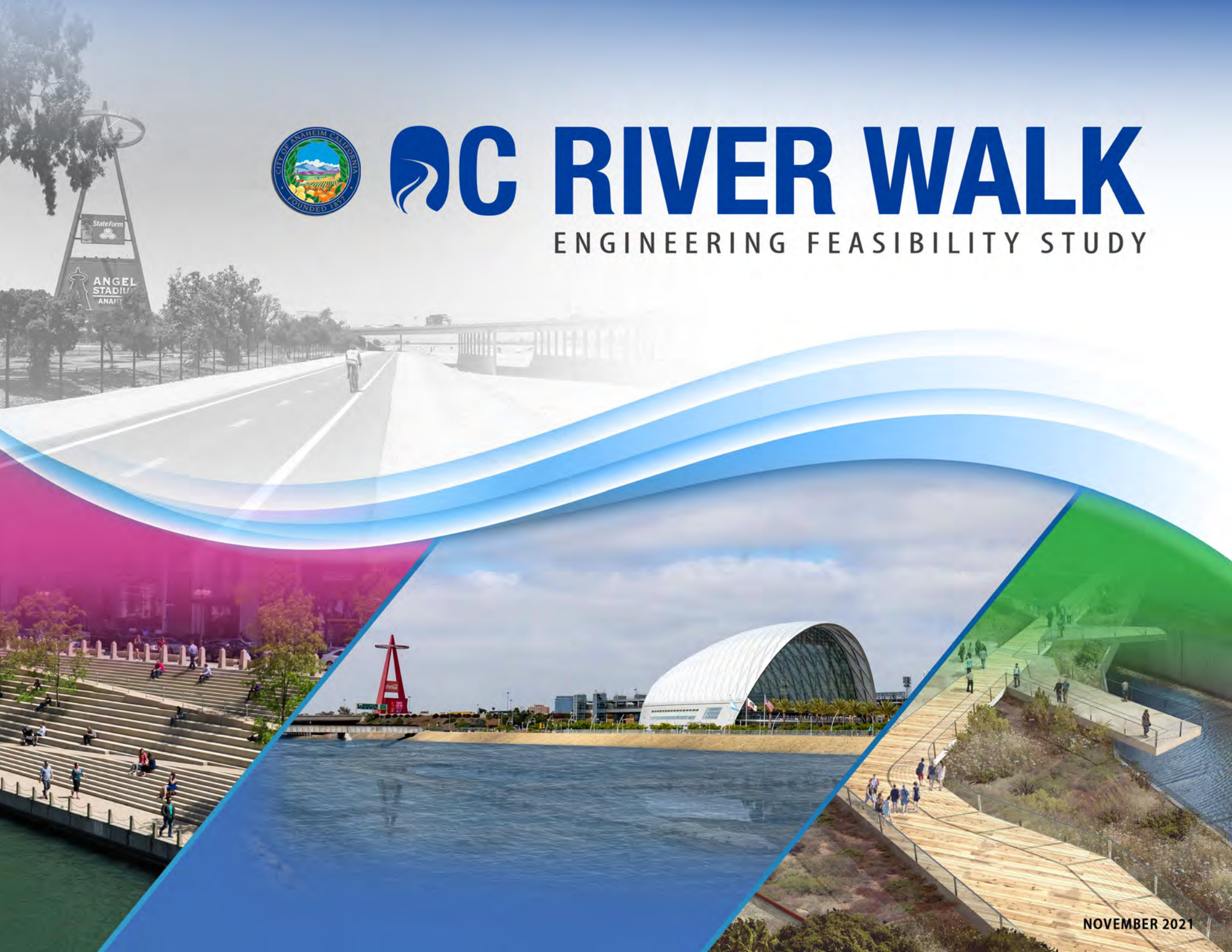
OC RIVER WALK

ENGINEERING FEASIBILITY STUDY



NOVEMBER 2021

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STUDIO-MLA PLACEWORKS

IN ASSOCIATION WITH:

Hunt ESI
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NOVEMBER 2021

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Full-scale appendix materials avaiable for download:
https://cutt.ly/OCRiverWalk-Appendix

Team Acknowledgements

Many individuals contributed to the successful completion of the OC River Walk Engineering Feasibility Report. The efforts and contributions of the individuals, organizations, and agencies listed below are especially appreciated and added immeasurably to the report.

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KEEP
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01

Introduction

Executive Summary

Introduction

Opportunity Fact Sheets

1. Bikeway / Pedestrian Trail Extension
2. Trail Culvert Undercrossing at Ball Rd.
3. SART East Bank Addition
4. Bike / Pedestrian Bridge
5. River Walk Width Expansion
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15. Integrated Public Education Art
16. Upland Habitat Restoration
17. Landscape Enhancement

Opportunity Summary Matrix

I. Opportunities Summary Matrix
II. Opportunities Permit Matrix

Executive Summary

The City of Anaheim aims to pay homage to its historical roots, putting the iconic Santa Ana River on display as an environmental, recreational, and economic benefit to the community to promote activity and engagement with the river once more. The portion of the Santa Ana River corridor running through Anaheim, as it exists today, is a rock-lined trapezoidal channel for stormwater conveyance, and water resource management. It protects the adjacent lands from flooding in large storm events, but it lacks engagement and integration with the community. There are tremendous multi-purpose opportunities to transform the river corridor into a world-renowned urban recreational destination.

Several visionary concepts have been developed to date, seeking to re-establish the river corridor as a place of interconnectivity between people, local businesses, and nearby Angel Stadium and the Honda Center within the Platinum Triangle while preserving the critical flood control functions of the Santa Ana River. The integration between private, public, and flood control facilities can be mutually beneficial and multi-purpose to maximize what the river corridor has to offer to the community. Through this Engineering Feasibility Study, a set of 17 unique opportunities have been identified to transform the Santa Ana River corridor into an iconic location and experience in of itself, to be known as ***OC River Walk***.

OC River Walk will create numerous mutual benefits with the adjacent property owners and proposed projects. The OC River Walk project site is located within the Santa Ana River corridor between the Ball Road and Orangewood Avenue bridge crossings, a 450-foot wide by 9,000-foot long area (approx. 90 acres and 2 miles) adjacent to Angel Stadium, ARTIC, and the Honda Center. The Honda Center has been selected as the 2028 Summer Olympics indoor volleyball venue, providing an incentive to improve infrastructure and accommodations for the surrounding area to facilitate tourist recreational activities. Additionally, the proposed development around the Honda Center (ocV!BE) and Angel Stadium (The Big A: 2050) will introduce additional residents and attract more local visitors and tourists. These ongoing development activities will further activate the existing recreational areas, pedestrian foot traffic, and bikeways in the vicinity.

COMMUNITY STAKEHOLDERS CONNECTIVITY COHESIVE STRATEGY

** All Green Map icons throughout report source: Green Map System Icons, CC BY-NC-SA*

COMMUNITY

Potential and sustainable projects will benefit and promote the community's health, recreation, economics, safety, entertainment, water supply, and natural resource needs.

STAKEHOLDERS

A collaborative partnership will be established with multiple stakeholders representing property owners, regulatory oversight, or community interest to achieve a successful project(s).

CONNECTIVITY

Future uses will be integrated to ensure that the project(s) connect and complement existing or planned recreational, entertainment and transportation facilities.

COHESIVE

Potential projects will be cohesive and complementary of existing and future amenities to create outdoor venues that benefit the local community while establishing a regional draw. The future project(s) will be a catalyst to encourage additional development, connectivity, and revitalization of the adjacent and future commercial, residential, and entertainment projects.

STRATEGY

A strategy will be established to transform the river to create a visually appealing asset and provides outdoor venues for recreation and entertainment while improving the ecology of the river corridor.

The previous planning effort reached a stage where it became critical to determine the feasibility of the identified opportunities from a technical, engineering, and economic perspective. While this study does not include detailed design, it does include a detailed investigation and engineering feasibility analysis, cost estimates, and schedule estimates of the 17 opportunities. The study also includes detailed investigation of available records, including wet and dry utilities, land ownership, right of way, easements, adjacent developments, infrastructure improvement plans, and pedestrian/bike/transit plans and programs. CEQA, NEPA, and other regulatory constraints and permits are also identified in this study.

17 distinct opportunities were identified and analyzed as part of this study effort. The 17 opportunities are organized into three distinct categories representative of the main goals of the OC River Walk experience:

Active Transportation
Connectivity

River Activation
Interaction

Community Amenities
Engagement

Each OC River Walk opportunity has its own design requirements, physical constraints, and overall impact on satisfying the project goals as a standalone individual concept. However, this feasibility study also aims to understand how the 17 opportunities synergize with each other and their combined collective impact on the overall surrounding space given the various alternatives and feasibility combinations.

The study includes the following elements:

01 **Introduction** (background and previous studies review)

02 **Baseline Conditions & Constraints** (identification and analysis)

03 **Corridor-Wide Analysis** (SWOT analysis, urban framework, and environmental review strategy)

04 **Opportunities Refinement & Analysis** (defining design and permitting requirements and estimates of costs)

05 **Conclusion and Next Steps** (identifying project implementation steps and potential funding sources)

The final product is a detailed guidance document that will serve as a roadmap of the vision and implementation steps to realize this iconic vision for the City of Anaheim.

Next Steps

- **Apply for grant funding.**
- **Enter into an Agreement with the landowning and operational partners, establishing support for the OC River Walk project.**
- **Environmental clearance (CEQA/NEPA) of the 2 mile corridor and all 17 opportunities.**
- **Engineering design of the top priority elements including:**
  - Two water impoundment structures
  - Riverbank modifications
  - Trail extension/connections to the existing Anaheim Coves Trail
  - Pedestrian/bike bridge located north of Katella Avenue
- **Regulatory permit applications for the top priority elements.**

> *"The Santa Ana River is one of Anaheim's great untapped opportunities. We have the chance to create a visionary concept that will benefit our community and the environment with parks, bike paths and public plazas while capturing and preserving our most precious resource, water. With big changes coming to Angel Stadium of Anaheim and Honda Center, we need an inviting and reimagined waterfront for the Platinum Triangle. The time for us to start planning and creating is now.*
>
> *– Mayor Harry Sidhu*

Introduction

HOME BY THE SANTA ANA RIVER

Founded in 1857, the City of Anaheim is the oldest city in Orange County, California – nowadays best known for its major attractions such as the Disneyland Resorts, Angel Stadium, the Honda Center, and ARTIC Station to name a few. These highly urbanized areas were built along the iconic Santa Ana River, which runs North to South through the center of the City.

It was this water source that initially attracted the City's founders, who at the time were searching for suitable land to grow grapes and produce wine. The Santa Ana River itself was the original major attraction bringing people to the area. Thus, the settlement was appropriately named after the river "Ana" combined with the Germanic residence-marker "-heim." In other words, the name "Anaheim" means home by the Santa Ana River.

Project Description

OC RIVER WALK

The City of Anaheim aims to pay homage to its historical roots, putting the iconic Santa Ana River on display as an environmental, recreational, and economic benefit to the community to promote activity and engagement with the river once more. The portion of the Santa Ana River corridor running through Anaheim, as it exists today, is a rock-lined trapezoidal channel for stormwater conveyance, water resource management, protecting the adjacent lands from flooding in large storm events. OC River Walk will complement the river's flood control functions while bringing focus and attention on historical and ongoing critical role of the river with the local community.

In the heart of Anaheim, known as the Platinum Triangle, the adjacent lands along the river from Ball Road to Orangewood Avenue have urbanized and developed right up along the embankments. Usage of the space and amenities strictly respects the boundaries of rock-lined embankments and the flood control protection they provide. Over time this has inadvertently turned the Santa Ana River into a barrier in the middle of a highly dense mixed-use area, an obstacle between cities, development, and commuters.

Several visionary concepts have been developed to date, seeking to re-establish the river corridor as a place of interconnectivity within the community for people, local businesses, Angel Stadium, and the Honda Center. The integration between private, public, and flood control facilities can be mutually beneficial and multi-purpose, maximizing what the river corridor has to offer to the community. Through this project study, a set of 17 unique opportunities have been identified to transform the Santa Ana River corridor into an iconic location and experience in of itself, to be known as OC River Walk.

OBJECTIVES

Specific objectives identified for OC River Walk include the following:

- **Community** – potential sustainable projects will benefit and promote the community's health, recreation, economic, safety, entertainment, water supply, and natural resource needs.
- **Stakeholders** – a collaborative partnership will be established with multiple stakeholders representing property owners, regulatory oversight, or community interest to achieve a successful project(s).
- **Connectivity** – future uses will be integrated to ensure that the project(s) connect and complement existing or planned recreational, entertainment and transportation facilities.
- **Cohesion** – potential projects will be cohesive and complementary of existing and future amenities to create outdoor venues that benefit the local community while establishing a regional draw. The future project(s) will be a catalyst to encourage additional development, connectivity, and revitalization of the adjacent and future commercial, residential, and entertainment projects.
- **Strategy** – a strategy will be established to transform the river to create a visually appealing asset and provides outdoor venues for recreation and entertainment while improving the ecology of the river corridor.

MUTUAL BENEFICIAL OPPORTUNITIES

OC River Walk will create numerous mutual benefits with the adjacent property owners and future proposed projects. The OC River Walk project site is located within the Santa Ana River corridor between the Ball Road and Orangewood Avenue bridge crossings, a 450-foot wide by 9,000-foot long area (approx. 90 acres and 1.2 miles) adjacent to Angel Stadium, ARTIC, and the Honda Center. The Honda Center has been selected as the 2028 Summer Olympics indoor volleyball venue, providing an incentive to improve infrastructure and accommodations and for the surrounding area to facilitate tourist recreational activities. Additionally, the proposed development around the Honda Center (ocV!BE) and Angel Stadium (The Big A: 2050) will introduce additional residents and attract more local visitors and tourists. These ongoing development activities will further activate the existing recreational areas, pedestrian foot traffic, and bikeways in the vicinity.

COMMUNITY CONNECTIVITY STRATEGY STAKEHOLDERS COHESION

Project Goals – Mutually Beneficial Projects that:

- Increase public recreation and connectivity
- Catalyzes economic growth and development
- Enhance aesthetic and ecology of the river and surrounding region
- Improve visual and physical access to the river

OC RIVER WALK

With the high-profile facilities and developments centrally located along and nearby the corridor of OC River Walk, the City has an opportunity to establish iconic placemaking that will become world-renowned. OC River Walk will become a destination for travelers and residents alike, similar to well-known river/waterfront areas such as the Chicago River Front Park, Tempe Town Lake, and San Antonio River Walk. Appendix I - Exhibit 02 demonstrates the comparable scale of OC River Walk to the aforementioned river/waterfront areas. OC River Walk will arguably have a greater diversity of recreation, open space, and economic opportunity, given the major adjacent destinations, existing trails and pathways, and open space that will be enhanced as part of this landmark project development.

Study Purpose

OPPORTUNITY FEASIBILITY

The previous planning effort reached a stage where it became critical to determine the feasibility of the identified opportunities from a technical, engineering, and economic perspective. The project study stretches approximately two miles from Ball Road to Orangewood Avenue. Both physical and regulatory constraints are present, so this feasibility analysis identifies all critical elements that will either hinder or promote the success of the various City-directed OC River Walk Opportunities. This effort will also lead to the placement of key project elements at the most beneficial and feasible locations.

While this study does not include detailed design, it does include a detailed investigation and engineering feasibility analysis, cost estimates, and schedule estimates of the 17 opportunities. The study also includes detailed investigation of available records, including wet and dry utilities, land ownership, right of way, easements, adjacent developments, infrastructure improvement plans, and pedestrian/bike/transit plans programs. CEQA, NEPA, and other regulatory constraints and permits are also identified in this study. A key element of the study was to ensure that all proposed opportunities can function in concert with the flood control role of Santa Ana River without impeding or impairing any of the critical flood protection activities.

The 17 opportunities are organized into three distinct categories representative of the main goals of the OC River Walk experience:

ACTIVE TRANSPORTATION

1. Bikeway / Pedestrian Trail Extension
2. Trail Culvert Undercrossing at Ball Road
3. SART East Bank Addition
4. Bikeway / Pedestrian Bridge
5. River Walk Width Expansion
6. Widen Existing Bridges for Bikeway/Pedestrians
7. SART Pinch Point Relief

RIVER ACTIVATION

8. River Impoundments
9. Riverbank Modifications
10. Urban Stormwater Treatment
11. River Recreation / Programming

Photo provided by City of Anaheim

COMMUNITY AMENITIES

12. Cantilever Decks
13. Engagement with Adjacent Spaces
14. Stepped River Embankment
15. Integrated Public Education / Art
16. Upland Habitat Restoration
17. Landscape Enhancement

Each OC River Walk opportunity has its own design requirements, physical constraints, and overall impact on satisfying the project goals as a standalone individual concept. However, this feasibility study also aims to understand the 17 opportunities synergize with each other and their combined collective impact on the overall surrounding space given the various alternatives and feasibility combinations.

Planning Process

OPPORTUNITY FEASIBILITY

The feasibility analysis is a planning foundation for which the City of Anaheim can determine which opportunities to pursue within a given schedule, budget, and timing to maximize mutual benefit and integration with neighboring development or other nearby projects being planned and/or constructed in tandem. Reviewing agencies and stakeholders will determine the selection, prioritization, and phasing of any or all of the 17 opportunities using the information and recommendations provided in the engineering feasibility analysis.

Angels	US Army Corps of Engineers	ARTIC Partners	Caltrans	City of Anaheim	City of Orange
City of Santa Ana	CoastKeeper	Fish and Wildlife Service	Friends of Harbors Beaches and Parks	Native Tribes	ocV!BE - Honda Center – Samueli
Orange County Flood Control District	Orange County Parks	Orange County Sanitation District	Orange County Transportation Authority	Orange County Mosquito and Vector Control District	Orange County Water District
Regional Water Quality Control Board	Santa Ana River Conservancy	Santa Ana River Flood Protection Agency	Southern California Association of Governments	Trust for Public Lands	Wildlands Conservancy

Previous Studies and Accomplishments

OPPORTUNITY FEASIBILITY

The City of Anaheim derived the OC River Walk opportunities from the aspirations and objectives of previous planning and projects aiming to achieve community connectivity, economic growth, engagement, and the overall ecology benefit of the Santa Ana River. The illustrated timeline features the major efforts previously completed.

1966

Anaheim Stadium Opened

Anaheim Stadium has served as the home of the Los Angeles Angels and Los Angeles Rams. The stadium is also known as The Big A.

1993

Honda Center Opened

Anaheim Arena construction completed (formerly known as the Arrowhead Pond of Anaheim). In 2006, Honda paid $60 million for the naming rights of Anaheim Arena.

2006

"A Vision Statement for the River" Completed

The planning and vision of the Santa Ana River in Anaheim dates back to 2006 when the UCLA Extension Landscape Architecture program completed "A Vision Statement for the River".

Photo provided by City of Anaheim.

2011


Photo provided by City of Anaheim.

Anaheim Coves Phase I Opened

Phase I of Anaheim Coves is open to the public.

2013

AnaheimOUTDOORS
"IT'S YOUR BACKYARD"

"Anaheim Outdoors Connectivity Plan - It's Your Backyard" Adopted

On April 30, 2013 the Anaheim City Council adopted the "Anaheim Outdoors Connectivity Plan - It's Your Backyard" along with ten policies that encourage connectivity citywide.

2014

Anaheim Regional Transportation Intermodal Center (ARTIC) Opened

A collaborative effort, known as the Santa Ana River Conservancy Program, was created by California State Legislature to address resource and recreation goals in the watershed. Under the advisory of a technical panel made up of 30 stakeholders, "The Santa Ana River Parkway & Open Space Plan" was developed to guide future development and management of the river and surrounding lands.

2018

ULI Technical Advisory Panel Convened on Santa Ana River Walk

Urban Land Institute (ULI), Orange County Inland Empire's Public Realm Initiative Council (ULI Council) began to examine what can be done with the River Corridor to improve recreation opportunities and enhance the aesthetics and ecology of the river.

2019

Anaheim Coves Phase II Opened

In June 2019, the city opened Phase II of the Anaheim Coves Project, which serves the recreational needs of the area, while enhancing the aesthetics and habitat of the river. Anaheim Coves is the first phase of the River Walk and extends for 2 ½ miles from Ball Road to Frontera Street. This project has received an Award of Excellence from the California Parks and Recreation Society.

ULI Technical Advisory Panel Santa Ana River Walk Study Published

In October 2019, a ULI Technical Advisory Panel (TAP) met to define a process required to address stakeholder engagement, along with opportunities and constraints of a river walk project. The TAP convened for a two-day workshop to look closer at the opportunities and constraints along the River, to examine the process, and engaged key stakeholders.

2021

OC River Walk Engineering Feasibility Study Published

The OC River Walk Engineering Feasibility Study (City of Anaheim along with PACE, Placeworks, Studio MLA, MK Enigneering, Inc.)

Opportunity Fact Sheets

A total of 17 opportunities were developed and analyzed within the Engineering Feasibility Study. Opportunities are defined as individual projects with specific locations determined or, in some cases, concepts that can be applied to multiple locations. These 17 opportunities were developed in response to the key objectives of OC River Walk and grouped into three categories:

ACTIVE TRANSPORTATION

RIVER ACTIVATION

COMMUNITY AMENITIES

2-page Opportunity Fact Sheets were developed for each opportunity to summarize the feasibility elements. Additionally, each of these opportunities are refined and analyzed in detail in Section 04 – Opportunities Refinement and Analysis.

- Overview
- Conceptual Layout
- Design Considerations
- Regulatory / Permitting
- Design & Construction Constraints
- Achievement of Mutual Community Benefit Objectives
- Synergy with other River Walk Opportunities
- Implementation Schedule
- Project Cost

These Opportunity Fact Sheets can be found in the following pages of this section.

OC RIVER WALK

1-7

ACTIVE TRANSPORTATION

1. Bikeway / Pedestrian Trail Extension: Katella to Anaheim Coves (Including RR Undercrossing)
2. Trail Culvert Undercrossing at Ball Road (Repurpose Existing OCWD RCB)
3. SART East Bank Addition of River from Katella to Orangewood
4. Bike / Pedestrian Bridge across the Santa Ana River
5. River Walk Width Expansion and Connectivity (Assume 2,000 LF at River & 2,000 LF offsite)
6. Widen Existing Bridges for Bikes / Pedestrian Lanes
7. SART Pinch Point Relief (2 Locations)

8-11

RIVER ACTIVATION

8. River Impoundment (Assume Inflatable Rubber Type Dam)
9. Riverbank Modifications (Assume Full Extent of Impoundments)
10. Urban Stormwater Treatment (Multi-Benefit OCPW, Cities, & OCWD / Recharge Enhancement)
11. River Recreation (Kayak, Electric Boats, Tube Ride, Water Jets / Fountain, Fire Water)

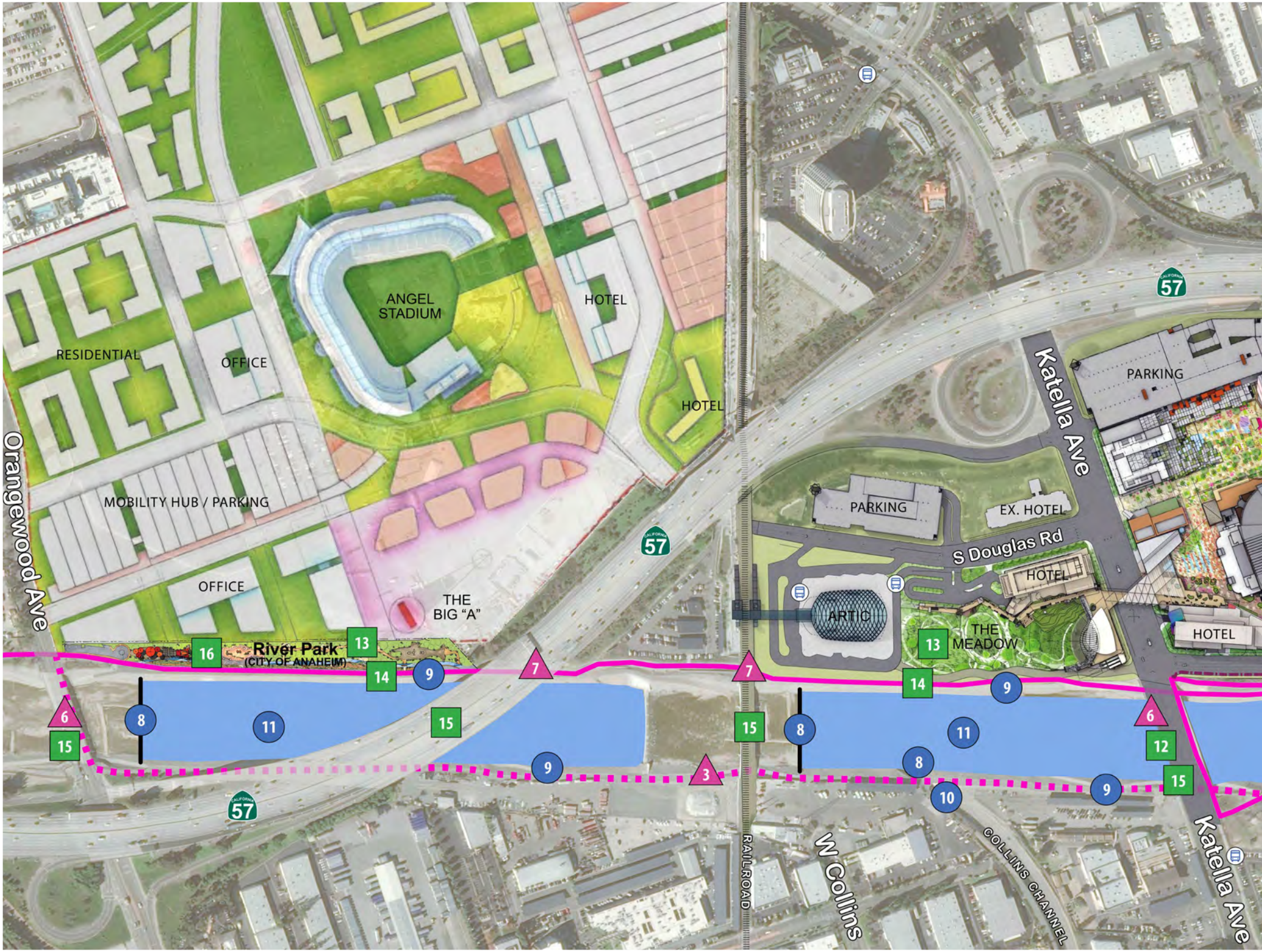
12-17

COMMUNITY AMENITIES

12. Cantilever Decks (2 Locations)
13. Engagement with Adjacent Spaces (5 Locations)
14. Stepped River Embankment (5 Locations)
15. Integrated Public Education / Art (Environmental/Cultural – Multiple Locations)
16. Upland Habitat Restoration (2 Locations)
17. Landscape Enhancement (Throughout OC River Walk)

SANTA ANA RIVER

PACE STUDIO-MLA


ANGEL STADIUM
HOTEL
RESIDENTIAL
OFFICE
HOTEL
MOBILITY HUB / PARKING
OFFICE
THE BIG "A"
Orangewood Ave
River Park
(CITY OF ANAHEIM)
57
Katella Ave
PARKING
PARKING
EX. HOTEL
S Douglas Rd
HOTEL
ARTIC
THE MEADOW
HOTEL
RAILROAD
W Collins
COLLINS CHANNEL
Katella Ave

OPPORTUNITIES

LEGEND

- Exist. Santa Ana River Trail (SART)
- Exist. OCTA Bus Stops
- OC River Walk Pedestrian / Bike Opportunities
- Proposed Class IV Bikeway (ocV!BE)

* *Opportunity located throughout the OC River Walk reach.*

ACTIVE TRANSPORTATION

1. Bikeway/Pedestrian Trail Extension
2. Trail Culvert Undercrossing at Ball Rd.
3. SART East Bank Addition
4. Bike/Pedestrian Bridge
5. River Walk Width Expansion*
6. Widen Existing Bridges for Bike/Ped.
7. SART Pinch Point Relief

RIVER ACTIVATION

8. River Impoundments
9. Riverbank Modifications*
10. Urban Stormwater Treatment
11. River Recreation/Programming

COMMUNITY AMENITIES

12. Cantilever Decks
13. Engagement with Adjacent Spaces
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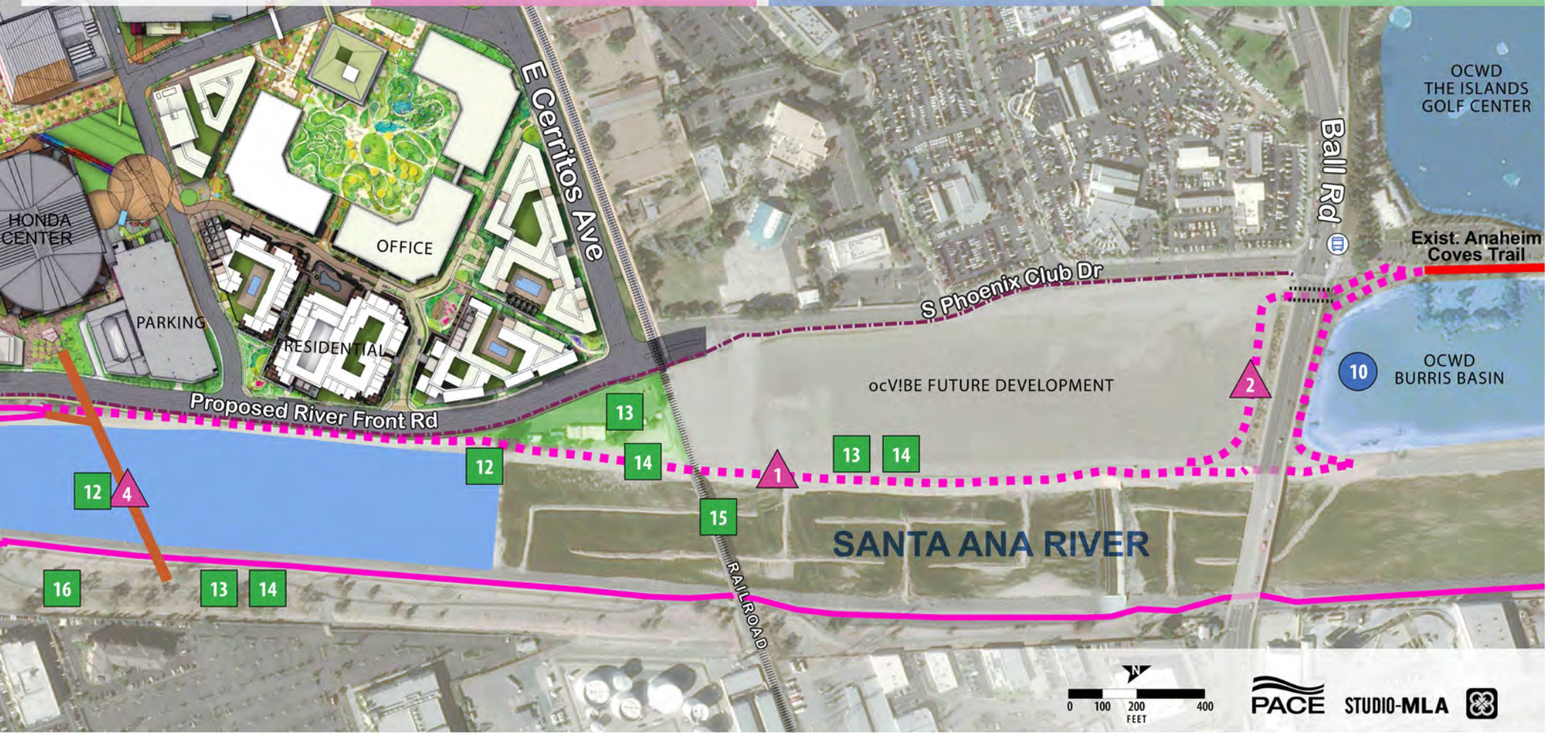
15. Integrated Public Education/Art
16. Upland Habitat Restoration
17. Landscape Enhancement*



ACTIVE TRANSPORTATION – OPPORTUNITY #1

Bikeway / Pedestrian Trail Extension

1

LEGEND

Opportunity #1

- OC River Walk Pedestrian / Bike Opportunities
- RR Crossing Option A
- RR Crossing Option B

Existing

- Exist. Santa Ana River Trail (SART)
- Exist. Anaheim Coves Trail
- Exist. Class III Bikeway
- Exist. Bridge Undercrossing

Overview

Opportunity #1 – Bikeway / Pedestrian Trail Extension: Katella to Anaheim Coves The Santa Ana River Trail (SART) currently exists on the west bank of the river north of Katella Avenue, crossing over to the west bank at the Katella Avenue bridge. An existing maintenance road on the east bank provides an opportunity to create a ¾ mile long multi-use trail that connects the popular Anaheim Coves trail to the SART, as well as to ARTIC, the proposed ocV!BE development and Angel Stadium.

The ROW along the existing maintenance road on the west bank varies between 12' and 32' and is interrupted by railroad tracks approximately 0.45 miles north of Katella Avenue. Developing a trail on the west bank will require crossing these tracks. The trail will connect to Anaheim Coves at the existing Ball Road bridge undercrossing.

Conceptual Layout

The location of the proposed trail along the west bank will be coincident with the existing maintenance road. There are two potential options for crossing the railroad tracks: (1) develop an undercrossing similar to the existing undercrossing on the east bank; (2) route the trail to the existing at-grade crossing at River Road/ Phoenix Club Drive. Both options can satisfy the design requirements and provide a multi-use connection between the SART, Anaheim Coves, ocV!BE, ARTIC, and Angel Stadium. The Ball Road bridge undercrossing may need to be widened to accommodate both bike and pedestrian traffic.

Design Considerations

- Provide multi-modal connection between Anaheim Coves, SART, ocV!BE, ARTIC, and Angel Stadium.
- Allow for continued use of maintenance road by OCWD and OCFCD per O&M requirements.
- Avoid impacts to hydrologic regime, especially during flood events.
- Meet all safety requirements and recommendations related to railroad crossings and trail widths.
- Long-term real eastate instrument and O&M plan.

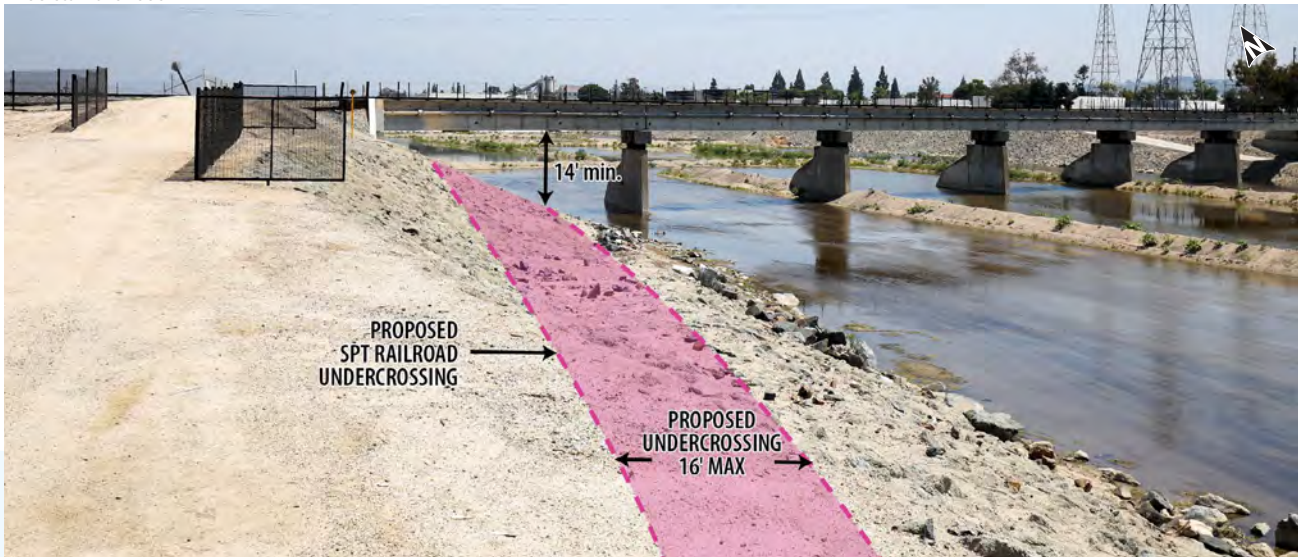
Regulatory / Permitting

- ACOE 404 & 408
- OCFCD/OCPW
- OCWD
- Formal application to CPUC: New and/or modified RR crossing and also requires OCTA approval
- CEQA/NEPA
- OC Parks construction/encroachment permit

Design & Construction Constraints

- Narrow width at points.
- Requirements for continued access for maintenance activities.
- Flood control embankment freeboard and erosion protection.
- Property ownership for re-routing of trail (easement/agreement).
- OC Parks approval – trail nexus, continuity of design and signage.
- Detailed detour plans.

▼ Existing Condition SPT Railroad - looking Northeast from westerly bank. The western bank does not have an undercrossing and a black gate/fence prohibits access across the railroad.



Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★★★★
Improves Visual and Physical Access to the River	★★★★★

Synergy with Other River Walk Opportunities

Active Transportation
2. Trail Culvert Undercrossing at Ball Road
5. River Walk Width Expansion

River Activation
9. Riverbank Modifications

Community Amenities
12. Cantilever Decks
13. Engagement with Adjacent Spaces
17. Landscape Enhancement

Implementation Schedule

Design	6-9 mo
Approval/ Permitting	9-15 mo
Construction	4-6 mo

Project Cost ($K)

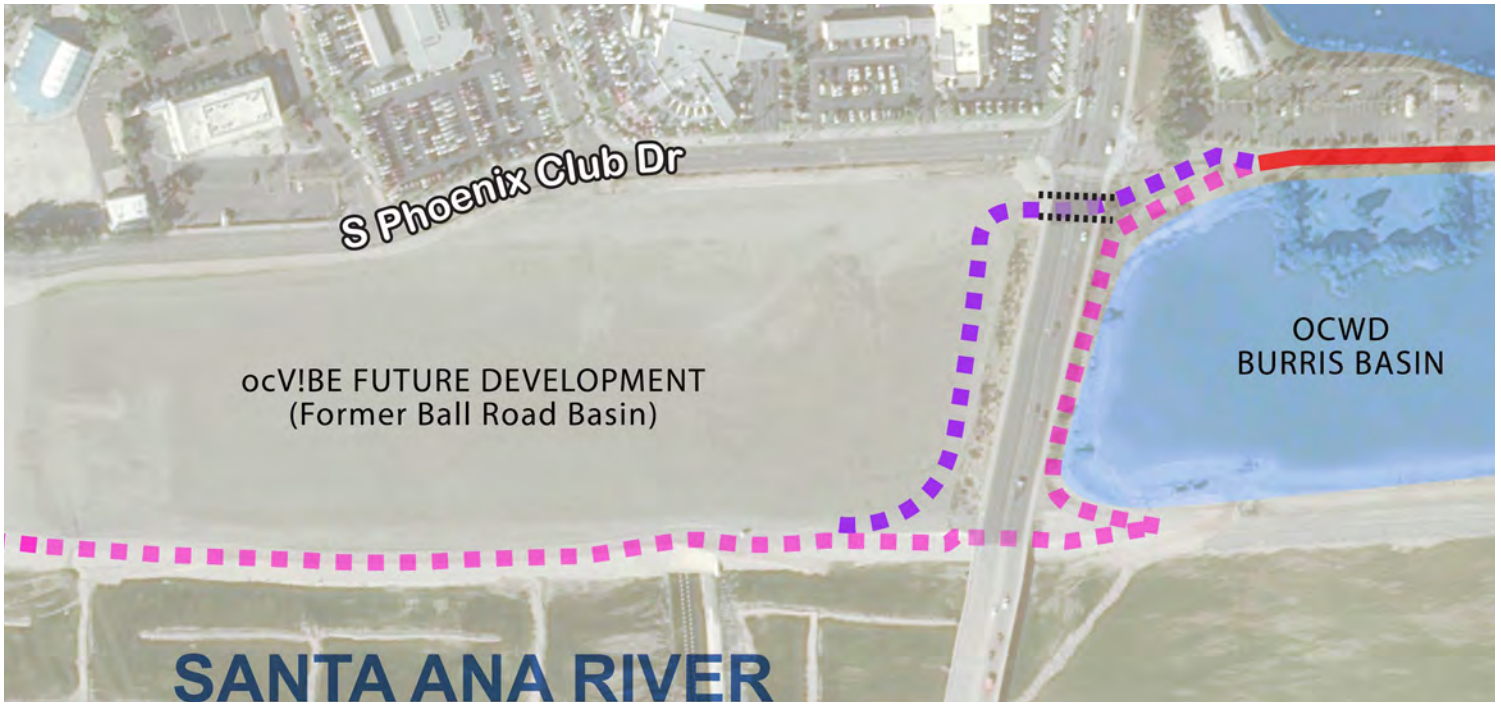
Design	$500
Construction	$4,000
O&M (annual)	$150

PACE STUDIO-MLA

ACTIVE TRANSPORTATION – OPPORTUNITY #2

Trail Culvert Undercrossing at Ball Road

2



LEGEND

Opportunity #2

- Ball Road Undercrossing via Existing Culvert
- AT #1

Existing

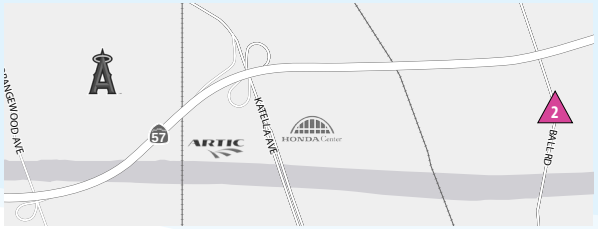
- Exist. Anaheim Coves Trail
- Exist. 14' x 14' RCB Culvert

Overview

Opportunity #2 – Trail Culvert Undercrossing at Ball Road The River Walk trail extension (AT #1) along the west bank of the river between Katella Avenue and Ball Road will need to cross Ball Road to connect with the existing Anaheim Coves trailhead. AT #1 includes a connection through an existing paved undercrossing at Ball Road bridge, but connection at a second point using the existing box culvert under Ball Road will create a grade-separated trail opportunity which could also be used to split bike and pedestrian traffic (AT #2). The existing 14' x 14' RCB is no longer needed by OCWD to transfer water to the former Ball Road Basin. Therefore, the RCB can be repurposed as a grade- separated crossing under Ball Road.

Conceptual Layout

The existing culvert under Ball Road that connects Ball Road Basin with Burris Basin presents a feasible alternative, by repurposing the existing 14' x 14' RCB for use as a grade-separated crossing under Ball Road. Design improvements required may include access, drainage, and lighting.



Design Considerations

- Provide multi-modal connection between River Walk trail extension at Ball Road to Anaheim Coves Trail.
- Meet all safety requirements and guidelines related to trail widths and street crossing.
- Long-term real estate instrument and maintenance and operations plan.

Regulatory / Permitting

- OCWD
- Coordination with ocV!BE development
- OCFCD/OCPW
- CEQA/NEPA

Design & Construction Constraints

- Narrow width at existing box culvert.
- Requirements for continued access for maintenance activities.
- Property ownership for routing of trail.
- OC Parks approval – trail nexus, continuity of design, and signage.

▼ View from south side of Ball Rd., east of Phoenix Club Dr. – Existing 14' x 14' RCB culvert repurposed for grade separated undercrossing.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★★★★
Improves Visual and Physical Access to the River	★★★★★

Synergy with Other River Walk Opportunities

Active Transportation
1. Bikeway/Pedestrian Trail Extension

Community Amenities
13. Engagement with Adjacent Spaces
17. Landscape Enhancement

Implementation Schedule

Design	3-5 mo
Approval/ Permitting	3-5 mo
Construction	3-6 mo

Project Cost ($K)

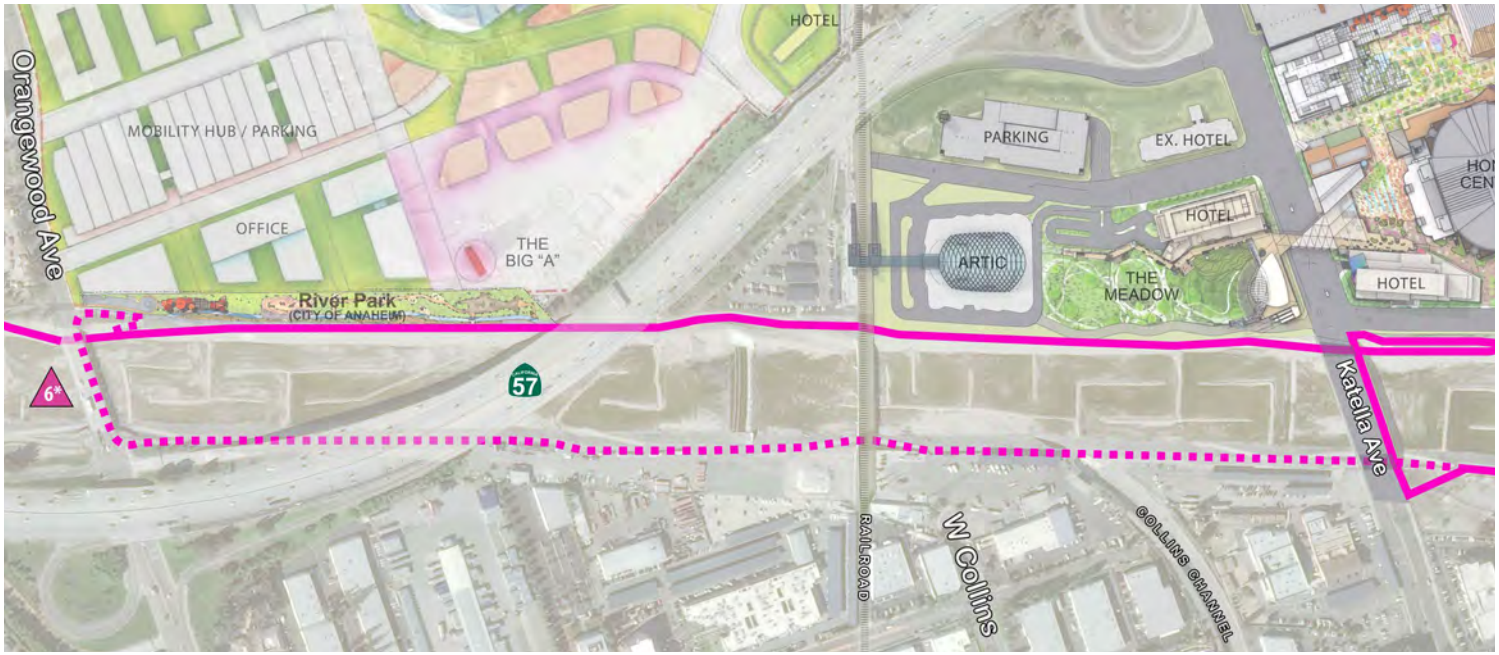
Design	$150
Construction	$1,000
O&M	$50

PACE STUDIO-MLA

ACTIVE TRANSPORTATION – OPPORTUNITY #3

SART East Bank Addition

3



LEGEND

Opportunity #3

- Continuation of SART on east bank of river to Orangewood Avenue
- 6* OC River Walk AT #6 Orangewood Bridge widening for Ped/ Bike Lanes

Existing

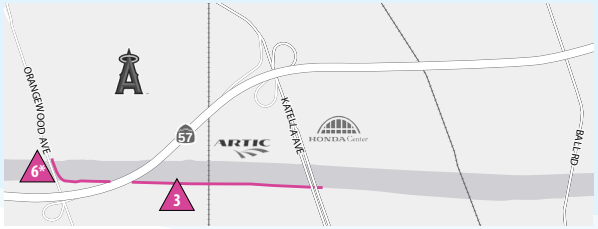
- Exist. Santa Ana River Trail (SART)

Overview

Opportunity #3 – SART East Bank Addition The SART follows the east bank of the river between Ball Road and Katella Avenue, where it crosses over to the west bank of the river. The SART is heavily used by pedestrians, recreational cyclists, commuter cyclists, and fitness cyclists; all of whom share the trail as they travel at different speeds. As development occurs along the west bank of the river at ocV!BE and Angel Stadium, it is anticipated that the SART may become congested, leading to conflicts between faster travelling trail users and those traveling at slower speeds. New connections from the river to Angel Stadium, the Honda Center, ARTIC, and Meadow Park could result in a greater number of pedestrians and slower traveling cyclists. Additionally, the Orangewood Avenue bridge is not currently wide enough to accommodate cyclists (AT #6 to address). In order to provide a safe route for cyclists preferring to travel at higher speeds, the SART could remain on the east side of the river past Katella Avenue to Orangewood Avenue and the path on the west bank of the river could be dedicated to slower traffic.

Conceptual Layout

The east side of the river between Katella Avenue and Orangewood Avenue is currently a dedicated service road for OC Sheriff, OCPW, OCWD and others. The service road is also used by the businesses that flank the river for delivery of goods and materials. When the gates to this maintenance road are left open, it is used by cyclists traveling along the east bank of the river. The maintenance road already connects to the SART at Katella Avenue via an undercrossing on the east bank of the river and to Orangewood Avenue in a similar manner. Improvements to the east side trail would include signage, lighting, and landscaping.



Design Considerations

- Allow for continued use of maintenance road by OC Sheriff, OCWD and OCFCD per O&M requirements; provide access solutions to river-adjacent businesses.
- Provide signage and trail maps indicating route options.
- Meet all safety requirements and guidelines related to trail widths and street crossings.
- Long-term real estate instrument and maintenance and operations plan.

Regulatory / Permitting

- Coordination with OCFCD and OCWD
- Coordination with SART and OC Parks
- CEQA/NEPA

Design & Construction Constraints

- Current uses of maintenance road may conflict with higher speed bicycle traffic.
- Property ownership for alternative access routes for business.
- Requirements for continued access for maintenance activities.
- OC Parks approval – trail nexus, continuity of design, and signage.

▼ View from east bank of river, north of ARTIC railroad bridge – Increased connectivity for pedestrians and commuter cyclists on the Santa Ana River Trail.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★★★★
Improves Visual and Physical Access to the River	★★★★★

Synergy with Other River Walk Opportunities

Active Transportation

1. Bikeway/Pedestrian Trail Extension
5. River Walk Width Expansion
6. Widen Existing Bridges for Bike/Ped.

Implementation Schedule

Design	6-9 mo
Approval/ Permitting	6-9 mo
Construction	4-6 mo

Project Cost ($K)

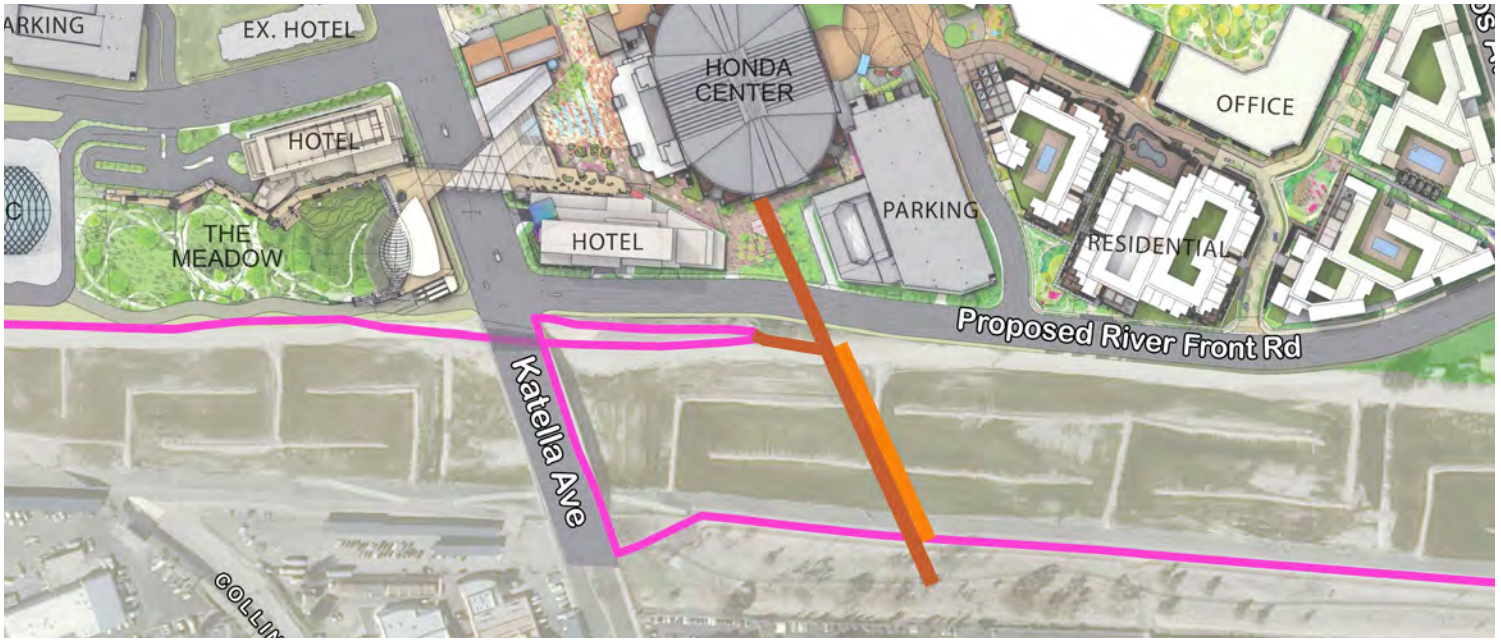
Design	$200
Construction	$2,000
O&M	$125

PACE STUDIO-MLA

ACTIVE TRANSPORTATION – OPPORTUNITY #4

Bike / Pedestrian Bridge

4



LEGEND

Opportunity #4

- Option A Extended Bridge
- Option B (minimum) Bank to Bank Bridge

Existing

- Exist. Santa Ana River Trail (SART)

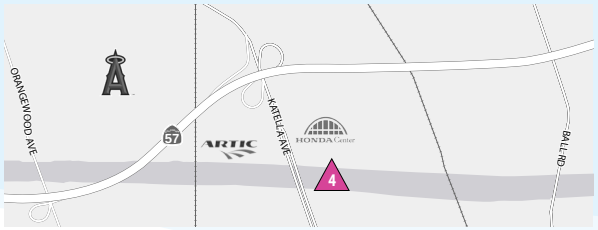
Overview

Opportunity #4 – New Bike / Pedestrian Bridge Across the Santa Ana River The River Walk project creates an opportunity to improve non-motorized connections on both sides of the Santa Ana River through an additional east-west access point dedicated to pedestrians and bicyclists. This bridge could replace the SART river crossing on Katella bridge.

Two options are feasible for the bike / pedestrian bridge, which is proposed between Katella Avenue and Ball Road. Option A is a bridge with an extended length across River Road to land within the ocV!BE development. Option B is a minimal length, connecting the top of the river banks. Both options would greatly improve connections between the Honda Center in the City of Anaheim and the Stadium Promenade shopping center in the City of Orange.

Conceptual Layout

While Option B allows for a more cost-efficient bridge construction (requiring around a 450' length) and a potentially faster timeline for implementation. It will require special design considerations to provide the minimum O&M clearance around the bank landings. Option A (requiring around a 1000' length) can more easily provide O&M clearance and a more direct connection to destinations on both sides of the river. Both options allow for a diverse range of bridge types, from utilitarian to iconic, including steel-rolled beams, concrete box girders, arch, suspension, concrete curve, and steel tubular v-truss designs.



Design Considerations

- Coordinate the location of bridge landings with those of the OC River Walk trail, SART, and all relevant destinations immediately surrounding the bridge as necessary.
- Ensure that the bridge does not conflict with O&M requirements from OCWD and OCFCD.
- Meet all safety requirements and recommendations related to the design of the design of a non-vehicular multi-modal bridge.
- Bridge width to comply with Santa Ana River Parkway and Open Space Plan guidelines to allow for separated facilities for pedestrians and bicyclists (minimum 25' width).

Regulatory / Permitting

- OCFCD/OCPW/SART/OC Parks
- CDFW 1600
- ACOE 404 & 408
- RWQCB 401 & SWPPP
- CEQA/NEPA

Design & Construction Constraints

- Requirements for continued access for maintenance activities.
- Must coordinate with property ownership at bridge landings.
- New bridge piers shall not negatively impact Santa Ana River hydraulics upstream or downstream.

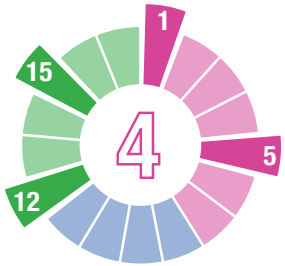
▼ Sample photo of a bike and pedestrian bridge, Tempe Town Lake.

Photo provided by City of Anaheim.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★★★★
Improves Visual and Physical Access to the River	★★★★★

Synergy with Other River Walk Opportunities



Active Transportation
1. Bikeway / Pedestrian Trail Extension
5. River Walk Width Expansion

Community Amenities
12. Cantilever Decks
15. Integrated Public Education/Art

Implementation Schedule

Design	12-18 mo
Approval/ Permitting	9-15 mo
Construction	8-12 mo

Project Cost ($K)

Design	$1,400
Construction	$16,000
O&M	$200

PACE STUDIO-MLA

ACTIVE TRANSPORTATION – OPPORTUNITY #5

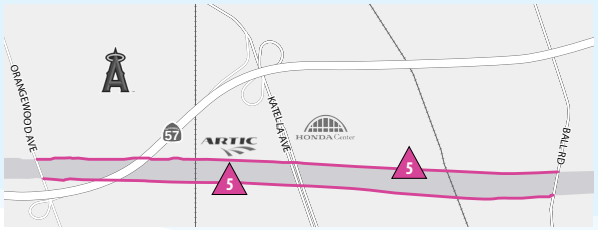
River Walk Width Expansion

5

LEGEND

Existing Trail Width

- 12′ – 18′
- 18′ – 25′
- 25′ – 32′
- > 32′
- Option A
- Option B
- Improved connectivity from ARTIC to the Honda Center
- Improved connectivity from ARTIC to the SART



Overview

Opportunity #5 – River Walk Width Expansion Available right-of-way along the River Walk through the west bank of the Santa Ana River varies between 12' and 32' from Orangewood Avenue to Ball Road. Ideally, a minimum of 25' in right-of-way should be available to allow for dedicated bikeways and separated pedestrian paths along the River Walk to conform to trail guidelines of the Santa Ana River Parkway and Open Space Plan. A number of solutions are proposed to mitigate these right-of-way challenges to allow for a positive biking and walking experience along the OC River Walk.

Conceptual Layout

Maximizing the width expansion of the trail allows for more improvements along the trail per other proposed OC River Walk opportunities. Options should investigate the installation of improved wayfinding and an east-west connection directly from the station platforms to OC River Walk. To remedy the narrow right-of-way areas, there should be a consideration to provide a split trail so pedestrians and bicyclists can have their own dedicated right-of-way. Utilizing the available right-of-way to separate modes of transportation will provide more efficient flow of foot and bicycle traffic and increased safety. This may be applied through two options – one option allows for the bicycle trail to drop closer to the riverbank, providing dedicated access during non-flood events, while the other option allows it to be within the ocV!BE development, with the right-of-way allowed to meander into the future Meadow Park.

Design Considerations

- Provide multi-modal connection between Anaheim Coves, SART, ocV!BE, ARTIC, and Angel Stadium.
- Allow for continuous separation of right-of-way from pedestrians and bicyclists.
- Allow for continued use of maintenance road by OCWD and OCFCD per O&M requirements.
- Meet all safety requirements and recommendations related to trail widths.
- Satisfy SARP & OSP design guidelines.
- Avoid impacts to hydrologic regime, especially during flood events.

Regulatory / Permitting

- OCFCD/OCPW
- OCWD
- RWQCB 401, NPDES& SWPPP
- Caltrans
- CDFW 1600
- SART/OC Parks
- CEQA/NEPA

Design & Construction Constraints

- Narrow width at points.
- Requirements for continued access for maintenance activities.
- Flood control embankment freeboard and erosion protection.
- Property ownership for re-routing of trail and trail access points.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★☆☆
Catalyzes Economic Growth and Development	★★★★☆
Improves Visual and Physical Access to the River	★★★★★

Synergy with Other River Walk Opportunities

Active Transportation
1. Bikeway / Pedestrian Trail Extension
7. SART Pinch Point Relief

River Activation
9. Riverbank Modifications

Community Amenities
12. Cantilever Decks
13. Engagement with Adjacent Spaces
14. Stepped River Embankment
16. Upland Habitat Restoration

Implementation Schedule

Design	8-12 mo
Approval/ Permitting	4-6 mo
Construction	12-18 mo

Project Cost ($K)

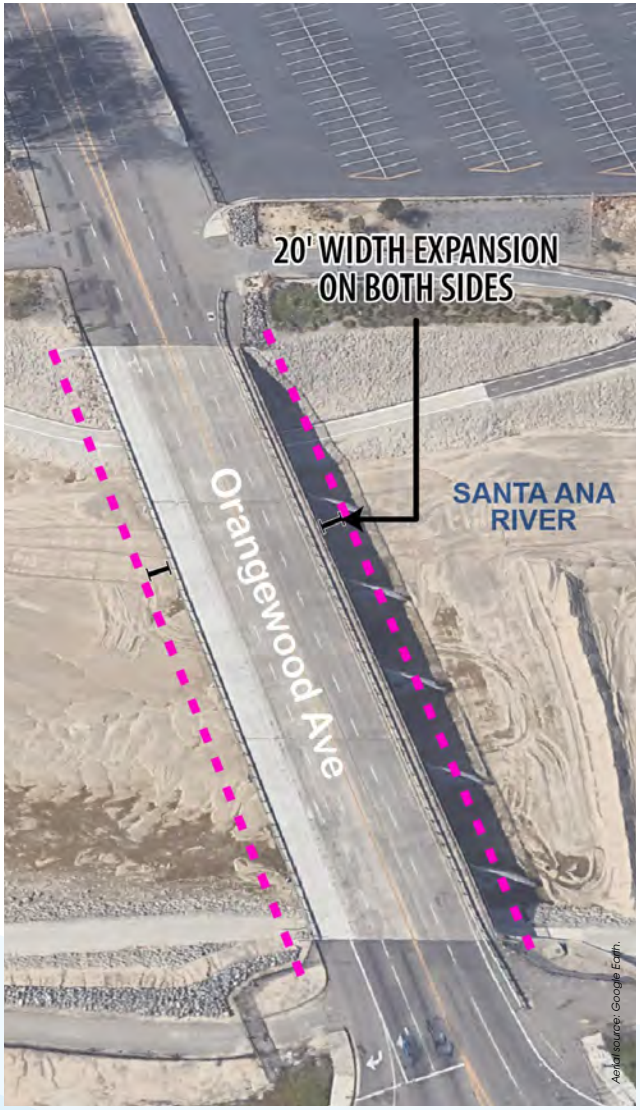
Design	$200
Construction	$2,000
O&M	$100

PACE STUDIO-MLA

ACTIVE TRANSPORTATION – OPPORTUNITY #6

Widen Existing Bridges for Bikes / Pedestrians

6



▲ Photos show the aerial plan view extents of a 20-foot widening on both bridges.

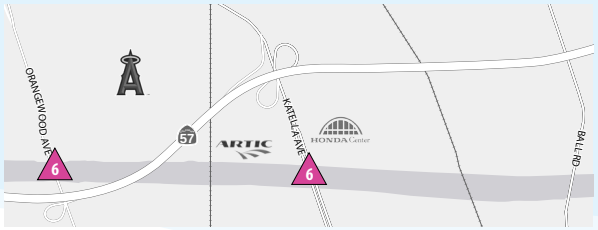
Overview

Opportunity #6 – Widen Existing Bridges for Bikes / Pedestrians While both Orangewood Avenue and Katella Avenue contain bridges that provide east-west access over the Santa Ana River, non-motorized access is limited to a sidewalk on the north side of Orangewood Avenue, a sidewalk on the south side of Katella and a protected bike lane on the north side of Katella Avenue. However, there are opportunities to provide dedicated and separated infrastructure for bicyclists and pedestrians. Expanding the existing bridges by 20 feet on either sides allows for the addition of striped bicycle lanes with safety buffers adjacent westbound and eastbound vehicle traffic.

▲ Orangewood Ave. bridge at west end. with narrow non-motorized access.

Conceptual Layout

With an expansion of 20 feet on either sides, both cyclists and pedestrians can have a designated 8 feet width each with 2 feet buffers in-between for safety separation and/or railings. The upcoming reconstruction of the Orangewood Avenue bridge includes enough space for a buffered path for pedestrians and bicyclists that could connect the SART and maintenance trail on the east bank of the river.



Design Considerations

- Provide additional east-west multi-modal connections to SART, allowing for additional connections to ocV!BE, ARTIC, and Angel Stadium.
- Satisfy roadway standards and safety requirements.
- Avoid significant impacts to the existing bridge right-of-way, allowing for quick implementation of the project and not impact vehicular capacity.
- Create opportunities to view and enjoy the Santa Ana River for pedestrians and bicyclists.
- Follow the vision of the City of Anaheim Bicycle Master Plan and OC Active Plan.

Regulatory / Permitting

- OCFCD/OCPW
- RWQCB 401, NPDES& SWPPP
- CDFW 1600
- ACOE 404 & 408
- CEQA/NEPA

Design & Construction Constraints

- Must adhere to design standards per the Orange County MPAH and City-designated truck routes (requires coordination with OCTA).
- Due to proximity of the Katella and Orangewood Avenue bridges to the 57 Freeway, Caltrans should be consulted to review any enhancements to the bridges prior to construction.
- Due to both roadways being designated on the Orange County MPAH, any amendments deviating from MPAH standards require approval from OCTA.

▼ Potential width allocation for Katella Ave.

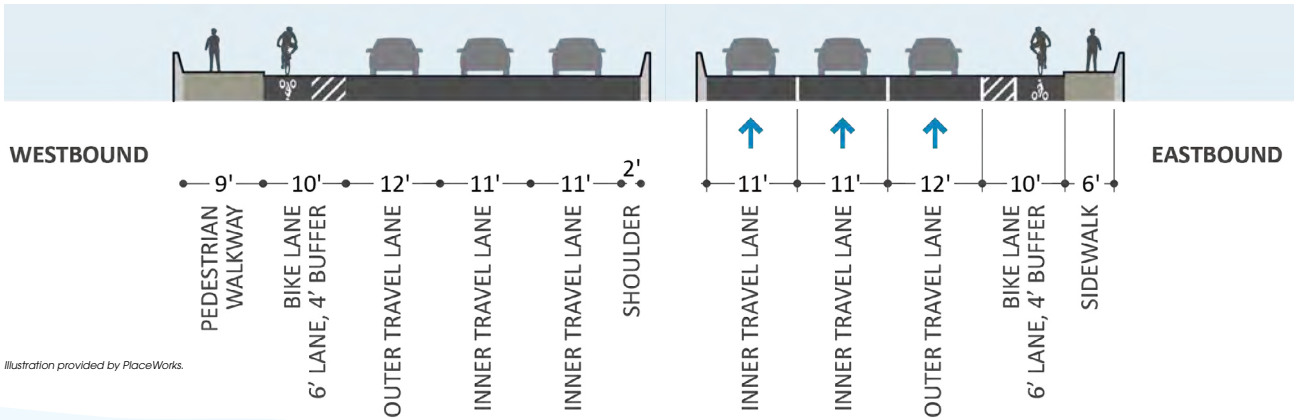


Illustration provided by PlaceWorks.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★★★★
Improves Visual and Physical Access to the River	★★★★★

Synergy with Other River Walk Opportunities

Active Transportation
3. SART East Bank Addition
4. Bike/Pedestrian Bridge

Community Amenities
15. Integrated Public Education/Art

Implementation Schedule

Design	12-18 mo
Approval/ Permitting	12-18 mo
Construction	12-18 mo

Project Cost ($K, EACH BRIDGE)

Design	$1,500
Construction	$14,000
O&M	$50

PACE STUDIO-MLA

7

ACTIVE TRANSPORTATION – OPPORTUNITY #7

SART Pinch-Point Relief

LEGEND

Opportunity #7

- 7A
  Retaining wall extents
  350 LF
- 7B – Option 1
  Add parallel 15' x 15' RCB
- 7B – Option 2
  Bikeway bridge
  undercrossing

Existing

- Exist. Santa Ana River Trail (SART)

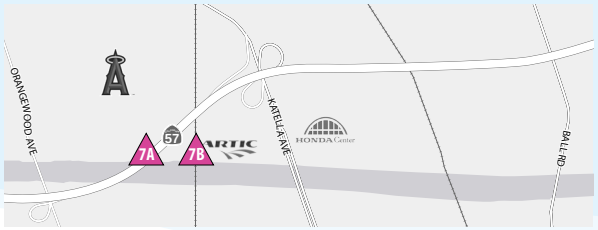
Overview

Opportunity #7 – SART Pinch-Point Relief The width of the ROW for the OC River Walk trail varies along its length, with two noticeable physical pinch-points. The first (**7A**) pinch-point is located under the 57 freeway. Here, a sloped bank under the freeway reduces the width available for the trail. The second (**7B**), located where the ARTIC railroad tracks cross the trail, is constrained by the width of the concrete box used to create the rail undercrossing. The trail here does not meet ADA standards, as the depth creates steep slopes on both sides of the undercrossing. Both pinch-points could be relieved through careful modification of the existing constraints, which would allow for better separation of bicycle and pedestrian uses.

Conceptual Layout

7A – 57 Freeway Pinch-Point: A vertical retaining wall could partially or completely replace the sloped bank, creating more width for the trail and allowing for comfortably separated pedestrian and bicyclist experiences.

7B – ARTIC Railroad Undercrossing Pinch-Point: Adding a second, pedestrian only, undercrossing box directly west adjacent to the existing undercrossing will provide an ADA compliant route that safely separates fast and slow modes of travel.



Design Considerations

- Allow for continuous separation of pedestrians and bicyclists.
- Comply with ADA requirements.
- Meet all safety requirements and recommendations related to trail widths.
- Avoid impacts to O&M activities along trail, Metrolink track, and 57 Freeway.

Regulatory / Permitting

- Coordination with Caltrans and Metrolink/OCTA
- Formal Application to CPUC: new and/or modified RR crossing
- OCFCD/OCPW
- SART/OC Parks
- CEQA/NEPA

Design & Construction Constraints

- Coordination process with large public agencies such as Caltrans and the CPUC can be time-consuming and costly.
- Design and construction cannot impact rail traffic or traffic along the 57 Freeway.

▼ View north on existing trail at pinch-point under Metrolink Railroad.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★★★★
Improves Visual and Physical Access to the River	★★★★★

Synergy with Other River Walk Opportunities

Active Transportation

1. Bikeway / Pedestrian Trail Extension
2. Trail Culvert Undercrossing at Ball Road
5. River Walk Width Expansion

Community Amenities

15. Integrated Public Education / Art

Implementation Schedule

Design	6-9 mo
Approval/ Permitting	12-18 mo
Construction	3-6 mo

Project Cost ($K, EACH LOCATION)

Design	$300
Construction	$1,500
O&M	$20-30

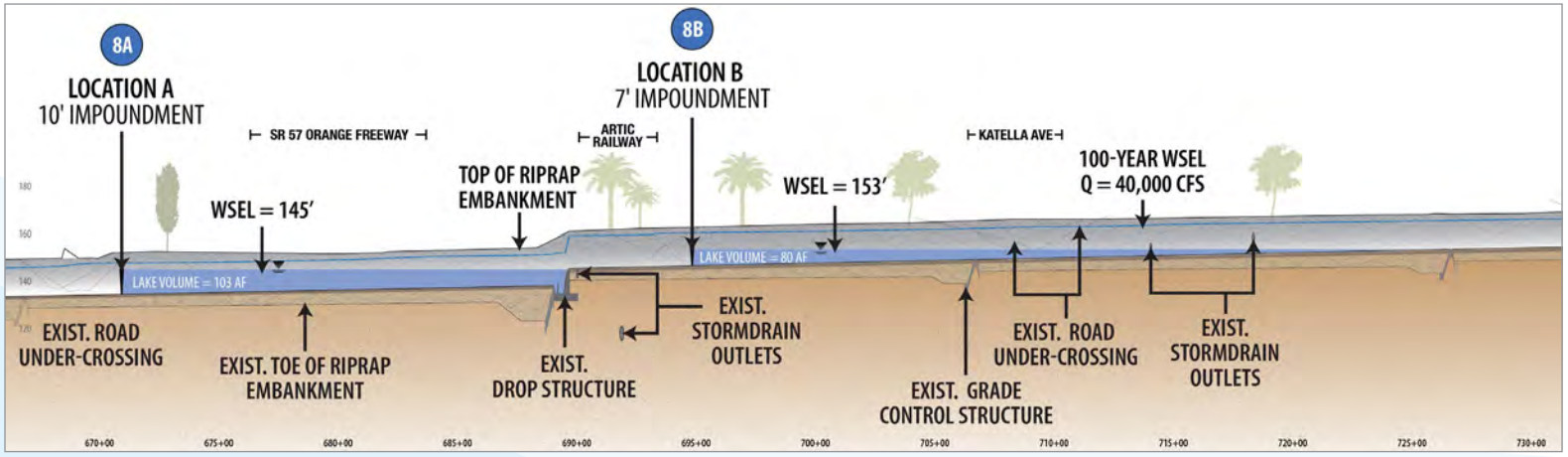
PACE STUDIO-MLA

RIVER ACTIVATION – OPPORTUNITY #8

River Impoundments

8

▲ River Impoundment Plan View

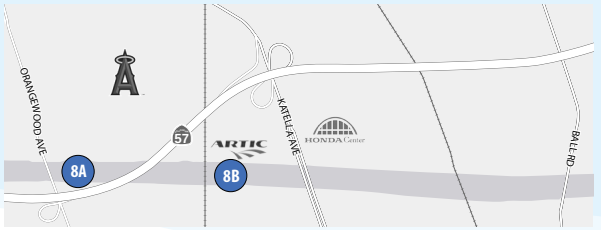


▲ River Impoundment Profile View

▲ Existing Santa River

▲ Proposed Santa Ana River impoundment

▲ Existing OCWD rubber dam impoundment



Overview

Opportunity #8 – River Impoundments OC River Walk is located between Orangewood Avenue and Ball Road and provides a unique opportunity to create additional OCWD groundwater recharge location by impounding water in the river, utilizing a much larger footprint for infiltration along the riverbed. This additional impoundment area not only provides recharge volume on site, but also serves as a safety net that allows the existing upstream recharge systems to operate more aggressively. The proposed river impoundments will increase infiltration of stormwater in the Santa Ana River below Ball Road and will eliminate the need for OCWD grading "T" and "L" soil levees in the riverbed.

The river impoundments can infiltrate nearly year-round (except for maintenance), using the upcoming GWRS pipeline turnout as a nearby water source. The GWRS is the world's largest purification system for indirect potable reuse. The process produces high quality water that meets or exceeds all state and federal drinking water standards. This allows the river impoundment to also function as a water feature for safe public engagement and interaction with the river. Also, the impoundments will not reduce the river's hydraulic capacity for flood conveyance.

Conceptual Layout

There are two potential river impoundments: 8A (14.4 ac) and 8B (23.5 ac). Both areas can satisfy the design requirements and maximizes the mutual benefit of groundwater recharge and river engagement as a public benefit water element.

Regulatory / Permitting

- Water quality monitoring & vector control
- OCWD
- ACOE 404 & 408
- OCFCD/OCPW
- RWQCB 401, NPDES & SWPPP
- CDFW 1600
- GWRS approval
- CEQA/NEPA

Design Considerations

- Consider field test to assess recharge rate and water quality.
- Maintain original flood conveyance capacity and freeboard per ACOE/OCFCD approval.
- Design impoundment per OCWD recharge O&M requirements.
- Allow for easy impoundment take-down and deployment.
- Consider one-way flow valves for existing stormwater outlets or reroute them out of impoundment inundation area.
- Incorporate vector control at the shallow end of the impoundment.
- Prevent impoundment inundation into Collin's Channel (8B).

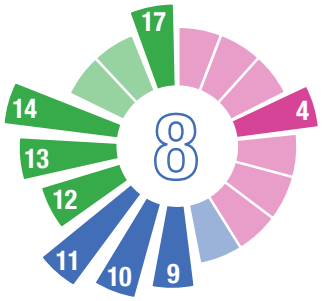
Design & Construction Constraints

- Impoundment hydraulic impacts when deployed and not deployed.
- Flood control embankment freeboard and erosion protection.
- Water source availability.
- Debris and trash removal system for impoundment areas.
- Design to mitigate vectors (insects, algae).
- Sediment removal, water circulation and other necessary maintenance and opertaion elements.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★☆
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★★☆☆
Improves Visual and Physical Access to the River	★★★★★

Synergy with Other River Walk Opportunities



Active Transportation
4. Bike / Pedestrian Bridge

River Activation
9. Riverbank Modifications
10. Urban Stormwater Treatment
11. River Recreation / Programming

Community Amenities
12. Cantilever Decks
13. Engagement with Adjacent Spaces
14. Stepped River Embankment
17. Landscape Enhancement

Implementation Schedule

Design	12-18 mo
Approval/ Permitting	12-18 mo
Construction	12-18 mo

Project Cost

($K, EACH IMPOUNDMENT)

Design	$1,200-1,500
Construction	$8,000- 8,500
O&M (year)	$200-300

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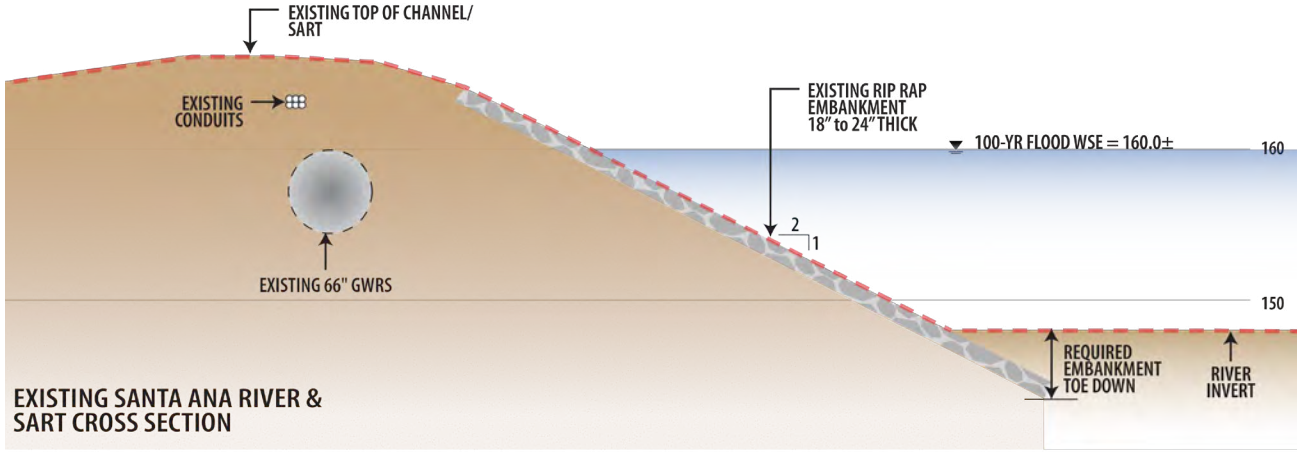
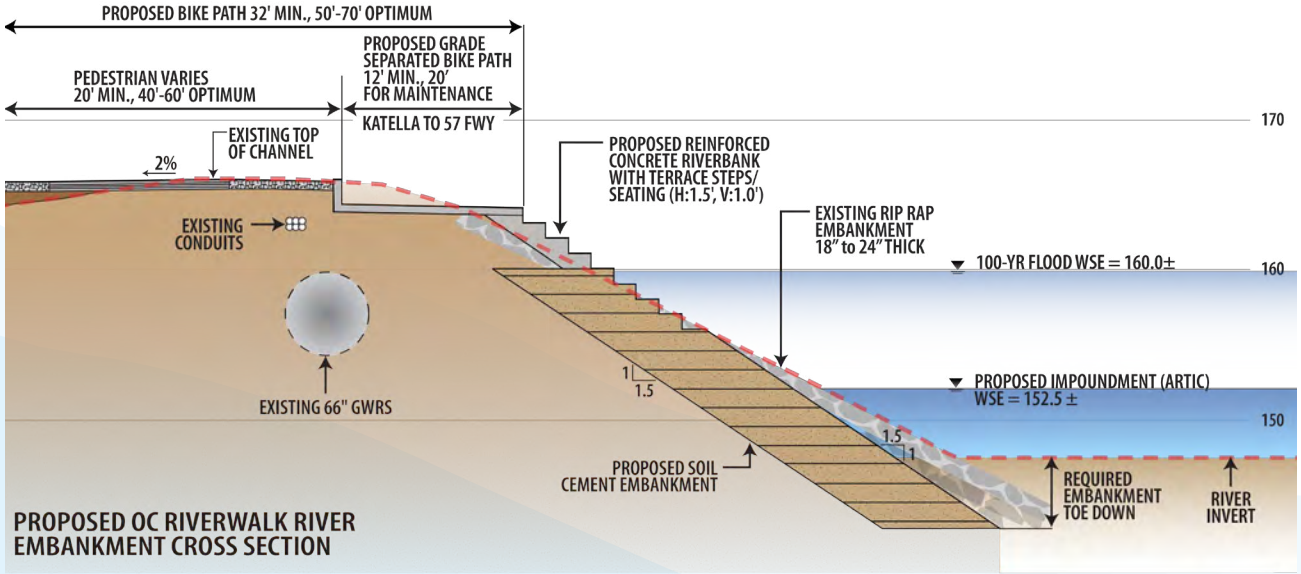
RIVER ACTIVATION – OPPORTUNITY #9

River Bank Modifications

9



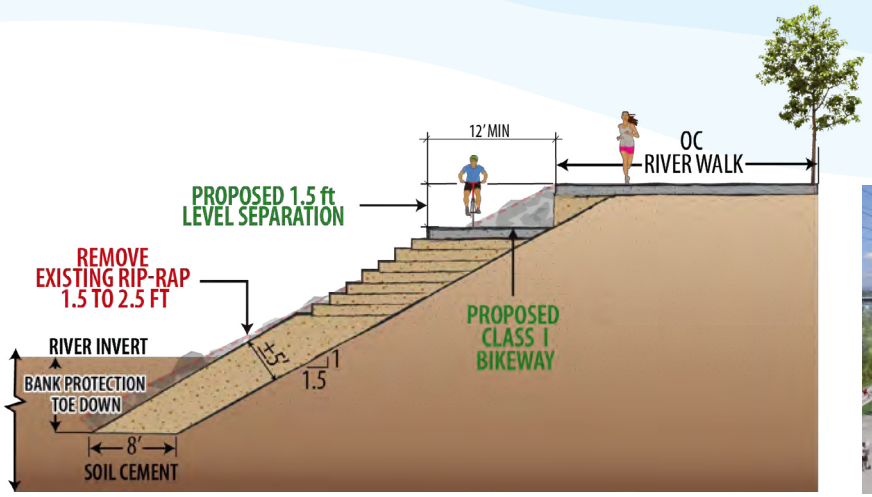


Overview

Opportunity #9 – River Bank Modifications There are approximately 3.5 miles of riprap-lined riverbank along the western and eastern sides of the Santa Ana River between Ball Road and Orangewood Avenue. While riprap is highly functional as a bank protection method, modifications to the existing riverbank can be made to maximize the river corridor's versatility, while maintaining stormwater flood protection, and also providing safe public access and engagement with the Santa Ana River. Riverbank modifications can incorporate features such as stepped embankment to provide seating, terracing, landscape planters, or even recreational activities such as vertical rock climbing walls. Preliminary hydraulic analysis resulted in very minimal impacts to the 100-year storm WSEL, localized around modeled pilot areas of slope modifications.

Riverbank modifications can be uniquely molded and constructed using soil cement. Similar to concrete and riprap, soil cement is strong enough to protect the banks from erosion, but offer the added benefit of an aesthetically pleasing natural appearance and provide smoother integration between adjacent land uses and the river itself. The transformation of the OC River Walk Corridor will bring an influx of local residents, tourists, and sports fans. Riverbank Modifications will support this future demand of additional public amenities along the Santa Ana River.

◀ Exhibit available in Appendix I - Exhibit 08.



▲ Stadium Step Riverbank - Profile View Designated Bike and Pedestrian Trail Option.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★☆☆☆
Improves Visual and Physical Access to the River	★★★★★

Synergy with Other River Walk Opportunities

Active Transportation
1. Bikeway / Pedestrian Trail Extension
5. River Walk Width Expansion

River Activation
8. River Impoundments
11. River Recreation/Programming

Community Amenities
12. Cantilever Decks
14. Stepped River Embankment
17. Landscape Enhancement

Conceptual Layout

Stretches of riverbank modifications are ideally located near points of public access, such as the trail located along the top of the bank, trail entrance and exit points, or places where other OC River Walk Opportunities are proposed; for example, in and around the River Impoundments (RA #8). It is important that the riverbanks (both east & west banks), if intended for access and use by the public, are designed with easily accessible exit points in the event of a rain storm where deep, swiftly moving water in the river should be avoided. For estimate purposes, roughly 10,000 LF of river bank modification is proposed as a minimum.

Design Considerations

- Maintain original flood conveyance capacity and freeboard per OCFCD approval.
- Design soil cement banks according to industry standards.
- Toe-down depth of soil cement prevents scour below toe.
- Structural engineering required for any proposed vertical walls.
- Public safety and signage.
- Facility O& M Plan.
- Allow for easy entrance/exit, including ADA.
- Appropriate landscape plant palette selection for Southern California and periodic inundation by flood waters.
- Landscaping in accordance with ACOE requirements.

Regulatory / Permitting

- OCFCD Approval
- ACOE 404 & 408
- RWQCB 401, NPDES & SWPPP
- CDFW 1600
- CEQA/NEPA

Design & Construction Constraints

- Existing utilities and storm drains.
- Bridge crossings.
- Hydraulic impacts during normal river operations and the 100-year storm event.
- Flood control embankment freeboard and erosion protection.
- Public entry/exit points and ADA compliant ramps.

Implementation Schedule

Design	14-18 mo
Approval/ Permitting	12-18 mo
Construction	12-18 mo

Project Cost ($K)

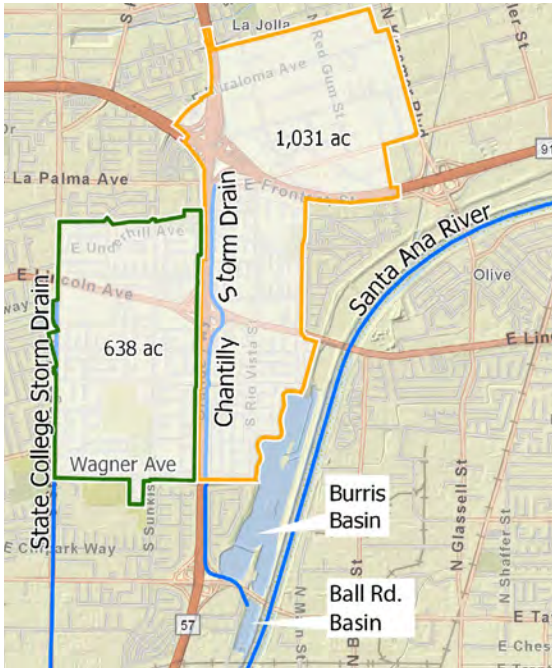
Design	$1,800
Construction	$12,000
O&M	$100

PACE STUDIO-MLA

RIVER ACTIVATION – OPPORTUNITY #10

Urban Stormwater Treatment

10

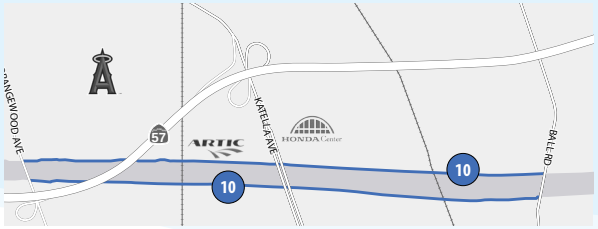


▲ Chantilly Storm Drain

▲ Collins Channel

Overview

Opportunity #10 – Urban Stormwater Treatment In conjunction with the other proposed River Walk opportunities, there is incentive for water quality treatment for the local urban stormwater runoff discharging into the project area. With the proposed planning and design of riverbank modifications and river impoundment, all existing storm drains and channels that enter the Santa Ana River within the project area will undergo alterations to prevent any negative impacts from nearby proposed improvements. Thus, there is a mutual benefit opportunity to include urban stormwater treatment as part of the alterations to these existing facilities in coordination with existing water quality/watershed master plans which may identify local potential BMP treatment potential.



Conceptual Layout

Three main urban stormwater treatment opportunities arise from the River Walk opportunity improvements:

(10A) Local Storm Drains – water quality treatment for all storm drain pipes that discharge into the Santa Ana River within the project site (prompted by proposed Riverbank Modifications, RA #9).

(10B) Collin's Channel – treatment system and sediment handling (prompted by proposed River Impoundment RA #8, location 8A).

(10C) State College and Chantilly Storm Drains - dry weather diversion of most storm events into nearby Burris Basin for groundwater recharge as part of the WIPS (prompted by proposed Riverbank Modifications, RA #9).

Design Considerations

- Stormwater quality treatment and infiltration per OCPW and OCWD standards.
- Maintain existing land use function.
- Construction of Burris Basin outfall with appropriate scour protection apron.
- Proposed diversion pipelines to be sized for gravity flow.
- Structural and Geotechnical Engineering for any proposed vertical walls.
- O&M Plan per OCPW and OCWD standards.
- Address current storm water quality issues with OCWD.

Regulatory / Permitting

- ACOE 404 & 408 (10B only)
- OCFCD/OCPW
- OCWD (10C only)
- RWQCB 401, NPDES & SWPPP
- CEQA/NEPA

Design & Construction Constraints

- Existing utilities and storm drains.
- Existing elevations for gravity diversion.
- Hydraulic impacts during normal river operations and the 100-year storm event.
- Local infiltration rates.
- Geotechnical soil conditions for underground facilities.

◀ Underground BMP treatment/storage facilities such as this are popular water quality treatments options in high density areas.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★★★★
Improves Visual and Physical Access to the River	★★★★★

Synergy with Other River Walk Opportunities

River Activation
8. River Impoundments
9. Riverbank Modifications
11. River Recreation / Programming

Community Amenities
16. Upland Habitat Restoration

Implementation Schedule

Design	6-12 mo
Approval/ Permitting	10-18 mo
Construction	12-16 mo

Project Cost ($K, EACH LOCATION)

Design	$400-600
Construction	$2,500-4,000 (allowance)
O&M	$TBD

PACE STUDIO-MLA

RIVER ACTIVATION – OPPORTUNITY #11

River Recreation / Programming

11

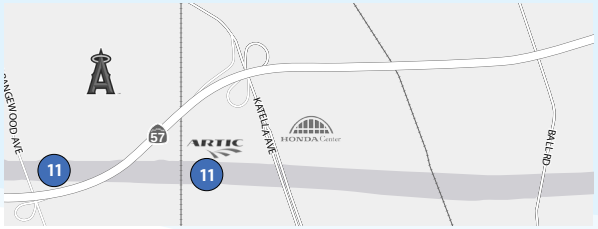
▲ Proposed River Recreation Impoundment.

Overview

Opportunity #11 – River Recreation / Programming The transformation of the River Walk Corridor will bring an influx of local community and tourists, creating an incentive for recreational water activities in and around the Santa Ana River. OCWD's GWRS local operations present a unique opportunity to develop a mutually beneficial system that will enhance groundwater recharge programs, while providing a pristine water supply source for the river water features. A new pipeline turnout is being proposed for the GWRS program and could also serve as the water source for the river recreation features. Recreation activities range from passive, non-contact to active programmed recreation. This programming might include kayaking, a lazy river, urban beaches, or playful water jets along the embankment. In conjunction with RA #8 (River Impoundments), programmed, on-going recreational activities can be offered, as well as larger water programming events, reminiscent of Anaheim's 1996 Jet Jam–with specialized water management systems that ensure no adverse environmental impacts.

Conceptual Layout

The water recreation activities and water programming would be organized by the City of Anaheim and are best suited near City parks. The City may elect to develop and manage recreational activities with its staff resources, or potentially contract out the recreation operations. A robust community outreach/engagement effort is planned to solicit input on preferred river recreational opportunities.



Design Considerations

- Maintain original flood conveyance capacity and freeboard per OC Flood approval.
- Design water feature per City of Anaheim O&M requirements.
- Structural engineering for proposed facilities, temporary or permanent.
- Public Safety – Facility O&M Plan
- Allow for easy take-down and deployment.
- Consider one-way flow valves for existing stormwater outlets or reroute them out of water feature area.

Regulatory / Permitting

TBD, but potentially:

- OCFCD/OCPW
- OCWD
- ACOE 404 & 408
- RWQCB 401, NPDES & SWPPP
- CDFW 1600
- Railroad CPUC

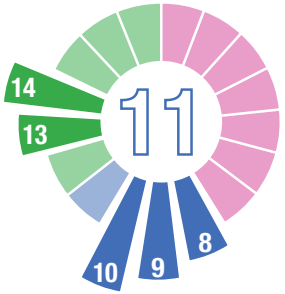
Design & Construction Constraints

- Existing utilities and storm drains.
- Hydraulic impacts during normal river operations and the 100-year storm event.
- Flood control embankment freeboard and erosion protection.
- Flood control operations and maintenance access.
- Water source availability.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★☆☆☆
Catalyzes Economic Growth and Development	★★★★★
Improves Visual and Physical Access to the River	★★★★☆

Synergy with Other River Walk Opportunities



River Activation

8. River Impoundments
9. Riverbank Modifications
10. Urban Stormwater Treatment

Community Amenities

13. Engagement with Adjacent Spaces
14. Stepped River Embankment

Implementation Schedule

Design	6-12 mo
Approval/ Permitting	6-18 mo
Construction	6-18 mo

Project Cost ($K)

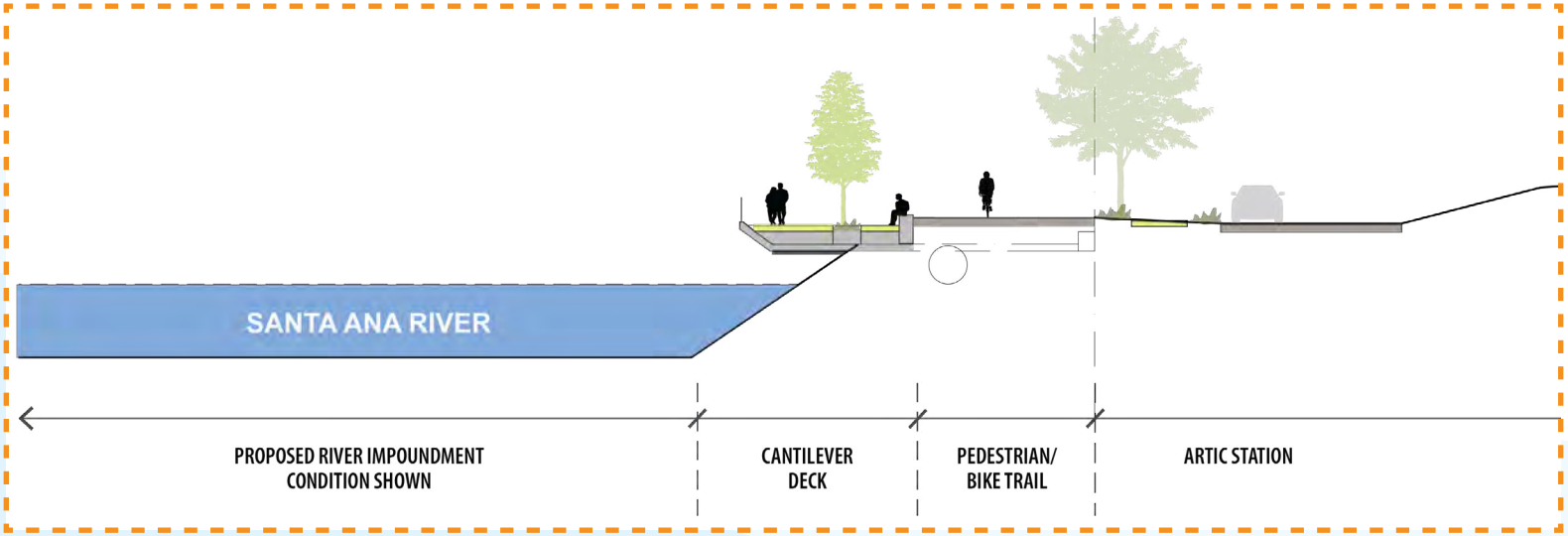
Design	$50-1,000
Construction	$2,000-10,000 (allowance)
O&M	$TBD

PACE STUDIO-MLA

12

COMMUNITY AMENITIES – OPPORTUNITY #12

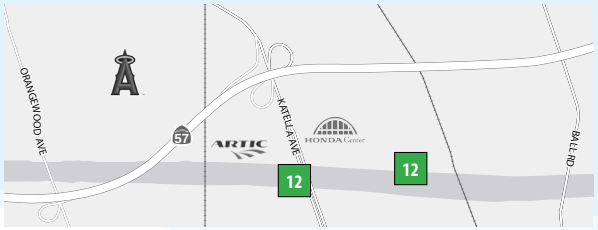
Cantilever Decks



◀ Plan and section view of cantilever deck.

▲ Iconic forms.

▲ Commercial opportunity.



Overview

Opportunity #12 – Cantilever Decks With the intent to maximize the river identity and create a memorable destination(s), creating opportunities to suspend people above the Santa Ana River via a cantilever deck accentuates one's experience at OC River Walk.

Conceptual Layout

There are multiple opportunities to implement a cantilever deck which would provide a more engaged experience along the river being suspended above the ground or water. The layout of the deck would respect conditions of structure, footings, clearance, capacity, and orientation of view itself. In addition, opportunities exist to build the deck from an existing trail, accessible bridge, and/or proposed improvement (i.e. park, trail, etc.). The two priority opportunities include: 1) Katella Avenue – view towards ARTIC Station and 2) Cerritos Park- view towards Santa Ana River/LA Live/ Honda Center.

Design Considerations

- Maintain original flood conveyance capacity and freeboard per OCFCD approval.
- Avoid impacts to existing utilities, as possible.
- Integration with adjacent circulation systems.
- Ensure ADA accessibility.

Regulatory / Permitting

- OCPW
- ACOE 408 (Katella location only)

Design & Construction Constraints

- Utilities and road undercrossings.
- Access from existing or proposed trails, streets, or bridges.

▼ Cantilever deck rendering featuring two deck locations and integration into boardwalk-type pedestrian path.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★☆☆☆☆
Catalyzes Economic Growth and Development	★★☆☆☆
Improves Visual and Physical Access to the River	★★★★★

Synergy with Other River Walk Opportunities

Active Transportation
1. Bikeway/Pedestrian Trail Extension
5. River Walk Width Expansion

River Activation
8. River Impoundments
9. Riverbank Modifications

Community Amenities
13. Engagement with Adjacent Spaces

Implementation Schedule

Design	8-12 mo
Approval/ Permitting	12-18 mo
Construction	10-12 mo

Project Cost ($K, EACH LOCATION)

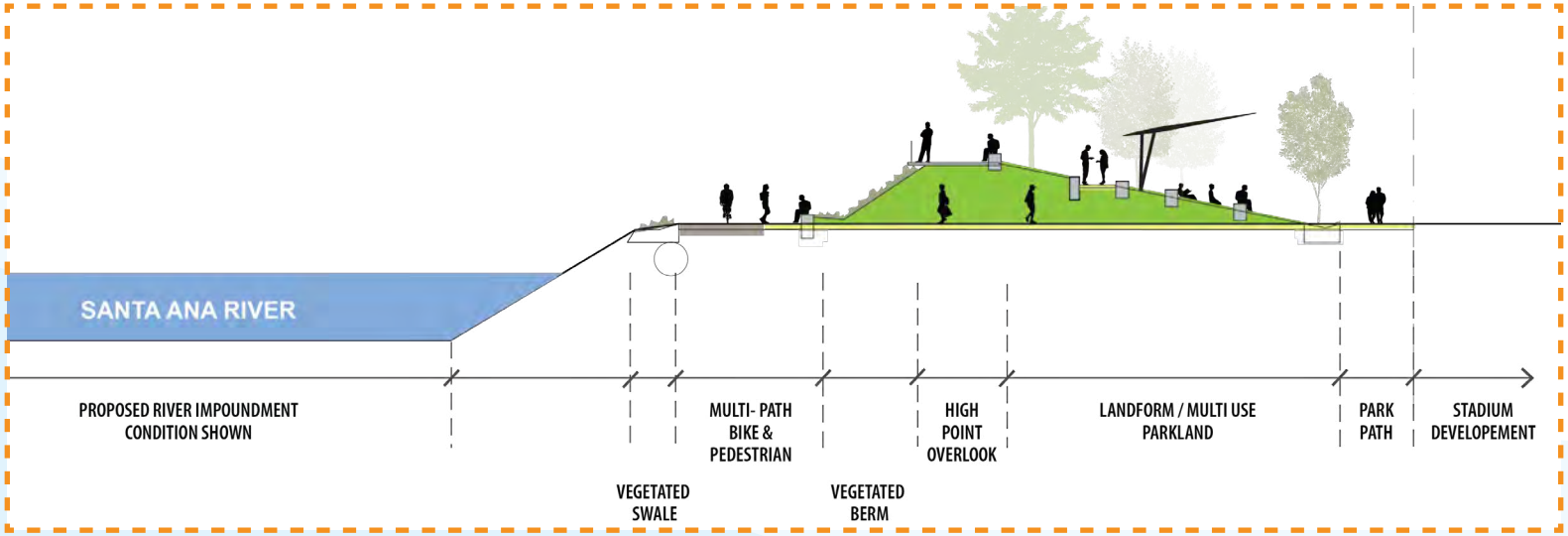
Design	$500
Construction	$2,500
O&M	$30

PACE STUDIO-MLA

COMMUNITY AMENITIES – OPPORTUNITY #13

Engagement with Adjacent Spaces

13



◀ Plan and section view of engagement spaces.

▲ Example images of landscaping, facilities and signage serving to activate corridors.

Overview

Opportunity #13 – Engagement with Adjacent Spaces The opportunity to engage with adjacent spaces along the OC River Walk creates inherent value for the future programming, activation, and character of the river. Engagement with the river includes improved access, circulation, and enhanced property frontage offering both permanent and temporary programming and engagement elements. Given the added diversity of uses and robust nature of the planned improvements for both Angel Stadium and ocV!BE, the extents of OC River Walk will become an increasingly more utilized and sought-after community amenity.

The spaces between OC River Walk and parcels vary in condition, ownership, and size along the length of project. These spaces subsequently have varying potential for accessibility and programming. Priority opportunities include the frontage of the Angel Stadium and the ocV!BE development – both adding a synergy to activate the river with people and new experiences. Through the conversion of surface parking and other underutilized conditions, the river's edge can become spaces for parks, plazas, terraces, and other means to accentuate the relationship to the river.

▼ Example images of landscaping, facilities and signage serving to activate corridors.

Photo provided by City of Anaheim.

Conceptual Layout

The ability for the project to engage with adjacent spaces is perhaps one of the most important elements of OC River Walk. Opportunities exist to transform what are typical "back of house" frontages or underutilized areas into more livable, usable spaces for the community. Improvements to these areas can include landscape improvements, hardscaping for programmed uses, and infrastructure to accommodate community events. Opportunities include permanent features and dedicated spaces to host events, such as food trucks, art exhibitions and community gatherings. Five locations have been identified as priority locations based on their vicinity to important features and locations along OC River Walk.

Design Considerations

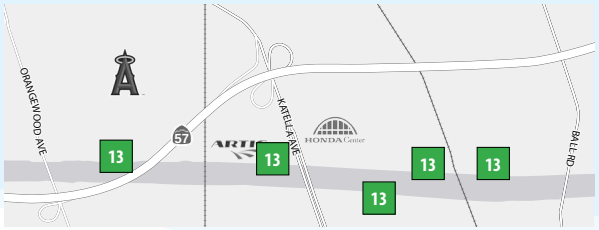
- Maintain original flood conveyance capacity and freeboard, per OCFCD/ACOE approval.
- Avoid impacts to existing utilities as possible.
- Integration with adjacent circulation systems.

Regulatory / Permitting

- TBD

Design & Construction Constraints

- Utilities and road under-crossings.
- Access from existing or proposed trails, streets, or bridges.
- Varied pedestrian experience.
- Views of the river.
- Commercial opportunities.



Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★★★☆
Improves Visual and Physical Access to the River	★★☆☆☆

Synergy with Other River Walk Opportunities

Active Transportation
1. Bikeway / Pedestrian Trail Extension
2. Trail Culvert Undercrossing at Ball Road

River Activation
8. River Impoundments
10. Urban Stormwater Treatment
11. River Recreation/Programming

Community Amenities
12. Cantilever Decks
14. Stepped River Embankment

Implementation Schedule

Design	4-8 mo
Approval/ Permitting	2-3 mo
Construction	6-9 mo

Project Cost ($K, 5 LOCATIONS)

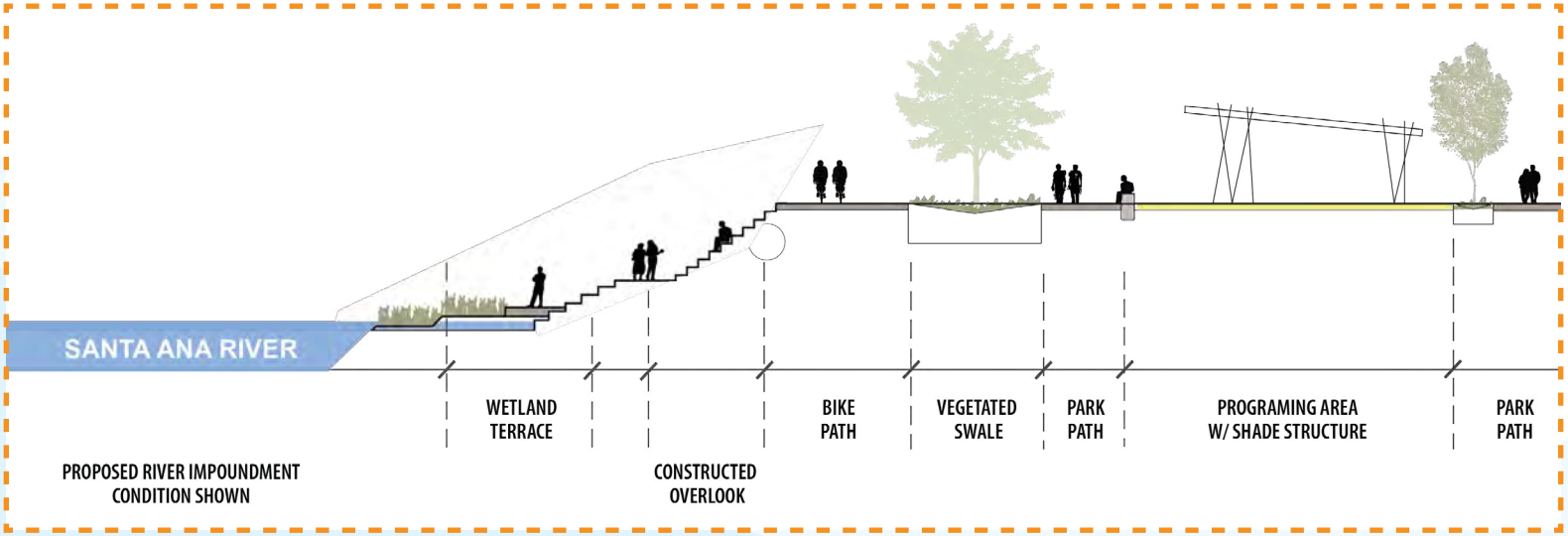
Design	$220
Construction	$2,000
O&M	$80

PACE STUDIO-MLA

14

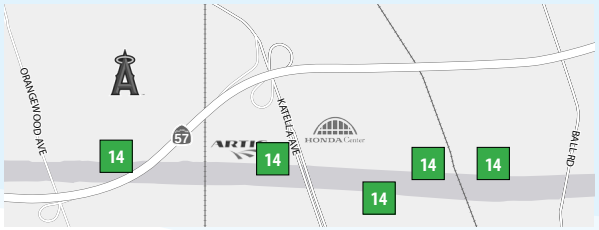
COMMUNITY AMENITIES – OPPORTUNITY #14

Stepped River Embankment



◀ Section view of stepped embankment activity elements

▲ Chicago Riverwalk stepped embankment.



Overview

Opportunity #14 – Stepped River Embankment Stair-stepping and terracing the grades of the riverbank unlock multiple benefits to the river that include enhanced hydraulics, additional capacity for circulation, augmented space for programs, and improved ecological function of the river. Alteration of the riverbank should always meet or exceed the capacity of the river channel to avoid any impacts to hydraulic function or potential flood impacts.

Conceptual Layout

There are several opportunities to incorporate stepped embankments along OC River Walk for various purposes. At the more active, populated portions of the project area including Angel Stadium, ARTIC Station, and ocV!BE, the addition of terracing at the upper portion of the embankment creates opportunities for enhanced programming and additional space for group gatherings. Throughout the project, stepped embankments of the river provides opportunities to create habitat areas for the river as well as integration of stormwater filtration. There are five priority locations, where they best interact with adjacent impoundment areas, on the east side of the river, and north of the SPT railroad.

Design Considerations

- Maintain original flood conveyance capacity and freeboard, per OCFCD/ACOE approval.
- Avoid impacts to existing utilities, as possible.
- Integration with adjacent circulation systems.

Regulatory / Permitting

- ACOE 404 & 408
- OCPW/OCFCD

Design & Construction Constraints

- Utilities and road under-crossings.
- Access from existing or proposed trails, streets, or bridges.

▼ Direct water access.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★★
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★★☆☆
Improves Visual and Physical Access to the River	★★★★★

Synergy with Other River Walk Opportunities

Active Transportation
2. Trail Culvert Undercrossing at Ball Road

River Activation
8. River Impoundments
9. Riverbank Modifications
11. River Recreation/Programming

Community Amenities
13. Engagement with Adjacent Spaces
15. Integrated Public Education/Art
17. Landscape Enhancement

Implementation Schedule

Design	6-8 mo
Approval/ Permitting	8-10 mo
Construction	6-9 mo

Project Cost ($K, 5 LOCATIONS)

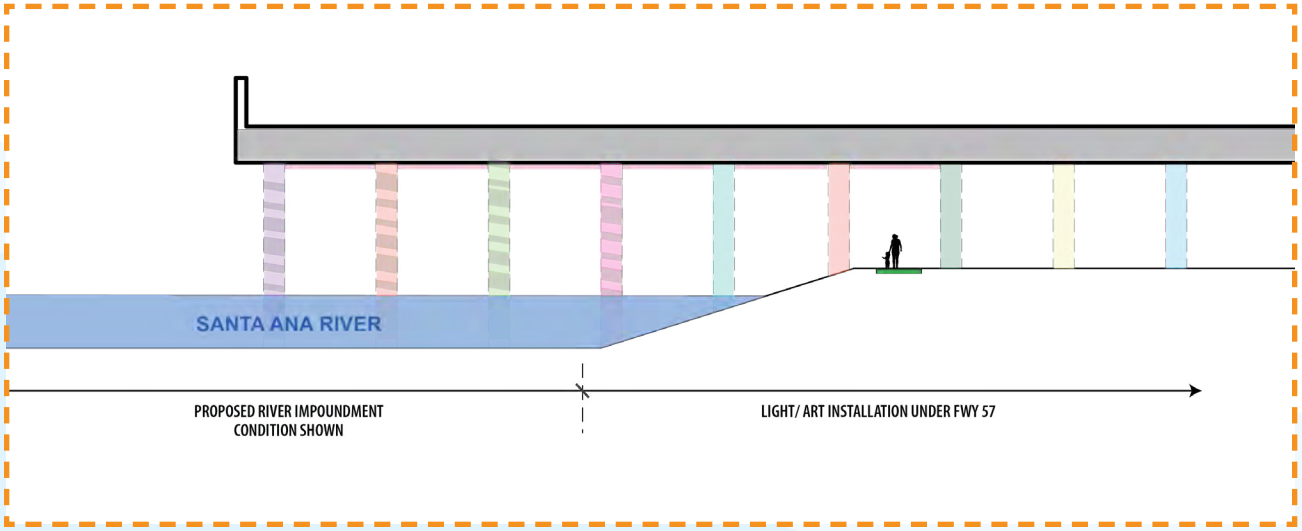
Design	$600
Construction	$5,000
O&M	$60

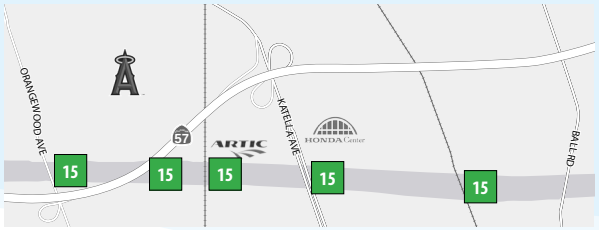
PACE STUDIO-MLA

COMMUNITY AMENITIES – OPPORTUNITY #15

Integrated Public Education / Art

15





Overview

Opportunity #15 – Integrated Public Education / Art The integration of art and educational features with OC River Walk will elevate the experience and identity of the project. Given the opportunity, artists should use their creativity to explore varying means and media to integrate art into visitors river experience. Art opportunities may be fully conceptual in nature, however, should strive to provide a deeper meaning and connection to and with the Santa Ana River and support educational programming about the significance and history of the river. Artists from around the world should be welcomed and efforts should be made to highlight emerging talent from local schools and colleges, particularly from disadvantaged communities.

Conceptual Layout

There are numerous opportunities to showcase art/education at OC River Walk. From light shows underneath the 57 Freeway columns (15A), bridge murals paying homage to native river fish (15B), and educational kiosks every 1/4 mile-marker along the trail (15C), the river's history and describing the river's important ecological functions and telling the stories of indigenous peoples, there should be few limitations to encourage OC River Walk as an open 'canvas'. Opportunities for integration may also include standalone art installations.

Design Considerations

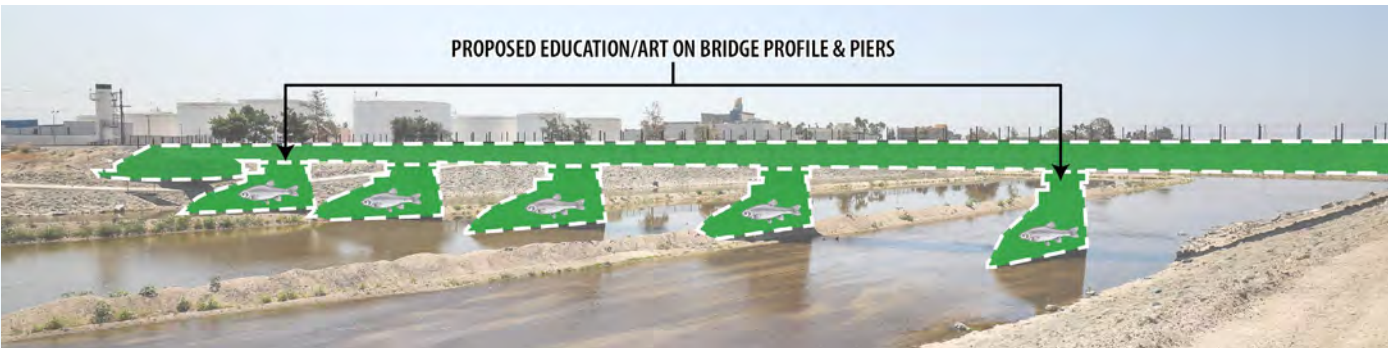
- Maintain original flood conveyance capacity and freeboard per OCFCD approval.
- Avoid impacts to existing utilities as possible.
- Integration with adjacent circulation systems.

Regulatory / Permitting

- ACOE 404 & 408 (15A thru 15E)
- OCFCD/OCPW (15A thru 15E)
- Caltrans (15B only)
- SART (15F only)

Design & Construction Constraints

- Utilities and road under-crossings.
- Access from existing or proposed trails, streets, or viaducts.
- Varied pedestrian experience.
- Views of the river.
- Commercial opportunities.



Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★☆☆
Enhances Aesthetic and Ecology of the River and Surrounding Region	★☆☆☆☆
Catalyzes Economic Growth and Development	★★☆☆☆
Improves Visual and Physical Access to the River	★☆☆☆☆

Synergy with Other River Walk Opportunities

Active Transportation
4. Bike / Pedestrian Bridge
5. River Walk Width Expansion
6. Widen Existing Bridges for Bike/Ped.
7. Trail Pinch Point Relief

River Activation
9. Riverbank Modifications

Community Amenities
12. Cantilever Decks
14. Stepped Embankment

Implementation Schedule

Design	8-10 mo
Approval/ Permitting	6-8 mo
Construction	3-8 mo

Project Cost
($K, EACH LOCATION/TYPE)

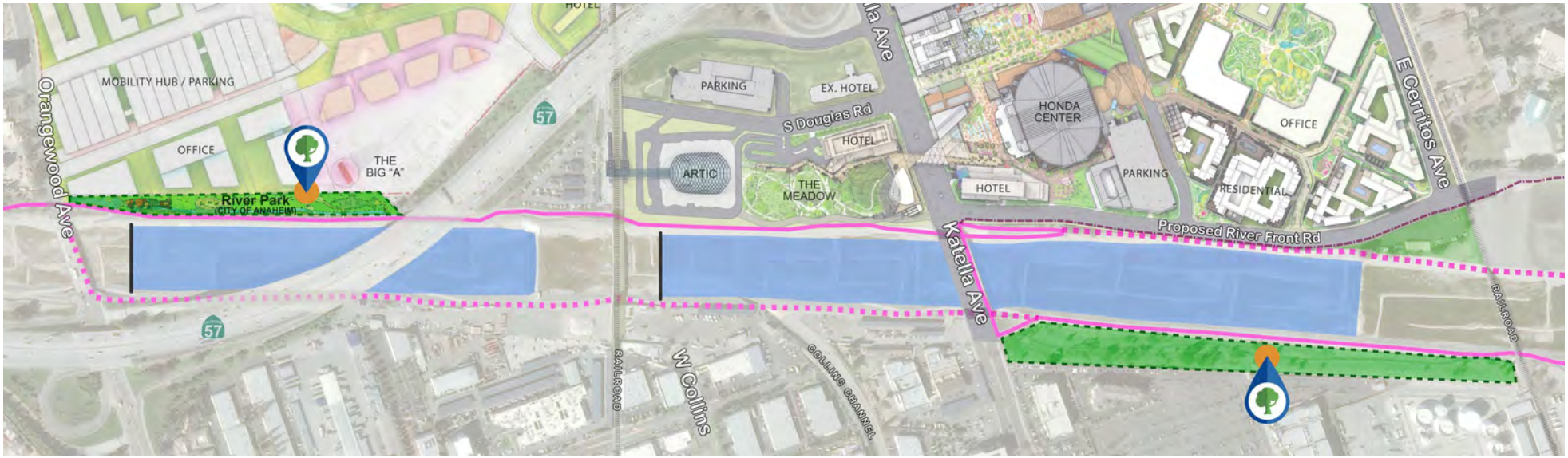
Design	$75-150
Construction	$500-1,500
O&M	$20-40

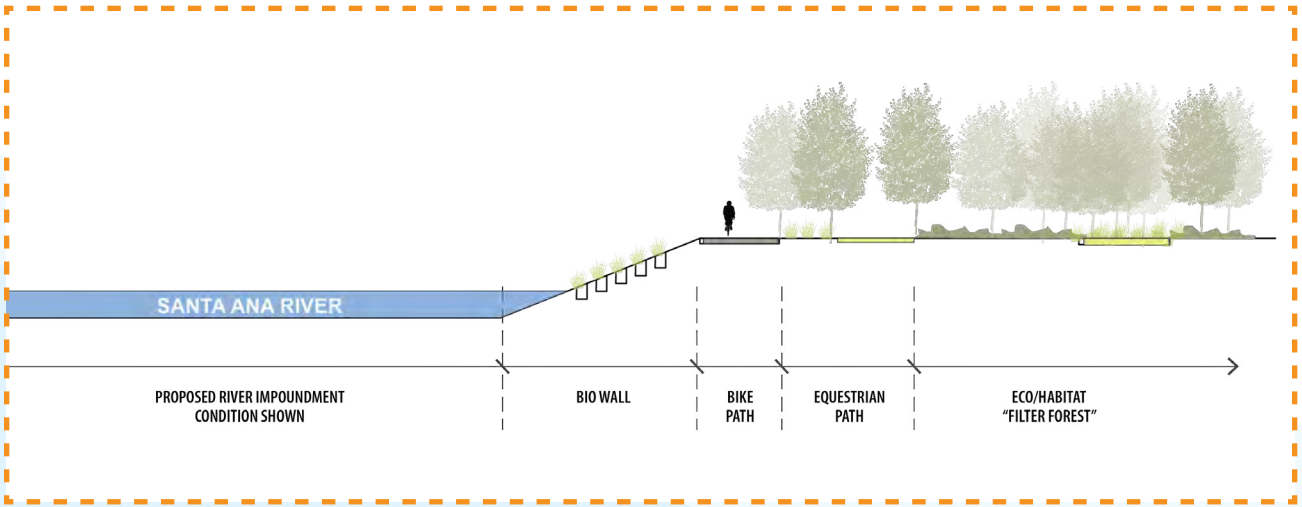
PACE STUDIO-MLA

16

COMMUNITY AMENITIES – OPPORTUNITY #16

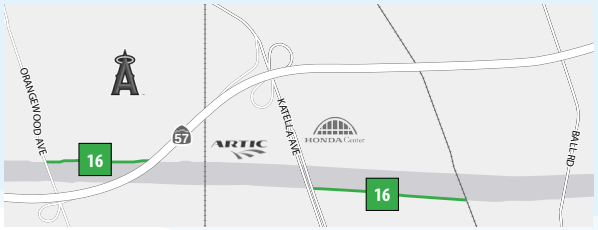
Upland Habitat Restoration





▲ Plan and section view of habitat restoration areas.

▲ Increased permeability.



Overview

Opportunity #16 – Upland Habitat Restoration The City and its partners have worked hard to restore habitat, through successful projects like Anaheim Coves. However, the restored natural beauty at the Coves is still strikingly absent along the banks of the river and the riverbed itself. A lack of trees or other vegetation means minimal avian habitat compared to more natural sections of the river that welcome great blue herons, great egrets, American white pelicans, gnatcatchers, American avocets, and more. The upland areas of OC River Walk offer tremendous opportunity for habitat restoration / enhancement.

Conceptual Layout

Upland habitat restoration will consist of native, low-maintenance and drought tolerant plantings to support local wildlife and urban greening along the upland river corridor areas. There are two priority locations for upland habitat restoration, including 30% of the area of River Park, located adjacent to Angel Stadium, just south of the 57 Freeway, and 70% of the area along the east bank of the river, extending north of Katella Avenue to the SPT railroad within an existing OCFCD property.

Design Considerations

- Understanding of river embankment – structurally and hydraulically.
- Avoid impacts to existing utilities as possible.
- Integration with adjacent circulation systems.

Regulatory / Permitting

- TBD

▼ Enhanced habitat areas.

Design & Construction Constraints

- Access from existing or proposed trails, streets, or viaducts.
- Varied pedestrian experience.
- Water supply for irrigation systems.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★☆
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★☆☆☆
Improves Visual and Physical Access to the River	★★★☆☆

Synergy with Other River Walk Opportunities

Active Transportation
5. River Walk Width Expansion

River Activation
10. Urban Stormwater Treatment

Community Amenities
13. Engagement with Adjacent Spaces
17. Landscape Enhancement

Implementation Schedule

Design	3-6 mo
Approval/ Permitting	2-8 mo
Construction	3-8 mo

Project Cost ($K, EACH LOCATION)

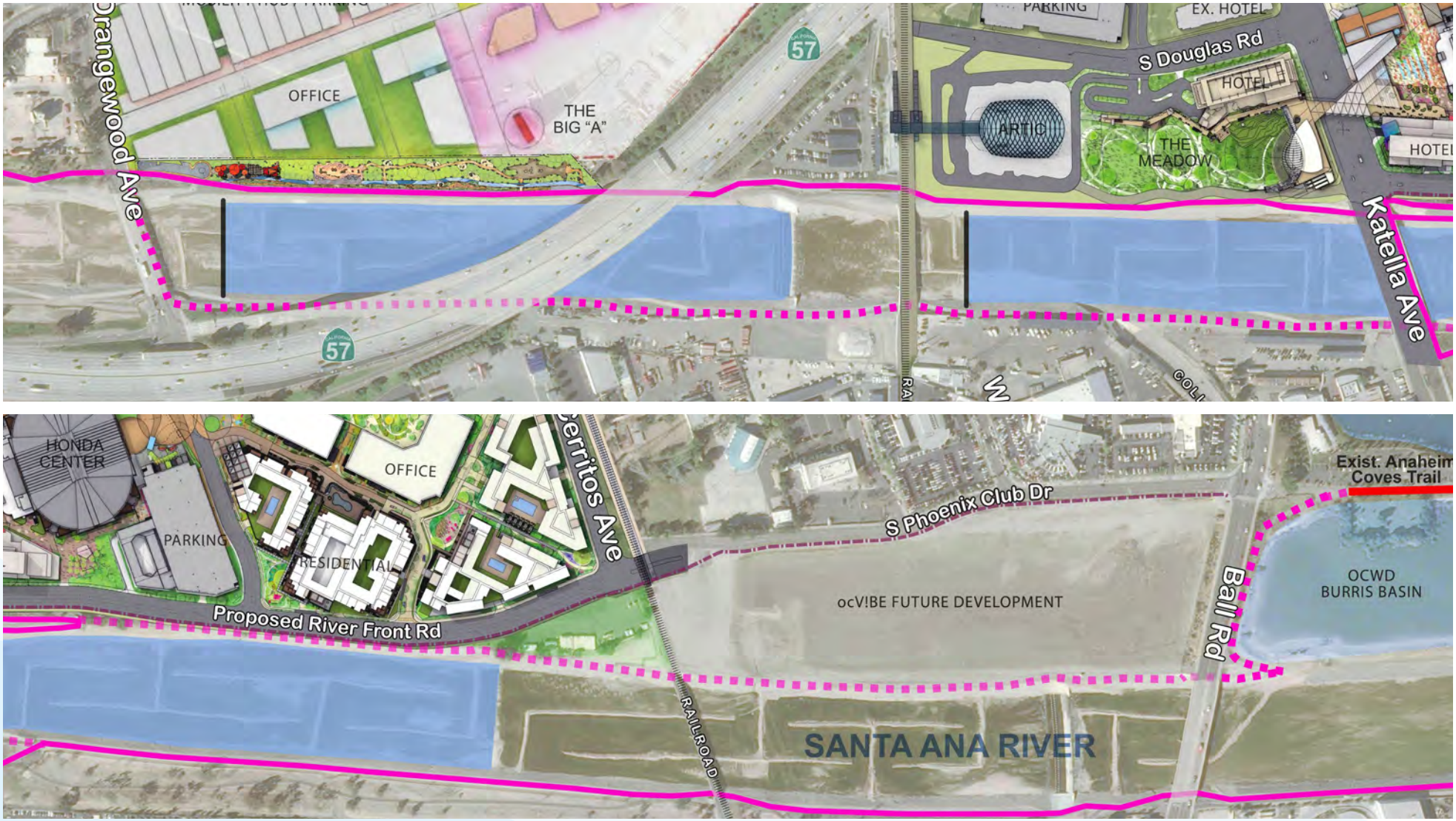
Design	$50-200
Construction	$550-3,200
O&M	$40-250

PACE STUDIO-MLA

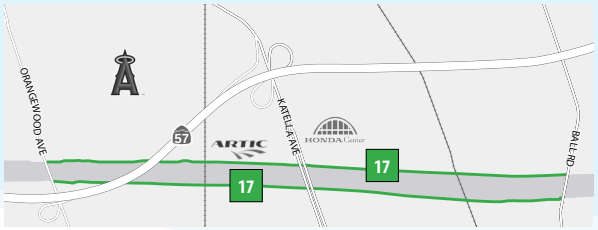
COMMUNITY AMENITIES OPPORTUNITY #17

Landscape Enhancement

17



▲ Plan view of OC River Walk; landscape enhancement opportunities exist throughout the OC River Walk reach.

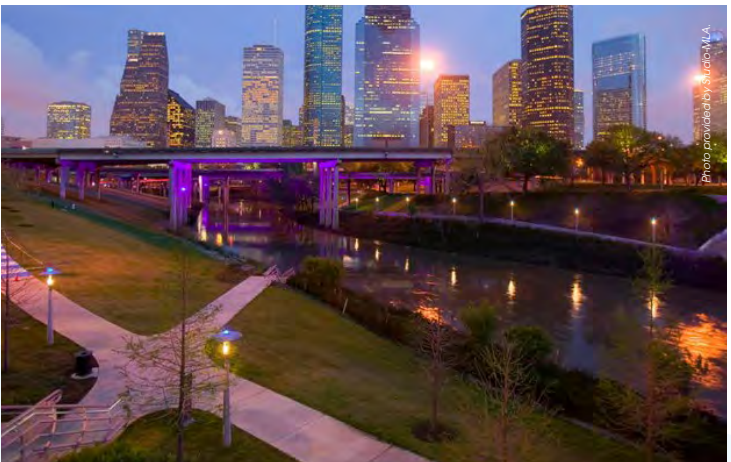


Overview

Opportunity #17 – Landscape Enhancement OC River Walk has the potential to generate more robust landscape for the river. Planting of trees, in particular, have significant benefits that include increased shade, evapotranspiration, and greater environmental conditions that can translate to improved air quality, reduced stormwater runoff, and more comfortable conditions for passive and active recreation. Through the integration of native species and removal of invasive species, the river can begin to ecologically restore itself and host a more intact habitat for migratory birds and water-based species as part of a broader riparian system.

Conceptual Layout

Throughout the extent of OC River Walk, landscape enhancement opportunities exist in many forms, layouts, and locations. Considerations for intensity of use, program and access will factor into the planning and design of landscape enhancements. The top of river embankment provides ample space for creating a softer edge and habitat to complement OC River Walk and associated spaces. Easements on both sides of the river become great opportunities for more intensive tree planting, or 'filter forests', which help improve air quality, sequester carbon, and mitigate the heat island effect. This strategy is particularly useful given the proximity to the elevated condition of the 57 Freeway and other commercial corridors.



Design Considerations

- Understanding of river embankment – structurally and hydraulically.
- Avoid impacts to existing utilities.
- Integration with adjacent circulation systems.

Regulatory / Permitting

- Hydraulic Modeling
- Construction and Mechanical Plans
- Accessibility Permit

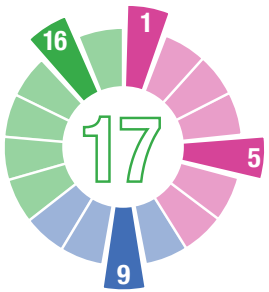
Design & Construction Constraints

- Utilities and road undercrossings.
- Access from existing or proposed trails, streets, or viaducts.
- Varied pedestrian experience.
- Water supply for irrigation systems.

Achievement of Mutual Community Benefit Objectives

Increases Public Interaction and Connectivity	★★★★☆
Enhances Aesthetic and Ecology of the River and Surrounding Region	★★★★★
Catalyzes Economic Growth and Development	★★☆☆☆
Improves Visual and Physical Access to the River	★★★☆☆

Synergy with Other River Walk Opportunities



Active Transportation
1. Bikeway/Pedestrian Trail Extension
5. River Walk Width Expansion

River Activation
9. Riverbank Modifications

Community Amenities
16. Upland Habitat Restoration

Implementation Schedule

Design	4-6 mo
Approval/ Permitting	4-8 mo
Construction	4-8 mo

Project Cost ($K)

Design	$200
Construction	$2,000 (allowance)
O&M	$100

PACE STUDIO-MLA

Opportunities Summary Matrix

	OC RIVER WALK OPPORTUNITIES & DESCRIPTION	QUANTITY DESCRIPTION & COST	CEQA / NEPA		REQUIRED PERMITS (SEE PERMIT MATRIX)	PERMITTING	DESIGN		CONSTRUCTION		OPERATIONS & MAINTENANCE
			PROGRAM	PROJECT		SCHEDULE (MONTHS)	SCHEDULE (MONTHS)	COST ($K)	SCHEDULE (MONTHS)	COST ($K)	COST $K/YEAR
AT	I. ACTIVE TRANSPORTATION/REGIONAL TRAILS CONNECTION OPPORTUNITIES										
1	Bikeway/Pedestrian Trail Extension: Katella to Anaheim Coves (Including RR Undercrossing)	5,600 LF (30 FT wide trail/path) @ $550/LF, SP RR @ $600K & Ball Rd @ $200K. Bridge Undercrossings = $4M	X	X	ACOE, CPUC, OCTA, OCPW	9 - 15	6 - 9	500	4 - 6	4,000	150
2	Trail Culvert Undercrossing at Ball Road (Repurpose Existing OCWD RCB)	1,700 LF (20 FT wide trail/path) @ $400/LF, Repurpose RCB (Drainage, Lighting) @ $300K = $1M	X	X	Minimal	3 - 5	3 - 5	150	3 - 6	1,000	50
3	SART East Bank Addition of River from Katella to Orangewood	4,700 LF trail/path existing: Upgrade to OC River Walk @ $425/LF = $2M	X	Potentially	SART, OC Parks	6 - 9	6 - 9	200	4 - 6	2,000	125
4	Bike/Pedestrian Bridge across the Santa Ana River	Max 1,000 LF (40 FT wide) @ $400/SF = $1.6M	X	X	ACOE, OCPW, RWQCB	9 - 15	12 - 18	1,400	8 - 12	16,000	200
5	River Walk Width Expansion and Connectivity (Assume 2,000 LF at River & 2,000 LF offsite)	2,000 LF @ $650/LF OC River Walk + 2,000 LF @ $300/LF = $2M	X	Potentially	OCPW	4 - 6	8 - 12	200	12 - 18	2,000	100
6	Widen Existing Bridges for Bikes/Pedestrian	Assume add 20 FT East & West Bound Lanes at Both Bridges			ACOE, OCPW, CDFW						
	a. Katella Ave.	2 x (500 LF x 20 FT wide) = 2 (1,000 SF @ $700/SF) = 2 ($7M) = $14M	X	No	ACOE, OCPW	12 - 18	12 - 18	1,500	12 - 18	14,000	50
	b. Orangewood Ave. (Currently road being widened to North ± 30 FT - Est. completion 2024)	2 x (500 LF x 20 FT wide) = 2 (1,000 SF @ $700/SF) = 2 ($7M) = $14M	X	No	ACOE, OCPW	12 - 18	12 - 18	1,500	12 - 18	14,000	50
7	SART Pinch Point Relief										
	a. West Bank at CA-57 FWY (CalTrans Retaining Wall)	350 LF retaining wall, height 12 FT= 4,200 SF @ $350/SF = $1.5M	X	Potentially	CalTrans	12 - 18	6 - 9	300	4 - 6	1,500	20
	b. West Bank at ARTIC RR Crossing (Double the Width of Existing Culvert Undercrossing)	Parallel 15'x 15' RCB structure 50 LF @ $6,500/LF & Wing Walls 1,000 SF @ $150/LF & RR Shoring $500K = $1.5M	X	Potentially	ACOE, CPUC, OCTA, OCPW	12 - 18	6 - 9	300	3 - 4	1,500	30
RA	II. RIVER ACTIVATION OPPORTUNITIES										
8	River Impoundment (Assume Inflatable Rubber Type Dam)	All Adjacent Storm Drains with Back Flow Prevention or Flow Diverted									
	a. Dam North of Orangewood (10 FT High, 14 AC, 80 AF)	350 LF (10 FT high with Foundation) $6M + $1M Storm Drain + (Trash, Recirculation, Misc. $1M) = $8M	X	X	ACOE, OCWD, CDFW	12 - 18	12 - 18	1,200	12 - 18	8,000	200
	b. Dam North of ARTIC (7 FT High, 23 AC, 100 AF)	350 LF (7 FT high with Foundation) $5M + Collins Channel Dam $1.5M + $1M Storm Drain + (Trash, Recirculation, Misc. $1M) = $8.5M	X	X	ACOE, OCWD, CDFW	12 - 18	12 - 18	1,500	12 - 18	8,500	300
9	Riverbank Modifications (Assume Full Extent of Impoundments)	10,000 LF x 25 FT @$550/LF OC River Walk + $650/LF Soil Cement = $12M	X	X	ACOE, OCPW	12 - 18	14 - 18	1,800	12 - 18	12,000	100
10	Urban Stormwater Treatment (Multi-Benefit OCPW, Cities, & OCWD/Recharge Enhancement)	Diversion, Treatment, Re-Use Opportunity	X	X							
	a. Existing Storm Drains Tributary to Proposed Impoundments	Multiple (Approx. 12) 18" - 48" Outlets, Combine for Single Treatment 12 @ 200K/ea + $600K Treatment = $3M	X	X	OCPW, RWQCB	10 - 12	6 - 9	600	6 - 8	3,000 ALLOWANCE	TBD
	b. Collins Channel (OC WIPS/MS4 Permit Opportunity)	Treatment of Dry Weather & Portion of MS4 Run-Off	X	X	OCPW, RWQCB	10 - 12	6 - 9	400	8 - 10	2,500 ALLOWANCE	TBD
	c. Chantilly/State College SD (ocV!BE, Angels, OCPW, OCWD/MS4 Permit Opportunity)	Future Storm Drain Diversion, Treatment & OCWD Recharge (>500 AF/YR)	X	No	OCWD, OCPW, RWQCB	12 - 18	10 - 12	600	12 - 16	4,000 ALLOWANCE	TBD
11	River Recreation (Kayak, Electric Boats, Tube Ride, Water Jets/Fountain, Fire Water)	TBD based on City programming level of interest	X	Potentially	TBD	6 - 18	6 - 12	50 - 1,000	6 - 18	2M-10M ALLOWANCE	TBD
CA	III. COMMUNITY AMENITIES/COMMUNITY & CONNECTIVITY TO ADJACENT DEVELOPMENT OPPORTUNITIES										
12	Cantilever Decks/View Platforms										
	a. Existing Katella Bridge (South Side of Bridge)	Approx. 100 FT x 30 FT = 3,000 SF @ $800/SF = $2.5M	X	No	OCPW (Roadway)	12 - 18	8 - 12	500	10 - 12	2,500	30
	b. OCFCD Staging Area South of Cerritos Avenue (West Bank of River)	Approx. 100 FT x 30 FT = 3,000 SF @ $800/SF = $2.5M	X	No	ACOE, OCPW	12 - 18	8 - 12	500	10 - 12	2,500	30
13	Engagement with Adjacent Spaces: (5 Locations)	5 Locations @ $400K/EA = $2M	X	Potentially	Minimal	2 - 3	4 - 8	220	6 - 9	2,000	80
14	Stepped River Embankment: (5 Locations)	5 (400 LF x 10 FT High @ $250/SF) = 5 ($1M) = $5M	X	X	ACOE, OCPW	8 - 10	6 - 8	600	6 - 9	5,000	60
15	Integrated Public Education/Art (Environmental/Cultural): Multiple Locations										
	a. CA-57 Bridge Pier Columns (Lights, Color, etc.) - 15A	Lights color on 36 columns 6' diam x 20 FT tall	X	X	CalTrans, ACOE, OCTA	6 - 8	8 - 10	150	6 - 8	1,500	40
	b. Orangewood/Katella Bridges, ARTIC, SP (Upstream Pier Nose & Bridge Graphics) - 15B-E	Murals on both sides of (20) pier noses, RR Bridge Art (4 @ $300K) = $1.2M	X	X	Minimal	6 - 8	8 - 10	150	6 - 8	1,500	20
	c. Trail Mile Markers & Educational Kiosk (at 0.25 mile spacing) - 15F	20 Kiosks/Markers @ $25,000 EA = $500K	X	X	SART, OC Parks	2 - 3	4 - 5	75	3 - 5	500	20
16	Upland Habitat Restoration	Landscaping & Irrigation (Land Purchase Not Included)									
	a. City of Anaheim River Park	30% of Park Area (30% of 3.5 AC = 45,000 SF) @ $12/SF = $550K	N/A	N/A	Minimal	2 - 3	3 - 4	50	3 - 4	550	40
	b. OCFCD Property East Bank North of Katella (Possible TCA Mitigation)	9 AC Gross 70% Upland Habitat @ $500K/AC x 6.3 AC = $3.2M	X	Potentially	Minimal	3 - 5	4 - 6	200	5 - 7	3,200	250
17	Landscape Enhancement - Throughout OC River Walk	5% of OC River Walk Trails: 5% of 20,000 FT x 40 FT X $50/SF =$2M	X	Potentially	OCPW, ACOE	4 - 8	4 - 6	200	4 - 8	2,000 ALLOWANCE	100

Opportunities Permit Matrix

	OC RIVER WALK OPPORTUNITIES & DESCRIPTION	ACOE 404 PERMIT ESTIMATED JURISDICTIONAL IMPACTS		ACOE 408 (PERMIT DIFFICULTY)	OCFCD/ OCPW PERMIT	OCWD APPROVAL PERMIT	RWQCB 401 & SWPPP PERMIT	CDFW 1600 PERMIT	CALTRANS PERMIT	RAILROAD (ARTIC & SPT) CPUC, OCTA PERMIT	SART, OC PARKS APPROVAL	PERMIT GWRS TURNOUT & IMPOUNDMENT	PERMITTING SCHEDULE
		TEMPORARY (SF)	PERMANENT (SF)										ESTIMATED (MONTHS)
AT	I. ACTIVE TRANSPORTATION OPPORTUNITIES												
1	Bikeway/Pedestrian Trail Extension: Katella to Anaheim Coves (Including RR Undercrossing)	300' x 10' = 3,000 SF	300' x 16' = 4,800 SF	X - (Typical)	X	X	X	X		X			9 - 15
2	Trail Culvert Undercrossing at Ball Road (Repurpose Existing OCWD RCB)				X	X							3 - 5
3	SART East Bank Addition of River from Katella to Orangewood	—	—	—	X						X		6 - 9
4	Bike/Pedestrian Bridge across the Santa Ana River	70' x 300' = 21,000 SF	(3) (3' x 30')= 300 SF	X - (Typical)	X		X	X					9 - 15
5	River Walk Width Expansion and Connectivity (Assume 2,000 LF at River & 2,000 LF offsite)	TBD	TBD		X	X	X	X	X		X		4 - 6
6	Widen Existing Bridges for Bikes/Pedestrian												
	a. Katella Ave.	Minimal Construction Area	Pier Footprint (3) (3' x 24')= 250 SF	X - (Typical)	X		X	X					12 - 18
	b. Orangewood Ave. (Currently Road being widened to North ± 30 FT - Est. completion 2024)	Minimal Construction Area	Pier Footprint (5) (3' x 24')= 375 SF	X - (Typical)	X		X	X					12 - 18
7	SART Pinch Point Relief												
	a. West Bank at CA-57 FWY (CalTrans Retaining Wall)				X				X		X		12 - 18
	b. West Bank at ARTIC RR Crossing (Double the Width of Existing Culvert Undercrossing)				X					X	X		12 - 18
RA	II. RIVER ACTIVATION OPPORTUNITIES												
8	River Impoundment (Assume Inflatable Rubber Type Dam)												
	a. Dam North of Orangewood (10 FT High, 14 AC, 80 AF)	300' x 40' = 12,000 SF	300' x 30' = 9,000 SF (14 AC Impoundment)	X - (High)	X	X	X	X	X			X	12 - 18
	b. Dam North of ARTIC (7 FT High, 23 AC, 100 AF)	300' x 40' = 12,000 SF	300' x 20' = 6,000 SF (23 AC Impoundment)	X - (High)	X	X	X	X				X	12 - 18
9	Riverbank Modifications (Assume Full Extent of Impoundments)	9,800' x 30' = 7 AC	No Loss (Potential add 4' River Width: 1 AC)	X - (High)	X		X	X			X		12 - 18
10	Urban Stormwater Treatment (Multi-Benefit OCPW, Cities, & OCWD/Recharge Enhancement)												
	a. Existing Storm Drains Tributary to Proposed Impoundments	None	None		X		X						10 - 12
	b. Collins Channel OC WIPS (MS4 Permit)	25' x 80' = 2,000 SF	25' x 40' = 1,000 SF	X - (Typical)	X		X						10 - 12
	c. Chantilly/State College SD (OC Vibe, Angels, OCPW, OCWD)	None	None		X	X	X						12 - 18
11	River Recreation: Kayak, Electric Boats, Tube Ride, Water Jets/Fountain, Fire Water	TBD	TBD	TBD	X	X	X	X	X	X			6 - 18
CA	III. COMMUNITY AMENITIES & CONNECTIVITY TO ADJACENT DEVELOPMENT OPPORTUNITIES												
12	Cantilever Decks/View Platforms												
	a. Existing Katella Bridge (South Side of Bridge)	None	None	X - (Typical)	X								12 - 18
	b. OCFCD Staging Area South of Cerritos Avenue (West Bank of River)	None	None		X								12 - 18
13	Engagement with Adjacent Spaces: (5 Locations)			—									2 - 3
14	Stepped River Embankment; (5 Locations)	Minimal	Minimal	X	X		X	X					8 - 10
15	Integrated Public Education/Art (Environmental/Cultural): Multiple Locations												
	a. CA-57 Bridge Pier Columns (Lights, Color, etc.)	Access Only	None	X - (Minimal)	X				X				6 - 8
	b. Orangewood/Katella Bridges, ARTIC, SP (Upstream Pier Nose & Bridge Graphics)	Access Only	None	X - (Minimal)									6 - 8
	c. Trail Mile Markers & Educational Kiosk (at 0.25 mile spacing)	None	None								X		2 - 3
16	Upland Habitat Restoration												
	a. City of Anaheim River Park	None	None										2 - 3
	b. OCFCD Property East Bank North of Katella (Possible TCA Mitigation)	None	None										3 - 5
17	Landscape Enhancement - Throughout OC River Walk	Minimal	TBD		X								4 - 8
Preliminary ACOE Jurisdictional Delineation based on Q10 = 16,313 cfs (Approximate depth of flow + 6 ft)													

Photo provided by Studio-MLA

02

Baseline Conditions & Constraints

Utilities

Geography

Project Site Reconnaissance

Santa Ana River

Future Local Area Development

Baseline Conditions and Constraints

The objective of the baseline conditions assessment is to quantify and map existing utilities, terrain, hydrology, and physical properties within the OC River Walk project boundaries. The existing project site infrastructure and its original design criteria is important to understand to adequately identify physical and environmental constraints. Baseline conditions were established using data collected from mapping data available in GIS, various resources for existing information such as as-builts, previous study efforts, other adjacent projects and various modeling programs. Numerous agencies, private institutions, jurisdictions, and other public resources were contacted and sourced in order to collect existing data. The data collected was delivered in various formats such as GIS databases, as-built drawings, hydrology models, and reports. GIS was utilized to collect, organize and present the data in a visual and interactive format. The following is a list of collected data and the associated constraints that impact opportunity feasibility:

Utilities

ELECTRICAL INFRASTRUCTURE

SCE provided locations of electrical boxes, transmission lines and poles. Locations were confirmed in the ACOE Record Drawings, provided by OCPW. Locations of electrical infrastructure in the ground or overhead effects the construction feasibility of proposed opportunities and improvements.

SEWER LINES

All sewer pipelines were provided by OCSD, including the Inland Empire SARI Line that runs parallel to the Santa Ana River. Sewer lines require minimum set-backs from other pipelines. New utility connections or improvements prompted from proposed opportunities would need to respect the existing sewer setback boundaries to be feasible. Moving sewer lines is possible, but a lengthy and difficult endeavor.

STORM DRAINS

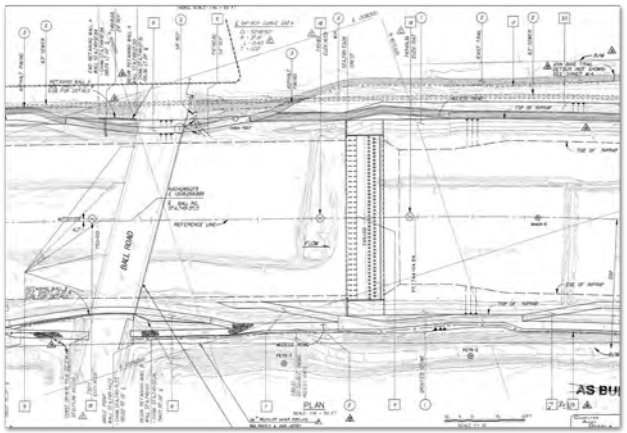
The storm drainage data was provided by the City of Anaheim and the County of Orange. A thorough survey of the project site was performed to confirm coordinates and pipe inverts. There are a total of 18 storm drains that outlet into the Santa Ana River within the OC River Walk project site. Proposed opportunities within the river would require design parameters to accommodate existing inverts and outlet locations or re-route the storm drain further downstream/upstream if there is available slope to maintain gravity flow.

DOMESTIC WATER

Domestic water pipeline data was supplied by the City of Anaheim. Domestic water lines have a setback boundary associated with their locations. These water lines exist near or adjacent to the OC River Walk project site at three locations and would need to be considered during the design of nearby proposed opportunities.

RECYCLED WATER

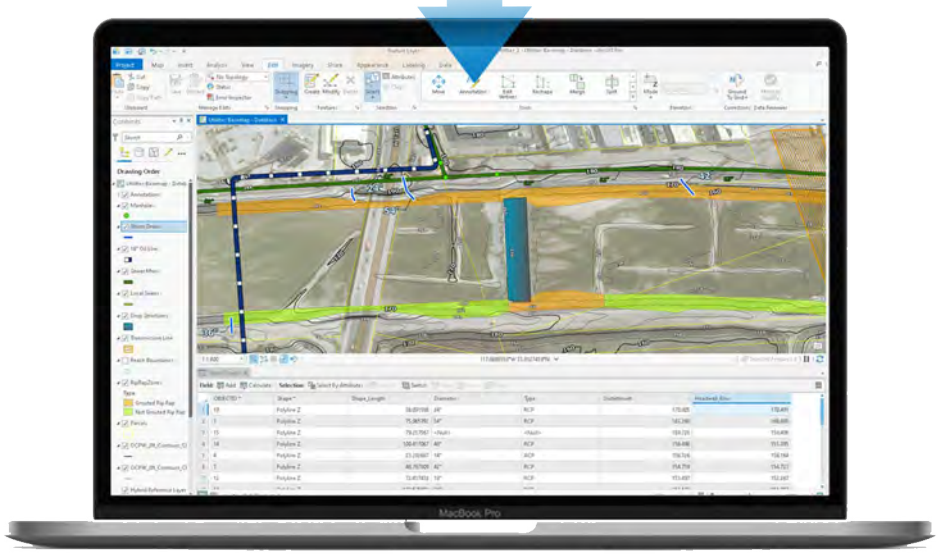
The recycled water infrastructure exists and is part of the GWRS, consisting of a 66" pipeline that runs parallel to the river in the channel right-of-way within the OC River Walk project boundary. Depths and position were collected from as-built plans provided by the OCWD. The GWRS line runs underneath the existing SART and is a noteworthy physical constraint for the design of proposed opportunities along the trail and riverbanks due to the large pipe size, required cover, and setback requirements.



Record Drawings & Construction Documents

Data from Local Utility Agencies

Site Survey Data Collection



GIS Database

▲ Data is confirmed from multiple sources and site survey inspection before compiled into the GIS database, organized into layers.

Geography

TOPOGRAPHY

The City of Anaheim supplied high-resolution LiDAR data, and one-foot contours were generated from the Bare Earth point cloud.

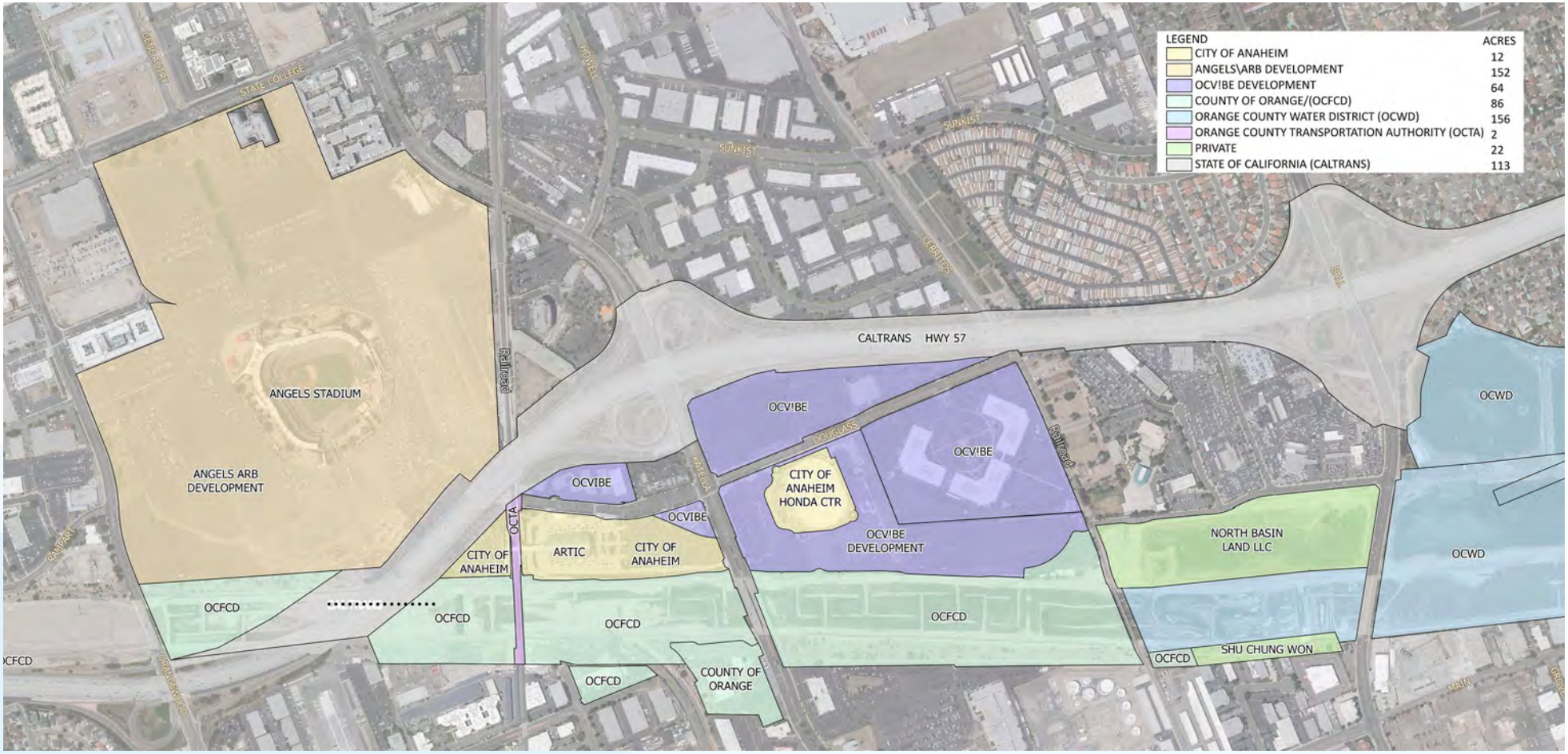
RIGHT-OF-WAY

The City of Anaheim and County Public Parcels were sources of ROW boundaries near and around the river corridor.

LAND OWNERSHIP

Data was compiled from multiple sources, including the City of Anaheim, other nearby agencies, and stakeholders, and from that data, a Land Ownership Map exhibit was generated.

▼ Land ownership boundaries in and around the OC River Walk project site (Exhibit available in Appendix I - Exhibit 03).



▲ Storm drain invert GPS coordinates were collected for the GIS database.

▲ Bridge undercrossing measurements were taken to establish available freeboard and minimum height requirements for maintenance vehicles.

Project Site Reconnaissance

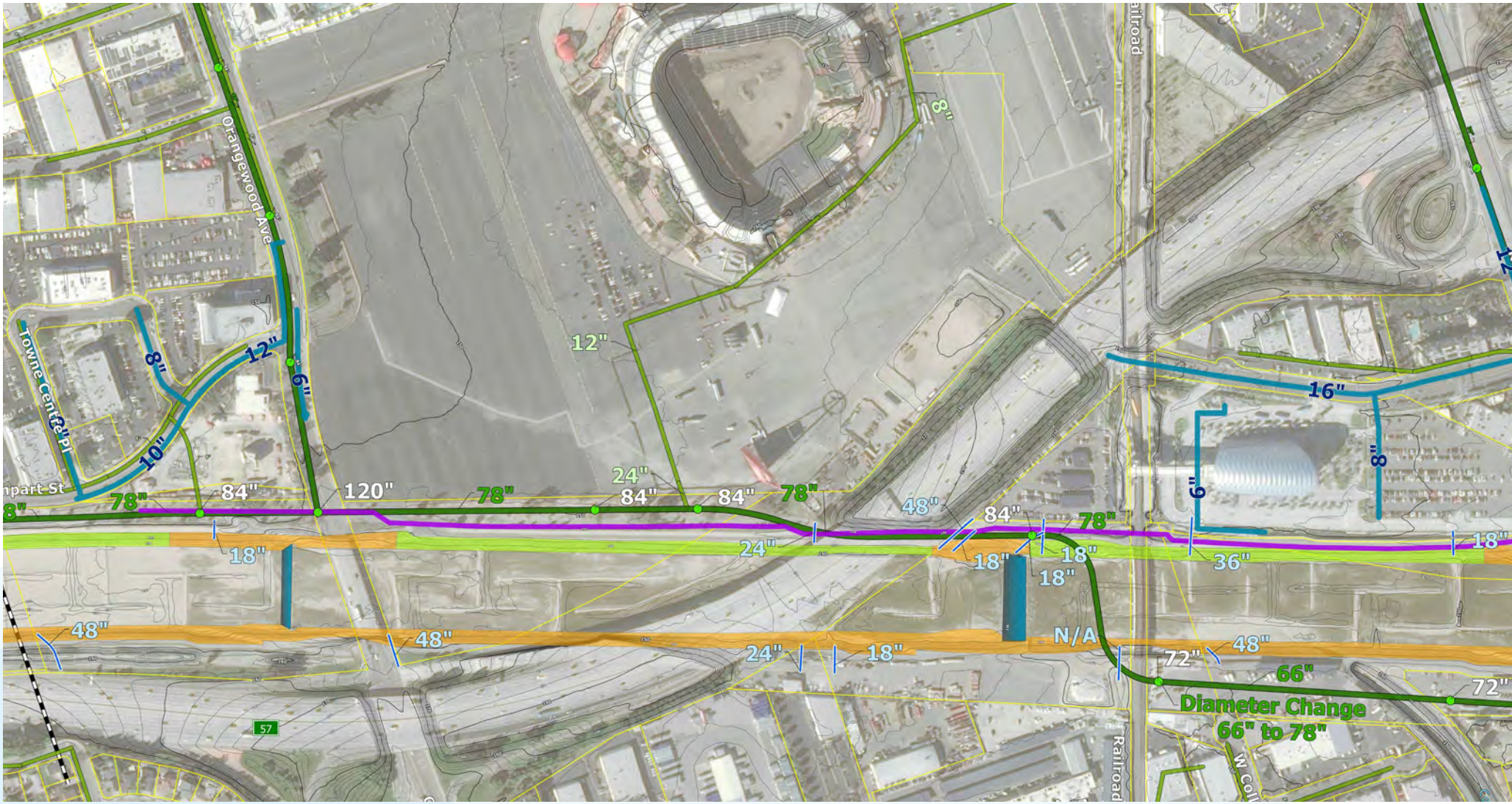
EXISTING PUBLIC ACCESS

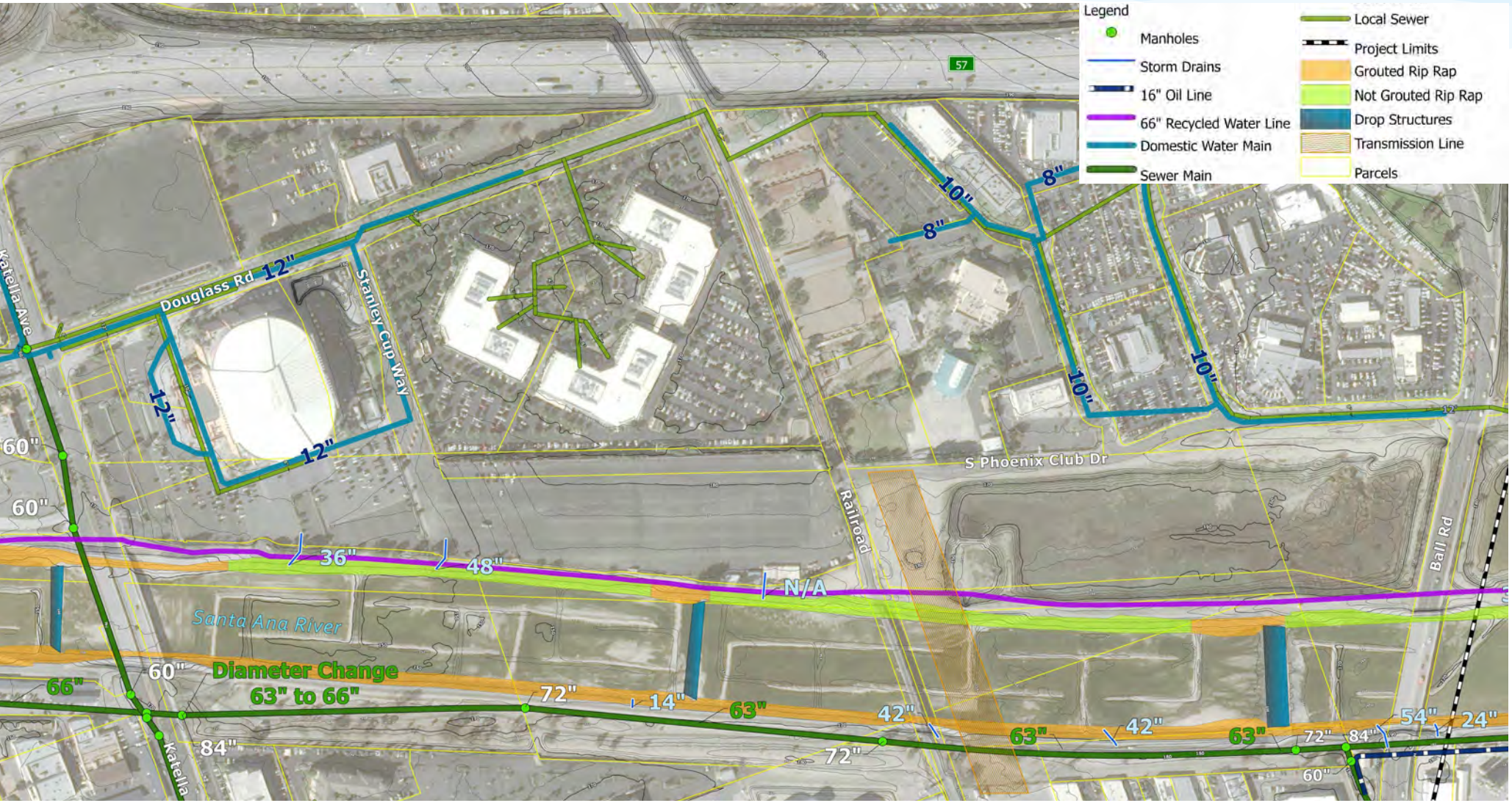
Public access along the project site is currently available at every street bridge crossing along the two-mile SART corridor. At every major street crossing (Ball Road, Katella Avenue, and Orangewood Avenue), four gates allow entry into the SART from the west bank or the east bank in either the northern or southern directions. The entrances are gated and unlocked during the SART's public hours of 7 am to 9 pm. There is also another public entrance and exit to the project site located at the adjacent ARTIC Station.

UTILITY BASE MAP

Storm drain outlet information was collected in the field using a highly accurate GPS unit at each storm drain outlet to the Santa Ana River within the project area. General locations were extracted from record drawings and GIS data and confirmed out in the field. Field verification was performed to ensure that all existing utilities and drainage infrastructure were accurately documented, and any missing data could be filled in and considered in the feasibility analysis.

The compilation of data pertinent to the feasibility study is summarized in the Utilities Base Map. The dry and wet utilities, drainage infrastructure, and flood control structures represent the baseline condition of the project site and the associated constraints that the proposed OC River Walk Opportunities will need to consider in their locations, footprint, design elements, and regulatory requirements.





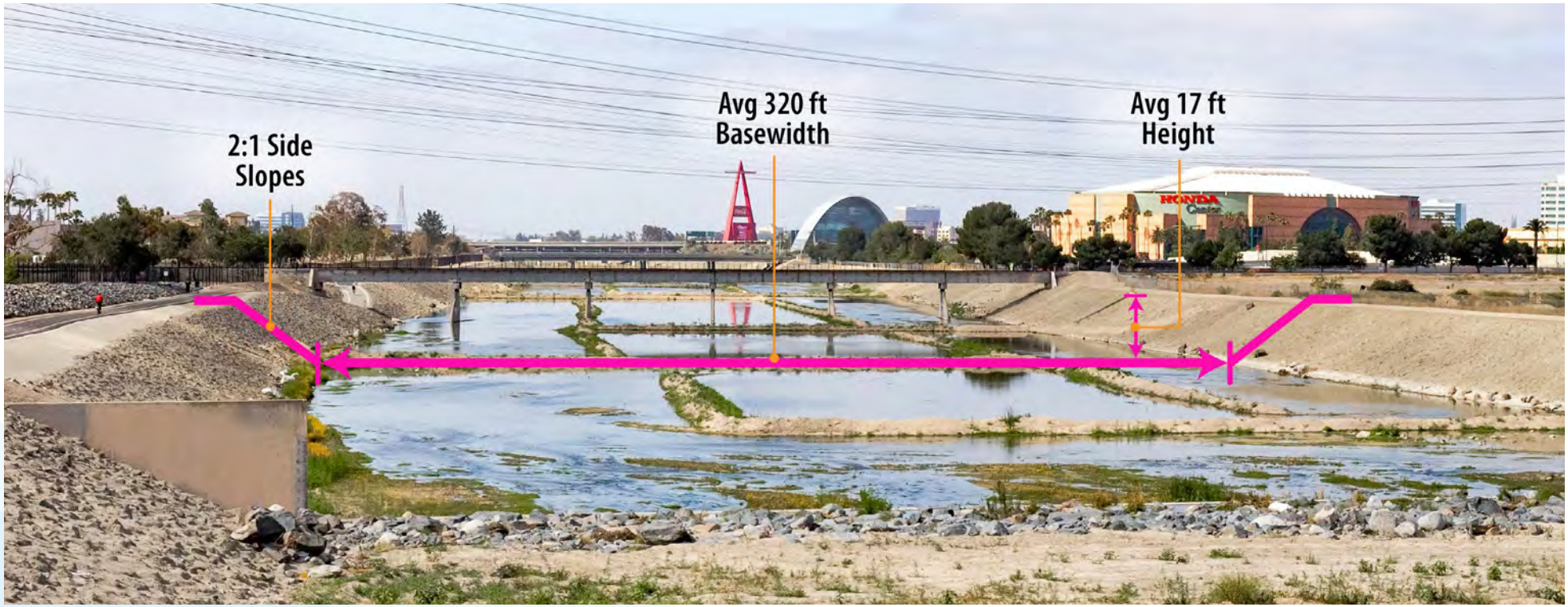
▲ The Utilities Base Map was generated from the GIS database developed for the project site. Exhibit available in Appendix I - Exhibit 04.

Santa Ana River

CHANNEL CHARACTERISTICS

The OC River Walk project is located along the downstream end of the Santa Ana River, approximately 15 miles upstream from the Pacific Ocean and adjacent to major City of Anaheim landmarks such as the Honda Center, ARTIC Station, and Angel Stadium. Hydrologically, it is a prime watershed location for aquifer recharge and impactful water quality treatments as stormwater approaches its final outlet into the ocean. The portion of the channel to be utilized for the OC River Walk is trapezoidal-shaped, with an average base width of 320 feet, concrete-lined side slopes of 2(H): 1(V), and a natural, unlined soft bottom. "T" and "L" levees are regularly graded and maintained along the river bed to create longer retention times and maximize infiltration.

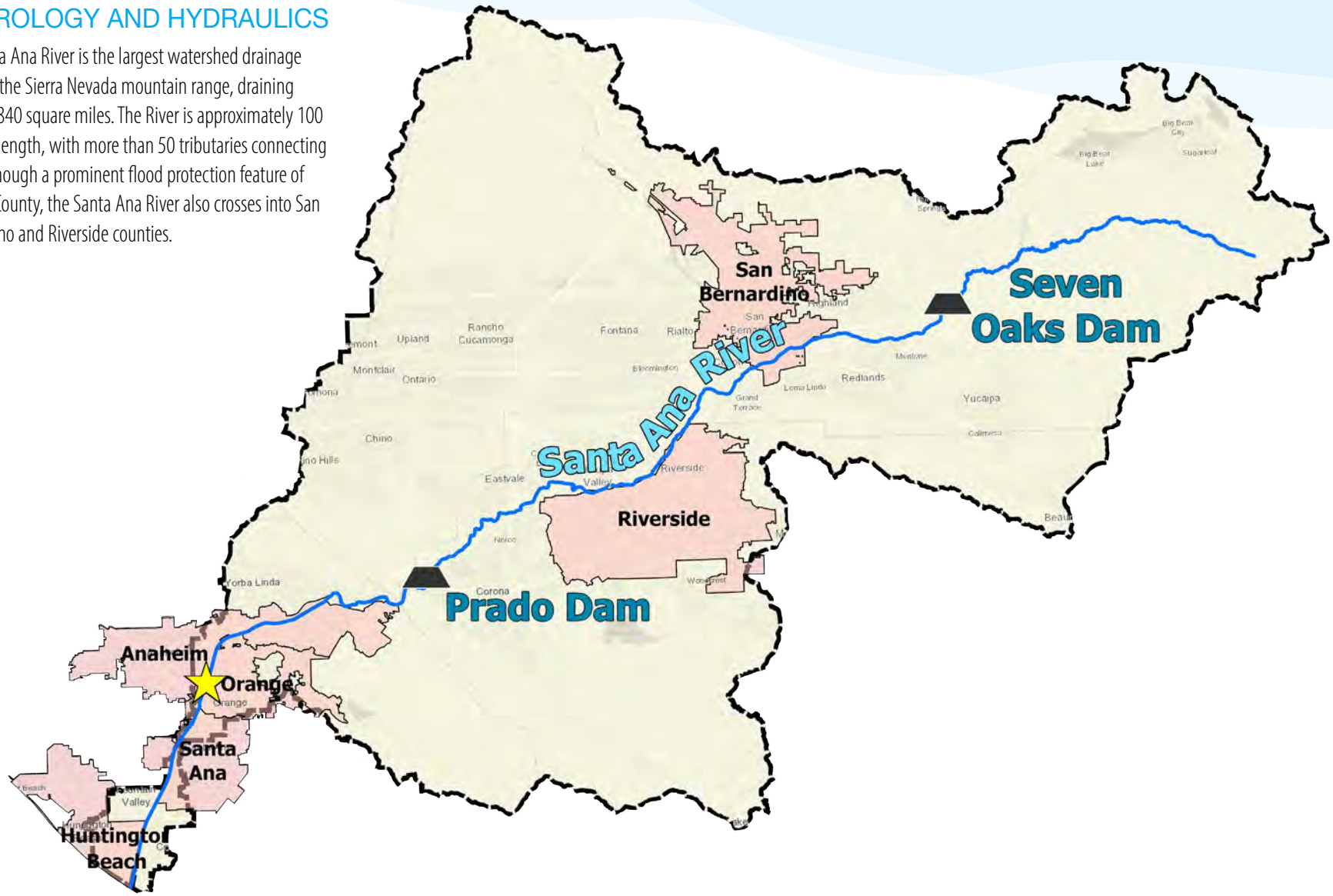
▼ Photo looking downstream of the Santa Ana River. The paved SART is visible on the left. Riprap and concrete-lined embankments are located on the left and right riverbanks, respectively. In the center, the river "T and L levees" force stormwater to flow in longer travel paths. The OC River Walk major landmarks are visible in the background: Honda Center, ARTIC Station, and the Big A.



Proposed features within the channel are limited by the available channel geometry. Any changes to the side slopes, whether increasing or decreasing that slope, would need to ensure that the current channel capacity (namely flow area) is not reduced in any way. A reduction in channel capacity translates to an increase in WSEL during large storms.

HYDROLOGY AND HYDRAULICS

The Santa Ana River is the largest watershed drainage south of the Sierra Nevada mountain range, draining about 2,840 square miles. The River is approximately 100 miles in length, with more than 50 tributaries connecting to it. Although a prominent flood protection feature of Orange County, the Santa Ana River also crosses into San Bernardino and Riverside counties.



▲ Santa Ana River watershed extents. The OC River Walk project is located approximately 30 miles downstream of Prado Dam.

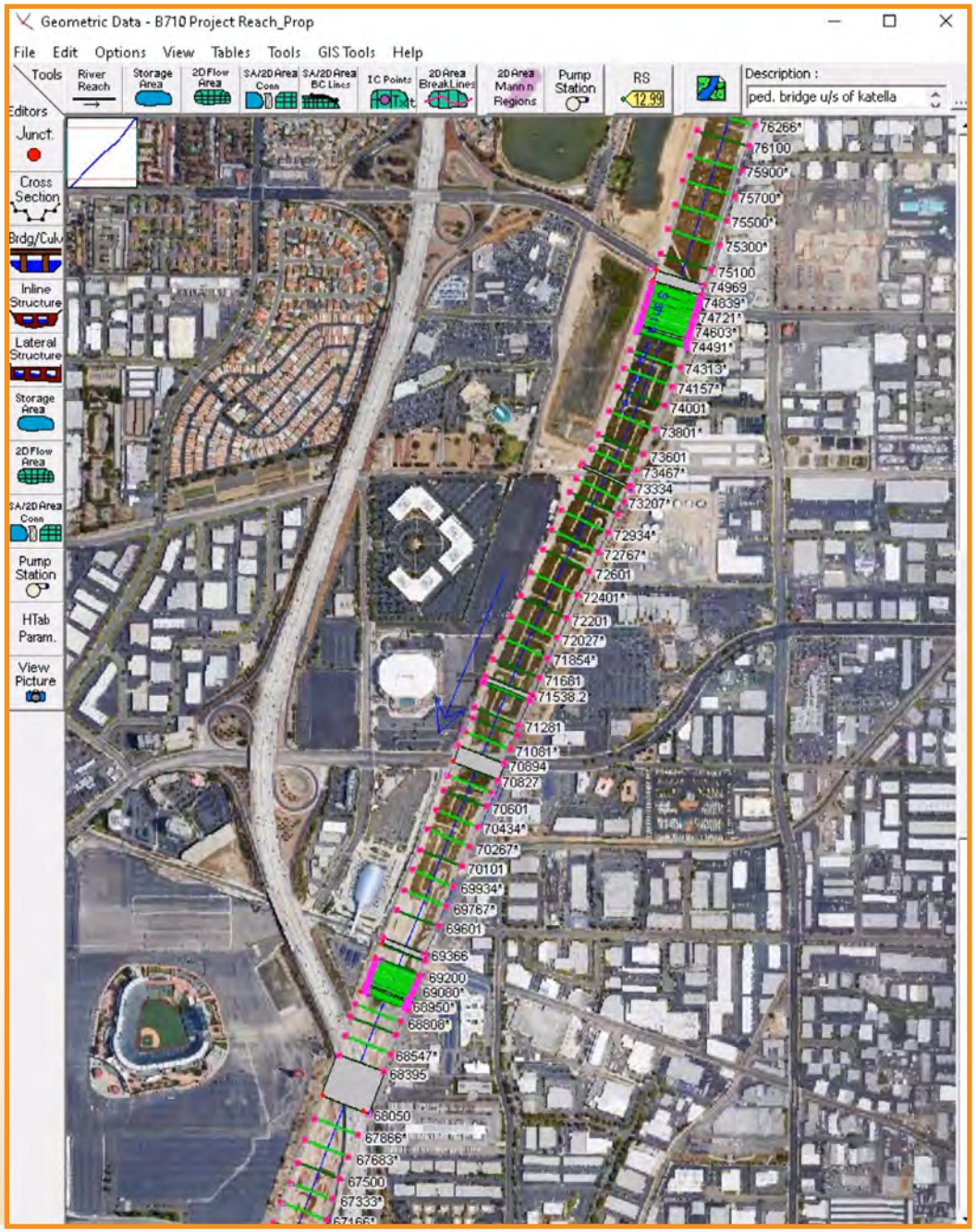
The portion of the Santa Ana River to be incorporated into the OC River Walk, was originally constructed in 1994, as shown on ACOE Record Drawing E01-101-31R. As part of the design process, the river was modeled using software produced by the ACOE, called HEC-RAS. This software uses a combination of input data involving channel geometry taken at sections regularly spaced apart and flow data, consisting of flow rates derived from a detailed hydrologic study also produced by ACOE. The model results yield outputs such as velocity, water surface elevations, and other hydraulic data, providing the necessary baseline data to support the opportunity feasibility analysis.

Most flood control facilities are required to contain no less than a 100-year storm event. A 100-year storm event is a storm with a 1% chance of occurring in any given year, unique to the area's geographic location. For example, a 100-year storm event in semi-arid Southern California is smaller than a 100-year storm event in tropical Hawaii.

The Santa Ana River 1988 Phase 2 General Design Memorandum was the hydrologic study produced by ACOE to obtain the 100-year flow rates used in the hydraulic model. The ACOE 100-year storm flow rate at the location of the OC River Walk improvements is approximately 40,000 cfs.

The ACOE HEC-RAS model is key to understanding the Santa Ana River and how it behaves hydraulically in existing conditions. All proposed opportunities rely on this existing conditions model as a baseline for comparison.

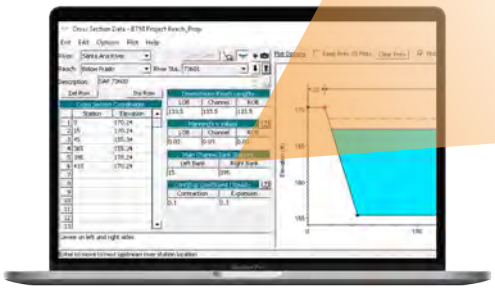
▶ Screenshot of the Santa Ana River HEC-RAS model geometric data. Proposed structures (such as new bridges or modified embankments) can be inserted into an existing condition model to understand/compare the upstream and downstream impacts of proposed design characteristics.



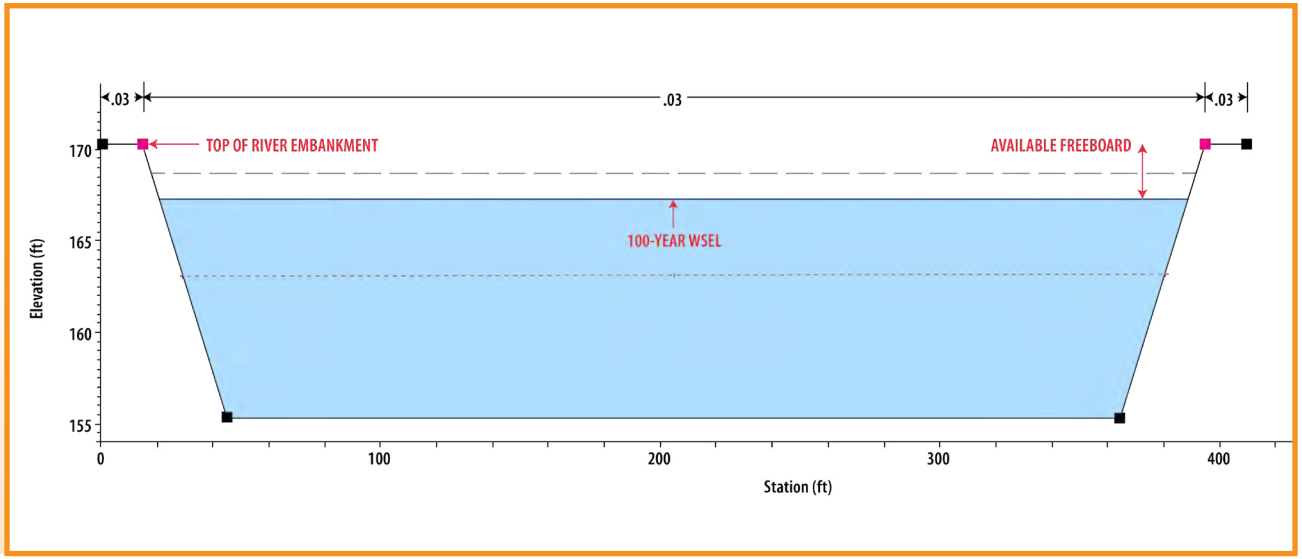
As it exists today, the Santa Ana River has an average of 4.5 feet between the 100-year WSEL and the western top of bank (freeboard); however, some portions have less freeboard than this, namely the portion of the channel between the OCTA/SCRRA Railroad bridge and the 57-Fwy. This portion of the river has 100-year water surfaces approximately 2 feet below the top of bank in the existing conditions HEC-RAS hydraulic model.

The available freeboard provides the constraint of proposed structures in and around the Santa Ana River. Proposed modifications within the channel designs should not reduce the available freeboard. The channel is, first and foremost, a flood control facility. The primary constraint on adding in-stream structures to the Santa Ana River is the potential to reduce already limited freeboard. With the addition of in-stream structures comes an increase in friction between the water and those structures. Increased friction equates to slower moving water, which, in turn, equates to greater depths of water in the channel. Any increase in WSEL in an area with already limited freeboard will not likely be approved, as it puts more properties and lives at risk in a large flood event.

Proposed in-stream structures intended for public use/access pose a concern for public safety during a storm event. At a minimum, appropriate signage would need to be posted to warn of the dangers of entering the river during a storm. Physical barriers to entry to the river might also be considered to minimize the risk of an accident occuring.



Cross-section output from Santa Ana River HEC-RAS model. Available freeboard is the difference between the top of the river embankment elevation and the 100-year W SEL.



WATER QUALITY

OCWD continuously tests the water quality of many locations along the Santa Ana River monthly, quarterly, and annually as part of their ongoing groundwater recharge projects. The Santa Ana River is an important facility currently used for groundwater recharge along the soft riverbed and in offline infiltration basins upstream of the project site. The existing water quality of the baseflow is of utmost importance to maintain when proposing any new developments or improvements in or around the Santa Ana River.

As a stormwater conveyance facility, monitoring for the presence of any abnormal amounts of minerals, solvents, and pesticides also helps to identify areas where BMP Treatment may be needed before urban storm drains discharge into the r iver.

Other water quality constituents that OCWD is currently monitoring include new emerging concerns such as PFAS, which are man-made chemicals normally found in commercial household cleaning products, paints, polishes, and non-stick products, etc. Any proposed OC River Walk opportunities should consider materials not produced or processed using PFAS.

REGULATORY AGENCIES

Within the OC River Walk project site, the Santa Ana River and its flood control functions is owned, operated, and maintained by multiple regulatory agencies:

Army Corps of Engineers (ACOE)

Federal Emergency Management Agency (FEMA)

Orange County Flood Control District (OCFCD)

Orange County Water District (OCWD)

Orange County Public Works (OCPW)

The ACOE designed and constructed Prado Dam in 1941 in response to back-to-back historic-level flooding events. Since then, the dam and the lower Santa Ana River channel have undergone reconstruction for increased flood capacity and other general improvements. The OC River Walk project proposes to continue improvements in the lower Santa Ana River channel, maintaining the flood capacity while also positively transforming the corridor.

FEMA is responsible for mapping flood zones and determining which properties are required to maintain flood insurance. As part of the flood zone mapping process, FEMA also produces hydraulic models of flood control systems like the Santa Ana River to extract water surfaces for the 100-year and 500-year storm events. For the proposed project, hydraulic modeling was requested from FEMA, but they have not created a detailed model of the reach of interest yet.

OCFCD owns the majority of the river channel, as shown on the Land Ownership Map. The operational requirements of the channel help to identify the design constraints of proposed opportunities. Such design constraints could include ensuring adequate space for maintenance ramps (minimum 15 feet wide for the Santa Ana River), and sufficient freeboard for non-levee or levee condition areas along the channel (two feet and three feet of freeboard, respectively). For channels that are not in levee conditions and are designed for a storm event greater than the 25-year event, the required freeboard is 1.5 feet above the calculated WSEL.

Levee condition is defined where the riverbank is raised above the surrounding adjacent area to contain water flow that would otherwise flood the opposite side if not for the raised riverbank. According to the online FEMA flood mapping, the western bank of the Santa Ana River is mapped as a levee condition. However, no FEMA hydraulic modeling was available for the area when it was requested.

▲ Prado Dam is located in San Bernardino County and controls the flowrate of the Santa Ana River downstream from the facility, co-owned and operated by ACOE and OCWD. The lower half of the Santa Ana River runs through the OC River Walk project corridor and is integral to the over all flood risk management project system.

Additional requirements are listed in the OCFCD design manual for levees near structures (such as bridges) and at the upstream end of the levee. This report does not describe the freeboard required for other channel conditions listed in the OCFCD design manual that are not relevant to the proposed project.

OCWD operates groundwater recharge facilities within and adjacent to the Santa Ana River. The closest facility is Burris Basin, an offline infiltration basin just upstream of Ball Road, the northern OC River Walk study limit. As part of the study, coordination with OCWD was pertinent to analyze the feasibility and design requirements of other potential groundwater recharge facilities as the project site is a prime infiltration location with proximity to other existing OCWD facilities. A technical memorandum was produced to document and define the mutual benefits OC River Walk has to offer for OCWD considerations and is available in Appendix VI.

OCWD is responsible for initiating community projects, programs, and plans for Orange County. OCPW provides services and reviews for permits and planning applications proposed projects. The OC River Walk project and its 17 opportunities fall under various categories of programming under OCPW. These opportunities would apply for conceptual review with OCPW either as an overall project with multiple infrastructure elements or as individual stand-alone projects dependent on construction phasing and/or available budget feasibility.

Future Local Area Development

One of the largest driving factors of the OC River Walk project is the upcoming development currently underway:

- **ocV!BE to develop the area surrounding the Honda Center**
- **The Big A: 2050 to develop the area surrounding Angel Stadium**
- **River Park by City of Anaheim to develop a community park and recreation area**

These future development projects will introduce additional residents, attract more local visitors, trail users, and tourists to the project vicinity, which is already a highly trafficked destination due to existing facilities (Honda Center, ARTIC, and Angel Stadium). These ongoing development activities will further activate the existing recreational areas, pedestrian foot traffic, and bikeways in the vicinity and incentivize additional infrastructure and improvements in the area, such as the ones proposed by the OC River Walk project. In addition, the Honda Center has been selected as the 2028 Summer Olympics indoor volleyball venue, providing an incentive to improve local infrastructure and accommodations to facilitate tourist recreational activities.

DEVELOPMENT	DEVELOPMENT SIZE (AC)	RESIDENTIAL UNITS	HOTEL ROOMS	PUBLIC SPACE AMENITIES (AC)	OFFICE / COMMERCIAL SPACE (AC)
ocV!BE	95	1,500	550	20	25
Big A 2050	150	5,200	1,000	12	62 / 40
River Park	3.3	N/A	N/A	3.3	N/A

These three development projects will modify the edge condition along the OC River Walk project, and the proposed land plans have been incorporated in the feasibility study. The OC River Walk, River Park, ocV!BE, and The Big A: 2050 all share the same vision of transforming the area with similar goals of increasing recreation, catalyze economic growth, and enhance the surrounding region. The OC River Walk opportunities uniquely bring connectivity and river accessibility to the area as well. Coordination between the future development projects guided refinements of the proposed OC River Walk opportunities to maximize the mutual benefits and are considered in the feasibility analysis. The sharing of proposed data and conditions assisted with opportunity design requirements and constraints for a seamless project boundary integration along the Santa Ana River corridor.

TOP ▶
Existing Edge Condition along OC River Walk project site.

BOTTOM ▶
Proposed Edge Condition along OC River Walk project site.


Photo source: Google Earth


ocV!BE FUTURE DEVELOPMENT
Photo source: Google Earth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03

Corridor-Wide Analysis

Corridor SWOT Analysis

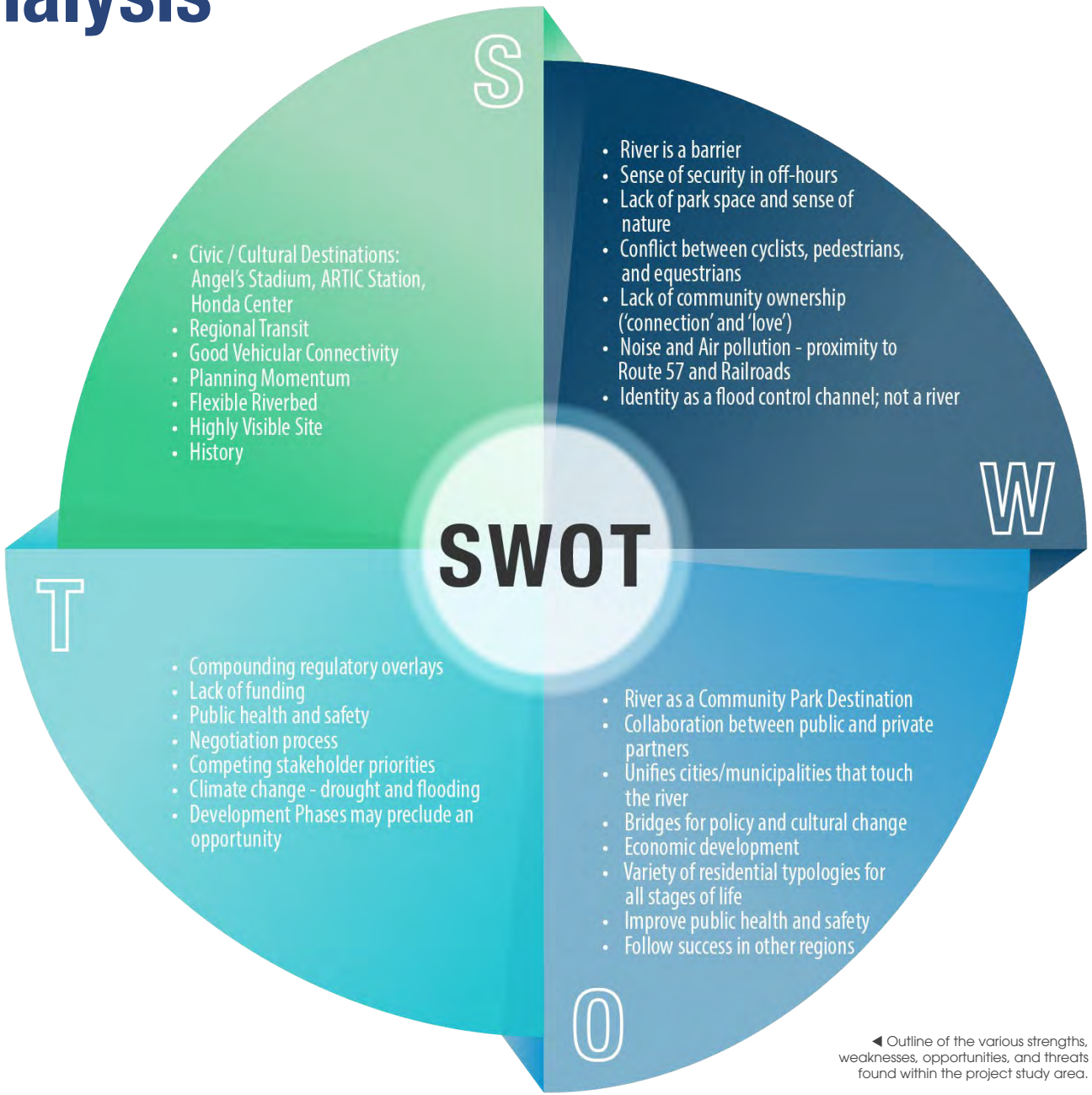
River Walk Urban Framework

Environmental Review Strategy

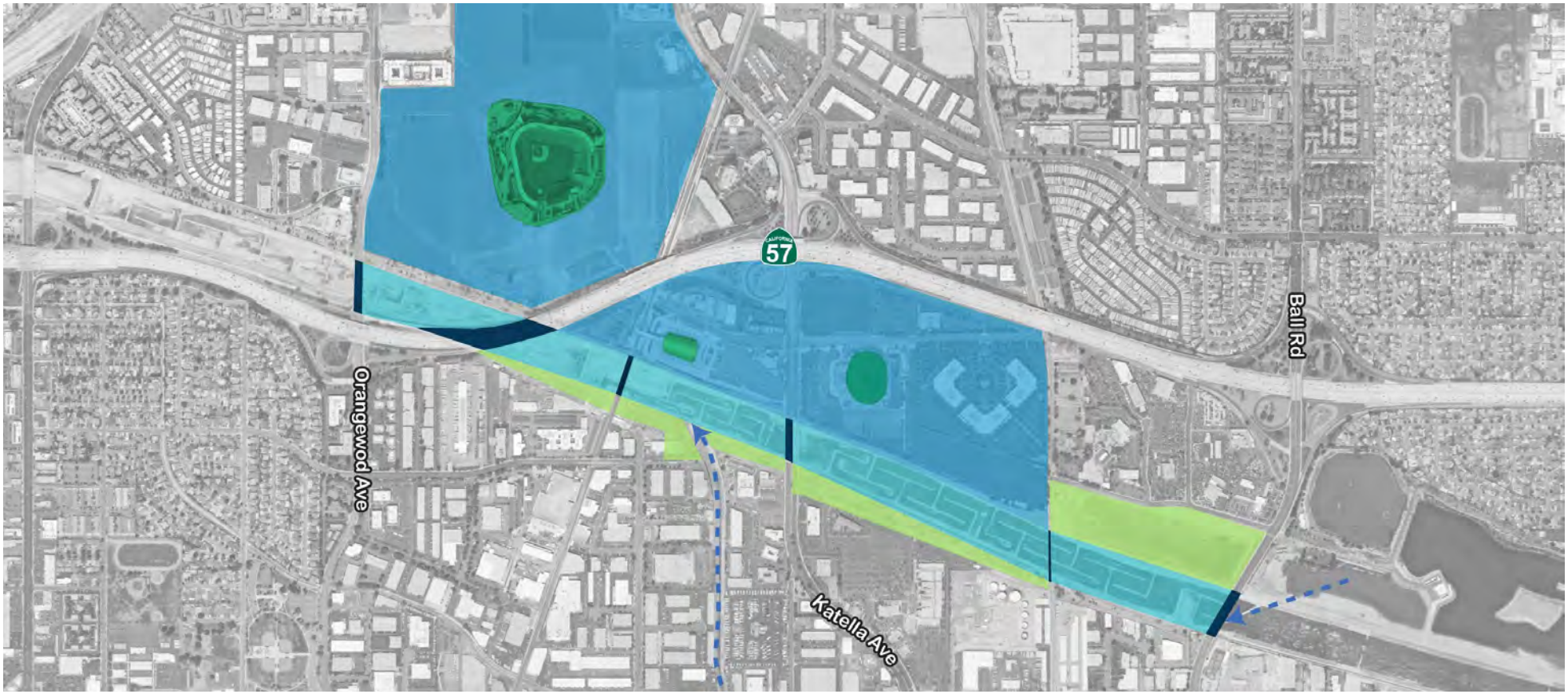
Corridor SWOT Analysis

Strength, Weakness, Opportunity, and Threats (SWOT) Analysis to understand the site area conditions as they relate to the general conditions of the proposed project.

The Santa Ana River Walk Feasibility Study seeks to identify a series of opportunities that will improve, enhance, and create a destination at the Santa Ana River while putting the health, activation, and identity of the river forward as a tremendous asset to the City of Anaheim, City of Orange, Orange County, stakeholders, and the community at large. The strength of the project area has many key factors. Among the strongest is the series of civic and cultural destinations (e.g. Angel Stadium, ARTIC Station, Honda Center) which create a unique draw and present key partners that can greatly enhance the quality of the River Walk experience. The series of planned developments along the City of Anaheim portion of the River Walk will draw more users and create a greater emphasis on pedestrian connectivity and places to occupy. The weakness of the existing condition stems largely from the fact that the Santa Ana River appears to most as utilitarian infrastructure rather than as a healthy river. This 'managed condition' of the river has created a historical "back-of-house" relationship, whereby little or no connection between people and the river occurs. Many opportunities exist to improve the current user experience and function of the River Walk. This feasibility report will provide several specific opportunities as they relate to river function, circulation/connectivity, and community amenity. The success of these opportunities lies within the collaboration and cooperation between agencies, stakeholders and future partners to fulfill the River Walk's potential.

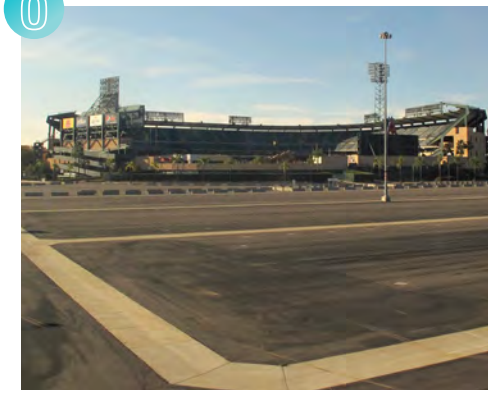


◀ Outline of the various strengths, weaknesses, opportunities, and threats found within the project study area.



Strength: Civil / cultural destinations

Weakness: Roadway / connectivity



Opportunity: Surface parking

Threat: River is "unseen," not an attraction

River Walk Urban Framework

The Urban Framework for the OC River Walk intends to frame the overarching conditions for the project with respect to both historic and future factors that have influence on the area.

At the time shortly after the completion of the Anaheim Angel Stadium in 1951, the land was mostly occupied by citrus orchards and the Santa River had just undergone a more robust transformation as a flood control channel. (see image). Seventy years later the area has become highly urbanized yet lacking focused activation to the public realm and slow to create much needed park space to the community. Although the Santa Ana River lacks in green space and through much of the year, water, it has drawn people to utilize its embankments as key circulation corridor for cyclists, runners, pedestrians, and equestrians.

The Urban Framework diagram distinguishes the River Walk into four reaches – reach one: "The Big A: 2050", reach two: ARTIC Station, reach three: ocV!BE, and reach four: Future Residential. The reaches are directly influenced by their adjacent land/property providing a more active/passive response to the improvement. The four reaches include both sides of the river and are determined by the existing roads and rail corridors.

TOP ▶
Aerial Photo 1948. The Santa Ana River reflects its prechannelization condition as "braided stream" having a much broader reach across the mostly agrarian landscape.

BOTTOM ▶
Aerial Photo 1968. The Santa Ana River post channelization and early urbanization of land takes place including the completion of 'Anaheim Stadium'.

The following categories represent a response and condition that lends to the context of the urban framework – each range from a more active, transitional to passive setting for change.

URBAN ACTIVE

Maximize potential for activation through the connectivity of circulation and active programming including events that promote active recreation in the river.

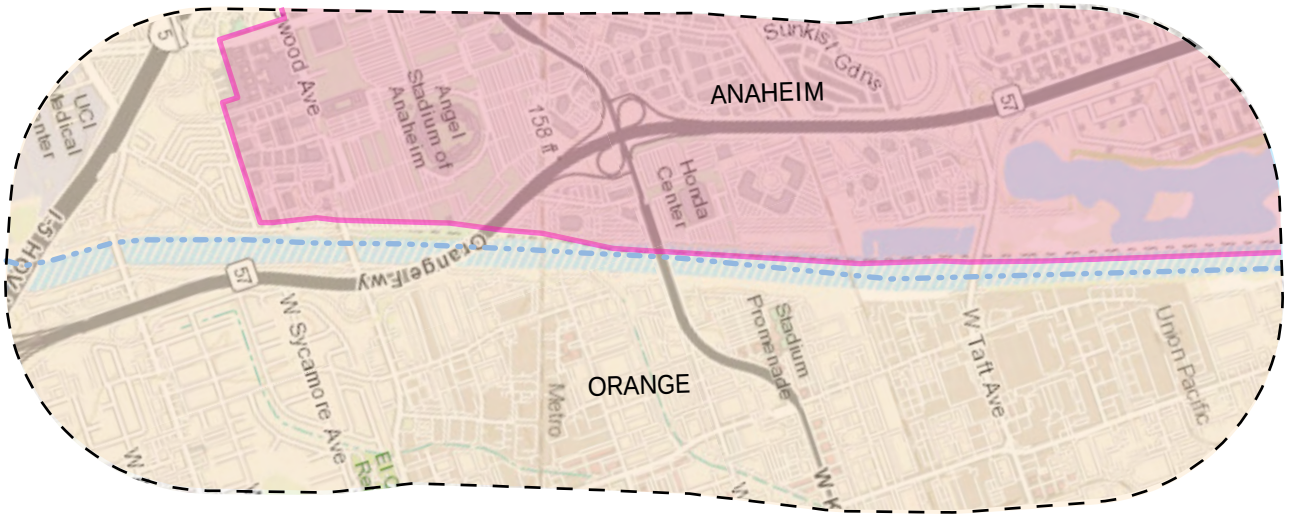
CIVIC TRANSITION

Provide a transitional character that promotes connectivity, facilitates various programming, and augments experience along the river through cultural interpretation.

ECOLOGICAL EDGE

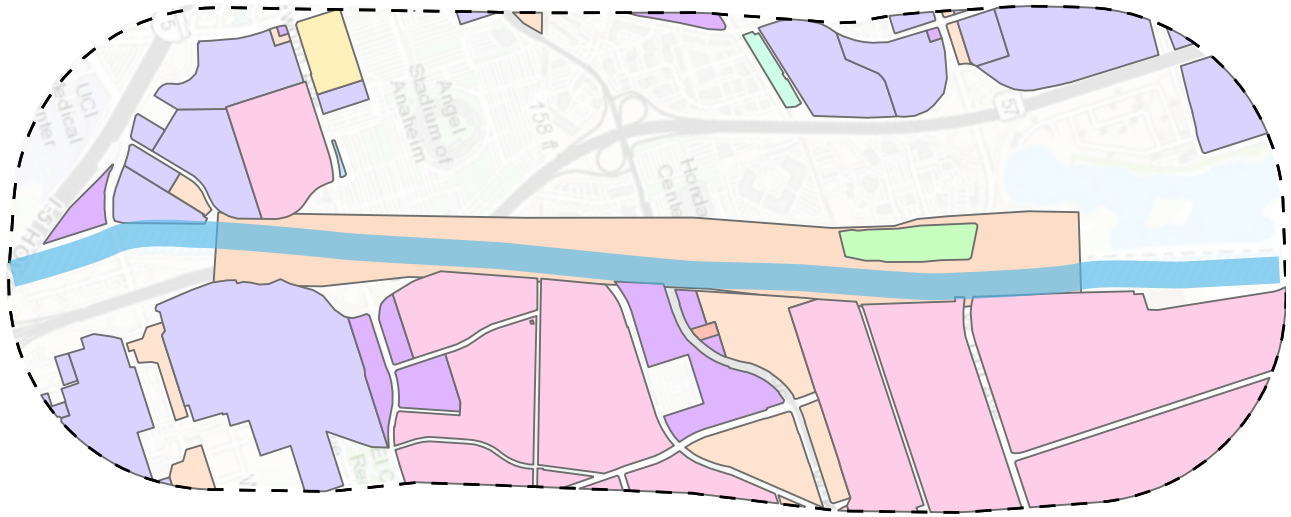
Established areas to maximize river's riparian habitat and character, large scale tree planting (i.e. "Filter Forests"), and opportunities for river channel modification for enhanced capacity.

The Santa Ana River Walk will provide an important public interface to the Santa Ana River. Many of the land/parcels within the City of Anaheim along the Santa Ana River are planned for development within the near-term horizon, whereas most of the land/parcels within the City of Orange are still largely unplanned and present a question of change from their current uses.



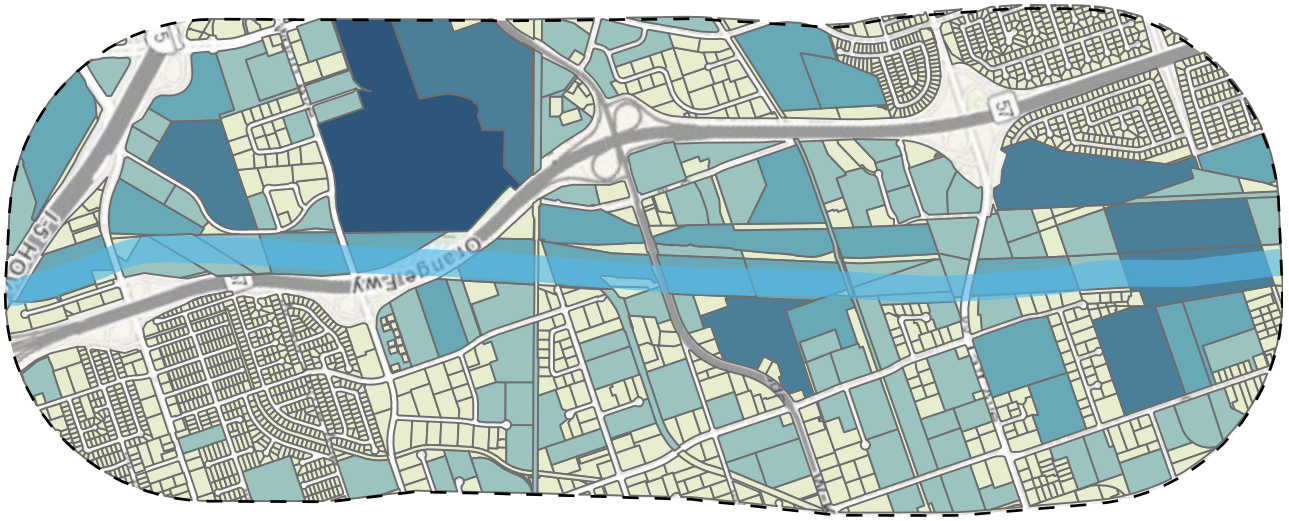
MUNICIPALITY

- Anaheim
- Orange
- Santa Ana River (centerline)



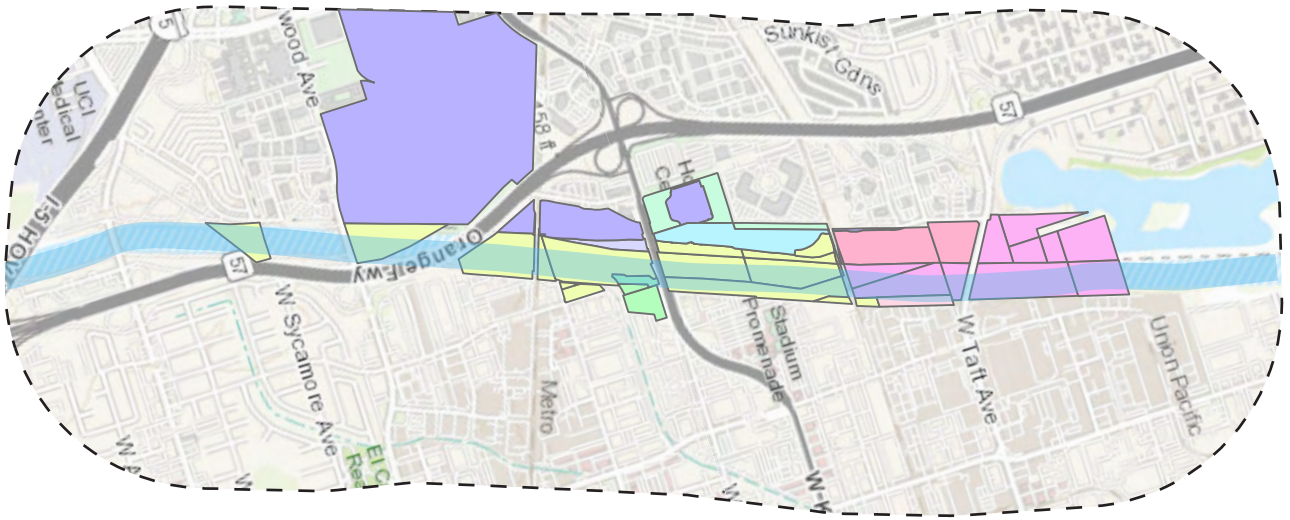
LAND USE

- Basin
- Commercial
- Construction
- Grass
- Greenfield
- Industrial
- Meadow
- Residential
- Retail
- .5 mi Buffer
- Santa Ana River



PARCEL SIZE

- 0 - 2
- 3 - 8
- 9 - 20
- 21- 45
- 46 - 99
- .5 mi Buffer
- Santa Ana River



OWNERSHIP

- City of Anaheim
- County of Orange
- FCD LLC
- North Basin Land LLC
- Orange County
- Orange County Flood
- Orange County
- Water
- Shu Chung Won
- TS Anaheim LLC
- .5 mi Buffer
  Santa Ana River

◀ For updated ownership map, see exhibit in Appendix – Exhibit 03.

ANGEL STADIUM

Angel Stadium is planning to develop the existing surface parking into a mixed-use development that would add residential, hotel, office, retail uses as well as parks and open spaces. This development has the potential to extend its planned circulation ways to meet the edges of the river and promote connectivity to and from the development, creating a more engaged and dynamic experience. For this reason, coordination along the river's edge will be important to ensure accessibility and maximize programming opportunities.

ARTIC STATION

The ARTIC Station provides regional access to the River Walk and surrounding destinations. It is important to consider both pedestrian and bicycle infrastructure to support enhanced mobility (i.e. "First-Last Mile Connectivity") as well as provide opportunities for a more civic address to the river. The existing conditions for the ARTIC Station and rail corridor create both constraints and opportunities for access and circulation.

HONDA CENTER

The Honda Center and surroundings is also included as part of the planned ocV!BE development which intends to provide a mix of uses that creates daily interest for retail, office, hotel and residential uses. This reach of the river currently provides the County bike trail connection across the river via Katella Drive. On the City of Orange portion of the reach, the existing retail shopping mall attracts people for both shopping and parking (to then walk to access events at Honda Center, Angel Stadium.)

PROJECT BENEFITS

Community Destination
- Prominent, unique, and welcoming presence Integration of historical legacy
- Community Park as destination - "Living Room"

Neighborhood Character
- Strengthens the sense of Community
- Foster safe, walkable streets, and quality of life Human-scaled: Responsive to Neighborhood Scale
- Collaboration between public and private resources Riverine Open space

Balanced Land Use
- Community serving commercial and amenities
- Retail that supports local businesses
- Variety of residential typologies for all stages of life Civic components that serve and celebrate

Connectivity & Equity
- Porous and permeable edges
- Adjacency between synergistic programs and amenities View corridors and light
- Invite everyone in

Resilience & Sustainability
- Promote Wellness & Fresh Food
- Energy Efficiency
- Water Management
- District Resources
- Crisis Response

RESIDENTIAL

The planned residential community will attract people to live on the river – creating a greater need for access, connectivity to transit and park space. This area is a desirable location to provide open space that can both fulfill passive open space programming, walking, jogging and modest recreation while also greatly contributing to the restored Riparian habitat of the embankments.

Environmental Review Strategy

Below is the suggested environmental review strategy for both NEPA and CEQA.

NEPA

The Santa Ana River is considered a "water of the United States." Section 404 of the CWA generally requires that a permit be obtained from the U.S. Army Corps of Engineers to discharge dredge or fill material into "navigable waters." The term "navigable waters" is defined as "the waters of the United States, including the territorial seas." In turn, the Corps of Engineers and the "EPA" have each adopted rules that define "waters of the United States" to include virtually every type of water body imaginable, as well as the tributaries of such waters. Under the Section 404 permit program, regulated "discharges" include activities such as placing fill material into a watercourse or wetland area in connection with routine construction activities.

The general assumption in site planning is that if overall impacts to waters of the United States are one-half acre or less, then the project is likely to qualify for an NWP and permitting is likely to take (from submittal of preconstruction notice) less than a year. If impacts exceed an acre or wetlands would be filled, however, an individual permit will likely be needed, which may take up to one year to process. Additionally, the need for an individual 404 permit normally require review under the NEPA before the permit can be issued. In reviewing the activities associated with the Proposed Project, all activities within the Santa Ana River could be mitigated to a less than significant impact. Therefore, the appropriate NEPA document would be an EA in support of a FONSI.

CEQA

Since the Project Site includes the Santa Ana River, a review of biological resources potentially affected by the implementation of the Proposed Project, including existing and potential biological resources within the Project Site would be required. Biological resources include common vegetation and wildlife, sensitive plant communities, and special status plant and animal species. Special status species and their habitats would be evaluated for potential impacts as a result of the Proposed Project. Additionally, before European contact, the Tongva (Gabrielino) Indians, who lived along the Santa Ana River basin, set up temporary camps here for gathering food. AB 52 consultation would be required for the Proposed Project and would be fulfilled as part of the CEQA process.

Based on our review of the project-related materials, our understanding of CEQA, and the environmental issues associated with the project, it appears that the appropriate CEQA document would be an EIR at this time.

CEQA requires that all state and local governmental agencies consider the environmental consequences of projects over which they have discretionary authority prior to taking action on those projects. It is anticipated that the EIR would address would address the following environmental topics:

- Aesthetics
- Air Quality
- Biological Resources
- Cultural Resources
- Geology and Soils
- Greenhouse Gas Emissions
- Hydrology and Water Quality
- Noise
- Recreation
- Transportation
- Tribal Cultural Resources

The EIR would evaluate the project's impact related to each topic. The analysis will provide a conclusion that describes the significance of the project's impact before and after mitigation. The analysis to support such conclusions will consider all applicable environmental regulations and policies as well as guidance provided by responsible, trustee, and oversight agencies.

EIR STRATEGY

River Walk, while identifying potential environmental impacts at a cumulative scale. This approach leverages the current level of planning detail to avoid future duplicative environmental impacts analyses.

For the opportunities that have been planned in enough detail that the location, scale and specific elements are defined, a project-level EIR analysis will be performed and incorporated into the Program EIR document. For opportunities requiring additional refinement for adequate environmental impact analysis, future addenda tiering off of the Program EIR may be prepared, or separate Project EIRs may be developed, if considered necessary to comply with CEQA.

MITIGATION MONITORING AND REPORTING PROGRAM

Preparation of a MMRP based on mitigation measures identified in the EIR and pursuant to Section 21081.6 of the CEQA Public Resources Code would be required. The MMRP will be defined through working with City staff to identify appropriate monitoring steps/procedures in order to provide a basis for monitoring such measures during and upon project implementation. It will be in standard City format and will identify the significant impacts that would result from the Proposed Project; proposed mitigation measures for each impact; the timing at which the measures will need to be conducted; the entity responsible for implementing the mitigation measure; and the City department or other agency responsible for monitoring the mitigation effort and ensuring its success.

Discretionary Approvals and Permitting Requirements

The table below lists the discretionary approvals and permitting requirements that would be required under the Proposed Project. The Project Site is located in the City of Orange, however, the City of Anaheim would have the greatest involvement in carrying out the project. Therefore, it is anticipated that the City of Anaheim would be the Lead Agency for the project and the City of Orange would be a responsible agency.

LEAD AGENCY	ACTION
City of Anaheim City Council	• Certify the EIR. • Adoption of Mitigation Monitoring and Reporting Program . • Annexation from the City of Orange into the City of Anaheim (if necessary). • Approval of the Santa Ana River Corridor Concept Plan.
RESPONSIBLE AGENCIES	**ACTION**
South Coast Air Quality Management District	• Issue necessary air quality permits to implement the project.
State Water Resources Control Board (SWRCB) with Santa Ana RWQCB providing local oversight and enforcement	• Issue a NPDPES Permit to allow for the implementation of the project. • Compliance with all applicable water quality standards as specified in the Santa Ana River RWQCB Basin Plan. • Issuance of a 401 Water Quality Certification.
City of Orange	• Issuance of grading permits, approval of street improvement plans.
Caltrans	• Provide necessary encroachment permits, if necessary.
Orange County Public Works	• Encroachment permit for retaining wall.
Army Corps of Engineers (ACOE)	• Adoption of the EA/FONSI. • Issuance of an individual 404 permit.
California Department of Fish and Wildlife (CDFW)	• Section 1602 Streambed Alteration Agreement, if necessary.


Coca-Cola
ECOWATER
Santa Ana
Orange
Long Beach
Orangewood Ave
WATCH FOR MAINTENANCE VEHICLE
BIKE PATH
NO MOTOR VEHICLES

04

Opportunities Refinement & Analysis

1. Bikeway / Pedestrian Trail Extension
2. Trail Culvert Undercrossing at Ball Rd.
3. SART East Bank Addition
4. Bike / Pedestrian Bridge
5. River Walk Width Expansion
6. Widen Existing Bridges
7. SART Pinch Point Relief
8. River Impoundment
9. Riverbank Modifications
10. Urban Stormwater Treatment
11. River Recreation / Programming
12. Cantilever Decks
13. Engagement with Adjacent Spaces
14. Stepped River Embankment
15. Integrated Public Education Art
16. Upland Habitat Restoration
17. Landscape Enhancement

1

ACTIVE TRANSPORTATION – OPPORTUNITY #1

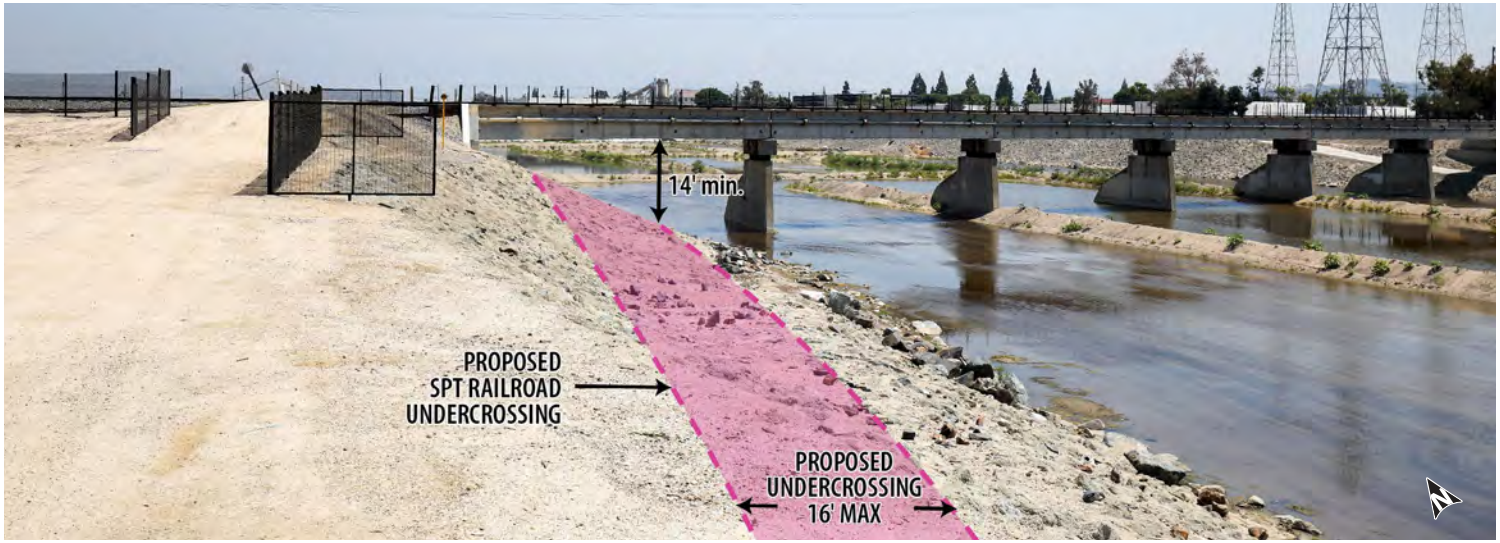
Bikeway/Pedestrian Trail Extension: Katella to Anaheim Coves (Including RR Undercrossing)

Opportunity

Open a bikeway and pedestrian trail along the west bank from Katella Avenue to Ball Road, which includes a proposed undercrossing at SPT Railroad, and connect the trail to the Anaheim Coves Trailhead.

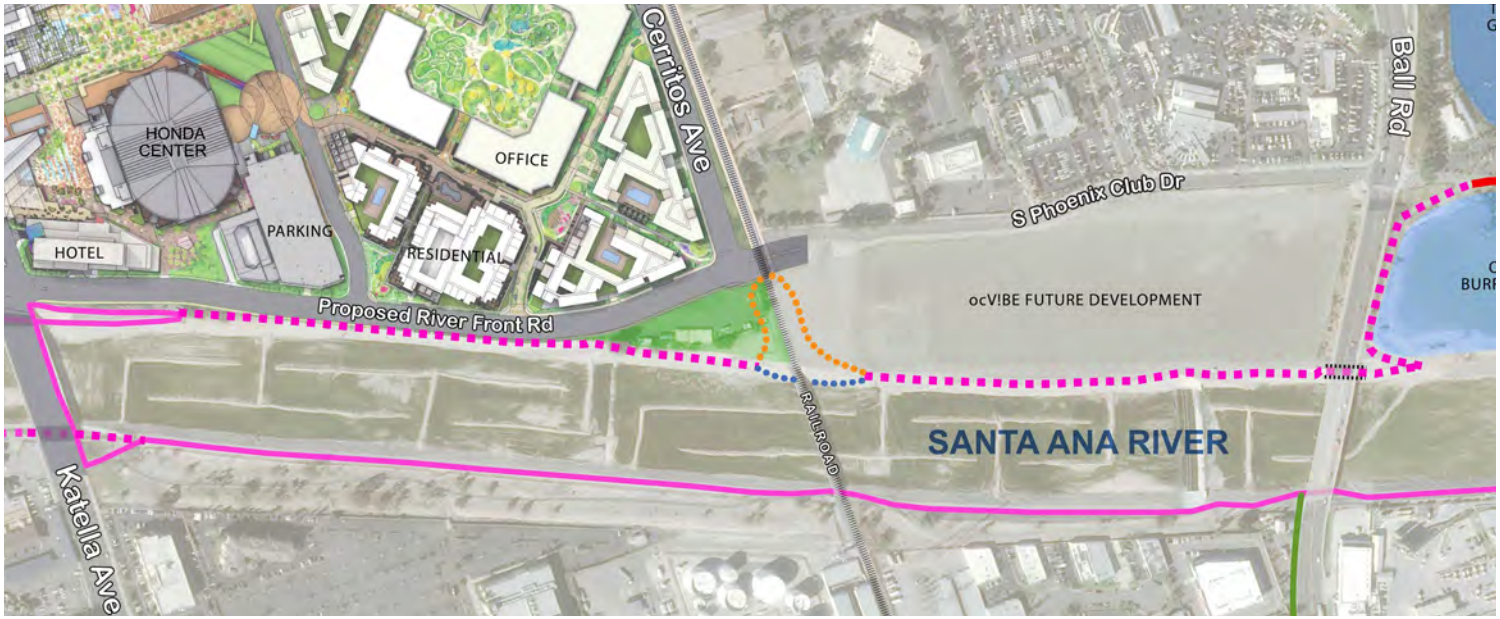
The mapped SART exists on the east bank of the river from Ball Road to Katella Avenue, then crosses over the Katella Avenue bridge, to continue along the west bank towards Orangewood Avenue. An existing maintenance road on the west bank from Ball Road to Katella Avenue provides an opportunity to create a ¾-mile-long bikeway and pedestrian trail that connects to the popular 3-mile-long Anaheim Coves trailhead. As the photo below shows, the maintenance road is currently gated/fenced off blocking public use and access due to unsafe conditions at the SPT railroad crossing.

▲ At the west bank Katella Ave. turnaround, looking north at the gated maintenance road in between Katella Ave. and Ball Rd.



The SPT Railroad bridge crosses the Santa Ana River approximately midway between Katella Avenue and Ball Road. There are two options for the proposed trail extension to cross the SPT Railroad.

◀ Photo shows existing condition SPT railroad – looking northeast from westerly bank. The western bank does not have an undercrossing and a black gate/fence prohibits access across the railroad. Option A potential footprint and alignment is highlighted.



LEGEND

Opportunity #1

- OC River Walk Pedestrian / Bike Opportunities
- RR Crossing Option A
- RR Crossing Option B

Existing

- Exist. Santa Ana River Trail (SART)
- Exist. Anaheim Coves Trail
- Exist. Class III Bikeway
- Exist. Bridge Undercrossing

◀ Plan view of proposed AT #3 extents and connections.

Option A is to provide an undercrossing along the West bank in similar fashion to the existing East bank undercrossing. Option B is to route the trail to the future at-grade street crossing along the proposed River Road. Both options will allow the new bikeway and pedestrian trail extension to connect all the way from Katella Avenue, past Ball Road, and to the Anaheim Coves Trailhead.

This opportunity for a new stretch of proposed trail extension and improvements would provide active transportation connection along the west bank for numerous destinations: Anaheim Coves, the SART, ARTIC Station, the proposed ocV!BE development, and the proposed The Big A: 2050 project at Angel Stadium.

▲ Detailed isometric aerial of proposed connection to Anaheim Coves Trailhead.

▲ Rio Vista St. trailhead entrance for Anaheim Coves.

Feasibility Considerations

Trail improvements are estimated to be approximately 5,600 LF and 30 feet wide to make way for both cyclists and pedestrian usage safely. The width along the existing maintenance road on the west bank varies between 12 to 32 feet and is interrupted by railroad tracks approximately 0.45 miles north of Katella Avenue. The proposed trail extension and improvements along the west bank can feasibly follow the existing maintenance road alignment.

Developing a trail on the west bank will require crossing the SPT Railroad tracks. A locked gate currently restricts access across the tracks, used for rail traffic approximately once a day.

▶ On west bank, looking south at the proposed SPT undercrossing footprint and alignment. A similar at-grade gate & fence to be installed on the North side, identical to the South side.

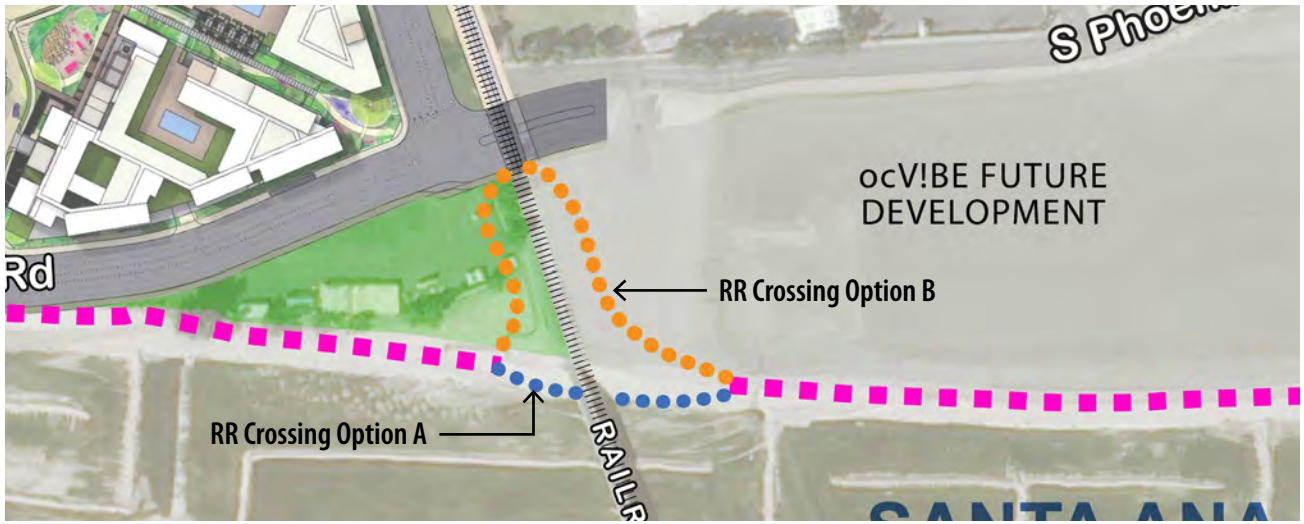
There are two potential options for the proposed multipurpose trail across the SPT railroad tracks. Option A will develop an undercrossing along the riverbank similar to the existing undercrossing on the east bank, while Option B will route the trail to the at-grade crossing at proposed River Road/Phoenix Club Drive intersection. Both options can satisfy the design requirements per the Santa Ana River Park and Open Space Master Plan and provide a multi-use connection between the SART, Anaheim Coves, ocV!BE, ARTIC, and Angel Stadium.

Each option has its own unique set of opportunities and constraints. For Option A, while initial analyses conducted suggest that an undercrossing along the railroad will have minimal impacts to flooding, hydrologic studies will be required to ensure that any impacts on river flow during flood events are eliminated or minimized. Coordination will be required with OCFCD to ensure operations will not be impacted through utilization of the undercrossing, while coordination with ACOE will be required if any modifications to the riverbank occur as a result of improvements associated with the undercrossing.

For Option B, routing the trail away from the undercrossing provides an opportunity to cross concurrent with proposed River Road. In order for this option to occur, it assumes that proposed River Road will include an at-grade crossing that meets all CPUC requirements, including provisions for pedestrians and bicyclists. It will also require coordination with OCFCD to route the trail across their property, which is currently used as a staging area. Option B adds approximately 500' to the travel distance required to cross the railroad tracks. Overall, Option A allows for a more-direct, safe, and uninterrupted connection from attractions south of Katella Avenue to those north of Ball Road compared to Option B.

As the trail/path continues north, the proposed Ball Road crossing anticipates use of the existing riverside ramps and Ball Road bridge that is currently only used by OCFCD/OCWD for maintenance access (see the photos).

▲ On west bank, looking south at the proposed SPT undercrossing footprint and alignment. A similar at-grade gate & fence to be installed on the North side, identical to the South side.



Design Requirements

DESIGN ELEMENTS

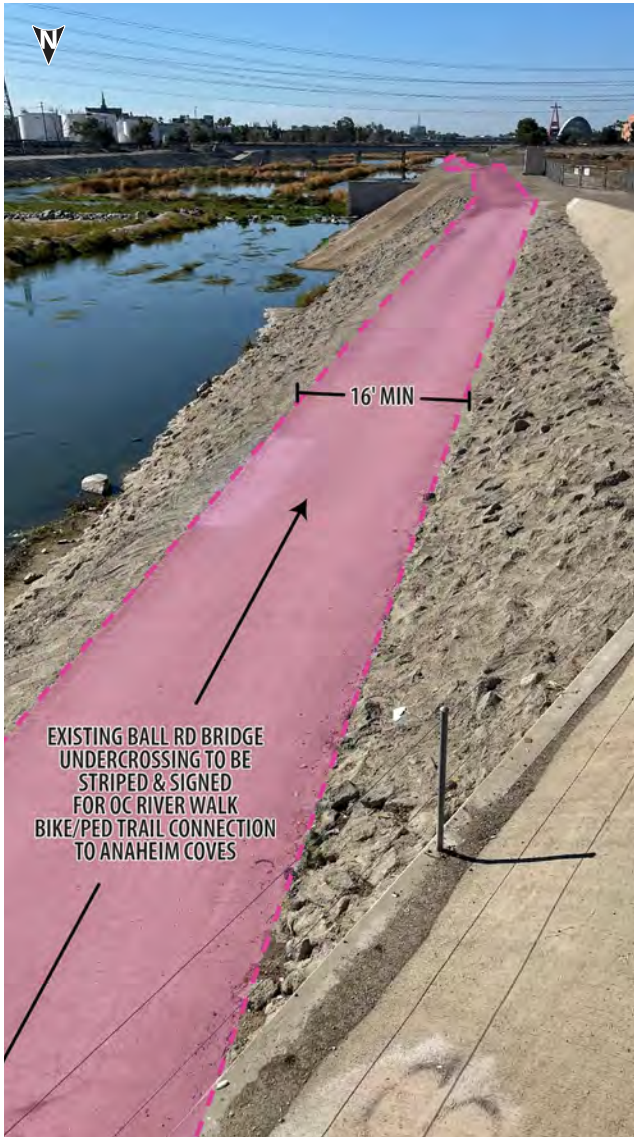
The paved bike path from Katella Avenue to Ball Road would connect with the existing SART and must meet minimum Caltrans design standards – a 10-foot-wide paved path with 1-foot-wide shoulders on both sides. The trail must allow for continued use of the maintenance road by OCWD and OCFCD per operations and maintenance requirements. Signage and gates will control pedestrian and bicycle traffic during maintenance activities that are not compatible with public use of the trail.

Trail design and configuration will need to avoid significant impacts to hydrologic regime, especially during flood events. Safety considerations include meeting all safety requirements related to pedestrian/bicycle railroad crossings.

There are opportunities to add place making elements along the route such as interpretive signage, directional/informational signage, and public art. The design of functional components such as gates and railings should be consistent with other OC River Walk segments.

TOP ▶
The available width for proposed OC River Walk improvements along the existing maintenance road between Katella Avenue (bridge pictured in the distance) and Ball Road.

BOTTOM ▶
Proposed OC River Walk South of Ball Road.



▲ The existing undercrossing at Ball Road bridge to be utilized for trail extension and connection.

▲ West bank, looking West toward the existing trail between Ball Road and Burris Basin, leading to S. Phoenix Club Dr.

TECHNICAL STUDY REQUIREMENTS

Technical studies will include a hydrologic study to determine the impacts of trail improvements along the river corridor (which may include bank modifications per RA#9), and a technical traffic study of at-grade crossing possibilities at the proposed River Road for Option B. Other technical studies would need to investigate:

- Areas of narrow width along the existing maintenance road
- Requirements for continued access for maintenance activities along the trail improvements
- Flood control embankment freeboard and erosion protection
- Property ownership for rerouting of the trail and acquiring easements

TECHNICAL STUDY REQUIREMENTS

Required permits include a formal application to CPUC and UPRR for a new and/or modified railroad crossing, with a 9 to 15-month schedule to receive permits. The permit schedule varies widely depending on the findings discovered from the technical studies and mitigations required as part of the permitting process. Other expected permits include coordination with the following: ACOE 404 and 408, OCFCD, OCPW, RWQCB 401, SWPPP, and CDWF 1600.

DESIGN & CONSTRUCTION SCHEDULE

The design schedule is variable and depends on the level of mitigation required by agencies including USACE and OCFCD, with 6-9 months expected to develop a complete set of drawings with a design fee of ~$500,000. Option A would involve flood mitigation, riverbank improvements and grading adjustments, and Option B would involve signalization and roadway design adjustments. Construction of improvements is expected to occur over a period of 4-6 months.

CONSTRUCTION COST ESTIMATES

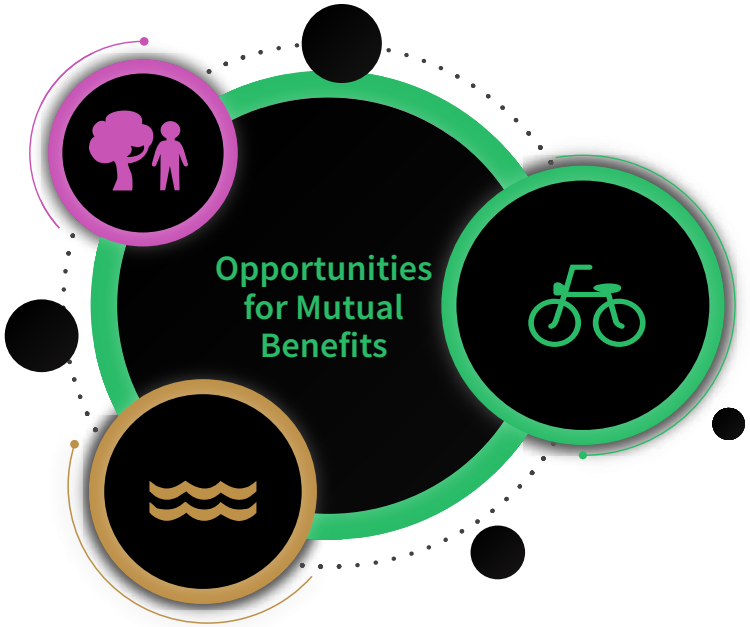
Construction costs will vary considerably depending on the amount and extent of trail improvements along the extension and connection to Anaheim Coves. Trail improvements as part of the OC River Walk project are estimated to be ~$550,000 per linear foot, assuming the trail is 30 feet wide to comfortably and safely accommodate both cyclists and pedestrians. The undercrossing improvement lump sum for Ball Road (~$200,000) are lower than SPT Railroad (~$600,000) because there is already an existing undercrossing at Ball Road and proposed improvements at that location would not require extensive grading and new hydraulic modeling efforts in comparison to SPT Railroad. As for Option B 's above-ground crossing, it will likely be less expensive to construct, although costs may also go up significantly depending on mitigations that may be required for roadway and railroad crossing improvements. The total engineering cost estimate, assuming the preferred Option A, is ~$4,000,000.

OPERATIONS COST ESTIMATES

Operations and maintenance costs for a segment of this length would likely be in the range of $150,000 annually.

Environmental / Regulatory Requirements

Environmental review under the CEQA and the NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile river corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place. The CEQA/NEPA process is expected to take between 12 and 18 months to complete.



1 Increases Public Interaction and Connectivity

A trail extension closes a significant gap in the future trail network along the Santa Ana River and extends non-motorized connections along the west bank of the Santa Ana River from Katella Avenue to Ball Road.

2 Enhances Aesthetics and Ecology of the River and Surrounding Region

More opportunities to view the Santa Ana River will enable the opportunity for the public to appreciate the natural and built destinations in the surrounding area.

3 Catalyzes Economic Growth and Development

The trail extension provides direct connections to future development opportunities, including the potential ocV!BE development.

4 Improves Visual and Physical Access to the River

The improvements provide additional opportunities to view and experience the Santa Ana River, as there will now be trails on both sides of the river from Katella Avenue to Ball Road.

2

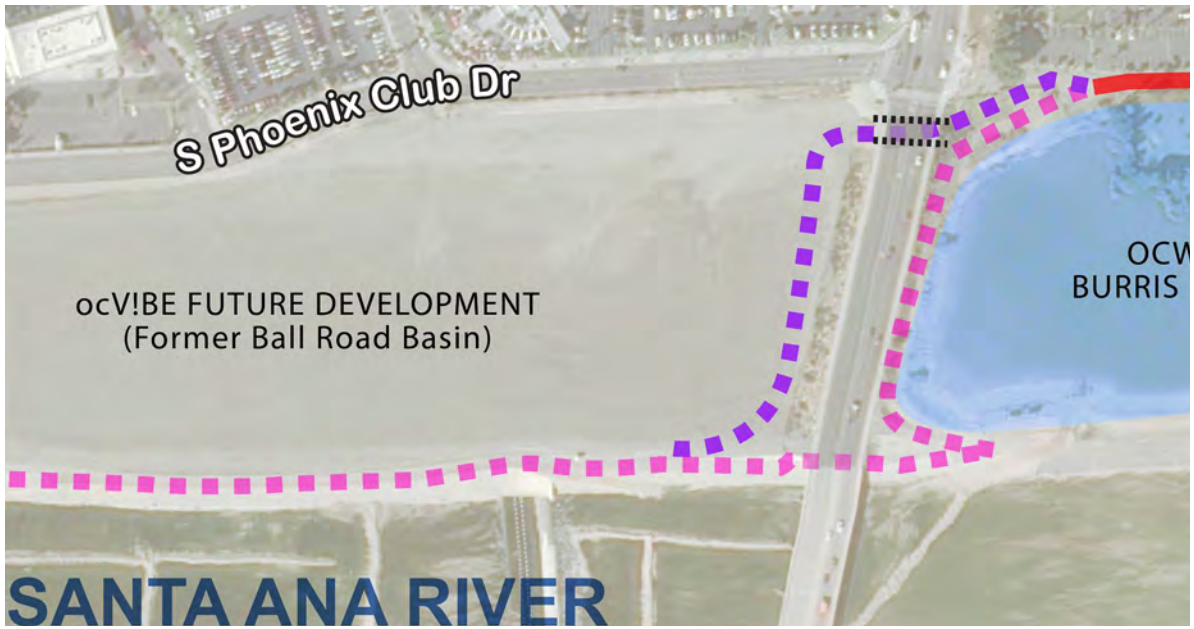
ACTIVE TRANSPORTATION – OPPORTUNITY #2

Trail Culvert Undercrossing at Ball Road (Repurpose Existing OCWD RCB)

Opportunity

Repurpose the existing OCWD RCB culvert at the intersection of Ball Road and South Phoenix Club Drive as a trail connection from OC River Walk to Anaheim Coves.

The proposed extended trail opportunity (AT #1) utilizes the existing Ball Road bridge undercrossing along the Santa Ana River to cross Ball Road. Further west from the bridge undercrossing, there is an existing 14'x 14'RCB underneath the intersection of Ball Road and South Phoenix Club Drive that would provide a secondary grade separated connection point from the OC River Walk trail to Anaheim Coves.



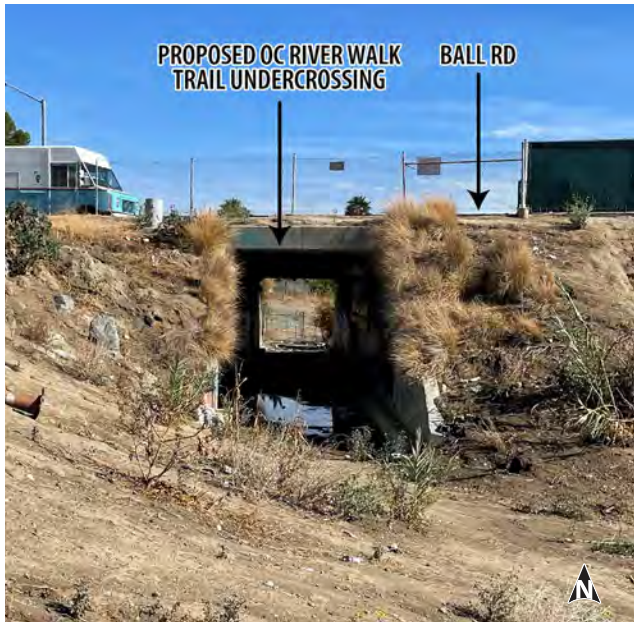
LEGEND

Opportunity #2

- Ball Road Undercrossing via Existing Culvert
- AT #1

Existing

- Exist. Anaheim Coves Trail
- Exist. 14' x 14' RCB Culvert



▲ TOP: Existing RCB under Ball Road & S. Phoenix Club Dr.

◀ LEFT: Plan view of Opportunity #2 trail connection to Anaheim Coves.

Feasibility Considerations

The OC River Walk trail would be grade separated from Ball Road along the south side as it enters the existing box culvert. This Ball Road crossing opportunity is roughly ¼ mile in length, similar to the crossing opportunity described in AT #1. Both opportunities could be implemented independent from one another or together to give the trail user a choice of routes and alternatives.

▲ TOP LEFT: West bank of river, south of Ball Rd.
TOP RIGHT: South side of Ball Rd., west of river
BOTTOM LEFT: South side of Ball Rd., east of Phoenix Club Dr.
BOTTOM RIGHT: North side of Ball Rd. at Phoenix Club Dr.

The trail extension would extend along the south side of Ball Road (currently gated as shown on the top-left photo) and continue along an improved path between ocV!BE's Future Development and Ball Road (the magenta footprint highlighted in the top-right photo), and then proceed through the repurposed box culvert at the intersection of Ball Road and South Phoenix Club Drive (pictured in the bottom-left photo).

OCWD recently sold the former "Ball Road Basin" (+ 20 AC) to a private land development company and therefore the 14' x 14' RCB culvert which was previously used by OCWD to transfer water between Burris and Ball Basins is no longer needed by OCWD. As part of OC River Walk, the existing 14' x 14' RCB could be repurposed to provide a safe grade separated crossing under Ball Road. The culvert repurposing would require improvements including grading, drainage, lighting, signage, etc.

The existing RCB culvert and available open space is large enough to satisfy the design requirements of a multi-use trail connection between the extended OC River Walk trail and Anaheim Coves. The trail improvements would be an addition 1,700 LF to connect along the south side of Ball Road.

Combining routes with AT#1 could be considered to improve user experience; for example, an approach could combine use of the box culvert for pedestrians only and use of the existing Ball Road undercrossing for bicyclists only. The box culvert and grade separated trail is a safer router compared to crossing Ball Road at-grade; it enables bicyclists to stay mounted and pedestrians do not have to cross Ball Road alongside busy traffic.

Location, grading, and alignment of the OC River Walk trail from the river to the RCB culvert will require coordination with the land development property owner, integrating the open space edge condition alongside Ball Road and future development plans.

▲ North of Ball Rd, near the Anaheim Coves trailhead.

Design Requirements

DESIGN ELEMENTS

A new multi-modal connection between the OC River Walk extension and Anaheim Coves shall allow for continued use of Burris Basin by OCWD per operations and maintenance requirements. Improvements must avoid significant impacts to hydrologic regime, especially during flood events, and meet all safety requirements and guidelines related to trail widths and street crossing.

TECHNICAL STUDY REQUIREMENTS

Required technical studies would address the safety of the existing box culvert for cyclists and pedestrians to potentially share, as well as requirements for continued access for maintenance activities.

PERMIT REQUIREMENT, SCHEDULE, AND COST ESTIMATE

There would be significant coordination with the ocV!BE development. Permitting schedules would vary, ranging from an estimated time of 3-5 months, applying for permits with OCFCD, OCPW, and OCWD.

DESIGN & CONSTRUCTION SCHEDULE

The design schedule varies depending on the extent of trail improvements, associated landscaping, and associated culvert modifications taking about 6-9 months of design effort. Costs for preparing design plans would likely be around $150,000.

CONSTRUCTION COST ESTIMATES

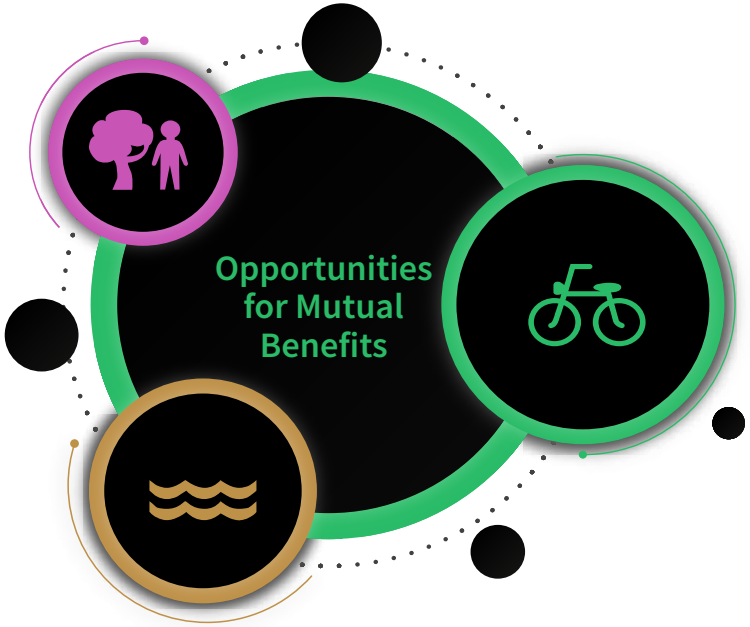
Assuming a 20-foot (16 feet minimum) trail width, the cost of trail improvements are ~$400 per linear foot. The improvements required for a repurposed box culvert (striping, potential artwork, signage) would cost ~$300,000. Altogether, Opportunity #2 would be approximately $1,000,000 total.

OPERATIONS COST ESTIMATES

Annual O&M costs are expected to be ~$50,000.

Environmental / Regulatory Requirements

Environmental review under the CEQA and the NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile River corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place. The CEQA/NEPA process is expected to take between 12 and 18 months to complete.



1 Increases Public Interaction and Connectivity

A new connection between the OC River Walk extension and Anaheim Coves trail improves local and regional connectivity to multiple destinations, and connects two important, highly popular recreational resources.

2 Enhances Aesthetics and Ecology of the River and Surrounding Region

More opportunities to view the Santa Ana River will enable the opportunity for the public to appreciate the natural and built destinations in the surrounding area.

3 Catalyzes Economic Growth and Development

The connection improves connections from the Santa Ana River to nearby destinations such as The Phoenix Club.

4 Improves Visual and Physical Access to the River

The connection extends access to the River Walk trail on the western bank of the Santa Ana River and allows for direct access to the Santa Ana River along Ball Road.

3

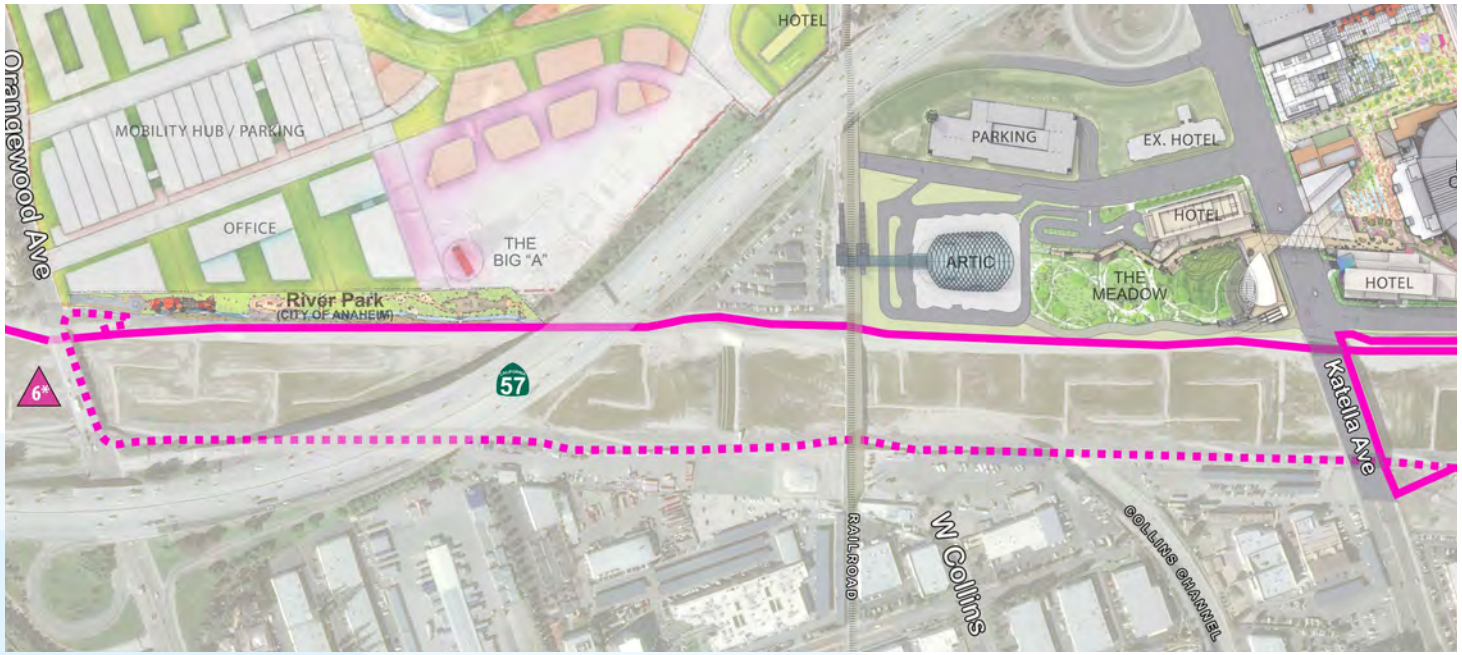
ACTIVE TRANSPORTATION – OPPORTUNITY #3

SART East Bank Addition of River from Katella to Orangewood

Opportunity

Improve the east bank as part of OC River Walk and designated as SART from Katella Avenue to Orangewood Avenue.

The designated SART follows the east bank between Ball Road and Katella Avenue and then crosses over the Katella bridge to proceed along the west bank towards Orangewood Avenue. From there, the SART continues south all the way to the Pacific coastline. On the east bank, there is an existing maintenance road/business delivery driveway that extends from Katella Avenue to Orangewood Avenue, where SART is not designated. While the maintenance road is paved, it is not a striped or meant for pedestrian/bike use. The roadway became a de facto shared path between OCFCD/OCWD maintenance vehicles and delivery vehicles accessing the rear of some businesses adjacent to the river.



LEGEND

Opportunity #3

- Continuation of SART on east bank of river to Orangewood Avenue
- 6* OC River Walk AT #6 Orangewood Bridge widening for Ped/Bike Lanes

Existing

- Exist. Santa Ana River Trail (SART)

▲ Plan view of Opportunity #3 extents along the OC River Walk corridor.

The SART is heavily used by pedestrians, recreational cyclists, commuter cyclists, and fitness cyclists; all of whom share the trail as they travel at varying speeds. In certain confluence areas, the SART becomes congested and leads to conflicts between trail users travelling at significantly different speeds. New connections from the river to Angel Stadium, ocV!BE, the Honda Center, ARTIC Station, and Meadow Park will result in a greater number of pedestrians and cyclists generally travelling at lower speeds. To provide a safe route for cyclists preferring to travel at higher speeds, the existing east-bank path could be designated, signed and maintained as the primary SART route from Katella Avenue southward to Orangewood Avenue (approximately 0.8 miles). As a result, the path on the west bank would be relieved of some congestion and could be dedicated to slower traffic, and higher density of pedestrian traffic.

Feasibility Considerations

While it would be easy to designate the eastern bank of the Santa Ana River as the SART since the right-of-way is already paved, a designation change requires coordination with OCFCD, OC Parks, and OCWD to obtain approval to move the official SART trail location to the east bank of the river.

▲ On east bank, looking south at the existing road currently utilized for authorized vehicles only. The footprint width can accommodate OC River Walk trail improvements.

The existing maintenance/service road with the integrated multi-use path is currently 12 feet wide, with paved buffers on each side allowing for approximately 18 feet of total right-of-way width through the majority of the segment between Katella Avenue and Orangewood Avenue (approximately 4,700 LF), with some areas dropping below 18 feet in right-of-way width. If there is interest in expanding the maintenance road for separated multi-modal travel per the Santa Ana Parks and Open Space Master Plan trail guidelines (Appendix III), additional coordination will be required with local businesses, OCFCD, OC Parks, and OCWD to provide space to have a continuous 18 feet-wide easement.

Design Requirements

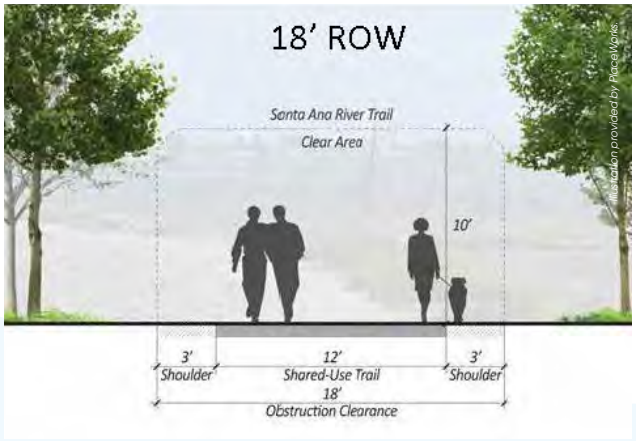
DESIGN ELEMENTS

Designation of an east side SART route must allow for continued use of the maintenance road by OCWD and OCFCD per O&M requirements, and provide convenient access to river-adjacent businesses. New signage and revised trail maps would indicate the two route options and show recommended users (pedestrians and slower-moving bicycles on the west bank, fast-moving bicycles on the east side). The newly designated trail must meet all safety requirements and guidelines related to trail widths and street crossings.

▲ The SART is shared by many users from commuter cyclists, recreational cyclists, to joggers, and walkers.

TECHNICAL STUDY REQUIREMENTS

Technical studies would ensure that there would be continued access for maintenance vehicles and limit conflicts between maintenance efforts and trail users. Any property owners that would be impacted by the proposed improvements would need to have alternative access provided to them.



▶ Standard allocation of space for a shared-used trail.

PERMIT REQUIREMENT, SCHEDULE, AND COST ESTIMATE

There would be significant coordination with OCPW, OCFCD, Santa Ana River Conservancy. and OC Parks for SART designation. The permitting process would take an estimated 6-9 months.

DESIGN & CONSTRUCTION SCHEDULE

Design of improvements would likely take 6-9 months and would primarily focus on the design of signs and reprinting of bike maps. Design fee would be ~$200,000. Sign fabrication and installation would likely take 4-6 months. Expansion of SART to OC River Walk level of design and amenities could increase design and permitting to be 6 to 12 months.

CONSTRUCTION COST ESTIMATES

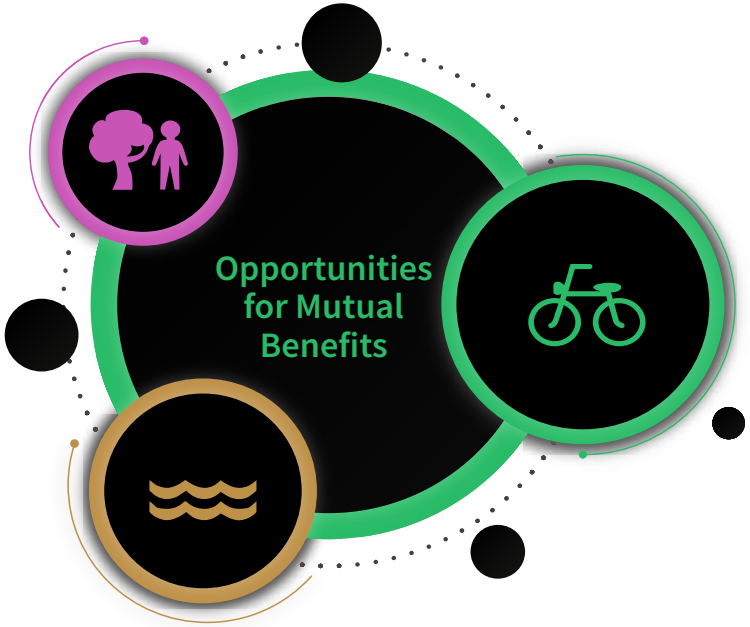
Costs would likely be around $10,000-$20,000 for new signage directing cyclists and pedestrians to the SART on the east bank of the river. Additional costs would be anticipated if there is interest in widening portions of the trail segment to directly align with Santa Ana Parks and Open Space Master Plan guidelines. In addition to OC River Walk trial improvements of ~$425 per linear foot, assuming a 20-foot width, the total cost for Opportunity #3 totals ~$2,000,000.

OPERATIONS COST ESTIMATES

While bicyclists already utilize the maintenance road along the east bank of the river, additional ridership will be expected if the east bank is officially designated, requiring additional maintenance to clean and maintain roadway infrastructure. Operations costs are estimated to be ~$125,000 annually.

Environmental / Regulatory Requirements

Environmental review under the CEQA and the NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile River corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place. The CEQA/NEPA process is expected to take between 12 and 18 months to complete.



1 **Increases Public Interaction and Connectivity**

Designating the east bank as the SART allows for commuter cyclists travelling at higher speeds the option of riding on the eastern side of the river while slower cyclists can ride on the western bank of the river.

2 **Enhances Aesthetics and Ecology of the River and Surrounding Region**

More opportunities to view the Santa Ana River will enable the opportunity for the public to appreciate the natural and built destinations in the surrounding area.

3 **Catalyzes Economic Growth and Development**

By officially designating the east bank as the SART on maps and signage, people will be encouraged to utilize both sides of the river, potentially increasing usage of trails and allowing people to visit area destinations more frequently and conveniently.

4 **Improves Visual and Physical Access to the River**

Providing more interconnectivity around and through the river allows trail users to embrace the river as a community amenity.

4

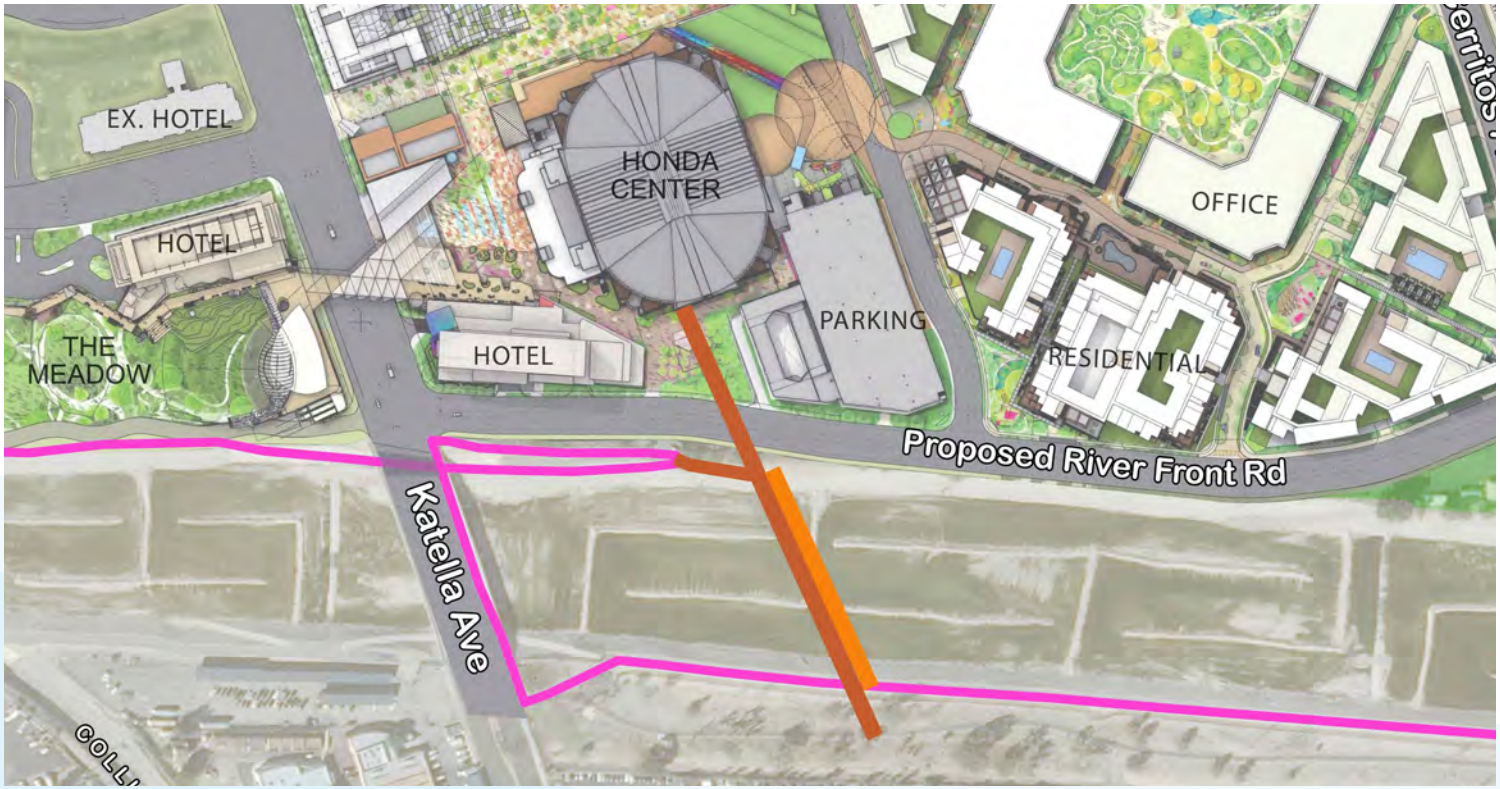
ACTIVE TRANSPORTATION – OPPORTUNITY #4

Bike/Pedestrian Bridge across the Santa Ana River

Opportunity

Propose a new non-vehicular, multi-modal bridge across the Santa Ana River focused for bicycle and pedestrian use.

The OC River Walk project creates an opportunity to improve non-motorized connections on the Santa Ana River through the construction of a new bike and pedestrian bridge. The multi-modal bridge would improve access for residents, visitors, employees of nearby businesses, and commuters using the SART.



LEGEND

Opportunity #4

- Option A Extended Bridge
- Option B (minimum) Bank to Bank Bridge

Existing

- Exist. Santa Ana River Trail (SART)

Feasibility Considerations

Two options are feasible for the new bike and pedestrian bridge. Both are best located approximately 500 feet north of Katella Avenue due to mutual-benefit landing configurations and proximity to Honda Center. The conceptual alignment was chosen to be in parallel with Katella Avenue so that the new bridge may draw structural and hydraulic comparisons to the existing three piers supporting the Katella bridge.

Option A is a new bridge with a ~1,000 foot span, extending beyond the river width and option to provide a direct connection to the proposed ocV!BE development and the open space area along the East bank, which would be undergoing improvements as well per CA#16. Strong coordination with ocV!BE will be required for a seamless integration and transition of OC River Walk improvements into ocV!BE's development. Option A would also provide an additional fork landing along the existing SART turnaround loop just off of the at-grade Katella Avenue crossing, allowing users to continue along the OC River Walk trail as well. Option B would have a minimum span ~450 feet, bank to bank across only the Santa Ana River width. Both options include proposed easterly bridge landing at/or within 150 feet of the existing SART. The east bridge landing will not extend into the adjacent commercial area.

Option A concept, pictured on the top left, does not show the additional landing along the existing SART turnaround. Additional structural analysis for landing detail along the turnaround is required. On the right is a bike and pedestrian bridge at the Tempe Town Lake, Arizona.

Both options allow for a diverse range of bridge types, from utilitarian to iconic, including steel-rolled beams, concrete box girders, arch, suspension, concrete curve, and steel tubular v-truss designs. A minimum width of 25 feet would allow both pedestrian and bicyclists to have dedicated lanes/facilities.

▲ TOP: Option A: Proposed Bike/Pedestrian Bridge
BOTTOM: Non-vehicular bridge across Tempe Town Lake.

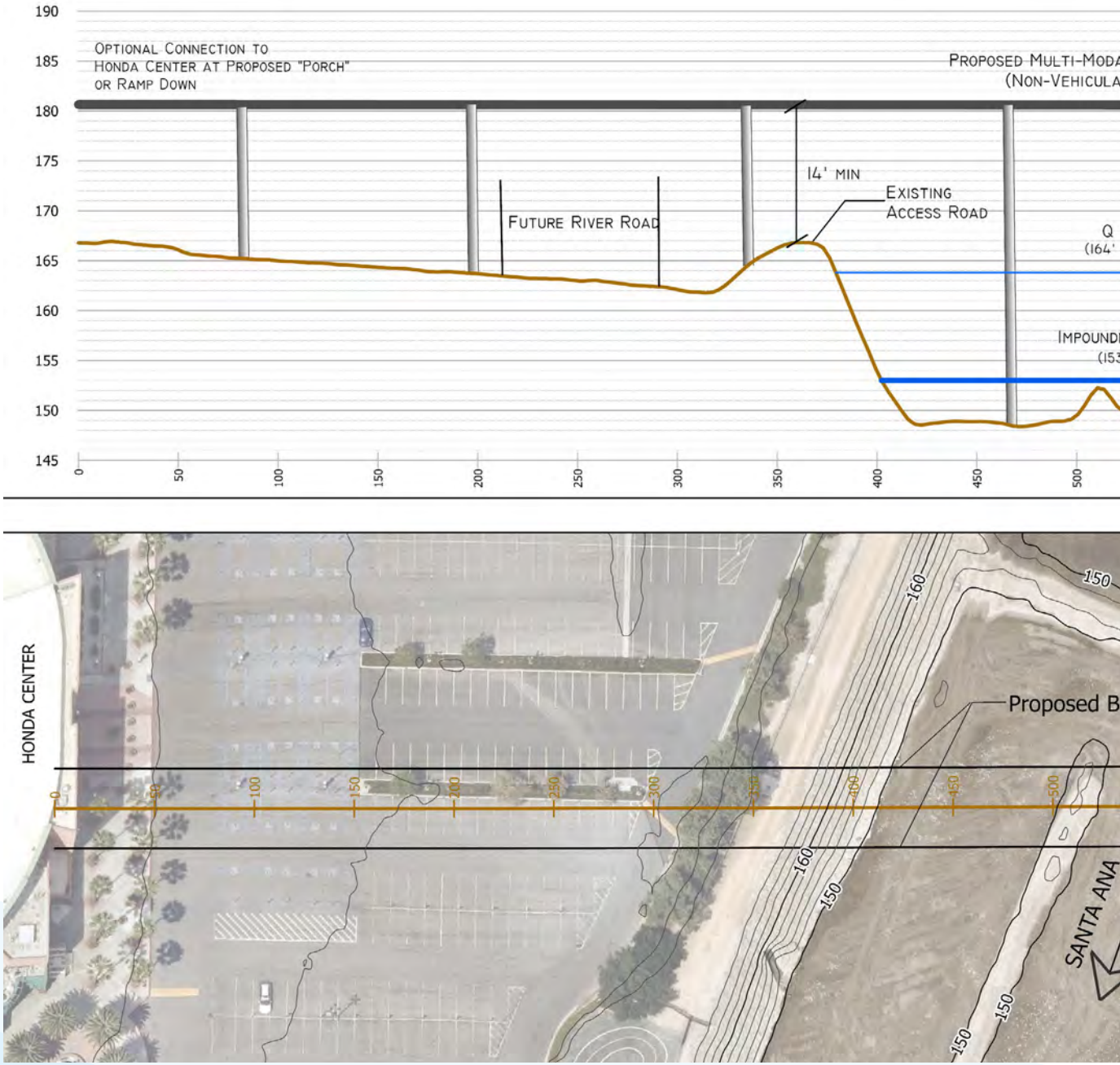
Design Requirements

DESIGN ELEMENTS

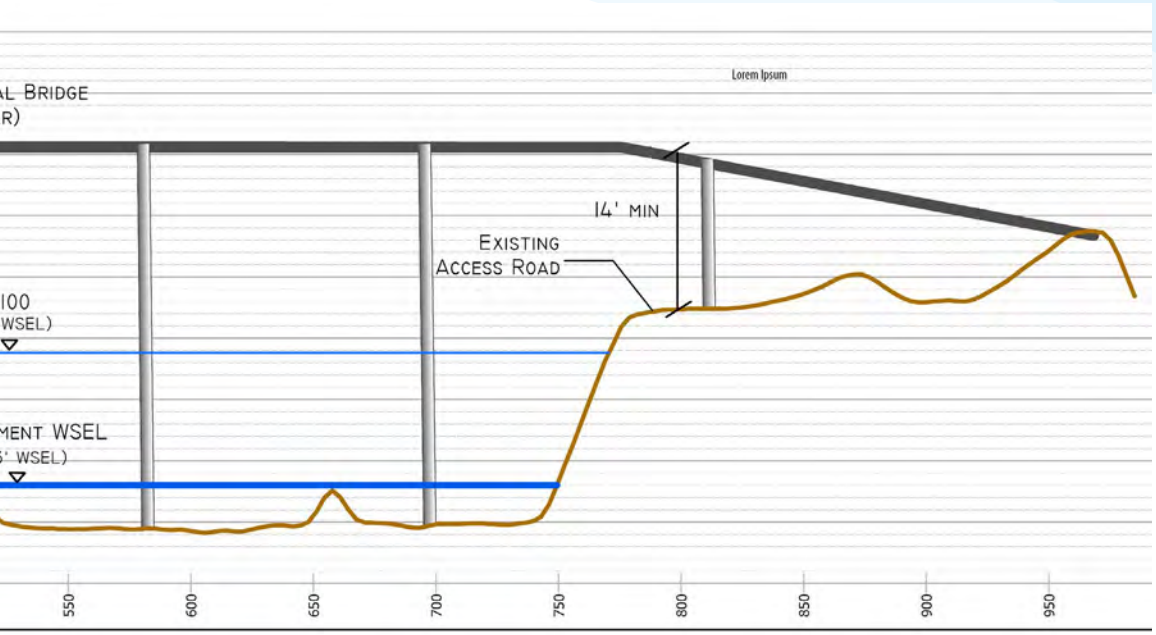
The bridge would connect the future OC River Walk trail, SART, and major destinations on either side of the river including the Honda Center and potential future mixed-use development on the west side, and the SART & future Urban Forest/Upland Habitat Park (CA #16) on the east side. Landings would be designed to provide accessible connections to trails on either side of the river and pathway networks leading to these key destinations.

Bridge width should comply with guidelines set by the Santa Ana River Parkway and Open Space Plan, which recommends 18' minimum width for shared use facilities and a 25' minimum width to accommodate separated pedestrian and bicycle facilities.

The bridge shall also be designed as such that river O&M can be performed without hindrance. The recommended minimum clearance per OC O&M is 14 feet of vertical height clearance.



Proposed pedestrian / bike bridge plan and profile (Exhibit available in Appendix I - Exhibit 05).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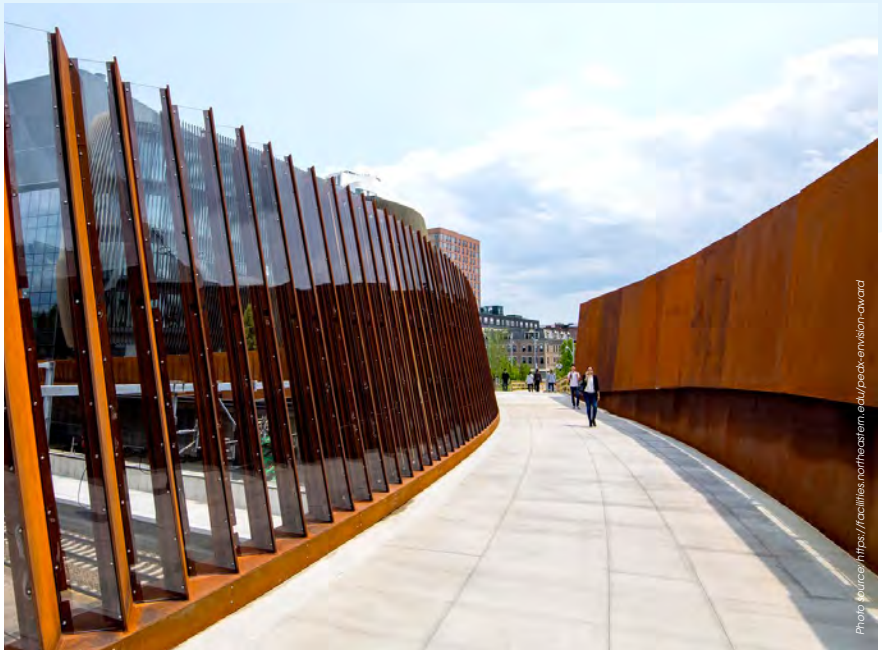
Photo Source: https://facilities.northeastern.edu/peak-envision-award


ridge (40' width)
RIVER
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160
170
550
600
650
700
750
800
850
900
950

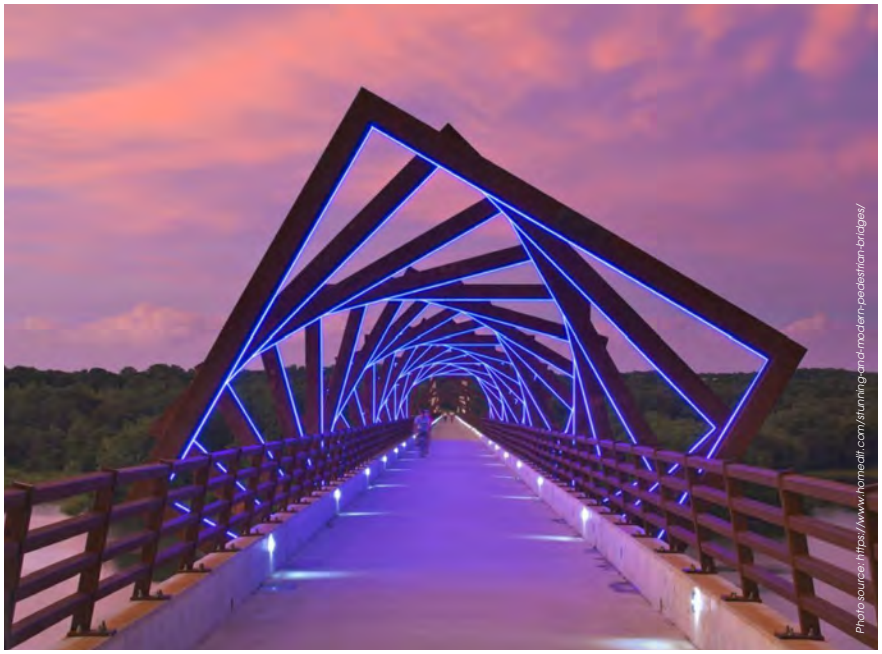


Photo source: https://www.homedit.com/stunning-and-modern-pedestrian-bridges/

TECHNICAL STUDY REQUIREMENTS

Technical studies such as hydrologic studies would ensure compliance with relevant requirements and regulations related to a multi-modal bridge constructed over a waterway, especially considering safety associated with potential floods. The multi-modal bridge must comply with OCWD and OCFCD O&M requirements. It must be sited and designed to accommodate maintenance access to the river. Project development would need to coordinate with property owners at locations of bridge landings and pathways leading to the bridge and riverside trails.

A preliminary HEC-RAS hydraulic model was created to study the potential hydraulic impacts of a new bridge during a 100-year storm event. No significant impacts to the WSEL were observed greater than or less than 0.1 feet compared to the existing condition. Velocity and freeboard were also minimally impacted in the same manner and all localized around the new bike and pedestrian bridge in the model. No impacts upstream or downstream of the proposed structure were observed. The modeling methodology discussion and complete detailed hydraulic model results are available in the OCFCD Concept Review in Appendix V. The concept review was prepared to engage stakeholders at an early stage and incorporate feedback into the design requirements and feasibility report herein. Further in-depth hydraulic modeling is required to support a 30% bridge design across the Santa Ana River.

Example bridges, representing the lower and upper cost ranges for a bike and pedestrian bridge.

PERMIT REQUIREMENT, SCHEDULE, AND COST ESTIMATE

It is estimated that it will take around 9-15 months to obtain the following permits: ACOE 404 and 408, OCFCD, RWQCB 401, NPDES, and SWPPP, and CDFW 1600.

DESIGN & CONSTRUCTION SCHEDULE

It is estimated that it will take around 12-18 months to produce documents for a non-vehicular, multi-modal bridge from design concepts to schematic designs and construction. The total cost to produce these documents range from around $1,400,000 depending on the width, length and complexity of bridge construction. After design documents are complete, it will take ~8-12 months to complete construction.

CONSTRUCTION COST ESTIMATES

Assuming a typical cost efficient bridge for an Option A, the preferred bridge option and assuming a maximum 1,000 feet of linear foot bridge length with 40 feet width and at $400/SF the total construction cost is estimated to be ~$16,000,000.

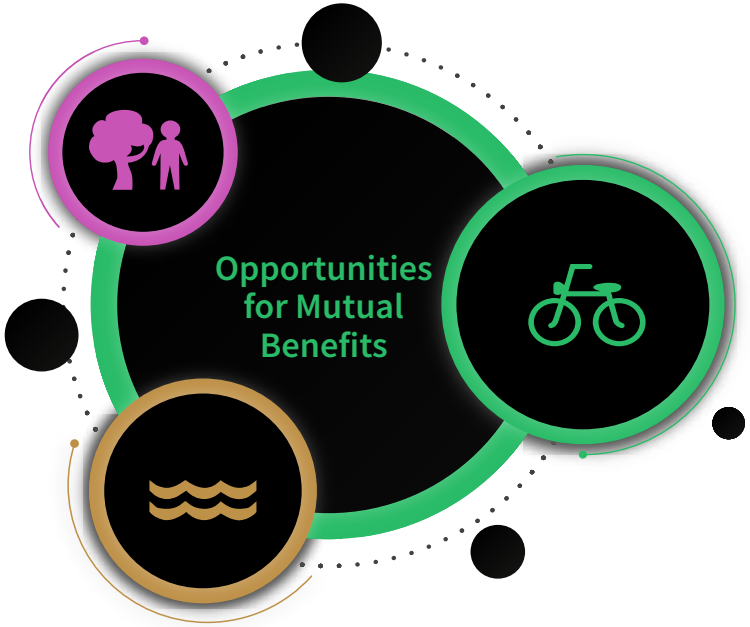
Construction cost estimates vary widely depending on the bridge type and the amount of features that are installed on a bridge. Less expensive bridge options include steel rolled beam, concrete box girder and steel tubular bridges, which can cost approximately $275 - $325/SF.

OPERATIONS COST ESTIMATES

Typical operations costs vary widely depending on bridge size and design, types and quantity of users, and pedestrian/bicycle facility design. A high-level estimate of operations costs could be ~$200,000 annual. Routine maintenance (taken as a percentage of total bridge construction costs) is advised as it will extend the life of the bridge and not require bridge replacement or high deferred-maintenance costs.

Environmental / Regulatory Requirements

Environmental review under the CEQA and the NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile River corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place. The CEQA/NEPA process is expected to take between 12 and 18 months to complete.



1 **Increases Public Interaction and Connectivity**

A new bike and pedestrian bridge provides a new east-west connection across the Santa Ana River and improves non-motorized connectivity to destinations directly adjacent to the Santa Ana River including Honda Center, ARTIC, Angel Stadium, and nearby shopping centers.

2 **Enhances Aesthetics and Ecology of the River and Surrounding Region**

A new bike and pedestrian bridge provides an additional connection across the Santa Ana River increasing the river's scenic value to the City of Anaheim and surrounding region.

3 **Catalyzes Economic Growth and Development**

Depending on type and design, a new bridge can create a new landmark and destination for the City of Anaheim and surrounding areas. As a key new amenity, it would enhance recreational opportunities associated with the SART, adding value to adjacent areas.

4 **Improves Visual and Physical Access to the River**

A new non-motorized connection across the Santa Ana River will increase access to both sides of the river and opportunities to view and experience the river. A well-designed bridge can provide an attractive physical landmark.

5

ACTIVE TRANSPORTATION – OPPORTUNITY #5

River Walk Width Expansion and Connectivity (Assume 2,000 LF at River & 2,000 LF offsite)

Opportunity

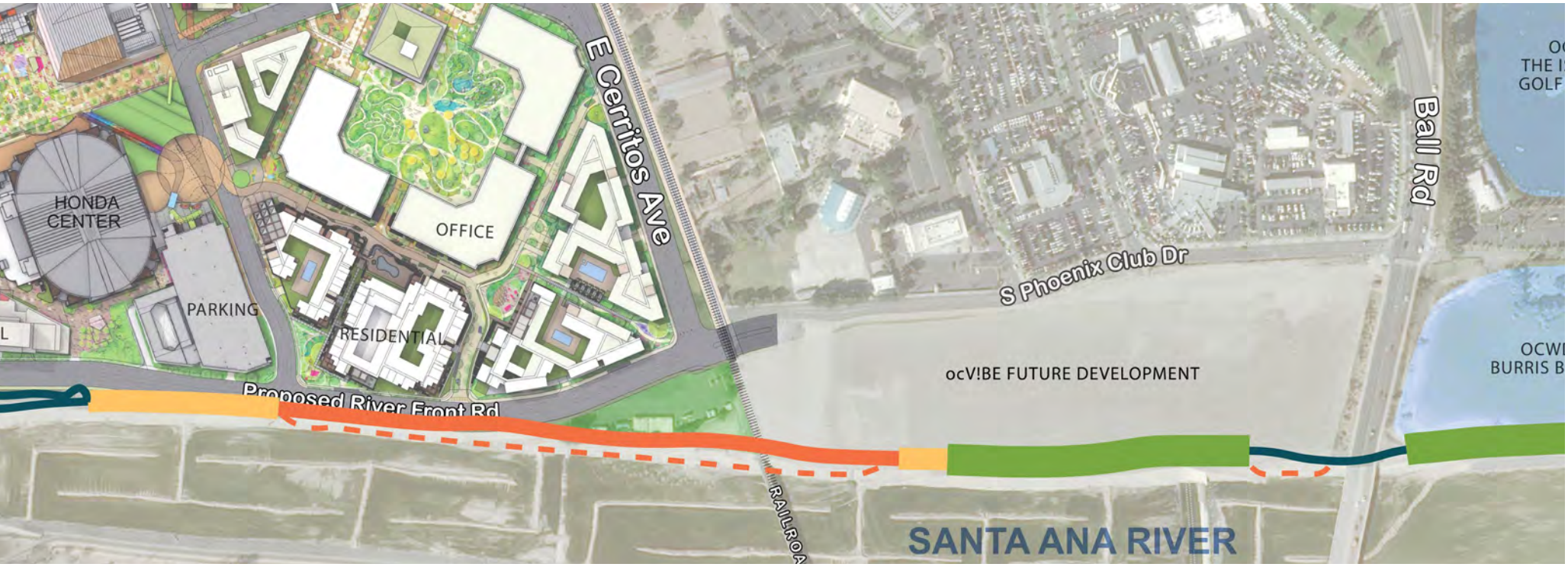
Maximize the available trail width along the top of riverbank for proposed OC River Walk improvements.

LEGEND

Existing Trail Width

- 12′ – 18′
- 18′ – 25′
- 25′ – 32′
- > 32′
- Option A
- Option B
- Improved connectivity from ARTIC to the Honda Center
- Improved connectivity from ARTIC to the SART

Available right-of-way along the River Walk through the west bank of the Santa Ana River varies between 12 to 32 feet from Orangewood Avenue to Ball Road. Ideally, a minimum of 25 feet in right-of-way should be available to allow for 12 feet allocated for dedicated bikeways and 10 feet for separated pedestrian paths along OC River Walk to conform to trail guidelines of the Santa Ana River Parkway and Open Space Plan (available in Appendix III). A number of solutions are proposed to mitigate these right-of-way challenges to allow for a positive biking and walking experience along OC River Walk. While some of the solutions are described in greater detail in other sections of the report, additional opportunities to improve the right-of-way include a public pedestrian bridge over Katella Avenue (ocV!BE) and a proposed River Road, improved connections to ARTIC, and an option to incorporate an expanded trail width and potential for split-grade trail are described below.



Feasibility Considerations

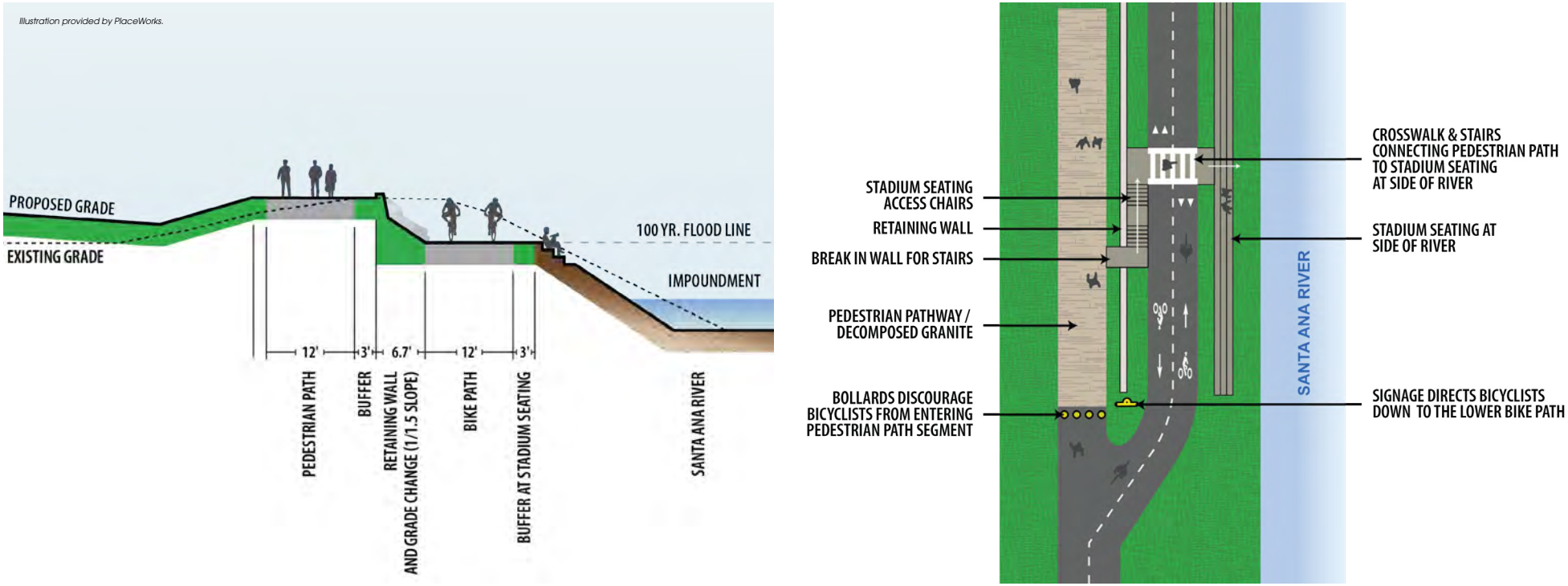
Maximizing the available right-of-way allows more separation between modes of active transportation along the project corridor and will relieve the existing pinch point at the Katella undercrossing, where available right-of-way decreases to around 18'. Directing pedestrians to the crossing over the Santa Ana River will allow for the existing right-of-way to be available for bicyclists, creating a more comfortable experience for all and enabling the River Walk path to maintain trail right-of-way guidelines per the Santa Ana River Parkway and Open Space Master Plan. This improvement will become more valuable as the incoming ocV!BE development is constructed and the surrounding park spaces around the Honda Center are completed.

Connections from ARTIC to OC River Walk are currently limited to a ¼ mile walk from the station platforms north through the parking lot to the southern edge of Katella Avenue, with no wayfinding to provide instructions to connect from the train station to the multi-use trail. Options should investigate the installation of improved wayfinding and a direct east-west connection from the station platforms to River Walk, cutting the walking distance from a ¼ mile to 200 feet.

▲ View from west bank of river near ARTIC parking lot on SART. Currently, commuter cyclists already utilize the full width of existing striped trail. The existing space on either side of the trail is not designated or utilized.

▲ Grade-separated lanes for passing or slow/fast active transportation.

To remedy the areas where the River Walk encounters right-of-way where separate pedestrian and bicycle facilities are unable to be accommodated (less than 25'), there should be a consideration to provide a split trail so pedestrians and bicyclists can continue to have their own dedicated right-of-way. This may be applied through two options – one option allows for the bicycle trail to drop closer to the riverbank, providing dedicated access during non-flood events, while the other option allows it to be within the ocV!BE development, with the right-of-way allowed to meander into the future Meadow Park. Assuming that trail improvements in the River Walk advance around the same time frame as the ocV!BE development, both Option A and B can be potentially implemented.



▲ Example plan view and section of signage and specified material locations for directing modes of transportation.

Regardless of which option moves forward, it is imperative to establish clear direction to users on who can access each facility. Clarifying this access can be demonstrated through the establishment of bollards separating pedestrian paths from bicycle paths, with the pedestrian path beyond the bollards to be surfaced with decomposed granite while bicycle paths will be paved with concrete or asphalt. Additionally, signage will be installed in areas where the pedestrian and bicycle paths split to further direct users where to go. Establishment of these design solutions will also help integrate opportunities where pedestrians may access the river for events adjacent to the proposed river impoundment areas between Katella Avenue and the proposed multi-use bridge north of Orangewood Avenue.

Design Requirements

DESIGN ELEMENTS

All improvements described will provide enhanced multi-modal connection between Anaheim Coves, SART, ocV!BE, ARTIC, and Angel Stadium and allow for continuous separation of ROW from pedestrians and bicyclists. In order for these improvements to be implementable, the designs need to account for continued use of maintenance road by OCWD and OCFCD per O&M requirements. Additionally, the design of all improvements must meet all safety requirements and recommendations related to trail widths as well as satisfy SARP & OSP design guidelines. The improvements shall also avoid significant impacts to hydrologic regime, especially during flood events.

TECHNICAL STUDY REQUIREMENTS

Any technical studies that will be conducted as result of implementing improvements to the River Walk must investigate how to remedy the narrow width at points as well as account for property ownership for any re-routing of the OC River Walk trail and trail access points. The studies need to also investigate the requirements for continued access for maintenance activities and evaluate requirements for flood control embankment freeboard and erosion protection.

PERMIT REQUIREMENT, SCHEDULE, AND COST ESTIMATE

Required permits and approval from the following are expected: OCFCD, OCPW, RWQCB 401, NPDES and SWPPP, CDFW 1600, Caltrans, and SART. Design and Construction Schedule Permit efforts are estimated to require 4-6 months for approval.

▼ River Walk width expansion is a mutaul benefit to all types of cyclists: commuter, fitness, and recreational.

DESIGN & CONSTRUCTION SCHEDULE

It is estimated that it will take around 8-12 months to produce documents for OC River Walk connectivity improvements from design concepts to schematic designs and an additional 12-18 months for construction. The total cost to produce these documents are ~$200,000.

CONSTRUCTION COST ESTIMATES

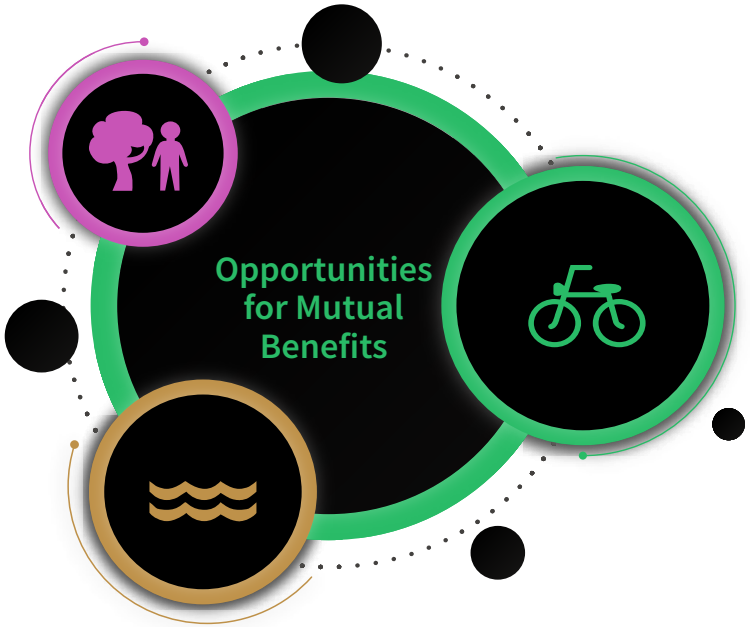
The cost of OC River Walk trail improvements are estimated to be ~$650 per LF, assuming a maximized right-of-way. Areas that are already maximized with narrow widths are estimated to be ~$300 per LF since not as many features and improvements can be implemented along these stretches. In total, the cost of improvements are expected to be~$2,000,000.

OPERATIONS COST ESTIMATES

Operations and maintenance costs for all improvements implemented together is anticipated to range between $100,000 annually.

Environmental / Regulatory Requirements

Environmental review under the CEQA and the NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile river corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place. The CEQA/NEPA process is expected to take between 12 and 18 months to complete.



1 **Increases Public Interaction and Connectivity**

These improvements will also contain additional right-of-way for non-motorized modes, allowing to accommodate more pedestrians and bicyclists, which will likely be necessary given the amount of planned development and public spaces anticipated for the area. Crossing and split path options will shorten the distance from the ARTIC station platform to SART, providing more direct and improved multi-modal access.

2 **Enhances Aesthetics and Ecology of the River and Surrounding Region**

Development of a split path along the River Walk will enable people to be closer to the river, allowing for additional viewing opportunities.

3 **Catalyzes Economic Growth and Development**

Crossing and split path options will allow for improved access to existing and proposed destinations adjacent to the Santa Ana River and surrounding region.

4 **Improves Visual and Physical Access to the River**

The implementation of split path options will enable people to be closer to the river, allowing for additional viewing opportunities.

6

ACTIVE TRANSPORTATION – OPPORTUNITY #6

Widen Existing Bridges for Bike / Pedestrian Lanes

Opportunity

Widen the existing Katella Avenue and Orangewood Avenue bridge crossings to accommodate designated bike lanes and wider pedestrian sidewalks.

Both Orangewood Avenue and Katella Avenue contain bridges that provide limited east-west non-motorized access over the Santa Ana River. On Katella Avenue, there is a narrow sidewalk on the south side and a protected two-way multi-use path on the north side. The path is mapped as part of the official SART, connecting the west-bank and east-bank trails. On Orangewood Avenue, pedestrian access is limited to a narrow sidewalk on the north side, and there are no dedicated bicycle facilities. There are opportunities to provide safer and more-welcoming dedicated and separated infrastructure for bicyclists and pedestrians along Orangewood Avenue and Katella Avenue. By widening the bridges at by at least 20 feet on both the North and South, there would be additional space for improved non-motorized infrastructure including striped bicycle lanes with buffers adjacent to westbound and eastbound vehicle travel lanes.

▲ View from west side of Katella Ave. The existing narrow multi-use SART crossing on Katella Avenue.

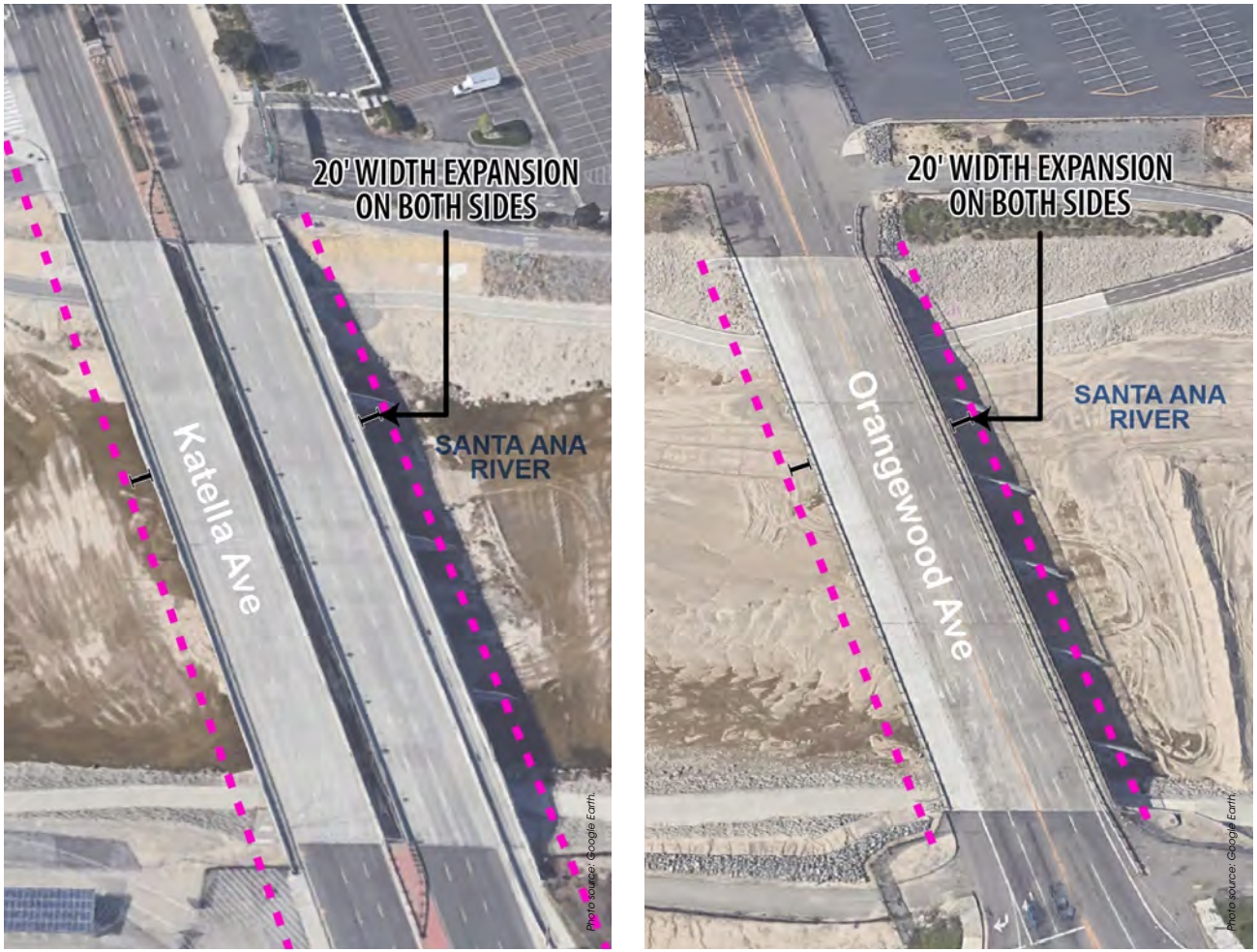
▲ View from Orangewood Ave. bridge at west en. Orangewood Avenue has minimal safety buffer between the pedestrian access and busy traffic.

Feasibility Considerations

Widening the existing bridges by 20 feet on both sides will allow for separate non-modal facilities: a striped bicycle lane and designated pedestrian sidewalks (8 feet for each) with 2 feet physical buffers zones for safety (e.g., bollards or posts) in both directions.

A Class IV bicycle lanes in each direction requires a 6'travel lane and 4'of buffer space. This allocation of width expansion space is feasible as well. Another option for Katella Avenue is to extend the existing curbs to allow for bi-directional multi-use paths on both sides of the roadway, each with separated facilities for pedestrians and bicyclists rather than the shared pedestrian/bike lanes currently on the north side.

The City of Anaheim is currently underway with design and permitting of vehicular traffic land widening project to add 30 feet to the north side of the Orangewood Avenue bridge, thus, the proposed OC River Walk allocation of designated non-modal use along a widened Orangewood Avenue could be implemented in coordination with this existing upcoming reconstruction project.



▲ Aerial plan view shows the extents of a 20-foot widening on both bridges.

Design Requirements

DESIGN ELEMENTS

Modifying the existing bridges along Katella Avenue and Orangewood Avenue would provide additional east-west multi-modal connections to the SART, providing additional connections to key destinations including ocV!BE, ARTIC, and Angel Stadium. These improvements would implement recommendations made in the City of Anaheim Bicycle Master Plan and OC Active Plan. In addition to access improvements, additional benefits include new opportunities to view and enjoy the Santa Ana River. The types of modifications described above avoid

significant impacts to the existing right-of-way or vehicle capacity, allowing for relatively quick implementation. With a widening of 20 feet on either side, it is feasible to incorporate separated facilities for both cyclist and pedestrian use. Various allocations of space configurations can be configured depending on preferred safety buffer zone spacing in coordination with the City of Orange and City of Anaheim.

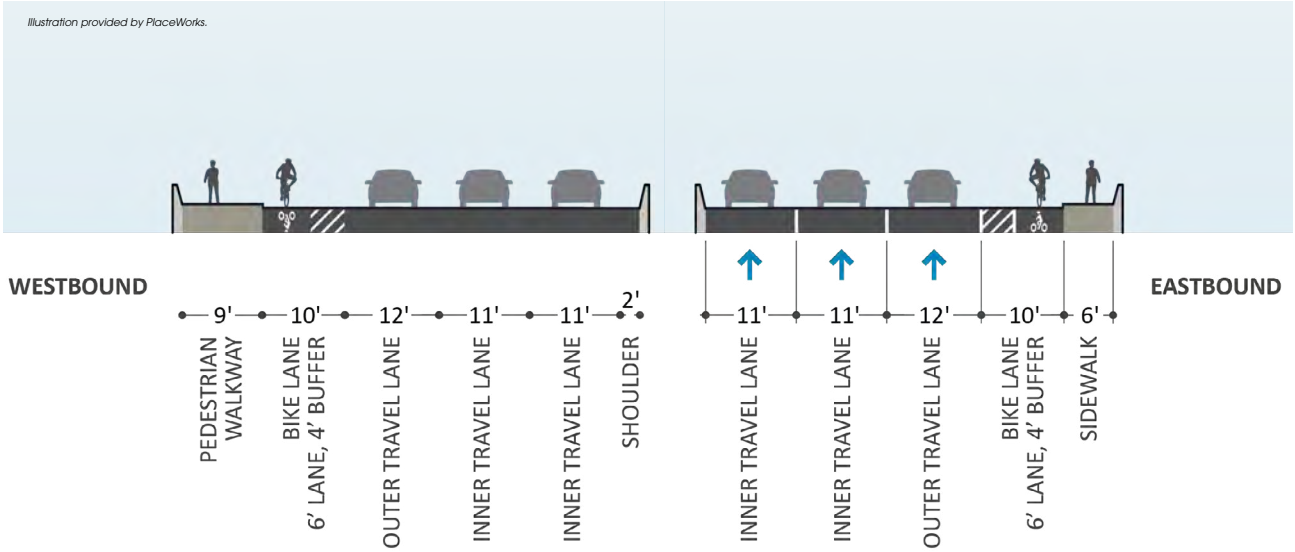
TECHNICAL STUDY REQUIREMENTS

Technical studies will need to consider the limited right-of-way to incorporate improvements for non-motorized travel. Road reconfigurations and facility design must adhere to design standards per the Orange County MPAH and City-designated truck routes.

Due to proximity of the Katella and Orangewood Avenue bridges to the 57 Freeway, Caltrans should be consulted to review any enhancements to the bridges prior to construction. In addition, due to both roadways being designated on the Orange County MPAH, any amendments deviating from MPAH standards will require approval from OCTA.

PERMIT REQUIREMENTS, SCHEDULE, AND COST ESTIMATE

It is estimated that it will take around 12-18 months to obtain the following permits in coordination with: ACOE 404 and 408, OCFCD, OCPW, RWQCB 401, NPDES and SWPPP, and CDWF 1600.



▲ Example cross section of the various potential space allocation configurations on Katella Avenue.

DESIGN AND CONSTRUCTION SCHEDULE

It is estimated that it will take around 12-18 months to produce documents to enhance the existing bridges at Katella Avenue and Orangewood Avenue. This timeline includes the development of design concepts to schematic designs and construction. The total cost to produce these documents are approximately $1,500,000. The time to construct bridge improvements and expand the existing bridges are estimated to be another 12-18 months.

CONSTRUCTION COST ESTIMATES

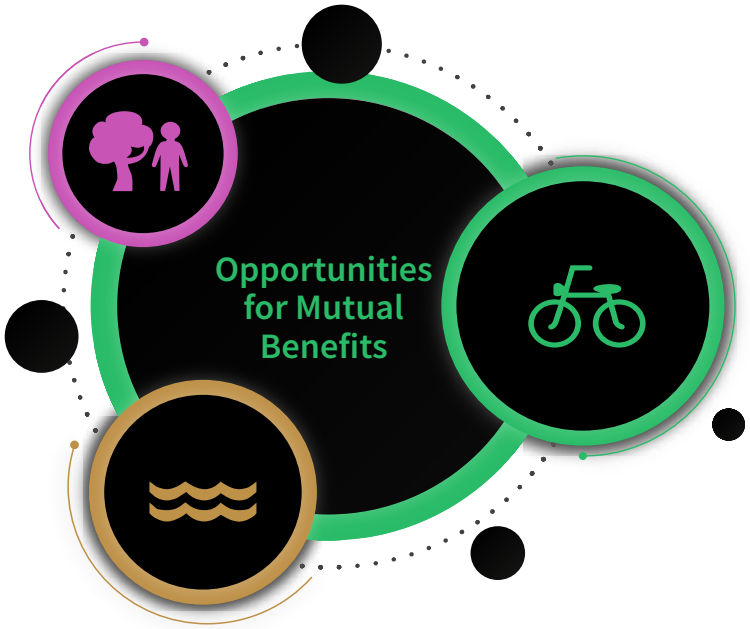
The construction budget is estimated to be around $14,000,000 per bridge widening, assuming 20 feet widening on either sides along 500 LF of bridge span. If there are additional improvements proposed that go beyond these assumptions, such as adding viewing spaces for the Santa Ana River, including any seating, this may require modifications to the bridge. These modifications may range from as adding cantilevers to the existing bridge structure or adding precast concrete box girders that provide independent structural support, effectively "widening" the existing bridge, increasing construction costs upwards of $500,000.

OPERATIONS COST ESTIMATE

Operation costs vary widely due to the magnitude of improvements that may occur on the Katella Avenue and Orangewood Avenue bridges, with estimates ranging from a minimum of $500 per year for striping and guardrail improvements to upwards of $50,000 per year to maintain improvements that include viewing areas and bridge modifications/expansions. These costs assume maintenance for the bicycle/pedestrian portions of the bridge on an annual basis. Costs for the remaining (vehicle travel) portions of the bridge are not factored into this cost. It is recommended that this additional cost be integrated to existing bridge maintenance activities.

Environmental / Regulatory Requirements

Environmental review under the CEQA and the NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile river corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place. The CEQA/NEPA process is expected to take between 12 and 18 months to complete.



1 **Increases Public Interaction and Connectivity**

Bridge modifications to better accommodate non-motorized travel will enable enhanced connectivity to the River Walk Path and SART, improving overall mobility in the City of Anaheim and surrounding region.

2 **Enhances Aesthetics and Ecology of the River and Surrounding Region**

More opportunities to view the Santa Ana River will enable the opportunity for the public to appreciate the natural and built destinations in the surrounding area.

3 **Catalyzes Economic Growth and Development**

Additional non-motorized connections will enable opportunities to visit the area's numerous attractions (including Honda Center, ARTIC, local shops, businesses, etc.) increasing economic growth without having to build additional automobile parking to accommodate these new visitors.

4 **Improves Visual and Physical Access to the River**

With the bridge widening, there is opportunity to add areas for seating and viewing the river without any modifications to the existing bridge. Seating and viewing opportunities can be accommodated if pedestrian path of travel can be narrowed to minimum 5 feet. Additional opportunities may be present to retrofit within the proposed 20 feet of additional width space on both sides of the Katella Avenue and Orangewood Avenue bridge.

7

ACTIVE TRANSPORTATION – OPPORTUNITY #7

SART Pinch Point Relief

Opportunity

Provide relief for narrow trail areas, identified at the 57 Freeway underpass and the ARTIC Railroad undercrossing box.

The width of the available right-of-way for the OC River Walk trail along the top of river bank varies along its length from 12 to 32 feet (as described in AT #5), with two noticeable physical pinch-points. The first pinch-point (7A) is located where the 57 freeway crosses over the trail. Here, a sloped bank under the freeway reduces the width available for the trail. The second pinch-point (7B), located where the ARTIC railroad tracks cross the trail, is constrained by the width of the concrete box used to create the rail undercrossing. The trail here does not meet ADA standards, as the depth creates steep slopes on both sides of the undercrossing. Both pinch-points could be relieved through careful modification of existing constraints, which would allow for better separation of bicycle and pedestrian uses.

▲ 7A – The existing trail pinch point under the 57 Freeway.

▲ 7B – The existing trail pinch point at ARTIC Railroad crossing.

The trail pinch-point under the 57 Freeway can be resolved with a retaining wall. The ARTIC Railroad pinch-point has two opportunity options: Option 1 is to add an identical box right next to the existing box. Option 2 is to grade an undercrossing similar to the what currently exists on the East bank.

LEGEND

Opportunity #7

- 7A
  Retaining wall extents
  350 LF
- 7B – Option 1
  Add parallel 15' x 15' RCB
- 7B – Option 2
  Bikeway bridge undercrossing

Existing

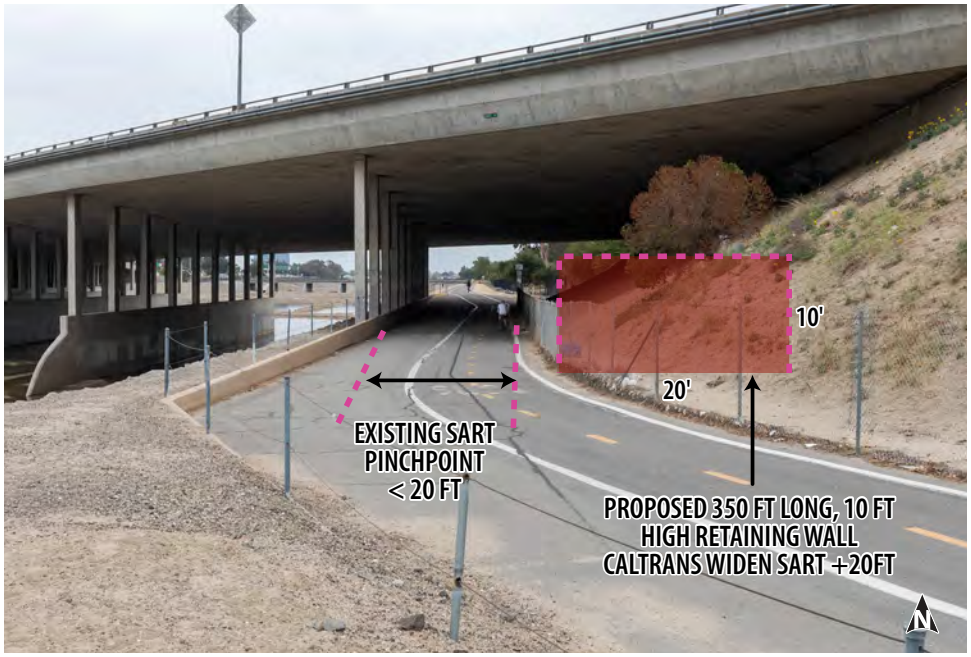
- Exist. Santa Ana River Trail (SART)

PACE STUDIO-MLA

Feasibility Considerations

7A – 57 Freeway Undercrossing Pinch-Point – At this location, a vertical retaining wall could partially replace the sloped bank, creating more width for the trail and allowing for comfortably separated pedestrian and bicyclist experiences. Depending on structural analysis and coordination with Caltrans, the widened trail width add up to 20 feet to the existing width.

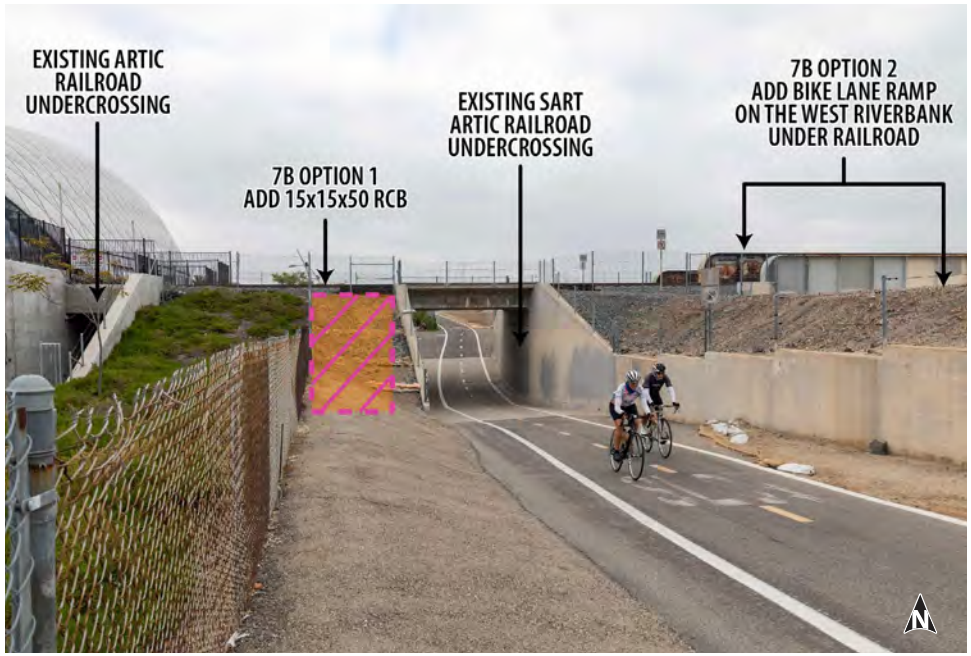
▲ On west bank, looking south at the isometric concept of a retaining wall, to push back the slope and create more trail width.



▲ On west bank, looking north at the potential dimensions of a retaining wall relative to the existing SART width.

7B – ARTIC Railroad Crossing – At this location, the steep grade of the trail and the narrow walls of the undercrossing structure constrict passage. Adding a second, pedestrian-only undercrossing directly adjacent to the existing undercrossing will provide an ADA compliant route that safely separates fast and slow modes of travel. Both Option 1 and 2 have their challenges due to crossing an active rail line and requires coordination with entities that utilize the railroad tracks, as they will to need to be shut down during construction to accommodate the modification of the concrete box. All options should modify the grade of the SART at the undercrossing to ensure that it is ADA accessible. For Option 2, the embankment modifications and undercrossing grading shall not negatively impact the hydraulic capacity of the Santa Ana River.

▲ SART from north of ARTIC railroad. The additional box for Option 1 to relive pinch point congestion can be installed in either of the locations shown.



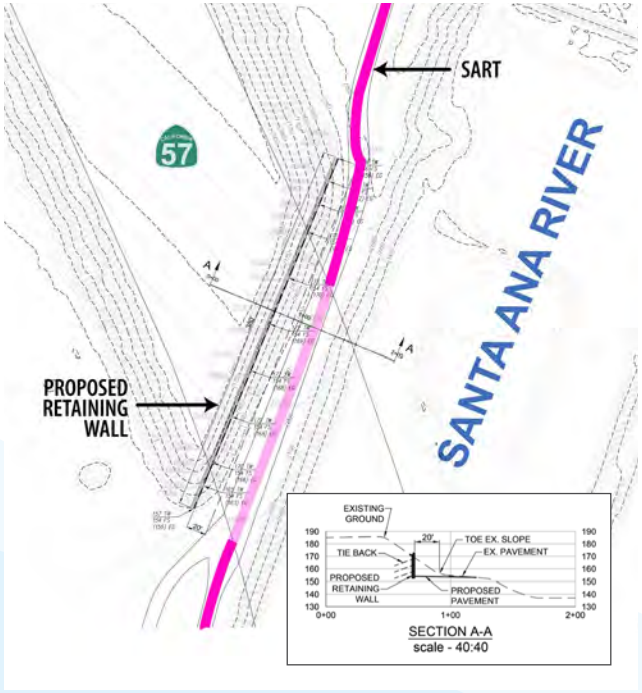
▲ SART from south of ARTIC railroad. The additional box for Option 2 to relive pinch point congestion can be installed in either of the locations shown.

OCTA is the landowner for the ARTIC railroad line and any crossing (over or under) of the railroad would require approval by OCTA. Additionally, OCTA is member of Metrolink. Metrolink is railroad operator for OCTA and other members. Part of Metrolink operations responsibility is review and approval of any construction adjacent, under, or over the railroad. Finally, the CPUC will need to issue approval and licensing for any new designated rail crossing. The CPUC Los Angeles Division of Rail Safety is responsible for review, approval and licensing newly designated railroad crossing for OC River Walk.

Design Requirements

DESIGN ELEMENTS

Both pinch-point improvements will be designed to allow for the continuous separation of pedestrians and bicyclists and comply with ADA requirements. Additionally, they will meet all safety requirements and recommendations related to trail widths. The design of the pinch-point improvements will also avoid impacts to the O&M activities along the SART, ARTIC train tracks, the Santa Ana River, and the 57 Freeway.



▲ Preliminary engineering plan and cross section was developed to access the feasibility of the proposed retaining wall (Exhibit available in Appendix I - Exhibit 06).

TECHNICAL STUDY REQUIREMENTS

A utilities conflict study will need to be conducted for the railroad undercrossing pinch-point to ensure that the improvements do not impact existing rail operations. For the Option B undercrossing, further hydraulic modeling will be required to ensure the bank modification does not negatively impact the Santa Ana River flood control conveyance.

Preliminary hydraulic modeling of a proposed undercrossing bank modifications at the SPT railroad was completed for AT #1 feasibility analysis. No negative impacts were observed upstream or downstream; any minor 0.1 increase or decrease in WSEL, velocity, and freeboard were localized around the proposed improvement. Similar results are expected for a proposed undercrossing at ARTIC railroad as part of AT #7. The OCFCD Conceptual Review is available in Appendix V for detailed discussion on the HEC-RAS modeling methodology and full results.

PERMIT REQUIREMENTS, SCHEDULE, AND COST ESTIMATE

Required permits for the railroad undercrossing pinch-point include a formal application to the CPUC for a new and/or modified railroad crossing and coordination with Metrolink and OCTA. The 57 Freeway undercrossing will require coordination with CalTrans. Other permits/approvals anticipated include OCFCD, OCPW, Caltrans (A only), and SART. Permitting for both pinch-points will take approximately 12-18 months. The permit schedule varies to account for the consultation process with multiple transportation agencies.

DESIGN AND CONSTRUCTION SCHEDULE

It is estimated that it will take around 6-9 months to produce design concepts, schematic designs and construction documents for each pinch-point option. The total cost to produce these documents range from around $300,000 for each pinch point. After design documents are complete, it will take around 3-6 months to construct the improvements. Design and construction cannot impact rail traffic or traffic along 57 Freeway.

CONSTRUCTION COST ESTIMATES

Estimates vary dramatically due to engineering complications that may occur during the process or if there are additional design elements that are instituted with the improvements such as artwork per CA #15, general landscaping per CA #17, and/or miscellaneous OC River Walk trail improvements throughout.

7A – 57 Freeway Pinch-Point:
Construction a proposed retaining wall that is 350 feet in length and 10 feet in vertical height is estimated to be a total ~$1,500,000.

7B – ARTIC Railroad Pinch-Point:
Option 1 cost estimate is a total of ~$1,500,000, assuming a 15' x 15' RCB box installation, with a length of 50 LF and 1,000 square foot wing walls.

Option 2, which would include trail improvements and an undercrossing grading effort in the riverbank is estimated to be ~$600,000.

OPERATIONS COST ESTIMATE

Annual O&M cost for the ARTIC Railroad pinch-point is approximately $30,000 as it is expected to be utilized often as part of the ARTIC Station, while the 57 Freeway pinch-point would be a general $20,000 annual for inspection and general adjacent trail maintenance.

Environmental / Regulatory Requirements

Environmental review under the CEQA and the NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile River corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place. The CEQA/NEPA process is expected to take between 12 and 18 months to complete.

1 **Increases Public Interaction and Connectivity**

Removing the existing pinch-points along the SART will increase the available ROW for non-motorized travel, allowing for greater volumes to bicycle and pedestrian traffic to travel safely along the Santa Ana River to nearby destinations.

The pinch-point improvements will enhance connections to adjacent transit opportunities, including those at ARTIC. The improvements will also upgrade the infrastructure along the SART to be ADA-compliant, allowing for access to the trail for all ages and abilities.

2 **Enhances Aesthetics and Ecology of the River and Surrounding Region**

More opportunities and comfortable areas to view the Santa Ana River will enable the opportunity for the public to appreciate the natural and built destinations in the surrounding area.

3 **Catalyzes Economic Growth and Development**

Creating a more safe and comfortable trail experience entices foot traffic along the direct trails connections to popular destinations and future development by ocV!BE and The Big A: 2050.

4 **Improves Visual and Physical Access to the River**

Improved and widened connections along the SART allow for people to access and experience the Santa Ana River.

8

RIVER ACTIVATION – OPPORTUNITY #8

River Impoundment

Opportunity

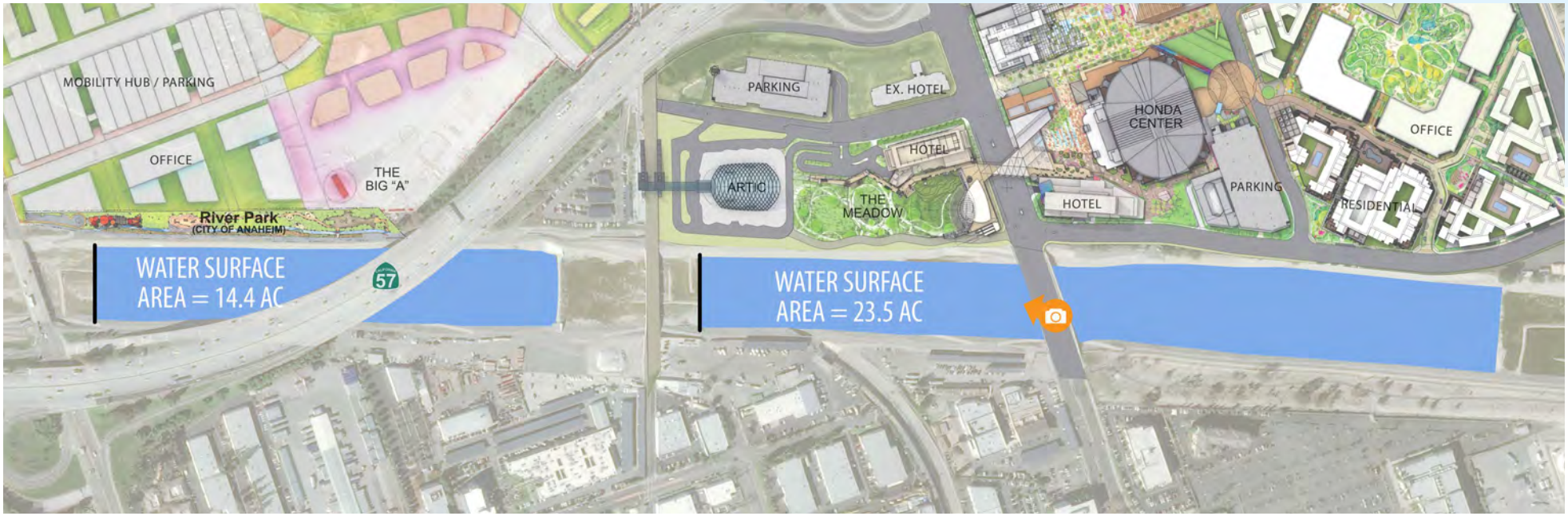
Impound water in the Santa Ana River with a dam structure with rapid take-down capabilities.

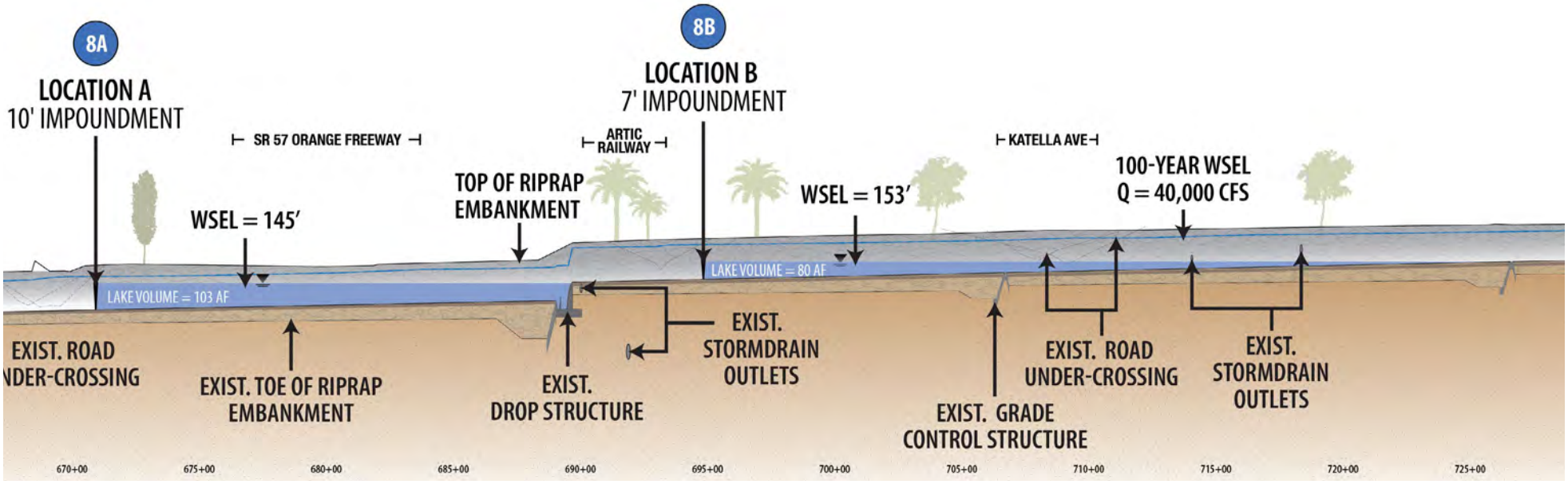
The existing 2-mile stretch of Santa Ana River between Ball Road and Orangewood Avenue is utilized for stormwater and flood control conveyance and some minor excess river water infiltration by OCWD. Upstream of the River Walk project site, the OCWD operates a series of rubber dam impoundments (The Imperial Dam and the Five Coves Dam) that diverts river water into offline infiltration basins for groundwater recharge. This system has been in operation for over 30 years and is a critical component in the County's water sustainability goals in accordance to the California Water Action Plan. The proposed project impoundment will increase storm water infiltration and eliminate the need for OCWD to grade "T" and "L" levees in the riverbed.

▲ Existing condition Santa Ana River.

▲ Rendering of proposed Santa Ana River impoundment location 8B.

▶
TOP. River impoundment plan view.
BOTTOM: River impoundment profile view.


MOBILITY HUB / PARKING
OFFICE
THE BIG "A"
River Park
(CITY OF ANAHEIM)
WATER SURFACE
AREA = 14.4 AC
57
PARKING
EX. HOTEL
HOTEL
ARTIC
THE MEADOW
HONDA CENTER
HOTEL
PARKING
OFFICE
RESIDENTIAL
WATER SURFACE
AREA = 23.5 AC


8A
LOCATION A
10' IMPOUNDMENT
SR 57 ORANGE FREEWAY
WSEL = 145'
LAKE VOLUME = 103 AF
EXIST. ROAD
NDER-CROSSING
EXIST. TOE OF RIPRAP
EMBANKMENT
8B
LOCATION B
7' IMPOUNDMENT
ARTIC
RAILWAY
TOP OF RIPRAP
EMBANKMENT
EXIST.
DROP STRUCTURE
EXIST.
STORMDRAIN
OUTLETS
WSEL = 153'
LAKE VOLUME = 80 AF
KATELLA AVE
EXIST. GRADE
CONTROL STRUCTURE
100-YEAR WSEL
Q = 40,000 CFS
EXIST. ROAD
UNDER-CROSSING
EXIST.
STORMDRAIN
OUTLETS
670+00
675+00
680+00
685+00
690+00
695+00
700+00
705+00
710+00
715+00
720+00
725+00

There is opportunity to construct similar impoundment structure(s) in the Santa Ana River adjacent to the proposed OC River Walk trail. The OC River Walk project site is a suitable location for additional groundwater recharge with its large riverbed footprint and infiltration rates. Impounding water in the river itself, rather than diverting water to an offline infiltration basin, means that the impoundment is essentially a safety net plug, allowing the existing upstream recharge systems to operate more aggressively. If any stormwater does not infiltrate by the time it reaches Ball Road, it will be captured for infiltration by the river impoundment opportunity at OC River Walk.

The proposed impoundment also provides exceptional mutual benefit as a water feature amenity for the surrounding future development, the local community, and overall aesthetic of the Santa Ana River corridor. The River Impoundment opportunity has great potential to become another iconic destination and feature of Orange County.

Feasibility Considerations

HYDRAULIC CAPACITY

he Santa Ana River is, first and foremost, a flood control and flood conveyance system. Any proposed impoundment structure and associated facilities shall not reduce the flood protection, conveyance, capacity, or flood resiliency in any way. The proposed impoundment dam structure will be designed with rapid take-down capabilities and will be flush with the existing river invert when not in use. Thus, there shall be no negative hydraulic impacts.

WATER SOURCE AVAILABILITY

Multiple water sources were considered for the feasibility of keeping a continuous volume of water body impoundment in the Santa Ana River. OCWD's current groundwater replenishment supply arrives from three places. First, the OCWD has legal ownership of all water flowing in the Santa Ana River below Prado Dam. Secondly, the OCWD recycled wastewater delivered to them from the OCSD at the rate of 100 MGD. That daily production from the GWRS will increase to 130 MGD by the year 2023. A large amount of GWRS is pumped 14 miles north through a large diameter pipeline within the Santa Ana River riverbank to OCWD's Anaheim recharge facilities.

Conveniently, that 60-inch pipeline runs directly adjacent to the OC River Walk project site on its way north. The third source of recharge water is Metropolitan Water District's imported water delivered from the Colorado River and Northern California. A fourth source, regional urban stormwater run-off will be discussed in RA #10 in this report. The relative cost of these water sources is dramatically different with the Santa Ana River water being free, the GWRS recycled water being approximately $600 per acre foot and imported water exceeding $1,000 per acre foot.

OCWD has issued a letter of support to the City of Anaheim's efforts and has stated the river impoundments will positively impact the local groundwater basin. OCWD has committed to developing future authorities, permits and agreements together to lead to the eventual construction, O&M of the facilities. Their intent is to operate and maintain the impoundment(s).

The annual evaporation loss (38ac x 4.5ft) 170 AF from the proposed impoundments will be offset by the annual infiltration (10-15 cfs Ball Road to Orangewood Avenue) capacity of 6,000 to 9,000 AF/yr (assuming 300 days/year).

▲
TOP. Ultra clear and clean GWRS water.
BOTTOM: OCWD-GWRS turn out structure.

STRUCTURE LOCATION AND IMPACT

Along the corridor, several constraints narrowed down the potential locations and height of the river impoundment structure:

- The existing bridge undercrossings (maintenance access ramps) controls how high the impoundment WSEL can be. The undercrossing shall stay unsubmerged with the impoundment in place in normal non-storm event conditions. The invert of the undercrossing also cannot be easily raised as there is a minimum height clearance requirement for maintenance vehicle use. Therefore, it is ideal for a proposed impoundment structure to avoid submerging existing and proposed future undercrossings either by location and/or structure height which effects the impounded water depth and extents.

- The existing stormdrain outlets were identified along the project site corridor (10RA). Impounded water can back-up within the storm drain system unless the stormdrain is re-routed downstream or upstream of the impounded water body. The stormdrains do not create a hard physical constraint, but simply need to be accounted for in the design requirements and cost estimate of a proposed impoundment. It is ideal to minimize the number of impacted stormdrain outlets, but at the same time, re-routing stormdrains also creates an incentive and additional opportunity for water quality and BMP treatment.

- The existing drop structures within the Santa Ana River control the potential impounded water body extents. The drops create an upstream water extent limit, but can be incorporated as a design benefit as vector control and minimum water depth. So long as the proposed impoundment structure is an adequate amount downstream from the drop structure, a balance of maximized water body extent can be achieved in conjunction with utilizing the drop structure in the upstream.

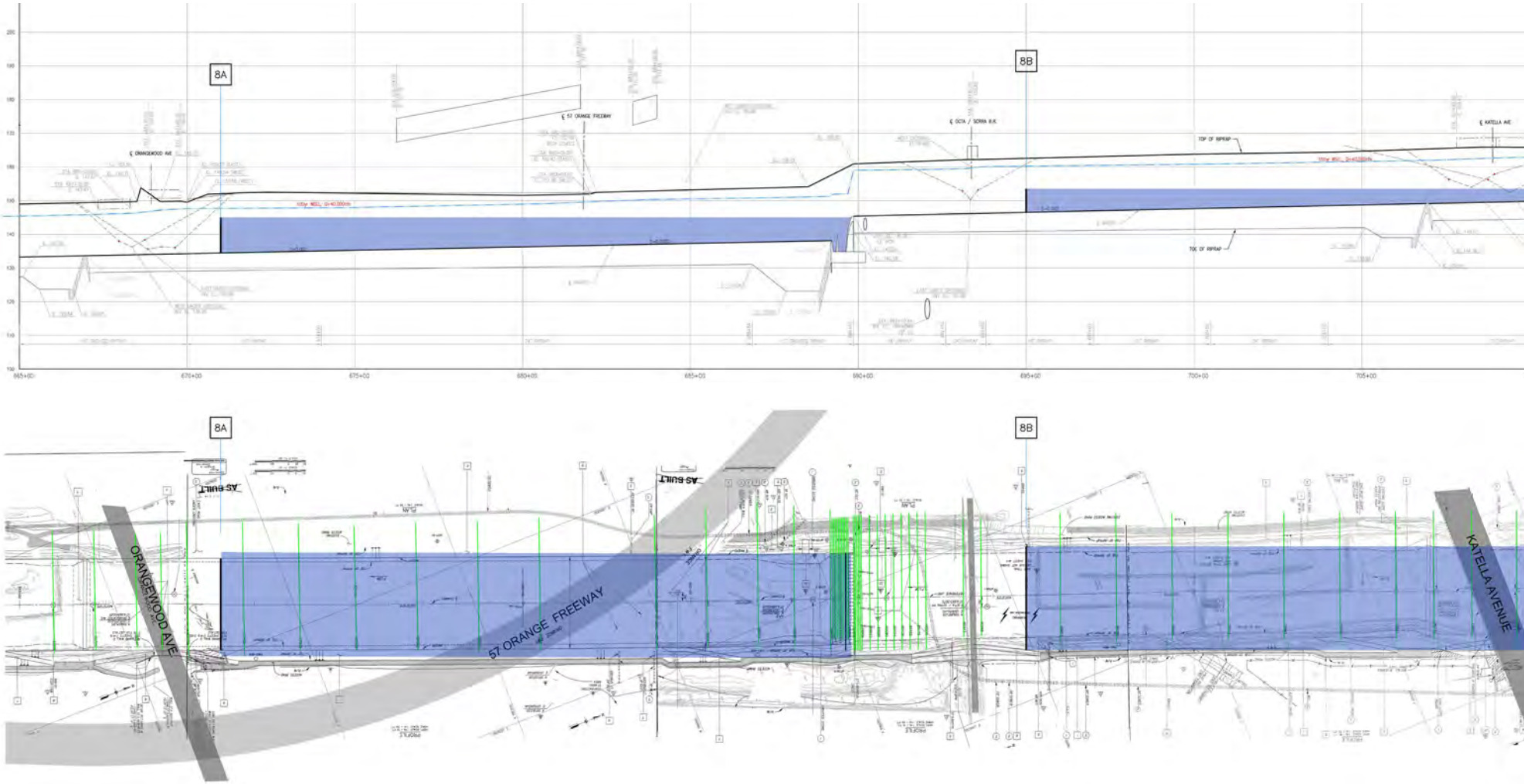
IMPOUNDMENT LOCATION	IMPOUNDMENT STRUCTURE HEIGHT (FT)	IMPOUNDMENT STRUCTURE LENGTH (FT)	WATER SURFACE AREA (AC)	WATER SURFACE ELEVATION (FT)	WATER VOLUME (AC-FT)
ARTIC	7	320	23.5	153'	80
Orangewood	10	350	14.4	145'	103

▲ Potential Impoundment Location Summary: (note these are approximate figures)

- The adjacent edge condition also effects the mutual benefit of a proposed impoundment. A clean water body can serve as a waterfront view amenity for nearby destinations and other proposed opportunities. The potential iconic attraction may entice stakeholders, agencies, or developers to become involved with funding and design coordination, maximizing the Santa Ana River as a multi-purpose flood control facility.

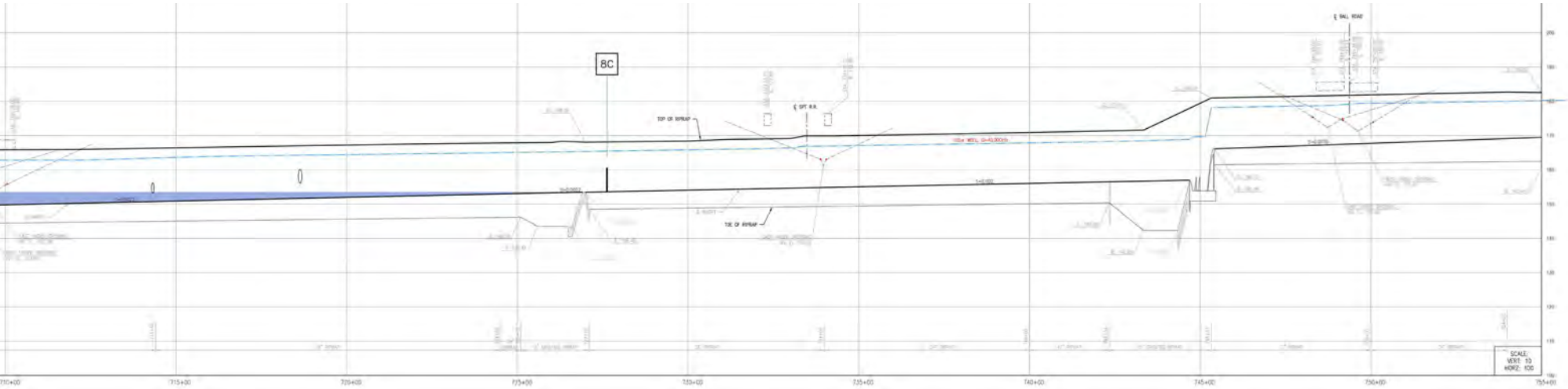
Taking these constraints into consideration and maximizing mutual benefits, two (2) potential locations were identified:

- **Location A:** The first impoundment location is upstream of the ARTIC railroad bridge crossing and creates a water surface almost to the SPT railroad bridge crossing. An additional impoundment structure (a seasonal sand/earthen berm) at the upstream end could be added to establish a minimum water depth to avoid shallow water conditions where WSEL meets the riverbed grade. Another impoundment structure would be installed at Collins Channel, which joins the Santa Ana River within the impounded water area. This structure would prevent impoundment water in the Santa Ana River from migrating upstream in Collins Channel and causing any potential adverse backwater impacts in Collins Channel. There are two existing stormdrains located near the shallow end of the impoundment. These would also require some addition structure and/or diversion to prevent potential backwater impacts to the local stormdrain system and preserve the water quality in the impoundment area.



▲ An engineering plan & profile was prepared identifying both impoundment locations and summarizing the constraints and location descriptions. This plan & profile is derived from the ACOE Santa Ana River Record Drawings. Exhibit is available in Appendix I – Exhibit 07.

- **Location B:** The second impoundment location is upstream of the Orangewood Avenue bridge crossing and creates a water surface, terminating at the existing river drop structure just downstream of the ARTIC railroad bridge crossing. This potential location does not require another impoundment structure upstream, as the existing river drop structure can be utilized to achieve a minimum water depth. There are two existing stormdrains further upstream of the existing drop structure. They are not within the impounded water footprint, but diversions may still be necessary to prevent any adverse impacts to the stormwater system or impounded water quality.



O&M

The water impoundment within the river will be similar to OCWD's existing rubber dam impoundments (Five Coves and Imperial, see photo herein) currently in place for river flow diversion to groundwater recharge. However, instead of diverting water into offline basins, OC River Walk impoundment structures (rubber dam or similar) would be installed to create semi-permanent water bodies in the Santa Ana River for groundwater recharge and public community benefit, and infiltrate through the soft bottom riverbed. Identical to existing OCWD structures, the impoundment structures would lower automatically during storm events or to drain the impounded water when otherwise desired. OCWD has indicated the impoundment(s) could be filled with water from the Groundwater Replenishment System (GWRS) line in the dry season (April 15 – November 15). During the wet season (Nov 16 – April 14), the impoundment would be filled from Prado Dam and the seasonal river flow. The OCWD would operate and maintain the impoundment(s).

▲ From west bank of river, south of Katella Ave. near ARTIC parking lot. Impoundment structure eliminates need for OCWD to continually grade "T" & "L" levees in the bed of the Santa Ana River.

▲ Santa Ana River Imperial Rubber Dam – looking Northeast from the southerly river bank. OCWD operates the seven-foot-high rubber dam and diversion facility for water impoundment and groundwater recharge.

▲ Close up of impoundment O&M at Five Coves location.

Design Requirements

DESIGN ELEMENTS

The river was designed by the U.S. Army Corps of Engineers to safely convey the 100-year storm event, a flowrate of 40,000 cfs with about 2 feet of freeboard. Freeboard is the extra space of safety between the highest water surface level and the top of the embankment. Aside from a major storm event, this stretch of Santa Ana River is normally dry.

The design of the impoundment structure would be in coordination with OCWD such that design plans are approved by their O&M department and groundwater recharge goals.

TECHNICAL STUDY REQUIREMENTS

Impoundment design would include a geotechnical, structural and detailed river hydraulic evaluation of the proposed structures, impounded water condition, and potential impacts to the river bank. River bed structures such as bridge piers, grade control structures, and channel drop structures would also be included in the evaluation.

The CEQA requires that all state and local governmental agencies consider the environmental consequences of projects over which they have discretionary authority prior to taking action on those projects. It is anticipated that the EIR would address would address the following environmental topics:

- Aesthetics
- Air Quality
- Biological Resources
- Cultural Resources
- Geology and Soils
- Greenhouse Gas Emissions
- Hydrology and Water Quality
- Noise
- Recreation
- Transportation
- Tribal Cultural Resources

PERMIT REQUIREMENTS, SCHEDULE, AND COST ESTIMATE

The cost estimate to complete the EIR and EA including all technical studies is $300,000 to $400,000. It is anticipated that CEQA and NEPA review could be completed within 12 to 18 months from completion of 30% design drawings.

DESIGN AND CONSTRUCTION SCHEDULE

Engineering design and drafting construction document efforts are estimate to take 12-18 months for each impoundment location. Location B requires design modifications for Collin's Channel as well. Therefore, the design fee for Location A is ~$800,000, while Location B is ~$1,200,000.

▲ Santa Ana River OCWD rubber dam and impoundment at Imperial diversion.

CONSTRUCTION COST ESTIMATES

Construction of the impoundments include the dam structure itself with appropriate foundations (~$2,000,00 each), existing storm drain and Collin's Channel modifications (~1,500,000 to $2,000,000). Location A totals to approximately ~$4,500,000 and Location B is ~$6,000,000.

OPERATIONS COST ESTIMATE

Estimated annual O&M is ~$200,000 for Location A and ~$300,000 for Location B since Collin's Channel modification and maintenance are included as part of the impoundment design at Location B.

Environmental / Regulatory Requirements

It is anticipated that the proposed project will require environmental review under the CEQA and the NEPA. As a result, the City proposes to prepare a EIR in compliance with CEQA and an EA in compliance with NEPA:

1. ACOE - CWA, Section 404 permit
2. CDFW - Section 1602 Streambed Alteration Agreement
3. RWQCB, Santa Ana Region
    a. Federal CWA Section 401 Water Quality Certification
    b. NPDES permit/notification
    c. SWPPP

1 **Increases Public Interaction and Connectivity**

Water impoundment opens up opportunity for community engagement and water programming events.

2 **Enhances Aesthetics and Ecology of the River and Surrounding Region**

The impounded water will improve the overall corridor with an amazing scenic view and over all ecology.

3 **Catalyzes Economic Growth and Development**

Adjacent land owners and developers are incentivized to embrace the river as an attractive amenity.

4 **Improves Visual and Physical Access to the River**

Together with other proposed OC River Walk opportunities, there will be many points along the corridor to enjoy the impoundment as a water feature amenity and areas to enjoy the water up close.

▲ Existing view from the Katella Avenue Bridge looking downstream facing the ARTIC station, Angel Stadium, the Big "A" sign and Meadow View Park.

▲ Proposed render of view from the Katella Avenue bridge, looking downstream at RA #8 impoundment location B.

RIVER ACTIVATION – OPPORTUNITY #9

Riverbank Modifications

9

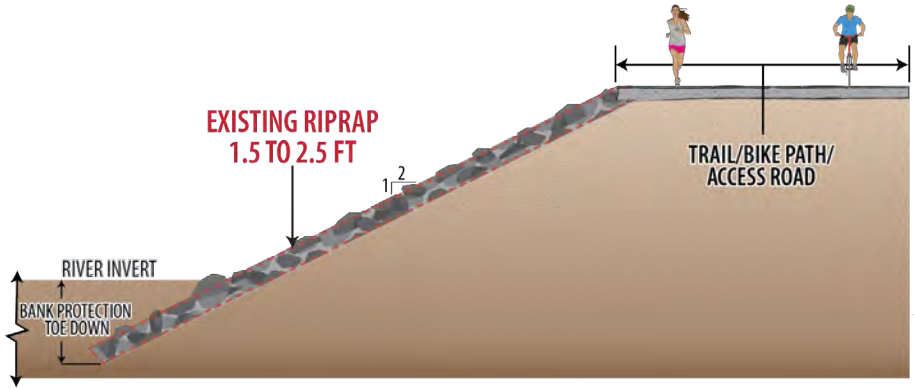
Opportunity

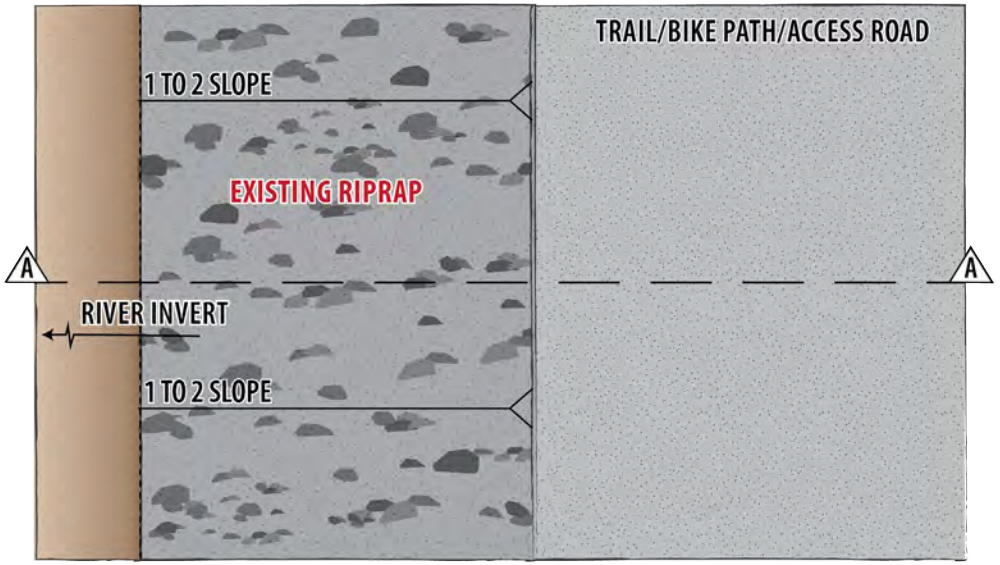
Modify and improve the embankment along the Santa Ana River for multi-purpose use.

There is approximately 3 miles of riprap-lined riverbank along the western and eastern sides of the Santa Ana River between Ball Road and Orangewood Avenue. According to the ACOE as-built record of the Santa Ana River, the existing riverbank protection is comprised of loose and grouted riprap at a 2(H):1(V) slope. Loose riprap thickness ranges from 24" to 42". Areas around drop structures are grouted at 15" thickness. The OC River Walk proposed improvements may include soil cement bank protection with slopes of 1.5(H):1(V).

While riprap is highly functional as a bank protection method, modifications to the existing riverbank can be made to maximize the river corridor's versatility, maintaining adequate stormwater flood protection, but also providing safe public access and engagement with the Santa Ana River. There is opportunity for riverbank modifications to incorporate features such as stadium step seating, grade separation/variance, terracing, or landscape planters. This would effectively transform the footprint of single-purpose riverbank into a multi-purpose infrastructure.

Photo shows the proximity of the existing riprap to the SART





▲ Bank protection existing riprap at 20 to 30% of river width.

Based upon initial feasibility analysis meeting with the OCFCD & ACOE, existing conditions river bank stability analysis will need to be provided based upon saturated soils condition as a result of the proposed impoundments (RA #8). In the event the existing riprap bank protection is unstable, it will be necessary to provide alternative river bank solution.

▲ From west bank of river, north of Katella Ave. bridge (view of undercrossing ramp). Photo shows areas of grouted riprap versus loose riprap above the riverbank.

▲ From west bank of river, south of Katella Ave. Photo showcases what the existing 2:1 grouted riprap slope looks like throughout the majority of the corridor.

Feasibility Considerations

The Santa Ana River is, first and foremost, a flood control and flood conveyance system. Any modifications to the embankments shall not reduce the hydraulic capacity or resiliency in any way.

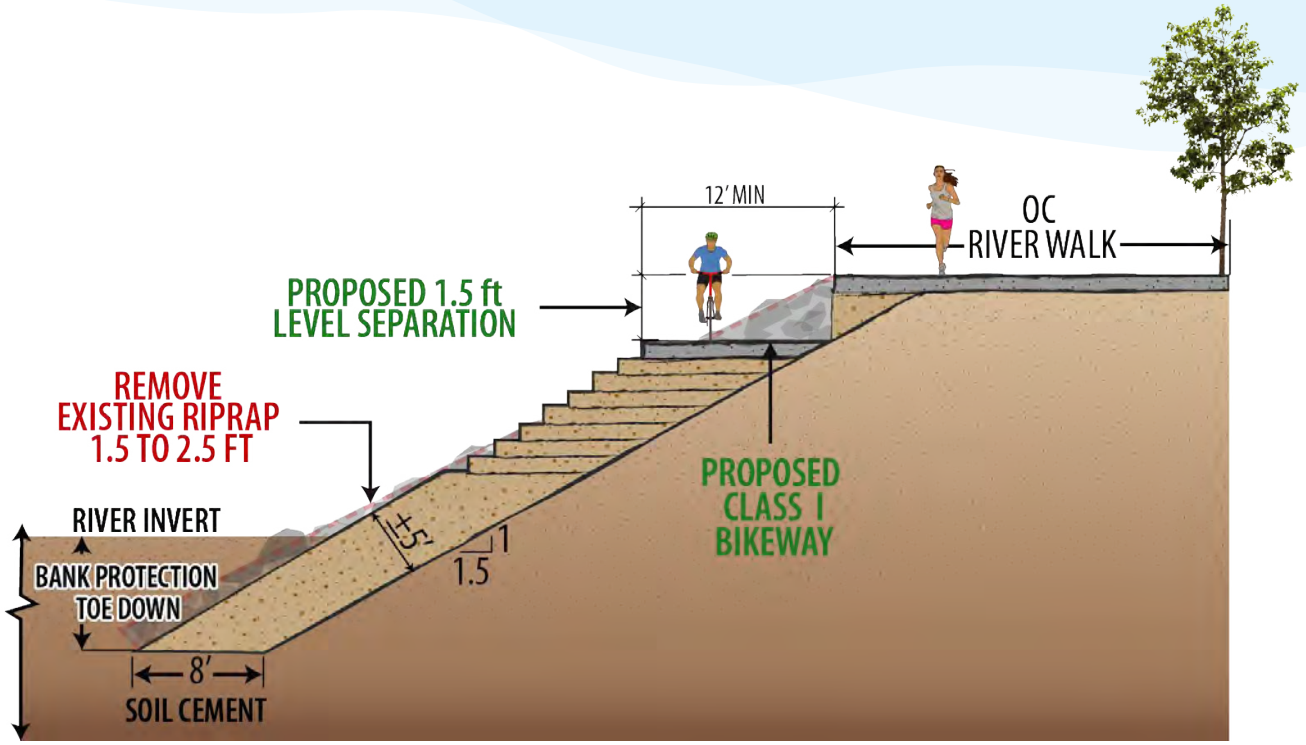
Therefore, all river bank modifications and all flood control related OC River Walk opportunities, hydraulic modeling and proposed improvements will be prepared and submitted to both OCFCD and ACOE. OCFCD has primary review, approval and permitting role for County as OCFCD maintains flood control for the Santa Ana River. The ACOE has secondary role of review and approval related to many and all impacts to existing river related flood control structure through the 408 Permitting Program. The ACOE Waters of the U.S. Regulatory permitting is covered under the 404 Permitting Program.

▲ Example of concrete stamping in the river bank to add artistic/creative elements.

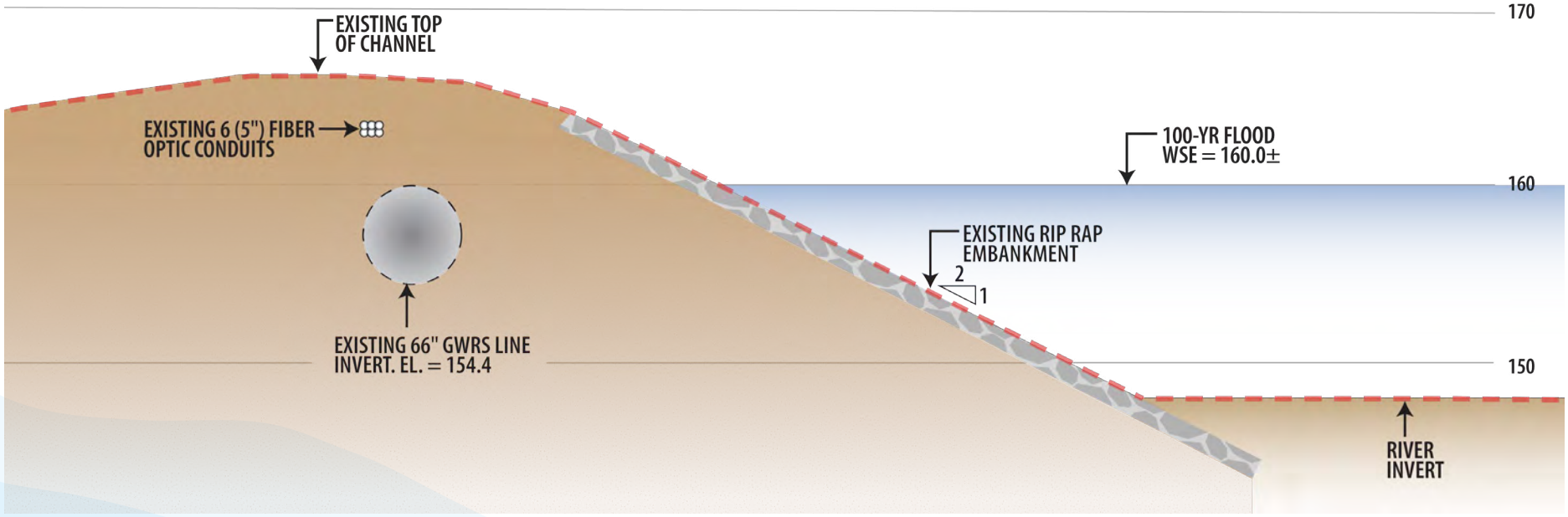
CONSTRUCTION MATERIALS

Soil cement is widely used for its flexible application, aesthetic appeal, cost efficiency, and high durability for channel stabilization. Similar to concrete and riprap, soil cement is strong enough to protect the banks from erosion, but offer the added benefit of an aesthetically pleasing natural appearance and provide smoother integration between adjacent land uses and the river itself. Riverbank stamps and planters can also be incorporated into soil cement as shown in the examples below. Such artistic elements and landscaping enhance the overall aesthetic. Together with landscaping enhancement opportunities, designs of soil-cement riverbanks can connect the area with the ideals of the community.

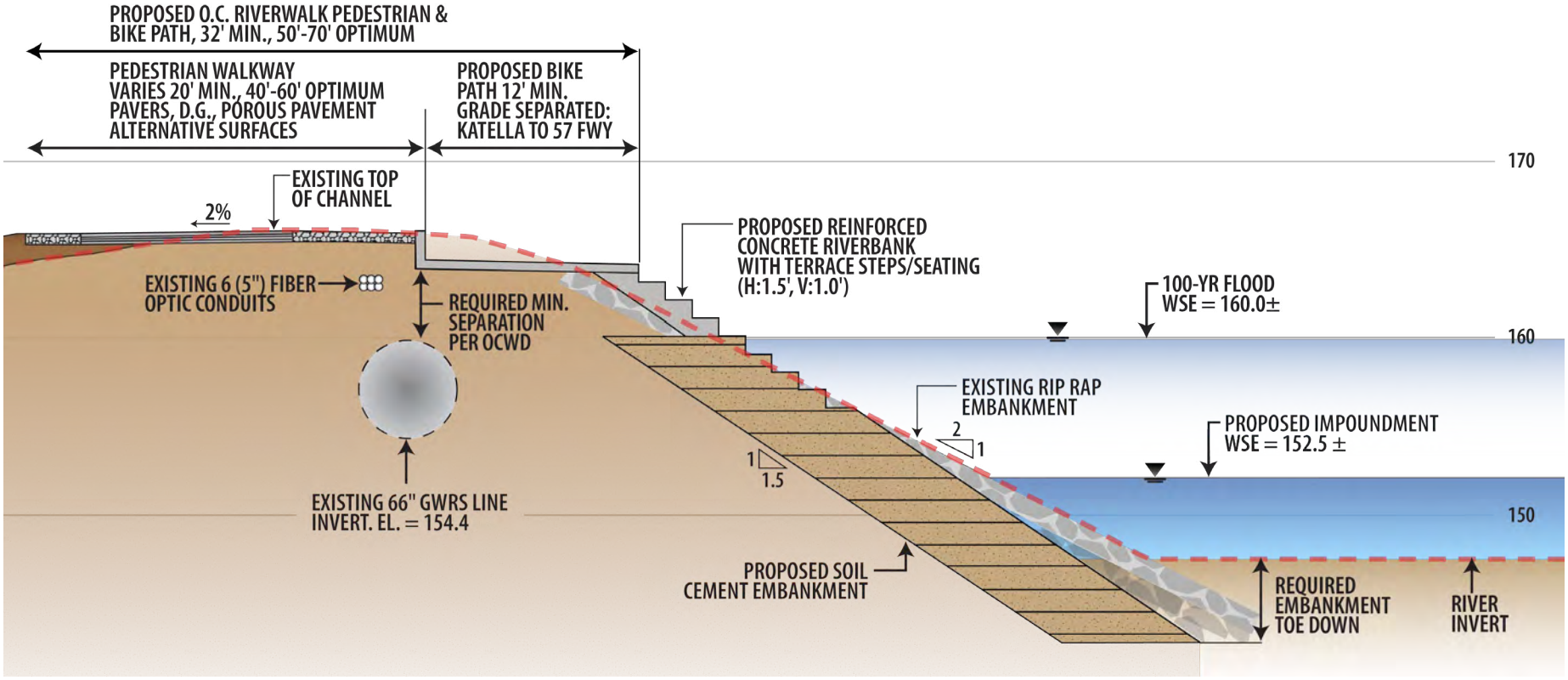
Other modifications include the opportunity for grade separated bike path along the top of the riverbank. This would be done while maintaining hydraulic capacity in the channel by slightly increasing the cross-sectional flow area. With the upcoming proposed development of OC River Walk, The Big A: 2050, and ocV!BE, the existing undercrossing box will experience even more pedestrian and bicycle volume. High-speed commuter cyclists would use the proposed grade-separated trail, which would run parallel to the existing SART. The proposed bicycle path shall be designed above 100-year stormwater surface elevations except at the bridge undercrossing locations. This option of riverbank modification offers great AT mutual benefit, but also the most involved hydraulic modeling to ensure design requirements are met.



▲ Conceptual cross section of the grade-separated bike path.



▲ A preliminary engineering cross section analysis was created to ascertain the feasibility of the conceptual cross section of a grade-separated bike path along the modified embankment extents, shown below. Existing is shown on left and proposed is shown on right (Exhibit is available in Appendix I – Exhibit 08).


PROPOSED O.C. RIVERWALK PEDESTRIAN & BIKE PATH, 32' MIN., 50'-70' OPTIMUM
PEDESTRIAN WALKWAY VARIES 20' MIN., 40'-60' OPTIMUM PAVERS, D.G., POROUS PAVEMENT ALTERNATIVE SURFACES
PROPOSED BIKE PATH 12' MIN. GRADE SEPARATED: KATELLA TO 57 FWY
170
EXISTING TOP OF CHANNEL
2%
PROPOSED REINFORCED CONCRETE RIVERBANK WITH TERRACE STEPS/SEATING (H:1.5', V:1.0')
100-YR FLOOD WSE = 160.0±
160
EXISTING 6 (5") FIBER OPTIC CONDUITS
REQUIRED MIN. SEPARATION PER OCWD
EXISTING RIP RAP EMBANKMENT
2
1
PROPOSED IMPOUNDMENT WSE = 152.5 ±
1
1.5
150
EXISTING 66" GWRS LINE INVERT. EL. = 154.4
PROPOSED SOIL CEMENT EMBANKMENT
REQUIRED EMBANKMENT TOE DOWN
RIVER INVERT

Design Requirements

DESIGN ELEMENTS

The river and riverbanks were designed by the U.S. Army Corps of Engineers to safely convey the 100-year storm event, a flowrate of 40,000 cfs with about 2 feet of freeboard and erosion protected with riprap. Any riverbank modifications shall not compromise the 100-year storm conveyance or level of embankment protection. Existing utilities must also be respected.

TECHNICAL STUDY REQUIREMENTS

- Maintain original flood conveyance capacity and freeboard per OCFCD approval.
- Design soil cement banks according to industry standards.
- Toe-down depth of soil cement prevents scour below toe.
- Structural engineering required for any proposed vertical walls.
- Public Safety Signage
- Facility O&M Plan
- Allow for easy entrance/exit, including ADA.
- Appropriate landscape plant palette selection for Southern California and periodic inundation by flood waters.

Preliminary HEC-RAS hydraulic analysis of steepened riverbank modifications resulted in very minimal impacts to the 100-year storm WSEL, localized around modeled pilot areas of slope modifications. Full preliminary hydraulic modeling is detailed in a technical memorandum for OCPW Conceptual Review, enclosed in Appendix V.

PERMIT REQUIREMENTS, SCHEDULE, AND COST ESTIMATE

Permitting / approvals are anticipated for:

1. UACOE - CWA, Section 404 permit
2. CDFW - Section 1602 Streambed Alteration Agreement
3. RWQCB, Santa Ana Region
   a. Federal CWA Section 401 Water Quality Certification
   b. NPDES permit/notification
   c. SWPPP

The permitting/approval process is likely to take 12-18 months to complete.

▲ From west bank of river, north of Katella Ave.

DESIGN AND CONSTRUCTION SCHEDULE

Design and construction document drafting is expected to take 14-18 months and construction completion to be another 12-18 months.

CONSTRUCTION COST ESTIMATES

Riverbank modifications per linear foot are estimated to be ~$550, assuming 25 feet of embankment height. Soil cement embankment costs are estimated at $650/LF. Both West and East improvement measure a total of approximately 10,000 LF and the total cost of soil cement material and construction is ~$12,000,000.

OPERATIONS COST ESTIMATE

Annual O&M for the modified riverbanks are estimated to be ~$100,000.

Environmental / Regulatory Requirements

The cost estimate to complete the EIR and EA including all technical studies is $300,000 to $400,000. It is anticipated that CEQA and NEPA review could be completed within 12 to 24 months from completion of 30% design drawings

1 **Increases Public Interaction and Connectivity**

Providing a grade-separated bike path along the Santa Ana River corridor increases the active transportation connectivety in and around the Orange County region.

2 **Enhances Aesthetics and Ecology of the River and Surrounding Region**

Removing the existing grouted riprap and replacing with soil cement allows for artwork and multi-purpose use of the embankment protection footprint that is necessary for safe river hydraulics.

3 **Catalyzes Economic Growth and Development**

Proposed improvements along the riverbanks attract more public use of the area and connection to the adjacent lands' attractions and development.

4 **Improves Visual and Physical Access to the River**

Proposed soil cement embankments can be designed as a multi-purpose community amenity for stepped embankment (CA#14), bringing people closer to the river for engagement.

RIVER ACTIVATION – OPPORTUNITY #10

Urban Stormwater Treatment

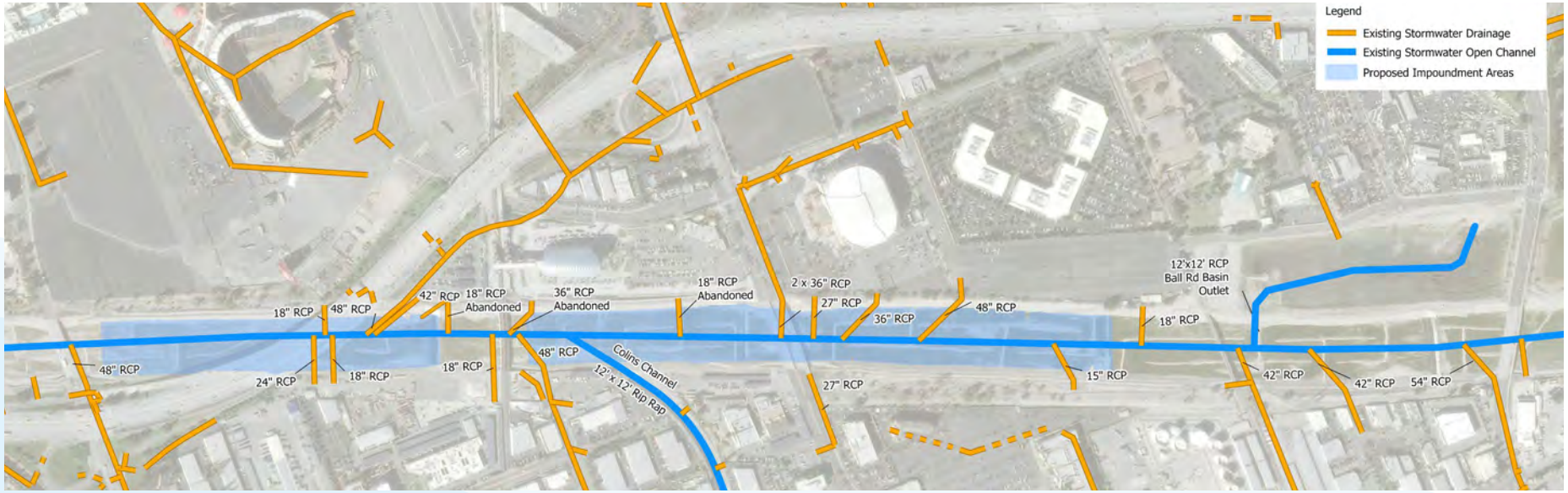
10

Opportunity

Include urban stormwater treatment where OC River Walk opportunity improvements would provide incentive to incorporate BMP/ LID features with the proposed design and modifications in coordination with existing stormwater quality project studies such as OC WIPS, OCWD Recharge Enhancements, and City runoff water quality goals.

Some of the proposed OC River Walk opportunities require extensive construction efforts, not only to install the proposed improvements, but also to tie-in those improvements and/or structures to existing adjacent systems and associated facilities. For such a large planning and designing endeavor, there is opportunity to incorporate mutual-benefit urban stormwater treatment features with the proposed opportunity design and construction efforts. Three urban stormwater treatment potentials are incentivized by some of the key elements of OC River Walk opportunity improvements.

10A – Existing storm drains: The first stormwater treatment potential would be all the existing storm drains that discharge into the Santa Ana River within the extents of the OC River Walk project corridor. There is opportunity to provide treatment for these point discharges. The 10A component of the OC River Walk includes diversion, collection (pumping/piping) and treatment of the BMP run-off from the tributary watersheds for the west side of the river.

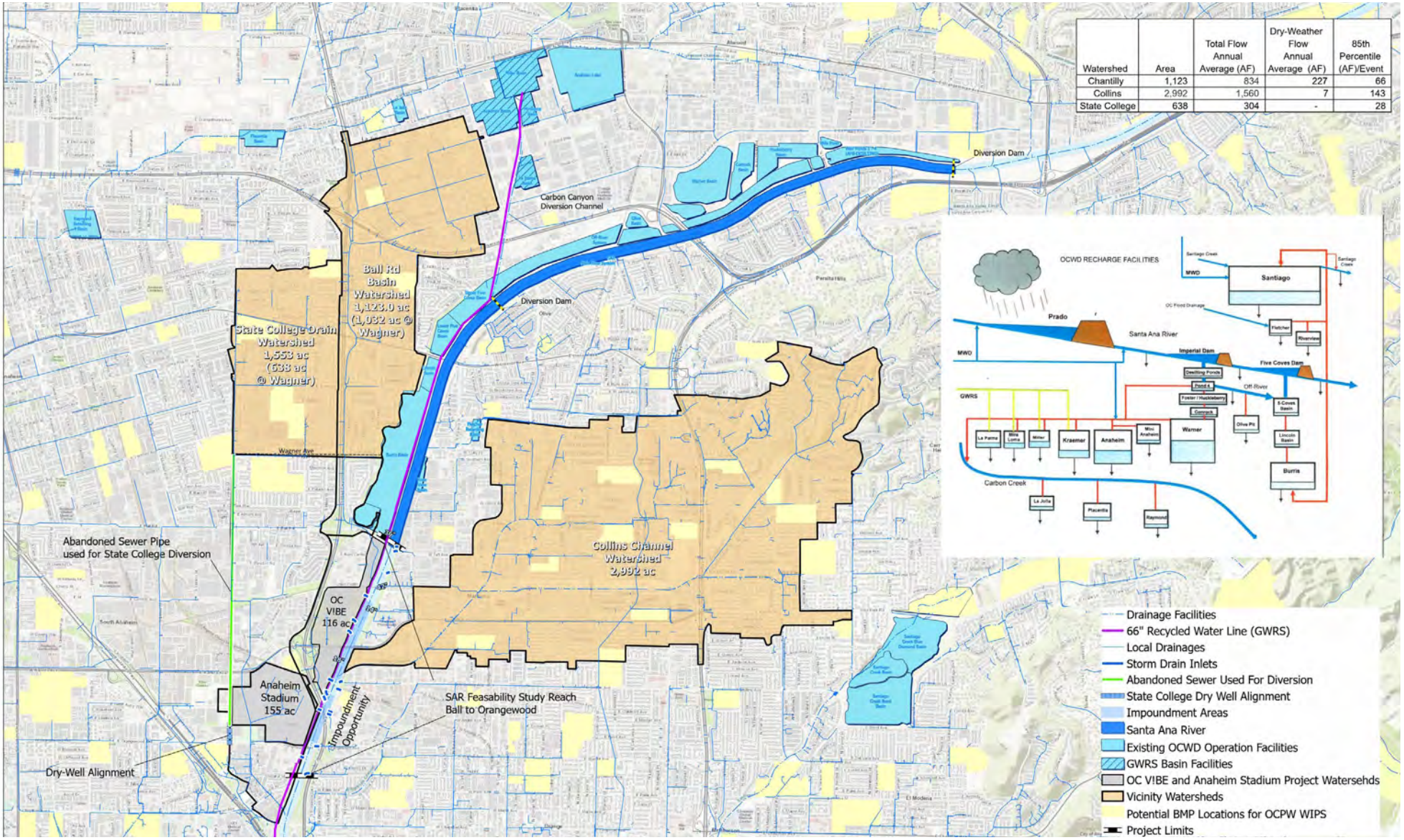


▲ Existing storm drains (Exhibit is available in Appendix I – Exhibit 10).

10B – Collin's Channel: The second treatment incentive is the Collin's Channel as part of the existing OC Watershed Improvement Projects (WIPs) study. The channel merges into the Santa Ana River where the proposed impoundment Location B would be. As part of RA#8 design, a structure in Collin's Channel would be proposed to prevent any negative impact from backwater effects from the impounded water. Therefore, providing incentive for other mutual benefits that can be incorporated into Collin's Channel such as urban stormwater treatment. This collection and treatment could also be extended to all other storm drain outlets on the east bank of the river.

▶ From west bank of river, south of Katella Ave.

10C – Chantilly Storm Drain Diversion: The third potential treatment project related to the two upstream watersheds that feed into the Santa Ana River: Chantilly and State College Watershed and storm drain.



▲ Example of Concrete Stamping in the Riverbank to Add Artistic/Creative Elements to the River (Full-scale exhibit is available in Appendix - 09).

Feasibility Considerations

10A – Existing storm drains: The river embankment is proposed to under-go modifications per multiple proposed opportunity improvements and therefore, all storm drains will be impacted. For example, with the proposed impoundments of RA #8. Each storm drain can either be outfitted with flap/tide gates to prevent negative backwater effects or rerouted downstream of the impoundment footprint to not mix urban runoff with the clean impounded GWRS water. Building upon a storm drain bypass or rerouting modification, there is opportunity to capture small storms or nuisance flows into a nearby BMP/LID facility. For a highly dense area such as the OC River Walk project site, most of the footprint is already developed and underground BMP/LID facilities would be ideal for multi-purpose land use.

◀ LEFT: Photo shows how some existing storm drains within the project corridor already have back flow gates installed. Storm drain outlet back flow prevention.
▲ RIGHT: Photo is an example underground BMP facility by StormTrap. Product such as these are popular choices for urbanized areas that don't have open space footprint available for other conventional BMP/LID solutions.

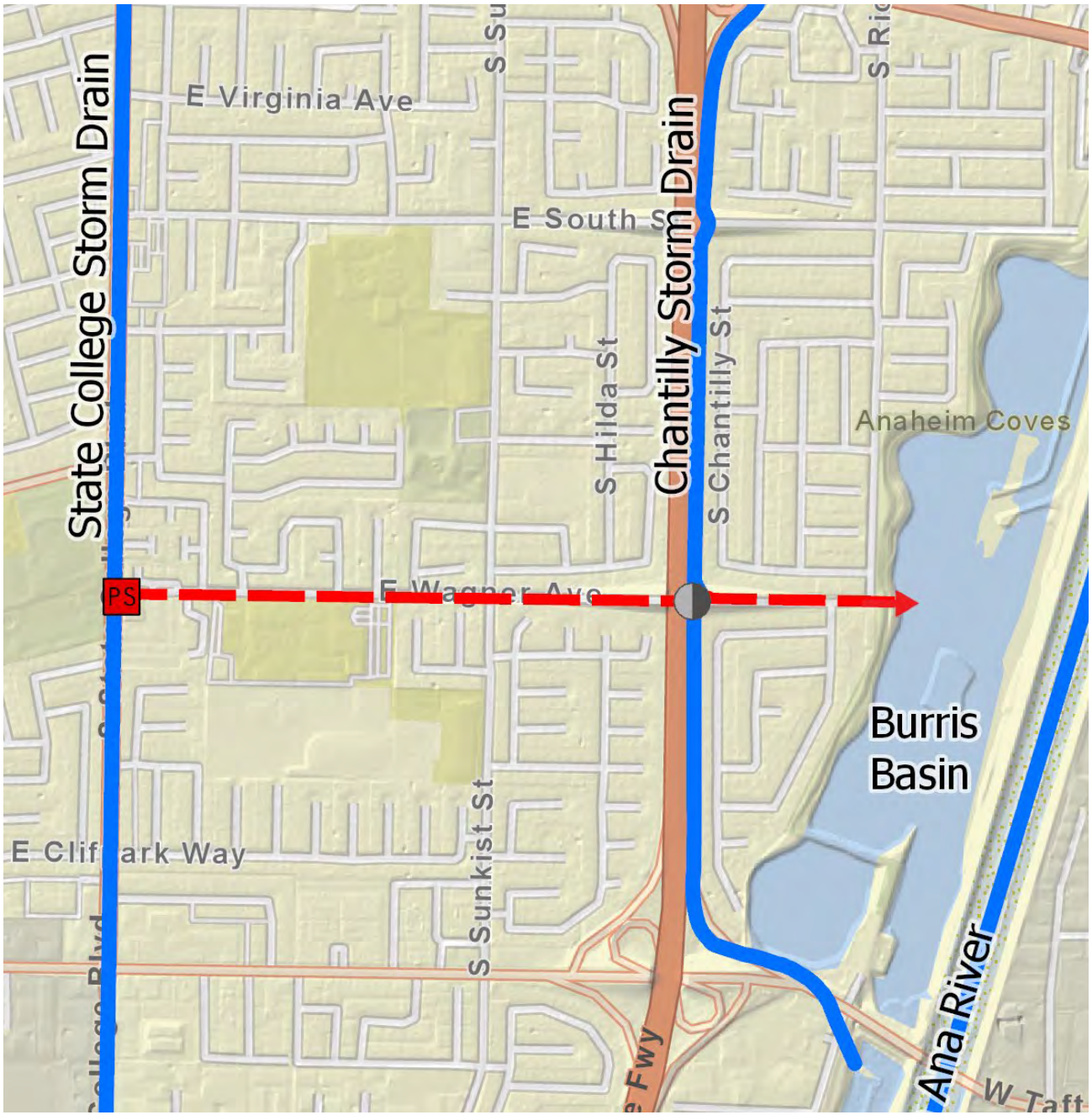
10B – Collin's Channel: Similar to the existing storm drains, Collin's Channel will also require backwater prevention structure since it is located near the RA#8 impoundment across ARTIC Station. A small-scale rubber dam can satisfy that purpose.

With the potential rubber dam, Collin's Channel will have some impounded stormwater behind it during small storms and also collect nuisance flow. Before releasing the impounded stormwater by deflating the rubber dam, there is opportunity to treat the impounded water that is essentially captured by the rubber dam.

Improvements to sediment accumulation and management O&M in Collin's Channel can also be incorporated into the mutual benefit design and modification of Collin's Channel.

TOP EFT: Storm drain outlet back flow prevention.
TOP RIGHT: From east bank of river. Conceptual rubber dam proposed in Collin's Channel as part of the RA #8 Impoundment design requirement.
BOTTOM: From east bank of river, north of ARTIC bridge.

10C – Chantilly Storm Drain Diversion: Two large watersheds, Chantilly (1,031 acres) and State College (638 acres), are part of the overall Santa Ana River Watershed. Chantilly Storm Drain (an underground 12'x10' RCB) discharges into Chantilly Basin. Chantilly Basin is an offline groundwater recharge facility adjacent to the Santa Ana River, but has poor infiltration rates. OC WIPs has identified and proposed a stormwater diversion project to take some of Chantilly Storm Drain and the parallel State College Storm Drain into Burris Basin instead, another offline groundwater recharge facility adjacent to the Santa Ana River. Burris Basin has better infiltration rates and it is located just upstream of the OC River Walk project site, past Ball Road. The Chantilly Storm Drain Diversion project has incentivized opportunity to become implemented along with OC River Walk improvements and overall project momentum.



The OC WIPs Fact Sheet for the proposed diversion project proposes a small pump station along the State College Storm Drain to meet with the Chantilly Storm Drain diversion structure. A total of 1,400 feet of gravity pipeline and 4,200 feet of forcemain pipeline would bring capture an estimated 1,040 acre feet of water per year into Burris Basin.

Design Requirements

DESIGN ELEMENTS

10A – Collection, stormwater treatment and beneficial use for treated stormwater for all of the storm drain outlets within the limits of the proposed river impoundments or more widely all of the storm drain outlets into the river from Orangewood to Ball Road. The opportunity exists for the City of Anaheim (OC River Walk Project) to partner with OCPW, City of Orange, and private development to address RWQCB M4 Permit requirements that require municipal treatment of stormwater run-off of urbanized watersheds. The collected and treated stormwater could be used as water source to supplement the OC River Walk impoundments.

The design and implementation of the identified urban stormwater applications would be heavily dependent on coordination with external stormwater management agencies and water quality goals that currently exist as part of on-going watershed improvement plans. The OC River Walk project simply incentivizes these external stakeholders to prioritize these local areas for urban stormwater treatment and provides/identifies the opportunity to coordinate design features into the proposed improvements of the OC River Walk project. Therefore, the design concept and examples provided herein; such, the storm drain flap gates, underground BMP/LID facilities, and summary of the existing Chantilly Storm Drain Diversion project are open to change upon maximized mutual benefit coordination.

TECHNICAL STUDY REQUIREMENTS

All of the urban stormwater treatment potentials would require hydraulic modeling to ensure the additional mutual benefit features, structures, and/or systems can be integrated or considered for add-on at a later date with the associated proposed OC River Walk improvements. A hydrologic study would also need to be performed to determine the overall watershed improvement impacts along the river corridor if any or all urban stormwater treatment potentials are implemented.

Other technical studies would need to investigate:

- Requirements for continued access for maintenance activities if there are BMP/LID facilities incorporated into the OC River Walk project site.
- Property ownership and easements associated with the urban stormwater treatment structures in or along the river corridor.

PERMIT REQUIREMENTS, SCHEDULE, AND COST ESTIMATE

Required permits for various urban stormwater treatment potentials would coincide with the proposed OC River Walk opportunity that it may be implemented with. It is possible for the identified treatment potentials to move forward independently, but with coordinated construction schedule timing only. Some required permits will include: OCFCD, OCPW, ACOE 408, and RWQCB 401, and SWPPP. Approved permitting is estimated to take 10-12 months for treatment of the existing storm drains and Collin's Channel each, and 12-18 months for the Chantilly Storm Drain Diversion project.

DESIGN AND CONSTRUCTION SCHEDULE

It is estimated that it will take around 6-9 months to design and prepare construction documents for the existing storm drains (design fee ~$600,000) and the same amount of time for Collin's Channel (design fee ~$400,000). The Chantilly Storm Drain Diversion as described herein would take approximately 10-12 months with a design fee of ~$600,000. The construction for existing storm drains, Collins Channel and Chantilly Storm Drain Diversion are estimated at 9-12 months, 8-10 months and 12-16 months, respectively.

CONSTRUCTION COST ESTIMATES

10A – Existing storm drains: There are approximately 9 outlets that vary in size (18" to 48" diameter). These can be combined for single treatment, the treatment extent would depend on the designated allowance. A minimum allowance for significant treatment results would be ~$3,000,000.

10B – Collin's Channel: The extent/amount of treatment for dry water flow and MS4 runoff could also be implemented within a designated allowance. A minimum allowance for significant treatment results would be ~$2,500,000.

10C – Chantilly Storm Drain Diversion: If constructed as described herein, the estimated total costs for the diversion project would be ~$1,200,000. However, the project could also be scaled down or up to treat within a designated allowance between $2,000,000 and $10,000,000.

OPERATIONS COST ESTIMATE

The estimated annual O&M for these various urban stormwater treatment facilities are to be determined per further coordination.

Environmental / Regulatory Requirements

Environmental review under the CEQA and the NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile river corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place.

1 **Increases Public Interaction and Connectivity**

Ensuring that the water quality in and around the OC River Walk experience is clean and inviting, will entice public use of the facilities, bringing connectivity not only within the community but with the larger overall Santa Ana River Watershed.

2 **Enhances Aesthetics and Ecology of the River and Surrounding Region**

Improving the watershed not only enhances the ecology of the immediate area, but also has lasting impacts downstream of the watershed as well. For OC River Walk, it is even more imperative to care for the surrounding watershed as the project site is almost the last stop before stormwater reaches the ocean outfall.

3 **Catalyzes Economic Growth and Development**

The OC River Walk project alone, incentivizes these identified urban stormwater projects and serves as a catalyst for other watershed development projects in and around the region.

4 **Improves Visual and Physical Access to the River**

The proposed stormwater treatment potential will improve the water quality visual not only within the project site, but downstream as well.

RIVER ACTIVATION – OPPORTUNITY #11

11

River Recreation: Kayak, Electric Boats, Tube Ride, Water Jets/Fountain, Fire Water

Opportunity

Bring unique water recreation to the Santa Ana River through programmed water activity offerings within the water impoundment areas (see RA #8).

The transformation of the OC River Walk corridor will bring an influx of local community and tourists, creating an incentive for recreational water activities in and around the Santa Ana River. OCWD's GWRS local operations present a unique opportunity to develop a mutually beneficial system that will enhance groundwater recharge programs, while providing a pristine water supply source for the river water features (see RA #8). A new pipeline turnout is being proposed for the GWRS program and could also serve as the water source for the river recreation features. Recreation activities could range from passive,

▲ Priority locations for improvements to enhance engagement with adjacent spaces.

non-contact to active programmed recreation. This programming might include allowing non-motorized flotation / boating, urban beaches, or playful water jets along the embankment or designated areas for more active events and programming. Larger water programming events could also be organized, reminiscent of Anaheim's 1996 Jet Jam—with specialized water management systems that ensure no adverse environmental impacts.

Two priority impoundment locations have been identified, including:

1. ARTIC: Approximately 23.5 acres surface area, located upstream of the ARTIC railroad bridge crossing and creates a water surface almost to the SPT railroad bridge crossing.
2. Orangewood Avenue bridge: Approximately 14.4 acres surface area upstream of the Orangewood Avenue bridge crossing and creates a water surface, terminating at the existing river drop structure just downstream of the ARTIC railroad bridge crossing.

▲ Examples of potential recreation opportunities.

▲ TOP: Examples of potential recreation opportunities.
BOTTOM: Jet Jam jet ski race event on the Santa Ana River in Anaheim (1997).

Feasibility Considerations

The water recreation activities and water programming would be organized by the City of Anaheim and are best-suited near City parks. The City may elect to develop and manage recreational activities with its staff resources, or potentially contract out the recreation operations. A robust community outreach / engagement effort is planned to solicit input on preferred river recreational opportunities. The next phase of design and planning will incorporate more detailed programming and concept development. Until the impoundment opportunities are more fully developed and the permitting is initiated, the limitations and potential uses cannot be fully established.

Design Requirements

TECHNICAL STUDY REQUIREMENTS

All design concepts will need to adhere to the following design requirements:

- Maintain original flood conveyance capacity and freeboard per OCFCD/ACOE approval.
- Design water feature per City of Anaheim O&M requirements.
- Structural engineering for proposed facilities, temporary or permanent.
- Public Safety – Facility O&M Plan.
- Allow for easy take-down and deployment.
- Consider one-way flow valves for existing stormwater outlets or reroute them out of water feature area.

PERMIT REQUIREMENTS, SCHEDULE, AND COST ESTIMATE

Permits required are largely dependent on the various recreational programming. Generally, permitting and approvals may be required by the following entities, among others:

- OCFCD /OCPW
- ACOE
- OCWD
- RWQCB
- CDFW
- Caltrans
- Railroad/CPUC

Depending on the type of permit required, the permitting time frame can range between 6 and 18 months.

DESIGN AND CONSTRUCTION SCHEDULE

- Existing utilities and storm drains.
- Hydraulic impacts during normal river operations and the 100-year storm event.
- Flood control embankment freeboard and erosion protection.
- Flood control operations and maintenance access.
- Water source availability.

CONSTRUCTION COST ESTIMATES

Construction costs will be dependent on the water recreation programming, but for budgeting purposes a range of $2,000,000 to $10,000,000 is estimated.

OPERATIONS COST ESTIMATE

Operations costs will be dependent on the recreational programming so a budget is not established.

Environmental / Regulatory Requirements

Environmental review under CEQA and NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile river corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place.

1 Increases Public Interaction and Connectivity

Hosting recreational events and programs in or along the river is a direct way of encouraging public interaction and connectivity with the river corridor.

2 Enhances Aesthetics and Ecology of the River and Surrounding Region

Utilizing the river corridor for recreational use incentivizes the community to maintain the public facilities and general area in pristine condition.

3 Catalyzes Economic Growth and Development

Adjacent development, businesses, local schools, and other organizations are encouraged to think of the river itself as a venue for gathering and special events.

4 Improves Visual and Physical Access to the River

Programmatic water activities, even simple visual light or fire events along the water, is the most direct way to reconnect the community to the Santa Ana River.

River Recreation and Programming Case Studies

There are several active urban river systems maintained by municipalities and public agencies that represent successful models of organized recreational programming in a controlled environment. Three such systems include Bend Whitewater Park in Bend, OR, Tempe Town Lake in Tempe, AZ and the Adventure Lagoon in Anaheim, CA.

BEND WHITEWATER PARK

Bend White Water Park is located in the Deschutes River in Bend, OR and is owned and operated by the Bend Park and Recreation District. The park / riverbed was developed in 2015 to provide a variety of river recreation activities such as tubing, kayaking and surfing and serves approximately 250,000 visitors annually. The system is configured with three distinct channels to separate level of difficulty and activities appropriately. The three channels consist of a Fish Ladder, the Whitewater Channel, and a Habitat Channel. The Fish Ladder has the mildest flow conditions and is suitable for gentle tubing and less experienced river rafters. The Whitewater Channel is suitable for kayaking, surfing and paddle boarding with four programmed wave features to offer a range of difficulty and conditions. The Habitat Channel is off limits to the public and serves to enhance the river habitat, which includes a fish ladder installed to return fish migration that was cutoff with a previous dam construction. Two islands were developed to create access to each channel.

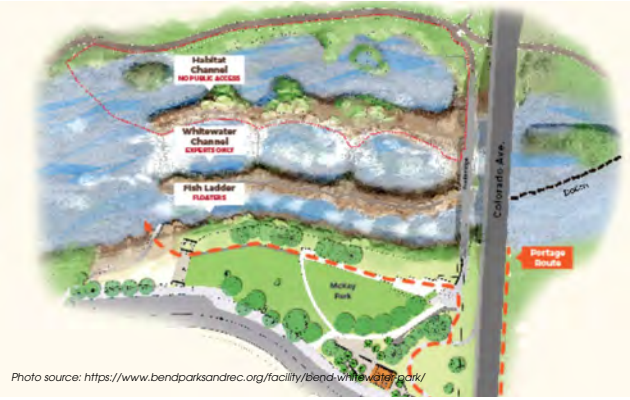


Photo source: https://www.bendparksandrec.org/facility/bend-whitewater-park/

Photo source: Google Earth

The Park District offers tube rental services and life jackets are available to rent for free. Park operators, known as wave shapers, operate and adjust gate configurations to adjust flow conditions to create the desired user experience. 26 air bladders or gates are affixed to the river bed to shape the whitewater conditions. Operators control water depths and mimic natural seasonal flow changes and conditions.

◀ LEFT: Bend Whitewater Park channels.
RIGHT: Bend Whitewater Park aerial view.
▲ TOP: Whitewater channel for expert level kayaking and surfing.

▲ Surfing in whitewater channel.

▲ Kayaking in the fishladder channel.

▲ A series of rules dictate the permissible activities and safety precautions at Bend Whitewater Park. The complete list of regulations can be found at https://www.bendparksandrec.org/facility/bend-whitewater-park/#whitewater. The range of regulations include requirements for wearing a life jacket for certain activities and age groups, restrictions on what type of equipment is allowed in the water and access points.

TEMPE TOWN LAKE

Tempe Town Lake is a 2-mile long area of the Salt River with 220 surface acres of water impounded with an inflatable rubber dam in the river to create a lake-like condition. The lake was created in 1999 after 30 years of visioning and planning. Town Lake has a capacity of 3,000 AF or 977 million gallons of water that is fed by reclaimed water, recharge and recovery and water exchanges. Water loss by seepage is prevented by a three-tier system of containment and recovery technologies. Soil cement levees, restrict lateral seepage loss, a cement clay cutoff wall connects to shallow bedrock to prevent lateral seepage below the river channel, and clay and concrete liners minimize seepage loss where the bedrock is much deeper. A groundwater recovery system consisting of 10 wells pumps water that seeps into the ground back into the lake. The lake also provides regional flood control by containing the 500-year flood event.

▶ Original rubber dam impoundment system.

The impoundment of water was originally accomplished by utilizing eight rubber bladders that formed two inflatable dams, along with the channelized boundaries of the Salt River. However, due to the harsh desert environment's effects on the rubber dams, a hydraulically operated steel gate dam was installed in 2016 to replace the deteriorating rubber dams. The system is comprised of eight fabricated mounted to a roller-compacted concrete foundation and reinforced concrete spillway slab. Each gate is 106 feet long and 17 feet tall. The steel gates can be lowered safely to allow flows to enter the lake from the Salt River, and the system is the largest hydraulically-operated steel gate dam system in the US. An automated system regulates the gates to maintain a constant lake level. The steel gate system project was completed at a cost of approximately $4 million, including the removal of the previous rubber dam system.

▶ Tempe Town lake boat beach activity rules.

Recreation activities include rowing, boating, fishing, and beach use. The lake serves more than 2,000 rowers annually. More than a dozen varieties of fish reside in the lake and thousands of rainbow trout are stocked in the cooler months of the year. Swimming is not permitted in the lake with the exception of organized special events, after county-regulated water quality tests are conducted and lifeguards are present. The City of Tempe's website indicates the Town Lake has generated $1.5 billion of economic impact to date.

▲ Recreational activities include non-contact, non-motorized boating.

The Elmore Pedestrian Bridge is a pedestrian and bicyclist bridge constructed along the west end dam in 2011 to link the north and south banks of the Town Lake, and also serves as a public art piece. The bridge enhanced the recreational opportunities at Town Lake and connected existing trails on both banks. The bridge is 12 feet wide, 34 feet tall over 900 feet long with four arch spans suspended by 32 metal cables.

▲ Elmore Pedestrian bridge.

THE ADVENTURE LAGOON

The Anaheim Lagoon is a new seasonal water park located at the Miraloma Basin, a groundwater recharge basin owned and operated by OCWD. The 14-acre site includes a 9-acre water body with depths ranging from one to fourteen feet, fed by up to 30,000 gpm of reverse osmosis treated water that comes from OCWD's groundwater replenishment program source water. The water is treated with reverse osmosis to drinking water standards before entering the basin and enters the basin at a constant 78 degrees Fahrenheit due to the water treatment process.

The water park will operate seasonally through a lease by The Adventure Lagoon. Park entry fees will be charged along with hourly rates for use of various water park features. Recreational facilities include floating structures / obstacle courses, kayaking, paddle boarding, inner tubing, a children's area with water rides and beach chairs along the waterfront. No gas-powered motors or equipment are permitted in the basin to protect the water quality. These amenities are supported by temporary structures including a pro-shop, life jacket distribution, restrooms and movable shaded seating areas. 101 parking spaces are available on decomposed granite ground cover.

The waterpark was issued a Notice of Determination with a Conditional Use Permit from the City of Anaheim. Other permits and regulatory coordination involved OCWD, Orange County Health Department, California State Water Board and the RWQCB.

Photo source: https://www.nbcpalmsprings.com/news/anaheim-waterpark-makes-splash_3127.html

Photo source: https://www.vvdailypress.com/story/life/travel/2021/05/04/meyers-byways-hp-adventure-lagoon-anaheims-latest-attraction/7540326002/

▶ Adventure Lagoon water park.

Photo source: https://www.theepochtimes.com/new-anaheim-waterpark-makes-a-splash_3794752.html


Photo source: https://www.theepochtimes.com/new-anaheim-waterpark-makes-a-splash_3794752.html


Photo source: https://www.vvdailypress.com/story/lifestyle/travel/2021/06/04/beyers-byways-trip-adventure-lagoon-anaheims-latest-attraction/7540848002/

COMMUNITY AMENITIES – OPPORTUNITY #12

Cantilever Decks/View Platforms

12

Opportunity

Create visual and physical connections to the Santa Ana River through elevated decks that extend over the river channel.

Cantilever decks will maximize the river's identity and create memorable destinations. Being suspended above the Santa Ana River via a cantilever deck accentuates one's experience on OC River Walk. There are multiple opportunities to implement cantilever decks, offering a more engaging experience along the river as users are suspended above the ground or water. Several locations were identified as feasible for this experience, and two were identified as priority opportunities, including:

1) Katella Avenue – view towards ARTIC Station, Meadow Park, The Big A, and Angel Stadium
2) Cerritos Park – view towards Santa Ana River, LA Live and Honda Center

▲ Priority cantilever deck locations interface with many of the 17 identified OC River Walk opportunities.

These two locations were selected as priority locations due to their high traffic likelihood along OC River Walk and their vicinity and engagement with other opportunities such as:

- AT #1 – Bikeway / Pedestrian Trail Extension
- AT #3 – SART East Bank Addition
- AT # 5 – River Walk Width Expansion
- AT #6 – Widen Existing Bridges for Bikes / Pedestrians
- RA #8 – River Impoundments
- RA #11 – River Recreation / Programming
- CA #13 – Engagement with Adjacent Spaces
- CA #17 – Landscape Enhancement

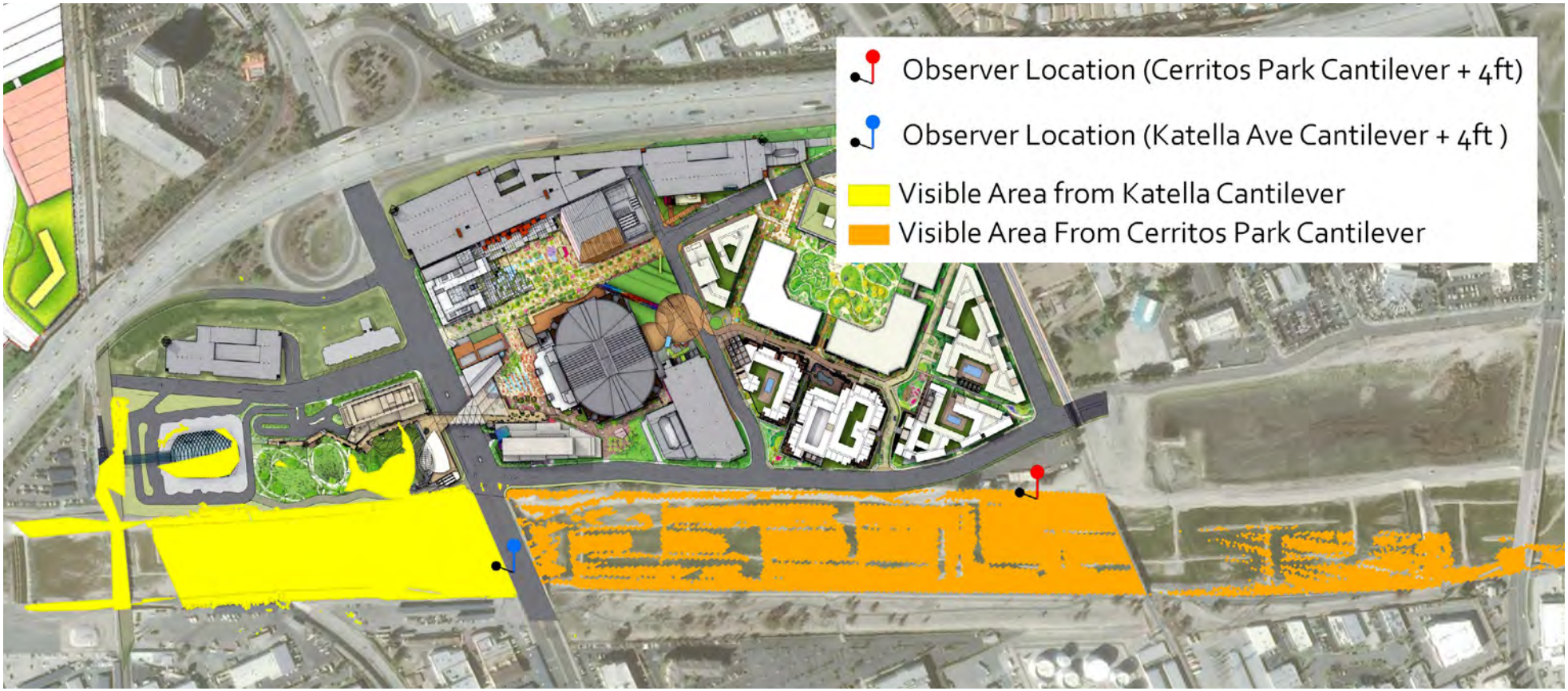
These locations also offer ideal and expansive view corridors facing the key iconic facilities within this river reach. These locations will also facilitate views of river wildlife and water recreation activities.

▶ Cantilever deck rendering featuring two deck locations and integration into boardwalk-type pedestrian path.

Feasibility Considerations

The layout of the deck would need to respect conditions of structure, footings, clearance, capacity, and orientation of the view, itself. In addition, opportunities exist to build the deck from existing trails, bridges, and/or proposed improvements (i.e. park, trail, grade separated bike path, etc.). At the Katella Avenue location, there could be direct interaction with AT #6, the widening of the Katella Avenue bridge. The engineering requirements for both the bridge widening and the cantilever deck structure could be addressed together. The Cerritos Park cantilever deck would be a stand-alone structure, and the specific location should be determined based on how it will interact with the SART and create the most optimal viewscape of the river and area.

◀ Cantilever deck examples over waterways.



▲ A viewscape analysis was conducted from the Cerritos Park and Katella Avenue bridge proposed cantilever deck locations. The shaded areas represent the extended visibility offered from the cantilever (Exhibit available in Appendix I – Exhibit 11).

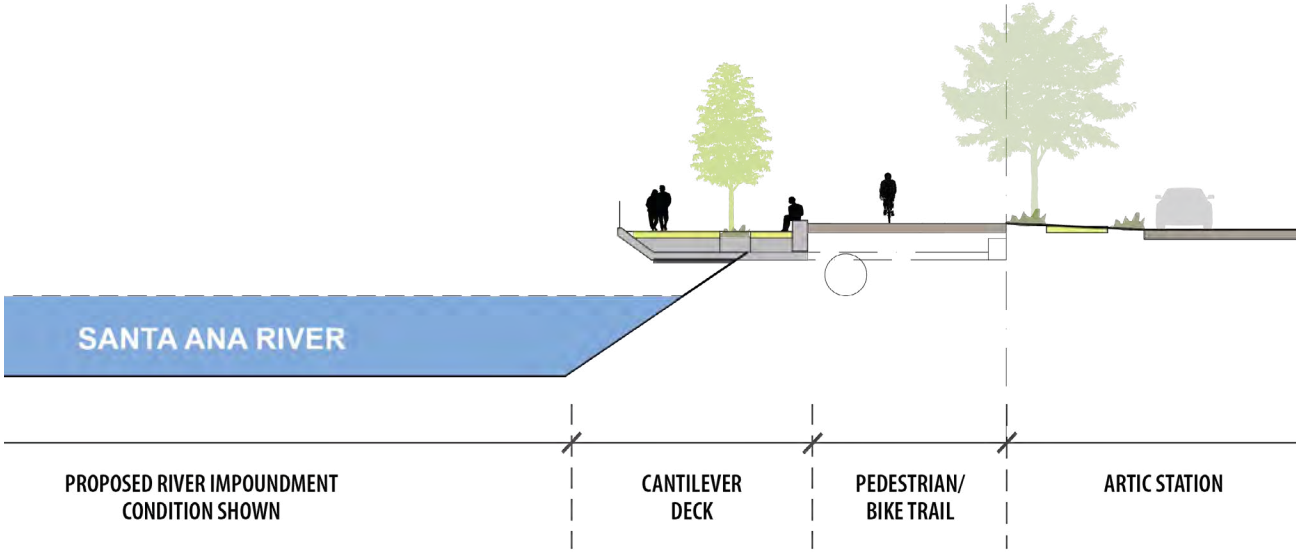
▲ Rendered view from the Katella Avenue Bridge looking downstream facing the ARTIC station, Angel Stadium, the Big A sign and Meadow View Park.

Design Requirements

- » Maintain original flood conveyance capacity and freeboard, per OCFCD / ACOE approval.
- » Avoid impacts to existing utilities, as possible.
- » Integration with adjacent pedestrian and bike circulation systems.
- » Ensure ADA accessibility.

DESIGN ELEMENTS

The design of the cantilever decks should create a sense of awe by suspending users in the air with views directed to the river. Siting of the cantilever decks should consider both directionality of view and the ability to project from either existing or proposed structure, trail, or bridge element. Design must achieve a smooth and safe transition on the deck surface and provide sufficient protection from a fall. In addition to creating an observation point, the cantilever deck could also be designed to incorporate a type of enclosure for a leasable space (i.e., pavilion, kiosk, etc.) that could further activate the experience along the river.



▲ Conceptual cross-section of a cantilever deck over the river.

TECHNICAL STUDY REQUIREMENTS

A structural engineer or certified professional must develop the engineering system to support the targeted loads on the deck system as well as develop the appropriate footing and structural design to tie into either the existing terrain (on grade), existing structure (i.e., roadway bridge), or work in conjunction with a new proposed structure (i.e., proposed multi-modal bridge). The deck structure must have adequate clearance of the river's freeboard and/or clearance from a person's head height if located above or adjacent to a trail or other circulation element. The approach to the deck must provide universal accessibility and follow all ADA regulations and guidelines.

PERMIT REQUIREMENT, SCHEDULE, AND COST ESTIMATE

Permits / approvals anticipated include:

- » OCFCD/OCPW
- » ACOE 408 (Katella Bridge)

The permitting / approval process is anticipated to take 12-18 months. Modifications to an existing roadway bridge may extend the procedures for attaining permits and thereby have a longer schedule. Each individual permit is anticipated to cost approximately $40,000.

DESIGN AND CONSTRUCTION SCHEDULE

It is estimated that design documents for the cantilever deck improvements would range from 8-12 months, including the development of design concepts, schematic designs, and construction documents. The total cost to produce these documents is estimated at $500,000 for each cantilever deck. After design documents are complete, it will take around 10-12 months to complete construction. Off-site construction or prefabricated design may help reduce the overall construction schedule.

CONSTRUCTION COST ESTIMATES

Given the variability of the design, the estimated range of construction cost is $1,000,000-3,000,000, and $2,500,000 is referenced for budgeting purposes. The low-end of this cost estimate would include a relatively simple cantilever deck without architectural design elements located in an area without major constraints. Higher costs would be associated with more complex engineering, along with more elaborate architectural design elements and/or create leasable space for related river activation.

OPERATIONS COST ESTIMATE

The estimated operations and maintenance cost is approximately $30,000 annually.

Environmental / Regulatory Requirements

Environmental review under CEQA and NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile river corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place.

1 Increases Public Interaction and Connectivity

The cantilevered deck provides a unique opportunity along OC River Walk to attract people as a feature destination and a place for passersby encounters, creating an opportunity to view out over the river.

2 Enhances Aesthetics and Ecology of the River and Surrounding Region

The design of the cantilever deck will contribute to the aesthetics of the river and should be conceived as both 'iconic' and 'timeless' in its design. As a place to observe the river, people will have the ability to observe species – especially migratory birds – that utilize the Santa Ana River and its embankments as habitat.

3 Catalyzes Economic Growth and Development

Given the location and relationship to existing uses, it would become a highly visited place stimulating public interaction and river engagement. If the design incorporated a leasable space to support river activation (e.g. café, bike shop, or wildlife outpost), revenue could support maintenance, programming, or future improvements along the river.

4 Improves Visual and Physical Access to the River

As a site-specific element, the cantilever deck will provide an enhanced experience to observe the river. While not physically accessing the river, it will create a unique feeling of being suspended above the river to capture people's curiosity.

COMMUNITY AMENITIES – OPPORTUNITY #13

Engagement with Adjacent Spaces

13

Opportunity

Add valuable connectivity with adjacent spaces through strategic landscaping and programming along OC River Walk.

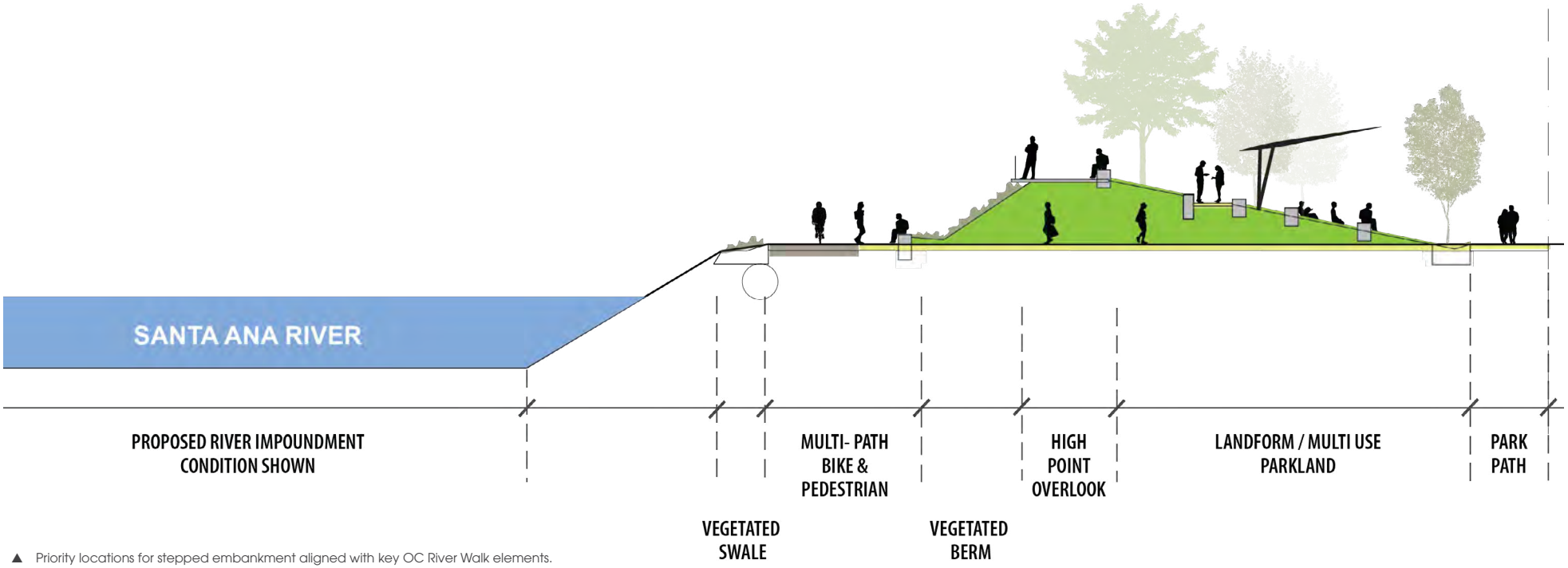
The opportunity to engage with adjacent spaces along OC River Walk creates inherent value for the future programming, activation, and character of the river. Engagement of the river includes improved waterfront access, accessible circulation, and enhanced property frontage. Given the added diversity of uses along the river and robust nature of the planned improvements for both Angel Stadium and ocV!BE, the extents of the OC River Walk project will become an increasingly more utilized and sought-after community amenity.

▲ Priority locations for improvements to enhance engagement with adjacent spaces.

The ability for the project to connect with its adjacent spaces is perhaps one of the most important. Many great opportunities currently exist along OC River Walk to engage including transportation centers (ARTIC Station, Katella Bridge), event destinations (Angel Stadium, Honda Center), and related new programming opportunities. Additionally, there are many future adjacent spaces that OC River Walk can plan to engage with such as the City of Anaheim River Park, Meadow Park, Cerritos Park and the proposed multi-modal bridge. Implementation of a connected OC River Walk will contribute significantly to the overall success of the area by delivering multiple benefits such as improved public realm condition, a more connected health and recreation system, and the transformation of underutilized space into more livable and usable public space for the community.

Five locations have been identified as priority locations based on their vicinities to important features and locations along OC River Walk. These locations include:

1. River Park
2. Meadow Park
3. OCFCD property along the east bank of the river, extending north of Katella Avenue to the SPT Railroad
4. Cerritos Park
5. ocV!BE



▲ Priority locations for stepped embankment aligned with key OC River Walk elements.

Feasibility Considerations

The spaces between OC River Walk and parcels vary in condition, ownership, and size along the length of project. These spaces subsequently have varying potential for accessibility and programming. Priority opportunities include the frontage of the Angel Stadium, the ocV!BE development, and others adding a synergy to activate the river with people and new experiences. Through the conversion of surface parking and other underutilized conditions, the river's edge can become spaces for parks, plazas, terraces, and other means to accentuate and develop a closer relationship to the river.

Design Requirements

DESIGN ELEMENTS

The ability to engage with adjacent spaces enables OC River Walk to become a multi-experiential, continuous open space network. The range of these experiences will differ within the context of the Urban Framework and the conditions for accessibility, character, materiality, and program will fundamentally drive what design elements are most appropriate. Design elements could support program opportunities that would range from passive (e.g. wildlife observation, bike repair station) to active (e.g. fitness station, tot lot). The opportunities can also vary between permanent features and dedicated spaces for temporary space uses for events such as food trucks, art exhibitions, and community gatherings.

▶ Example images of landscaping, facilities and signage serving to activate corridors.


Photo provided by City of Anaheim.


Photo provided by USA SHADE & Fabric Structures.


Photo provided by USA SHADE & Fabric Structures.


Photo provided by USA SHADE & Fabric Structures.

TECHNICAL STUDY REQUIREMENTS

The conditions for accessibility will need to be reviewed that include both grading, universal access and other conditions for access that include review of lighting, handrail/guardrails and security.

PERMIT REQUIREMENT, SCHEDULE, AND COST ESTIMATE

Depending on whether the conditions for engaging spaces along OC River Walk include lands under the control of public agencies, private entities, or within OC River Walk, ownership and jurisdictions should be fully reviewed to assess any required permits. These permits are expected to take two to three months each to complete. It is assumed that a cooperative agreement will be in place prior to permitting and would continue into design documentation and through construction.

▼ Example images of landscaping, facilities and signage serving to activate corridors.

Photo provided by City of Anaheim

Photo provided by City of Anaheim

DESIGN AND CONSTRUCTION SCHEDULE

The conditions for design and construction schedule will relate to the size and complexity of each project, however it is assumed that estimated duration for design could be 4-8 months each and construction could be six to nine months for each element location.

CONSTRUCTION COST ESTIMATES

Construction costs are difficult to estimate during this feasibility stage since specific elements have not been identified and programmatically planned yet. For budgeting purposes, $2,000,000 is currently estimated, assuming elements at five locations.

OPERATIONS COST ESTIMATE

The operational requirements will relate to the type of connectivity element implemented, but for budgeting purposes, $80,000 annually is assumed covering 5 locations.

Environmental / Regulatory Requirements

Environmental review under CEQA and NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile river corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place.

1 Increases Public Interaction and Connectivity

OC River Walk stands to be the connective tissue between other existing and planned activity centers within the area. A strong element of engagement with adjacent spaces will bring more users to and through the space and create a unified "destination."

2 Enhances Aesthetics and Ecology of the River and Surrounding Region

Engaging with spaces adjacent to OC River Walk enhances overall aesthetics by creating a more unified experience and design narrative. These spaces may include trees and other elements that add to the area's habitat and provide a connection to nature. Landscape and green infrastructure elements can have other ecological benefits as well such as infiltrating stormwater and introducing native plants.

3 Catalyzes Economic Growth and Development

Catalyzing economic growth adjacent to OC River Walk depends on creating an inspiring place that brings people together. By engaging with adjacent spaces, OC River Walk can become a destination for diverse user groups, spurring economic and development activity.

4 Improves Visual and Physical Access to the River

By connecting and engaging with adjacent spaces and creating a cohesive space, OC River Walk will become more visually appealing to both users and people passing by in the area. This will invite users visually into the space, where they will have greater physical access to the river through park space, amenities, and landscaping.

COMMUNITY AMENITIES – OPPORTUNITY #14

Stepped River Embankment

14

Opportunity

Create physical connections, improve ecological function and enhance aesthetics of the Santa Ana River through riverbank modification to stepped embankment.

Stair-stepping and terracing the grades of the riverbank unlock multiple benefits to the river that include additional capacity for circulation, augmented space for programs and events, improved ecological function of the river, and enhanced hydraulics. The physical manipulation of the riverbank edge through hard and soft techniques is one way to increase physical and visual connections to the river, improving the urban environment while ensuring current use and operations of the site can still be maintained. Alteration of the riverbank will always meet or exceed the capacity of the river channel to avoid any impacts to hydraulic capacity, flood conveyance, and flood safety.

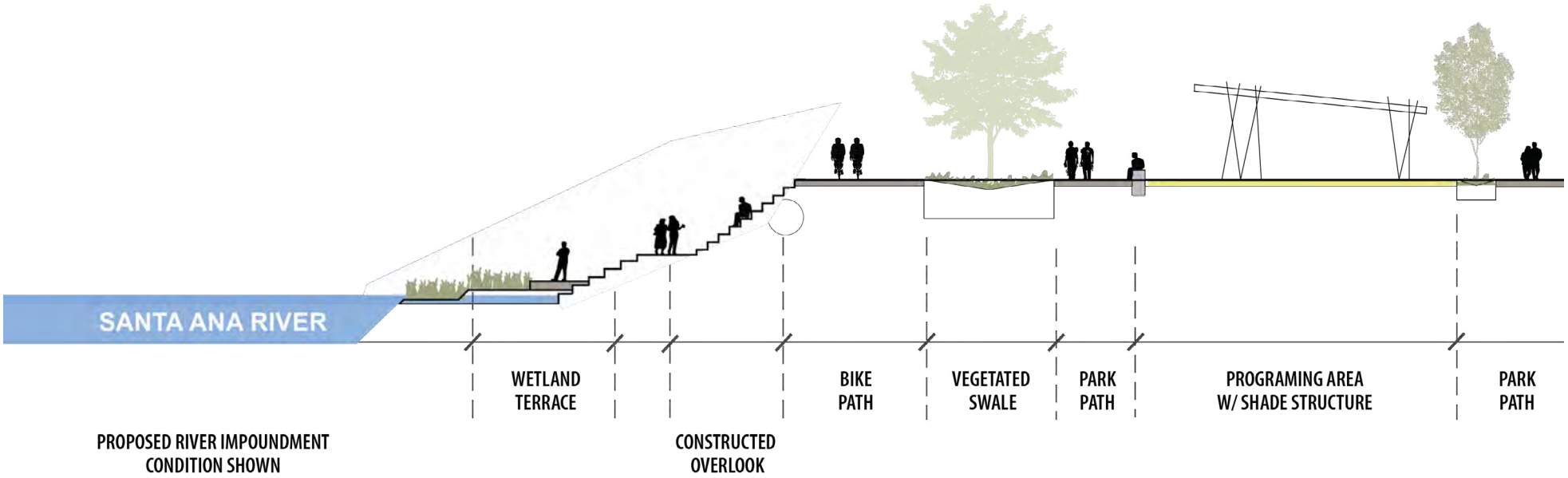
▲ Priority locations for education / art installations.

Five locations have been identified as priority locations based on their vicinities to important features and locations along OC River Walk. These locations include:

1. River Park
2. Meadow Park
3. OCFCD Property along the east bank of the river, extending north of Katella Avenue to the SPT Railroad
4. Cerritos Park
5. ocV!BE

These locations align with the proposed impoundment facilities and will provide visual and physical access and engagement with the impounded water and its recreational opportunities. Additionally, where located in park or upland habitat restoration areas, these stepped embankments add unique and attractive elements to further engage these open spaces.

Signage and public education will be critical to maintain public safety when the river is conveying flood waters. Public safety elements may include placing signage and barriers to accessing portions of the stepped river bank during the winter (rainy season) months.



▲ Section view of stepped embankment activity elements.

Feasibility Considerations

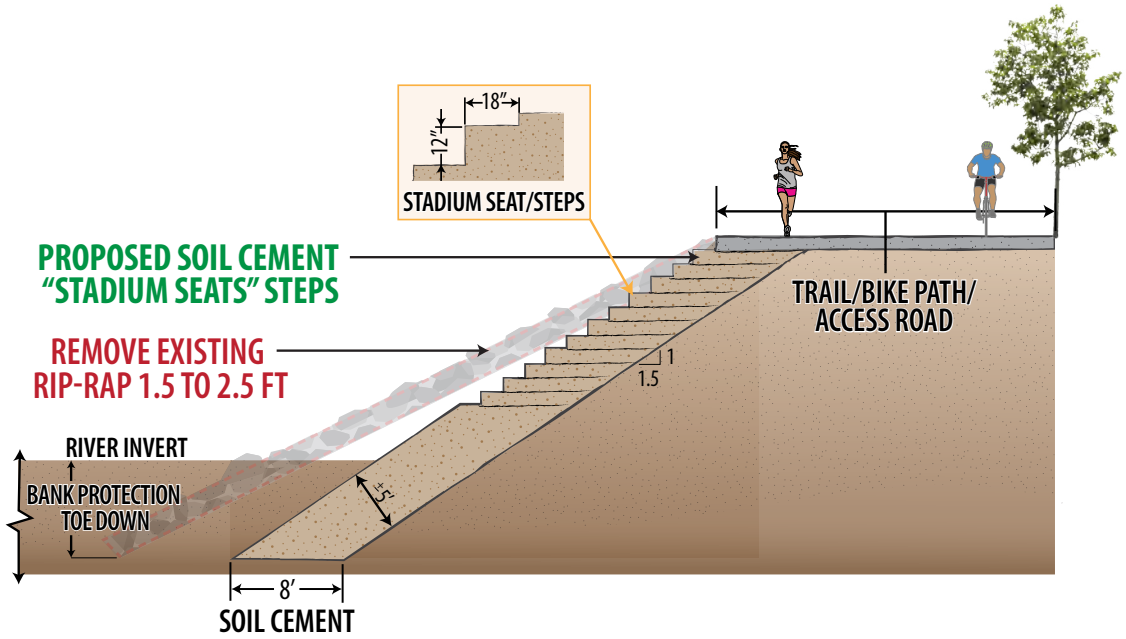
Sustainability fundamentals should be embraced such as permeability, native plant material, carbon sequestration, heat island effect mitigation, and drought tolerant vegetation. Upland habitat landscape enhancements can remain flexible to meet varying feasibility considerations throughout the project area. A maintenance plan is key to the long-term success of plantings. Considerations for irrigation, tree litter, pruning, weeding and regular upkeep need to be considered early in the design of landscape elements. Given the multi-jurisdictional nature of the project area, the maintenance responsibilities of any new landscape enhancements should be clear and agreed upon early in the design process with funding ear-marked for maintenance efforts.

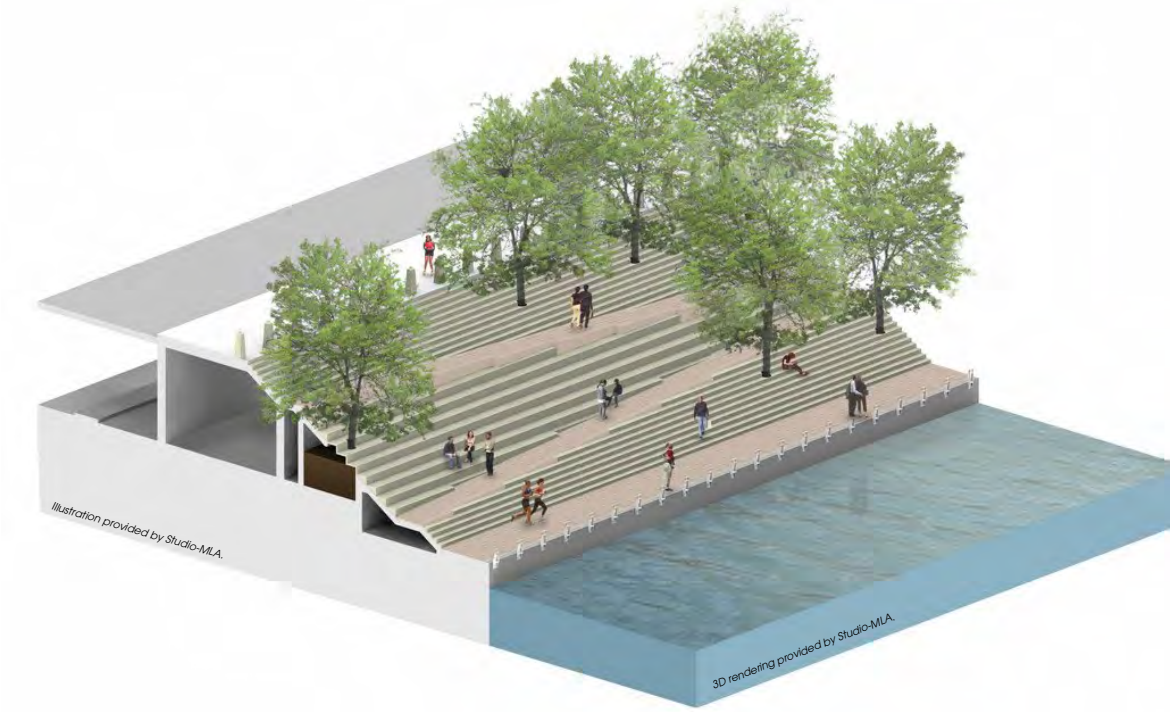
Design Requirements

DESIGN ELEMENTS

The incorporation of seating into, along or atop the riverbank allows for additional capacity for visitors to sit, enjoy and view the river and surrounding amenities and landmarks. Alteration to the river embankment would be the means to create a strong, fully integrated design for the river, however given the additional permitting required, would be a strategy considered as part of a larger project effort such as the landing for the multi-modal bridge, cantilever deck, or other significant structure. Examples of other seating element should strive to find a consistent design language that relates to site work along the river.

A riverbank slope change modification along portions of the banks of the Santa Ana River could allow for a grade-separated bike path while maintaining hydraulic capacity in the channel by slightly increasing the cross-sectional flow area, as described in RA #9. The reconstruction of the riverbank in this area would also provide an opportunity to modify the side slope material and configuration, such as stepped side slope to provide public interaction and engagement closer to the river, soil cement lining, concrete stamping, including sustainable river bank protection methods, etc. The embankment modifications will maintain/improve current hydraulic capacity and bank stability.





TOP ▶
Stepped embankment alternative bank protection using soil cement.

BOTTOM ▶
Example of stepped embankment conceptual rendering.

PACE STUDIO-MLA

▲ Example of concrete Stamping in the riverbank to add artistic/creative elements to the river.

▲ Example of stepped embankment with access to river.

▲ Chicago riverwalk stepped embankment.

▲ Chicago riverwalk stepped embankment.

The existing riverbank protection is comprised of loose and grouted riprap at a 2(H):1(V) slope, as confirmed by ACOE as-built plans. Loose riprap thickness ranges from 18" to 24". Areas around drop structures are grouted at 15" thickness. OC River Walk proposed improvements may include soil cement bank protection with slopes of 1.5(H):1(V). Soil cement is widely used for its sustainability, structural stability, flexible application, aesthetic appeal, cost efficiency, and high durability for channel stabilization.

To assess the feasibility of the proposed stepped embankment improvement opportunities, preliminary hydraulic modeling was performed using conceptual design parameters. The proposed non-motorized bridge piers, additional SPT undercrossing, and a large section of proposed riverbank modification were incorporated into a HEC-RAS model of the Santa Ana River obtained from the ACOE (model dated April 2014). The model obtained from ACOE was used as the existing conditions (baseline) model to compare and analyze output results with the proposed condition within the study reach. More details on this hydraulic analyses are described in the "OCFCD Conceptual Review, which is included in the Appendix V. The preliminary hydraulic modeling and analysis performed conclude the design requirements for embankment improvement opportunities would maintain (if not improve) the flood control and stormwater capacity of the Santa Ana River. Additionally, the adjoined proposed infrastructure added into the model did not result in significant impacts upstream or downstream of the project site. Impacts were very minimal and immediately localized to the proposed opportunity locations. At a conceptual design level, preliminary modeling efforts showed promising feasibility for the proposed infrastructure associated with the OC River Walk opportunities in the Santa Ana River.

TECHNICAL STUDY REQUIREMENTS

- Maintain original flood conveyance capacity, freeboard, and overall flood protection, per OCFCD/ACOE approval.
- Avoid impacts to existing utilities.
- Integration with adjacent pedestrian and bike circulation systems.

PERMIT REQUIREMENT, SCHEDULE, AND COST ESTIMATE

- ACOE 404, 408
- OCPW/OCFCD
- RWQCB 401 & SWPPP Permit
- CDFW 1600 Permit

Permitting and approvals duration is anticipated to take approximately 8-10 months, unless these permits and approvals were achieved through RA #9, in which case the process may be simpler.

DESIGN AND CONSTRUCTION SCHEDULE

Design is estimated to take 6-8 months, and construction schedule is estimated at 6-9 months per location.

CONSTRUCTION COST ESTIMATES

The construction cost estimate assumes five locations, 400 LF, 10 feet high @$250/SF each for a total cost of $5,000,000. Variables include length, material type, and integration with riverbank.

OPERATIONS COST ESTIMATE

Operations costs are estimated at approximately $60,000 annually.

Environmental / Regulatory Requirements

Environmental review under CEQA and NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile river corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place. The CEQA/NEPA process is expected to take between 12 and 18 months to complete.

1 Increases Public Interaction and Connectivity

A stepped embankment not only provides valuable seating but also increases public interaction with the river and OC River Walk by providing access to the water and inviting users to spend time on the riverbank. Currently the steeply slanted walls of riprap are hard to walk on, creating a sense of danger and driving users away from the riverbank.

2 Enhances Aesthetics and Ecology of the River and Surrounding Region

Stepped embankments can be designed in many appealing ways which increase the river channel's aesthetics by adding architectural design elements.

3 Catalyzes Economic Growth and Development

A more accessible and beautiful riverbank which invites users to spend time in the area will bring with it economic activity, growth, and development. Stepped riverbank seating can become a valuable amenity for existing and future residents nearby as well as shoppers and visitors alike.

4 Improves Visual and Physical Access to the River

Stepped riverbanks are aesthetic and functional improvements that will enhance the visual character of the river as well as provide access in a very direct way.

15

COMMUNITY AMENITIES – OPPORTUNITY #15

Integrated Public Education / Art (Environmental / Cultural)

Opportunity

Incorporate cultural and environmental education through art forms to elevate placemaking and illustrate the significance of the river.

The integration of art and educational elements within OC River Walk will elevate the experience and identity of the project. Given the opportunity, artists should use their creativity to explore varying means and media to integrate art into visitors river experience. Art opportunities may be fully conceptual in nature, however, should strive to provide a deeper meaning and connection to and with the Santa Ana River and support educational programming about the significance and history of the river. Artists from around the world should be welcomed, and efforts should be made to highlight emerging talent from local schools and colleges, particularly from disadvantaged communities.

▲ Priority locations for education / art installations.

Five priority locations have been identified for art / educational elements, as well as educational kiosks at every ¼ mile marker along OC River Walk. The five specific locations include:

15A: Orangewood Avenue Bridge
15B: 57 Freeway Bridge
15C: ARTIC Railroad Bridge
15D: Katella Avenue Bridge
15E: SPT Railroad Bridge
15F: OC River Walk Path / Trail Mile Markers & Educational Kiosks

Feasibility Considerations

There are numerous opportunities to showcase art/education at OC River Walk. From murals and lighting to the undersides of the freeway viaduct to solar trellises that feature the historic timeline to the paving of the River Walk to tell the stories of indigenous people, there should be few limitations to encourage OC River Walk as an open canvas. Opportunities for integration may also include standalone art installations.

Design Requirements

DESIGN ELEMENTS

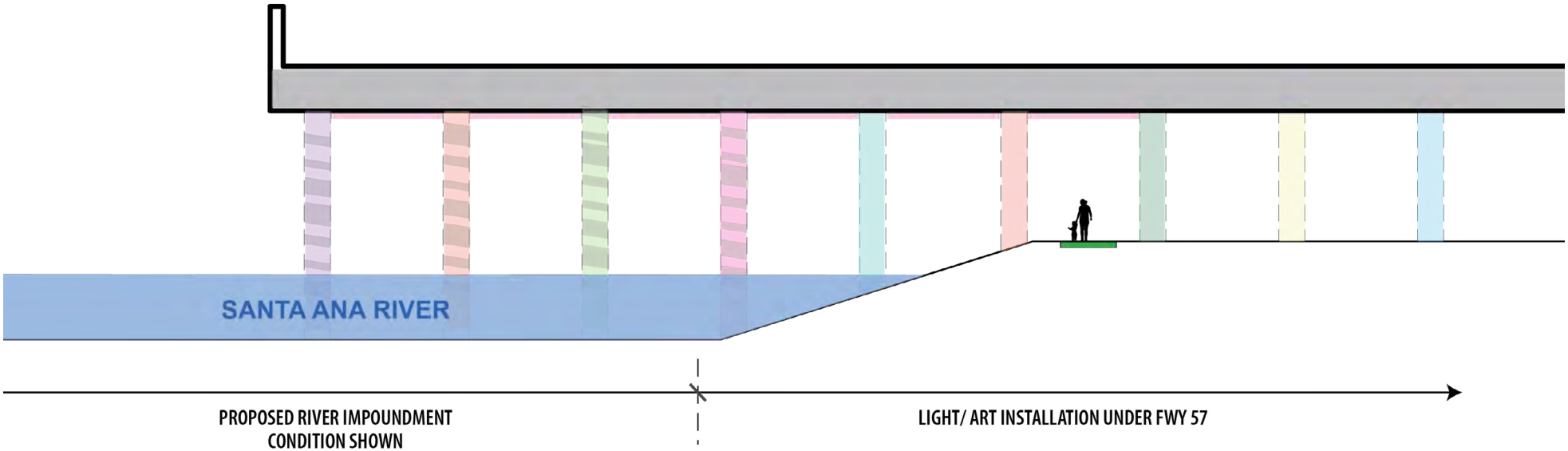
Public art and educational installations can activate the area in various ways: from a play on the built form that creates aesthetic relationships, to an homage to the history and community of Anaheim. Sculptural elements can be stand alone or integrated with other pieces of infrastructure or site elements (i.e., bridge columns, paving, handrail, etc.).

TOP: From west bank of SART, north of Orangewood Ave. bridge. 15A Sample rendering of art placed on bridge pier columns featuring indigenous fish species.

BOTTOM: From west bank of SART, north of 57 fwy. 15B Rendering of column lighting art form under 57 Freeway looking south.

**Art for placement only, not actual concept.*

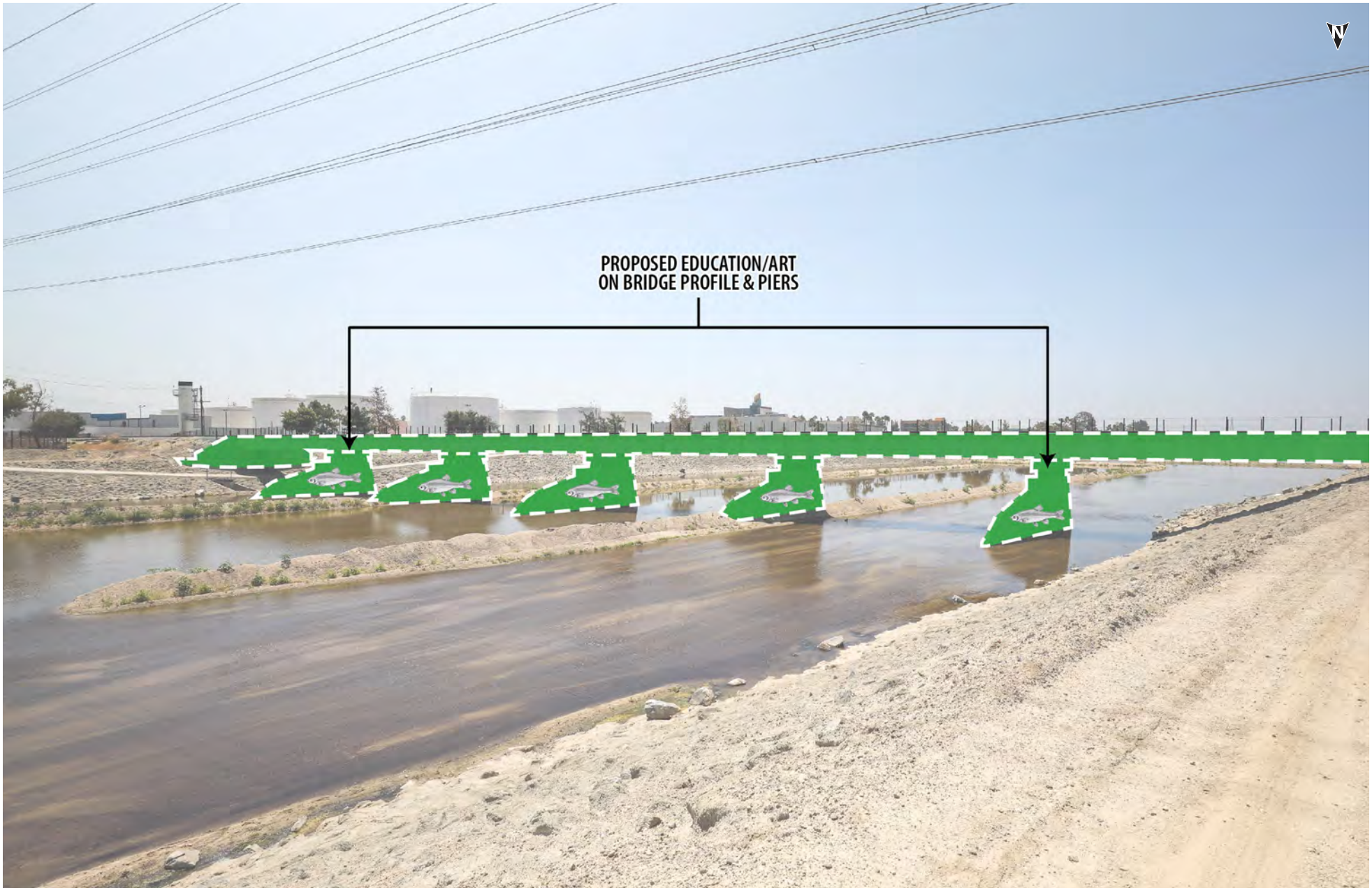
▲ From west bank of SART, south of 57 fwy. 15B Rendering of column lighting art form under 57 Freeway looking north.



▲ 15B Illustrative rendering of art form under 57 Freeway.

▲ From ARTIC Station, north of railroad. 15C ARTIC Railroad bridge with education/art area shaded. **Art for placement only, not actual concept.*

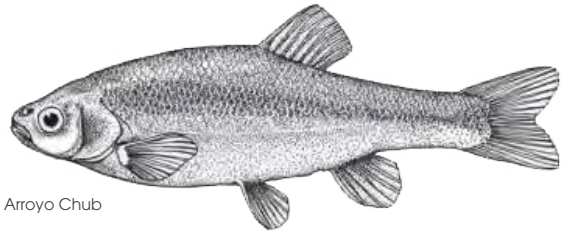
▲ From west bank of river, north of Katella Avenue. 15D conceptual rendering of ample area for artistic/educational installation. **Art for placement only, not actual concept.*



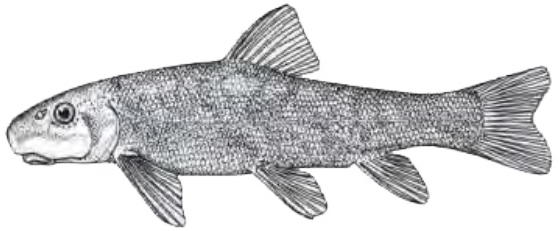
▲ From west bank of river, north of SPT Railroad bridge. 15E conceptual rendering of ample area for artistic/educational installation. **Art for placement only, not actual concept.*

One education/art concept entails featuring the five fish species native to this reach of the Santa Ana River. Each bridge pier of the SPT Railroad bridge could feature one of each fish type and adjacent educational kiosks would describe the history and significance of these species.

The Coastal Rainbow Trout (above) Begins Life in Freshwater Streams of Coastal Californa, Migrates to the Ocean, then Returns Upstream Late in its Life Cycle as the Steelhead (below).



Arroyo Chub



Santa Ana Sucker

Speckled Dace

Threespine Stickleback

Photo provided by City of Anaheim.

▲ Images of fish species endemic to the Santa Ana River.

Photo provided by City of Anaheim.

Photo provided by City of Anaheim.

▲ Example trail mile marker and trail-side educational kiosks.

▲ Examples of murals placed on existing infrastructure and buildings.

▲ Examples of murals placed on existing infrastructure and buildings.

▲ Example canoe structure pays homage to Native American history of the river.

▲ Example tile mural mosaic education/art installation.

TECHNICAL STUDY REQUIREMENTS

Art and education can be a flexible part of the project and in many cases needs no technical study. In other cases, the artwork will be integrated into larger parts of infrastructure and should be coordinated with the relevant parties. For instance, there may be an opportunity for an artist to create work that is a part of public seating elements, walls, landscaping, or other infrastructure.

Additionally, curation and selection of art and education elements can be a highly subjective process that will need to involve stakeholders. Organizations such as the Anaheim Cultural Heritage Commission could help create definitions and organize the selection of art and artists. The Orange County Arts and Cultural Affairs Office could also be a resource for identifying art and its funding. Alternatively, a committee could be set up to specifically manage art at OC River Walk. An artist residency that commissions an artist to consider the river and create art interventions could be a way to generate a more involved process. There might also be an art festival or biennale that invites artists to activate OC River Walk with more temporary installations.

PERMIT REQUIREMENT, SCHEDULE, AND COST ESTIMATE

Permitting/approval requirements will be dependent on the locations and type of installation or display. ACOE 404 and 408 permits will be required for temporary impacts based on construction access for the 57 Freeway Bridge pier columns, Orangewood Avenue, Katella Avenue, ARTIC, and SPT bridges with a 6-8 month schedule. Caltrans approval is anticipated to be needed for the 57 Freeway bridge pier columns. SART/OC Parks approval will be required for the Trail Mile Markers and Educational Kiosks with a 2-3 month schedule.

DESIGN AND CONSTRUCTION SCHEDULE

Estimated schedule for design is 4-10 month and construction is estimated at 3-8 months, varying based on the scope and complexity of the installation or program.

CONSTRUCTION COST ESTIMATES

Pier columns are estimated at $1,500,000, consisting of colored lighting on 60 6-foot diameter columns, each approximately 20 feet tall. Integrated education/art pieces along the Orangewood, Katella, ARTIC and SPT bridges are estimated based on mural placement on both sides of pier noses (20 total) and along the railroad bridges. Each location is estimated at $300,000, for a total of $1,200,000. Trail mile markers and educational kiosks are assumed to be spaced at 0.25-mile intervals along OC River Walk for a total of 20 kiosks/markers at a cost of $25,000 each and a total estimate of $500,000.

Other types of art activations may vary greatly in size and scope, so they cannot be estimated at this stage. On the low-end, a temporary pop-up art installation of art fair might activate the river for a day or a weekend. On the upper-end, a permanent installation might be integrated into the OC River Walk infrastructure after undergoing an extensive design and construction process.

OPERATIONS COST ESTIMATE

Annual operation is restimated to range between $20,000-40,000.

Environmental / Regulatory Requirements

Environmental review under CEQA and NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile river corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place.

1 **Increases Public Interaction and Connectivity**

Artwork can be used to make the OC River Walk feel more welcoming and part of the community. Art should consider the use of Interactive elements that allows for a more engaging experience with the OC River Walk. Art can also be informative with elements that integrate wayfinding or other creative ways that help users connect to the river and understand the natural and urban context.

2 **Enhances Aesthetics and Ecology of the River and Surrounding Region**

Art directly contributes to the aesthetics of the river and may indirectly contribute to the river ecology through educational signage or gardens that provide habitat while informing visitors about natural systems.

3 **Catalyzes Economic Growth and Development**

Art contributes to placemaking and the overall quality of a space. The more users enjoy and seek out the OC River Walk, the greater the opportunity for economic growth and development.

4 **Improves Visual and Physical Access to the River**

Art that speaks to the community and tells the story of the river will invite people visually into the space. By giving artists from the community a platform to express their experiences, the river may feel more accessible to those who may feel excluded otherwise.

16

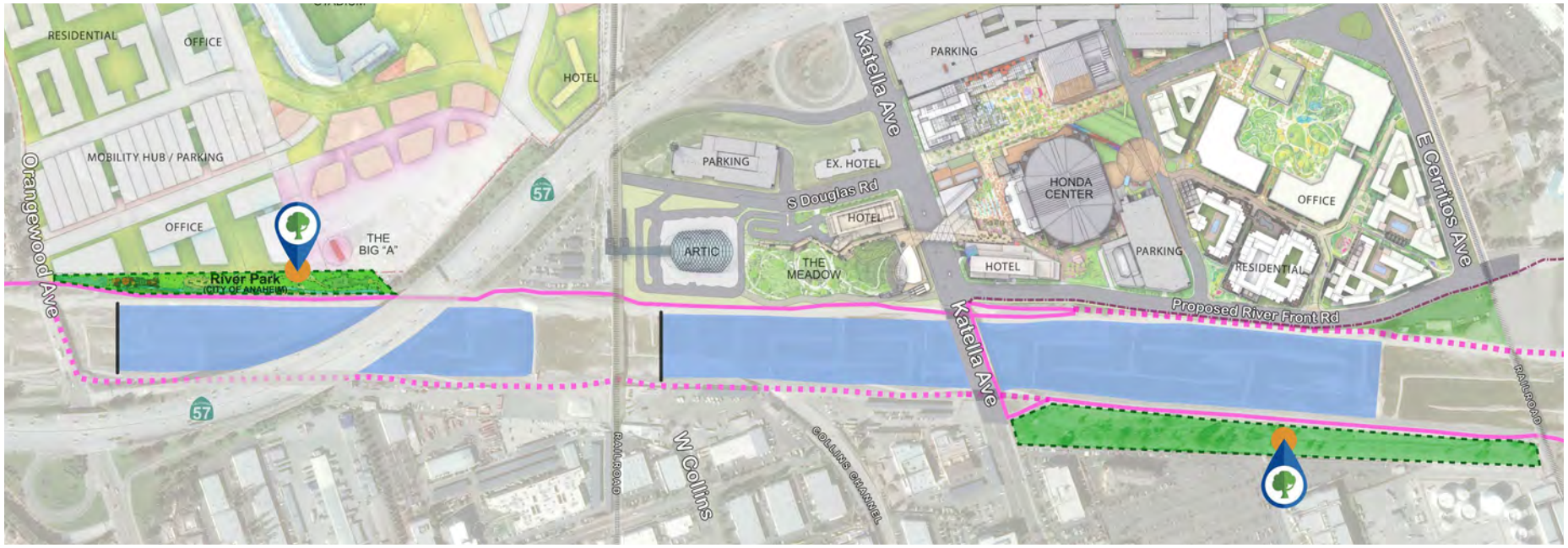
COMMUNITY AMENITIES – OPPORTUNITY #16

Upland Habitat Restoration

Opportunity

Create native landscape habitat for indigenous wildlife and restore the natural ecosystem of the Santa Ana River corridor.

Over the last 150 years, concerns over flooding, rapid urban development, and battles over water have shifted the river from a natural waterway to a contained, artificial channel. The City and its partners have worked hard to restore habitat, through successful projects like Anaheim Coves. However, the restored natural beauty at the Coves is still strikingly absent along the banks of the river and the riverbed itself. A lack of trees or other riparian vegetation means minimal avian habitat compared to more natural sections of the river that welcome great blue herons, great egrets, American white pelicans, gnatcatchers, American avocets, and more. The upland areas of the project offer tremendous opportunity for habitat restoration / enhancement. Focus on the upland reaches of OC River Walk will create an enhanced naturalized open space experience that is sparsely available in this area of Anaheim. Upland habitat restoration will enhance both the aesthetic and native riparian ecology of the river, particularly through the return of native flora and fauna in the upland reaches.

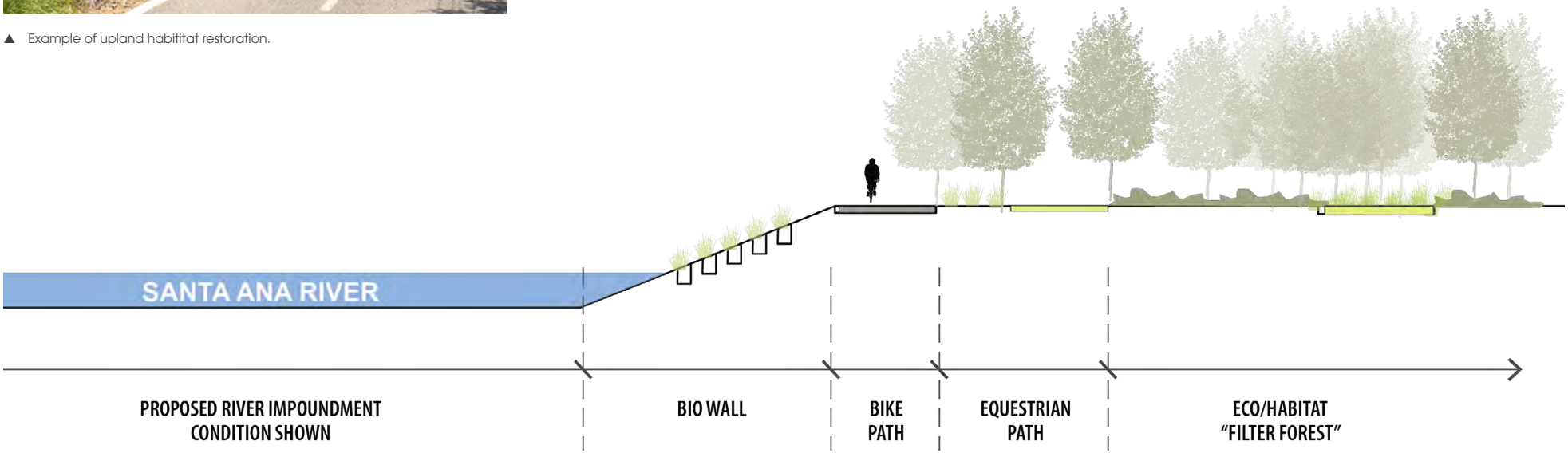


▲ Priority locations for upland habitat restoration.

▲ Example of upland habititat restoration.

Two priority locations are targeted for upland habitat restoration, including:

1. River Park: 30% of the proposed area of River Park will be dedicated to upland habitat restoration, creating passive recreation utilizing a native, drought tolerant landscape palette.
2. OCFCD east river bank area: 70% of the OCFCD site located along the river's east bank between Katella Avenue and the SPT Railroad.



▲ Section view of habitat restoration areas.

Feasibility Considerations

Sustainability fundamentals should be embraced such as permeability, native plant material, carbon sequestration, heat island effect mitigation, and drought tolerant vegetation. Upland habitat landscape enhancements can remain flexible to meet varying feasibility considerations throughout the project area. A maintenance plan is key to the long-term success of plantings. Considerations for irrigation, tree litter, pruning, weeding and regular upkeep need to be considered early in the design of landscape elements. Given the multi-jurisdictional nature of the project area, the maintenance responsibilities of any new landscape enhancements should be clear and agreed upon early in the design process with funding ear-marked for maintenance efforts.

▲ View from SART west bank of river, south of 57 Fwy. Proposed River Park will dedicate 30% of the park land to upland.

Design Requirements

DESIGN ELEMENTS

Upland habitat restoration will consist of native riparian, low-maintenance and drought tolerant plantings to support local wildlife and urban greening along the upland river corridor areas. The landscape programming will entail minimal maintenance and limited irrigation requirements, instead depending on vegetation to establish and thrive as historically native vegetation that is tolerant of the semi-arid conditions of this region. Vegetation may consist of native trees, low lying shrubs and grasses. Special focus should be on selecting vegetation that supports important food, nesting habitat, cover and migration corridors for native wildlife species. The restoration programming may also include invasive plant removal and control.

TECHNICAL STUDY REQUIREMENTS

A review of completed research on the River Ecosystem or new studies to better understand the habitat needs in the area would focus plant selection and determine highest suitability potential habitat threats and opportunities.

A study of the pollution (particulate matter, carbon, exhaust) being emitted from the adjacent roadways could help identify plant species, placement, and orientation that would be most beneficial to path users and the surrounding community.

Specific design considerations include:

» Understanding of river embankment – structurally and hydraulically.
» Avoid impacts to existing utilities as possible.
» Integration with adjacent circulation systems.

PERMIT REQUIREMENT, SCHEDULE, AND COST ESTIMATE

Regulatory approvals and permitting are not currently anticipated for this habitat restoration effort.

DESIGN AND CONSTRUCTION SCHEDULE

Estimated design schedule is 3-6 months and construction is estimated at 3-7 months.

CONSTRUCTION COST ESTIMATES

Construction costs will depend on the area of habitat restored and types of habitat established. Costs may range from $550,000 to $$3,200,000. Landscape enhancements can range from small planting additions or restorations to large scale tree-planting projects along with requisite irrigation and planter infrastructure.

OPERATIONS COST ESTIMATE

Annual operations costs are estimated at $40,000 for River Park and $250,000 for the OCFCD property.

Environmental / Regulatory Requirements

Environmental review under CEQA and NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile river corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place.

1 Increases Public Interaction and Connectivity

Landscaping generally creates a more favorable public environment and a sense of place. The native habitat landscape can promote an awareness of the river's natural character and remind visitors of the area's rich natural history. Connection to nature has been proven to reduce stress and promote mental wellness.

2 Enhances Aesthetics and Ecology of the River and Surrounding Region

The ecology of the river is directly related to a healthy and endemic landscape. Promoting a healthy relationship between the landscape, the river, and all the species in between will have lasting environmental benefits for the river itself, and the surrounding region. Landscaping can greatly enhance the aesthetics of the area. Given the currently oppressive aesthetics of large parking lots, cement, and overpasses; landscaping can help bring a human scale and beauty to the area.

3 Catalyzes Economic Growth and Development

Riparian habitat landscape that is inviting and beautiful will draw people to the area, and along with them economic activity. As the river becomes a destination for a variety of users, developers in the area will be drawn in by the opportunity to become part of an emerging "River District." Commercial and residential developments can capitalize on their adjacency to the river as it becomes a more beautiful environmental and community resource.

4 Improves Visual and Physical Access to the River

Riparian habitat landscape has the ability to make places more inviting and familiar. A well-tuned landscape makes people feel welcome and more likely to seek out the river as a destination. The river as a green space will be visually enhance the area from all angles. Trees can draw the eye to the river and remind even a driver passing by that they are near a river.

17

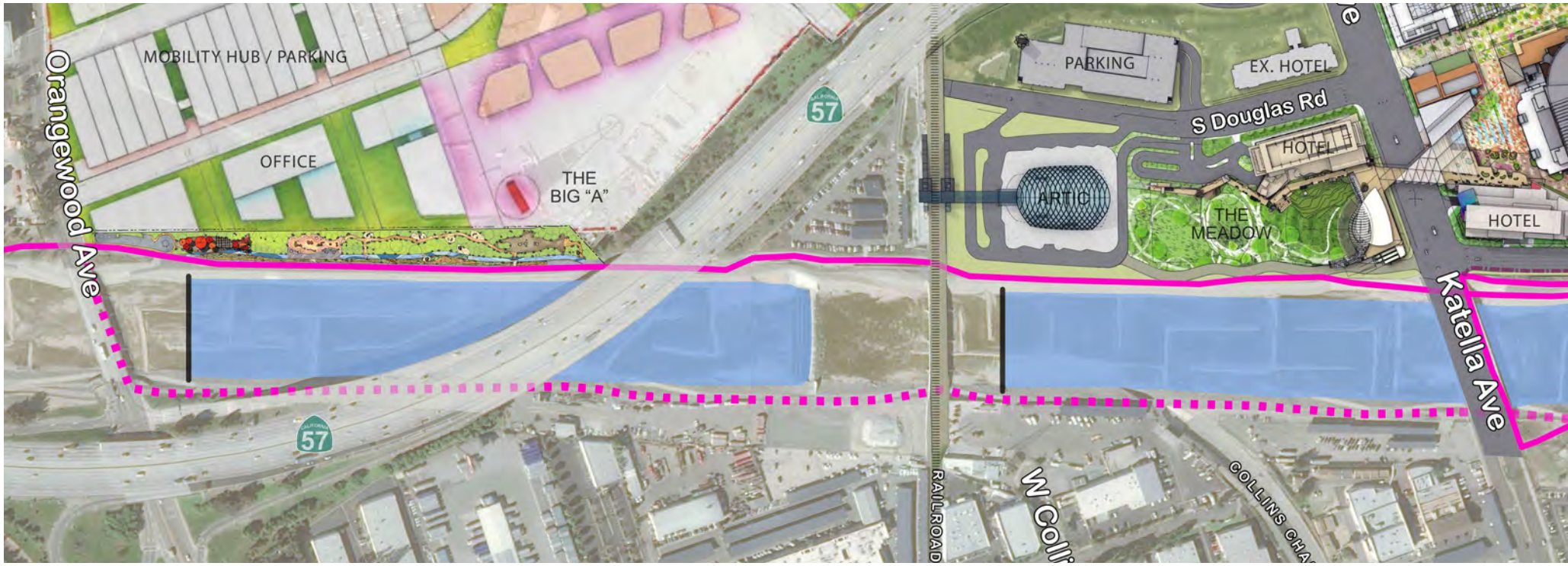
COMMUNITY AMENITIES – OPPORTUNITY #17

Landscape Enhancement - Throughout OC River Walk

Opportunity

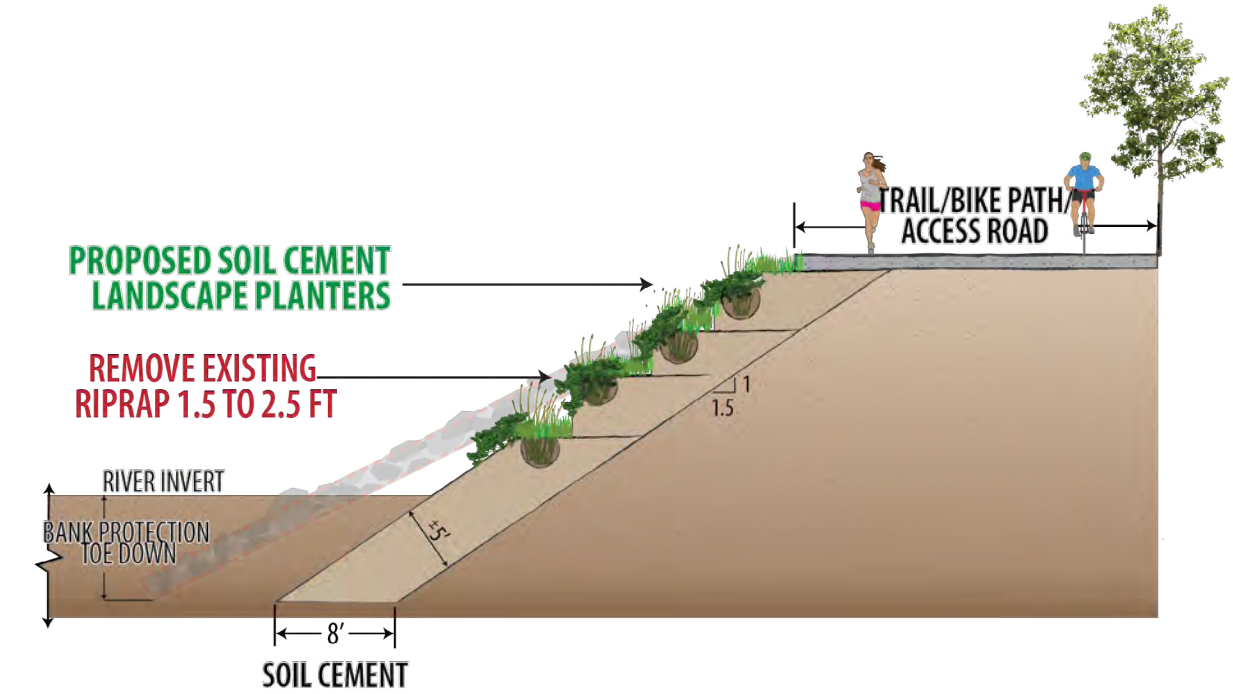
Introduce landscaping throughout OC River Walk to add greenery, attractive gathering areas and facilitate the unique OC River Walk experience.

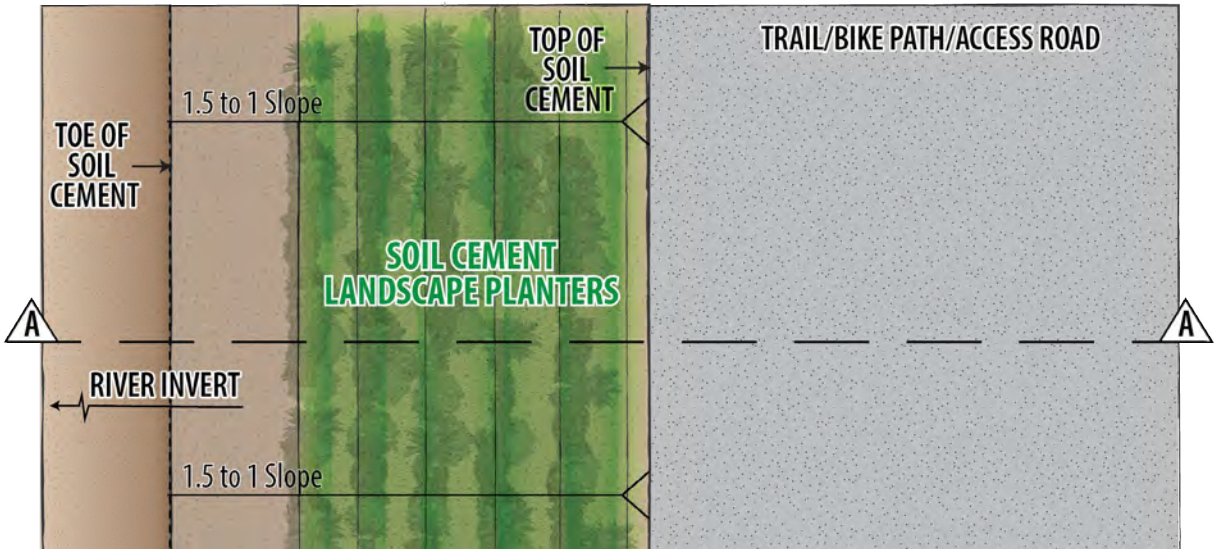
OC River Walk has the potential to influence a more robust landscape for the river overbank and areas adjacent to the river. Planting of trees, in particular, has significant benefits that include increased shade, evapotranspiration, and environmental benefits for carbon sequestration, improve air quality, reduce stormwater runoff, and more comfortable conditions for passive and active recreation. Through the selection of native species and removal of invasive species, the river region can begin to ecologically restore itself and host a more intact habitat for migratory birds and water-based species as part of a broader riparian ecological system. Throughout the extent of OC River Walk, landscape enhancement opportunities exist in many forms, layouts, and locations. Considerations for intensity of use,



programming and access will factor into the planning and design of landscape enhancements. The top of the river embankment provides ample space for creating a softer edge and habitat to complement OC River Walk and associated spaces. Easements on both sides of the river become great opportunities for more intensive tree planting – or 'filter forests' – which help improve air quality, sequester carbon, and mitigate the heat island effect. This strategy is particularly useful given the proximity to the elevated condition of 57 Freeway and other commercial corridors. Finally, the river channel itself has the opportunity to become an enhanced landscape through bioengineering – creating a cellular system for plants to grow.

▲ TOP LEFT: Trail adjacent plantings with integrated seating areas.
TOP RIGHT: Integrated LID bioinfiltration landscaping will address runoff management and promote sustainability.
BOTTOM: Example of landscaping incorporated into river embankment.





Feasibility Considerations

Landscape enhancements can remain flexible to meet varying feasibility considerations throughout the project area. As with all landscape projects, a maintenance plan is key to the long-term success of plantings. Considerations for irrigation, tree litter, pruning, weeding and regular upkeep need to be considered early in the design of landscape elements. Given the multi-jurisdictional nature of the project area, the maintenance responsibilities of any new landscape enhancements should be clear and agreed upon early in the design process with funding ear-marked for maintenance efforts.

◀ Section and plan view of landscape planter river bank soil cement.

Design Requirements

DESIGN ELEMENTS

Plant selections should consider including those which are both native to the Santa Ana River and support the restoration of river habitat. Landscape alterations of the riverbank will always meet or exceed the capacity of the river channel to avoid any impacts to hydraulic capacity, flood conveyance, and flood safety. Given the urbanized condition of the river and overlap of infrastructure (particularly 57 Freeway), trees should be planted in the areas most adjacent to major roads and freeways to act as "filtration forests" that can help sequester carbon and remove particulate matter. Research suggests that certain species can be more advantageous in the fight against pollutants than others. For instance, super-micrometer particles are best sequestered by leaves with ridges or grooves. Generally advantageous traits include small leaf size and high leaf complexity, but optimal vegetation height, form and density depend on planting configuration with respect to the immediate physical environment.

Design typologies for landscape enhancements include:

1. Filter Forests
2. Embankment Planting
3. Green Infrastructure (stormwater management planting, detention basins, bioswales)
4. Habitat Areas (pollinator garden, planting areas specific to host native habitat)

TECHNICAL STUDY REQUIREMENTS

A review of completed research on the River Ecosystem or new studies to better understand the habitat needs in the area would focus plant selection and determine highest suitability potential habitat threats and opportunities.

A study of the pollution (particulate matter, carbon, exhaust) being emitted from the adjacent roadways could help identify plant species, placement, and orientation that would be most beneficial to path users and the surrounding community.

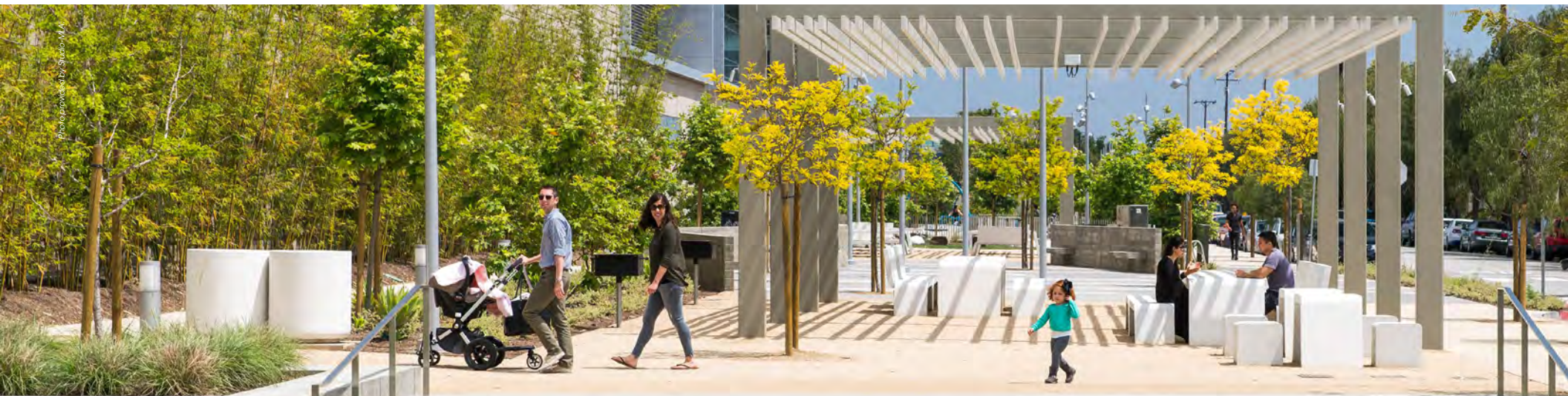
PERMIT REQUIREMENTS, SCHEDULE, AND COST ESTIMATE

» OCPW/OCFCD
» ACOE 404

Depending on the type of permit required, the permitting time frame can range between 4 and 8 months and each permit may cost $40,000.

DESIGN AND CONSTRUCTION SCHEDULE

The design and construction schedule will vary widely based on the scope and scale of the landscaping effort. For budgeting purposes, design is estimated to take four to six months and construction may run four to eight months.



CONSTRUCTION COST ESTIMATES

Construction costs will be dependent on the landscape programming, but for budgeting purposes an estimate of $2,000,000 is estimated.

OPERATIONS COST ESTIMATE

Operations costs will be dependent on the landscape programming, but for budgeting purposes an estimate of $100,000 per year is estimated.

Environmental / Regulatory Requirements

Environmental review under CEQA and NEPA are anticipated for the entirety of OC River Walk. A Programmatic EIR in compliance with CEQA and an EA in compliance with NEPA will be prepared examining all 17 opportunities in the 2-mile river corridor. Where opportunities are more thoroughly defined, a project level environmental analysis will take place.

1 Increases Public Interaction and Connectivity

Landscaping generally creates a more favorable public environment and a sense of place. The landscape can promote an awareness of the river's natural character and remind path users of the area's rich natural history. Connection to nature has been proven to reduce stress and promote mental wellness.

2 Enhances Aesthetics and Ecology of the River and Surrounding Region

The ecology of the river is directly related to a healthy and endemic landscape. Promoting a healthy relationship between the landscape, the river, and all the species in between will have lasting environmental benefits for the river itself, and the surrounding region. Landscaping can greatly enhance the aesthetics of the area. Given the currently oppressive aesthetics of large parking lots, cement, and overpasses; landscaping can help bring a human scale and beauty to the area.

3 Catalyzes Economic Growth and Development

Landscape that is inviting and beautiful will draw people to the area, and along with them economic activity. As the river becomes a destination for a variety of users, developers in the area will be drawn in by the opportunity to become part of an emerging "River District." Commercial and residential developments can capitalize on their adjacency to the river as it becomes a more beautiful environmental and community resource.

4 Improves Visual and Physical Access to the River

Landscape has the ability to make places more inviting and familiar. A well-tuned landscape makes people feel welcome and more likely to seek out the river as a destination. The river as a green space will be visually enhance the area from all angles. Trees can draw the eye to the river and remind even a driver passing by that they are near a river.


jackson
kayak

05
Conclusions & Next Steps

Conclusions & Next Steps

Potential Funding Sources

Conclusions & Next Steps

The Feasibility Study has established the framework for 17 feasible opportunities that combined make up the totality of OC River Walk. The opportunities were defined, analyzed, and placed in their optimal locations. Important information was researched and defined to qualify these opportunities as feasible and to ensure they each produce multiple benefits for the City of Anaheim and regional community aligned with the objectives of OC River Walk, including:

COMMUNITY STAKEHOLDERS CONNECTIVITY COHESIVE STRATEGY

The study work effort defined key constraints, design requirements, regulatory requirements, cost, and schedule are important foundational elements that will support the next logical steps in the development process. Additionally, the level of detail defined for each opportunity will support grant funding applications, planning, and budgeting.

The next steps in the development process are anticipated as follows:

01 Share the Engineering Feasibility Study with the stakeholders for review and comment, including OCFCD, OC Parks, OCWD, City of Orange, ocV!BE and Angels Baseball. Continue to apply for grant funding.

02 Execute an Agreement with the landowning and operational partners potentially including OCFCD, OC Parks, OCWD, City of Orange, and OCTA that will set terms, conditions, and funding responsibilities between the partners to implement the project(s). A future cooperative agreement will identify which agency will take responsibility for the lead agency for planning, design, permits, environmental, and construction, ownership (additional lease agreements may be required), coordination for grant funding applications, maintenance, liability, operations, and programming. A separate cooperative agreement will be executed with OCWD concerning their participation, ownership, and operations of the Santa Ana River impoundment structures.

03 Environmental clearance (CEQA/NEPA) of the two-mile corridor and all 17 opportunities.

04 Engineering design of the top priority elements including:

- Two water impoundment structures
- Riverbank modifications
- Trail Extension/connection to existing Anaheim Coves Trail
- Pedestrian/bike bridge located north of Katella Avenue
- Regulatory permit applications for the priority opportunities

Potential Funding Sources

Several strategies for funding and implementing infrastructure improvements are outlined herein that may be available to enhance public use of the riverfront and the river itself. Potential sources described include Federal, State, regional, and local funding programs that are particularly suitable for project recommendations, with examples of funded projects provided for reference. Complementing this summary is a matrix that identifies active transportation, river activation, and community amenity/connectivity opportunities in the feasibility study eligible for specific grants described in this memorandum. Both the matrix and memorandum include notes on how to increase competitiveness for obtaining funding through the respective programs. See Appendix IV for funding source descriptions.

FEDERAL SOURCES

- Infrastructure for Rebuilding America (INFRA) Grants
- Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grants
- Land and Water Conservation Fund (LWCF)
- Recreational Trails Program
- The Transportation Infrastructure Finance and Innovation Act (TIFIA) Program

STATE SOURCES

- Active Transportation Program (ATP)
- Local Partnership Program (LPP)
- State Transportation Improvement Program (STIP)
- State Highway Operation and Protection Program (SHOPP)
- Local Streets and Roads Program (LSRP)
- Highway Safety Improvement Program (HSIP)
- Environmental Enhancement and Mitigation Program (EEM)
- Urban Greening Grant Program
- Urban and Community Forestry Program

REGIONAL/LOCAL SOURCES

- RMC Grant Program
- Local Fair Share Program
- Bicycle Corridor Improvement Program (BCIP)

Potential Funding Sources

	OPPORTUNITIES	FEDERAL					STATE					
		INFRA GRANTS (1)	RAISE GRANTS (2)	LWCF	RTP	TIFIA	ATP GRANTS (3)	LPP	STIP	SHOPP	LSRP	HSIP
AT	**I. ACTIVE TRANSPORTATION OPPORTUNITIES**											
1	**Bikeway/Pedestrian Trail Extension: Katella to Anaheim Coves (Includes RR Undercrossing)**		X	X	X		X				X	X
2	**Trail Culvert Undercrossing at Ball Rd (Repurpose Existing OCWD RCB)**		X	X	X		X	X		X	X	X
3	**SART East Bank Addition of River from Katella to Orangewood**											
4	**Multi-Modal Bike/Pedestrian Bridge Across the Santa Ana River**	X	X			X	X	X	X			
	a. Extended Landing	X	X			X	X	X	X			
	b. Bank to Bank	X	X			X	X	X	X			
5	**River Walk Width Expansion & Connectivity (Assume 2,000 LF at River & 2,000 LF Offsite)**		X	X	X		X				X	X
6	**Widen Existing Bridges for Bikes/Pedestrians**	X	X			X	X	X	X	X	X	X
	a. Katella Avenue	X	X			X	X	X	X	X	X	X
	b. Orangewood Avenue	X	X			X	X	X	X	X	X	X
7	**SART Pinch Point Relief**		X		X	X	X		X	X		X
	a. West Trail at CA-57 FWY (CalTrans retaining wall)		X		X	X	X		X	X	X	X
	b. West Trail at ARTIC RR Crossing (Double the Width of Existing Culvert Undercrossing)		X		X	X	X		X	X		X
RA	**II. RIVER ACTIVATION OPPORTUNITIES**											
8	**River Impoundment (Assume Inflatable Rubber Type Dam)**	X				X						
	a. Dam North of Orangewood (10 FT High, 14 AC, 80 AF)	X				X						
	b. Dam North of ARTIC (7 FT High, 23 AC, 100 AF)	X				X						
9	**Riverbank Modifications (Assume Full Extent of Impoundments)**			X (a)								
	a. Soil Cement Stepped Embankment			X (a)								
	b. Grade Separated Riverbank			X (a)								
10	**Urban Stormwater Treatment (Multi-Benefit OCPW, Cities, & OCWD/Recharge Enhancement)**	X				X						
	a. Existing Storm Drains Tributary to Proposed Impoundments	X				X						
	b. Collins Channel (OC WIPS/MS4 Permit Opportunity)	X				X						
	c. Chantilly/State College SD (OC Vibe, Angels, OCPW, OCWD/MS4 Permit Opportunity)	X				X						
11	**River Recreation (Kayak, Electric Boats, Tube Ride, Water Jets/Fountain, Fire Water)**			X								
CA	**III. COMMUNITY AMENITY OPPORTUNITIES**											
12	**Cantilever Decks/View Platforms**	X		X		X						
13	**Engagement with Adjacent Spaces: (5 Locations)**			X								
14	**Stepped Embankment: (5 Locations)**			X								
15	**Integrated Public Education/Art (Environmental/Cultural): Multiple Locations**			X (a)	X (c)							
	a. CA-57 Bridge Pier Columns (Lights, Color, etc.) - 15A			X (a)	X (c)							
	b. Orangewood/Katella Bridges, ARTIC, SP (Upstream Pier Nose & Bridge Graphics) - 15B-E			X (a)	X (c)							
	c. Trail Mile Markers & Educational Kiosk (at 0.25 mile spacing) - 15F			X (a)	X (c)							
16	**Upland Habitat Restoration**											
	a. City of Anaheim River Park											
	b. OCFCD Property East Bank North of Katella (Possible TCA Mitigation)											
17	**Landscape Enhancement**			X	X							

			REGIONAL / LOCAL		
EEM	UGGP (4)	UCFP	RMC GRANT	LFSP	BCIP
X	X	X	X	X	X
X	X	X	X	X	X
				X	X
				X	X
				X	X
	X		X	X	X
				X	X
				X	X
				X	X
				X	X
				X	X
				X	X
X			X		
X			X		
X			X		
	X		X	X	
	X		X	X	
	X		X	X	
X	X		X		
X	X		X		
X	X		X		
X	X		X		
X	X		X		
X		X	X		
X		X	X		
X		X	X		
X	X	X	X		

NOTES

FEDERAL
INFRA = Infrastructure for Rebuilding America
RAISE = Rebuilding American Infrastructure with Sustainability and Equity
LWCF = Land and Water Conservation Fund
RTP = Recreational Trails Program
TIFIA = The Transportation Infrastructure Finance and Innovation Act

STATE
ATP = CalTrans Active Transportation Program
LPP = Local Partnership Program
STIP = State Transportation Improvement Program
SHOPP = State Highway Operation and Protection Program
LSRP = Local Streets and Roads Program
HSIP = Highway Safety Improvement Program
EEM = Environmental Enhancement and Mitigation Program
UGGP = Urban Greening Grant Program
UCFP = Urban and Community Forestry Program

REGIONAL / LOCAL
RMC = Rivers and Mountains Conservancy Grant Program
LFSP = Local Fair Share Program
BCIP = Bicycle Corridor Improvement Program

1) For the INFRA grant, projects should be packaged together with other transportation improvements (including those involving rail and roadways) to increase competitiveness to demonstrate a significant regional transportation project.
2) To increase competitiveness for the RAISE grant, multi-modal projects should be packaged together as one cohesive project.
3) The Caltrans Active Transportation Program is the main source of funding for active transportation infrastructure projects in the State of California.
4) For the Urban Greening Grant, competitive applications should include an active transportation component alongside landscape and water quality improvements.

a) Considered an eligible "support" amenity in the grant program, this should be packaged with an active recreational amenity for a competitive application.
b) When submitting trail improvments for this grant program, the applicant needs to emphasize recreational and greening benefits of the trail as improvements for commuting benefits are not eligible.
c) Should be packaged with landscaping and recreational trail enhancements for a competitive application.
d) Any active transportation or stormwater improvements need to be packaged with landscaping improvements for a competitive application.


Main St
Broadway

06

Appendix

Technical Exhibits

Support Letters

Santa Ana River Parkway & Open Space Plan - Trail Terminology

Funding Source Desscription

OCFCD Conceptual Review Submittal

Cooperative Water Impoundment Technical Memorandum

Index of Abbreviation and Acronyms

Full-scale appendix materials avaiable for download: https://cutt.ly/OCRiverWalk-Appendix

Technical Exhibits

EXHIBIT 01

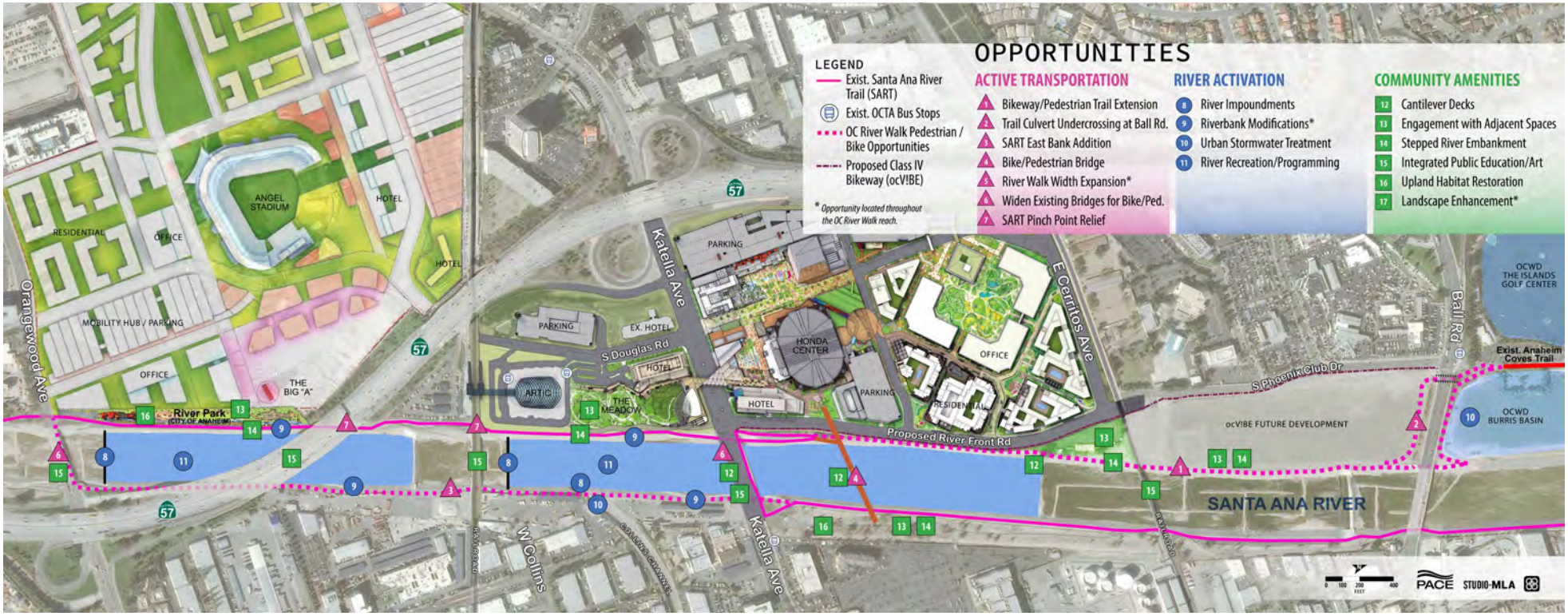
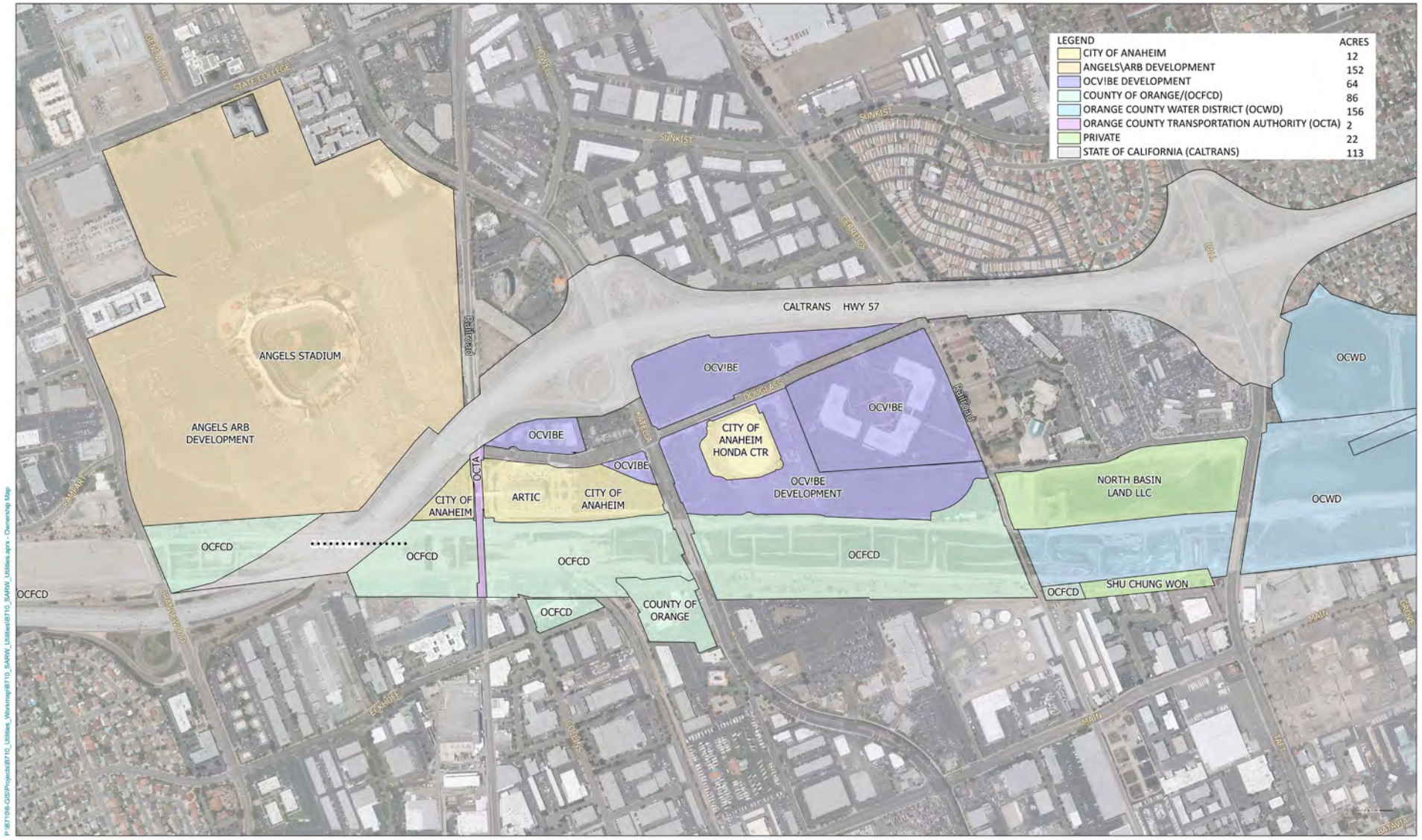

OPPORTUNITIES
LEGEND
Exist. Santa Ana River Trail (SART)
Exist. OCTA Bus Stops
OC River Walk Pedestrian / Bike Opportunities
Proposed Class IV Bikeway (ocVIBE)
* Opportunity located throughout the OC River Walk reach.
ACTIVE TRANSPORTATION
1 Bikeway/Pedestrian Trail Extension
2 Trail Culvert Undercrossing at Ball Rd.
3 SART East Bank Addition
4 Bike/Pedestrian Bridge
5 River Walk Width Expansion*
6 Widen Existing Bridges for Bike/Ped.
7 SART Pinch Point Relief
RIVER ACTIVATION
8 River Impoundments
9 Riverbank Modifications*
10 Urban Stormwater Treatment
11 River Recreation/Programming
COMMUNITY AMENITIES
12 Cantilever Decks
13 Engagement with Adjacent Spaces
14 Stepped River Embankment
15 Integrated Public Education/Art
16 Upland Habitat Restoration
17 Landscape Enhancement*
ANGEL STADIUM
RESIDENTIAL
OFFICE
HOTEL
MOBILITY HUB / PARKING
Orangewood Ave
THE BIG "A"
River Park
PARKING
EX. HOTEL
S Douglas Rd
ARTIC
THE MEADOW
Katella Ave
HONDA CENTER
E Cerritos Ave
Proposed River Front Rd
S Phoenix Club Dr
ocVIBE FUTURE DEVELOPMENT
Ball Rd
OCWD THE ISLANDS GOLF CENTER
Exist. Anaheim Coves Trail
OCWD BURRIS BASIN
SANTA ANA RIVER
W Collins
57
PACE
STUDIO-MLA

EXHIBIT 02

CITY OF ANAHEIM - "OC RIVER WALK" COMPARISONS

EXHIBIT 03



O.C. RIVER WALK

SANTA ANA RIVER AND ADJACENT OWNERSHIP

PACE

0 300 600 1,200 Feet

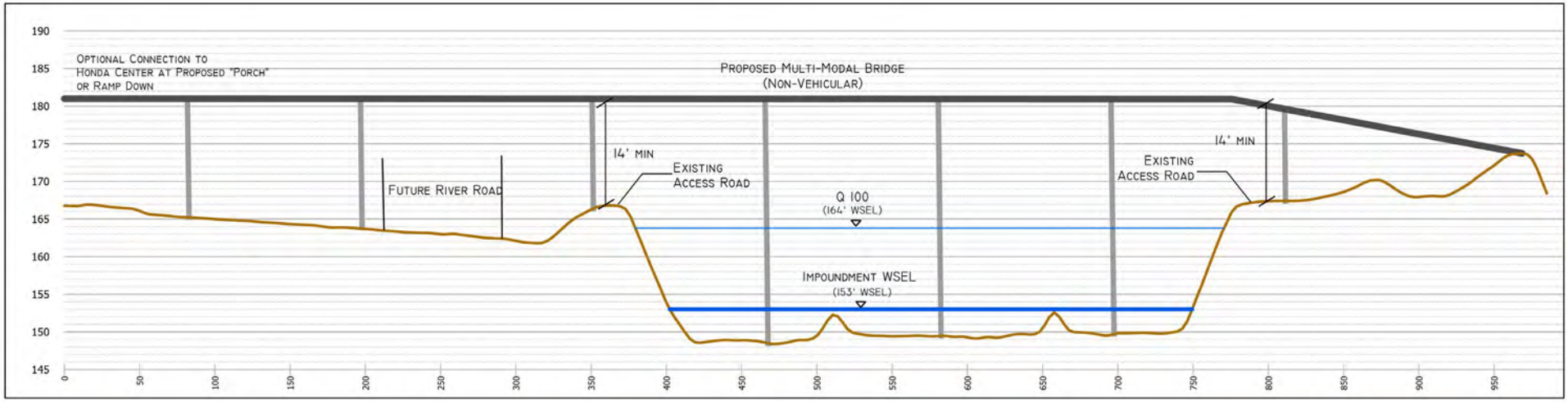
Date: 10/7/2021

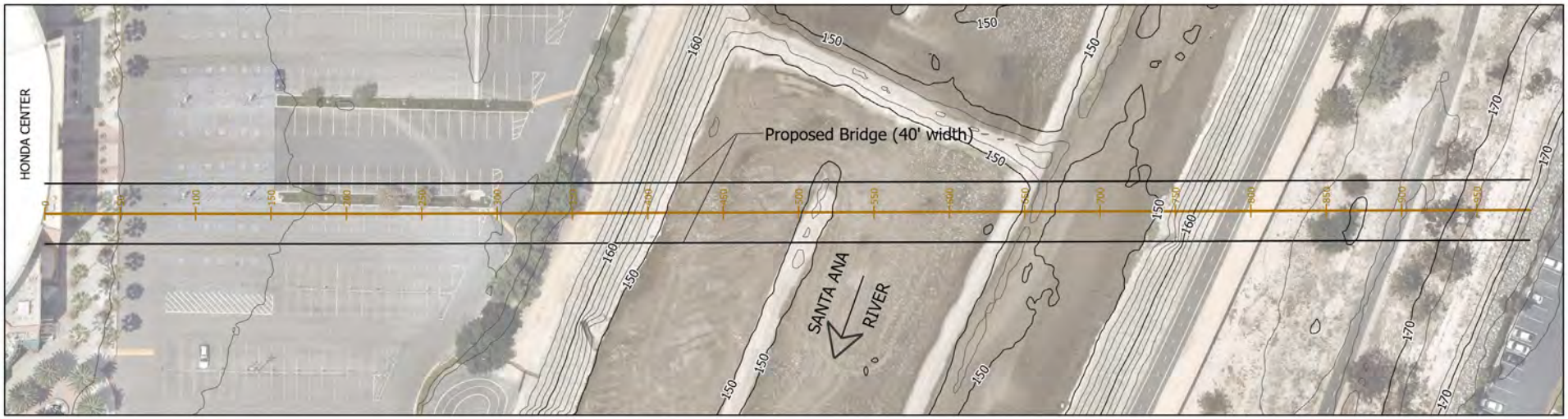
Job Number: 8710

PACE STUDIO-MLA

EXHIBIT 04

EXHIBIT 05





OC RIVERWALK

PROPOSED PEDESTRIAN/BIKE BRIDGE PLAN AND PROFILE

PACE

0 30 60 120 Feet

Date: 9/16/2021

Job Number: B710

PACE STUDIO-MLA

EXHIBIT 06

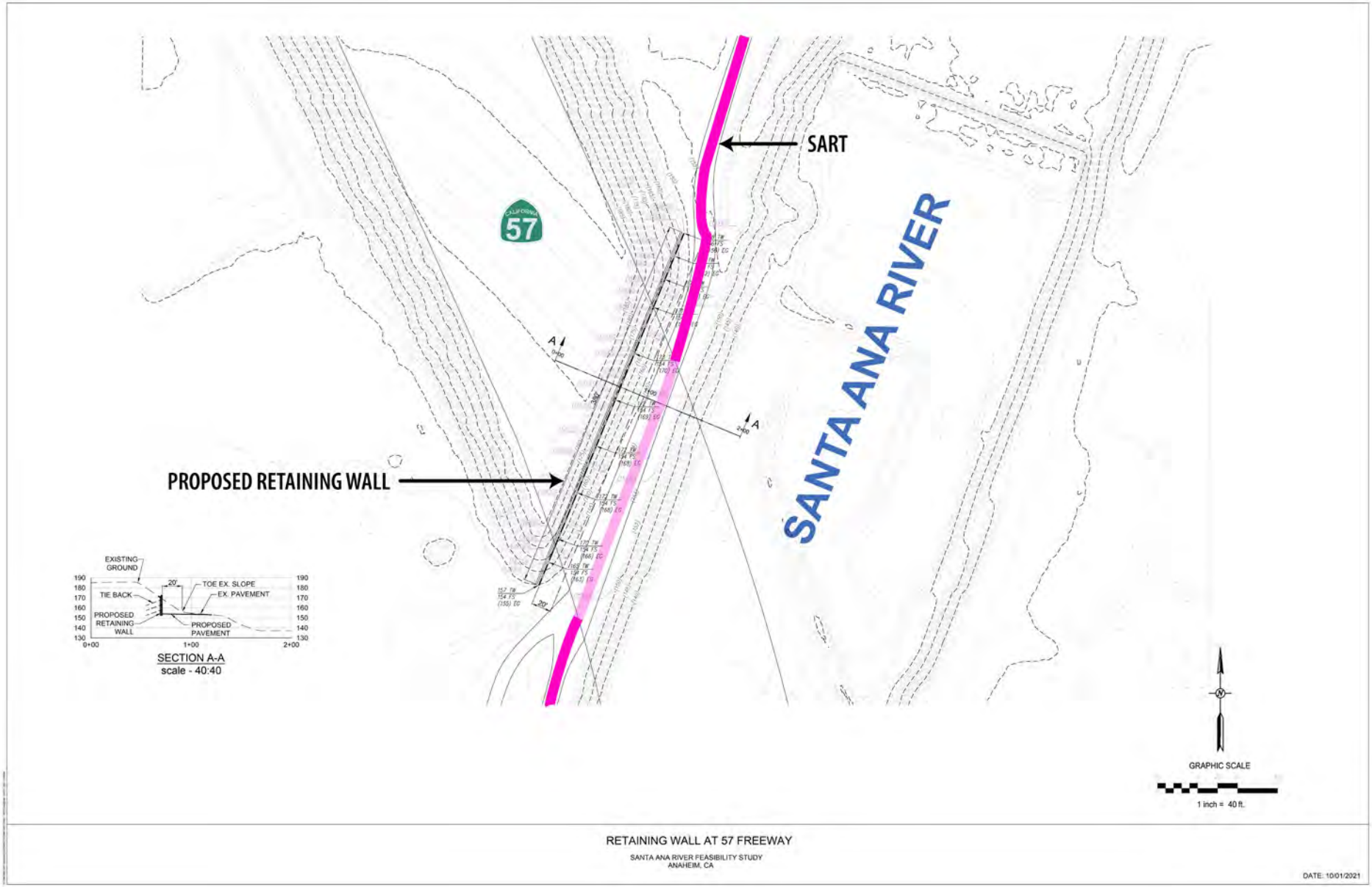

SART
SANTA ANA RIVER
57
PROPOSED RETAINING WALL
A
A
EXISTING GROUND
TIE BACK
20'
TOE EX. SLOPE
EX. PAVEMENT
PROPOSED RETAINING WALL
PROPOSED PAVEMENT
190
180
170
160
150
140
130
0+00
1+00
2+00
SECTION A-A
scale - 40:40
GRAPHIC SCALE
1 inch = 40 ft.
RETAINING WALL AT 57 FREEWAY
SANTA ANA RIVER FEASIBILITY STUDY
ANAHEIM, CA
DATE: 10/01/2021

EXHIBIT 07

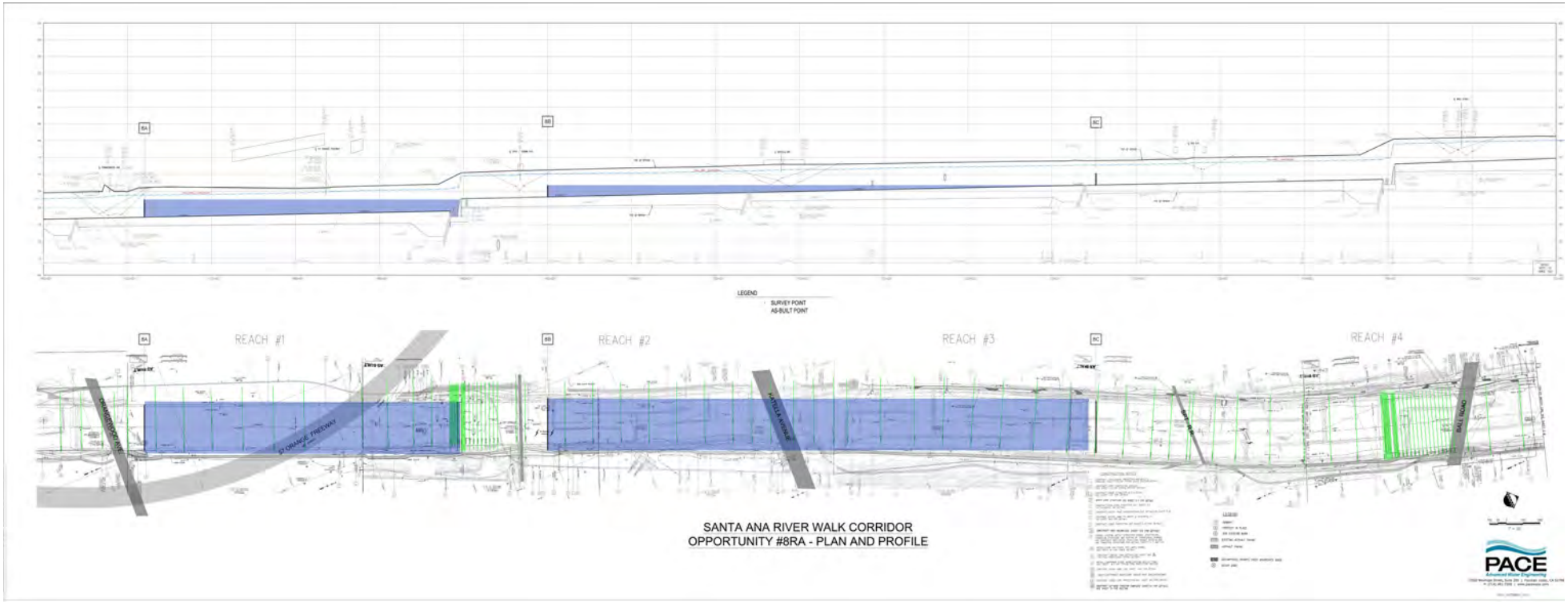
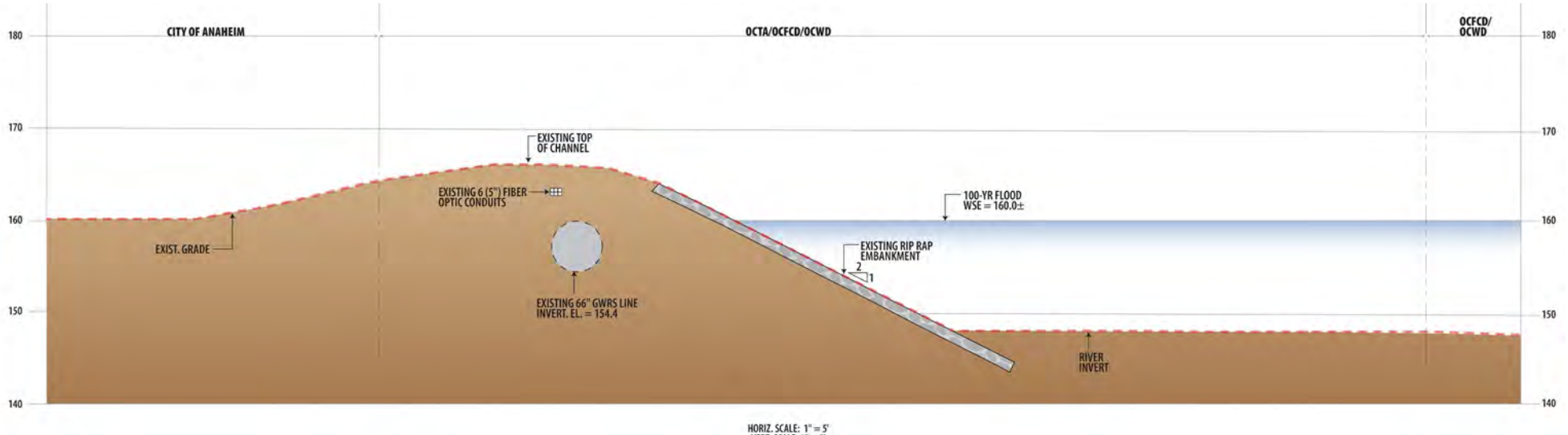
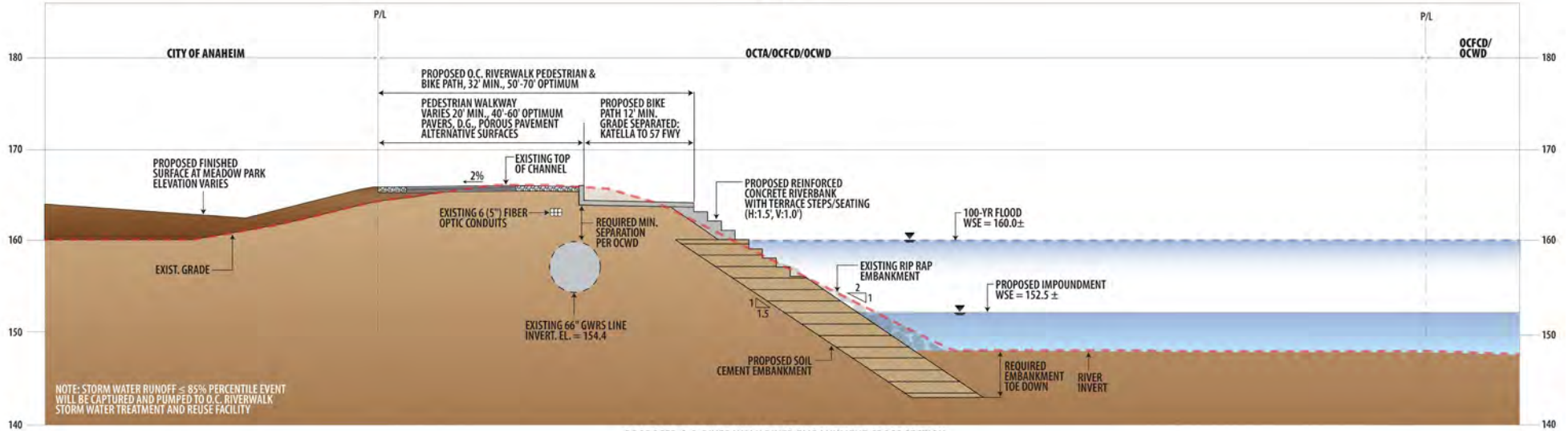

LEGEND
SURVEY POINT
AS-BUILT POINT
REACH #1
REACH #2
REACH #3
REACH #4
SANTA ANA RIVER WALK CORRIDOR
OPPORTUNITY #8RA - PLAN AND PROFILE
PACE

EXHIBIT 08





PROPOSED O.C. RIVER WALK RIVER EMBANKMENT CROSS SECTION

HORIZ. SCALE: 1" = 5'
VERT. SCALE: 1" = 5'

PREPARED BY:

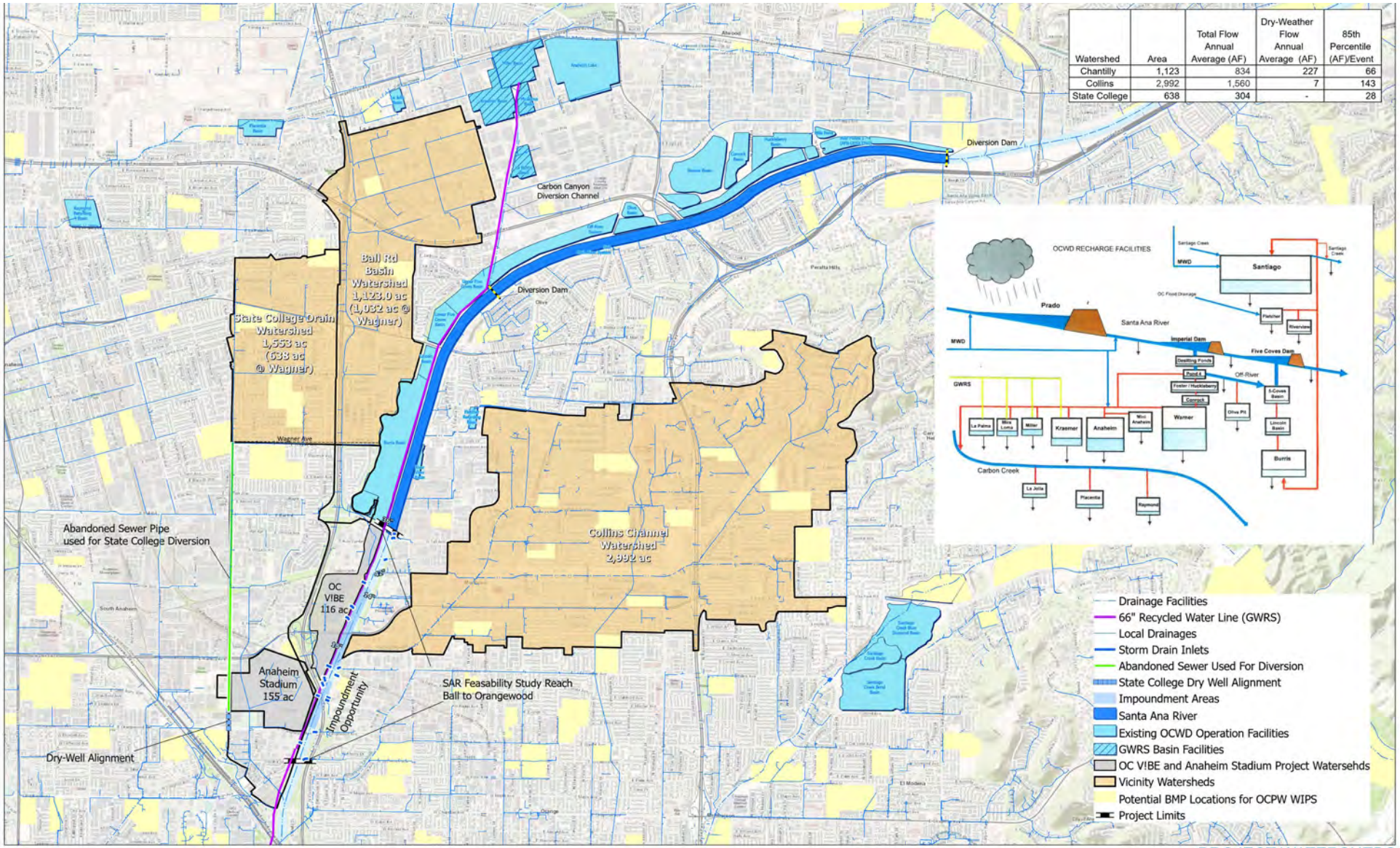
MK ENGINEERING GROUP
17820 NEWHOPE ST. - SUITE 140
FOUNTAIN VALLEY, CA 92708
(714) 460-7899

CROSS SECTION EXHIBIT

SANTA ANA RIVER FEASIBILITY STUDY
ANAHEIM, CA

DATE: 06/01/2021

EXHIBIT 09

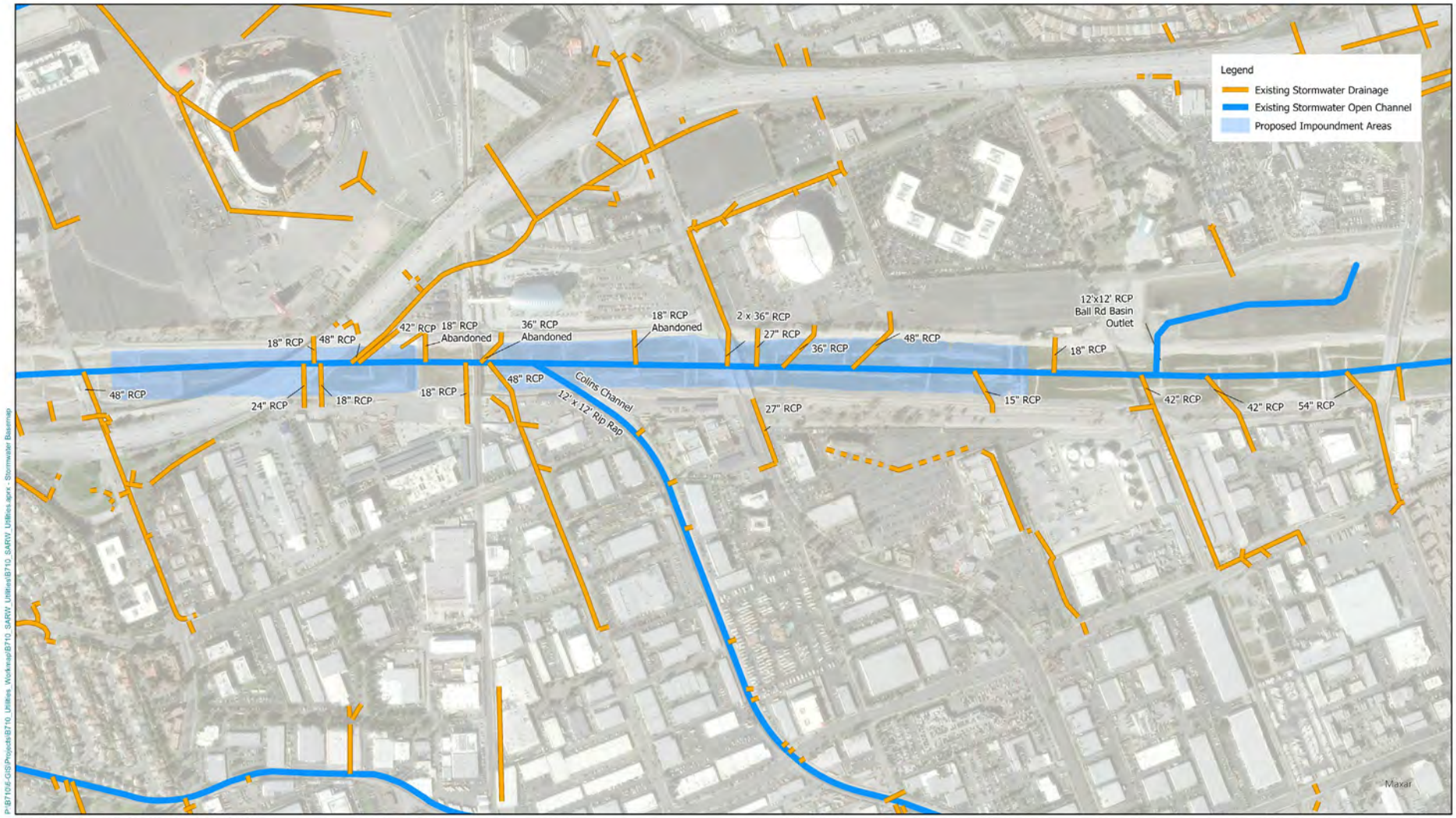


OC RIVERWALK

PROJECT WATERSHEDS AND REGIONAL FACILITIES

PACE STUDIO-MLA

EXHIBIT 10



Source: Orange County Public Works

O.C. RIVER WALK

EXISTING STORMWATER OUTLETS

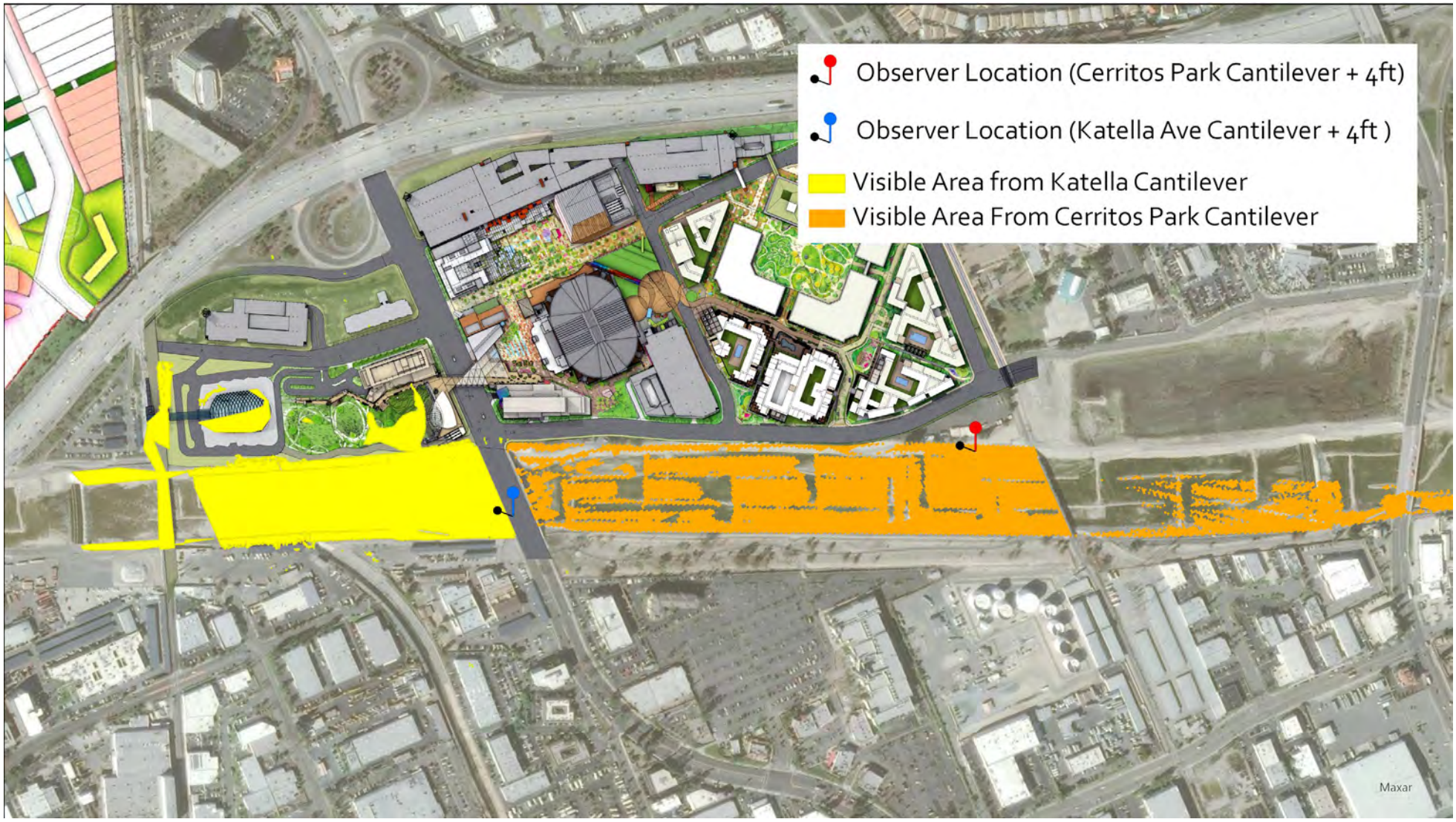
PACE Advanced Water Engineering

0 250 500 1,000 Feet

Date: 9/28/2021

Job Number: B710

EXHIBIT 11


Observer Location (Cerritos Park Cantilever + 4ft)
Observer Location (Katella Ave Cantilever + 4ft)
Visible Area from Katella Cantilever
Visible Area From Cerritos Park Cantilever
Maxar

Support Letters

Congress of the United States
Washington, DC 20515

January 5, 2021

Pamela Galera
Parks Manager
City of Anaheim
200 South Anaheim Boulevard
Anaheim, CA 92805

RE: City of Anaheim - Riverwalk Plan

Dear Ms. Galera:

I am happy to provide this letter in support of the City of Anaheim's effort to create a Riverwalk Development Plan for the Santa Ana River near Angels Stadium and Honda Center. I have the pleasure of representing the majority of the city of Anaheim in the United States Congress.

Creating a Riverwalk along the Santa Ana River and adjacent to the Santa Ana River Trail would be a welcome public space asset for the residents and visitors to Anaheim. It would provide important active transportation connections, increase park and open space, and help to restore the Santa Ana River as a desirable location for recreation and habitat. The proposed plan, which includes designs for impounding water south of Katella Avenue near ARTIC, a future public park, and a pedestrian/bicycle bridge over the River to connect the cities of Anaheim with Orange, demonstrates the vision Anaheim consistently extends to the entire region.

Anaheim is expecting significant construction in this area in the coming years, particularly with the private development planned by Angels Baseball and the Honda Center/Anaheim Ducks. The area is the eastern border of what is known as the Platinum Triangle - home to industry and high-density housing, with more to come. The proposed planning project will serve the recreation needs of this growing area, while also helping to preserve natural habitat and open space.

The Santa Ana River is one of our region's most important natural resources. It was the reason native Californians and settlers flocked to Anaheim centuries ago – providing vital water supply, reeds and plants for housing and baskets, fertile soil for crops, and habitat for fish and wildlife. Today the river continues to contribute to our drinking water supply by recharging our groundwater aquifer. This project will honor the importance of the river, once again restoring it as a focal point in our City, while also increasing groundwater recharge through the water impoundment.

I have reviewed the City's proposed planning project and I believe it will bring much needed improvements to the entire region.

Respectfully,

J. LUIS CORREA
Member of Congress

PRINTED ON RECYCLED PAPER

Gabrielino/Tongva Nation
A California Tribal Sovereign

106 1/2 Judge John Aiso St. #231, Los Angeles, CA 90012
www.gabrielino-tongva.com

December 17, 2020

Tribal Council Members:

Sandonne Goad
Tribal Council Chairwoman

Adam Loya
Tribal Council Vice Chairman

Ed White
Tribal Council Secretary

Joey Aguirre
Tribal Council Member

Reuben Dominguez, II
Tribal Council Member

Eric Martin Del Campo
Tribal Council Member

Patricia Neminski
Tribal Council Member

Victor Velasquez
Tribal Council Member

Sen. Richard G. Polanco (Ret.)
CEO

Pamela Galera
Parks Manager
City of Anaheim
200 South Anaheim Boulevard
Anaheim, CA 92805

RE: City of Anaheim – River Walk Plan

Dear Ms. Galera:

It is with great pleasure that the Tribal Council for the Gabrielino/Tongva Nation offers its support for the City of Anaheim's effort to develop a River Walk Plan along the banks of the Santa Ana River. We are particularly excited about the opportunity to share the connection between the river and the Native California people through art and interpretation, which we encourage as you plan design elements along the proposed River Walk.

For more than 9,000 years, the Tongva People have lived along the Santa Ana River - the largest riparian ecosystem in Southern California - which provided abundant food and water to sustain about 15,000 native people. The Tongva people called the river Wanaawna and made their homes nearby. The village of Hotuukngа, in fact, was situated very near what is now Anaheim.

We welcome the intent of the City of Anaheim to develop a Plan to honor the importance of the River to our tribe, especially as you seek to add a future public park and a pedestrian/bicycle bridge over the Santa Ana River, as well as to protect valuable water resources. We encourage the City to utilize the new elements to educate and inform others about our traditions through art and interpretation. This will give children and adults an opportunity to marvel at the River and the wildlife it supports, and further understand its connection to our history and culture, which is rooted in a sense of community.

Native trees and plant material were once abundant along the Santa Ana River and with them came birds, and butterflies and other wildlife. We are thrilled to see the City seek to restore and protect this habitat.

We look forward to working with you to share the history and culture of our tribe as you move forward with this effort.

Sincerely,

Sandonne Goad
Tribal Council Chairwoman
Gabrielino/Tongva Nation

"The Gabrielino/Tongva Nation for all Gabrielinos"

County Administration South
601 North Ross Street
Santa Ana, CA 92701

P.O. Box 4048
Santa Ana, CA 92702

(714) 667-8800
info@ocpw.ocgov.com
OCPublicWorks.com

Administrative Services
OC Development Services
OC Facilities Design & Construction Management
OC Facilities Maintenance & CUF
OC Fleet Services
OC Construction
OC Environmental Resources
OC Operations & Maintenance
OC Infrastructure Programs
OC Survey

OC Public Works

December 22, 2020

Pamela Galera
Parks Manager City of Anaheim
200 South Anaheim Blvd
Anaheim, CA 92805

Re: Anaheim River Park Project

Dear Ms. Galera:

On behalf of the County of Orange, I am offering our support for the City of Anaheim's proposed River Park Project Study (Project), an urban recreation and habitat restoration project that will revitalize a portion of the Santa Ana River corridor. We understand from our meetings with the City that this Project is being developed to include, among other things, completion of preliminary engineering for temporary and periodic impoundment of water for recreational purposes within the Santa Ana River through the construction of a dam feature south of Katella Avenue. We also understand that the City intends the Project's underlying CEQA/NEPA environmental document to incorporate this feature as well as a public pedestrian/bicycle bridge over the river that will connect the cities of Anaheim and Orange.

This letter confirms that OC Public Works will provide further information and direction, as appropriate, to foster the City's efforts in this Project. This would include review of Project design plans which impact County property or facilities to ensure compatibility with County and Orange County Flood Control District operational needs and entering into agreements with the City of Anaheim to further the Project forward to construction and to address any post-construction concerns. Please note that our support for your Project is predicated on the fact that the Santa Ana River channel will remain, first and foremost, a flood-control facility which should be a major consideration in your design. Additionally, the Santa Ana River channel is a federally constructed project; thus, the US Army Corps of Engineers will need to be involved as well in the plan reviews and decision-making process as well as issuance of a 408 permit.

We acknowledge that the City of Anaheim is leading this effort to revitalize the Santa Ana River in this very urban area and believe the Project could result in a multitude of public benefits, from connecting open space with a trail that improves access and recreation, to providing greater opportunities to increase groundwater infiltration and improve or restore habitat for native flora and fauna. We recognize an appreciation for the Santa Ana River, which has been so central to the history, economy and environment of the region and therefore, support this Study.

Please let me know if you have any questions or require any additional information.

Sincerely,

Nardy K Khan

Nardy Khan, PE/PMP
Deputy Director of Infrastructure Programs

December 17, 2020

Pamela Galera
Parks Manager
City of Anaheim
200 South Anaheim Boulevard
Anaheim, CA 92805

RE: City of Anaheim - River Walk Plan

Dear Ms. Galera:

The Orange County Water District (OCWD) supports the City of Anaheim's effort to complete a River Walk Plan for the area surrounding the Santa Ana River near the ARTIC and Stadium/Arena properties. We are particularly excited by the opportunity to impound water in the river, north of Orangewood Avenue, and the positive impact that effort will have on our groundwater basin.

OCWD is an internationally recognized leader in the water industry. We take the limited water supply found in nature and supplement it to provide water for more than 2.5 million customers in Orange County. Annual rainfall in Orange County can be unpredictable, and we are constantly innovating in our quest to meet water demands.

We are excited to continue our partnership with the City of Anaheim through this planning effort. Anaheim is home to several important OCWD facilities, including the La Palma Recharge Basin – also along the Santa Ana River to the north of the current project site – which has capacity to recharge 51,000 acre feet of water per year into the basin. The proposed project will allow the City to create 30% design drawings and complete environmental clearance for a project that could result in opportunities for even greater infiltration of stormwater as well as opportunities to restore important natural habitat along the River.

We recognize that this an ambitious project, and we applaud your vision for this region. Every drop of water from the Santa Ana River is precious, and we welcome continued opportunities to capture that water before it is lost to the Pacific Ocean. We understand that many agreements are needed before full implementation of this project can occur. We are willing to work with the City of Anaheim to determine future authorities, permits and agreements needed for the eventual construction, operation and maintenance of the facilities that are part of this plan.

Sincerely,

Michael R. Markus, P.E., D.WRE, BCEE, F.ASCE
General Manager

PO Box 8300
Fountain Valley, CA 92728-8300

18700 Ward Street
Fountain Valley, CA 92708

(714) 378-3200
(714) 378-3373 fax

www.ocwd.com

CITY OF ORANGE

DEPARTMENT OF COMMUNITY DEVELOPMENT www.cityoforange.org

ADMINISTRATION	PLANNING DIVISION	BUILDING DIVISION	CODE ENFORCEMENT DIVISION
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December 7, 2020

Pamela Galera
Parks Manager
City of Anaheim
200 South Anaheim Blvd
Anaheim, CA 92805

Subject: River Walk Plan Grant Application

Dear Ms. Galera:

The City of Orange is supportive of the City of Anaheim's effort to create a River Walk Plan and have enjoyed working with you on ideas for the corridor between Ball Road and Orangewood Avenue. A recreational amenity like the River Walk is something that residents of both of our cities would enjoy for generations. It would serve to reimagine and celebrate the Santa Ana River beyond the largely utilitarian flood control and groundwater recharge function it is presently recognized for.

As the completed phases of the River Walk known as Anaheim Coves has demonstrated, Anaheim and Orange have only begun to scratch the surface of the recreational opportunities the river corridor has to offer. The City of Orange supports the next phase of the River Walk that might include the impoundment of water south of Katella Avenue adjacent to our western city limit that is home to an emerging mixed-use urban district. These residential and commercial land uses already benefit from their proximity to ARTIC and sports venues, and the prospects of a future public park, and a pedestrian/bicycle bridge over the river, connecting our cities in this location can only enhance quality of life in the community.

The Santa Ana River has been underutilized and underappreciated in the area between our cities for too long. Once a lifeline for native Californians and settlers to our region, the river is no longer a welcoming refuge for native flora and fauna. Our residents and visitors use the Regional Santa Ana River Bike Path to commute, but not to recreate. The City of Orange is excited by the potential to change this pattern and bring our community back to the river as a more naturalized, recreational setting similar to that experienced by other cities to our east in Orange and Riverside counties.

Sincerely,

Anna C. Pehoushek, AICP
Assistant Community Development Director

c: Rick Otto, City Manager

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December 17, 2020

Pamela Galera, Parks Manager
City of Anaheim
200 South Anaheim Boulevard
Anaheim, CA 92805

RE: City of Anaheim - River Walk Plan

Dear Ms. Galera:

Friends of Harbors, Beaches and Parks (FHBP) is an Orange County nonprofit organization with a stated mission to protect our natural lands, waterways, and beaches. In addition to our coalition of some 80 conservation and community groups, FHBP has more than 5,000 individual members who support our regional work. Since its founding in 1997, FHBP has been a longstanding supporter of parks and open space.

We are excited to support the City of Anaheim in its efforts to secure funding for the creation of the new River Walk Plan, and with it, reestablishing community along the banks of the Santa Ana River. The proposed River Walk Plan touches on many areas of interest to FHBP. The proposed plan will lead to the development of recreation and park space in an underserved community and will encourage active transportation through the addition of a pedestrian/bicycle bridge over the River. These features will draw attention to and appreciation of the Santa Ana River and will serve as a gateway to future projects to restore the river's habitat in the Anaheim area. Further, the impoundment of water south of Katella Avenue near the ARTIC transportation facility will help to increase groundwater infiltration, provide additional habitat for birds, fish and other wildlife, and reduce urban runoff and contamination of our harbors and beaches. The plan will help to protect and enhance open space in an extremely built-out environment.

FHBP supports the development of the proposed plan and urges the City of Anaheim to continue its efforts to recognize the recreational and environmental benefits of a restored Santa Ana River.

Sincerely,

Michael Wellborn
President

P.O. Box 9256 • Newport Beach, CA 92658 • www.FHBP.org

ORANGE COUNTY COASTKEEPER
3151 Airway Avenue, Suite F-110
Costa Mesa, CA 92626
Phone 714-850-1965
Fax 714-850-1592
www.coastkeeper.org

January 6, 2021

Pamela Galera
Parks Manager
City of Anaheim
200 South Anaheim Boulevard
Anaheim, CA 92805

RE: Anaheim's River Walk Plan

Dear Ms. Galera:

On behalf of Orange County Coastkeeper, I am excited to learn of the City of Anaheim's plan to develop a River Walk Plan for the portion of central Anaheim that borders the Santa Ana River. The proposed plan will prepare the City to add elements such as a pedestrian/bicycle bridge between Anaheim and Orange, a public park, and impound a precious water source in the area. Most importantly, it will help restore the Santa Ana River as a focal point in an otherwise urban and developed area.

The Santa Ana River has played a central role in the history and development of Orange County. Water from the river irrigated the land and provided fresh drinking water for generations of native Californians and the settlers that followed. During the early part of the last century, efforts to protect the region from rare but catastrophic flooding greatly changed the river's course. Those efforts, combined with decades of rapid growth and development in Anaheim, have eliminated much of the natural habitat for the flora and fauna that once dominated the riverbanks.

Orange County Coastkeeper has been highly supportive of efforts to restore habitat along the river to support a healthy watershed. Our mission at Coast Keeper is to protect our region's water resources so that they are swimmable, drinkable, and fishable for present and future generations. We believe a River Walk Plan is an important project for the City of Anaheim. It will bring focus to the Santa Ana River as a location for recreation and an opportunity to enjoy nature, and will provide a home for native birds, butterflies and other wildlife. In addition, this project will greatly increase opportunities for stormwater infiltration opportunities, which will significantly reduce the pollutants that flow from the busy City streets to the Pacific Ocean.

We strongly support this effort and the positive benefits it will have for our watershed.

Sincerely,

Garry W. Brown
Founding Director
Orange County Coastkeeper

Orange County Bicycle Coalition
2400 Calle Monte Carlo • San Clemente CA 92672 • 949 492 7575

December 8, 2020

Pamela Galera
Parks Manager
City of Anaheim
200 South Anaheim Boulevard
Anaheim, CA 92805

RE: Support for City of Anaheim's River Walk Plan

Dear Ms. Galera:

The Orange County Bicycle Coalition is pleased to support the City of Anaheim's effort to secure grant funding for the construction of the proposed new River Park. We are thrilled by the City's commitment to restoring habitat and recreation opportunities along the Santa Ana River, as well as taking on the integration of the 24/7 Active Transportation corridor we know as the Santa Ana River Trail bikeway. It has been a National Recreation Trail since 1977 and until recently has served as a Class I Bikeway day & night for cyclists to avoid busy street traffic.

OC Bicycle Coalition is non-profit organization that has worked for decades to promote bicycling as an everyday means of transportation and recreation. The Santa Ana River Trail is one of Orange County's premier bicycle facilities, allowing bicyclists to ride safely for nearly 30 miles on a separate Class 1 trail from the Pacific Ocean to Corona (and eventually for a total of 110 uninterrupted miles to Big Bear Lake in the San Bernardino Mountains).

The City of Anaheim has made great strides in restoring nature along the Santa Ana River with the completion of the Anaheim Coves project. We applaud the extended vision and your ideas for the corridor between Ball Road and Orangewood Avenue, including a future bicycle/pedestrian bridge over the River, and a public park. Connecting the bike trail between Anaheim and Orange will give cyclists a safe traffic free opportunity to reach the Santa Ana River Trail from the east, and pursue health and enjoyment of nature.

Our coalition's members utilize the Santa Ana River Trail for recreation and exercise, as well as for their daily commutes. We welcome opportunities to partner with the City in ways that enhance the access, connectivity and safety of our County's bicycle corridors – elements that will encourage more people to leave their cars at home and use their bikes instead – and we have hope that the proposed River Walk bridge plan will do just that!

The OCBC represents cyclists in Orange County that actively travel on bicycles (including eBikes) for work, education and recreational fitness. The project will complement the goals and objectives of OCBC by providing an improved link for alternative modes of transportation, promote health, and enhance the environment across Orange County.

Sincerely,

Pete van Nuys
Executive Director
info@OCBike.org

Santa Ana River Parkway & Open Space Plan - Trail Terminology

PARKWAY & OPEN SPACE PLAN

Expanding the River's Reach

Trail Terminology

In the trail design guidelines below, the following terminology applies.

- **"Santa Ana River Trail" or "SART" or "Trail"** refers to the paved and/or natural surface portion that defines the user's primary travel space including trail shoulders if present. In cases where the Santa Ana River Trail passes through heavily used areas such as urban parks or plazas, striped pavement edge markings may define the trail. In some cases the SART will be a shared-use trail. In some segments the SART may segregate trail users with two parallel trail routes.
- **"Shared-Use Trail"** is used to describe the SART where it provides a completely separated right-of-way for exclusive non-motorized use with cross-flow minimized to the extent possible. A shared-use trail is used by people of all shapes, sizes, ages, and abilities. In selected locations a shared-use trail may, by design, include equestrians although nothing in the guidelines precludes equestrians from using any segment of the SART. A shared-use trail may be paved or unpaved depending on the surrounding land use circumstances. A shared-use trail may generally be analogous to the terms "Class I" bike path used in the California Highway Design Manual and the term "Shared-Use Path" used by the American Association of State Highway Transportation Officials.
- **"Trail Shoulder"** as part of the SART refers to a clear area immediately adjacent to the trail that serves a number of functions including: use for a wide variety of trail-related activities; providing a buffer free of obstructions; and/or being used as a permeable water quality control feature.
- **"Riding and Hiking Trail"** as part of the SART trail system, is a natural-surfaced trail that would be used by equestrians, hikers, and mountain bicyclists and would typically be in conjunction with either a Class I bicycle path or other bicycle route facilities.
- **"Side or Connecting Trail"** as part of the SART trail system, is a trail that may be of the same design of the SART, or may be a narrower trail that either provides river access, trail loop opportunities, or access from surrounding communities.
- **"Tributary Trail"** is a trail that may be of the same design of the SART or may be a Class IV cycle track[1] and sidewalk system that that connects core urban areas with the SART.

Trail Design Principles

Trail design principles that apply to the overall SART trail network include the following, each of which is described below in greater detail.

9. Design Comprehensively and Consider the Overall Trail System
10. Understand SART Trail System Users and Use Dynamics
11. Make the SART Enjoyable and Safe for All User Groups
12. Anticipate Future Use Conditions
13. Assure a Seamless Linear Trail System Experience
14. Provide Access to the River
15. Anticipate Sea Level Rise

1 A cycle track is defined by the National Association of City Transportation Officials (NACTO) as "an exclusive bike facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bike lane."

Design Comprehensively and Consider the Overall Trail System

Design implies intent, and each segment of the SART involves a wide range of opportunities and constraints requiring careful investigation and thoughtful design decisions. Sometimes trail design choices are clear and straightforward, as when a stream must be crossed and a bridge is needed. Sometimes the choices are more complex. Key design considerations include:

- **Collaboration:** there are numerous local and regional agencies whose individual policies and standards regarding the SART and its setting need to be considered. These will vary from trail segment to trail segment. Communication among involved professionals is paramount to a successful design that can be both permitted and constructed.
- **Width and Sight Lines:** With some exceptions, the SART rarely travels in a straight line. It turns because of topography, to avoid obstacles, or to capture important views of the river. The SART travels up and down slopes, over and under roads, railroads, and side channels, and follows the contours of the river itself. It is recommended that the SART corridor, i.e., the right-of-way around the actual trail, be planned and designed to be wide enough to accommodate the expected future level of use when the SART system is fully completed. (Refer to Figure 8-4).

- **Surface:** The SART surface will typically be paved outside of the San Bernardino National Forest, but may also include non-paved shoulders for a variety of uses. Within the National Forest and in limited cases in other areas of the Parkway, such as in areas of sensitive habitat or on levees with particular maintenance conditions, the entire trail tread may be composed of stabilized natural materials.
- **Water Quality:** To protect the river, storm water runoff from the trail can be managed with sheet drainage directed to a system of water quality control features or through use of permeable paving materials.
- **Constrained Right-of-Way:** On occasion, the planning and design of the SART involves adapting to existing physical conditions. In these instances, creative solutions are required such as reducing the width of adjacent road travel lanes, eliminating trail shoulders, or adding signage or other measures.

Figure 8-4 Standard Santa Ana River Trail Width – Shared-Use (Bicyclists and Pedestrians)

PARKWAY & OPEN SPACE PLAN

Expanding the River's Reach

Understand SART Trail System Users and Use Dynamics

The SART, simply defined, accommodates pedestrian, bicycle, equestrian, and other non-motorized forms of movement. However, SART users cannot be easily characterized as simply bicyclists or pedestrians or equestrians. A goal of the SART is to accommodate and provide access to the largest spectrum of non-motorized users possible.

SART users can be:

- Any age with any level of physical ability.
- Solo travelers, small groups that might be traveling side-by-side, or part of a bicycle club or large group led by a docent or teacher.
- On individual bicycles, tandem bicycles, bicycles with trailers, or tricycles.
- Using skateboards, rollerblades, or non-motorized scooters.
- Carrying nothing or in some cases carrying a variety of equipment such as for picnicking, water play, sunning, observing nature, teaching a class or leading a tour. .
- Pushing strollers or pulling wagons with children in them.
- Walking, running, or bicycling with one or more dogs.

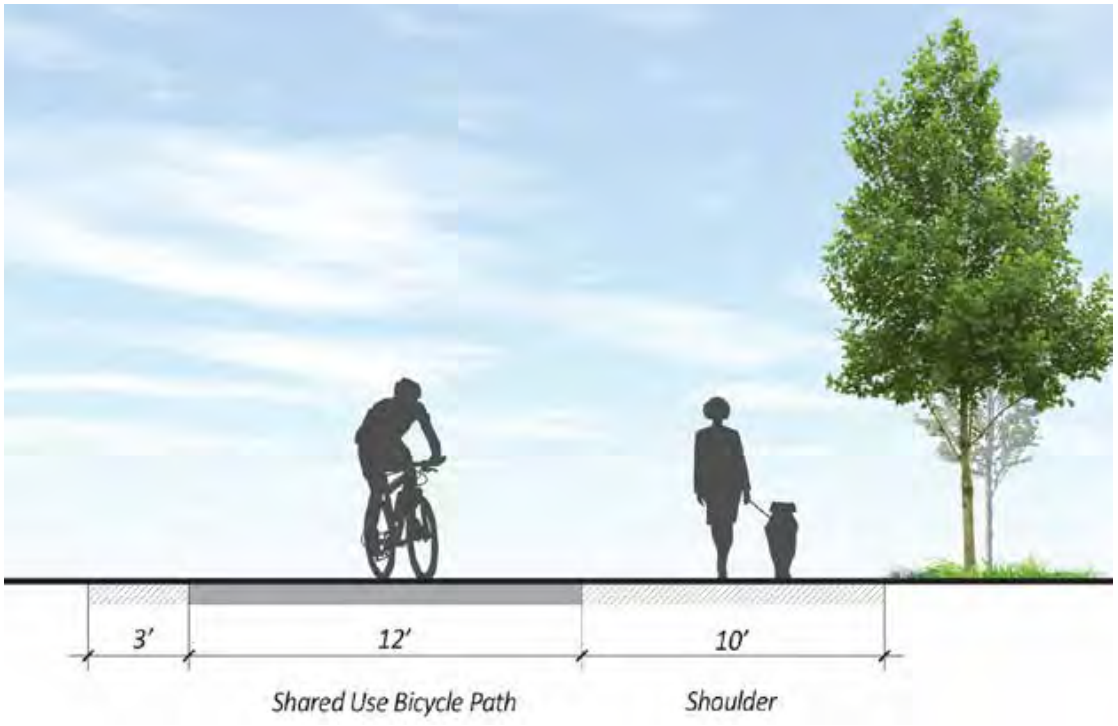

Figure 8-5 Santa Ana River Trail – Bicycles Separated from Pedestrians

SART users can also vary in the speed at which they use the trail. Because of these varied use types and mannerisms, the paramount design consideration related to the SART system trails are the dynamics of shared-use and the quality of the visitor experience. A chief SART design goal is to provide sufficient future capacity, width, line of sight, and in some cases delineating the trail corridor to accommodate this variety of use and help minimize conflicts among uses, as illustrated in Figures 8-5 and 8-6. A critical concept in design of the SART is consideration of its use level when the entire SART system is completed and linked to nearby communities.

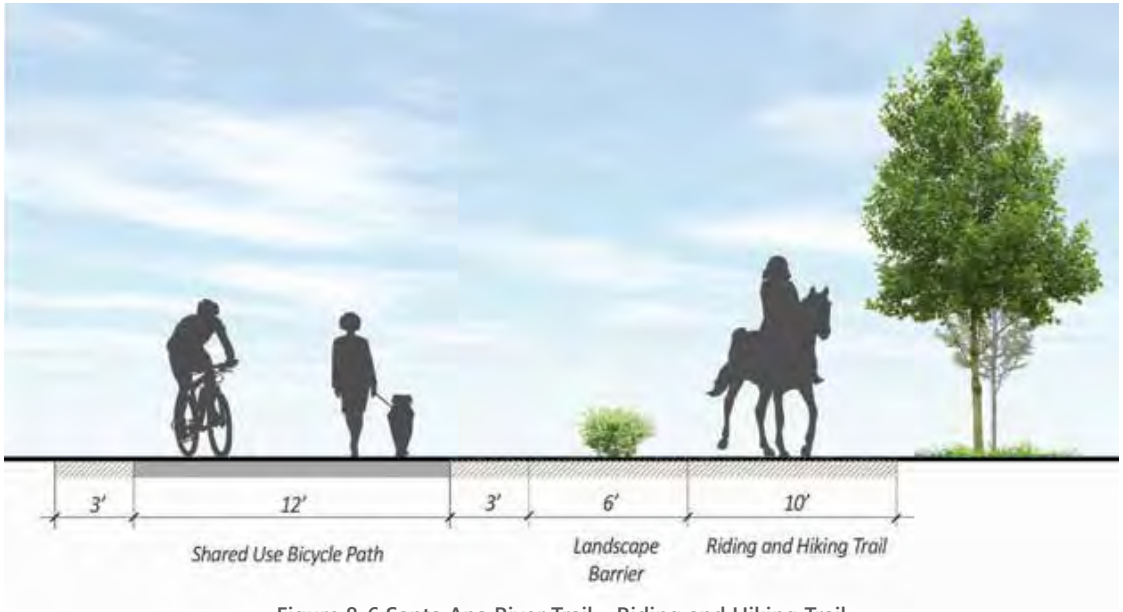

Figure 8-6 Santa Ana River Trail – Riding and Hiking Trail

Make the SART Enjoyable and Safe for All User Groups

The SART in its entirety, including all associated trail features, should be designed to be usable by as many people and user types as possible. A well-designed trail is a safe trail that minimizes conflicts between trail users and other nearby activities. Accomplishing safe and enjoyable trails for all involves:

- Developing a complete trail along the river that is separate from motor vehicles.
- Designing a trail wide enough to accommodate expected future levels and types of use, and to provide adequate capacity in order to minimize conflicts between trail users.
- Developing the SART for personal safety with open sight lines so that existing and future users can more easily avoid obstructions.
- Specifying trail and shoulder surfaces that accommodate different users such as bicyclists and joggers.
- Avoiding constraining trail conditions or obstructions that reduce the functional width of the trail.
- Providing safety and security lighting to facilitate 24 hours a day, 7 days a week access where appropriate. Commuter routes may benefit from specialized signs and lighting.

Design Principles and Guidelines

- Providing essential public amenities such as benches, drinking fountains, bike repair stations, and restrooms that encourage and support long-distance travel.
- Providing wayfinding and distance signage at all decision-making points to identify the SART and at regular intervals as needed when the SART is located on-street.
- Incorporating accessibility into the design of the SART and all related trail amenities, to the maximum feasible extent. For additional information, refer to the *U.S. Access Board's Design Guidelines* (www.access-board.gov), the California Building Code, and local regulations on accessibility.
- Designing the trail for all forms of non-motorized use and ensuring the trail design width accommodates bi-directional bicycle and pedestrian use for the expected level of future use when the SART is completed or upgraded.

Anticipate Future Use Conditions

Since its inception, the SART has drawn a growing number of users each year. With every additional segment of the SART completed, and more direct connections from other bicycle and pedestrian systems being made, more connectivity is created and even more use occurs. The higher the user numbers and the greater the variety in users traveling at different speeds for different purposes, the more the need will increase for designs that expand the capacity and width of the SART. The trail must be designed to accommodate the growing population in the watershed and the expected increased use of the SART system. Anticipating future use conditions means providing a wider trail where the anticipated volume of use is expected to be higher than typical, and separating faster- moving and slower-moving uses on wider trails.

Assure a Seamless Linear Trail System Experience

There are two aspects of a seamless linear trail: Continuity and connectivity.

Continuity

The SART experience is about continuous linear travel. The SART will be fully functional when it provides a continuous route that connects San Bernardino National Forest lands, 3 counties, and all the cities that border the Santa Ana River. From a functional standpoint, the SART design must consider all the dynamics involved with two-way circulation for bicyclists and pedestrians including continuity of travel, lines of sight, turning movements, user interactions, traffic signs and signalization, and physical obstructions.

Connectivity

Direct pedestrian and bicycle connections with adjacent cities, activity centers, park and recreation areas, and public transit facilities, including MetroLink, will exponentially increase SART use by the general public. This involves:

- Incorporating the SART, connecting trails to it, and other Parkway amenities into all projects within the Parkway corridor and providing clear, continuous and seamless transitions to local and regional trail systems.
- Working with property owners and local jurisdictions to provide clear transitions to the SART from other pedestrian and bicycle facilities.
- Providing clear transitions when bicycle and pedestrian facilities shift between Class I bike paths, Class II bike lanes, Class IV separated bikeways, and sidewalks.
- Connecting the SART to all transit sources within walking and bicycling distance, such as buses and rail systems.
- Connecting the SART with schools, civic areas and government offices, commercial districts, businesses, and other activity centers in adjacent cities.
- Coordinating SART staging areas and access points with regional parks and open spaces and local municipal parks.
- Providing clear wayfinding signs at all decision points.
- Coordinating with transit agencies to include amenities such as bike stations, bike racks, and real-time applications that encourage use.

Provide Access to the River

Access is both physical and visual. It is recommended that development of the SART take maximum advantage of opportunities to see the Santa Ana River and, where appropriate, use its waters for a variety of recreational and educational activities. Consider locating the SART as close to the river as feasible and include, where appropriate, side loop trails within the river floodplain. Consider including point access trails to the river and its beaches and specific interpretive and observation points.

Anticipate Sea Level Rise and Flooding

While scientific uncertainty remains regarding the pace and amount of future sea level rise, and only the most downstream portions of the Parkway would be subject to sea level rise, it is recommended that the SART trail design use the most current regional sea level rise projections available, as shown in Figure 8-7. While the SART is ideally located at the edge of the Santa Ana River corridor to enjoy views of the river's water and riparian zone, that proximity often creates a vulnerability to flooding. When near the Pacific Ocean, a redeveloped segment of the SART may also afford the opportunity of protecting other Parkway Use Areas from the effects of sea level rise. This would be accomplished by:

- Integrating the SART into the design of new protection structures and assuring that the top elevations are sufficiently wide to accommodate the SART and future SART expansion.
- Involving knowledgeable geotechnical and civil engineering professionals in the design of the trail.
- Including adjacent structural (e.g., levees, seawalls) and non-structural (e.g., wetlands, vegetative buffers) erosion control measures to protect the SART from damage.

Funding Source Descriptions

Federal Sources

Infrastructure for Rebuilding America (INFRA) Grants

INFRA extends a pre-existing grant program established by the Fixing America's Surface Transportation (FAST) Act of 2015 and utilizes updated criteria to evaluate projects that align with national and regional economic vitality goals. INFRA promotes innovative safety solutions that will improve the nation's transportation system, and it targets performance and accountability in project delivery and operations. Eligible INFRA project costs may include reconstruction, rehabilitation, acquisition of property (including land related to the project and improvements to the land), environmental mitigation, construction contingencies, equipment acquisition, and operational improvements directly related to system performance. In the most current grant round (FY 2021), projects are sought that address climate and environmental justice. All projects submitted as part of the INFRA grant program will be evaluated on their strategies to reduce greenhouse gas emissions, encouraging modal shift and a reduction in vehicle miles traveled.

INFRA grants are broken into two categories. For a large project, the INFRA grant application must be at least $25 million. For a small project, the grant must be at least $5 million. Local government agencies do not need to partner with a county/regional transportation agency or a metropolitan planning organization and may apply for funding directly. Before initiating the application process through http://www.grants.gov, all applicants must first obtain a Data Universal Numbering System (DUNS) number; register with the System for Award Management (SAM); create a Grants.gov username and password; and register at least one Authorized Organization Representative (AOR) to serve as the point of contact.

Most projects that are awarded INFRA grants consist of multiple transportation modes. It is advised that if the City of Anaheim pursued funding through the INFRA grant program that it would collaborate with other agencies to pursue a project that focuses on multiple transportation improvements (e.g., integrating River Walk improvements with transit improvements along the Amtrak/Metrolink rail corridor) for a competitive application.

Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grants

Formerly known as Transportation Investment Generating Economic Recovery (TIGER) and BUILD grants, RAISE grants are administered by the U.S. Department of Transportation and provides funding for the construction of large-scale transportation infrastructure projects, including higher-priced bicycle and pedestrian facilities. The grant program is highly competitive, with projects to be evaluated based on merit criteria that include safety, environmental sustainability, quality of life, economic competitiveness, state of good repair, innovation and partnership.

Like INFRA grants, local agencies are not required to partner with county/regional transportation agencies or metropolitan planning organizations and may apply for RAISE grants directly. Grant applications are also processed through https://www.grants.gov and applicants must complete the same pre-registration steps before submitting their proposals. Complete Streets activities and multi-modal transportation hubs are two examples of eligible active transportation projects. RAISE grants may also fund active transportation facilities such as multi-modal bridges, although such facilities would be more competitive for funding if the grant application effectively demonstrates that it improves connectivity at a regional level and is included as part of a larger package of transportation improvements.

Funded projects through prior TIGER and BUILD grant program cycles include:

- Eastside Access Improvements (LA Metro, 2014) – Streetscape, pedestrian, and bicycle access improvements to enhance livability around transit hubs.
- Rail to Rail Active Transportation Corridor Connector (LA Metro, 2015) – Creation of a multi-use corridor that connects regionally significant transit lines.

Land and Water Conservation Fund (LWCF)

Originally established in 1964 by President Lyndon B. Johnson, the annual LWCF program provides federal support for the acquisition and development of outdoor recreation space, including landscape and public art improvements. Grant cycles typically occur on an annual basis or every other year. Cities and counties are eligible to apply for funding of up to $6 million to assist with local projects that will create new recreation space, expand existing recreation space, and/or develop recreation features. Among other things, funding may be used to establish recreational/active transportation trail corridors that connect significant community locations, such as neighborhoods, workplaces, and schools. Although the National Parks Service (NPS) administers the program nationwide, local agencies submit their proposals directly to California Department of Parks and Recreation

(CDPR). CDPR is responsible for selecting the most competitive California applications and sends them to the NPS for final review and approval. The last grant cycle had $40 million in funding available nationwide, with applications due in April 2020 and submissions requiring acquisitions given funding priority. Awards from the previous grant cycles in California averaged $518,000. The deadline for the next application cycle is expected in February 2022. The City may consider pursuing this grant if it is determined that right-of-way will need to be acquired to advance the opportunities described in this study, with opportunities focusing directly on trail improvements likely being the most competitive.

Funded projects through LWCF include:

- The Tracks at Brea (Brea, 2012 & 2015) – Acquire 3.6 acres of land to develop a pedestrian and bicycle path that extends the Brea Trail.

Recreational Trails Program

The Federal Highway Administration's (FHWA) Recreational Trails Program offers local jurisdictions additional funding for active transportation infrastructure through a state-run competitive process. On a biennial basis, the FHWA distributes federal Surface Transportation Block Grant Program funds to state parks departments evenly based on a prescribed formula. California receives approximately $5 million per fiscal year, or roughly $10 million over the span of the 2-year funding cycle, to distribute to local agencies through a competitive grant application process. Although funding is primarily awarded to projects that establish or maintain recreational trails in parks (county, state, federal), trail connector corridors along roadways are also eligible if they link two sections of previously disconnected recreational trail. Cities, counties, and other entities with the authority to manage parks are eligible to apply. The most recent Recreational Trails Program grant cycle was released in Fall 2019, with applications due in February 2020, with $3 million in grant funds available.

Funded projects through the Recreational Trails Program include:

- Salt Creek Trail Enhancement Project (Laguna Niguel, 2009 – Construction of one mile of multi-use trail.
- Flower Street Bike Trail Gap Closure (Santa Ana, 2010) – Construction of one-half mile section of bike trail that closes a gap in the Flower Street bike trail.

The Transportation Infrastructure Finance and Innovation Act (TIFIA) Program

The TIFIA program offers funding to state and local governments for larger-scale surface transportation projects of regional or national significance. The TIFIA program offers three types of financial assistance: 1) **a secured (direct) loan** provides combined construction and permanent financing of capital costs; 2) **a loan guarantee** provides full-faith-and-credit guarantees by the Federal government and guarantees a borrower's repayments to a non-Federal lender; 3) **a standby line of credit** provides a secondary source of funding in the form of a contingent Federal loan to supplement project revenues during the first 10 years of project operations. TIFIA interest rates are equivalent to Federal Treasury rates, so they are often lower than what may be obtained through other sources. This funding opportunity may be useful for high-cost projects such as a multi-modal bridge, and it may also allow for a public/private partnership between the City of Anaheim and nearby developers/property owners. TIFIA loans are recommended to projects that apply for but do not receive INFRA or RAISE grant funding or to close a gap between other grant funds received for a project.

State Sources

Active Transportation Program (ATP)

The California Active Transportation Program was created in 2013 and consolidated existing federal and State transportation programs, including the Transportation Alternatives Program (TAP), the Bicycle Transportation Account (BTA), as well as federal and State Safe Routes to School programs (SRTS). In 2017, an additional infusion of funding was committed to the program through SB1 funding sources, adding approximately $100 million per every ATP grant cycle.

The ATP provides a key source of funding for cities, counties, and regional transportation agencies for bike lanes, pedestrian paths, multi-use paths, sidewalks, Safe Routes to Schools, and other projects that help reduce reliance on cars. The Caltrans ATP Cycle 5 Call for Projects was released in May 2020, with $440 million in grant funding available for bicycle, pedestrian, and multi-modal trail projects, with applications due on September 15, 2020. The ATP has grant cycles that occur every other year, with the next grant cycle anticipated for Spring 2022. Based on past grant cycles, the average award for projects in the ATP program is just under $2 million dollars. However, it is not uncommon for the ATP program to award $10 million dollars of funding for individual projects.

Projects that are within or directly connect to disadvantaged communities as defined by CalEnviroScreen are prioritized to receive funding, which include portions of the study area north of Ball Road and east of the Santa Ana River. In addition to Caltrans leading a statewide competitive grant application process, SCAG administers a sub-allocation of the grant program on a regional basis. All ATP-related projects listed in the River Walk Feasibility Study would be eligible to apply for grant funding under this program, including lower-cost (e.g., $1.5-6 million dollar) multi-modal bridges.

Funded projects through the ATP grant program include:

- Edinger Protected Bike Lanes (Santa Ana, 2015) – Installation of bike lanes along a 1.7-mile stretch of roadway and implementation of Safe Routes to School programs at 3 schools.
- Western Avenue Pedestrian Signal Project (Anaheim, 2014 – Rehabilitation and installation of pedestrian infrastructure near three schools.

Local Partnership Program (LPP)

Part of the SB 1 bundle of funding programs, the LPP supplements voter-approved transportation tax investments made by local communities by providing matching funds. The California Transportation Commission (CTC) intends for this program to balance the priority of directing increased revenues to areas of the state with the highest level of transportation need while maintaining fair distribution of grant funds statewide. Eligible projects include road maintenance, road rehabilitation and other transportation infrastructure improvements. The CTC distributes roughly $200 million in funding split evenly between competitive and formula grants. The next grant cycle is expected in Spring 2022. The majority of projects funded in the last grant cycle (2020) consisted of larger transportation projects with roadway rehabilitation alongside multi-modal improvements.

State Transportation Improvement Program (STIP)

The STIP is a multi-year capital improvement program for transportation projects on and off the State Highway System funded by revenues from the Transportation Investment Fund and other federal sources. The City of Anaheim should work with the Orange County Transportation Authority (OCTA), as appropriate, to nominate projects for inclusion in the STIP. Bicycle and pedestrian projects may be programmed by OCTA in its Regional Transportation Improvement Plans (RTIP) as these projects are eligible for either State Highway Account or Federal funds. The recently adopted 2020 STIP includes over $2.5B in new funding over the next 5 years. While STIP projects tend to focus on higher-cost transit, rail and roadway projects, active transportation projects may be included as part of a larger transportation infrastructure project funded by STIP.

Funded projects through STIP include:

- Anaheim Regional Transportation Intermodal Center (Anaheim, 2010) – Construction of a 67,000 square foot regional transportation center with direct access to bus and rail service and the Santa Ana River bike trail.

State Highway Operation and Protection Program (SHOPP)

The SHOPP is the State's "fix-it-first" funding mechanism for the rehabilitation and reconstruction of all state highways and bridges, including Interstate highways; the supporting infrastructure for those facilities such as culverts, traffic operations systems, safety roadside rest areas, and maintenance stations; and most importantly, to address safety and emergency repair needs. SHOPP also provides the opportunities to address other vital State priorities, such as the reduction of transportation related greenhouse gas (GHG) emissions and implementation of Complete Streets elements like pedestrian and bicycle facilities. Streets and Highways Code Section 2030 (b)(1)(D) states that complete street components, including active transportation purposes, pedestrian and bicycle safety projects, and multi-modal transit facilities are SHOPP-eligible in conjunction with any other allowable project.

Funded projects through SHOPP include:

- Newport Beach bike trail rebuild (OCTA, 2016) – Rebuild failed slope paving, construct cut-off wall, and improve the bike trail.

Local Streets and Roads Program (LSRP)

SB 1 dedicated approximately $1.5 billion per year in new formula revenues to cities and counties for basic road maintenance, rehabilitation, and critical safety projects on the local streets and roads system. To be eligible for funding, cities and counties must submit a list of proposed projects to the California Transportation Commission (CTC) and a project expenditure report at the end of the year detailing the description, location, amount of funds expended, and estimated useful life of improvements constructed with program funding.

LSRP funding is available for road maintenance and rehabilitation; safety projects; Complete Streets Components (including active transportation projects, pedestrian and bicycle safety projects, and multi-modal transit facilities in conjunction with any other allowable project); and Traffic Control Devices.

Funded projects through LSRP include:

- Valley View Traffic Improvements (Buena Park, 2018) – Installation of new traffic signals, lighting, signing & striping and sidewalks.
- Euclid Street Rehabilitation (Santa Ana, 2018) – Rehabilitation of one-half mile of street, installation of pedestrian and bicycle infrastructure.

Highway Safety Improvement Program (HSIP)

The Highway Safety Improvement Program (HSIP) helps fund projects that reduce fatalities and serious injuries on all public roads. Eligible projects include improvements to any public road, bicycle or pedestrian pathway, or trail. The program is data-driven and requires records such as crash experience (data that has already been collected to identify intersections with potential for improved safety), crash potential (further refined data to identify locations with high-risk roadway characteristics), and crash rates.

A portion of HSIP funds are set aside for distribution to local government agencies through a competitive application process. Caltrans issues a call for projects on an annual or biennial basis. Approved projects from Caltrans are submitted to Southern California Association of Governments (SCAG) for inclusion in the FTIP and funds are dispersed accordingly. The minimum funding amount is $100,000.

Funded projects through HSIP include:

- Countywide Bicycle and Pedestrian Facility Enhancements (OCTA, 2010) – Construction and maintenance of bicycle and pedestrian facilities throughout Orange County.
- Bud Turner Recreation Trail at Laguna Lake (Fullerton, 2010) –

Construction of multi-use trail that connects to Juanita Cooke Greenbelt.

Environmental Enhancement and Mitigation Program (EEM)

This program is a State fund established by the Legislature and managed by the California Natural Resources Agency to fund beautification improvements to roadsides to mitigate the effects of transportation projects. Grant cycles are released annually, with approximately $7 million dollars in available funding in an average funding cycle, with the average project awarded $467,000. Eligible projects include restoration of urban waterways, planting of trees, and greening of local roadways and trails. The current funding cycle was released in January 2021, with grant awards anticipated in late Summer 2021. Grant cycles have allowed grant application submittals of up $1 million dollars for projects that required acquisition of properties. A local cash match is required for all application submissions.

Funded projects through the EEM program include:

- Emerald Necklace Expanded Green Infrastructure Network (Amigos de los Rios, 2013) – Creation of parks and open space network connected by river greenways and multi-use trails.

Urban Greening Grant Program

The California Natural Resources Agency's Urban Greening Program is intended to fund projects that reduce greenhouse gases by sequestering carbon, decreasing energy consumption, and reducing vehicle miles traveled, while also transforming the built environment into places that are more sustainable, enjoyable, and effective in creating healthy and vibrant communities. Examples of eligible urban greening projects include green streets, alleyways, and non-motorized urban trails that provide safe routes for travel between residences, workplaces, commercial centers, and schools.

While the California Natural Resources Agency's Urban Greening grant cycles are irregular and dependent on securing a funding source, in recent years the grant has been offered on an annual basis. The most recent grant cycle offered $28.5 million in funding, with applications due on July 15, 2020, with no maximum limit on funds awarded to an individual project. Total funding offered in the grant program through previous cycles range from $25 million to $80 million, with the average grant award at $2 million dollars for an individual project. Like the Caltrans Active Transportation Program, the Urban Greening Grant Program prioritizes the award of grant funds to disadvantaged communities.

Funded projects through the Urban Greening Grant Program include:

- Mendez Historic Trail and Green Street Bikeway Project (Westminster, 2017) – Construction of pedestrian and bicycle trail along former U.S. Navy railroad right-of-way.
- Tracks at Brea – Segment 2 (Brea, 2012) – Construction of 4-mile multi-use trail through city with multiple access points.

Urban and Community Forestry Program

Like the Urban Greening Grant Program, CAL FIRE's Urban and Community Forestry Program provides grant funding for projects that result in a net reduction of greenhouse gases through reforestation efforts. The program features a two-part selection process: (1) initial concept proposals are submitted and scored; and (2) high-scoring proposals are invited to submit a complete application package. During the 2016-2017 application cycle, CAL FIRE distributed more than $19.5 million in grant funding to projects that will plant a combined 35,000 trees and reduce greenhouse gases by an estimated 106,000 metric tons.

Although the program is focused on landscape improvements, former awardees also utilized funds to enhance stormwater, pedestrian, bicycle, and transit amenities. CAL FIRE awarded $18.5 million in grants for the 2019-2020 application cycle. Eligible applicants include cities, counties, qualifying districts, and nonprofit organizations. Grant guidelines have recently been released for the current grant cycle, with application due on July 14, 2021. Grant amounts for winning projects in this cycle will range from $150,000 to $1.5 million dollars.

Funded projects through the Urban and Community Forestry Program include:

- Huntington Park/Cudahy Canopy Expansion (2016-2017) Plant and maintain 1,400 shade trees along parkways and commercial corridors.

Regional Sources

RMC Grant Program

The San Gabriel and Lower Los Angeles Rivers and Mountain Conservancy (RMC) awards approximately $30 million each year to projects that protect open space, preserve or restore natural habitat, and encourage low-impact uses. Funded by Proposition 68, the RMC Grant Program helps advance state and local environmental goals and objectives. While evaluation criteria focuses heavily on land and water resource conservation, a percentage of funding is also allocated for projects that support low-impact trail uses such as walking and bicycling. Cities, counties, public agencies, joint power agencies, and non-profit organizations are all eligible to apply for funding so long as they fall within the RMC jurisdictional boundary. There are a total of 68 cities within the RMC jurisdiction, which includes the City of Anaheim. Application cycles typically occur during the latter half of the year, but RMC may release additional calls for projects if funds are available.

Funded projects through the RMC Grant Program include:

- Coyote Creek Bikeway Master Plan (2018)
  A feasibility assessment and implementation guide for a 15-mile section of multi-use trails between Brea and Long Beach.

Local Fair Share Program

Under the OC Go initiative, the Local Fair Share Program provides municipalities in Orange County with additional funding for street improvement projects. Examples of projects include transit expansion, active transportation infrastructure, and environmental mitigation efforts. To receive funding, cities must agree to adhere to several criteria related to fund management, including but not limited to accounting, eligible expenditures, and reporting protocols. Funding is distributed by the Orange County Transportation Authority (OCTA) according to a formula that considers population, total street mileage, and gross sales tax collected. This formula favors larger cities such as the City of Anaheim; however, distribution of funds are proportional to the factors mentioned above.

Bicycle Corridor Improvement Program (BCIP)

Every two years, the Orange County Transportation Authority (OCTA) issues a call for transportation-related projects that promote safe walking and biking, increase regional connectivity, and improve air quality throughout the County. BCIP funding is made possible by the federal Congestion Mitigation and Air Quality Improvement Program (CMAQ) and is allocated to projects through a competitive application process. Although local agencies submit project proposals directly to OCTA, Caltrans is responsible for the distribution of funds and plays a role in the administration of selected projects. Eligible projects include new bicycle or multi-use facilities; bicycle boulevards and sharrows; bicycle racks, lockers, and parking; bicycle crossing infrastructure; bicycle facility improvements; and pedestrian improvements in conjunction with bicycle facilities. OCTA recommended 17 projects totaling $25.8 million for the 2019-2021 cycle.

OCFCD Conceptual Review - OC River Walk Feasibility Study

PACE
Advanced Water Engineering

Technical Memorandum

REGISTERED PROFESSIONAL ENGINEER
MARK EDWARD KREBS
No. 049292
Exp. 9/30/22
CIVIL
STATE OF CALIFORNIA

Date: June 15, 2021

To: Nardy Khan, Deputy Director, OC Public Works

From: Mark Krebs, P.E., President
Bruce Phillips, MS, P.E., Sr. Vice President
Jackie Phuekhunthod, MS, EIT, Project Engineer

CC: Pamela Galera, Parks Manager, City of Anaheim
Carlos Castellanos, City Engineer, City of Anaheim
Anna Pehoushek, Assistant Community Development Director, City of Orange
Greg Woodside, Executive Director of Planning & Natural Resources, OCWD

Re: OCFCD Conceptual Review Submittal for City of Anaheim
Santa Ana River Proposed "OC River Walk" Opportunities Feasibility Study B710

Introduction

Last Fall, the City of Anaheim retained Pacific Advanced Civil Engineering, Inc. (PACE) to produce an engineering feasibility study of 17 improvement opportunities on a portion of the Santa Ana River corridor from Ball Road to Orangewood Avenue, to be known as "OC River Walk." These 17 City-led community / river enhancement opportunities include elements adjacent to and within the river channel ranging from active transportation pedestrian walkways, bike paths, temporary river water impoundment structures, and community amenities such as parks, plazas, and art. Five of these opportunities are located within or interact with the river channel and are described herein. There are three existing major destinations interface with the OC River Walk and they are incorporated within the feasibility study, including but not limited to:

- Angel's Stadium
- Honda Center
- Anaheim Regional Transportation Intermodal Center (ARTIC)

Additionally, including OC River Walk, there are three major upcoming projects within the general vicinity also incorporated within the feasibility study:

- OC River Walk: ~90 acres
- ocV!BE: 95 acres (Honda Center and adjacent redevelopment)
- Big A 2050: 150 acres (Angel Stadium and Adjacent redevelopment)

Refer to the enclosed Exhibit 1: *OC River Walk – Opportunity Map* for the City of Anaheim feasibility study extents, which maps the locations of all 17 opportunities and nearby development projects.

In coordination with the adjacent development projects, existing venues and associated stakeholders, the overall goals of the City of Anaheim's OC River Walk project are to:

1. Increase public recreation and connectivity.
2. Catalyze economic growth and development.

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3. Enhance the aesthetics and ecology of the river and surrounding region.
4. Improve visual and physical access to the river.

To date, the City of Anaheim has been working with multiple stakeholders, including (but not limited to):

- City of Orange
- CoastKeepers
- Friends of Harbors Beaches and Parks
- Big A 2050 (Angel Stadium – SRB Development)
- Native Tribal Council
- ocV!BE (Ducks-Samueli Foundation)
- Orange County Flood Control District
- Orange County Parks
- Orange County Water District (OCWD)
- Santa Ana River Conservancy

The purpose of this conceptual review submittal to OCFCD is to introduce the project study area (Figure 1 below) and describe the proposed OC River Walk improvement opportunities located in the river corridor and ascertain their design and construction feasibility. This memo demonstrates that the proposed impoundments and associated opportunity features are feasible to design and construct and do not create detrimental impacts to public safety, hydraulics, or the Santa Ana River function as designed. The City of Anaheim understands the Santa Ana River is, first and foremost, a flood control and flood conveyance system. Therefore, nothing proposed is anticipated to reduce flood protection, conveyance, capacity, or flood resiliency in any way.

Figure 1: OC River Walk – Feasibility Study Area

Project Background-General

The City of Anaheim's proposed OC River Walk project site is located within the Santa Ana River Corridor between Ball Road and Orangewood Avenue bridge crossings, a 450-foot-wide by 9,000-foot-long area (approx. 90 acres and 1.6 miles) adjacent to Angel's Stadium, ARTIC and the Honda Center. The Honda Center has been selected as the 2028 Summer Olympics indoor volleyball vanue, providing an incentive to improve infrastructure and accommodations, and for the surrounding area to facilitate tourist recreational activities. Additionally, the proposed development around the Honda Center (ocV!BE) and Angel's Stadium (Big A 2050) will introduce additional residents and attract more local visitors and tourists. These ongoing development activities will further activate the existing recreational areas, pedestrian foot traffic, and bikeways in the vicinity.

PACE

Table 1: Proposed developments adjacent to OC River Walk

Development	Development Size (ac)	Residential Units	Hotel Rooms	Public Space Amenities (ac)	Office / Commercial Space (ac)
ocV!BE	95	1,500	550	20	25
Big A 2050	150	5,200	1,000	12	62 / 40

Upstream of OC River Walk, OCWD operates groundwater recharge facilities in and adjacent to the Santa Ana River. The Five Coves recharge facility includes the Anaheim Coves Trail project, completed in 2019 which extends from Ball Road north approximately 2.5 miles to Frontera Street. Anaheim Coves Trail was developed as a partnership between the City of Anaheim with OCWD, OCFCD and Southern California Edison. The City maintains the public trails while OCWD performs operations and maintenance of the recharge facility. The Imperial and Five Coves Diversions utilize rubber dams to impound water in the Santa Ana River and divert flow into offline recharge basins adjacent to the Santa Ana River. Also, because the river bottom is unlined, infiltration of captured stormwater and dry weather flow takes place along the Santa Ana River for OCWD recharge. Stormwater that travels south of Ball Road (the upstream limit of OC River Walk) does not have adequate residence time to recharge to the primary aquifer and is minimally beneficial for groundwater recharge.

Thus, the reach of the Santa Ana River downstream of Ball Road and adjacent to the upcoming development around the sports arenas offers a unique multi-benefit opportunity to provide additional groundwater recharge through water impoundment for OCWD and become an iconic outdoor river amenity for the community. Several opportunities in and along the river are also under consideration to improve public access and safe engagement with the river, altogether becoming the OC River Walk experience.

Proposed OC River Walk Improvements Within the River Cross Section

The City of Anaheim has studied the engineering feasibility of 17 improvement opportunities to transform the river corridor into a multi-beneficial recreational amenity area. Five of the improvement opportunities are within or interact with the Santa Ana River hydraulic section, and include:

1. River impoundment(s) in the Santa Ana River for increased groundwater recharge capabilities and beautification of the area with public access and recreation within normally full water bodies.
2. Non-motorized (pedestrian and bicycle) bridge across the Santa Ana River near the Honda Center to facilitate pedestrian and bicycle use of the river corridor.
3. River trail (pedestrian and bicycle) undercrossing at Southern Pacific Transportation (SPT) Railroad on the west bank to match the existing river trail east bank undercrossing.
4. River trail (bike) undercrossing at ARTIC railroad on the west bank to match the existing river trail east bank undercrossing. The undercrossing will facilitate a grade-separated bicycle path at the core area of OC River Walk.
5. Riverbank modifications to provide improved aesthetics, safe interaction, and engagement for the public with the Santa Ana River while maintaining river flood control hydraulic capacity and bank stability.

These five improvement opportunities located within the river hydraulic cross section are the focus of this conceptual review submittal to OCFCD.

1. River Impoundment

The water impoundment within the river will be similar to OCWD's existing rubber dam impoundments (Five Coves and Imperial, see Figure 2 herein) currently in place for river flow diversion to groundwater recharge. However, instead of diverting water into offline basins, OC Riverwalk impoundment structures (rubber dam or similar) would be installed to create semi-permanent water bodies in the Santa Ana River for groundwater recharge and public community benefit, and infiltrate through the soft bottom riverbed. Identical to existing OCWD structures, the impoundment structures would lower automatically during storm events or to drain the impounded water when otherwise desired. OCWD has indicated the impoundment(s) could be filled with water from the Groundwater Recharge System (GWRS) line in the dry season (April 15 – November 15). During the wet season (Nov 16 – April 14), the impoundment would be filled from Prado Dam and the seasonal river flow. The OCWD would operate and maintain the impoundment(s). The City of Anaheim feasibility analysis identified locations for two river impoundments. Existing storm drains that discharge into the Santa Ana River within the impoundment areas will be diverted for treatment and released within or downstream of the impoundment areas. See Figure 3 herein for the two potential impoundment locations in relation to future adjacent development projects and the enclosed Exhibit 2: *River Impoundment Opportunity - Plan and Profile*.

The first impoundment location is upstream of the ARTIC railroad bridge crossing and creates about 23 acres of water surface almost to the SPT railroad bridge crossing. The proposed impoundment would be up to seven feet deep at the location of the dam structure, which provides roughly an additional 80 acre-feet of static recharge volume for capture and infiltration into the ground. An additional impoundment structure (a seasonal sand/earthen berm) at the upstream end could be added to establish a minimum water depth to avoid shallow water conditions where water surface elevation meets the riverbed grade. Another impoundment structure would be installed at Collins Channel, which joins the Santa Ana River within the impounded water area. This structure would prevent any potential adverse backwater impacts in Collins Channel. There are two existing stormdrains located near the shallow end of the impoundment. These would also require some addition structure and/or diversion to prevent potential backwater impacts to the local stormdrain system and preserve the water quality in the impoundment area.

The second impoundment location is upstream of the Orangewood Avenue bridge crossing and creates about 14.4 acres of water surface, terminating at the existing river drop structure just downstream of the ARTIC railroad bridge crossing. The proposed impoundment would be up to 10 feet deep at the location of the dam structure, which provides roughly an additional 103 acre-feet of static recharge volume. This potential location does not require another impoundment structure upstream, as the existing river drop structure can be utilized to achieve a minimum water depth. There are two existing stormdrains further upstream of the existing drop structure. They are not within the impounded water footprint, but diversions may still be necessary to prevent any adverse impacts to the stormwater system or impounded water quality.

Table 2: Potential Impoundment Location Summary (note these are approximate figures)

Impoundment Location	Impoundment Structure Height (ft)	Impoundment Structure Length (ft)	Water Surface Area (ac)	Water Surface Elevation (ft)	Water Recharge Volume (ac-ft)
ARTIC	7	300	23	153'	80
Orangewood	10	340	14.4	145'	103

Figure 2: Santa Ana River Imperial Rubber Dam – looking Northeast from the southerly river bank. OCWD operates the seven-foot-high rubber dam and diversion facility for water impoundment and groundwater recharge.

The OC River Walk impoundment opportunity can be compared to other existing water impoundment river walk developments such as Arizona's Tempe Town Lake, Illinois' Chicago River Front Park, and Texas' San Antonio River Walk. The extents of these impoundments can be seen in the enclosed Exhibit 3: *OC River Walk Comparisons.*

The next phase of the impoundment design would include a geotechnical, structural and detailed river hydraulic evaluation of the proposed structures, impounded water condition, and potential impacts to the river bank. River bed structures such as bridge piers, grade control structures, and channel drop structures would also be included in the evaluation.

▲Existing Santa Ana River

▲Proposed Santa Ana River Impoundment

Figure 3: Plan & Profile and Conceptual Render of Potential Impoundment Location

2. Non-Motorized Multi-Modal Bridge

A new multi-modal bridge from one side of the river to the other is proposed to better facilitate pedestrian and bicycle access and to connect the west and east banks of the Santa Ana River Trail (SART). This connection will enhance the trail user experience by eliminating gaps in the SART path in this area on the west bank. The feasibility analysis identified two options for bridge landings, as depicted in Figure 4 below. Option A is a bank to bank connection, and Option B is a bridge landing extension to adjacent development. See Figure 4 below.

The proposed non-motorized bridge crossing is located near the Honda Center, approximately 500 feet upstream and parallel to Katella Avenue. The pedestrian bridge will also provide a scenic view to observe the river and water impoundment below. As a result, residents and visitors will gain more accessibility around the OC River Walk corridor.

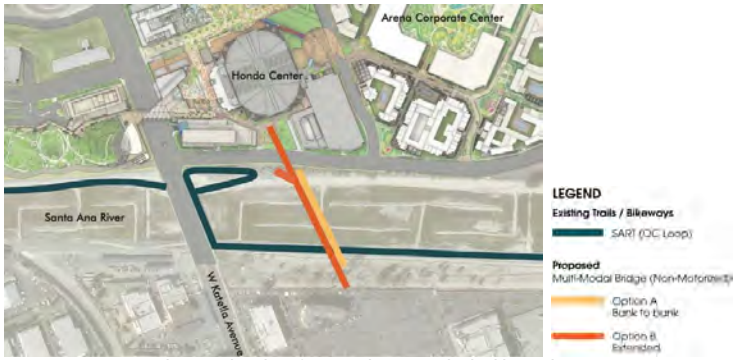

Figure 4: Plan View of Proposed Non-Motorized Bridge Options

3. SPT Railroad Undercrossing

The SART, a public access river walk trail, already exists along a portion of the east and west banks of the Santa Ana River within the project site. However, there is no trail for public access on the west bank between Ball Road and Katella Avenue (Figures 6 and 7). The OC River Walk project would establish a trail along the west bank. This new trail will connect the SART with a proposed Class II bikeway along Ball Road (Anaheim Bicycle Master Plan, 2020) and the Anaheim Coves Trail north of Ball Road, opening up both river banks as public recreational areas, creating a circulation loop with the new proposed non-motorized bridge. A trail on the west bank would require a crossing at the SPT railroad bridge.

The feasibility analysis identified two options for crossing the SPT railroad, as shown in Figure 5 below. Option A is an undercrossing at the SPT railroad bridge, similar, if not identical, in design to the undercrossing that currently exists along the east bank, and Option B directs trail users to the road crossing at-grade. Option A is the preferred option as the undercrossing will provide a safe way for pedestrians and bikers to travel under the SPT railroad tracks along an uninterrupted trail from Ball Road to Katella. See Figure 5 herein.

This land is currently dedicated OCFCD and OCWD river maintenance access that is currently fenced and gated to keep pedestrians and cyclists out, but the surrounding area is heavily used by local and

commuter pedestrian/bicycle traffic, and an expansion that adds public access to this west bank area would have high utilization and value to the community.

Figure 5: Plan View of SPT Railroad Crossing Options

Figure 6: SPT Railroad – looking Northeast from the westerly bank. The eastern undercrossing is visible on the right. The western bank [on the left] does not have an undercrossing, and a black gate/fence prohibits access across the railroad.

Figure 7: SPT Railroad – looking Southwest from the eastern undercrossing. The western bank does not have an undercrossing, but has potential space for a similar proposed undercrossing.

4. ARTIC Railroad Undercrossing and Grade Separated Bicycle Path

The SART has an existing ARTIC railroad undercrossing box on the west bank (City of Anaheim). However, the undercrossing is very narrow (approximately 18 feet wide) and unsuitable for safe and comfortable usage by both pedestrians and cyclists, as shown in Figure 8 below. With the upcoming proposed development of OC River Walk, Big A 2050, and ocV!BE, the existing undercrossing box will experience even more pedestrian and bicycle volume.

Figure 8: Existing ARTIC undercrossing box – looking North from the SART. The existing undercrossing is narrow and too congested for shared pedestrian and cyclist usage.

The OC River Walk project proposes to provide a grade-separated bicycle path immediately adjacent to the river, from Katella Avenue to south of the 57 Freeway (see Figure 9 below). The existing ARTIC undercrossing box would be utilized for pedestrians. At the same time, high-speed commuter cyclists would use the proposed grade-separated trail, which would run parallel to the existing SART and include an additional undercrossing on the west bank at the ARTIC railroad. The proposed bicycle path shall be designed above 100-year stormwater surface elevations except at the bridge undercrossing locations.

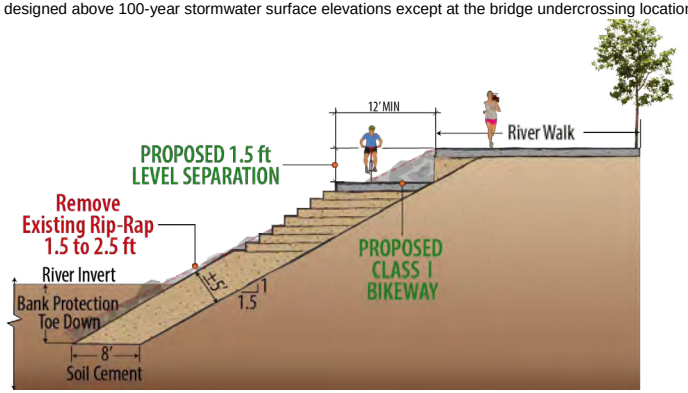

Figure 9: Conceptual Cross-Section of the Grade-Separated Bike Path

5. Riverbank Modifications

A riverbank slope change modification along a portion of the west bank of the Santa Ana River would allow for a grade-separated bike path while maintaining hydraulic capacity in the channel by slightly increasing the cross-sectional flow area. The reconstruction of the channel lining in this area would also provide an opportunity to change the side slope material and configuration, such as stepped side slope to provide public interaction and engagement closer to the river, soil cement lining, concrete stamping, etc. Example of concrete stamping is shown below in Figure 10. The embankment modifications will maintain/improve current hydraulic capacity and bank stability.

Figure 10: Example of Concrete Stamping in the Riverbank to Add Artistic/Creative Elements to the River

According to the Army Corps of Engineers (ACOE) as-built record of the Santa Ana River, the existing riverbank protection is comprised of loose and grouted riprap at a 2(H):1(V) slope. Loose riprap thickness ranges from 24" to 42". Areas around drop structures are grouted at 15" thickness. The City of Anaheim's OC River Walk proposed improvements may include soil cement bank protection with slopes of 1.5(H):1(V). Soil cement is widely used for its flexible application, aesthetic appeal, cost efficiency, and high durability for channel stabilization. Riverbank planters can also be incorporated into soil cement as shown in the example Figure 11 below.

Refer to Exhibit 4: *OC River Walk River Embankment Cross Section* for a typical example of proposed riverbank modifications adjacent to proposed Meadow Park (City of Anaheim) in the ocV!BE development.

Figure 11: Example of Soil Cement Riverbank Planters that can be Controlled Outside of the River Bottom

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Preliminary Hydraulic Modeling of Proposed Opportunities

To assess the feasibility of the proposed improvement opportunities described above, preliminary hydraulic modeling was performed using conceptual design parameters. The proposed non-motorized bridge piers, additional SPT undercrossing, and a large section of proposed riverbank modification were incorporated into a HEC-RAS model of the Santa Ana River obtained from the ACOE (model dated April 2014). The additional ARTIC undercrossing was not included in the preliminary modeling study, but the concept is similar to the SPT undercrossing, and impacts would also be similar. The model obtained from ACOE was used as the existing conditions (baseline) model to compare and analyze output results with the proposed condition within the study reach.

Modeling Parameters

The latest version of HEC-RAS (version 5.0.7) was used to run both the existing and proposed condition hydraulic models. Although the ACOE model extends from the Prado Dam to the Pacific Ocean, the study's reach extends from the Ball Road bridge crossing (upstream end) to the Orangewood Avenue bridge crossing (downstream end), with a length of approximately 1.5 miles. Therefore, the ACOE model was truncated. The cross-section furthest upstream is RS 77600, approximately 2,600 feet upstream of the Ball Road bridge crossing. The cross-section furthest downstream is RS 65766, approximately 1,100 feet downstream of the Orangewood Avenue bridge crossing. The cross-sections are spaced roughly 200 feet apart except for sections located near bridges, drop structures, or other abrupt changes in channel geometry. In total, the HEC-RAS models contain 127 cross-sections. The ACOE model elevations were originally in the National Geodetic Vertical Datum of 1929 (NGVD 29), but were converted and geo-referenced to the North American Vertical Datum of 1988 (NAVD 88), California State Plane Coordinate System for this study.

The existing conditions ACOE model was used to obtain the 100-yr water surface elevations. The 100-year flow rate used in the modeling was obtained from the ACOE model inputs (Q_{100} = 40,000 cfs). ACOE *Santa Ana River Design Memorandum No. 1 Phase II GDM on the Santa Ana River Mainstem including Santiago Creek (August 1988)* identifies the 100-year river flow rate of 40,000 cfs from I-5 (downstream of Orangewood Avenue) upstream to Carbon Canyon Diversion Creek (upstream of Ball Road). This 40,000 cfs flow rate is also the 100-year flow rate provided in the ACOE HEC-RAS model.

Channel freeboard is the vertical distance from the design river water surface elevation (100-year flow) to the top of the channel elevation. The existing freeboard value for the study reach of the river is included in Table 1 of *Orange County Flood Control District Design Manual (November 2000) Addendum No. 3, Freeboard (January 28, 1988)* and defines specific freeboard calculations for various channel conditions. In a recent design for the Orangewood Avenue bridge widening project, Michael Baker International (MBI) indicated that the required freeboard upstream of the Orangewood Avenue bridge is 1.5 feet.

FEMA

This ACOE 100-year flow rate was compared to the 100-year flow rate published in the most recent FEMA Flood Insurance Study (FIS No. 06059CV001C Version No. 2.3.3.1, Revised March 21, 2019). The 100-year flow rate listed for the Santa Ana River in Table 10 of the FIS is 50,000 cfs (see excerpt in Appendix). This flow rate is accompanied by a footnote stating, "Approximately 2,225 square miles controlled by Prado Dam", which indicates the 50,000 cfs flow rate is based on a maximum release discharge from the Prado Dam, as opposed to a peak flow rate resulting from a storm runoff hydrograph. An information request was submitted to FEMA to obtain hydraulic modeling that uses the 50,000 cfs flow rate without success, and it appears the study reach has not been previously modeled. FEMA's published 100-year flow rate (50,000 cfs) encroaches upon and even exceeds the required freeboard buffer between the banks and water surface at some locations (i.e., the OCTA/SCRRA railroad bridge), which casts some doubt on the accuracy of this higher flow rate. Without a FEMA hydraulic model to confirm the 50,000 cfs flow rate as the channel design flow rate for the Santa Ana River, the ACOE flow rate of 40,000 cfs was used for the OC River Walk feasibility analysis.

Modeling Proposed OC River Walk Opportunities

PACE prepared the proposed conditions hydraulic model, developed from the existing conditions model. Additions in the proposed conditions model included:

- bridge approximately 500 feet upstream of the Katella Avenue bridge crossing
- undercrossing on the west bank of the Santa Ana River beneath the SPT railroad bridge crossing
- side slope adjustment along the west bank of the Santa Ana River, steepening the existing slope from 2H:1V to 1.5H:1V to provide additional hydraulic capacity

Both the existing conditions model and proposed conditions model are enclosed in the Appendix. See **Figures 12, 13, 14, and 15** respectively, for the model modification locations and extents. In these figures, the green lines shown above are from the existing ACOE HEC-RAS cross sections. Magenta lines and orange shading represent the modified cross sections and slopes that were added into the existing condition model to create a proposed condition model.

As suggested by OCPW during preliminary project discussions, the proposed pedestrian bridge was modeled with the same width and number of piers as the Katella Avenue bridge to provide a conservative initial analysis.

Both existing and proposed hydraulic models used a steady-state condition with the subcritical flow regime option. The subcritical flow regime gives the most conservative estimates of water surface elevations, which is preferable to determine the impact to freeboard in proposed conditions. Normal depth is used as the boundary condition for the downstream end. The boundary condition at the upstream end was not included in the models, as it is only necessary when performing supercritical flow regime calculations. The normal depth calculation requires the slope of the water surface profile, estimated using the channel bed slope, which equals 0.002 ft/ft at the downstream end of the model.

The Manning's roughness values for the HEC-RAS models are consistent with the values used in the ACOE model. The Manning's values for the left and right overbanks are consistently set to n = 0.03, while the main channel varies from n = 0.03 to n = 0.05.

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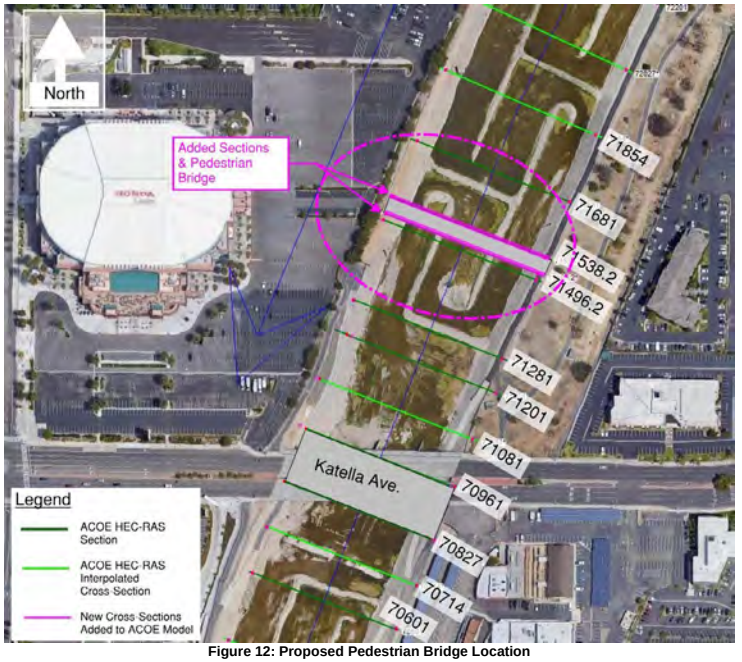

Figure 12: Proposed Pedestrian Bridge Location

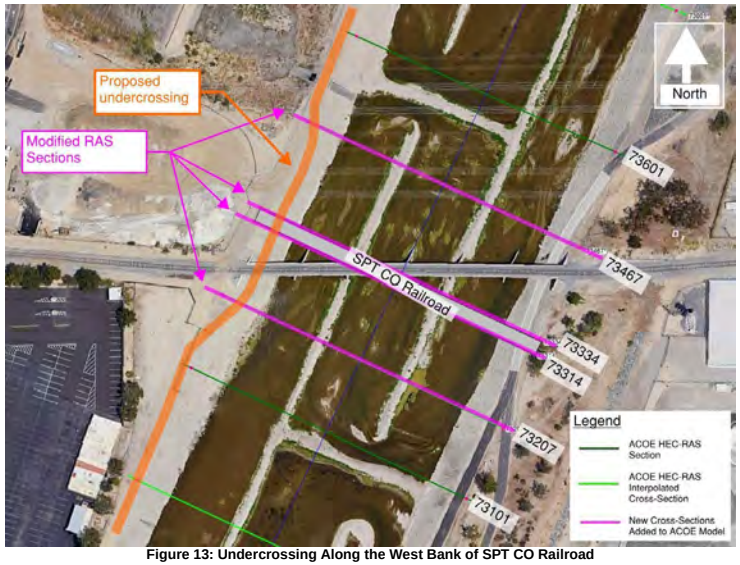

Figure 13: Undercrossing Along the West Bank of SPT CO Railroad

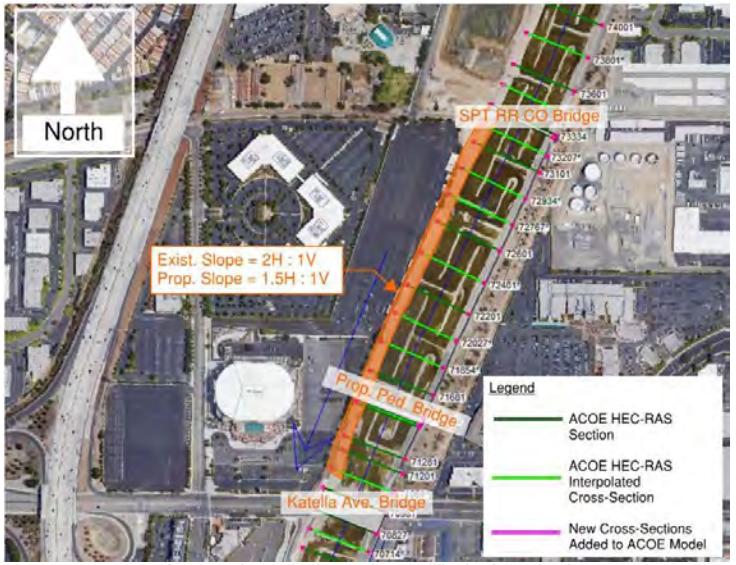

Figure 14: River Embankment Slope Modification (2:1 to 1.5:1)

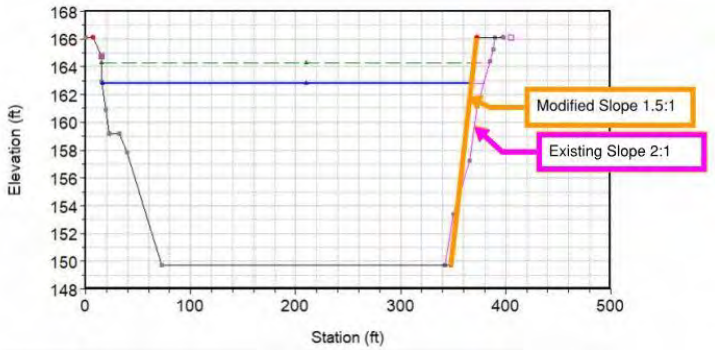

Figure 15: Example Cross Section of Modified Slope (XS 71081* in proposed model)

Preliminary Hydraulic Modeling Results

The water surface elevations for Q_{100} (40,000 cfs) were obtained from the existing and proposed conditions HEC-RAS model outputs and compared to one another to determine the impacts of the proposed project features. The results are summarized below in Table 3.

The rows of results that represent modified/added data input are color coded, matching Figures 12, 13, and 14. Magenta cells represent geometric modifications or additional cross sections input into the existing conditons model to create the proposed condition. Orange cells represent cross sections where the west bank slope was modified to be 1.5H:1V. Elevations are in NAVD88, and for the purposes of this feasibility study, the freeboard of interest is measured from the western top of bank, adjacent to the City of Anaheim's proposed OC River Walk project.

This analysis shows that, in the condition where all proposed features are combined in the same model, a maximum increase of 0.1 feet and a decrease of -0.1 feet in water surface elevation are observed. Similar velocity and freeboard differences between the existing and proposed conditions are observed. All resulting non-zero delta(Δ) differences are cell shaded in blue below.

Table 3: Existing vs. Proposed Hydraulic Results (NAVD 88)

Cell Color Legend:

Modified or Added cross sections	Slope Modification (westerly bank only)	Non-Zero Impact	Bridge Crossing

HEC-RAS Cross Section River Station	Proposed W.S. Elev (40,000 cfs) (ft)	Existing W.S. Elev (40,000 cfs) (ft)	Existing Freeboard (40,000 cfs) (ft)	Δ WSEL Pr-Ex (ft)	Δ Velocity Pr-Ex (ft)	Δ Freeboard Pr-Ex (ft)
77600	184.2	184.2	7.4	0.0	0.0	0.0
77433	183.9	183.9	7.8	0.0	0.0	0.0
77266	183.5	183.5	8.1	0.0	0.0	0.0
77100	183.2	183.2	8.5	0.0	0.0	0.0
76933	182.9	182.9	8.8	0.0	0.0	0.0
76766	182.6	182.6	9.0	0.0	0.0	0.0
76600	182.3	182.3	9.3	0.0	0.0	0.0
76433	182.0	182.0	9.7	0.0	0.0	0.0
76266	181.6	181.6	10.0	0.0	0.0	0.0
76100	181.3	181.3	10.4	0.0	0.0	0.0
75900	180.9	180.9	10.7	0.0	0.0	0.0
75700	180.5	180.5	11.1	0.0	0.0	0.0
75500	180.2	180.2	11.5	0.0	0.0	0.0
75300	179.8	179.8	11.8	0.0	0.0	0.0
75100	179.5	179.5	12.1	0.0	0.0	0.0
74969	179.4	179.4	12.2	0.0	-0.1	0.0
Ball Road Bridge						
74886	178.8	178.8	8.6	0.0	0.0	0.0
74862	178.8	178.8	8.2	0.0	0.0	0.0
74839	178.7	178.7	7.8	0.0	0.0	0.0
74815	178.7	178.7	7.4	0.0	0.0	0.0
74792	178.6	178.6	7.0	0.0	0.0	0.0
74768	178.6	178.6	6.6	0.0	0.0	0.0
74745	178.6	178.6	6.2	0.0	0.0	0.0
74721	178.5	178.5	5.8	0.0	0.0	0.0

HEC-RAS Cross Section River Station	Proposed W.S. Elev (40,000 cfs) (ft)	Existing W.S. Elev (40,000 cfs) (ft)	Existing Freeboard (40,000 cfs) (ft)	Δ WSEL Pr-Ex (ft)	Δ Velocity Pr-Ex (ft)	Δ Freeboard Pr-Ex (ft)
74697	178.5	178.5	5.5	0.0	0.0	0.0
74674	178.4	178.4	5.1	0.0	0.0	0.0
74650	178.4	178.4	4.7	0.0	0.0	0.0
74627	178.4	178.4	4.3	0.0	0.0	0.0
74603	178.3	178.3	3.9	0.0	0.0	0.0
74580	178.3	178.3	3.5	0.0	0.0	0.0
74556	178.2	178.2	3.1	0.0	0.0	0.0
74552	178.2	178.2	3.0	0.0	0.0	0.0
74547	178.2	178.2	3.0	0.0	0.0	0.0
74542	178.2	178.2	2.9	0.0	0.0	0.0
74537	178.2	178.2	2.8	0.0	0.0	0.0
74533	178.2	178.2	2.7	0.0	0.0	0.0
74515	169.7	169.7	8.4	0.0	0.0	0.0
74510	169.7	169.7	6.5	0.0	0.0	0.0
74505	169.7	169.7	6.7	0.0	0.0	0.0
74500	169.7	169.7	6.9	0.0	0.0	0.0
74496	169.7	169.7	7.0	0.0	0.0	0.0
74491	169.7	169.7	7.1	0.0	0.0	0.0
74486	169.7	169.7	7.3	0.0	0.0	0.0
74481	169.6	169.7	7.4	-0.1	0.0	0.1
74477	169.6	169.6	7.5	0.0	0.0	0.0
74469	168.9	168.9	8.4	0.0	0.0	0.0
74313	168.4	168.4	7.1	0.0	0.0	0.0
74157	168.1	168.1	5.0	0.0	0.0	0.0
74001	167.9	167.9	3.0	0.0	0.0	0.0
73801	167.6	167.6	3.0	0.0	0.0	0.0
73601	167.3	167.3	3.0	0.0	0.0	0.0
73467	167.0	167.0	6.8	0.0	-0.1	0.0
73334	166.9	166.9	10.5	0.0	-0.2	0.0
SPT RR CO Bridge						
73314	166.5	166.5	10.9	0.0	-0.2	0.0
73207	166.1	166.2	6.9	-0.1	-0.1	0.1
73101	166.0	166.0	2.8	0.0	0.0	0.0
72934	165.7	165.7	2.9	0.0	0.0	0.0
72767	165.5	165.5	3.0	0.0	0.0	0.0
72601	165.3	165.2	3.0	0.1	0.0	-0.1
72401	165.0	165.0	3.2	0.0	0.0	0.0
72201	164.7	164.7	3.3	0.0	-0.1	0.0
72027	164.5	164.5	2.9	0.0	-0.1	0.0
71854	164.3	164.3	2.9	0.0	-0.1	0.0
71681	164.1	164.1	2.8	0.0	0.0	0.0
71538.2	163.8	-	-	-	-	-
Proposed Non-Motorized Bridge						
71496.2	163.6	-	-	-	-	-
71481	163.6	163.6	3.2	0.0	0.0	0.0
71281	163.0	163.0	3.5	0.0	0.0	0.0
71201	162.8	162.8	3.0	0.0	0.0	0.0
71081	162.8	162.8	3.3	0.0	0.0	0.0

HEC-RAS Cross Section River Station	Proposed W.S. Elev (40,000 cfs) (ft)	Existing W.S. Elev (40,000 cfs) (ft)	Existing Freeboard (40,000 cfs) (ft)	Δ WSEL Pr-Ex (ft)	Δ Velocity Pr-Ex (ft)	Δ Freeboard Pr-Ex (ft)
70961	162.8	162.8	3.0	0.0	0.0	0.0
Katella Ave. Bridge						
70827	162.4	162.4	3.5	0.0	0.0	0.0
70714	162.0	162.0	3.3	0.0	0.0	0.0
70601	161.8	161.8	3.1	0.0	0.0	0.0
70434	161.5	161.5	3.0	0.0	0.0	0.0
70267	161.2	161.2	3.0	0.0	0.0	0.0
70101	160.9	160.9	3.0	0.0	0.0	0.0
69934	160.7	160.7	2.8	0.0	0.0	0.0
69767	160.5	160.5	2.6	0.0	0.0	0.0
69601	160.4	160.4	2.4	0.0	0.0	0.0
69366	160.1	160.1	2.3	0.0	-0.1	0.0
OCTA/SCRRA Railroad Bridge						
69313	159.4	159.4	2.8	0.0	0.0	0.0
69200	159.3	159.3	2.2	0.0	-0.2	0.0
69176	159.3	159.3	2.2	0.0	0.0	0.0
69152	159.2	159.2	2.2	0.0	0.0	0.0
69128	159.2	159.2	2.1	0.0	0.0	0.0
69104	159.2	159.2	2.1	0.0	0.0	0.0
69080	159.1	159.1	2.0	0.0	0.0	0.0
69056	159.1	159.1	2.0	0.0	0.0	0.0
69032	159.0	159.0	2.0	0.0	0.0	0.0
69009	159.0	159.0	1.9	0.0	0.0	0.0
69004	159.0	159.0	1.9	0.0	0.0	0.0
68999	159.0	159.0	1.9	0.0	0.0	0.0
68994	159.0	159.0	1.9	0.0	0.0	0.0
68989	159.0	159.0	1.9	0.0	0.0	0.0
68985	159.0	159.0	1.9	0.0	0.0	0.0
68969	152.0	152.0	8.2	0.0	0.0	0.0
68964	152.0	152.0	8.0	0.0	0.0	0.0
68959	152.0	152.0	7.8	0.0	0.0	0.0
68955	152.0	152.0	7.6	0.0	0.0	0.0
68950	152.0	152.0	7.3	0.0	0.0	0.0
68945	152.0	152.0	7.1	0.0	0.0	0.0
68940	151.9	151.9	6.9	0.0	0.0	0.0
68936	151.9	151.9	6.7	0.0	0.0	0.0
68931	151.9	151.9	6.5	0.0	0.0	0.0
68926	151.9	151.9	6.3	0.0	0.0	0.0
68922	151.9	151.9	6.1	0.0	0.0	0.0
68916	151.4	151.4	6.2	0.0	0.0	0.0
68808	151.0	151.0	6.4	0.0	0.3	0.0
68700	150.8	150.8	5.5	0.0	0.0	0.0
68547	150.6	150.6	2.6	0.0	0.0	0.0
68395	150.4	150.4	2.0	0.0	0.0	0.0
57 Fwy Bridge						
68050	149.1	149.1	3.6	0.0	0.0	0.0
67866	148.7	148.7	3.5	0.0	0.0	0.0
67683	148.3	148.3	9.4	0.0	0.0	0.0

HEC-RAS Cross Section River Station	Proposed W.S. Elev (40,000 cfs) (ft)	Existing W.S. Elev (40,000 cfs) (ft)	Existing Freeboard (40,000 cfs) (ft)	Δ WSEL Pr-Ex (ft)	Δ Velocity Pr-Ex (ft)	Δ Freeboard Pr-Ex (ft)
67500	148.0	148.0	3.4	0.0	0.0	0.0
67333	147.8	147.8	3.2	0.0	0.0	0.0
67166	147.7	147.7	2.9	0.0	0.0	0.0
67000	147.6	147.6	2.7	0.0	0.0	0.0
66922	147.2	147.2	2.9	0.0	0.0	0.0
Orangewood Ave. Bridge						
66847	146.3	146.3	3.8	0.0	0.0	0.0
66723	145.9	145.9	3.9	0.0	0.0	0.0
66600	145.6	145.6	3.7	0.0	0.0	0.0
66433	145.3	145.3	4.1	0.0	0.0	0.0
66266	144.9	144.9	4.4	0.0	0.0	0.0
66100	144.6	144.6	4.7	0.0	0.0	0.0
65933	144.2	144.2	4.3	0.0	0.0	0.0
65766	143.9	143.9	4.0	0.0	0.0	0.0

Public Safety Measures

The OC River Walk project aims to be a multi-beneficial project, incorporating the best interests of adjacent land owners (see Exhibit 5: *Santa Ana River Adjacent Ownership*). The following safety measures will be incorporated into the design details and parameters for each opportunity in coordination with the adjacent land owners, agencies, and stakeholders:

- Signage / restrict public access before/during flooding events
- Depth of impoundment for safe engagement
- Stepped side slopes (easier to get out of channel than a steep slope)
- Undercrossing at SPT railroad to direct people safely around/under the railroad tracks
- Non-motorized bridge to promote public safety

Conclusions

The design requirements for each of these City of Anaheim conceptual improvement opportunities would maintain (if not improve) the flood control and stormwater capacity of the Santa Ana River. The proposed infrastructure added into the model did not result in significant impacts upstream or downstream of the project site. Impacts were very minimal and immediately localized to the proposed opportunity locations. At a conceptual design level, preliminary modeling efforts showed promising feasibility for the proposed infrastructure associated with the City of Anaheim's OC River Walk opportunities in the Santa Ana River.

On behalf of the OC River Walk project, the City of Anaheim welcomes comments and review at this early conceptual stage to refine the feasibility analysis of the proposed opportunities and identify design requirements, physical constraints, and associated environmental regulation.

Next Steps

The City of Anaheim OC River Walk Feasibility Study has established the viability of the five proposed opportunities located within the river or interacting with the river, and the following additional steps are currently anticipated to move toward the implementation stage:

1. Preliminary meeting with ACOE regarding OC River Walk to review proposed river hydraulics.
2. Completion of OC River Walk Feasibility Analysis (including OCFCD Concept Review Memo).

3. Geotechnical analysis for proposed river and bank modifications.
4. Preliminary Design (30% level construction documents) for OC River Walk Opportunities.
5. Detailed hydraulic modeling of the Santa Ana River – OC River Walk Opportunities and submittal to OCFCD and ACOE.
6. City of Anaheim to continue coordination with OC River Walk property owners and easement holders for overlay of OC River Walk access. (See Exhibit 5: *Santa Ana River Adjacent Ownership*)

References

City of Anaheim and Bike Anaheim. *Bicycle Master Plan*. (May 23, 2017) Amended by City Council (July 14, 2020).

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Michael Baker International. *Basis of Design Report Santa Ana River at Orangewood Avenue Bridge Crossing Anaheim, California Scour Analysis.* Anaheim, California. Prepared for City of Anaheim and County of Orange (March 2020)

Michael Baker International. *Draft Type Selection Report for Orangewood Avenue Bridge Widening Bridge No. 55C-0050.* Prepared for City of Anaheim Public Works. (March 2018)

Michael Baker International. *Orangewood Avenue Bridge Scour Protection* letter addressed to Rafael Contreras, PE with Public Works Department, City of Anaheim. (January 5, 2018)

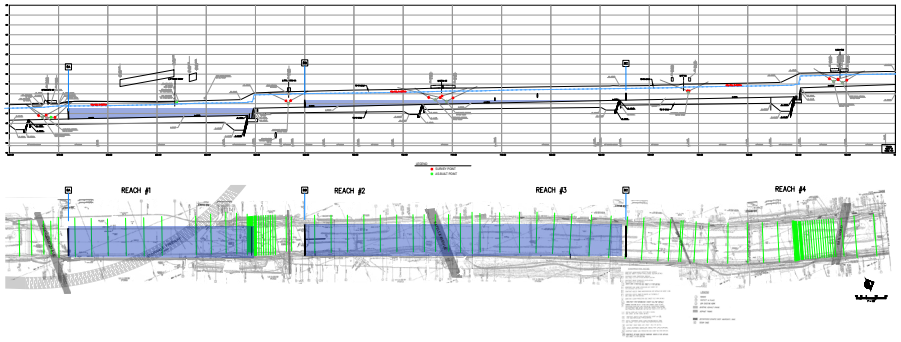
U. S. Army Corps of Engineers. *Santa Ana River Design Memorandum No. 1 Phase II GDM on the Santa Ana River Mainstem including Santiago Creek,* Volume 7, Hydrology. Santa Ana River Basin, California (August 1988)

U. S. Army Corps of Engineers. *Lower Santa Ana River* HEC-RAS Version 4.1. Los Angeles District, California (revised April 2014)

Exhibits

EXHIBIT 1 OC RIVER WALK OPPORTUNITY MAP

EXHIBIT 2 RIVER IMPOUNDMENT OPPORTUNITY - PLAN AND PROFILE

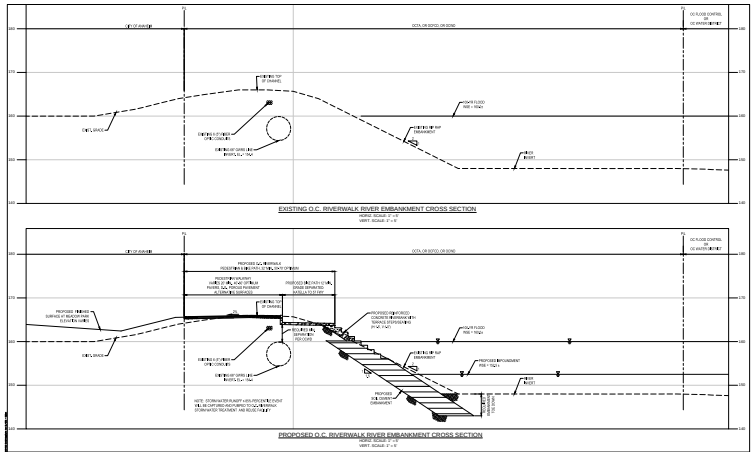


PACE

EXHIBIT 3 OC RIVER WALK COMPARISONS

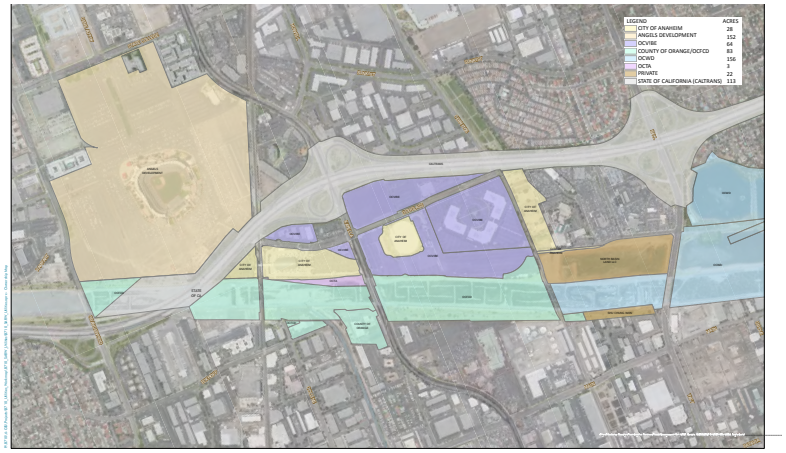
PACE

EXHIBIT 4 OC RIVER WALK EMBANKMENT CROSS SECTION



PACE

EXHIBIT 5 SANTA ANA RIVER AND ADJACENT OWNERSHIP



PACE

Cooperative Water Impoundment Technical Memorandum

MEMORANDUM

DATE: December 3, 2020

TO: Mark Krebs, PACE

FROM: Bill Hunt, Hunt Environmental Services, Inc.

SUBJECT: Cooperative Water Impoundment, Santa Ana River (SAR) at Ball Road

Background:

The City of Anaheim has retained PACE engineering to analyze the engineering feasibility of design ideas that might be incorporated into a large redevelopment of the areas surrounding the existing Anaheim Stadium, The Pond, and the ARTIC. The area of study is referred to as the Riverwalk and will include public access parks, bike and walking trails, pedestrian bridges over the river and reconfiguration of the river levees and river bottom itself.

This memo is focused on beautifying the river bottom for public enjoyment and possibly building an inflatable dam to impound water without water loss or impairment of the river's drainage capacity during floods. Stakeholders interested in this aspect of the project include the City of Anaheim (City) for aesthetic and public enjoyment reasons, the Orange County Flood Control (OCFC) for issues associated with maintaining the physical integrity of the River and its stormwater capacity, and the Orange County Water District (OCWD), considering that the SAR flows and recycled water used for impoundment belongs to them.

Considerations for City of Anaheim:

Improvements in the river bottom produce many advantages for the City, with the most notable being the elimination of what is now a nondescript patch of sand at best and an eyesore of weeds & debris at worst. To fill the dry riverbed with water by use of a rubber dam would represent an overwhelming improvement in the beauty of the Riverwalk, and would be the centerpiece of an impressive regional attraction. There is no doubt that water in the river would make all the difference toward project success.

Water in the river would also be more than visually appealing. It could also allow for aquatic activities such as paddle boating, kayaking, tubing, swimming, remote control boating, and possibly even fishing. Also, it would offer the opportunity for water features including rock waterfalls, suspended overlooks, high tech fountains and light shows. Water in the river would also be the perfect backdrop for amphitheater concerts, theatrical performances and monumental holiday season decorations.

The risks associated with a water impoundment from the city's perspective would fall under the categories of security and cost. A water feature is attractive and that attraction requires some level of security oversight. However, the risk is low. There is precedent for rubber dam impoundments along the river. The OCWD currently operates two of them, located a few miles up the river without any notable history of trespassing, vandalism or injury. The nearby Anaheim Coves lake has also been relatively free of security problems, with thousands of citizens enjoying that lakeside park each week.

The cost for the city will include paying for the structural improvements including the dam, paying for the evaporative loss of water (estimated at 50-acre feet annually from a ½ million ft^2 impoundment) and OCWD's labor to operate the dam and the water conveyance activities to keep it full. It is likely that permitting and water supply would be easily approved if the operation of the river were left to the OCWD, an agency that has been trusted by flood control managers since OCWD river operations began in the 1930's. OCWD is also the only entity that can maximize water availability to the impoundment over the many dry months each year. It is reasonable to assume that the OCWD would expect to be financially reimbursed in any such cooperative agreement with the City.

Considerations for OCFC:

Flood control is the first priority for SAR operations. Water conservation, habitat maintenance and public enjoyment are all secondary considerations from the OCFC's perspective. This is understandable and a constraint that the Riverwalk project planners are well aware of. Any modification to the river levees, river bottom, or any facilities constructed on or near the river must be approved and consistent with the flood control priority. The Riverwalk impoundment considered here is consistent with that. The facilities under consideration are the same as the long-established Imperial and Five Coves Dams operation up the river a few miles. It is envisioned that the proposed rubber dam would be operated similarly and have the same failsafe systems and administrative controls such as automatic dam deflation during times of high flows.

It is recommended that an arrangement be made between the City and OCWD naming OCWD as the operator of the new dam, considering the OCWD's long history operating similar dams upriver and the OCFC's confidence in their ability to run such an important operation.

Considerations for OCWD:

The OCWD's charter is to acquire water and put it into the ground for aquifer recharge. Their recharge activities are internationally recognized for sustaining aquifer yield over the years and have in fact doubled the basin's production capacity since replenishment activities began. Their replenishment supply arrives from three places. First, the OCWD has legal ownership of all water flowing in the Santa Ana River below Prado Dam. Secondly, the OCWD recycles wastewater delivered to them from the Orange County Sanitation District at the rate of 100 million gallons per day (mgd). That daily production from the Groundwater Replenishment System (GWRS) will increase by 30% in the year 2023 to 130 mgd. Approximately 30 mgd of that water is injected into the seawater barrier along Ellis Avenue in Fountain Valley. The rest is pumped 14 miles north through a large diameter pipeline within the Santa Ana River levee to OCWD's Anaheim recharge facilities. Conveniently, that 60-inch pipeline runs directly beneath the Riverwalk project on its way north. The third source of recharge water is Metropolitan Water District's imported water delivered from the Colorado River and Northern California. The relative cost of these water sources is dramatically different with the SAR water being free, the GWRS recycled water being approximately $600 per acre foot and imported water exceeding $1,000 per acre foot. The cost to municipal water producers to extract water from the ground is paid as a replenishment assessment that is essentially a proportional blend of these three costs.

From the OCWD's perspective, an impoundment of water in the SAR south of Ball Road could be seen as an additional recharge facility proportional to many of the other OCWD facilities. Current operations of the OCWD include the annual construction of what are referred to as "T & L" levees in the river bottom.

These levees are built to force the shallow water to flow back and forth between the banks of the river, thereby maximizing its percolating surface. Although the river is usually dry in this lower reach, it is the OCWD's goal to capture and recharge every gallon it can.

Not all OCWD recharge facilities are equal. The effectiveness of each one is determined by the water quality fed to it, the surface area of the impoundment, and most importantly the underlying geology. The reasons that the temporary T&L levees built by the OCWD in this reach of the river have never been replaced by a more effective and easier to use rubber dam includes the following:

1. The river flows are effectively diverted upstream, leaving little or no flow at Ball Road for 9 or 10 months per year. In other words, a surface impoundment or rubber dam is usually not needed there.

2. The Geology is not favorable. Although the river bottom is sandy, the underlying geology is in what is referred to as the mid basin "pressure area," an area of Orange County underlain by alternating layers of sand and clay that allows for lateral movement of groundwater but inhibits its vertical flow and downward recharge.

3. The cost of building a recharge facility in this reach of the river has not been justified compared to other capital projects that offer better results.

While it is understandable that the OCWD does not consider an impoundment in this reach of the river as a priority at this time, it has been considered in the past. Some of the arguments in favor have included:

1. Any water that percolates in this area is not lost. It ends up in the regional aquifer, it is just a matter of time. What can be counted on in the near term is the pressure effect in the main aquifer of loading water into the perched aquifer system. The introduction of distilled quality water in the perched system will also provide water quality benefits over time.

2. The OCWD is currently spending millions of dollars installing Mid-Basin injection wells 5 miles below this reach of the river to increase recharge that is chronically over-drafted by Santa Ana and IRWD pumping.

3. The OCWD's Recharge Enhancement Working Group (REWG) has studied the effectiveness of drilling transfer wells through the layering in this area to enhance the rate of downward percolation of water and increasing heads in the underlying Main Aquifer. A report was prepared in January 2011 entitled "*Orange County Water District Transfer Well No. OCWD-TW1.*"

4. The six miles of SAR bottom extending between Imperial Highway and Ball Road is one of the most important and effective recharge facilities for the OCWD. The river is a great recharge facility for two reasons: one is that it can consume approximately 150 cubic feet per second along its path, and secondly is that it is "self-cleaning."

   The constraint on the maximum use of the river is the need for operators to make a judgment call on how much flow to send down the lower reach of the river. Too much, and water flows past Ball Road into the ocean. Too little, and the maxim recharge capacity of the river is not realized. A rubber dam and impoundment at the Riverwalk park would act as a water backstop and eliminate the risk of overloading the river upstream. The OCWD's REWG study group made this argument in favor of a dam near the Ball Road Basin to allow for more aggressive use of the river as a recharge facility, however it did not get traction at the time because of higher priorities elsewhere.

   As far as recharge facilities go, none is better that the river itself because of its self-cleaning nature. Terminal recharge basins require periodic draining and cleaning to remove a thin layer of silt and foulant. The river on the other hand does not. Seasonal storm flows in the river completely cleans the foulant away, leaving "beach sand" after each storm. The Riverwalk impoundment would also be self-cleaning.

<u>GWRS as the Primary Source of Supply:</u>

The Riverwalk project needs GWRS water. Impounding the natural flow of water from the SAR, and nearby street drains alone cannot justify building an expensive impoundment by itself. The use of ultra-pure GWRS on the other hand would be completely reliable and would justify an absolutely perfect water feature for public enjoyment. The questions are:

1. Will the diversion of GWRS water into this impoundment result in unacceptable water losses?

   The only "loss" would be through evaporation. Water percolating through the porous bottom is additional groundwater recharge and therefore not a loss. The evaporation can be estimated using published tables. Our calculations indicate a loss of approximately 50-acre feet per year. To keep these losses in perspective, the evaporation from this impoundment will be offset somewhat by the elimination of T & L levee operations elsewhere. In addition, this 20-acre facility would represent only 2% of the surface area of the OCWD's existing 1,100-acre operations (not counting the Prado ponds).

2. Can enough water be diverted on a regular basis to keep the impoundment full?

   Percolation rates in this stretch of the river are not precisely known. The best estimates that we can derive are based on an overall percolation of 150 cfs over six miles of river bottom or 1 foot per day. The proportionate rate in this last 2,200 feet would be 10 cfs (or 6.5 mgd). The ten-year average in the nearby Burris Pit indicates a percolation rate of only 0.2 feet per day (or 0.8 mgd). Burris is never cleaned and is obviously plugged. If this represents the range of values, then the SAR's 10 mgd might be a conservative estimate. The initial rate of percolation might be higher, but eventually the water will mound on the underlying clay layering and the sustained rate will then be determined by its lateral flow underground.

3. Is a new facility for GWRS recharge inconsistent with OCWD's current priorities?

   The Riverwalk impoundment is completely consistent with OCWD priorities. The construction of a dam along that stretch of the river will help reduce stormflow losses to the ocean. The impoundment will retain river water as it arrives and only use the GWRS river as a supplemental supply to keep the facility full to just below dam height. It would undoubtedly increase overall recharge and would provide a high-profile example of the virtues of water recycling and public access. The OCWD has a long history of public use of its facilities, with examples such as Anaheim Coves, Santa Ana River Lakes, Raahauge's shooting range and the irrigation of Mile Square Park.

This project, with the pristine GWRS water on full display, could provide an example of water recycling public advocacy as high-profile as the GWRS itself.

4. Will this project help with the mid-basin overdraft problem?

   As a future improvement, if the OCWD desires to put more water in the ground in this mid-basin area, then the idea of transfer wells can be reconsidered using the Riverwalk impoundment as the transfer wellfield's "forebay". Transfer well(s) could be drilled adjacent or even in the river bottom itself, making this facility a low maintenance and low-cost alternative to additional mid-basin injection wells.

5. Does this provide benefits for the OCWD in terms of increased recharge and emergency storage during wet months?

   Yes, with the expansion of the GWRS to 130 mgd, and the telescoping of the large diameter GWRS pipeline, a turnout at this location feeding the river impoundment and the Burris Pit could eliminate the need for a booster pump to carry the additional flow up to the La Palma Basin. This might be especially important when the Barrier is full during wet winter months, making water deliveries to the northern recharge facilities more critical. Although the future of the Poseidon seawater desalination project is unknown, the Riverwalk recharge project and others like it might be necessary to take that additional water during the winter reduced-producer-demand months.

6. What would be the operational needs and flow parameters for such a system?

   The OCWD recharge system operators could alternatively fill the impoundment with SAR water or with GWRS, depending on the season. The maximum capacity for the turnout into the SAR is preliminarily estimated to be between 10 and 20 mgd. The actual flow into the impoundment would be automatically controlled by a flow control valve and a level indicator located near the dam. Currently a turnout into Burris is under consideration by the OCWD. As currently envisioned, it will only discharge on the west side of the center levee into Burris Basin. The Riverwalk project would require a redesign to include a turnout into the SAR. Water would flow down the river from that point and passively accumulate in the downstream Riverwalk impoundment. A redesigned turnout can be collocated with at Burris, one side into Burris and a mirror image structure into the SAR.

7. What are the regulatory needs and limitations from the DDW and RWQCB?

   The permit applications for the currently anticipated Burris turnout are worded for a specific periodic usage during emergencies and wet years when other OCWD recharge capacities are maxed out. This permitting of discharge to the Burris, Santiago Basins and Santiago Creek are subparts of the larger GWRS expansion project. The expansion of GWRS from 100 mgd to 130 mgd is now under construction and is expected to be completed in the First Quarter of 2023.

   The current permit applications include an update to the existing CA Department of Drinking Water (DDW) permit for discharges into Burris Basin and the Santiago Reservoir. DDW permit amendment application submission is expected in the First Quarter of 2021.

   An NPDES permit (SA RWQCB) is also needed because of the anticipated discharge of GWRS water into Santiago Creek. It is the same as what would be needed to discharge this water into the SAR and the Riverwalk project. The NPDES permit is only required when discharging into "Waters of the State" (Santiago Creek and SAR). Burris and Santiago Reservoir are privately owned by the OCWD and thus do not call for NPDES permits. OCWD's NPDES application for Santiago Creek is expected to go out during the 4th Quarter of 2021. This permit will require additional monitoring typical of a Sewage Plant discharger. The OCWD might consider this to be more trouble than it is worth, considering the limited need for Santiago Creek discharge of this water. Because this would be critically important for the City of Anaheim discharging to the SAR, this might be an area that the City of Anaheim negotiates a financial reimbursement arrangement to the OCWD for the extra monitoring required.

   Recharge of recycled GWRS water requires a 4-month travel time underground before arriving in any drinking water well (OCWD currently trying to negotiate a shorter 2-month timeframe). OCWD is currently preparing groundwater modeling using its own staff for the GWRS outfall locations. Additional groundwater modeling would be required to add the Riverwalk and SAR as a new location. The good news is that it appears that Anaheim drinking water wells are far away and should not be an issue.

Index of Abbreviations and Acronyms

This list is not comprehensive.

ACOE or USACE – United States Army Corps of Engineers
AF (af) – acre-feet or acre-foot
AFY – acre-feet per year
ADA – Americans with Disabilities Act
ARTIC – Anaheim Regional Transportation Intermodal Center
AT – Active Transportation
BMP – Best Management Practice
CA – Community Amenities
Caltrans – California Department of Transportation
CDFW – California Department of Fish and Wildlife
CEQA – California Environmental Quality Act
CFS (cfs) – cubic feet per second
CPUC – California Public Utilities Commission
CWA – Clean Water Act
EA – Environmental Assessment
EIR – Environmental Impact Report
EPA – Environmental Protection Agency
FEMA – Federal Emergency Management Agency
FONSI – Finding of No Significant Impact
GIS – geographic information system
GPS – global positioning system
GWRS – Groundwater Replenishment System
HEC-RAS – Hydrologic Engineering Center - River Analysis System
LID – Low Impact Development
LIDAR – light detection and ranging
LF – linear feet
MGD (mgd) – million gallons per day
MMRP – Mitigation Monitoring and Reporting Program
MPAH – Master Plan of Arterial Highways
NEPA – National Environmental Policy Act
NPDES – National Pollutant Discharge Elimination System
NWP – Nationwide Permit
O&M – operation and maintenance
OC – Orange County
OCFCD – Orange County Flood Control District
OCPW – Orange County Public Works
OCSD – Orange County Sanitation District
OCTA – Orange County Transportation Authority
OCWD – Orange County Water District
PFAS – polyfluoroalkyl substances
RA – River Activation
RCB – reinforced concrete box
ROW – right-of-way
RR – railroad
RWQCB – Regional Water Quality Control Board
SARI – Santa Ana Regional Interceptor
SART – Santa Ana River Trail
SCE – Southern California Edison
SPT – Southern Pacific Transportation
SWPPP – Stormwater Pollution Prevention Plan
USACE or ACOE – United States Army Corps of Engineers
UPRR – Union Pacific Railroad
WIPS – watershed improvement projects
WSEL – water surface elevation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