



Feasibility and Design of a Multi-Objective Stream Restoration in a Highly Constrained Urban Environment:

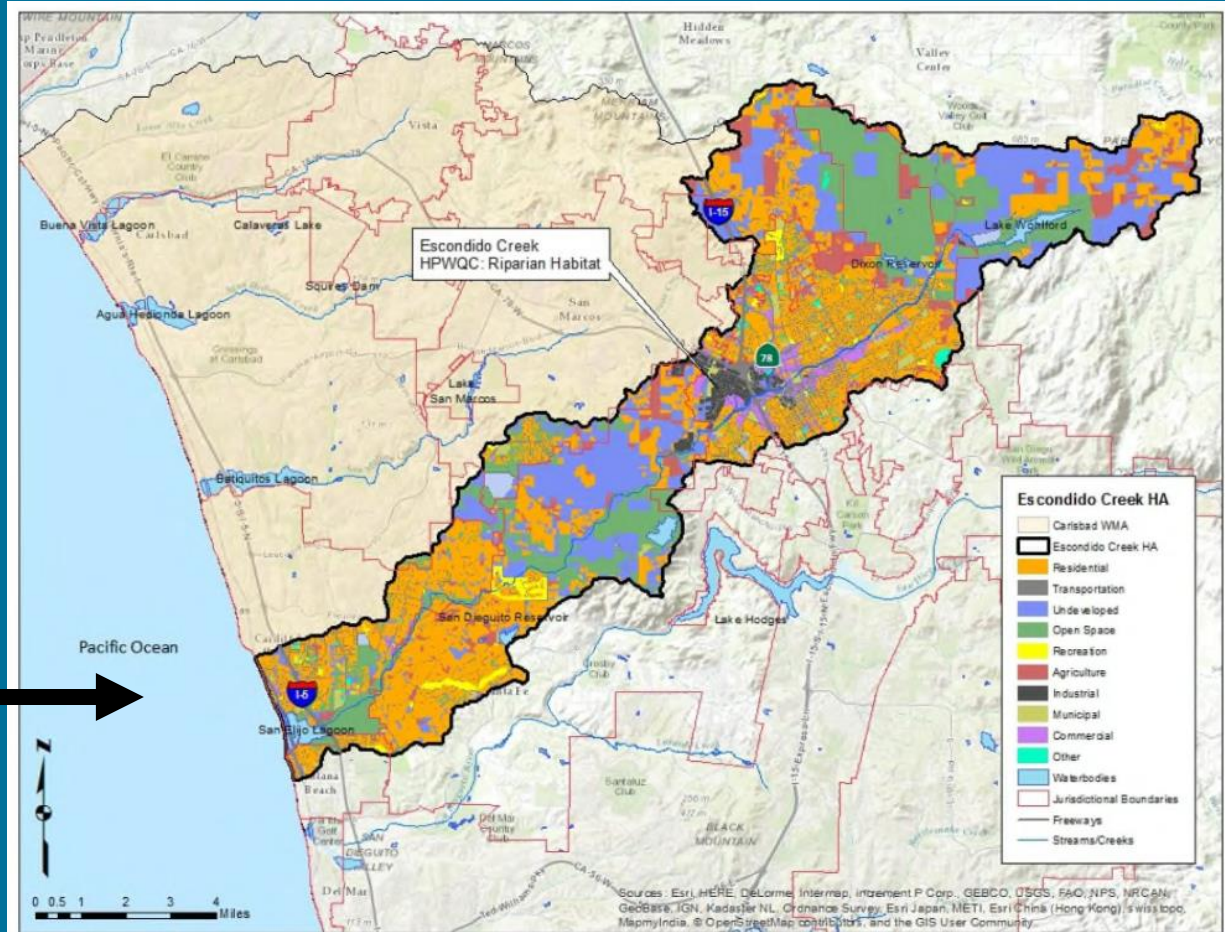
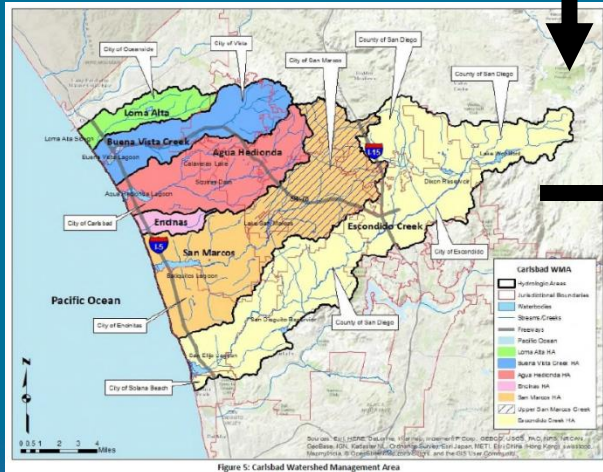
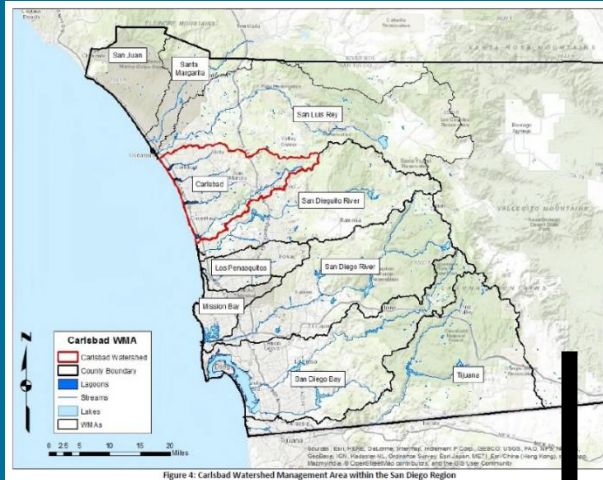
Escondido Creek in Escondido, CA

Luke Tillmann
cbec eco engineering

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cbec eco engineering



The Escondido Creek Watershed – Overview



Source: Carlsbad Watershed Management Area Water Quality Improvement Plan (WQIP, 2016)

Existing Conditions – Escondido Creek Transect



Upstream of FCC



Upstream end of FCC



Grape Day Park Reach

Photos all taken on same day in mid-August 2018



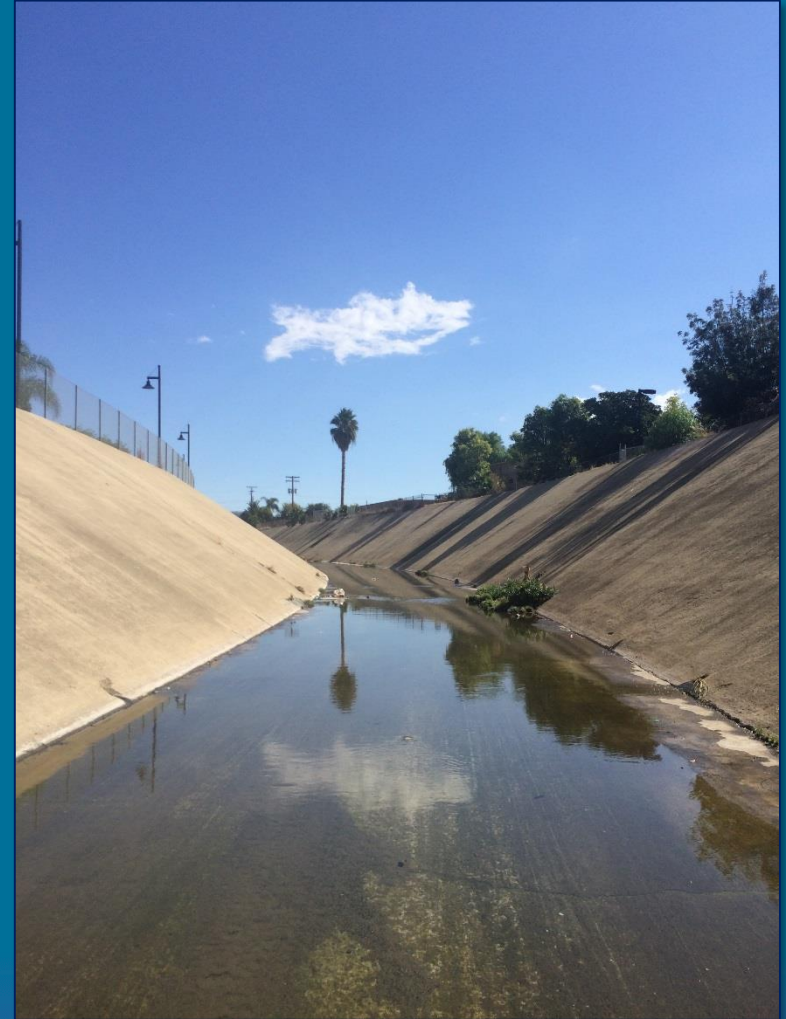
Downstream of FCC



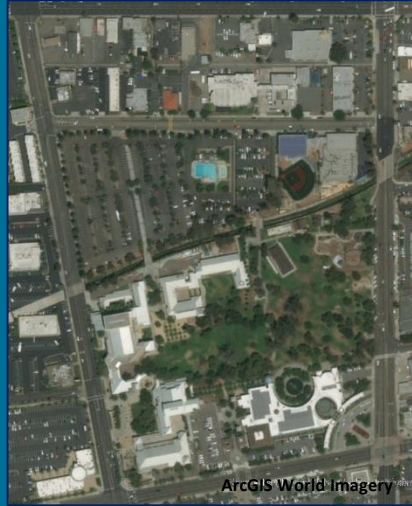
Downstream end of FCC

Existing Conditions – Water Quality Concerns

- **2010 CWA Section 303(d) Listing:**
 - Enterococcus, fecal coliform, manganese, phosphate, selenium, sulfates, TDS, N, DDT, toxicity
- **Water Quality Improvement Plan:**
 - Highest Priority Water Quality Condition: riparian habitat degradation:
 - Non-native vegetation
 - Concrete-lined channels
 - Dry weather flows
 - Trash
 - Water quality concerns



Existing Conditions - Escondido Creek at Grape Day Park



Past Restoration / Stormwater BMP Considerations

- **City of Escondido Creeks Hydraulic Study (Michael Baker)**
 - **Four Alternatives:**
 - Vegetate channel bottom (about 34 ft wide)
 - Grade control (rock weirs) + minor vegetation
 - Grade control + greater vegetation
 - Vegetate 10 ft width of channel bottom
 - **Outcomes**
 - Varying levels of percolation for dry season flows
 - Increases in 100-year flood WSE by 2.2 – 11.7 ft, necessitating channel widening of up to over 4x existing width
 - **Alternative Compliance / LID:**
 - Parking lot: underground BMP for stormwater retention, infiltration

Past Restoration / Stormwater BMP Considerations



Michael Baker
INTERNATIONAL



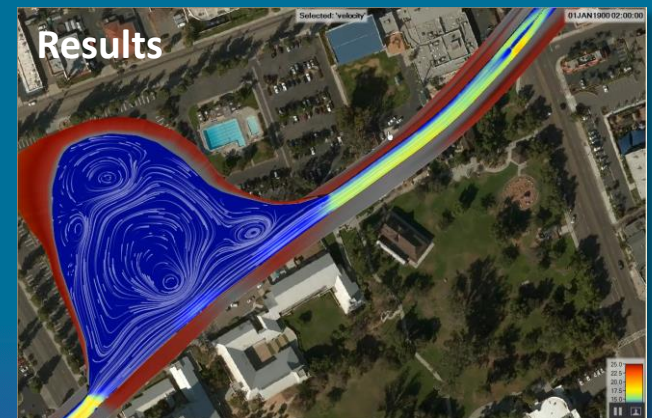
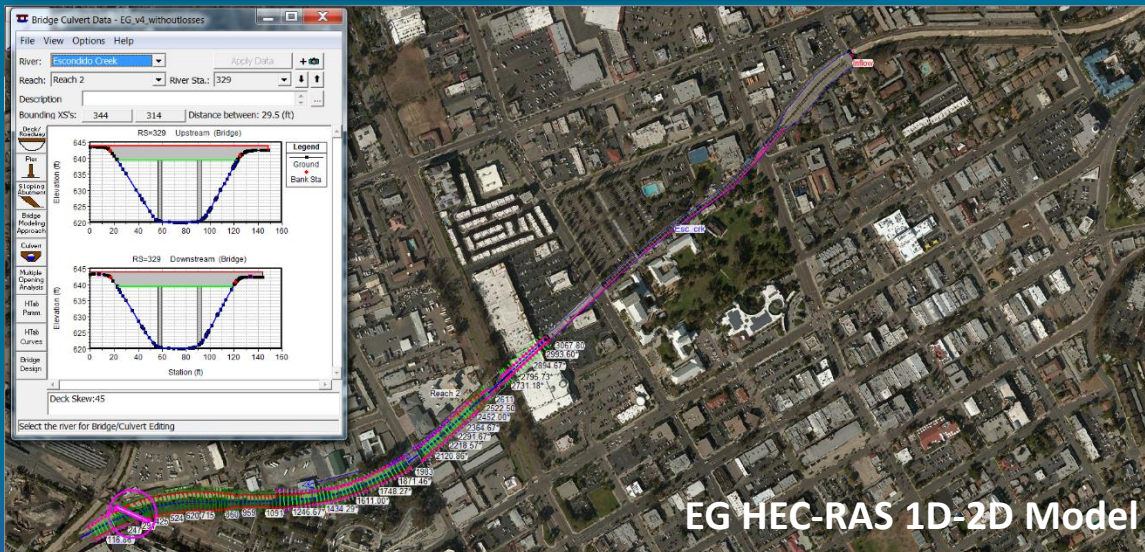
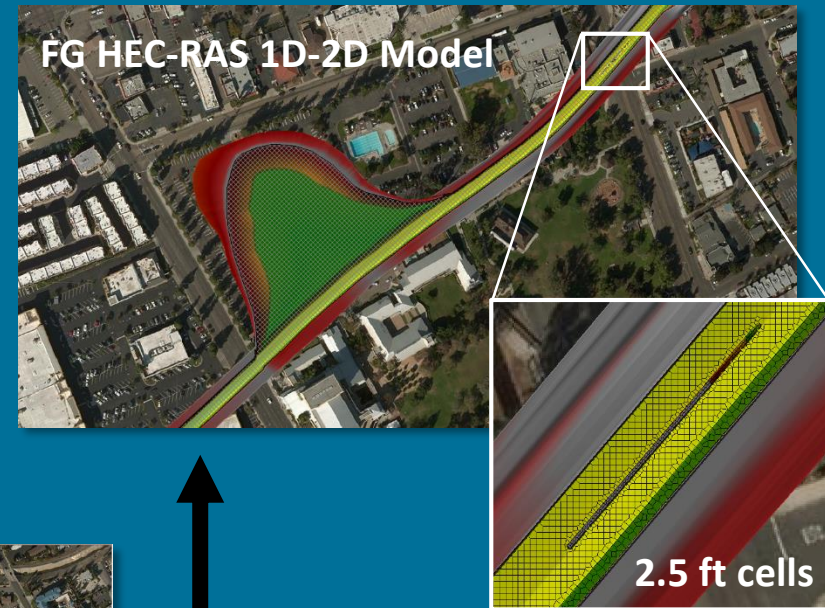
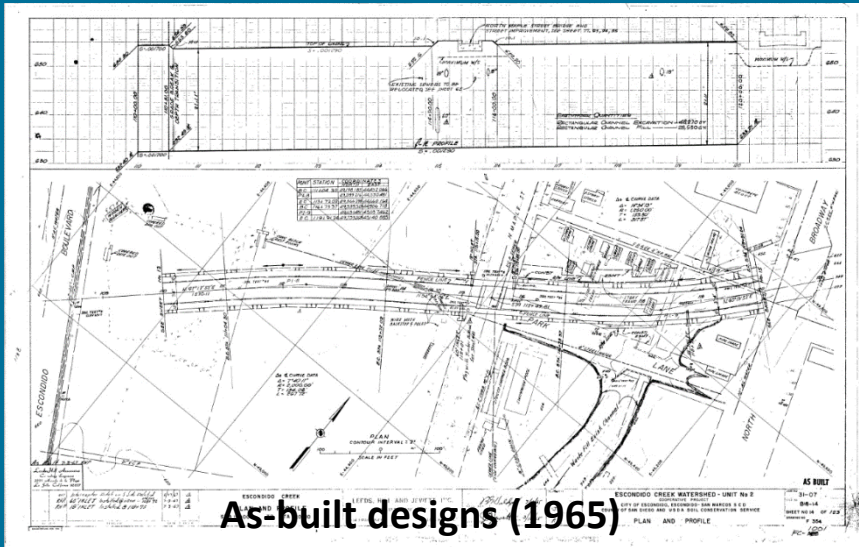
Escondido Creeks Hydraulic Study
Alternative Compliance Potential Projects Assessment

Woodward Parking Lot
Site 9 - Underground Storage & Infiltration

Current Restoration Considerations

- **Possibilities for Design**
 - **Sloped, vegetated side wall**
 - Relatively little land needed
 - Increases flow area
 - **Inset floodplain:**
 - Naturalized bed for percolation
 - Raised floodplain feature for high flows
 - Allows for flow expansion
 - Can double as recreation space
 - **Connected side channel:**
 - Limits flood impacts by retaining FCC structure
 - Natural bed for percolation, habitat
 - Most land, cost intensive

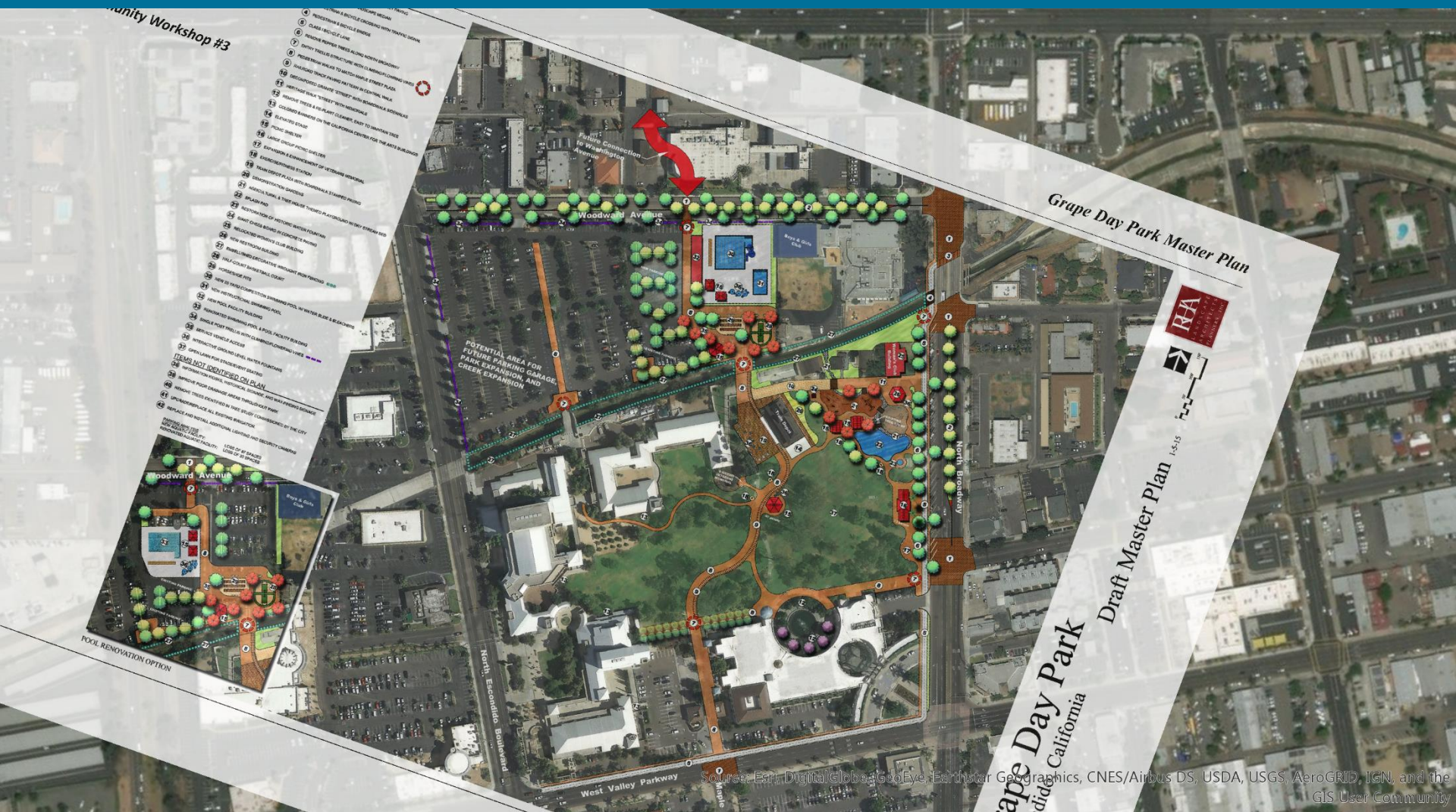
Inset Floodplain Concept – Hydraulic Modeling



Shifting to Side Channel Concept

- **Inset floodplain likely infeasible**
 - With FCC design flow discharges of ~ 30 ft/s in supercritical flow regime...
 - Hydraulic jump forms at location of floodplain
 - Validated with 1-D modeling as well
- **Side channel concept progressed**
 - Multi-objective considerations
 - Maintain flood capacity of FCC
 - Incorporate into existing plans for Grape Day Park
 - Provide for recreation activities / public access
 - Urban habitat
 - Water quality
 - Economics / Redevelopment

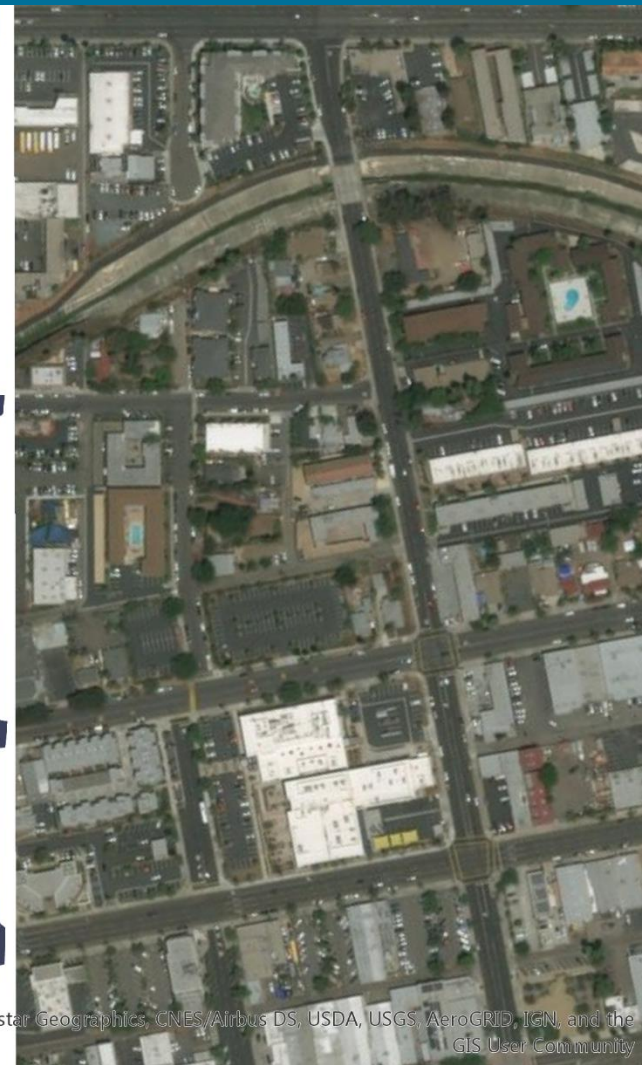
Design Considerations - Grape Day Park Master Plan



Design Considerations - People to the Park concept



cbec-TECC concept

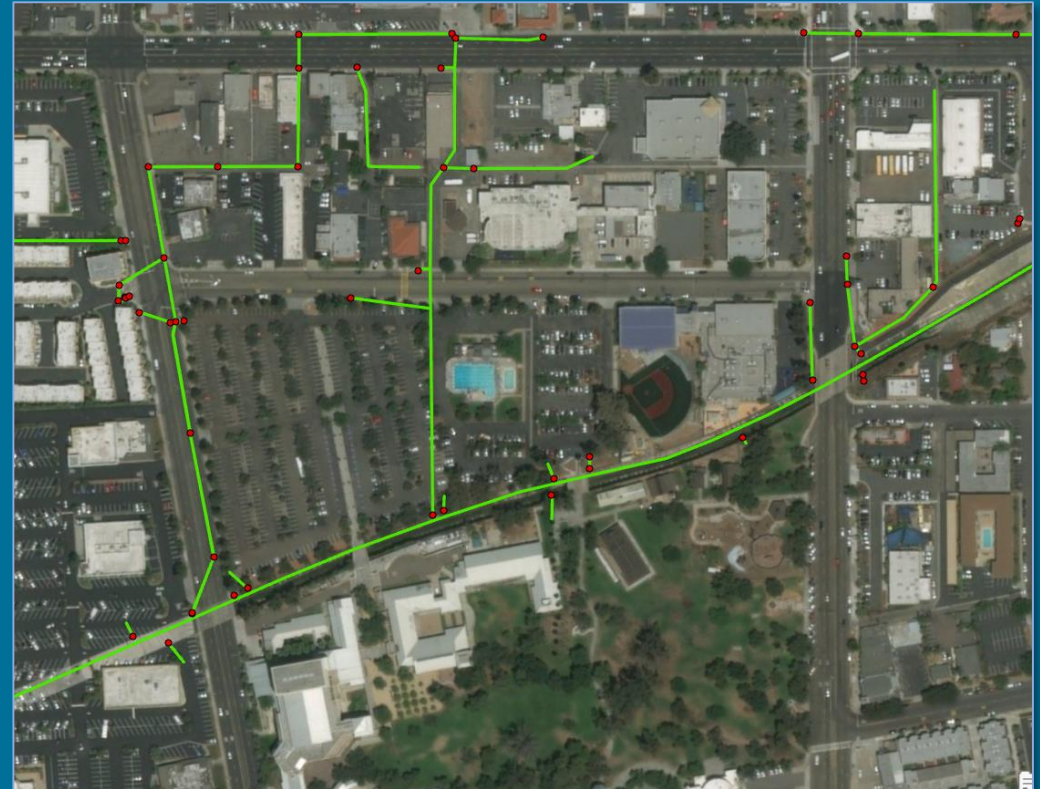


cbec-TECC concept



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Potential for Alternative Compliance



Portion of storm drainage network

Vision and Inspirations – Twin Cities, MN



Berg Larsen Group



Credit: Colleen McGuire

Wood Lake Nature Center

Minneapolis: “City by Nature,” “City of Lakes,” “City of Parks”

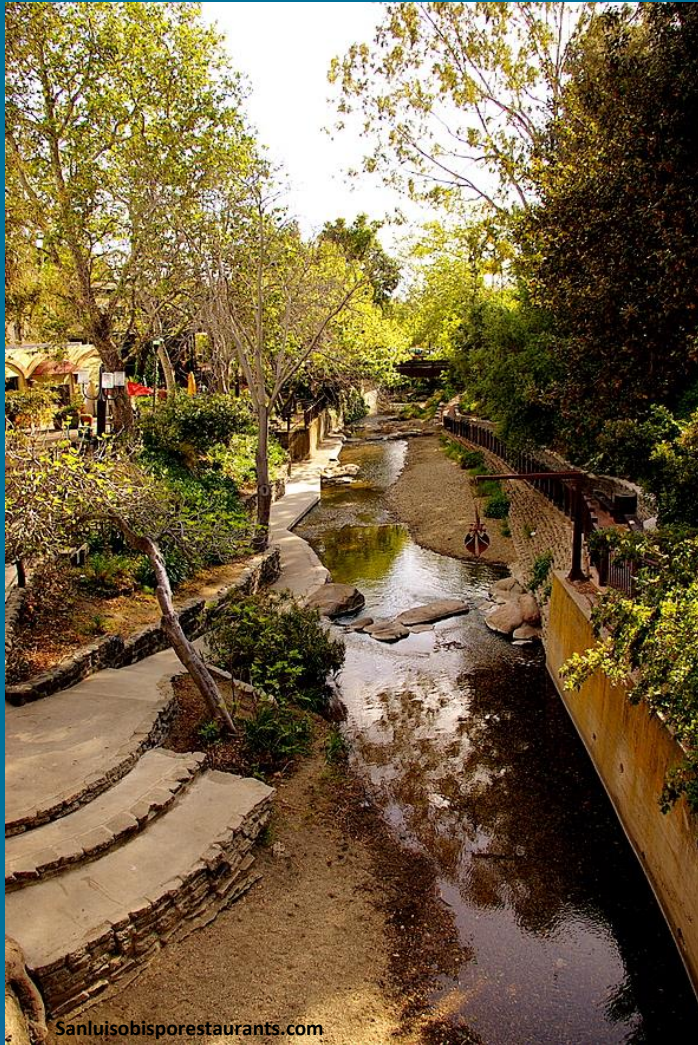
Elements:

- Urban nature / recreation
- Branding / economic dev.



Grand Rounds National Scenic Byway

Vision and Inspirations – San Luis Obispo, CA



Sanluisobisporestaurants.com

San Luis Obispo Creek - Mission Plaza



TripAdvisor

Development along creek corridor

Elements:

- Urban stream restoration
- Economic redevelopment

Vision and Inspirations – Davis, CA



UC Davis Arboretum

Elements:

- Highly managed, pseudo-natural system
- Blend of recreation opportunities
- Habitat
- Stormwater management



Historic Putah Creek Channel



UC Davis Arboretum

Vision and Inspirations – Escondido, CA...



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Questions?



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