LOW-COST AERIAL SURVEY METHODS

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Coastal Environments

Introduction

- Aerial survey methods vary from taking simple photographs to using a digital video camera, GPS and image processing techniques.
- We will present three case studies where aerial surveys (utilizing a small airplane and digital camera) proved useful for addressing coastal problems.
- These case studies address three different problems, showing the wide applicability and value of this technique.

Aerial Survey Methods

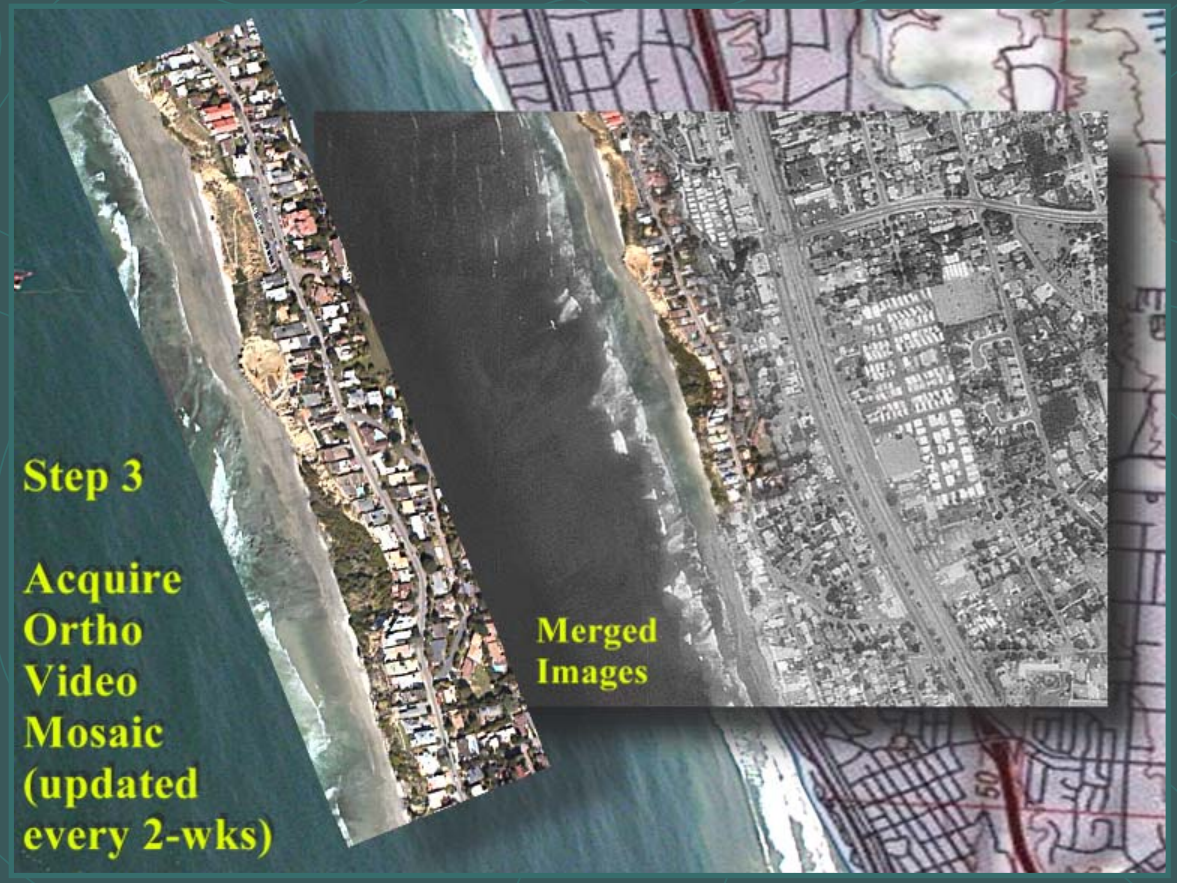
For all three cases presented, the system consisted of:

- Airplane Platform
- Remote Sensing System
- Image Processing Procedures
- Ground-Truthing

Ultra-Lite Aircraft

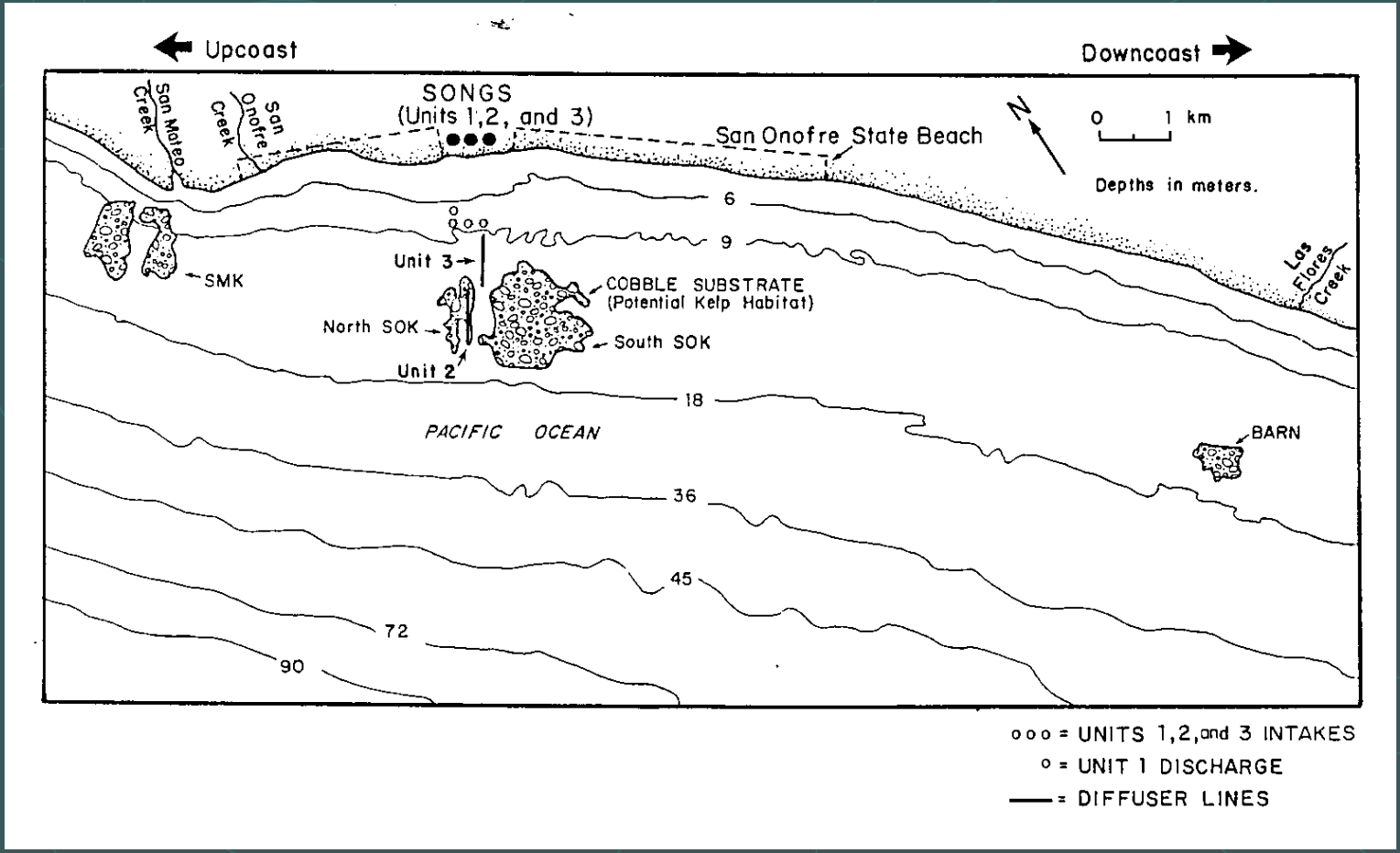
GT500 Model.

High-Resolution Remote Sensing



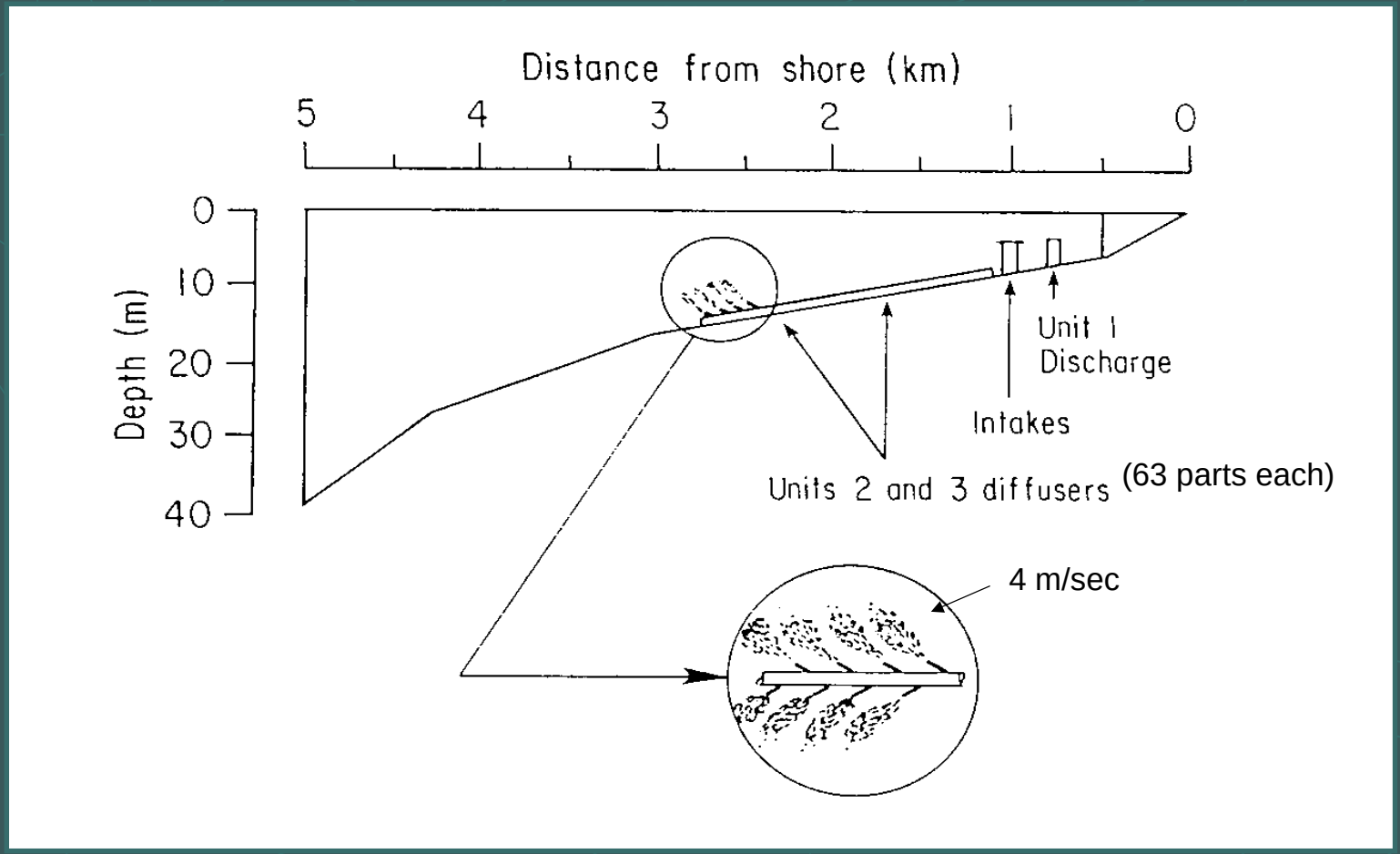
Ortho-Rectified and Geo-Referenced the Images using PCI Geo-Works Software.

Case 1: Thermal Plume Monitoring



Location of San Onofre Nuclear Generating Station (SONGS) cooling system.

Case 1: Cooling System

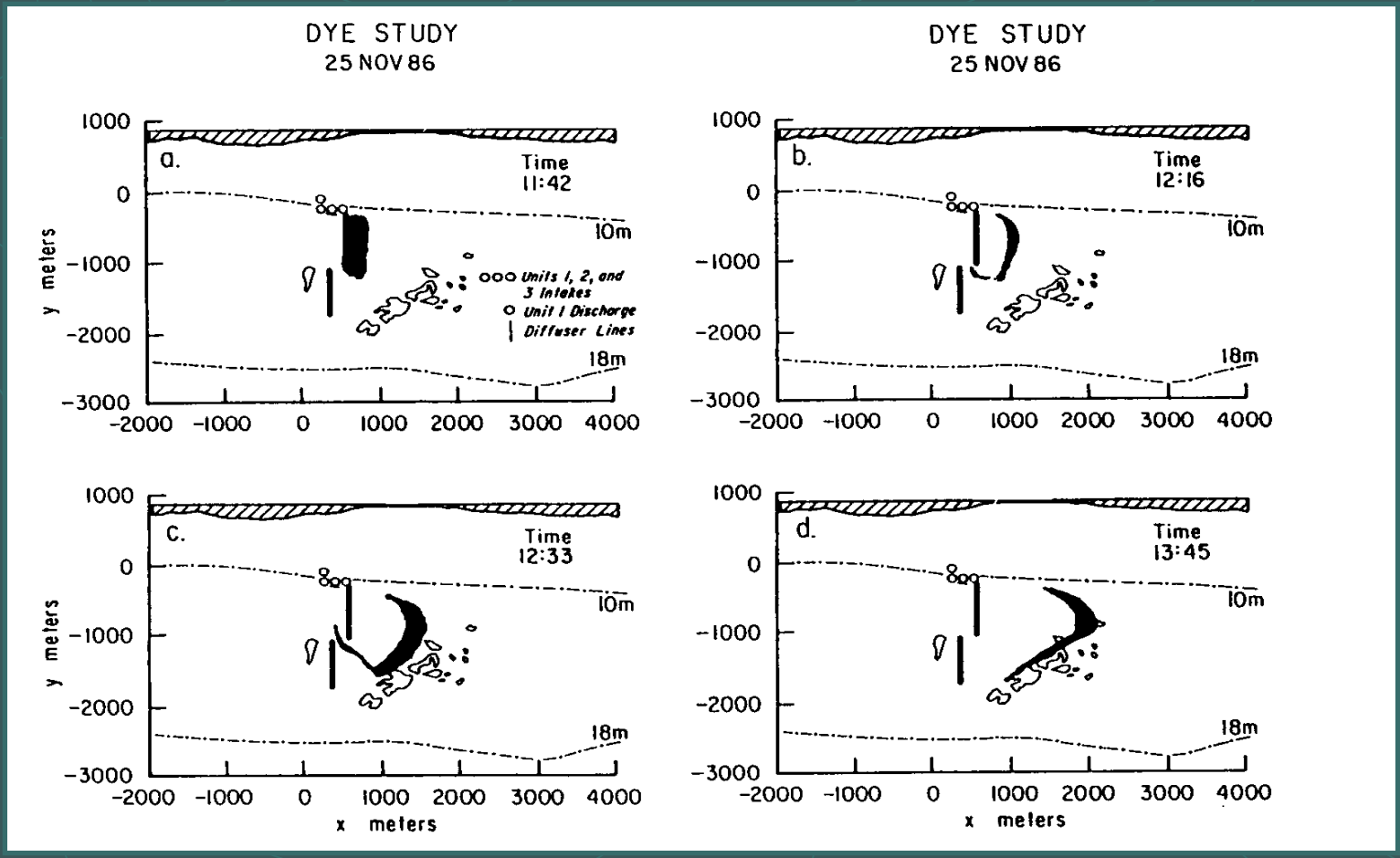


Profile of offshore cooling system of SONGS.

Case 1: Upcoast Plume (North Current)

Aerial photograph taken in August 1986, showing upcoast plume with sharp boundaries from diffusers of Units 2 and 3.

Case 1: Downcoast Plume (South Current)



Location of 25 November 1986 dye stripe as moved alongshore.

Case 1: Interaction of Down Coast Plume with Nearshore Turbidity

Aerial photograph taken in December 1986, showing downcoast plume with nearshore turbidity extending offshore.

Case 1: Thermal Plume Monitoring Conclusions

- Photos synoptically documented turbidity plume (*surface shape, location, and extent of plume)*.
- Provided insight into discharge interaction with other nearshore oceanographic parameters (water temperature and stratification).

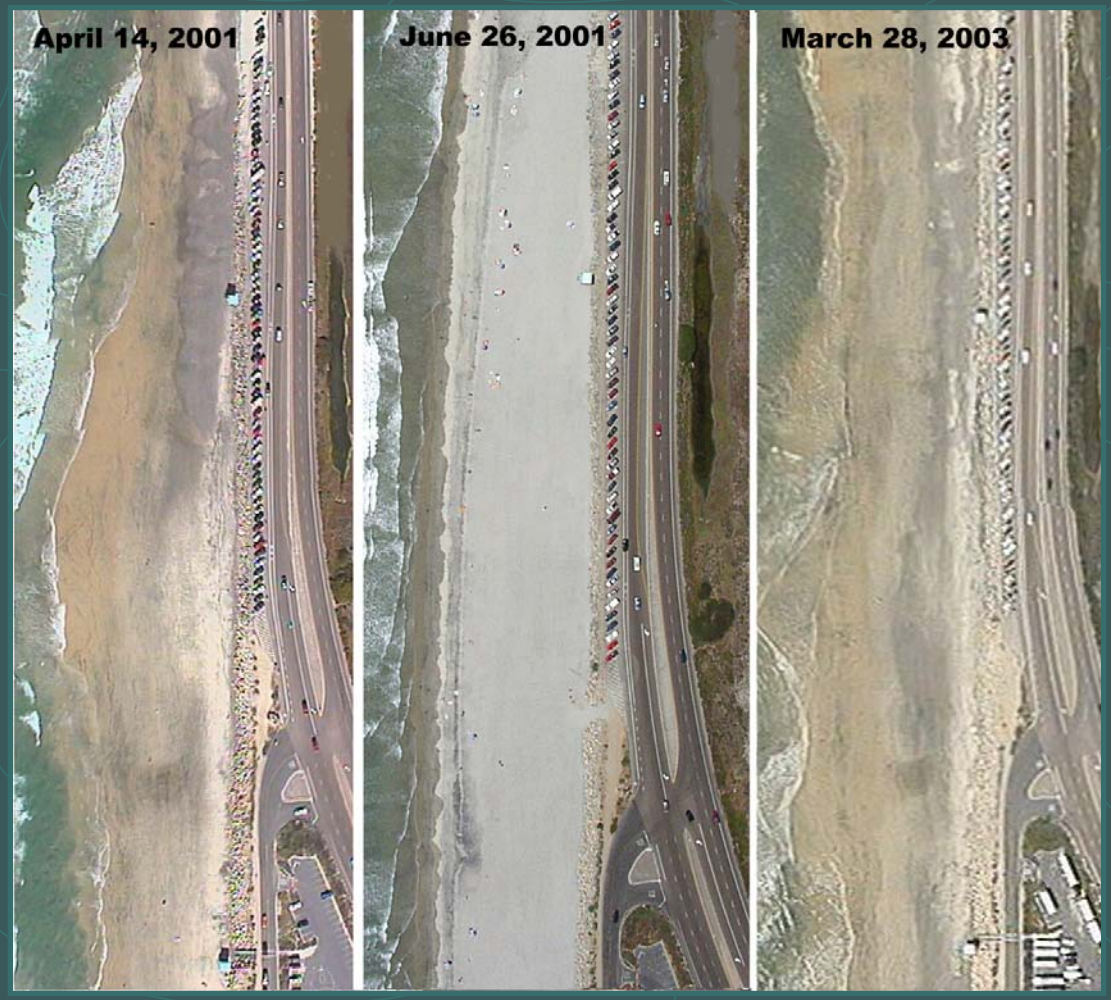
Case 2: Beach Sand Dispersion Tracking

- During Spring and Summer 2001, 12 beaches at San Diego, California were chosen to receive sand from six offshore borrow sites along the coast, whereby sand was dredged and transported to the beach via pipe. Heavy equipment then distributed sand on the beach. On average every site received 260,000 yd^3. Project conducted by SANDAG.

Case 2: South Carlsbad Beach Before, Immediately After, and 2 Years Later

Photograph showing South Carlsbad Beach before and after 260,000 yd^3 of sand placement on the beach in April 2001.

Case 2: Torrey Pines Beach Before, Immediately After, and 2 Years Later

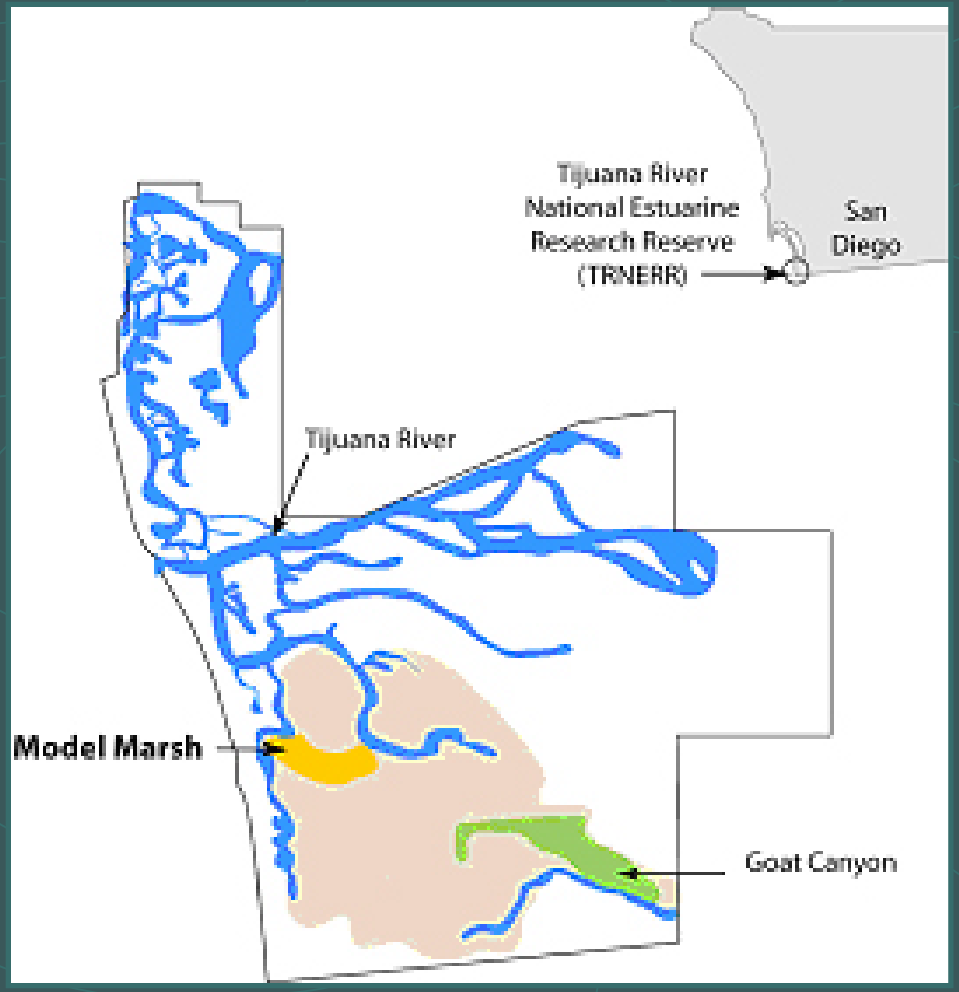


Photograph showing Torrey Pines Beach before and after 260,000 yd^3 of sand placement on the beach in April 2001.

Case 2: Beach Sand Dispersion Tracking Conclusions

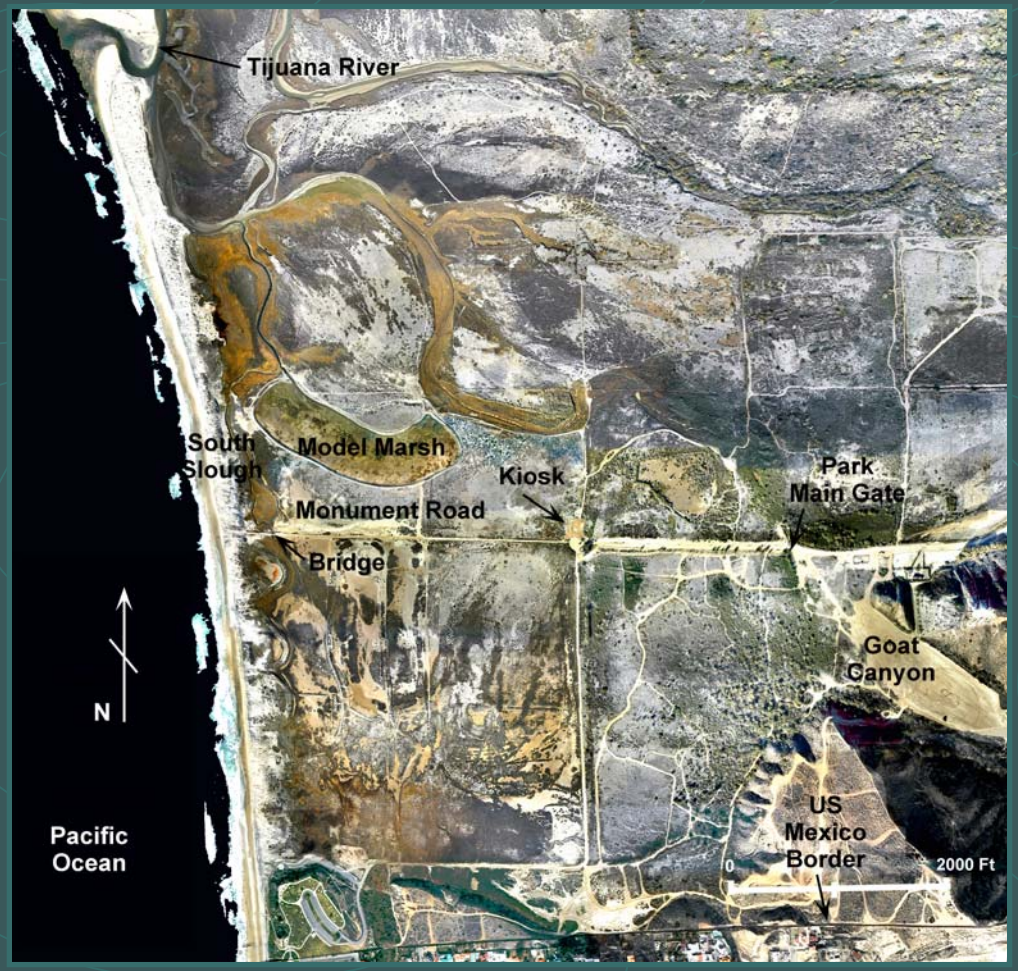
- Residence time of Sand on the beach was addressed using aerial photos that provided data showing a rough estimate of beach width change over a large area at more frequent intervals and at a more reasonable cost.

Case 3: Sedimentation of Southern Tijuana Estuary



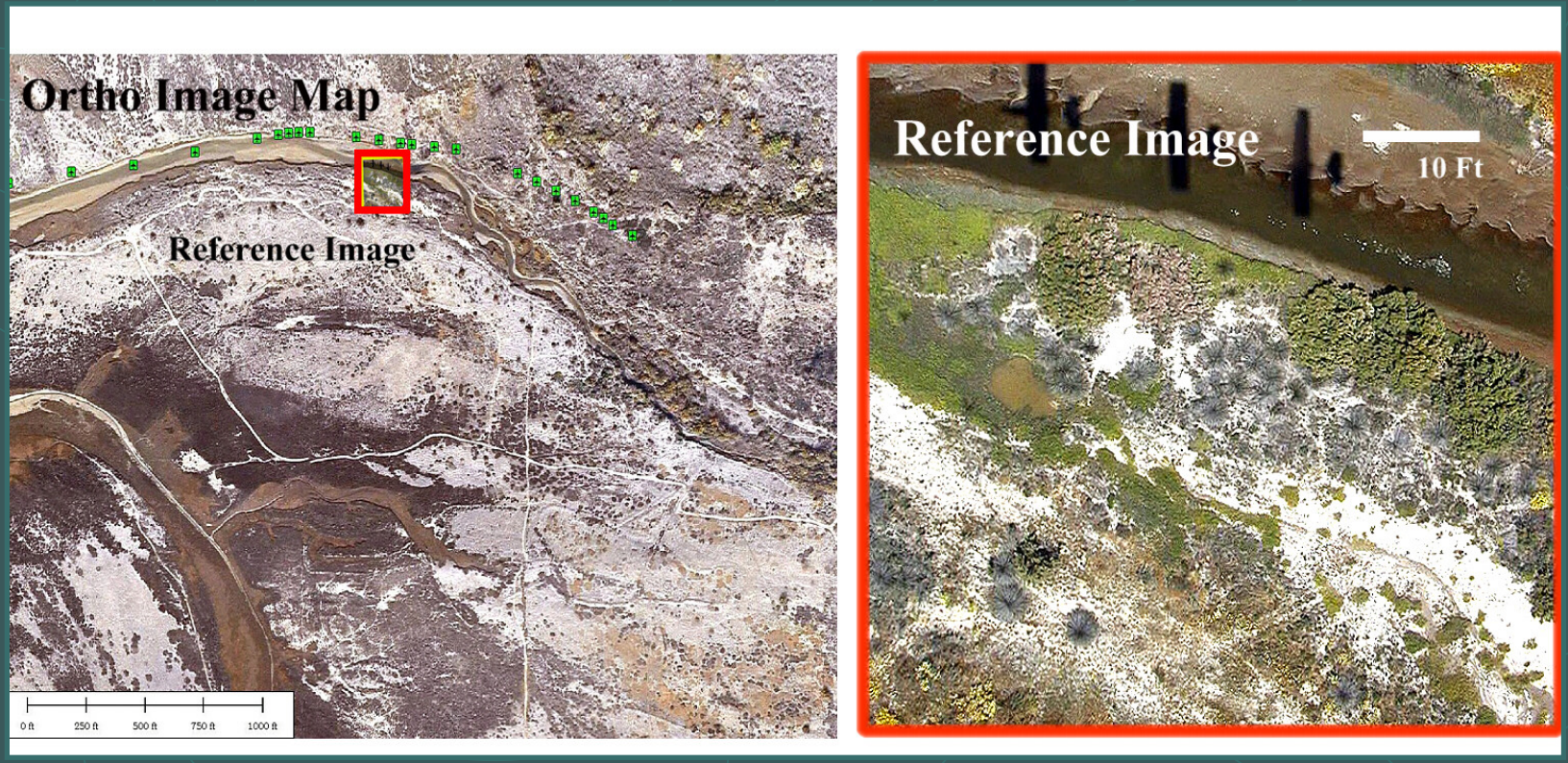
Location map of Tijuana Estuary showing the Model Marsh (Courtesy of Southwest Wetlands Interpretive Association).

Case 3: Aerial Photo taken in December '02



Aerial photograph of southern Tijuana Estuary and Model Marsh taken in December 2002, showing sand dispersion from Goat Canyon into the southern estuary.

Case 3: Ground Truthing



Ground-truthing using camera's 24:1 telephoto lens and flying at an altitude of 1000 ft (pixel resolutions of 1-2 inches. The square in the left photo is enlarged in the right photo to identify habitat and features.

Case 3: Sedimentation in Tijuana Estuary Conclusions

- The aerial survey produced detailed images of the southern estuary for mapping sediment coverage.
- Ground-truthing ensured accurate mapping of the sediment moving from Goat Canyon into the southern Tijuana Estuary.
- Aerial image mapping enabled us to design annual sediment monitoring program by providing a good representation of the locations of survey transects and sediment pipes in order to quantify the annual volume of sand delivered to the estuary.

General Conclusions

- Low-cost aerial survey methods are especially valuable for studies that require large-scale spatial coverage.
- For example, aerial surveys and ground-truthing provide cost-effective ways to delineate wetlands and watersheds and to monitor plumes, pollutant dispersion, and beach width changes.
- These methods are also particularly valuable when access is limited because the coast is surrounded, either by high cliffs or by private property.
- The value of these techniques increases still further when they are combined with conventional methods.
- Although these techniques are, at times, only capable of providing qualitative information, this information is often very useful for assessment.