Mobilizing a rapid response to the threat posed by *Paspalum vaginatum* to tidal marsh conservation in both northern and southern California

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Drew Kerr
Kerr Ecological Solutions
& Alys Arenas
Newport Bay Conservancy

Alternate title(s) for this presentation:

Paspalum vaginatum:
We don't want putting greens in our tidal marsh restoration!

OR

Ignorance is bliss:
Paspalum? What *Paspalum*?

Weed Alerts 2020

and more…

Jutta Burger

Science Program Director, California Invasive Plant Council

Robert Price

Primary State Botanist, California Dept. of Food & Agriculture

CAL IPC CALIFORNIA INVASIVE PLANT COUNCIL

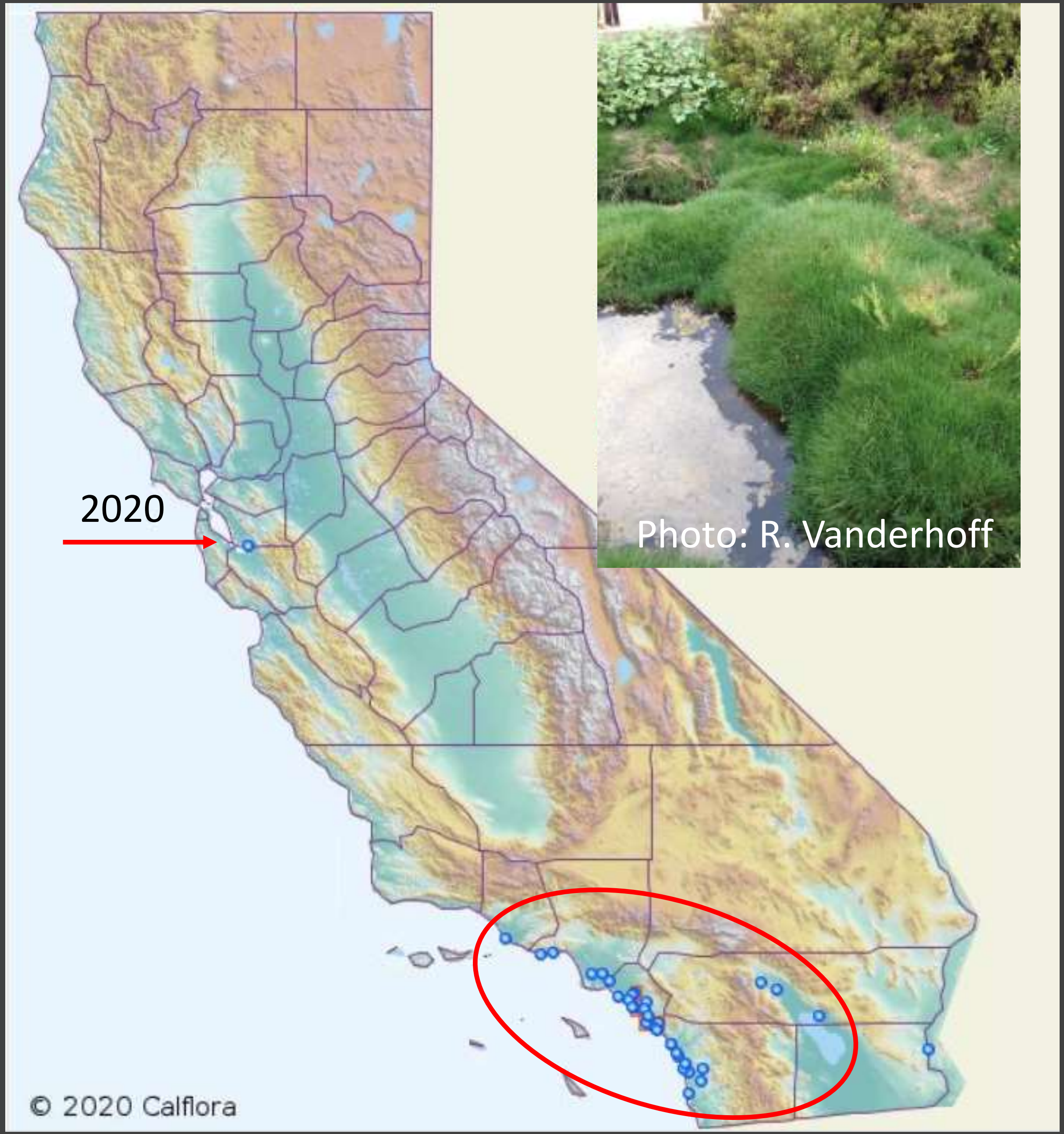
cdfa 100 YEARS CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE 1919 - 2019

Creeping Loosestrife (*Lythrum junceum*)

Photo: Ken Hickman

Seashore Paspalum
Paspalum vaginatum Sw.
(Poaceae)

- Cal-IPC “Watch” [PRE = 18]
- First recorded in 1994 [Riverside Co.], 2002 [San Diego Co.], 2003 [Orange Co.]
- Aggressively invades wetlands
- Spreads by rhizomes, stolons, seed(?)
- Widely established in warm climate areas worldwide, incl. coastal SE U.S.
- Popular turf grass



- # Seashore Paspalum
  Paspalum vaginatum Sw.
  (Poaceae)

- Can be easily confused with other Paspalum, Zoysia and Bermuda grass
- Leaves narrow, sharp-tipped, folded or flat
- Ligules are membranous and have hairs
- 2-branched inflorescence
- Spikelets in two rows
- Seeds smooth

- Highly salt tolerant


Photo: Ron Vanderhoff


Photo: Ron Vanderhoff

Video clip from “The Lawn Expert” [Youtube]


Photo: Ron Vanderhoff

Invasive *Paspalum vaginatum* Key Traits

From Riefner & Columbus (2010) Key to *Paspalum*

- Spikelets entirely glabrous, solitary

Key character to differentiate from native *P. distichum*

- Spikelets elliptic-lanceolate
- 3-4.5 mm long
- Rachis of racemes winged

- Rhizomatous & stoloniferous
- Mostly estuarine but tolerates a wide range of salinity

Invasive *Paspalum vaginatum* Literature

- Perennial grass known from tropical/subtropical regions around the world
- Riefner & Columbus (2008) reported for the 1st time for California; referred to as “now widespread & highly invasive in estuarine wetlands in southern California” from Journal of the Botanical Research Institute of Texas
- “Likely unrecognized in the field for decades…”

- Shaw & Allen (2003) confirm what is evident in the San Francisco Estuary
- “[PAVA is]…an early and effective colonizer of disturbed, bare or ephemeral soil deposits and once established it can exclude indigenous species recruitment for many years”

- Siemens (2006) found PAVA was associated with a shift from an aquatic to more terrestrial invertebrate community (Galapagos)
- Degraded water bird habitat; most water birds did not associate with PAVA

Invasive *Paspalum vaginatum* Distribution & Key Traits

- Exact native range uncertain (Riefner & Columbus, 2008)
- Likely native to the southeastern U.S. seaboard from North Carolina to Florida and across the Gulf States to Texas (also occurs in New Mexico)
- <u>Commonly associated with brackish wetlands</u>

Source of the San Francisco Estuary PAVA infestation is still unknown…

- Spreads by rhizomes and stolons, forming a thick turf (up to 2 feet thick or more)
- Rarely produces viable seed in significant quantities; must propagate vegetatively (Hall 1994, Duncan & Carrow 1999)

- Dispersed primarily by water; fragments of stolon or rhizome can be carried long distances **and root easily**, forming new infestations (Weber 2003)

Paspalum vaginatum Look-Alikes

Native saltgrass (*Distichlis spicata*)

Common in middle to high marsh, the same marsh zones as PAVA
But "plays well with others" and doesn't form the complete exclusion monocultures of PAVA

More flat/fan-like appearance than PAVA, shown here with salt crystals on leaves. Stem thick & often woody at base

Photos: Calflora & iNaturalist

Inflorescence a panicle as opposed to the racemes of PAVA

Paspalum vaginatum Look-Alikes

Invasive Bermuda grass (*Cynodon dactylon*)

In San Francisco Estuary, Bermuda grass was found in upper reaches of tidal flood control channels, but at an elevation above tidal inundation (above PAVA, although growing adjacent)

Bermuda grass mats don't appear to get as thick/dense as PAVA

Right: invasive Bermuda grass (*Cynodon dactylon*); inflorescence with 5 spikes (3-7) resembles a bird's foot
Left: invasive PAVA; inflorescence with 2 (3) spikes

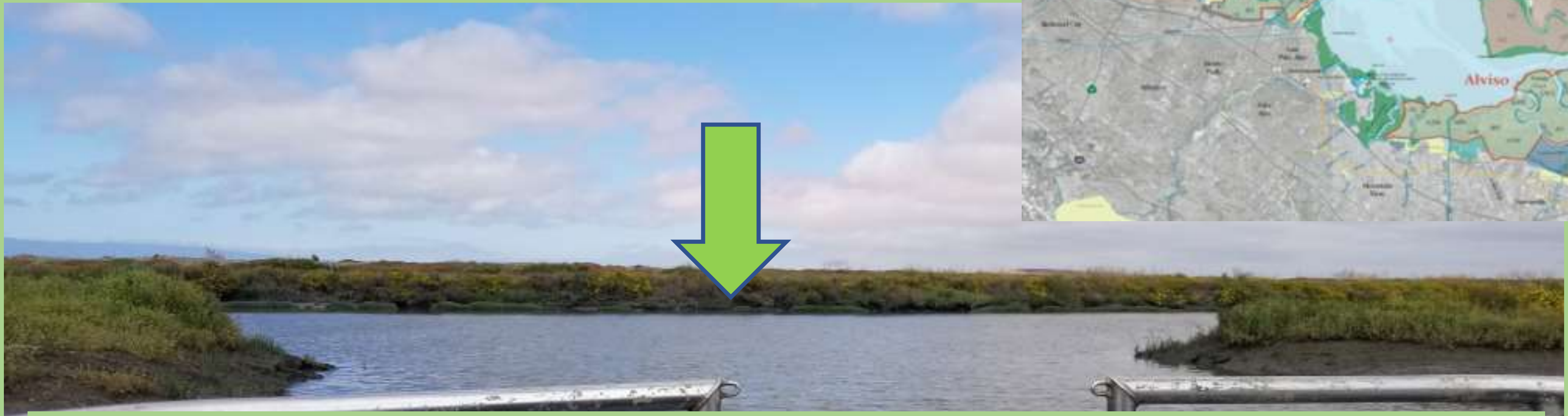
Invasive *Paspalum vaginatum* Fun/Disturbing Facts

- Sold commercially by the turf industry, as early as 1970’s & 80’s in SoCal
- One common name is “marsh couch” (dense mats 2ft+ thick). ***Comfy!!***
- Used as bedding in trade ships sailing b/w Africa and New World in 1700’s

- Can survive being waterlogged or submerged for several days at a time
- So salt-tolerant that can even be irrigated with saltwater!!
- Been shown to survive pollution with crude oil!!
- USDA NRCS stated “No environmental concerns” in 2008 fact sheet; Illustrates a common problem with new introductions, especially to novel habitats

- Plants will resprout from fragments so mechanical control not an option (Global Invasive Species Database http://www.iucngisd.org/gisd/species.php?sc=1351)
- As worldwide water shortages worsen, a turf grass that can be irrigated w/ saltwater IS an amazing advancement, **just not for our tidal marshes!!**

Impetus for Action in San Francisco Bay

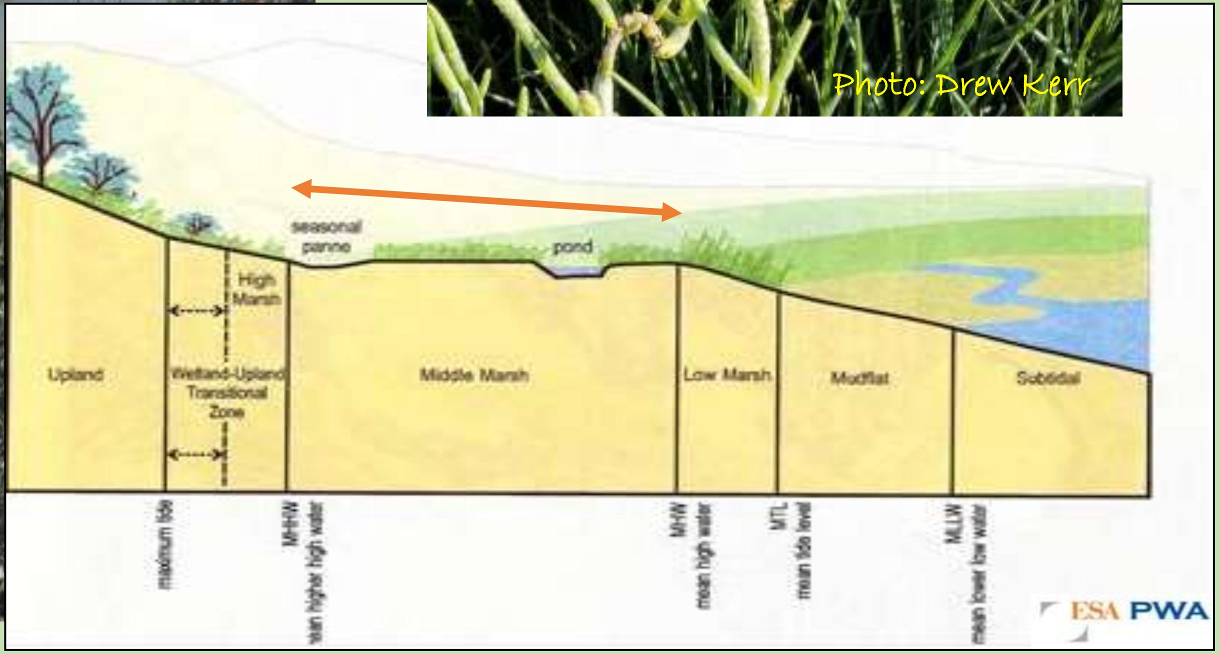


- Planned 2021 breach from Mud Slough into Island Ponds A19 (shown July 2022)
- Intended to speed sediment accretion and marsh development at this restoration

- PAVA presence in Mud Slough generated the impetus for an initial management effort to reduce dispersal to A19
- South Bay Salt Pond Restoration Project interim funding

Invasive *Paspalum vaginatum*

Coyote Creek Lagoon, SF Estuary



Invasive *Paspalum vaginatum* at Coyote Lagoon

Expands by stolons (aboveground runners)
Engulfing & entwining the adjacent native mid-marsh vegetation such as bulrush (below) and these *Grindelia stricta*/gumplant (left)

Thick mats will inhibit native plant regeneration

Invasive *Paspalum vaginatum*

Northern Island Pond A20 (Mud Slough just beyond the levee). biologists demonstrating that the invasive PAVA is penetrating back into the thick bulrush stand via stolons.

PAVA colonizing bare mud bench below the marsh scarp along upper Coyote Creek

Still very early invasion in some sites :
$75m^2$ net cover detected along upper Coyote Creek
$134m^2$ net within A20

Invasive *Paspalum vaginatum*

Colonizing on open mudplain at mid-marsh elevation

1st colonizer can OWN the space & inhibit native plants when cover is this dense and thick

Tidal Habitat at Risk from PAVA

PAVA threatening to dominate unvegetated mud at marshplain tidal elevation that has no biotic resistance to invasion, while the native plants that have established along the slough banks are already completely surrounded by PAVA

PAVA treatment from airboat & backpack in 2021-2022

Upstream PAVA Treatment along Flood Control Channel Laguna Creek

By the appearance of the nearly 2 miles of continuous PAVA infestation upstream of the Coyote Creek Lagoon epicenter in native marsh habitat, it appears likely that a storm event washed propagules from landscaping turf into these flood control channels to start the infestation

Treatment Efficacy from Year 1 (2021)

Brown tussocks = demised PAVA one year after treatment
Excellent competitive release of the native bulrush that was already persisting at a greatly reduced density due to the heavy PAVA mats at its feet

Treatment Efficacy from Year 1 (2021)

Careful spot treatment of PAVA trellising up within *Grindelia* succeeded in killing the invasive with minimal damage to the native

Treated PAVA reduced to brown mats of dead biomass as well as open mud, with <5% regrowth and great preservation of native *Grindelia*

Treatment Efficacy from Year 1 (2021)

Annual pickleweed colonizing footprint where PAVA was treated in 2021 in Island Pond A19, with <5% regrowth of the invasive

Dead tussocks of PAVA with minimal regrowth & competitive release of other plants

Treatment Efficacy from Year 1 (2021)

Coyote Creek Lagoon north

San Francisco Estuary PAVA epicenter

within native marsh habitat

10,971 m^2 treated with imazapyr in 2021

746 m^2 mapped in same footprint in 2022 & subsequently treated in Year 2

That's a 93% reduction after just one year!!

Amazingly, the southern half of the lagoon was surveyed and IS actually that clear of PAVA

Invasive *Paspalum vaginatum* in San Francisco Estuary

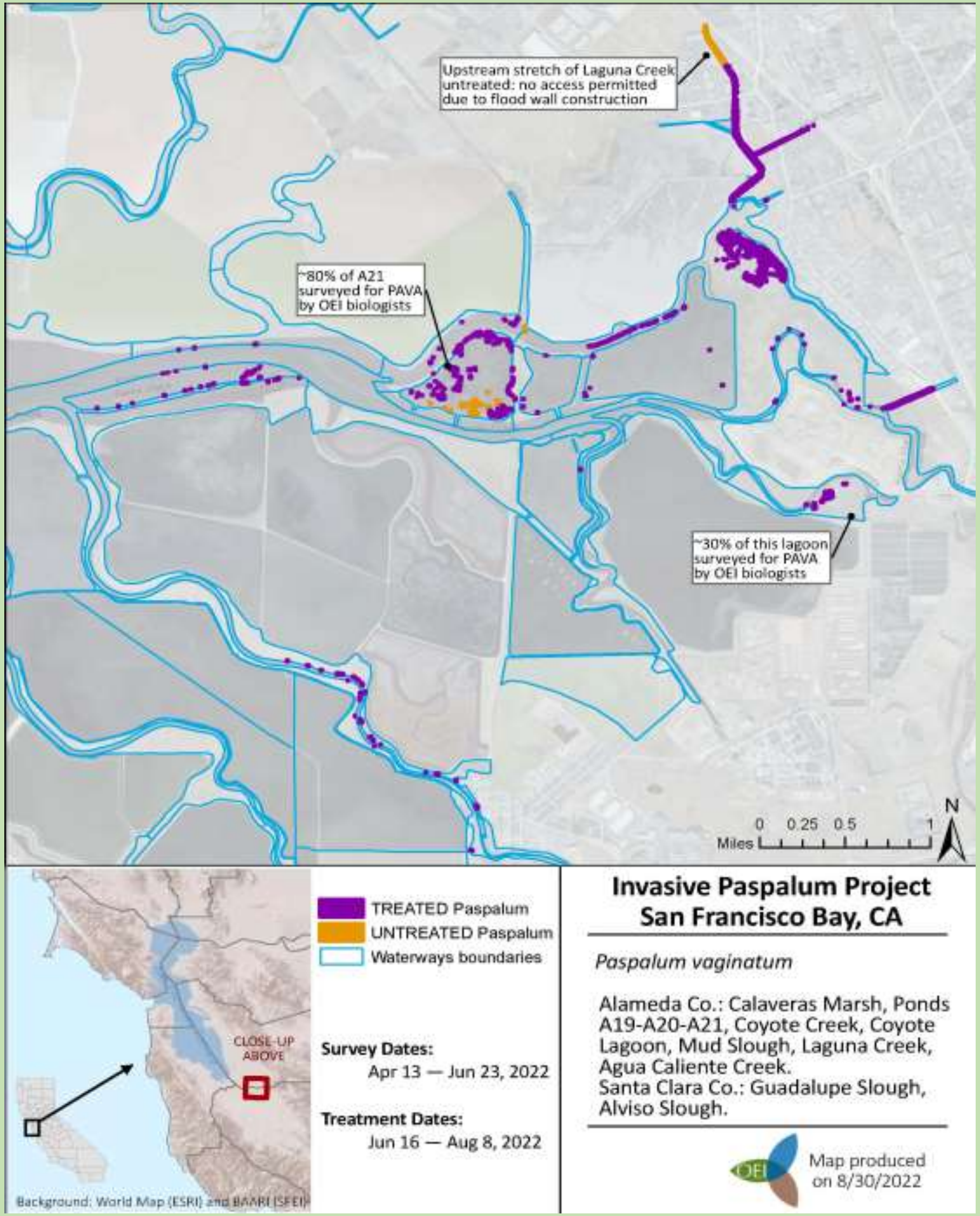
Net cover of PAVA mapped in initial project area **2021** = 14,835 m^2 (3.67 ac.)

Treated PAVA net cover **2021** = 13,945 m^2 (3.45 ac.)
94% of what was mapped

Net cover of PAVA mapped across entire project area **2022** = 17,816 m^2 (4.40 ac.)

Treated PAVA net cover **2022** = 14,441 m^2 (3.57 ac.)
81% of what was mapped

Total peak infestation summing initial mapping from 2021 & 2022 pre-treatment = approximately 30,000 m^2 net (7.4 ac.)

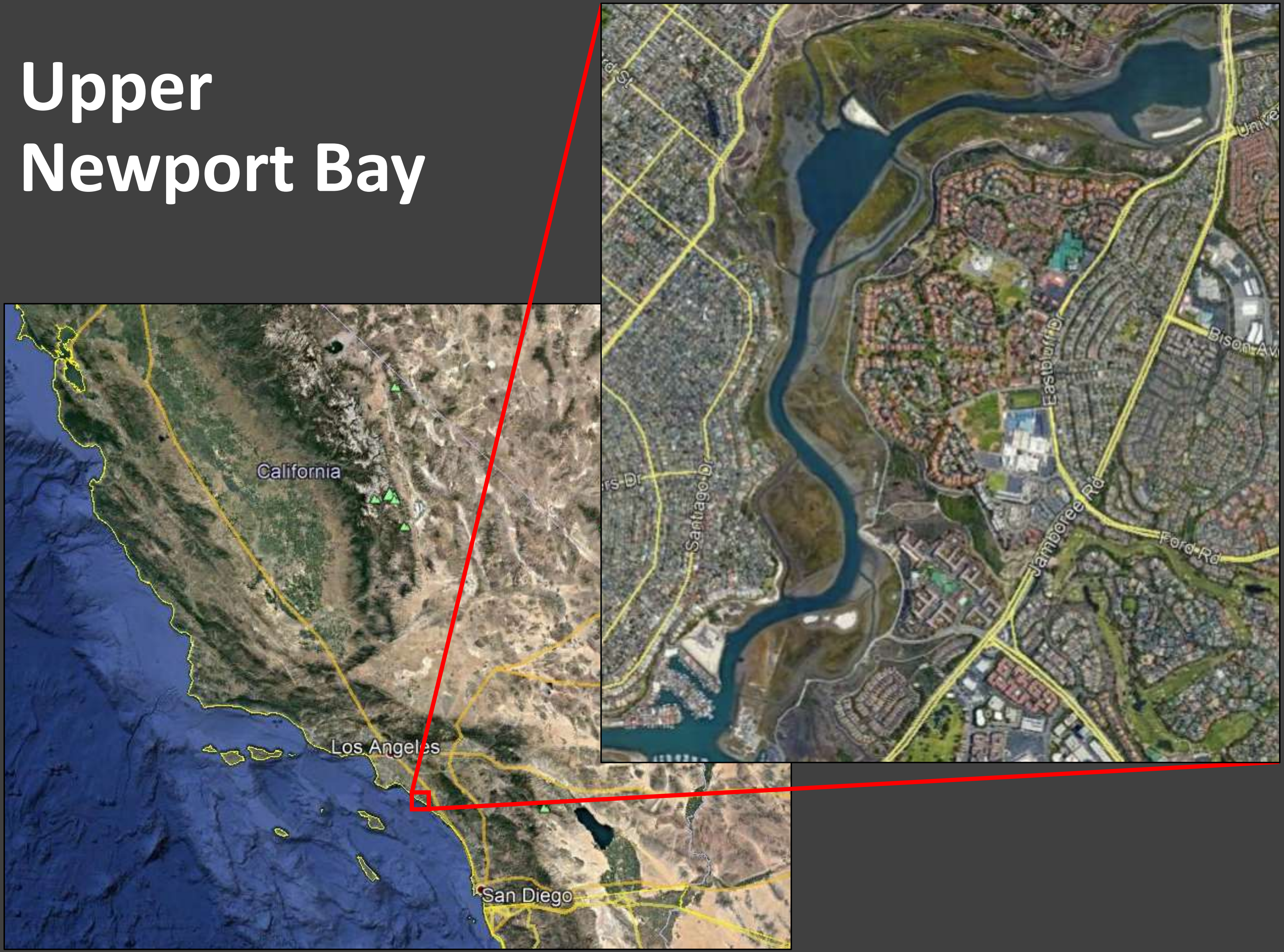


Chronology of a Relatively Early Detection & Rapid Response for PAVA in San Francisco Estuary

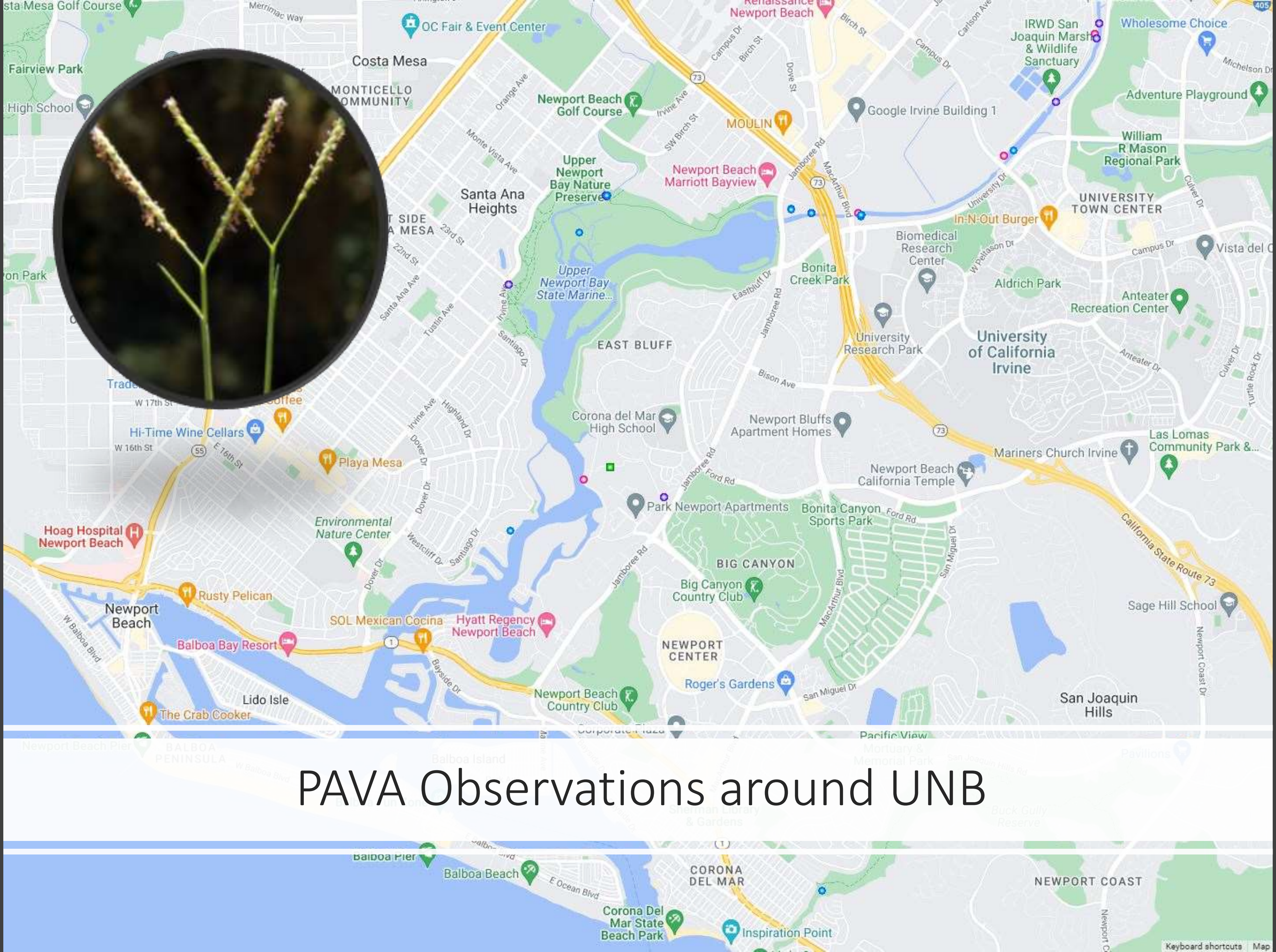
- Called out in the annual Weed Alerts at the 2020 Cal-IPC Symposium
- Field confirmation of the presence of PAVA generated conversations with landowners & managers
- South Bay Salt Pond Restoration Project stepped up with interim funding in 2021 (& 2022) to begin to delimit the scope of the problem and initiate management actions
- DENWR awarded an ED/RR grant from USFWS for 2023-2024 PAVA management

Illustrates importance of vigilance by knowledgeable biologists/stewards to protect biodiversity

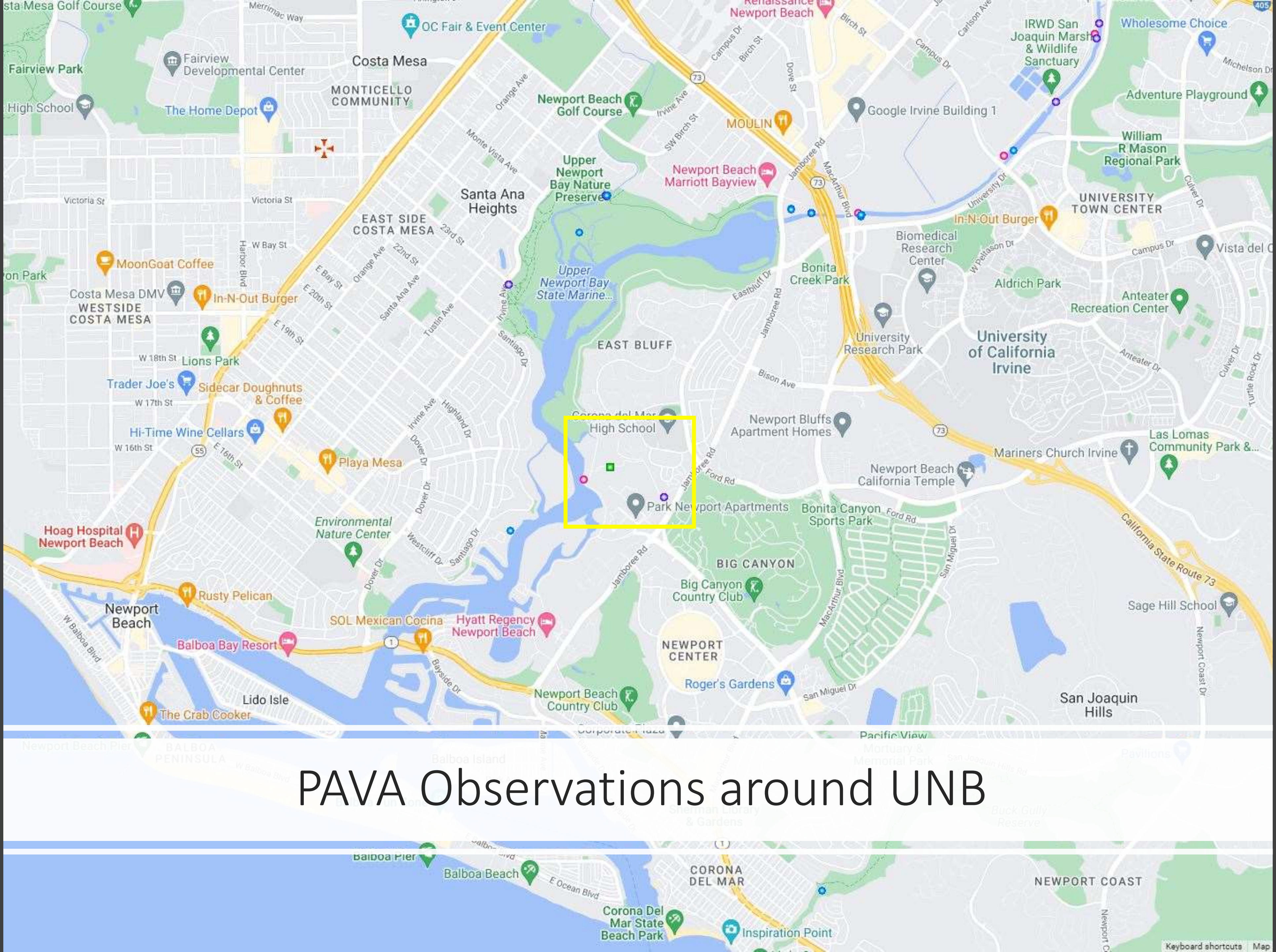
Upper Newport Bay



PAVA Observations around UNB



PAVA Observations around UNB

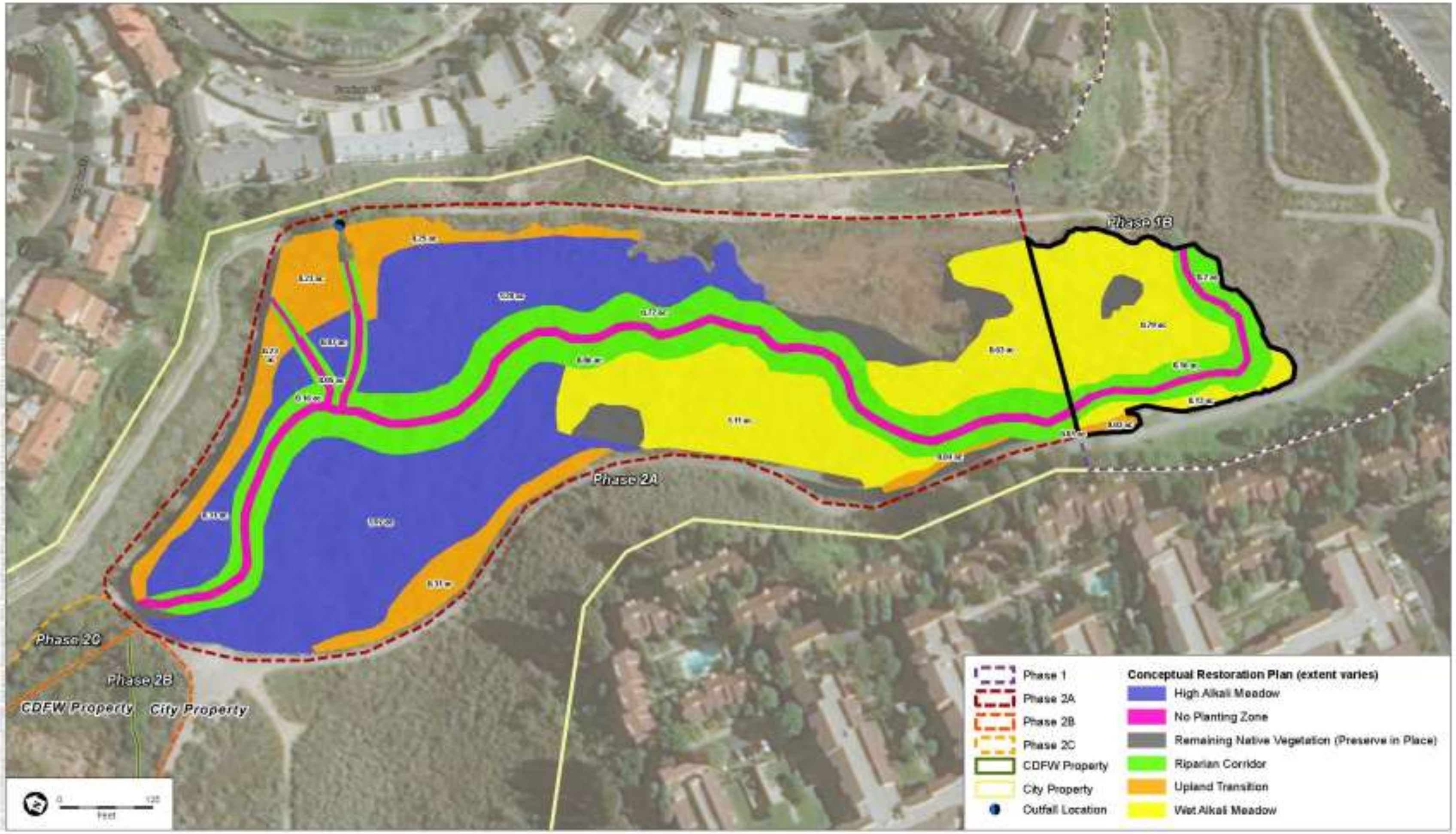


Back Bay Dr
Domingo Dr
Park Newport
Big Canyon Creek
Existing Road
Jamboree Rd
Big Canyon Country Club
Big Canyon Dr
Phase II
Phase 2A: Coastal Canyon Creek and Riparian Restoration - Includes Areas of Non-tidal Alkaline Marsh (9.61 acres)
Phase 2B: Coastal Canyon Creek Restoration Selenium Management of Impacted Pond Reeds and Sediment (4.83 acres)
Phase 2C: Removal of Invasive Pepper Trees and Creation of Transitional Zone Habitat for SLR Adaptation (4.34 acres)
Phase I: Creek and Riparian Habitat Restoration
Parcel Boundaries
City of Newport Beach property
California Dept. of Fish & Wildlife Property
0
400
Feet









SOURCE: ESRI; Dudek; ESA

Big Canyon Restoration - Phase 2A

Figure X
As-Built Restoration Plan


Aquatic Complex
Corona del Mar High School
Avenida Campo
Vista Bonita
Barranca
Mar Vista Dr
Big Canyon Trail
San Bruno
Baja
Vista Bonita
Mar Vista Dr
Big Canyon Trail
Fire Rd
Fire Rd
Domingo Dr
Our Lady Queen of Angels Catholic Church
Domingo Dr
Big Canyon
Big Canyon Trail
Newport Bay Marine Protected Area
Domingo Apartments
Domingo Dr
Domingo Pines Apartments
Millennium Digital Media
Back Bay Bluffs Spur
Back Bay Bluffs Spur
Fire Rd
Back Bay Slope
Amigos Way
Jamboree Rd
Mountains to the Sea Trail & Bikeway
Roadside Assistance Newport Beach
English Los Angeles
Jamboree Rd
Park Newport
Terry A Worsdell CPA
Park Newport
Park Newport Apartments

Working towards the goal of healthy, resilient NATIVE marshes

Ongoing stewardship is essential

to maintain the health of our marshes & guard against future threats