanent addition consisting of the installation of a fence surrounding the cannabis cultivation area. Although Appellant argues that the use of "hoop-houses" means that this project is not a minor alteration, as explained previously, the Agricultural Shade Structures that the Applicant will be using are not <u>permanent structures</u>.

As has already been pointed out numerous times by both the Staff Report, and even the Appellant, is that the property is zoned for Agricultural (A zoned) and has a long history of agricultural use over an area that is significantly larger than that which would be allowed for under this use permit.

Appellant states that the change in use is significant because grapes previously grown on the property are dry farmed, but the fact that the variety of grapes currently on the property is a dry-farmed variety is simply a coincidence. There was no regulation in effect when they were planted that required the then-owner to only grow a variety of grapes that is dry farmed, and there is no law, regulation, or condition that states that only dry-farmed grapes can be grown on the property now. The Applicant has every right to start watering the vineyard if they chose to or replace the existing vineyard with another variety of grapes that requires watering. By choosing not to irrigate the vineyard in the past, the Applicant has not somehow waived or given up their right to irrigate crops on the property in the future. Choosing not to irrigate agricultural crops on an agricultural property in the past does not mean that the owners have somehow forfeited their right to ever do so in the future.

C. The Proposed Cannabis Cultivation Does Not Create a Significant Cumulative Impact per CEQA Guidelines Sections 14 CCR 15300.2(b) and 15300(c).

Appellant argues that despite the County's findings that that this project qualifies for Class 1 and Class 4 CEQA exemptions, those exemptions are inapplicable regardless because of CEQA Guidelines Sections 15300.2(b)'s "Cumulative Impact" provision. Under CEQA Guidelines Sections 15300.2(b), "*exemptions are inapplicable when the cumulative impact of successive projects of the same type in the same place, over time is significant*." Despite Appellant's contentions, the "growth of cannabis in Santa County," and in particular in the region of this project does not create a significant cumulative impact given that cannabis cultivation in the County accounts for only approximately 0.3% of the acreage of land currently being used for agriculture within the County, and essentially none in the immediate vicinity of this project.

1. The Growth of Cannabis in Santa Cruz County is Insignificant in Relation to Existing Agricultural Use Within the County.

Appellant argues that the Project will have a significant cumulative impact because the "increasing push for cannabis cultivation in the County will strain already overstretched water resources." (Page 6 of appeal letter). Despite Appellant's unsubstantiated claims of a "push for cannabis cultivation", the amount of cannabis being cultivated in Santa Cruz County is miniscule in comparison to the County's existing agricultural industry. According to the 2020 Crop Report prepared by the County of Santa Cruz Office of the Agricultural Commissioner (Exhibit A, County Agricultural Commissioner's 2020 Crop Report), as of 2020, within the County of Santa Cruz the total acreage of agricultural productions of the County's four largest crop types was as follows:

Crop	**Acreage (43,560 square feet per acre)**
Berries	5,236
Wine, Apples and Misc. Fruit.	2,951
Vegetable Crops	7,722
Nursery Crops	862
Total	*16,771 (730,544,760 square feet)*

By contrast, California Department of Cannabis Control records show that there are only a total of 175 active cannabis cultivation licenses in Santa Cruz County. Of those, twelve are "specialty"

licenses which allow for cultivation of no more than 500 square feet of cannabis, and 111 are "small" licenses which allow for no more than 10,000 square feet of cannabis. Under County regulations, the remaining licenses allow a maximum of only 44,000 square feet (approximately one acre) of cannabis, with many licensees not even being allowed that full amount. It is also important to note that a significant number of these cultivation licenses are for indoor cultivation only within the City of Santa Cruz and/or the City of Watsonville, in which case the any irrigation water used would not be drawn from a well at all, but rather municipal water sources (tap water).

Given the number of active licenses and the maximum number of square footage allowed under them, the total amount of cannabis being cultivated in the entire unincorporated County of Santa Cruz has never exceeded 54 total acres of cultivation area. Further, due to a fall in cannabis prices, a number of licensed or previously licensed cultivators have chosen to either reduce the amount of cannabis that they cultivate this year or stop cultivating altogether. All cannabis production in the entire County represents approximately 0.3% of the total acreage of agricultural land cultivated for County's top four crop types. This applicant's proposed project would allow a maximum canopy of less than one-half of an acre (20,000 square feet). This represents 0.0027% of the acreage being cultivated of the four crop types listed above.

In addition, in this case, the applicant's property, near Zayante Creek, is located in the San Lorenzo River watershed. The vast majority of (virtually all) of the other outdoor commercial cannabis cultivation in Santa Cruz County occurs in the Pajaro Valley watershed in south Santa Cruz County, which is the location of the majority of the commercial agriculture (CA) zoned parcels. Cannabis cultivation in the Santa Cruz Mountains has become extremely rare. After consulting with County Cannabis License Officer Sam LoForti, I discovered that there is only one other actively used, licensed outdoor cannabis cultivation facility in the entire San Lorenzo River watershed, and it is in the Kings Creek drainage, and therefore has no effect on groundwater levels in upper Zayante. The two sites are over six miles apart in a straight line (Exhibit B).

While the Appellant states that "the County is failing to consider the immense impact on water resources that cannabis grows will cumulatively cause", the reality is that the cumulative total water usage for the cannabis cultivation is infinitesimal compared to the amount of water used by other agricultural activities in the County. Further, there is not a single other license cannabis cultivation site within the Zayante Creek watershed that could result in any cumulative effect on groundwater levels in the area of the applicant's vicinity.

2. Appellant's Estimates of Water Use at 375 Old Mount Rd are Grossly Exaggerated.

Appellant estimates that cannabis cultivation under the applied for license "would use, at least, an astonishing 3,000,000 gallons of water per year" (Appeal Letter, Page 7). As Appellant states, this estimate is based on water usage rates in their frequently cited 2015 *Bioscience* article, which estimates water usage at a rate of 430,000,000 liters per square kilometer for outdoor-grown marijuana. This article is outdated, based on data and information gathered from "black market and semi-legal grows" and the article itself states that, in its calculations it the authors "assume a planting density of 130,000 plants per km^2", indicating that the 430,000,000 liters per square kilometer figure quoted is a rough approximation.

More recently, in 2021, the University of California, Berkeley's Cannabis Research Center, the Resource Innovation Center, and New Frontier Data collaborated to publish a study titled "Cannabis H2O Water Use & Sustainability in Cultivation" ("Berkeley Study", attached Exhibit C). This study utilizes more recent, real-world data collected for license and regulated commercial cannabis cultivation sites (not "black-market" cultivators as cited by Appellant) in a number of States, including California. This study,

based on data from 618 licensed California cultivators for the year 2019, determined that average water usage for outdoor commercial cannabis cultivation in California is 11.3 gallons per square foot, per year (Exhibit C, page 41). At this, rate, which is calculated from recently collected data from licensed and regulated cultivators, the proposed project would only use approximately 226,000 gallons of water per year. Appellant's estimate of water usage for the project is more than twelve times more than will likely actually be used by the applicant as calculated by the more recent and more accurate Berkeley Study and will require only approximately 7.5% of the water estimated by the Appellant.

In addition, Santa Cruz County Cannabis Licensing Officer Sam LoForti, in a letter written to the Zoning Administrator in support of this project (Exhibit D, Page 2), states that information he has received from other licensed cultivators in Santa Cruz County indicates that their typical water usage is lower than the usage rate determined in the Berkeley Study. This is likely due to Santa Cruz County's requirement that low-flow/drip irrigation is used for commercial cannabis cultivation (including this project), which is not required in all jurisdictions. Local data collected by the Cannabis Licensing Officer indicates water usage for cultivation in the Santa Cruz Mountains to average 72,000-90,000 gallons per 10,000 square feet of cultivation space. At this rate, this project, which allows for a maximum of 20,000 square feet of cultivation space, will use 144,000-180,000 gallons of water per year, equal to only 4.8-6% of the estimate provided by Appellant.

Regardless of whether you go by the data collected in the larger Berkeley Study, which includes data from a number of Northern California Counties, or the more localized data provided by the Cannabis Licensing Officer, the Appellant's estimate of water usage for the proposed cannabis cultivation at 375 Old Mount Rd, is clearly grossly inaccurate and deceptively exaggerated. Appellant states that cannabis is "thirsty and consumes excessive resources" (Appeal Letter, page 6) when in reality, the data gathered in the Berkeley Study shows that the water required for cannabis cultivation is not particularly high among agricultural crops. In addition, in a previous report prepared for the County Board of Supervisors (Exhibit E), Mr. LoForti did a comparison between water usage for cannabis irrigation in relation to the County's other most commonly grown crops, which was based on data provided by the *Pajaro Valley Water Agency Irrigation Rate Analysis Update Memorandum* (2013). Based on the data collected by the Pajaro Valley Water Agency, it was determined that water use for cannabis irrigation is actually significantly lower than many of Santa Cruz County's most commonly grown agricultural crops. Outdoor cannabis cultivation requires less water (11.3 gallons, per square foot per year, Exhibit C, page 41) than the County's top agricultural crops, strawberries (18.7), vegetable row crops (18.7), mixed-berries (15.7), raspberries (15.0) and nurseries/cut-flowers (13.5) (Exhibit E, Page 4). Despite Appellant's contention otherwise, cannabis is not a particularly "thirsty" crop when compared to others commonly grown in the County.

3. Appellant Incorrectly Describes the Project's Potential Impact on Wildlife

Appellant cites a study performed by the University of California, Berkeley's Cannabis Research Center in stating three ways that the Project will "have a substantial impact on wildlife", specifically (1) "disturbance from light and noise, (for example from generators or grow lights)," (2) "modification of natural vegetation (for example clearing land or fencing off an entire parcel)" and (3) "unmonitored use of plastic monofilament could result in animals getting entangled and injured in lines, or ingesting plastics." Appellant fails to discuss however that based on the use permit applications, none of these potential impacts is applicable to this project (Exhibit F, Staff Report).

With respect to the first potential impact, disturbance from light and noise, the use permit at issue is for outdoor cannabis cultivation without the use of supplemental lighting. No lighting is intended and

the use-permit does not allow for the use of lighting. With regards to noise created by generators, SCCC 7.128.170(f) specifically states that "outside of an emergency, generators may not be used as a power source." This project complies with this County Code provision, and there is no intent or proposal to use a generator as a part of the project.

This project also does not require "modification of natural vegetation" as described by the Appellant. The project consists of cannabis cultivation of an open field that has been cleared for many years. No new vegetation clearing is proposed, and the entire parcel will not be fenced off (although a fence will be placed around the immediate area of the 20,000 square foot cultivation area for security purposes.

Finally, the Project does not involve the use of any monofilament for any purpose, so there will not be any risk of wildlife becoming entangled in, injured by or eating monofilament or plastic.

It is also worth noting that as part of the California State Department of Cannabis Control application process, each applicant is required to go through a review process with the California Department of Fish and Wildlife prior to the issuance of a commercial cannabis license. No cannabis can be cultivated until this review process is complete and CDFW has approved the project. Here, the applicants have gone through the CDFW review process and have been approved.

4. The Applicant Has a Security Plan Which Was Approved by the Santa Cruz County Sheriff's Department.

The Appellant states that the County has failed to address security concerns related to the proposed project. However, as part of the cannabis licensing process, the applicant is required to submit a security plan to the Santa Cruz County Sheriff's Department for approval. The applicant has done so, and approval was given. The security plan is not included in the previous Staff Report however, nor is it included in other cannabis business applications, because the Staff Report is public record, and publishing it would allow anyone to review it for a potentially unguarded point of entry.

In addition, there is only one other residence that is accessed by Old Mount Road, which is a private cul-de-sac, and as is required under the SCCC 13.10.650's setback requirements, no cannabis shall be cultivated within 400 feet of a habitable structure on an adjacent property. There is an existing fence between the cultivation site and the nearest residence and a gate at the property entrance, and an additional fence will be built around the cannabis cultivation site. Even in the event that a security incident did occur, there is no reason that someone intending to steal cannabis would cross two fences to go to a building over 400 feet away and on another property where there is no cannabis is located. Furthermore, once again, the applicant has submitted a security plan to the County Sheriff's Office, who has evaluated the plan and given their approval.

D. There is No Legitimate Evidence to Support Appellant's Claim that Cannabis Cultivation will Affect Wine Production on Adjacent Properties.

Appellant has argued that the presence of cannabis cultivated at 375 Old Mount Road will taint wine grapes on adjacent properties, citing an October 28, 2019, document authored by Dr. Anita Oberholster PHD, in which Dr. Oberholster expresses concerns about the potential for terpenes released by cannabis plants to potentially effect the flavor of wine grapes nearby. The concern is based on similar effects caused by eucalyptus trees, which also release terpenes. This effect has also been observed with lavender.

Although Dr. Oberholster expressed concern, she does not state that there is any actual evidence showing that cultivation of cannabis in the vicinity of wine grapes affects flavor. She specifically describes a "lack of evidence-based information on the potential impacts of the cannabis industry on established vineyards is a risk to the future viability of the grape and wine industry." In her conclusion, Dr. Oberhauser simply states that "outdoor cannabis cultivation, particularly on a large scale with large canopy area, could have a potentially significant impact on terpene composition of wine grapes" and that care be taken that "while research seeks to provide objective metrics of allowable concentrations and appropriate strains of cannabis to be grown in proximity to high quality wine grapes." At no point during the document does Dr. Oberhauser state that there has been any actual affirmative evidence that cannabis cultivation does in fact taint wine grapes, or any definition as to what constitutes a "large canopy area," what distances terpenes could potentially drift, or any objective information, as no such information exists.

Since the document was authored in 2019, Santa Barbara County, a county renowned for world class wine production, has gone on to become the top cannabis producing county in the State of California. The California Department of Cannabis Control currently lists 1,949 active cannabis cultivation licenses in the County of Santa Barbara. By comparison, the County of Santa Cruz has only 175 active state licenses (which includes both indoor and outdoor cultivation, and licenses within the City of Santa Cruz and City of Watsonville). Likewise, Monterey and Mendocino Counties, each also known for production of high-quality wine grapes, have also become major producers of cannabis, with 515 and 750 state cannabis cultivation licenses issued in those Counties respectively. Despite the proliferation of cannabis cultivation in these counties, there has been no objective study showing that cannabis cultivation effects the quality or flavor of wine grapes grown nearby. Appellant's claims regarding cannabis's effects on neighboring vineyards are pure speculation.

In addition, given the potential effects of cannabis terpenes comparisons to terpenes released by eucalyptus trees, it is also worth noting that the Australian Wine Research institute has determined that high levels of eucalyptus terpenes (specifically 1,8-cinoele) are only noted in grapes grown in very close proximity to eucalyptus trees, and that "grapes harvested from rows greater than 25 or 50 m from Eucalyptus trees gave wines very low levels of 1,8-cinoeole, whilst those grown close to trees contained significant amounts" (Exhibit G, Page 1). In this instance, the nearest wine grapes to the proposed cannabis cultivation site are well over fifty (50) meters from the nearest wine grapes.

E. The Familial Relationship Between the Parties Co-Locating on the Property Does Not Make Their Co-Location a "Sham" and Complies with County Code.

SCCC 7.128.110 allows for multiple applicants to co-locate and seek commercial cannabis cultivation licensing on the same property. Doing so allows for each to have a separate canopy area that is equal to the size of if only a single applicant is located on the property.

Appellant states that because the parties co-locating and seeking licensing for cultivation are related, that this somehow makes their application illegitimate and a "sham." There is nothing in County regulations that states that co-location applicants cannot be related to one another, and co-location between related parties has been allowed on other cannabis cultivation sites. Appellant is simply grasping at straws by implying that two relatives choosing to co-locate on the same property is part of some sinister "sham" or conspiracy, despite there being no basis in fact to support their statement.

CONCLUSION

Despite the Appellant's claims to the contrary, the Zoning Administrator was correct in her decision to approve the use-permit applied for at 375 Old Mount Rd. Her decision was based on the recommendations of a number of different County experts in the planning department, the cannabis licensing office, and the environmental health department. Based on their review and fact-finding, it has been correctly determined that the project meets the standards for Class 1 and Class 4 CEQA categorical exemptions due to its use of existing facilities and because it will result in only minor alterations to the land and existing, long time agricultural use.

This project has been thoroughly reviewed and vetted by a wide number of separate departments and agencies including planning, the cannabis licensing office, the environmental health department, CalFire, the Santa Cruz County Sheriff's Department, the California Department of Fish and Wildlife, and the State Waterboard all of which have approved of and endorsed the project. In addition, prior to proceeding with the project, the project will be reviewed yet again by the California Department of Cannabis Control, and annual filing with the State Water Board reporting water use are also required. This project has been extremely thoroughly vetted prior to receiving the recommendation for approval by staff, and the applicants have gone out of their way to minimize their impact. We therefore request that the Planning Commission uphold the Zoning Administrator's findings and follow the staff recommendation to allow the project to move forward.

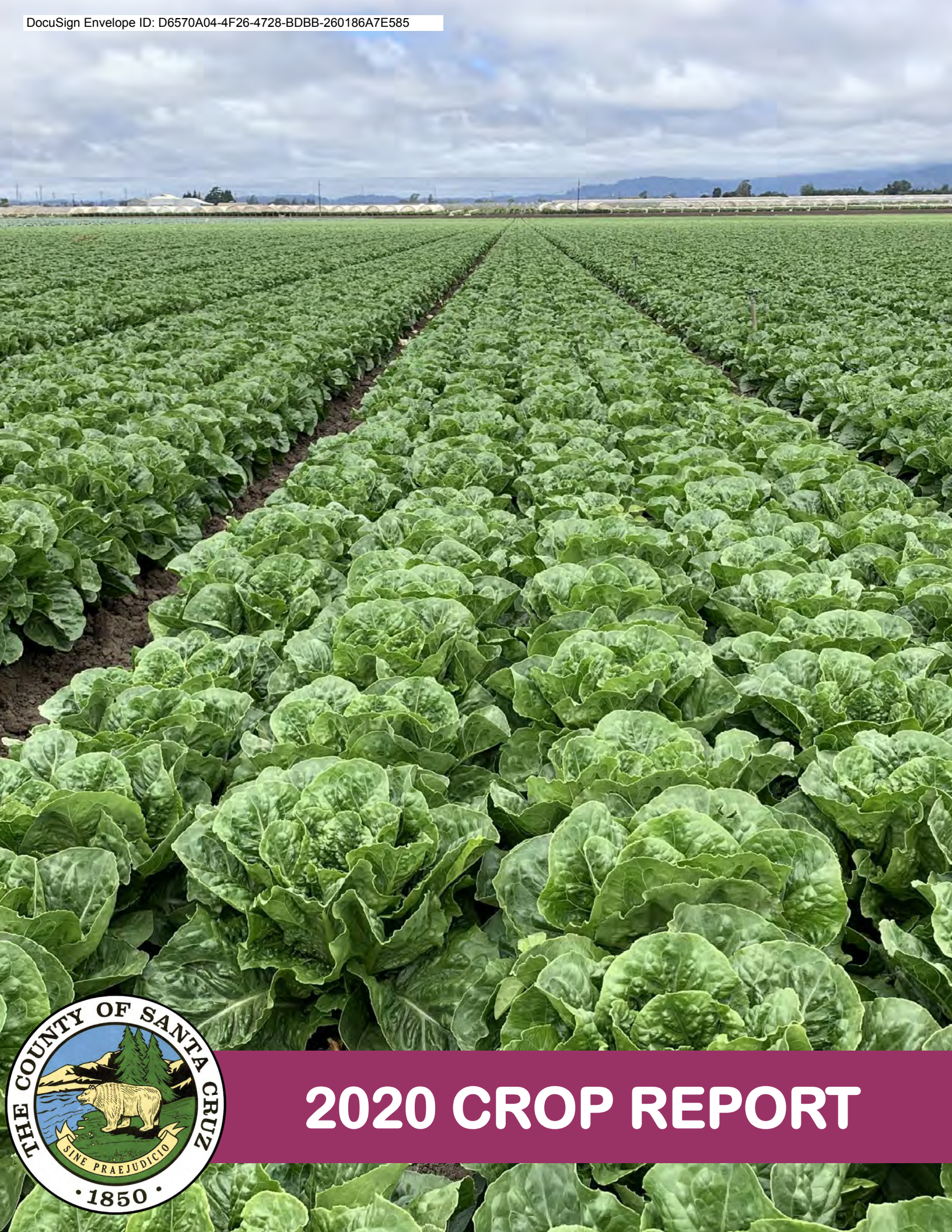
Sincerely

DocuSigned by:
Trevor Luxon
0F4A4899B94B40D...

Trevor Luxon

EXHIBIT A

SANTA CRUZ COUNTY AGRICUTURAL COMMISSIONER'S 2020 CROP REPORT



2020 CROP REPORT

COUNTY OF SANTA CRUZ

OFFICE OF THE AGRICULTURAL COMMISSIONER
JUAN HIDALGO
AGRICULTURAL COMMISSIONER
SEALER OF WEIGHTS AND MEASURES
DIRECTOR, MOSQUITO AND VECTOR CONTROL

Karen Ross, Secretary, California Department of Food and Agriculture
And
The Honorable Board of Supervisors of the County of Santa Cruz

Bruce McPherson,	5th District, Chair
Manu Koenig,	1st District
Zach Friend,	2nd District
Ryan Coonerty,	3rd District
Greg Caput,	4th District

In accordance with the provisions of Section 2279 of the California Food and Agricultural Code, I am pleased to present the 2020 Crop Report for Santa Cruz County. The report represents estimated acreage, yield and gross values of agricultural products produced in Santa Cruz County.

The total gross production value of Santa Cruz County agricultural commodities for 2020 is $636,032,000. This represents an increase of 1.7 percent, or $10,701,000 above the 2019 production value of $625,331,000. Gross production yield and value is influenced by factors such as weather, labor, and the marketplace. The COVID-19 pandemic, unusual trend of very hot days during certain times of the growing season, and the wildfires impacted the values of many of our commodities in 2020. Resilience and adjustment throughout the season by our growers, along with strong support and demand from our communities for fresh fruits and vegetables during a year of unprecedented difficulties, minimized agricultural losses in our County.

It is important to emphasize that figures presented in this report are gross values and do not include costs incurred by growers that include but are not limited to labor, land preparation, irrigation, pest management, transportation, cooling, marketing, equipment, assessments, regulatory costs or loss experienced by individual operations. Also, the figures do not reflect the total contribution of agriculture to the economy of Santa Cruz County. Farm employment and other farm-related services add significant value and benefits to the local economy.

Strawberries remain the number one crop in Santa Cruz County with an estimated value of $193,911,000 on approximately 2,137 planted acres. Raspberries are our number two crop with an estimated value of $139,934,000. Berries (strawberries, raspberries, and blackberries) saw an overall increase in gross value of 6.4 percent, or $23,841,000 compared to 2019, for a total value of $397,139,000. Berries represent approximately 60 percent of the total gross production value for our County.

Vegetable production remained strong in Santa Cruz County with an overall value of $89,462,000, a slight decrease from the 2019 production value of $94,636,000. Unusually hot weather in August impacted apple production, contributing to a 46 percent decrease in value to $10,981,000 compared to the 2019 production value of $19,669,000. Wine grapes were impacted by wildfire smoke and saw a production value of $4,814,000, a decrease of 18 percent compared to the 2019 production value of $5,586,000. The pandemic hit our cut flower and cut greens industry particularly hard with overall value decreasing 58 percent compared to 2019, from $27,127,000 to $11,515,000.

I would like to express my sincere appreciation to all the farmers, ranchers, boards, commissions, packinghouses and agencies who contributed vital data without which this report would not be possible, and many thanks to my staff for their dedication to compiling and producing the 2020 Santa Cruz County Crop Report.

Respectfully submitted,

Juan Hidalgo
Agricultural Commissioner

SANTA CRUZ COUNTY
AGRICULTURAL COMMISSIONER
SEALER OF WEIGHTS AND MEASURES
DIRECTOR OF MOSQUITO and VECTOR CONTROL

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Photos by Alberto Vinuela

IN APPRECIATION OF AGRICULTURE

The 2020 Santa Cruz County Crop Report is dedicated to all our essential agricultural workers and agricultural operations in Santa Cruz County and our State. Thank you for being the lifeline to our communities during these unprecedented and trying times. Your sacrifices will not be forgotten and will always stand as a reminder of the importance of the work you do, the importance of agriculture in California and the key role agricultural workers and growers play in bringing food to our tables.

SANTA CRUZ COUNTY

FRUIT CROPS

CROP	YEAR	ACRES	PRODUCTION (TONS PER ACRE)	TOTAL PRODUCTION (TONS)	PRICE (PER TON)	TOTAL VALUE
STRAWBERRIES	**2020**	**2,137**	**34.90**	**74,581**	**$2,600**	**$193,911,000**
	2019	2,308	35.62	82,220	$2,200	$180,884,000
RASPBERRIES	**2020**	**2,050**	**9.85**	**20,193**	**$6,930**	**$139,934,000**
	2019	1,972	9.36	18,458	$7,564	$139,616,000
BLACKBERRIES	**2020**	**1,049**	**8.55**	**8,969**	**$7,057**	**$63,294,000**
	2019	908	8.74	7,936	$6,653	$52,798,000
TOTAL BERRIES	**2020**	**5,236**				**$397,139,000**
	2019	5,188				$373,298,000

APPLES, FRESH AND PROCESSED	**2020**	**2,030**	**15.50**	**31,465**	**$349**	**$10,981,000**
	2019	2,025	26.32	53,298	$369	$19,669,000
WINE GRAPES	**2020**	**670**	**2.39**	**1,601**	**$3,006**	**$4,814,000**
	2019	679	2.54	1,725	$3,394	$5,856,000
TOTAL APPLE, WINE AND MISC. FRUIT*	**2020**	**2,951**				**$16,247,000**
	2019	2,937				$25,723,000

*The total acres and value figures include the categories miscellaneous berries, tree and vine fruit, which were reported in a separate category in previous reports. Miscellaneous berries, tree and vine fruit includes boysenberries, blueberries, olallieberries, apricots, avocados, figs, kiwifruit, lemons, olives, peaches, pears, plums, persimmons, pomegranates, prunes and walnuts.

SANTA CRUZ COUNTY

VEGETABLE CROPS

CROP	YEAR	ACRES	PRODUCTION (TONS PER ACRE)	TOTAL PRODUCTION (TONS)	PRICE (PER TON)	TOTAL VALUE
BRUSSELS SPROUTS	**2020**	**935**	**13.01**	**12,164**	**$1,155**	**$14,050,000**
	2019	1057	9.19	9,714	$1,141	$11,083,000
LETTUCE, HEAD	**2020**	**1,708**	**22.10**	**37,747**	**$335**	**$12,645,000**
	2019	1,615	20.83	33,633	$414	$13,924,000
LETTUCE, LEAF	**2020**	**1,418**	**16.51**	**23,411**	**$543**	**$12,712,000**
	2019	1,765	14.99	26,457	$553	$14,620,000
MISC. VEGETABLES**	**2020**	**3,661**				**$50,055,000**
	2019	3,848				$55,009,000
TOTAL VEGETABLES	**2020**	**7,722**				**$89,462,000**
	2019	8,285				$94,636,000

**Miscellaneous Vegetables includes artichokes, beans, beets, broccoli, cabbage, cauliflower, celery, chard, chicory, collards, cucumbers, herbs, kale, leeks, mushrooms, mustard, peas, pumpkins, radicchio, spinach, squash, vegetable seed, and other vegetables.

SANTA CRUZ COUNTY

NURSERY CROPS

CROP	YEAR	ACRES	TOTAL VALUE
CUT FLOWERS & CUT GREENS*	**2020**	**313**	**$11,515,000**
	2019	302	$27,127,000
NURSERY STOCK**	**2020**	**549**	**$108,146,000**
	2019	475	$92,356,000

*Cut flowers and cut greens includes field and greenhouse production.

**Nursery stock includes the categories: Indoor Potted Plants, Landscape Plants and Other Plants. (Other plants include farm stock and Christmas trees.)

TOTAL NURSERY	**2020**	**862**	**$119,661,000**
	2019	777	$119,483,000

SANTA CRUZ COUNTY

LIVESTOCK AND ANIMAL PRODUCTS

CROP	YEAR	TOTAL VALUE
TOTAL LIVESTOCK AND PRODUCTS*	**2020**	**$7,166,000**
	2019	$7,680,000

*livestock, honey, and eggs.

TIMBER

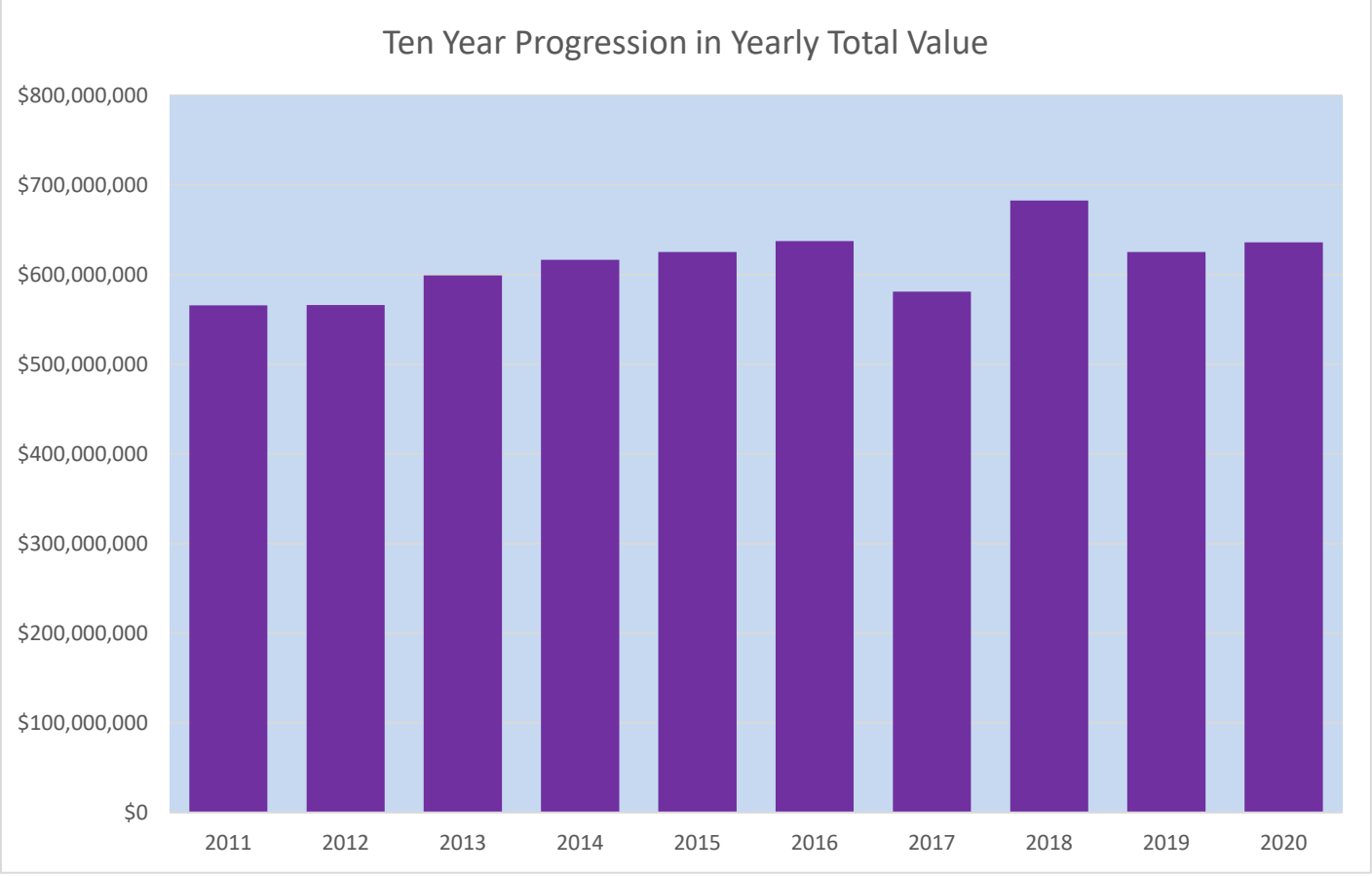
CROP	YEAR	PRODUCTION (MBF) (THOUSAND BOARD FEET)*	TOTAL VALUE
TIMBER	**2020**	**10,171**	**$6,357,000**
	2019	5,459	$4,511,000

*previously reported incorrectly in million board feet

SANTA CRUZ COUNTY

SUMMARY OF CROP REPORT VALUES

CROP	2019	**2020**
STRAWBERRIES, RASPBERRIES AND BLACKBERRIES	$373,298,000	**$397,139,000**
NURSERY CROPS	$119,483,000	**$119,661,000**
VEGETABLES	$94,636,000	**$89,462,000**
APPLES, WINE GRAPES AND MISC. FRUIT	$25,723,000	**$16,247,000**
TIMBER	$4,511,000	**$6,357,000**
LIVESTOCK AND ANIMAL PRODUCTS	$7,680,000	**$7,166,000**
TOTAL VALUE	$625,331,000	**$636,032,000**

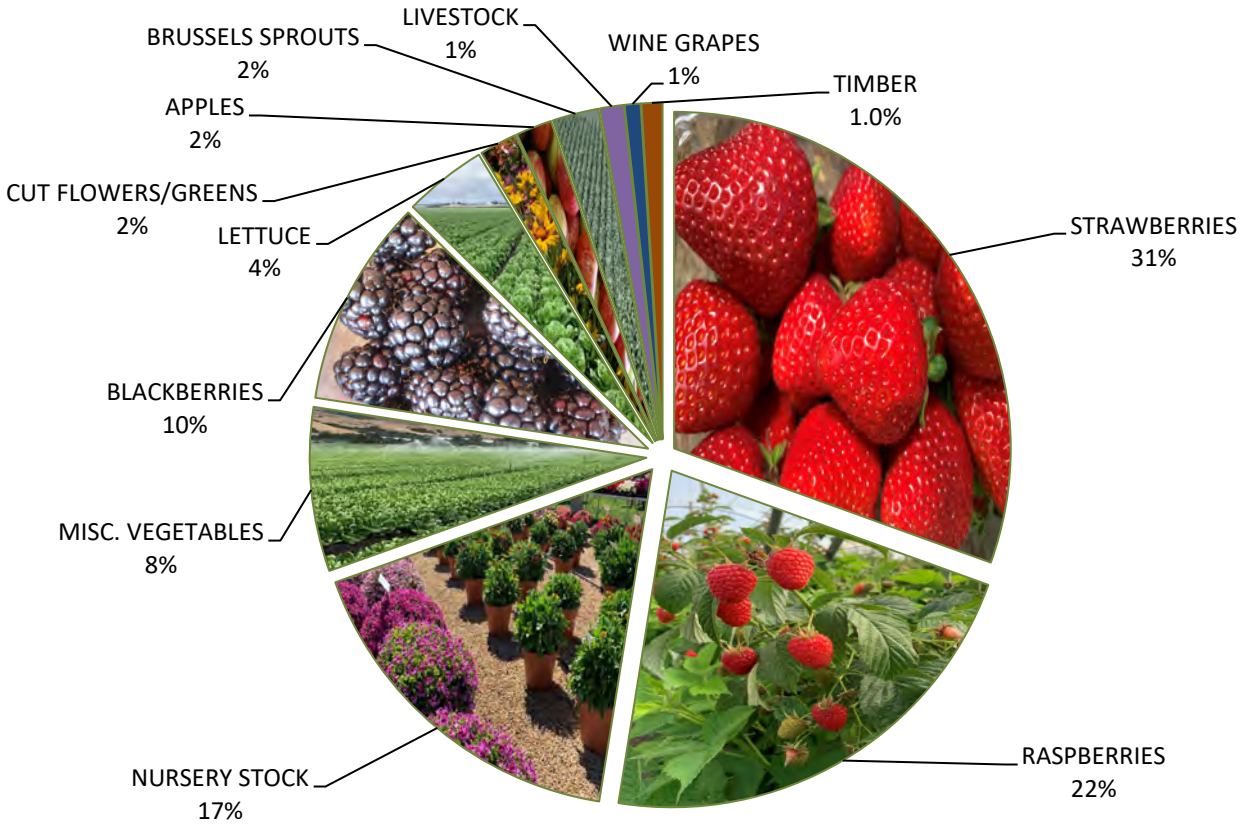


SANTA CRUZ COUNTY

CROP VALUE OVERVIEW

STRAWBERRIES	$193,911,000
RASPBERRIES	$139,934,000
NURSERY STOCK	$108,146,000
MISC. VEGETABLES	$50,055,000
BLACKBERRIES	$63,294,000
LETTUCE, HEAD & LEAF	$25,357,000
CUT FLOWERS & CUT GREENS	$11,515,000
APPLES	$10,981,000
BRUSSELS SPROUTS	$14,050,000
LIVESTOCK AND ANIMAL PRODUCTS	$7,166,000
WINE GRAPES	$4,814,000
TIMBER	$6,357,000

2020 Santa Cruz County Million Dollar Crops



SANTA CRUZ COUNTY

ORGANIC FARMING

There are approximately 147 registered organic operations in Santa Cruz County.
The figures below represent approximate acres and values registered with the State Organic Program.

YEAR	ACRES	VALUE
2020	7917*	$135,634,000
2019	8032*	$147,667,000
2018	6940*	$126,376,000
2017	6702*	$109,058,000
2016	6859*	$115,528,000

*Includes organic pasture.

INDUSTRIAL HEMP

YEAR	# REGISTRANTS	REGISTERED ACREAGE	HARVESTED ACREAGE	VALUE
2020	**23**	**207**	**63**	**n/a***
2019	**21**	**185**	**132**	**n/a***

*The California Department of Food and Agriculture launched the Industrial Hemp Program in the spring of 2019. This program is in its infancy and no value is available for industrial hemp at this time as growers focus on finding varieties that do well in our area and new markets become available.

SANTA CRUZ COUNTY

EXPORT COMMODITIES OF SANTA CRUZ COUNTY

Assorted Cut Flowers
Assorted Cut Greens
Assorted Nursery Plants
Artichoke
Bean
Beet
Bell Pepper
Blackberry
Blueberry
Bok Choy
Broccoli
Brussels Sprout
Cabbage
Carrot
Cauliflower
Celery
Chard
Cilantro
Collard
Cucumber
Dandelion
Dill
Eggplant
Endive
Escarole
Fennel
Kale
Leek
Lettuce
Parsley
Radicchio
Radish
Raspberry
Spinach
Strawberry

EXPORT TRADE PARTNERS OF SANTA CRUZ COUNTY

Australia
Canada
Chile
Colombia
Germany
Guatemala
Haiti
Indonesia
Japan
Mexico
Netherlands
New Zealand
Peru
Philippines
Qatar
South Africa
Spain
United Kingdom

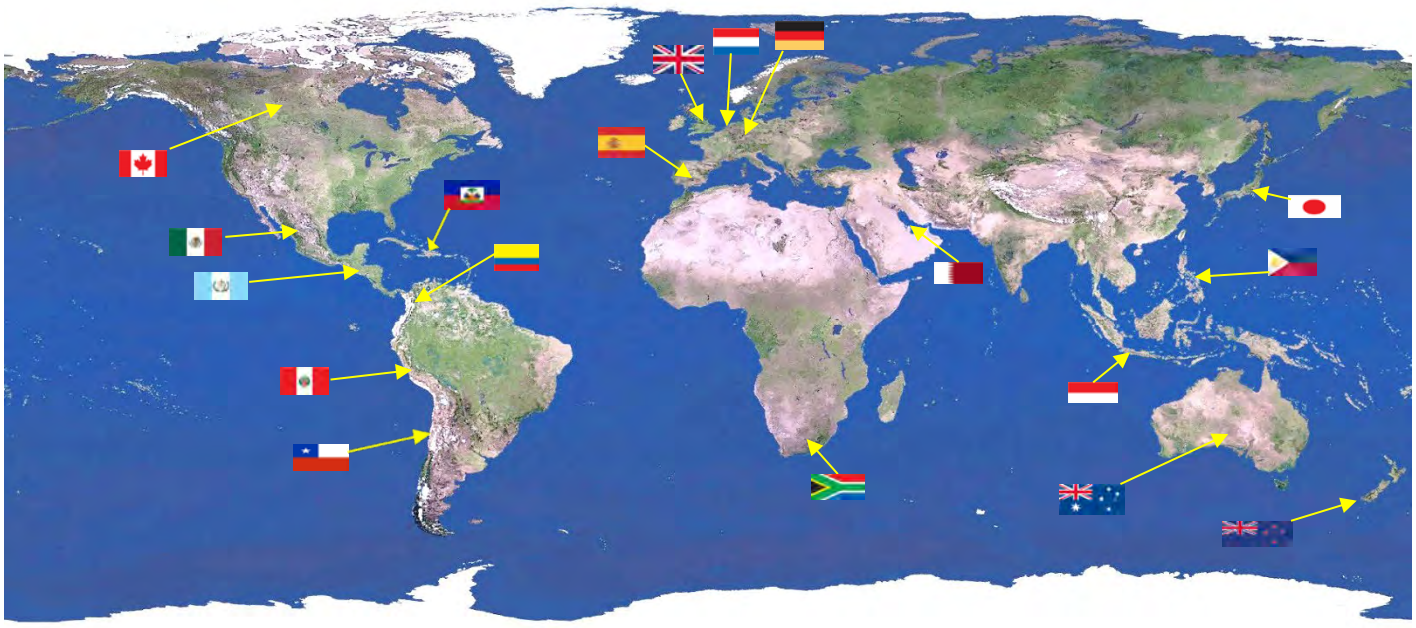


Image by NASA

EXHIBIT B

DIAGRAM OF NEAREST LICENSED CULTIVATION SITE (6.08 MILES)

Measurement Units: Feet / Square Feet | 0 | Total: 32103.90

Get | Lat: 36 58 40.0835 | Long: -122 1 21.2146

GoTo | Lat Long (DMS) | Lat Long (DD) | State Plane

EXHIBIT C

"CANNABIS H2O: WATER USE AND SUSTAINABILITY IN CULTIVATION" STUDY

Cannabis H_2O

WATER USE & SUSTAINABILITY IN CULTIVATION

Coauthored by:

RESOURCE INNOVATION INSTITUTE

Berkeley Cannabis Research Center

New Frontier® data

Contents

letter from the Publisher

IN A PERFECT WORLD, cannabis cultivators could focus on terrior, the particular geographical and climactic influences which (as for wine vintners) influence a seasonal crop and vintage. In today's world, however, outside concerns intrude a bit more terribly: While environmental conditions have traditionally favored Western states of the United States for the outdoor cultivation of cannabis, the 21st-century's burden of changing climate conditions is increasingly leaving them vulnerable to some of the most acute drought conditions in the country. Arizona, California, Colorado, Nevada, New Mexico, and Oregon (which collectively account for 71% of the nation's total cannabis supply, both legal and illicit) are being keenly afflicted, according to the National Oceanic and Atmospheric Administration's Drought Monitor.

To better understand and anticipate the industry's realities and responsibilities, New Frontier Data and our report partners at the Resource Innovation Institute (RII) and the Berkeley Cannabis Research Center present ***Cannabis H2O: Water Use & Sustainability in Cultivation*** to foster a fundamental understanding of how, and how much, water is used for cannabis cultivation.

It has never been more incumbent upon industry to identify how it can improve resource efficiency. Indeed, the premium to be placed on systemic responsibility becomes ever more important as the nation's legalized cannabis markets expand. Including the latest five states which mandated programs in the November elections, New Frontier Data expects the overall legal U.S. cannabis industry to grow at a compound annual growth rate of 21% through 2025, to reach $41.5 billion. That figure represents more than 3x the $13.2 billion legal market of 2019. Our projections reveal that while legal production of cannabis represented nearly a quarter of the 2020 total U.S. market (including illicit sales), that share should increase to reach 35% of the market by 2025. Conversely, the nation's illicit market is expected to see sales decline from $66 billion in 2019 to $64 billion in 2025.

During that same period, researchers expect total water use in the legal cannabis market to increase by 86%. Though some critics and opponents have seized upon water use as a policy issue, the regulated, legalized cannabis industry In California generally uses significantly less water than do some of the Golden State's other major agricultural crops (e.g., cotton, tomatoes, wheat, and corn). That noted, it is a virtual given that the trend toward longer, more acute droughts will be sustained well into the future, which lends more urgency to the Water Working Group's efforts and messaging.

Cultivators are being advised to design, build, and operate their operations appropriately to address the changing adversity of climate conditions, including longer, hotter, and drier summer

growing seasons. Cultivators will need to adapt to restrictions on water access. Facility operators will be tested by evolving building standards to increase energy efficiency, reduce waste, and preserve indoor and outdoor air quality via mechanisms like California's Title 24. There will be more carefully and expensively supplied municipal water, increased cooling demand for indoor and greenhouse growers to offset higher loads, and higher operational expenses for temperature control and water management systems.

As the legal cannabis industry matures, water-use efficiency will necessarily become more important, as it likewise will for other agricultural crops. Environmental and ecological pressures will mount, including for the reduction of input and energy costs, increased protection of the environment, addressing evolving regulatory standards, and ultimately being responsible stewards not only of industry but its ecology.

As with all our reports available through New Frontier Data's online intelligence portal Equio™, we trust that readers will benefit from this fact-based assessment, our unbiased insights, and the actionable intelligence provided to continue to succeed in the global legal cannabis arena.

New Frontier Data's mission is to elevate the discussion around the legal cannabis industry globally by providing unbiased, vetted information intended for educating stakeholders to make informed decisions. We provide individuals and organizations operating, researching, or investing amid the cannabis industry with unparalleled access to actionable industry intelligence and insights, helping each to leverage the power of knowledge to succeed in a fast-paced and dynamic market.

Please do enjoy our newest report as you shape your strategy and devise your action plan within the cannabis industry!

Giadha A. DeCarcer
Founder and CEO,
New Frontier Data

Strength in Knowledge®

executive Summary

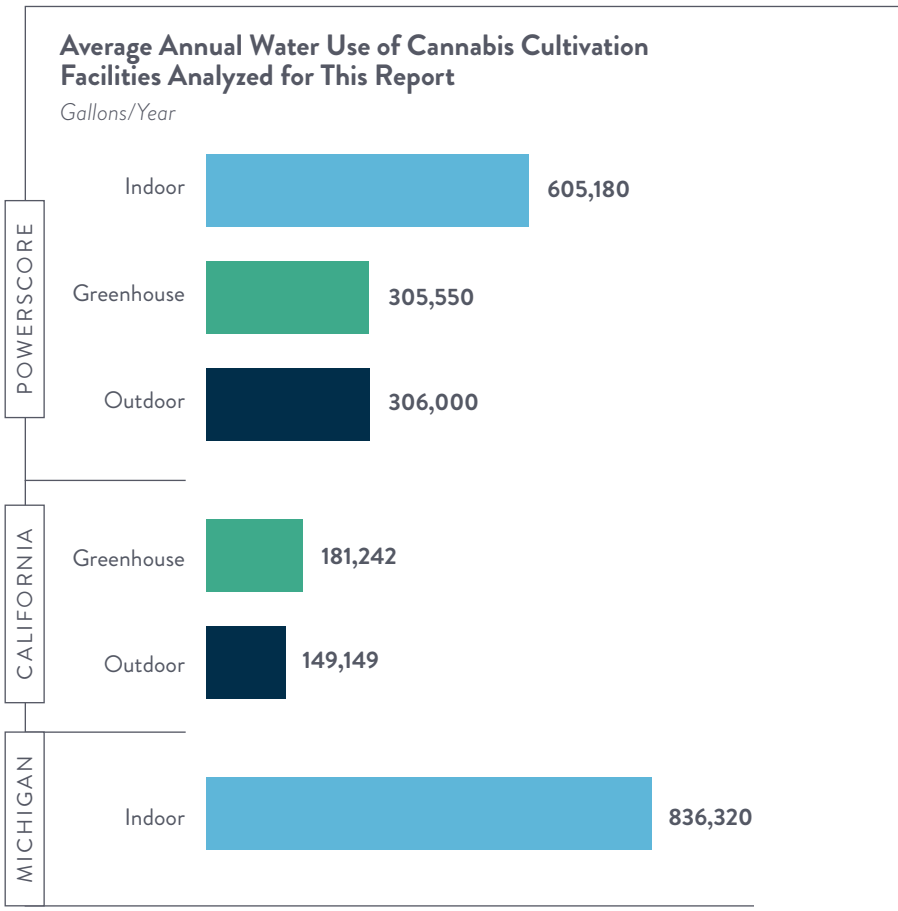
THE DRAMATIC EXPANSION of the legal cannabis industry in recent years has led to significant advances in the way that cannabis is grown. Surging consumer demand for legal products, coupled with increasing competition, has led growers to increasingly focus on improving operational efficiency to lower costs, optimize yields, and increase revenues. While substantial research has been conducted on energy use in cannabis cultivation, the use of water is far less well understood.

With the demand for legal cannabis forecast to double in the next five years, understanding how water is currently used — and how growers can reduce its use — is key for establishing industry practices to improve industry-wide efficiency at a critical stage in the industry's growth.

Using data collected by Resource Innovation Institute via its Cannabis PowerScore benchmarking platform and with researchers, utilities, and regulatory agencies in California and Michigan, this report explores ways that water is used by cannabis growers, establishes key benchmarks for water use across different types of facilities, identifies innovations that are driving greater water-use efficiency, and offers strategic recommendations for producers and regulators to advance water-use efficiency throughout the industry. Given the need for more data, it should be clearly understood that the numbers presented in this report are directional rather than representative of the broader regulated industry. Likewise, this report should not be conflated with a best practices guide.

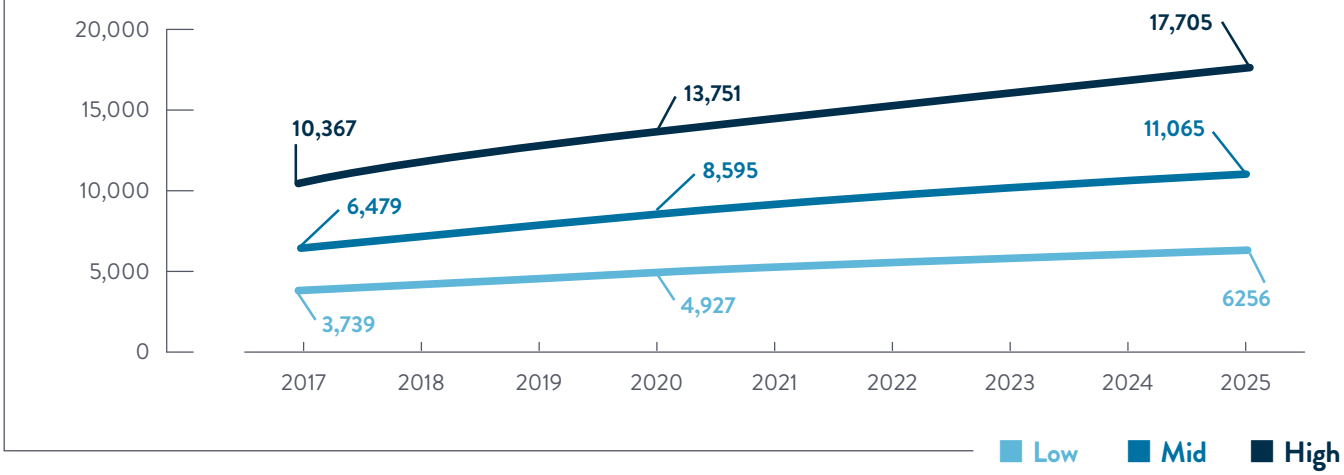
Cultivation Practices Are Keys to Water Use

- Water is used in a range of ways for cannabis cultivation. Irrigation is its primary use, but water is also used to dissolve nutrients, humidify and cool the cultivation environment, and manage pests or perform cleaning.



Total Industry Water Used in Cannabis Cultivation: Acre-Feet

Low/Mid/High Estimates



- Irrigation practices vary widely across facilities, ranging from hand-based irrigation with hoses, to piped irrigation systems with sensors measuring ambient conditions in real time, to application of micro-pulses of water to maintain moisture levels for optimal conditions. The transition from hand-watering to drip irrigation is one of the most basic but effective steps which growers can take to being reducing their water use.

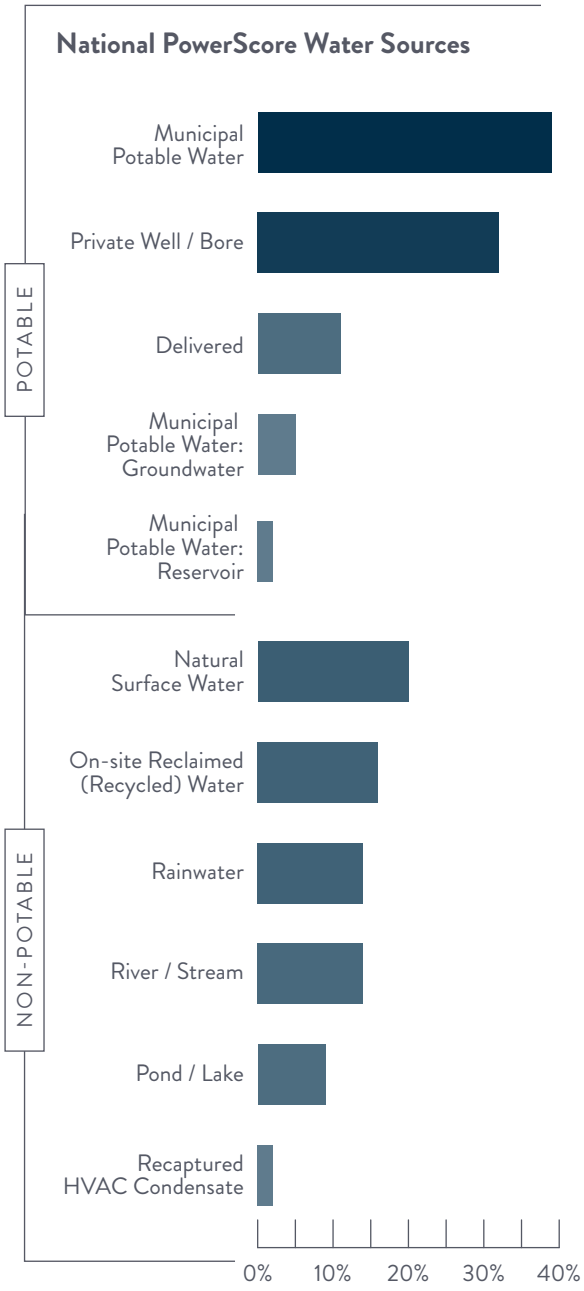
- The substrate – or medium in which the cannabis is grown – plays a critical role in irrigation, further complicating the ability to standardize disparate approaches for water use. Growers using soil can irrigate more heavily, but at only a few intervals per day, whereas an inert substrate like stonewool (or rock wool) has a high water holding capacity and can therefore be watered with lower volumes of water, up to 20 times per day.

- Water efficiency (i.e., gallons/square foot) is significantly influenced by the type of cultivation facility and the number of harvests. Indoor facilities (which have five or more harvests per year) use significantly more water per square foot per year, compared to outdoor facilities (which typically yield one harvest per year). On average, facilities use 121 gallons per square foot per year, with indoor facilities averaging 209 gallons, compared to outdoor facilities averaging 11 gallons per square foot per year. The number of annual harvests is obviously significant in the cyclicality of water use, with multi-harvest facilities requiring more steady water use throughout the year, whereas outdoor facilities are likelier to see their highest rates of use in late summer and early fall, as harvests approach.

Despite Surging Production and Market Revenues, Water Use in Cannabis is Nominal Relative to Other Major Agricultural Crops

- Compared to major agricultural crops, including cotton, grapes, and corn, the total water used to grow cannabis has a nominal impact on total water use in farming.

- While a wholesale pound of rice and table grapes sell for approximately $0.71, and $0.78 respectively, a wholesale pound of smokable cannabis bud can fetch $1,500 - $3,000 or more. This stark differential means the market value of the cannabis industry grows dramatically even with only incremental increases in production.



Reclamation and Reuse Present Underutilized Opportunities to Improve Water Efficiency

- Since more than 90% of water absorbed by plants is lost through evapotranspiration, a significant portion of water used in irrigation for indoor and greenhouse environments can be reclaimed as condensate collected in the facility's HVAC systems. However, few facilities are designed to collect, store, and treat condensate.

- Concerns about spreading pathogens or heavy metals through a grown environment has been a long-standing barrier to adoption of water reclamation practices. However, with effective water-recycling solutions becoming more commonplace, cost savings from reusing treated water are driving increased adoption of reclamation solutions.

Water Sources Used Vary Widely, with Each Presenting Different Options for Efficiency Gains

- Indoor growers are the most likely to use municipal water as their primary source, whereas greenhouse and outdoor growers are more apt to use onsite wells, natural surface water, or rainwater. Space constraints often limit onsite water storage in indoor facilities, whereas large-scale storage tanks are commonly used in greenhouses and outdoor facilities, especially in areas lacking stable water supplies.

- While growers in newer legal markets (especially those in the most recent Northeastern or Midwestern markets with reliable access to water) may feel less incentivized to prioritize water efficiency when building out their new facilities, established markets have shown that increased pricing competition puts enormous pressure over time on less-efficient operators. As such, it is critical that growers plan for downward price pressure as the market matures, and identify ways to reduce operational costs early. Instituting early, cost-saving best practices for water efficiency can enable growers in increasingly crowded markets to compete more effectively.

Benchmarking Water Use is Vital to Improving Industry-wide Outcomes, but Establishing Appropriate Metrics Is Critical

- Cannabis industry regulators should consider requiring licensed growers to report their water use (as some states have done) to encourage more data collection on the little-understood aspect of cultivation while enabling industry-wide data comparisons. Enabling growers to benchmark their water efficiency against their peers' will create incentives for less-efficient operators to improve their functional performance. Using tools like the Cannabis PowerScore resource benchmarking platform enables growers to compare their water efficiency against their peers' will create incentives for less-efficient operators to improve their functional performance.

- Establishing appropriate benchmarks will be key: The type and size of a facility must be considered to enable effective peer benchmarking. Similarly, while water use per plant has historically been used as an efficiency metric, wide variations in plant sizes and lengths of cultivation cycles effectively render a per-plant metric meaningless, thus it should not be used as a comparative performance indicator.

Climate Change Is Fueling Urgency to Reduce Water Use in Key Production Regions

- Key legal cannabis markets in Western states (e.g., Arizona, California, Colorado, Nevada, and Oregon) are currently experiencing historic drought conditions, with water shortages expected to become increasingly pronounced as effects of climate change become more acute. Facing a future of both increased water scarcity and higher water costs is stirring new urgency to increase production efficiency in the country's most productive cannabis cultivation markets.

- Governments and industry regulators can play important roles by incentivizing growers to adopt water-efficiency solutions as parts of broader government efforts to mitigate impacts from climate change on the agricultural economy.

With the legal cannabis market in the U.S. positioned for catalytic growth over the next five years, and with many more countries enacting laws legalizing cannabis use, efficiency practices adopted now will play defining roles in reducing the industry's total water use during this critical stage of its growth.

About
New Frontier Data

NEW FRONTIER DATA is an independent, technology-driven analytics company specializing in the global cannabis industry. It offers vetted data, actionable business intelligence and risk management solutions for investors, operators, researchers, and policy makers. New Frontier Data's reports and data have been cited in more than 85 countries worldwide to inform industry leaders. Founded in 2014, New Frontier Data is headquartered in Washington, D.C., with additional offices in Denver, CO, and London, U.K.

New Frontier Data does not take a position on the merits of cannabis legalization. Rather, its mission and mandate are to inform cannabis-related policy and business decisions through rigorous, issue-neutral, and comprehensive analysis of the legal cannabis industry worldwide.

For more information about New Frontier Data, please visit: NewFrontierData.com.

Mission

New Frontier Data's mission is to elevate the discussion around the legal cannabis industry worldwide by providing unbiased and vetted information intended to educate stakeholders to make informed decisions.

Core Values

- Honesty
- Respect
- Understanding

Vision

Be the Global Big Data & Intelligence Authority for the Cannabis Industry.

Commitment to Our Clients

The trusted one-stop shop for actionable cannabis intelligence, New Frontier Data provides individuals and organizations operating, researching, or investing in the cannabis industry with unparalleled access to actionable industry intelligence and insight, helping them leverage the power of big data to succeed in a fast-paced and dynamic market.

We are committed to the highest standards and most rigorous protocols in data collection, analysis, and reporting, protecting all IP and sources, as we continue to improve transparency into the global cannabis industry.

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About
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Resource Innovation Institute

Resource Innovation Institute (RII) is an objective, data-driven non-profit organization who establishes industry standards, facilitates best practices and advocates for effective policies and incentives that accelerate conservation. With its Cannabis PowerScore benchmarking platform, RII helps producers confidentially assess the efficiency and productivity of their cultivation facilities using industry-standard Key Performance Indicators (KPIs) on energy, emissions, water and waste. RII's Technical Advisory Council brings together multidisciplinary stakeholders and subject matter experts to define best practices through comprehensive peer review. As an aggregator of knowledge, RII trains the market and informs governments and utilities about baselines and standards for resilient, high-performance production.

Cannabis Research Center

The Cannabis Research Center (CRC) is a research group based at the University of California, Berkeley. Our goal is to promote interdisciplinary scholarship on the social and environmental dimensions of cannabis production. Through scientific research and engagement with community, government, and academic entities, we advance understanding of cannabis agriculture in socioecological systems at local, national, and global scales. We seek to inform public dialogue and contribute to the development of prosperous communities and healthy environments.

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Introduction

Water Used for Cannabis Cultivation

Irrigation Practices Vary Widely Across the Industry, with Many Opportunities to Improve Efficiency

Compared to other commercial horticultural sectors where decades of agricultural research and innovation have normalized cultivation practices, in cannabis (where the illicit market still accounts for the majority of crop grown) growers use a wide range of irrigation techniques ranging from high-volume/low-frequency events (where the crops are heavily watered by hand once or twice a day), to low-volume/high-frequency models where the crops receive small bursts of water 20 or more times per day, delivered via state-of-the-art, sensor-based irrigation systems.

Federal prohibition has further hampered efforts to understand resource use and efficiency opportunities, as research institutions which receive federal funding have been prohibited from conducting research on cannabis that would inform cultivation best practices. While there has been cultivation research done in other countries (notably Israel and Canada), the lessons from those studies are not always readily applicable to local conditions in the U.S.

Expansion of the legal market is leading to greater transparency into cannabis cultivation practices, and greater prioritization of efficiency and operational cost containment. As a result, growers have begun to transition from larger substrate volumes and less efficient watering techniques, to smaller pot sizes and greater integration of more precise irrigation techniques (e.g., high-frequency/low volume irrigation). No matter how water is applied, grower methods can be optimized, and opportunities to increase efficiency of water use across the industry are considerable.

Benchmarking water use, defining its best practices, and educating growers on the economic and environmental benefits of reducing their water use will be keys to ensuring that water efficiency is a priority for integration into the next stage of the legal cannabis market's growth.

Limited Analysis of Water Efficiency, and Fears that Operational Disruptions Have Slowed Progress Toward Optimizing Water Use

As the economics of cannabis have shifted with increased competition and downward price pressure, cost containment has been a critical issue for growers. Since operational efficiency was not considered a priority in the illicit market, many opportunities exist across cultivation environments to increase resource efficiency and lower costs. Some examples include: 1) reducing energy demand and consumption by using LED lighting systems; 2) switching from sole-source lighting treatments for indoor cultivation to greenhouse or mixed-light environments which use natural light; 3) leveraging automation to reduce labor costs and optimize operational performance by employing automatic trimmers or sensor based technologies to monitor and manage climatic conditions in the grow environment; or 4) analyzing use of cultivation inputs from nutrients to substrate to minimize waste and negotiate better rates from suppliers to lower expenses.

While growers may understand the positive impact of reducing water use on the environment, there has been far less research done into the role that efficient water use can play in improving an operation's bottom line. Consequently, growers often incorrectly overestimate the cost of deploying water management solutions while underestimating the impact that those strategies have on lowering business costs.

Getting growers to view water efficiency not just as an environmental benefit but as a business opportunity will be a key step in accelerating adoption of water optimization solutions for cannabis cultivation.

Legalization Is Reducing Water-Related Environmental Harm Caused By Illicit Grows on Public Land

The environmental impact of illegal (i.e., trespass) cultivation on public lands is among the less prominent but immensely consequential outcomes of unregulated cannabis production. Throughout the western United States in particular, cannabis cultivation in national forests and other public lands has had devastating effects on the ecology and watersheds where the cannabis has been grown. Trespass growers may dam streams or divert water flow for their plants, and unmanaged runoff from their operations can result in the introduction of fertilizers, pesticides, rodenticides, and other contaminants to the watershed, causing significant environmental damage downstream.

Yet, two recently published peer-reviewed manuscripts[2] provide encouraging news. Both papers show evidence how states that legalize cannabis see a decrease in trespass cannabis grows on federal lands. By extension, the decrease in trespass grows likely also leads to decreased environmental harms.

The emerging research suggests that legalizing cannabis market can lead to some environmental wins. If combined, regulatory compliance in the legal market, coupled with the economic advantage of reducing operational costs, leads to more careful management of water resources and heightened focus on minimizing water use in the legal market. In turn, an economically and environmentally successful legal market reduces the environmental harms caused by unregulated growers by undermining their profitability. All told, a water-efficient legal market has the potential to help reduce trespass growing, and may do so more effectively than could be achieved solely through increased prohibition and enforcement.

Beyond water use, legalization is stimulating some increased focus on resource use and efficiency management across the cannabis ecosystem. As noted in the 2018 Energy Report and in RII's ongoing energy and resource management research, the legal industry is driving significant gains for energy efficiency in cultivation, both as best practices become more normalized and performance-improving technologies (e.g., LED lighting systems and climate-monitoring solutions) become more widely adopted. These trends are expected to continue as the legal market expands and matures.

2. Prestemon, J.P., Koch, F.H., Donovan, G.H. & Lihou, M.T. (2019). Cannabis legalization by states reduces illegal growing on US national forests. Ecol. Econ., 164, 106366.

Klassen, M. & Anthony, B.P. (2019). The effects of recreational cannabis legalization on forest management and conservation efforts in U.S. national forests in the Pacific Northwest. Ecol. Econ., 162, 39–48.

Water Use in Cannabis Cultivation

WATER SOURCES

Cannabis growers use a variety of sources for both potable and non-potable water, depending on water availability in their regions and the cultivation practices used by operators (please consult the glossary for more information about each water type).

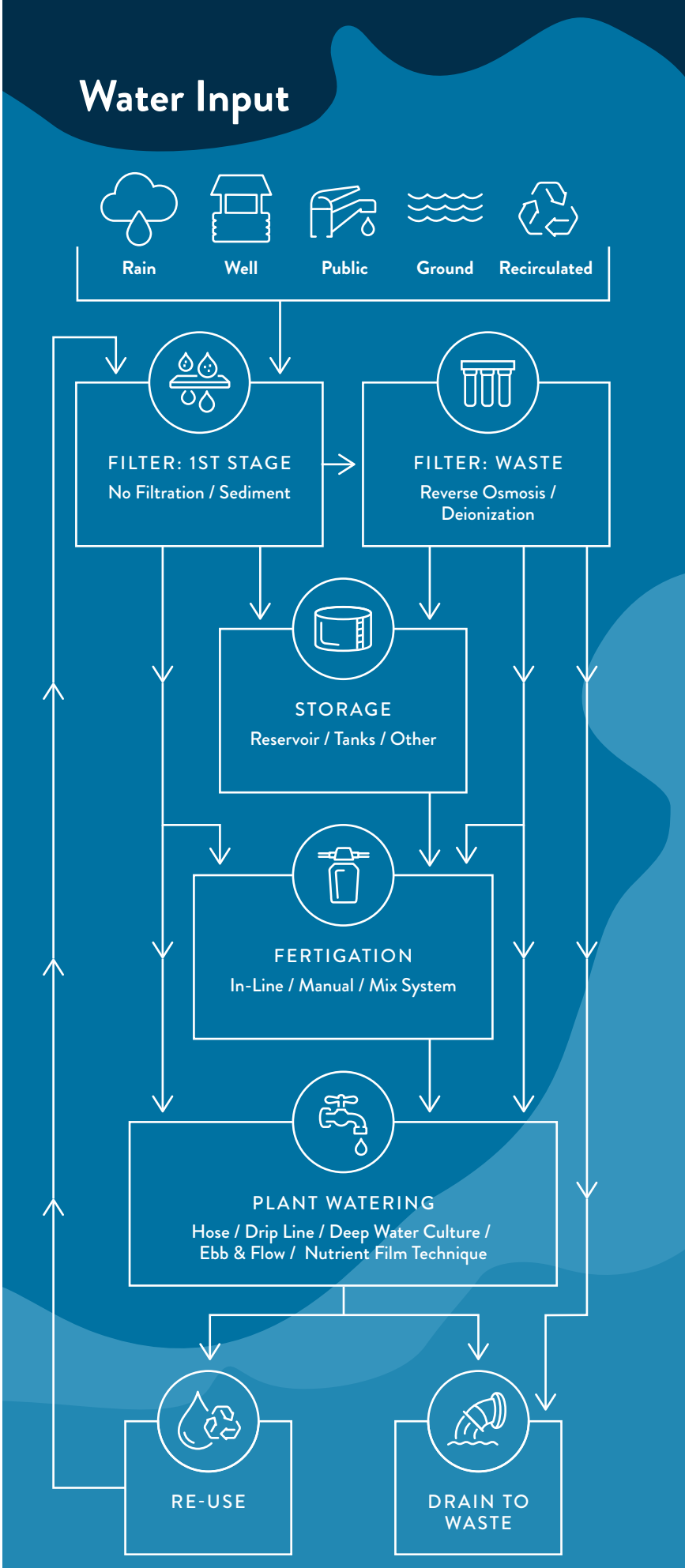
- **Potable**
  - Municipal Potable Water
  - Delivered Water
  - Private Well / Bore
- **Non-potable sources**
  - On-site Reclaimed (Recycled) Water
  - HVAC Condensate
  - Natural sources
    - Rain
    - Surface Water

WATER USE IN CANNABIS CULTIVATION FACILITIES

Generally, cannabis cultivation facilities use water in eight ways:

1) **Irrigation:** Ensuring that plants remain appropriately hydrated during their life cycle;

2) **Storage:** While some facilities irrigate directly from a water source, many facilities have temporary water storage tanks for filtration and fertigation . Operators of facilities with limited or



unreliable water supplies will often have more substantial long-term storage capacity to ensure keeping water on site for future irrigation;water storage is a key aspect for cultivation;

3) **Applying nutrients or other dissolved substances to the plants:** Many growers mix root zone inputs into their irrigation water, adjusting formulations based on plant needs at each stage of growth;

4) **Humidification:** Maintaining the optimal ambient moisture level in the grow environment (especially in indoor cultivation facilities);

5) **Cooling:** Drawing out excess heat from the grow space using HVAC and dehumidification equipment;

6) **Cleaning:** Maintenance of the cultivation equipment;

7) **Pest Control:** Water can be an effective way to keep pests off plants without applying chemical treatments; and

8) **Non-Cultivation:** Water used for 'domestic' activities like handwashing, toilets, and kitchen areas for employees.

Of these applications, irrigation is the most water-intensive application.

However, irrigation also presents the greatest opportunity for water reclamation. Since plants use as much as 99%[3] of the water they absorb to keep the leaves cool and move nutrients through the plant via evapotranspiration, the vast majority of water applied in indoor and greenhouse facilities can often be reclaimed and reused. There are two types of recapture and reuse: recapture of irrigation runoff water and recapture of HVAC condensate (water in the air from evapotranspiration).

HVAC water makes up the majority of reclaimed water. The amount of nutrient runoff water that can be recaptured depends greatly on the grow strategy (deep water culture will produce more runoff than soil). Recaptured runoff water must be treated differently than the HVAC water before reuse. Depending on the water treatment system, we sometimes find that the energy requirements for treating this water is not worth the amount of water reclaimed.

3. *Sterling, T, Transpiration – Water Movement through Plants', New Mexico State University, 2004*

A NOTE ABOUT WATER USE FOR CLIMATE CONTROL IN GREENHOUSES

Many greenhouses use evaporative cooling pads to control temperatures in warmer seasons. As a result, water use in greenhouses can triple during the summer, not just due to higher irrigation requirements, but also because when the evaporative pads are running (and pumps trickle water over them), some water runs off, typically into drains, to keep salts from accumulating in the pump reservoirs. With 24 greenhouse rooms each running off 0.5 gpm water for 8 hours on a 90-degree day, usage for evaporative cooling can exceed 5000 gallons/day.

As a result, evaporative cooling can significantly drive up water requirements in greenhouses located in hot, arid areas.

Solutions to Increase Water Efficiency in Cannabis Cultivation

Growers Have an Array of Options to Reduce Water Use

Growers use different techniques to apply water to their crops, including using a hose to water individual plants, using drip irrigation solutions, and using hydroponics, where the plants' roots are routinely flushed with a nutrient solution (examples include deep water culture, nutrient film technique, and aquaponics).

There is a wide array of ways in which technology is helping reduce water use:

DRIP IRRIGATION

Perhaps the most widely used water efficiency solution, drip irrigation systems allow growers to direct water to each individual plant without having to irrigate the entire cultivation area. Compared to using a hose to irrigate the plants, or to a flood-and-drain technique which is highly water-intensive, the precise targeting of drip irrigation[4] [5] can reduce water consumption by 30% to 70%, and improve water productivity by 20% to 90% (potentially more if the hose is not turned off as it is being moved between plants, a practice which can waste as much as 50% of applied water if the plants are not densely packed together).

Research by Dr. Neil Mattson of Cornell University, for one, has shown that the efficiency of drip irrigation systems can be further enhanced through the use of substrate and ambient environment sensors which monitor each the moisture continent, temperature, humidity, and electrical conductivity of the cultivation environment in real time, and can automatically start and stop irrigation whenever conditions reach preprogrammed parameters.

SENSOR-BASED MICRO-PULSE IRRIGATION

A more advanced variant of drip irrigation systems is the use of sensor-based systems that deliver steady micropulses of water to each plant. While the technologies are not widely available at scale, researchers have found that the use of microbursts of water or nutrient solution are far more water-efficient than even drip irrigation methods which tend to saturate the grow medium, resulting in higher levels of runoff.

One agricultural researcher reported that a self-built, micro-sensor-based system used up to 20 times less water than hose-based irrigation, with equal to better crop yields. Additional benefits of such a system include:

- **Fewer pests,** such as fungus gnats and shore flies, which are attracted to the moisture in the grow medium and are often seen in heavily watered plants; and
- **The ability to simulate drought conditions** through the precise calibration of the amount of water reaching the plant: For some cannabis plants, drought conditions have been shown to stimulate production of some cannabinoids, which are becoming increasingly valuable in legal markets.

As the cannabis industry matures, the deep integration of sensor-based technologies will become more commonplace as growers seek to optimize their use of resources and maximize the performance of their crops. Already, many producers are optimizing the timing of fertigation cycles based on measurements of what is happening to the plant, by weighing plants and using measurements to determine how much of the feeding and

4. *Zafari, J ,Mohammadi, N, A Review on Drip Fertigation on Field Crops, International Journal of Engineering Research & Technology, 2/12/2019*

5. *O'Connor, N, Mehta, K. Modes of Greenhouse Water Savings, Procedia Engineering, Vol. 159, 2016*

watering cycle has been completed. Some producers are measuring the moisture content in the substrate, and using the change in moisture to determine when the plants should be fed/watered. Other growers measure the moisture content of the leaves, and use the information to decide on feeding and watering cycles as opposed to simply basing those cycles on time.

LEACHATE CAPTURE AND RECIRCULATION

Depending on the watering techniques used, 25% or more of the water applied runs off into the drain; when applying water using a hose in indoor facilities, often half of the applied water does not reach the pot. Reclaiming and reusing irrigation runoff is widely done in other horticultural sectors: The tomato sector in particular, where tight margins have driven major technological advancements to maximize water efficiency, deploys effective solutions readily replicated for cannabis. Advancements in water reclamation and discharge reduction have also largely been driven by increasingly stringent regulatory action on behalf of large greenhouse-producing countries and regions. For example, the Netherlands has a goal of zero discharge by 2027, and similarly strict regulations in Ontario are helping drive innovation and increase water-use efficiency.

However, two operational concerns have slowed adoption of reclamation and reuse for cannabis cultivation:

- **Concerns about the effort required to process reclaimed water for reuse.** Runoff from irrigation has a different nutrient profile than the solution applied to the plant, which is based on how much of each nutrient in the water the plants absorbed. Consequently, growers must carefully and routinely test runoff to determine how the nutrient profile has changed, then meticulously rebalance the solution to restore it to optimal levels. In most cases, growers must do significantly more than simply test runoff to accurately rebalance drain-recaptured solution to the correct elemental parts-per-million (ppm) contributions. The runoff profile is different due to the fact that plants remove ions from aqueous solutions at demonstrably different rates[6], so cumulative nutrient imbalances are prone to occur. Concern about errors made during the process of testing and reformulation has led many growers to conclude that it is both easier and safer to use new water.

An empirically sound strategy involves combining runoff analysis, pore water extraction analysis, and leaf tissue analysis to correctly reinject elements or fertilizers parts at appropriate doses. Such testing is almost invariably done by third-party labs rather than in house, due to the technical nature of analysis and the necessarily high frequency of instrumentation calibration.

> Depending on watering techniques, 25% or more of applied water drains as runoff.

6. *Bugbee, B., Nutrient Management in Recirculating Hydroponic Culture, Acta Horticulturae, 2, 2004*

However, rebalancing can be achieved successfully during the process of introducing additional new water to offset nutrient loss. Sensors can supplement water-quality testing to make the process more efficient.

An alternative is to use filtration and scrub out the nutrients with processes like reverse osmosis (RO), which reduces the reuse efficiency (though 50% reuse is better than 0%).

- **The risk of distributing pathogens or other contaminants into the grow environment.** Another key concern is the risk of distributing waterborne malignant or opportunistic plant and root-zone pathogens, such as Pythium and Fusarium (i.e., root rot from pathogens that affect roots and stems), into the full operation through contaminated reclaimed water. If the reused water is not processed correctly, isolated issues with a limited number of plants can quickly spread throughout the operation, putting the entire crop at risk. For many growers, the downside risk of losing an entire crop outweighs the cost savings and efficiency gains to reclamation and reuse.

While those concerns are understandable given the high value of each cannabis harvest, they belie the reality that many well established solutions already exist to increase water efficiency in cultivation, as widely used in other horticultural markets.

RECLAMATION OF HVAC CONDENSATE

In indoor and greenhouse facilities, HVAC and dehumidification systems can capture significant proportions of the water lost through evapotranspiration. Often, reclaimed water is discarded, but given the volume of water being extracted it presents a significant opportunity for reclamation and reuse, either for irrigation or other applications throughout the cultivation facility.

There are some considerations when reclaiming condensate from HVAC and dehumidification systems:

- WATER STORAGE
  For space constrained operations, installing the large-scale water tanks needed to store all the condensate can be an issue, especially when being added to an already existing facility. However, for newly built facilities or those with room to expand, adding water storage capacity can be relatively easy and inexpensive.
- WATER PURIFICATION
  Some HVAC systems apply disinfectants or other chemicals to prevent algae and other microbiological growth in the reclaimed water. Growers must therefore plan to process chemicals that may negatively impact plant growth from the water before it is reused.
- COPPER OR ZINC CONTAMINATION
  HVAC systems that use copper piping can often accumulate significant levels of copper in the condensate (see Figure 4 for typical contaminant levels in condensate samples). Zinc can build up in systems of facilities using galvanized metal plumbing. Shifting to PVC or other leach-resistant piping can reduce the risk of heavy metal contamination when the condensate is applied to the crops. However, regular testing of condensate water for microbiological and heavy metal contamination is the best way to ensure that the condensate does not introduce adulterants to the growing environment.

FIGURE 1: Chemical Contaminants in HVAC Condensate

	Chemical Contaminant	Aluminum	Calcium	Copper	Iron	Lead	Magnesium	Nickel	Potassium	Sodium	Zinc
Condensate Samples	Practical Quantitation Limit (PQL)	0.050	1.00	0.010	0.050	0.010	0.050	0.010	1.0	1.00	0.010
	Number of Samples in Which Contaminant Detected	3	0	13	2	0	1	1	0	1	15
	Values/Range of Detected Contaminant	0.053 0.078 0.547	-	0.016 - 1.34	0.130 0.956	–	0.059	0.171	–	11.3	0.018 - 0.267
	Average of Detected Contaminant	0.226	–	0.23	0.543	–	0.059	0.171	–	11.3	0.18
	Drinking Water Primary Maximum Contamination Level (PMCL)	–	–	1.3	–	0.015	–	–	–	–	–
	Drinking Water Secondary Maximum Contamination Level (SMCL)	0.2	–	1.0	0.3	–	–	–	–	–	5
	SAWS Drinking Water Quality	<0.02	56.2 - 99.0	<0.002 - 0.379	<0.01 - 0.0191	<0.001 - 0.0163	8.99 - 18.2	0.0011 - 0.0062	1.10 - 6.53	8.08 - 23.4	<0.005 - 0.0328

REVERSE OSMOSIS (RO) FOR WATER PURIFICATION & LEACHATE RECLAMATION

Water is a common source of heavy metal contamination, particularly when sourced from rivers containing industrial pollutants. Plants deal with heavy metals by evolving either to limit root absorption, or by allowing absorption and sequestering the heavy metals where they can do less physiological harm (e.g., in the cell vacuoles or specialized proteins). Unfortunately, cannabis is one among such bioaccumulators.

RO is widely used in cannabis facilities to purify water from municipal, groundwater, or reclaimed sources. RO allows growers to apply uncontaminated water to their crops due to the effectiveness of the process in removing pollutants and adulterants from the water. It is especially important in places where municipal and groundwater has high levels of sodium, such as coastal areas in the western U.S. states. Since the cultivation techniques developed in the early markets of California, Oregon, and Washington have been adopted by growers nationally, and water-quality issues impact U.S. communities, the use of RO has expanded nationwide.

While RO has gained traction in the industry, it is worth noting that cannabis is the only major U.S. horticultural sector that uses RO for water treatment. RO water is especially helpful in cannabis because it is one of the only means to remove sodium and heavy metals from the plant, hence its widespread use in converting seawater to potable water. Given the stringent testing for heavy metals in cannabis, removal of such adulterants in water is critical for growers to ensure that their products are regulations-compliant. Growers thus err on the side of caution with the costly but effective method for treating water.

There are several reasons why RO is not more widely used in commercial agriculture:

- **RO generates a lot of waste.** While the most efficient systems can yield 1 gallon of brine (i.e., waste water) for every 10 gallons of purified water produced, less efficient systems produce 1 or 2 gallons of clean water per each gallon of brine.
- **RO energy intensive:** Running RO equipment uses a lot of electricity, offsetting efforts to reduce energy use in the cannabis operation.
- **RO water is significantly more prone to pH fluctuation:** Due to its low buffering capacity and lack of bicarbonates, maintaining RO water's optimal pH levels requires careful management to ensure optimal nutrient absorption. RO water's low TDS content of permeate allows it to absorb gaseous contaminants (e.g.,volatile organics and CO2), which tends to lower pH levels

One way to potentially reduce the high cost of using RO water as the sole source of irrigation water is to use a mix of it with municipal or ground water. However, with strict cannabis testing requirements for heavy metals and other adulterants unlikely to change, RO will likely remain commonplace in cannabis in the medium term, even as the sector is poised for innovation both to reduce cost and increase efficiency of water purification processes.

Growing Systems and Substrate Options

Choices for substrate are influenced by cultivation approaches and system choices.

CULTIVATION APPROACH AFFECTS PLANT SIZE

- **Indoor**
  - Sea of green
  - Larger plants
- **Greenhouse**
  - Medium plants (3- to 5-gallon pots)
  - Large plants (>10-gallon pots)
- **Outdoor**
  - Field/in-ground
  - Container-grown (100- to 1,000-gallon containers)
    - Cannabis plants grown fully outdoors without any structural covering are often grown to prioritize the size of individual plants. Plants may be grown directly in existing topsoil, or more often in planters or bags of imported substrate.
    - Outdoor plants often attain heights of 8 feet or more, with a diameter of over 10 feet. In comparison with smaller plants grown indoors or in greenhouses, a relatively higher proportion of biomass is dedicated to their vegetative (i.e., nonflowering) growth for structural support.

WATER MANAGEMENT APPROACH AFFECTS SUBSTRATE & LEACH PERCENTAGE

- **Hydroponic**
  - Deep water
  - Aeroponics
  - Recirculating (no leach) approaches such as deep water culture, aeroponics, top feed drip reclaim, or ebb-and-flow
- **Rock wool**
  - Drain to waste
  - Recirculating (i.e., with no leach)
- **Coir**
  - Minimal leach
  - Leach (10% to 25 %)
- **Peat**
  - No or minimal leach
  - Leach (10% to 15 % range)

Approaches to Water Disinfection

An Overview

There are typically at least two steps required for disinfecting cultivation water supplies:

1. **Pre-Treatment/Pre-filtration:** Removing organic and organic debris, including plant material, sediment, and algae.

2. **Sanitation:** A purification process which removes potentially harmful contaminants including microbiological organisms, heavy metals, and residual chemicals.

Treatment solutions can include physical, chemical, and biological systems, as summarized below. The systems are often used in combination to achieve optimal results.

PHYSICAL

Eliminate contaminants either by passing them through the treatment system, or by killing organisms in the water without removing them. Treatment methods generally do not have a residual effect on the irrigation system itself, and generally have no phytotoxic effects. Physical treatment generally does not prevent biofilm buildup or prevent clogging.

- Filtration – from sand separators to reverse osmosis
- Rapid media filtration (rapid sand, greensand, activated carbon)
- Ultraviolet irradiation
- Heat treatment (pasteurization)

CHEMICAL

Chemical treatment systems function by damaging cell membranes and/or internal cell organs, causing organism death. Chemical treatment can also prevent biofilm buildup in an irrigation system.

- Oxidizing agents
  - Chlorine & Bromine – oxidation to destroy organisms such as algae, fungi, and bacteria
    - *Bromine*
    - *Calcium hypochlorite (solid); 60-70% available Cl*
    - *Chlorine dioxide*
    - *Chlorine gas*
    - *Electro-Chemical Activation (ECA)*
    - *Sodium hypochlorite (liquid; bleach)*
  - Hydrogen Peroxide, Peroxyacetic acid
  - Ozone
- Combined Physical and/or Chemical: Advanced Oxidation
- Copper and Silver
  - Copper ionization
  - Copper salts
  - Copper / spin-out fabric liner
  - Silver

BIOLOGICAL

Biological treatment systems generally combine a number of treatment processes: physical separation, competition by other organisms, or creating an unfavorable environment for pathogens. These systems can often provide nutrient removal, and manage water that cannot be recirculated.

- Slow media filters and fluidized beds
- Constructed wetlands
- Wood chip denitrification bioreactors
- Hybrid treatment systems
- Bioswales
- Vegetated filter strips
- Land application

NOTE: Biological systems are often implemented outdoors, and are responsive to temperature. Design consideration should be given to temperature management in regions which experience extreme fluctuations during the year.

Source: Adapted from Water Treatment Guide for Greenhouses & Nurseries, West, J., Huber, A., Carlow, C., April 9, 2018

Impact of Substrate on Irrigation Frequency

Below is an overview of the most commonly used substrates used for indoor and greenhouse cultivation, in order based on prevalence of use in the legal market.

Note that the ratio of selected substrate volume to plant biomass will dictate the volume and frequency of irrigation events alongside physical properties and water-behavior characteristics. Growers may use a large volume of peat substrate that only demands low-frequency irrigation but larger volumes of water per event to reach uniform saturation. Others may have a small volume of substrate that necessitates higher-frequency irrigation but in lower volumes due to the overall lower water-holding capacity.

COCONUT COIR

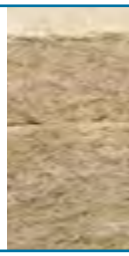
Higher-frequency, lower-volume irrigation strategy: Coir irrigation can range between 1 and 12 water application events/day (depending on the size of the pot).

Coconut coir substrate has for over a decade been a very popular growing substrate in the cannabis industry. Growers like to use it because the physical and chemical properties of coir make it ideal for a range of different irrigation practices, container sizes, environmental conditions, and nutritional strategies.

Proper composition of coir (e.g., pith, fiber, and chunks) provides excellent water retention, aeration, and drainage under both frequent and less frequent irrigation practices across a variety of container sizes. The chemical properties of properly composted, washed, and buffered coir also provide an optimal pH range, while having low electrical conductivity, sodium and potassium content.

Coir is often used on its own, or mixed with perlite, commonly using a 70% coir/30% perlite ratio. It is compostable and can be sustainably produced, but coir requires significant volumes of water during the manufacturing process to remove unwanted ions that adsorb to the cation exchange sites. If sodium and other chemicals are not washed from the coir they can negatively impact growth performance.

ROCK WOOL (STONE WOOL)



Higher-frequency, lower-volume irrigation strategy (more extreme than coco coir): Grodan (the leading producer of rock wool for horticultural use) recommends up to 20 irrigation events a day, depending on the needs of the crop.

Rock wool (i.e., stonewool or mineral wool) is a fibrous material made from molten rock, spun into fibers and then formed into plugs, blocks, and slabs of varying sizes and shapes. It is an inert substrate, meaning that it does not bind any applied water and nutrition, and therefore has no influence on the availability of the nutrient solution delivered by the grower. The sterile nature of production under extreme temperatures keeps the substrate clean and free of pests and pathogens. That means that it has to be constantly irrigated with nutrient solution in order to provide nutrients to the crop.

Rock wool has a high water-holding capacity relative to its volume when compared with other substrates, due to its high volume of air. It can be irrigated with varying volumes and frequencies of water in relation to the volume of the substrate, and based on the differing needs of the plants during the cropping cycle. With uniform fibers and structure, water and nutrient contents can be controlled with minimal leachate.

Rock wool is sometimes referred to as a "sports car" of the substrate world: It can deliver very high plant performance, but if not carefully managed it is easy to"'crash" as plant development happens extremely quickly and can require closer monitoring to ensure balanced production. Because of its low water retention, if rock wool irrigation is off or goes down, plants can more easily experience drought stress or even permanent wilting damage/death. There is a learning curve to using rock wool, especially in the cannabis industry where growers are used to irrigating once or twice a day rather than on the average of 8 to 14 irrigation events required for rock wool.

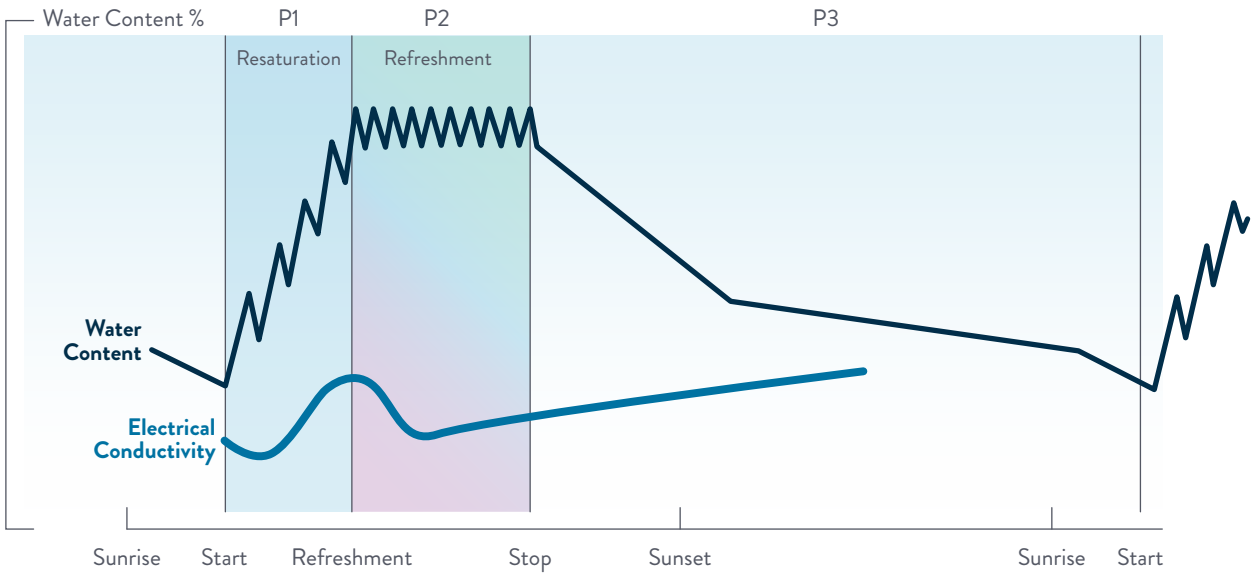
Because rock wool is inert and ions are not bound or exchanged on substrate particle surfaces, it requires a relatively high leachate percentage to keep its pore water solution elementally balanced and avoid cumulative nutrient imbalances in the plant tissue.

PEAT

Lower-frequency, higher-volume irrigation strategy: Peat-based mixes were historically very common in both unregulated and commercial cannabis production. They have begun to fall out of favor in commercial situations, with coir and rock wool taking the lead due to the greater precision which those options afford in managing substrate.

Peat can hold as high a volume of water as coir, but the portion of nonavailable water is greater. Sphagnum fibers are softer than coir, and cannot support as much weight. Inclusion of expanded mineral, wood fiber, or aged bark help to maintain proper aeration in those mixes.

FIGURE 2: Sample Watering Frequency Using Rock Wool



Source: Adapted from Best Practice Guidelines for Greenhouse Water Management, Grodan 2016

Peat mixes are almost always used with a high percentage of perlite in order to increase aeration of the mix, but that also decreases water retention. Other amendments include organic composts, nutrient charges, vermiculite (less common), aged bark/sawdust, and sand.

Peat mixes are a very wide-ranging category. Peat-lite mixes revolutionized the greenhouse industry back in the 1960s, as they greatly reduced costs for transporting substrate due to its light weight. Peat-lite mixes are made from a high proportion of Canadian sphagnum moss similar to the standard horticulture, with a density of 140 to 180 g/L. Peat may also be amended with various minerals and organic matters, making the mix much denser (200 to 400 g/L) with higher water retention and lower aeration.

Living soils, which blend decomposed organic ingredients (such as various compost), reproduce a natural edaphic environment with diversified microflora. The irrigation management approaches for peat-lite and living soil mixes are different, as the dynamic between water retention and aeration is much different.

WATER CULTURE

Constant application, low-volume: Plants' roots are submerged in solution, and growers typically top off the solution once or twice a week before a complete solution replacement.

Often built using a recirculating system, water culture is considered the most water-efficient cultivation technique. However, due to the high degree of sophistication required to build, operate, and maintain a water culture system, it is not an approach often used in large-scale commercial cannabis cultivation.

Understanding Substrates: When Soil Is Not Soil

It is rare to use amendments (e.g., perlite, sand, sawdust/bark, vermiculite, diatomaceous earth) on their own to grow cannabis. Peat and coco will generally be used as bases for amendments added to achieve an optimal moisture and aeration profile.

Comparatively, rock wool is always used on its own without any amendments, unless for the exception of instances where a rock wool cube is placed atop a coconut coir slab as is common in tomato, cucumber, or pepper greenhouses.

While soilless media is often referred to as soil, it is important to distinguish between the two: Soilless mixes contain no field soil, but typically one or more components like peat, coir, bark, perlite, or vermiculite.

Often, what may be referred to as "living soil" is actually soilless media, but with a highly variable mixture of different organic amendments. In opposition to hydroponics, where most or all of the nutrients for the plant are dissolved in water, all or most nutrients in living soil come from the breakdown of organic matter in the root zone. Thus, living soil can contain some percentage of field soil, or may be soilless substrate.

The two primary water culture systems are:

- DEEP WATER CULTURE: Plants roots are suspended in nutrient solution which is oxygenated with an airstone to allow for root growth. Individual plants are often grown in large (2 to 5-gallon) buckets connected by PVC piping; and
- AEROPONICS: Plant roots are suspended in the air (under some cover to prevent light infiltration). The roots are misted extremely frequently (i.e., 5 to 15 or more times hourly) with small pulses of nutrient solution.

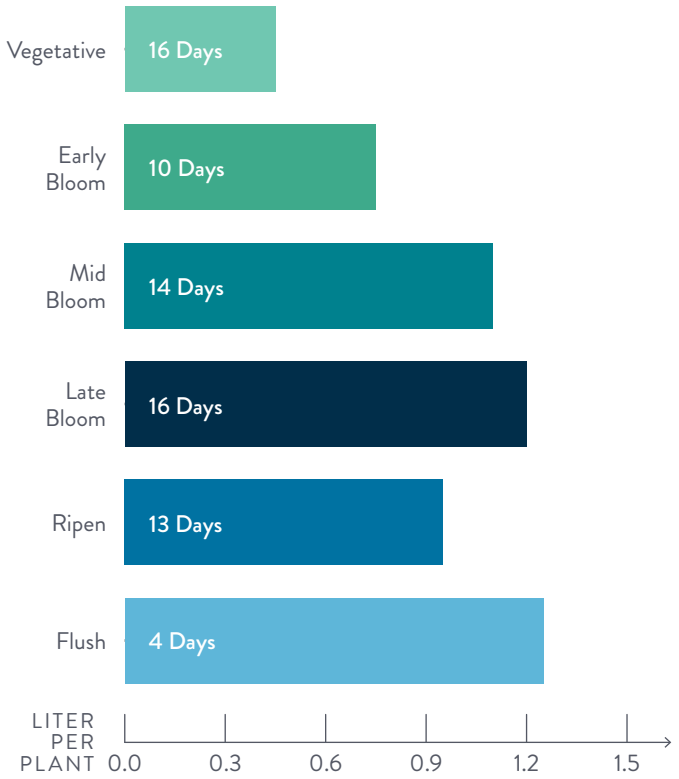
Water Use at Different Stages of Plant Growth

As demonstrated from a trial run in Quebec (Figure 3), irrigation scheduling was determined by using a tensiometer in conjunction with moisture release curve, so water use and the moisture content of the substrate was driving irrigation.

The graph is only intended to show the general water usage at different stages of growth. As the crop develops, water use increases until the ripening stage, where growers may induce drought stress on the crop. The response from the plant is supposed to increase inflorescence, dry weight, and potency.[7] There remains limited data to support it, but the practice is documented in published studies of cannabis cultivators. Water use peaks in the final stage just before harvest, when the plants are commonly flushed with the goal of eliminating any potential contaminants or adulterants before harvest.[8] Due to the industry's stringent testing requirements, permitted growers may use more water in the final stage than growers in the illicit market whose crops are not tested.

FIGURE 3: Minimum Water Usage

Indoor Cultivation 3 Gallon Pot ½ Plant/ft²



Based on Figure 3, the annual water consumption of an indoor operation would be approximately 80 to 100 gallons/plant or 40 to 50 gallons/feet² of growing area depending on the runoff percentage practices of the operator.

7. Caplan,D., Dixon, M., Zheng, Y., Increasing Inflorescence Dry Weight and Cannabinoid Content in Medical Cannabis Using Controlled Drought Stress, HortScience , May 2018

8. *This practice has been shown to be largely ineffective at reducing concentrations in plants by the University of Guelph in 2017: Results "showed that the intended purpose of flushing to reduce nutrient concentrations within the bud has no effect. These data show that for the last two weeks of the flower cycle for cannabis, it was possible to use no fertilizer water for irrigation with no significant impact on yield while saving input costs on fertilizer."*

Water Insecurity Risks

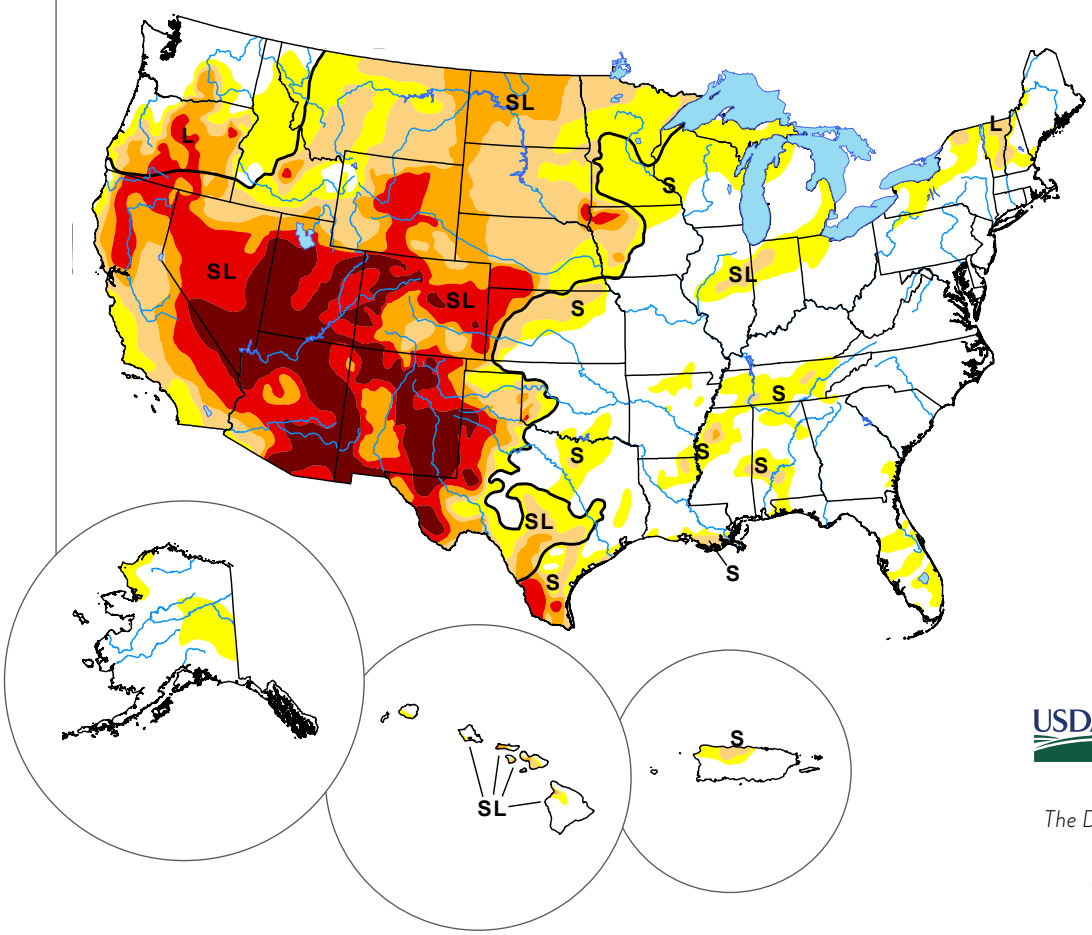
As Drought Conditions Worsen, Risks Rise in America's Most Productive Cannabis Regions

According to NASA, 2020 was the hottest year recorded in the United States since recordkeeping began in 1880; globally, the seven-warmest years recorded have all occurred since 2014. The changing climate is fueling the worst drought experienced in the U.S. in decades, accelerating water scarcity in many parts of the country while driving new urgency to address water use in cannabis cultivation.

Ideal environmental conditions have historically made the western states well suited for outdoor cannabis cultivation, but those states now face the most acute drought conditions in the country. Arizona, California, Colorado, Nevada, New Mexico, and Oregon (which collectively account for 71% of the nation's total cannabis

FIGURE 4: Drought Conditions in the United States

Feb. 16, 2021, Released Thursday, Feb. 18, Valid 7 a.m. EST



DROUGHT IMPACT TYPES

~ Delineates dominant impacts

S Short-Term, typically less than 6 mo. (e.g. agriculture, grasslands)

L Long-Term, typically greater than 6 mo. (e.g. hydrology, ecology)

INTENSITY

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary.

Source: United States Drought Monitor

FIGURE 5: Severe Drought Cycles in the United States

Percentage of the Country Experiencing D3-D4 Level Drought (1/4/20 - 2/2/21)

Source: United States Drought Monitor

supply, both legal and illicit) are facing severe to exceptional drought conditions according to the National Oceanic and Atmospheric Administration's Drought Monitor.[1]

Nationally, during peak drought cycles approximately one-quarter of the country experiences extreme or exceptional drought, as seen in 2002 (23%), 2012 (24%), and early 2021 (22%).

Amidst the current prolonged and historic drought, a future of rising costs and tightening access to water are making efficiency an increasingly urgent priority.

As California is the country's largest cannabis producer, the extent of its drought over the past decade has been especially noteworthy. In the decade since 2010, not only did the entire state experience multiple consecutive years of severe drought, but between 2014 and 2017 nearly half the state suffered exceptional drought conditions (e.g., Figure 6).

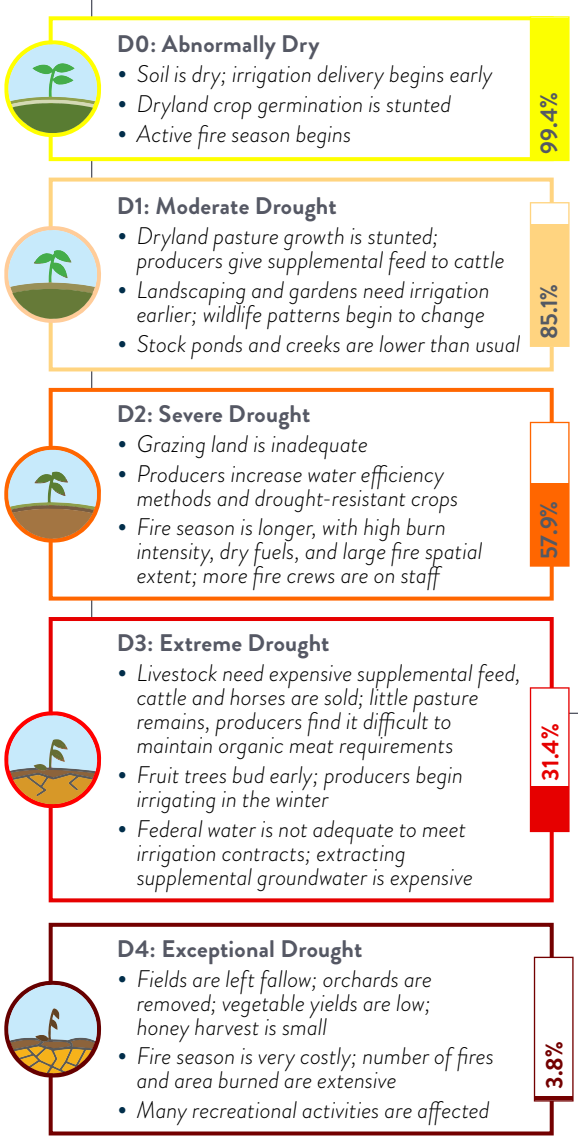
While the intensity of the drought has eased slightly over the past three years, cannabis growers should assume that the trend toward longer, more acute droughts will be sustained well into the future. They should accordingly build their operations to reflect the changing climate, assuming:

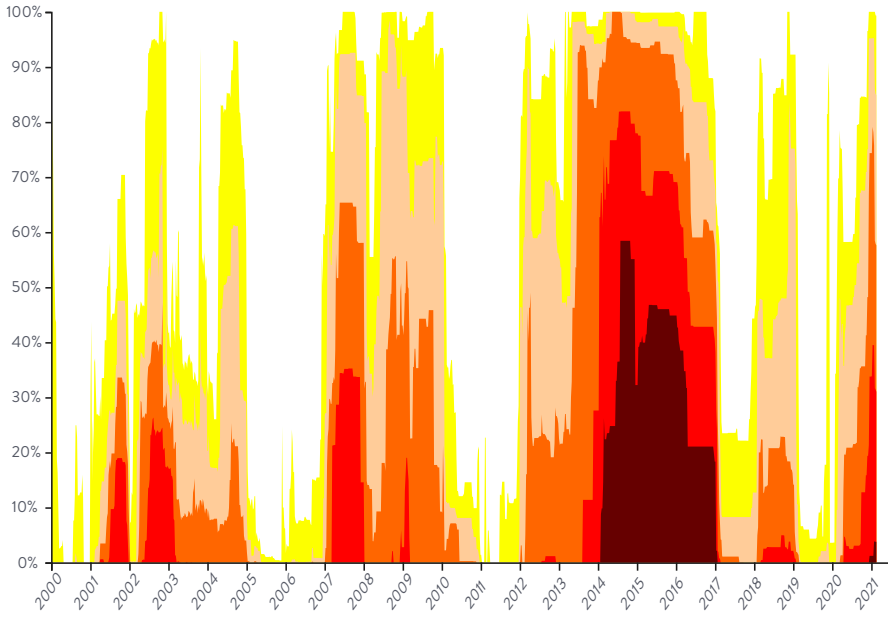
- Longer, hotter and drier summers;

1. *The Drought Monitor has been a team effort since its inception in 1999, produced jointly by each the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of Agriculture (USDA).*

FIGURE 6: Drought Conditions for California

(1/4/20 - 2/2/21)





Source: National Integrated Drought Information System

- New restrictions on water access, water discharge volumes, and minimum effluent quality standards/monitoring as groundwater sources become more scarce;
- That states like California will iteratively tighten building codes to increase energy efficiency, reduce waste, and preserve indoor and outdoor air quality via mechanisms like Title 24, the state's triannually updated Building Energy Efficiency Standards (such regulations will have implications for HVAC, humidity control, and other environmental management systems which impact water use in the grow environment);
- More expensive water supply from public systems;
- Increased cooling demand for indoor and greenhouse growers to offset higher loads; and
- Higher operational expenses for temperature control and water management systems

Additionally, due to limited research, impacts of drought stresses on a cannabis plant's maturation and cannabinoid production remains poorly understood. For the thousands of outdoor growers in the western states, a drier, hotter future could have significant implications for which cultivars they grow, and what techniques they will need to adopt to optimize both crop yield and harvest quality.

Water Benchmarks

The ***Cannabis H2O: Water Use & Sustainability in Cultivation*** report is the combination of two original works: The first includes the U.S. cultivation estimates for both the illicit and legal markets (with all estimates based on New Frontier Data's analysis of legalized production in legal states, and careful assessment of illicit activities in non-legalized markets); the second work incorporates water-performance indicators based on data submitted by cultivators to Resource Innovation Institute's Cannabis PowerScore resource benchmarking platform. The estimated total production volume, flowering canopy, and total U.S. cannabis industry cultivation water use are respectively derived from those two sources.

Background & Methodology

This section of the report provides benchmark performance standards, and explores potential causes of performance variation. As described on page 4, all analysis herein has been performed using data aggregated by RII's Cannabis PowerScore platform.

The data here comes from multiple sources. The primary source is the Resource Innovation Institute's Cannabis PowerScore resource benchmarking platform. Cultivators and supply-chain partners throughout North America use PowerScore to submit facility details such as square footage of flowering canopy, amount of product produced, and annual resource consumption data, to receive a competitive performance benchmark comparing their operation's KPIs to others growing like them.

In summer 2020, RII expanded its Technical Advisory Council to include a Water Working Group to establish a scientific understanding of how (and how much) water is used for cannabis cultivation; the aim was to give cultivators confidence in taking steps to be more efficient, and help industry leaders, governments, and media be more accurately informed about the range of water practices in today's regulated market. Members include cultivators, regulatory agencies, academic researchers, equipment manufacturers, engineers, and substrate suppliers.

Members of the Water Working Group offered RII recommendations to expand PowerScore to accept new information about water management practices, to better inform new reports and KPIs describing resource applications, storage, and usage. RII also developed a data transfer protocol, and PowerScore was upgraded to accept submissions of portfolios of facility data, so that larger batches of self-reported data from regional regulatory agencies could be analyzed.

In autumn 2020, RII integrated data from a variety of sources, ensured representation across various locations and methods, and standardized metrics to enable a range of performance.

The Berkeley Cannabis Research Center, Resource Innovation Institute, and New Frontier Data cooperatively consolidated, analyzed, and formulated observations about the information. New Frontier Data used its extensive knowledge of the industry to help summarize the overall market, contextualize the data, and develop industry forecasts.

The teams collaborated to evaluate the data findings and articulate the most salient items to benefit readers of this report, intending to provide the greatest impact for operators, water suppliers, investors, and policymakers.

About Cannabis PowerScore

PowerScore is an online software suite of tools including a survey, facility-level performance benchmarks, dashboards, and reports. The PowerScore survey collects self-reported performance data and cultivation characteristics (e.g., annual production, monthly water consumption, flowering canopy area, cultivation approach, and substrate), to generate a performance benchmark summarizing up to 14 key performance indicators (KPIs) at the facility level. Users benefit by instantly being shown their operation's ranking relative to the rest of the PowerScore's database, through the Ranked Data Set. All data is kept anonymous.

Study Limitations

PowerScore data has potential limitations which the report authors have addressed with data quality protocols described in this section. This report analyzes self-reported data from PowerScore; user-submitted data carry the risk of being either submitted with errors, or with a different interpretation than what the survey creators intended. Since separate and dedicated water-use metering is not always available to growers, monthly water-use submissions might include water from noncultivation-related occupancy or process. For example, while a user might report monthly water usage for a facility, reported annual consumption of the operation could include water consumption for processes other than cultivation, leaving undetermined the portion of water used for cultivation alone.

In an attempt to minimize errors from self-reported data, the report's authors have removed outlier submissions with the guidance of members of RII's Technical Advisory Council and Water Working Group. Facility records using application rates and outputs from water management systems are considered records of the highest quality; those using best guesses were removed from the dataset when records noted the characteristic.

In most cases, users submit data to PowerScore on their own accord, and are not compelled by their regulators. While in most regions power and water consumption information is not required by regulators, there is a growing trend in states and municipalities to mandate reporting. Beginning in summer 2020, cultivators in Massachusetts began complying with energy and water-reporting requirements, and some facilities in the Ranked Data Set contain the required information. For records voluntarily submitted, there is potential for a submission bias wherein the data overrepresents cultivators who are actively engaged in improving their environmental performance. Future iterations of this work will continue to utilize larger and less potentially biased datasets, as more states' regulators require benchmarking and reporting of the industry's resource efficiency metrics. Likewise, future reports will also feature aggregate data from a broader geographical distribution of data.

The analysis in this report focuses specifically on facility-level water used in cultivation. It is important to note that there is additional water embedded within the supply chain and other processes that is not accounted for in this analysis. The estimates in this report do not include other areas such as the water used for controlling environmental conditions with heating, cooling, and humidification equipment, post-harvest processing (i.e., production of extracts and derivatives), irrigation water production and treatment outside the facility, or water used for power generation equipment.

Assumptions & Model Estimations

Developing market estimates for national water use estimates for cannabis required key assumptions due to the data limitations in the cannabis industry. Key data challenges include:

1) **Limited production data availability:** Very limited information is available about production practices in the illicit market which accounts for the majority of cannabis grown in the U.S. In the legal markets, data collection on production varies widely across markets. As such, the model relies heavily on consumption data and the limited data available from regulated markets (i.e., Colorado) to estimate overall production volumes.

2) **Widely divergent cultivation practices:** Across the legal and unregulated markets, growers use widely varied practices to cultivate practices. Differences include:

   - **Number of harvests per year.** Some growers only harvest once a year, others, especially in indoor facilities, can harvest five or more times per year
   - **Plant sizes.** Correlated to harvest frequency, growers with low harvest frequency will produce crops that can be 10 feet tall or taller, whereas plants in a frequent harvest facility may only reach 3-4 feet.
   - **Substrate variance.** The substrate, or medium in which the crop is grown, varies widely, from soil and peat, to rockwool and hydroponics. Each substrate used requires different watering techniques, adding further complexity to estimating average water use.
   - **Plant density.** Space-constrained facilities often pack the plants tightly together, whereas outdoor facilities in particular tend to have wide spaces between plants. This significantly influences both the estimates for water used and the yields per square foot.

3) **Changes in production practices for smokable flower versus value added (extract-based) products.** Historically, cannabis buds were sold for smoking (loose flower and pre-rolls) whereas the plant's leaves and trim from preparing the buds was sold for extraction. However, as the market for extracts has grown, some growers are now producing plants which are fully intended for the extracts market. Production for extraction-only remains a small proportion of all cultivation in the U.S.

Assumptions

Production volume per dollar of revenue earned.

Based on the sales revenue data collected, we developed an estimate for the volume of production required to meet the retail demand. This estimate was based on the production volumes reported in Colorado, the country's most mature cannabis market.

KEY ASSUMPTION: The revenues earned in Colorado per pound of cannabis produced are an effective proxy for production practices across the country due to the longitudinal data available, and the mix of cultivation facility types used in the state.

Pounds of smokable flower produced.

The estimates for pounds produced are for smokable flower only. It does not include the biomass weight produced from trim of leaves. The smokable bud estimates are based on the cured finished product, not on the wet weight at the time of harvest.

KEY ASSUMPTION: The trim and leaf used to produce extracts is from the same plants from which the smokable bud is harvested. As such the square footage used to produce smokable flower is the same as what is used to supply the extract market.

Percentage of production for import/export.

The illicit market accounts for most of the cannabis consumed in the U.S. Most states are net importers of cannabis, relying on exports primarily from California. Based on analysis of data from the U.S. government's cannabis eradication program, and inputs from industry and cannabis policy experts, we developed estimates for total production in each state based the estimated volume of domestically produced and imported cannabis.

KEY ASSUMPTIONS:

- Cannabis imports only apply to the illicit market. All legal market products are produced within the states where they are sold.
- The volume of imports declines over time as legal markets are established in each state.

Distribution of facility types in each state.

Based on analysis of licensing data (where available) and discussions with in-state operations experts, we estimated the proportion of indoor, greenhouse, and outdoor facilities in each state. Generally, states which experience more extreme weather were more likely to have indoor and greenhouse facilities, whereas those in more temperate regions were more likely to grow outdoors.

KEY ASSUMPTION: The proportion of indoor, greenhouse, and outdoor facilities in each state are similar in the legal and illicit production facilities within each state.

Average yield per square foot of flowering canopy.

To determine the average yield per square footage and facility type, we reviewed existing market data and polled licensed cannabis producers operating in different U.S. markets. These estimates were used to great the national aggregated estimate for total square footage used to grow cannabis. Due to the limited number of inputs, the estimated values can significantly influence the total national estimates for production scale.

Square footage of Flowering Canopy vs. Square Footage of Total Canopy or Total Facility Size.

There are three common metrics used for cannabis facilities:

- **Flowering canopy:** The area used to grow the plants during their final stage of growth before harvest.
- **Total Canopy:** The square footage used to grow plants during the seedling, vegetative, and flowering stages.
- **Total Facility Size:** The total size of the cultivation facility, including canopy, production areas, offices, etc.

KEY ASSUMPTION: For purposes of this report, the canopy areas referenced are for *flowering canopy only* since the surveyed growers measure their yields per square foot of flowering canopy.

Water Data Sets

Three sets of data are included in the PowerScore analysis: the national PowerScore Ranked Water Data Set, the Northern California 2019 dataset, and the Michigan 2020 dataset.

The use of these datasets is opportunistic, yet also provides a good snapshot of current cannabis production. Each dataset has its own strengths. The national PowerScore data is broadly representative of cannabis production across the United States, and provides data from many of the largest producing regions. The Northern California data is by far the largest dataset, and therefore may provide the most reliable picture of regional water use. The Northern California data is nevertheless important, as that area still contains the majority of California's permitted cannabis farms, and likely a majority of unpermitted farms also. The Michigan dataset provides a glimpse into water use in a rapidly changing new market.

"The use of these datasets is opportunistic, yet also provides a good snapshot of current cannabis production."

POWERSCORE RANKED WATER DATA SET

The PowerScore Ranked Water Data Set contains 44 total records with complete water KPIs. These records include indoor facilities, greenhouses, and outdoor farms in nine states (i.e., California, Colorado, Illinois, Maryland, Massachusetts, Ohio, Oregon, Vermont, and Washington).

Each PowerScore record reports flowering canopy square feet, annual production, and gallons of water both stored and applied by month.

Also provided is limited plant count data, with plant counts extrapolated from total canopy square feet (per plant gleaned from the Northern California 2019 Data Set for mixed-light and outdoor farms).

Within the set of 44 facility records, there are several subgroups of facilities:

The PowerScore Ranked Water Data Set is biased towards smaller operations, with less representation of larger farms. The average flowering canopy area is 44,900 square feet for outdoor farms, 10,400 square feet for greenhouse operations, and 6,210 square feet for indoor facilities in this data set. That farm size is significantly smaller than farm size data in California. Analysis by UC Berkeley using government data and aerial imaging analysis shows that larger farms make up a significantly higher proportion of California's total canopy than do smaller ones: Farms with over 30,000 square feet account for 71% of permitted canopy, and 35% of unpermitted farms.

The report's analysis of total water use was based on the distribution of square footage in each group, not the percentage of PowerScore records in each category.

FIGURE 7: PowerScore

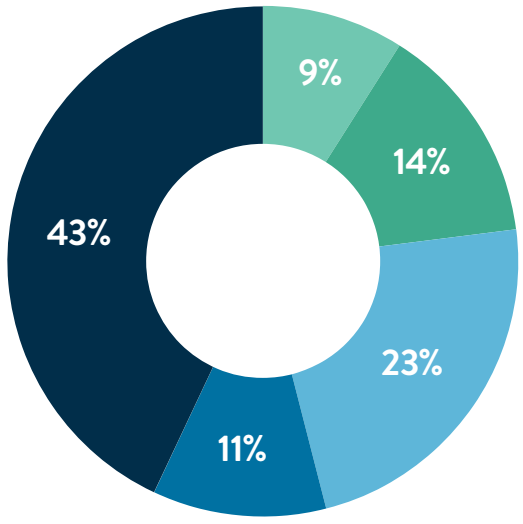
Flowering Canopy Square Feet	PowerScore Ranked Water Data Set	California Percentage of Canopy Square Footage by Farm Size: California Permitted Farms % sq. ft.	California Non-Permitted Farms % sq. ft.	California Average % Total sq. ft.
<5,000 SF	**51%**	2%	16%	**9%**
5,000 - 10,000	**13%**	12%	16%	**14%**
10,001 - 30,000	**15%**	14%	32%	**23%**
30,001 - 50,000	**13%**	11%	10%	**11%**
>50,000	**8%**	61%	25%	**43%**

Figure 7 illustrates the distribution of PowerScore Ranked Water Data Set records by flowering canopy size, compared against UC Berkeley's assessed distribution of permitted and non-permitted California farm sizes.

Nearly half of the PowerScore Ranked Water Data Set records are for indoor facilities, with the data regionally concentrated primarily between the Pacific Northwest and New England.

For indoor facilities, water use is more heavily influenced by the plants than by the outdoor environment, due to the greater insulation from exterior conditions. Consequently, limited variance in water use is expected between identically designed indoor facilities across the country.

FIGURE 8: California Average % Total sq. ft.



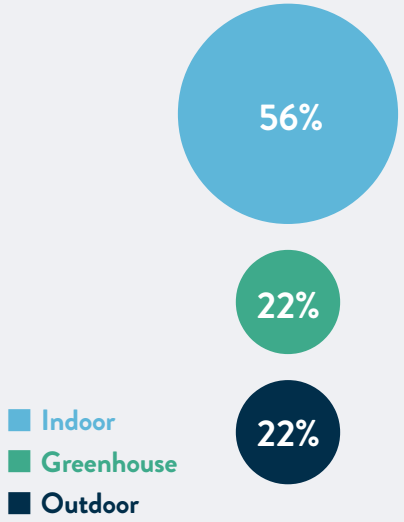
However, the wide variance in climatic conditions nationally means that exterior conditions will have far greater impact on resource use in greenhouse and outdoor operations. As such, while this analysis provides an illustrative view into the industry's water use, and identifies opportunities to increase water efficiency, it does not capture the regional variance of non-indoor facilities across the country.

RII will continue to work to capture data from nationally distributed operators as legal markets extend across the northern states (e.g., Michigan, Illinois, Montana) which experience mild summers and long, cold winters, across southwestern states (e.g., Arizona and New Mexico) with warmer, drier conditions, and into southern states (e.g., Florida, Georgia, Louisiana, Oklahoma) which experience hot, humid conditions.

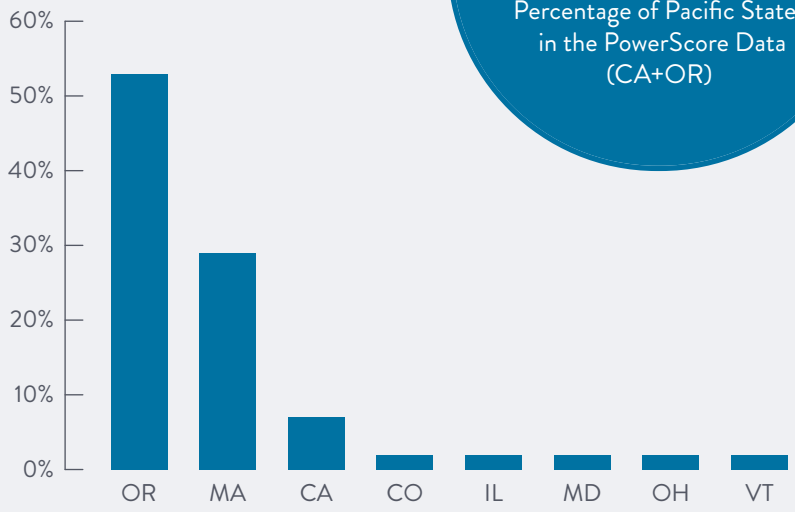
The PowerScore Ranked Water Data Set records represent facilities using several cultivation techniques that could influence water usage for cultivation.

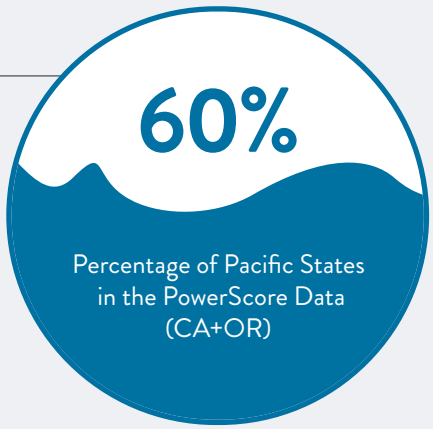
FIGURE 9: PowerScore Records by State & Cultivation Approach

Facility Types in PowerScore



State Distribution in PowerScore





The PowerScore Ranked Water Data Set records represent facilities using a variety of water sources, including potable and natural water sources.

FIGURE 10: National PowerScore Water Sources

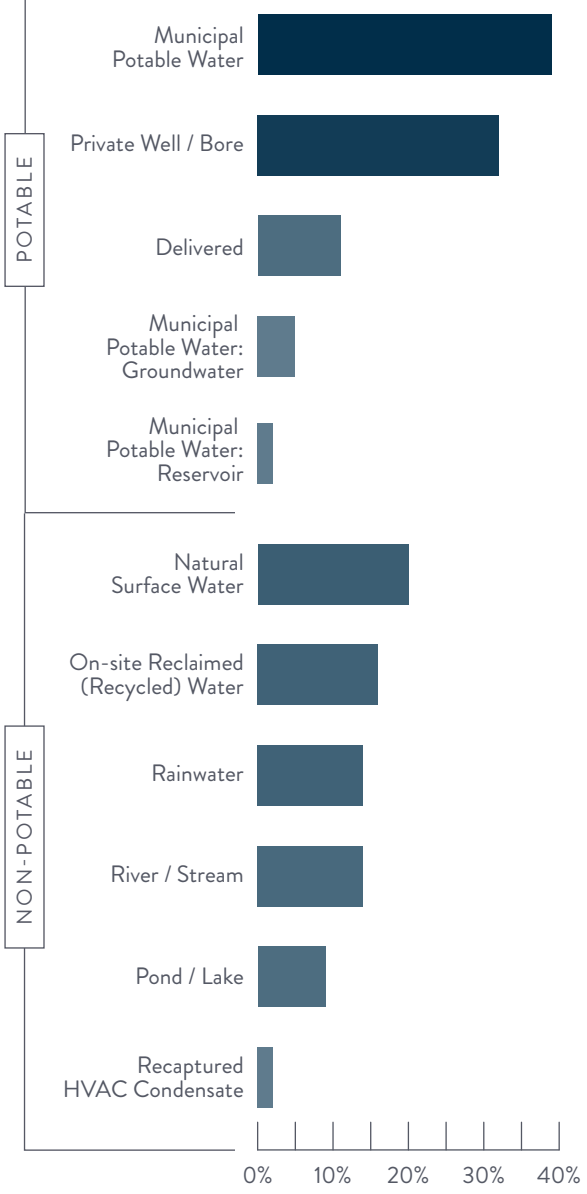


FIGURE 11: Potable Water Sources

by Facility Type

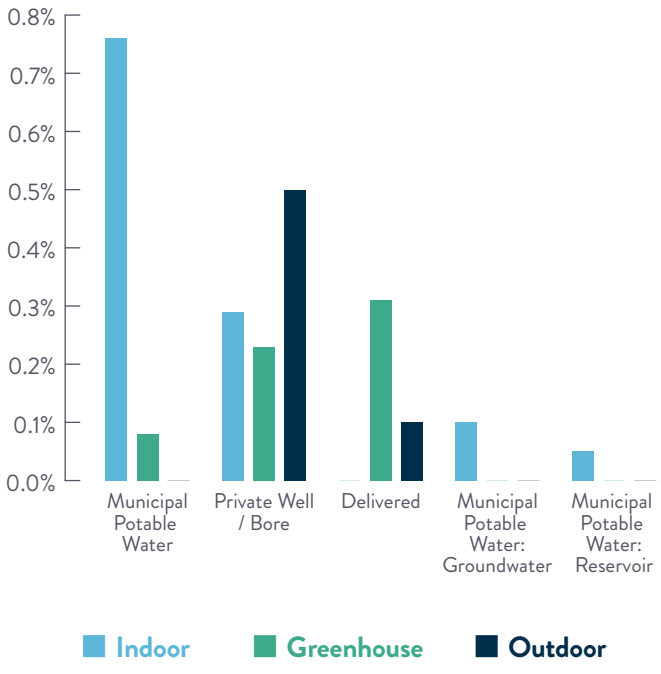
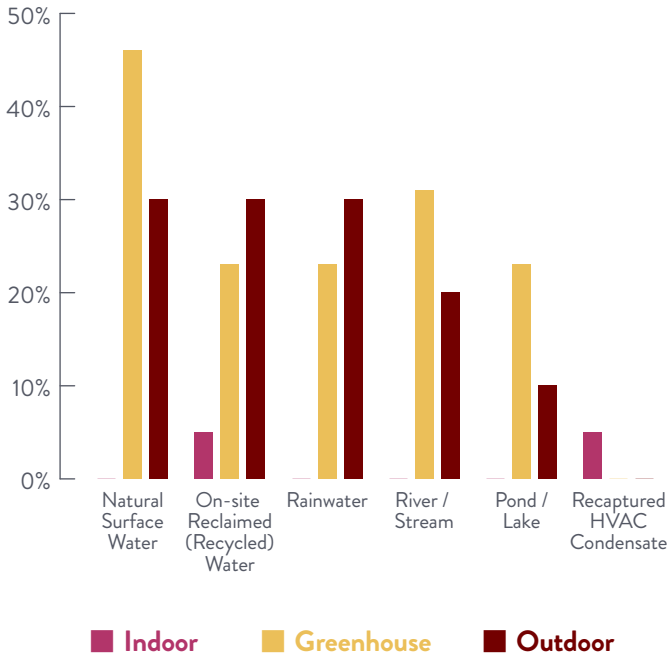


FIGURE 12: Non-Potable Water Sources

by Facility Type



NORTHERN CALIFORNIA 2019 DATA SET

The Northern California 2019 Data Set contains 618 records covering greenhouses and outdoor farms in Mendocino, Humboldt, Trinity, and Sonoma counties that have received cultivation permits from the state of California. The data was obtained via a Public Records Act request to the California Water Boards. Each record reports a plant count, total canopy square feet, and gallons of water stored and applied monthly. The dataset does not contain production data.

The Northern California 2019 Data Set is biased towards small- to medium-sized operations, and has less representation of larger farms. In the data set, the average flowering canopy area for outdoor farms is 12,650 square feet, and 10,200 square feet for greenhouse operations.

The Northern California 2019 Data Set has a concentration of greenhouse facilities (i.e., operations using supplemental light).

FIGURE 13: California Cultivation Facility Data

by County

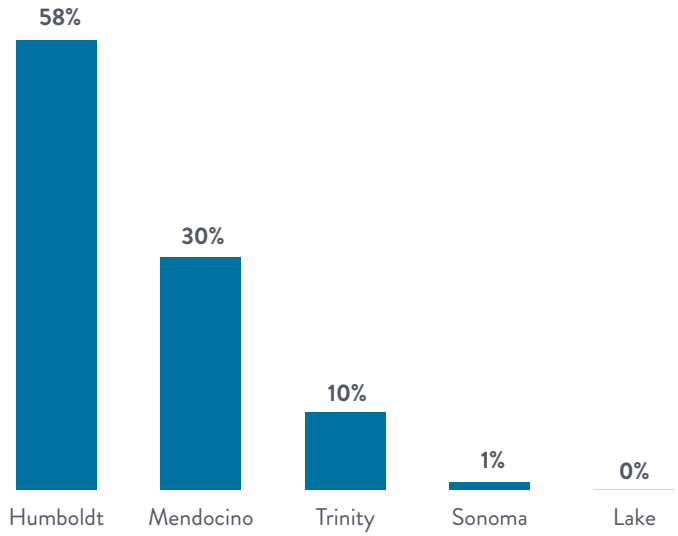
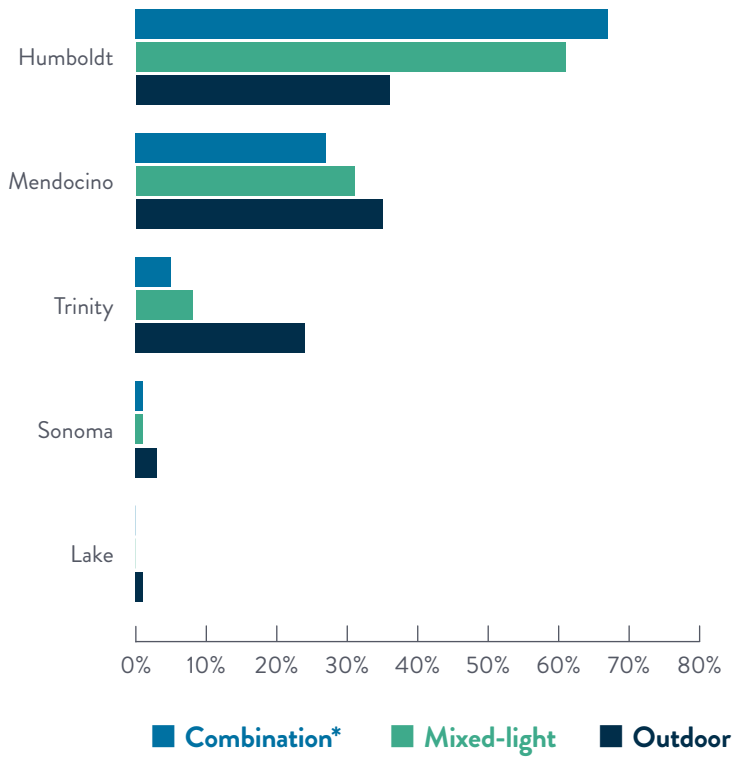


FIGURE 14: California Cultivation Facility Type

by County



** Farms with canopy area both outdoors and in mixed light environments*

FIGURE 15: California Average Canopy Area

by Facility Type

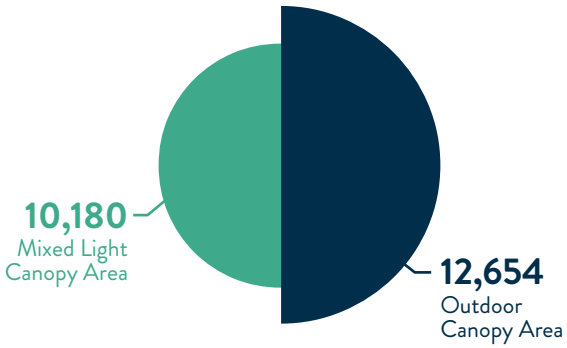


FIGURE 16: California Primary Source of Water

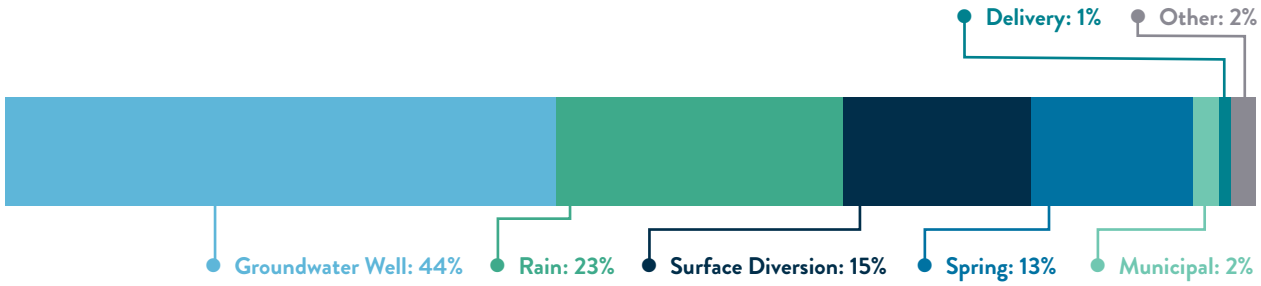


FIGURE 17: California Secondary Source of Water

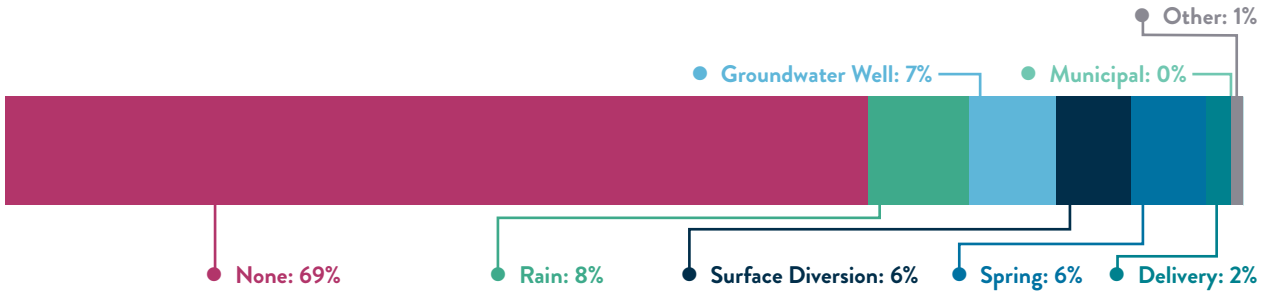
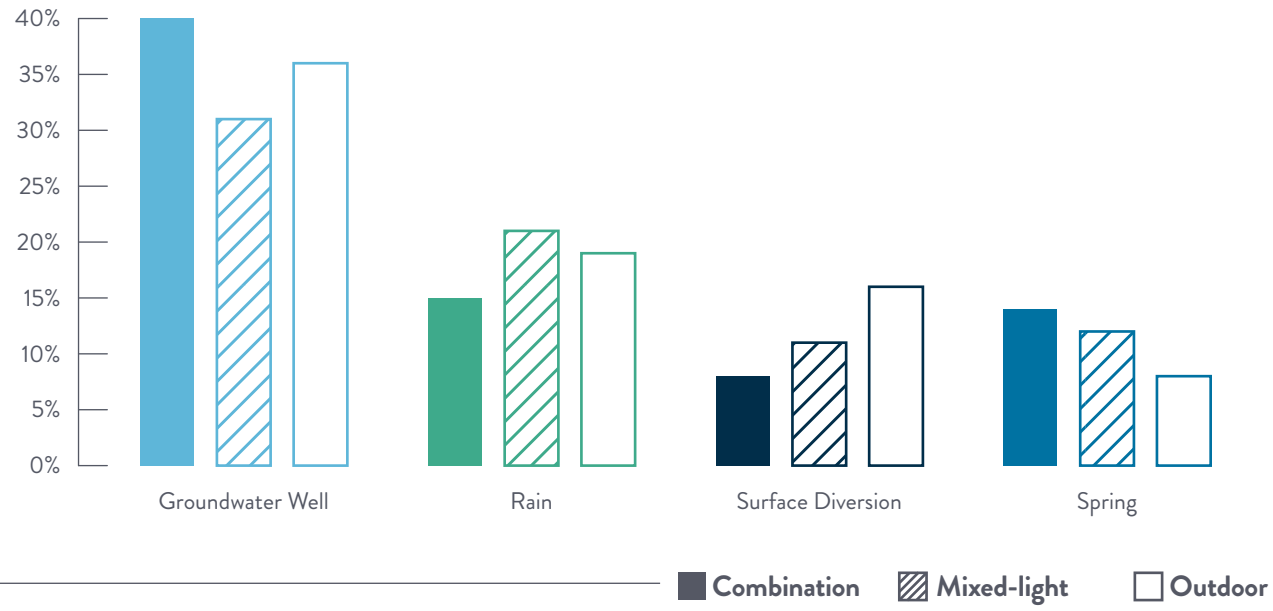


FIGURE 18: California Primary Sources of Water

by Facility Type



MICHIGAN 2020 DATA SET

The Michigan 2020 Data Set represents 12 indoor facilities licensed in Lansing, Michigan. The indoor facility records report gallons of water applied by month of year. All facilities in the data set are served by the local public water system. Information about storage infrastructure is undetermined.

The dataset does not provide plant count data, but regulations in Michigan limit plant count:

- CLASS A – 500 Plants Med/100 Plants for Adult Use (AU)
- CLASS B – 1,000 Plants Med/500 Plants for Adult Use (AU)
- CLASS C – 1,500 Plants Med/ 2,000 Plants for Adult Use (AU)
- EXCESS LICENSE – 2,000 Extra Plants (Medical)

Class C licenses are the license type for 92% of the records in the Michigan dataset.

Water Sources

A majority of mixed-light (50%) and outdoor (56%) facilities in Northern California use groundwater wells as water sources. Most (61%) mixed-light facilities also use tanks of stored water, and nearly a quarter (23%) use rain as a water source. Six in 10 mixed-light facilities (61%) and nearly half of the outdoor facilities (48%) use tanks, while one-quarter (23%) of mixed-light facilities and 17% of outdoor farms use rain as a water source.

It is worth noting that facilities using rainwater often collect the rainwater during the offseason, due to the limited rainfall during summers when the crops are being grown.

All indoor facilities in the PowerScore Ranked Data Set use potable water for source water. No indoor facilities use natural surface water, but 5% use on-site reclaimed water from use of recovered condensate from HVAC and dehumidification equipment. No indoor facilities in the PowerScore Ranked Data Set rely on rain as a water source, and none has water delivered to their facility.

Growers in other parts of the country, especially the water-rich Northeast and Midwest states are more likely to rely on public water than invest in building onsite groundwater supplies. Furthermore, these areas are less likely to see major water disruptions due to drought and are therefore less likely to need redundancy systems to back up their primary water supply.

Key Benchmarks

The table below shows four key benchmarks for tracking a cultivation organization's water performance by cultivation approach from PowerScore, California, and Michigan. Ranges are used to describe water performance of varying cultivation approaches. More detail is provided on each key performance indicator in the following sections:

1) **Water Productivity**
2) **Water Efficiency**
3) **Water Demand**
4) **Water Storage**

NOTE: LIMITATIONS OF MEASURING WATER USE PER PLANT

Early efforts over the past decade by state environmental agencies to quantify water efficiency of cannabis production facilities used unit metrics such as gallons per plant as a baseline for typical performance. However, with the extremely broad range of planting densities —which can range from as low as 300 plants per acre in outdoor farms to as many as thousands of plants per acre indoors — the plant size and duration of the cultivation period range so widely that they render any water-use per plant comparison meaningless. Therefore, an attempt has been made to develop efficiency measures that are comparable across plant densities.

FIGURE 19: Key Metrics on Cultivation Facility Water Use

PowerScore

	Indoor	Greenhouse	Outdoor
Water Facility (Gallons/sq. ft.)	198	79.9	10.8
Average Monthly Usage	87,436	27,833	25,500
Total Annual Usage	649,000	334,000	306,000
Water Productivity (grams/gallon)	3.74	1.88	3.13

California Cultivation Facilities

	Combination	Mixed-Light	Outdoor
Water Facility (Gallons/sq. ft.)*	11.4	14.9	11.3
Average Monthly Usage	15,921	15,104	12,429
Total Annual Usage	206,977	196,346	161,578
Storage Gallons / Canopy Square Feet	12.2	14.8	9.99
Total Annual Storage	221,403	194,960	174,028

** Collected as applied gallons per square foot.*

Michigan Cultivation Facilities

	Average
Average Monthly Usage	64,629
Total Annual Usage	775,543

Water Productivity (grams/gallon)

Of all metrics relevant to water consumption, water productivity best represents how efficiently a cultivator is using water to produce cannabis. The metric represents a cultivator's cannabis output relative to water input. Over a 12-month period, cannabis output is measured in grams of dry (trimmed) flower produced, with water input measured in gallons of water applied for irrigation. A higher value for water productivity indicates more effective use of water as a resource.

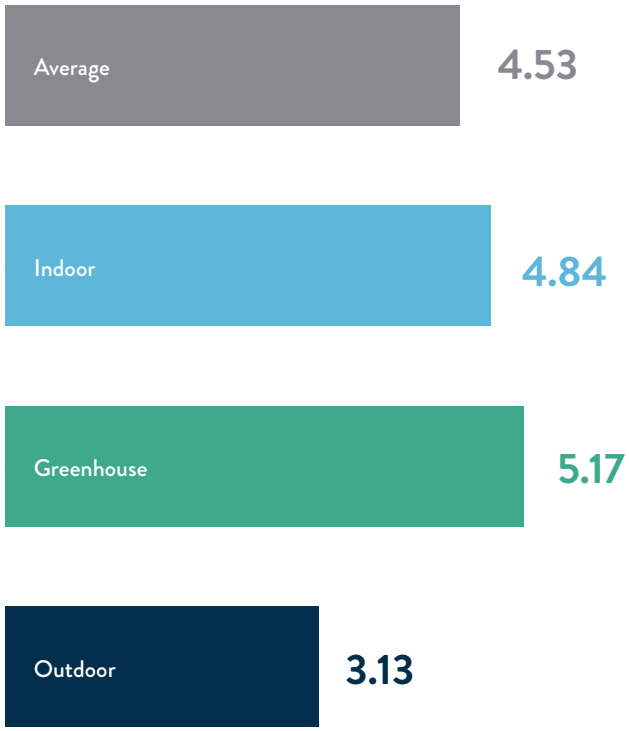
PowerScore Water Productivity (grams/gallon)

Data from the PowerScore Ranked Water Data Set show average water productivities of 4.8, 5.1, and 3.1 grams per gallon for indoor, greenhouse/hybrid/mixed-light,[9] and outdoor cultivation operations, respectively.

The average water productivity of the PowerScore Ranked Water Data Set shows greenhouse facilities achieving the best grams per gallon, using the least amount of water per gram of cannabis produced, closely followed by indoor facilities. Outdoor facilities had the lowest yield per gallon.

9. Facilities are categorized as hybrid type if they are designated as a greenhouse, or if the data for the latest plant growth stage reports using both sunlight and electric light. The average water productivity performance of greenhouses compared to outdoor farms may be influenced by outdoor farms generally including total land area in their flowering canopy area totals; having wider spacing between the plants, they may appear to be more efficient because their farm footprint is much larger than their true flowering canopy area, giving them a much larger denominator.

FIGURE 20: PowerScore Water Productivity
Grams/Gallon



> The PowerScore Ranked Water Data Set shows greenhouse facilities achieving the best grams per gallon, using the least amount of water per gram of cannabis produced.

Water Efficiency (gallons/square foot)

The metric describes a cultivation facility's annual application of water for irrigation per unit of area. A lower value for water efficiency indicates more effective use of water as a resource.

Energy industry professionals are presumably familiar with energy use intensity (EUI), a metric used for characterizing building energy consumption, and often used in benchmarking exercises. While water-use intensity (WUI) is similar, it typically is divided by total (i.e., gross) building area for other kinds of buildings, whereas the version of the metric in question uses flowering canopy (rather than total building area) as the relevant definition of area, as PowerScore also uses for energy KPIs. Canopy is defined as the tray-and-table area used for plant production, not the total area available for planting (excluding all aisles, walkways, and noncultivation areas). Flowering canopy includes only tray-and-table area used for flowering cannabis plants (excluding canopy area for younger plants).

It is worth noting that the reported canopy of outdoor grows is more likely to include non-water-using areas between plants than in greenhouse grows, where the plants are typically more densely planted together. That thereby lowers the water usage by area for outdoor farms, since the area measurement includes a larger overall footprint than is being actually used for cultivation. Additionally, the variability in plant spacing and plant sizes in outdoor farms makes it impossible to create a uniform way to account for the unused space between plants.

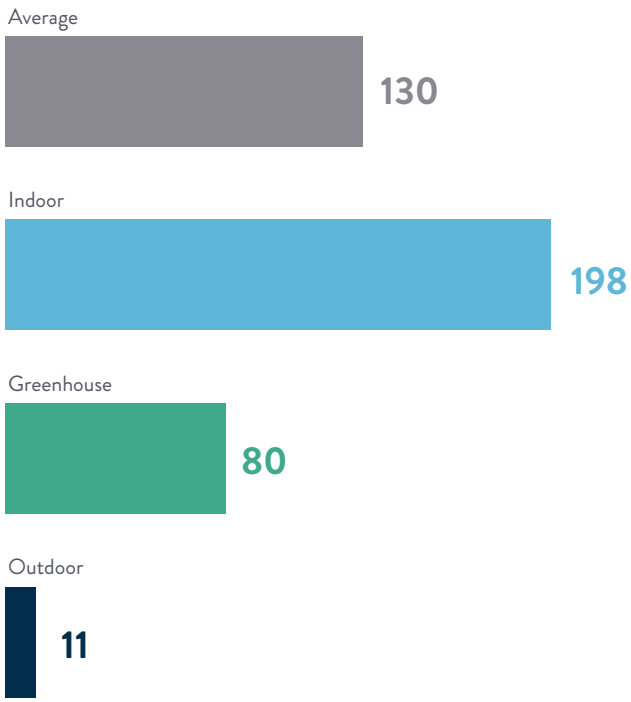
Also, when applying any metric with area in the denominator, it is worth considering how a given site's utilization might impact results. Consider a new facility that is still ramping up production, or one that reduces output in response to low prices during the outdoor harvest months: Compared to a facility of identical size and efficiency that operates at 100% utilization, the water efficiency at the lower utilization facility will be lower (despite electricity productivity being the same). The dynamic is likely expressed in some of the Cannabis PowerScore data.

PowerScore Water Efficiency (gallons/square foot)

Data from the PowerScore Ranked Water Data Set show average water efficiencies of 198, 80, and 11 gallons per square foot of flowering canopy for indoor, mixed-light, and outdoor cultivation operations, respectively.

FIGURE 21: PowerScore Water Efficiency

Gallons/sq. ft.



The average water efficiency of the PowerScore Ranked Water Data Set shows outdoor farms attaining the best water efficiency, using the least amount of water per area of flowering canopy.

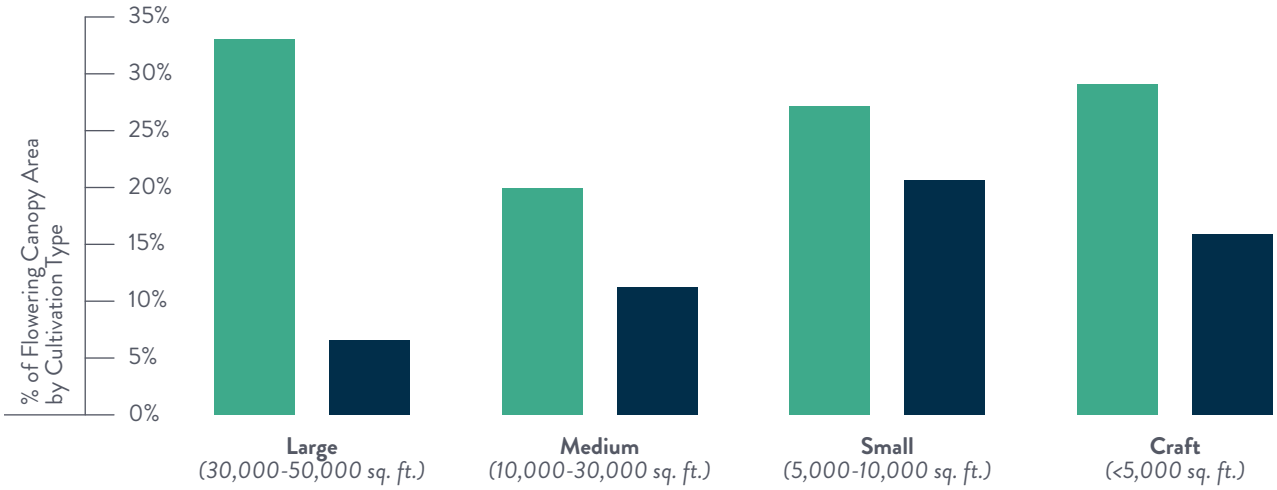
The indoor operations have the highest water use per square foot. At nearly 200 gallons/sq. ft., the PowerScore indoor reported averages are significantly higher than typically seen range between 50-73 gallons/sq. ft. This suggests the PowerScore participants may be running more harvest cycles per year than average, thereby driving up their use.

Northern California Water Efficiency (gallons/square ft)

Data from the Northern California 2019 Data Set show a range of average water efficiencies of greenhouse and outdoor facilities by flowering canopy size. Greenhouses range between 20-33 gallons per square foot of flowering canopy per year, while outdoor operations achieved better average water efficiency values of 6.5-21 gallons per flowering canopy square foot.

FIGURE 22: California Annual Water Use

Gallons Applied per Flowering Canopy Area sq. ft.



Facility Type	Annual Gallons Applied per Flowering Canopy Area			
	Large (30,000 - 50,000 sq. ft.)	Medium (10,000 - 30,000 sq. ft.)	Small (5,000 - 10,000 sq. ft.)	Craft (<5,000 sq. ft.)
Greenhouse	33.0 14 records	19.9 72 records	27.1 123 records	29.1 62 records
Outdoor	6.54 7 records	11.2 26 records	20.6 71 records	15.9 19 records

Greenhouse Outdoor

Water Demand (gallons/month)

The metrics herein describe a cultivation facility's water consumption per month, to represent how much water each facility and plant demands as they produce cannabis. There are two kinds of water demand: storage demand, and application demand. Storage demand conveys how much water is held on-site, and can be described using gallons per year and per month. Application demand also describes how much water per year and per month.

The PowerScore Ranked Water Data Set collects both application and storage water demand to understand the related activities of water application and water storage, and to make the data more comparable across all data sets and types of facilities.

The Northern California Data Set and the Michigan Data Set describe only application water; California dataset does not distinguish water storage demand from water application demand, and instead distinguishes applied water demand that is served directly by water sources and demand served by stored water.

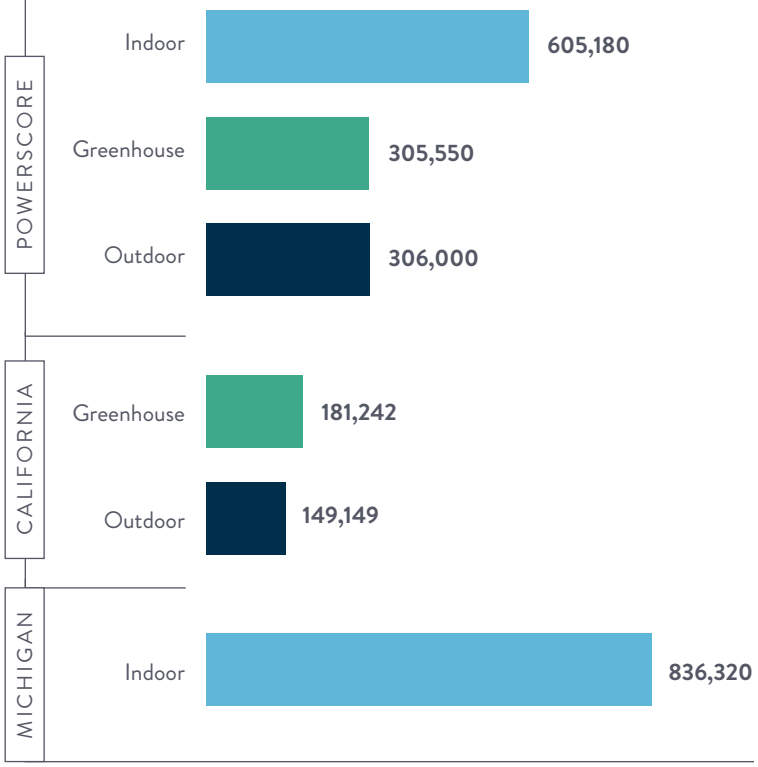
Facility Water Demand (gallons/year)

Facilities in the PowerScore Ranked Water Data Set show average annual water usage of 605,180; 305,550; and 306,000 gallons per year for indoor, mixed-light, and outdoor cultivation operations, respectively.

Facilities in the Northern California 2019 Data Set show average annual water usage of 181,242 and 149,149 gallons per year for mixed-light and outdoor cultivation operations, respectively.

FIGURE 23: Average Annual Water Use

Gallons/Year



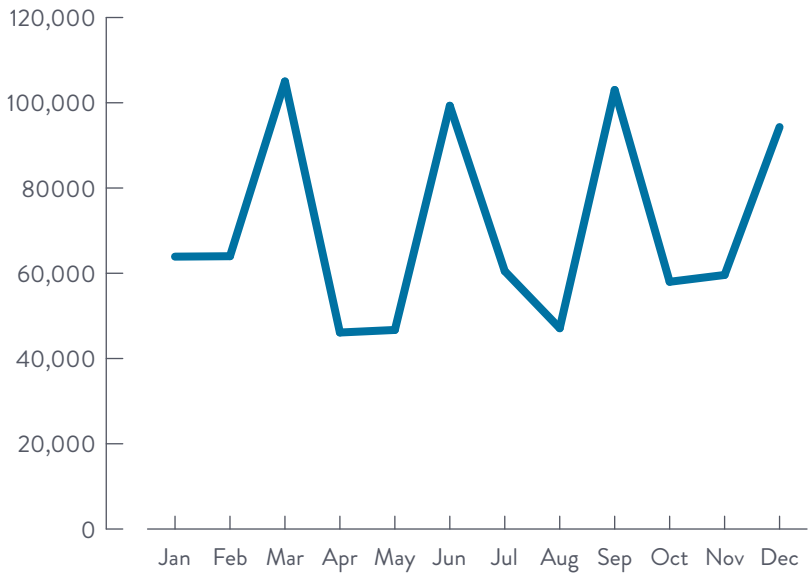
Indoor facilities in the Michigan 2020 Data Set show average annual water usage of 836,320 gallons per year.

Facility Water Demand (gallons/month)

Indoor facilities in the PowerScore Ranked Water Data Set show average monthly water application rates of 69,200 to 124,000 gallons per month, with peaks in each of March, June, September, and December. There are three months between each peak, which coincides with the interval between harvest cycles of mature cannabis (three-month plant lifespan). Some reasons why cyclical peaks emerge in the small data set of 23 records may include:

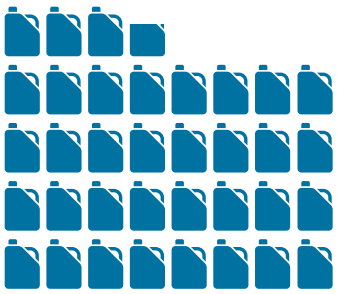
FIGURE 24: PowerScore Average Monthly Water Use

Gallons Applied per Month



357,000

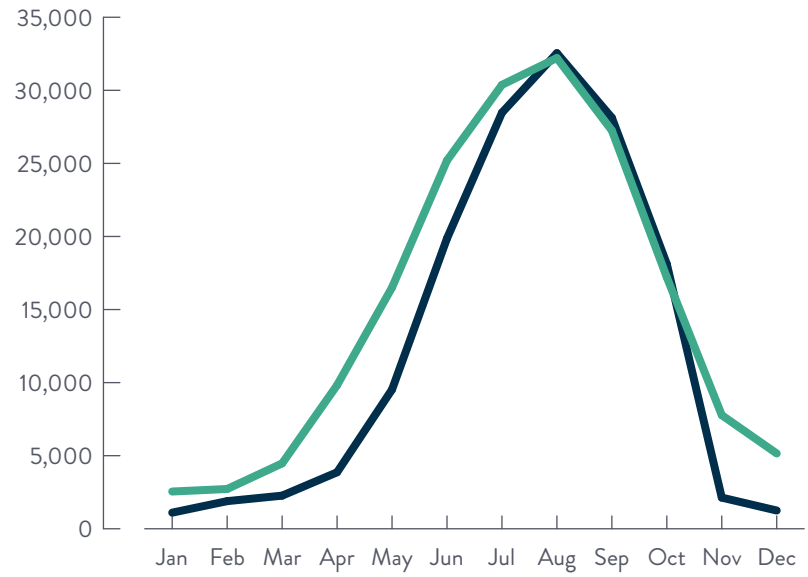
PowerScore Applied Gallons Annual Average



= 10,000 Gallons

FIGURE 25: California Average Monthly Water Use

Gallons Applied per Month



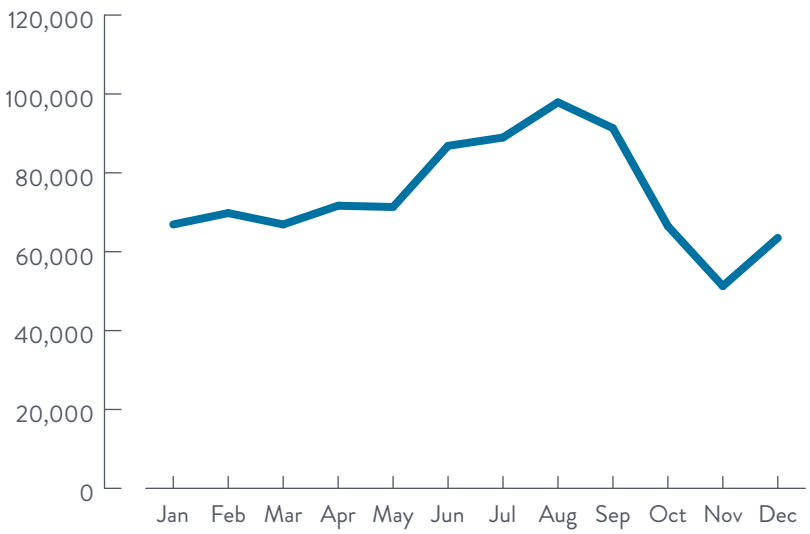
181,261

California Applied Gallons Annual Average

Mixed-light Outdoor

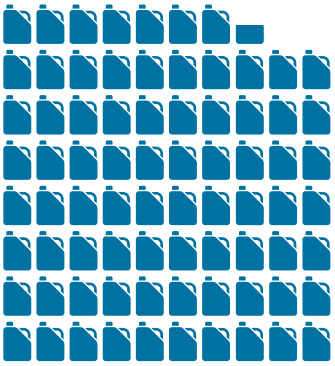
= 10,000 Gallons

FIGURE 26: Michigan Average Monthly Applied Gallons



775,543

Michigan Applied Gallons
Annual Average



- The cultivators are predominantly single harvests at one time, instead of perpetual harvests throughout the year;
- Legalization schedules may take effect at the beginning of a calendar year; or
- Christmas and summer representing the biggest months for demand, so cultivators may sync with sales demand

Greenhouse operations in the Northern California Data Set show average monthly water application rates of 2,547 to 32,211 gallons per month, with peaks from June to September. Outdoor farms in the Northern California Data Set show average monthly water application rates of 1,102 to 32,546 gallons per month, with June to September also representing a peak period.

Some reasons why cyclical peaks may emerge in the data set include:

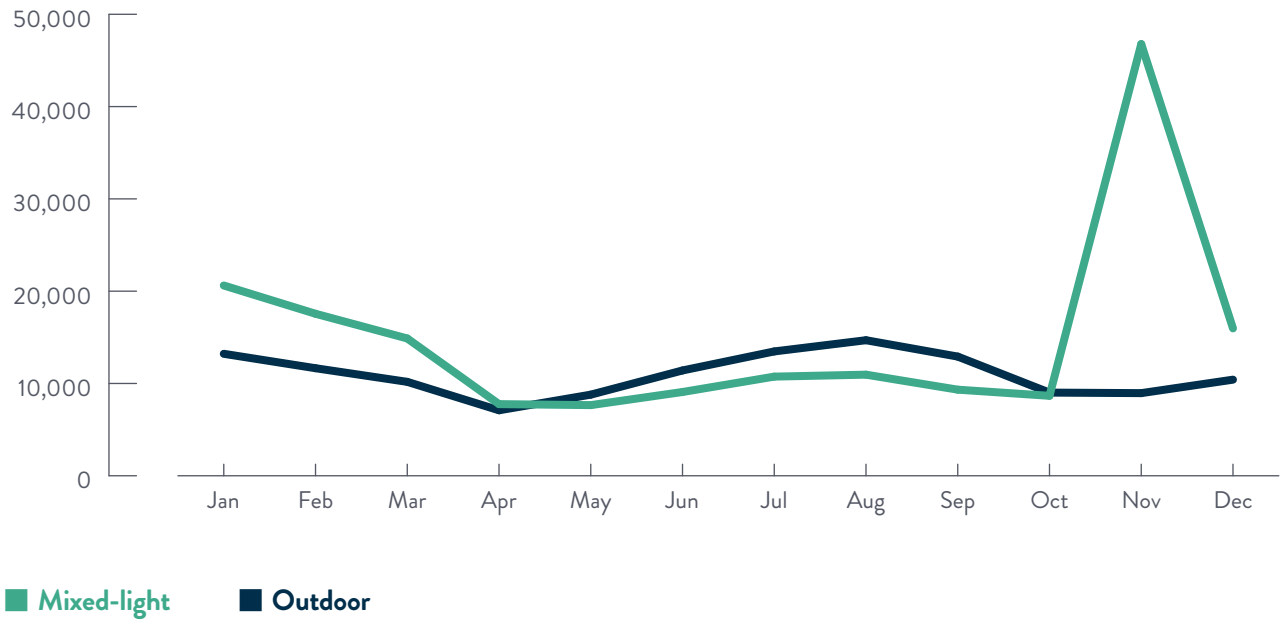
- Facilities cultivating sun-grown cannabis, and those using supplemental light, are affected by seasonal changes in photoperiod and intensity of solar radiation; and
- June through September is the warmest period among California's seasons.

Indoor facilities in Michigan show average monthly water application rates of 47,100 to 105,000 gallons per month, with peaks in June to September. Compared to the PowerScore Ranked Water Data Set facilities, Michigan facilities have lower peak water application rates.

- Some reasons why cyclical peaks do not emerge in this small data set of 12 records may include:
- Some cultivators getting started in their first year of operations, with data not yet representing fully typical water application rates.

FIGURE 27: California Average Monthly Water Storage

Gallons Stored per Month



Average Water Stored by Facility Type

Gallons Stored by Month

Month	Mixed-light	Outdoor
January	20,615	13,214
February	17,552	11,652
March	14,876	10,176
April	7,762	7,094
May	7,654	8,788
June	9,075	11,409
July	10,742	13,471
August	10,954	14,686
September	9,328	12,913
October	8,663	9,010
November	46,774	8,953
December	15,968	10,412

Water Storage Rates (gallons/year & gallons/month)

Mixed-light facilities in the Northern California Data Set show average monthly water storage rates (i.e., average amount of water stored on-site each month) of 7,654 to 46,774 gallons per month, with peak storage in November. Outdoor farms in the Northern California Data Set show average monthly water storage rates of 7,094 to 14,686 gallons per month, with peak storage in August. Input to storage from surface water or springs is generally prohibited from March to November in Northern California. Therefore, most input to storage from April to October likely comes from wells, and is most likely not long-term storage.

total industry Water Consumption

U.S Cannabis Industry Size & Demand Outlook

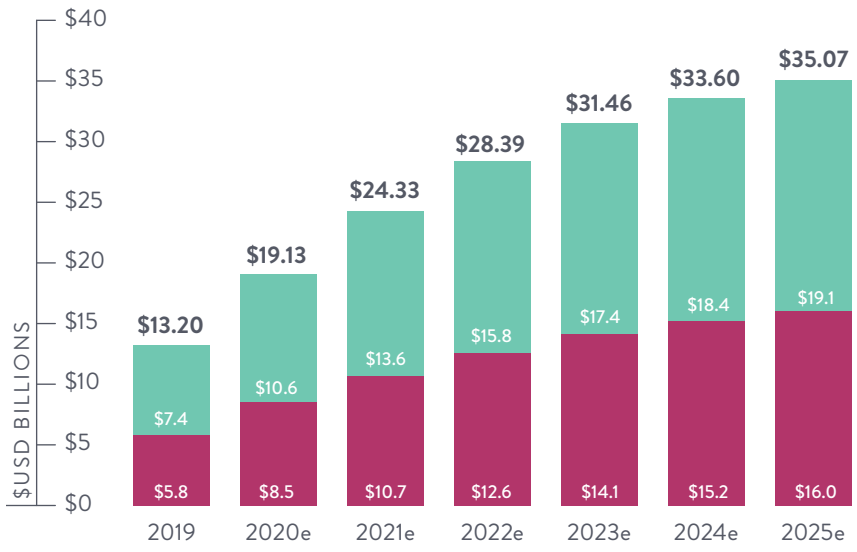
U.S. Cannabis Industry Growth & Market Outlook

The U.S. cannabis industry is experiencing surging growth, driven both by continued expansion of legal markets and rising consumer demand. With the market growing at a compound annual growth rate of 18%, legal market sales in 2020 are estimated at $19.1 billion, rising to over $35 billion by 2025. However, despite the legal market's growth, the illicit market continues to be the primary source for the majority of cannabis consumers, generating $67 billion in sales in 2020 alone.

Collectively, total U.S. consumer spending on cannabis totaled $86 billion in 2020, and is forecast to grow to over $105 billion by 2025.

The growth in revenue is fueled by rising rates of cannabis use in the U.S. According to the National Survey on Drug Use and Health, the prevalence of past-month cannabis use among adults aged 18+ increased 50% between 2010 and 2018, from 6.8% to 9.5%. By 2025, the prevalence of adult cannabis use is forecast to reach 12.5%, an 85% increase from 2010.

FIGURE 28: Growth of the U.S. Legal Cannabis Industry
2019-2025 est. ($USD billions)



2019-2025 GROWTH RATES (CAGR)

18%
TOTAL LEGAL SALES

Legal Adult-Use Sales: 17.2%

Legal Medical Sales: 18.3%

Legal Adult-Use
Legal Medical Use

Note: Market size projections are based solely on the state markets that have passed medical and adult-use legalization initiatives as of August 2020, and do not include assumptions for any additional states that may pass legalization measures in the future.

The legal market's growth is driven by the growing number of states that have passed medical or adult-use measures. In 2020, four states (Arizona, Montana, New Jersey, and South Dakota) passed adult-use measures, and two (Mississippi along with South Dakota, again) approved medical measures, increasing the number of adult-use states to 15, with 36 states legalizing medical use. While the forecasts account for only those states where cannabis is currently legal, large markets including New York, Florida, and Pennsylvania are all expected to pass adult- use measures in the next two years, while Texas and Southeastern states including Alabama, Georgia, and the Carolinas are expected to advance medical-use legalization.

KEY TRENDS DRIVING INCREASED DEMAND FOR CANNABIS

A convergence of market factors is driving increased demand for cannabis in the U.S.

SCIENTIFIC AFFIRMATION OF THE THERAPEUTIC APPLICATIONS FOR CANNABIS

There are over 60 medical conditions for which states permit patients to use medical cannabis, ranging from cancer and chronic pain, to glaucoma and multiple sclerosis. Further, some states including California and Oklahoma allow physicians to recommend cannabis for any condition for which the provider believes the patient might benefit.. With a large body of scientific research patient testimonials affirming medical cannabis, a growing proportion of the population are integrating cannabis into their treatment options.

DIVERSIFICATION OF CONSUMER PRODUCTS AND USE CASES

In the illicit market, smokable flower and concentrates, including vapes, are the most widely consumed product forms. However, in legal markets, well-capitalized companies have been able to develop increasingly elegant value-added products ranging from infused edibles and beverages, to cosmetics, suppositories, and feminine care products. These noncombustible products create new use cases for cannabis, enabling consumers to integrate cannabis into their lives in novel ways. While flower remains the most popular product among legal markets, over the past six years its share of sales has fallen from over 90% to approximately 50% in mature adult-use markets like Colorado. The trend is expected to accelerate as more states legalize, and as consumers across the country are more exposed to the value-added product segment.

SHIFTING SOCIAL ATTITUDES.

Public attitudes around cannabis have shifted dramatically in recent years. Fully two-thirds of Americans now support full legalization, and (per a 2020 Gallup study) 70% of Americans view smoking cannabis as morally acceptable. The erosion of cannabis stigma has resulted in its being consumed in many more social settings than where it was considered acceptable even a few years ago, providing infrequent consumers with more use occasions while displacing some alcohol sales. Displacement of alcohol sales by cannabis is expected to be a durable long-term trend, especially among younger consumers maturing in environments where cannabis is increasingly viewed as equally acceptable, legal, or safer than alcohol.

National Water Use In Cannabis Cultivation

Estimating Total Production Volume

To estimate the total water used in U.S.cannabis cultivation, the first step was to determine the quantity of cannabis produced to serve U.S. demand. Using production data from Colorado (which shows how much cannabis was produced to serve the retail demand), we developed a national estimate for cannabis flower production by facility type.

For 2020, we estimated that 34 million pounds of cannabis flower were produced to serve U.S. consumers across both legal and illicit markets, with a production forecast to rise to nearly 41 million pounds by 2025. The legal market accounted for approximately one-quarter (23%) of the market's supply.

FIGURE 29: Share of Market, Pounds Produced

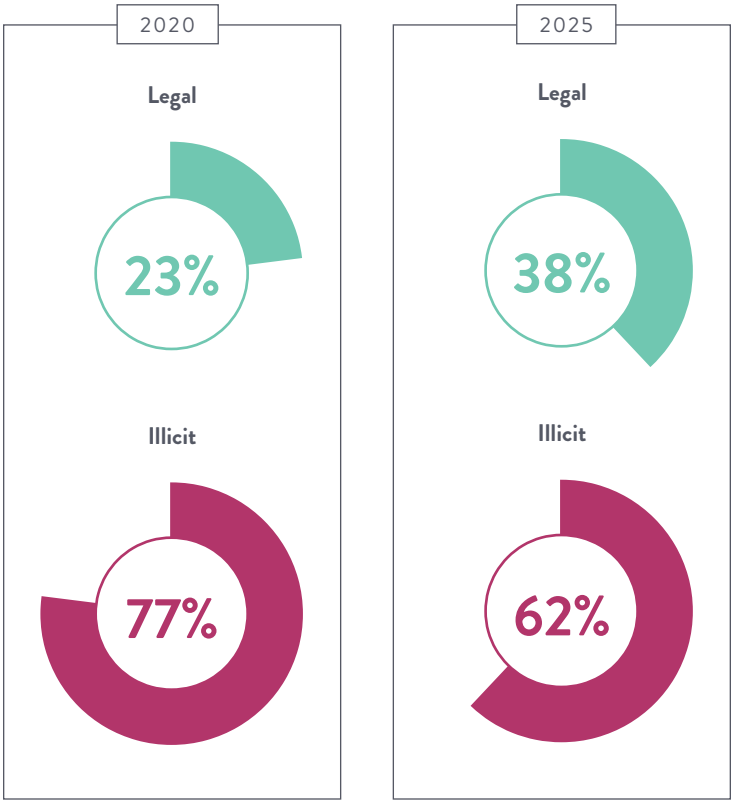
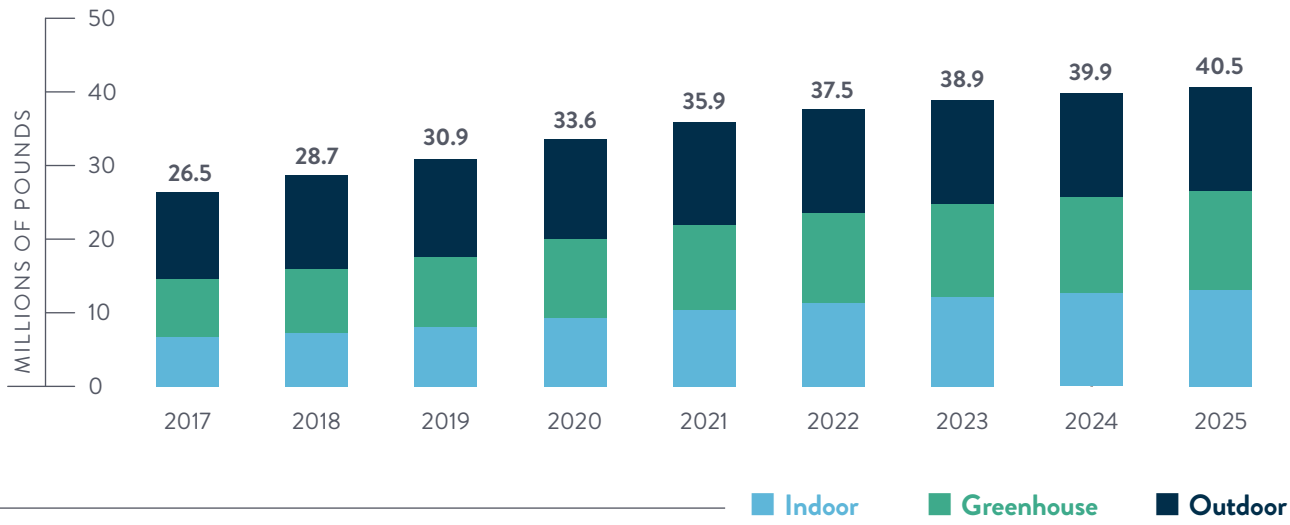


FIGURE 30: U.S. Total Cannabis Cultivation
by Facility Type, 2017-2025



LEGAL MARKET PRODUCTION

With the strong growth of the legal market, including the addition of five new legal states following the 2020 election, U.S. legal production is forecast to grow 102% between 2020 and 2025, from 7.7 million pounds to 15.6 million pounds. Since many of the newly legal states are in areas with suboptimal environmental conditions to produce cannabis outdoors, most of the growth in production will be in indoor and greenhouse/mixed-light facilities.

ILLICIT MARKET PRODUCTION

Outdoor production dominates the illicit market, accounting for nearly half (48%) of all production, in large part due to California's outsized share of cannabis sold across the U.S. Compared to the legal market, the illicit market is forecast to decline by 4% between 2020 and 2025, underscoring the increasing role that the legal market is playing is disrupting the illicit market.

Facility Size Estimates

Based on input provided by RII's Technical Advisory Council and Water Working Group, and consultation with other growers in the legal market on the average yields per square foot of flowering canopy, we developed high-, medium-, and low-range estimates for the amount of square footage required to meet the national production volume.

FIGURE 31: U.S. Legal Cannabis Cultivation

by Facility Type, 2017-2025

102%
2020-2025 Change

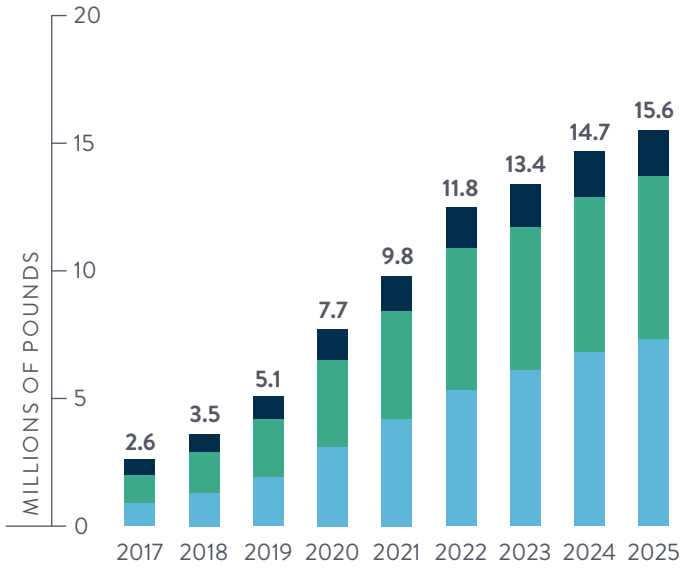


FIGURE 32: U.S. Illicit Cannabis Cultivation

by Facility Type, 2017-2025

-4%
2020-2025 Change

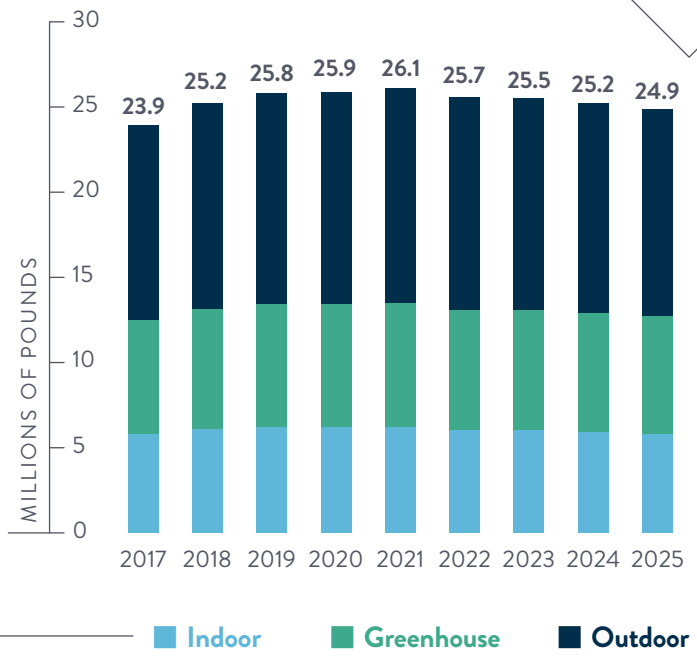


FIGURE 33: 2020 Share of Sq. Footage

Mid-Range Estimates

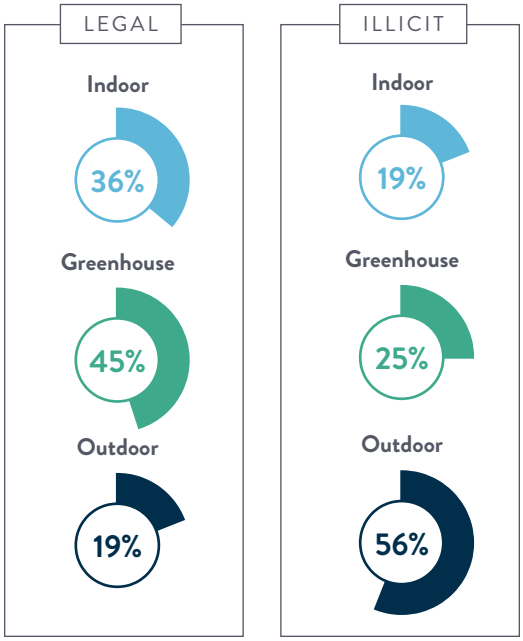
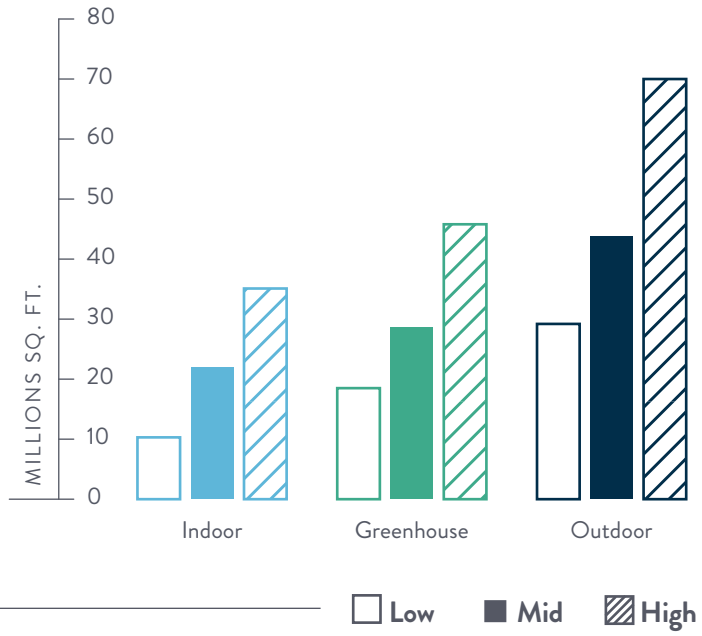


FIGURE 34: 2020 Cannabis Cultivation by Facility Type

Low/Mid/High Estimates



In 2020, the estimated square footage for indoor flowering canopy ranged from 10.3 million to 35 million square feet; greenhouse flowering canopy ranged from 18 million to 45 million square feet, and outdoor canopy ranged from 29 million to 70 million square feet.

Based on the mid-range estimate, 94 million square feet of flowering canopy was harvested in 2020, and is forecast to grow to nearly 112 million square feet by 2025.

Under the mid-range estimate, legal flowering canopy accounts for approximately one-fifth (36%) of the 112 million total square feet of flowering canopy in the U.S.

FIGURE 35: Total Sq. Footage Used to Grow Cannabis

Single Annual Harvest, Low/Mid/High Estimates

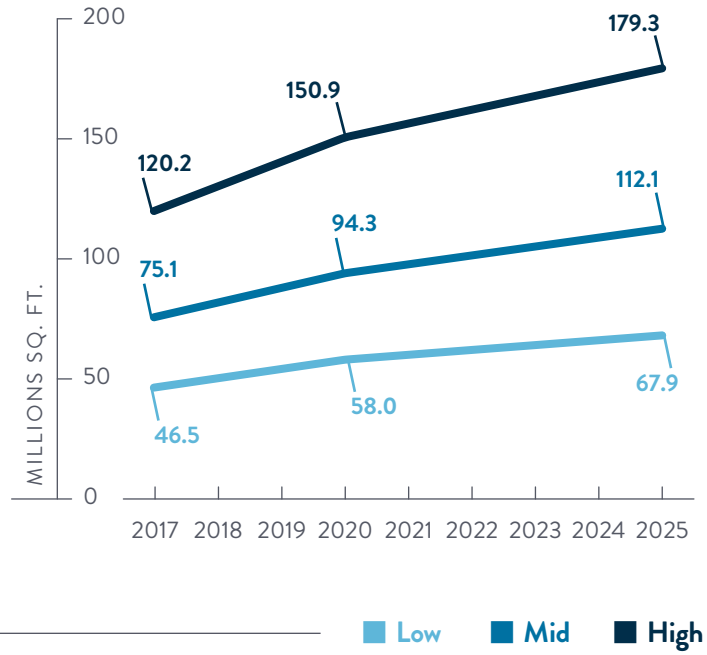
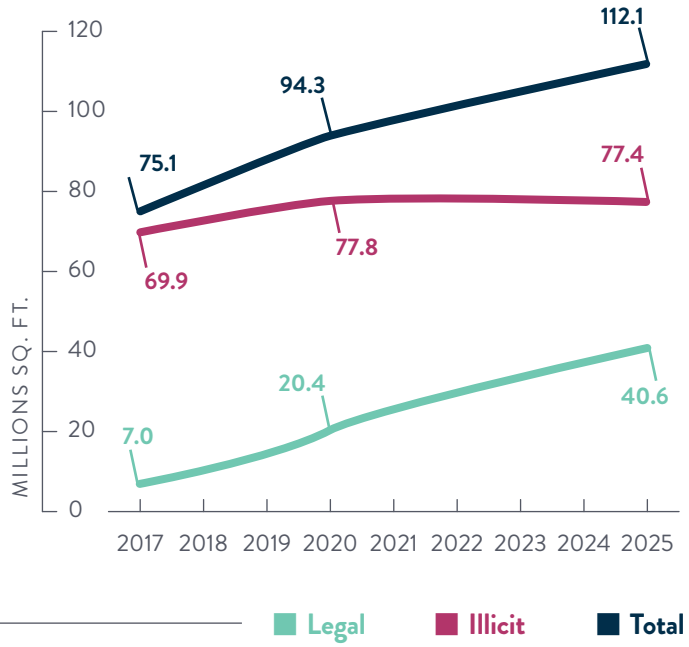


FIGURE 36: U.S. Cannabis Cultivation Total Sq. Footage

by Market, Mid-Range Estimates



Operational Flowering Canopy

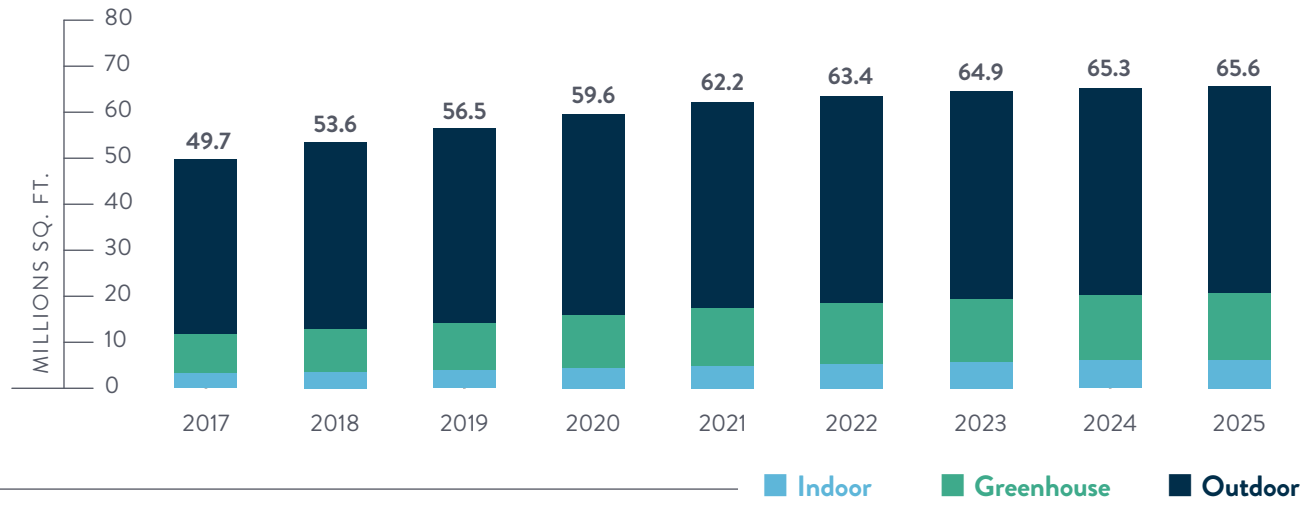
One of the challenges in measuring the operational square footage used to produce cannabis in the U.S. is the variance in the number of harvests per year within each type of facility. Typically, while outdoor growers only harvest once a year, greenhouse growers can harvest two or three times per year, and indoor growers can harvest five or more times per year.

Assuming the multiple harvests for indoor and greenhouse growers above, and a single harvest for outdoor growers, there was an estimated 60 million square feet of operational flowering square footage in 2020, growing to 66 million by 2025.

FIGURE 37: Typical Number of Harvests per Year

Indoor	Greenhouse *without Supplemental Light*	Greenhouse *with Supplemental Light*	Outdoor
5	3	2	1

FIGURE 38: U.S. Total Sq. Footage of Flowering Canopy



Water Usage

Data provided from Northern California established a baseline for applied water and storage capacity across cannabis cultivation operations. While the water use data in California may not be fully representative of operational practices elsewhere in the country, as the country's largest cannabis producer, the state's data offers valuable perspective on water use in the country's most consequential cannabis market.

Extrapolating the California usage data to the national market, we estimate that cannabis producers apply nearly 700 million gallons of water to their crops, and store nearly 850 million gallons of water for their operations.

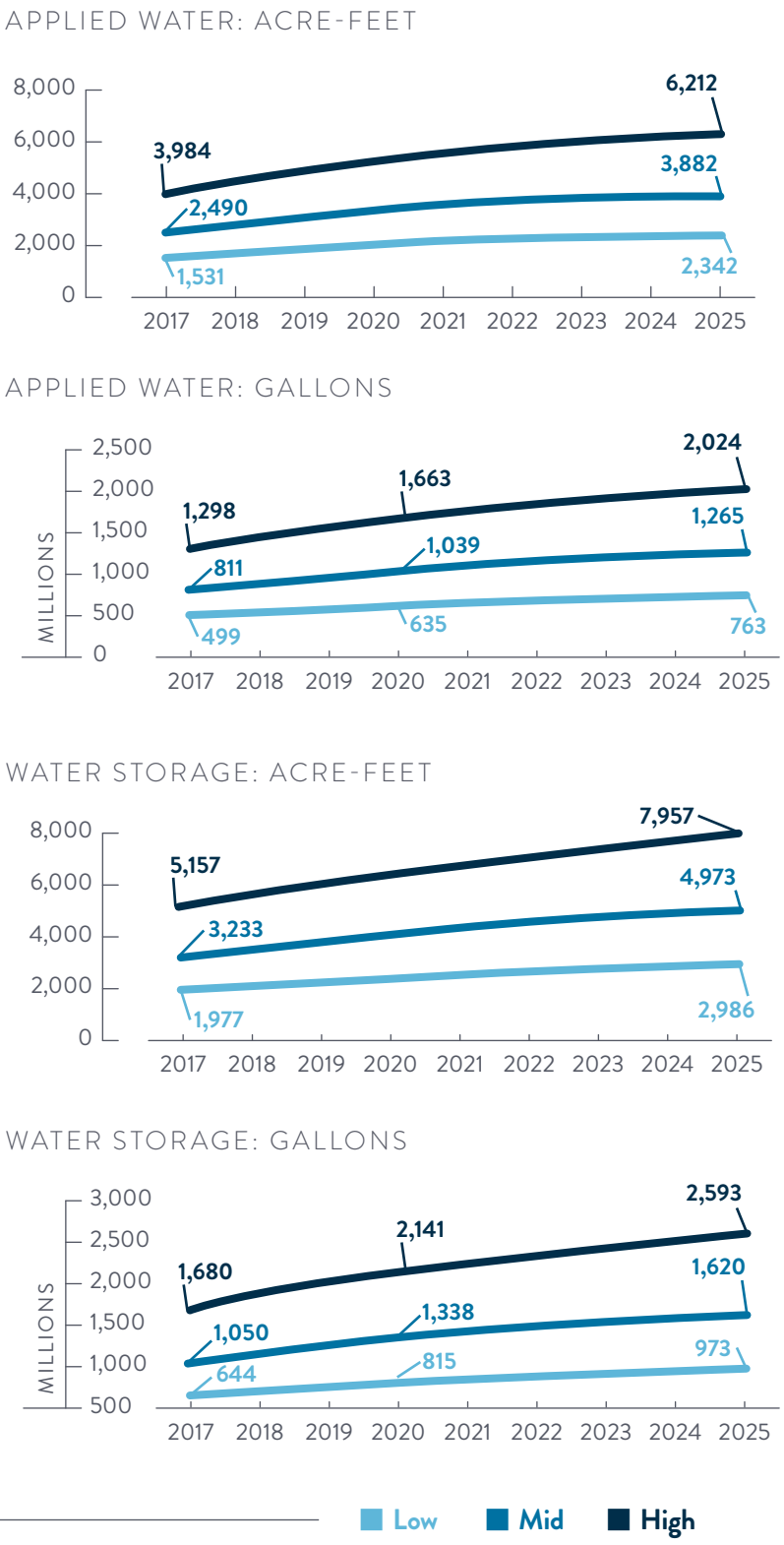
RII's PowerScore: Total Water Usage

The RII PowerScore data offers a more expansive view on the total volume of water used to cultivate cannabis. Extrapolating the acre-feet used per acre of flowering canopy yields an mid-range estimate of 8,595 acre-feet of water being used annually across the industry. Water use is forecast to rise to 11,065 acre-feet by 2025.

The illicit market will remain the primary driver of water use over the

FIGURE 39: Water Use in Cannabis Cultivation

Low/Mid/High Estimates



next five years, accounting for 83% of water use in 2020, and declining to 69% in 2025. However, water use in the legal market is expected to increase dramatically, rising 68% between 2020 and 2025 as the currently legal markets operationalize and build capacity to meet surging consumer demand.

The shifting economics of cannabis, with greater focus on efficiency and reducing resource use, will drive down production costs in the legal market, making it more competitive against the unregulated market.

FIGURE 42:
Change in Total Water Use
by Market Type

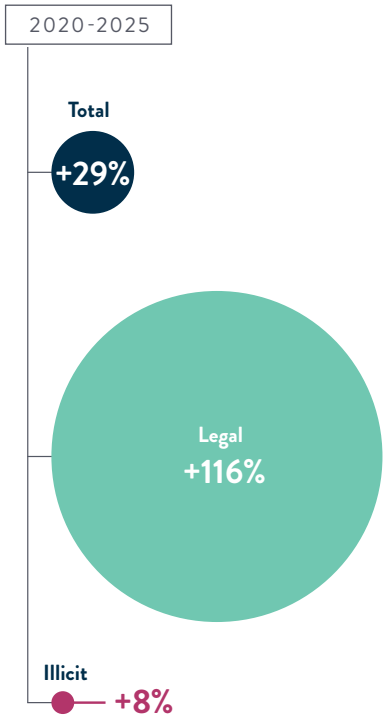


FIGURE 40: Water Use in Cannabis Cultivation
Low/Mid/High Estimates

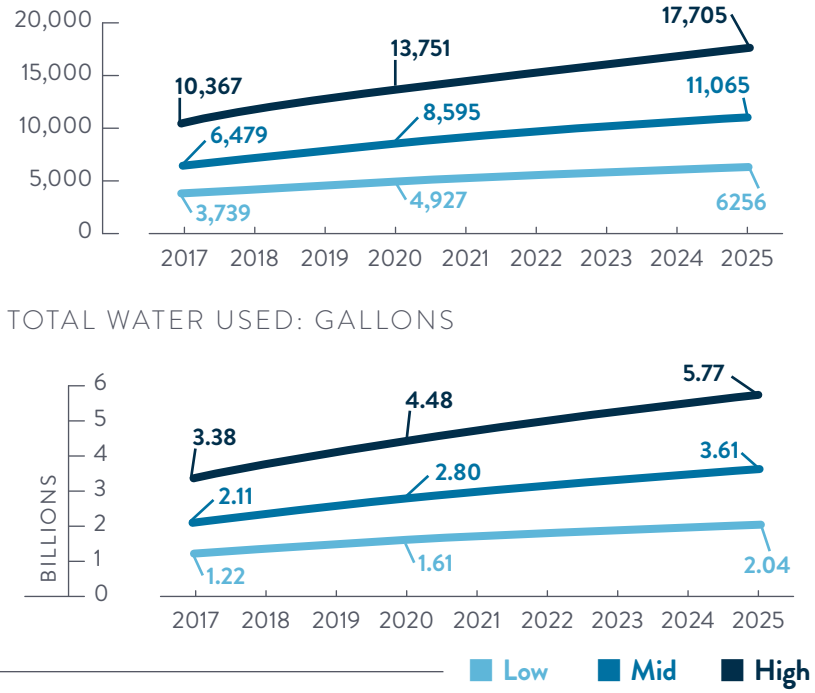
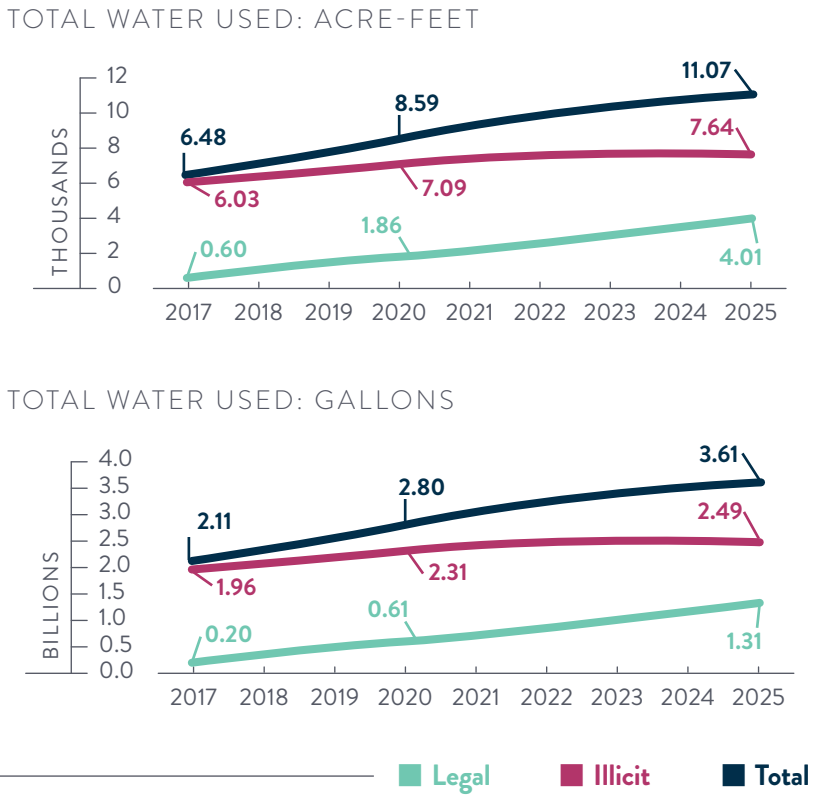


FIGURE 41: Water Use by Market Type



Estimating Water Use Per Plant

Estimating the water used per cannabis plant is challenging, due to the wide variability in the number of plants grown per acre. Outdoor growers seeking to maximize the size of their plants may grow as few as 300 plants per acre, whereas indoor growers may choose a far more densely packed approach for thousands of plants per acre. The extremely high variability in plant size and length of cultivation cycle makes it impossible to create meaningful comparisons of water use per plant across different facilities with widely varied operational practices. Consequently, the wide ranges render meaningless any attempts to establish a per-plant benchmark, because plant density is so heavily dependent on the grower's preferred approach.

Equivalencies: Cannabis Cultivation Water Use in Context

At 2.23 billion gallons per year,
the water use in cannabis is equivalent to...

39.5 Million
American's Daily Water Use
A little more than the population of TX

Daily Industry Water Use in...

Livestock Farming: 2 Billion gal/day

Mining: 4 Billion gal/day

4,276
Olympic Size Swimming Pools

9,671
Coffee Shops Annual Water
Based on each shop using 800 gal/day
Equiv. to the number of Dunkin Donuts in the U.S.

6 Days
in U.S. Hotels
If every room was occupied
Assuming 100 gal/room/day

1.3 Days
on U.S. Golf Courses
Amount of water used to irrigate all U.S. golf courses

1 Hour
at Niagara Falls
62 minutes of water over the falls

1" of Rain
Over New Orleans
Equiv. to 1" of rain over 167 sq. mt.

Case Studies

Case Study #1

UNDERSTANDING THE ENVIRONMENTAL IMPORTANCE OF WATER STORAGE IN NORTHERN CALIFORNIA

The Medicinal and Adult-Use Cannabis Regulation and Safety Act (MAUCRSA) creates the general framework for the commercial regulation of medicinal and adult-use cannabis in California. A feature of the act is that it granted ability to the California Department of Fish and Wildlife and the state's Water Boards to provide the licensing authority with data showing that a watershed is significantly adversely impacted by cannabis cultivation. The licensing authority may then limit the number of plants or licenses within an impacted watershed. Elijah Portugal is a senior environmental scientist with the California Department of Fish and Wildlife, working with the cannabis and instream flow unit which assesses cannabis impacts on the environment, and helps to guide CDFW decision-making. Since the program's inception, Portugal and other CDFW scientists have been developing studies and protocols to monitor the interaction between cannabis water use and stream health. "Many of the watersheds where cannabis has historically been grown are important habitats for threatened or endangered salmon and steelhead trout" Portugal has noted. "Through a two-year pilot study conducted solely in the headwaters of the Upper Mattole River Watershed, we did not document a systematic trend of flow impairment due to cannabis, but we did document some flow impairment in one of our study streams. Specifically, we documented that water withdrawals, primarily for cannabis, reduced streamflows to a hazardous level ~ 2 weeks earlier during the baseflow period than would have occurred without any water use. Our monitoring and research efforts are focused on understanding the relationship between cannabis and the environment. We are especially concerned about watersheds that have experienced recent, unregulated growth in the cannabis industry, and also contain populations of salmon or other threatened or endangered species."

The need for such a program stems from the unique climate and geology of Northern California. "In Northern California, we have a Mediterranean-type climate where we typically don't get rain in the summertime. Even in the absence of any human water use, it's common for streams to be at base flow, or in the case of intermittent streams completely dry for much of the late summer," Portugal explained. "This is a time when Northern California streams are the most vulnerable to dewatering. The endangered salmonids and other aquatic and amphibian biota that require sufficient instream flow are going to be even more impacted than they already are, if cannabis cultivators are diverting during this period."

The regulated cultivator community is required to forbear from surface water diversions from April 1-October 31, but a large portion of cultivators in the state are not in the regulated market, and are likely diverting during the late summer period. Of additional concern to CDFW is the prevalence of late summer

well use to meet cannabis water demand. Currently there are no requirements for well users to refrain from pumping groundwater for cannabis during the low flow period, but fundamental principles of hydrology and the primary literature reveal that groundwater and surface water are connected but – over extremely variable timescales. This means that, depending on the underlying lithology and proximity to the stream and characteristics of the well itself, much well use can have little to no impact on surface water, but in some cases it can impact surface water. The timing of low streamflow presents an issue generally for cannabis diverters, because the months that have the lowest natural stream flows are also the months that require the most irrigation for cannabis. Cannabis farmers need to irrigate the most during this time period, so there is potential for competition and conflict.

One important way to potentially mitigate conflict is through water storage. “Storage is really critical from our perspective,” Portugal notes. “Essentially, if a cultivator has enough storage through permitted off-stream ponds, water tanks, bladders or other means, they are able to irrigate in the summer without reducing base flows.” That is because the Northern California region receives plenty of rain in the winter, and farmers therefore can either store water directly from rain or pump water from streams in the winter, when water is more abundant.

“Farmers can take flow during the wetter winter months, and use that to meet late summer water demand,” Portugal explains. “That really is the best way that farmers can minimize or eliminate streamflow impacts. If they're not extracting water from the watershed during its most vulnerable period, that's great, and that's supported by CDFW.”

Case Study #2

GETTING BACK TO BASICS

In nine seasons working at Humboldt Nation Farms, Dave Stanley had a firsthand view of massive changes impacting the cannabis industry. Now the operations manager, Stanley's tenure includes the farm's maturation during California's medicinal and recreational rollouts. While the farm has strictly adopted California's stringent licensing requirements, including handicapped-accessible parking and building codes, the farm itself has not greatly changed since Proposition 64 in 2016.

Stanley said the farm cultivates about 7,200 square feet of canopy, which at any time holds between 1,200 to 1,600 plants. The plants are grown in raised beds primarily composed of soils nourished over 15 to 20 years. The farm is terraced, with sufficient water resources from a 500,000-gallon, rain-fed pond.

"We have always emphasized caring for the soil, and believe that we can make the farm better all the time," Stanley said. He has adopted a back-to-basics watering approach over the past few seasons. "We had trouble with our drip irrigation system, primarily because of the terraced nature of the farm. With my assistant, we now water every plant by hand, usually every other day."

Watering 1,400 plants by hand is neither quick nor easy. "I start at the top, and my partner starts at the bottom of the terraces," Stanley said. "It takes us about two hours to complete the job." To facilitate the watering technique, plants are planted in small, dug-out bowls in the soil. "We then flood the bowl each time we water, basically flood-irrigating every plant individually."On average, that means a five-second squirt for each plant, equal to about a half-gallon.

While the growing techniques have not radically altered due to regulations, there have been a few unexpected changes. First, water use is now closely measured and recorded. "In the old days, the theory was not to write anything down. Now, we can record our water use and other data. This allows us to improve our farm," Stanley said. Another unintended consequence has to do with the use of hay mulch. For years, Humboldt Nation had used hay mulch to help conserve water. Yet, it is difficult to obtain organic hay. "If we used hay that happened to have any pesticide residue on it, it could get into our plants and we could fail a test," Stanley said, adding that "it is just not worth the risk." Subsequently, Humboldt Nation no longer uses any mulch, and Stanley suspects that the hard crust that forms after watering effectively prevents water from evaporating.

While watering by hand is time-consuming, it offers many benefits. "We always have plants at the end of the rows that get more sunlight; by hand-watering, we are able to make sure these plants get just a bit more water." Beyond precision water application, there are other, larger benefits. "Because we are watering by hand, we see every plant, at least every other day," Stanley said. "This allows us to really observe our plants, and catch problems early on."

Key Takeaways
& Strategic Recommendations

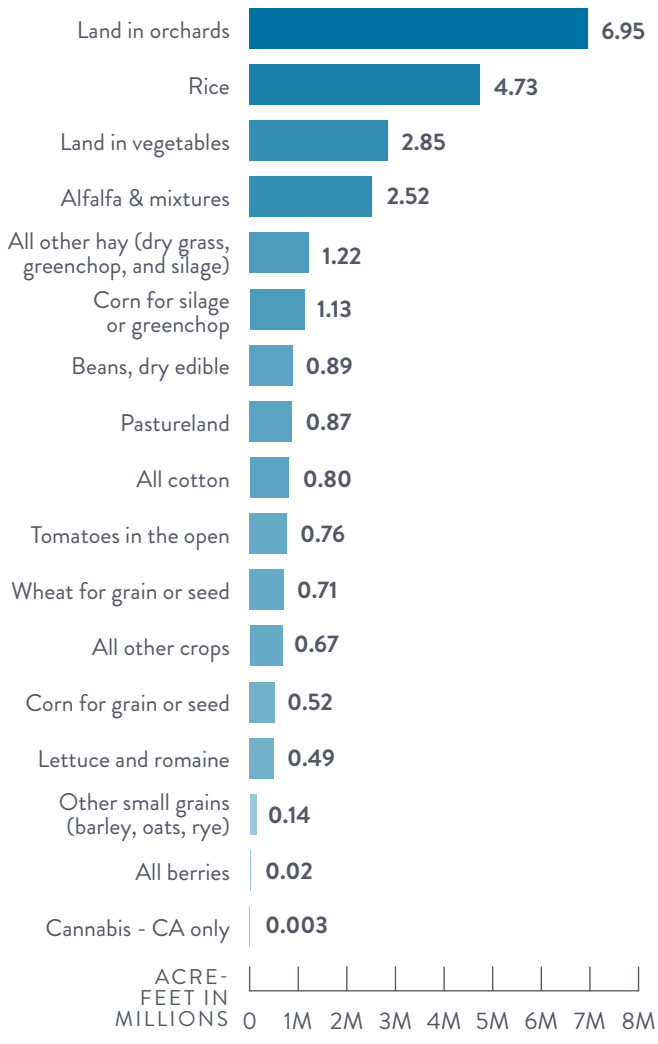
Cannabis is Not a Major Contributor to Water Use in U.S. Agriculture

As states like California have faced increasingly acute water shortages, the fast-growing cannabis industry has often been blamed for drawing down the state's water supply. That assessment is often based on an incorrect correlation between large revenues earned by the cannabis industry and production levels seen in other high-revenue cash crops. However, whereas wholesale pounds of cotton, rice, and table grapes may sell for about$0.60, $0.71, and $0.78, respectively, a wholesale pound of smokable cannabis bud can fetch $1,500 to $3,000 or more, depending on the quality. Consequently, the market value for the cannabis industry grows dramatically, even with only incremental increases in production.

Furthermore, relative to other major crops, cannabis requires significantly lower production volumes to meet consumer demand. For example, approximately 2.5 pounds (40 ounces) of grapes are required to produce a bottle of wine; by comparison, 40 ounces of smokable bud is over 3x more cannabis than

FIGURE 43: Water Use in California's Top Agricultural Crops*

Total Acre-Feet Applied



** Water use estimates for non-cannabis use crops are from 2013. Cannabis water use estimates are from 2020.*

Source: Johnson, R., Cody, B., California Agricultural Production and Irrigated Water Use, Congressional Research Service, June 30, 2015, New Frontier Data

a frequent consumer would use in a calendar year. The low-volume nature of cannabis means that even as the industry grows it will continue to have limited impact on the overall use of water in California or across the country.

This analysis demonstrates that the volume of water used to grow cannabis is poised to increase significantly as demand for cannabis (especially in the legal market) surges. However, compared to typical major crops in the U.S. agricultural economy, the cannabis industry has a nominal impact on water used for farming. The impact of the industry's water use may be more pronounced in the drought-prone areas in the Western states. However, even in California and Oregon – two of the country's largest cannabis production markets – the volume of water use is dwarfed by other crops (e.g., fruit trees, grapes, corn, cotton, and rice). The industry is well positioned to improve the efficiency of water use as best practices become better known and water-efficiency solutions become more widely adopted. However, those gains will have greater impact on the bottom line for producers than against the national agricultural water supply.

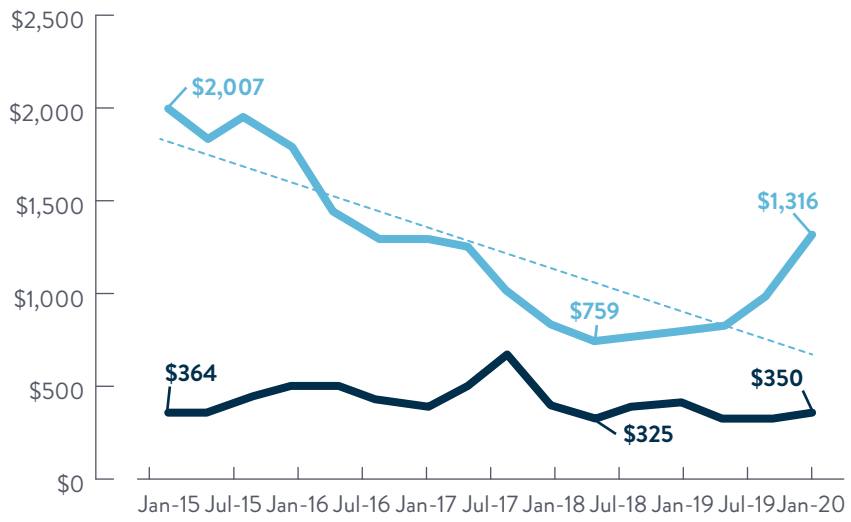
A Competitive Cannabis Market Demands Water Efficiency

Surging Popularity of Value Added Products is Driving Increased Demand for Cannabis Biomass

Cannabis, the plant, can be grown to produce varying types of biomass. The 2018 Farm Act removed hemp (defined as cannabis with <0.3% THC) from the federal Schedule 1 controlled substances list, making it an ordinary agricultural commodity. Cannabis is grown to produce a few different industrial and

FIGURE 44: Average Market Rate for Cannabis Flower & Trim in Colorado

Jan 2015 - Oct 2020



CHANGE IN VALUE: FLOWER

-34% -$691

CHANGE IN VALUE: TRIM

-4% -$14

Flower Rate ($/lb) Trim Rate ($/lb)

agricultural products: fiber, seed, and flower. Flower can be harvested to be delivered to customers directly as smokable products, or can be refined further to be manufactured into value-added products.

The share of flower sales has fallen dramatically as the popularity of value-added products has surged, expanding the volume of cannabis biomass that must be produced to meet the production requirements for several new product categories.

Nationally, the share of flower across markets varies widely, influenced by the maturity of the market, regulations governing the sale of flower and other value-added options, and the structure of the operators in each market (i.e., in vertically integrated markets, non-flower products tend to emerge more slowly than in markets where individual licenses can be obtained for each point in the supply chain).

> Over time, value-added products will ultimately account for half or more of all product sales.

Generally, however, the trend toward a highly diversified product environment is consistent across all markets, with flower remaining the leading category, but over time value-added products will ultimately account for half or more of all product sales.

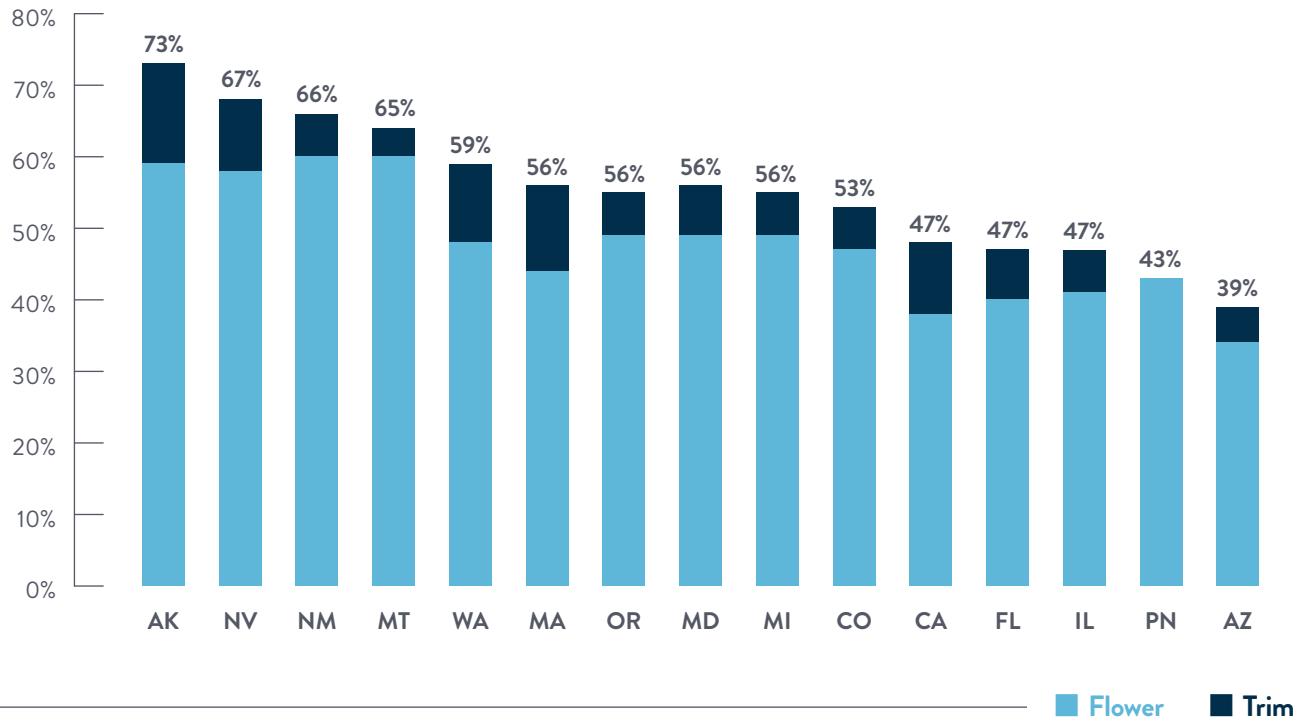
The Shifting Economics of Cannabis Underscores the Imperative for Operational Efficiency

The wholesale price of cannabis has been on a steady downward trajectory, driven by increased competition in the legal market as the number of licensed producers has risen, and greater efficiencies and economies and scale. Since 2015, the average price per pound in Colorado has fallen by one-third (34%), with the prices recovering significantly following a 61% decline to less than $800 per pound in the fall of 2018.

In the early period of high wholesale prices, low competition, and abundant resources, growers have little incentive to invest heavily in optimizing their efficiency but the speed at which market conditions shifted left inefficient operators unprepared to compete. Some companies, however, have recognized early the utility of maximizing efficiency early. In Oregon, Eco Firma Firms was a notable example, as the company brought its production cost per pound below $200/lb when many in the state were producing at two to four times that cost, and the company was able to continue to enjoy comfortable margins even as the average wholesale price per pound fell below $750.

Across the most mature markets, growers who have been unable to compete when prices were at their lowest were forced to sell or close their businesses. The loss of less efficient operators has eased some competition and allowed prices to rebound. However, with the market's continued evolution, including the continued evolution of consumer demand, the accelerating fragmentation

FIGURE 45: Flower & Pre-Roll Share of Sales in Select States
Oct 2020



of the consumer product environment, and the prospect of federal legalization over the next few years, growers must continue to work to maximize returns by prioritizing efficiency across their operators.

Not only will the most efficient growers be able to compete most effectively, they will be best positioned to secure investment capital, and will be the most attractive targets for acquisition as the industry consolidates and builds national and international scale.

To address the need for more data, governments should consider requiring producers to report their annual usage, as some U.S. states have done. Cannabis is in a unique position relative to other agricultural markets, as the legal market to serve most of the future demand remains very nascent. For now, governments and industry regulators have a shared opportunity to establish data collection and benchmarking processes to support the industry's future growth while the industry is in urgent need of performance metrics to inform industry-wide performance improvements. Governments should work with licensed operators to develop reporting protocols for resource use; while burdensome for growers to comply with, such protocols can provide a feedback mechanism to let them compare their performances against their peers', and make it easier to identify and share best practices among the industry's

leaders. Resources such as Resource Innovation Institute's PowerScore tool offer a ready-made solution for secure deployment to collect high-value data for both regulators and operators.

The cannabis industry is primed for breakthrough advances in water efficiency, but significant research and knowledge-sharing will be required to capture and disseminate best practices. Governments, industry stakeholders, and others (e.g., philanthropic environmental foundations) should consider funding research and education about best practices for water efficiency. Lack of understanding about how growers can optimize their water use has led to too many inefficient practices being adopted from the unregulated market. However, with hundreds of new cannabis cultivation operations now positioned to come online in coming years as more states legalize medical and adult use, the value of investing in such knowledge-sharing can pay major dividends if done while the industry is at its infancy, before major investments are dedicated to new operations.

Analysis of water practices should not be performed on a "per plant" basis, and instead should consider a more thorough assessment of productivity, efficiency, demand, storage, and consumption. Growers use widely varied plant-management practices, making it extremely difficult to established normalized metrics for water use on a per-plant basis. While per-plant comparisons may be of value when comparing similar facilities with identical cultivation practices, using performance metrics that are pegged against size, yields, and total demand enables more effective comparative benchmarking industry-wide.

The industry should strongly encourage establishment of data-driven voluntary standards and recognition of top performers. In the emerging, quickly evolving market of legal cannabis, regulations can lag behind significant market developments. As such, waiting for government mandates about sustainability standards or dissemination of industry best practices will result in needlessly lost opportunities at a key period in the industry's growth. Industry trade groups at state and national levels should work aggressively to incorporate sustainability benchmarking and knowledge-sharing, and recognize those achieving the greatest improvements in efficiency.

Water impacts beyond direct runoff and discharge should also be evaluated. Other agricultural sectors are beginning to examine impacts from cultivation operations such as transportation, whereby fragments of vehicle tires have been found to cause fish die-off, and the cost of vehicular water transportation contributes to the industry's carbon footprint for water use. Similarly, though the widespread use of energy-intensive reverse osmosis may allow growers to reclaim and reuse water, it adds to overall production costs and resource inefficiencies due to those high energy requirements. As the industry works to develop resource-use metrics, operators and resource-management stakeholders should think expansively (and creatively) about how best to measure the total impact of all the inputs used to produce cannabis, and to measure the most efficient approaches based on the increasingly diverse solutions available to the market.

Conclusion

AS THE CANNABIS INDUSTRY matures, water use efficiency will become more important, as it has for other agricultural crops. Pressures to use water efficiently will mount from multiple channels including - reducing input and energy cost, protecting the environment, meeting regulatory standards and simply being good stewards.

We recommend that industry and regulators focus efforts on the following areas:

1. When grown outdoors, water for cannabis production should be assessed like any other agricultural crop and be subject to state and local regulations that apply to other crops. Our research indicates that cannabis neither uses a massive share of water or uses more water than other agricultural crops. Applying the same standards to cannabis as to other agricultural crops will correctly categorize outdoor grown cannabis as an agricultural crop.

2. In areas where there may be conflict between water use for cannabis and environmental concerns, regulators and the industry should focus (1) on the timing of water use and (2) the potential of storage to mitigate environmental conflict. Our results show that in many parts of the country legal cannabis farmers have ample water storage to satisfy their needs. In areas where storage is insufficient, increasing storage should be a priority for farmers and regulators.

3. Our research shows there are still massive differences between cannabis production techniques and to some extent this variation also is seen in our water use data. None-the-less, water efficiency is not the most important metric for most cannabis farmers. As farmers continue to experiment and improve, we expect to see water use be a more important part of cannabis farming decisions and expect new plant varieties and growing techniques to be developed that increase water use efficiency.

4. As indoor production continues to grow, especially in areas that have unfavorable climatic conditions for outdoor growing, we expect more cannabis users to rely on municipal water sources. Yet, it is unclear if municipal water suppliers are equipped to work with the cannabis industry. We suggest outreach efforts between the cannabis industry and municipal water suppliers to incentivise efficiency where possible.

Glossary

ACRE-FOOT: The acre-foot is a non-SI (i.e., International System of Units) unit of volume commonly used in reference to large-scale water resources, such as reservoirs, aqueducts, canals, sewer flow capacity, irrigation water, and river flows. An acre-foot equals approximately an eight-lane swimming pool (e.g., 82 feet long, by 52 feet wide, by 9.8 feet deep) OR a unit of volume equal to the volume of a sheet of water both one acre (0.405 hectare) in area and one foot (30.48 cm) in depth, i.e., 43,560 cubic feet (1,233.5 cubic meters).

AEROPONICS: The process of growing plants in an air or mist environment without the use of soil or an aggregate medium.

AQUAPONICS: Aquaponics refers to a food production system that couples aquaculture with hydroponics in a symbiotic environment whereby the nutrient-rich aquaculture water is fed to a hydroponically grown plant, involving nitrifying bacteria for converting ammonia into nitrates.

CATION: Positively charged ions. The essential soil cations are ammonium, calcium, magnesium, and potassium. They are critical for any plant to grow and flourish. Additional soil cations include sodium, aluminum, and hydrogen.

COCONUT (COCO) COIR: Coir, or coconut fiber, is a natural fiber extracted from the outer husk of coconut and used in products including floor mats, doormats, brushes, and mattresses. Coir is also the fibrous material found between the hard, internal shell and the outer coat of a coconut.

CONDENSATE: Water that accumulates as a result of condensation within a cultivation facility's heating, ventilation, and air-conditioning (HVAC) system.

DIATOMACEOUS EARTH: Diatomaceous earth consists of fossilized remains of diatoms, a type of hard-shelled protist. Diatomaceous earth has myriad industrial and horticultural applications, including non toxic pest control.

EVAPOTRANSPIRATION/TRANSPIRATION: Evapotranspiration is the sum of water evaporation and transpiration from a surface area to the atmosphere. Evaporation accounts for the movement of water to the air from sources such as the soil, canopy interception, and water bodies.

ELECTRICAL CONDUCTIVITY: The ability of water to conduct an electrical current; important because it can detect how much dissolved substances, chemicals, and minerals are present in the water. Higher amounts of the solutes will lead to a higher conductivity. While pure water has very low conductivity, sea water comes with much higher conductivity. Even a small amount of dissolved salts and chemicals can heighten the conductivity of water.

DELIVERED WATER: Water taken from a source and delivered to a user for either indoor or outdoor watering.

GREENHOUSE CULTIVATION: Greenhouse cultivation is the unique farm practice of growing crops within sheltered structures glazed with a transparent, or partially transparent, material like a hoop-house, glasshouse, conservatory, hothouse, or similar structure. The main purpose of a greenhouse is to use the sun to provide as much light energy for plants as possible, employing supplemental electric light as needed, and to protect crops from unfavorable weather and various pests.

HYDROPONICS: Hydroponics is a type of horticulture and a subset of hydroculture, which is a method of growing plants (usually crops) without soil by delivering nutrition and fertilizer via an aqueous solvent (e.g., water).

INDOOR CULTIVATION: Indoor cultivation is a farm practice of growing crops in sheltered structures with sole-source electric light. The main purpose of indoor cultivation is to control the growing environment more precisely to maintain optimal growing conditions and extend growing seasons.

LEACHATE: A leachate is any liquid that, in passing through matter, extracts either soluble or suspended solids, or any other component of the material through which it has passed.

LEACHATE PERCENTAGE: Volume of leachate divided by the volume of nutrient solution given to the crop.

LIVING SOIL: Living soil or no-till soil is a growing medium rich with organisms which function as their own ecosystem, breaking down organic and inorganic matter and providing nutrients to plants and other surrounding organisms. Often it is a soilless substrate, but with a highly variable mixture of different organic amendments.

OUTDOOR CULTIVATION: Outdoor cultivation is a traditional farm practice of growing crops in the ground without artificial lighting. Outdoor cultivation may allow for lower operating costs, but less control over the plant's growth cycle.

PERLITE: Perlite is a volcanic glass treated with heat to produce an especially lightweight material. In potting soil, perlite is a nonorganic additive used to aerate the substrate.

PH: Potential of hydrogen (pH) is a scale used to specify the acidity or basicity of an aqueous solution. Acidic solutions (i.e., solutions with higher concentrations of H+ ions) are measured to have lower pH values than found in basic or alkaline solutions.

REVERSE OSMOSIS: A water-purification process that uses a partially permeable membrane to separate ions, unwanted molecules, and larger particles from drinking water.

ROCK WOOL: Rock wool is a lightweight, hydroponic substrate made from spinning molten basaltic rock into fine fibers formed into a range of cubes, blocks, growing slabs, and granular products. The product is chemically and biologically inert (i.e., ions are not bound or exchanged on substrate particle surfaces) and creates an ideal growing medium for hydroponic growing strategies.

POTABLE: Fresh water appropriate for human consumption, drawn from public drinking water supply systems or private wells.

MUNICIPAL POTABLE WATER: Water for public supply which has been determined to be fit or suitable for drinking.

NATURAL WATER SOURCE: Non-potable water occurring naturally (e.g., rainwater, surface water, or well water).

PRIVATE WELL / BORE: A private water source taken directly from the earth, e.g., when a hole is drilled to the aquifer for a pump system to deliver water to the surface.

NON-POTABLE: Not fit or suitable for drinking, but possibly of use for other purposes, depending on quality.

ON-SITE RECLAIMED (RECYCLED) WATER: Recycled water generally refers to treated domestic wastewater used more than once before passing back into the water cycle. The terms "reused" and "recycled" are often used interchangeably. . Reclaimed water is not reused or recycled until it is put to some purpose. It can be reclaimed and usable for a purpose, but not recycled until somebody uses it.

MIXED-LIGHT: Mixed-lighting refers to a lighting situation where both natural and artificial or supplemental lighting sources are utilized during the growth cycle.

PHYTOTOXIC: Toxic to plants.

SUBSTRATE: Substrate is the base on which cannabis plants grow. In agriculture, soil is the most common substrate. For cannabis, growers often use other media, including rock wool, coir, or peat.

SUPPLEMENTAL LIGHTING: Supplemental lighting, is often used in greenhouses, and refers to any additional quantity and quality of illumination not obtained by the general lighting system to support or increase crop production.

VERMICULITE: A group of hydrated laminar minerals. Horticultural vermiculite is processed with heat and expanded into pellets which can improve water and nutrient retention.

WATER DEMAND: A key benchmark in measuring water for cultivation, water demand is a measure of gallons applied per month or year.

WATER EFFICIENCY: A key benchmark in measuring water for cultivation, water efficiency is a measure of gallons applied per flowering canopy square feet.

WATER PRODUCTIVITY: A key benchmark in measuring water for cultivation, water productivity is a measure of gallons applied per gram of dry cannabis flower.

Appendix 1
U.S. Drought Monitor Classification Definitions

Category	Impact
D0	• *Soil is dry; irrigation begins early* • *Dryland crop germination is stunted* • *Active fire season begins* • *Winter resort visitation is low; snowpack is minimal*
D1	• *Dryland pasture growth is stunted; producers give supplemental feed to cattle* • *Landscaping and gardens need irrigation earlier, wildlife patterns begin to change* • *Stock ponds and creeks are lower than usual*
D2	• *Grazing land is inadequate* • *Producers increase water efficiency methods and drought-resistant crops* • *Fire season is longer, with high burn intensity, dry fuels, and large fire spatial extent; more fire crews are on staff* • *Wine country tourism increases, lake and river-based tourism declines; boat ramps close* • *Trees are stressed; plants increase reproductive mechanisms, wildlife diseases increase* • *Water temperature increases, programs to divert water to protect fish begin* • *River flows decrease; reservoir levels are low and banks are exposed*
D3	• *Livestock need expensive supplemental feed, cattle and horses are sold; little pasture remains, producers find it difficult to maintain organic meat requirements* • *Fruit trees bud early, producers begin irrigating in the winter* • *Federal water is not adequate to meet irrigation contracts; extracting supplemental groundwater is expensive* • *Dairy operations close* • *Marijuana growers illegally tap water out of rivers* • *Fire season lasts year-round; fires occur in typically wet parts of the state; burn bans are implemented* • *Ski and rafting business is low, mountain communities suffer* • *Orchard removal and well drilling company business increase; panning for gold increases* • *Low river levels impede fish migration and cause lower survival rates* • *Wildlife encroach on developed areas; little native food and water is available for bears, which hibernate less* • *Water sanitation is a concern, reservoir levels drop significantly, surface water is nearly dry, flows are very low; water theft occurs* • *Wells and aquifer levels decrease, homeowners drill new wells* • *Water conservation rebate programs increase, water use restrictions are implemented; water transfers increase* • *Water is inadequate for agriculture, wildlife, and urban needs; reservoirs are extremely low, hydropower is restricted*
D4	• *Field are left fallow; orchards are removed, vegetable yields are low; honey harvest is small* • *Fire season is very costly; number of fires and area burned are extensive* • *Many recreational activities are affected* • *Fish rescue and relocation begins; pine beetle infestation occurs; forest mortality is high; wetlands dry up; survival of native plants and animals is low; fewer wildflowers bloom; wildlife death is widespread; algae blooms appear* • *Policy change; agriculture unemployment is high, food aid is needed* • *Poor air quality affects health; greenhouse gas emissions increase as hydropower production decreases; West Nile Virus outbreaks rise* • *Water shortages are widespread; surface water is depleted; federal irrigation water deliveries are extremely low, junior water rights are curtailed; water prices are extremely high; wells are dry, more and deeper wells are drilled; water quality is poor*

Source: United States Drought Monitor

Appendix 2
Imperial to Metric Conversion

Imperial		Metric	
1	Gallons	3.79	Liters
1	Gallons/Sq. Ft.	4.07	Centimeter
1	Square Feet	0.09	Square Meters
1	Acres	4046.86	Square Meters
1	Acrefoot	1233.48	Cubic Meter
1	Ounce	28.35	Gram
1	Pound	452.60	Gram

Appendix 3

Acceptable Ranges for Chemical Properties in Irrigation Water

Chemical Property	Acceptable Range for Most Container-Grown Woody Crop	Acceptable Range for Most Container-Grown Herbaceous Perennials/ Greenhouse Crops	Acceptable Irrigation Purposes in a Greenhouse Using Soilless Substrates (Rockwool, Oasis, Peat or Coir)
pH	5.0-7.0	5.0-7.0	5.0-7.0
EC *(electrical conductivity - a measure of soluble salts)*	<1.75 mS/cm	<1.0 mS/cm	<1.0 mS/cm
Calcium Carbonates (CaCO3)	<150 ppm	<120 ppm	<120 ppm
Bicarbonates (HCO3)	<150-200 ppm (lower if not leached with rainfall)	<100-150 ppm (lower if not leached with rainfall)	<100-150 ppm
Sodium (Na)	<70 ppm	<60 ppm	<60 ppm
Chloride (Cl)	<140 ppm	<100 ppm	<100 ppm
Sulphur (S)	<70 ppm	<70 ppm	<70 ppm
Sulphates (SO4)	<200 ppm	<200 ppm	<200 ppm
Iron (Fe)	<0.5 ppm	<0.5 ppm)	<05. ppm
Boron (B)	<0.8 ppm	<0.5 ppm	<0.5 ppm
These are guidelines only. Crops will vary greatly in their sensitivity to soluble salts and water chemical properties.			

Adapted from: West, J, Huber, A, Carlow C, Water Treatment Guide for Greenhouses & Nurseries, April 9, 2018

Appendix 4

Comparing Yields and Market Values of Leading California Crops

	Production (1,000 tons)	Total Wholesale Value ($1,000)
Cannabis - CA Production (Instate + Exports)*	9.6	$24,765,680
Cannabis - CA Production- For Instate Demand Only**	2.6	$6,799,067
Grapes, All	7,130.0	$6,254,211
Almond (Shelled)	2,280.0	$5,468,040
Pistachios	987.0	$2,615,550
Berries, All Strawberries	1,443.5	$2,340,315
Oranges, All	5,327.0	$1,121,566
Walnuts	676.0	$878,800
Hay, Alfalfa & Other	5,682.0	$769,826
Rice	2,431.8	$755,763
Lemons	966.0	$681,564
Cotton, Lint All	216.5	$548,816
Avocados	171.0	$383,485
Plums and Prunes	190.2	$345,540
Berries, Raspberries	80.1	$331,088
Peaches, All	479.0	$304,213
Potatoes, (Excl. sweet)	772.9	$258,625
Potatoes, Sweet	435.1	$198,912
Cherries, Sweet	44.8	$140,395
Berries, Blueberries	36.3	$139,755
Nectarines	120.5	$104,626
Dates	30.0	$86,109
Grapefruit, All	564.0	$78,872
Cottonseed	339.0	$78,725
Pears, All	161.5	$77,344
Apples	125.0	$71,000
Beans, Dry	59.6	$68,885
Wheat, All	348.2	$68,167
Sugar Beets	1,092.0	$52,761
Grain, Corn	314.9	$52,570
Olives	53.6	$40,523
Apricots	31.7	$38,055
Oil Crops*	121.5	$37,797
Kiwifruit	37.8	$32,886
Barley	43.1	$8,578
Pecans	3.7	$7,400
Oats	6.7	$1,448

** Yield in smokable flower only. Does not include mass of leaf, trip, or bud for extraction. 2019 values. Assumes wholesale market half the value of the retail market (based on prevailing mark-up rates).*

*** Model assumes that California produces approximately 57% of all cannabis consumed in the U.S., with most products sold outside of the state. The state's share of national production will continue to fall as more states legalize.*

Source: California Agricultural Statistics Review 2018 -2019, California Department of Food & Agriculture

EXHIBIT D

LETTER TO ZONING ADMINISTRATOR BY CANNABIS LICENSING OFFICER SAM LOFORTI

County of Santa Cruz
Cannabis Licensing Office
701 Ocean Street, Room 520
Santa Cruz, CA 95060
831-454-3833
Cannabisinfo@santacruzcounty.us

Santa Cruz County
cannabis licensing

Date: March 3, 2021

Dear Ms. Drake,

On behalf of the Cannabis Licensing Office ("CLO"), I'd like to provide some additional information for your consideration of Application #211083 for commercial cannabis cultivation at 375 Old Mount Road in Felton (the "project"). The project proposes a co-location cannabis cultivation operation with a total of 20,000 square feet of cultivation space in an A (Agriculture) zone district.

Per the application materials, the project will not utilize any electricity for cultivation. Electricity will be utilized to power refrigerated trailers used to temporarily store cannabis prior to being removed from the site during harvest operations. Electricity is required to be provided to these trailers from a stationary source as generators for cannabis operations, outside of the commercial agricultural zone district, are prohibited.

The property has an existing agricultural use: grape vines. The proposed changes to the existing agricultural use are negligible and do not amount to any significant environmental impacts. Commercially grown cannabis will replace commercially grown grapes on a half-acre portion of an existing 5-acre vineyard. A 20,000 square foot area of existing vines will be replaced with cannabis plants in above-ground pots. There is no expansion of the agricultural use proposed through this application as no additional land will be used for agriculture.

Cannabis cultivation is defined by Santa Cruz County Code ("County Code" or "SCCC") Section 13.10.700-C as: "The planting, growing, developing, propagating, harvesting, drying, processing, curing, grading, trimming, packaging, or storage of one or more cannabis plants or any part thereof in any location, indoor or outdoor, including within a fully enclosed and secure building." This definition should be read consistently with the definition for cannabis cultivation set forth in SCCC 7.128, to the extent there any differences. The County considers cannabis cultivation to be an agricultural activity. Per the County Code, cannabis cultivation is an agricultural activity similar to the cultivation of any other row crop, including grape vines.

The temporary use of refrigerated trailers being brought on-site to store the cannabis plant material during harvest operations is similar to the existing vineyard uses on-site. The vineyard use includes seasonal employees and commercial vehicles are brought on-site to harvest and transport grapes off-site. The difference is the cannabis must be stored temporarily in refrigerated trucks to preserve the harvested goods prior to transporting it off-site. This is a negligible

difference between the existing operation and the proposed operation. As previously stated, the County prohibits generators from being used so the refrigerated trucks will be supplied power from the existing residence. This electrical power versus generator power further decreases potential impacts.

The proposed use of hoop houses at the site is also temporary in nature. Hoop houses are not permanent structures per the County Code, and impacts from the use of hoop houses will be further mitigated as the covers are required to be removed during the rainy season. This requirement was developed with the Department of Public Works to prevent sedimentation from concentrated run off which can occur from impervious surfaces. This is also a best management practice that the State Water Resources Control Board has identified for all agricultural operations.

The project's proposed water use will be minimized on the site through the use of drip irrigation, as required by CLO's Best Management Operations Practices plan with which all cannabis businesses are required to comply. The County calculated potential water use at this site based on existing operators within the County and a recently published study by the Resource Innovation Institute, Berkeley Cannabis Research Center and New Frontier Data, Cannabis H2O Water Use & Sustainability in Cultivation, 2021 ("Berkeley Study") (Exhibit A). The Berkeley Study utilizes real world data from various cannabis cultivation sites in multiple states, including separate data for California cultivation facilities. The results of that study show the average water use for outdoor cultivation is 11.3 gallons per square foot, per year. That is equivalent to 226,000 gallons of water per year for this proposed site.

Additionally, data CLO have from another cultivator in the Santa Cruz mountains show they use on average 72,000-90,000 gallons for 10,000 square feet of canopy per year; meaning that even at the top end of this average, the project might use 180,000 gallons of water per year for 20,000 square feet of canopy. This estimated water use is below the average value observed in the Berkeley Study likely due to the County's requirements to utilize drip irrigation. It is worth repeating here that County oversight of water use for commercial agricultural operations is limited to the issuance of permits for well construction and on-site wastewater disposal facilities (septic systems), which means the County does not regulate the total amount of water used. The County employs the drip irrigation requirement as a way to minimize water use. The property has a permitted well, and it is CLO's understanding that the well can provide enough water for the project.

Notably, an average home uses 131,400 gallons of water per year. The project will likely use slightly more water than an average home at 150,000-200,000 gallons per year. A residential project that included a new residence and an accessory dwelling unit with a projected use of 150,000-200,000 gallons of water per year would be considered a minor additional use or a minor alteration. For that reason, the environmental impact of the project's water use is negligible. The proposed water to be used for the project's agricultural purpose on a parcel zoned for agriculture constitutes a minor alteration. Unlike other crops, the State of California regulates water use for cannabis operations through the State Water Resources Control Board and the Department of Fish and Wildlife. The applicant for this project obtained coverage from both agencies, meaning the water use from the on-site well has been approved by the appropriate state agencies.

The compliance with CLO's Best Management Operations Practices plan paired with frequent inspections will ensure there are no additional impacts to wildlife at the proposed site. There will

be no light pollution or noise generated from the project as the outdoor cultivation does not use lighting or any significant noise producing apparatus. The existing vines that will be removed from the site will be replaced by cannabis planted in above-ground pots. Therefore, soil disturbance is not anticipated. The site is currently fenced, and the proposed operations do not include additional fencing which would prevent wildlife movement in the area.

Cumulative impacts from cannabis operations are considered when evaluating this and all cannabis projects for the purpose of CEQA review. The Cannabis Licensing Office and the Planning Department have spent significant time and resources on this issue. Our efforts include the development of a draft Environmental Impact Report ("EIR") for the County, which identified potential impacts from the legalization of cannabis. The draft EIR was never certified because the State provided a CEQA exemption for local cannabis cultivation ordinances during the legalization process. However, the County used those identified impacts in the draft EIR to develop a Best Management Operations Practices plan, which is the basis for mitigation measures for non-retail cannabis operations in the County. In terms of cumulative impacts from water use, the County has followed the science and available data from agencies in our area. In addition to the Berkeley Study cited above, the County has analyzed data from the Pajaro Valley Water Management Agency ("PVWMA"), Irrigation Rate Analysis Update Memorandum, 2013 (Exhibit B). We compared the data from PVWMA and the Berkeley Study and publicized the following table in October 2021 via an update to the Board of Supervisors (Exhibit C).

Crop	Water Use Per Square Foot Per Year (Gallons)*	Water Use Per Acre Per Year (Gallons)
Apples	3.7	162,925
Cannabis (Outdoor)	11.3	492,228
Nurseries / Cut Flowers	13.5	586,532
Cannabis (Mixed-Light)	14.9	649,044
Raspberries	15.0	651,702
Mixed Berries	15.7	684,287
Strawberries	18.7	814,628
Vegetables Row Crops	18.7	814,628
Average Water Use to irrigate lands in the Pajaro Valley	16.5	716,873

These data are critical in our understanding of water use impacts for cannabis and non-cannabis crops. The County's analysis paired with these data and collaboration with partner agencies at the state level are critical to understanding why this project does not have the potential to contribute to a significant cumulative impact on water resources. Evidence to support this assessment are:

- The inclusion of mitigation measures required by our ordinance (the Best Management Operations Practices) minimize cumulative impacts;

- The specifics of this project being an agricultural use replacing an existing agricultural use further minimize any contribution to cumulative impacts; and

- The absence of other existing or proposed cannabis cultivation sites in the vicinity of this proposed site.

This cumulative impact analysis conforms with the June 17, 2019 Memorandum published by the California Department of Food and Agriculture's CEQA Practice Recommendations from the CDFA for Cannabis Cultivation – Categorical Exemptions (Exhibit D).

This information is intended to assist you in your determination of CEQA compliance for the proposed operations. Should you have any questions I will be available during the public hearing to address any items and provide clarity.

Samuel LoForti
Cannabis Licensing Manager
County of Santa Cruz

EXHIBIT E

CANNABIS LICENSING OFFICE REPORT TO OBARD OF SUPERVISORS

County of Santa Cruz Board of Supervisors
Agenda Item Submittal
From: County Administrative Office
(831) 454-2100
Subject: Cannabis Licensing Moratorium and Setback Analysis
Meeting Date: October 19, 2021

Recommended Action(s):

1) Consider report on updates and potential changes to the Non-Retail Commercial Cannabis Program.

2) Provide specific direction to staff regarding amendments to the Non-Retail Commercial Cannabis Program codified in the Santa Cruz County Code.

3) Determine whether or not to extend a temporary moratorium on the issuance of cannabis business licenses on CA parcels that are within 500 feet of a residence on a residentially-zoned parcel.

4) If the Board chooses to extend the temporary moratorium, adopt an ordinance to extend the moratorium for 10 months and 15 days by a four-fifths vote pursuant to Government Code Section 65858.

5) Direct staff to bring any proposed changes to the Non-Retail Commercial Cannabis Program to the Planning Commission for a recommendation to the Board.

Executive Summary

The purpose of this item is to provide the Board with options regarding potential changes to the Non-Retail Commercial Cannabis Program regulations related to activity in the Commercial Agricultural zones contained in Santa Cruz County Code (SCCC) Chapters 7.128 and 13.10 as well as the current moratorium on pending and new cannabis licenses. Specific draft ordinance changes will be presented to the Board at a later date, pending the outcome of today's Board direction and decisions. Ordinance changes must also be considered by the Planning Commission prior to a public hearing with the Board.

Background

From the passage of the original ordinance in 2018 regarding the regulation of non-retail cannabis licensing activities, which was created with significant community and Board input over a two-year process, the Cannabis Licensing Office has been committed to balancing the needs of the industry with environmental protection and neighborhood preservation throughout the County. As such, the original ordinance has been amended several times since its inception as core questions and issues have arisen while the industry grows and matures.

In May 2018, the Board adopted the first non-retail cannabis licensing ordinance, which contained setbacks to sensitive receptors. Those setbacks applied to all zone districts and included:

- 200 ft setback for indoor cultivation from any habitable structure on a neighboring parcel; and
- 400 ft setback for outdoor cultivation from any habitable structure on a neighboring parcel.

In June 2019, the Board adopted changes to the non-retail cannabis licensing ordinance which included various updates to align the County Ordinance with State law, including the addition of nursery and processor license types.

In June 2020, the Board adopted additional changes to the non-retail cannabis licensing program which clarified that cannabis cultivation is an agricultural activity, it allowed cannabis cultivation and distribution in the CA zone as a principally permitted use in line with other commercial agricultural operations, and per the Board's direction the setbacks in the CA zone district were decreased to 100 feet for all types of cultivation.

On August 24, 2021, the Cannabis Licensing Office (CLO) presented a quarterly report on licensing activities for the 2021-21 fiscal year. At that meeting, a Board member identified and elevated community concerns regarding neighborhood conflicts arising from cannabis cultivation in the Commercial Agricultural (CA) zone that were adjacent to or near residentially zoned properties. The Board requested the following from the Cannabis Licensing Office:

- To evaluate the impacts of a potential code modification to non-retail cannabis cultivation which would prohibit cultivation of cannabis on a CA property that is adjacent to residential zoned parcels and within 500 feet of such parcels;

- To report on applicants and existing license holders which would be in conflict with this potential code modification including how many there are and potential mitigation measures;

- To bring back language which would institute a moratorium on applications in process and any potential new licensees while the Board deliberated on the above proposed prohibition and County Code changes;

- To create a noticing applicability and community input process for non-retail license applicants which mirrors the process approved for the retail operations; and,

- To provide options for the Board to consider which would help the cannabis industry or increase tax revenue.

On September 14, 2021, staff provided for the Board's consideration an interim urgency ordinance to impose a temporary moratorium on the issuance of cannabis business licenses on CA parcels adjacent to residentially-zoned parcels. In addition, staff provided details on the number of CA zoned parcels (773) and applicants in process

(29) that would be impacted by the suggested prohibition of cannabis cultivation in the (CA) zone that were adjacent to or within 500 feet of a residentially-zoned parcel. Analysis included all General Plan zoned parcels which would allow for a residential dwelling including the designations RA (Residential Agriculture), RR (Rural Residential), R-1 (Single-Family Residential), RM (Multifamily Residential), RB (Ocean Beach Residential), and SU (Special use).

At that meeting, the Board adopted a temporary moratorium on the issuance of cannabis business licenses on CA parcels that are within 500 feet of a residence on a residentially-zoned parcel. Additionally, the Board requested that staff return with an analysis of the proposed prohibition in the CA and an assessment of the impacts a 500-foot setback from a residential structure (rather than parcel line) would have and that SU designations be removed from consideration during the analysis. It was also noted during Board discussion that RA properties over 5 acres are allowed to grow a limited amount of cannabis per the current ordinance and that staff would also analyze those RA parcels over 5 acres in relation to the CA parcel prohibitions.

Analysis

Conflicts between residential and agricultural uses are not new or unique to our county. The extensive work that went into crafting the non-retail cannabis ordinance is a testament to the receptiveness of this Board, staff and community members, who identified and mitigated these concerns through code. Specifically, these concerns are addressed in both Chapter 7.128 and 13.10 of County Code via the Best Management and Operational Practices (BMOP). Cannabis cultivation has more restrictions than any other commercial agricultural crop. Unlike other crops, cannabis cultivation has operating hour restrictions, noise restrictions, visual restrictions, water use restrictions, stormwater drainage restrictions, herbivory control restrictions, riparian buffers and irrigation restrictions.

Community Concerns and the Current Ordinance

At the September 14, 2021 meeting, community members testified to concerns they had with commercial cannabis operations being adjacent to residentially-zoned area. Those concerns included guns on cannabis sites, noise, water use, traffic, and odor. Additionally, they stated the draft environmental impact report (EIR) identified these as unmitigated issues.

Staff notes that many of these concerns were in fact addressed within the ordinance itself or the BMOP governing non-retail activities. Specifically:

1) Guns are not allowed on cannabis sites and no guns have been found on licensed sites. From speaking with community members about this concern it was revealed this concern is based on the quarterly reports presented to the Board. Those reports included a summary of enforcement actions taken by the Sheriff's Office which include gun seizures. Guns seized by the Sheriff's Office have been seized from illegal operations. No guns have been seized from any licensed site and no guns have been observed at any licensed site.

2) Excessive noise is not allowed on cannabis sites, unlike other farming activities which are specifically exempted by county noise ordinance. As of September 24,

2021, the CLO has received one noise complaint related to a licensed operation, this complaint was investigated and found not to be in violation of County Code. The source of the noise was identified and the operating equipment generating the noise was removed from service and replaced within 72 hours, which remedied the concerns of the neighbor.

3) Water use is a concern on cannabis sites just as it is on any agricultural operations. Water use is minimized on cannabis sites through the use of drip irrigation as required by the BMOP, which is integrated into SCCC 7.128.170. Cannabis cultivators must obtain clearance from the Department of Fish and Wildlife to utilize water from groundwater wells to ensure they are not impacting surface water bodies. To better assess cannabis water use staff researched various sources. The table below represents data on cannabis from the Resource Innovation Institute, Berkeley Cannabis Research Center and New Frontier Data, *Cannabis H2O Water Use & Sustainability in Cultivation,* 2021 and data on other crops from the Pajaro Valley Water Management Agency, *Irrigation Rate Analysis Update Memorandum*, 2013. These reports provide context for cannabis water uses versus other commercial crops commonly found in our county.

Table 1: Comparison of Water Use

Crop	**Water Use Per Square Foot Per Year (Gallons)***	**Water Use Per Acre Per Year (Gallons)**
Apples	3.7	162,925
Cannabis (Outdoor)	11.3	492,228
Nurseries / Cut Flowers	13.5	586,532
Cannabis (Mixed-Light)	14.9	649,044
Raspberries	15.0	651,702
Mixed Berries	15.7	684,287
Strawberries	18.7	814,628
Vegetables Row Crops	18.7	814,628
Average Water Use for irrigate lands in the Pajaro Valley	*16.5*	*716,873*

* Square foot of the operational area not the actual canopy

Another analogy for cannabis cultivation and water usage is a comparison to home use. An average home uses 131,400 gallons per year which is approximately 18,000 more gallons of water than a 10,000 square foot outdoor cultivation site.

4) Traffic was a concern raised by some community members. The Pajaro Valley has a history of high dollar truck or table ready agricultural crops which include extensive transportation needs. Cannabis operations are more labor intensive than

apples and in line with berry production, cut flower and ornamental nursery uses. Cannabis operations are required to reduce the vehicle miles traveled to and from there sites via carpooling and the use of vanpools. This requirement has not been enforced recently due to social distancing requirements associated with COVID-19. These requirements will be enforced once health guidelines change. The CLO has received complaints associated with traffic at a site in Corralitos. Traffic concerns at the site have been resolved via staggering shifts and the movement of the entry gate at the site. Agriculture is not a static industry, and the evolution of that industry locally includes the cultivation of berries, which came after culinary herbs cut flowers, ornamental nurseries, which came after apples, etc. As crops have changed labor demands and the need for transportation has also shifted.

5) Odor was a concern raised by community members. Cannabis plants generate an odor that can be smelled beyond the property boundary of the cultivation sites. The same odor is generated by industrial hemp plants. Currently, registered hemp cultivation occurs in nearly four times the acreage of commercial cannabis production and hemp parcels abut 45 residentially zoned parcels. To date, the CLO has received odor complaints about two licensees, only one of which has been verified by the Monterey Bay Air Resources district.

6) Lastly, the community concern about the draft EIR identify these impacts as being unmitigable and being the basis for why the report was not finalized does not reflect the history of that report or its findings. The draft EIR was not finalized because the State determined it would not accept programmatic EIR's for cannabis related activities. The State required localities to do individual site-specific California Environmental Quality Act (CEQA) determinations. Facing this new reality, the County utilized the impacts identified in the draft EIR to develop the BMOP. The impacts were assessed individually, and mitigation measures were identified. All impacts and mitigation measures were compiled into the BMOP, and all non-retail cannabis operations must comply with these requirements. Each cannabis applicant must address all aspects of the BMOP prior to obtaining a license and the CLO inspects sites for compliance with these quarterly. In addition to the county requirements cannabis cultivators must comply the Cannabis general order, from the State Water Resources Control Board. The requirements of the Cannabis General Order are centered around erosion minimization and water discharges to prevent surface and ground water impacts from cannabis cultivation.

It is also important to remember that all cannabis operations are inspected quarterly and issued notices of correction or violation if they are not operating in accordance with their license and use permit(s). In addition, cannabis operations are licensed annually, and the County always has the option to refuse to renew a license should the operations be out of compliance consistently throughout the previous year.

Agricultural Protections in County Code

Cannabis is defined as agriculture by both State and local definitions and there are several relevant chapters of County Code which are relevant to cannabis cultivation in the CA zone district. SCCC 13.10.311 defines the purposes of agricultural zone districts, which are to preserve the commercial agricultural lands, to maintain the economic integrity of farms and to implement the agricultural preservation policy of

SCCC 16.50.010 all while encouraging commercial agricultural uses to the exclusion of other land use which may conflict with it. Previous policy makers have affirmed that it is in the public interest to preserve and protect commercial agricultural land for exclusive agricultural use and to enhance and encourage agricultural operations within the County, and that certain agricultural land in the County, not presently of commercial value, also merits protection. They also found that nonagricultural development adjacent to these lands often leads to restrictions on the County's agricultural industry as a whole.

In order to address areas of conflict between commercial agriculture operations and residential areas that have been developed near such operations the County Code goes on to protect agricultural activities through a notification and disclosure which is required for all real estate transactions in the County. That disclosure reads:

"Santa Cruz County has a strong rural character and an active historical agricultural sector. As a property owner or lessee, you should be prepared to accept properly conducted agricultural practices that are allowed for in Federal, State and County laws and regulations, are consistent with accepted customs and standards, and are operated in a non-negligent manner. Accepted agricultural practices that may cause inconveniences to property owners during any 24-hour period may include but are not limited to: Noise, odors, fumes, dust, smoke, pests, operation of farm equipment, storage and application and disposal of manure and the application of pesticides and fertilizers by ground or air. The County of Santa Cruz will not consider an agricultural practice to be a nuisance if implemented in accordance with Federal, State, and local law. Nothing herein is intended to limit rights under Federal, State, and local regulations governing pesticide use."

In addition to this disclosure agricultural lands have setback requirements for habitable uses within 200 feet of parcel lines to prevent or minimize potential conflicts between existing or future agricultural and residential uses. When a property owner chooses to pursue residential development in an agricultural buffer, they must acknowledge that they may be subject to inconvenience or discomfort arising from the use of the adjacent agricultural lands. Additionally, the acknowledgement is recorded and binding on that property owner and all future owners as described in SCCC 16.50.090.

SCCC 13.10 and 16.50 are intended to protect agricultural uses against all other land use which conflict with it. The protections afforded to agricultural operations by County Code are intended to protect agricultural operations from residential conflicts. The Agricultural Policy Advisory Commission (APAC), *Recommendations Regarding the Draft EIR on the Proposed Cannabis Cultivation and Manufacturing Ordinances*, from November 2017 further reinforced these protections are applicable to cannabis.

Cannabis cultivation does have some unique safety concerns due to its history of illegality and because of its high dollar value in the marketplace. As the market matures, prices drop, and illegal operations are abated and eliminated cannabis will simply become the growing of a plant in the ground so that it can be sold on a commercial market similar to any other agricultural crop.

Assessment of Impacted Parcels

During the many deliberations on the original proposed ordinance, the Board stated that in order to best preserve environmental and neighborhood protections, it was preferable to encourage cannabis production in CA zoned areas while limiting its production in other areas. This led to the current limitations on both canopy size and minimum acreage required for growing cannabis on non-CA-zoned lands.

There are currently 1,462 parcels zoned CA throughout Santa Cruz County representing a total of 43,624 acres. These parcels are primarily concentrated in the South County in Districts 2 and 4, with a scattering of parcels located in the rest of the county, including along the north coast in District 3. The following table shows the total CA zoned parcels by district.

Table 2: CA Zoned Parcels by District

	District 1	District 2	District 3	District 4	District 5	Total Parcels	Total acreage
CA Zoned Parcels	30	691	82	628	31	1,462	43,624

The following data was presented via a map at the September 14 meeting on CA parcels that abutted or were within 500 feet of a residential zoned parcel (including SU) as requested at the August 24th Board meeting. Staff has updated this data to show it by district. It is presented in the table below.

Table 3: CA Zoned Parcels by District with August Prohibitions

	District 1	District 2	District 3	District 4	District 5	Total Parcels	Total acreage
CA Zoned Parcels	30	691	82	628	31	1,462	43,624
Less CA parcels abutting or within 500 feet of a residentially zoned parcel	30	450	64	201	28	773	21,670
CA parcels available for licensing	**0**	**241**	**18**	**427**	**3**	**689**	**21,954**

In accordance with directions provided at the September 14 meeting the following data presents CA parcels that abut or were within 500 feet of a residential structure (excluding SU parcels) from the CA parcel line.

Table 4: CA Zoned Parcels by District with September Prohibitions

	District 1	District 2	District 3	District 4	District 5	Total Parcels	Total acreage
CA Zoned Parcels	30	691	82	628	31	1,462	43,624
Less CA parcels within 500 feet of a residential structure from CA parcel line	30	378	28	132	24	592	15,915
CA parcels available for licensing	**0**	**313**	**54**	**496**	**7**	**870**	**27,709**

In addition, staff looked at RA parcels of 5 acres or more which abut CA zoned parcels. This is because these RA parcels are allowed to grow a limited amount of cannabis (1.25% of parcel on 5 to 10 acres up to a maximum of 5,100 square feet or up to 10,000 square feet on parcels greater than 10 acres). The logic in looking at these parcels was that an RA neighbor to CA zoned parcels, who could also grow cannabis on their land, might not have the same objections to a cannabis operation next door and those parcels could be eliminated from the prohibitions. The following data shows information on RA zoned parcels eligible to grow cannabis abutting CA zoned parcels.

Table 5: RA Zoned Parcels by District Abutting CA Zoned Parcels

	District 1	District 2	District 3	District 4	District 5	Total Parcels	Total acreage
RA parcels 5 acres or more	405	438	163	77	318	1,401	15,011
RA parcels 5 acres or more abutting a CA zoned parcel	32	104	14	33	5	188	2,739

Staff also assessed the impact to applicants currently in process for their cannabis license. Some are working on meeting their use permit conditions of approval, building out their facility to become operational as well as those who have submitted pre-applications (in yellow) to start the licensing process. There was no change to the number of impacted potential licensees based on the modification suggested in September.

Table 6: Potentially Impacted Licensees with August or September Prohibitions

Supervisorial District	Total Potential Licenses	Current Applications in review	Current Licenses on the Parcel
2	5	1	1
4	3	0	1
4	7	0	2
2	2	1	0
2	2	1	0
Subtotal	**19**	**3**	**4**
2	1	0	0
2	2	0	0
2	2	0	0
Subtotal	**5**	**0**	**0**
Grand Total	***24***	***3***	***4***

The total potential licenses, excluding those that are in the pre-application phase represent approximately 22,000 sq ft of indoor canopy cultivation, 530,000 of greenhouse canopy operations, 20,000 sq ft of hoop house canopy cultivation, 150,000 sq ft of greenhouse nursery operations and 22,000 sq ft of outdoor canopy cultivation. The total value of the potential revenue loss of CBT is estimated at about $2.5 million should these potential licensees be eliminated from pursuing their current license application.

Options for Addressing CA Zoned Parcels

Taken all together, this data presents various options for discussion and consideration by the Board in order to provide staff with specific policy direction for ordinance changes.

Option 1: Maintain current ordinance. This allows for a 100-foot setback on any CA zoned parcel. This is measured from the cultivation area to adjacent property parcel line. Based on the community concerns expressed this is not a preferred option.

Option 2: Update the ordinance to disallow cannabis cultivation on CA parcels that abutted or were within 500 feet of a residential zoned parcel per the current moratorium. This option has the potential to address some community concerns such as noise, odor

and transportation impacts and water use from residential neighbors. It eliminates 773 or 52% of the CA zoned parcels for potential cannabis operations representing 21,670 acres and takes parcels out of consideration, no matter what their size or how far a cultivation site may actually be from a habitable structure. For example, a large parcel may be able to locate a cannabis operation acres away from a residence but the parcel would be eliminated simply because it abuts or is within 500 feet of a residentially zoned parcel.

Option 3: Update the ordinance to disallow cannabis cultivation on CA parcels that are within 500 feet of a residential structure from the CA parcel line per the September 24th Board discussion. This option is similar to option 2 in terms of the advantages and disadvantages. It eliminates 592 or 40% of the CA zoned parcels for potential cannabis operations representing 15,915 acres.

While it is difficult to assess the potential tax impacts due to the highly fluctuating market process for cannabis, the various options for growing (nursery, flower, full plant), and the likelihood of any of this "lost" production area actually being used for cannabis, staff has estimated the following potential tax revenue impacts as follows.

Table 8: Potentially Revenue Losses

	August Option	September Option
Total eliminated parcels	773	592
Representing total "lost" acreage	21,670	15,915
Maximum amount of cannabis allowed (5%)	1,084	796
Reduce by 60%	433	318
Acreage converted to Square feet	18,878,904	13,865,148
Approximate sales Value per sq ft (outdoor)	$ 9.63	$ 9.63
Approximate Gross Sales Potential	$ 181,803,846	$ 133,521,375
Potential loss of tax revenue (6% of gross receipts)	$ 10,908,231	$ 8,011,283

* Assumes only 40% of potential properties will grow cannabis

Option 4: Revise setbacks in CA to align with the original code approved. This includes a 400-foot setback from residence to outdoor grow area, which is twice the setback than allowed in other agricultural operations. The original code also allowed for exceptions down to 100 foot subject to a Level V use permit (as allowed for all other zone districts). Further define setbacks for indoor cultivation to be 100 ft from residences to cultivation area and 50 ft from nursery operations to residences. The advantage of this option would allow for site specific evaluations which can be a better way to address specific neighborhood concerns without a broad stroke elimination of eligible parcels. It also aligns the CA zone with all other zone districts that allow cannabis cultivation. In addition, exceptions to setbacks would require a public hearing, allowing for community input and adjudication by an impartial administrator. This option also honors the protections for agricultural production as codified in SCCC16.50.095 while doubling the setbacks for any other agricultural operation.

Option 5: The same as option 4 with increased setbacks of 500 feet for outdoor cultivation, 200 feet for indoor cultivation and 100 feet for nursery operations.

Thus, far the code along with the use permit public process and imposed conditions has been an effective tool in maintaining the balance between the nascent cannabis industry, environmental and neighborhood protection and use of the CA zone as previously deemed the most appropriate zone for cannabis cultivation by the Board.

Thus, staff recommends the choice of either option 4 or 5 to address the conflicts inherent in agricultural production near residential use while also allowing the ever-evolving cannabis industry to respond more appropriately to specific neighborhood concerns.

Current Licensees and CA Zone Changes

At the September 14th meeting, the Board clarified that current licensees would be allowed to continue in their licensed operations and not be impacted by any ordinance changes at their license renewal period.

Moratorium Options

At the September 14 meeting, a moratorium was implemented on any new applications as well as on any applications in process in order to allow the Board time to consider its many options regarding regulations in the CA zone and to give staff specific directions for an ordinance change. A few Board members expressed concern over the length of the moratorium and staff is providing options for Board consideration on the moratorium.

Option 1: Leave the moratorium in place as is, halting the acceptance of any new applications for cannabis licensing and freezing all those in process that are located on CA zoned property which abuts or is within 500 feet of a residence until a new ordinance is approved by the Board. (An extension of the moratorium is required for this option and included as an attachment.) This is similar to the way the Board managed an update to the vacation rental ordinance a few years ago. In that case all applications were frozen while a new ordinance was developed and once applications were accepted, “frozen” applicants were given priority processing if they met the criteria under the new ordinance. The advantage of this option is it allows for continued public debate and extensive Board and Planning Commission thoughtful deliberation. The disadvantage of this option is that it puts significant capital investments at risk for those currently awaiting their use permits, potentially opening the County to litigation and could also impact the current fiscal year revenue projections for licensing. Our budgeted tax and licensing revenue for the current fiscal year included an increase based on projects in the pipeline as well as on current licensed operations.

Option 2: Eliminate the moratorium for applications in process but halt the acceptance of any new applications on CA zoned land abutting or within 500 feet of a residence until a new ordinance is approved by the Board. This would allow potential licensees to continue in the process under the conditions as when they first applied while also allowing the use permit process to address neighborhood concerns on a case-by-case basis. It could also preserve potential tax and licensing revenue while eliminating potential litigation threats. The disadvantage of this option is that changing Board thinking on CA zoned properties would not be implemented for applications in process. Staff recommends this option.

Noticing and Community Input Process

Recent changes to the retail cannabis ordinance provided a public notice and appeal procedures for Licensing Official decisions related to the relocation of cannabis retailers seeking a setback waiver. The addition of the proposed language defined the public notification and the appeal process. The public notification process includes a mailer sent to all property owners within 600 feet of the proposed location and all lawful occupants of properties within 100 feet of the proposed location. The public notification also includes the posting of a sign on the proposed location at least 14 days prior to the end of the appeal window. These public notification procedures align with current Planning Department public notification procedures for Level IV proposed development. The new appeal procedure included having an Administrative Hearing Officer review the matter de novo and render a written decision.

Through the use permit process public notification and input procedures within the Planning Department are currently in place when a cannabis applicant seeks a use permit for their cannabis application. It is staff's understanding that the Board wanted the non-retail licensing process to mirror the retail licensing process when setback exceptions are requested. Any time a setback exception is requested this triggers a Level V use permit, which requires public notification and a Zoning Administrator public hearing. It is, therefore, recommended that the current public hearing and notification procedures remain in place rather than having redundant notifications for the same project.

Opportunities for Future Cannabis Operations

At the conclusion of the August 24th meeting, staff was directed to return with ideas that would help grow the cannabis industry and increase the tax base of cannabis operations. The following ideas are presented to encourage future discussions and not intended to be a part of the discussion or direction provided today to staff for ordinance changes on CA-zoned parcels.

Increasing Production to Increase Cannabis Business Tax

Cannabis Business Taxes (CBT) are based on gross sales amounts. An increase to the production of cannabis could increase CBT.

1) Use of greenhouses on CA parcels less than 10 acres. Currently, CA parcels of less than 10 acres are limited in the amount of square footage cultivation to a maximum of 22,000 square feet. However, especially in areas previously devoted to cut flowers, greenhouses may constitute significantly more square footage on the parcel. Greenhouses allow for greater controls, including odor, on cannabis production and the Board should consider allowing for all greenhouses on a CA zoned property to be used for cannabis production. An alternative concept would be to allow excess greenhouse capacity to be devoted to nursey production only with no square footage limitations.

2) Allow parcels zoned A (Agricultural) that are greater than 30 or 40 acres to follow the same guidelines as CA zoned parcels which would allow for increased cultivation area. There are 74 A zone parcels greater than 30 acres and 41 parcels greater than 40 acres, as shown on Exhibit A.

3) Increase the canopy limits in certain zone districts. This would allow operators to expand their existing sites rather than seeking out new land for production. It is suggested that a pilot project that allowed for community input during the project be conducted to assess the interest and impacts of production changes.

Increasing Overall Sales to Increase Cannabis Business Tax

4) Allow retail sales and consumption of non-manufactured cannabis goods grown by a licensed farm, similar to a winery. Again, a pilot project with a limited number of exceptional operators is suggested for assessing and evaluating this option. Limitations such as only the use of existing structures of 120 square feet or less, no new parking or impervious area allowed, limited hours and potential seasonal limitations on such operations could also be imposed.

5) Allow current retail operations the option to have on-site consumption lounges similar to breweries. Use of the model for compliance and human health have been established in San Francisco and should be considered as a best practice when assessing and evaluating this concept through a pilot project. This idea could also create additional jobs.

Financial Impact
Financial impacts vary by potential changes to the Non-Retail Commercial Cannabis Program.

Strategic Plan Element(s)
This item supports the Strategic Plan Element of Comprehensive Health and Safety and Dynamic Economy.

Submitted by:
Carlos J. Palacios, County Administrative Officer

Recommended by:
Carlos J. Palacios, County Administrative Officer

Attachments:

a Extension Ordinance - Moratorium on Cannabis in CA (10-13-21) final
b Map of A zone 30 acres or more

EXHIBIT F

375 OLD MOUNT ROAD STAFF REPORT

Staff Report to the Zoning Administrator

Application Number: 211083

Applicant: David Whitfield
Owner: Masood Madani
APN: 091-161-31
Site Address: 375 Old Mount Rd., Felton, CA 95018

Agenda Date: March 02, 2022
Agenda Item #: 2
Time: After 9:00 a.m.

Project Description: Proposal to operate an outdoor "Class A" cannabis cultivation facility with a maximum of 20,000 square feet of canopy. Requires a Level 5 Agricultural Development Permit (211083) and a determination that the project is exempt from further environmental review under the California Environmental Quality Act (CEQA).

Location: Property is located off East Zayante Road on Old Mount Road in Felton (375 Old Mount Road)

Permits Required: Agricultural Development Permit

Supervisorial District: 5th District (Supervisor: Bruce McPherson)

Staff Recommendation:

- Determine that the proposal is exempt from further Environmental Review under the California Environmental Quality Act.
- Approval of Application 211083, based on the attached findings and conditions.

Project Description & Setting

Setting

The subject property is located within the Skyline Planning Area in a mountainous rural part of mid-county approximately three miles north of the community of Zayante. The property is situated approximately 2,000 feet north-west of the intersection of Lower Ellen Rd. and East Zayante Rd. on the lower (eastern) portion of a ridge that divides the watersheds of Lompico Creek and Zayante Creek.

The 31.5-acre property (091-161-31) includes a portion of an original 65-acre residual orchard and vineyard established prior to 1950 (Albion Environmental Phase 1 study), which was subsequently divided into (3) equally-sized parcels. Sloped areas forested with redwood/mixed-conifer and oak woodland vegetation lie south and west of the developed portion of the subject property (vineyard,

residence, former tasting room). Cannabis was cultivated on a one-acre plot near the established residence under a provisional State-issued license.

Two neighboring parcels of similar size (APNs 091-161-30, 091-161-32), to the north and east of 091-161-31, contain residences, accessory structures, vineyards and open pastureland. A 0.3 mile private road (Old Mount Road) serves the neighbor to the east (091-161-32) and the subject parcel, terminating in a driveway secured by an electric gate (Project Plans, Sheet A 02).

The parcel is mapped within the "high" State Responsibility Fire response area.

Project Details

The proposed outdoor cultivation operation would be sited approximately 500 feet south-west of the operator/site manager residence in a portion of the existing vineyard (Project Plans- Sheet A11) and 500 feet south-east of a neighboring residence (set back 20 feet east of the fenced property boundary line and neighbor's open pasture). The perimeter of the subject property is fenced with existing fencing measuring five to six feet in height and comprised of mixed material types.

The total allowable mature and immature commercial cannabis canopy area on this "A-zone" site is limited to 20,000 square feet, the maximum canopy-area allowance for co-located licenses in the zone district (SCCC 13.10.650(C)(3)(h).

Cannabis would be cultivated to maturity in hoop houses with "light deprivation" covers between the months of April and November (April 15th to October 31st)..

Imported immature plants (clones) would be cultivated to maturity in pots set upon weed cloth placed on bare soil in the hoop houses. Harvested cannabis would be temporarily stored in (2) 20' x 40' refrigerated trailers parked near the residence and powered by a permitted stationary source (item 5.0, Sheet A 11). Cannabis material would be transported off-site by a licensed 3rd-party distributor.

The applicant proposes two (2) full time resident-operators and five to ten (5-10) seasonal employees for harvest and post-harvest operations. Parking spaces for the residents are at the dwelling. Sheds near the driveway access will be removed to create parking areas for the temporary trailers and harvest workers (three spaces).

The applicant has provided a vegetation management plan to address fire protection concerns at the site ("Fire Prevention Plan Diagram and Notes"- Project Plans, Sheet A 50), including establishment of 100 ft. of defensible space around structures and incorporation of Zayante Fire's compliance requirements into a fire prevention check-list for employee use.

Permit Requirements

Pursuant to County Code Section 13.10.323, cannabis cultivation facilities located within the Agriculture (A) zoned district are subject to an Agricultural Development Permit and a public hearing with approval by the Zoning Administrator.

Zoning & General Plan Consistency

The subject property is a 31.5-acre parcel located in the A (Agriculture) zone district, a designation which allows agricultural and residential uses. Cannabis cultivation is akin to a vineyard, orchard, or other agricultural activity allowed in the "A" zone district with exception of security requirements specific to cannabis storage and operational restrictions detailed in the best management operational practices plan. The proposed cannabis cultivation use is an allowed use within the "Agriculture" zone district and the project is consistent with the site's R-M (Mountain Residential) General Plan designation.

Key Regulatory Issues

Siting

The owner/operator's residence is located at the end of a 0.3 mile paved private road (Old Mount Road) which runs from East Zayante Road. A driveway splits off to the neighbor's residence to the east (255 Old Mount Rd.). An electric gate controls access to 375 Old Mount Rd. The 12-ft. wide road is surfaced with pavement to the gate and with baserock/gravel to the residence. The proposed parking area for seasonal employees and temporary harvest storage trailers would be sited off the driveway about 200 ft. north of the residence (Sheet A 11). The cannabis cultivation/garden area would be located approximately 400 ft. south-west of the residence near the existing fence bordering the neighbor's property to the west (255 Old Mount Rd.).

The plans sheet shows a 400 ft. setback distance from the cultivation site and harvest storage area to a neighboring residence to the west (091-161-32). The proposed cultivation site meets cannabis-specific setback requirement of (a minimum of) 400 feet between a neighboring habitable structure(s) and an outdoor cultivation site, including garden areas and processing facilities (13.10.650(C)(4). The cannabis plants would be located in seasonal hoop houses, concealing them from view from the neighboring property. Additionally, a hedgerow will be installed along the eastern property line to obscure the hoop houses from the view of the neighboring residential structure.

Biotic Resources (Sandhills Habitat and established pond)

No cannabis activities are allowed in the Sandhills habitat (SCCC 13.10.650(5) or within a 100-foot distance of a perennial body of water (SCCC 13.10.650(C)(4). County GIS mapping suggests that soil associations and vegetation characteristic of the protected Sandhills Habitat may occur in the vicinity of the subject property, including a small, naturally vegetated portion of the southern corner/boundary of APN 091-161-31. A one-acre pond is located about 250 feet from the eastern limit of the proposed cultivation site.

County Environmental Planning staff visited the property on 4/13/2021 and evaluate the proposed cannabis cultivation site, which is proposed to be located within a portion of an established vineyard, and determined that 1) the area proposed for cultivation was devoid of the soil and vegetation indicative of Sandhills habitat, 2) no sensitive species were present on the site and 3) the cultivation area meets the required minimum 100-foot setback distance to a lake or pond.

Archaeological Resources

The County GIS includes mapped areas where archaeological resources may be present, including in sections of the Upper Zayante region, which is where the project site is located. Thus, the applicant was required to complete an archaeological report, including a ground survey of the project area, to confirm the presence/absence of cultural resources on or near the proposed cultivation site. No cultural resources were found at the cultivation site (vineyard). An archaeological report, prepared by Albion Consultants, was accepted by Environmental Planning on 4/29/21. The report is kept in a confidential file pursuant to County practices and procedures.

The proposed cultivation operation would be above the ground surface, with plants grown to maturity in "smart pots" on a weed cloth base. No excavation or grading is proposed for this project.

Condition II. of the "Conditions of Approval" includes this requirement for project operations.

"Pursuant to Sections 16.40.040 of the County Code, if at any time during site preparation, excavation, or other ground disturbance associated with this development, any artifact or other evidence of an historic archaeological resource or a Native American cultural site is discovered, the responsible persons shall immediately cease and desist from all further site excavation and notify the Sheriff-Coroner if the discovery contains human remains, or the Planning Director if the discovery contains no human remains. The procedures established in Sections 16.40.040 shall be observed."

Water Use for Agriculture

Commercial agriculture is a principally-permitted use on the subject property and neighboring parcels, which are zoned "A" (for Agriculture). A portion of the subject property is currently developed with a dry farmed vineyard. County oversight of water use on agricultural operations on General Plan-designated agricultural lands is limited to the issuance of permits for well construction and on-site wastewater disposal facilities (septic systems). Cannabis operations must meet stricter standards under County and State codes, including certifying that water is sourced from permitted wells and/or stream diversions, water-wise irrigation Best Management Practices are employed, and measures to limit runoff volume from cultivation sites are applied.

The "Best Management Operations Practices (BMOP)" plan required for this project under SCCC 13.10.650(B), (Project Plans- Exhibit D. Sheet A 05, section D.7), includes a commitment by the applicant to mitigate the impacts of cannabis cultivation operations below the threshold of County land-use code requirements for agriculture, including the mandatory use of high-efficiency irrigation practices for cannabis cultivation.

Further, the State requires that water use from wells be permitted via the California Department of Fish and Wildlife (CDFW) Lake and Streambed Alteration (LSA) Agreement. LSA Agreements are required when there are potential impacts to surface water bodies. This site was determined not to have any potential impacts by the CDFW via EPIMS-05074-R3.

Fire Hazard Reduction

As proposed and conditioned, the applicant shall maintain vegetation in accordance with the "Fire Prevention Plan, Diagram, and Notes" (Sheet A 50). Given the seasonally high fire risk in the area,

a vegetation management plan focused on maintaining defensible space around the residence was prepared by the applicant to minimize fire risks to neighboring properties. A constructed pond on the property provides a source of water for fire suppression.

Canopy Area

The table below provides relevant information regarding the allowed and proposed cultivation activity. The proposed cultivation meets the code limits as shown.

Cultivation Canopy Allowance						
Zone District - License Type	**Number of Licenses**	**Site Acreage***	**Maximum Outdoor Cultivation Canopy Allowance**	**Outdoor Cultivation Canopy Proposed**	**Indoor Cultivation Canopy Proposed**	**Total Canopy Proposed**
A - Class A	Multiple Licenses	31 acres	1.5 % of parcel, but not to exceed 22,000 square feet	20,000 square feet	N/A	20,000 Square feet

Conclusion

As proposed and conditioned, the project is consistent with all applicable codes and policies of the Zoning Ordinance and General Plan/LCP. Please see Exhibit "B" ("Findings") for a complete listing of findings and evidence related to the above discussion.

Staff Recommendation

- Determine that the proposal is exempt from further Environmental Review under the California Environmental Quality Act.
- **APPROVAL** of Application Number 211083**,** based on the attached findings and conditions.

Supplementary reports and information referred to in this report are on file and available for viewing at the Santa Cruz County Planning Department, and are hereby made a part of the administrative record for the proposed project.

The County Code and General Plan, as well as hearing agendas and additional information are available online at: www.sccoplanning.com

If you have any questions about this project, please contact Michael Sapunor at: michael.sapunor@santacruzcounty.us.

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San Francisco, CA 94110

Exhibits

A. Categorical Exemption (CEQA determination)
B. Findings
C. Conditions
D. Project plans
E. Assessor's, Location, Zoning and General Plan Maps
F. Parcel information

CALIFORNIA ENVIRONMENTAL QUALITY ACT
NOTICE OF EXEMPTION

The Santa Cruz County Planning Department has reviewed the project described below and has determined that it is exempt from the provisions of CEQA as specified in Sections 15061 - 15332 of CEQA for the reason(s) which have been specified in this document.

Application Number: 211083
Assessor Parcel Number: 091-161-31
Project Location: 275 Old Mount Rd., Felton CA 95018

Project Description: Proposal to operate a "Class A" outdoor cannabis cultivation facility with a maximum of 20,000 square feet of canopy area on a property zoned A (Agriculture) on site with a single-family dwelling, vineyard, and accessory structures. Requires a Commercial Development Permit, an Archaeological Report Review, and a determination that the project is exempt from further environmental review under the California Environmental Quality Act (CEQA).

Person or Agency Proposing Project: David Whitfield

Contact Phone Number: (415) 724-6279

A. _____ The proposed activity is not a project under CEQA Guidelines Section 15378.
B. _____ The proposed activity is not subject to CEQA as specified under CEQA Guidelines Section 15060 (c).
C. _____ **Ministerial Project** involving only the use of fixed standards or objective measurements without personal judgment.
D. _____ **Statutory Exemption** other than a Ministerial Project (CEQA Guidelines Section 15260 to 15285).

E. __X__ **Categorical Exemption**

EXHIBIT A

Specify type: See below

Class	Category	Description	Environmental Commitments (B.M.O.P.)
Class 1	Existing Facilities	Consists of the operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination. (Cal. Code Regs., tit. 14, §15301.)	See attached "CEQA Project Description form", item #4. "Best Management and Operational Practices" (BMOP) requirements apply to all non-retail commercial cannabis businesses to reduce the environmental impacts of cannabis operations (Santa Cruz County Code Ch. 7.128.090.(A)(1)(a)(xi). The BMOP is included in the "Green Coast Old Mount Farms" project plans (Exhibit D, Sheet A 05) and operational conditions for the cannabis business license.
Class 4	Minor Alterations to Land	Consists of minor public or private alterations in the condition of land, water, and/or vegetation which do not involve removal of healthy, mature, scenic trees except for forestry and agricultural purposes. (Cal. Code Regs., tit. 14, § 15304.)	

F. Reasons why the project is exempt:

Cultivation of agricultural crops, including minor alterations to the land for security fencing and lighting associated with agricultural cultivation. The Class 1 exemption is based upon the use of the existing facilities (well, septic tank, driveway, electrical service, land) to cultivate and temporarily store the harvested cannabis prior to transport off site. The Class 4 exemption is based upon the crop change from grapes to cannabis within an existing vineyard.

In addition, none of the conditions described in Section 15300.2 apply to this project.

_____ Date: _____

Michael Sapunor, Resource Planner

EXHIBIT A

CEQA PROJECT DESCRIPTION FORM

Lead Agency: County of Santa Cruz Planning Department

Applicant: David Whitfield

Project: Outdoor Cannabis Cultivation

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1. Description of Project Site:

General Topographic Features (slopes and other features): 31.5-acre property includes flat and sloped terrain.

Natural Features (general vegetation types, presence of streams and wetlands, forested areas): Sloped areas forested with redwood/mixed-conifer and oak woodland are situated to the south and west of a vineyard and residence.

Existing Land Uses/Zoning: Agriculture (A) zoning for orchards, row crops, and vineyards. Cannabis cultivation requires a discretionary use permit under the "A" zoning regulations.

Existing Constructed Features (buildings, facilities, and other improvements): (1) single-family residence w/ attached garage, small sheds, (2) 5000 gallon water storage tanks.

Surrounding Land Uses (including sensitive uses): Agriculture, residential, timber production.

2. Required Site Improvements and Construction Activities:

Site Improvements: The project consists of outdoor cannabis cultivation (immature and mature/flowering plantings) on a half-acre portion of an existing 5-acre vineyard. Harvested cannabis would be temporarily stored in (2) refrigerated trailers and processed off-site. Improvements include enclosure of the cultivation area with a 6 ft. security fence, installation of an electrical sub-panel at the trailer parking pad, and installation of motion-sensor lights and digital cameras for security.

Construction Activities: None.

3. Operation and Maintenance Activities:

Hours of Operation/Work Shifts: 7:00am to 7:00pm

Number of employees (total and by shift): (2) resident-operators. (5-10) temporary workers for harvest operations.

Estimated Daily Trip Generation: 10 or fewer round-trips per day on average.

Source(s) of Water: Agricultural water well on the property

Wastewater Treatment Facilities: Septic system serving the residence and portable toilets.

Source(s) of Power: PG&E service

EXHIBIT A

4. Environmental Commitments:

"Best Management and Operational Practices" (BMOP) requirements apply to all non-retail commercial cannabis businesses to reduce the environmental impacts of cannabis operations (Santa Cruz County Code Ch. 7.128.090.(A)(1)(a)(xi). The BMOP is included in the "Green Coast Old Mount Farms" project plans (Exhibit D, Sheet A 05) and operational conditions for the cannabis business license.

BMOP requirements related to the CEQA determination are noted below:

BMOP "Siting Criteria" (Section A) and "Site Design" (Section B) measures to avoid and minimize impact to land and biotic resources include: A.1 Avoidance of Excessive Grading, A.2 Minimizing Site Disturbance/Reducing Forest Fragmentation, A.2.b. Limit Development Footprint, A.3. Biological Assessments, A.3.c. No Cannabis Activity in Sandhills, A.4.Archeaological Surveys; B.1 Fencing and Security, B1.a. Wildlife-Friendly Fencing and Neighborhood Compatibility, B.1.b. Lighting for Security, B.2. Use of Impermeable and Permeable Surfaces, B.2.a. Limit Surfaces that May Impair Long-Term Native Soil Productivity, B.3. Visual Blending of Cannabis Infrastructure, B.4 Water Resources-Drainage, B.5. Water Storage.

BMOP Section D. "Operational Requirements" include: D.1.a. Employee TDM measures, D.1.b. Worker Rights and Safety, D.2. Herbivory Prevention Plan, D.3. Riparian Buffer Protection, D.5.Pesticides, Fuel Storage, and Hazardous Materials, D.7. Water Supply and Quality, D7.a. SWRCB Certification, D.7.b. CDFW Certification, D.7.d. Irrigation efficiency, D.8. Waste Management.

The County of Santa Cruz Cannabis Licensing Office has determined that the proposed project 1) is not visible from scenic highways and/or impactful to scenic resources, 2) is not located on a "Cortese List" site, 3) does not substantially change a historic resource, 4) is likely to not contribute to a significant cumulative environmental impact, 5) is not subject (by location and/or design) to unusual circumstances that would reasonably contribute to a significant environmental impact.

5. Environmental Permits Required (List all required federal, state, and local permits required):

Agency	Permit	Status
California Department of Fish and Wildlife	Section 1602 Lake or Streambed Alteration Agreement	EPIMS-05074-R3
State Water Resources Control Board / Regional Water Quality Control Board	Water quality protection program	pending

EXHIBIT A

Commercial Development Permit Findings

1. That the proposed location of the project and the conditions under which it would be operated or maintained will not be detrimental to the health, safety, or welfare of persons residing or working in the neighborhood or the general public, and will not result in inefficient or wasteful use of energy, and will not be materially injurious to properties or improvements in the vicinity.

This finding can be made, in that the cannabis cultivation would be outdoors in an existing vineyard; the weighing and storage of cannabis material would occur within temporary storage trailers connected to a permitted power source; and the harvested cannabis transported off-site for processing at a licensed facility. The 31.5-acre parcel exceeds the minimum 10-acre parcel area standard for cultivation on single parcels in the A zone district.

The Cannabis Licensing Manager reviewed the proposed project and recommends the approval of the proposed security plan and Best Management and Operations Practices (BMOP). The proposed cultivation is located a sufficient distance from legally established adjacent residential development sites, limiting odor from the proposed cultivation. Further, the security plan has been reviewed and meets criteria of the County Sheriff's office. In addition, the project is limited in scope, facility improvements, and number of employees. The project, as designed and conditioned, and the conditions under which it would be operated, will not be detrimental to the health, safety, or welfare of persons residing or working in the neighborhood or the general public. In addition, the use will not be materially injurious to properties or improvements in the vicinity. The project will not result in inefficient or wasteful use of energy.

Facility improvements will be limited to removal of several sheds and an extension of electrical power to a trailer parking area 150 ft. north of the residence. Conditions of Approval, including prohibiting camping and campfires on the property, requiring employee safety training, and maintaining defensible space around the residence, will ensure public health and safety. All improvements will comply with prevailing building technology, the California Building Code, and the County Building ordinance to ensure the optimum in safety and the conservation of energy and resources.

2. That the proposed location of the project and the conditions under which it would be operated or maintained will be consistent with all pertinent County ordinances and the purpose of the zone district in which the site is located.

This finding can be made, in that the proposed location of the cannabis cultivation use and the conditions under which it would be established and operated will be consistent with all pertinent County ordinances and the purpose of the A (Agriculture) zone district, and the proposed cannabis use meets all current site standards for the zone district and cannabis regulations.

3. That the proposed use is consistent with all elements of the County General Plan and with any specific plan which has been adopted for the area.

This finding can be made, in that the proposed cannabis cultivation use is consistent with the use and density requirements specified for the RM (Mountain Residential) land use designation in the

County General Plan. With the small scope of proposed project, security measures, as approved by the County Sheriff, and vegetation management and employee safety training, the proposed cultivation will be consistent with the General Plan policies to ensure public health and safety.

A specific plan has not been adopted for this portion of the County.

4. That the proposed use will not overload utilities, and will not generate more than the acceptable level of traffic on the streets in the vicinity.

Two full time employees (owners living on site) and five to ten seasonal employees are proposed. The expected level of traffic generated by the proposed project is not anticipated to be adversely impact existing roads or intersections in the surrounding area. Solar-powered motion sensor lighting is proposed for security lighting of the operational areas.

Thus, the proposed use will not overload utilities and will not generate more than the acceptable level of traffic on the streets in the vicinity.

5. That the proposed project will complement and harmonize with the existing and proposed land uses in the vicinity and will be compatible with the physical design aspects, land use intensities, and dwelling unit densities of the neighborhood.

This finding can be made, in that the site is located in a rural area of the county with mixed residential/agricultural uses and is located off a public roadway and accessed through a gated driveway. The limited access to the property, and invisibility of the cultivation site from East Zayante Road and neighboring properties, provides for neighborhood peace and public safety. The scope of the operation is limited to two (2) full time employees living on site and five to ten seasonal harvest employees and will not modify the primary residential use of the site and will complement the rural area.

6. The proposed development project is consistent with the Design Standards and Guidelines (sections 13.11.070 through 13.11.076), and any other applicable requirements of this chapter.

This finding can be made, in that the proposed use will be of an appropriate small scale and type of design that will not affect the aesthetic qualities of the surrounding properties and will not reduce or visually impact available open space in the surrounding area.

Conditions of Approval

I. This permit authorizes operation of a 20,000 square foot, Class A, outdoor cannabis cultivation facility in the A (Agriculture) zone district on a site with an existing single-family dwelling. The cultivation includes the temporary use of (2) 42-foot refrigerated semi trailers for secure harvest storage as indicated on Sheet A 11 of the approved Exhibit "D" for this permit. This approval does not confer legal status on any existing structure(s) or existing use(s) on the subject property that are not specifically authorized by this permit. Prior to exercising any rights granted by this permit including, without limitation, all construction or site disturbance, the applicant/owner shall:

A. Sign, date, and return to the Planning Department one copy of the approval to indicate acceptance and agreement with the conditions thereof.

B. Apply for a Class A Cultivation License from the Cannabis Licensing Office. Cannabis manufacture is not authorized in the use permit approval.

C. Obtain a Building Permit from the Santa Cruz County Building Official for:

1. Installation of electrical service to the temporary trailer parking area.

Note: Any outstanding balance due to the Planning Department must be paid prior to making a Building Permit application. Applications for Building Permits will not be accepted or processed while there is an outstanding balance due.

II. The applicant shall comply with the archeological report that has been reviewed and accepted by County staff on 4/29/2021 and comments A-B below.

A. Pursuant to Sections 16.40.040 of the County Code, if at any time during site preparation, excavation, or other ground disturbance associated with this development, any artifact or other evidence of an historic archaeological resource or a Native American cultural site is discovered, the responsible persons shall immediately cease and desist from all further site excavation and notify the Sheriff-Coroner if the discovery contains human remains, or the Planning Director if the discovery contains no human remains. The procedures established in Sections 16.40.040 shall be observed.

B. The building permit application shall include conditions A, above, and shall provide the contact information for the archaeologist of record.

III. Prior to issuance of an annual Cultivation License by the Cannabis Licensing Office:

A. Obtain a clearance for this cultivation project from the Environmental Health Services Department, including but not limited to:

1. Enroll for Coverage under Cannabis Cultivation General Order WQ 2019-001-DWQ. Contact (805) 594-6194 or http://www.waterboards.ca.gov/centralcoast/water_issues/programs/cannabis cultivation/intex.html

2. Confirmation of the use of portable toilets for seasonal (harvest) employees.

3. Payment of fees for previous work that was performed without benefit of permit. Contact Environmental Health staff, Heather Reynolds, 454-2748.

B. Meet all requirements and pay any applicable plan check fee of Zayante Fire..

C. The applicant shall apply for a Building Permit from the Planning Department for installation of the electrical service. The building permit must be "finaled" prior to use of the wheeled semi-trailers for secure harvest storage.

D. The applicant shall Obtain an Operator Identification Number (OIN) for pesticide application and meet all requirements of the County Agricultural Commissioner's Office.

E. Security cameras and data storage equipment must be implemented prior to beginning State-licensed cannabis operations as per the Security Plan. Exception: for cultivation of immature cannabis a single camera at the entry gate is required.

IV. Prior to issuance of a Building Permit (for installation of electrical power to the trailer parking and, if necessary, for security cameras and security lighting) the applicant/owner shall:

A. Submit final architectural plans for review and approval by the Planning Department. The final plans shall be in substantial compliance with the plans marked Exhibit "D" on file with the Planning Department. Any changes from the approved Exhibit "D" for this development permit on the plans submitted for the Building Permit must be clearly called out and labeled by standard architectural methods to indicate such changes. Any changes that are not properly called out and labeled will not be authorized by any Building Permit that is issued for the proposed development. The final plans shall include the following additional information:

1. A copy of the text of these conditions of approval incorporated into the full-size sheets of the architectural plan set.

2. A copy of the preliminary Best Management and Operational Practices Plan (BMOP) incorporated into the full-sized sheets of the architectural plan set.

3. Building plans shall exclude the security plan sheet, as this is confidential to the Sheriff's Office.

B. Meet all requirements of and pay drainage fees to the County Department of Public Works, Stormwater Management program. Drainage fees will be assessed on the net increase in impervious area. Project scope shall be limited to less than

500 square feet of new permanent impervious area due to the installation of the water storage tanks, equipment shed and proposed parking areas. As proposed, no additional impervious or semi-impervious surfacing (including expansion of baserock or paving of walkways or driveways or under canopy areas, trailer storage during the rainy season, or hoop house coverings during the rainy season) is permitted as part of this permit application.

Plans shall address the following prior to building permit/cannabis license issuance:

1. The final plans shall update the summary table 'impervious area information' on sheet A02 to remove the proposed 12,500 square feet of structure impervious areas to be consistent with the information provided on the other plan sheets (A05, A13 and A40).

2. The project shall specify on the final plans the annual documentation and removal of hoop house coverings and temporary trailers from the site between October 31st and April 15th of each year (the statement of "seasonal hoop house structures" is not sufficient).

C. Meet all requirements of the Agricultural Commissioner's Office, including updating operator certifications for the temporarily-licensed cultivation operation at the site if required.

D. Provide required off-street parking, including 2 spaces for the single family residence and an accessible/van space at the trailer parking site (as noted on Exhibit D, Sheet A11). Parking spaces must be 8.5 feet wide by 18 feet long. Parking must be clearly designated on the Site Plan.

V. All construction shall be performed according to the approved plans for the Building Permit. Prior to final building inspection, the applicant/owner must meet the following conditions:

A. All site improvements shown on the final approved Building Permit plans shall be installed.

B. All inspections required by the building permit shall be completed to the satisfaction of the County Building Official.

C. Pursuant to Sections 16.40.040 and 16.42.080 of the County Code, if at any time during site preparation, excavation, or other ground disturbance associated with this development, any artifact or other evidence of an historic archaeological resource or a Native American cultural site is discovered, the responsible persons shall immediately cease and desist from all further site excavation and notify the Sheriff-Coroner if the discovery contains human remains, or the Planning Director if the discovery contains no human remains. The procedures established in Sections 16.40.040 and 16.42.080, shall be observed.

VI, Operational Conditions

A. Prior to the first cannabis harvest, the Building Permit shall be finaled by the Building Official, including clearance of all agency holds.

B. The cultivation licensee shall maintain a valid state license, posted in a conspicuous location.

C. All conditions of approval of this approval and the Cannabis Licensing Official shall remain in effect.

D. All measures of the security plan as adopted by the Cannabis Licensing Office, per the Sheriff's Office, shall remain in effect.

E. The following security measures shall be maintained:

1. The security gate at the entry to the driveway shall be locked to control access to the property for the duration of all licensed cannabis operations (seasonal activities).

2. No advertising or signage is allowed that displays either in words or symbols the presence of cannabis on-site.

3. Each employee shall receive training regarding the site's security plan.

F. Hours of operation shall be limited to 7:00 a.m. and 7:00 p.m. seven days a week. Deliveries shall be limited to 7:00 a.m. and 7:00 p.m. seven days a week.

G. The cannabis cultivation operation shall adhere to the best management operational practices per the approved plans. Descriptions of the following operational practices must be attached to the Cannabis Cultivation License application: Herbivory prevention, water conservation, cannabis plant material and cannabis solid waste management, and cultivation site clean-up and restoration plan.

H. In the event that odor complaints are substantiated by the Monterey Bay Air Quality Control Board, the Licensing Official may reduce the canopy allowance associated with this use permit to minimize odor, as appropriate.

I. There will be no on-site retail sales of cannabis products and the premises shall not be open to the public.

J. This permit authorizes a maximum of one (2) cultivation licenses.

K. All employee vehicle parking, including full time, seasonal employees, and distribution and delivery parking associated with the operation shall be provided in designated parking areas, per approved plans.

L. No camping, un-permitted temporary generators, or campfires shall be permitted on site.

M. The Vegetation Management Plan, included in the approved plans, shall be maintained throughout operations to ensure public health and safety.

N. In the event that future County inspections of the subject property by the Cannabis Licensing Office or the Planning Department disclose noncompliance with any Conditions of this approval or any violation of the County Code, the owner shall pay to the County the full cost of such County inspections, including any follow-up inspections and/or necessary enforcement actions, up to and including use permit revocation.

VII. As a condition of this development approval, the holder of this development approval ("Development Approval Holder"), is required to defend, indemnify, and hold harmless the COUNTY, its officers, employees, and agents, from and against any claim (including attorneys' fees), against the COUNTY, it officers, employees, and agents to attack, set aside, void, or annul this development approval of the COUNTY or any subsequent amendment of this development approval which is requested by the Development Approval Holder.

A. COUNTY shall promptly notify the Development Approval Holder of any claim, action, or proceeding against which the COUNTY seeks to be defended, indemnified, or held harmless. COUNTY shall cooperate fully in such defense. If COUNTY fails to notify the Development Approval Holder within sixty (60) days of any such claim, action, or proceeding, or fails to cooperate fully in the defense thereof, the Development Approval Holder shall not thereafter be responsible to defend, indemnify, or hold harmless the COUNTY if such failure to notify or cooperate was significantly prejudicial to the Development Approval Holder.

B. Nothing contained herein shall prohibit the COUNTY from participating in the defense of any claim, action, or proceeding if both of the following occur:

1. COUNTY bears its own attorney's fees and costs; and

2. COUNTY defends the action in good faith.

C. Settlement. The Development Approval Holder shall not be required to pay or perform any settlement unless such Development Approval Holder has approved the settlement. When representing the County, the Development Approval Holder shall not enter into any stipulation or settlement modifying or affecting the interpretation or validity of any of the terms or conditions of the development approval without the prior written consent of the County.

D. Successors Bound. "Development Approval Holder" shall include the applicant and the successor'(s) in interest, transferee(s), and assign(s) of the applicant.

Minor variations to this permit which do not affect the overall concept or density may be approved by the Planning Director at the request of the applicant or staff in accordance with Chapter 18.10 of the County Code.

EXHIBIT C

Application #:211083
APN: 091-161-31
Owner: Masood Madani

Please note: This permit expires three years from the effective date listed below unless a building permit (or permits) and cannabis license(s) are obtained for the primary structure and cannabis use described in the development permit (does not include demolition, temporary power pole or other site preparation permits, or accessory structures unless these are the primary subject of the development permit). Failure to exercise the building permit and to complete all of the construction under the building permit, resulting in the expiration of the building permit, and to obtain the cannabis license, will void the development permit, unless there are special circumstances as determined by the Planning Director and Cannabis Licensing Official.

Approval Date:

Effective Date:

Expiration date:

EXHIBIT C

Application #:211083
APN: 091-161-31
Owner: Masood Madani

Parcel Information

Services Information

Urban/Rural Services Line:	__ Inside _x_ Outside
Water Supply:	Well
Sewage Disposal:	Septic
Fire District:	Zayante Fire
Drainage District:	N/A

Parcel Information

Parcel Size:	31.5 acres
Existing Land Use - Parcel:	Agriculture (vineyard), residential
Existing Land Use - Surrounding:	Agriculture & residential
Project Access:	Old Mount Rd. (private)
Planning Area:	Skyline
Land Use Designation:	R-M (Mountain Residential)
Zone District:	A (Agriculture)
Coastal Zone:	__ Inside _x_ Outside
Appealable to Calif. Coastal Comm.	__ Yes _x_ No

Technical Reviews: None.

Environmental Information

Geologic Hazards:	n/a
Fire Hazard:	n/a
Slopes:	0-15 percent
Env. Sen. Habitat:	Not mapped/no physical evidence on site
Grading:	No grading required
Tree Removal:	No trees proposed to be removed
Scenic:	Not a mapped resource
Archeology:	Mapped, An archaeological report was prepared for this proposal.

EXHIBIT F

EXHIBIT G

AUSTRALIAN WINE RESEARCH INSTITUTE

"EUCALYPTUS CHARACTER IN WINE"

The Australian Wine Research Institute

Fact Sheet
WINEMAKING

Eucalyptus character in wine

Introduction

While native to Australia, *Eucalyptus* trees are now grown throughout the world. Most species of *Eucalyptus* trees contain essential oils in their leaves and, depending on the species, the main component of the oil is a volatile compound called 1,8-cineole, commonly known as eucalyptol. This compound is found above sensory detection thresholds in some red wines, where it is responsible for characters described as 'eucalypt', 'camphor', and 'minty'. For some winemakers these characters are a selling point and their red wines are known for their 'eucalypt' sensory properties. For others, however, 'eucalypt' characters are something they prefer to avoid, or at the very least limit through effective management strategies. The AWRI's research on 'eucalypt' character in wine has focused on understanding the source of the character and providing options for winemakers to be able to control it.

What are the key outcomes from the AWRI's research into 'eucalypt' character?

- While 1,8-cineole has been found in wines made from grapes grown with no *Eucalyptus* trees nearby, the AWRI's research showed that only negligible levels are found in wine from grape-derived sources. *Eucalyptus* trees growing close to vineyards are the primary source of the flavour in wine. Grapes harvested from rows greater than 25 or 50 m from *Eucalyptus* trees gave wines with very low levels of 1,8-cineole whilst those grown close to the trees contained significant amounts of 1,8-cineole. The research also found that the compound is found in the skin of the berry, and is extracted during fermentation on skins, with white wines generally having negligible amounts.

- 1,8-cineole is stable in a wine over time, and the compound is not significantly absorbed by closures.
- Consumer response to eucalypt flavour in red wines was assessed. Results showed that even at very low levels, most consumers reacted to the flavour, and interestingly more consumers liked wines with the 'minty' flavour than those who didn't.
- Further work showed that absorption of the compound by grape berries, while important, is much less a factor than the presence of *Eucalyptus* leaves or bark in harvested grapes. Machine harvesting of the rows closest to *Eucalyptus* trees will more than likely produce bins of grapes with numerous *Eucalyptus* leaves, and these have a very large effect on levels of 1,8-cineole in wine. Even hand harvesting of grapes can result in a surprising number of *Eucalyptus* leaves in the picking bins. Unexpectedly, grape leaves or grape stems were also a major source of the compound.
- No translocation of 1,8-cineole compound was observed from the soil to the grape berries or from the grape leaves to the berries.
- The main take-home message from the research is that avoiding material other than grapes (MOG) in picking bins, especially *Eucalyptus* leaves, will dramatically reduce the level of 'eucalypt' flavour in wine.

What are some options to manage the 'Eucalypt' character in wine?

- Harvested fruit grown closest to *Eucalyptus* trees could be fermented separately from the rest of the vineyard and blended with other wine as desired.
- Removing by hand any *Eucalyptus* leaves or woody material from the vines prior to harvest would minimise the quantity ending up in a machine harvester bin. Hand harvesting with attention to avoiding *Eucalyptus* leaves in those rows close to trees might also be an

alternative. A somewhat more expensive option would be the use of sorting tables to remove MOG from the harvest.

- Altering machine harvester settings for rows closest to trees should be a straightforward strategy so that less non-grape material is collected.

Can other species of trees affect wine flavour?

The AWRI will continue to work with wine producers to assist them with management strategies to control the 'minty'/'eucalypt' compound 1,8-cineole in wine. Other local vegetation, including trees planted as windbreaks, can also impart flavour to grapes and wine, with recent work indicating Monterey Cypress can give a pine-like flavour to wine, while she-oaks were suggested to have a negligible effect

Acknowledgement

This work was supported by Australia's grapegrowers and winemakers through their investment body Wine Australia, with matching funds from the Australian Government. The AWRI is a member of the Wine Innovation Cluster.

References and further reading

Eucalyptol information pack - https://www.awri.com.au/information_services/information-packs/information-pack-eucalyptol/

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Capone, D., Bey, L., Barker, A., Nandorfy, D.E., Williamson, P., Solomon, M., Francis, L. 2017. Trees and vines: can different types of local vegetation contribute to wine flavour? *AWRI Tech. Rev.* 229: 7-10. Available at: https://www.awri.com.au/wp-content/uploads/2011/07/Technical_Review_Issue_229_Capone.pdf

Contact

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Dr Leigh Francis

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Website www.awri.com.au

Address Wine Innovation Central Building, Corner of Hartley Grove & Paratoo Rd, Urrbrae (Adelaide), SA 5064

375 Old Mount Road

Industrial Hemp License

COUNTY OF SANTA CRUZ

OFFICE OF THE AGRICULTURAL COMMISSIONER
175 Westridge Drive, Watsonville, CA 95076
(831) 763-8080 Fax: (831) 763-8255
JUAN HIDALGO, AGRICULTURAL COMMISSIONER

Masood Madani
Green Coast, LLC.
325 Sunnycroft Rd.
Ben Lomond,CA 95005

Thank you for registering to cultivate industrial hemp. Your registration for industrial hemp cultivation is valid from **5/23/2022 through 5/22/2023**. Your registration number may be found in the upper right-hand corner of the Proof of Registration for Industrial Hemp Cultivation attached below.

If you have any questions regarding your registration, please contact the number listed above.

Santa Cruz County
Office of the Agricultural Commissioner
175 Westridge Drive
Watsonville, CA 95076
(831) 763-8080

Registration Number:
06_442219G

Registration Expires:
5/22/2023

PROOF OF REGISTRATION FOR INDUSTRIAL HEMP CULTIVATION

Masood Madani
Green Coast, LLC.
325 Sunnycroft Rd.
Ben Lomond,CA 95005

Juan Hidalgo
Agricultural Commissioner