



NATURE KNOWS BEST:

Using Green Infrastructure to Improve Stormwater Management and Community Recreation



TABLE OF CONTENTS

PROJECT INTRODUCTION.....	1-2	CASE STUDIES.....	23-26
Statement.....	1	Kinnickinnic River.....	23
Justification.....	2	San Luis Obispo Creek.....	24
PROJECT PROPOSAL.....	3-4	California Botanic Garden.....	25
Goals.....	3	Walgrove Wildlands.....	26
Objectives.....	4	DESIGN DEVELOPMENT.....	27-50
SITE AND ANALYSIS.....	5-18	Design Metaphor.....	27-28
Site Location.....	5	Illustrative Site Plan.....	29
Site History.....	6	Implementing Goals and Objectives...	30
Site Photos.....	7	Major Program Elements.....	31-34
Stakeholders and User Groups.....	8	Naturalized Channel Details.....	35-40
Context.....	9	Bioswale Details.....	41-44
Context Photos.....	10-12	Plant Palette.....	45-46
Site Analysis.....	13-14	Nature Play Details.....	47-50
Opportunities.....	15	CONCLUSION.....	51
Constraints.....	16	SUMMARY.....	52
Existing Trees.....	17	BOARDS.....	53-56
Existing Wildlife.....	18	ACKNOWLEDGEMENTS.....	57
DESIGN METHODOLOGY.....	19-21	REFERENCES.....	58-59
Green Infrastructure.....	19-20		
Stormwater Management.....	21		
SITE TYPOLOGY.....	22		

PROJECT STATEMENT

In response to urban development and previous flooding of urban areas, man-made channels were constructed to collect and redirect stormwater, taking the place of natural waterway systems. This has minimized wildlife habitats and created a disconnect between communities and natural systems.

The Los Cerritos Watershed Flood Channel System exhibits the characteristics of a typical urban waterway, designed solely to serve the function of directing stormwater away from developed areas, to eventually reach the ocean. These concrete channels cut through commercial zones, residential subdivisions, and even neighborhood parks.

The proposed project seeks to transorm stormwater management and enhance community recreation opportunities within a neighborhood park in Long Beach, utilizing ecologically sensitive methods.

By applying these methods and improving the park with an environmentally sensitive approach, the community is provided with a safer and more sustainable stormwater system and greater connection to their natural environment.



JUSTIFICATION

Typically constructed entirely of concrete, flood channels prevent groundwater recharge, bioremediation of stormwater, and provide minimal habitat for wildlife. Stormwater can become highly contaminated within the flood channel, including pesticide runoff, animal and human waste, oil from streets, industrial chemicals, and more. Concrete flood channels also pose a threat of drowning, as they can fill with high volumes of fast-moving water during rain events. Every year at least six people die in flood control channel incidents in Los Angeles County. This can be prevented by reducing the flow speed of water through the channel and pollutants can be reduced through filtration via bioremediation.

The current design of many neighborhood parks focuses primarily on organized sports and open turf space. This design method does not consider the need for biodiversity conservation and restoration within urban environments. This design approach also neglects to engage and connect the community to environmental sustainability.

GOALS

Improve Stormwater Management

Green infrastructure stormwater management aims to capture rain where it falls, allowing it to permeate into the earth and encourage groundwater recharge. This method improves water quality, reducing the amount of stormwater that reaches major waterways, and decreasing levels of contaminants in water that does.

Reintroduce Biodiversity

Southern California includes arid deserts, lush forests, snow-covered mountains, and the coast, creating habitat for an exceptional number of species found nowhere else on Earth. This region is also one of the fastest growing in the country, resulting in the constant need for urban infrastructure growth. This combination of characteristics makes Southern California one of the country’s most difficult and important regions for proper management of wildlands and green spaces. Transforming open turf areas into low water and California-friendly garden space will help to increase biodiversity and aim to reduce overall water usage.

Increase Community Engagement and Connection to Natural Environment

We can easily become disconnected from nature because we are increasingly more set in a man-made world. Nature connectedness, the extent to which individuals include nature as part of their identity, includes an understanding of the natural environment. Connectivity with nature can change based on an individual’s experience with nature. This means that the more time an individual spends in nature, the more connected they feel, resulting in more interest and concern for nature. By transforming the site to a more diverse space, it can appeal to more people and lead to prolonged visits to the site, resulting in an increase in nature connectedness among visitors.

OBJECTIVES

Remove concrete channel and direct stormwater through naturalized waterway

Capture stormwater on-site

Utilize low points on-site for bioswale and retentiion areas and rain gardens

Provide wildlife habitat throughout California garden, vegetation in naturalized waterway and dispersed throughout site

Create protected areas for wildlife

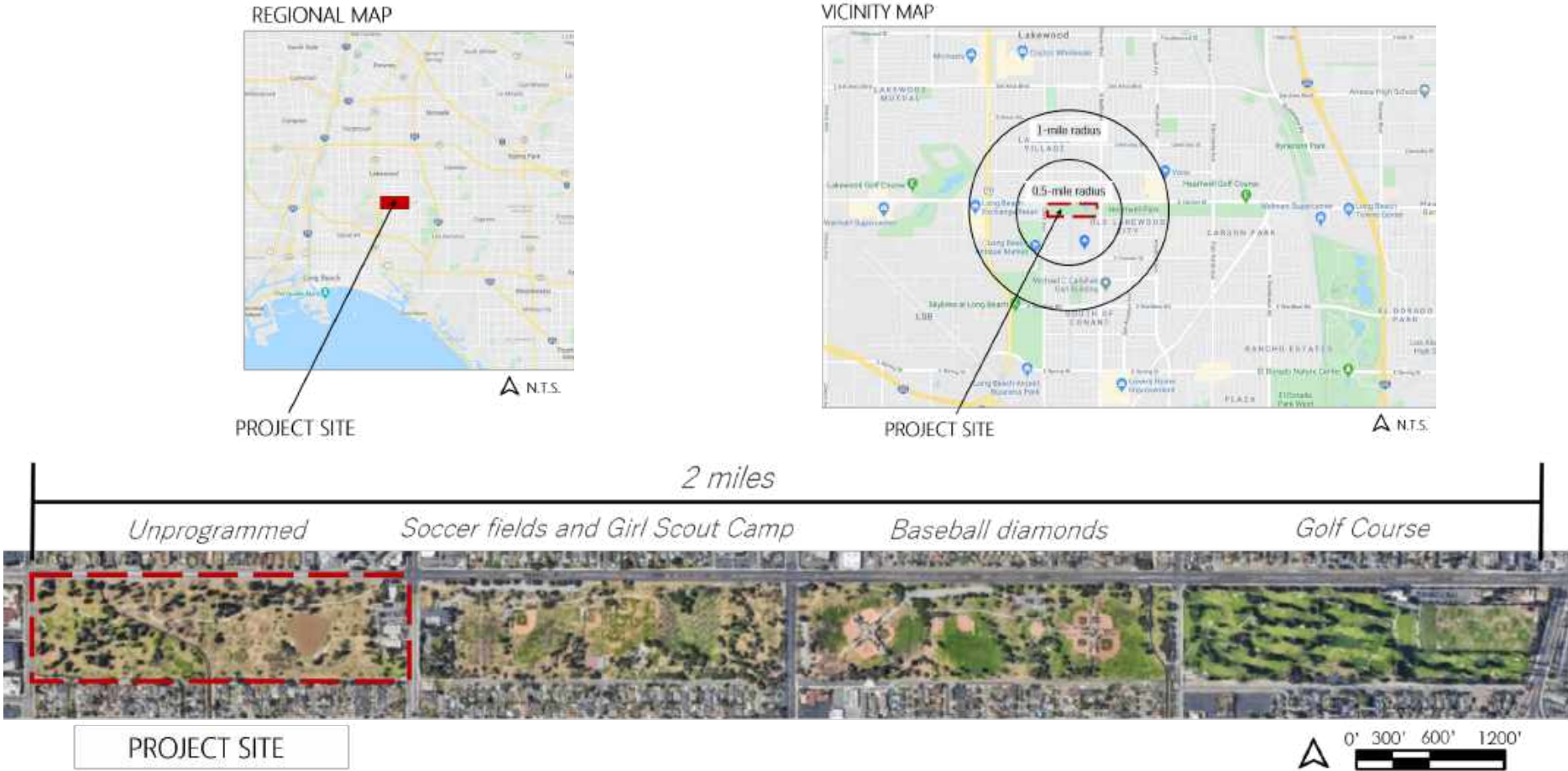
Create inviting entrances to draw in visitors

Provide engaging areas for visitors of all ages

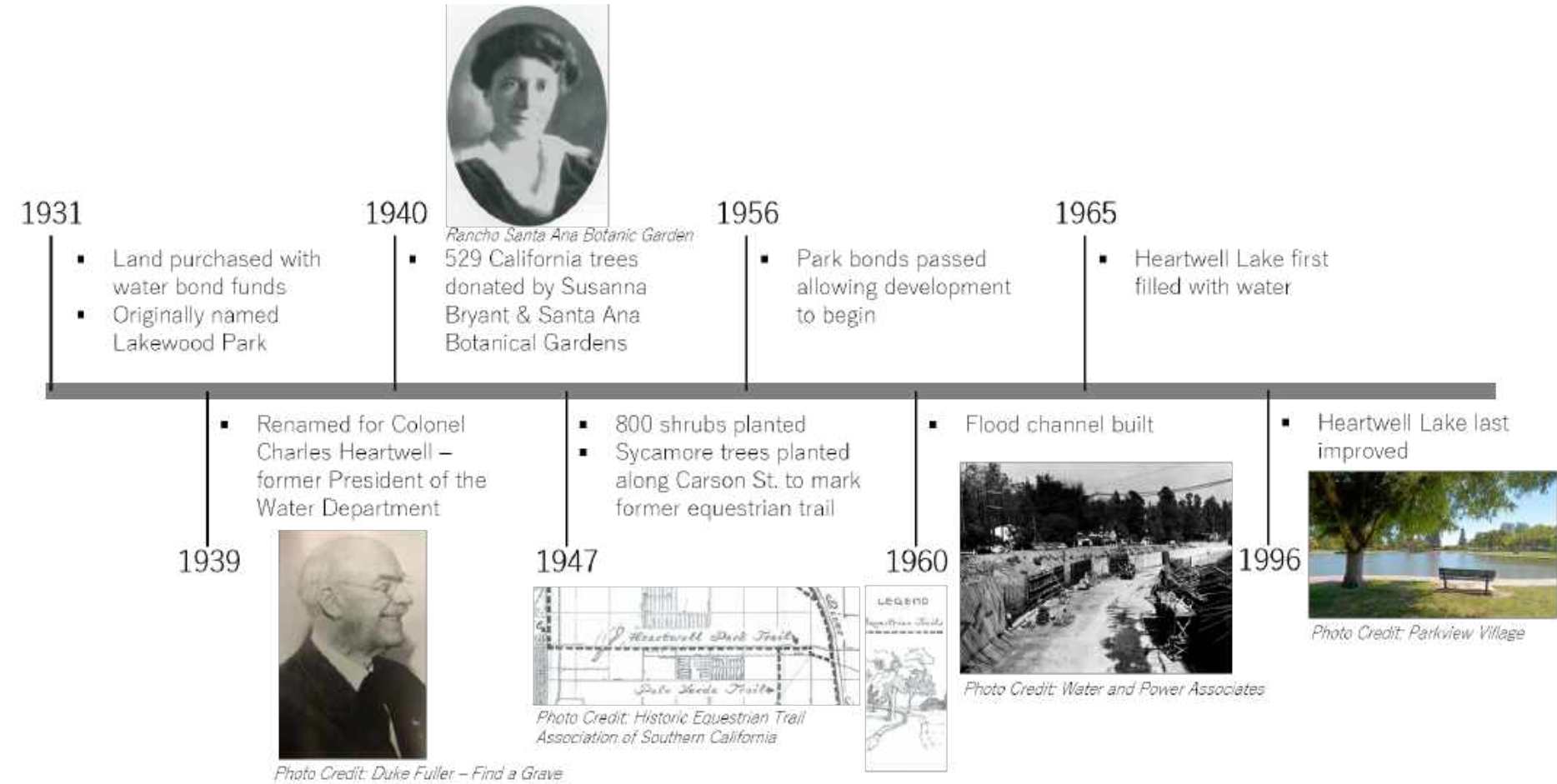
The more time an individual spends in nature, the more connected they feel, resulting in more interest and concern for the natural environment

SITE LOCATION

The selected site is located in Long Beach along E. Carson Street. It is a section of Heartwell Park, which is 2 miles long in total and includes a Girl Scout camp, soccer fields, baseball diamonds, and a golf course. The chosen section of Heartwell Park is approximately 30 acres and is currently unprogrammed, with a concrete flood channel running through the West end of the site.



SITE HISTORY



SITE PHOTOS



SITE STAKEHOLDERS AND USER GROUPS

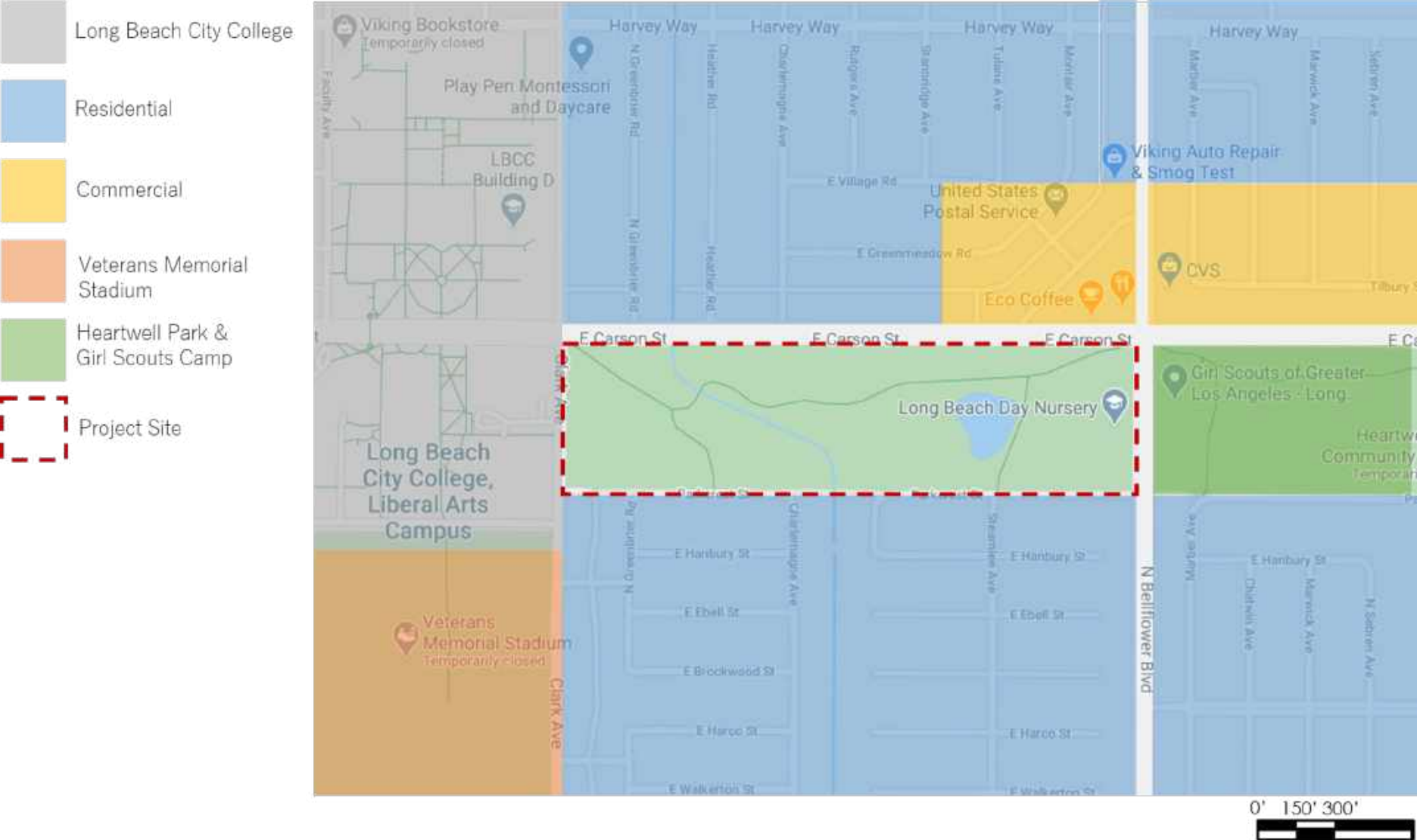
PROPOSED STAKEHOLDERS:
City of Long Beach Parks, Recreation, and Marine
City of Long Beach Public Works
LA County Flood Control District
Friends of Heartwell Park



PROPOSED USER GROUPS:
Old Lakewood City and Lakewood Village Residents
Residents of neighboring areas
Ruth Bach Neighborhood Library visitors
Long Beach College Students
Patrons of neighboring establishments



SITE CONTEXT



SITE CONTEXT PHOTOS

The site is located in a primarily residential area, with Long Beach City College to the West , commercial establishments to the Northeast, and Heartwell Park continuing directly East. This allows for a variety of potential park visitors including residents of different ages, City College students and faculty, as well as patrons of the surrounding shops and restaurants.



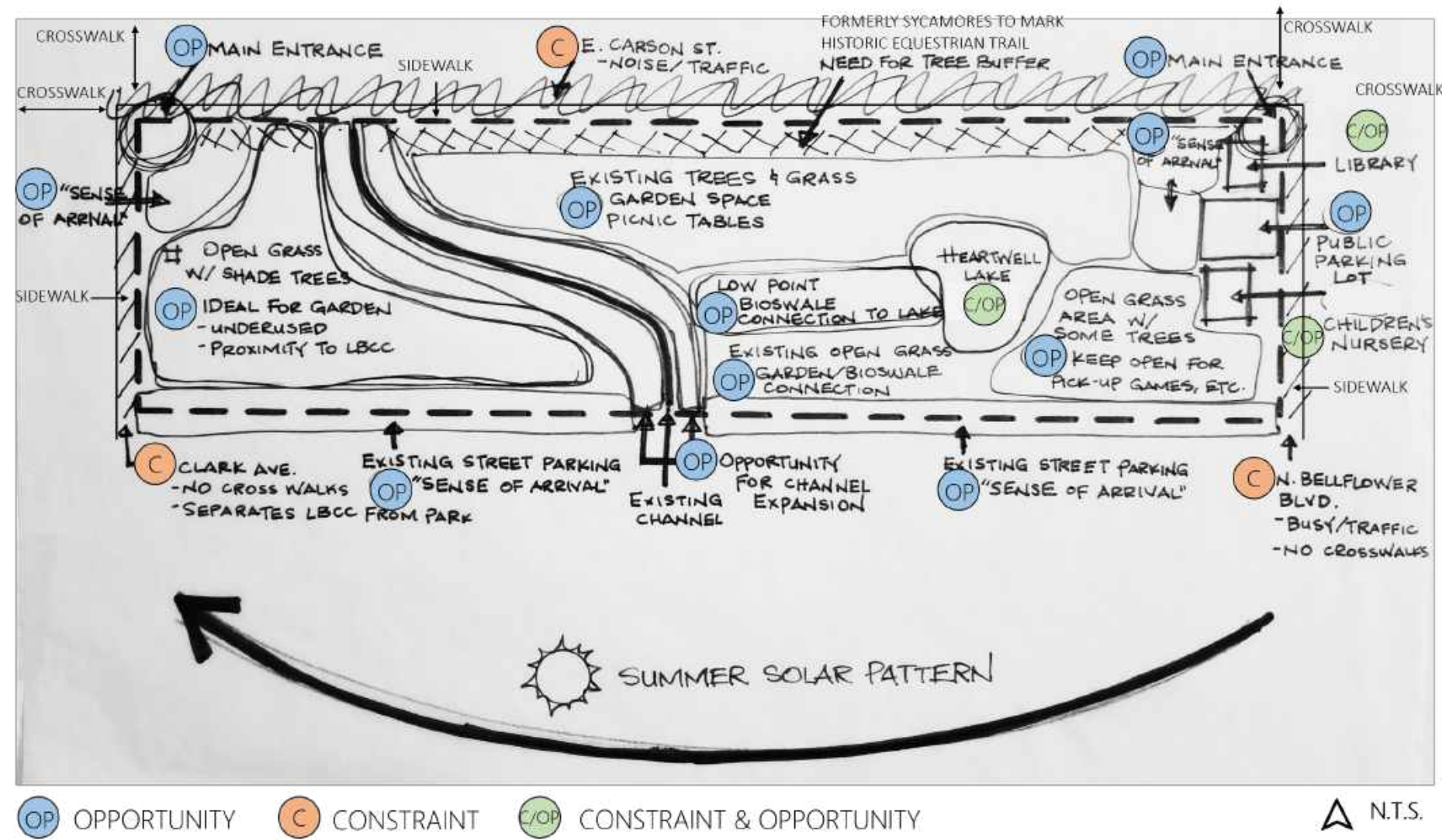
SITE CONTEXT PHOTOS



SITE CONTEXT PHOTOS



SITE ANALYSIS



SITE ANALYSIS

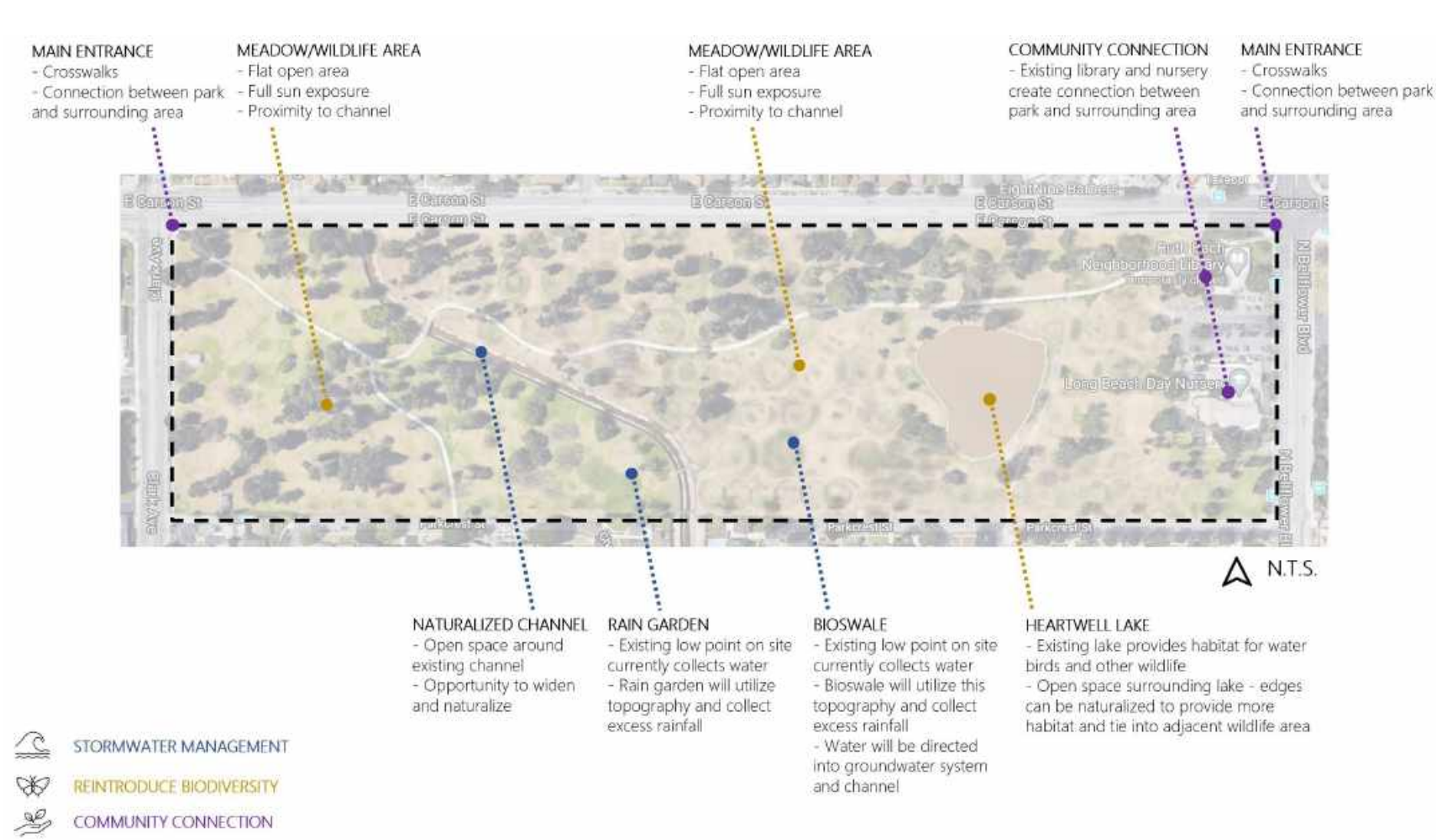
The site sits on E. Carson St. which is a busy main street that runs East to West. Constant traffic on E. Carson St. creates noise pollution and poses a potential danger to pedestrians within the park. A tree buffer along the North edge of the site will help to minimize noise traveling into the park and will help to keep park visitors safe.

Existing open green space allows for expansion of the flood channel, which will help in maintaining flow capacity with a new naturalized channel design. Full sun exposure across the site allows for a diverse planting palette, which will include primarily low-water and California-friendly plant material.

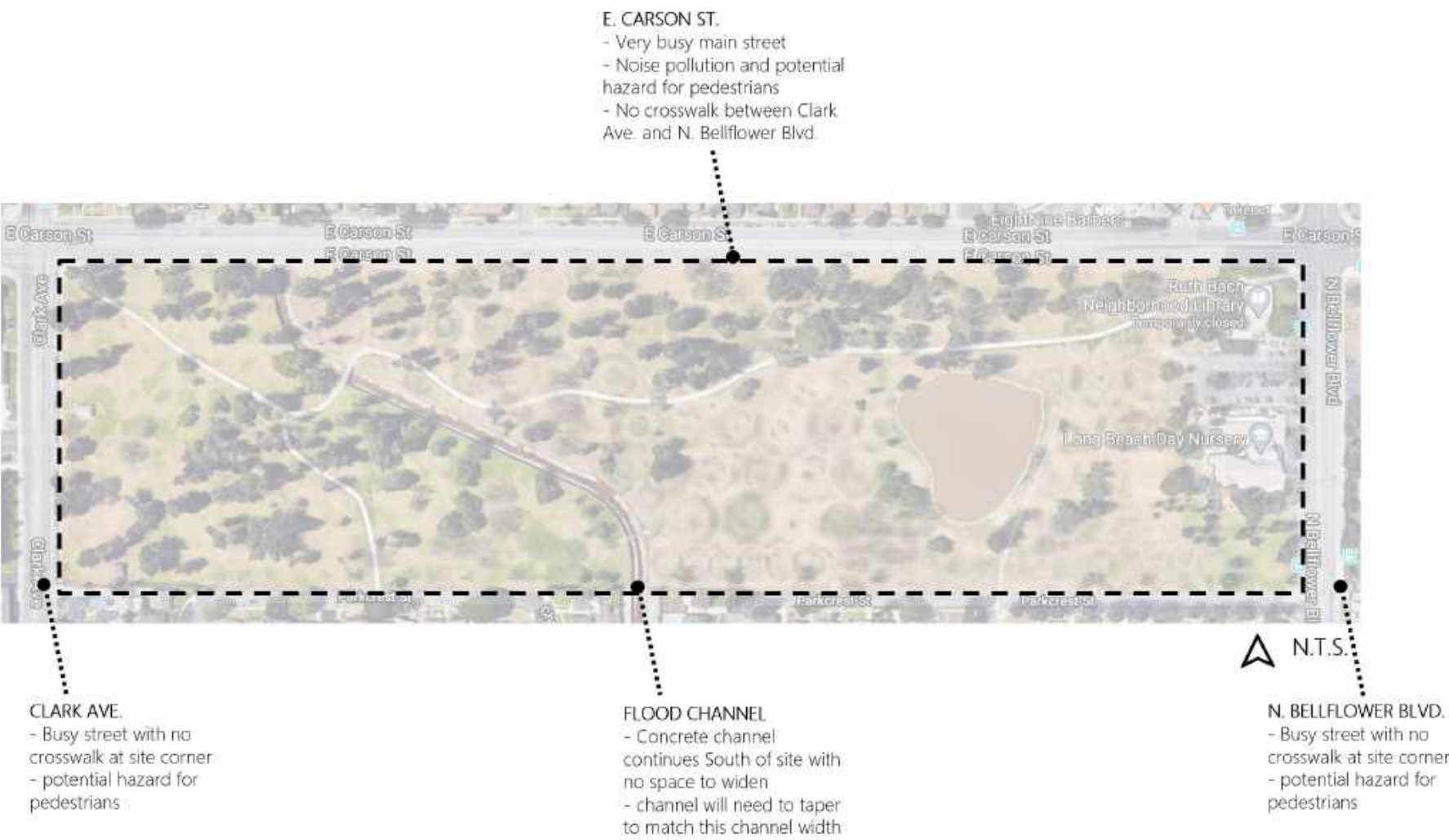
The existing flood channel is approximately 30' wide and 10' deep, with vertical sides. The channel bottom slopes slightly towards the center to help direct water flow. All channel sides are concrete and a chain-link fence runs along the perimeter of the channel at ground level to keep park visitors from entering the channel.



OPPORTUNITIES



CONSTRAINTS



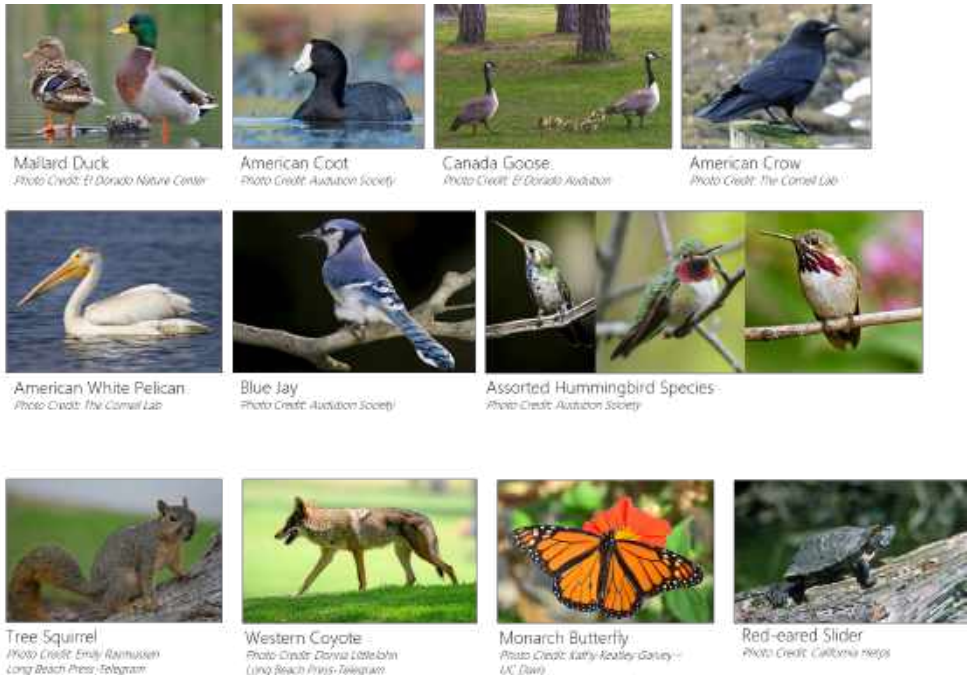
EXISTING TREES



The existing trees on the site include Jacaranda, Western Sycamore, and Chinese Elm. These trees are common throughout the surrounding area as well, however, they are not the best option when considering water conservation and increasing biodiversity.

The existing trees will be removed to allow for a new planting palette more suitable for the site and project goals.

EXISTING WILDLIFE



The most commonly found wildlife on the site are ducks, Canadian Geese, and assorted hummingbirds, as well as squirrels, butterflies and red-eared slider turtles.

DESIGN METHODOLOGY

GREEN INFRASTRUCTURE

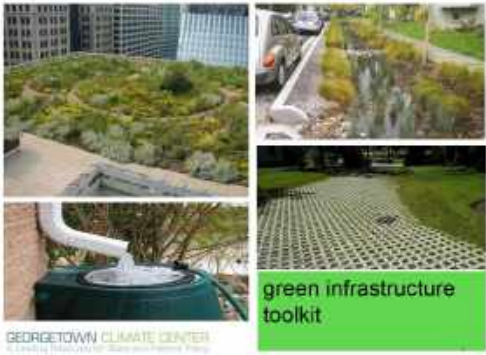
Green infrastructure is an approach to water management that aims to protect, restore, or mimic the natural water cycle. This approach is effective, economical, and enhances community safety and quality of life. The following guidelines are outlined by the *EPA: Green Infrastructure in Parks: A Guide to Collaboration, Funding, and Community Engagement*:

- **Enhance Recreation Value:**
 - design to improve park amenities
 - restore degraded areas to provide wildlife habitat
- **Create Attractive Park Features:**
 - include a diverse palette of native and locally adapted plants
 - provide pathways and benches for public use and enjoyment
 - utilize infiltration areas to enhance the site topography
- **Enhance Social and Environmental Equity:**
 - provide opportunities for physical activity, interactions with nature, and destination community gathering places
- **Reduce Maintenance:**
 - improve drainage, reduce erosion, and eliminate standing water
 - convert high maintenance vegetation to lower maintenance native and adapted vegetation can reduce the need for supplemental water and other inputs

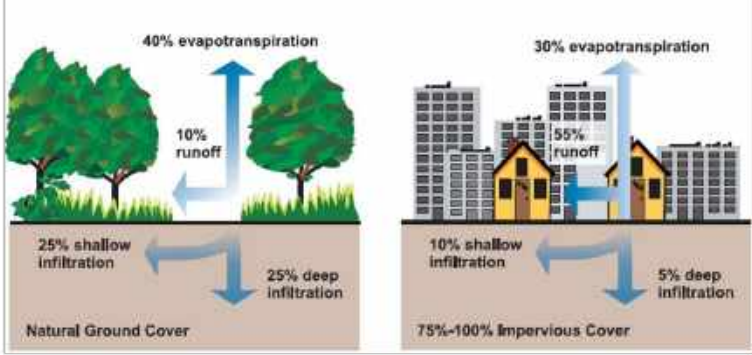
DESIGN METHODOLOGY

GREEN INFRASTRUCTURE

- **Provide Economic Benefits:**
 - Use captured water for irrigation when possible
- **Improve Drainage:**
 - Utilize permeable pavement, soil amendments, enhanced infiltration, and underground storage to mitigate drainage issues
- **Help to Educate the Public:**
 - Place interpretive signage where green infrastructure is used to raise public awareness
- **Improve Water Quality:**
 - Maximize pervious surfaces for rainwater and runoff absorption
- **Benefit the Overall Environment:**
 - Incorporate vegetation, specifically trees, where pavement or conventional turf landscapes previously existed to reduce urban heat island impacts
 - Incorporate native and locally adapted plants to attract beneficial wildlife such as birds, butterflies, and other pollinators



<https://nati.growth.org/georgetown-climate-center-green-infrastructure-toolkit/>



<https://www.birminghamal.gov/about/city-directory/planning-engineering-permits/storm-water-management/stormwater-faq/>

DESIGN METHODOLOGY

STORMWATER MANAGEMENT

The Conservation Element of the City of Long Beach General Plan advocates conservation of water with the following guidelines:

- Utilize reclaimed wastewater
- Capture and control stormwater runoff
- Minimize the impact of flood damage
- Reduce pollution from all sources
- Restrict development where hazardous conditions are present
- Protect and preserve the natural qualities of the coastal zone and ocean as a benefit to the City

OPEN SPACES AND PARKS

The following guidelines regarding open spaces and parks are outlined by the City of Long Beach Urban Design Plan:

- **STRATEGY NO. 30:** Provide greater access to the open space network to promote pedestrian and bicycle activity, to support the health and well-being of residents, and to increase opportunities for recreation
- **POLICY UD 30-1:** Preserve and enhance access to existing open space through improvements to existing facilities and wayfinding programs for new and existing open spaces
- **POLICY UD 30-2:** Seek opportunities to provide new publicly accessible open spaces and linkages to the greater open space network within residential projects
- **POLICY UD 30-3:** Look for opportunities on underutilized streets to be repurposed as open space
- **POLICY UD 30-4:** Encourage projects to integrate required open space with a beneficial relationship to the public realm

SITE TYPOLOGY

The site and proposed project fall under the following typologies:

- **NEIGHBORHOOD PARK**
 - Incorporate elements common to small active parks and large parks
 - Typically built within the existing neighborhood, often taking advantage of sites with dramatic topography or steep terrain
 - Some features included in neighborhood parks are planted perimeters, views, and open space
- **INFORMAL TRAILS, PATHS, AND PASSIVE RECREATION**
 - Can be integrated into naturalistic landscapes
 - The intention of such landscape features is to provide access to natural areas for individuals and groups as an alternative to more formal and urban places
 - Path materials can vary but should blend into a natural setting
- **GARDENS**
 - Provide small-scale, secluded outdoor spaces for study, private conversation, small gatherings, and social events
 - Informal in layout, horticulturally intensive, with benches and areas for seating
 - Minimal paving, meandering paths
 - Variety of plant species and types
 - Integration of graywater storage encouraged to provide non-potable water source for irrigation
- **STREAM/WETLAND**
 - Appropriate for low-lying areas to provide stormwater management, water quality treatment, wildlife habitat, and daytime public use
 - Low-maintenance plantings suitable for climate and mesic environment that benefit wildlife

CASE STUDIES: Kinnickinnic River, Milwaukee, WI



Kinnickinnic River
before rehabilitation



Kinnickinnic River
after rehabilitation

KEY TAKEAWAYS:

- Streamlined into concrete channel as a result of expanding urbanization
- Concrete corridor has led to flooding and hazardous conditions and created an environment unsuitable for wildlife
- Channel restoration and flood management has led to a community restoration effort
- River restoration has resulted in a more suitable habitat for fish and other wildlife species
- Flood risk is being reduced with the redesign of the flood channel

CASE STUDIES: San Luis Obispo Creek, San Luis Obispo, CA



San Luis Obispo Creek
before restoration



San Luis Obispo Creek
after restoration

KEY TAKEAWAYS:

- Formerly vertical eroding banks and no protective riparian vegetation
- Habitat and water quality were adversely impacted by poor channel conditions
- Involved construction of a series of rock veins and rock weirs designed by River Morphologist, Don Funk
 - rock veins and weirs gently direct the stream flow toward the center of the stream and away from the channel sides
- Boulder structures were designed to direct stream flows toward the center of the channel, slowing velocities, reducing the channel grade, and providing pools for wildlife habitat

CASE STUDIES: California Botanic Garden, Claremont, CA



KEY TAKEAWAYS:

- Founder: Susanna Bixby Bryant (1927)
- Started native plant garden on 200 acres on Bryant’s ranch in Santa Ana Canyon in memory of her father, John Williams Bixby
- Now 86 acres - largest garden dedicated exclusively to California’s native plants
- Conservation of rare and endangered species is among their top priorities
- Mission: *“to promote botany conservation and horticulture to inspire, inform, and educate the public to the collection, cultivation, study, and display of native California plants and to graduate training and research in plant systematics and evolution. Through all its programs, the Garden makes significant contributions to the appreciation, enjoyment, understanding and thoughtful utilization of our natural heritage.”*

CASE STUDIES: Walgrove Wildlands, Los Angeles, CA



KEY TAKEAWAYS:

- Urban eco-lab, native ecosystem, and National Wildlife Federation Monarch Butterfly Way Station
- Guiding Principles:
 - Create a schoolyard habitat that restores native species and works towards recreating a native ecosystem
 - Create a hands-on, outdoor laboratory in which students learn about science, ecology, and environmental stewardship
 - Pursue a joint-use agreement to make greened area available to the community after school hours
 - Encourage the community ownership of the habitat to participate actively in its maintenance
- The wildlands restore the land to its natural state - includes woodland, meadow, chaparral, and wetland/riparian elements

DESIGN METAPHOR

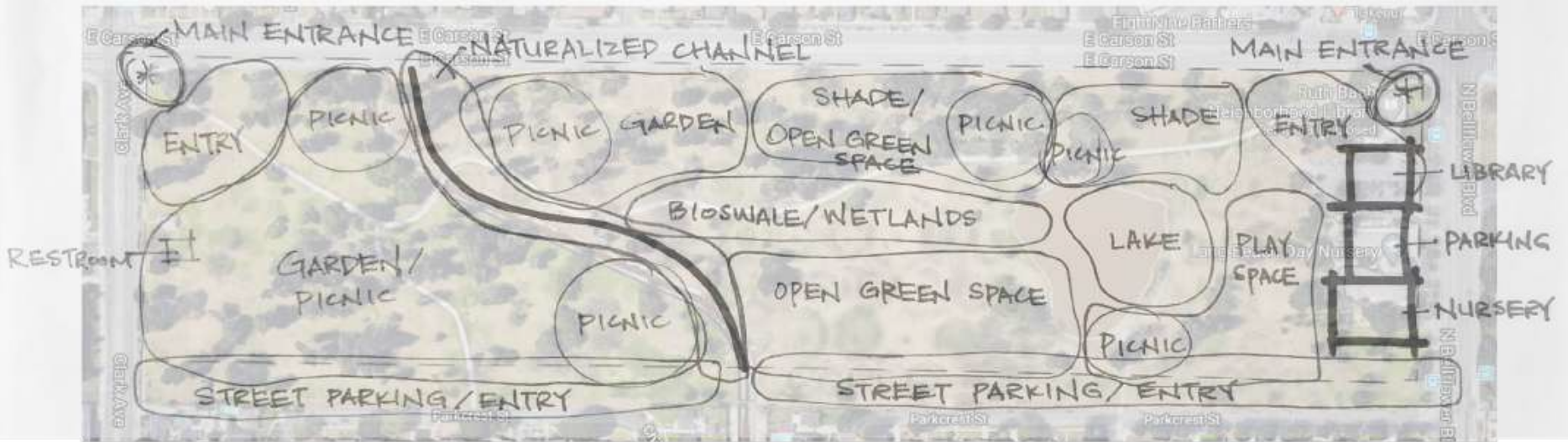
Platanus racemosa - Western Sycamore

The overall structure of the Western Sycamore tree will serve as the design metaphor for the site. This tree is significant to the site, as many were planted in the 1940s to commemorate a former equestrian trail along E. Carson St.

A full canopy, palmate leaves, and hanging seed pods all offer design elements to apply to the space.



DESIGN METAPHOR



- Grouping of active program elements to create the “crown” of the tree
- Bioswale and central elements serve as the “trunk”
- Flood channel and meandering pathways are laid out as the “root system”

ILLUSTRATIVE SITE PLAN

IMPLEMENTING GOALS AND OBJECTIVES



- STORMWATER MANAGEMENT**

 - 1 Naturalized Channel
 - 2 Bioswale
 - 3 Rain Garden
 - 4 Heartwell Lake
- REINTRODUCE BIODIVERSITY**

 - 5 Wildlife Habitat
 - 6 Entrance Garden
 - 7 Sycamore Row
- COMMUNITY CONNECTION**

 - 8 Biking Path
 - 9 Walking Path
 - 10 Event Space
 - 11 Picnic Pods
 - 12 Open Turf – Active Recreation
 - 13 Passive Recreation
 - 14 Dog Park – separate small and large dog spaces
 - 15 Relax/Study Space
 - 16 Nature Play
- EXISTING FEATURES**

 - 17 Public Parking Lot
 - 18 Ruth Bach Neighborhood Library
 - 19 Long Beach Day Nursery
 - 20 Public Restroom



- IMPROVE STORMWATER MANAGEMENT**

 - Channel is widened and naturalized with directional changes to slow water flow
 - Channel edges are planted with bank stabilizing plant material that will help remove pollutants from stormwater
 - Bioswales on either side of the channel to collect rainwater in low points of site
 - Water will soak into soil and recharge groundwater system
 - Excess water will be collected in catch basins within the bioswales
 - Permeable paving to be used on all pathways to reduce sitting water
- REINTRODUCE BIODIVERSITY**

 - Plant palette to include a variety of canopy trees and understory shrubs and groundcovers to increase variety of flora throughout the site
 - Plant palette is selected to provide food, shelter, and nesting space for birds, butterflies, and mammals
- INCREASE COMMUNITY ENGAGEMENT AND CONNECTION TO NATURAL ENVIRONMENT**

 - Picnic pods, study spaces, and nature play areas create an inviting and engaging space for all ages

MAJOR PROGRAM ELEMENTS

NATURALIZED CHANNEL - 0.2 miles

- improves stormwater management
- improves aesthetics and functionality of the site
- safe seating and viewing areas, interpretive signage, pedestrian bridges

BIOSWALE - approximately 0.2 acres

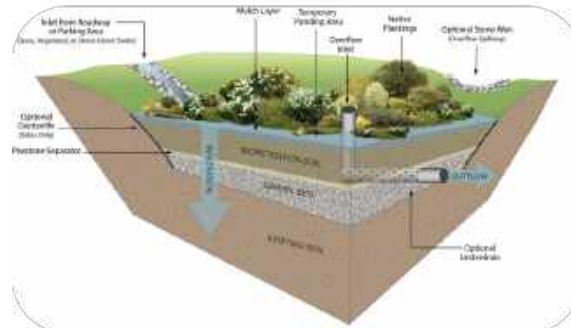
- will temporarily hold and/or redirect water in the case of higher rainfall
- serves as connection to Heartwell Lake
- safe seating and viewing areas, interpretive signage
- bridge to cross over bioswale for accessibility through park and views of bioswale feature

LOW-WATER GARDEN - throughout site

- will showcase a variety of native California plants and low water plants suitable for our climate
- garden areas to be dispersed throughout site
- safe seating and viewing areas, interpretive signage



Photo: University of Waterloo



<https://megamannual.geosyntec.com/npsmanual/bioretentionareasandraingardens.aspx>



Photo: California Dream Big

MAJOR PROGRAM ELEMENTS

MULTIMODAL PATH SYSTEM - 12-14' wide

- separate pathways for bicyclists and walkers
- will guide visitors through site
- shade and seating along pathways, picnic areas
- ADA accessible

INTERPRETIVE SIGNAGE

- clear educational messages and content
- throughout garden and along naturalized channel and bioswale

EVENT SPACE - approximately 5000 sf.

- open green space with amphitheater seating
- available for community events, classes, and daily use
- shade dispersed throughout seating area
- ADA accessible



Photo: Dallas Park and Recreation



Photo: Walgrove Wildlands - Facebook



Photo: GreenWorks

MAJOR PROGRAM ELEMENTS

SHADED OUTDOOR READING/STUDY AREAS

- courtyard-like spaces with ample seating and shade
- encourages connection between Ruth Bach Neighborhood Library and the park, as well as between Long Beach City College and the park
- ADA accessible



Photo: Irvine Campus Housing Authority, Inc.

DOG PARK - 0.5 -1 acre

- perimeter fenced
- shaded seating areas
- separate small and large dog areas



Photo: Manatee County Florida – Parks, Preserves and Beaches – Laurie Crawford Dog Park

NATURE PLAY SPACE

- natural play structures for all ages
- small dry riverbed feature
- shaded seating



Photo: Playscapes – Westmoreland Nature Play Area, Portland, OR

MAJOR PROGRAM ELEMENTS



Photo: University of Waterloo



<https://megamanual-geosyntec.com/npsmanual/bioretentionareasandraingardens.aspx>



Photo: California Dream Big



Photo: Dallas Park and Recreation



Photo: Walgrove Wildlands - Facebook



Photo: GreenWorks



Photo: Irvine Campus Housing Authority, Inc.

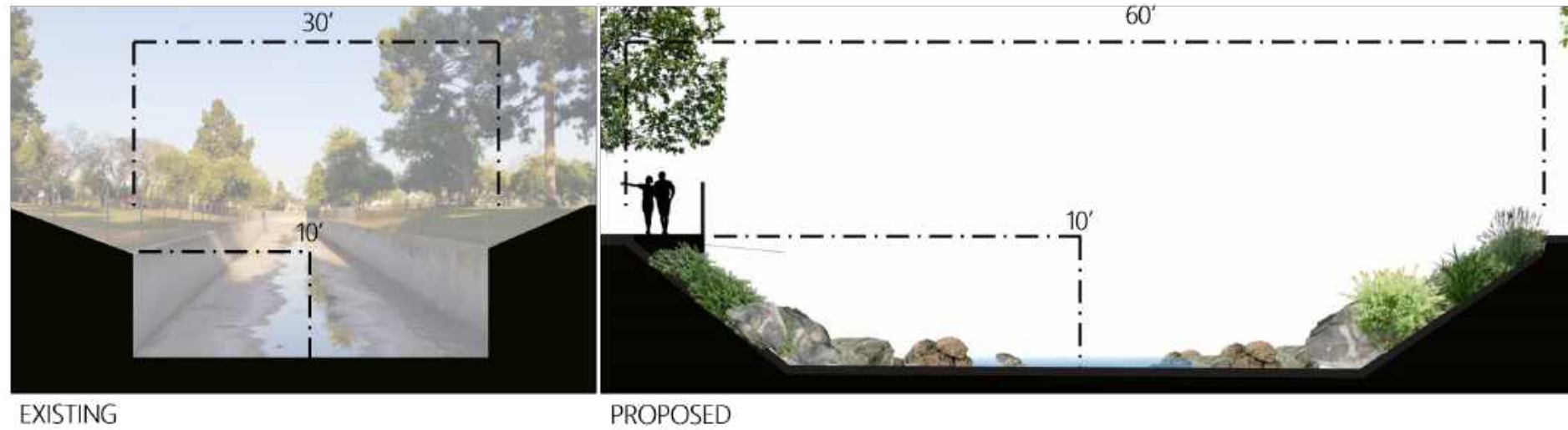


Photo: Manatee County Florida – Parks, Preserves and Beaches – Laurie Crawford Dog Park



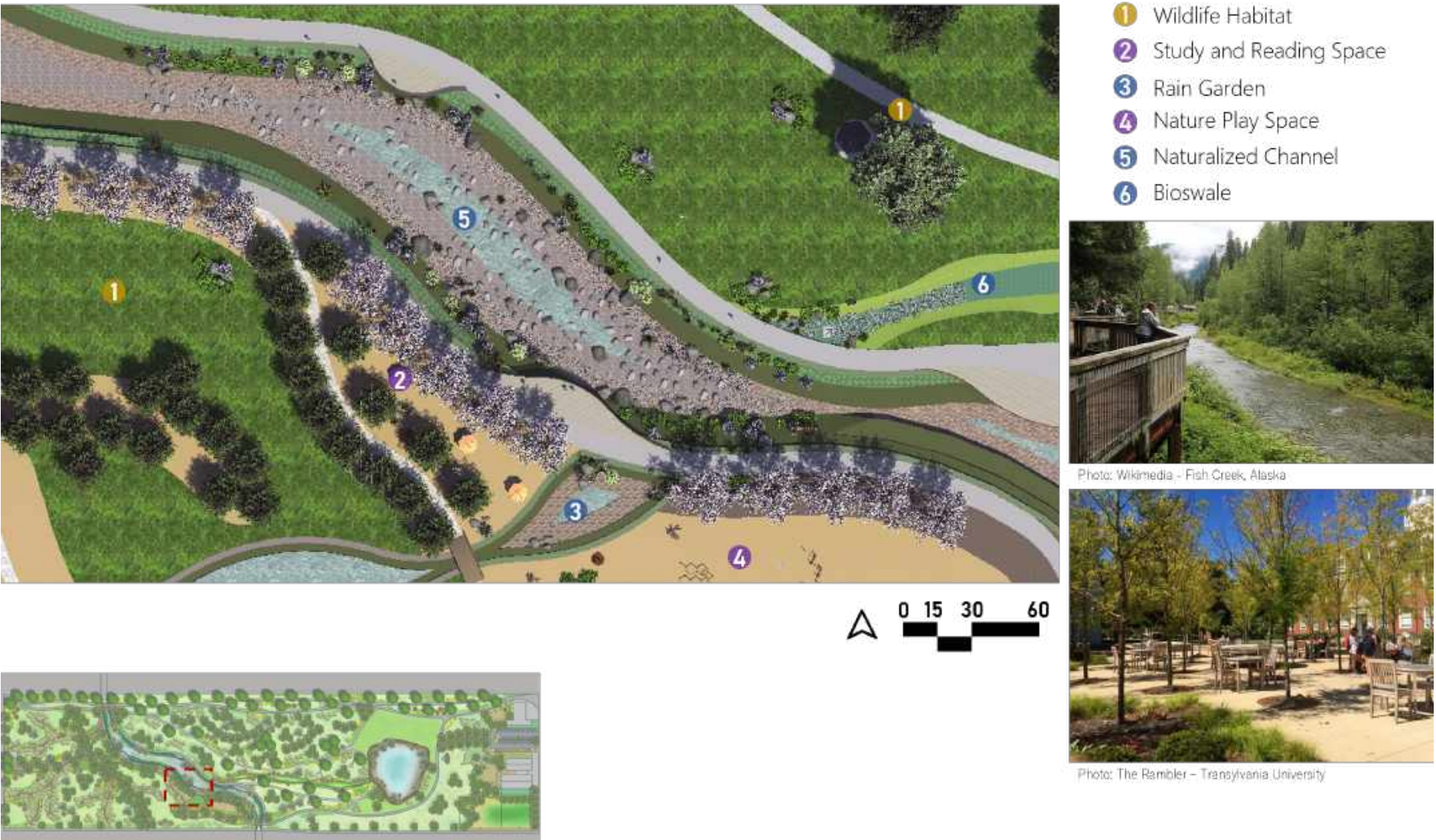
Photo: Playscapes – Westmoreland Nature Play Area, Portland, OR

NATURALIZED CHANNEL

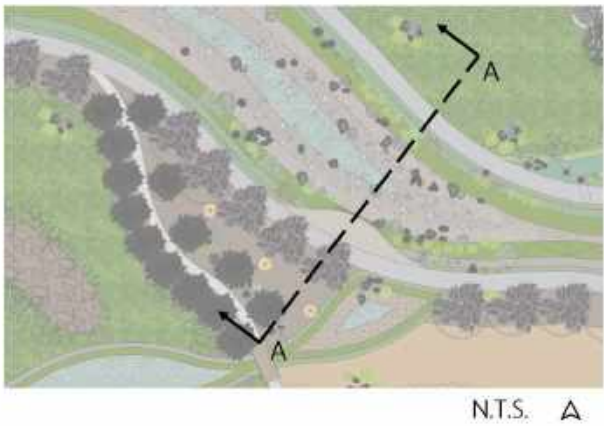
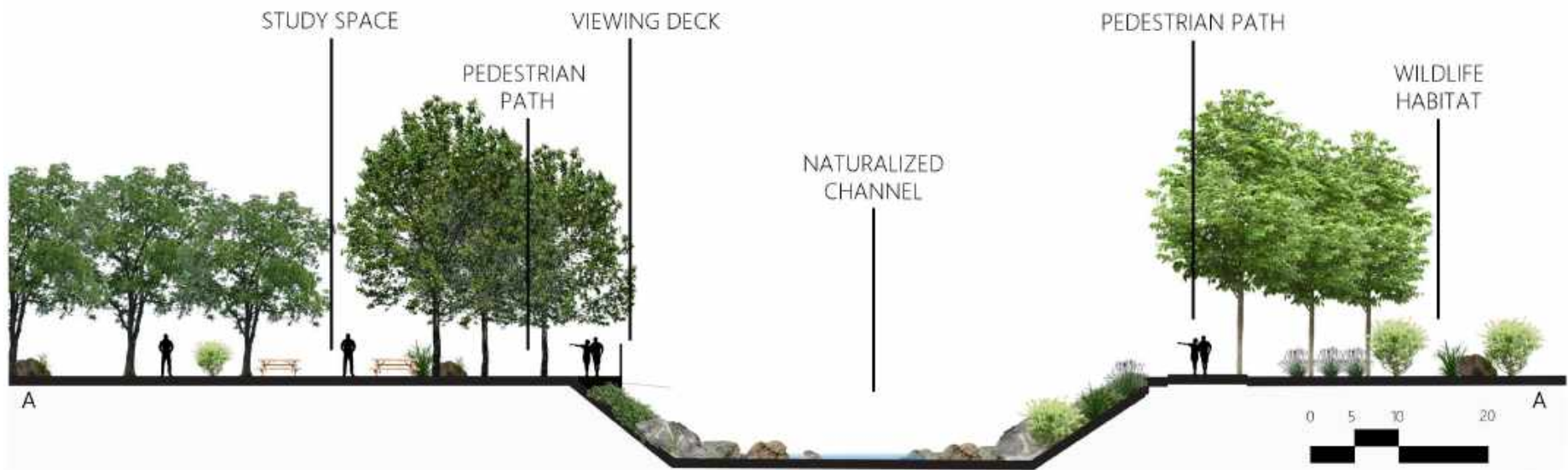


- OBJECTIVES:**
- Widen channel and create sloping sides for vegetation
 - Maintain flow capacity
 - Remove concrete bottom to allow water to permeate soil and recharge groundwater system

ENLARGEMENT



SECTION



PERSPECTIVES

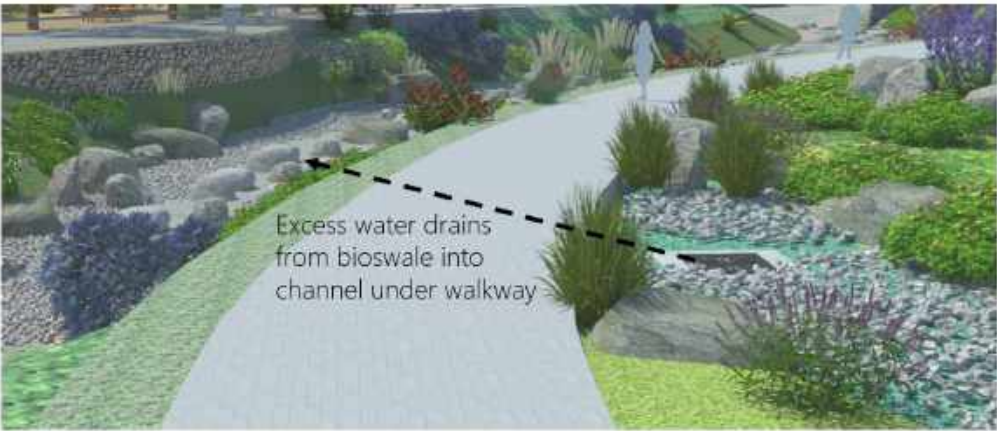


PERSPECTIVES

2



BIOSWALE-CHANNEL CONNECTION



ENLARGEMENT



- 1 Bioswale
- 2 Picnic Pods
- 3 Wildlife Habitat
- 4 Heartwell Lake
- 5 Active Recreation Turf



Photo: Landscape Architecture Foundation



Photo: Ladera Life Parks

SECTION



N.T.S. A

PERSPECTIVES



PERSPECTIVES



PLANT PALETTE - WILDLIFE AREAS

OBJECTIVE: Utilize native and California-friendly plant material with low water need to provide food, shelter, and nesting space for local wildlife and pollinators

TREES:

- Arbutus menziesii* - Madrone
- Cercis occidentalis* - Western Redbud
- Chilopsis linearis* - Desert Willow
- Platanus racemosa* - Western Sycamore
- Umbellularia californica* - California laurel

SHRUBS:

- Arctostaphylos edmundsii* - Manzanita
- Artemesia californica* - California Sagebrush
- Baccharis pilularis* - Dwarf Coyote Bush
- Ceanothus thyrsiflorus* - California Lilac
- Heteromeles arbutifolia* - Toyon
- Salvia spp.* - Assorted Sage

GROUNDCOVER:

- Myoporum parvifolium* - Pink Myoporum
- Lippia nodiflora* - Kurapia



PLANT PALETTE - BIOSWALE AND RAIN GARDEN

OBJECTIVE: Utilize native and California-friendly plant material with low water need to filter water captured within the bioswale and rain garden features, as well as throughout the flood channel

SHRUBS:

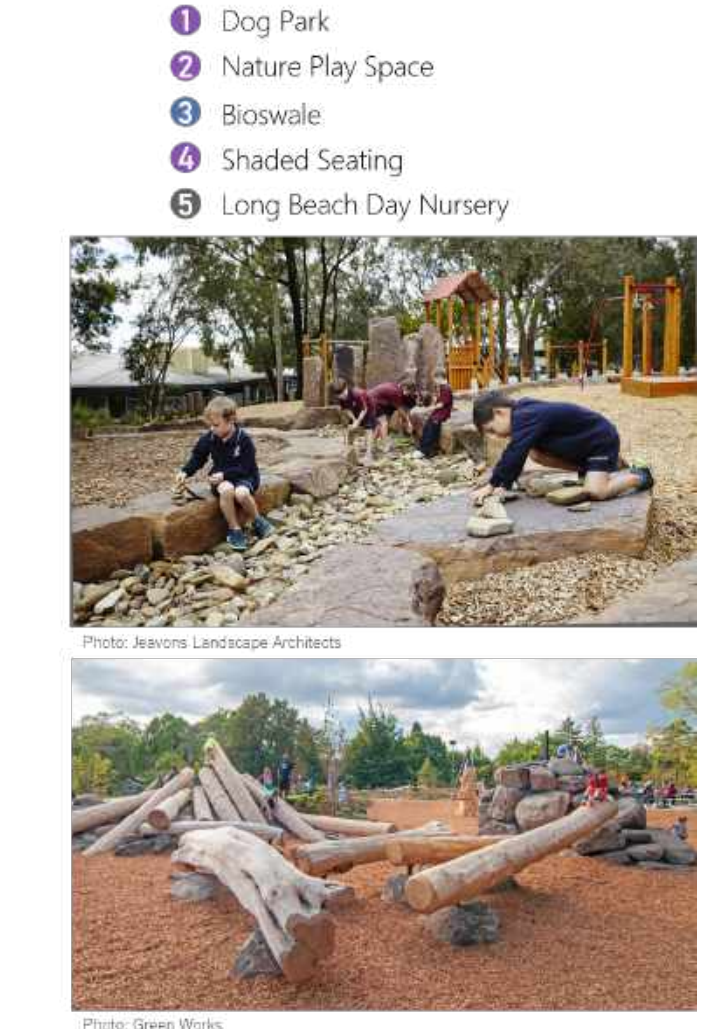
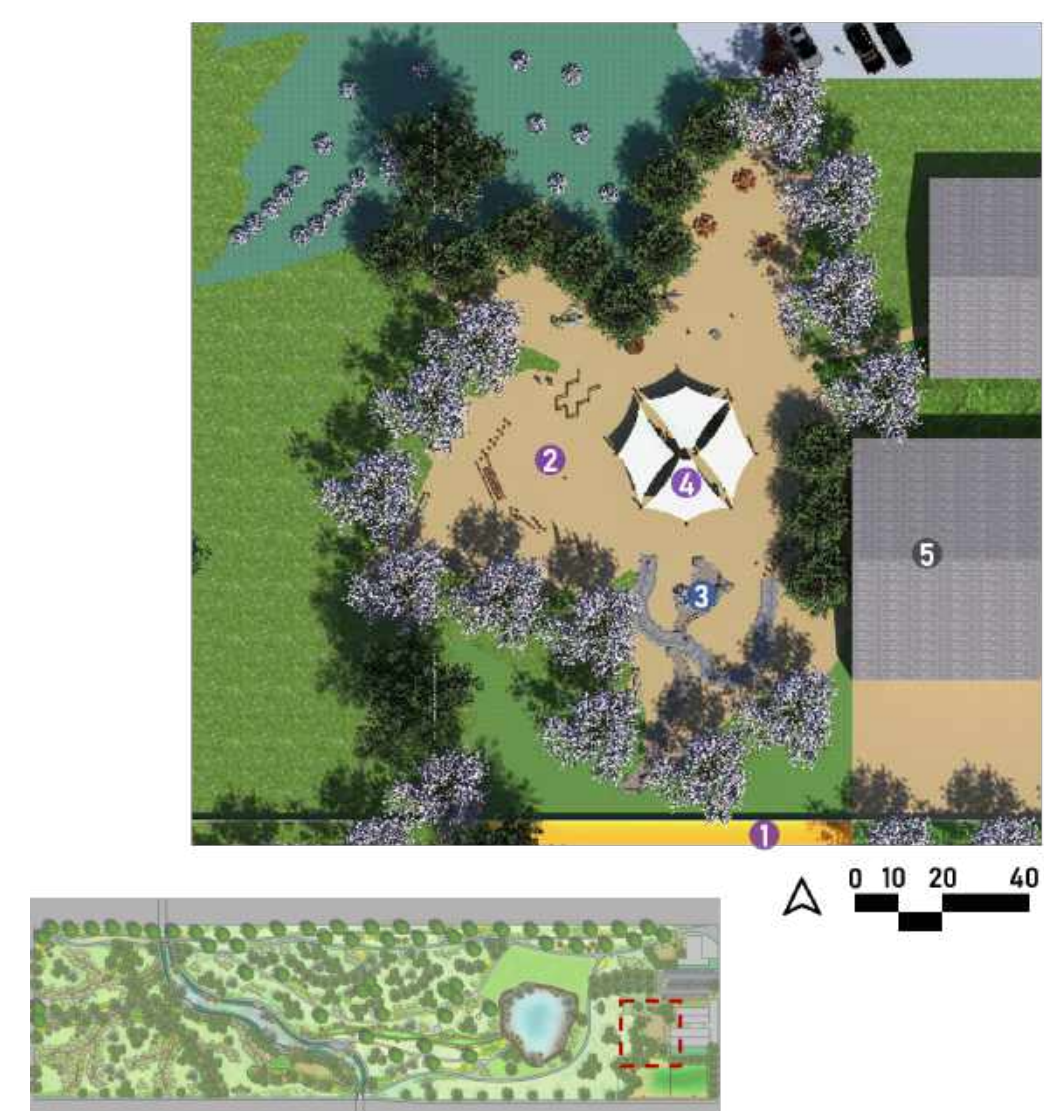
- Achillea millefolium* - Common Yarrow
- Polypodium californicum* - California Polypody Fern
- Salvia spathacea* - Hummingbird Sage
- Zauschneria californica* - California Fuschia

GRASSES/GRASS-LIKE:

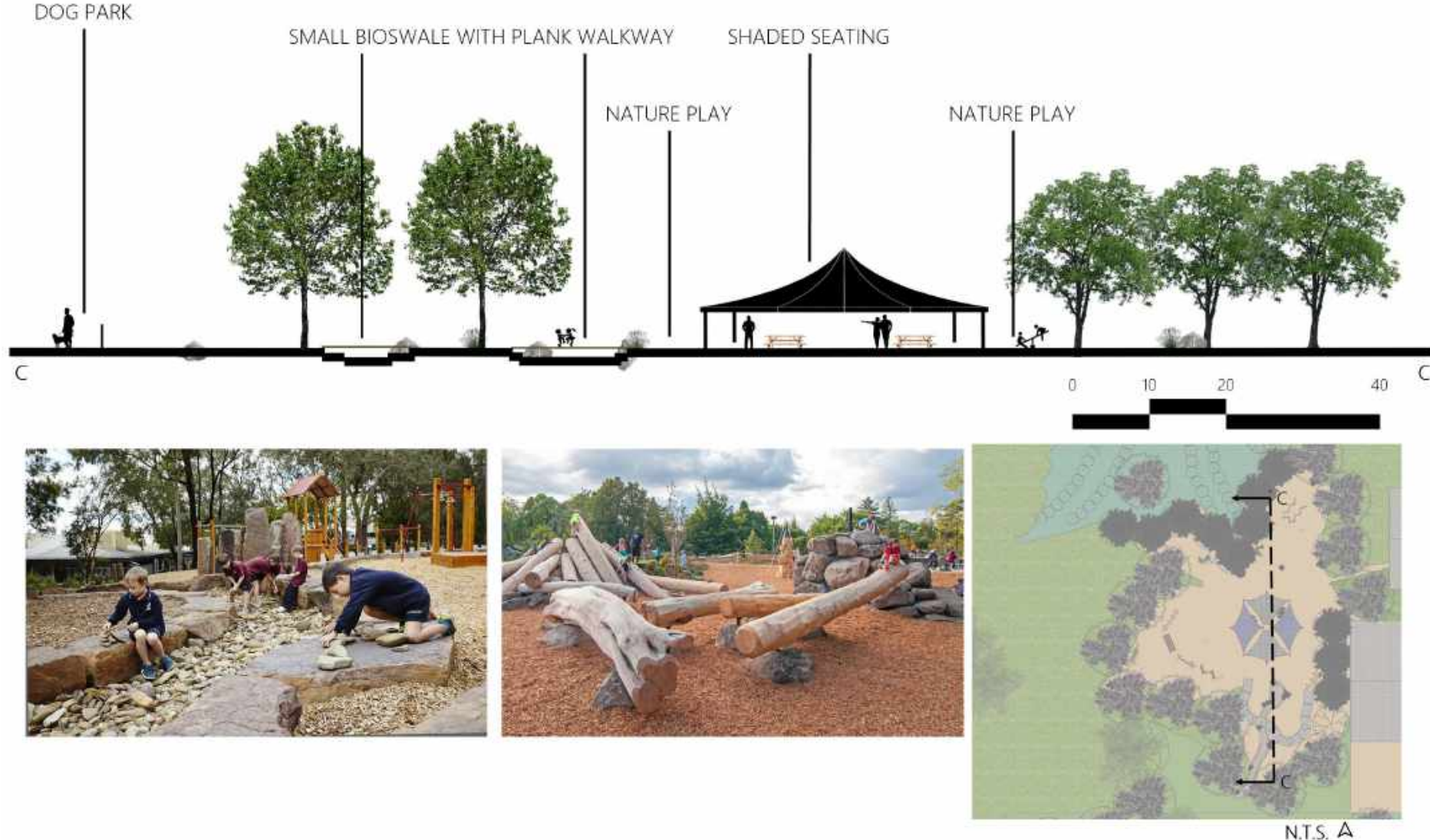
- Carex praegracilis* - Clustered Field Sedge
- Carex glauca* - Blue Sedge
- Juncus patens* - Common Rush



ENLARGEMENT



SECTION



PERSPECTIVES



PERSPECTIVES



CONCLUSION

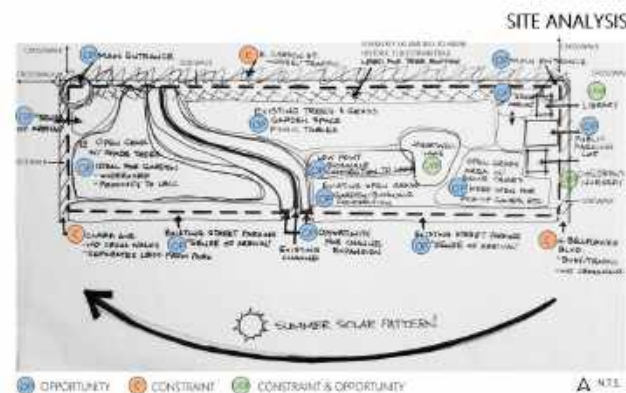


SUMMARY

STATEMENT:
The proposed project seeks to transform stormwater management and enhance community recreation opportunities within a neighborhood park in Long Beach, utilizing ecologically sensitive methods. By applying these methods and improving the park with an environmentally sensitive approach, the community is provided with a safer and more sustainable stormwater system and greater connection to their natural environment.

- GOALS AND OBJECTIVES:**
- **Improve Stormwater Management**
 - Naturalized Channel
 - Bioswale
 - Rain Garden
 - **Reintroduce Biodiversity**
 - Low water and California-friendly garden space
 - **Increase Community Engagement and Connection to Natural Environment**
 - Multi-modal Path System
 - Interpretive Signage
 - Event Space
 - Shaded Outdoor Reading/Study Space
 - Dog Park
 - Nature Play Space





STATEMENT: The proposed project seeks to transform stormwater management and enhance community recreation opportunities within a neighborhood park, utilizing ecologically sensitive methods. By applying these methods to a site in Long Beach and improving the park with an environmentally sensitive approach, the community is provided with a safer and more sustainable stormwater system and greater connection to their natural environment.

GOALS:

- IMPROVE STORMWATER MANAGEMENT
- REINTRODUCE BIODIVERSITY
- INCREASE COMMUNITY ENGAGEMENT AND CONNECTION TO NATURAL ENVIRONMENT

- OBJECTIVES:**
- Remove concrete channel and direct stormwater through naturalized waterway
 - Soil and plant material help to capture and remove pollutants from stormwater through absorption, filtration, plant uptake, and decomposition of organic matter
 - Capture stormwater on-site
 - Utilize low points on-site for bioswale and retention areas/rain gardens
 - Provide wildlife habitat throughout California garden, vegetation in naturalized waterway and dispersed throughout site
 - Create protected areas for wildlife
 - Create inviting entrances to draw in visitors
 - Provide engaging areas for visitors of all ages



ILLUSTRATIVE SITE PLAN



STORMWATER MANAGEMENT

- 1 Naturalized Channel
- 2 Bioswale
- 3 Rain Garden
- 4 Heartwell Lake

COMMUNITY CONNECTION

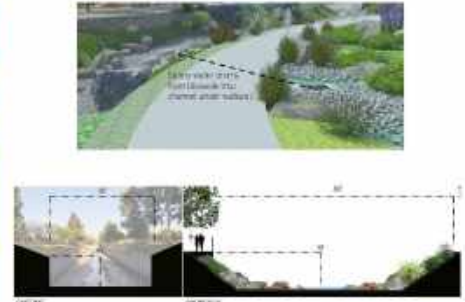
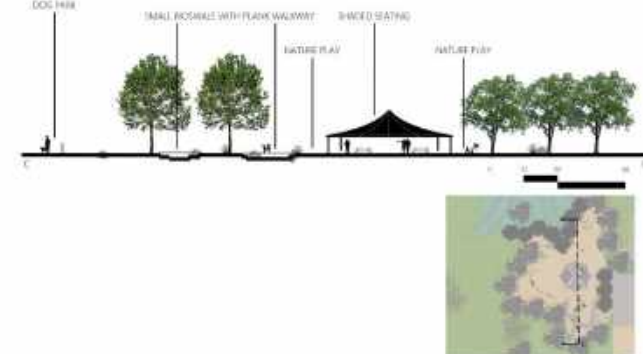
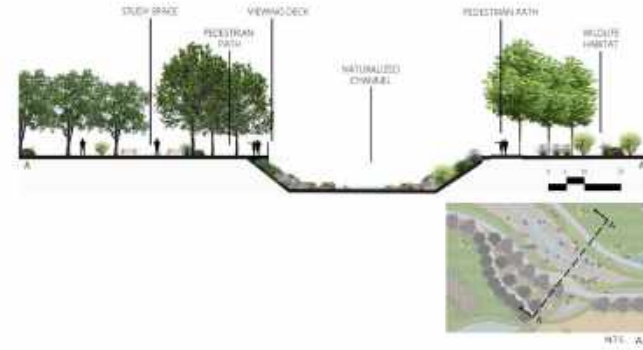
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- 7 Sycamore Row



ACKNOWLEDGEMENTS

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REFERENCES

ONLINE SOURCES:

1. City of Long Beach Development Services, Urban Design Plan, August 2016
<http://longbeach.gov/globalassets/lbds/media-library/documents/planning/environmental/environmental-reports/pending/2016-land-use-element-lueurban-design-element-ude/appendix-f-ude-part-2-reduced>
2. Dolesh, Richard J., Green Infrastructure Stormwater Management in Parks, National Recreation and Parks Association, updated April 3, 2017
<https://www.nrpa.org/parks-recreation-magazine/2017/april/green-infrastructure-stormwater-management-in-parks/>
3. Evans, Marni, What is Environmental Sustainability? The Balance - Small Business, August 11, 2019
<https://www.thebalancesmb.com/what-is-sustainability-3157876>
4. Green Infrastructure in Parks: A Guide to Collaboration, Funding, and Community Engagement, United States Environmental Protection Agency
https://www.epa.gov/sites/production/files/2017-05/documents/gi_parksplaybook_2017-05-01_508.pdf
5. Kinnickinnic River Rehabilitation, Short Elliot Hendrickson Inc.
<http://www.sehinc.com/news/kinnickinnic-river-rehabilitation>
6. Long Beach Fire Departement, Flood Control Channel Dangers
<http://www.longbeach.gov/globalassets/fire/media-library/documents/fire-prevention/code-enforcement/floodcontrol-lbusd>

REFERENCES

ONLINE SOURCES:

7. Los Angeles County Flood Control District, Alamos Bay/Los Cerritos Channel Watershed Management Program, revised May 28, 2015
https://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/watershed_management/los_cerritos_channel/alamitos_bay/AlamosBay-LosCerritosChannel_FinalWMP.pdf

8. Office of the Architect, University of Virginia, Landscape Typologies and Standards, 2011
<https://officearchitect.virginia.edu/pdfs/typologies.pdf>

9. So-Cal Wild, Center for Biological Diversity
https://www.biologicaldiversity.org/campaigns/so_cal_wild/index.html

10. Stormwater Management and Green Infrastructure Research. United States Environmental Protection Agency
<https://www.epa.gov/water-research/stormwater-management-and-green-infrastructure-research>

11. Walgrove Elementary, About the Wildlands
<https://www.wearewalgrove.com/wildlands-about/>

BOOKS:

1. Harris, Charles W. and Nicholas T. Dines - Time-Saver Standards for Landscape Architecture

