

# Great Divide Brewery Location Planning

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## 1. Introduction

### 1.1. Background

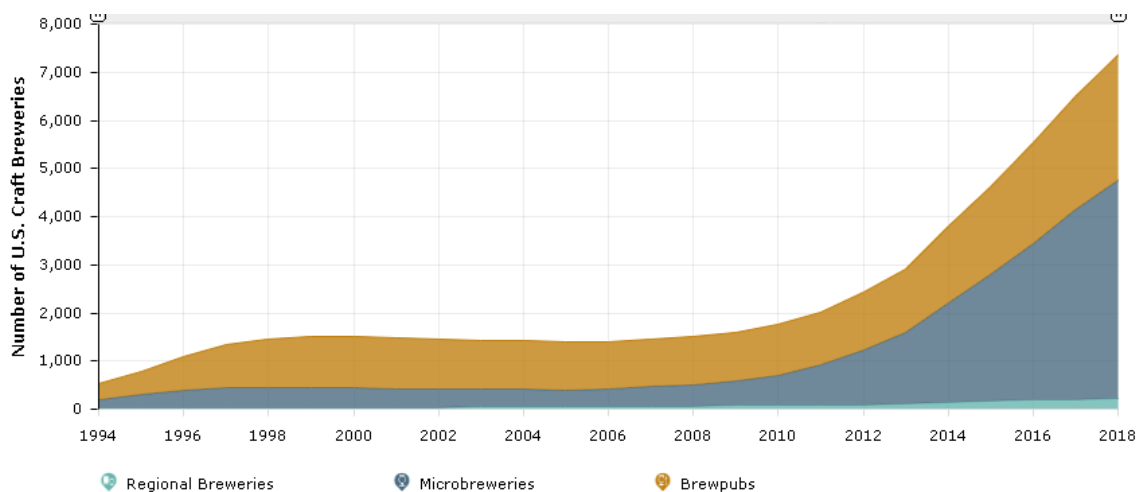
Craft Beer is popular in the United States, with a rapid expansion of Microbreweries across the Northeast, Michigan, and Northwest. Craft Brewing is potentially very profitable, especially once establishing distribution.

Great Divide Brewing is expanding into Michigan with a brewery and taproom. Great Divide sells well with Household incomes over \$75,000. It offers a lineup of premium Microbrew styles, ranging from Bold IPAs to Easy Drinking Pilsners that appeal to more affluent and established professionals.

### 2.1. Problem

As of Calendar Year end 2018, there were over 7,000 Craft Breweries in the United States (Figure 1). Due to this increase of Brewing in the United States, expansion location need to be chose carefully as the density of breweries increase. Neighborhoods should have a population greater than 15,000 to ensure enough sales demand and the County Median Household Income should be greater than \$75k/year. Find a Neighborhood that meets these criteria, in popular area for food/restaurants without many Breweries and Bars.

Figure 1. US Craft Brewing by Category



## 2. Data Acquisition and Cleaning

### 2.1.Data Sources

For determination of Household Incomes by County in Michigan, attention was initially turned to the US Census Bureau. After extensive searching, a representative Data Set was unable to be located. After additional web searches, Wikipedia was found to have the Household Income data [here](#).

For determination of Communities in Michigan that have population greater than 15,000, attention was again turned to US Census Bureau. Again, a representative Data Set was unable to be located. Wikipedia was found to have the Population data by Community [here](#).

Latitude and Longitude values for related Communities was queried [here](#) by zip code, with results being output into a .csv file for later merging.

For searching of popular Venues, Foursquare was queried by Latitude and Longitude values merged from .csv file.

### 2.2.Data Cleaning

Household income was scraped from Wikipedia using Beautiful Soup and loaded into a Data Frame. Some rows contained unrelated data and were dropped using a String search. Data was then sorted to in descending order by Median Household Income.

Michigan community population was scraped from Wikipedia and loaded into a Data Frame. A new Data Frame was then created from the Counties that met the >\$75K Criteria. Once Data was loaded, unrelated features were dropped as were Communities with a population of less than 15,000.

## 3. Exploratory Data Analysis

### 3.1. Determination of Counties with income >\$75k

Upon scraping, loading, cleaning, and sorting income information, it was determined that there is a County in Michigan that could meet the >\$75K Median Household Income, this was determined to be Oakland County as shown in Table 1.

Table 1. Top 5 Michigan Counties by Median Income

	Rank	County	Per Capita Income	Median Household Income	Median Family Income	Population	Number of Households
0	1	Oakland	\$56,138	\$85,991	\$94,783	1,202,362	483,698
1	2	Leelanau	\$32,194	\$56,527	\$65,342	21,708	9,255
2	3	Livingston	\$31,609	\$72,129	\$82,637	180,967	67,380
3	4	Washtenaw	\$31,316	\$59,065	\$82,184	344,791	137,193
4	5	Charlevoix	\$28,403	\$48,704	\$57,022	25,949	10,882

### 3.2.Determination of Communities within Oakland County

Upon scraping, loading, cleaning, and sorting income information, it was determined that there are 25 Communities in Oakland County that have a population greater than 15,000 as shown in Table 2.

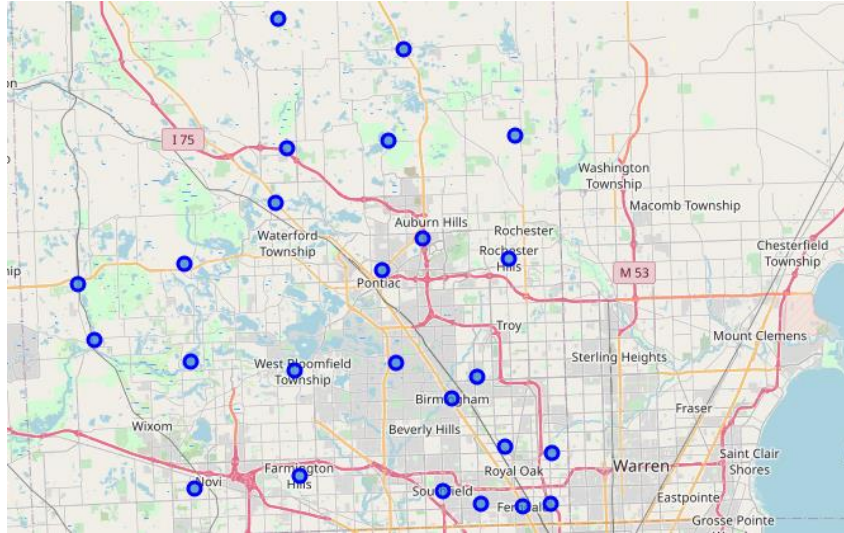
Table 2. Cities of Oakland County with Population >15,000

	Neighborhood	Type	County	Population 2010
0	Troy	City	Oakland	80980.0
1	Farmington Hills	City	Oakland	79740.0
2	Southfield	City	Oakland	71739.0
3	Waterford	Charter Township	Oakland	71707.0
4	Rochester Hills	City	Oakland	70995.0
5	West Bloomfield	Charter Township	Oakland	64690.0
6	Pontiac	City	Oakland	59515.0
7	Royal Oak	City	Oakland	57236.0
8	Novi	City	Oakland	55224.0
9	Bloomfield	Charter Township	Oakland	41070.0
10	Commerce	Charter Township	Oakland	40186.0
11	Orion	Charter Township	Oakland	35394.0
12	Independence	Charter Township	Oakland	34681.0
13	White Lake	Charter Township	Oakland	30019.0
14	Madison Heights	City	Oakland	29694.0
15	Oak Park	City	Oakland	29319.0
16	Auburn Hills	City	Oakland	21412.0
17	Oxford	Charter Township	Oakland	20526.0
18	Birmingham	City	Oakland	20103.0
19	Ferndale	City	Oakland	19900.0
20	Highland	Charter Township	Oakland	19202.0
21	Oakland	Charter Township	Oakland	16779.0
22	Hazel Park	City	Oakland	16422.0
23	Milford	Charter Township	Oakland	15736.0
24	Brandon	Charter Township	Oakland	15175.0

### 3.3. Visualization of Qualifying Cities

Using Folium, a map was generated showing Cities of Oakland County that met the population criteria as shown in Figure 2.

Figure 2. Cities of Oakland County Mapped with Population >15,000



### 3.4. Understanding Top Venues of Qualifying Cities

Focus was next turned to Foursquare to obtain top venues for each city within a 1000-meter radius of the geographical center point. One Hot encoding was subsequently used to rank Venues based on prevalence as shown in Table 3. Areas of potential concern are highlighted Orange. Cities with Bars/Breweries in Top 5 Venues should be avoided.

Table 3. Cities of Oakland County Mapped with Population >15,000

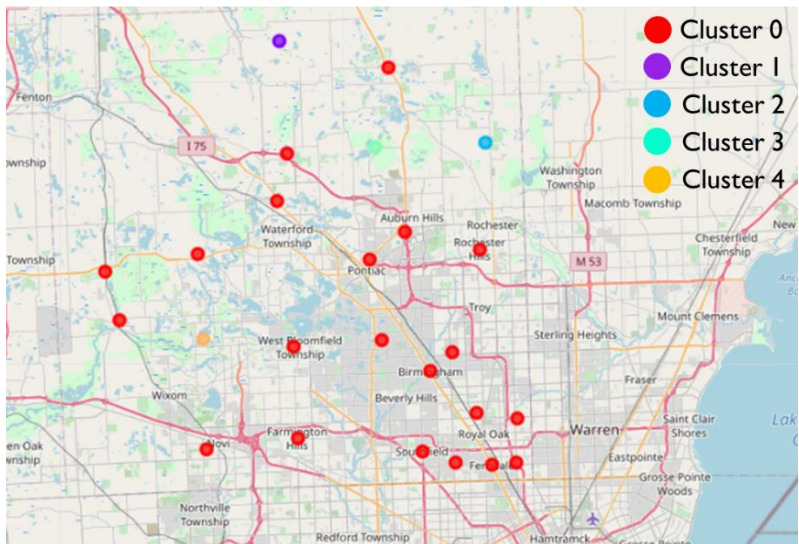
	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Auburn Hills	Sandwich Place	Hotel	Pizza Place	American Restaurant	Coffee Shop
1	Birmingham	American Restaurant	Coffee Shop	Spa	Steakhouse	Salon / Barbershop
2	Bloomfield	Pizza Place	Frozen Yogurt Shop	Bagel Shop	Pharmacy	Supermarket
3	Brandon	Flower Shop	Yoga Studio	Gas Station	Furniture / Home Store	Frozen Yogurt Shop
4	Commerce	Convenience Store	Liquor Store	Ice Cream Shop	Lake	Park
5	Farmington Hills	Park	Hotel	Bank	Sandwich Place	Theater
6	Ferndale	Bar	Coffee Shop	Sandwich Place	Sushi Restaurant	Pizza Place
7	Hazel Park	Bar	Pizza Place	Sandwich Place	Fast Food Restaurant	Diner
8	Highland	Grocery Store	Pizza Place	Bank	Chinese Restaurant	Martial Arts Dojo
9	Independence	Fast Food Restaurant	Pharmacy	Pizza Place	Intersection	Bar
10	Madison Heights	Coffee Shop	Fast Food Restaurant	American Restaurant	Pizza Place	Vietnamese Restaurant
11	Milford	Sandwich Place	Pizza Place	American Restaurant	Coffee Shop	Burger Joint
12	Novi	Sandwich Place	Furniture / Home Store	Mobile Phone Shop	Mexican Restaurant	Pizza Place
13	Oak Park	Pizza Place	Discount Store	Pharmacy	Cosmetics Shop	Sandwich Place
14	Oakland	Golf Course	Farmers Market	Restaurant	Garden Center	Fish & Chips Shop
15	Orion	Dog Run	Park	Gift Shop	Boutique	Construction & Landscaping
16	Oxford	Pizza Place	Sandwich Place	Bank	Chinese Restaurant	Gym / Fitness Center
17	Pontiac	Pizza Place	Fast Food Restaurant	Diner	Nightclub	Music Venue
18	Rochester Hills	Furniture / Home Store	Yoga Studio	Sporting Goods Shop	Intersection	Fast Food Restaurant
19	Royal Oak	Grocery Store	Gym / Fitness Center	American Restaurant	Sandwich Place	Pizza Place
20	Southfield	Pharmacy	American Restaurant	Sandwich Place	Intersection	Mobile Phone Shop
21	Troy	Seafood Restaurant	Hotel	Department Store	Burger Joint	Italian Restaurant
22	Waterford	American Restaurant	Pizza Place	Gas Station	Coffee Shop	Sporting Goods Shop
23	West Bloomfield	Golf Course	Middle Eastern Restaurant	Pharmacy	Trail	Dessert Shop
24	White Lake	American Restaurant	Cosmetics Shop	Department Store	Construction & Landscaping	Pet Store

4. Unsupervised Learning using K-means Clustering

4.1. Clustering of Qualifying Cities

Using K-means, it was decided based on group size, that N=5 clusters should give a good distribution of data. Upon Clustering, cities were plotted again using Folium to understand geographical distribution as shown in Figure 3.

Figure 3. K-means Clustering of Oakland Count Cities based on Venue prevalence



4.2.Resulting Clusters and Attributes

Cluster 0 has a variety of cafes and restaurants in the top 5 venues. This would be a good place to look for locating the Brewery, so long as bars and breweries are not common in the Neighborhood as shown in orange.

Table 4. Cluster 0 Venue Prevalence

Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Troy	0	Seafood Restaurant	Hotel	Department Store	Burger Joint	Italian Restaurant
Farmington Hills	0	Park	Hotel	Bank	Sandwich Place	Theater
Southfield	0	Pharmacy	American Restaurant	Sandwich Place	Intersection	Mobile Phone Shop
Waterford	0	American Restaurant	Pizza Place	Gas Station	Coffee Shop	Sporting Goods Shop
Rochester Hills	0	Furniture / Home Store	Yoga Studio	Sporting Goods Shop	Intersection	Fast Food Restaurant
West Bloomfield	0	Golf Course	Middle Eastern Restaurant	Pharmacy	Trail	Dessert Shop
Pontiac	0	Pizza Place	Fast Food Restaurant	Diner	Nightclub	Music Venue
Royal Oak	0	Grocery Store	Gym / Fitness Center	American Restaurant	Sandwich Place	Pizza Place
Novi	0	Sandwich Place	Furniture / Home Store	Mobile Phone Shop	Mexican Restaurant	Pizza Place
Bloomfield	0	Pizza Place	Frozen Yogurt Shop	Bagel Shop	Pharmacy	Supermarket
Independence	0	Fast Food Restaurant	Pharmacy	Pizza Place	Intersection	Bar
White Lake	0	American Restaurant	Cosmetics Shop	Department Store	Construction & Landscaping	Pet Store
Madison Heights	0	Coffee Shop	Fast Food Restaurant	American Restaurant	Pizza Place	Vietnamese Restaurant
Oak Park	0	Pizza Place	Discount Store	Pharmacy	Cosmetics Shop	Sandwich Place
Auburn Hills	0	Sandwich Place	Hotel	Pizza Place	American Restaurant	Coffee Shop
Oxford	0	Pizza Place	Sandwich Place	Bank	Chinese Restaurant	Gym / Fitness Center
Birmingham	0	American Restaurant	Coffee Shop	Spa	Steakhouse	Salon / Barbershop
Ferndale	0	Bar	Coffee Shop	Sandwich Place	Sushi Restaurant	Pizza Place
Highland	0	Grocery Store	Pizza Place	Bank	Chinese Restaurant	Martial Arts Dojo
Hazel Park	0	Bar	Pizza Place	Sandwich Place	Fast Food Restaurant	Diner
Milford	0	Sandwich Place	Pizza Place	American Restaurant	Coffee Shop	Burger Joint

Cluster 1 appears to not be an area of dining or nightlife as shown in Table 5. This cluster would probably not be a good place for a brewery.

Table 5. Cluster 1 Venue Prevalence

Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Brandon	1	Flower Shop	Yoga Studio	Gas Station	Furniture / Home Store	Frozen Yogurt Shop

Cluster 2 is primarily related to recreation and shopping as shown in Table 6. This cluster would also not be a good place for a brewery if looking for high foot traffic.

Table 6. Cluster 2 Venue prevalence

Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Oakland	2	Golf Course	Farmers Market	Restaurant	Garden Center	Fish & Chips Shop

Cluster 3 appears to be an area of recreation, shopping, and commercial as shown in Table 7. This cluster would probably not be a good place for a brewery.

Table 7. Cluster 3 Venue Prevalence

Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Orion	3	Dog Run	Park	Gift Shop	Boutique	Construction & Landscaping

Cluster 4 is primarily related to shopping and recreation as shown in Table 8. This would not be a good area to locate a brewery either.

Table 8. Cluster 4 Venue Prevalence

Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Commerce	4	Convenience Store	Liquor Store	Ice Cream Shop	Lake	Park

## 5. Conclusions

Michigan does have a region that would meet Great Divide's Criteria for locating a Brewery and Tap Room. Oakland County met the Household Income >\$75K Criteria, coming in at approx. \$86k/year. Within Oakland County, there are several Neighborhoods that meet the >15K population criteria as well. These Neighborhoods when Clustered into 5 groups, show Cluster 0 as the most likely group to for a brewery location. This is due a variety of cafes and restaurants in the top 5 venues. Within Cluster 0, Troy, Waterford, Pontiac, Madison Heights, Auburn Hills, and Milford have at least 4 out of 5 top Venues being related to Cafes, Eateries, but not Bars or Breweries. It is recommended that Great Divide focus on these Neighborhoods for locating a brewery.

## 6. Future Directions

It would be worth looking into Population Density as well as consideration of areas that have both Restaurants and Hotels within walking distance. There will be Communities larger than 15,000 people that are spread out over a larger geographical range, potentially making placement of the Brewery less desirable. Hotels also generate additional population density that would not be part of census data.