Community Park Planning Along The Los Angeles River: An Equitable Approach Based On Environmental, Socioeconomic, and Health Metrics

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Introduction

Problems

Throughout the dense urban sprawl of Los Angeles, community parks are few and far between. Whereas the average high-density U.S. city has 6.8 acres of park space per 1,000 residents, Los Angeles has less than half of this, with only 3.3 acres per 1,000 residents (LA County Department of Public Health, 2016). This shortage does not affect everyone equally. Despite the nonprofit movement toward park equity, there are still huge disparities in park access, particularly for low income communities and communities of color. This affects community health and exacerbates existing issues of injustice and pollution.

In an effort to transition towards more park access, Los Angeles County and Los Angeles County Public Works have turned to the Los Angeles River (LA River). Once a meandering waterway that supported a diverse ecosystem, the LA River currently functions as a concrete flood channel with limited public access that runs through many industrialized, low income communities. The county has drafted the LA River Master Plan with the aim of reimagining the river and shaping it into a “tangible, multi-benefit resource” (Los Angeles County, 2022). The plan outlines a number of proposed development projects — including bikeways, trails, floodplain reclamation, and bridges — from different organizations. One of the more controversial options being considered is “platform parks”, or concrete bridges over the river topped with green space (Los Angeles County, 2022). These projects would be expensive; cost estimates for just two platform parks range betwen $3 and $4 billion dollars, based on a cost-per-acre projection (Federal Highway Administration, 2012).

Our client, the nonprofit LA Waterkeeper, has proposed building pocket parks alongside the river as an alternative solution that could provide more immediate benefits to residents. Pocket parks, or small, dispersed parks in urban spaces, could be a viable alternative solution due to their lower cost. Given that community parks typically cost between $3 and $7 million (California Department of Parks and Recreation, 2020), a budget of $5 billion would build roughly 853 pocket parks. This could benefit a much larger number of communities along the river. However, choosing where to place new parks is a complex undertaking that involves the consideration of a number of factors, including land availability, potential community and environmental benefits, funding, and locations of existing parks.

Objectives

This report's objective is to establish a framework for identifying park locations that best meet community needs and are feasible to construct in the short term. To move toward a more equitable distribution of green space, our analysis prioritizes communities that have been subject to environmental injustices. We used maps and tables to visualize current park access, community health factors, urban heat island effect severity, soil type, elevation,and economic feasibility of potential locations.

This report is intended to serve as a resource to those involved in the park planning process, including nonprofits. In response to major governmental divestment from parks and equity concerns, nonprofits have taken an active role in creating and maintaining parks in LA (Rigolon, 2017). However, these organizations often work with limited time and resources to address the overwhelming need for parks. Ideally, this research will complement their work by providing tools that will guide park planning decisions, such as how to prioritize different neighborhoods and vacant lots.

Our Approach

Park need is high all over Los Angeles and across the entire course of the river. Given our objective of proposing specific sites for park placement, the approach we are taking to arrive at a localized set of sites is to integrate our framework into three distinct scales of spatial analysis. Beginning with the broadest scale, we look at the river as a whole to distinguish the characteristics of surrounding regions. The river follows a

51-mile course across Los Angeles County, beginning in Canoga Park and draining into the Pacific Ocean at the Port of Long Beach (Los Angeles County, 2021). It is often discussed in terms of two sections – the Upper LA River (ULAR) and the Lower LA River (LLAR) – with the City of Vernon serving as the informal division point. While this regional distinction already provides some context, here we can begin to use maps to visually compare the quantitative characteristics of the ULAR and the LLAR based on three metrics of our framework. We created maps to illustrate how community health, park access, and ecological benefits vary across regions surrounding the entire length of the river. The community health maps illustrate disparities in pollution burden among river-adjacent communities, allowing us to identify which regions can benefit most from improved air quality. Park access maps assessing NDVI along with additional data from the LA County Parks Needs Assessment can point us towards regions that generally lack accessible green space. From a watershed perspective, a river-wide view is also needed to identify which parts of the river could most benefit from groundwater infiltration, stormwater capture, and other ecological benefits of parks based on topography and soil considerations.

Once we combined the above metrics and narrowed in on a region of focus, we used other considerations to select specific communities to focus on within that region. Rather than relying on maps and quantitative data, the community-selection phase of our process leans more on qualitative factors. First, we conducted a literature review of past and current environmental injustices to better understand the sheer amount of harm faced by river-adjacent communities. From an environmental justice perspective, there is no shortage of communities in desperate need of parks – however, exploring the history helps to guide our selection of which neighborhoods could benefit most from increased park presence both in terms of restorative and practical considerations. From there, we can begin to assess how economic and legal factors come into play.

Once we narrowed in on specific communities, we focused on site selection. Here, our framework metrics were combined with various other considerations to inform which vacant lots as well as sites on public school grounds within a community are the most feasible and accessible park locations. Looking at walkability, the ideal park location is one that will serve the most residents within walking distance. In terms of general feasibility, we first consider factors such as current land use and whether the site is publicly owned. We also look at other factors that could present challenges, such as acreage and whether the site requires remediation. This stage of our methodology required a site visit in order to inspect the physical characteristics of sites that might not be evident without viewing the site in person, such as potential safety hazards and ease of access.

Limitations

While we strove to create a comprehensive and equitable framework, our analysis has some procedural justice and scope limitations. In a park planning context, procedural justice involves prioritizing equity and including marginalized groups in the process of selecting and designing parks (Rigolon, 2019). Because we took a primarily research-based approach to the issue and did not meaningfully engage with residents of river-adjacent communities, procedural justice considerations in our report are limited. Should our suggested park locations be further considered, residents should be given space to share their opinions and concerns, since they will ultimately be the ones most impacted by park placement (Rigolon, 2019). Going about this process in a meaningful and deliberate manner – whether that be through surveys, public forums, or collaboration with community groups – will also reincorporate procedural justice into the park-planning process.

While procedural justice was not an integral component in our analysis, distributional justice – the distribution of access to parks and environmental amenities – guided our research of river-adjacent communities (Rigolon, 2019). We prioritized park placement recommendations in communities that have been marginalized and denied park access in the past. This list of location recommendations is available in Appendix A. However, this list is non-exhaustive — it is possible that there are sites we did not include that are equally suitable for parks. The sites we highlight in this report are meant to serve as examples of how to apply our framework to assess other potential locations, in addition to being promising potential park locations themselves.

The framework we used to select the sites and communities included in this report is also non-exhaustive, and could be expanded to include other important park placement factors, such as political will, available funding, and community action. Municipal bureaucracies often work slowly, which can delay funding and construction processes after a park location is approved. This can be further complicated when multiple agencies are involved (Rigolon, 2017). Additionally, the budget for parks is often limited and varies between cities, which can prevent parks from being placed in areas where they are most needed (Schnalzer, 2021b). City officials, non-profits, or community leaders often have to string together multiple funding sources to build parks in areas with sparse funding, which requires additional time and energy (Rigolon, 2017). Community buy-in and engagement are also important factors that are difficult to quantify. If a community is vocal about wanting a park, city officials may be more likely to fund one in their area (Schalzer, 2021b). However, park planning agencies are not always equally receptive to demands. Lower-income communities of color often have limited resources and have historically been excluded from having green space in their communities, even when proposals are made (Humphrey, 2019). These factors are all important when considering the feasibility of potential park locations, and must be taken into account in conjunction with our analysis.

Our Process

In order to grapple with the difficult undertaking that is choosing where to put parks, we have developed a framework based on six primary metrics: existing park access, community health benefits, hydrology, zoning and land use restrictions, environmental justice history, and available funding. Although there are many other factors to consider, we hope that together, these components will inform our recommendations for alternative park locations in a comprehensive way. We developed this framework as a tool for stakeholders to use in their decision-making process. The following sections explore in depth how each metric can be used to narrow down park locations at the regional, community-level, and site-specific scales.

Regional Selection

Existing Park Access

Park access, or the lack thereof, is a striking indicator of environmental justice and equity. As a central objective of this project is to create a greater number of distributed parks in closer proximity to residents, we found an analysis of current park distribution to be important in our framework. To better understand current park and greenspace need across Los Angeles County, we analyzed the Normalized Vegetation Index (NDVI) in tandem with the distribution and number of publicly accessible parks, as seen in Appendix B. NDVI employs Landsat imagery and quantifies vegetation presence on a scale from -1 to +1 based on the difference between near-infrared light (which vegetation reflects) and red light (which vegetation absorbs). A map of NDVI will feature a gradient of red to green, with green areas representing high vegetation presence.

However, there are limitations involved with analyzing NDVI alone as a metric for park presence. Some of the green patches scattered throughout Los Angeles, for example, represent private golf courses; these areas are not publicly accessible and only offer recreation opportunities to a select few in Los Angeles. As our project is concerned with equitable park distribution and access, we found it necessary to also create maps of publicly accessible parks across LA County and the number of parks per Census tract. While all the parks included on these two maps (Maps B2 & B3, Appendix B) are publicly accessible, not all of these plots are green spaces; they can be basketball courts, playgrounds, or skateparks, all of which offer opportunities for public recreation but may not offer the same benefits of green space, like urban heat island alleviation.

The maps in Appendix B explore vegetation presence and park access in Los Angeles, along the path of the LA River. In broad strokes, these variables help depict which communities have access to green spaces, including both satellite and census data. They reveal the general trend that the Lower LA River, except for its lowermost tip, has fewer parks than the Upper LA River. This is in part due to the presence of the industrial district surrounding the path of the Lower LA River and a history of being excluded from governmental decision making; heavily urbanized and concrete-laden, this region is park poor. While maps detailing public park access and vegetation indices are useful in informing our spatial understanding, they can be misleading if referenced alone. Analyzing NDVI alongside community health factors, for example, provides a better understanding of which areas might benefit most from vegetation presence and park access. We employed a further analysis of spatial data, using a series of factors that incorporated community metrics to aid us in our analysis of park need across Los Angeles County.

Community Health Risk Factors

There is an increasing body of scientific literature pointing to the correlation between the presence of green space and benefits to human physical and mental health. In conducting our analysis of community health benefits and risks associated with park placement, we investigated localized areas within river-adjacent cities that will be most beneficial in prioritizing public health in these communities.

CalEnviroScreen is a good starting point when analyzing the intersection of health effects and environmental factors. CalEnviroScreen is an aggregate metric developed by the California Office of Environmental Health and Hazards that takes into account metrics such as air particulates, water contaminants, toxic releases, and hazardous waste facilities to produce an overall score that demonstrates the environmental risk factor and population vulnerability of assessed cities. Map C1 (Appendix C) shows the CalEnviroScreen score for Census tracts within a two-kilometer buffer of the LA River. The map demonstrates that Census tracts along the Lower LA River have exceptionally high risk percentiles, many of which are above 80. Following the understanding that a lack of parks worsens health and other environmentally related conditions, the CalEnviroScreen map is consistent with the large numbers of environmental justice cases previously mentioned in low-income areas along much of the Lower LA River.

We also investigated the individual effects of metrics included in CalEnviroScreen, such as PM2.5, cardiovascular disease, and asthma rates. Long-term exposure to PM2.5, or particulate matter with a diameter of less than 2.5 microns, is dangerous because it can cause nonfatal heart attacks, irregular heartbeats, and irritation in the lungs (U.S. EPA, 2016). PM2.5 pollution levels along the LA River are shown in Map C2 (Appendix C). The map's gradient is concentrated in the center near Paramount and Boyle Heights, between Burbank to the north and Long Beach to the south. It is notable that Paramount and Boyle Heights are both lower income communities. Boyle Heights is largely residential, with a predominantly Latino population and a median household income of $40,000 (U.S. Census Bureau, 2020). Paramount, similarly, is a residential community and with a median salary of $55,000 (U.S. Census Bureau, 2020). Providing pocket parks in these communities could help mitigate further air pollution and health effects from PM2.5 within communities with high pollution levels.

In addition to high PM2.5 pollution levels, Paramount and Boyle Heights face health disparities, including high levels of cardiovascular and respiratory diseases, such as asthma (County of Los Angeles Department of

Public Health, 2018). These elevated rates of health problems can likely be attributed to elevated pollution levels in these areas. Map C3 (Appendix C) demonstrates the rate of cardiovascular disease along the LA River, visualized by Census tract. The map shows a clear difference in cardiovascular disease rates between the Upper and Lower LA River. Tracts along the Lower LA River, specifically in Boyle Heights and Paramount, have a high disease percentile scores of 80 and above. This is a comparative difference to areas in the Upper Los Angeles River with average disease scores of 0 to 40. The disparities between these two areas demonstrate a lack of community health concerns and the need for implementation of walking space and exercise amenities. Adding pocket parks along the Lower LA River would provide space for recreation and community services, such as farmers markets and health programs, and could help reduce the rate of cardiovascular disease in these communities. This is particularly important given that cardiovascular disease can be fatal – health concerns include heart failure, strokes, and acute heart attacks (U.S. EPA, 2016).

High air pollution levels have also been linked to higher rates of asthma. Map C4 (Appendix C) shows asthma percentile in the Census tracts adjacent to the LA River. The gradient on this map is less dramatic between the Upper and Lower LA River. The health effects of asthma include trouble breathing and lung capacity deficiency (U.S. EPA, 2016). However, it is difficult to localize river-adjacent areas with the highest instances of asthma. By comparing our asthma and particulate matter maps, they can be used to help narrow down specific regions of interest for park placement.

Collectively, Maps C2, C3, and C4 demonstrate that the Lower LA River suffers more environmental health burdens than the Upper region. Each map serves as a visual representation of the health disparities by percentile and how similar these disparities are within the scope of the cities impacted by environmental justice. Implementing parks in these regions could help reduce air pollutants, making it easier and cleaner for everyone to breathe (U.S. EPA, 2016).

Hydrology: Elevation and Soil Type

In addition to increasing the amount of green space for residents, pocket parks have hydrological benefits for Los Angeles. During precipitation events, the open, undeveloped space in parks allows for groundwater recharge, or the process of surface water (which includes rainfall runoff) percolating into the ground and becoming part of the groundwater supply. Having an adequate groundwater supply is important in Los Angeles, as the city receives about 10% of its water from groundwater reservoirs (Schnalzer, 2021a). Despite the importance of this reserve, the majority of rainfall in the city is flushed out to the Pacific Ocean rather than being infiltrated into the ground. For example, after three days of rain in 2017, Los Angeles County Department of Public Works estimated that about 77,000 acre-feet of rainwater was flushed out to the Pacific Ocean, while only about 12,000 acre-feet was retained (Boxall, 2017). The majority of the rainwater that was retained was infiltrated into the ground in unpaved areas, such as parks.

The infiltration rate of rainfall, and in effect, the total volume of water that can be infiltrated in a specific area, is dependent on a number of variables, including topography (Water Science School, 2019). If an area is steep, rainfall will run off of it quickly and infiltrate less than it would in a flatter area. In contrast, shallow valleys may collect runoff, and therefore allow a larger volume of water to infiltrate.

Map D1 (Appendix D) shows elevation within a two-kilometer buffer of the LA River. The limited color variation along the river reveals that the river-adjacent land is relatively flat, with a slight downhill gradient following the river from north to south. Because of the general uniformity in elevation along the Lower LA River, we ruled that it will not help us differentiate between potential park locations, and therefore have not included elevation information in our recommendations. If there was more variation in elevation, we would have used this information to eliminate hilly areas that would likely be unideal park locations due to their topography.

Soil type, which includes clay, sand, and silt, is another variable that is important to determining infiltration rate (Water Science School, 2019). Each of these soils are composed of particles of different sizes and shapes, which affects the rate at which water can pass through them. In general, sandy soils are composed of the largest particles, while clay soils are made of small particles that are closely packed together. A visualization of each of these soil types is available in Table D1 (Appendix D). Soils that are composed of a mixture of clay, sand, and silt are known as loam. Loam soils are often described with the material that makes up their majority proportion – for example, a loam soil that is composed of a majority of sand is called “sandy loam”.

A map of soil type along the LA River is available in Map D2 (Appendix D). All the soils present are varieties of loam, with large areas of sandy loam along the Lower LA River and stretches of loam and clay loam along the Upper LA River. There are also areas with silty loam soils, but these are significantly smaller than areas with other soil types. Each of the soil types along the LA River has a different infiltration rate, which is largely dependent on whether the majority proportion is sand, silt, or clay. The infiltration rates of these varying soil types are listed in Table D2 (Appendix D). Sandy loam soils have the highest infiltration rate of the soil types within two kilometers of the river, and thus these areas would be most ideal for parks in terms of hydrological benefits.

Different soil types also support different types of vegetation. If soil type varied dramatically along the LA River, this would likely be an important consideration for park placement, since the plants in parks affect maintenance costs, park longevity, and potential uses for the park. However, since all the soils along the LA River are varieties of loam, the vegetation that can thrive in the area is likely to be relatively uniform. Table D3 (Appendix D) lists native southern California vegetation that is particularly suited to the soil types along the river. While they are grouped by soil type, there is a fair amount of overlap between the different soils as many plants can grow in multiple soil types along the river.

Community Selection

Environmental Justice History of the LA River Region

Indigenous Inhabitants: Gabrieliño-Tongva, Fernandeño Tataviam, and Ventureño Chumash

Creating parks that meet community needs requires understanding these communities and their histories. By looking back in time, we can gain context for present-day cultural, economic, environmental, and physical characteristics of the LA River region. Any discussion of history must begin with the native Gabrieliño-Tongva, Fernandeño Tataviam, and Ventureño Chumash peoples, who inhabited the land along the LA River for millenia (Elrick, 2007). The river still holds cultural and spiritual significance to these Tribal Nations, and they have a vested interest in potential development plans.

While meaningful engagement with Gabrieliño-Tongva tribal members is outside the scope and feasibility of this report, future park planning efforts should incorporate procedural justice through the consultation of tribal representatives. Additionally, maps created by Tribal Council member Julia Bogany identifying historic Tongva settlements along the river could potentially highlight symbolic locations for new parks (Bogany, n.d.). Similar to the cultural center at the Kuruvungna Sacred Springs in West LA (Santa Monica Conservancy, n.d.), these sacred sites could be memorialized through the creation of parks that could host cultural and educational events. For instance, a settlement called Gerevonga was located in the industrial sector at Mission Junction, near Chinatown and Downtown LA. Another site, Apachia, may have been located around Sheridan Street Elementary School in Boyle Heights . Finally, a community named Tevaaxa'anga, or "the old house", was located near the intersection of the 710 and 405 freeways in North Long Beach (Bogany, n.d.). Placing parks in these areas could create opportunities for memorials or art celebrating Tongva culture and heritage and honor the legacy of the land's original inhabitants.

El Pueblo de Los Angeles: Privatization of Land and River Access

One of the most compelling reasons to build parks along the river is to give public land back to communities that have been denied access to land and water resources since the founding of Los Angeles. Following millennia of Indigenous existence along the river, Spanish settlers established the El Pueblo de Los Angeles outpost at the edge of the LA River in 1781 (Kim, 2017). At the time, Spanish law established communal water rights, meaning community members could freely use the river for irrigation, domestic water supply, and recreation. Then, when California became a state in 1848 and Anglo settlers arrived from the east, they dismantled communal rights and established private ownership of the land and river. The concretization of the river in the 20th century, along with the construction of freeway networks in the 1930s and 40s, blocked public access to the waterway and eliminated connectivity across the river and between neighborhoods. Today, this infrastructure remains in place, and residents living in and around Elysian Valley, Chinatown, and El Pueblo still lack access to public green space (Kim, 2017). Building pocket parks in these communities would be a form of restorative justice, or returning the land to communities who have been denied free access for centuries.

El Pueblo de Los Angeles: Park Development and Displacement

While building parks on original Pueblo land could bring restorative justice to communities, there are many challenges to park planning in this area due to displacement concerns and past failures. In the 1950's, the city forcibly removed the Chicano neighborhood of Chavez Ravine and razed their homes to the ground in order to build Dodger Stadium (Kim, 2017). Many of the displaced residents moved to Elysian Valley, where they continued to be subjected to noise and pollution from the construction of the I-5 freeway. In 1999, a diverse coalition of residents successfully prevented the industrialization of a plot of land known as the Chinatown Cornfield, and it was turned into the Los Angeles State Historic Park instead. However, this park and surrounding development have been a major source of gentrification over time, and displacement concerns in Chinatown and Elysian Valley, known colloquially as "Frogtown", persist to this day. While the rich cultural history and diversity of this area make it an appealing option for river restoration and park projects, residents are rightfully concerned that this will accelerate green gentrification (Kim, 2017). Studies have shown that parks built closer to downtowns tend to promote gentrification, so park planning in this area should proceed cautiously (Rigolon & Németh, 2020).

Southeast Los Angeles: "The Diesel Death Zone"

Further south along the river, the region of Southeast LA, nicknamed the "Diesel Death Zone", has extremely high park need due to a long history of pollution and environmental racism. During the post-war suburbanization era of the 1940's and 50's, the LA River was used as a racialized landmark in restrictive practices such as redlining and the discriminatory zoning laws (Kim, 2017). As a result, today there are consistently lower levels of park accessibility in Latino, African-American, and Asian-Pacific Islander-dominated neighborhoods relative to White-dominated neighborhoods (Wolch et al., 2005). Communities of color also tend to be higher density, with fewer available spaces for parks (Wolch et al., 2005). Southeast LA is also one of the most polluted areas in LA due to heavy industrialization, a high number of factories and toxic waste facilities, and diesel pollution from the many crisscrossing freeways (Gómez, 2019).

As the demographics of Southeast LA have shifted over recent decades, pocket parks have sprung up in spite of the dense urban sprawl. Before the 1960s, neighborhoods such as South Gate, Huntington Park, Bell, and Maywood were white-dominated, but white flight to the outer suburbs created space for a massive influx of immigrants, particularly from Mexico (Gómez, 2019). Today, approximately 96% of the population of Southeast LA identifies as Latino (Gómez, 2019). Beginning in the 1980s, there was a boom of unpermitted, makeshift housing construction due to the lack of housing infrastructure to accommodate new immigrants. The resulting cityscape was dense and heterogeneous– not conducive to large community parks– but residents still created tiny backyard gardens and improvised park-like spaces in alleyways (Gómez, 2019). Since then, the majority of successful park additions have been accomplished by grassroots community organizations such as the LA Neighborhood Land Trust. Clearly, there is precedent for squeezing pocket parks into dense neighborhoods; however, logistics and funding pose a challenge, since few park funds have historically been distributed to this region (Wolch et al., 2005). Additionally, even small parks have been shown to accelerate gentrification, so anti-displacement strategies should be utilized early in the planning process (Rigolon & Németh, 2020).

Past Environmental Justice Cases Along the LA River

Looking at specific environmental justice cases from the past illuminates neighborhoods that could be ideal park locations, for both symbolic and practical purposes. Areas with a history of pollution are often forced to deal with after-effects for decades, even if the offending facilities are shut down. Parks offer an opportunity for these communities to shift from recovery to renewal. To narrow in on communities with high need and a history of environmental justice, we performed a literature review of each of the neighborhoods within a two kilometer buffer of the river. We searched multiple databases, using the city name and "environmental justice cases" as our search term. Table E1 (Appendix E) outlines the cases that our research produced, the associated neighborhood, and its publication source. Note that many of these cases are very recent, illustrating the fact that these communities are still actively fighting against pollution and injustice. Map E1 (Appendix E) shows the locations of some of these neighborhoods with historical EJ cases. It is clear that the majority are clustered along the lower river segment, near the river bend and Southeast LA, suggesting that these should be high priority regions.

A few cases from this list are worth pointing out. At the southern end of the river where it empties into the ocean, the city of Long Beach has suffered from poor air quality for decades due to industrial port activities (Mousavi et. al, 2019). Lower income communities of color in Long Beach, including communities dominated by Native Hawaiians and Pacific Islanders (NHPIs), have been exposed to disproportionately high quantities of toxic waste and pollution thanks to the high concentration of vehicles, ships, locomotives, and freeways (Morey, 2014). Most recently, in March of

2022, 30,000 to 40,000 gallons of sewage spilled into the LA River, causing public swimming beaches in Long Beach to close (Austin, 2022). Given this city's industrial landscape and the continued pollution of communities, building parks in Long Beach is an urgent need.

Just north of Long Beach, the city of Carson is dotted with landfills and auto dismantling plants, which were built when the city was unincorporated and lacking political power to resist (City of Carson, n.d.). Not only do these landfills and abandoned junk yards pollute the groundwater and clutter the city with trash, they are also underutilized space. Converting them to parks would clean the air and water and improve community health immensely. In October 2021, elevated levels of hydrogen sulfide in Carson caused a pungent odor to permeate the neighborhood, causing headaches and nausea (South Coast AQMD, 2021). These residents deserve beautiful green spaces, not junk piles.

Further north along the river, communities continue to be polluted and marginalized. In 2018, the city of Compton attempted to pass an ordinance banning fracking within the city. However, the city was successfully sued by Western States Petroleum Association for unconstitutionality, and oil drilling continues (Shamasunder, 2018). In early 2020, Delta Airlines dumped 15,000 gallons of jet fuel over the neighborhood of Cudahy, injuring children and teachers while at school (Vives, 2020). Residents protested the incident at a town hall meeting and demanded more recognition, while a county health official downplayed the seriousness of the issue. In 2021, the city filed a lawsuit against KIPP for proposing to build a charter school on a hazardous waste site (Petersen, 2021). A local public school, Park Avenue Elementary, already sits on top of a site contaminated with toxic sludge. With a population made up of 31% children, Cudahy is in desperate need of a cleaner environment. Park Avenue Elementary could be a promising location for a new park, depending on site cleanup progress.

Near the Arroyo Seco confluence with the LA River and the proposed platform park locations, the cities of South Gate and Paramount are areas of high park need. In Paramount, several metal-finishing facilities are located near schools and hospitals, and high levels of lead and Chromium-6 pollutants have been detected in the air (Hasheminassab et al., 2020). South Gate has three superfund sites within a quarter mile of each other (CDC, 2016). There is a disproportionate amount of polluting transportation infrastructure along Alameda Corridor and the rail lines, as well as 15 factories that release 134,132 pounds of air toxins each year (Huerta, 2005). Interestingly, in 2001, a 550-Megawatt power plant project was scrapped after a successful protest by South Gate residents (Huerta, 2005). Currently, nonprofits are working on building a new park in South Gate called the Urban Orchard Project, at the intersection of the river and the I-710 freeway (City of South Gate, 2021).

The city of Bell Gardens has a long history of toxic pollution. In 1999, two chrome plating facilities near Suva Elementary and Middle Schools were emitting highly toxic chromium VI, causing 22 students and six teachers to become diagnosed with cancer and increasing miscarriage rates among teachers (Gold, 1999). Fortunately, the nonprofit Communities for a Better Environment (CBE) managed to shut down the facilities and strengthened the emission standards for chromium VI (Communities for a Better Environment, n.d.). Still, this victory has not erased the tragic deaths experienced by this community. Providing Bell Gardens with more environmental amenities could be part of the healing process for these impacted residents.

The city of Maywood is notable for its years-long fight for improved water quality. The local domestic water supply is controlled by small private companies, and for years residents complained about the foul odor and color of the water (Carter, 2016). Groups such as the Environmental Justice Coalition for Water (EJCW) pushed for reform until finally, in 2021, the State Water Board approved a $2.7 million water quality improvement project to filter iron and manganese contaminants from the groundwater (California Water Boards, 2021).

Along the bend of the river lies Vernon, a barren tract filled with heavy industry facilities and warehouses. While home to very few residents, the polluting factories in Vernon have deteriorated community health in neighboring cities. Most notably, Exide Technologies, a lead-acid battery recycling facility in Vernon, illegally transported and dumped hazardous wastes into the ground for over three decades (Barboza, 2020). In 2020, the community was outraged when Exide Technologies proposed a bankruptcy plan, effectively allowing them to abandon the site cleanup process. The cleanup of soil contaminants continues to this day. Similarly, Central Metals was a metal recycling facility in Vernon that improperly handled hazardous wastes for over a decade. The facility was finally shut down in 2016 after years of heroic activism by CBE and the United Residents of Southeast Los Angeles (URSELA). Community parks on these previously contaminated sites could be symbols of resistance that return the land to the community. However, since these sites are far from residential areas, these parks would have limited access and direct impact. Vernon's industrial maze has a lot of symbolic potential, but access concerns make it a lower priority than residential areas.

Boyle Heights is a hot spot for diesel pollution due to the convergence of LA's infamous freeway networks. In the 30s, the city demolished homes and displaced families to make room for the new freeways (Gómez, 2019). Since this traumatic event, vehicle emissions have continued to contaminate the area, and the neighborhood continues to have a very high poverty rate and pollution burden (Gómez, 2019). Diesel pollution from five railyards in the area only adds to the overall poor air quality (AQMD, n.d.). If built correctly and with procedural justice, new parks in Boyle Heights could help correct this history of displacement by bringing community members together instead of driving them out.

Finally, one of the few neighborhoods along the Upper LA River that has experienced environmental injustices is Canoga Park. A 51-acre former Raytheon Missile nuclear testing and toxic waste site in the neighborhood poses threats to public health and safety according to recent reports (Shrader-Frechette and Biondo, 2021). Unsurprisingly, Canoga Park is home to higher percentages of low-income people of color and children. Cleanups of sites like this are still ongoing, which reinforces the need for new parks in the immediate future.

These are just a few of the many neighborhoods in LA that have experienced injustices, and this literature review may not be comprehensive. However, our findings line up fairly well with existing research. The LA County Parks Needs Assessment is a report published in 2016 along with a set of interactive maps. Park need is measured on a scale of 1 to 5, and metrics used include park condition, park access, park amenities, park land, and park pressure. The following neighborhoods received a score of "5" indicating that they have extremely high need: Bell Gardens, Canoga Park/Winnetka, Bell, East Rancho Dominguez, Paramount, Historic South Central, Huntington Park, Boyle Heights, Maywood, North Sherman Oaks, Cudahy, and South Gate. Many of these communities have also faced various environmental injustices according to our research, reinforcing the fact that they should be considered top priority for new parks.

Each of these neighborhoods deserves the right to have beautiful green spaces. Park locations must be carefully chosen so that residents can enjoy cleaner air, cooler climates, and community events spaces. Of course, park planning logistics vary from city to city, and feasibility of each location must be considered. Thus, we turn our attention now to funding considerations on a community scale.

Funding

The economic aspect of park development serves as one of the framework metrics used for analysis at the community-selection step of our methodology. Although funding can present challenges at multiple scales in the process of park development, it differentiates most between communities due to the critical role played by local governments in funding parks. Different municipalities within a region can have distinct grant programs, incentives, and financing measures related to greenspace. Community parks are generally funded through a collaboration of stakeholders including nonprofit organizations, city government agencies, and private donors (Trust for Public Land, 2022). These entities have specific functions which are influenced by localized programs. While nonprofits are typically more involved in the initial stages of park creation, which include grantwriting and land acquisition, local government agencies are responsible for overall management and long-term maintenance costs of parks.

This report has demonstrated, like other studies (Schnalzer, 2021b), that park need is high all over Los Angeles, and especially so along the Lower LA River (LLAR). This means that park building organizations, such as the Trust for Public Land (TPL), and local governments are confronted with a high demand for parks in dense neighborhoods with scarce resources. A strong partnership between nonprofit organizations and government agencies is central to the delivery of successful parks, yet this dynamic can get complicated due to challenges that naturally arise in park development. One example that illustrates the complexity of these collaborative efforts is the Maywood Riverfront Park located in the City of Maywood. TPL helped in the process of acquiring the land for this park before passing the project on to the City (Roybal-Allard, 2008). This process was convoluted because multiple land parcels were involved, each of them with a different owner and one of them being a superfund site (Trust for Public Land, 2022). Soil remediation and contentious negotiations with landowners serve as an example of obstacles that an organization may face when it comes to early fundraising efforts. Still, this project ultimately succeeded and since opening in 2006, the Maywood Riverfront Park has doubled the parkspace in the most densely populated city in California (Los Angeles County Public Works, 2008).

Not all park projects are as complex as the acquisition of this Maywood property, yet the nature of bureaucracy can complicate even the simplest of projects. Future applications of this framework metric in the community-selection stage can include the intricacies of the local grassroots organizations, available grant programs, and bureaucratic procedures that differ across city and county lines. To put into perspective the extent to which bureaucracy influences the economic side of park development, it is helpful to look at multiple examples of parks delivered by the TPL. While not a comprehensive list, Table F1 (Appendix F) lists a few of the major parks made possible by TPL and its various partnerships, with the second column listing all the funding sources needed for each respective park. This table demonstrates that to fund a single park, grants from local governments and conservancies are pooled together with sums from foundations and other private donations for the early costs while city governments are responsible for funding long-term park operation. Even when many grants are available, each grant is a relatively small sum which means multiple grants need to be acquired to fund the project (Trust for Public Land, 2022). Finally, when a park project gets approved and funding is secured, communities still have to wait months (or years) before construction begins.

Given the immediate need for parks across river-adjacent communities, park development is an especially slow and tedious process. Much of that is due to the distinct set of procedures and independent progress reporting required by each agency, which is why it is helpful to organize the wait times for each grant at this point in the community-selection process. Not only can our framework be used to compare the economic feasibility of building parks in different communities, but it can also be used to estimate the potential timelines of the park development process. This can help point to communities whose need for parks is likely to be met most urgently.

Currently, the LA County budgets for parks are relatively high – thanks to recent ballot initiatives such as Measure A and Measure W – allowing the Los Angeles County Department of Parks and Recreation more flexibility with financing projects related to the expansion of greenspace and amenities. In addition to these ballot initiatives, the third round of Proposition 68 grant awards was distributed by the California Department of Parks and Recreation in 2020, with $54 million allocated to LA County (Sharp, 2021). Proposition 68 was a bond measure passed in 2018 which awards grants to jurisdictions for the purpose of developing park amenities. The $54 million sum is financing a total of 15 projects, some of which are expansions to current park infrastructure while others are the creation of new pocket parks. Table F2 (Appendix F) demonstrates some examples of the new parks that are funded by Prop 68 grants along with their respective costs, acreage, and amenities (California Department of Parks and Recreation, 2020). The smallest of these parks is 0.19 acres and the largest is about 1 acre, and costs range from about $3 million to $7 million. This variance in cost can be attributed to size, types of amenities offered, and location as these parks are distributed among multiple municipalities within LA County.

Despite the variance, it is clear that the average price of these small parks is staggeringly low compared to the price of the proposed platform parks in the LA River Master Plan. For reference, the estimated cost of constructing the platform parks are $784.807 million dollars for the Compton-Paramount Connectivity Corridor and $3.481 billion dollars for the Rio Hondo Confluence (Federal Highway Administration, 2012). As the LA River Master Plan has not released any information regarding the true price of the platform parks, these estimates are based on a cost-per-acre projection using an existing platform park, the Klyde Warren Park in Dallas, Texas which cost $21,153,846.20 per acre. The actual construction costs of the proposed platform parks will thus be slightly different due to location and structural disparities between the capping of a river and the capping of a freeway, however this projection is still useful for putting into perspective the price of platform parks compared to pocket parks. Using $5 million to represent the construction cost of an average pocket park based on the $3 to $7 million range reveals that 157 pocket parks can be built for the price of the Connectivity Corridor and 696 pocket parks can be built for the price of the Rio Hondo Confluence. Considering that hundreds of pocket parks can be built for the price of a single platform park, pocket parks appear to be the more economically feasible way to address the immediate need for distributed, accessible greenspace in Southeast LA.

Site Selection

Zoning and Land Use Restrictions

Development of parks and other greenspace is regulated by restrictions and permitting requirements dictated in municipal codes and other legal documents. For example, the Los Angeles County Code of Ordinances has various permitting and evaluation requirements depending upon a given development's proposal.

At the start of this report's creation, zoning limitations were considered important in assessing the feasibility of various potential park locations. However, examining LA County ordinances showed that there is no complete inhibition of the development of parks and green space in many areas. Instead, parks, playgrounds and beaches only require conditional use permits and ministerial site plan reviews for development in agricultural, open space, resort and recreation, and watershed zones. Community gardens are even less restricted. They are permitted without restrictions in all of the same land use zones except watershed zones, where they are not allowed (Los Angeles County Code, 1987). Due to the less restrictive nature of parks, playground and community garden development requirements, zoning is a minor consideration in the proposed park locations.

Beyond zoning, there are other legal considerations which may be important to keep in mind when planning and developing a park. For example, differences in ease of acquisition between public and privately owned land can strongly dictate the feasibility of various potential park locations. Due to the case-by-case nature of such legal factors, this consideration was only generally referenced in our study and no detailed evaluation of ownership feasibility was conducted.

Walkability

Walkability, or "the extent to which an urban environment is considered pedestrian friendly," affects the likelihood that local residents will visit greenspace in their neighborhoods (Moura et al., 2017; Zuniga-Teran et al., 2019). Perceptions of walkability are influenced by a number of factors, including feelings of community, traffic safety, surveillance, and land use in the neighborhood where greenspace is present (Zuniga-Teran et al., 2019). Community refers to the extent to which the landscape in a neighborhood encourages social interactions. For example, areas like plazas and community centers may encourage neighbors to build relationships with each other. Traffic safety includes the presence of sidewalks, crosswalks, and other infrastructure that protects pedestrians from fast-moving vehicles. Surveillance refers to the extent to which pedestrians can be seen from nearby buildings. Transparent windows, front porches, and building proximity to sidewalks all increase levels of surveillance. Finally, land use refers to the types of structures that are built in an area and the amenities available.

A study of resident perceptions of walkability in Tucson, Arizona, found that increased levels of community, traffic safety, and surveillance around park spaces increased residents' perceptions of walkability to that park space (Zuniga-Teran et al., 2019). In contrast, the study found that having a diversity of land uses surrounding a park decreased residents' perceptions of walkability. Because parks that are perceived to be more walkable are more likely to be visited regularly by residents, these factors should be taken into consideration when evaluating potential park sites. While much of this information could be gathered remotely, it is difficult to fully assess walkability of a potential site without visiting it in person. While visiting potential park sites, we recommend that park planners note the availability of pedestrian friendly infrastructure, surrounding land uses, visibility of pedestrians from inside nearby buildings, and the presence of community-fostering spaces.

Urban Heat Island Effect Severity

The Urban Heat Island Index (UHI), in conjunction with the other metrics discussed, can be layered amongst one another to present the most ideal sites for park placement. Using heat island data is important because many communities suffer from extreme heat exposure and building greenspace helps reduce the effect felt by the people (U.S. EPA, 2022). Extreme heat can lead to several health concerns, including heat stroke, dehydration and respiratory failure and "those most susceptible to heat include pregnant women, young children, the elderly, and people with certain pre-existing conditions" (U.S. EPA, 2022). Areas such as big cities or residential neighborhoods with large apartment complexes would benefit most from reduced heat island effect through park placement because they are highly susceptible to high heat temperatures. Within large cities, large, tall buildings built next to smaller stores can cause an increase in temperature per lot. Based on heat island data, the lot that serves the tall building will be hotter than the store in the adjacent lot due to all the energy consuming amenities and energy required to power the tall building. The tall building would require proper ventilation through air conditioning units which contribute to increased outdoor temperatures (U.S. EPA, 2014). Additionally, tall buildings themselves contain infrastructure that absorb the sun's heat and re-emit them at greater volumes compared to natural landscapes such as parks or ponds (U.S. EPA, 2014).

Heat island data can also be used to prioritize areas with multiple apartment complexes. Apartment complexes use immense amounts of energy and offer limited amenities that reduce heat absorptions. These locations also contain a high population density in one lot compared to a single family lot, and apartments have been shown to increase temperatures at the surface level due to centralized human activities (Li et al, 2020). The urban heat island data is a great additional metric to use to help identify specific locations that would offer additional benefits towards the community and those living in it. By developing parks near areas of high urban heat, we can reduce the amount of individuals affected by increasing temperatures and reduce the health risks that come as a result.

RESULTS AND RECOMMENDATIONS

This report lays out two approaches to selecting park locations. The first approach assesses urban greenspace from a broad perspective and suggests factors which can be used to select regions and cities of particular interest. The second approach proposes some ways to find and rank specific locations and lots for park development within a given city. Based upon our framework, these are two scales at which rule makers, non-profit organizations and community members can start to address park needs in Los Angeles.

Regional Selection

Looking at framework deliverables and maps, most patterns showed that the Lower Los Angeles River region is the most park poor and has the most environmental justice violations. This led research efforts to focus on this half of the River. Within the Lower Los Angeles River, it is also possible to see some framework category-specific results pointing to certain cities or smaller regions of interest.

The CalEnviroScreen results (Map C1, Appendix C) showed a higher environmental risk percentile for census tracts in most of the Lower Los Angeles River. Community health maps focused on PM 2.5 (Map C2, Appendix C), cardiovascular disease (Map C3, Appendix C), and asthma (Map C4, Appendix C) also show higher risk and disease rates along the Lower LA River and South Central Los Angeles.

Soil type (Map D2, Appendix D) was consistent in focusing efforts toward the Lower LA River due to sandy loam soil being the primary soil type in that region — the Upper Los Angeles River is characterized by more loam and clay loam soils. Sandy loam has the highest infiltration rates of soil types within two kilometers of the LA River and is therefore most ideal for park development from a hydrological benefit perspective.

Community Selection

Investigation of environmental justice along the Los Angeles River led to a few specific points of interest. These include Bell Gardens, Boyle Heights, Canoga Park, Carson, Chinatown, Compton, Cudahy, Huntington Park, Long Beach Maywood, Paramount, South Gate, and Vernon. A map of where these neighborhoods are located was created to illustrate patterns and provide geographical context (Map E1, Appendix E).

Community health maps also gave specific community suggestions. The cardiovascular disease map, Map C3 (Appendix C), showed that the Lower LA River had the highest disease percentiles at 80 percent or higher. In particular, the areas surrounding Boyle Heights and Paramount were notable. Data regarding PM 2.5 concentrations (Map D2, Appendix D) further emphasized these two cities.

When official park planning is conducted, funding sources and availability would also play a strong influence on community selection. This is because funding is dependent upon specific municipalities, as well as which non-profit organizations are active in the area and able to generate or provide park development funding.

Site Selection

Environmental justice cases and vacant lot availability were used to create a broader list of park location options. While not comprehensive, these 17 options (Appendix A) include vacant lots, 0.5 to 7 acres in area, and schools. In this section, South Gate will be used as an example of how specific locations can be considered and selected when planning parks within specific cities. South Gate was chosen due to its history of environmental injustices. This includes high levels of pollution and environmental risk factors, numerous superfund sites and toxic facilities, and lack of existing park access. In addition, one of the proposed platform parks would be located within its city boundaries if constructed and the vacant lot data extent and availability made it a good case study.

South Gate holds 11 vacant lots (Map G1, Appendix G), seven of which are publicly owned. Six publicly owned lots are owned by the Los Angeles Unified School District and one is owned by South Gate City. Choosing to focus on publicly owned land can ease difficulties associated with obtaining land and park development rights. After determining vacant lot availability through existing data, a field visit allowed for an on-the-ground understanding of site viability. For example, many vacant lots were relatively walkable from houses and had nearby crosswalks if they were along busy roads. However, only one lot had a bus stop on the sidewalk along its border while others may require the creation of a small parking lot or short walks from nearby bus stops.

The methodology used to assess vacant lots in South Gate for park development viability could be used to select park locations in other neighborhoods near the Los Angeles River.

Vacant lot data was sourced from the Southern California Associate of Governments (SCAG) Regional Data Platform. HELPR 2.0 is a data source which provides parcel-scale information across Southern California, including existing vacant lots. The HELPR 2.0 default size of 0.5 to 10 acres was used in selecting vacant lots. Two maps (Map G2 and G3, Appendix G) show all vacant lots present in cities selected through environmental justice cases and vacant lot data availability. The cities include Bell Gardens, Compton, Long Beach, Paramount, South Gate, and Vernon.

CONCLUSION

The purpose of this study is to provide new park locations for disadvantaged communities. Our framework includes metrics such as: environmental justice, park access, community health, hydrological benefits, park and legal feasibility and funding. Determined by these metrics, communities like South Gate, Paramount, and Boyle Heights are appealing potential park placements based on environmental justice analysis that pin-points the lack of green spaces. Overlapping these quantitative metrics identifies the most efficient spaces for the construction of these parks that will provide additional external benefits to the community. A future direction for this project could be the use of these metrics to apply towards other key areas of park development such as analyzing and uncovering brownfields, abandoned lots, and underused residential sites to create further green spaces and recreational areas.

A platform park creates a uniform distribution of park access along the Los Angeles river, but is expensive in comparison to pocket parks. $3.5 billion dollars would need to be allocated for the Rio Hondo Confluence platform park whereas $54 million is already financing a total of 15 park projects. Every city would benefit from having a park built within their community. Pocket parks allow greenspace to be integrated within communities at distributed levels. Therefore, each pocket park can be designed uniquely and express the local history and heritage within their communities. Using these metrics at hand, we can identify the usable spaces to create these pocket parks with currently allocated funds toward similar projects which can benefit a community at a larger scale. These pocket parks' impact can be in a variety of social and cultural forms that aid communities that have been affected by environmental injustice.

ACKNOWLEDGEMENTS

This report was produced in partnership with Los Angeles Waterkeeper, with a special thank you to Ben Harris, Staff Attorney, and Bruce Reznik, Executive Director. We would also like to thank Mia Lehrer, Robin Mark, Stephanie Pincetl, and Tori Kjer for their valuable insight on the park building process in Los Angeles.

Appendices

Appendix A: Potential Park Sites

Table A1. Potential park site location information.

Table A2. Characteristics of potential park locations.

Appendix B: NDVI & Current Park Locations

Map B1. NDVI in the LA River region.

Map B2. Current parks within a two-kilometer buffer of the LA River.

Map B3. Number of parks within a two-kilometer buffer of the LA River, visualized by Census tract.

Appendix C: Community Health in LA River-Adjacent Census Tracts

Map C1. CalEnviroScreen percentile within a two-kilometer buffer of the LA River, visualized by Census tract.

Map C2. PM2.5 percentile within a two-kilometer buffer of the LA River, visualized by Census tract.

Map C3. Cardiovascular disease percentile within a two-kilometer buffer of the LA River, visualized by Census tract.

Map C4. Asthma percentile within a two-kilometer buffer of the LA River, visualized by Census tract.

Appendix D Environmental Factors Influencing Park Location

Map D1. Elevation within a two-kilometer buffer of the LA River.

Map D2. Soil type within a two-kilometer buffer of the LA River.

Table D1. Soil types and their characteristics.

Table D2. Infiltration rates of soils along the LA River.

Table D3. Plant varieties suited for soil types along the LA River.

Appendix E: Environmental Justice Cases in Los Angeles

Map E1. Neighborhoods with environmental justice cases within a two-kilometer buffer of the LA River.

Table E1. Environmental justice cases in LA River-adjacent neighborhoods.

Appendix F: Funding Sources for TPL Park Projects

Table F1. Funding sources for TPL park projects.

Table F2. Parks funded by Proposition 68 round 3 grant awards.

Appendix G: Vacant Lots in the City of South Gate

Map G1. Vacant lots in South Gate.

Map G2. All vacant lots found for the report. Includes Bell Gardens, Compton, Long Beach, Paramount, South Gate, and Vernon.

Map G3. All vacant lots found for the report, with each city denoted as a different color. Includes Bell Gardens (yellow), Compton (green), Long Beach (pink), Paramount (purple), South Gate (red), and Vernon (blue).

Appendix H: Spatial Data Library

Appendix A: Potential Park Sites

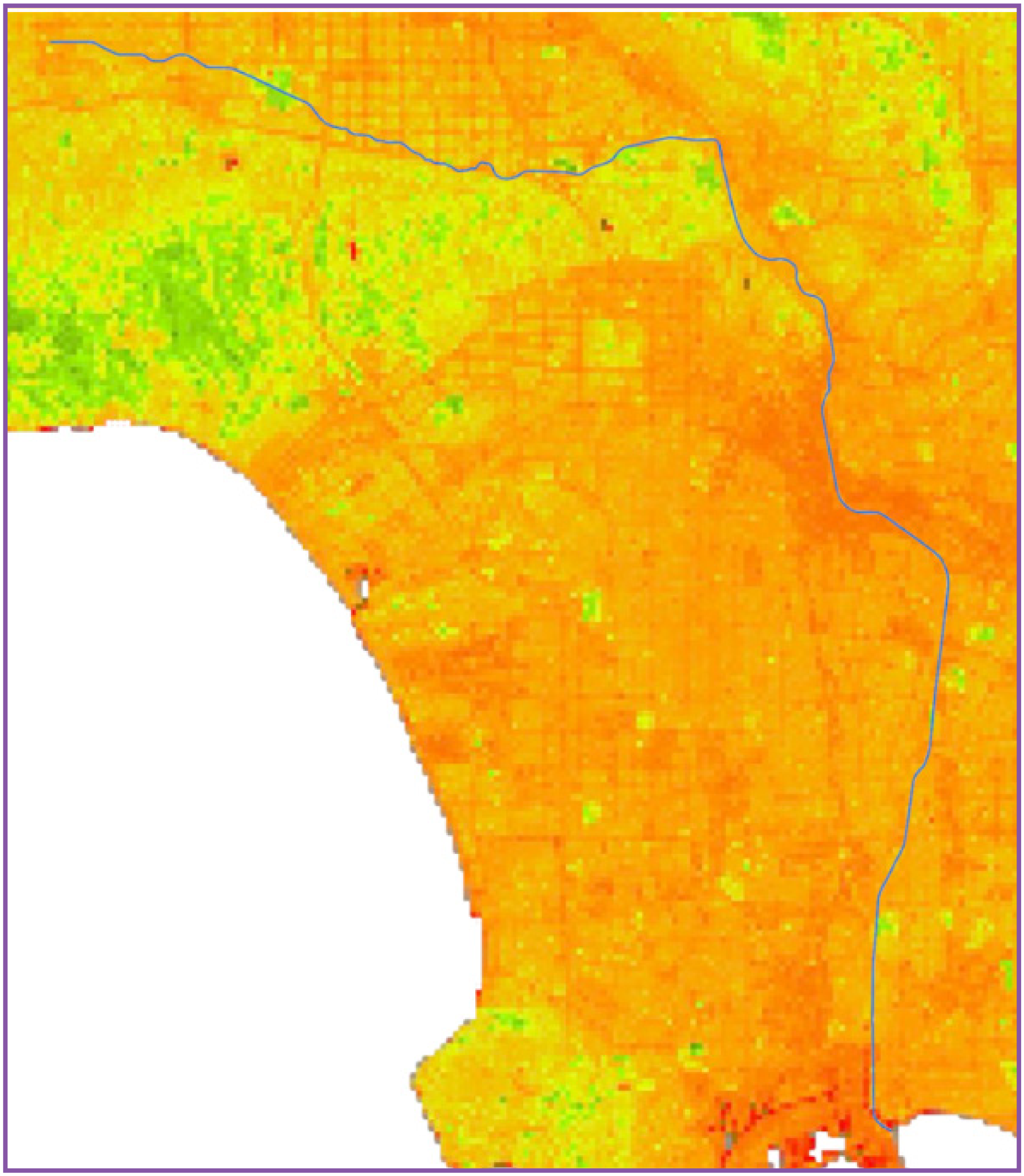
Table A1. Potential park site location information.

Site Name	Neighborhood	Approximate GPS Coordinates	Parcel Area (Acres)	Land Use Type
Bell Gardens Vacant Lot	Bell Gardens	33.95475, -118.16963	0.62	Vacant Lot
Suva Elementary School	Bell Gardens	33.96756, -118.14182	5.63	Open Space and Recreation
Sheridan Street Elementary School	Boyle Heights	34.05053, -118.20783	3.50	Education
Compton Vacant Lot 1	Compton	33.89079, -118.22101	8.71	Transportation, Communications, and Utilities
Compton Vacant Lot 2	Compton	33.89569, -118.23503	0.77	Vacant Lot
Park Avenue Elementary School	Cudahy	33.96062, -118.17409	4.05	Vacant Lot
Long Beach Vacant Lot 1	Long Beach	33.82621, -118.20221	9.81	Open Space and Recreation
Long Beach Vacant Lot 2	Long Beach	33.82415, -118.20345	4.76	Vacant Lot
Long Beach Vacant Lot 3	Long Beach (North)	33.82159, -118.20346	1.07	Vacant Lot
Albion Elementary School	Los Angeles (East)	34.06914, -118.22050	3.04	Education
Maywood Elementary School	Maywood	33.99335, -118.18449	0.43	Education
Paramount Vacant Lot 1	Paramount	33.90118, -118.17333	17.36	Transportation, Communications, and Utilities
Paramount Vacant Lot 2	Paramount	33.88681, -118.16418	0.55	Vacant Lot
South Gate Vacant Lot 1	South Gate	33.94680, -118.17182	6.90	Vacant Lot
South Gate Vacant Lot 2	South Gate	33.95555, -118.21507	0.69	Vacant Lot
Vernon Vacant Lot 1	Vernon	34.01332, -118.20844	3.13	Vacant Lot
Vernon Vacant Lot 2	Vernon	34.00259, -118.23474	0.91	Vacant Lot

Table A2. Characteristics of potential park locations.

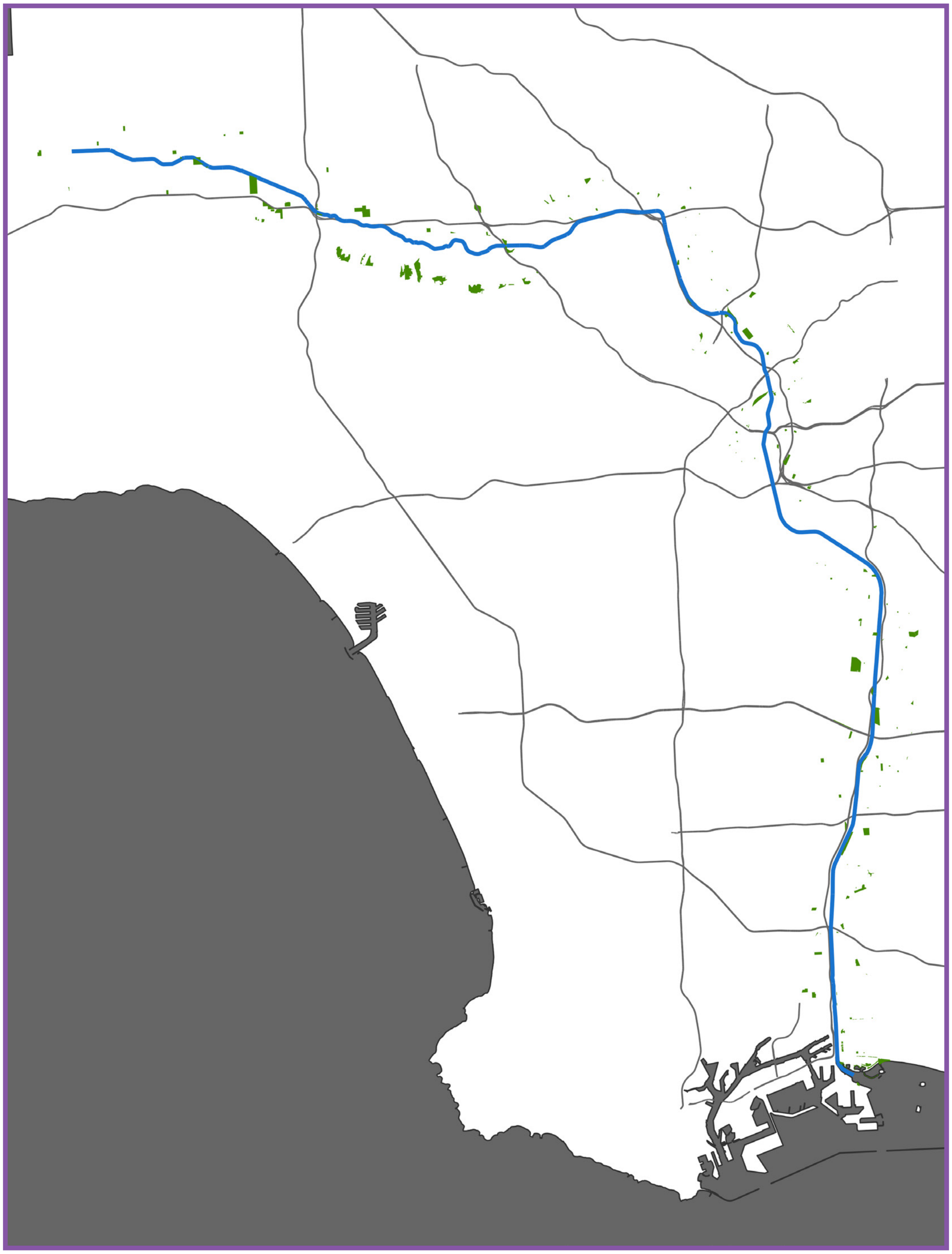
Site Name	Owned by a Public Agency	Walkable from Residential Areas	Distance from LA River (miles)	Soil Type
Bell Gardens Vacant Lot	Yes (Redevelopment Agency of Bell Gardens)	Yes	0	Sandy Loam
Suva Elementary School	Yes (Montebello Unified School District)	Yes	0.32 (from Rio Hondo Confluence)	Sandy Loam
Sheridan Street Elementary School	Yes (Los Angeles Unified School District (LAUSD))	Yes	1.23	Loam
Compton Vacant Lot 1	Yes (Compton Unified School District)	Yes	1.92	Silt Loam
Compton Vacant Lot 2	No	Yes	2.77	Silt Loam
Park Avenue Elementary School	Yes (LAUSD)	Yes	0	Sandy Loam
Long Beach Vacant Lot 1	No	Yes	0	Loam
Long Beach Vacant Lot 2	No	Yes	0	Loam
Long Beach Vacant Lot 3	No	Yes	0	Loam
Albion Elementary School	Yes (LAUSD)	Yes	0.23	Sandy Loam
Maywood Elementary School	Yes (LAUSD)	Yes	0.10	Sandy Loam
Paramount Vacant Lot 1	No	Yes	0.41	Sandy Loam
Paramount Vacant Lot 2	No	No	1.37	Sandy Loam
South Gate Vacant Lot 1	Yes (City of South Gate)	No	0	Sandy Loam
South Gate Vacant Lot 2	No	Yes	2.42	Silt Loam
Vernon Vacant Lot 1	No	No	0.44	Sandy Loam
Vernon Vacant Lot 2	No	No	1.00	Sandy Loam

Map B1. Map B1. NDVI in the LA River region.



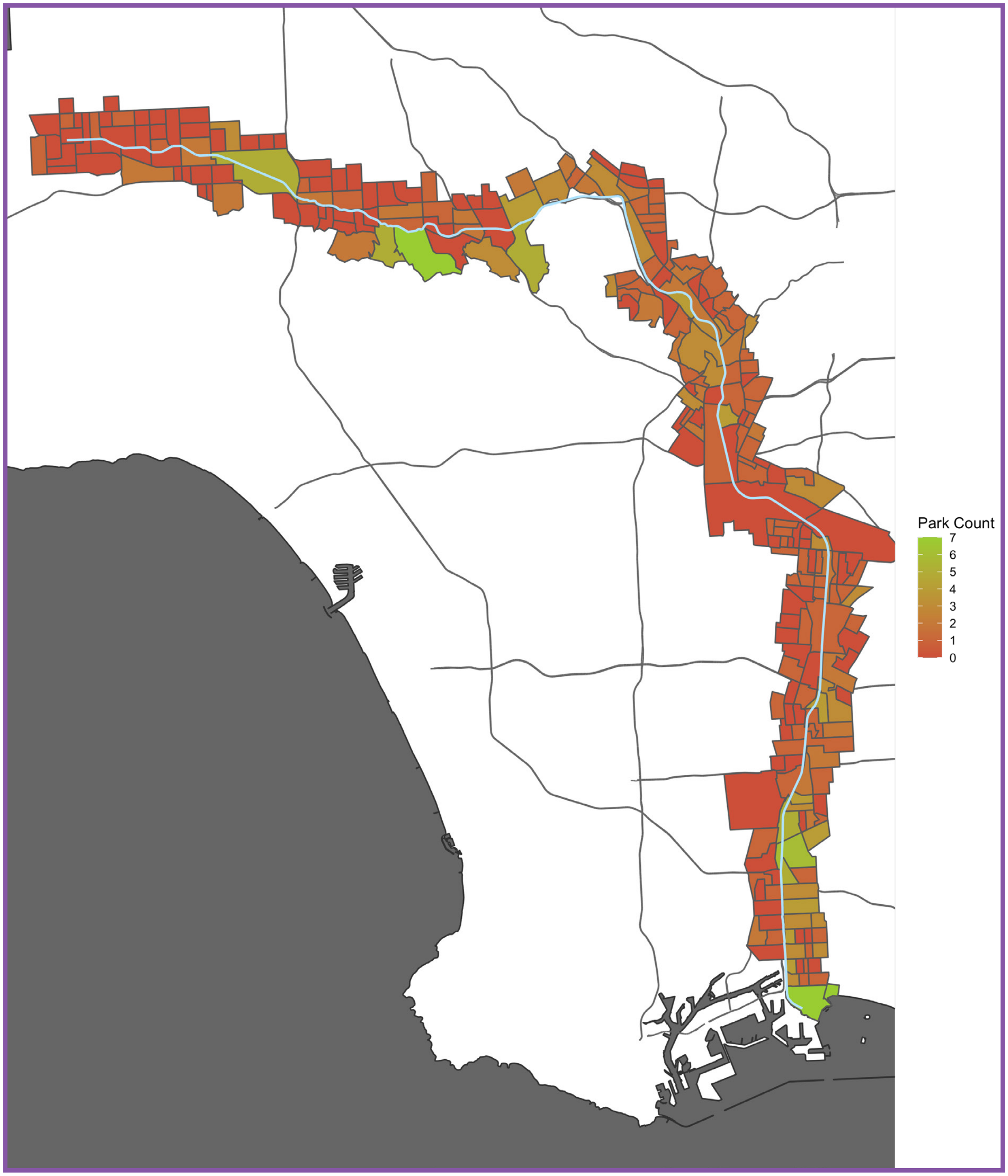
Data sources: California Department of Fish and WIldlife, U.S. Census Bureau.

Map B2. Current parks within a two-kilometer buffer of the LA River.



Data sources: County of Los Angeles, U.S. Census Bureau.

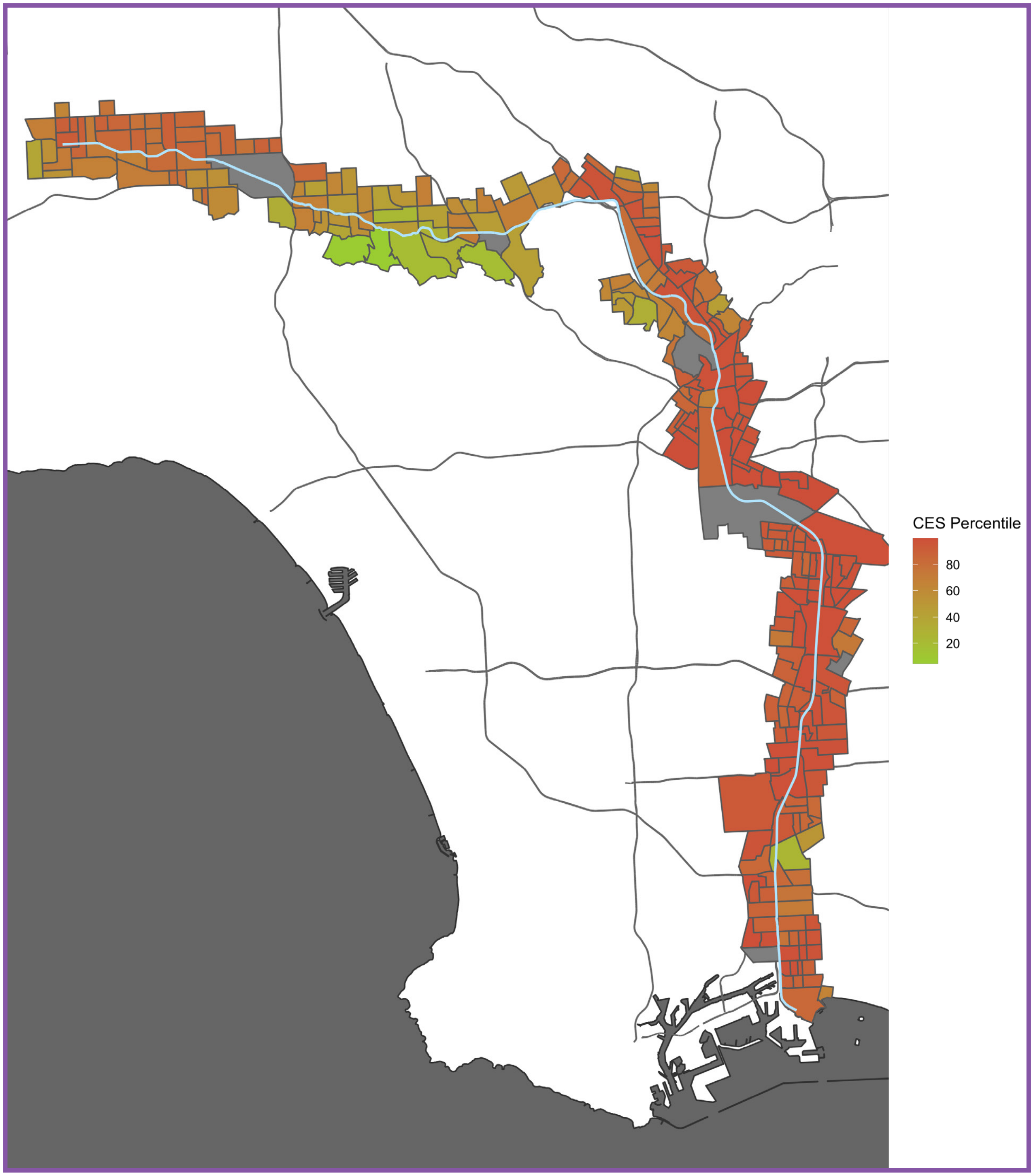
Map B3. Number of parks within a two-kilometer buffer of the LA River, visualized by Census tract.



Data sources: County of Los Angeles, U.S. Census Bureau.

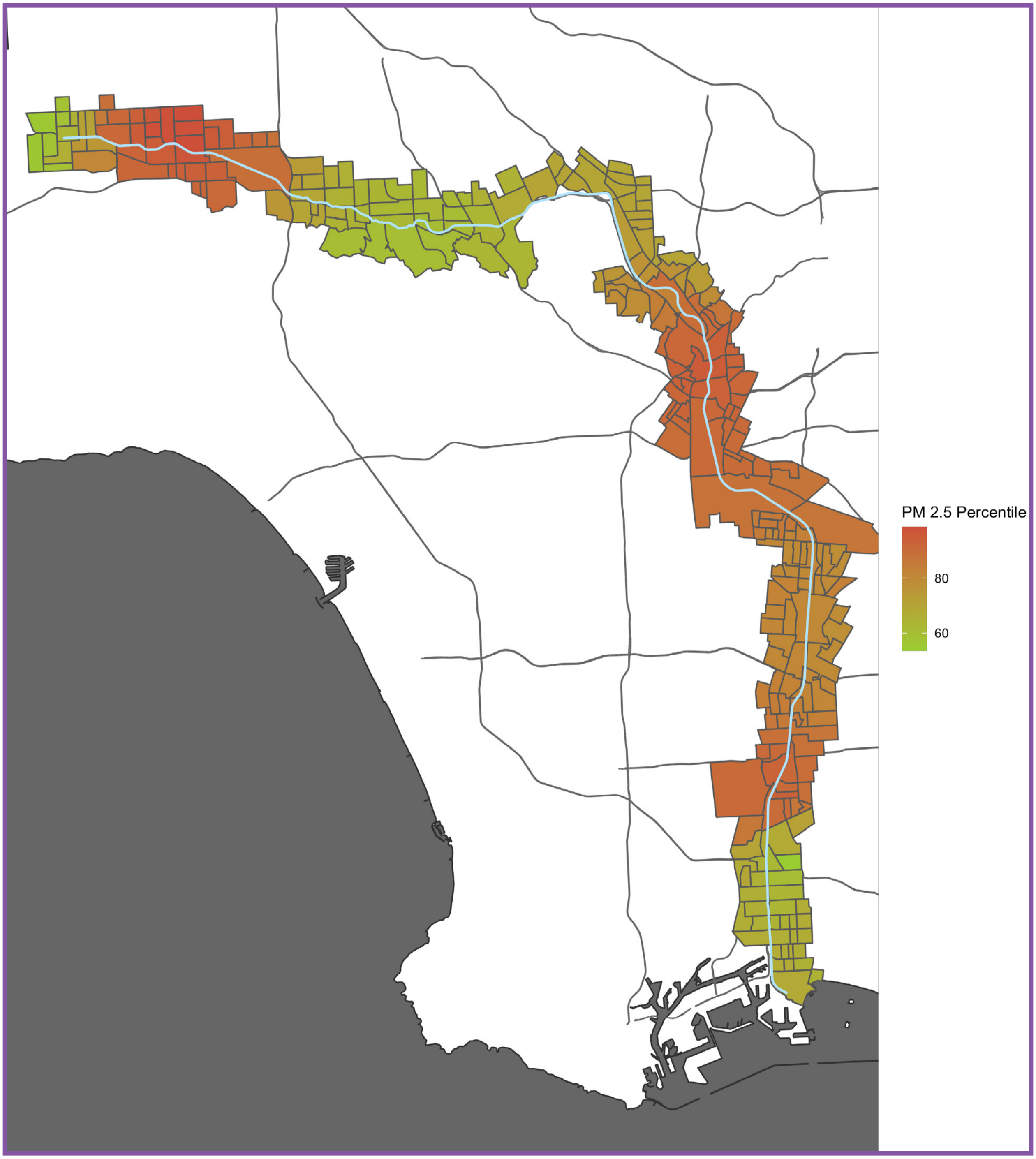
Appendix C: Community Health in LA River-Adjacent Census Tracts

Map C1. CalEnviroScreen percentile within a two-kilometer buffer of the LA River, visualized by Census tract.



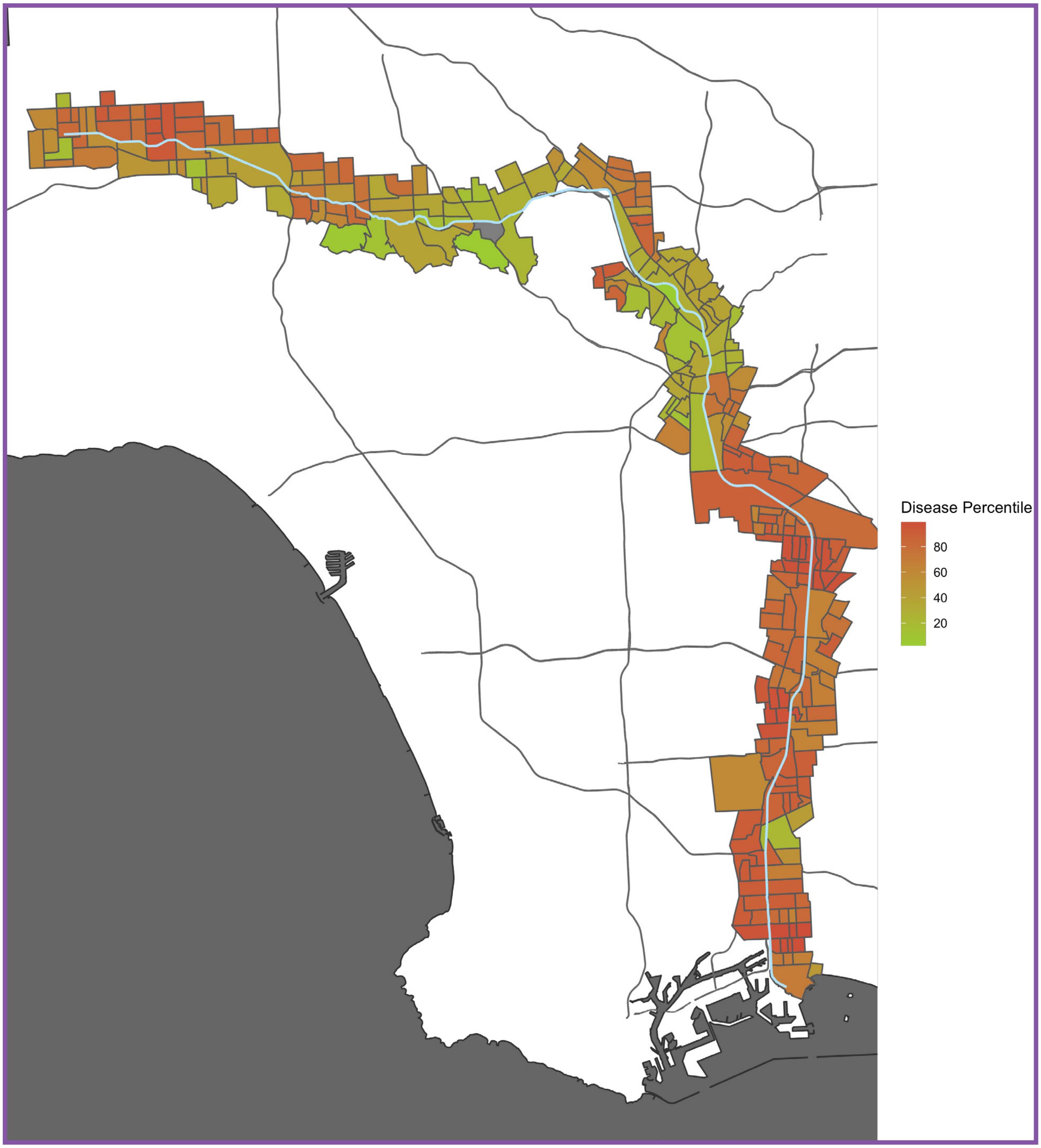
Data sources: California Office of Environmental Health Hazard Assessment, County of Los Angeles, U.S. Census Bureau.

Map C2. PM2.5 percentile within a two-kilometer buffer of the LA River, visualized by Census tract.



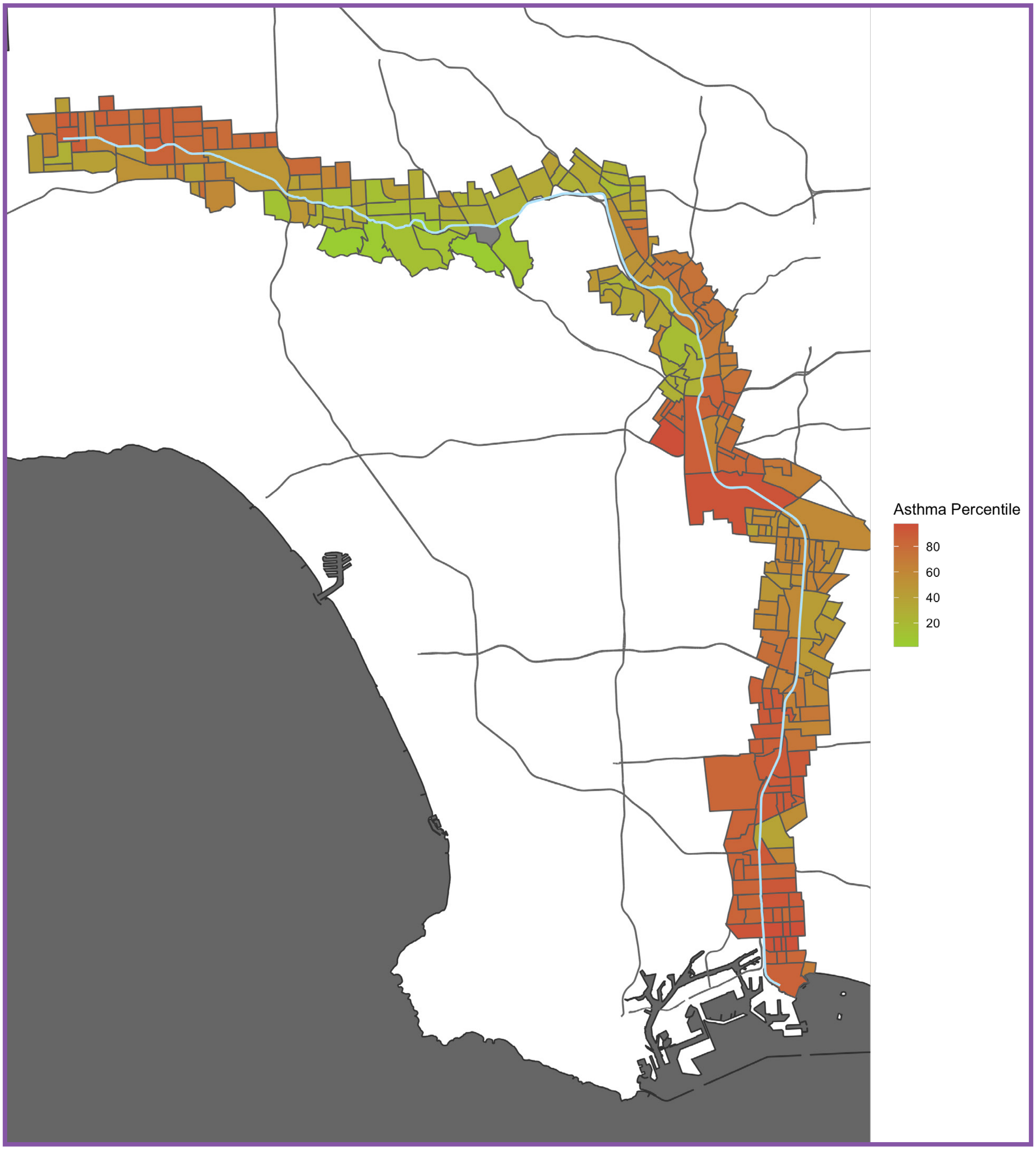
Data sources: California Office of Environmental Health Hazard Assessment, County of Los Angeles, U.S. Census Bureau.

Map C3. Cardiovascular disease percentile within a two-kilometer buffer of the LA River, visualized by Census tract.



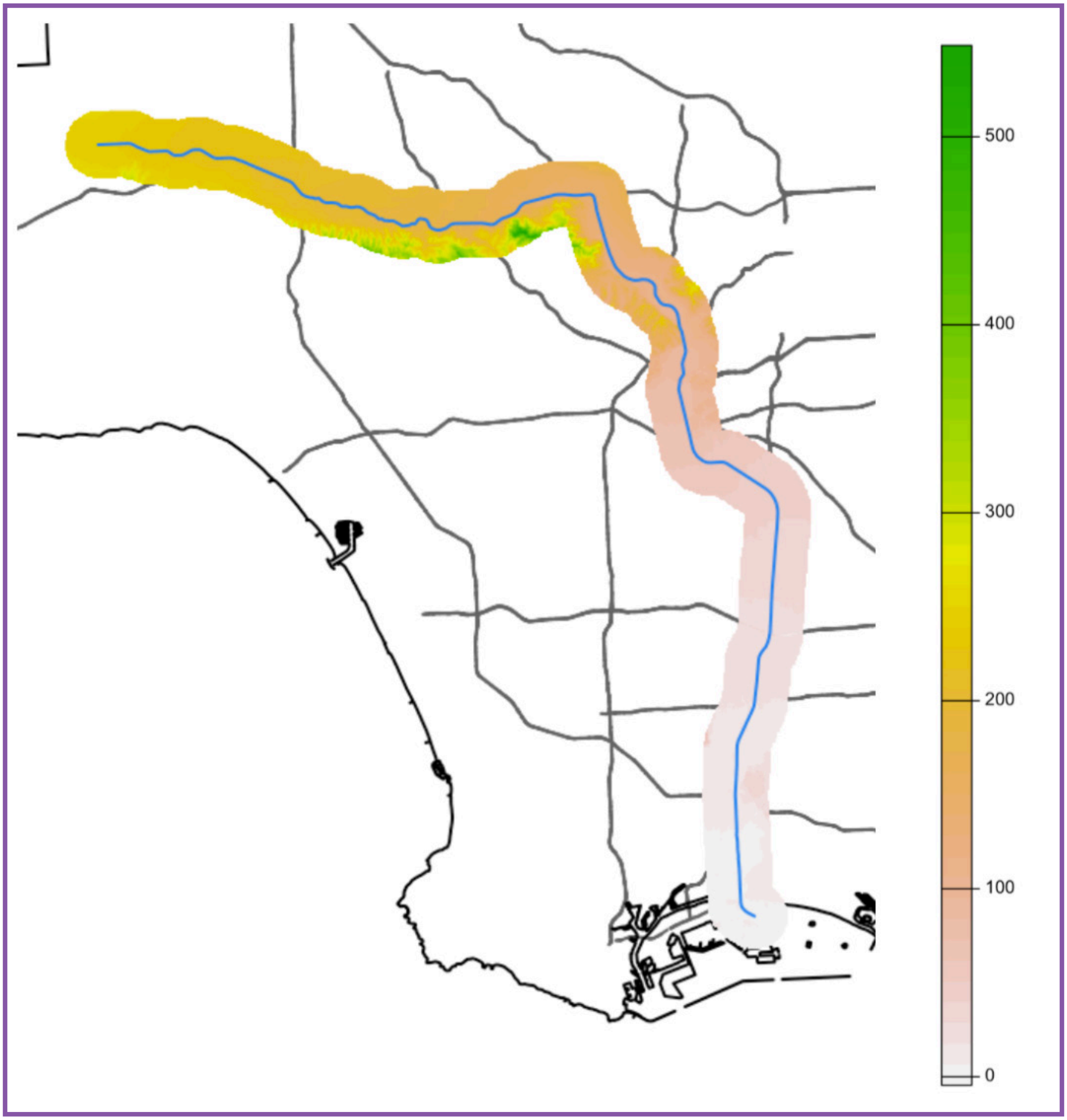
Data sources: California Office of Environmental Health Hazard Assessment, County of Los Angeles, U.S. Census Bureau.

Map C4. Asthma percentile within a two-kilometer buffer of the LA River, visualized by Census tract.



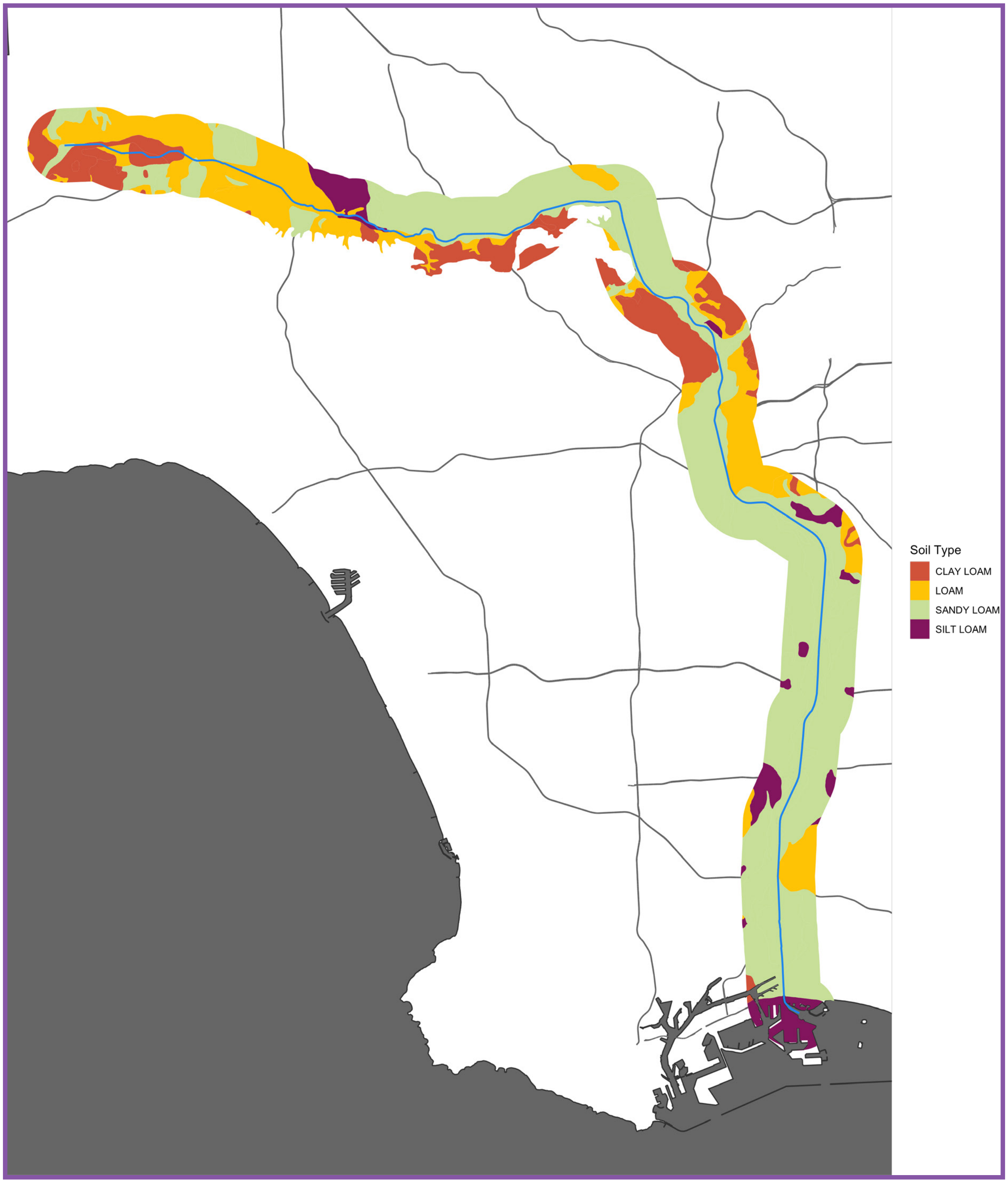
Data sources: California Office of Environmental Health Hazard Assessment, County of Los Angeles, U.S. Census Bureau.

Map D1. Elevation within a two-kilometer buffer of the LA River.



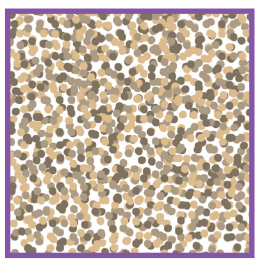
Data sources: United States Geological Survey, County of Los Angeles, U.S. Census Bureau.

Map D2. Soil type within a two-kilometer buffer of the LA River



Data sources: County of Los Angeles, U.S. Census Bureau.

Table D1. Soil types and their characteristics.

Soil Type	Particle Size (nm)	Visualization of Particles
Clay	< 0.002	
Sand	0.05 - 2	
Silt	0.002 - 0.05	

Information on particle size is sourced from Green Electronics LLC. Graphics are original and were created in Canva.

Table D2. Infiltration rates of soils along the LA River.

Soil Type	Infiltration Rate (cm/hr)
Clay Loam	0.15
Loam	0.76
Sandy Loam	2.02
Silt Loam	0.76

Information on infiltration rates is sourced from the Minnesota Stormwater Manual, which was last updated in 2020.

Table D3. Plant varieties suited for soil types along the LA River.

Soil Type	Plant Type	Suitable Varieties
Clay Loam	Grasses	Clustered Field Sedge (Carex praegracilis) Common Rush (Juncus patens) Deergrass (Muhlenbergia rigens) Giant Wild Rye (Leymus (Elymus) condensatus) June Grass (Koeleria macrantha) Purple Needlegrass (Nassella pulchra) Purple Three-Awn (Aristida purpurea)
	Perennial Herbs	California Fuschia (Epilobium) California Goldenrod (Solidago californica) Island Alum Root (Heuchera maxima) Matilija Poppy (Romneya coulteri) Narrowleaf Milkweed (Asclepias fascicularis) Seaside Daisy (Erigeron glaucus 'Wayne Roderick') Western Marsh Rosemary (Limonium californicum)
	Shrubs	Ceanothus (Ceanothus 'Concha') Cleveland Sage (Salvia clevelandii 'Winifred Gilma') Dwarf Coyote Bush (Baccharis pilularis 'Pigeon Point) Fuchsia Flowering Gooseberry (Ribes speciosum) Island Bush Snapdragon (Galvezia speciosa 'Firecracker') Lemonade Berry (Rhus integrifolia) Malva Rose (Lavatera assurgentiflora) Manzanita (Arctostaphylos densiflora 'Howard McMinn') Pozo Blue Sage (Salvia 'Pozo Blue') San Diego Honeysuckle (Lonicera subspicata denudata) Sugarbush (Rhus ovata) Toyon (Heteromeles arbutifolia) Wallace's Pitcher Sage (Lepechinia fragrans) White Flowering Currant (Ribes indecorum) White Sage (Salvia apiana)
	Trees	Pacific Madrone (Arbutus menziesii) Santa Cruz Cypress (Hesperocyparis abramsiana) Tecate Cypress (Cupressus forbesii)
	Vines	California Wild Grape (Vitis californica 'Roger's Red')
Loam	Grasses	Deergrass (Muhlenbergia rigens) Giant Wild Rye (Leymus condensatus)
	Perennial Herbs	Blue-Eyed Grass (Sisyrinchium bellum) California Fuchsia (Epilobium canum) Common Yarrow (Achillea millefolium)
	Shrubs	Bush monkey flower (Mimulus aurantiacus) Bush sunflower (Encelia californica) California gooseberry (Ribes californicum) Chaparral mallow (Malacothamnus fasciculatus) Coffeeberry (Frangula californica) Lemonade Berry (Rhus integrifolia) Manzanita (Arctostaphylos) Sage (Salvia) Toyon (Heteromeles arbutifolia)

Table D3. Plant varieties suited for soil types along the LA River. (Cont.)

Soil Type	Plant Type	Suitable Varieties
Sandy Loam	Grasses	Giant Wild Rye (Elymus condensatus) June Grass (Koeleria macrantha) Purple Needlegrass (Nassella pulchra)
	Perennial Herbs	California Goldenrod (Solidago californica) Island Alum Root (Heuchera maxima) Narrowleaf Milkweed (Asclepias fascicularis) Red Buckwheat (Eriogonum grande var. rubescens) Seaside Daisy (Erigeron glaucus 'Wayne Roderick') Western Marsh Rosemary (Limonium californicum) Wooly Pink (Achillea tomentosa)
	Shrubs	Agave (Agave attenuata) Brown-Eyed Susan, Coast Sunflower (Encelia californica) Flannel Bush (Fremontodendron californicum 'California Glory') Fuchsia Flowering Gooseberry (Ribes speciosum) Island Bush Snapdragon (Galvezia speciosa 'Firecracker') Lemonade Berry (Rhus integrifolia) Malva Rose (Lavatera assurgentiflora) Manzanita (Arctostaphylos densiflora 'Howard McMinn') Matilija Poppy (Romneya coulteri) Pozo Blue Sage (Salvia 'Pozo Blue') San Diego Honeysuckle (Lonicera subspicata denudata) St. Catherine's Lace (Eriogonum giganteum) Sugarbush (Rhus ovata) Wallace's Pitcher Sage (Lepechinia fragrans) White Flowering Currant (Ribes indecorum) White Sage (Salvia apiana)
	Trees	California Bay Laurel (Umbellularia californica)
	Vines	California Wild Grape (Vitis californica 'Roger's Red')
Silty Loam	Grasses	Alkali Sacaton (Sporobolus airoides) Blue Wild Rye (Elymus glaucus) Purple Needlegrass (Nassella pulchra)
	Perennial Herbs	California Poppy (Eschscholzia californica) Common Yarrow (Achillea millefolium) Island Alum Root (Heuchera maxima) Saltbush (Extriplex californica)
	Shrubs	California Buckwheat (Eriogonum fasciculatum) California Bush Sunflower (Encelia californica) California Sagebrush (Artemisia californica) California Wild Rose (Rosa californica) Coyote Bush (Baccharis pilularis) Elderberry (Sambucus mexicana) Golden Currant (Ribes aureum) Island Bush Snapdragon (Galvezia speciosa 'Firecracker') Laurel Sumac (Malosma laurina) Lemonade Berry (Rhus integrifolia) Malva Rose (Lavatera assurgentiflora) Manzanita (Arctostaphylos densiflora 'Howard McMinn') Mountain Mahogany (Cercocarpus betuloides) Sage (Salvia) St. Catherine's Lace (Eriogonum giganteum)

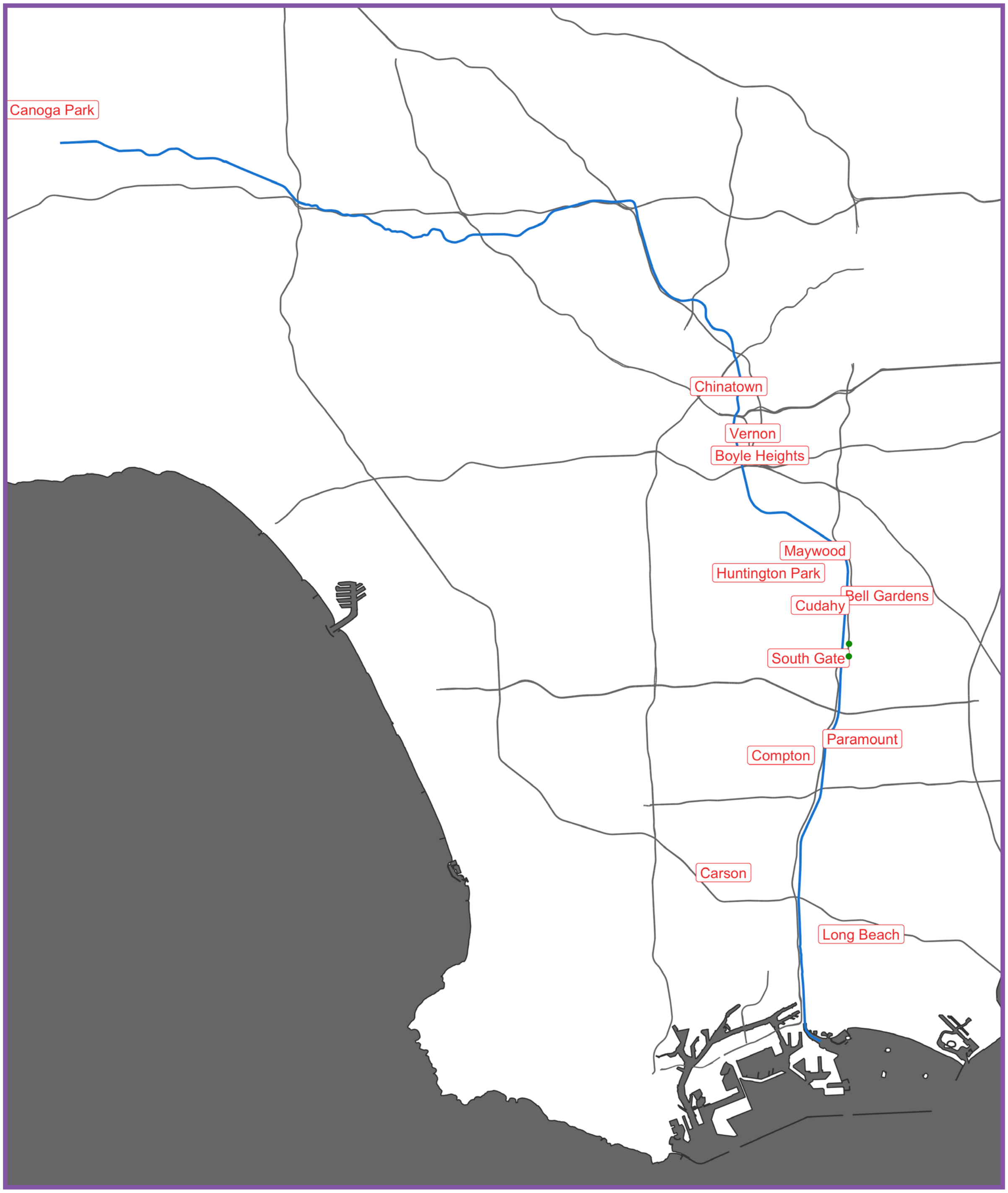
Table D3. Plant varieties suited for soil types along the LA River. (Cont.)

Soil Type	Plant Type	Suitable Varieties
Silty Loam	Trees	Bigleaf Maple (Acer macrophyllum) White Alder (Alnus rhombifolia) California Ash (Fraxinus dipetala) Southern California Black Walnut (Juglans californica) Western Sycamore (Platanus racemosa) Fremont Cottonwood (Populus fremontii) Coast Live Oak (Quercus agrifolia) Canyon Live Oak (Quercus chrysolepis) Engelmann Oak (Quercus engelmannii)

Information in this table is sourced from The Drought Tolerant Garden, a handbook published by Los Angeles County in 2012, as well as the Theodore Payne Foundation (2009) and the website LawnStarter (2022).

Appendix E: Environmental Justice Cases in Los Angeles

Map E1. Neighborhoods with environmental justice cases within a two-kilometer buffer of the LA River.



Data sources: County of Los Angeles, U.S. Census Bureau.

Appendix E: Environmental Justice Cases in Los Angeles

Table E1. Environmental justice cases in LA River-adjacent neighborhoods.

Neighborhood	Environmental Justice Cases
Bell	Lead and arsenic emissions from Exide facility caused "various illnesses including respiratory diseases, cancer and neurological disorders" (Pulido, 2016)
Bell Gardens	Chrome plating facilities near Suva School led to cancer-related deaths (Gold, 1999)
Boyle Heights	Freeway construction demolished homes and displaced residents (Gómez, 2019) High levels of lead and chromium 6 air pollutants (Carter, 2016) Possible Tongva settlement near Sheridan St Elementary School (Bogany, n.d.) Diesel pollution from 5 railyards in the area (AQMD, n.d.) Lead and arsenic emissions from Exide facility caused "various illnesses including respiratory diseases, cancer and neurological disorders" (Pulido, 2016)
Canoga Park	51-acre former Raytheon Missile nuclear testing and toxic waste site poses threats to public health and safety (Shrader-Frechette and Biondo, 2021)
Carson	Unincorporated city cited for landfills and auto dismantling plants (City of Carson, n.d.) Elevated levels of hydrogen sulfide caused pungent odor and nausea in community (AQMD, 2021) Communities dominated by Native Hawaiians and Pacific Islanders (NHPIs) exposed to disproportionately high toxic waste, industrial air pollution, and freeway pollution (Morey, 2014)
Chinatown	Mexican neighborhood Chavez Ravine demolished to build Dodger Stadium (Kim, 2017) A diverse coalition of residents and environmental justice advocates successfully prevented the industrialization of a plot of land known as the Chinatown Cornfield (Kim, 2017)
Compton	Compton attempted to ban oil drilling within the city, Western States Petroleum Association sued the city for the unconstitutional ordinance (Shamasunder, 2018)
Cudahy	Delta Airlines dumped 15,000 gallons of jet fuel over the neighborhood (Vives, 2020) Park Avenue Elementary built on toxic sludge site (Petersen, 2021)
Huntington Park	"La Montaña": Mountain of concrete debris on Cottage Street (Drury, 2008) Lead and arsenic emissions from Exide facility caused "various illnesses including respiratory diseases, cancer and neurological disorders" (Pulido, 2016)
Long Beach	Possible Tongva Sacred Site- Tevaaxa'anga (Bogany, n.d.) High concentration of PM0.25 due to port activities such as the operation of "ships, locomotives, and heavy-duty vehicles (HDVs)" (Mousavi et. al, 2019) 30,000 to 40,00 gallons of sewage spilled into the LA River and forced beaches to close (Austin, 2022)
Maywood	Iron and manganese contaminants found in domestic water supply (Carter, 2016) High levels of lead and chromium 6 air pollutants (Carter, 2016) Lead and arsenic emissions from Exide facility caused "various illnesses including respiratory diseases, cancer and neurological disorders" (Pulido, 2016)
Paramount	High levels of lead and chromium 6 air pollutants (Carter, 2016) Several metal-processing and finishing companies near schools and hospitals (Hasheminassab et al., 2020) Sewage pipe clog caused 30,000 to 40,00 gallons of sewage to spill into the LA River (Austin, 2022)

Table E1. Environmental justice cases in LA River-adjacent neighborhoods (cont.)

Neighborhood	Environmental Justice Cases
South Gate	550-Megawatt power plant project scrapped after successful protest in 2001 (Huerta, 2005) 15 facilities that release 134,132 lbs of air toxins each year (Huerta, 2005) Disproportionate transportation infrastructure: Alameda Corridor and rail lines (Huerta, 2005) 7.4 square mile city, 96,000 residents, 3 superfund sites within ¼ mile of each other (CDC, 2016)
Vernon	Exide facility illegally dumped hazardous waste for over 3 decades, site still contaminated (Barboza, 2020) Central Metals dumped hazardous waste for over a decade, shut down in 2016 (Gomez, 2019)

Information in this table is sourced from various articles compiled from a literature review. UC Library Search and Google Scholar were the search engines utilized.

Appendix F: Funding Sources for Park Projects

Table F1. Funding sources for TPL park projects.

Park	Funding Sources	Year Opened	Notes
Maywood Riverfront Park	• California State Parks • Los Angeles County Proposition A • Rivers and Mountains Conservancy • California Resources Agency • California Coastal Conservancy	2006	• 7.3-acres • Location: City of Maywood • Maintenance funded by a $1 million stewardship fund.
Pine Avenue Park	• MetLife Foundation • Rivers and Mountains Conservancy • The City of Maywood • Union de Vecinos • Padres Unidos de Maywood	2011	• 6600 sq ft. • Location: City of Maywood • 12,000 people live within ½ mile of the park
Rudolph Park	• California State Parks Statewide Park program • Edison International • Kaiser Permanente • the Max Factor Family Foundation • Ralph M. Parsons Foundation • Rosalinde & Arthur Gilbert Foundation	2016	• 1.5 acres • Location: City of Lawndale • Before this park was established, the 33,000 residents of the city were served by only one park.
Runyon Canyon Park	• Los Angeles County Prop A • Santa Monica Mountains Conservancy Prop 1 • City of Los Angeles Prop K • California Natural Resources Agency EEMP • California Department of Parks and Recreation Stateside Land and Water Conservation Fund (LWCF) • Friends of Runyon Canyon	2017	• 15 acres of privately owned land acquired by TPL to protect from the threat of development. • Location: Hollywood Hills, Los Angeles
Madison Avenue Park and Community Garden	• The City of Los Angeles • Department of Recreation and Parks • the East Hollywood Neighborhood Council • Los Angeles Neighborhood Land Trust • Los Angeles Community Garden Council • California State Parks • Statewide Park Development & Community Revitalization Grant Program • The Ahmanson Foundation • Kaiser Permanente • The Ralph M. Parsons Foundation • SL Gimbel Foundation Fund • MUFG Union Bank Foundation.	2019	• 0.5 acres • Location: East Hollywood • 12,600 people live within a 10 minute walk of the park.

Information from this table is sourced from the Trust for Public Land's website. These projects are examples of parks developed for TPL's "Parks for People - Los Angeles" initiative.

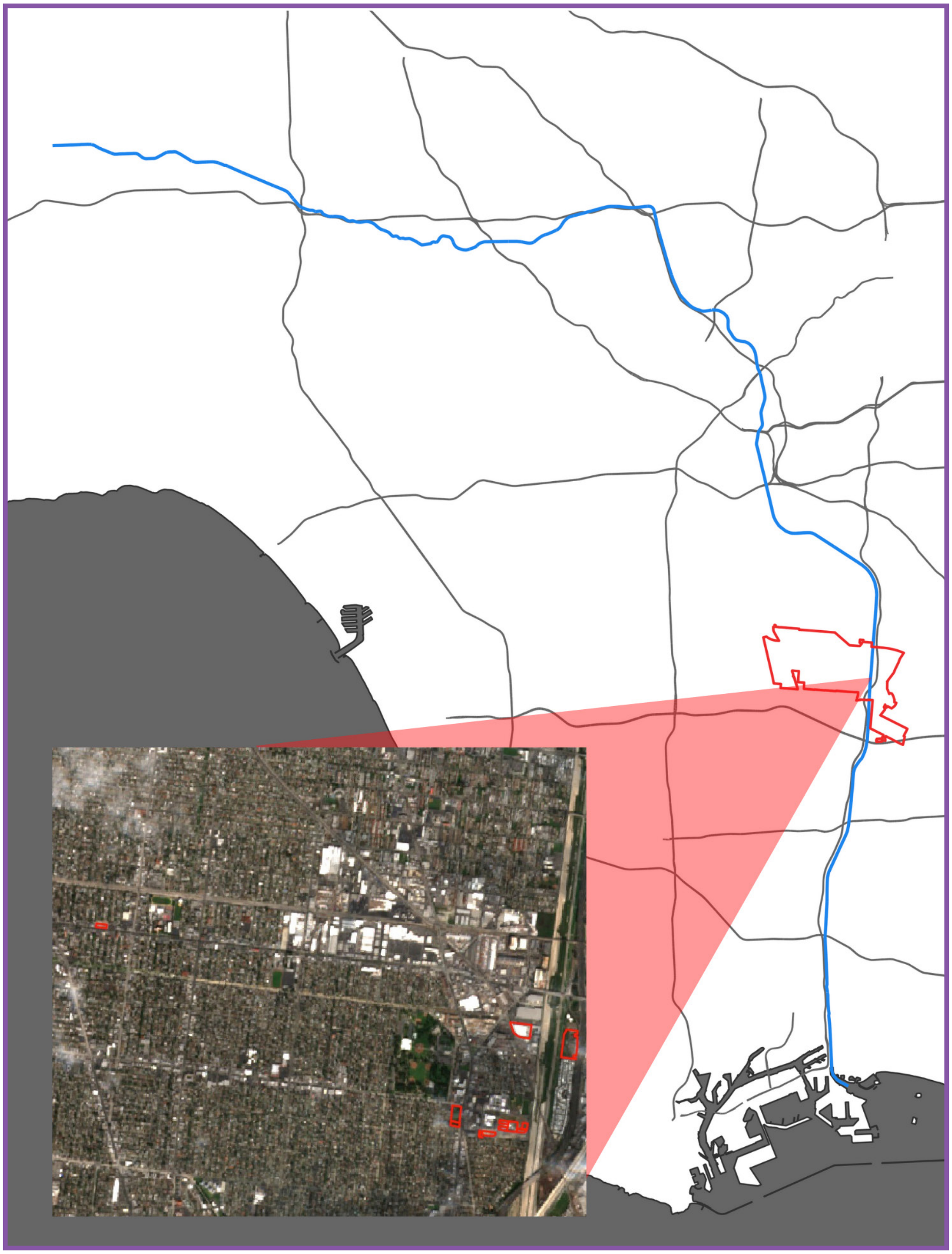
Table F2. Parks funded by Proposition 68 round 3 grant awards.

Park	Cost	Acreage	Amenities
Allegheny Street Park	$6,986,400	1 acre	Two splash pads Two playgrounds Walking/fitness path Fitness equipment Public art Two BBQ and picnic areas Shade structures Restroom Landscaping Lighting throughout the park
Brooklyn Heights Park	$5,198,400	0.19 acre	Three new playgrounds New fitness equipment Plaza Shade structure Walking path Public art Landscaping Lighting throughout the park
Walnut Park Pocket Park	$4,322,842	0.5 acre	Playgrounds Exercise equipment Splash pad Walking path Performance stage Picnic area Public restrooms Public art
Primrose Park	$2,972,058	0.5 acre	Playground picnic area open space lawn walking track exercise equipment public art water features

Information from this table is sourced from the California Department of Parks and Recreation's published list of projects receiving funding from the Prop 68 Statewide Park Program Round 3 Grant Awards, which were distributed in 2020.

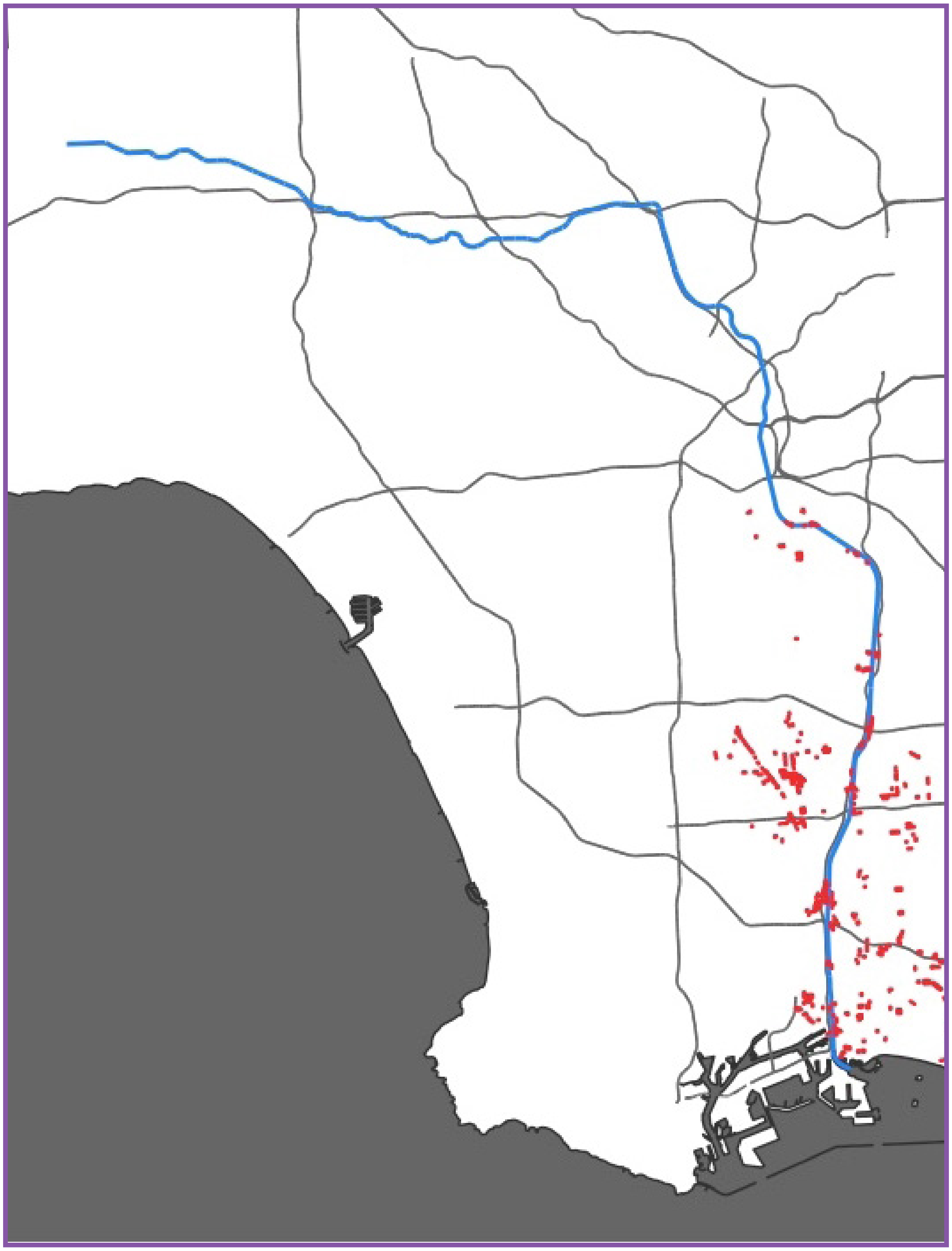
Appendix G: Vacant Lots in the City of South Gate

Map G1. Vacant lots in South Gate.



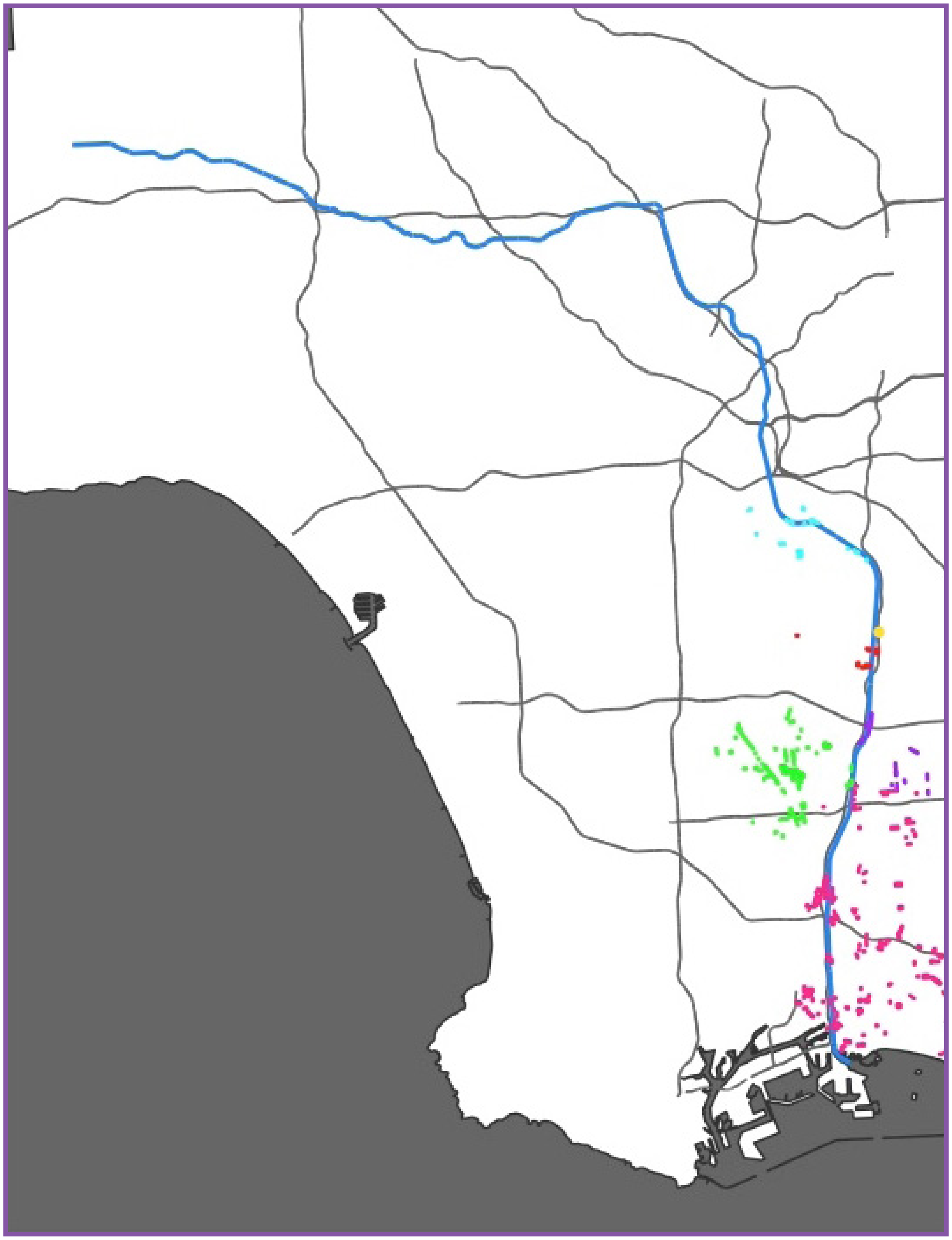
Data sources: California Office of Environmental Health Hazard Assessment, U.S. Census Bureau.

Map G2. All vacant lots found for the report. Includes Bell Gardens, Compton, Long Beach, Paramount, South Gate, and Vernon.



Data sources: Southern California Association of Governments, County of Los Angeles, U.S. Census Bureau.

Map G3. All vacant lots found for the report, with each city denoted as a different color. Includes Bell Gardens (yellow), Compton (green), Long Beach (pink), Paramount (purple), South Gate (red), and Vernon (blue).



Data sources: Southern California Association of Governments, County of Los Angeles, U.S. Census Bureau.

Appendices (cont.)

Appendix H: Spatial Data Library

Name	Theme	Source	Extent	Year
County Census Boundaries	Administrative Boundaries	United States Census Bureau	California	2018
CalEnviroScreen	Environment	California Office of Environmental Health Hazard Assessment	Los Angeles County	2021
California NDVI	Environment	California Department of Fish and Wildlife	California	2021
Elevation	Environment	United States Geological Survey	United States	2018
LA River	Environment	County of Los Angeles	Los Angeles County	2022
Ozone	Environment	California Office of Environmental Health Hazard Assessment	California	2021
Soil Types	Environment	County of Los Angeles	Los Angeles County	2020
Asthma	Health	California Office of Environmental Health Hazard Assessment	California	2021
Cardiovascular Disease	Health	California Office of Environmental Health Hazard Assessment	California	2021
Particulate Matter 2.5	Health	California Office of Environmental Health Hazard Assessment	California	2021
Countywide Building Outlines	Land Use and Planning	County of Los Angeles	Los Angeles County	2022
Vacant Lots	Land Use and Planning	Southern California Association of Governments	Southern California	2022

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