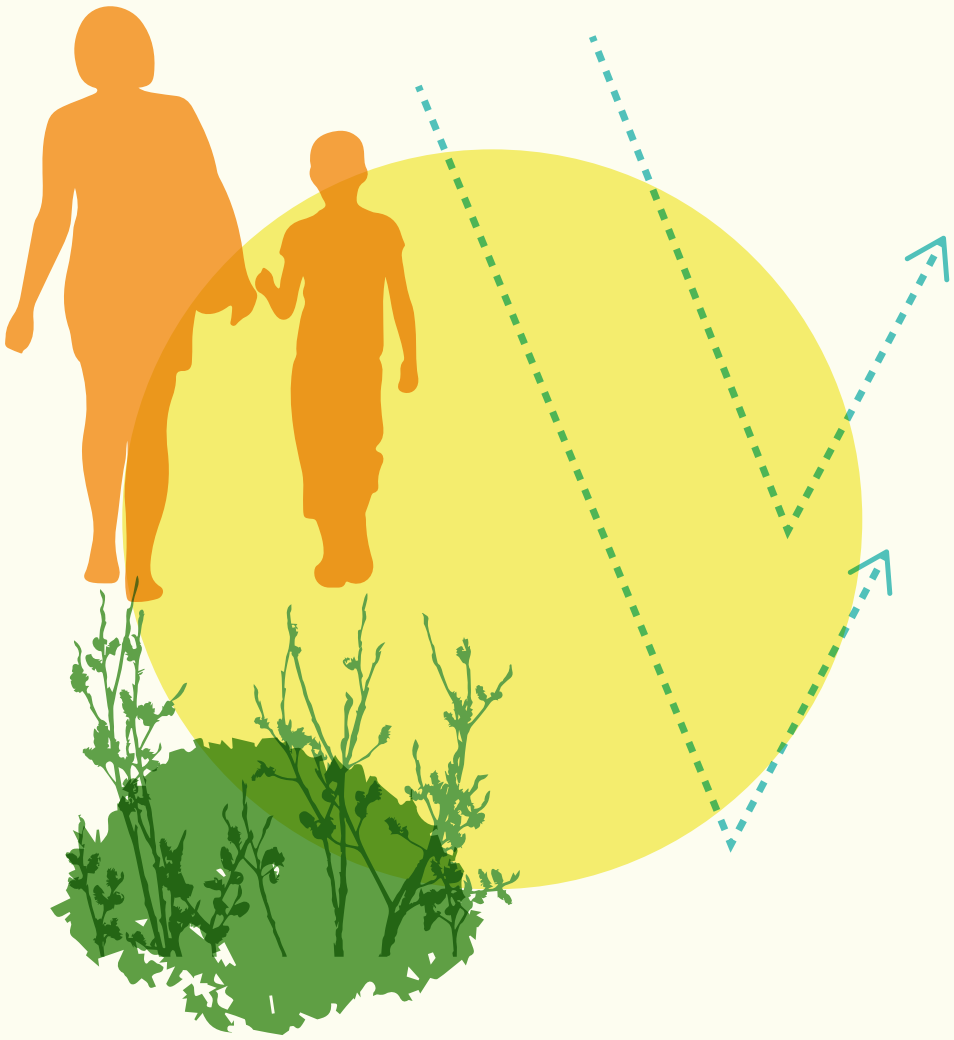
Green Streets

Cool Streets

Complete Streets

Living Streets

A Guide for Los Angeles



The purpose of this document is *to provide elected leaders, city staff, advocates and community members with information and resources to accelerate development of "Living Streets" in Los Angeles as a strategy to adapt to a changing climate and make the city more livable and resilient. This booklet was developed by Heal the Bay, Green LA Coalition and Climate Resolve.*

Partners

HEAL THE BAY is a non-profit environmental organization making Southern California coastal waters and watersheds, including Santa Monica Bay, safe, healthy and clean. We use science, education, community action and advocacy to pursue our mission.

GREEN LA COALITION is a volunteer-run network of organizations and advocates working on local water issues facing the City of Los Angeles and our region. Stephanie Taylor and Holly Harper, formerly staff of Green LA Coalition, worked on this Living Streets project.

CLIMATE RESOLVE is a Los Angeles based climate change advocacy organization dedicated to creating real, practical solutions to meet the climate challenge while creating a better Southern California today and in the future.

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Living Streets: A Guide for Los Angeles

Introduction: Why Living Streets 2

UCLA Temperature Study, *Alex Hall* 6

Infographic:
What is a Living Street 10

Green Streets 12

Cool Streets 14

Complete Streets 16

Cost Benefit Analysis 20

Policy Recommendations 26

Infographic:
Agency Jurisdictions on a Typical Street 32

Conclusion 34

December 2015

Why Living Streets

Our streets are arterials that touch and connect every neighborhood in Los Angeles. They span the length of the city and are utilized by everyone. Because of this, there are arguably no other infrastructure projects that can have a greater impact on the health and environment of an urban area like L.A. For most of the city's history our streets have been built largely with the sole purpose of servicing the automobile. It's time for a new perspective. It's no longer acceptable to build roads the way we did in 1950; we must start building the streets of 2050 and beyond. Those new streets should be Living Streets.

A Living Street is a street designed to enhance environmental benefits while making the surrounding areas more livable, walkable and healthier.

Investing in Living Streets is more important now than ever before to help us adapt to a new climate reality. No matter how many steps we take to reduce greenhouse gas emissions today we've already added enough to the atmosphere to change the climate for decades as it takes that amount of time for heat trapping gasses to dissipate. As a result we must adapt so as not to merely survive but to thrive. UCLA predicts temperatures will rise 3.5-5°F in the Los Angeles region between 2040 and 2060. Furthermore they anticipate the number of extreme heat days (days above 95°F) will double and in some parts of the city triple.

A hotter Los Angeles is exacerbated by the Urban Heat Island Effect (UHIE), the phenomenon in which urban areas are 4-5°F warmer than the surrounding areas. This is due to all the paved surface area which absorbs heat from the sun and by exhaust from automobiles and manufacturing. Because approximately 40% of landmass in the city is streets, mostly comprised of heat absorbing black asphalt, they are the biggest UHIE offender. By developing and utilizing a "cool" slurry seal (the topcoat) for our roads we can dramatically reduce temperatures in the city leading to improved air quality, a reduction in greenhouse gas emissions and fewer heat-related hospitalizations. An overhaul of paved area with cooler and greener surfaces will reduce the UHIE effect, helping offset some or all of the warming expected in the future and essentially allowing us to keep the temperatures we enjoy today.

Largely due to increased temperatures, precipitation will be significantly affected in the coming decades according to UCLA. The amount of precipitation we get in an average year is expected to be about the same as we get today but a greater portion will fall as rain instead of snow. A 40% decrease in snowfall in Southern California mountains by mid-century is expected. Whereas snow is stored in the mountains until it gradually melts in the spring, rainfall runs off the mountains right away. Scientists also forecast the increase in rainfall to come in shorter periods meaning stronger storms bringing greater amounts of precipitation all at once, which our current infrastructure is simply not prepared to handle.

City streets transport far more than just people; they are also the primary conveyance for rainwater. Unfortunately, old and outdated standards are designed to flush rainwater to our rivers and oceans as fast as possible during storm events, throwing away billions of gallons we could use for water supply. Additionally, every day, tens of millions of gallons of oil, litter and toxic contaminants wash off streets, roads, and freeways and pour into rivers, creeks and beaches in the City of Los Angeles. When it rains, large volumes of water cause flooding and safety concerns on many streets.

Living Streets help capture rainwater as a valuable local water source while filtering pollutants that would otherwise flow into our rivers and oceans. Green streets perform these critical services while also beautifying our neighborhoods, reducing flooding and adding shade trees that further help reduce the Urban Heat Island Effect. Increased urban tree canopy not only provides shade and absorbs radiant energy from the sun (using it for photosynthesis, rather than releasing it as heat and warming the ambient air temperature) but through its process of evapotranspiration acts as a natural air-conditioner.

City streets transport far more than just people: they are also the primary conveyance for rainwater.

In order to prioritize the safety of all travelers, a Living Street provides for the mobility needs of people of all ages and abilities, regardless of their transportation mode. Reconstruction and road rehabilitation provide a cost-effective opportunity to incorporate multimodal improvements such as enhanced biking and walking through the expansion of bike lanes and by addressing the backlog of repairs for sidewalks.

These are the elements that make up a Living Street and through better planning and coordination as well as innovation, Living Streets can be the standard for all of Los Angeles.

By taking a Living Streets approach, L.A. could take a significant and much needed step in slowing further climate change while simultaneously preparing for anticipated climate impacts. The following section will thoroughly describe the research performed by UCLA which details predictions for climate impacts in Los Angeles between 2040 and 2060. A better understanding of the future climate of Los Angeles will help demonstrate the need for investment in climate resilience strategies such as Living Streets.

UCLA Temperature Study

Alex Hall

How is climate change affecting Los Angeles? By using an innovative technique for downscaling global climate models, Dr. Alex Hall and his UCLA research team have been able to provide assessments that detail how climate change will directly affect us at the local level. The team was able to predict how temperature, precipitation, and a diminishing snowcap will affect us in the future.

Temperature:

The Facts

Los Angeles is sure to face a warmer future as a result of climate change. Just how warm and different the future Los Angeles will be as compared to today's Los Angeles depends on what action is taken to reduce greenhouse gas emissions.

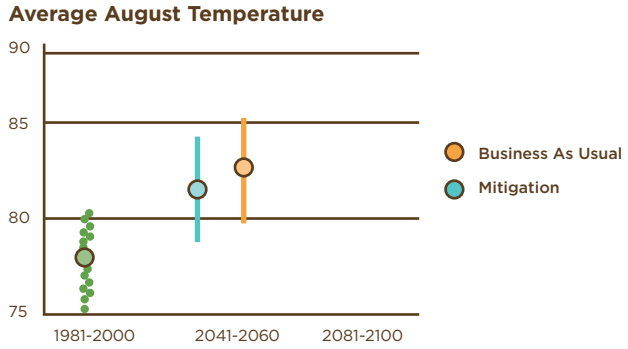
The Good News

If the world takes action to reduce greenhouse gas emissions, Los Angeles will only be moderately warmer by the end of the century—only about as much as the warmest temperatures we experience today. However, if we don't reduce global greenhouse gas emissions, Los Angeles is likely to have a new climate system by the end of this century—one where winter is replaced by spring, and summer starts earlier, extends longer into fall months, and reaches temperatures unlike any we experience today. Effectively, Los Angeles will have a new season—a "super summer" of extreme heat—and winter as we know it today will be lost. The results of this two-part study indicate specific temperature changes in Los Angeles, and demonstrate the importance of global greenhouse mitigation in preserving a livable future in Los Angeles.

How Much Warmer Will Los Angeles Get?

By mid-century, the Los Angeles region will be about 3°F warmer, regardless of global action to reduce greenhouse gas emissions.

We will experience hotter than normal temperatures mainly in the late summer and early fall. Trends for the month of August show just how much temperatures will change during those hotter than normal times. A future with mitigation, meaning global efforts at reducing greenhouse gases, will help us avoid some warming by mid-century, but warming is inevitable nonetheless.



Legend: *The big green dot shows present day average temps in August in Los Angeles based on several years of monthly average (green dots). The blue dot shows the expected future average temperature in August under a scenario where there is global greenhouse gas mitigation and the blue bar shows the range of possible future temperatures within which there is a 95% chance the actual future temperature will fall. The orange dot shows expected future average August temperature under a scenario where there is no major global effort to reduce greenhouse gas emissions, with the bar showing the 95% confidence range of possible temperatures.*

Without mitigation of greenhouse gas emissions, the Los Angeles region will be more than 7°F warmer on average by the end of the century.

Looking again at the month of August, we can see just how much more temperatures could change by the end-of-century as a result of climate change. It is clear that global action to reduce greenhouse gas emissions will be extremely important to the climate in Los Angeles. It will help us avoid several degrees of warming as shown by the difference between the orange and the blue data points

over the end-of-century time period. The temperature studies show us two possible futures, one with average monthly temperatures of ~81°F with global climate action or ~87°F without it. At the extremes of the possibilities, global climate action could help us return the climate system to current temperatures (bottom of the blue line) or, with no action, make August 10°F warmer than it is today.

The temperatures studies also reveal that in all cases (mid-century and end-of-century, with and without mitigation), coastal areas will warm less than inland areas, and mountain peaks will warm the most. Warming is most extreme on mountain peaks because loss of snow cover causes even more warming. When present, snow cover has a cooling effect due to its reflective surface (known as the "snow-albedo feedback").

How Different Will the Future Be?

By mid-century, Los Angeles will experience temperatures similar to what we experience today about 75-80% of the time (274-292 days a year), with hotter than normal temperatures occurring mostly in the late summer and early fall. But, if we don't reduce global greenhouse gas emissions, Los Angeles will continue to get warmer. And, by the end of the century, temperatures will be like they are today only 50-65% of the time (183-243 days a year), with December to January and July to August changing the most relative to today.

Snowfall & Precipitation:

Overview

Highs and lows, but little to no change in total precipitation

Los Angeles can expect roughly the same amount of total precipitation throughout the 21st century as it received in the last few decades of the 20th century. In the present-day climate, the region experiences wide swings in precipitation from year to year, and the UCLA researchers behind the study expect this variability to continue under climate change.

Snowfall

By 2050, Los Angeles area mountains will lose a substantial amount of snowfall. The region's mountains may see a reduction in snowfall of up to 42% of their annual averages, if greenhouse gas emissions continue to increase. If immediate efforts are made to substantively reduce emissions through mitigation, mid-century loss of snow will be limited to 31%.

The study's results indicate that whether or not we take action to rein in greenhouse gas emissions, substantial snowfall loss by mid-century is inevitable, and we have to adapt to these changes. However, by end-of-century, cutting greenhouse gases curbs further loss of snowfall—indicating that mitigation is an important strategy for preserving snow in the region.

End-Century Snowfall (2081-2100) **Business As Usual**

End-Century Snowfall (2081-2100) **Mitigation**

More Rain Than Snow

Over this century, Southern Californians may be at an increased risk of flooding and will have smaller windows of time to capture local water because, although the UCLA researchers found that the amount of precipitation is expected to remain nearly the same, more will fall as rain instead of snow. “Although we don’t expect the total amount of precipitation to change much, we know from the snowfall study that warmer temperatures will cause less of that precipitation to fall as snow,” says Dr. Hall.

Preparing for the Future

While snow stored in the mountains generally melts in the spring, rainfall runs off the mountains immediately, which poses a greater risk of flooding and shortens the chance to capture water.

As we see here Los Angeles is expected to grow warmer, with less snowfall in the local mountains while becoming more prone to drought and heavy rains in short periods. **The following sections will describe each element of a Living Street and how they could be important climate resilience strategies that can prepare us for this new climate reality while helping slow global climate change.**

http://www.kcet.org/news/climate_change_la/climate-studies/

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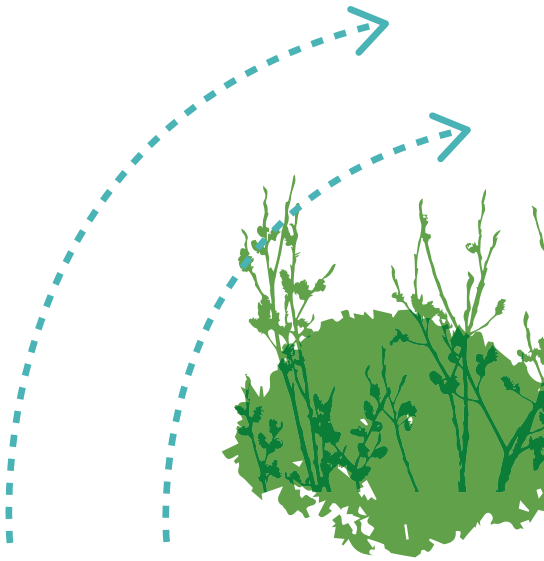


Elements of a Living Street

Green Streets

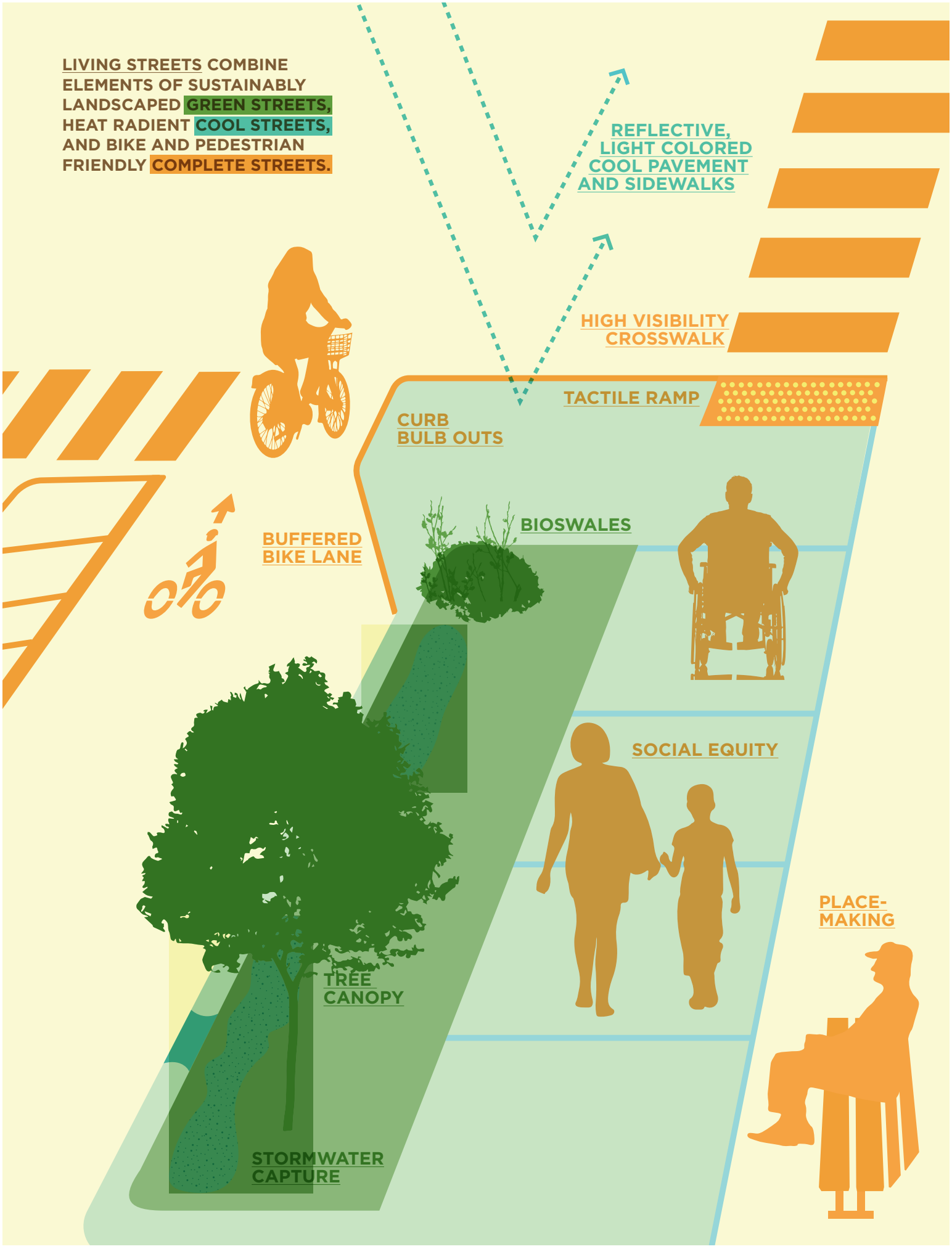
stormwater management and capture / tree canopies / bioswales / etc.

Cool Streets

light colored cool pavement / cool streets

Complete Streets

safe streets for all users / accessible / encourages all modes of transportation / bicycle and pedestrian improvements


LIVING STREETS COMBINE ELEMENTS OF SUSTAINABLY LANDSCAPED GREEN STREETS, HEAT RADIENT COOL STREETS, AND BIKE AND PEDESTRIAN FRIENDLY COMPLETE STREETS.
REFLECTIVE, LIGHT COLORED COOL PAVEMENT AND SIDEWALKS
HIGH VISIBILITY CROSSWALK
TACTILE RAMP
CURB BULB OUTS
BUFFERED BIKE LANE
BIOSWALES
SOCIAL EQUITY
PLACE-MAKING
TREE CANOPY
STORMWATER CAPTURE

Green Streets

The storm drain system was built to drain our cities, an agglomeration of impervious buildings, roads, and sidewalks. When it rains, our streets and sidewalks are designed to become a conveyance mechanism for the runoff. This stormwater often carries with it trash, bacteria, heavy metals, and other pollutants from the urban landscape out to receiving waters, like rivers, creeks, lakes, and oceans. The environmental impact of degraded waters is compounded by the lost opportunity for groundwater recharge through capture and infiltration.

As future droughts are expected to become lengthier and snowpack in the local mountains will be more precarious it is imperative that we preserve and protect the key to our future water security. This can happen if we transition our planning strategies for streets and sidewalks to more comprehensive thinking and planning. Green Streets use an environmental services approach to manage stormwater runoff at its source in order to meet regulatory compliance, by improving water quality and enhancing watershed health. It has the added benefit of reducing urban heating, reducing carbon footprints and beautifying neighborhoods. Green Streets can incorporate a wide variety of design elements. Although the design and appearance of Green Streets will vary, the functional goals are the same:

- **provide source control of stormwater,**
- **limit its transport,**
- **reduce pollutant conveyance to the collection system,**
- **provide environmentally enhanced roads.**

Trees are also a key component of Green Streets because not only do they have the ability to intercept and hold rain, but they help reduce the Urban Heat Island Effect. With future projections in Los Angeles of warmer average temperatures and a greater number of extreme heat days expected, increasing the urban tree canopy by lining our streets with shade trees will help offset some of that heat. This is achieved by keeping the sun's radiant energy off paved surfaces and through evaporative cooling, a trees natural process of shedding water vapor into the air.

(left) A bioswale captures rainwater on Elmer Avenue, in the North Hollywood neighborhood of Los Angeles. Photo via Council for Watershed Health.

Green Street Elements:

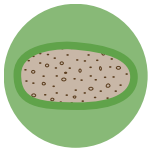
Trees and Vegetative Cover
are a main feature of Green Streets and can be part of a water management system, like planter boxes or bioswales. Aside from their ability to sequester carbon, trees also provide shading that helps to cool neighborhoods during hot days through the process of evapotranspiration.

Mulch
refers to any substance used to cover and protect soil. The primary function of mulch is to reduce evaporation of moisture from the soil.

Planter Boxes
are urban rain gardens with vertical walls and open or closed bottoms that collect and absorb runoff from sidewalks, parking lots, and streets.

Bioswales
are vegetated, mulched, or xevriscaped channels that provide treatment and retention as they move stormwater from one place to another.

Curb-Cuts
are openings created in the curb to allow stormwater from the street (or any adjacent impervious surface, like a parking lot) to flow into a depressed infiltration and planting area.



Sediment Traps
capture and collect sediment at the entrance to bioretention areas, facilitating periodic sediment removal and extending the functional life of these features.

Permeable Pavement
are paved surfaces that infiltrate, treat, and/or store rainwater where it falls.

Cool Streets

Cool Streets are streets designed to cool our cities and reduce the Urban Heat Island Effect (UHIE). The UHIE is primarily caused by placement of dark impervious surfaces (such as roads and rooftops) that absorb radiant energy from the sun and warm the surrounding air temperature.

This surface modification usually entails removal of canopy cover (trees) or soft scape (ground level vegetation) that shade and provide cooling evapotranspiration, thus further exacerbating the UHIE. A secondary contributor is waste heat generated by energy use, like air conditioning and tailpipe exhaust in cars and trucks.

There are various types of cool pavements such as reflective slurry seal, conventional, chip seals, resin, white-topping, vegetated permeable, etc., that reduce surrounding temperatures either by reflecting radiation or evaporating water.

Cool pavements provide a number of benefits maybe none more important than the reduction of ambient air temperatures and the UHIE which leads to a number of co-benefits such as: lower energy consumption and reduced greenhouse gas emissions (from reduced air-conditioning), improved air-quality as there is a direct correlation between heat and ozone (smog formation), fewer heat related illnesses and mortalities, increased pavement performance/durability (a key contributor to road deformation is heat). Other benefits include: 1) Reduced runoff temperature, resulting in less thermal shock to aquatic life meeting with runoff water. 2) By reflecting more light at night, streets stay more visible enhancing road safety. Additionally, greater reflectivity can reduce the electricity necessary to illuminate streets allowing street lamps to run using lower wattage bulbs.

Cool Street Elements:

Tree and Vegetative Cover
Tree and vegetative cover reduce local temperatures by shading hardscape and providing cooling evapotranspiration.

Cool Pavement
Cool pavements reflect more solar radiation reducing surface temperature and/or cool pavement through evaporation.

(left) Jordan Woods of the Berkeley Lab Heat Island group takes measurements of new cool pavement coating using an albedometer. Photo courtesy of Berkeley Lab.

Complete Streets

Complete Streets are designed and operated to enable safe access for all users. Pedestrians, bicyclists, motorists, and public transportation users of all ages and abilities are able to safely move along and across a Complete Street.

There is no one size fits all design for Complete Streets. While the ultimate goal is to design a street that is convenient and safe for all users, every Complete Street design evolves from a process of evaluating a number of factors (some possibly competing) that influence the ultimate design of the street. These factors include, but are not limited to:

- **Number and types of users**
- **Available and planned right-of-way**
- **Existing amenities**
- **Existing and planned land use context**
- **Community desires**
- **Available budget**
- **Parking needs**
- **Utilities**

Complete Streets give solo drivers options to easily shift toward other modes of transport. In Los Angeles 47% of all trips are less than 3 miles (within walking/biking distance) and 84% of these trips are currently made by car. Furthermore, 87% of all roads in Los Angeles are relatively flat (less than 5% grade) and 300 days/year there is favorable weather conditions for active transportation (sunshine, moderate temperatures) (LA Draft Mobility Plan 2035).

Design of Complete Streets should also take into account the additional needs of underserved communities. Grassroots public engagement and attention to issues such as social equity and public health will allow for maximum impact within high need communities.

Complete Street Elements:

Median/Island

A median is the portion of the roadway separating opposing directions of the roadway, or local lanes from through travel lanes. They are used to control traffic movements.

Traffic Calming Circle

A traffic calming circle is a raised island located in the center of an intersection around which traffic must circulate. Traffic calming circles are generally used at low volume neighborhood intersections.

Curb Extension/Gateway

Curb extensions visually and physically narrow the roadway, creating safer and shorter crossings for pedestrians while increasing the available space for street furniture, benches, plantings, and street trees.

Midblock Pedestrian Crossing

This is a pedestrian crosswalk that is located mid-block. As a rule of thumb, pedestrians will not walk more than 200 feet laterally in order to cross a street, and pedestrians will begin to seek out mid-block crossing opportunities when intersection spacing exceeds 400 feet.

Raised Crosswalk

Raised pedestrian crosswalks serve as traffic calming measures by extending the sidewalk across the road and bringing motor vehicles to the pedestrian level.

Corner Radii Design

Corner radii, when designed appropriately, result in smaller, more pedestrian-scaled intersections, reduce pedestrian cross times, encourage appropriate vehicular speeds and allow for proper placement of marked crosswalks.

On-Street Parking

On-street parking provides an additional buffer between the sidewalk and travel lanes. Additionally, on-street parking encourages lower motor vehicle operating speeds (consistent with the target speed).

Public Transit

Well-planned and designed transit facilities provide safe, comfortable and intentional locations for riders to access transit. People walking to the transit stop should find their path safe and inviting. Dedicated transit lanes, appropriate base signal timings, and operational traffic improvements ensure that the transit vehicle experiences minimal wait time at intersections and can move freely regardless of traffic congestion, providing a passenger experience competitive with driving.

Bicycle Lanes

Having a space for bicyclists to use encourages bicycling. There are various types of bicycle lanes.

Safe, Accessible, and Well-Maintained Sidewalks

Having a safe, accessible, and well-maintained sidewalk encourages walking.

Traffic Signal Treatments

Signal timing is an essential tool, not just for the movement of traffic, but also for a safer environment that supports walking, bicycling, and public transportation.

Lighting

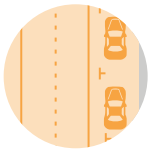
Studies have shown that the presence of lighting not only reduces the risk of traffic crashes, but also their severity. In most cases, roadway street lighting can be designed to illuminate the sidewalk area as well.

Smart Features

With all the current technology improvements, streets can employ different features (smart meters, digital tag, information panels) to make transit easier and safer for all users.

Lane Reductions*

Reducing the number of travel lanes on a multi-lane street can shift the balance of right-of-way (ROW) from motor vehicle to other users (pedestrians, bicyclists, etc.).



Lane Width Reduction*

This feature reduces the width of individual travel lanes, but keeping the total number of lanes constant. Lane width reductions are a good strategy for reclaiming street ROW for non-motor vehicle uses and for encouraging appropriate motor vehicle operating speeds.

Chicane*

A chicane is a series of alternating mid-block curb extensions or islands that narrow the roadway and require vehicles to follow a curving, S-shaped path.

Vertical Speed Control* (speed hump, speed cushion, speed table)

Vertical speed control elements manage traffic speeds and reinforce pedestrian-friendly, safe speeds. These devices may be appropriate on a range of street types, but are most widely applied along neighborhood, residential, or low-speed streets where freight traffic is discouraged.

Social Equity Criteria:

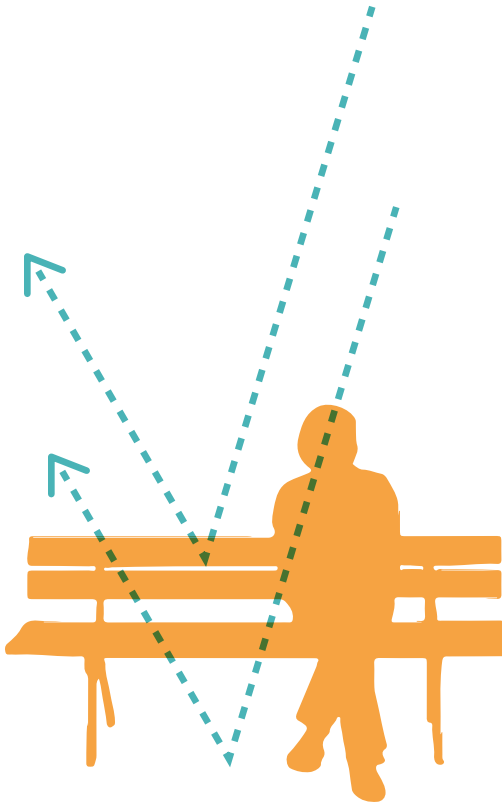
Collaboration with Local Partner Agency*
Effective community engagement can be facilitated by an organization that has a demonstrated history of organizing its constituents to affect positive change in their neighborhoods.

Project Identified Through Bottom-Up, Grassroots Process by Local Community Members*
Evidence of process and of consensus on project prioritization results to ensure community needs are addressed before design and engineering are completed.

Efforts Made to Address Potential Displacement of Current Residents*
Evidence of an anti-displacement strategy developed, to be applied throughout design, construction and maintenance of project.

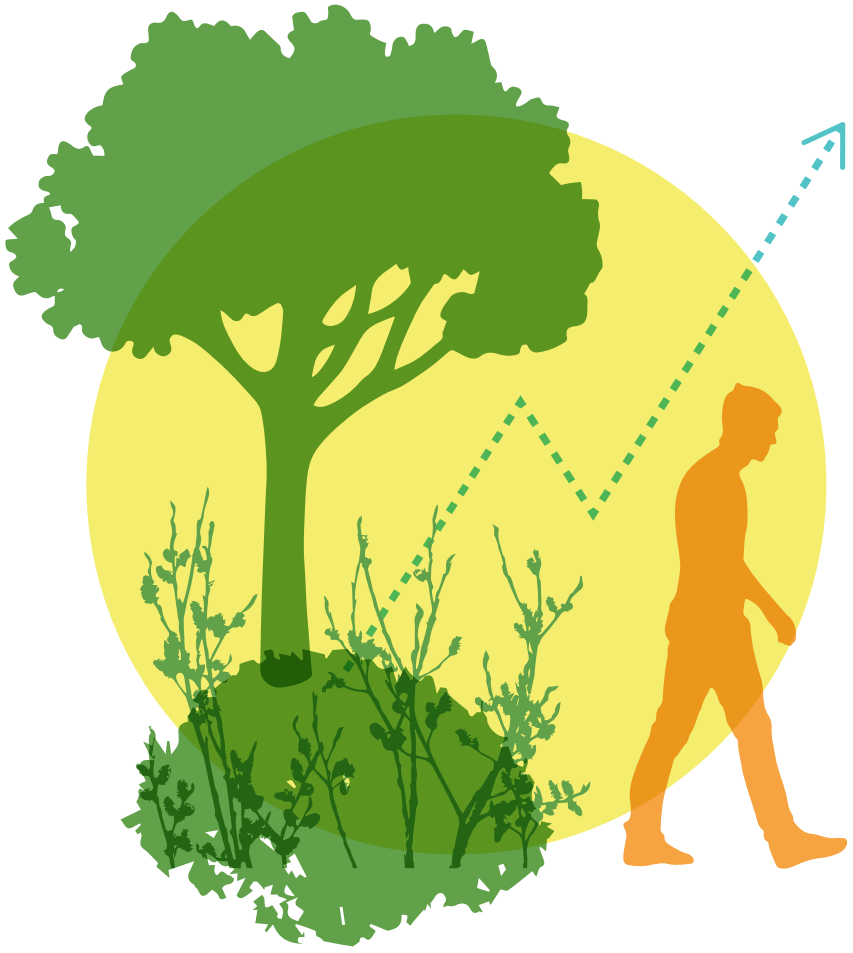
Ensure Other Concerns Identified by Community Are Considered, Such as Percent Local Hiring Requirements etc.*
Evidence of process and of consensus on specific project requirements results.

Grassroots public engagement and attention to issues such as social equity and public health will allow for maximum impact within high need communities.



*These elements were not studied in the cost benefit analysis

Cost Benefit Analysis



Modern and post-modern municipal planning strategies have been automobile-centric. In the City of Los Angeles, for example, 28% (86.5 square miles) of the 468.7 square miles of land area is occupied by streets, with another 800 miles of alleys and 181 miles of freeways (City of Los Angeles Mobility Plan 2035). These figures do not include the amount of land area devoted to idle cars, like parking lots, garages, or driveways. The hard infrastructure of streets and parking lots exacerbates issues such as flooding, increased street temperatures, and elevated exhaust emissions (carbon, pm, NOx and SOx).

The lack of green infrastructure makes the City's 4 million residents highly vulnerable to the effects of heat impacts. Asphalt streets, parking lots and playgrounds, with their dark, heat-absorbing materials, add upwards of 1.8-5.4°F (1-3°C) to the surrounding environment, warming nearby homes, schools and office buildings (Oke, 1997).

In addition to heat impacts, municipal streets and sidewalks act as a conveyance mechanism for carrying water runoff into streams, creeks, rivers, and oceans. It is estimated that every time it rains an inch in the City of LA, 3.8 billion gallons of runoff pollute our waterways and ocean (City of Los Angeles Integrated Resource Plan for Water). This runoff is often contaminated with pollutants such as metals, pathogens, toxins, nutrients, and trash. The impacts can be a missed opportunity to enhance our local water supply, unsafe beach water quality, contaminated fish, and impaired ecosystems.

The current "Business as Usual" (BAU) models for street and sidewalk maintenance—the simple repaving/resealing a street, and the outright reconstruction of the street and sidewalk—fail to address, if not worsen, a litany of issues confronting cities including: the lack of groundwater infiltration or recharge, large heat islands, and poor air quality. Poorly designed streets and sidewalks can be aesthetically disempowering and socially destructive for generating health capital, economic development, and public engagement.

Across the nation, city planning is adopting new strategies to address climate change. Cities must adapt and become more resilient in order to thrive in the face of climate change. Cities must promote public right-of-ways and spaces that generate multiple social benefits with environmental services built into them. Adaptation provides an opportunity to rethink the role of city streets and sidewalks. To this end, cities have recently investigated different street paradigms such as Complete, Green, and Cool Streets to capture rainwater, promote pedestrian usage, or reduce city temperatures.

This report proposes a more inclusive street paradigm, Living Streets, as an all-encompassing method to street and sidewalk construction for the City of Los Angeles. Living Streets combines all three alternative street strategies—Complete, Green, and Cool Streets—under the banner of Living Streets.

Living Streets are more equitable. They allow different populations to fairly use and share public resources. Living Streets are walkable, bikeable streets that:

- **Improve air quality by using vegetation to facilitate the removal of air pollutants and GHGs.**
- **Improve water quality and quantity by capturing, storing, and cleaning storm-water, helping to retain valuable water resources in drought stricken areas and prevent flooding and soil erosion.**
- **Improve human health and general well-being by lowering air temperatures, making streets cooler, cleaner, safer, walkable, and aesthetically pleasing.**

This results in decreased medical expenses and increased livability. Living Streets develop clean and safe open spaces and recreation. They provide a public greenway that can provide active and passive recreational opportunities for the surrounding neighborhoods.

This report details the costs and benefits associated with investing in Green, Cool, and Complete Streets in the City of Los Angeles compared to two "Business As Usual" or traditional approaches. It also investigates and discusses the enhanced or increased benefits

Table 1: Cost-Benefit Summary Comparing Green, Cool, Complete, and Living Streets to a Scenario Where the Streets are Simply Repaved (Known as BAU1)

Action Code	Total Cost	Total Benefit	Net Present Value	Pay Back (Years)	Benefit-Cost Ratio
BAU1-only	$738,677,265	$7,088,603,848	$6,349,926,582	3.0	9.6
Green-BAU1	$1,021,685,627	$7,602,417,470	$6,580,731,843	3.5	7.4
Cool-BAU1	$1,905,102,187	$8,190,384,713	$6,285,282,526	4.2	4.3
Complete-BAU1	$2,118,314,678	$9,395,271,662	$7,276,956,985	5.7	4.4
Living-BAU1	$3,301,975,358	$12,434,311,761	$9,132,336,403	4.6	3.8

of incorporating all three design elements into one Living Street.

According to this study, the Living Street paradigm generates the highest total benefits and the highest net present value of all street approaches. In Table 1, all four non-traditional approaches (Green, Cool, Complete, and Living) are compared to a simple repaving of the existing subgrade street infrastructure—called "BAU1-only". In this analysis, the Living Street (Living-BAU1) produces an additional $5.35 billion in total benefits to society when compared to BAU1-only approach and more than $3.04 billion to the next highest non-traditional street design (Complete-BAU1). In addition, Living Streets (Living-BAU1) produces $2.78 billion more in net present value over the lifetime of the project as compared to BAU1.

This analysis is meant to provide a high-level economic comparison of different street paradigms that could be implemented in the City of Los Angeles. The scenarios have been created using several assumptions to design 1,000 center-line miles of road for each scenario. The analysis uses averages for Los Angeles' road, weather, and population conditions. In addition, the analysis uses a discount rate of 4% as instructed by the Caltrans for Life-Cycle Cost Analysis of pavement structures (State of California, Department of Transportation, Pavement Standards Team & Division of Design, 2010). Finally, the results are presented in 2015 US Dollars.

The results, therefore, are meant to give a comparison of the costs and benefits associated with these elements. They are not meant to provide an estimate to the actual costs and benefits of a particular project implemented within the city.

Even though the BAU1-only approach (simply repaving) has a slightly faster pay-back period than the four other scenarios, it is not significant considering that average pay back period of any other alternative is 4.5 years, with the longest pay-back period (Complete-BAU1) taking less than six years.

In addition, the BAU1-only case has the highest benefit-cost ratio (BCR)—meaning that for every dollar invested a little more than $9 of benefits is generated. The Green Street approach has the next highest BCR value with $7-plus in benefits produced. The remaining three alternatives all have considerably lower BCR values.

However, when comparing 'net present value', the Living Street approach had the highest dollar value with over $9 billion generated. In contrast to the other economic indicators, BAU1-only was only slightly better ($6.35 billion) in terms of net present value than the lowest spot occupied by Cool Streets ($6.29 billion).*

When there are conflicting rankings, the net present value is the more ideal, better criterion to consider because it measures the economic contribution of each project in absolute terms.

*The projections of the Cool Streets scenario are based on estimated assumptions as the products used for this analysis are still in the development phase.

Table 2: Cost-Benefit Summary Comparing Green, Cool, Complete, and Living Streets to a Scenario Where the Streets and Sidewalks are Reconstructed (Known as BAU2)

Action Code	Total Cost	Total Benefit	Net Present Value	Pay Back (Years)	Benefit-Cost Ratio
BAU2-only	$1,086,995,688	$7,144,352,396	$6,057,356,708	4.3	6.6
Green-BAU2	$1,285,372,720	$7,652,323,491	$6,366,950,771	4.5	6.0
Cool-BAU2	$2,250,851,059	$8,246,133,262	$5,995,282,202	5.4	3.7
Complete-BAU2	$2,034,655,649	$9,303,142,393	$7,268,486,744	6.1	4.6
Living-BAU2	$3,741,949,842	$12,419,670,386	$8,677,720,544	6.2	3.3

The benefit-cost ratio is limited in that it conceals absolute magnitudes. For example, a project may have a high benefit-cost ratio but is small in terms of the absolute dollar amounts. In this scenario, an alternative street paradigm could appear less desirable than the BAU1 street paradigm because it has a lower benefit-cost ratio; yet, the alternative street paradigm would likely be the more economically prudent investment because of its larger scale and impact on the overall economy. As proven here, the Living Streets BAU1 has the highest net present value, and therefore makes it the best project to invest in from an economic perspective.

When looking at a complete street and sidewalk reconstruction, Table 2 shows all four alternative approaches compared to the business-as-usual or "BAU2-only." Again, the Living Street approach (Living-BAU2) provides similar benefits as witnessed in the repaving scenario, with $5.28 billion in total benefits accruing to society compared to the BAU2-only case. In addition, Living Streets produced in an additional $2.62 billion more in net present value over the lifetime of the project as compared to the BAU2-only case.

Looking at the overall costs and benefits of the entire project, the BAU2-only case has the lowest payback period. However, despite the higher initial cost by all the alternative scenarios, each one breaks-even within two-years of the BAU2-only approach.

Again, the BAU2-only case demonstrates the highest benefit-cost ratio, while Living-BAU2 has the highest net present value. When there are conflicting rankings, the net present value is the better criterion to consider as it measures the economic contribution of each project in absolute terms. Therefore, a BAU2 project could be less desirable than an alternative street paradigm that has a lower benefit-cost ratio, due to the lack of scale and/or impact on the overall economy. Investment in Living Streets BAU2 street design makes economic sense because of the higher net present value.

Investments in Living Streets can produce immense benefits to municipalities and their residents. Investing in Living Streets is more important now than ever before to help cities adapt to a new climate reality. This report is intended to provide city planners, policy makers, and elected officials the economic arguments and justifications for alternative street paradigms. The future of Los Angeles' street and sidewalk infrastructures can play an important role in city design, especially one that enables its residents to not merely survive, but thrive.

When City of Los Angeles electeds and transit experts state that "31% to 38% of the city streets…are so damaged that they can no longer be maintained" and the longer a roadway is allowed to deteriorate the more expensive it costs to repair them, then the time is now to begin embarking on a different street paradigm. The City of Los Angeles City Council forwarded a bond idea in 2014 with the intent of addressing the city's failing street infrastructure. The bond would solve the poor

street conditions, which were major impacts to the environment, goods-movement, damage done to vehicles, and public safety. The political will existed to place a measure on the ballot, but there was uncertainty if community support existed to ensure the bond would pass in an election.

Community groups wanted more in terms of multi-modal forms of transit, increased green infrastructure, and streets that worked for communities. As a Los Angeles Times editorial noted in April 2014, "All great amenities, but ones that could increase the project's cost and complexity." The editorial poignantly noted "Is [the bond] to fix crumbling asphalt? Or remake L.A.'s urban landscape? Can both be done affordably?" This report suggests that investing in both through Living Streets is the economically superior approach because of the tremendous societal benefits to be gained. Will it be affordable? Likely not, but simply doing Business As Usual with transit infrastructure is like paying mounting credit card debt, eventually you go bankrupt.

Investments in Living Streets can produce immense benefits to municipalities and their residents. Investing in Living Streets is more important now than ever before to help cities adapt to a new climate reality.

To view the entire Living Streets Cost Benefit Analysis document contact:

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Policy Recommendations

A Living Street promotes environmental benefits, making the surrounding areas more livable and walkable, with the flexibility to adapt to climate change. Now is the time to connect these separate efforts—Complete Streets (Mobility Plan 2035), Green Infrastructure (One Water LA, Green Streets Committee, Stormwater Management Guidelines Policy) and nascent reflective pavement technology to cool our streets—under a comprehensive approach called Living Streets.

Living Streets

A Living Street combines the goals of green infrastructure to naturally manage stormwater and improve water quality, with the goals of Complete Streets to provide safe access for all modes of travel and encourage community activity in public spaces.

Not every street can, nor should, include every physical aspect of a Living Street. However, every street project should be approached using multiple strategies to improve neighborhoods for people **today**, and assure we are resilient **tomorrow** by adapting to climate change.

Why Living Streets

For most of the city's history, our streets were built largely with the primary purpose of accommodating automobile traffic. It's time for a new perspective. New streets should be Living Streets, supporting and improving the lives of the people who use them every day.

- **Creating a Livable & Resilient Los Angeles:** L.A. could take a significant and much needed step in meeting our city's and state's sustainability goals.
- **Attracting Funding:** Living Streets presents an opportunity to expand the range and type of funding that can be applied to infrastructure projects that meet multiple objectives.
- **A Living Streets approach is the best investment from an economic perspective** because of its greater impact on the economy. When compared to a simple, Business As Usual, repaving project, the Living Streets approach, which combines Complete, Green and Cool street elements, has the highest net present value (meaning a positive net value of all cash inflows and outflows—expenses and benefits—computed in 2015 dollars).

In this analysis, the Living Street approach for 1,000 centerline miles in 30 years produces an additional $5.35 billion in total benefits to society when compared to simple repaving, and more than $3.04 billion when compared to the next highest non-traditional street design (Complete). In addition, Living Streets produces $2.78 billion more in net present value over the lifetime of the project as compared to simple repaving.

A Living Streets Approach is Within Reach

Existing efforts to implement *Complete Streets* by City Planning and *Green Streets* by the Department of Public Works can be combined to achieve most of Living Streets' goals and objectives. And, when cool pavement technology is tested and approved by the city, it should be relatively straightforward to include that, as well. The result could be a Living Streets approach that includes policies to ensure resources are allocated for maximum impact, especially in the most disadvantaged communities.

Importantly, the necessary inter-agency coordination for Living Streets projects starts with advance planning to proactively identify opportunities for multi-jurisdictional and multi-benefit capital improvement projects. The city currently does not have the organizational structure in place for this level of coordination, except on an informal or ad hoc basis. There are, however, several plans and efforts that seek to improve inter-departmental coordination.

a. **The Mayor's Sustainable City pLAn:** This provides a vision and proposes metrics, guiding city departments to act holistically, and coordinate to produce multi-benefit projects.
b. **Mobility Plan 2035:** This explicitly states that all street projects are to be Complete Streets—accessible and safe for all users with a clear and ambitious transportation infra-

structure plan containing simple, effective ways to both track and enforce progress.

c. **Green Streets Committee:** A monthly forum that facilitates the inter-agency cooperation necessary to implement Green Street infrastructure projects. Most recently the committee collaborated with the Mayor Garcetti's Great Streets Initiative.

d. **One Water LA Program:** This will create a *One Water Los Angeles 2040 Plan* that considers evolving environmental, economic, social, and sustainability factors.

e. **Stormwater Management Guidelines:** Councilmember Fuentes' motion requiring that all public street construction projects will be required to incorporate stormwater management practices.

Vision & Political Will

The City's effort to implement a holistic view of our streets demonstrates a vision that could support Living Streets. They have top level commitment and staff support. However, making sure there is connectivity between Complete Streets and Green Streets will require increased focus, funding, staff resources, and community and political support.

If the political will and existing efforts aren't enough, the city's need to comply with water quality regulations provides a powerful incentive to implement Living Streets, identify the necessary funds. Otherwise, it could face substantial fines and legal challenges. It is required, under regulations that govern the quality of stormwater and urban runoff discharges into our waterways and beaches, to mitigate them with street and road construction projects that include the use of green street infrastructure.

Creating a Living Streets Framework

A Living Streets approach requires a fundamental change from the way the City of Los Angeles has historically viewed its streets, from mostly single-purpose to a comprehensive (multi-benefit) approach. We offer the following steps for developing a Living Streets framework, if the expansion or connection of existing efforts discussed in the previous section is not possible.

- **Step 1: Estimate the Scope & Scale of Living Streets** identifies the scope and scale of possible projects.
- **Step 2: Advance Planning Prioritization** prioritizes the most impactful projects for funding that can best advance livability and sustainability goals.
- **Step 3: Implementation—Developing Projects for Funding** begins with identifying a lead agency from the inter-departmental team that will facilitate inter-agency coordination.
- **Step 4: Implementation—Final Project Development & Construction** requires a lead agency to coordinate multiple work plans to keep projects in sync and trouble-shoot project delivery challenges.

- **Step 5: Project Evaluation & Monitoring** identifies lead staff to facilitate monitoring and tracking of project performance.

A Living Streets Framework Requires Additional Tools

City staff and other professionals have been working for a number of years on overcoming implementation obstacles to multi-benefit projects. These efforts should be reviewed for lessons learned, best practices and additional tools and resources needed. For example, it has been noted that a better budgeting system is necessary to allow for the accounting of multi-benefits and cost sharing across multiple city departments.

Living Streets—Costs and Funding Opportunities

There is a misperception that multi-benefit projects are simply too expensive and complicated because they require multi-jurisdictional coordination to design and maintain. There is a need for the immediate education of policy makers, staff and the public. All infrastructure projects represent a considerable investment in the future. In the face of climate changes that are expected to be significant, it is irresponsible to invest scarce public funds to meet only a single goal. To return again and again to a single street to address additional project criteria or requirements is an extremely inefficient application of public funds and resources.

Increase Funding for Living Streets

The City will need to increase the level and types of capital project, operations and maintenance funding in order to implement Living Streets projects.

Existing Grant Funds:

- **Active Transportation Program** consolidates existing federal and state transportation programs into a single program with a focus on making California a national leader in active transportation.
- **Metro Call for Projects:** Metro is responsible for allocating discretionary federal, state and local transportation funds to improve all modes of surface transportation.
- **California's Natural Resources Agency Environmental Enhancement & Mitigation Program** offers $7 million each fiscal year for grants to state, local, federal and non-profit organizations for projects that are directly or indirectly related to the environmental impact of the modification of an existing transportation facility, or the construction of a new one.
- **Proposition 1: State Water Resources Control Board, Storm Water Grant Program** contains funds for multi-benefit storm water management projects, such as green infrastructure, and rainwater and stormwater capture projects.

Prospective Sources:

There are a number of sources that could provide an ongoing source of revenue for infrastructure projects. Most would need to be approved by voters and/or initiated and approved by the City Council and Mayor. Some of these efforts include:

1. **Stormwater Parcel Fee:** a fee charged to property owners to pay for stormwater pollution.
2. **Developer In-Lieu Fee option** for compliance with the city's Low Impact Development ordinance.
3. **A Los Angeles city bond measure for infrastructure.**
4. **Renew the city's 2004 Proposition O Water Bond.**
5. **Measure R 2.0 ballot measure:** likely to be placed on 2016 ballot to extend the LA County sales tax increase.

In addition, SB535 Greenhouse Gas Reduction Funds may be a source of funding for certain projects. Lastly, it should be explored how to include Living Streets infrastructure in projects that result from the Willits settlement that includes a commitment of $930 million to be used for repairing sidewalks for Americans With Disabilities Act compliance.

Call to Action

We close with a call to action. The project team looks to the City and our colleagues working day-to-day to implement a multi-benefit approach to carry the following action steps forward.

We hope by taking action now, we can seize the opportunity to leverage separate efforts—the work of the Mobility Plan 2035, One Water LA, the Green Streets Committee, Councilmember Fuentes' Stormwater Management Guidelines and the Mayor's Sustainable City pLAn.

Recommended Action Steps:

1. **Convene a Working Group:** We strongly urge the convening of a working group to identify steps for a path forward to Living Streets. Possible topics include:

- Using a Living Streets checklist for multi-benefit projects to use as a tool to assess which goals could be met as identified in the City's Sustainable City pLAn, Mobility Plan 2035, Enhanced Watershed Management Plans and others.
- Creating a Living Streets framework/ process to identify prospective multi-jurisdictional projects—assess how best to strengthen or continue existing multi-departmental collaborative efforts, such as: Green Streets Committee, Great Streets, Strategic Transportation Coordinating Committee, or the Department of City Planning's Grants Committee.

Photos courtesy of LADOT

- Using technology to share different capital improvement project lists.
- Pursuing innovations in financing and funding for public infrastructure.
- Breaking down silos with a budgeting system to account for multi-benefit projects and cost sharing across multiple city departments.
- Facilitating more flexible and productive partnerships and collaboration between public, NGO and private entities while not adversely affecting accountability and transparency.

2. **Implement Phase II of Living Streets Cost and Benefits Analysis:** Build on the cost benefit analysis identified in the Living Streets Feasibility Report.
3. **Identify an Entity to Coordinate Multi-Benefit, Inter-departmental Grant Funding Opportunities:** Under the current city process, individual departments identify funding opportunities that meet their individual department's goals and objectives. The Bureau of Sanitation's Financial Management Division takes the lead for that agency. The City Planning Department has a separate process to seek funding for mobility enhancement. One Water LA seeks funding opportunities for integrated water-related projects as part of the planning process. However, there remains a need for an entity to assume responsibility for taking a comprehensive approach to seeking funding opportunities.
4. **Support Recommendations Identified in Related Projects** which recommend that a multi-agency collaborative create a collaborative approach to managing our water goals.

To view the entire Living Streets Policy Recommendations document contact:

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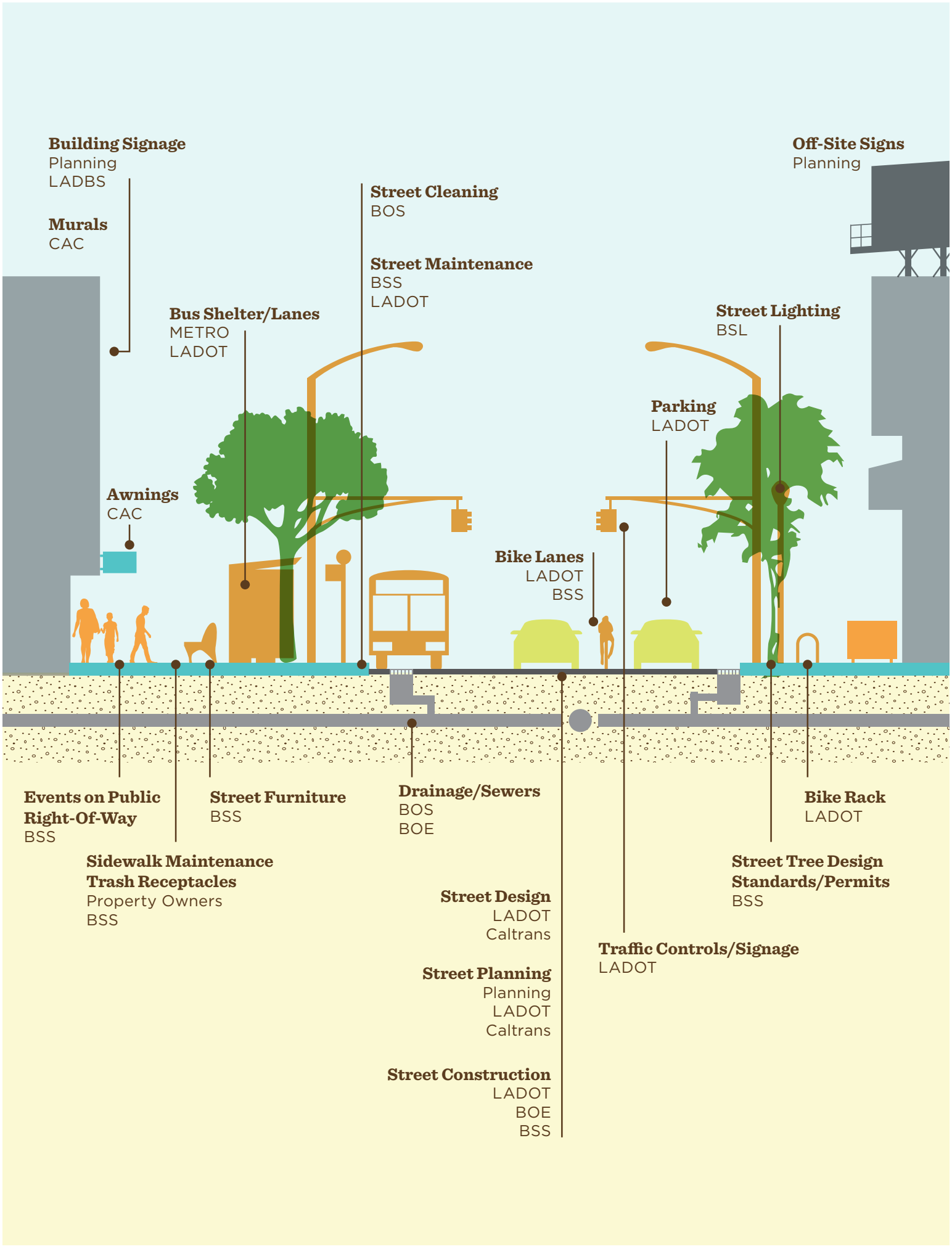
Agency Jurisdictions on a Typical Street in L.A.


Building Signage
Planning
LADBS
Murals
CAC
Off-Site Signs
Planning
Street Cleaning
BOS
Street Maintenance
BSS
LADOT
Bus Shelter/Lanes
METRO
LADOT
Street Lighting
BSL
Parking
LADOT
Awnings
CAC
Bike Lanes
LADOT
BSS
Events on Public Right-Of-Way
BSS
Street Furniture
BSS
Drainage/Sewers
BOS
BOE
Bike Rack
LADOT
Sidewalk Maintenance
Trash Receptacles
Property Owners
BSS
Street Design
LADOT
Caltrans
Street Tree Design Standards/Permits
BSS
Traffic Controls/Signage
LADOT
Street Planning
Planning
LADOT
Caltrans
Street Construction
LADOT
BOE
BSS

Conclusion

The prevailing Business As Usual standard of street development is failing to address the current needs of Los Angeles. It's also harming the future prosperity and health of the city. Innovation that promotes environmental progress on the street level has been stifled for far too long.

This guide has made an environmental, public health, public safety and economic case for changing how our street infrastructure needs are addressed.

Los Angeles has several disparate street improvement efforts that incorporate various Living Street elements. But, there is no cohesive, all-encompassing policy. Developing a Living Streets framework will ensure inter-agency coordination, advanced planning, project prioritization and provide an opportunity to attract and expand funding.

The Living Streets model generates the highest net benefit of all the scenarios studied in this survey. The Living Streets approach produces an additional $5.35 billion in total benefits to society, when compared to Business As Usual.

Advocating for improved street design and planning isn't just about any single benefit of the Living Streets approach. Living Streets is about an improved quality of life, and about a healthier, more resilient, more equitable and more livable city. It's about creating something new—a better Los Angeles for all Angelenos, both today and tomorrow.

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