BAYLANDS CHANGE BASEMAP:
Mapping Progress Toward Habitat Restoration Goals

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Why is this map needed?

Co-created with the **Wetland Regional Monitoring Program's** (WRMP) Geospatial Workgroup, the Baylands Change Basemap serves as a fundamental component for tracking bayland habitat change over time. It updates the existing map of tidal habitats and diked baylands, reflecting the significant changes in distribution over the past decade that has limited our understanding of the full impact of recent bayland habitat change and restoration efforts.

Funded by the **USEPA Water Quality Improvement Fund**, the Baylands Change Basemap establishes a new starting point for change detection via repeated mapping every 4-6 years, **guiding restoration efforts and informing regional adaptation practices** around San Francisco Bay.

How was the map developed?

Development of the Basemap utilized advanced **Object Based Image Analysis** (OBIA) techniques, including segmentation and classification, facilitated by the use of Trimble's eCognition software. Relative tidal elevation played a pivotal role, with modeled data establishing the relationship between tidal datums and digital elevation models (DEMs), forming the foundation for the initial mapping and hydrologic connectivity. A detailed habitat type key with clear definitions guided the classification process and will ensure consistency in future mapping efforts to support change analysis.

Integration of various data sources ensured comprehensive coverage and accuracy. These sources included the latest Lidar available and its derivatives (including slope and geomorphons), as well as the National Agriculture Imagery Program (NAIP) 2020 dataset, incorporating spectral indices for enhanced analysis. Additionally, the San Francisco Bay Shoreline Inventory provided crucial contextual information. Through this **meticulous ruleset process,** the Basemap's development achieved a high level of detail and reliability. By leveraging advancements in automated OBIA, this mapping effort **enables regular cost-effective updates and change detection analysis,** significantly increasing the value of this approach.
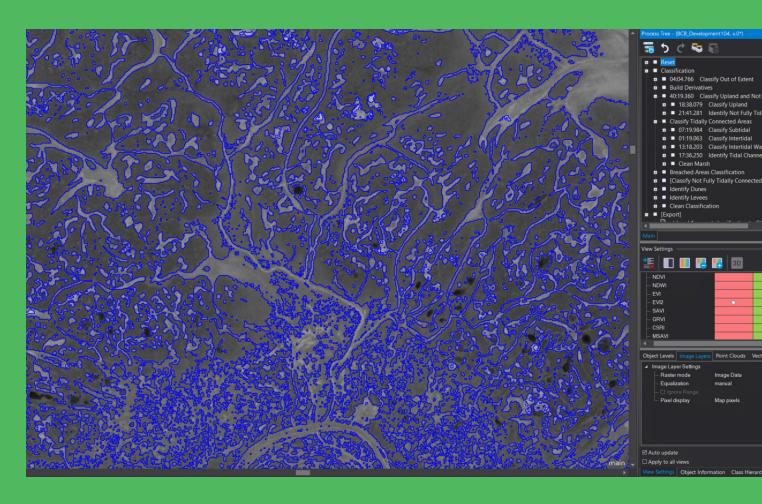

Fig 2. eCognition was used to support OBIA, through segmentation and the development of a rule based model, leveraging LiDAR, 60cm four band imagery, tidal datums, and local knowledge captured in vector layers.

Fig 3. Schematic illustrating how tidal datums relate to relative elevation (z*) values. It also shows how different relative elevation ranges are suitable for different habitat types.
From: SFEI and SPUR. 2019. San Francisco Bay Shoreline Adaptation Atlas: Working with Nature to Plan for Sea Level Rise Using Operational Landscape Units. Publication #915, San Francisco Estuary Institute, Richmond, CA
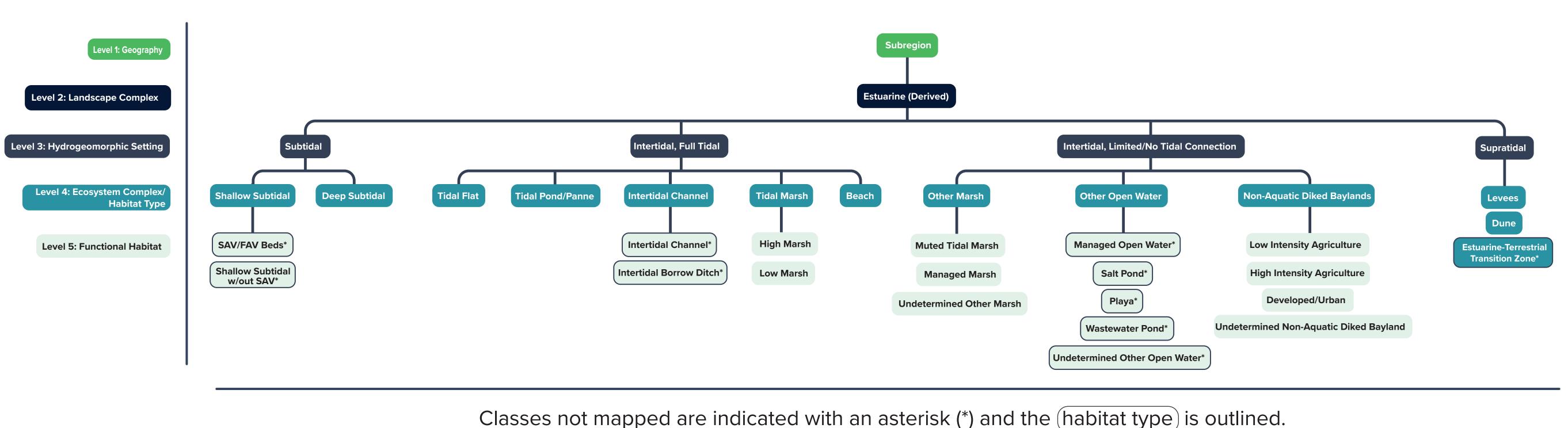

Fig 4. BCB uses the estuarine portion of the WRMP Habitat Classification System and maps to the **Level 4 classification: Ecosystem Complex/Habitat Type.**
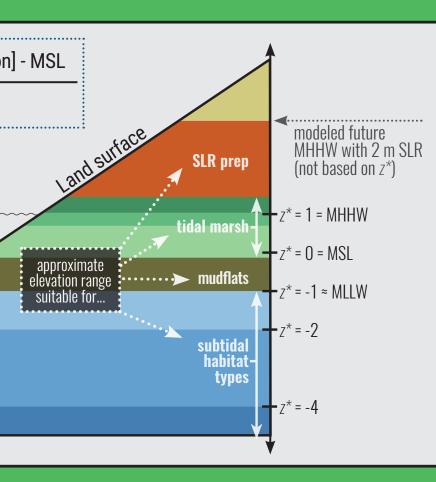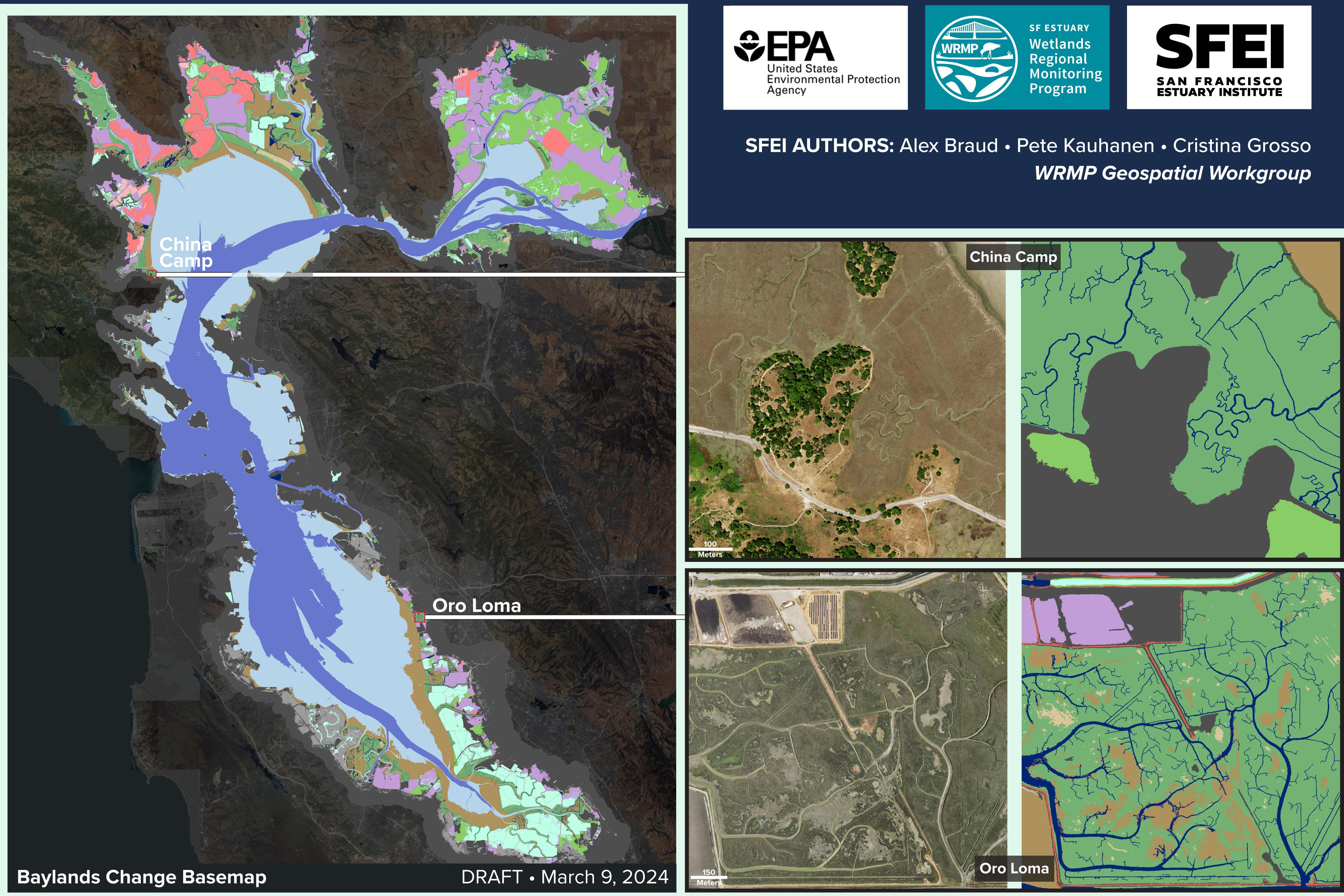
Classes not mapped are indicated with an asterisk (*) and the (habitat type) is outlined.

Baylands Change Basemap — DRAFT • March 9, 2024

Fig 1. Baylands Change Basemap, showing habitat classes and mapping extent.

China Camp
Oro Loma
Fig 5. Detailed examples of two mapped areas (China Camp, top, and Oro Loma restoration, bottom) depicting the NAIP 2020 imagery on left and the resulting Baylands Change Basemap classifications on the right.

Habitat Class

- Shallow Subtidal
- Deep Subtidal
- Tidal Flat
- Marsh Panne
- Tidal Channel
- Low Marsh
- Intertidal Marsh
- Beach
- Other Marsh
- Other Open Water
- Low-Intensity Agriculture
- High-Intensity Agriculture
- Non-Aquatic Diked Bayland
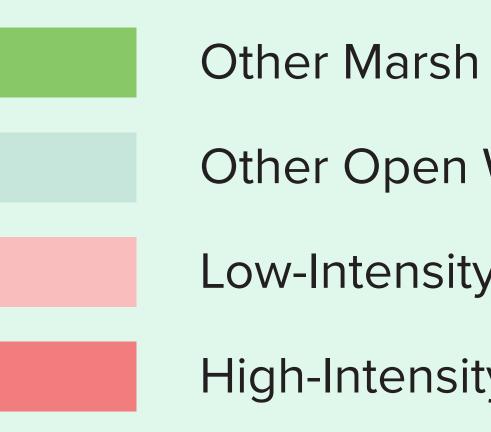- Developed/Urban
- Levees
- Upland

How will the map be used?

The Baylands Change Basemap will be a **fundamental component of the WRMP,** serving as a common reference map to help coordinate baylands protection, monitoring, and restoration across the region. Change detection techniques will be employed to identify and quantify changes in bayland ecosystems. It will be used commonly by public agencies to visualize and **track baylands projects and regional restoration goals in EcoAtlas** (ecoatlas.org).
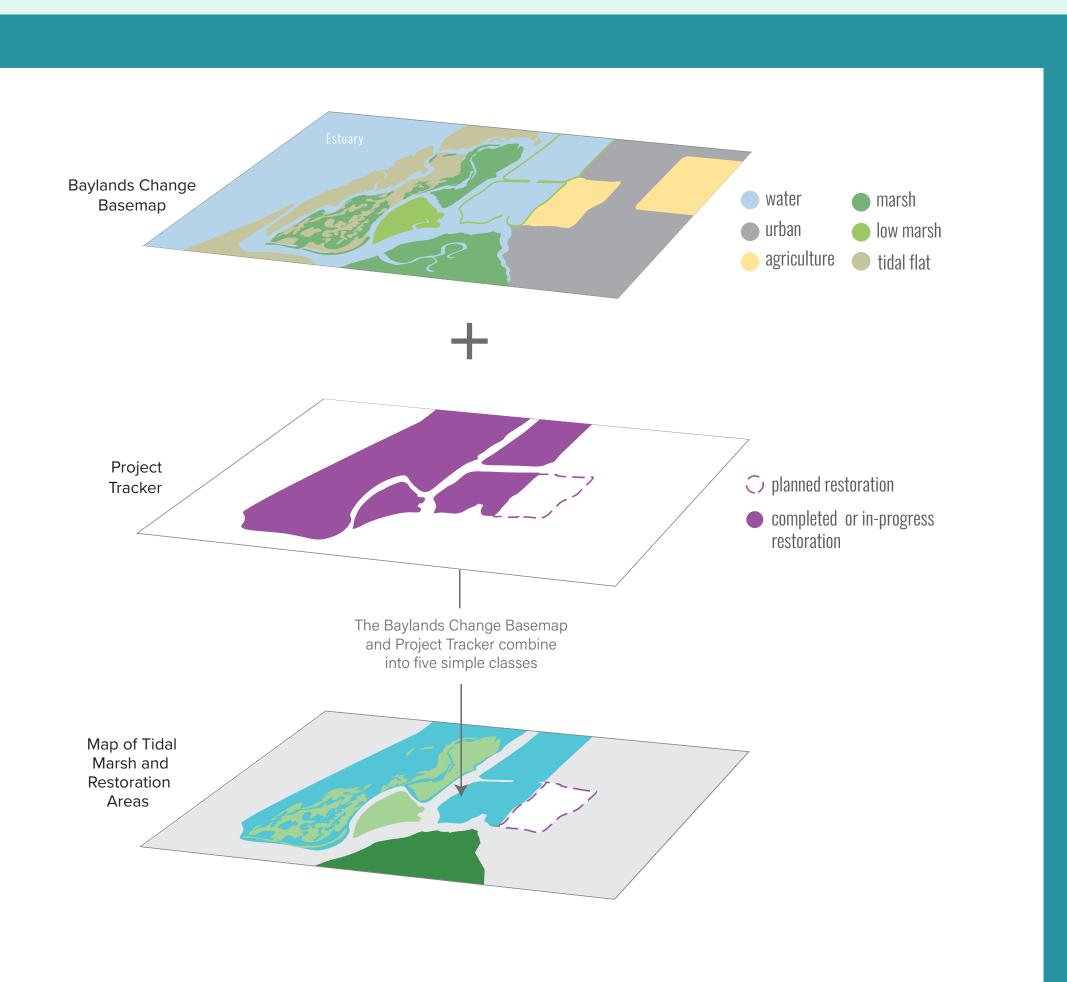
Furthermore, this foundational map will continue to feed into co-developed metrics to **assess bayland resilience and change** in support of WRMP goals and the Baylands Resilience Framework. This framework offers tangible tools to inform targeted projects, utilizing resilience metrics for site design and planning. It provides essential regional context for prioritization, **enabling informed decision-making** for planners, regulatory agencies, and community-based organizations.