Industrial Cannabis Cultivation Wastewater Characterization Study 2023

Introduction

This report summarizes the results of a wastewater characterization study (study) undertaken by the Water Board's Eastern California Cannabis Regulatory Unit (Cannabis Unit) at regulated industrial cannabis cultivation facilities in the southern Lahontan and northwestern Colorado River Basin Regions. Industrial cannabis wastewater generally consists of irrigation runoff, residues from filtration processes such as reverse osmosis (RO) used to treat influent or recycled water, runoff from decontamination processes, and any other waste liquids generated during industrial cultivation processes. Cannabis wastewater does not include domestic wastewater generated by cultivation facility staff. Domestic wastewater is routed separately to a community sewer system for treatment or an onsite wastewater treatment system (e.g., septic system).

Background and Study Objectives

At present, cannabis cultivators enrolled under the *General Waste Discharge Requirements and Waiver of Waste Discharge Requirements for Discharges of Waste Associated with Cannabis Cultivation Activities* (General Order) are not required to characterize the industrial wastewater generated during cultivation activities. To comply with the General Order, cultivators must either discharge industrial wastewater directly to a community sewer system that accepts cannabis wastewater or, if the local community sewer system does not accept cannabis wastewater, the cultivator must store and haul industrial wastewater to a permitted wastewater treatment facility that accepts that waste type.

When the State of California legalized cannabis cultivation in 2018 it deferred to county and city administrators to decide if cannabis cultivation facilities could operate in their jurisdictions. The result of this approach is a heterogeneous distribution of cultivation facilities in the portions of eastern California where the Cannabis Unit operates. Some jurisdictions have decided to allow cultivation, some have banned cultivation all together, and in some cases, such as San Bernardino or Kern Counties, there is intra-jurisdictional variation where cultivation is banned in unincorporated county areas but allowed in specific cities.

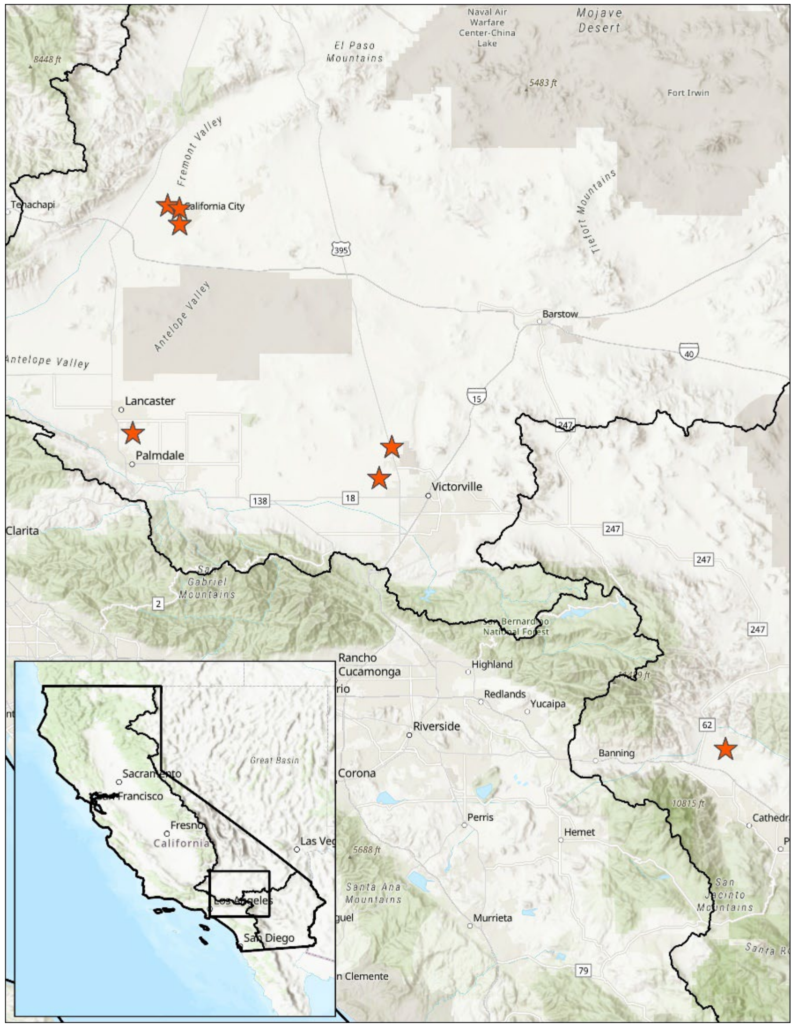
In several jurisdictions where cannabis cultivation is allowed, the local community sewer systems do not accept industrial cannabis wastewater, meaning that cannabis cultivators operating in those areas must store and haul cannabis wastewater to a permitted wastewater treatment facility for disposal. Community sewer systems which have chosen not to accept cannabis wastewater have done so because of the potential impacts to the ability of their wastewater treatment systems to meet effluent discharge limits for certain wastewater constituents such as nitrogen and total dissolved solids. In general, there is a lack of data characterizing industrial cannabis wastewater and many community sewer systems are unwilling to risk negative impacts to wastewater treatment system operations by accepting this waste type.

For cannabis cultivators operating where community sewer disposal is banned, tanking and hauling industrial cannabis wastewater incurs extra operating costs and presents another task that must be completed, both of which disincentivize the proper disposal of cannabis wastewater. Cannabis Unit staff have documented numerous instances of improper disposal of cannabis wastewater at permitted facilities, such as to septic tanks, deposited directly to land, used for facility landscaping irrigation, or discharged directly into irrigation ditches and ephemeral surface waters. Unauthorized discharges of cannabis cultivation wastewaters impact surface and groundwater quality and may result in impairment of Beneficial Uses.

The objective of this Wastewater Characterization Study is to generate data about the characteristics of industrial cannabis wastewater. These data may be useful to community sewer systems who are considering accepting cannabis wastewater or who are developing industrial pre-treatment programs for cannabis facilities and may also be useful to inform updates to community sewer system monitoring protocols. In the future, data from this study may be useful to update the General Order and could be helpful during evaluations of Reports of Waste Discharge (ROWD) submitted for the Small Industrial Wastewater General Order. Data and information generated by this study could also be useful to determine potential threats to water quality from cultivation facility discharge violations.

Study Overview

Study samples were collected at seven indoor cannabis cultivation facilities located in California City (three facilities), Adelanto (two facilities), Lancaster (one facility), and Desert Hot Springs (one facility). Map 1 depicts the location of the facilities. Six of the facilities located in California City, Adelanto, and Lancaster, were pre-selected because of their classification as “waste haulers” under the General Order. Samples from these facilities were collected by Cannabis Unit staff from wastewater holding tanks. The facility in Desert Hot Springs was sampled by Cannabis Unit staff during a permit compliance inspection in response to a complaint. Samples at this facility were collected from a wastewater holding tank.



Map 1: Location of facilities sampled for study. Inset maps shows location of sample area within the Lahontan and Colorado Water Boards jurisdiction.

Description of Cultivation Facilities

A summary of each facility is listed below in *Table 1: Facility Information*. Facilities vary by size, type of cultivation practice, quantity of wastewater produced, and source of wastewater produced (i.e. irrigation runoff [IR], decontamination runoff [DR], RO filtration residue [RO], etc.). Images of the wastewater holding tanks at each facility sampled are shown in *Table 2: Sampling Locations.*

Table 1: Facility Information

SITE NAME (location)	Department of Cannabis Control License Type	Wastewater Source	Wastewater Quantity Generated (gal/month)	Holding Tank Size (gal)	Frequency of Wastewater collection
St George Enterprise (Adelanto)	Specialty indoor – 501 to 5,000 square feet of canopy	IR, DR, RO[1]	25 (estimated)	250	Unknown. This facility recently became operational at time of sampling.
RBG Services (Adelanto)	Small indoor – 5,001 to 10,000 square feet of canopy	IR, DR, RO[1]	none	1000	Never, wastewater is treated using an RO system and reused for cultivation.
Greensky Organics (California City)	Small mixed-light Tier 1 and Tier 2 – 5,001 to 10,000 square feet of canopy	IR, DR	50	500	1-2 times/year
El Patron (California City)	Specialty indoor – 501 to 5,000 square feet of canopy	IR	2-5 (estimated)	55	1-2 times/year
Regal Green (California City)	Multiple 17,501-35,000 square feet of canopy	IR, DR, RO[2]	1250	1500	Monthly
Canndescent[3] (Desert Hot Springs)	Medium Mixed-Light Tier 2 - 10,001 to 22,000 square feet of canopy	IR, DR, RO	Not provided	1000	Unknown
The Desert Seven (Lancaster)	Small indoor – 5,001 to 10,000 square feet of canopy	IR, DR, RO	5000 gallon/month	10,000	Every 2 months

Table Notes:

1. St George Enterprise and RBG Services- RO filtration residue is generated onsite but is discharged to sewer.
2. Regal Green- RO filtration residue is generated onsite but is collected in a separate tank and was not included in the sample.
3. Canndescent- Samples collected during a complaint inspection, the facility is not currently hauling wastewater.

Table Abbreviations:

DR-Decontamination Runoff
gal-gallons
IR-Irrigation Runoff
RO-Reverse Osmosis filtration residue

Table 2: Sampling Locations

	
St. George Enterprises – 250-gallon above ground tank	RBG Services – 1,000-gallon underground tank

Greensky Organics – 500-gallon underground tank


The Desert Seven - 10,000-gallon above ground tank

El Patron - 55-gallon drum


Regal Green Remedies – 1,500-gallon underground tank

Sampling Methodology

Sampling at California City, Lancaster, and Adelanto was conducted on May 16, 2023. The facility in Desert Hot Springs was sampled on August 8, 2023. Samples were collected in accordance with the *Standard Operating Procedures – Cannabis Wastewater Sample Collection (2020) and the Surface Water Ambient Monitoring Program (SWAMP) Quality Assurance Program Plan v1.3 (QAPrP)*. Samples were priority shipped on ice to Babcock Laboratories, Inc in Riverside, California under chain-of-custody procedures for processing and analysis. Analytes are shown below in Table 3: Analyte List.

Table 3: Analyte List

Analyte Group	Analyte
Anions	• Bicarbonate • Chloride • Fluoride • Nitrate as N • Sulfate • Total Alkalinity
Organic	• Biochemical Oxygen Demand (BOD)
Metals (total)	• Antimony • Arsenic • Barium • Beryllium • Cadmium • Cobalt • Copper • Lead • Manganese • Mercury • Molybdenum • Nickel • Selenium • Silver • Total Chromium • Thallium • Vanadium • Zinc
Nutrients	• Ammonia-Nitrogen • Nitrite as N • Total Kjeldahl Nitrogen • Total Nitrogen • Total Phosphorus
Solids	• Total Dissolved Solids (TDS) • Total Suspended Solids (TSS)

Results

Analyte concentrations varied across the facilities tested. *Table 4: Sampling Results*, below, is a comprehensive list of sampling results. The analytical laboratory reports are included in Appendix A.

Table 4: Sampling Results

Analyte	Unit	The Desert Seven	El Patron	Green Sky Organics	Candescent	RBG Services	Regal Green Remedies	St. George Enterprises
Anions								
Bicarbonate	mg/L	150	200	240	160	ND	260	180
Chloride	mg/L	11	430	140	15	0.61	170	33
Fluoride	mg/L	0.6	1.2	1.6	0.5	ND	1.6	1.1
Nitrate as N	mg/L	22	200	30	49	ND	48	17
Sulfate	mg/L	180	1100	180	340	0.51	320	170
Total Alkalinity	mg/L	150	200	240	160	ND	260	180
Organic								
BOD	mg/L	ND	24	ND	97	91	40	ND
Metals (total)								
Antimony	ug/L	ND	ND	ND	ND	ND	ND	ND
Arsenic	ug/L	7.5	31	13	Not analyzed	ND	14	5.6
Barium	ug/L	25	ND	11	Not analyzed	ND	180	21
Beryllium	ug/L	ND	ND	ND	Not analyzed	ND	ND	ND
Cadmium	ug/L	ND	1.4	ND	Not analyzed	ND	0.3	ND
Cobalt	ug/L	0.42	12	ND	Not analyzed	ND	1.3	3.2
Copper	ug/L	130	690	4.7	Not analyzed	34	370	84
Lead	ug/L	ND	3.6	ND	Not analyzed	ND	7.8	ND
Manganese	ug/L	200	1300	19	Not analyzed	ND	660	87
Mercury	ug/L	ND	ND	ND	Not analyzed	ND	ND	ND
Molybdenum	ug/L	35	390	250	Not analyzed	ND	220	13
Nickel	ug/L	5.3	44	ND	Not analyzed	ND	ND	32
Selenium	ug/L	ND	3.1	ND	Not analyzed	ND	ND	ND
Silver	ug/L	ND	ND	ND	Not analyzed	ND	ND	ND
Thallium	ug/L	ND	ND	ND	Not analyzed	ND	ND	ND
Chromium	ug/L	19	5.2	4	Not analyzed	ND	70	4.7
Vanadium	ug/L	46	15	25	Not analyzed	ND	100	17
Zinc	ug/L	420	1600	69	Not analyzed	46	3000	220

Analyte	Unit	The Desert Seven	El Patron	Green Sky Organics	Candescent	RBG Services	Regal Green Remedies	St. George Enterprises
Nutrients								
Ammonia-Nitrogen	mg/L	1.1	6	0.07	2.2	0.6	2.8	0.6
Nitrite as N	mg/L	0.6	3	0.84	0.38	0.18	2.3	1.8
Total Kjeldahl Nitrogen (TKN)	mg/L	1.5	29	ND	6.5	0.7	9.2	2.3
Total Nitrogen	mg/L	24	230	31	56	0.87	60	21
Total Phosphorus	mg/L	19	150	41	34	ND	33	45
Solids								
TDS	mg/L	640	4600	1100	1100	10	1400	820
TSS	mg/L	21	3	0.9	Not analyzed	ND	360	11

Table Abbreviations:

ND - not detected at or above the analytical reporting limit

mg/L - milligram per liter

ug/L- microgram per liter

Not analyzed – Sample was not analyzed for analyte

Wastewater Composition Comparison

Results from this study were compared to the typical composition of untreated domestic wastewater. The purpose of the comparison is to understand how cannabis cultivation wastewater differs from untreated wastewater that treatment plants would typically receive. The typical concentrations found in untreated domestic wastewater come from Metcalf and Eddy's *Wastewater Engineering, Treatment and Resource Recovery* (5th Edition) and are based on wastewater flow rates in gallons per capita per day (gpcd).

There are three categories for typical wastewater concentration values: high-strength, medium-strength, and low-strength. The high-strength wastewater concentrations are based on wastewater flow rates of 50 gpcd, generally classed as low-flow. Medium strength and low strength wastewater concentrations are based on higher flow rates with correspondingly higher dilution rates of 100 gpcd and 150 gpcd, respectively. In this study, estimated wastewater flow rates were determined by averaging per capita water use data from 2021-2022 of the four cities where samples were collected, California City, Adelanto, Desert Hot Springs, and Lancaster, and applying a wastewater return factor of 0.80. Estimated wastewater flow rates ranged between 107 gpcd and 168 gpcd, falling between the categories of low-strength (150 gpcd) and medium-strength (100 gpcd) concentrations. Comparison with medium- and low-strength thresholds were therefore appropriate for this study because flowrates into the municipal wastewater treatment plants are within the flow rates for these thresholds.

In addition, high-strength wastewater concentrations were also included for comparison for some constituents that are expected to be highly concentrated in cannabis wastewater, such as total dissolved solids (TDS), nitrogen, phosphorus, sulfate, and chloride. Table 5 compares the cannabis wastewater concentrations detected in samples collected during this study to typical low-, medium-, and high-strength untreated domestic wastewater concentrations.

Table 5. Wastewater concentrations for typical constituents and results comparison

Constituent	Unit	Typical Untreated Domestic Wastewater Concentrations[1]			Cannabis Wastewater Concentrations		
		Low Strength 50 gpcd	Medium Strength 100 gpcd	High Strength 150 gpcd	Range	Mean	Median
BOD	mg/L	133	200	400	ND-97	38	24
TDS	mg/L	374	560	1121	10-4600	1381	1100
TSS	mg/L	130	195	389	ND-360	66	7
Total Solids (TSS + TDS)	mg/L	537	806	1612	10-4603	1494	966
Total Nitrogen	mg/L	23	35	69	0.87-230	60	31
Total Phosphorus	mg/L	3.7	5.6	11	ND-150	46	34
Chloride	mg/L	11	16	118	0.61-430	114	33
Sulfate	mg/L	39	59	72	0.51-1100	327	180

Table Notes:

1. Data from Metcalf and Eddy's *Wastewater Engineering, Treatment and Resource Recovery* (5th Edition)

Table Abbreviations:

gpcd - gallons per capita per day

mg/L – milligrams per liter

The average concentrations for most constituents exceed typical low- and medium-strength untreated domestic wastewater concentrations, except for BOD and TSS. However, there is a wide range of results at the facilities, with some facilities below and some above the typical low- and medium-strength concentrations, as illustrated in the bar charts for each analyte below.

<u>Total Nitrogen</u>

Nitrogen is an essential macronutrient for cannabis plants and fertilizers containing nitrogen are widely used in cannabis cultivation practices. Total Nitrogen concentrations ranged from 0.87 mg/L to 230 mg/L. Figure 1 shows the total nitrogen concentrations detected at each facility.

The facility with the highest total nitrogen concentration was El Patron who collects irrigation runoff in a 55-gallon drum. El Patron is a small cultivation facility which does not generate large volumes of cultivation runoff, meaning wastewater accumulates in the drum over several months and the wastewater is infrequently hauled offsite for disposal. A slow rate of accumulation could increase the concentrations of nutrients in the wastewater as evaporation concentrates the liquids in the drum.

Total nitrogen was detected at very low levels, 0.87 mg/L, in the wastewater generated by RBG Services. The facility fully recycles their irrigation runoff by filtering through an RO system and mixing it with fresh influent water which has also filtered through an RO system, which likely dilutes total nitrogen concentrations. The four remaining facilities had concentrations of total nitrogen ranging from 21 to 60 mg/L, all of which are below 69 mg/L, the typical high strength nitrogen concentration in domestic wastewater.

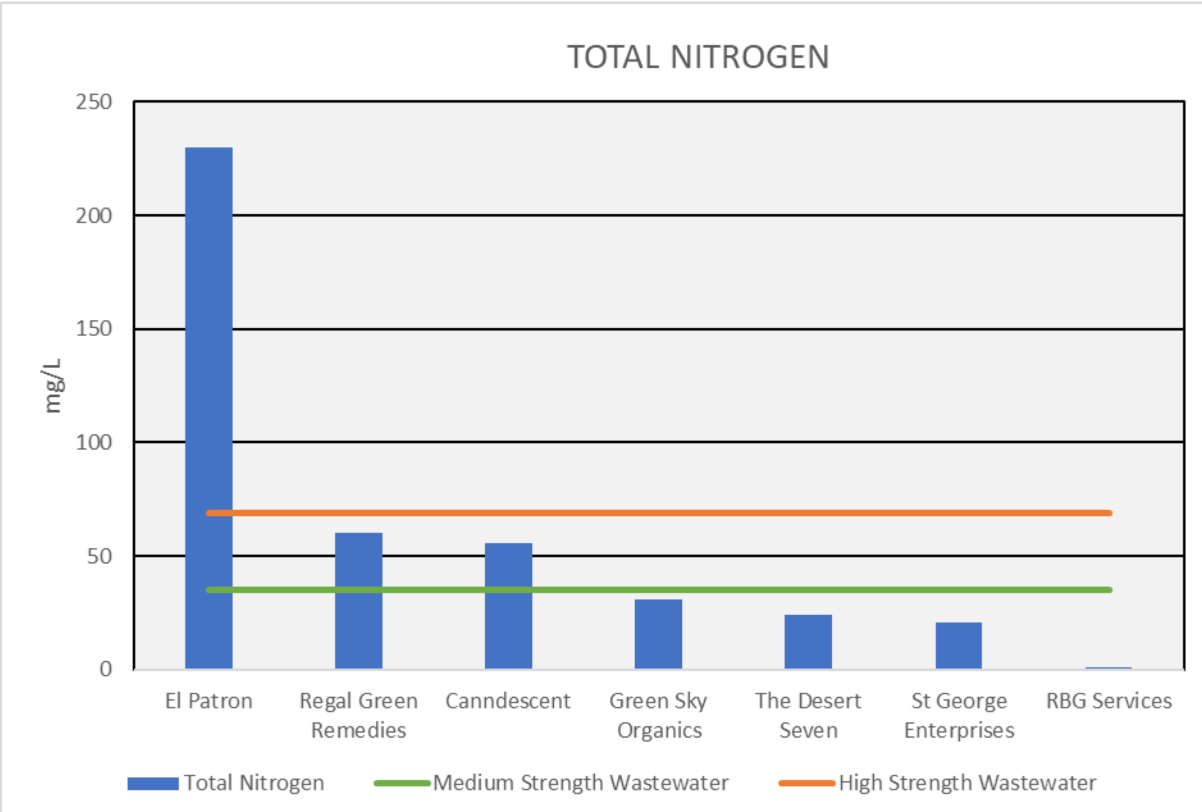


Figure 1: Total nitrogen measured in cannabis wastewater compared to total nitrogen concentrations in typical untreated domestic wastewater.

<u>Phosphorus</u>

Phosphorus is also an essential macronutrient for cannabis plants and fertilizers containing phosphorus are widely used in cannabis cultivation practices. Total phosphorus levels followed a similar trend to nitrogen with the highest concentration of 150 mg/L detected at El Patron, and the lowest concentration (not detected at or above the reporting limit [ND]) detected at RBG Services. Figure 2 shows the concentrations of phosphorus detected at each facility. Six of the seven facilities exceeded 11 mg/L, the typical phosphorus concentration in high strength domestic wastewater. The results from this study indicate that phosphorus is another pollutant of concern in cannabis wastewater.

While total nitrogen and phosphorus exceed the thresholds for typical wastewater, the El Patron facility skewed the average concentration for both parameters. The highest concentrations of total nitrogen and total phosphorus (230 mg/L and 150 mg/L, respectively) were detected in cannabis wastewater generated at El Patron, indicating higher use of fertilizer application and/or a longer retention period for wastewater storage at this facility when compared to other facilities sampled for this study.

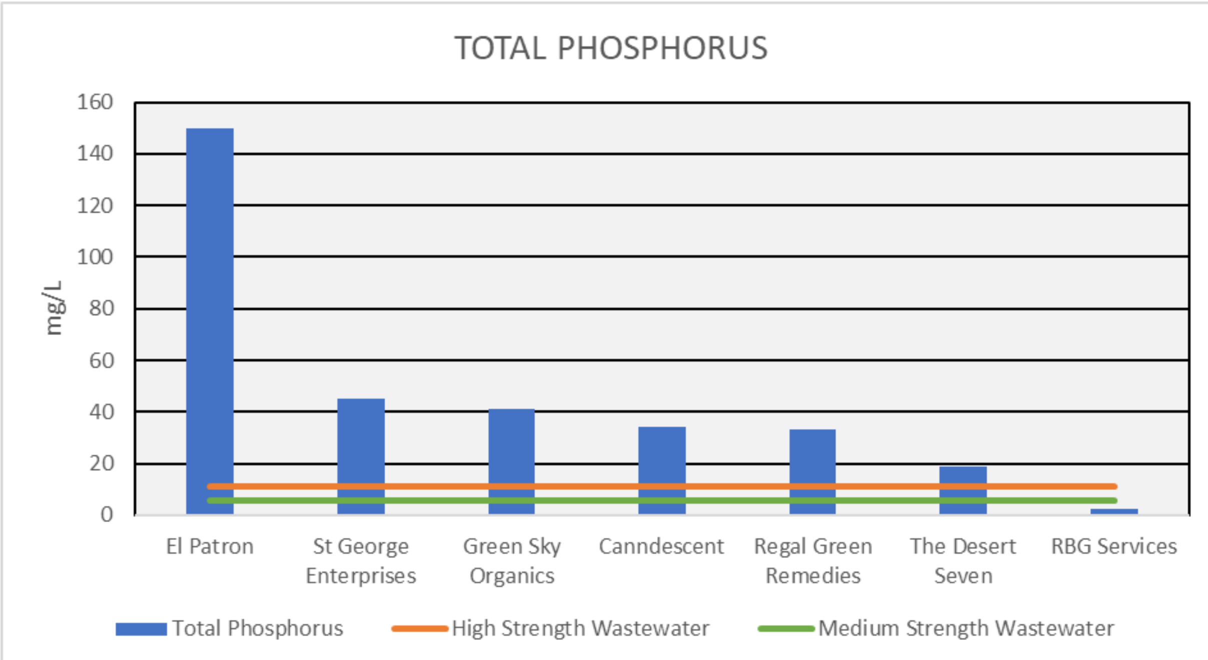


Figure 2: Total phosphorus concentrations measured in cannabis wastewater compared to total phosphorus concentrations in typical untreated domestic wastewater.

<u>Total Dissolved Solids (TDS)</u>

TDS measures the total concentration of dissolved organic and inorganic substances such as salts, minerals, and metals. TDS were detected at concentrations between 10 mg/L and 4,600 mg/L, with the highest concentration detected at El Patron and lowest concentration detected at RBG Services. However, cannabis wastewater may contain elevated concentrations of TDS from RO filtration residue, fertilizers, and influent source water. Figure 3 shows the concentrations of TDS detected at each facility. Six of the seven facilities exceeded the typical medium strength TDS concentration of 560 mg/L while only 2 facilities exceeded the typical high strength TDS concentration of 1,121 mg/L. TDS may be a constituent of concern at cannabis facilities, but concentrations in this study are variable.

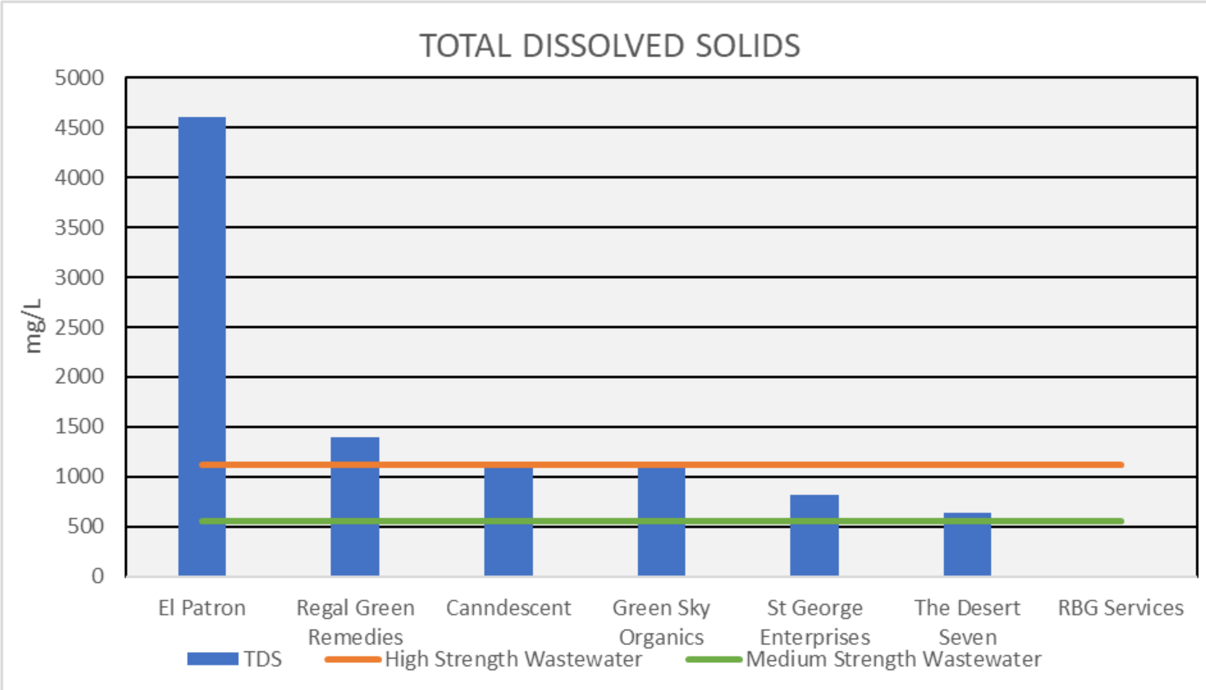


Figure 3: TDS concentrations measured in cannabis wastewater compared to TDS concentrations in typical untreated domestic wastewater.

<u>Total Suspended Solids (TSS)</u>

TSS measures the total concentration of organic and inorganic matter floating in water and affecting water clarity. TSS was detected at concentrations ranging from ND to 360 mg/L. The highest concentration was detected at Regal Green Remedies (360 mg/L), and the lowest concentrations, ND, at El Patron, Green Sky Organics, and RBG Services. Figure 4 shows the concentrations of TSS detected at each facility.

Distributions for TSS are below the medium and low strength wastewater thresholds, except for Regal Green Remedies which approaches typical TSS concentrations found in high strength wastewater. Cannabis cultivation wastewater generally does not include significant volumes of settleable and suspended solids, which likely explains the low TSS concentrations at most of the target facilities. Elevated TSS concentrations at Regal Green Remedies suggest that some form of solid material is being washed into the wastewater tank together with irrigation and cultivation process water.

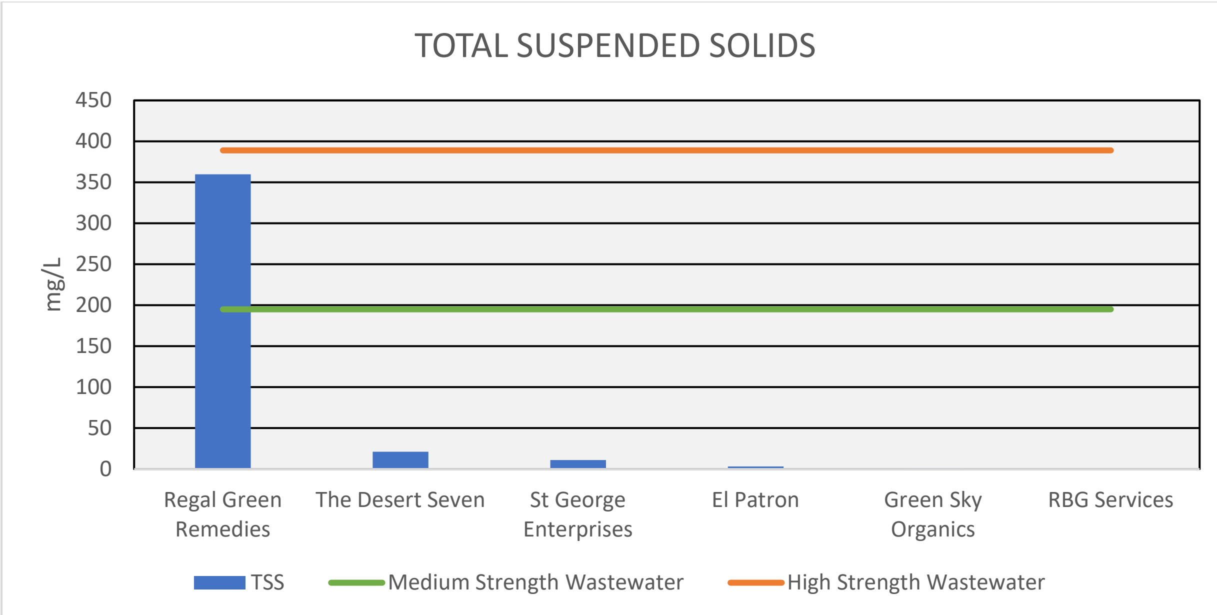


Figure 4: TSS concentrations measured in cannabis wastewater compared to TSS concentrations in typical untreated domestic wastewater.

<u>Chloride and Sulfate</u>

Chlorine and sulfur are essential nutrients for plant growth. Chloride and sulfate in cannabis wastewater likely originates from fertilizer application and RO filtration residue. Three of the seven facilities exceeded the typical high strength chloride concentration of 118 mg/L. Six of the seven facilities exceeded the typical high strength sulfate concentration of 72 mg/L indicating sulfate is a constituent of concern in cannabis wastewater. Figures 5 and 6 show the concentrations of chloride and sulfate detected at each facility.

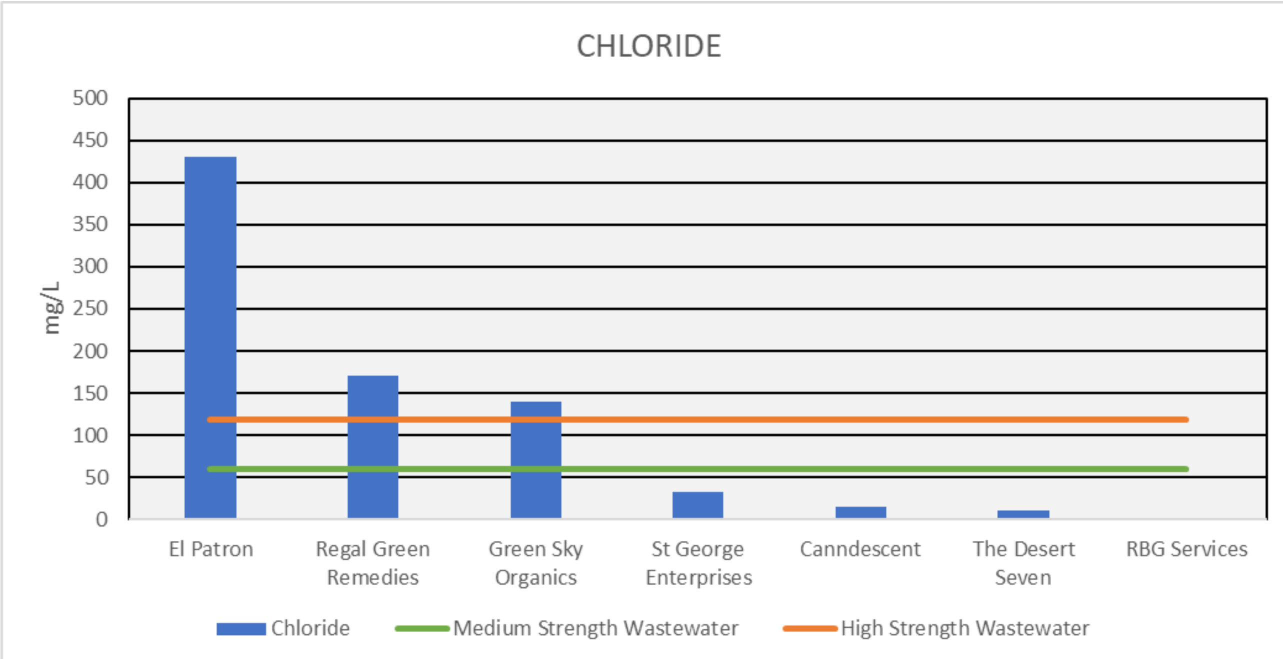


Figure 5: Chloride concentrations measured in cannabis wastewater compared to chloride concentrations in typical untreated domestic wastewater.

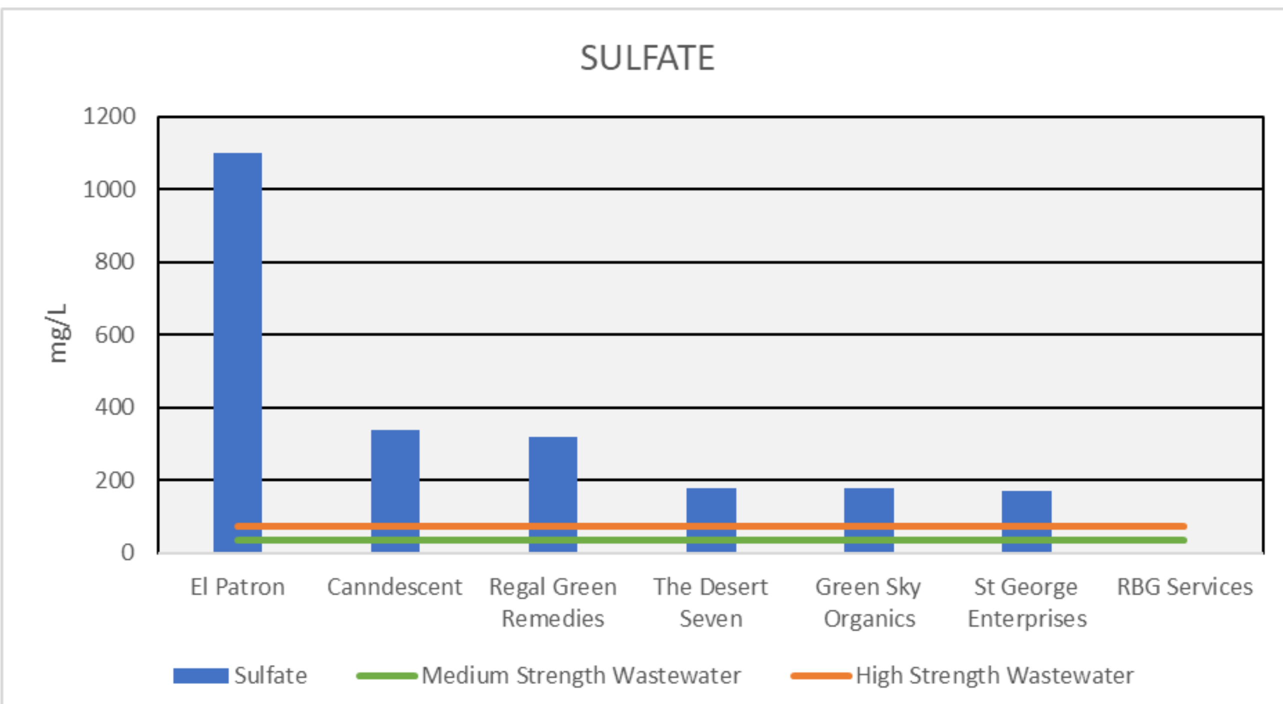


Figure 6: Sulfate concentrations measured in cannabis wastewater compared to sulfate concentrations in typical untreated domestic wastewater.

Biochemical Oxygen Demand (BOD)

BOD is an indicator of organic pollution in wastewater. The standard 5-day BOD test measures the rate at which dissolved oxygen declines during the biochemical oxidation of organic matter, and the measurement is used to determine the volume of oxygen required to biologically stabilize organic pollutants. BOD was included in this study to help characterize the strength of organic pollution coming from cannabis cultivation facilities. In general, lower volumes of organic matter are easier to treat, reducing impacts to wastewater treatment plant operations.

BOD was measured between ND and 97 mg/L. The two highest concentrations were at RBG Services (90 mg/L) and Canndescent (97 mg/L), and at three facilities (The Desert Seven, St George Enterprises, and Green Sky Organics) BOD was ND. All facilities sampled for this study were below typical low strength BOD concentrations found in domestic wastewater. Results suggests either that industrial cannabis wastewater generally does not contain large volumes of organic matter, or that organic matter in the wastewater holding tanks may have settled to the bottom and was not collected during sampling. Figure 7 shows the concentrations of BOD at each facility.

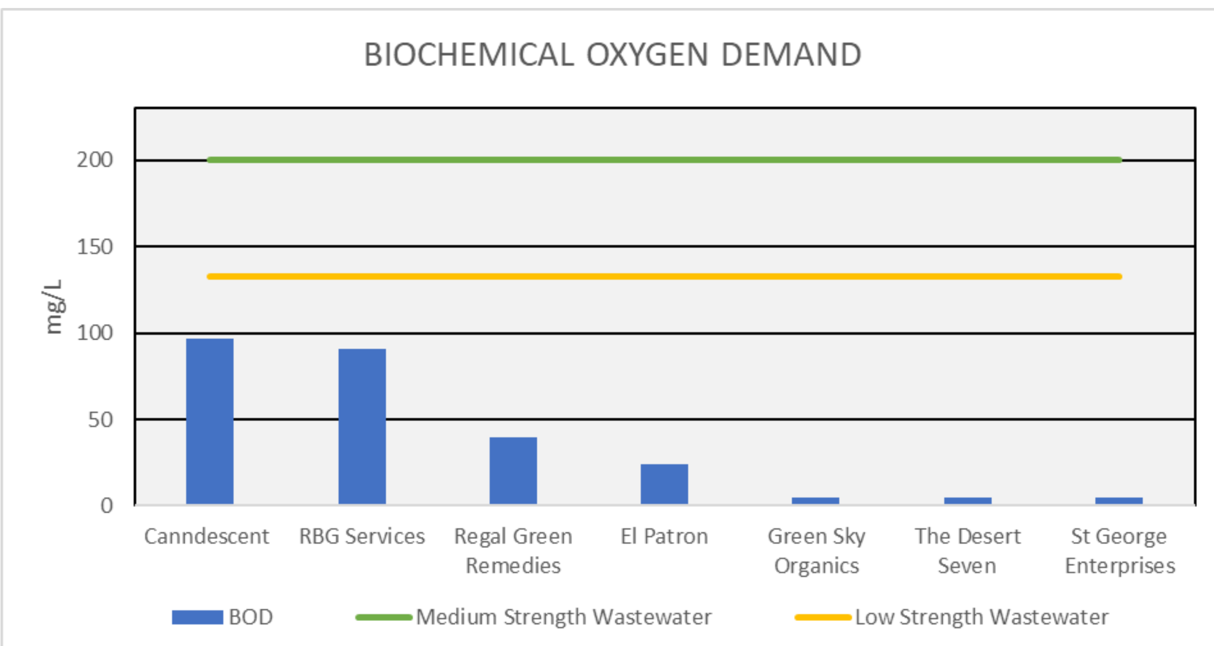


Figure 7: BOD measured in cannabis wastewater compared to BOD concentrations in typical untreated domestic wastewater.

Discussion

Overall, sampling results varied greatly by facility and there are many variables that may have influenced the measured concentrations. The discussion below examines some of the variables that most likely account for the variation in results.

Nutrients, metals, and solids concentrations from El Patron were consistently amongst the highest concentrations while results from RBG Services were consistently amongst the lowest, which is likely explained by differences in each facility's size, investment in water filtration and water recycling systems, and cultivation procedures. El Patron is one of the smallest facilities that participated in this study. The facility also has the smallest wastewater collection tank (55-gallon drum), and wastewater is comprised of irrigation runoff and decontamination runoff. The 55-gallon drum is not filled frequently due to the low volumes of wastewater generated at the facility, and wastewater remains in the drum for several weeks or months before it is removed for disposal. Wastewater in the tank may be subject to evaporation which concentrates the wastewater. Additionally, at the time of sampling El Patron had only been in business for several harvests and was still refining their cultivation procedures, potentially resulting in excessive application of fertilizers.

In comparison, RBG Services is one of the largest facilities and has one of most technically advanced water filtration and recycling systems in this study. Like El Patron, RBG Services generates wastewater from irrigation and decontamination runoff, but all wastewater generated is continuously recycled using RO filtration systems. RO filtration residues are discharged to the sewer, per approval from the community sewer system. Samples for this study were collected from the facility's wastewater holding tank, however this tank holds wastewater which has already passed through the RO filtration system and in general contains lower concentrations of cannabis wastewater constituents such as nitrogen, phosphorus, and TDS. The relatively higher BOD result from RBG Services could be attributed to the temperature of the sample water, which field staff noted to be elevated during sampling, or because of mixing occurring in the holding tank.

Concentrations of analytes from the other five facilities sampled in this study fell somewhere between El Patron and RBG Services. Total nitrogen, phosphorus and TDS concentrations fell within a range that is likely reflective of a typical cannabis cultivation facility which collects and hauls industrial wastewater offsite for disposal.

Fertilizers are expected to be one of the main components of cannabis cultivation wastewater. It is common practice to add nutrients to ensure healthy plant growth. Essential macronutrients for cannabis plant growth include nitrogen, phosphorus, and potassium, and these nutrients are needed in larger volumes when compared to secondary nutrients. Essential secondary nutrients include magnesium, calcium, and sulfur and are needed in smaller volumes than macronutrients. Essential micronutrients are necessary for healthy plant growth including boron, copper, manganese, molybdenum, iron, and zinc. Nitrogen, phosphorus, sulfate, copper, manganese, molybdenum, and zinc were detected in all the cannabis wastewater samples collected for this study and likely originate from the addition of fertilizers during fertigation.

The four different geographic areas of this study include Adelanto, California City, Desert Hot Springs, and Lancaster. Each area has different municipal source water providers and different source water quality. Municipal source waters used at each facility contain varying concentrations of contaminants, some of which were analysis targets in this study. Since source water at each facility was not specifically analyzed, the potential effect of contaminants typically found in municipal water relative to the cannabis wastewater sampling results could not be evaluated. As an example, arsenic is a naturally occurring element commonly found in municipal water supplies. In this study, arsenic levels exceeded the primary maximum contaminant level of 10 ug/L at three facilities, El Patron, Regal Green Remedies, and Green Sky Organics. These three facilities are in California City and wastewater at all three facilities consists of irrigation runoff and decontamination runoff but does not contain RO filtration residue. Arsenic that is contained in California City source water likely contributes to the concentrations found in wastewater samples from the California City facilities.

Cultivation practices also vary widely by facility. Variables include cultivation operation size, number of active cultivation rooms at each facility, the types and application rates of fertilizers, pesticides, and cleaning products used in decontamination. The length of time wastewater remains in a holding tank is also highly variable and may even vary within a specific facility depending on the current stage of cultivation. A smaller facility likely will not generate the same volume of wastewater as a larger facility, but the wastewater in the collection tank may sit for longer periods of time between hauling, leading to evaporation and concentration of waste constituents in the tank. In comparison, a larger facility may produce more wastewater but likely also has more frequent collections, reducing the residence time for wastes to concentrate in the tank. Other facilities have more advanced filtration and recycling systems that reduce or eliminate their wastewater production. Such facilities produce minimal wastewater but may produce waste residues or brines from filtration processes such as RO. Residues or brines are either mixed into the industrial waste stream of the facility, which is the case at Canndescent and Desert Seven, or are directly discharged to a community sewer system without mixing, which is the case at St. George Enterprise, RBG Services, and Regal Green. Characterization of RO filtration residues discharged directly to community sewer systems were not analyzed as part of this study.

Conclusions

Cannabis cultivation facilities differ in terms of their size and cultivation processes. In general, cultivation facilities use a wide range of fertilizers, pesticides, and cleaning products which are applied in varying amounts and at different times during or after a cultivation cycle. These variations directly affect the composition of wastewater each facility generates. While the results of this study give insight into some of the typical constituents found in indoor cannabis cultivation wastewater, concentrations of those constituents can vary widely and wastewater composition at each facility is unique. Influent water quality and facility-specific filtration processes also affect the composition of wastewater generated at each facility.

To determine the best method for cannabis wastewater disposal (i.e. disposal to a community sewer system or collecting and hauling), each cannabis cultivation facility should characterize its unique wastewater quality. Community sewer systems can use facility-specific wastewater information to determine if wastewater generated at that facility is within acceptable ranges to be discharged to the sewer system, if the facility should participate in a pre-treatment program before discharging to sewer, or if those wastewaters should be tanked and hauled offsite for disposal. The quantity of wastewater produced at a facility should also be recorded as it can determine potential effects at the receiving treatment facility. Smaller quantities of cannabis wastewater may not disrupt treatment operations, while larger quantities of cannabis wastewater could impact treatment processes.

For more information about this study, please reach out to the Eastern California Cannabis Regulatory Unit at Lahontan.cannabis@waterboards.ca.gov.