

**Which Beaches are Polluted? Socio-Environmental Factors and Bacterial Pollution in
Greater Los Angeles**

By

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Abstract:

One of the foundational concerns of the field of environmental justice is that relatively lower-income communities tend to face disproportionate harm from environmental pollution and degradation. In this paper, I use a comparative analysis to explore the relationship between coastal bacterial pollution and neighborhood-level affluence in the Greater Los Angeles area. Surprisingly, I find no overall correlation between bacterial pollution and neighborhood affluence, and that the most polluted waters are in fact adjacent to relatively wealthy neighborhoods. A closer examination suggests that other factors, including pollution-monitoring-station locations, popularity of specific beaches and the geography of communities experiencing homelessness, may be more influential on bacterial pollution levels than neighborhood affluence. I propose policy reforms to improve communication from the Department of Public Health of Los Angeles in order to adjust for the particularly polluted locations in the California Coastal Commission so that mitigation for bacterial pollution can reflect the effects of these factors.

Preface:

I grew up in America's finest city San Diego, California, where the ocean is a part of our culture and identities. Many cultures have aspects of nature mysticism and put an emphasis on respecting the relationship we as humans should have with nature. Thus, being a multiracial Person of Color I was taught from a very young age that the ocean was a gift that we must cherish and take care of. The ocean bears so much life and holds so much beauty and asks for nothing in return. She became a part of my life and I am eternally grateful for the many lessons the ocean has taught.

When I moved to Colorado to pursue my undergraduate degree, I longed for being near the ocean more than anything. Who was taking care of the ocean and her numerous species while I was gone? This led to more questions where my lens of intersectionality brought me to the crossroads of environmental and economic issues. Society values beaches for its economic opportunities above all else. It brings in the tourism dollar that comes with the natural beauty of the scenic view of the ocean without requiring too much investment. My studies infiltrated my mind and my multiple lenses seemed to kick into high gear.

An environmentalist follows the logic of everything in nature has intrinsic value meaning inherent value just by existing. Therefore, if everything in nature has value, we as people should respect that value and protect that valued nature. One then can assume that a healthy natural resource would bring in more revenue, more revenue would prompt those who utilize this resource to maintain the current state of that resource to ensure future use.

An economist perspective would cause me to be more cynical of this relationship because natural resources are often exploited and fall victim to the tragedy of the commons where negative externalities run rampant. This negative externality that often occurs at beaches tends to be pollution in many forms. More people lead to more pollution, more pollution means that beach health will decrease and cause a decrease in economic value of the area surrounding that beach. Both viewpoints are critical to understanding the multiple facets of environmental issues. Therefore, I wanted to create a project that incorporates both.

Acknowledgements:

As a first-generation college student, college wasn't necessarily in my life plans, let alone an honors thesis. A thesis requires determination, a strong work ethic, and a willingness to be pushed to your limits mentally. I did not know if I could complete it especially since this past year was the hardest for me. However, my curiosity and the lack of available research around this project fueled my passion for it. Dedication to learning and expanding my horizons kept pushing me further and further with this project. I was not alone in this journey and I have many people to appreciate that helped me through my process.

Therefore, I would love to thank: My Mother and Father, who gave me their military education benefits for me to be able to attend college, Matthew Burgess for attending countless meetings, taught me the importance of economics and environmental studies, overall made my undergraduate experience bearable. My family who kept me humble and my Best Friends from back home, Mary, Andrea and Abraham, who helped me learn patience and reminded me to relax occasionally.

Lastly, I would like to dedicate my thesis to my grandfather Chato, who passed away while I was trying to finish writing. I can't wait to tell you all about the things I know when I get to see you again. I love you and I hope life in Paradise is perfect.

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Introduction

Our oceans cover roughly over 71% of the Earth's surface (USGS 2020). With such a large amount of surface area, the oceans of our world demand a lot of attention from us. In recent years there has been extensive research on what is going on in these waters. Oceanic pollutants have become vastly more prevalent. However, there are not many people who have a grasp on what those oceanic pollutants are and what influences their concentrations. Using a comparative analysis of Southern California beaches, I explore socioeconomic and physical factors correlated with pollution levels, focusing specifically on bacterial pollutants. Bacterial pollutants are a subset of the major oceanic pollutants found in SC, which include heavy metals, oil, water discharge, Fecal Indicator Bacteria (FIBS) (i.e. bacteria associated with fecal matter), plastics, Enterococci (ENT), and Styrofoam. I summarize studies of these pollutants and their effects on ecosystems below.

Presence of Oceanic Pollutants in Southern California

Evidence of metals, in particular Cobalt, copper, manganese and zinc, have been found in seaweed in the area (Rodriguez-Figueroa et al 2009). The Palos Verdes Peninsula waters also reflected submarine discharge of treated municipal wastewater (Hershelman et al 1981). Some of the trace metals found in the submarine discharge are Ag-27; Cd-36; Cr-12; Cu-20; Hg-23; Ni-5.4; Pb-17; Zn-7.7 (Heshelman et al 1981). Pollution found in the California bay estuarine systems include nutrient loading (i.e. nitrogen and phosphorus), organochlorine, and heavy metal contamination (Allen et al 2006). In addition, there is a significant correlation between organic

carbon, lead, zinc and chromium with the presence of particulate matter from sewage. This sewage source can be linked with the Joint Water Pollution Control Plant (JWPCP), a wastewater treatment plant in Carson, CA (Finney et al 1989). There have been some restoration projects in California habitats aimed at addressing these types of pollution (Allen et al 2006). In conjunction to heavy metal pollution there have been significant correlations between trace metal pollution and oil slicks that can result in several square miles of contaminated surface water (Mikolaj et al 1972).

Water discharge from multiple sources often carrying bacteria was also a very significant source of water pollution. Experiments have indicated that urban river discharge is a prominent source of Southern California's water pollution (Dwight et al 2002). The Southern California Bight, ranging from Point Conception to San Diego, contained stormwater runoff and municipal wastewater plumes, in addition hydrocarbon seeps are pollution hazards (DiGiacomo et al 2004). Bird enterococci (ENT), coastal salt marsh and sewage plumes are sources of surf zone contamination (Choi et al 2013). Even sampling at Lovers Point suggested the presence of human-specific bacteroides in the adjacent beach and water (Yamahara et al 2007). These storm drains are found to release markers of human fecal materials such as Human-Specific Bacteroides Markers (HBM) during dry weather to surface waters in three urban California coastal watersheds (Sercu et al 2008). Fecal Indicator Bacteria (FIBs) were mobilized by adding seawater. The persistence of these were observed in this order (most to least persistent): *Campylobacter* > *Salmonella* > somatic coliphages > enterococci > *E. coli* > F+ phages (Yamahara et al 2012). FIB pollution that was found in Avalon Bay appears to be from multiple, primarily land-based, sources including bird droppings, contaminated subsurface water, leaking drains, and runoff from street wash-down activities (Boehm et al 2003). Multiple shoreline

samples and two subsurface water samples tested positive for human-specific bacteria and enterovirus, suggesting that at least a portion of the FIB contamination is from human sewage (Boehm et al 2003). FIB pollution was also found in Orange County, Santa Ana River and Talbert Marsh, thus illustrating the high levels of this pollution found in multiple areas of Southern California (Ha Kim et al 2004). In order to quantify the fecal pollution, like what was observed in the Santa Monica region, researchers used culture-based methods such as quantitative Polymerase Chain Reaction (PCR), quantitative reverse transcriptase PCR, and specific enterovirus genomes analysis (Nobel et al. 2006).

Impacts of Oceanic Pollutants on Marine Ecosystems

These high levels of the multitude of pollutants described above have had significant impacts on SC's coastal and estuarine ecosystems. Often these impacts can be observed through marine life. For example, pollution such as heavy industrial materials and boating-related materials reduced genetic diversity amongst the resident invertebrate populations of the bay mussel (*Mytilus galloprovincialis*) and the acorn barnacle (*Balanus glandula*) (Ma et al. 2000). These organisms have the capacity for concentrating pollutants in bays and estuaries (Ma et al. 2000). In nematodes, it was observed that mild pollutants increase the dominance of certain species while heavy pollution results in decreases in population and species (Hart et al. 2012). Beaches have received relatively little attention in pollution studies, perhaps due in part to their seemingly uniform appearance and in part to the difficulty of studying the dynamic habitat often subject to the heavy presence of crowds. Very large populations of annelids, crustaceans, mollusks, and interstitial fauna occur on beaches. Observation of molting increments allow researchers to use some of these species as suitable indicators for potential pollutant (Wenner

1988). It was observed that the molting increments were occurring at longer periods from each other with the organisms that were exposed to the oceanic pollutants (Wenner 1988).

Health Related Risks

Swimming in water contaminated with FIBs can cause infectious diseases in humans (The Caribbean Environment Programme 2010). Diseases one can contract by ingestion and bathing in fecal matter contaminated water can include: diarrhea, dysentery, cholera, and typhoid fever (The Caribbean Environment Programme 2010). Vulnerable populations such as young children and elderly people are at higher risk of contracting these diseases (Coliform Fact Sheet 2016).

Little research was recorded on the economic/human dimension of this problem. To my knowledge, the small amount of research can be attributed to the work done at the University of California in LA (UCLA) (Dwight et al. 2005). It was estimated that the economic burden per gastrointestinal illness (GI) amounts to \$36.58, the burden per acute respiratory disease is \$76.76, the burden per ear ailment is \$37.86, and the burden per eye ailment is \$27.31 (Dwight et al. 2005). The combination of excess illnesses associated with coastal water pollution resulted in a cumulative public health burden of \$3.3 million per year for these two beaches (Dwight et al. 2005).

Beach Protocols and Their Shortcomings

As one can see there are many issues stemming from oceanic pollutants in SC, and more research is needed to fully understand this problem. This can be seen in the lack of consistent water quality gauges of public beaches in SC. For example, when measurements of fecal

pollution in coastal bathing waters reach levels that might pose a significant health risk, warning signs are posted on public beaches in California. Analysis of historical shoreline monitoring data from Huntington Beach, Southern California, reveals that protocols used to decide whether to post a sign are prone to error (Ha Kim et al 2004). Public mis-notification of coastal water quality can be reduced by utilizing probabilistic approaches for predicting current coastal water quality, and adopting analog, instead of binary, warning systems (Ha Kim et al 2004).

Another study (Pendleton et al 2001) showed that residents of Los Angeles County tend to hold perceptions of marine water quality that are at odds with data on bacteriological measures of water quality collected by local sanitation districts. Their results suggested that perceptions of coastal water quality may be influenced less by “current coastal education campaigns” and more by the media and other factors (Pendleton et al 2001). Even studies of ENT, a very significant oceanic pollutant, show that resuspension of enterococci that are persistent in sediments may cause beach water quality failures and calls into question the specificity of this indicator for determining recent fecal contamination (Ferguson et al 2005). Thus, coastal water quality is forced by a complex combination of local and external processes, which raises questions about the efficacy of existing marine bathing water monitoring and reporting programs (Boehm et al 2003).

Environmental Injustice

The Environmental Justice Movement has emphasized the clear correlation between socio-economic status and pollution concentration (Dorecta 2014). Examples such as the water crisis in Flint, Michigan, the hazardous landfill in Warren, North Carolina and Cancer Alley in Louisiana, are fundamental environmental injustice cases that create that distinct line that ties the

presence of high pollution concentration to locations of lower income and often minority groups (Dorecta 2014). Each of these cases deal with fundamentally different forms of hazardous pollution yet have similar historic events that lead to those of marginalized groups. Policies and laws (like redlining) seemingly cause concentrations of similar socio-economic status tend to be historic events that cause such disproportionate harm to those in marginalized groups (Dorecta 2014). In addition, those of lower socio-economic status may not have the financial resources for harm reduction (Dorecta 2014). People cannot always avoid the harm by moving away or not utilizing specific contaminated resources if that is the only resource they have. It is important to analyze and address negative externalities created from economic decisions that harm vulnerable communities.

Knowledge Gap and Research Questions

From this literature review, there seems to be evidence of bacterial pollution having harmful effects on health, and reasons to hypothesize that pollution might concentrate in relatively economically disadvantaged neighborhoods. However, this relationship between coastal bacterial pollution and neighborhood-level affluence has not been tested in Los Angeles, to my knowledge. To address this gap, I explore correlations between these two factors, and comparatively explore what other socioeconomic and physical factors might be affecting coastal bacterial pollution.

Potential Impacts

The results of this project are of interest to the city of Los Angeles as a whole and to everyone who visits it. Beaches are critical to the city's overall economic structure. Beaches bring in thousands of tourists every year (State of The Beach 2017) This influx of beachgoers is also not as limited by seasons due to LA's considerable fair weather that happens year around. Therefore, LA depends on its beaches for its economic and aesthetic value that can be altered by the health of its coastal ecosystems.

This becomes important to numerous groups such as: the average waterfront homeowner who may not realize that their homes could be valued higher with more environmental mitigation toward pollutants, the average beach goer who could benefit from knowing which of their favorite beaches tend to be more polluted so that they could know what risks are involved when going to Los Angeles Beaches, and those apart of the Public Health Department of Los Angeles in order to further understand how to inform beach health policy to keep the beach ecosystems and its visitors safe. The results of this project may facilitate more environmental discourse that could lead to further protecting beach ecosystems that we all know and love.

Methods

In order to address the research questions at hand, I conducted a comparative analysis between median incomes of coastal neighborhoods of Los Angeles County (as of 2020) produced by the Los Angeles Times Newspaper and bacterial pollution concentrations (from multiple weekly measurements throughout 2018), from 101 geo-referenced pollution monitoring stations (locations shown in Figure 1), obtained from the Los Angeles Department of Public Health’s Database for Beach Health (B. Valenti, pers. comm.). Table 1 lists the bacteria measured and the tests used to measure their levels.

Types of Bacteria	Tests used to Measure Bacteria
Total Coliforms	Colilert 18
Fecal Coliforms	Colilert 18
Enterococcus	Enterolert

Table 1: The bacteria types that were used for this analysis and the corresponding test that was used to measure the presence of the bacterial organisms in the water.

I calculated annual mean levels of bacterial pollution from each monitoring station (bacterial types listed in Table 1). This required first harmonizing the format of tables from each station and then combining them, by hand in Microsoft Excel. I then calculated the means using R code shown in Appendix 1. I examined which stations had pollution levels exceeding California State Bacterial Pollution Standards (summarized in Table 2). Stations not georeferenced or not currently in use were removed from the analysis.

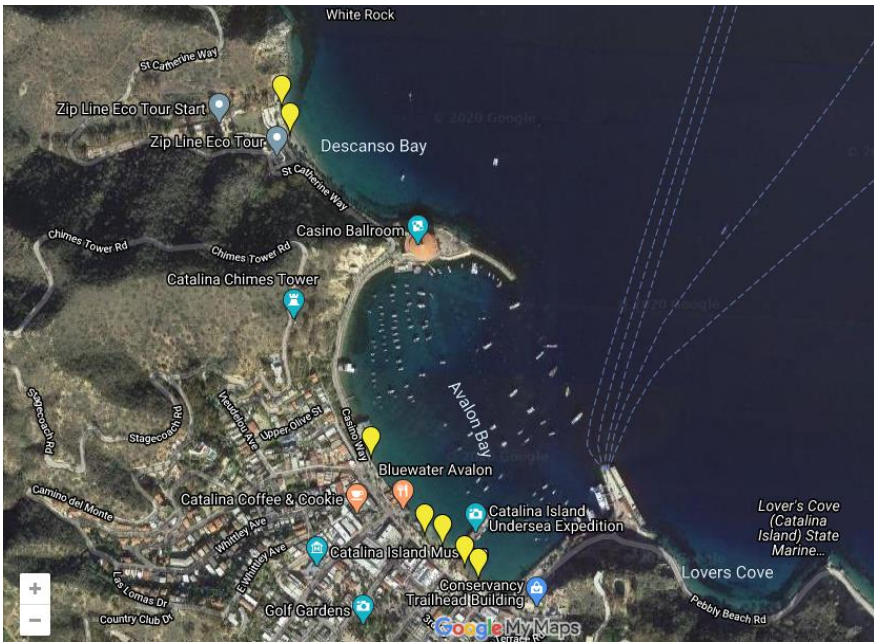
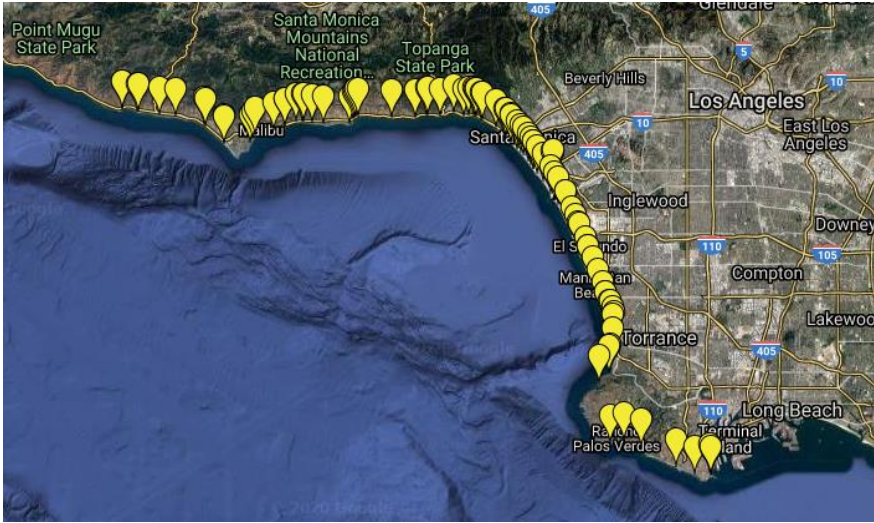


Figure 1. Top panel: A Current Water Monitoring Stations of Los Angeles Credit: LA County Public Health Department. Bottom panel: Current Water Monitoring Stations of Catalina Island (which is part of LA County). Both are generated with Google My Maps.

Results

My results were being held to the standards created by the California Coastal Commission listed below. I will be outlining stations and areas where bacteria pollution exceeds standards, gets within a close range of the standard and ones that have extremely low bacterial pollution.

The Following are the California State Bacterial Pollution Standard for Each Organisms: Total coliform level greater than 1,000 organisms per 100 ml. and the fecal/total coliform ratio is greater than 0.1.
Total coliform level exceeds 10,000 organisms per 100 ml.
Fecal coliform level exceeds 400 organisms per 100 ml.
Enterococcus level exceeds 104 organisms per 100 ml.

Table 2: The Bacterial Pollution Standard from California Credit: LA County of Public Health Department.

Bacterial pollution means for all stations and bacteria types are listed in Appendix 2. I found no correlation between pollution levels and neighborhood median income, for any of the three pollutants (Figure 2). Below, I focus on the stations of interest for this project, which include the stations that have a means that exceed the state standards, the stations whose averaged total coliforms exceeded 1,000 organisms per 100ml, and the stations whose averages are less than 5 organisms per 100ml (see Table 2 above). I focus on these stations because the stations who exceed the standards need immediate intervention in order to better inform the visitors of the health risks involved with interacting with bacteria pollution as well as create plans to prevent further instances of exceeding the state standards. The stations that have

averages with total coliform organisms over 1,000 organisms per 100ml are at risk for exceeding the state standards and can pose greater health risks for visitors and the ecosystems. Comparing these station locations to the locations of stations with little-to-no bacterial pollution can provide insight into what factors could promote more or less pollution.

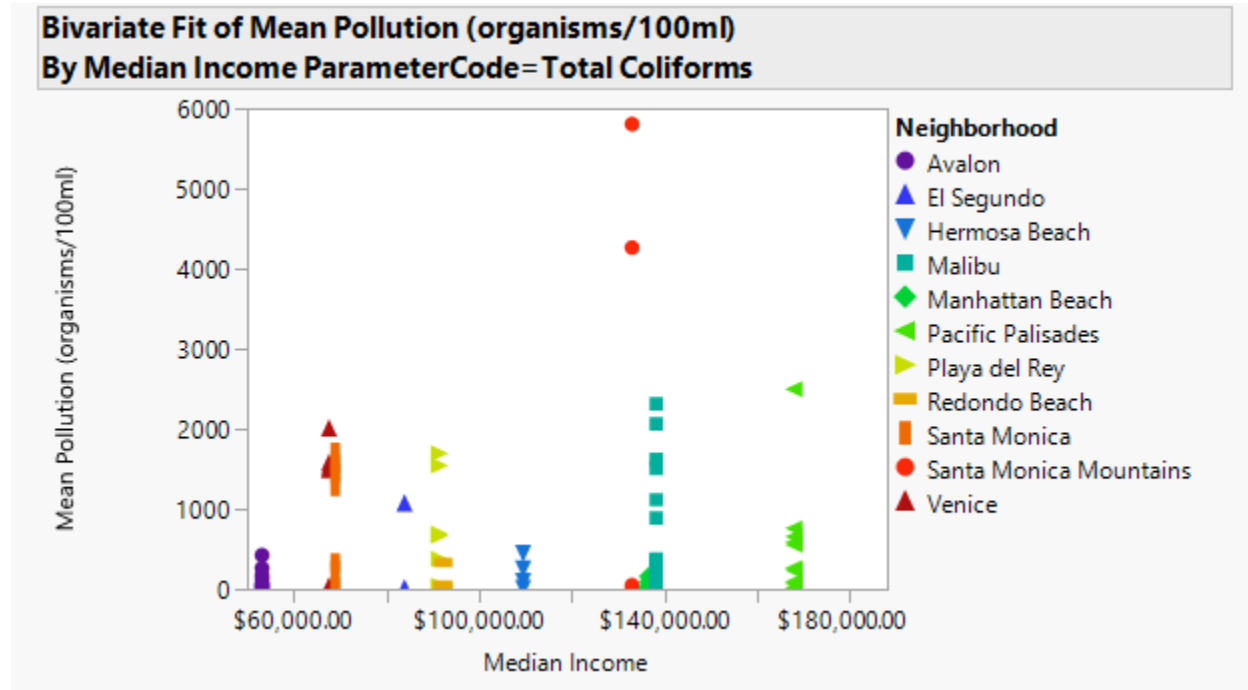


Figure 2: Mean Bacterial Pollution of Total Coliforms and Median Income organized by Neighborhood

I found that there was no correlation between median income and bacterial pollutants. Each bacterial type parameter resulted in similar graphs as seen above and had no direct correlation with median income. However, there were some stations that caught my attention and need to be addressed further.

Stations with Averages that Exceed State Standards

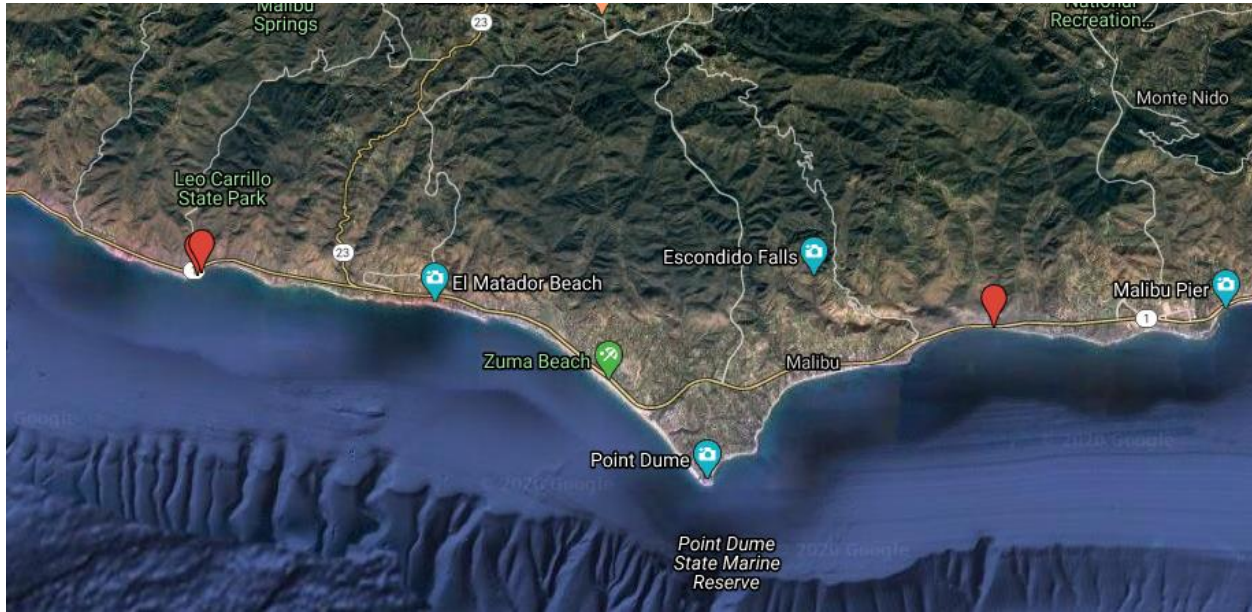


Figure 3: Stations where Enterococcus levels exceeds 104 organisms, Generated with Google Maps

The Stations that exceeded state standard			Location and Median Income Value Rank
DPH 010B	Enterococcus	274.8889	Unincorporated Santa Monica Mountains Ranked 13th at \$132,997
DPH 004	Enterococcus	132.7778	10th Rank Malibu \$138,215
DPH 010	Enterococcus	505.5556	Unincorporated Santa Monica Mountains Ranked 13th at \$132,997

Table 3: The Location and Median Income Value of the neighborhood where the station is located.

The mean Enterococcus levels at stations DPH 10,10B and 4 exceed the state standard for the number of organisms that can be present to be safe for visitors (Figure 3, Table 3). DPH 10 and 10B are found in the Unincorporated Santa Monica Mountains, which is the 13th wealthiest neighborhood according to median income value. DPH 4 is in Malibu which is ranked 10th in median income.

Stations with High Average Levels of Organisms

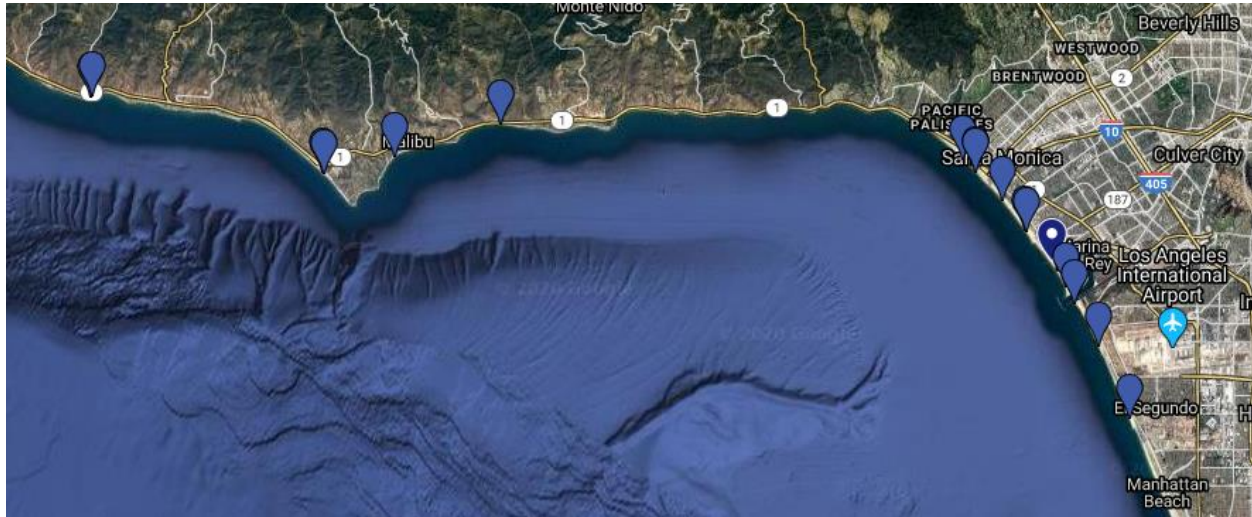


Figure 4: Stations whose total coliforms nearly violate state standards. Generated with Google My Maps.

The Total coliforms that are considered High			Location and Median Income Value Rank
DPH 004	Total Coliforms	1504.722	10th Rank Malibu 138,215
DPH 006	Total Coliforms	2311.556	10th Rank Malibu 138,215
DPH 007	Total Coliforms	1622.556	10th Rank Malibu 138,215
DPH 007B	Total Coliforms	2060.667	10th Rank Malibu 138,215
DPH 010	Total Coliforms	5804.889	Unincorporated Santa Monica Mountains Ranked 13th at \$132,997
DPH 010B	Total Coliforms	4263.278	Unincorporated Santa Monica Mountains Ranked 13th at \$132,997
DPH 102	Total Coliforms	2495.5	Pacific Palisades 5th rank \$168,008
DPH 104	Total Coliforms	1278.278	Santa Monica 99th rank at \$69,013

DPH 008	Total Coliforms	1114.944	10th Rank Malibu 138,215
DPH 104B	Total Coliforms	1563.111	Santa Monica 99th rank at \$69,013
DPH 105	Total Coliforms	1707.222	Santa Monica 99th rank at \$69,014
DPH 105B	Total Coliforms	1485.389	Santa Monica 99th rank at \$69,015
DPH 106	Total Coliforms	1441.278	Santa Monica 99th rank at \$69,013
DPH 107	Total Coliforms	2006.056	Venice 108th Ranking at \$67,647
DPH 107B	Total Coliforms	1517.889	Venice 108th Ranking at \$67,648
DPH 108	Total Coliforms	1486.056	Venice 108th Ranking at \$67,649
DPH 109	Total Coliforms	1574.111	Venice 108th Ranking at \$67,650
DPH 110	Total Coliforms	1543.167	Playa del Rey 47th \$91,339
DPH 112B	Total Coliforms	1070.5	El Segundo 59th \$83925
DPH 122	Total Coliforms	1695	Playa del Rey 47th \$91,339

Table 4: Locations and Median Income Ranks for stations that have high organism concentrations.

Examining the stations with coliform concentrations nearly violating state standards (Figure 4, Table 4) also finds these stations to be adjacent to relatively wealthy neighborhoods Malibu, Santa Monica, Venice, Unincorporated Santa Monica Mountains, Pacific Palisades and Playa Del Rey). These neighborhoods' median income values range from \$67,649- \$138,215 but most are within the first 50 ranked neighborhoods (see Appendix 3).

Stations with the Least Average Bacterial Organisms

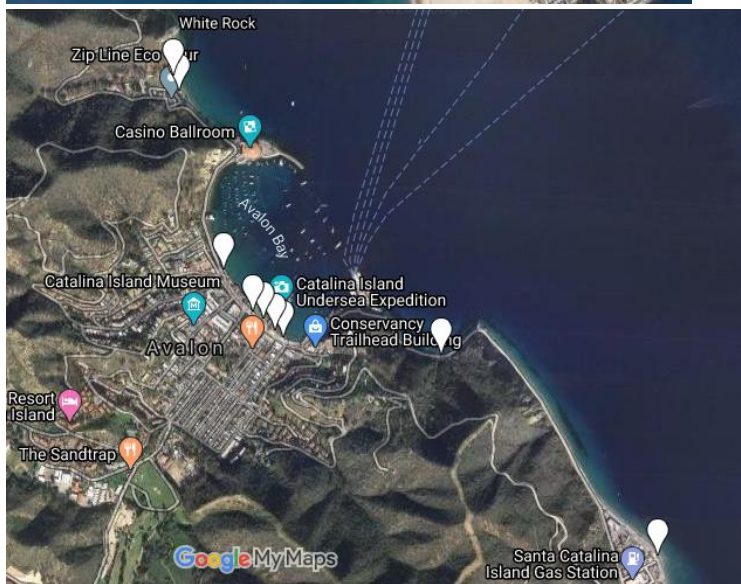
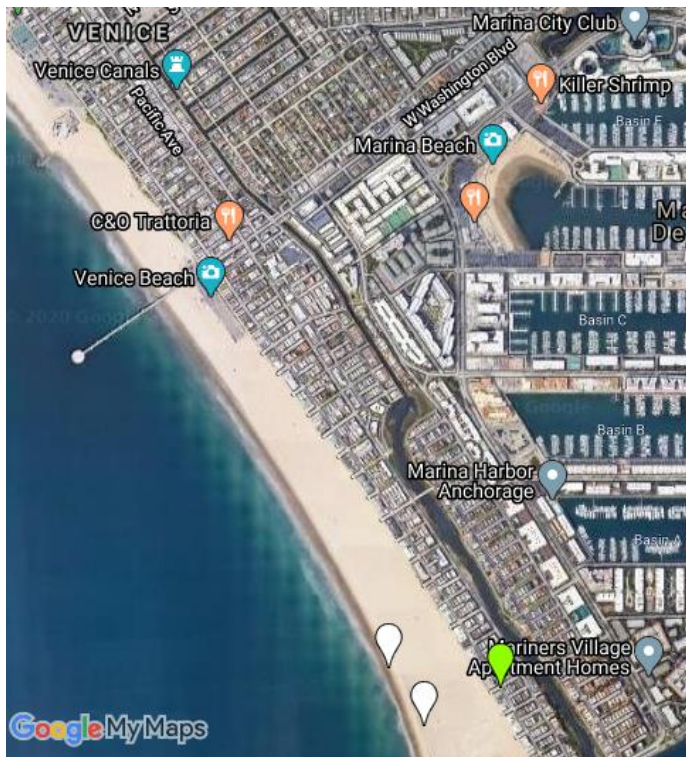


Figure 5: Stations with the lowest bacterial pollution levels in Coastal Los Angeles (top) and Catalina Island (bottom). Generated with Google My Maps

The Stations with the Lowest Values of Bacterial Pollution (less than 5 organism per 100ml)			Location and Median Income Value Rank
DHS (109)	Enterococcus	4.810127	Venice 108th Ranking at \$67,650
DHS (117)	Enterococcus	3.8875	Avalon 179th Ranking \$53,200
DHS (121)	Enterococcus	4.0125	Avalon 179th Ranking \$53,200
DPH 009B	Enterococcus	5	10th Rank Malibu 138,215
DPH 123	Enterococcus	0	Avalon 179th Ranking \$53,200
DPH 123	Fecal Coliforms	0	Avalon 179th Ranking \$53,200
DPH 123	Total Coliforms	0	Avalon 179th Ranking \$53,200
DPH 124	Enterococcus	0	Avalon 179th Ranking \$53,200
DPH 124	Fecal Coliforms	0	Avalon 179th Ranking \$53,200
DPH 124	Total Coliforms	0	Avalon 179th Ranking \$53,200
SS (123)	Enterococcus	4.493671	Avalon 179th Ranking \$53,200
SS (124)	Enterococcus	1.544304	Avalon 179th Ranking \$53,200
SS (124)	Fecal Coliforms	2.734177	Avalon 179th Ranking \$53,200
SS1	Enterococcus	0	Avalon 179th Ranking \$53,200
SS1	Fecal Coliforms	0	Avalon 179th Ranking \$53,200
SS1	Total Coliforms	0	Avalon 179th Ranking \$53,200
SS2	Enterococcus	0	Avalon 179th Ranking \$53,200
SS2	Fecal Coliforms	0	Avalon 179th Ranking \$53,200
SS2	Total Coliforms	0	Avalon 179th Ranking \$53,200

Table 5: Locations and Median Income Value with the Least Bacterial Pollution Levels

These stations are mainly located in Avalon, found on Catalina Island. In comparison to the rest of the neighborhoods, Avalon is relatively poor (median income \$53,200), but also has high tourist traffic. These stations have 5 or less average organisms on average thus are nowhere near the state limits.

Discussion

There can be numerous reasons for why my results came out as they did. I explore some of these possibilities such as physical, economic and the effects of differing populations of people experiencing homelessness could have on bacterial pollution levels. Then I will propose improvements on current policy in order to potentially alleviate the effects of these factors.

Possible Explanations for the Results

Physical Factors

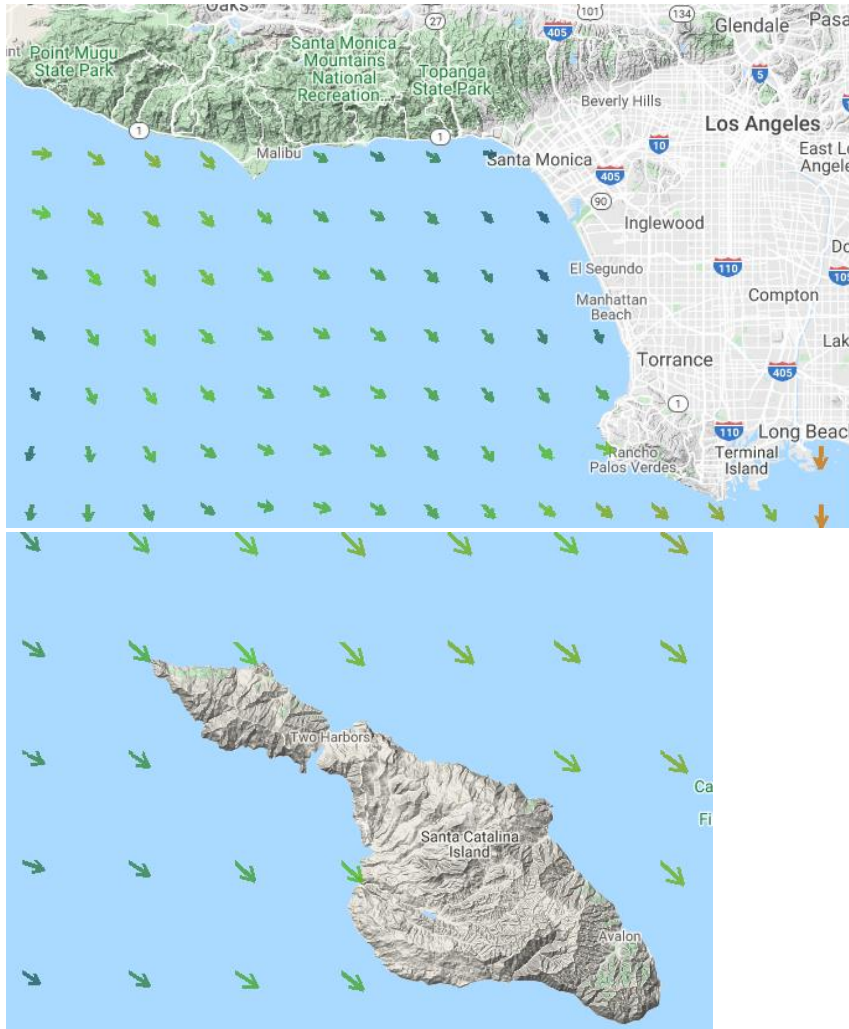


Figure 6a (above) 6b (below): The observed ocean currents around Los Angeles and Catalina Island. Source: Southern California Coastal Ocean Observing System Database 2020

Physical factors such as wind direction and speed, ocean currents, upwelling and locations of the water monitoring stations could have influenced these results. The California Current travels south east down the coast and is heavily influenced by the prevailing wind (Southern California Coastal Ocean Observing System Database 2020). The coastline tends to experience upwelling events that bring up the cold nutrient rich water to the surface, which the marine organisms of the California Coast depend on for feeding plankton and subsequently the rest of the ecosystem (Southern California Coastal Ocean Observing System Database 2020). These upwellings might encourage bacterial growth as well. Some sensors were placed in

locations that could be more likely to encounter coliforms such as the entrance of storm drains, the ends of rivers, and near the innermost parts of a bays, where particles tend to collect.

Economic Factors

Some beaches are more visited than others due to relevance in pop culture, unique architecture, and distance to other tourism attractions. For example, Venice Beach and Santa Monica are relatively close together, hold cultural relevance and both have piers which attract tourists. Tourism likely contributes to the high pollution levels on these beaches. Each of these focus beaches have different amounts of visitors per year. In 2016 the Unincorporated Santa Monica saw 1 million visitors (Southern California Public Radio 2017). In 2017 Malibu reported to get 13 million visitors that year (Bieler 2018). Santa Monica received 8.7 million visitors in 2017 (Santa Monica Travel and Tourism 2017). In 2015 Venice reported having 10 million visitors (Explore Venice 2017). Catalina Island stated that they had 1 million people visit in 2016 (Catalina Island by Numbers 2016). High tourist traffic may explain why Santa Monica, Malibu and Venice have the highest bacteria pollution concentration.

Homelessness in Los Angeles

Living on a beach in Los Angeles is incredibly expensive as seen by the median income of the LA neighborhoods (Appendix 3). According to Los Angeles Mission, there are 53,195 people experiencing homelessness and not enough shelters to house them in (Los Angeles Mission 2020). LA also has a law, Municipal Code (L.A.M.C.) section 41.18, that heavily restricts where homeless people can sit and lie down. These restrictions are highly enforced around sidewalks. However, the City of Los Angeles, had made living out of one's car legal as of

July 2019 (Santa Monica Daily Press 2019). Beaches often have free and open-access resources often used by people experiencing homelessness such as showers, restrooms and water fountains. Thus, people experiencing homelessness often chose to stay close to these resources and would be near the highly populated beaches. According to the Los Angeles Homelessness Services Authority, there are this amount of people experiencing homelessness in each respective neighborhoods: 0 in The Unincorporated Santa Monica Mountain, 83 in Malibu, 977 in Santa Monica, 847 in Venice, 22 in Playa Del Rey, and 55 in Pacific Palisades (LAHSA 2019) . In these data I noticed that Santa Monica and Venice have higher amounts of people experiencing homelessness. However, Malibu, which is a place of concern according to my research, seems to have a lower amount of people experiencing homelessness which could suggest that homelessness may not have the biggest effect on my results and should be explored further in order to understand the effect of homelessness on bacterial pollution.

Surprising Correlations

A common finding in environmental justice is that places with lower socio-economic status tend to have higher levels of pollution (e.g. Tessum et al. 2019). However, I found nearly the opposite pattern in the current study. Stations with higher median income value often had stations with higher levels of bacterial pollutants. This went against my initial hypothesis but makes sense upon reflection. Catalina Island and the neighborhood of Avalon can be considered touristy locations but receive far fewer tourists than Santa Monica, Venice, and Malibu beaches (see discussion above). Moreover, there are considerably larger populations of people experiencing homelessness in Santa Monica and Venice. Importantly though, my findings do

not negate the importance of environmental justice, nor do they undermine previous findings of concentrated pollution in socioeconomically disadvantaged neighborhoods documented by other studies.

Policy Recommendations

A first step to improving beach health policies should be improving environmental education and beach health notification alters. The Public Health Department of Los Angeles (PHDLA) could benefit from explaining some important factors that go into beach health, For example, The PHDLA could inform the public that it may not be safe to go swimming after a rain event because it could lead to more sewage runoff into the ocean. In order to do this the alert system needs to be altered so that more people can have it accessible. Currently the system the PHDLA's website is used to inform beach goers if the water is safe to go in or not. My suggestion would be to invest in phone alerts when beach closures need to be broadcasted since not everyone may have access to the internet at all times and be able to use the website (it would also be nice to have more people know that the website gives this information). In addition to these steps, more resources of hygienic facilities in which people experiencing homelessness can access would be beneficial to help eliminate any possible effect the absence of these facilities may have on bacterial pollution. Tourism in LA is important and by no means am I suggesting restricting tourism, however it is imperative for Los Angeles as a city to make environmental education more widely accessible so that anyone who visits or lives there can at least begin to understand the possible environmental consequences of their actions. Despite this project not

fitting in to the typical environmental justice framework of the trademark cases, everything meaning the environment, the economic market and people should be protected from unnecessary negative externalities that come from not improving upon current beach health protection policies as outlined by the California Coastal Commission.

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Appendix 1

Full Code from R program to get LA pollution means

```
library(readr)
D180102a_MASTER_COPY_ <- read_csv("C:/Users/nayam/Desktop/Honors thesis/CSV
files/D180102a(MASTER COPY).csv")
View(D180102a_MASTER_COPY_)

# calculate means using tidyverse
means <- D180102a_MASTER_COPY_%>%
  group_by(StationID,ParameterCode) %>%
  summarise(mean2018 = mean(Result, na.rm = T))

#create csv of results
write_csv(means,"LApollutionmeans.csv")
```

Appendix 2

Full LA pollution means

Values are organisms per 100ml

StationID	Bacteria Type	Bacterial Pollution Means of 2018
DHS (001)	Enterococcus	15.4375
DHS (001)	Fecal Coliforms	16.65
DHS (001)	Total Coliforms	29.325
DHS (002)	Enterococcus	8.575
DHS (002)	Fecal Coliforms	17.5875
DHS (002)	Total Coliforms	61.025
DHS (002B)	Enterococcus	12.575
DHS (002B)	Fecal Coliforms	16.8125
DHS (002B)	Total Coliforms	109.375

DHS (003)	Enterococcus	5.8125
DHS (003)	Fecal Coliforms	8.7
DHS (003)	Total Coliforms	24.65
DHS (004)	Enterococcus	8
DHS (004)	Fecal Coliforms	5.7625
DHS (004)	Total Coliforms	24.125
DHS (004B)	Enterococcus	8.367089
DHS (004B)	Fecal Coliforms	6.240506
DHS (004B)	Total Coliforms	18.29114
DHS (005)	Enterococcus	6.253165
DHS (005)	Fecal Coliforms	24.65823
DHS (005)	Total Coliforms	67.98734
DHS (005B)	Enterococcus	17.24051
DHS (005B)	Fecal Coliforms	12.68354
DHS (005B)	Total Coliforms	24.11392
DHS (006)	Enterococcus	19.17722
DHS (006)	Fecal Coliforms	23.59494
DHS (006)	Total Coliforms	365.3924
DHS (007)	Enterococcus	9.822785
DHS (007)	Fecal Coliforms	6.974684
DHS (007)	Total Coliforms	14.11392
DHS (007B)	Enterococcus	6.64557
DHS (007B)	Fecal Coliforms	7.544304
DHS (007B)	Total Coliforms	10.62025
DHS (008)	Enterococcus	8.037975
DHS (008)	Fecal Coliforms	6.113924
DHS (008)	Total Coliforms	16.18987
DHS (008B)	Enterococcus	11.31646
DHS (008B)	Fecal Coliforms	20.36709
DHS (008B)	Total Coliforms	34.64557
DHS (009)	Enterococcus	5.455696

DHS (009)	Fecal Coliforms	5.329114
DHS (009)	Total Coliforms	15.96203
DHS (009B)	Enterococcus	7.025316
DHS (009B)	Fecal Coliforms	8.455696
DHS (009B)	Total Coliforms	16.79747
DHS (010)	Enterococcus	7.594937
DHS (010)	Fecal Coliforms	6.759494
DHS (010)	Total Coliforms	12.05063
DHS (010B)	Enterococcus	6.518987
DHS (010B)	Fecal Coliforms	16.65823
DHS (010B)	Total Coliforms	48.13924
DHS (101)	Enterococcus	7.35443
DHS (101)	Fecal Coliforms	5.924051
DHS (101)	Total Coliforms	20
DHS (102)	Enterococcus	7.063291
DHS (102)	Fecal Coliforms	33.92405
DHS (102)	Total Coliforms	582.8734
DHS (102B)	Enterococcus	5.455696
DHS (102B)	Fecal Coliforms	17.12658
DHS (102B)	Total Coliforms	262.9241
DHS (103)	Enterococcus	11.77215
DHS (103)	Fecal Coliforms	11.08861
DHS (103)	Total Coliforms	233.8861
DHS (103B)	Enterococcus	6.746835
DHS (103B)	Fecal Coliforms	9.468354
DHS (103B)	Total Coliforms	94.12658
DHS (104)	Enterococcus	5.721519
DHS (104)	Fecal Coliforms	6
DHS (104)	Total Coliforms	10.3038
DHS (104B)	Enterococcus	5.721519
DHS (104B)	Fecal Coliforms	5.708861

DHS (104B)	Total Coliforms	10.83544
DHS (105)	Enterococcus	6.632911
DHS (105)	Fecal Coliforms	11.65823
DHS (105)	Total Coliforms	30.65823
DHS (105B)	Enterococcus	5.329114
DHS (105B)	Fecal Coliforms	10.89873
DHS (105B)	Total Coliforms	29.41772
DHS (106)	Enterococcus	7.101266
DHS (106)	Fecal Coliforms	8.810127
DHS (106)	Total Coliforms	22.1519
DHS (107)	Enterococcus	21.3038
DHS (107)	Fecal Coliforms	22.41772
DHS (107)	Total Coliforms	327.5443
DHS (107B)	Enterococcus	12.88608
DHS (107B)	Fecal Coliforms	17.12658
DHS (107B)	Total Coliforms	243.3797
DHS (108)	Enterococcus	12.55696
DHS (108)	Fecal Coliforms	6.139241
DHS (108)	Total Coliforms	33.6962
DHS (109)	Enterococcus	4.810127
DHS (109)	Fecal Coliforms	5.316456
DHS (109)	Total Coliforms	43.34177
DHS (110)	Enterococcus	7.56962
DHS (110)	Fecal Coliforms	8.835443
DHS (110)	Total Coliforms	42.3038
DHS (111)	Enterococcus	5.455696
DHS (111)	Fecal Coliforms	6.822785
DHS (111)	Total Coliforms	16.88608
DHS (112)	Enterococcus	5.341772
DHS (112)	Fecal Coliforms	5.329114
DHS (112)	Total Coliforms	11.06329

DHS (112B)	Enterococcus	5.329114
DHS (112B)	Fecal Coliforms	5.620253
DHS (112B)	Total Coliforms	11.32911
DHS (113)	Enterococcus	6.506329
DHS (113)	Fecal Coliforms	8.936709
DHS (113)	Total Coliforms	37.92405
DHS (113B)	Enterococcus	5.746835
DHS (113B)	Fecal Coliforms	5.468354
DHS (113B)	Total Coliforms	9.367089
DHS (114)	Enterococcus	7.088608
DHS (114)	Fecal Coliforms	6.303797
DHS (114)	Total Coliforms	13.50633
DHS (115)	Enterococcus	13.31646
DHS (115)	Fecal Coliforms	18.31646
DHS (115)	Total Coliforms	47.94937
DHS (115B)	Enterococcus	17.05063
DHS (115B)	Fecal Coliforms	12.98734
DHS (115B)	Total Coliforms	28.31646
DHS (116)	Enterococcus	5.063291
DHS (116)	Fecal Coliforms	5.860759
DHS (116)	Total Coliforms	16.65823
DHS (117)	Enterococcus	3.8875
DHS (117)	Fecal Coliforms	8.0375
DHS (117)	Total Coliforms	42.775
DHS (118)	Enterococcus	6.3125
DHS (118)	Fecal Coliforms	35.2875
DHS (118)	Total Coliforms	61.5875
DHS (119)	Enterococcus	18.225
DHS (119)	Fecal Coliforms	64.3625
DHS (119)	Total Coliforms	130.8375
DHS (120)	Enterococcus	8.6

DHS (120)	Fecal Coliforms	31.975
DHS (120)	Total Coliforms	74.625
DHS (121)	Enterococcus	4.0125
DHS (121)	Fecal Coliforms	7.6
DHS (121)	Total Coliforms	24.55
DPH (122)	Enterococcus	8.088608
DPH (122)	Fecal Coliforms	11.34177
DPH (122)	Total Coliforms	377.5316
DPH (122B)	Enterococcus	0.12987
DPH (122B)	Fecal Coliforms	0.12987
DPH (122B)	Total Coliforms	0.12987
DPH 001	Enterococcus	18.16667
DPH 001	Fecal Coliforms	19.94444
DPH 001	Total Coliforms	36.44444
DPH 002	Enterococcus	28.33333
DPH 002	Fecal Coliforms	67.61111
DPH 002	Total Coliforms	378.6111
DPH 002B	Enterococcus	17.94444
DPH 002B	Fecal Coliforms	53.94444
DPH 002B	Total Coliforms	241.5556
DPH 003	Enterococcus	28.33333
DPH 003	Fecal Coliforms	5.555556
DPH 003	Total Coliforms	63.5
DPH 004	Enterococcus	132.7778
DPH 004	Fecal Coliforms	25.77778
DPH 004	Total Coliforms	1504.722
DPH 004B	Enterococcus	15.11111
DPH 004B	Fecal Coliforms	8.388889
DPH 004B	Total Coliforms	213
DPH 005	Enterococcus	10.77778
DPH 005	Fecal Coliforms	11.83333

DPH 005	Total Coliforms	129.3889
DPH 005B	Enterococcus	9
DPH 005B	Fecal Coliforms	13.72222
DPH 005B	Total Coliforms	100.3333
DPH 006	Enterococcus	89.61111
DPH 006	Fecal Coliforms	56.94444
DPH 006	Total Coliforms	2311.556
DPH 007	Enterococcus	89.61111
DPH 007	Fecal Coliforms	44.16667
DPH 007	Total Coliforms	1622.556
DPH 007B	Enterococcus	102.0556
DPH 007B	Fecal Coliforms	41.33333
DPH 007B	Total Coliforms	2060.667
DPH 008	Enterococcus	39.5
DPH 008	Fecal Coliforms	31.05556
DPH 008	Total Coliforms	1114.944
DPH 008B	Enterococcus	64.94444
DPH 008B	Fecal Coliforms	22.11111
DPH 008B	Total Coliforms	885.3333
DPH 009	Enterococcus	9.666667
DPH 009	Fecal Coliforms	92.55556
DPH 009	Total Coliforms	327.2778
DPH 009B	Enterococcus	5
DPH 009B	Fecal Coliforms	6.666667
DPH 009B	Total Coliforms	55.22222
DPH 010	Enterococcus	505.5556
DPH 010	Fecal Coliforms	265.5556
DPH 010	Total Coliforms	5804.889
DPH 010B	Enterococcus	274.8889
DPH 010B	Fecal Coliforms	96.66667
DPH 010B	Total Coliforms	4263.278

DPH 101	Enterococcus	7.833333
DPH 101	Fecal Coliforms	32.72222
DPH 101	Total Coliforms	76.11111
DPH 102	Enterococcus	9.611111
DPH 102	Fecal Coliforms	47.22222
DPH 102	Total Coliforms	2495.5
DPH 102B	Enterococcus	7.777778
DPH 102B	Fecal Coliforms	21.22222
DPH 102B	Total Coliforms	554
DPH 103	Enterococcus	11.22222
DPH 103	Fecal Coliforms	26
DPH 103	Total Coliforms	758.0556
DPH 103B	Enterococcus	10.72222
DPH 103B	Fecal Coliforms	21.05556
DPH 103B	Total Coliforms	656.1111
DPH 104	Enterococcus	25.44444
DPH 104	Fecal Coliforms	75.61111
DPH 104	Total Coliforms	1278.278
DPH 104B	Enterococcus	20.88889
DPH 104B	Fecal Coliforms	67.11111
DPH 104B	Total Coliforms	1563.111
DPH 105	Enterococcus	46.83333
DPH 105	Fecal Coliforms	143.5556
DPH 105	Total Coliforms	1707.222
DPH 105B	Enterococcus	7.222222
DPH 105B	Fecal Coliforms	56.22222
DPH 105B	Total Coliforms	1485.389
DPH 106	Enterococcus	18.5
DPH 106	Fecal Coliforms	74.44444
DPH 106	Total Coliforms	1441.278
DPH 107	Enterococcus	17.11111

DPH 107	Fecal Coliforms	57.83333
DPH 107	Total Coliforms	2006.056
DPH 107B	Enterococcus	17.77778
DPH 107B	Fecal Coliforms	68.44444
DPH 107B	Total Coliforms	1517.889
DPH 108	Enterococcus	16.16667
DPH 108	Fecal Coliforms	95.33333
DPH 108	Total Coliforms	1486.056
DPH 109	Enterococcus	21.55556
DPH 109	Fecal Coliforms	100.2222
DPH 109	Total Coliforms	1574.111
DPH 110	Enterococcus	10.11111
DPH 110	Fecal Coliforms	48.61111
DPH 110	Total Coliforms	1543.167
DPH 111	Enterococcus	11.27778
DPH 111	Fecal Coliforms	19.5
DPH 111	Total Coliforms	666.8889
DPH 112	Enterococcus	11.88889
DPH 112	Fecal Coliforms	15.44444
DPH 112	Total Coliforms	691.6111
DPH 112B	Enterococcus	14.72222
DPH 112B	Fecal Coliforms	22.44444
DPH 112B	Total Coliforms	1070.5
DPH 113	Enterococcus	9.555556
DPH 113	Fecal Coliforms	11.88889
DPH 113	Total Coliforms	156.7222
DPH 113B	Enterococcus	7.222222
DPH 113B	Fecal Coliforms	8.388889
DPH 113B	Total Coliforms	88.16667
DPH 114	Enterococcus	25
DPH 114	Fecal Coliforms	16.22222

DPH 114	Total Coliforms	101.9444
DPH 115	Enterococcus	25.33333
DPH 115	Fecal Coliforms	34.11111
DPH 115	Total Coliforms	452.1111
DPH 115B	Enterococcus	31.5
DPH 115B	Fecal Coliforms	35.55556
DPH 115B	Total Coliforms	256.0556
DPH 116	Enterococcus	42.38889
DPH 116	Fecal Coliforms	20.38889
DPH 116	Total Coliforms	329.5556
DPH 117	Enterococcus	6
DPH 117	Fecal Coliforms	6
DPH 117	Total Coliforms	31.8
DPH 118	Enterococcus	8
DPH 118	Fecal Coliforms	16
DPH 118	Total Coliforms	173.2
DPH 119	Enterococcus	18.2
DPH 119	Fecal Coliforms	50.8
DPH 119	Total Coliforms	263
DPH 120	Enterococcus	26.6
DPH 120	Fecal Coliforms	109.6
DPH 120	Total Coliforms	423.8
DPH 121	Enterococcus	10
DPH 121	Fecal Coliforms	10
DPH 121	Total Coliforms	47.4
DPH 122	Enterococcus	56.33333
DPH 122	Fecal Coliforms	267.5556
DPH 122	Total Coliforms	1695
DPH 123	Enterococcus	0
DPH 123	Fecal Coliforms	0
DPH 123	Total Coliforms	0

DPH 124	Enterococcus	0
DPH 124	Fecal Coliforms	0
DPH 124	Total Coliforms	0
DPH(122C)	Enterococcus	0.12987
DPH(122C)	Fecal Coliforms	0.25974
DPH(122C)	Total Coliforms	0.675325
DPH(122D)	Enterococcus	0.12987
DPH(122D)	Fecal Coliforms	0.12987
DPH(122D)	Total Coliforms	0.12987
SS (123)	Enterococcus	4.493671
SS (123)	Fecal Coliforms	5.810127
SS (123)	Total Coliforms	17.92405
SS (124)	Enterococcus	1.544304
SS (124)	Fecal Coliforms	2.734177
SS (124)	Total Coliforms	21.55696
SS1	Enterococcus	0
SS1	Fecal Coliforms	0
SS1	Total Coliforms	0
SS2	Enterococcus	0
SS2	Fecal Coliforms	0
SS2	Total Coliforms	0

Appendix 3

Full LA Median Income Data and Rank (Credit Los Angeles Times)

RANK	NEIGHBORHOOD	MEDIAN INCOME
1	Bel-Air	\$207,938
2	Hidden Hills	\$203,199
3	Rolling Hills	\$184,777

4	<u>Beverly Crest</u>	\$169,282
5	<u>Pacific Palisades</u>	\$168,008
6	<u>Palos Verdes Estates</u>	\$167,344
7	<u>San Marino</u>	\$158,855
8	<u>La Cañada Flintridge</u>	\$148,996
9	<u>Rolling Hills Estates</u>	\$145,628
10	<u>Malibu</u>	\$138,215
11	<u>La Habra Heights</u>	\$137,034
12	<u>Manhattan Beach</u>	\$136,481
13	<u>Unincorporated Santa Monica Mountains</u>	\$132,997
14	<u>Rancho Palos Verdes</u>	\$128,321
15	<u>Westlake Village</u>	\$126,550
16	<u>Calabasas</u>	\$126,178
17	<u>West San Dimas</u>	\$125,984
18	<u>Bradbury</u>	\$123,773
19	<u>Stevenson Ranch</u>	\$122,833
20	<u>Porter Ranch</u>	\$121,428
21	<u>Topanga</u>	\$120,319
22	<u>Ladera Heights</u>	\$117,925

23	<u>Agoura Hills</u>	\$117,608
24	<u>Leona Valley</u>	\$117,526
25	<u>Brentwood</u>	\$112,927
26	<u>Cheviot Hills</u>	\$111,813
27	<u>Hermosa Beach</u>	\$109,509
28	<u>Castaic</u>	\$108,693
29	<u>Hollywood Hills West</u>	\$108,199
30	<u>Walnut</u>	\$106,893
31	<u>Hasley Canyon</u>	\$106,489
32	<u>Agua Dulce</u>	\$106,078
33	<u>Beverlywood</u>	\$105,253
34	<u>Northwest Palmdale</u>	\$103,013
35	<u>West Hills</u>	\$103,008
36	<u>Cerritos</u>	\$98,212
37	<u>Beverly Hills</u>	\$96,312
38	<u>Century City</u>	\$95,135
39	<u>North Whittier</u>	\$93,841
40	<u>Unincorporated Santa Susana Mountains</u>	\$93,825
41	<u>Castaic Canyons</u>	\$93,248
42	<u>San Pasqual</u>	\$92,917
43	<u>Ridge Route</u>	\$92,822

44	<u>Marina del Rey</u>	\$92,763
45	<u>Diamond Bar</u>	\$92,414
46	<u>Redondo Beach</u>	\$92,263
47	<u>Playa del Rey</u>	\$91,339
48	<u>Woodland Hills</u>	\$89,946
49	<u>Claremont</u>	\$89,804
50	<u>Santa Clarita</u>	\$88,987
51	<u>Sierra Madre</u>	\$88,008
52	<u>West Los Angeles</u>	\$86,403
53	<u>Ramona</u>	\$86,325
54	<u>Tujunga Canyons</u>	\$85,625
55	<u>Hancock Park</u>	\$85,277
56	<u>San Dimas</u>	\$84,953
57	<u>Chatsworth</u>	\$84,456
58	<u>Acton</u>	\$83,983
59	<u>El Segundo</u>	\$83,925
60	<u>Granada Hills</u>	\$83,911
61	<u>La Mirada</u>	\$83,514
62	<u>La Verne</u>	\$83,352
63	<u>Shadow Hills</u>	\$82,796
64	<u>La Crescenta-Montrose</u>	\$82,693

65	<u>Altadena</u>	\$82,676
66	<u>Glendora</u>	\$81,336
67	<u>Vernon</u>	\$81,279
68	<u>View Park-Windsor Hills</u>	\$81,214
69	<u>Desert View Highlands</u>	\$80,867
70	<u>Hacienda Heights</u>	\$80,762
71	<u>Lakewood</u>	\$78,764
72	<u>Green Valley</u>	\$78,712
73	<u>Encino</u>	\$78,529
74	<u>Quartz Hill</u>	\$77,498
75	<u>Westchester</u>	\$77,473
76	<u>Torrance</u>	\$76,866
77	<u>South Pasadena</u>	\$76,229
78	<u>Elizabeth Lake</u>	\$75,951
79	<u>Arcadia</u>	\$75,808
80	<u>Mission Hills</u>	\$75,675
81	<u>Studio City</u>	\$75,657
82	<u>Lake Hughes</u>	\$74,918
83	<u>East Pasadena</u>	\$73,690
84	<u>Tarzana</u>	\$73,195
85	<u>Toluca Lake</u>	\$73,111
86	<u>Angeles Crest</u>	\$72,841

87	<u>Rowland Heights</u>	\$72,638
88	<u>Rancho Dominguez</u>	\$72,097
89	<u>West Covina</u>	\$71,898
90	<u>Carthay</u>	\$71,398
91	<u>Culver City</u>	\$70,774
92	<u>Carson</u>	\$70,645
93	<u>Southeast Antelope Valley</u>	\$70,134
94	<u>Valinda</u>	\$70,037
95	<u>East La Mirada</u>	\$69,930
96	<u>Rancho Park</u>	\$69,724
97	<u>Sherman Oaks</u>	\$69,651
98	<u>Hollywood Hills</u>	\$69,277
99	<u>Santa Monica</u>	\$69,013
100	<u>Sunland</u>	\$68,720
101	<u>Westwood</u>	\$68,716
102	<u>Playa Vista</u>	\$68,597
103	<u>Duarte</u>	\$68,539
104	<u>Charter Oak</u>	\$68,092
105	<u>Val Verde</u>	\$68,073
106	<u>Lake View Terrace</u>	\$67,985
107	<u>Northridge</u>	\$67,906
108	<u>Venice</u>	\$67,647

109	<u>Mayflower Village</u>	\$67,592
110	<u>Eagle Rock</u>	\$67,253
111	<u>Whittier</u>	\$66,891
112	<u>West Carson</u>	\$66,805
113	<u>Citrus</u>	\$66,638
114	<u>Industry</u>	\$66,616
115	<u>Del Aire</u>	\$66,442
116	<u>Covina</u>	\$66,438
117	<u>Signal Hill</u>	\$66,283
118	<u>Vincent</u>	\$66,221
119	<u>Temple City</u>	\$65,965
120	<u>Fairfax</u>	\$65,938
121	<u>Sylmar</u>	\$65,783
122	<u>Arleta</u>	\$65,649
123	<u>South San Jose Hills</u>	\$65,527
124	<u>Lake Balboa</u>	\$65,336
125	<u>South San Gabriel</u>	\$64,827
126	<u>West Puente Valley</u>	\$64,809
127	<u>South Whittier</u>	\$64,670
128	<u>Avocado Heights</u>	\$64,544
129	<u>Burbank</u>	\$64,416
130	<u>East San Gabriel</u>	\$64,365
131	<u>Pico-Robertson</u>	\$63,356

132	<u>Palmdale</u>	\$63,317
133	<u>Beverly Grove</u>	\$63,039
134	<u>Pasadena</u>	\$62,825
135	<u>Mar Vista</u>	\$62,611
136	<u>Winnetka</u>	\$62,535
137	<u>Norwalk</u>	\$62,412
138	<u>Del Rey</u>	\$62,259
139	<u>Downey</u>	\$61,839
140	<u>Windsor Square</u>	\$61,767
141	<u>West Whittier-Los Nietos</u>	\$61,504
141	<u>Monrovia</u>	\$61,504
143	<u>Lopez/Kagel Canyons</u>	\$61,398
144	<u>Irwindale</u>	\$60,959
145	<u>Little Rock</u>	\$60,781
146	<u>Veterans Administration</u>	\$60,561
147	<u>Artesia</u>	\$60,538
148	<u>Santa Fe Springs</u>	\$60,445
149	<u>Lomita</u>	\$59,059
150	<u>Northwest Antelope Valley</u>	\$58,899
151	<u>Mid-Wilshire</u>	\$58,483
152	<u>Tujunga</u>	\$58,001

153	<u>Gramercy Park</u>	\$57,983
154	<u>Mount Washington</u>	\$57,725
155	<u>Sawtelle</u>	\$57,710
156	<u>San Pedro</u>	\$57,508
157	<u>Alondra Park</u>	\$57,177
158	<u>Glendale</u>	\$57,112
159	<u>San Gabriel</u>	\$56,687
160	<u>Pico Rivera</u>	\$56,683
161	<u>Baldwin Park</u>	\$56,585
162	<u>North El Monte</u>	\$56,577
163	<u>Unincorporated Catalina Island</u>	\$56,295
164	<u>Sun Village</u>	\$56,175
165	<u>Lancaster</u>	\$56,069
166	<u>La Puente</u>	\$55,902
167	<u>Montecito Heights</u>	\$55,901
168	<u>Valley Village</u>	\$55,470
169	<u>Harbor City</u>	\$55,454
170	<u>Monterey Park</u>	\$55,210
171	<u>Reseda</u>	\$54,771
172	<u>Silver Lake</u>	\$54,339
173	<u>Pomona</u>	\$54,242

174	<u>San Fernando</u>	\$54,068
175	<u>Atwater Village</u>	\$53,872
176	<u>Bellflower</u>	\$53,325
177	<u>Azusa</u>	\$53,299
178	<u>Alhambra</u>	\$53,224
179	<u>Avalon</u>	\$53,200
180	<u>Lawndale</u>	\$53,150
181	<u>Gardena</u>	\$52,897
182	<u>West Hollywood</u>	\$52,855
183	<u>Montebello</u>	\$52,623
184	<u>North Hills</u>	\$52,456
185	<u>Northeast Antelope Valley</u>	\$52,234
186	<u>Lake Los Angeles</u>	\$52,146
187	<u>Canoga Park</u>	\$51,601
188	<u>Sun Valley</u>	\$51,290
189	<u>Long Beach</u>	\$50,985
190	<u>Los Feliz</u>	\$50,793
191	<u>Palms</u>	\$50,684
192	<u>Glassell Park</u>	\$50,098
193	<u>Paramount</u>	\$49,815
194	<u>Rosemead</u>	\$49,387
195	<u>Pacoima</u>	\$49,066
196	<u>Elysian Valley</u>	\$49,013

197	<u>Athens</u>	\$48,824
198	<u>Walnut Park</u>	\$48,750
199	<u>Lynwood</u>	\$48,518
200	<u>South Gate</u>	\$48,312
201	<u>West Compton</u>	\$48,093
202	<u>Harbor Gateway</u>	\$47,849
203	<u>Larchmont</u>	\$47,780
204	<u>South El Monte</u>	\$46,912
205	<u>Hawaiian Gardens</u>	\$46,853
206	<u>Inglewood</u>	\$46,574
207	<u>Commerce</u>	\$46,245
208	<u>Valley Glen</u>	\$46,175
209	<u>Manchester Square</u>	\$46,093
210	<u>El Sereno</u>	\$45,866
211	<u>Leimert Park</u>	\$45,865
212	<u>Highland Park</u>	\$45,478
213	<u>Panorama City</u>	\$44,468
214	<u>East Compton</u>	\$44,439
215	<u>El Monte</u>	\$44,415
216	<u>Mid-City</u>	\$43,711
217	<u>Hawthorne</u>	\$43,602
218	<u>Compton</u>	\$43,157

219	<u>North Hollywood</u>	\$42,791
220	<u>Cypress Park</u>	\$42,615
221	<u>Bell Gardens</u>	\$41,532
222	<u>Maywood</u>	\$41,203
223	<u>Van Nuys</u>	\$41,134
224	<u>Wilmington</u>	\$40,627
225	<u>Bell</u>	\$40,556
226	<u>Hyde Park</u>	\$39,460
227	<u>Huntington Park</u>	\$39,185
228	<u>Cudahy</u>	\$39,048
229	<u>East Los Angeles</u>	\$38,621
230	<u>Willowbrook</u>	\$38,224
231	<u>West Adams</u>	\$38,209
232	<u>Baldwin Hills/Crenshaw</u>	\$37,948
233	<u>Lennox</u>	\$37,937
234	<u>Chesterfield Square</u>	\$37,737
235	<u>Echo Park</u>	\$37,708
236	<u>Harvard Park</u>	\$37,013
237	<u>Florence-Firestone</u>	\$34,408
238	<u>Exposition Park</u>	\$33,999
239	<u>Hollywood</u>	\$33,694

240	<u>Boyle Heights</u>	\$33,235
241	<u>Jefferson Park</u>	\$32,654
242	<u>Westmont</u>	\$31,572
243	<u>Central-Alameda</u>	\$31,559
244	<u>Arlington Heights</u>	\$31,421
245	<u>Green Meadows</u>	\$31,347
246	<u>Vermont Vista</u>	\$31,272
247	<u>Vermont-Slauson</u>	\$31,236
248	<u>Harvard Heights</u>	\$31,173
249	<u>Historic South-Central</u>	\$30,882
250	<u>Lincoln Heights</u>	\$30,579
251	<u>Koreatown</u>	\$30,558
252	<u>East Hollywood</u>	\$29,927
253	<u>Vermont Square</u>	\$29,904
254	<u>Broadway-Manchester</u>	\$29,897
255	<u>Adams-Normandie</u>	\$29,606
256	<u>South Park</u>	\$29,518
257	<u>Florence</u>	\$29,447
258	<u>Elysian Park</u>	\$28,263

259	<u>Vermont Knolls</u>	\$27,730
260	<u>Westlake</u>	\$26,757
261	<u>Pico-Union</u>	\$26,424
262	<u>Watts</u>	\$25,161
263	<u>Chinatown</u>	\$22,754
264	<u>University Park</u>	\$18,533
265	<u>Downtown</u>	\$15,003

Credit: Los Angeles Times Neighborhood Ranking According to Median Income