

Endangered Species Ecosystem: Striking a Balance With Flood Risk Management

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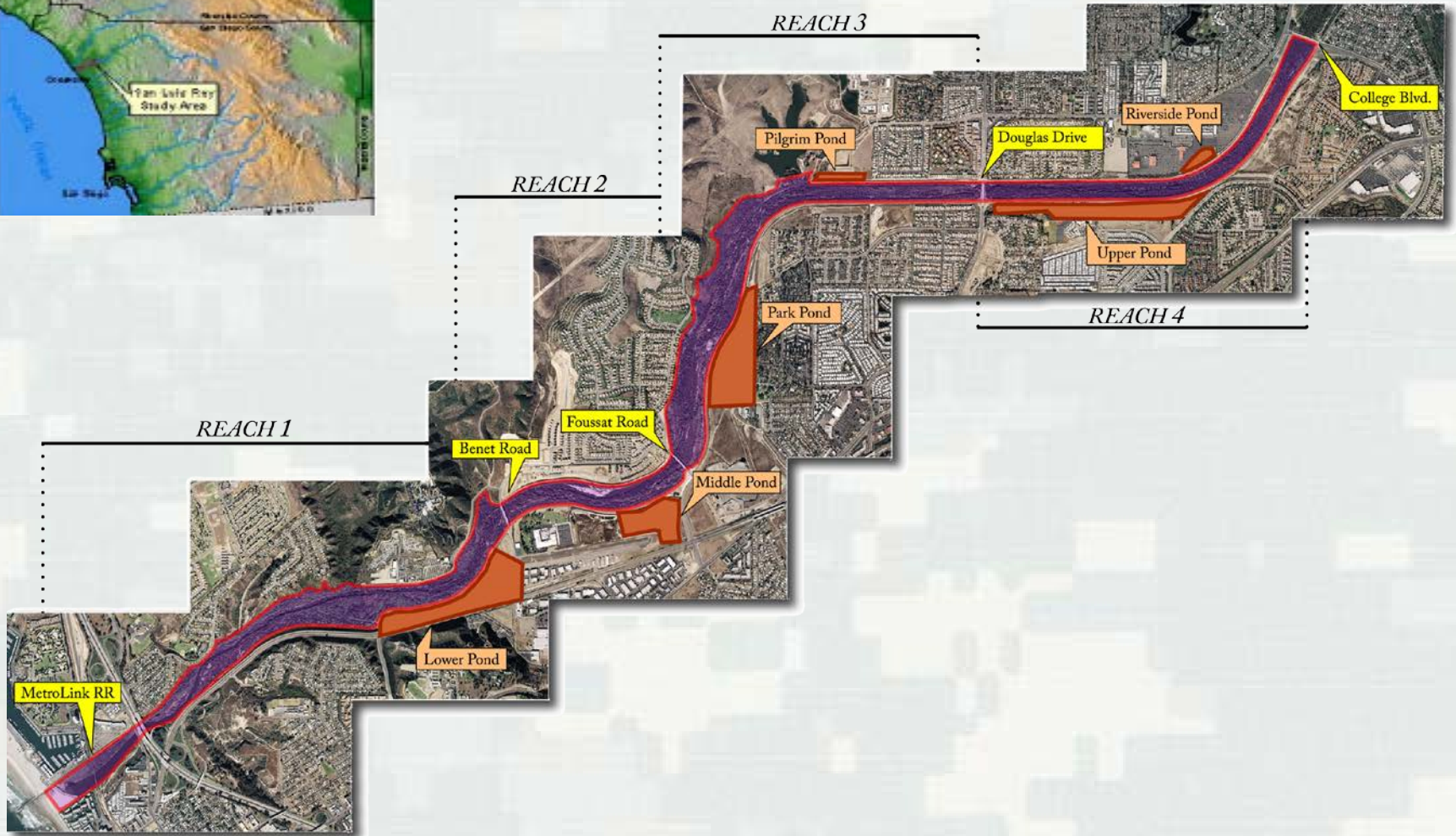




Setting and Background

- San Luis Rey River Flood Risk Management Project
 - City of Oceanside, Northern San Diego County, California
 - Authorized, under provisions of Section 201 of the Flood Control Act of 1965, in Dec. 1970.
 - Construction of 7.2 miles of improvements along the San Luis Rey River from College Blvd. Bridge to the Pacific Ocean.
 - 89,000 cfs flow conveyance (270 year).
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Project Area Map





Project Description

- Earth-bottom single and double levee trapezoidal channel (5.4 miles)
 - 400-ft wide flow conveyance zone
 - Bank removal (1.5 miles)
 - Parapet walls (total of 0.5 mile)
 - Interior drainage ponding (detention ponds – 138 acres).
 - Avoidance and minimization measures for loss of endangered species/riparian habitat.
 - Bicycle trail on the maintenance road/top of levee (5 miles)
 - Construction duration over 10+ years (1989 to 2000)
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Channel Conditions





Post Construction Issues

- Listed Species

- Population increase of and additional listing of endangered species and critical habitat forced major revisions to the O&M Plan (vegetation and sediment management)

- Flow Conveyance

- 89,000 cfs (270 years flood protection) as authorized by Congress is no longer achievable due to limited to no vegetation management (mowing)
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Endangered Species and Critical Habitat

- Endangered Species:

- Least Bell's Vireo**

- Southern Willow Flycatcher**

- Coastal California Tern

- Western Snowy Plover

- Arroyo Southwestern Toad

- Tidewater Goby

- Southern California Steelhead

- Critical Habitat:

- Least Bell's Vireo**

- Southwestern Willow Flycatcher**

- Coastal California Gnatcatcher



Primary Constituent Habitat Elements Least Bell's Vireo



- **Mixed willow riparian:** dominated by one or more willow species including black willow (*Salix gooddingii*), arroyo willow (*Salix lasiolepis*), and red willow (*S. laevigata*), with mule fat (*Baccharis salicifolia*) as a frequent co-dominant.
- **Willow-cottonwood:** Willow riparian habitat in which cottonwood (*Populus fremontii*) is a co-dominant.
- **Willow and/or mulefat scrub:** Dry and/or sandy habitat dominated by sandbar willow or mule fat, with few other woody species.
- Early succession vegetation types 5 years (sometimes 3 years) to 15 years age class; <60% canopy, >50% shrub cover.
- Edges or ecotone with the tree/shrub habitat component is essential.
- **Non-native:** Areas vegetated exclusively with non-native species such as giant reed (*Arundo donax*) and salt cedar/tamarisk (*Tamarix ramosissima*) followed by black mustard, and poison hemlock.

Primary Constituent Habitat Elements Southwestern Willow Flycatcher

- **Mixed willow riparian:** dominated by one or more willow species including black willow (*Salix gooddingii*), arroyo willow (*Salix lasiolepis*), and red willow (*S. laevigata*), with mule fat (*Baccharis salicifolia*) as a frequent co-dominant.
- **Willow-cottonwood:** Willow riparian habitat in which cottonwood (*Populus fremontii*) is a co-dominant.
- **Mid to late succession vegetation types 10-15 years age class. dense canopy (>60% closure) and dense shrub layer.**
- Edges or ecotone with the tree/shrub habitat component may be important but needs further research.
- **Non-native:** Area vegetated exclusively with non-native species such as salt cedar/tamarisk (*Tamarix ramosissima*) followed by poison hemlock.



LBVI and WIFL Habitat





Resource Agency Coordination and Consultation

- By 2008:
 - Amended Final Biological Opinion
 - CDFG California Endangered Species Act Permit
 - CDFG Streambed Alteration Agreement
 - CWA Section 401 Water Quality Certification
 - Coastal Consistency Determination
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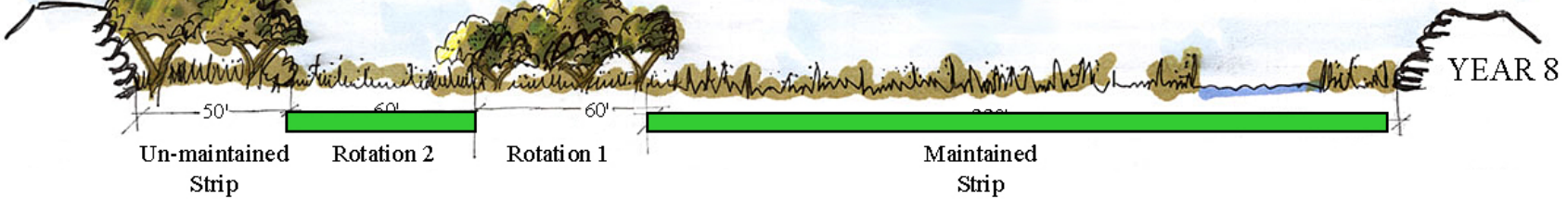
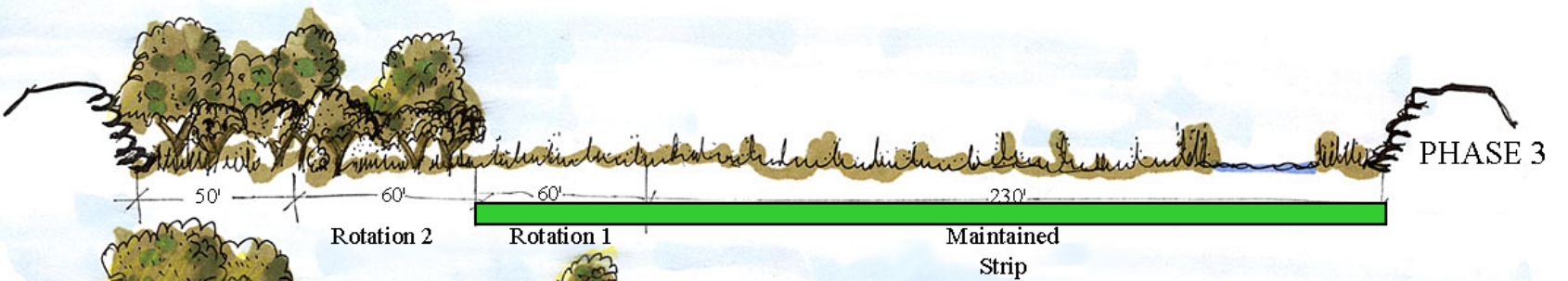
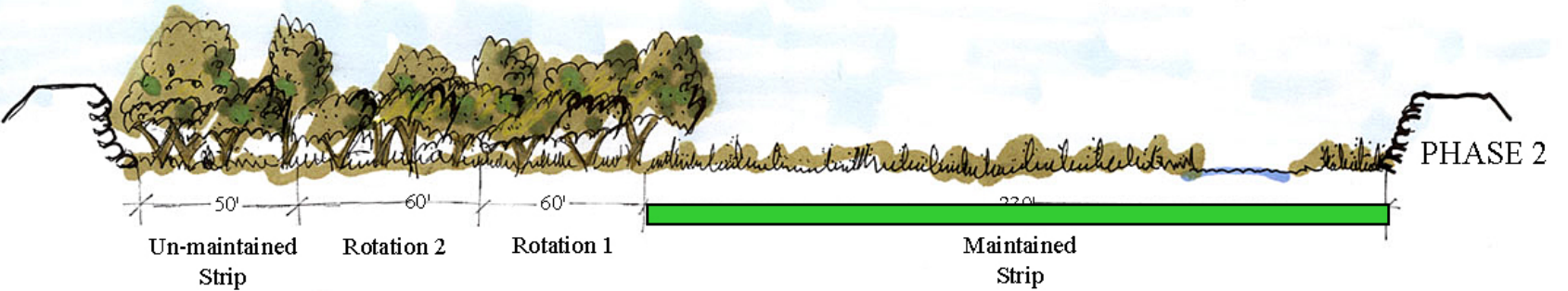
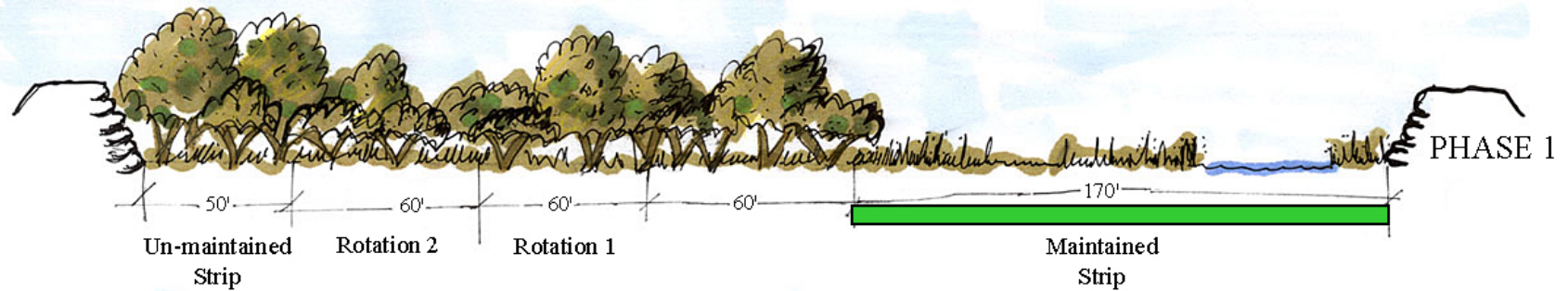
Recommended Plan (71,200 cfs)

■ Vegetation Management

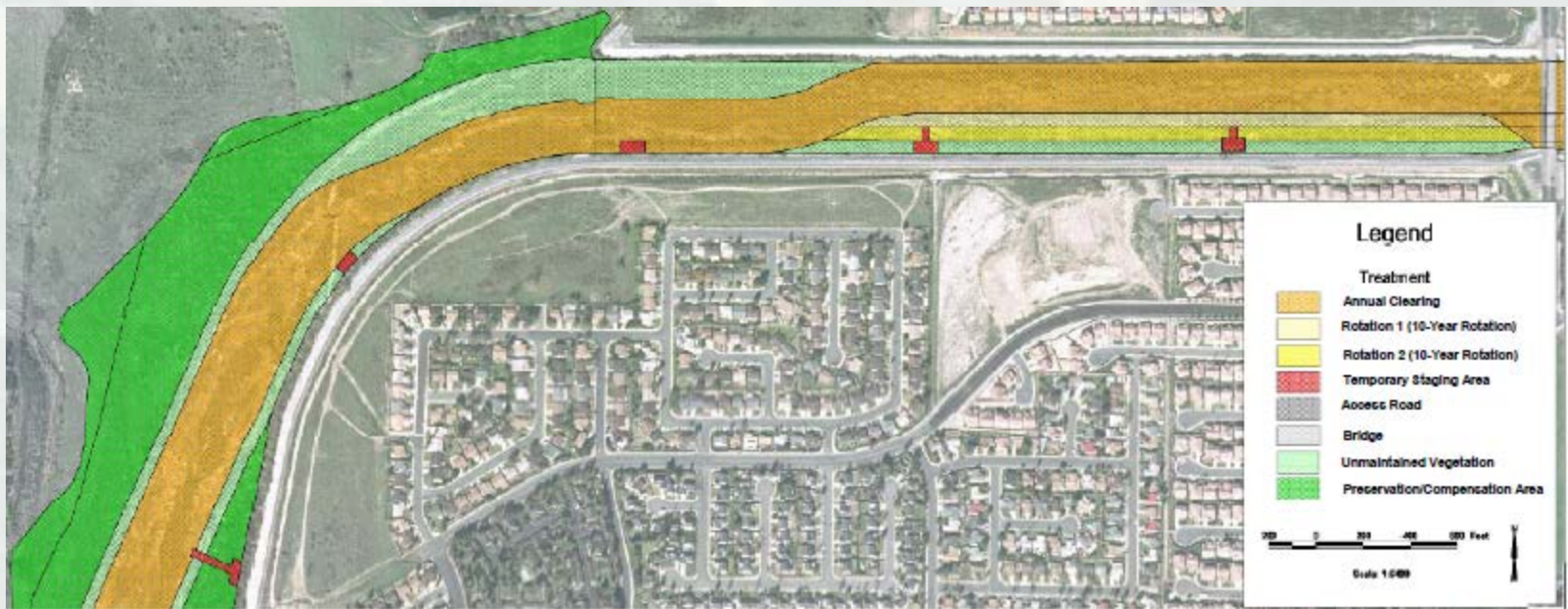
- Mowing swaths of vegetation in phases (3) and maintained on different schedules/frequencies:
 - Annually
 - Areas mowed every 10 years
 - Areas not subject to mowing for flood flow conveyance (Unmaintained, Compensation and Preservation Areas)

■ Sediment Management

- Periodic (localized) sediment removal
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Phases of Vegetation Management

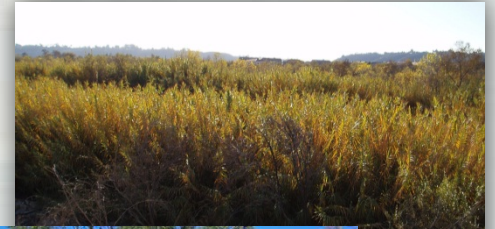


Phase 1 Mowed Area

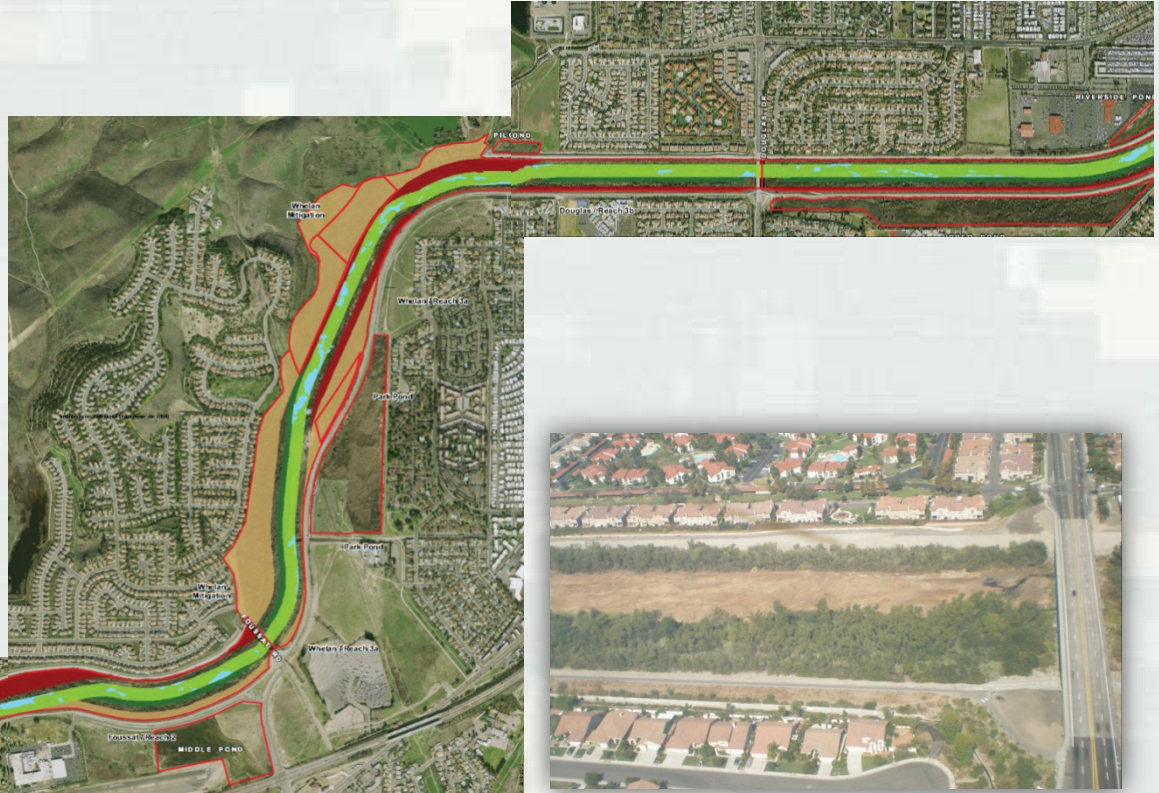


Restoration Objectives




- 122 acres of non-native invasive species removal
- 38.29 acres of Restoration
- 47.94 acres of Preservation
- Restore functional habitat for:
 - Least Bell's Vireo
 - Southwestern Willow Flycatcher






Restoration Objectives

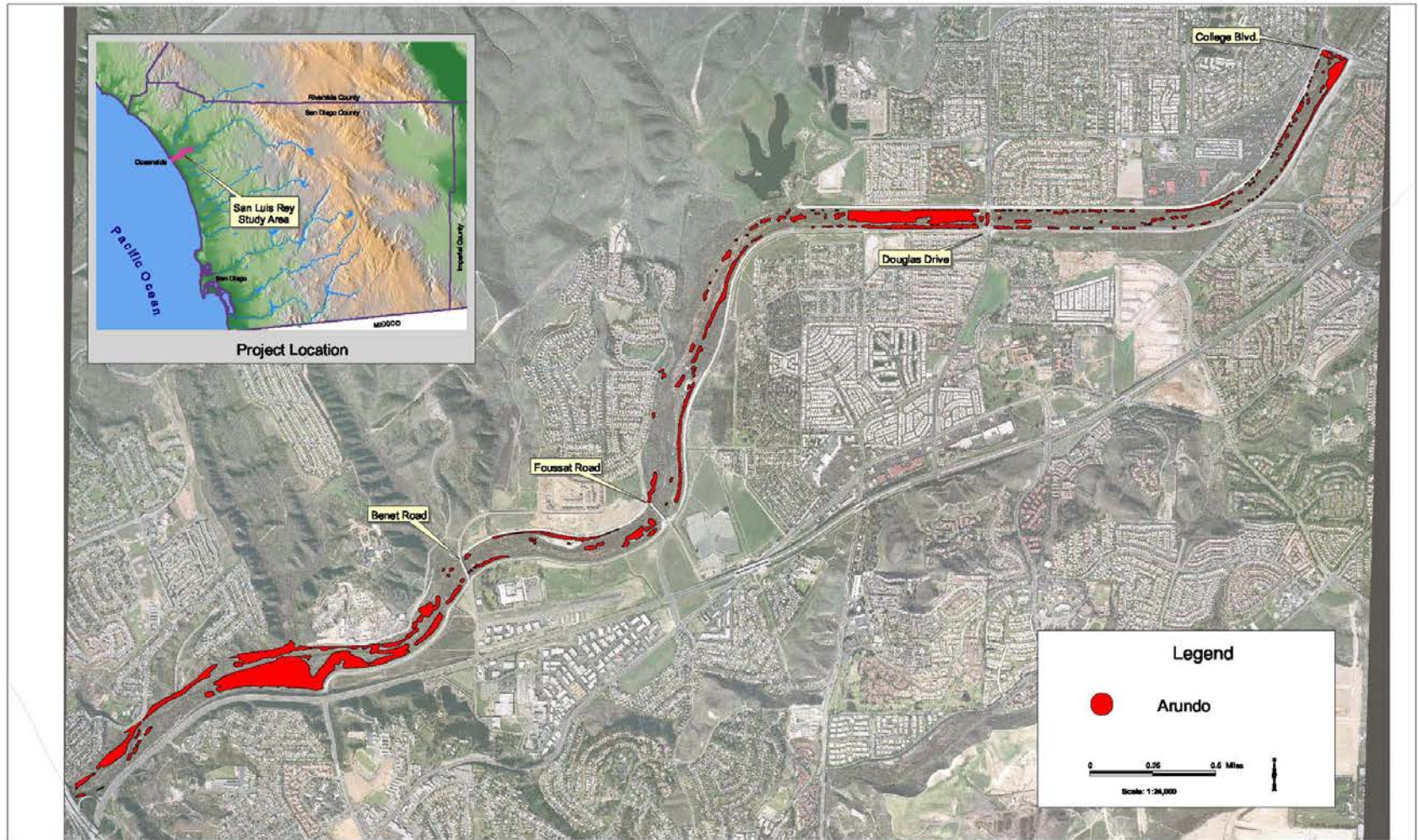


Vegetation Management Plan

-  1st 5-Year Mowing
-  Compensation/Preservation Area
-  Bridge

-  Phase 1 Annual Mowing
-  Unmaintained Vegetation
-  Freshwater Marsh

Restoration Opportunities

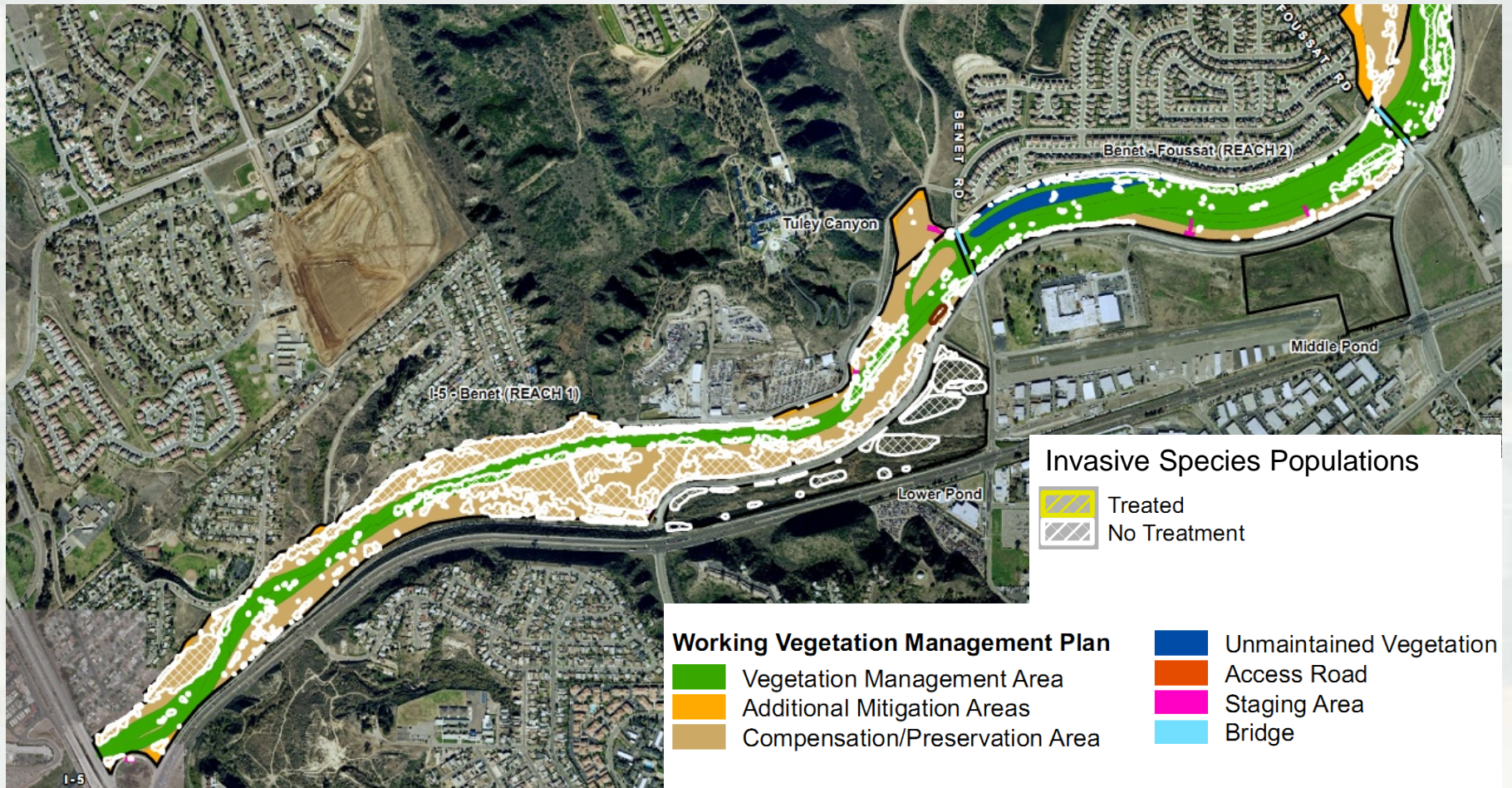


2010 Least Bell's Vireo Populations

Whelan Mitigation, Reach 3a, Pilgrim Pond, & Reach 3b Survey Sites



Restoration Approach



GIANT REED *Arundo donax*

Poaceae

Stem < 8 m; nodes glabrous; internodes < 4 cm thick

Leaf: blade < 1 m, 2–6 cm wide

Inflorescence 3–6 dm, plume-like; branches ascending

Spikelets 10–14 mm; glumes 10–13 mm, thin, brownish or purplish; lemmas 8–12 mm, tip 2-toothed, hairs < 8 mm,

silky; palea 3–5 mm, hairy at base; anthers 2.5–3 mm

Chromosomes: $2n=110$

Ecology: Moist places, seeps, ditchbanks

Elevation: < 500 m.

Bioregional distribution: c Sierra Nevada Foothills, Central Coast, South Coast, San Gabriel Mountains, Desert

Distribution outside California: native to Europe

Flowering time: Mar–Sep



Problems with *A. donax*

- Highly competitive, replaces native habitats
- Very few insects and wildlife use *A. donax*
- Increases flood risk
- Causes damage to structures
- Rapid growth rate (10 cm/day)
- Adapted to fire, increases fire risk
- Reduced canopy shading of rivers
- Prevalent in large low-gradient streams
- Can survive after 42 days in sea water



A. donax Establishment





2D 3D Road Aerial

Airport Rd

A. donax

A. donax

A. donax

25 feet 10 m

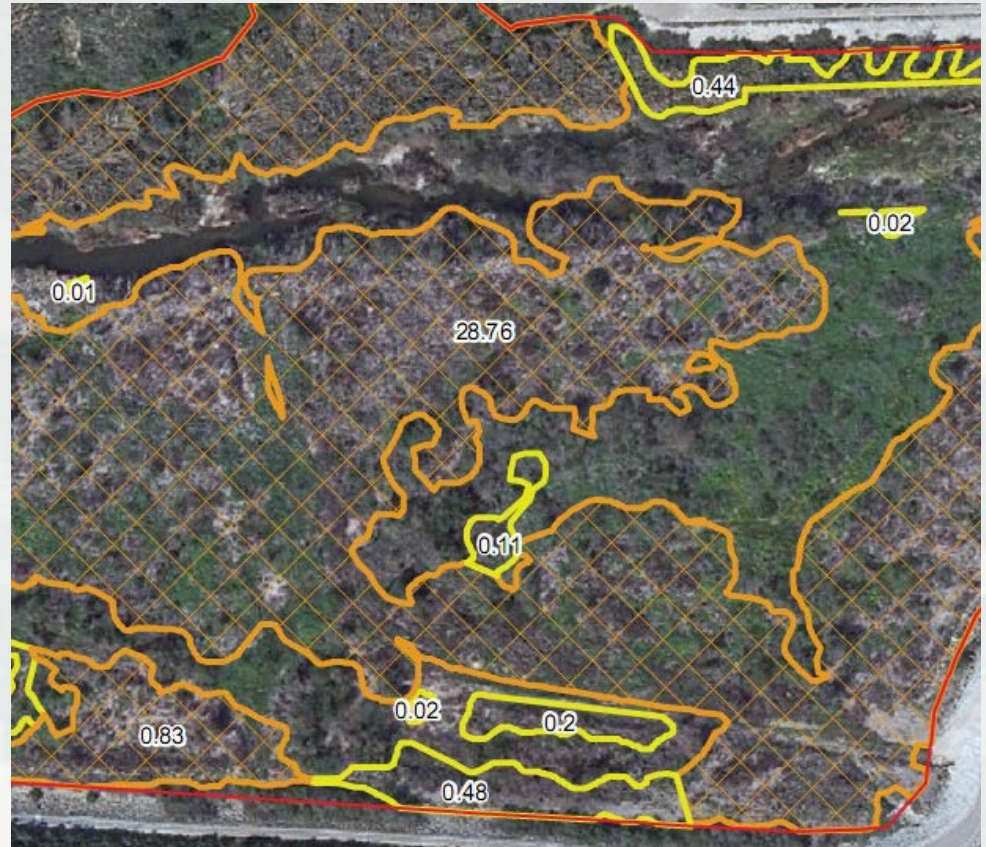
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Restoration Approach

- Eradicate invasive exotic weeds
- Create space for native species
 - Natural recruitment
 - Container planting



Area (Sq. Ft.)

Perimeter (Ln. Ft.)

Ratio < 24

Ratio > 24

Passive Restoration

Active Restoration



Active Restoration

- Invasive Exotic Species Management
- Mowing/ Shredding NNIV biomass
- Container planting
- Supplemental Irrigation
- Monitoring and Reporting

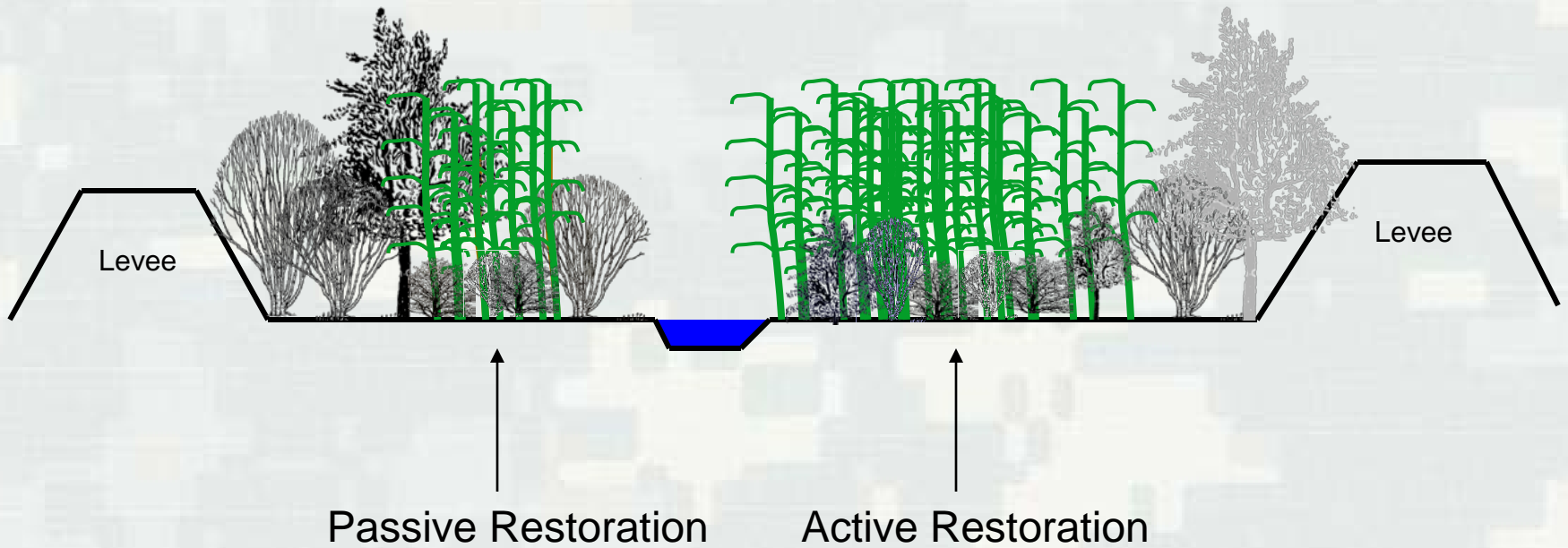


Passive Restoration

- Invasive Exotic Species Management
- Selective removal of biomass
- Adaptive Management
- Monitoring and Reporting



Restoration Approach



Management Considerations

- Size of Stand
 - Access
 - Season (fall vs. spring)
 - Diluted glyphosate application @ 60-100 gal/acre
 - Low vol. imazapyr application @ 10 gal/acre
 - Active vs. passive restoration
 - Proximity to sensitive species/habitats
 - Fire risk, public safety
-

Arundo donax control

- Bend and spray technique
 - Create separation between *A. donax* patch and native vegetation
 - Bend canes inward towards center of patch
 - Lay down *A. donax* in layers
 - Foliar spray each layer to ensure good coverage
 - 75% preparation, 25% spraying
 - Low volume foliar spray or conventional foliar
-

Bend and Spray



Mowing/Shredding Biomass



Mowing/Shredding Biomass

- Equipment
 - Rubber tire and track mowers
 - Carbide-tipped mower head
- Function
 - Mulches/ shreds biomass
 - Fractures *A. donax* at nodes
- Biomass is left as mulch



Container Planting



Restoration Conditions

- Low nutrient soils
- Inconsistent irrigation, infrequent maintenance
- Remote locations, animal damage, vandalism
- Bare land in full sun, high winds
- Larger in scale = less attention to each plant
- **Goal: Successful and sustainable plant establishment**



Restoration Quality

- Plants grown in same (native) soil
- Controlled drought situations in the nursery
- Minimal fertilizer and pesticide use
- Plants grown in full sun
- High root to shoot ratio
- Plants grown from seed
- Seed is source identified
- **Result: Genetically appropriate plants that survive.**

Maintenance Program

- Adaptive Management
- Weed control
 - *A. donax*
 - *Lepidium*
 - *Conium*
 - *Cortaderia*
 - *Tamarisk*
 - *Brassica*
- Supplemental Irrigation
- Replanting



Monitoring & Reporting

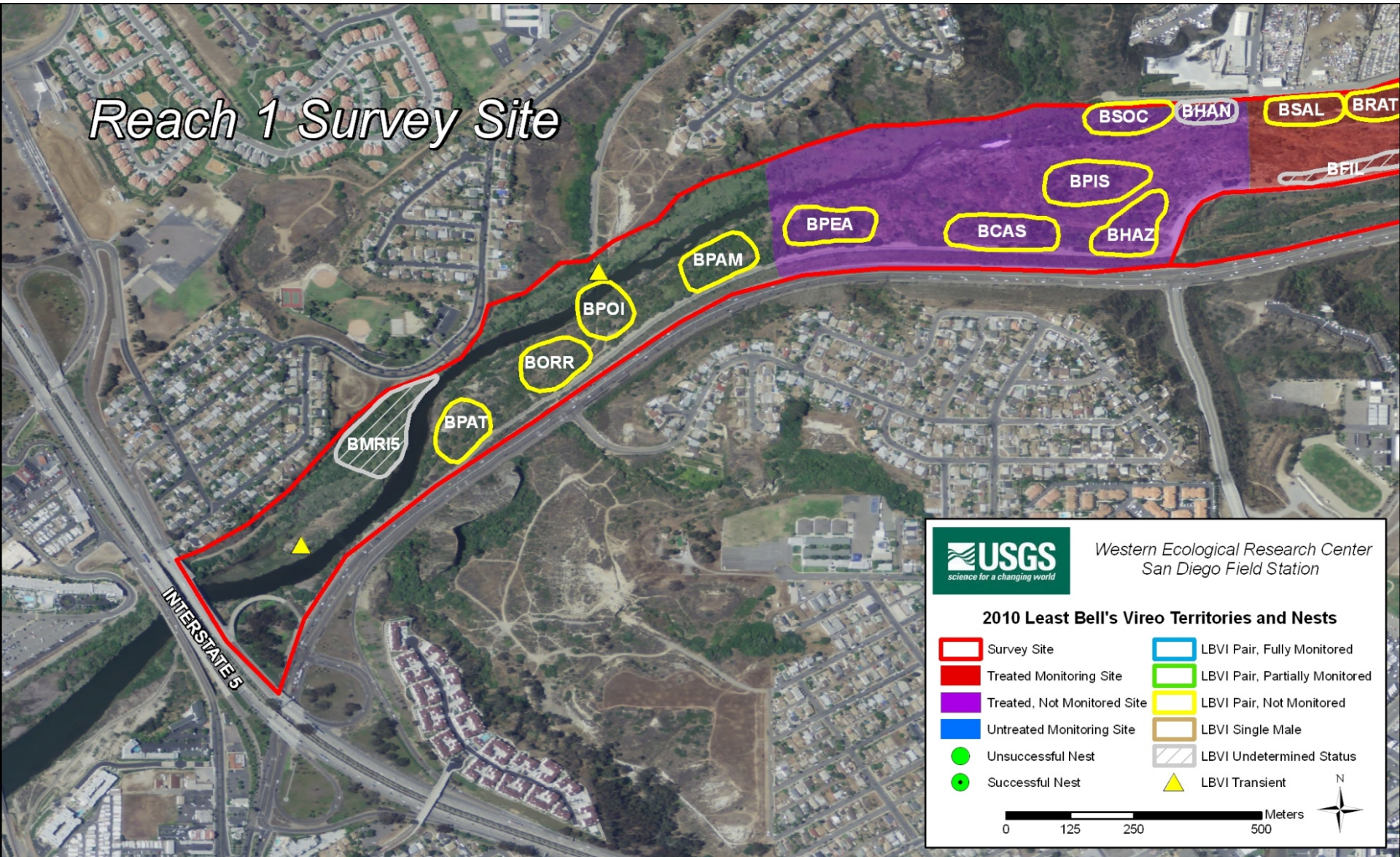
- California Native Plant Society Relevé Sampling Protocol
 - Native and non-native cover
 - Native species density
 - Native species diversity
- Reference site monitoring
- Performance standards



Year	Cover of Trees, Shrubs, and Herbs (analyzed separately)	Density	Diversity	Container Plant Survival	Non-native Coverage (not to exceed)
1	No Quantitative Performance Goals	-	-	80%	10%
2	50%	50%	60%	100%*	10%
3	60%	60%	70%	-	5%
4	80%	70%	75%	-	5%
5	90 – 100%	75%	75%	-	5%

LBVI Territories

Reach 1 Survey Site



Effect of Mowing on Productivity

Reproductive success and productivity of nesting Least Bell's Vireos at Treated and Untreated sites at the San Luis Rey Flood Risk Management Project Area, California, in 2010. Numbers given for all pairs, both fully and partially monitored, unless otherwise noted. Standard deviations presented with means.

Parameter	Number		Overall
	Treated ^a	Untreated ^b	
Completed nests per pair (std)	2.2 ± 1.0 (Range 1-5)	2.0 ± 0.8 (Range 1-4)	2.1 ± 0.9
Nests with eggs	111	42	153
Eggs laid	360	137	497
Average clutch size ^c	3.4 ± 0.6	3.4 ± 0.5	3.4 ± 0.6
Hatchlings	242	100	342
Nests with hatchlings	83	34	117
<i>Hatching success:</i>			
Eggs ^d	67%	73%	69%
Nests ^e	75%	81%	76%
Fledglings	151	72	223
Nests with fledglings	60	24	84
<i>Fledging success:</i>			
Hatchlings ^f	67%	72%	68%
Nests ^g	72%	71%	72%
Fledglings per nest	1.5	1.7	1.5
Average number of young fledged per pair ^h	2.7 ± 1.8	2.8 ± 1.8	2.8 ± 1.8
Pairs fledgling no young ⁱ	10 (18%)	5 (19%)	15 (19%)
Pairs fledging ≥ one young ⁱ	45 (82%)	21 (81%)	66 (81%)
Pairs fledging two broods	11 (20%)	3 (12%)	14 (17%)

^a Numbers were combined for Treated sites: Benet West and Channel.

^b Numbers were combined for Untreated sites: Upper Pond and Whelan Mitigation.

^c Based on 90 Treated and 39 Untreated nests with a full clutch (Two-sample *t*-test: $t_{0.05, 127} = 0.49$, $P = 0.62$).

^d Percent of all eggs that hatched.

^e Percent of all nests with eggs in which at least one egg hatched.

^f Percent of all nestlings that fledged.

^g Percent of all nests with nestlings in which at least one young fledged.

^h Based on 55 Treated and 26 Untreated pairs who were fully monitored (Two-sample *t*-test: $t_{0.05, 79} = -0.06$, $P = 0.96$).

ⁱ Based on pairs whose territories were fully monitored.

Thank You



Foussat / Reach 2