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# Estimating Canopy Size for the Washington Medical Marijuana Market

**Prepared for the Washington State Liquor and Cannabis Board**

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# I. EXECUTIVE SUMMARY

## A. Research Charge

The Washington State Liquor and Cannabis Board ("WSLCB") tasked the Cannabis Law & Policy Project ("CLPP") with quantifying the grow canopy[1] required to supply the legitimate medical marijuana market ("MMJ market") in Washington State in anticipation of the restructuring of MMJ under the WSLCB I-502 licensing system. Under recent legislation,[2] MMJ dispensaries are required to obtain a license from WSLCB or cease operations by July 1, 2016. At the same time, the producers and processors that supply the dispensaries that choose to stay in operation under WSLCB licenses must themselves be licensed. To date, WSLCB has granted producer licenses that amount to an upper limit of ten million square feet (10M sq. ft.) of grow canopy, with potentially more to be granted soon. In order to determine whether and how much more grow canopy to license, WSLCB arranged for CLPP to perform independent research on how much grow canopy would likely be required to adequately supply the ongoing MMJ market. This report summarizes our findings (the "Report").

## B. Relation to BOTEC Report

Separate from its arrangement with CLPP, WSLCB tasked BOTEC Analysis Corp. with estimating the size of the overall retail MMJ market in Washington State. BOTEC's report was submitted in December, 2015 (the "BOTEC Report").[3] The BOTEC Report did not, and was not intended to, estimate the grow canopy required to supply the ongoing MMJ market in Washington State. We consulted the BOTEC Report with regard to its estimate of the number of dispensaries in Washington State, and used that estimate as one input into our independent research on dispensaries in order to construct estimates of how much MMJ product is needed to supply those dispensaries as of the date of our Report. In turn, that estimate of MMJ product needed informed our estimated calculations of the grow canopy required to adequately supply the MMJ market going forward.

## C. Background and Methodology

Up until the recent legislation, the MMJ market was sparsely regulated. Dispensaries and collective gardens were required to obtain regular business licenses, pay standard business and occupation taxes, and otherwise comply with general business regulations in Washington State. But there were no industry-specific regulations, licensing, or taxes for MMJ. In particular, Washington State did not regulate how MMJ was grown, processed, obtained, or sold. This

[1] "Canopy" is defined in WAC 314-55-010 as "the square footage dedicated to live plant production, such as maintaining mother plants, propagating plants from seed to plant tissue, clones, vegetative or flowering area. Plant canopy does not include areas such as space used for the storage of fertilizers, pesticides, or other products, quarantine, office space, etc."
[2] In June 2015, The Washington Legislature passed HB 2136 and SB 5052, which changed the regulatory structure of MMJ by transferring it into WSLCB's I-502 licensing system.
[3] BOTEC Analysis Corp., Estimating the Size of the Medical Cannabis Market in Washington State (Dec. 15, 2015) *available at* www.lcb.wa.gov/publications/Marijuana/BOTEC%20reports/BOTEC-MMJ-Report.pdf.

meant that there was very little official data on the size and workings of the MMJ market in Washington State.

Accordingly, CLPP undertook to reach out directly to this "gray" market in order to produce an estimate of MMJ grow canopy required to supply the MMJ market based on figures of product supplied to dispensaries and collective gardens given by individuals who work at those facilities. This estimate of supplied product was then used to extrapolate back up the supply chain to estimate how much grow canopy is required to produce this supply.

CLPP met with WSLCB and provided a strategy plan (attached hereto as Exhibit A) whereby CLPP would execute the following research approaches: (1) direct contact, gathering data by reaching out to all identifiable dispensaries and collective gardens (identified through online lists such as leafly.com); (2) tax data, estimating canopy based on business & occupation tax data publicly available from the Washington State Department of Revenue ("DOR"); and (3) online survey, gathering data by posting a survey online and requesting dispensaries to complete it. A fourth approach, reaching out to counties with public records requests, was also executed, but no useful data was obtained. Nonetheless, that approach is also included in this report.

In performing our research, we relied on three possible dispensary counts, as well as our survey findings of average sales, as the basis for an estimation of MMJ market size. We then produced ranges of data based on marijuana price and estimated market share. Finally, we took these data ranges and applied them to figures of equivalency (how much marijuana it would take to produce edibles and concentrates) and canopy yield (how much marijuana is yielded per square foot), in order to produce the estimate below. We also surveyed dispensaries to ask the grow canopy they provided themselves, but this appeared to be unreliable and at any rate too small of a percentage of overall MMJ supply to be useful. Most of the product sold at dispensaries is derived from marijuana grown elsewhere.

D. Summary of Findings and Qualifications

**CLPP estimates that the grow canopy needed to supply the existing MMJ market in Washington State is between about 1.7 million and 2 million square feet, or an average of 1.85 million square feet (including both indoor and outdoor as described in more detail below) for all marijuana sales at dispensaries, including sales of marijuana flower, edibles, and concentrates.** These figures are based on the calculations below which rely on a range of sources.

It should be noted that the figures in this Report are intended as a broad estimate, and the data is hampered by the lightly regulated nature of the current MMJ market. Surveying is by nature a science of estimation. It is difficult, if not impossible, to know exactly how many dispensaries there are in Washington State, or to verify the numbers provided to us by dispensaries. Nearly all of the calculations in this Report require some measure of estimation, so we recommend that our conclusion not be seen as a hard conclusion but rather as a broad estimate.

Given these qualifications, we believe that our conclusion is reliable. WSLCB will ultimately decide whether its current licensure of 10 million square feet of canopy, with potentially more to be licensed in the near future, is sufficient for the demands of the MMJ

market. The BOTEC Report estimated that the overall marijuana market was divided into even thirds for MMJ, recreational, and illicit. Because we estimate that an upper range of 2 million square feet grow canopy is sufficient to supply the current MMJ market, and adopting BOTEC's estimate of market shares, we are inclined to believe that WSLCB's current grow canopy license limits are sufficient to supply both the recreational and MMJ markets, but we defer to WSLCB to make that final determination.

## II: Primary Research Approach: Direct Phone Survey

### A. Overview

The central focus of this Report is the phone survey that was conducted in January and February of 2016, in which a list of 467 potential dispensaries across Washington were contacted, 273 of which are believed to be actual dispensaries. This list was compiled using the databases provided publicly by leafly.com, weedmaps.com, and headshopfinder.com (accessed for a fee). Each of these websites were manually accessed by the authors, who recorded each dispensary found on the applicable map or list for Washington.

All 467 potential dispensaries were contacted, and about 100 follow-up calls were made as an additional attempt, due to being told the party was busy at the time or for some other reason. Measures were taken to eliminate duplicates. Once all were called, the list was divided into 4 categories: (1) Complete, meaning they participated and provided data; (2) Delivery, meaning these were delivery businesses and thus not interviewed, but are still counted in the list of dispensaries because they still serve a customer base; (3) Refused to answer, meaning they chose not to participate but are still counted in the list of dispensaries because it is believed they are a dispensary, and (4) N/A, meaning the number was disconnected, a wrong number, or some other reason in which there was no reason to believe that the contact was a dispensary. The four categories amounted to the following:

- Complete: 117
- Delivery: 18
- Refused to answer: 138
- N/A: 193

All told, we found 273 dispensaries that had reasonable belief of current or recent operation for purposes of assessing medical marijuana market demand. This number could be accurate, but suffers from two hindrances: (1) it is believed that many dispensaries have closed in recent months, even in the time between this report and BOTEC's report; and (2) we simply might have missed operating dispensaries, either that were not tracked by the three websites relied upon, or that fell into the "N/A" category.

DOR provides public tax data (examined in more detail below) for dispensaries that are taxed in Washington, and this information yields a count of 462 dispensaries.[4] This number

[4] The 467 count is based on the DOR's "Medical Marijuana Tax Table" accessed in March 2016, *available at* www.dor.wa.gov/content/aboutus/statisticsandreports/stats_mmjtaxes.aspx.

could be omitting dispensaries that have not reported themselves to the DOR, and it also might be including dispensaries that no longer operate. Still, it is a count that is worth including in our calculations.

Because it is nearly impossible to know the exact number of operating dispensaries in Washington, particularly since that number is in flux, we believe it prudent to offer a range of potential conclusions, including the three different dispensary counts: ours (273) BOTEC's (403), and the DOR's (462). For purposes of simplicity, future calculations based on these counts will be in that order.

BOTEC made two estimates of dispensary quantity in their report: one of 331 "verified" operations and one of 403 "unverified" operations. BOTEC explained that "verified" dispensaries were believed to have operated (meaning, been in business) in the previous 12 months, while "unverified" included dispensaries that had no such indication. BOTEC believed (and we agree) that many dispensaries have likely closed in the months following the HB 2136 and SB 5052 reforms, thus estimating the medical marijuana market in its current state might be underestimating what true medical marijuana demand is. Therefore, we relied upon the "unverified" count of 403 operations, which reflects an estimate of medical market demand prior to the likely recent rash of closures.

Dispensaries were asked the following questions:

- Do you grow your own marijuana?
- If no, where do you receive marijuana?
- If yes, what is the amount of square footage you allocate to growing marijuana?
- What is the average price per gram for usable marijuana (to processors/consumers)?
- Do you donate product?
- If so, how much marijuana do you donate to patients (pounds, grams, etc.)?
- How much marijuana do you sell per month (pounds, grams, etc.)?
- Yield: What is your yield (in weight) per year?[5]
- How many harvests, how much per harvest?[5]
- What proportion of your sales are flower, edibles, tinctures, concentrates?[5]
- What is the average price for edibles?[5]
- What is the average price for tinctures?[5]
- What is the average price for concentrates?[5]

B. Phone Survey Analysis

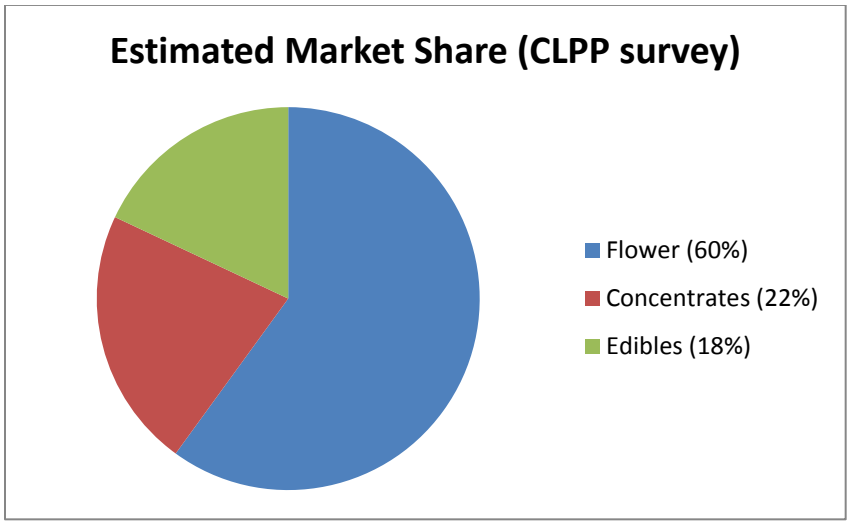
1. *Flower Estimated*

There were 44 responses to the question, "How much marijuana do you sell per month (pounds, grams, etc.)?" which produced an average of 9.55 pounds of marijuana flower[6] sold per month per dispensary, with a standard deviation of 9.06. Thus, based on our potential dispensary counts, we estimate the following:

[5] These questions were added in early February and thus not all dispensaries were asked. Still, we received sufficient results for them to make credible conclusions.
[6] Flower meaning, product that is pure marijuana and not sold in other form such as edibles, oil, etc.

| Dispensary Estimate | Average Monthly Sales (lbs) | Average Yearly Sales (lbs) |
|---|---|---|
| 273 (CLPP) | 2,607.15 | 31,285.8 |
| 403 (BOTEC) | 3,848.65 | 46,183.8 |
| 462 (DOR) | 4412.1 | 52,945.2 |
| Average Sales (among all three dispensary estimates): | 3622.63 | 43,471.6 |

Dispensaries were also asked the question, "What proportion of your sales are flower, edibles, tinctures, concentrates (in percentage)?", and 86 responses were given. This data showed that flower amounted to 60% of sales, edibles amounted to 18%, and, combining tinctures with concentrates, concentrates amounted to 22%, as shown here:




Therefore, the above figures on monthly and yearly sales should account for about 60% of the medical marijuana market, though an alternative market share estimate is below.

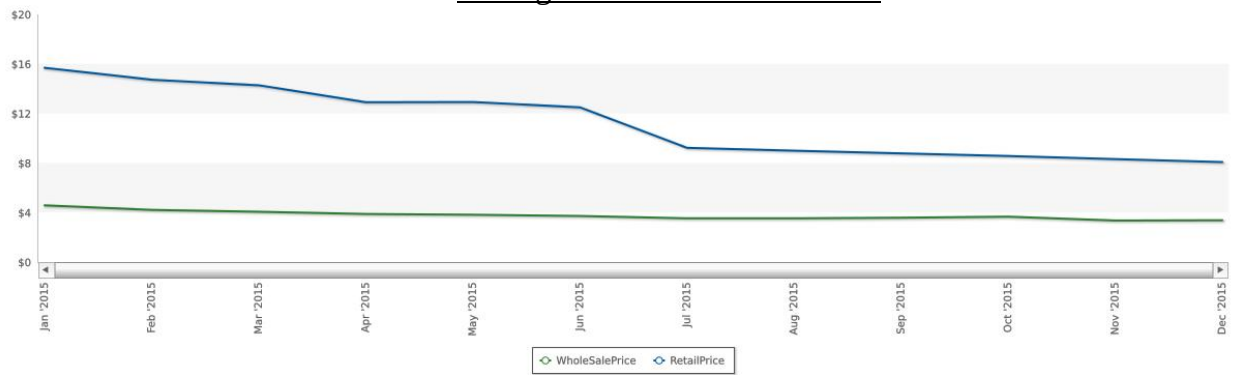
2. *The Market Expressed in Dollars*

In order to estimate the size of the edibles and concentrates markets, we will extrapolate the size of the markets in dollars. The median price of marijuana flower amounted to $10.00 per gram, with an average price of $9.80 and a standard deviation of 1.4.

We cross-checked these figures with Front Runner (www.frontrunnerdata.com), a data gathering and visualization service that utilizes data obtained from the WSLCB and from retailers. Front Runner has informed us that their data captures approximately one-third of the entire recreational market. While this data relies on the recreational marijuana market, it can still be a reliable source for pricing and market share if the excise tax is taken into account. Front

Runner reports the average price of marijuana flower per gram was $8.07 for December 2015, having dropped over time as seen below.[7] In the interests of being most comprehensive, we will use both figures and take an average at the end of the calculations.

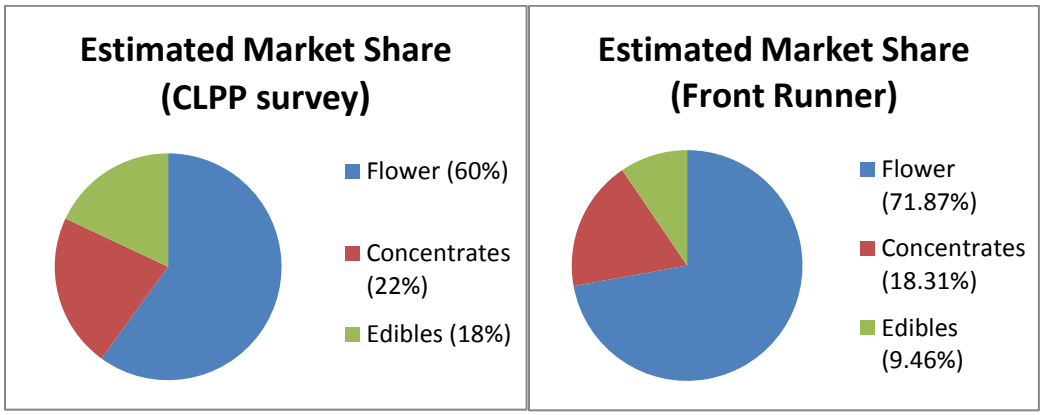
Average Flower Price Per Gram[8]




While many respondents provided data on what proportions different product classes were of their sales, very few would give specific sales data. Instead, we will extrapolate the entire market based on the flower estimates above. The flower market is believed to be within a range of $114 million and $236 million, with $176 million being the average of all estimates.[9] All market estimates and calculations are included in Exhibit B.

Further complicating these figures are estimating just how much market share flower takes up. Our survey reported the market being 60% flower, 18% edibles, and 22% concentrates. For February 2016 (with previous months being similar), Front Runner reported the recreational market as being 71.87% flower, 9.46% edibles, and 18.31% concentrates.[10] In order to provide the broadest range of potential estimates, we calculated using both figures. Thus we have two potential market share estimates:

[7] Front Runner, *available for subscription* at www.frontrunnerdata.com.
[8] *Id.*
[9] These figures have been rounded to the nearest million.
[10] *Id.* Note the concentrates figure includes the .4% topicals category listed on the website, which was combined due to its small size and unlikelihood to otherwise skew results.




We calculated 12 potential market estimates, based on the 3 different dispensary counts (from our survey, BOTEC's estimate, and the DOR count), 2 different prices per gram (from our survey and from Front Runner), and 2 different market share estimates (stated above, from our survey and from Front Runner).

According to these calculations, our market estimates are the following:

| Market Segment | Range | Average Estimate |
|---|---|---|
| Flower | $114-236 million | $176 million |
| Concentrates | $21-86 million | $48 million |
| Edibles | $11-70 million | $33 million |
| Total | $159-393 million | $269 million[11] |

As a reference, the BOTEC report estimated the market value of the medical market to be $290-690 million, with a best estimate of $480 million.[12] BOTEC's estimate is higher, but within a broad range of our estimate.

3. *The Market Expressed in Units*

How much marijuana goes into edibles and concentrates, unlike marijuana flower, is a more complicated question. It is straightforward enough to produce figures of sales data for marijuana flower; if one has an expected yield per square foot, that yield is processed and then sold directly to the consumer. Edibles and concentrates, however, come in a wide variety of types and products which can be produced in many different ways. Edibles include caramels, hard candies, brownies, cookies, and many other foods, and concentrates includes wax, shatter, kief, cartridges, and other products. These products vary in price and potency, so making broad estimates is difficult.

We reached out to 15 randomly chosen WSLCB-licensed processors to obtain data on pricing and on how much marijuana it takes to produce a given amount of product, but we soon

[11] *See* Exhibit B attached hereto.
[12] *See* BOTEC report, p.2.

realized that using the latter data would be making too many assumptions. Along with the issue of product variety is the fact that pure flower is not typically what is used to produce edibles and concentrates, though it can be. Processors often use marijuana trim, which consists of parts of the plant not sold as flower, e.g. leaves and stem, to produce edibles and concentrates. Thus the calculation changes, since a plant will produce both flower and trim. Instead, we relied on another report that accounted for this (see below).

However, the pricing data was found to be useful. Based on our short survey, concentrates are typically sold in 1 gram units with an average of $50 per gram. Edibles are typically sold in 100mg quantities (meaning that the product contains 100mg of THC and constitutes 10 servings), with pricing being an average of $35 per unit, or $3.50 per 10mg dose.

The previous section expressed our market estimates rounded off to the nearest million. To provide greater accuracy, we will use the non-rounded figures available on Exhibit B. This provides the following:

| Product Type | Average Estimated Market Value (unrounded) | Average Estimate by Weight or Dose |
|---|---|---|
| Flower | $176,183,635.83 | 43,471.6 pounds |
| Concentrates | $54,743,093.58 | 1,094,862 grams |
| Edibles | $38,022,767.27 | 10,863,647 doses |

4. *Converting Edibles & Concentrates Units to Marijuana Needed*

The question of how much marijuana it takes to make edibles and concentrates was considered and researched extensively in Colorado by the Marijuana Policy Group ("MPG") for the Colorado Department of Revenue in a report titled, "Marijuana Equivalency in Portion and Dosage."[13] MPG explained two methods: physical equivalency and pharmacokinetic equivalency. The latter concerns dosage and how 1 dose of marijuana smoked is not equivalent to 1 dose of marijuana ingested, but it is beyond the call of this report. Physical equivalency is defined in the report,

> Physical production equivalency is calculated by isolating the marijuana trim and shake inputs and determining a yield ratio. The THC methodology provides an equivalent amount of THC in various forms of marijuana products based on recent state testing information.[14]

The report then concludes,

[13] "Marijuana Equivalency in Portion and Dosage," by the Marijuana Policy Group. *Available at* www.colorado.gov/pacific/sites/default/files/MED%20Equivalency_Final%2008102015.pdf
[14] *Id.* at 6.

> [B]etween 347 and 413 edibles of 10mg strength can be produced from an ounce of marijuana, depending on the solvent type and production method. For concentrates, between 3.10 and 5.50 grams of concentrate are equivalent to an ounce of flower marijuana.[15]

Using these figures, we can expand the previous table to the following:

| Product Type | Average Estimated Market Value (unrounded) | Average Estimate by Weight or Dose | Equivalent Weight Range (lbs) | Average Equivalent Weight (lbs) |
|---|---|---|---|---|
| Flower | $176,183,635.83 | 43,471.6 pounds | 43,471.6 | 43,471.6 |
| Concentrates | $54,743,093.58 | 1,094,862 grams | 12,441.6 – 22,073.8 | 17,257.7 |
| Edibles | $38,022,767.27 | 10,863,647 doses | 1,644 – 1,956.7 | 1,800.4 |

| Total Market Estimate (Flower, Concentrates, Edibles) | Equivalent Weight Range (lbs): 57,557.2 – 67,502.2 | Average Equivalent Weight (lbs): 62,529.7 |
|---|---|---|

5. *Yield and Canopy*

In order to calculate how much canopy of marijuana is needed to grow this amount, an average yield of usable marijuana per square foot of plant grown is required.

Indoor and outdoor yields vary widely. Indoors, the United Nations Office on Drugs and Crime estimates that an average 500 grams per square meter, or about 0.10 pounds per square foot, is produced per harvest.[16] The report estimates 3 to 6 harvests are typically produced indoors, with an average of 5 harvests. Therefore, we estimate each square foot of indoor canopy produces an average of 0.50 pounds per year.

Outdoors, the same report estimated an average of 100 grams per square meter, or about 0.02 pounds per square foot per harvest. Due to its climate, Washington typically allows for only 1 harvest per year.

Important in these considerations is the market share of marijuana that is cultivated indoors or outdoors. Jon Gettman, former President of the National Organization for the Reform of Marijuana Laws, wrote in 2006 that 42.6% of marijuana grown in Washington was grown indoors.[17]

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[15] *Id.*
[16] Leggett, T. (2006). *A review of the world cannabis situation. Bulletin on Narcotics, Vol. LVIII, Nos 1 & 2*, pp.26, 30. *Available at* www.unodc.org/documents/data-and-analysis/bulletin/2006/Bulletin_on_Narcotics_2006_En.pdf
[17] Gettman, Jon. *Marijuana Production in the United States (2006)*. (2006). *Available at* http://www.drugscience.org/Archive/bcr2/domstprod.html

Applying these figures, we produce the following:

| | Range (lbs) | Average (lbs) | Annual Yield (lbs/ft$^2$) | Canopy Range (ft$^2$)[18] | Canopy Average(ft$^2$)[14] |
|---|---|---|---|---|---|
| Total Market Annual Estimate | 57,557.2 – 67,502.2 | 62,529.7 | -- | -- | -- |
| Indoor Canopy Needed (est. 42.6% of market) | 24,519.37 – 28,755.94 | 26,637.66 | .50 | 49,039 – 57,512 | 53,276 |
| Outdoor Canopy Needed (est. 57.4% of market) | 33,037.83 – 38,746.26 | 35,892.05 | .02 | 1,651,892 – 1,937,313 | 1,794,603 |
| **Total Canopy Needed** | -- | -- | -- | **1,700,931 to 1,994,825** | **1,847,879** |

## III. Alternative Approaches

Below are alternative approaches that we attempted but ultimately abandoned, either for being unable to obtain sufficient information or due to a belief that the numbers were too low.

### A. Surveying Square Feet

In our phone survey, dispensaries were asked the questions, "Do you grow your own marijuana?" and "If yes, what is the amount of square footage you allocate to growing marijuana?" We received 28 usable responses that were hugely varied, producing the following results:

| Dispensary Count | Canopy Range (ft$^2$) | Canopy Average (ft$^2$) | Total Estimated Canopy Needed (ft$^2$) |
|---|---|---|---|
| 273 | 100 – 30,000 | 4,629 | 1,263,717 |

This canopy range, with a standard deviation of 7,060, is extremely large. This, among other reasons, gives reason to believe these figures are less reliable than the phone survey's monthly sales figures. Dispensaries may sell products derived from marijuana grown themselves, but they very likely sell products from marijuana grown elsewhere, which is not accounted for in this approach. Furthermore, a sampling of 28 responses is very low compared to the total estimated number of dispensaries, or compared to the 44 responses we received for sales figures. For these reasons, we believe that this canopy estimate underrepresents total medical demand.

[18] Figures here are rounded to the nearest square foot.

B. Online Survey

We created an online survey that allowed dispensary and collective garden owners to voluntarily provide us with information about their businesses. We used Google Forms to create the survey, which allowed users to answer questions. We then compiled their answers in a spreadsheet. We made the survey available on the CLPP blog,[19] advertised it on Twitter, and sent a mass email to parties that applied for recreational marijuana retail licenses from the WSLCB.[20] Additionally, when we were making calls to dispensaries, we encouraged people to fill out the survey if they did not feel comfortable answering questions over the phone. The following is the list of questions in the survey:

- Are you associated with a medical marijuana dispensary or collective garden?
- If yes, what is the name of the dispensary or collective garden?
- What county is the dispensary/collective garden located in?
- Do you grow your own marijuana?
- If no, where do you receive marijuana?
- What is the amount of square footage you allocate to growing marijuana?
- What is your monthly yield of useable flower?
- What is the average price per gram for usable marijuana (to processors/consumers)?
- How much marijuana do you donate to patients (pounds, grams, etc.)?
- How much marijuana do you sell (pounds, grams, etc.)?
- Do you sell marijuana to other medical marijuana collective gardens or dispensaries and if so, how much (pounds, grams, percentage)?

We received 51 responses to our survey. Of those, 29 provided us with information on the amount of square footage allocated to growing marijuana.[21] The range of the allocated space was between 50 and 11,000 sq. ft., with an average of 1,830.9 sq. ft. per dispensary. 22 of the respondents provided information on both the allocation of square footage and the monthly yield of flower in pounds. From this we could extrapolate the amount of square footage required to produce one pound of marijuana. The average of the ratios was 238.40 sq. ft. required to produce a pound of marijuana per month. A table showing the complete data-set is attached as Exhibit C.

C. Taxes

For this strategy, the project relied on the reported revenue of medical marijuana from the Department of Revenue's ("DOR") website. This figure was going to be divided by the average prices for medical marijuana (divided by each market segment of flower, edibles, and concentrates) to obtain an estimated weight amount for the state, which would then be calculated into square footage, much like what was done above. There was to be some expected variance given different products requiring different amounts of marijuana, uneven reporting

[19] Available at: blogs.uw.edu/clpp/2015/12/26/clpps-medical-marijuana-survey.
[20] Approximately 2000 parties were contacted. A second email was sent to another approximately 2000 parties that applied for producer licences, but it is believed that none of these were received because Google's gmail client automatically returned all of them due to anti-spam policies.
[21] One response listed "15 plants" and another listed "1 plant."

requirements, potential for diversion, likelihood that all medical marijuana revenue is not derived solely from flower/bud, etc.).

The DOR reported $109,239,149.00 in taxable retail sales of medical marijuana in Washington for FY 2015. Given how much lower this amount was compared to even the lowest range of calculations based on our survey, and how much lower it is compared to the figures in the BOTEC report, we did not believe this figure was reliable, and thus abandoned the survey. There is a strong likelihood that dispensaries were underreporting taxable sales to the DOR, and there may be other reasons for this number being so low.

D. Public Records Requests

The project sent out public records requests to all counties in Washington. At the time this report was published, only 4 counties responded with records, while 9 stated they were in process. These records provided some use in cross-checking our list of dispensaries, but they provided no data as to approximate sales or canopy. Because no usable data has been obtained with this strategy, it has not been factored into the final calculations.[22]

## IV. FINDINGS AND CONCLUSION

This Report provides information based on research conducted between September 2015 and March 2016. Key findings from our survey include:

- **Estimated canopy needed for the state to satisfy the medical marijuana market: Between 1.7 million and 2 million square feet, average 1.85 million square feet;**
- Average price per gram: $9.80 (survey result) or $8.07 (Front Runner); median price per gram: $10.00 (survey result);
- Average amount of marijuana sold per month in each dispensary: 9.55 pounds.

We find it reasonable to believe that 10 million square feet of canopy, the current allotment set by the WSLCB for all licensed growers, is sufficient for Washington State's demand for both MMJ and recreational marijuana. This can be explained with more than one approach.

Firstly, the BOTEC Report estimated the marijuana market in Washington State to roughly be made up by one-third medical, one-third recreational, and one-third illicit markets, and we find that estimate reasonable. Thus by simply multiplying our total estimate by three, one could estimate the total grow canopy needed to be between 5.1 and 6 million square feet, well below the current WSLCB 10 million square feet licensure limit. This also factors in the entirety of the illicit market, and while it can be reduced, the illicit market will likely continue to exist in some form for some time outside of regulated canopy.

Secondly, one can make a quick estimate of how much marijuana would be produced with 10 million square feet of grow canopy. If we assume the Legget results on yield and the

[22] The text used in the public record request was: "Records relating to medical marijuana (as distinct from retail marijuana) retailers, processors, and/or producers, including collective gardens, in particular those records relating to location, amount of products produced, canopy estimates (estimated size of growing area or number of plants), and value of marijuana products sold"

Gettman estimate of 42.6% marijuana being grown indoors, then 10 million square feet could produce the following flower:

| | Canopy ($ft^2$) | Annual Yield (pounds) | Market Value[23] |
|---|---|---|---|
| Indoor Cultivation | 4.26 million | 2.13 million | $7,797,000,000 |
| Outdoor Cultivation | 5.74 million | 114,800 | $420,000,000 |
| Total | 10 million | 2.2448 million | $8,217,000,000 |

Thus, 10 million square feet of grow canopy could produce over $8 billion worth of marijuana. Total retail recreational sales in Washington for 2015 was about $323 million, and is unlikely to top $400 million for 2016.[24] BOTEC's highest estimate of the total marijuana market in Washington State, including the illicit market, was $1.6 billion. Both figures are far below the $8 billion worth of marijuana that could be produced from current canopy space.

Given the significant difference between the potential value of 10 million square feet of canopy space and current recreational sales, we believe the current allotment of square feet to be sufficient.

[23] This assumes the price of marijuana is $8.07 per gram, the figure reported by Front Runner, and is rounded to the nearest million.
[24] Sales figures available at 502data.com

Exhibit A

**Canopy Study – Quantifying Washington's Medical Marijuana Needs**
**Plan Summary**

Sam Mendez
Executive Director, Cannabis Law and Policy Project

The Washington Liquor and Cannabis Board (WSLCB) tasked the Cannabis Law and Policy Project (CLPP) with researching how much space (also known as canopy) is required to grow marijuana consumed for medical purposes in Washington. Given the unregulated nature of medical marijuana in the state, finding exact numbers is difficult. CLPP proposes three strategies aiming to address this issue:

1. **Direct Contact**: Gather a list of dispensaries, collective gardens, and individual growers, and contact them directly to find out how much canopy is used to supply them with product; if direct canopy numbers are not forthcoming, then we could try to estimate back from quantity of product dispensed;
2. **Tax Data**: Extrapolate estimated grower sales based on business & occupation (B&O) tax data available publicly from the Department of Revenue and try to estimate amount of product grown (and hence canopy size) to produce that level of sales; and
3. **Survey**: Conduct a survey where dispensaries, gardens, and individual growers will fill in and report how much canopy they grow under (alternatively, estimate canopy from estimates of products amounts they report).

Each of these strategies will be discussed separately.

**1. Direct Contact**

The Direct Contact strategy is perhaps the most labor-intensive strategy but also the one likely to provide the most detailed results. The Internet provides at least a few directories of medical dispensaries around the state that could be contacted. Potential issues:

- Dispensaries and other parties may be reluctant to share information;
- There is no way to verify the information we receive from these parties; and
- There are no similar directories for collective gardens or individual patients, so quantifying them would be difficult.

**2. Tax Data:**

The Tax Data strategy is unique among the three strategies in that it relies on raw numbers rather than information directly from people. This sidesteps the issue of people's potential reluctance and data verifiability. Potential issues:

- The Department of Revenue is unlikely to provide data beyond what is publicly available;
- The publicly available data is general, and does not provide information on number of dispensaries or other individualized information; and

- Given that the data is of B&O taxes, there will be no data on collective gardens or individual patients.

**3. <u>Survey:</u>**

The Survey strategy is advantageous in that it is not as labor intensive as the Direct Contact strategy, and there will be no reluctance issue because peopleself-select to take the survey. Potential issues:

- There is no way to verify the information we receive from these parties;
- The surveys might suffer from lack of participation; and
- Those who do participate, being self-selecting, might skew the data towards a particular demographic.

We also will examine the BOTEC report recently published, where we can use the data gathered to extrapolate how much additional canopy will be needed based on store sales.

Given that each strategy has its set of advantages and disadvantages, pursuing all three would be advisable and would provide the most balanced approach. The medical marijuana world, being largely unregulated until now, is naturally very difficult to quantify without conducting a massive study. But by pursuing all of the above strategies, the WSLCB would at least have educated approximations of the market.

Exhibit B – Fig.1

Flower Market Estimate

| Dispensary Estimate | Total Market Yearly Output (pounds) | Price Per Gram (ppg) | Total Flower Market Estimate |
|---|---|---|---|
| CLPP (273) | 31,285.8 | $8.07 (Front Runner) | $114,521,277.95 |
| | | $9.80 (survey) | $139,071,688.22 |
| BOTEC (403) | 46,183.8 | $8.07 (Front Runner) | $169,055,219.83 |
| | | $9.80 (survey) | $205,296,301.65 |
| DOR (462) | 52,945.2 | $8.07 (Front Runner) | $193,805,239.60 |
| | | $9.80 (survey) | $235,352,087.75 |

Average Total Flower Market Estimate: $176,183,635.83

Exhibit B – Fig. 2

Total Market Estimate

| Dispensary Estimate | Total Flower Market | Market Share | Total Market Estimate |
|---|---|---|---|
| CLPP (273) | $114,521,277.95 (Front Runner ppg) | Flower – 71.87% (Front Runner) | $159,345,036.80 |
| | $114,521,277.95 (Front Runner ppg) | Flower – 60% (Survey) | $190,868,796.58 |
| | $139,071,688.22 (Survey ppg) | Flower – 71.87% (Front Runner) | $193,504,505.66 |
| | $139,071,688.22 (Survey ppg) | Flower – 60% (Survey) | $231,786,147.03 |
| BOTEC (403) | $169,055,219.83 (Front Runner ppg) | Flower – 71.87% (Front Runner) | $235,223,625.75 |
| | $169,055,219.83 (Front Runner ppg) | Flower – 60% (Survey) | $281,758,699.72 |
| | $205,296,301.65 (Survey ppg) | Flower – 71.87% (Front Runner) | $285,649,508.35 |
| | $205,296,301.65 (Survey ppg) | Flower – 60% (Survey) | $342,160,502.75 |
| DOR (462) | $193,805,239.60 (Front Runner ppg) | Flower – 71.87% (Front Runner) | $269,660,831.50 |
| | $193,805,239.60 (Front Runner ppg) | Flower – 60% (Survey) | $323,008,732.67 |
| | $235,352,087.75 (Survey ppg) | Flower – 71.87% (Front Runner) | $327,469,163.42 |
| | $235,352,087.75 (Survey ppg) | Flower – 60% (Survey) | $392,253,479.58 |

Average Total Market Estimate: $269,390,752.48

Exhibit B – Fig. 3

Edibles Market Estimate

| Total Market Estimate (taken from Fig. 2 above) | Market Share | Total Edibles Market Estimate |
|---|---|---|
| $159,345,036.80 | 9.46% (Front Runner) | $15,074,040.48 |
| $190,868,796.58 | 18% (Survey) | $34,356,383.38 |
| $193,504,505.66 | 9.46% (Front Runner) | $18,305,526.23 |
| $231,786,147.03 | 18% (Survey) | $41,721,506.47 |
| $235,223,625.75 | 9.46% (Front Runner) | $22,252,155.00 |
| $281,758,699.72 | 18% (Survey) | $50,716,565.95 |
| $285,649,508.35 | 9.46% (Front Runner) | $27,022,443.49 |
| $342,160,502.75 | 18% (Survey) | $61,588,890.50 |
| $269,660,831.50 | 9.46% (Front Runner) | $25,509,914.66 |
| $323,008,732.67 | 18% (Survey) | $58,141,571.88 |
| $327,469,163.42 | 9.46% (Front Runner) | $30,978,582.86 |
| $392,253,479.58 | 18% (Survey) | $70,605,626.32 |

Average Total Edibles Market Estimate: $38,022,767.27

Exhibit B – Fig. 4

Concentrates Market Estimate

| Total Market Estimate (taken from Fig. 2 above) | Market Share | Total Concentrates Market Estimate |
|---|---|---|
| $159,345,036.80 | 18.31% (Front Runner) | $29,176,076.24 |
| $190,868,796.58 | 22% (Survey) | $41,991,135.25 |
| $193,504,505.66 | 18.31% (Front Runner) | $35,430,674.99 |
| $231,786,147.03 | 22% (Survey) | $50,992,952.35 |
| $235,223,625.75 | 18.31% (Front Runner) | $43,069,445.87 |
| $281,758,699.72 | 22% (Survey) | $61,986,913.94 |
| $285,649,508.35 | 18.31% (Front Runner) | $52,302,424.98 |
| $342,160,502.75 | 22% (Survey) | $75,275,310.61 |
| $269,660,831.50 | 18.31% (Front Runner) | $49,374,898.25 |
| $323,008,732.67 | 22% (Survey) | $71,061,921.19 |
| $327,469,163.42 | 18.31% (Front Runner) | $59,959,603.82 |
| $392,253,479.58 | 22% (Survey) | $86,295,765.51 |

Average Total Concentrates Market Estimate: $54,743,093.58

Exhibit C

| Allocated Square Footage | Monthly Flower Yield (lbs) | Yield ($ft^2$ required for 1 lb) |
|---|---|---|
| 1000 | 4 | 250 |
| 500 | 2.5 | 200 |
| 50 | 0.375 | 133.33 |
| 900 | 0.44 | 2045.45 |
| 11000 | 90 | 122.22 |
| 700 | 4 | 175 |
| 250 | 0.82 | 304.88 |
| 10000 | 15 | 666.67 |
| 200 | 1.5 | 133.33 |
| 200 | 1.5 | 133.33 |
| 200 | 1.5 | 133.33 |
| 200 | 10 | 20 |
| 700 | 12.5 | 56 |
| 1000 | 2 | 500 |
| 1000 | 6.5 | 153.85 |
| 1000 | 1 | 1000 |
| 10000 | 1 | 10000 |
| 1080 | 14 | 77.14 |
| 96 | 0.25 | 384 |
| 2000 | 8 | 250 |
| 4500 | 16 | 281.25 |
| 600 | 5 | 120 |
| Averages | | |
| 2144.36 | 8.99 | 238.40 |