QAPP

FOR

ENIRONMENTAL MONITORING AND ASSESSMENT PROGRAM
WEST COAST PILOT 2002 INTERTIDAL ASSESSMENT: CALIFORNIA INTENSIFICATION

Amendment to: Environmental Monitoring and Assessment Program National Coastal Assessment Quality Assurance Project Plan 2001-2004

by

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CONTENTS

A. PROJECT MANAGEMENT

1. INTRODUCTION

The purpose of this document is to provide a quality assurance project plan (QAPP) for the California Intensification of the EMAP West Coast Pilot 2002 Intertidal Assessment. This document supplements the *National Coastal Assessment Quality Assurance Project Plan 2001-2004* (U.S. EPA 2001a), the *National Coastal Assessment: Field Operations Manual* (U.S. EPA, 2001b) and the standard operating procedures established for the EMAP West Coast Pilot 2002 Intertidal Assessment (Lamberson et al. 2002).

2. GOALS

The EMAP Western Pilot is a five-year effort led by EPA's Office of Research and Development to advance the science of monitoring ecosystem health and to demonstrate the applicability of EMAP assessment tools. The overall objective is to assess estuarine condition through an integrated comprehensive coastal monitoring program along the West Coast (including Alaska and Hawaii). It is also intended to demonstrate the value of survey-based monitoring by applying these techniques to problems of regional and state interest. In 2002, EMAP is conducting an assessment of estuarine intertidal wetland condition in California, Washington, and Oregon, with an intensification of assessment effort in the California regions of San Francisco Bay and southern California. These activities advance EMAP's goal of expanding its program into wetlands, and provide continuity with data management and quality assurance procedures established in the previous years.

3. ORGANIZATION

The overall organization of project and tasks is maintained as is presented in the *National Coastal Assessment Quality Assurance Project Plan 2001-2004* (US EPA 2001a), with the additions of Martha Sutula (SCCWRP) and Josh Collins (SFEI) acting as the coordinators for the intensification efforts in southern California and San Francisco Bay respectively.

4. PROJECT DESCRIPTION

The 2002 Intertidal Assessment will expand previous EMAP assessment of subtidal and intertidal mudflat habitat to sample the intertidal mudflat and emergent macrophyte (marsh) habitats, with the following specific objectives:

1) Provide a statewide estimate of intertidal wetland condition for a core indicator set;
2) Intensify the assessment effort in southern California and the San Francisco (SF) Bay area;
3) Develop and apply additional indicators appropriate for wetland intertidal habitat.

Assessment efforts will be intensified in southern California and the SF Bay area in order to serve the information needs of local, well-established coastal zone management units in those regions. These coastal

zone management units are represented by the Southern California Wetland Recovery Project1 (WRP) and the San Francisco Bay Area Wetlands Regional Monitoring Program (WRMP)2, which were formed via cooperative agreement among the local, state, and federal agencies involved in wetland conservation, restoration, and management in their respective regions. Intensification in southern California and SF Bay will allow an independent estimate of wetland intertidal condition, which will allow EMAP to serve a management audience with data that would not be as useful if delivered as a statewide estimate alone. To achieve this, 30 sites will be randomly allocated along the California coastline, and 30 will be allocated to each of the two intensification regions.

Intensification of assessment in southern California and the SF Bay area also allows for the pilot study of additional indicators not included in the core set. Historically, EMAP assessments have focused on sediment contamination. While this issue is of great interest in southern California and the SF Bay areas, there are other important issues that are more specific to the intertidal wetland habitat, such as habitat fragmentation, threatened and endangered native species, the spread of non-indigenous species, modification of tidal flushing, and the impacts of urbanization of watersheds on wetland hydrology, water quality and habitat, etc. As part of the intensification effort, southern California and the SF Bay area will measure several new indicators to demonstrate the applicability of collecting such information using an EMAP probability-based survey. Tables A.1 and A.2 present the Core Indicators (conducted at 90 sites in California) and Intensification Indicators (conducted at 60 sites in San Francisco Bay and southern California)

Table A.1. EMAP Core Indicators

Core Indicators for Each EMAP Station ($1m^2$ Plot) (Details in Lamberson et al. 2002)	Type of Data Collection
Tidal water temperature, depth, salinity	Field Plot
Sediment pore water salinity	Field Plot
Sediment bulk density	Field Plot
Sediment % organic carbon	Field Plot
Sediment % N	Field Plot
Sediment % P	Field Plot
Sediment grain size	Field Plot
Sediment inorganic contaminants (see Lamberson et al. 2002 for list)	Field Plot
Sediment organic contaminants (see Lamberson et al. 2002 for list)	Field Plot
Benthic species richness	Field Plot
Plant biomass	Field Plot
SAV or macroalgal percent cover	Field Plot
SAV maximum shoot length	Field Plot

1 The WRP is a partnership of 17 state and federal agencies working to implement a regional plan for wetland recovery in southern California. A list of partner agencies in the WRP can be found on the California Coastal Conservancy website (http://www.coastalconservancy.ca.gov/scwrp/index.html)

2 The WRMP is a partnership of 16 state and federal agencies plus local governments and NGOs working to develop a regional program of wetlands monitoring and assessment in the S.F. Bay area.

Emergent macrophyte species richness,	Field Transect
Emergent macrophyte species density	Field Transect
Emergent macrophyte species maximum stem or shoot length	Field Transect
Percent of macrophyte species as non-indigenous species (NIS)	Field Transect

Table A.2. EMAP Intensification Indicators

Intensification Indicators (Details in Sections B.2.1-.3 of this document)	**Data Source**
Plant community composition and percent cover for drainage system	Field Transect
Wrack line trash composition for drainage system	Field Transect
Threatened/endangered species for patch	Records/reports
NIS plants for patch	Records/reports
Management objectives for patch	Records/reports
Number of recreational facilities and annual visitors for patch	Records/reports
Total annual POTW, industrial, power plant discharge for watershed	Records/reports
Human population density for watershed	GIS
Human population age structure for watershed	GIS
Habitat connectivity for patch	GIS
Intertidal channel density for patch	GIS
Total acreage for patch	GIS
Total perimeter for patch	GIS
Shoreline complexity index for patch	GIS
Shape index for patch	GIS
Adjacent land cover for patch	GIS
Size class distribution for all patches	GIS

5. DATA QUALITY OBJECTIVES (DQOs)

Data quality objectives (DQOs) for the California Intensification of the EMAP West Coast Pilot 2002 Intertidal Assessment are consistent which those presented in the *National Coastal Assessment Quality Assurance Project Plan 2001-2004* (US EPA 2001a). Measurement quality objectives (MQOs) for the various measurements made in the intensification assessment, expressed in terms of accuracy, precision, and completeness goals, are presented in Table A.3. These MQOs were established by obtaining estimates of the most likely data quality that is achievable based on either the historical data or best professional judgment.

Table A.3. Measurement quality objectives for the California Intensification indicators of EMAP West Coast Pilot 2002 Intertidal Assessment. Indicator type specifies the type of assessment activity (field transect, secondary data collection from reports/interviews, or geographic information system (GIS)). Accuracy (bias) goals are expressed either as absolute difference (+/- value) or percent deviation from the "true" value; precision goals are expressed as relative percent difference (RPD) or relative standard deviation (RSD) between two or more replicate measurements. The completeness goal is the percentage of expected results that are obtained successfully.

Indicator	Indicator Type	Maximum Allowable Accuracy (Bias) Goal	Maximum Allowable Precision Goal	Completeness Goal
Plant community:				
Composition	Field	10%	NA	100%
Percent cover	Transect	20%	20%	100%
Wrack line trash				
Composition	Field	10%	NA	100%
Percent Cover	Transect	20%	20%	100%
Threatened/endangered species	2ndary Data Collection	NA	NA	100%
Non-indigenous species (NIS) plants	2ndary Data Collection	NA	NA	100%
Management objectives	2ndary Data Collection	NA	NA	100%
Number of recreational facilities and annual visitors	2ndary Data Collection	NA	NA	100%
Total annual POTW, industrial, power plant discharge	2ndary Data Collection	NA	NA	100%
Human population density for watershed	GIS	10%	10%	100%
Human population age structure for watershed	GIS	10%	10%	100%
Habitat connectivity for patch	GIS	20%	20%	100%
Intertidal channel density for patch	GIS	20%	20%	100%
Total acreage for patch	GIS	20%	20%	100%
Total perimeter for patch	GIS	20%	20%	100%
Shoreline complexity index for patch	GIS	20%	20%	100%
Shape index for patch	GIS	20%	20%	100%
Adjacent land cover for patch	GIS	20%	20%	100%
Size class distribution for all patches	GIS	20%	20%	100%

6. DOCUMENTATION AND RECORDS

In general, documentation and recordkeeping for the California Intensification follow those guidelines established in the *National Coastal Assessment Quality Assurance Project Plan 2001-2004* (US EPA 2001a) and Lamberson et al. (2002). Each Intensification data value will be coded for its associated EMAP Core station. As per Lamberson et al. (2002), there will be a unique series of station codes for

each state. Each station code will include a state-specific two-character abbreviation (i.e., CA for California), year designator, and a sequential numerical value. For example, California's stations for field year 2002 will be coded CA02-01 through CA02-9999.

Whenever applicable, data values will be coded for their data types, as well as Core station reference. All data will also be coded for date of data collection and data collector.

Each indicator will have its own data sheet template. Examples of data sheet templates to be used are given in Appendix I. All raw data from completed data sheets will be transcribed into the computer database for each Intensification Project area within a reasonable time following data collection (target period one week). It is preferable that one person be responsible for all data entry for each indicator at each Intensification Project area. Accuracy and completeness of data entry from field sheets to the database will be checked by a supervisor. Completed hard copy intensification data sheets for each Core station will be compiled into a station package and copied to produce in-house working datasheets. Original data sheets and duplicates of all electronic data files will be archived by sponsoring state agencies. All electronic data files that have passed initial review by data collectors within each Intensification Project area will be transferred to the State IM coordinator for validation and for formatting review prior to being transmitted to the centralized Regional Information Management Node (IM Node), where additional validation screening and QC checks will be performed before the data are finally forwarded to the EMAP IM Center at EPA-AED. This QA/QC process is identical to what has already been authorized and implemented for previous years of the EMAP West Coast Pilot.

B. MEASUREMENT/DATA ACQUISITION

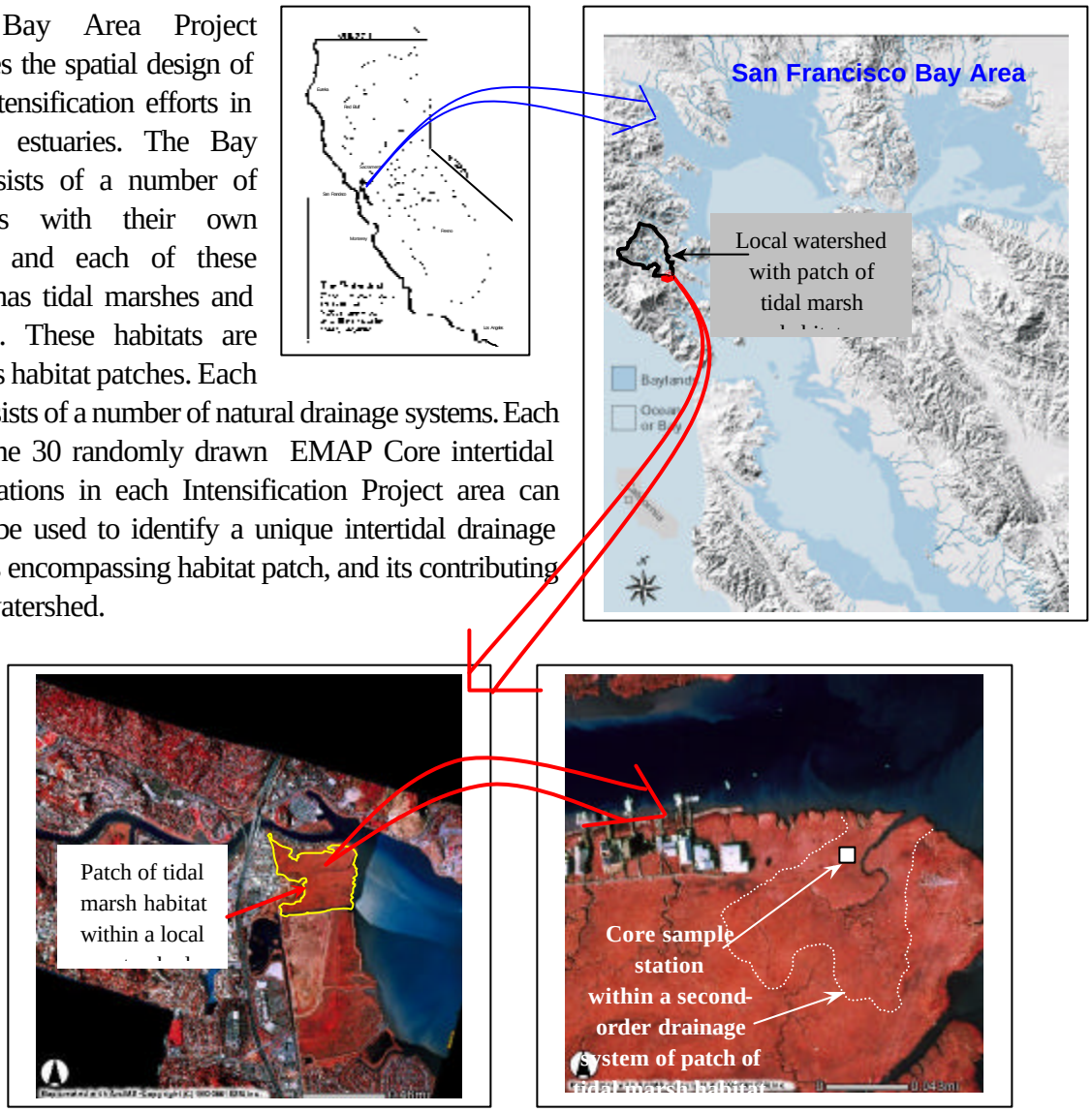
1. SAMPLING PROCESS DESIGN

The sampling process design utilized for the California Intensification of the EMAP West Coast Pilot 2002 Intertidal Assessment builds upon that established in the *National Coastal Assessment Quality Assurance Project Plan 2001-2004* (US EPA 2001a). The sampling protocols described here are designed to characterize condition and stressors in tidal marsh drainage systems and their encompassing tidal marsh patches and watersheds that contain randomly selected EMAP Core stations. According to EMAP standard practices, 30 1-m^2 Core sample plots are randomly selected from the total population of possible plots in each Intensification Project area. Each 1m^2 plot and a short line transect adjacent to the plot comprise a Core station. A variety of standard measures (Core indicators) are made within the selected plots and along adjacent transects using EMAP protocols, as described in Lamberson et al. (2002). The protocols described here are used to assess the stressors and/or condition of the watersheds, tidal marsh habitat patches, and tidal drainage systems to which the selected 1-m^2 plots belong (see Figure B.1). Since the Core stations are randomly selected, the associated drainage systems, patches, and watersheds are also randomly selected. This nested approach leads to statistical assessment of intertidal conditions at three spatial scales: Core stations, drainage systems that contain the Core stations, and habitat patches that contain the drainage systems. The nested approach also facilitates an assessment of watershed-level stressors that act on the intertidal habitats, drainage systems, and Core stations.

The California EMAP Intensification Projects in southern California and San Francisco Bay consist of three types of data: quantitative field surveys, qualitative data compiled from interviews and existing reports, and quantitative GIS analysis of aerial photography. The primary mode of analysis of these data will be to produce cumulative distribution frequencies (CDFs) of the indicator (of condition or stress) versus the percentage of drainage system, tidal wetland patch or watershed. Additional analyses will determine correlation between indicators of condition (e.g. plant community composition, trash composition) and stress (e.g. POTW discharge, human population density). Table B.1 lists the intensification indicators, the spatial scale of the data and units, units of X-axis on CDFs, and the type of data collection effort involved.

Managers within the project areas anticipate that the EMAP Intensification Projects will begin to answer some of their basic questions about the status and trends in the condition and stressors of intertidal habitats. Different questions pertain to the different spatial scales of the Project. At the watersheds scale and for each Project area as a whole, the main questions are about the distribution, abundance, and size of patches of tidal marshes and tidal flats, including restoration and mitigation projects. There is also concern about the effects of watershed outputs on the beneficial uses of individual habitat patches. It is generally understood that the intertidal habitats are physically linked to the rest of the world by the ebb and flow of energy and materials through their drainage systems, which also serve as natural, self-sustaining units of intertidal organization. The condition of these habitats can therefore be assessed based on examination of conditions within their representative drainage systems.

Figure B.1: San Francisco Bay example of the hierarchical spatial design and management rationale for the EMAP California Intensification Projects



The Bay Area Project exemplifies the spatial design of EMAP Intensification efforts in California estuaries. The Bay Area consists of a number of watersheds with their own estuaries, and each of these estuaries has tidal marshes and tidal flats. These habitats are mapped as habitat patches. Each patch consists of a number of natural drainage systems. Each Each of the 30 randomly drawn EMAP Core intertidal sample stations in each Intensification Project area can therefore be used to identify a unique intertidal drainage system, its encompassing habitat patch, and its contributing uplands watershed.

Table B.1. Intensification indicators, their spatial scale, units of assessments, and data sources (DS= drainage systems)

Intensification Indicators	Spatial Scale of Data	Indicator Data Units	Units of X-axis on Presentation Graphics	Basic Data Source
Plant community dominant species composition	Stratum[1] of Drainage system	Names or codes of taxa	% of each stratum	Field Transect
	Overall drainage system	Names or codes of taxa	% of drainage systems	Field Transect
Plant species richness	Stratum[1] of drainage system	N of species	% of each stratum	Field Transect
	Overall drainage system	N of species	% of drainage systems	Field Transect
Percent cover per dominant taxa	Stratum[1] of drainage system	% area	% of each stratum	Field Transect
	Overall drainage system	% area	% of drainage systems	Field Transect
Non-indigenous species (NIS) composition	Stratum[1] of Drainage system	Names or codes of Taxa	% of each stratum	Field Transect
	Overall drainage system	Names or codes of Taxa	% of drainage systems	Field Transect
Non-indigenous species (NIS) richness	Stratum[1] of Drainage system	N of species	% of each stratum	Field Transect
	Overall drainage system	N of species	% of drainage systems	Field Transect
Non-indigenous species (NIS) percent cover	Stratum[1] of Drainage system	% area	% of each stratum	Field Transect
	Overall drainage system	% area	% of drainage systems	Field Transect
Overall percent cover of trash in wrack line	Overall drainage system	% area	% of drainage systems	Field Transect
Trash composition of wrack line	Overall drainage system	Trash types	% of drainage systems	Field Transect
Threatened/endangered species richness	Habitat Patch	N of species	% of patches	Records/reports
Number of management objectives	Habitat Patch	N of objectives	% of patches	Records/reports
Type of management objectives	Habitat Patch	Names or codes of objectives	% of patches	Records/reports
Number of recreational facilities	Habitat Patch	N of facilities	% of patches	Records/reports
Annual number of visitors	Habitat Patch	N of people	% of patches	Records/reports
Habitat connectivity (Minimum distance to nearest patch)	Habitat Patch	Km	% of patches	GIS
Habitat connectivity (Number of patches within 5 km radius)	Habitat Patch	N of patches	% of patches	GIS

[1] Stratum refers to each of the five sampling strata (A-E) for tidal marsh drainage systems: backshore, mid-marsh plain along mainstem channel, mid-marsh plain away from channels, foreshore near mainstem channel, foreshore away from channels, and backshore.

Table B.1: Indicators, Their Spatial Scale, Units of Assessment, and Data Sources (continued)

Intensification Indicators	Spatial Scale of Data	Indicator Data Units	Units of X-axis on Presentation Graphics	Basic Data Source
Habitat connectivity (CV of minimum distance within 5 km radius)	Habitat Patch	CV (coefficient of variation)	% of patches	GIS
Habitat connectivity (Index of Isolation)	Habitat Patch	Km/area	% of patches	GIS
Habitat connectivity (Percent intertidal zone composition by marsh or tidal flat)	Habitat Patch	% area	% of patches	GIS
Intertidal channel density	Habitat Patch	Km/area	% of patches	GIS
Total acreage	Habitat Patch	Sq km	% of patches	GIS
Total perimeter length	Habitat Patch	Km	% of patches	GIS
Shoreline complexity index (D)	Habitat Patch	% (unitless)	% of patches	GIS
Percent adjacent landcover by cover type	Adjacent Landscape Spatial Interval	% area	% of each interval type	GIS
	Overall Adjacent Landscape	% area	% of patches	GIS
Percent adjacent agricultural cover or undeveloped land	Adjacent Landscape Spatial Interval	% area	% of each interval type	GIS
	Overall Adjacent Landscape	% area	% of patches	GIS
Total annual POTW, industrial, power plant discharge per watershed	Local Watershed	MGD (million gallons per day)	% of watersheds	Records/reports
Human population density per watershed	Local Watershed	N of people per area	% of watersheds	GIS
Median and CV of age of resident people per watershed	Local Watershed	N of people	% of watersheds	GIS
Median and CV of patch size	Habitat Patch	Sq km	Project area and subregions	GIS

2. SAMPLING METHODS

2.1 FIELD COLLECTION OF ENVIRONMENTAL DATA

2.1.1. General Instructions

In this Section, all references to habitat patches mean the level 1 definition of patch as presented in Section B.2.3

All Intensification field-sampling activities follow guidelines set out by Lamberson et al. (2002), unless specifically noted. It is preferable that sampling of Intensification indicators be conducted at the same time as EMAP Core sampling. In most instances, 3- to 4-person field crews will conduct the sampling from small, motorized boats (typically 20-25 ft), hovercraft, or on foot during a seasonal window spanning July to September. Sampling is planned as a one-time event per the intertidal drainage system of each Core station and habitat patch (i.e., there will be no repeat sampling within the 2002 field season). Intensification field activities performed at each drainage system and associated patch should require 3-4 hours, which is approximately the same amount of time required to complete EMAP Core sampling at each Core station (Lamberson et al., 2002).

All field Intensification indicators will be sampled within the drainage system that encompasses an EMAP Core station. The randomly selected coordinates of latitude and longitude for each of the Core stations will be used as a reference point for locating the plots and transects for the field Intensification indicators. Detailed explanations of Intensification sample locations are given for each indicator in Section B.2.1.4.

Table B.2: A summary of steps for assessment of Intensification field plant indicators.

STEPS IN ASSESSMENT OF INTENSIFICATION FIELD INDICATORS	
1	Complete pre-trip preparation and data collection (permits, photos and records, delineate drainage system
2	Locate EMAP Core station
3	Locate plant community transects and sample plant community
4	Locate wrack line transects and sample wrack composition
5	Collect qualitative reconnaissance data and take photos
6	Complete post-trip wrap up (e.g., data quality check)

2.1.2. Pre-deployment Preparation

Prior to the first sampling trip, the field crew will seek to verify that the EMAP Core stations are located within the sampling frame. Consult Lamberson et al. (2002) to correct any problems with the station location (e.g., location is not in the sample frame; access is denied, etc.). Contact EMAP Intensification Project coordinators for further guidance if necessary. Also prior to the first field trip,

obtain permits, and gather as much ecological and geomorphic information as possible about the stations and associated drainage systems and habitat patches. Desirable information includes copies of topographic maps, aerial photographs, previous studies, and lists of plants and threatened and endangered species. If convenient, the assessment of patch conditions based on the interview and report indicators may occur at this time (see Section B.2.1.4. for details).

Scale1:12,000 Digital Orthogonal Quarter Quadrangles (DOQQs) from the U.S. Geological Survey will be acquired for the habitat patches. These DOQQ's will serve as the photo-base maps for field sampling and GIS analysis (see Section B.2.3 for details). For each habitat patch, the largest drainage network that includes the EMAP Core station, up to a third-order network, will be delineated on the associated DOQQ. The method of assigning order to a channel will be as follows: The smallest channels with unvegetated bank-faces and that have no discernible tributaries are termed first-order; the confluence of two or more first-order channels forms the upstream beginning of a second-order channel; the confluence of two or more second-order channels forms a third-order channel, and so forth. A third-order network includes the entire length of one third-order channel plus all of its second-order tributaries plus all of their first-order tributaries. A third-order drainage system includes one third-order channel network plus all the marsh plain that contributes surface runoff to any part of the network. To delineate the boundaries of a drainage system across the marsh plain and between adjacent channel networks, the decision rule will be to follow a line half way between neighboring channels of the adjacent networks. The results of the assessment based on drainage systems (as a unit) are generally not sensitive to this decision rule of boundary delineation.

A list of candidate sensitive species and non-native species should be prepared for each selected habitat patch, since these are target resources for sampling. The list of candidate species will be based on existing databases and other resources. A potential resource for sensitive species is the California Natural Diversity database (http://www.dfg.ca.gov/whdab/html/cnddb.html) and for invasive non-native species: the California Exotic Pest Plant Council list (http://www.caleppc.org/info/plantlist.html).

Errors in delineation of the drainage system should be corrected on the DOQQ for the habitat patch. It is preferable that a preliminary layout of the quantitative field sampling transects be done prior to going to the field, as this will likely speed up field work (see Section B.2.1.4 for details on sampling design and transect layout). In addition, prepared maps and photos will be useful in determining access to the target habitat patch and drainage system.

2.1.3. Site Deployment, Station occupation, and Site Description

Once the EMAP Core station has been located in the field, the boundaries of the encompassing intertidal drainage system, as estimated on the DOQQ base map of the habitat patch, should be validated. The data sheets for field sampling are designed to lead the sampling team through a logical sequence of steps and checks that further ensure sampling protocols are followed. All field datasheets will be labeled with the unique Station ID code and dated; upon completion of the field entries, the person recording the data will sign each sheet. Prior to departing the site, the in-field supervisor of the fieldwork will verify that all data sheets are accounted for and complete.

Table B.3: Handling and storage guidelines for EMAP Intensification field samples.

SAMPLE TYPE	CONTAINER TYPE	FIELD HOLDING SPECIFICATIONS	LAB STORAGE SPECIFICATIONS	MAXIMUM HOLDING TIME
Plant reference specimens	Individuals in Ziploc bags	Wet ice (4^0C)	Herbarium, dry - humidity controlled	Indefinitely
Unidentified plant taxa specimens	Individuals in Ziploc bags	Wet ice (4^0C)	Herbarium, dry - humidity controlled	Indefinitely

Upon arriving at a habitat patch, the Intensification field crew will use GPS to locate the EMAP Core station, and then indicate the location on the photo-base map. The crew will then record the following information on the data sheets:

1. Core station ID code
2. Date
3. Time of day
4. Station description (Intensification Project area, Patch common name if available, and additional identifying information)
5. Data collectors' initials
6. Data collectors' institutional affiliation
7. Indicator name
8. Vessel name (or indicate access by walk-in)
9. EMAP Core station GPS coordinates
10. Weather (lu08)
11. Wind speed
12. Wind direction (luDirection)
13. Sea state (luSeaState)
14. Air temperature

From the vantage point of the EMAP Core station, photos of the landscape should be taken in the direction of the foreshore, the main channel of the drainage system, and the backshore. For tidal flats, the foreshore is the boundary between the subtidal and the intertidal zone, and the backshore is the boundary between the tidal flat and the vegetated marsh. For the tidal marsh, the foreshore is the same as the backshore of the tidal flat, and the backshore is the boundary between the tidal marsh and the upland.

The crew should then proceed to set up and carry out the plant community sampling (see Section B.2.1.4), and wrack line trash composition.(see Section B.2.1.5). During and following completion of this quantitative sampling, the crew will record its observations of natural and anthropogenic features and disturbances, sensitive plant species, habitat for threatened and endangered species, and occurrence of non-indigenous and native plant species (see Section B.2.1.6). These observations can be made as the field crew walks the drainage system during the quantitative surveys, but must be completed and fully recorded before the crew leave the field.

2.1.4. Plant Community Species Composition and Percent Cover.

Introduction

This protocol is designed to evaluate three important plant community parameters in tidal marshes: 1) plant species diversity, 2) community physical structure, and 3) the invasion of non-native species.

Table B.4: Definitions of key terms used in this protocol.

Term	Definition
Site	A wetland project or other patch of tidal marsh
EMAP Core Station	A 1-m^2 plot of tidal marsh habitat randomly chosen by EMAP.
Drainage System	The area of tidal marsh that drains to a third-order or smaller channel network that includes the EMAP Core station. The drainage system includes its channel network.
Mainstem Channel	The highest-order channel within a drainage system. For this protocol, the mainstem channel is third-order or smaller.
Site	Location of a transect within a selected drainage basin. There are five Sites (A-E) associated with each EMAP Core station. Sites A-D are always within the drainage system of a Core station. Site E is along the backshore and may also be within the same drainage system as Sites A-D.
Transect	15-m distance along which Plots are randomly located at a Site. There is one Transect per Site.
Plot	A randomly chosen area 1-m x 2-m in size within which data are collected. There are five plots at Sites A, B and E, and three plots at Sites C and D.
Subplot	A 1-m x 1-m subsection of a Plot. There are two subplots within each Plot. Designations are given below for subplot numbering, and data are collected separately for each subplot.

A stratified-random sampling approach is used to characterize the plant community for these three parameters along major gradients of environmental factors that are expected to affect community structure, including its overall heterogeneity. The underlying assumptions of this approach are that species diversity and structural heterogeneity are sensitive to environmental stress, and that wetland managers seek to monitor stress levels. Sampling should therefore occur along gradients of factors that control or correlate to community heterogeneity. In tidal marshes, the key factors of interest within a marsh, such as tidal hydroperiod, environmental moisture, aqueous salinity, susceptibility to invasion by NIS plants, and edaphic chemical factors vary with intertidal elevation and distance from tidal source. This protocol therefore uses this spatial pattern of key factor variation as a sampling template. This protocol is to be used for tidally influenced wetland habitats including the backshore (i.e., upland transition zone), marsh plains, channel margins, tidal pannes and ponds, and foreshore (i.e., bay-ward transition zones from the marsh plain to open tidal mud flats).

Locating sites and transects

This following field process results in five sampling Sites for each third-order or smaller randomly chosen tidal marsh drainage system and habitat patch. Sites A and B represent channel-side and marsh plain conditions for the mid marsh, respectively. Sites C and D represent channel-side and marsh plain conditions for the low marsh at the foreshore. Site E represents conditions near the backshore. There is one transect at each Site There are 5 Plots per transect at Sites A, B, and E, whereas there are 3 Plots per transect at Sites C and D. Large plots (1-m x 2-m) are randomly located along each transect. Each plot is evaluated for total vegetative cover, percent cover by species, percent cover by NIS plants, and maximum plant height.

1. **Locate the EMAP Core station**. A GIS is used to locate the EMAP Core station in the field. This station becomes the starting point for locating the 5 sampling Sites.

2. **Validate the delineation of the drainage system for the EMAP Core station**. Using the photo-base map, walk the boundary of the drainage system, and correct the delineation on the base map as necessary.

3. **Site A:** Draw a straight line parallel with the foreshore from the EMAP Core station to the nearest place along the mainstem channel of the drainage basin. This place is Site A.

4. **Site B:** Draw a line perpendicular to the channel bank from Site A to a place 20-m away on the marsh plain. This place is Site B.

5. **Site C:** Follow the channel downstream from Site A to a place near the opening of the channel at the foreshore. This is Site C.

6. **Site D:** Draw a line parallel to the foreshore from Site C to a place 20-m away from Site C. This place is Site D.

7. **Site E:** Draw a line from the EMAP Core station to the nearest place along the backshore. This place is Site E.

Some fringe marshes along steep shorelines lack any channel networks larger than first-order, and these simple networks can be too short in overall length to warrant establishing all 5 sampling Sites. If the EMAP Core station does not occur within a self-evident drainage system, then both of the near channel Sites (A and C) will be dropped, and sampling will be completed only at Sites B, D, and E. The beginning of the transect at Site B will be located by walking parallel to the foreshore 20 m away from the EMAP Core station. The beginning of the transect for Site D will be located by walking directly towards the foreshore from the EMAP Core station, and the beginning of the transect for Site E will be located by walking in the opposite direction from the EMAP Core station until reaching the backshore.

Sampling at each Site

At each site, a photograph should be taken of the showing the general location of the transect and general condition of the site. The quantitative data are collected at five plots that are randomly selected along each Transect at each Site, according to the following instructions.

(1) For Sites A and B, mark the ends of a transect that extends 15 m parallel to the mainstem channel and toward the foreshore. For the transect that extends along the channel bank (at Site A), areas of the channel bank that have slumped or areas found at lower elevation in the channel are not considered part of the marsh plain and are excluded from the transect for this sampling protocol. The transect for Site B, which parallels the mainstem channel but at a distance 20 m away from the channel bank, is further constrained to be at least 10 m from any other channel (see Figure B.3 below). If the transect that begins at Site B crosses a panne (i.e., a shallow depression of bare ground 10 m^2 or larger with or without standing water), then Site B should be shifted far enough toward the foreshore or toward the backshore such that the transect from Site B does not intersect the panne. 5 Plots will be randomly located along each of these two transects.

(2) For Sites C and D, the transects begin at the apparent upper boundary of the low marsh plant zone. The low marsh zone is indicated by the plant assemblage that covers the foreshore. The transect runs downhill from this boundary to the foreshore. Three plots will be randomly selected along each transect line for C and D (Figure B.4). Only 3 plots are used for these sites because of the potentially narrow width of the low marsh zone. If transects within a site are less than 15 m, the first 3 random plots that are within the vegetated transect should be used.

(3) For the backshore (Site E), the 15-m transect is anchored at the Site marker (see Figure B.2). The transect runs 15 m parallel to the backshore (not along the elevation gradient). The protocol for setting up quadrats along this transect is the same as for transects at Sites A and B.

The locations for the sample plots at each Site are selected from the total number of 15 possible 1-m intervals on each transect (there may be fewer possible intervals at Sites C and D if the low marsh zone is less than 15-m wide; see discussion above). For transects A, B and E, five whole numbers between 0 and 14 are randomly selected, and the order of the numbers is recorded. Three random numbers are selected for both transects C and D. If a location is found to be unacceptable due to a disturbance or some other reason, an alternate random number should be used. Plots are situated along each transect using the random numbers (see Figure B.5).

Each of the randomly selected 1m x 2 m plots for each transect will be divided into two 1m x 1 m subplots (see Figure B.6). Each subplot is designated as either subplot 1 or subplot 2, and data are recorded separately for each subplot.

In the field, a 1-m x 1-m frame can be used to sample vegetation, moving it from sample subplot 1 to subplot 2. Plots are always oriented in a particular direction. The long, 2-m side of each plot is oriented perpendicular to the transect line. Subplot 1 is situated adjacent to the channel for Sites A, B, C and D, and adjacent to the upland for Site E (see Figure B.6).

Within each subplot, data are collected in the following order. First the percent cover of all non-

vegetated areas is estimated. Bare ground and litter-covered areas are estimated separately. Following this, the percent cover for each species is estimated separately.

Figure B.2: Schematic of Sampling Site Locations

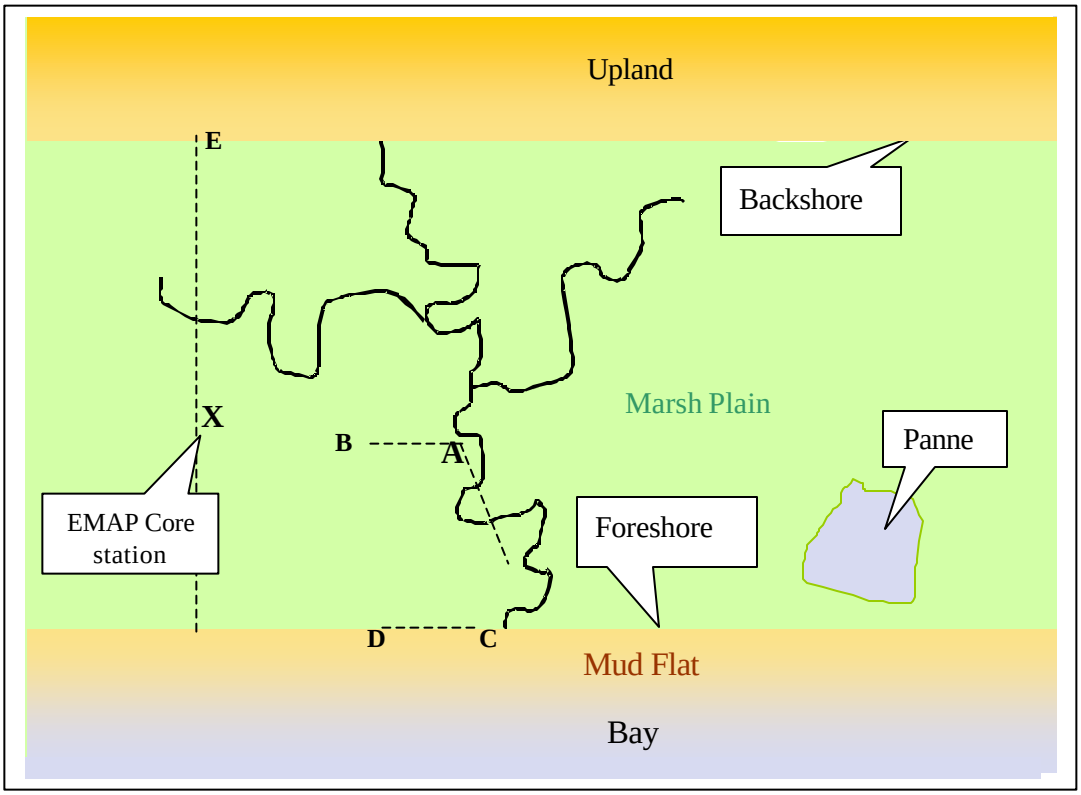


Figure B.3: Schematic diagram of mid marsh Sites A and B and their transects (bold lines).

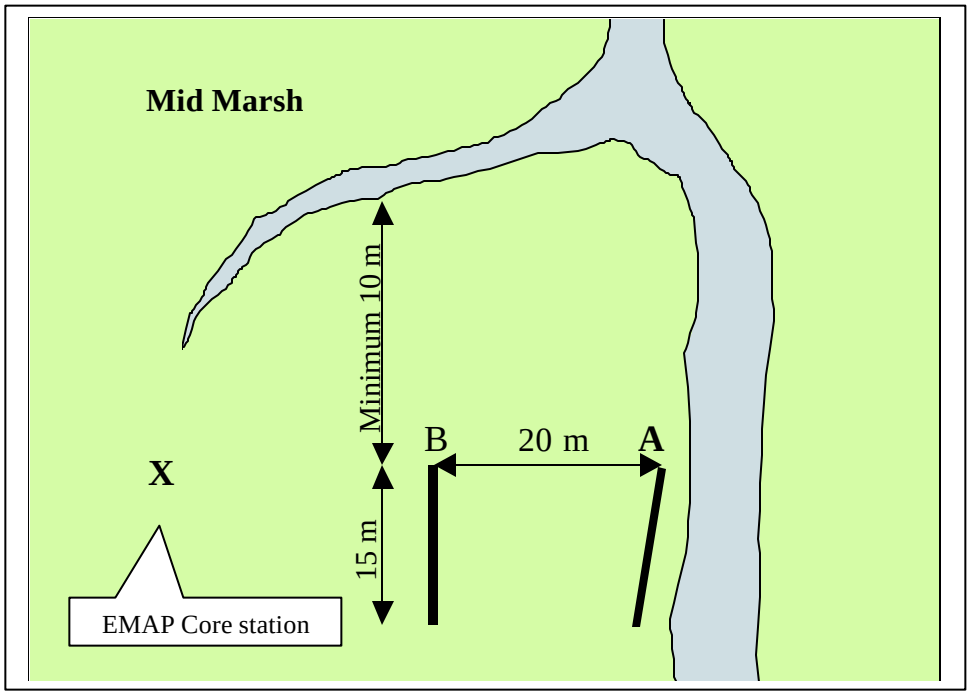


Figure B.4: Schematic diagram of low marsh Sites C and D and their transects (bold lines).

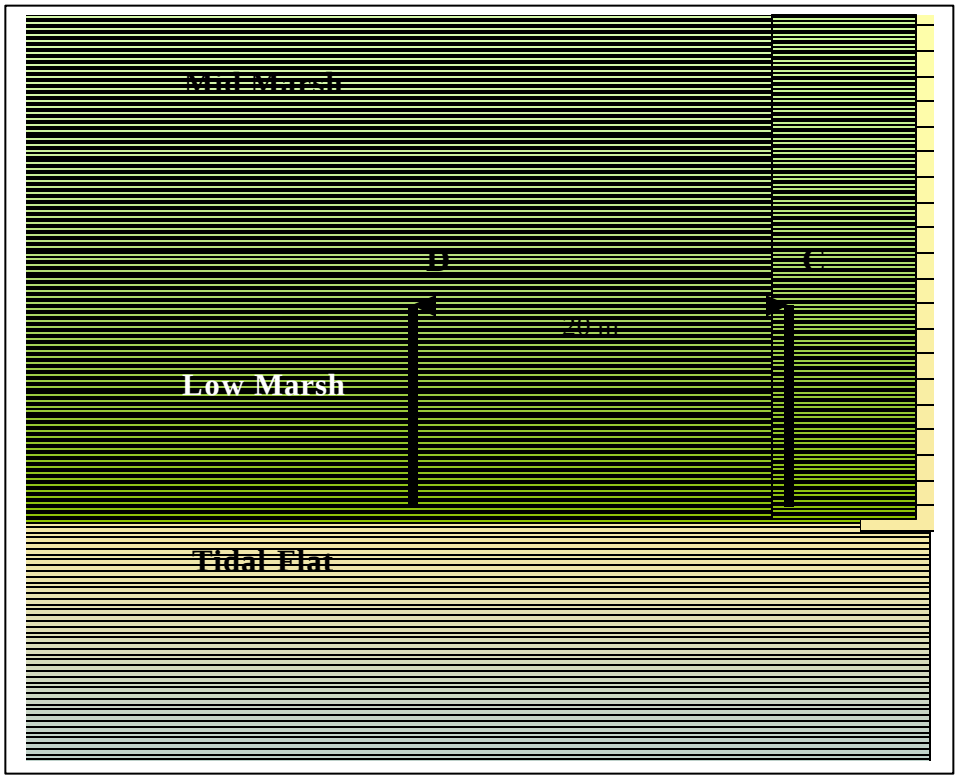


Figure B.5: Five Plots are located randomly along each transect using a random numbers table. Each Plot is divided into 2 Subplots. This illustration shows a hypothetical sampling routine for the mid-marsh Sites A and B.

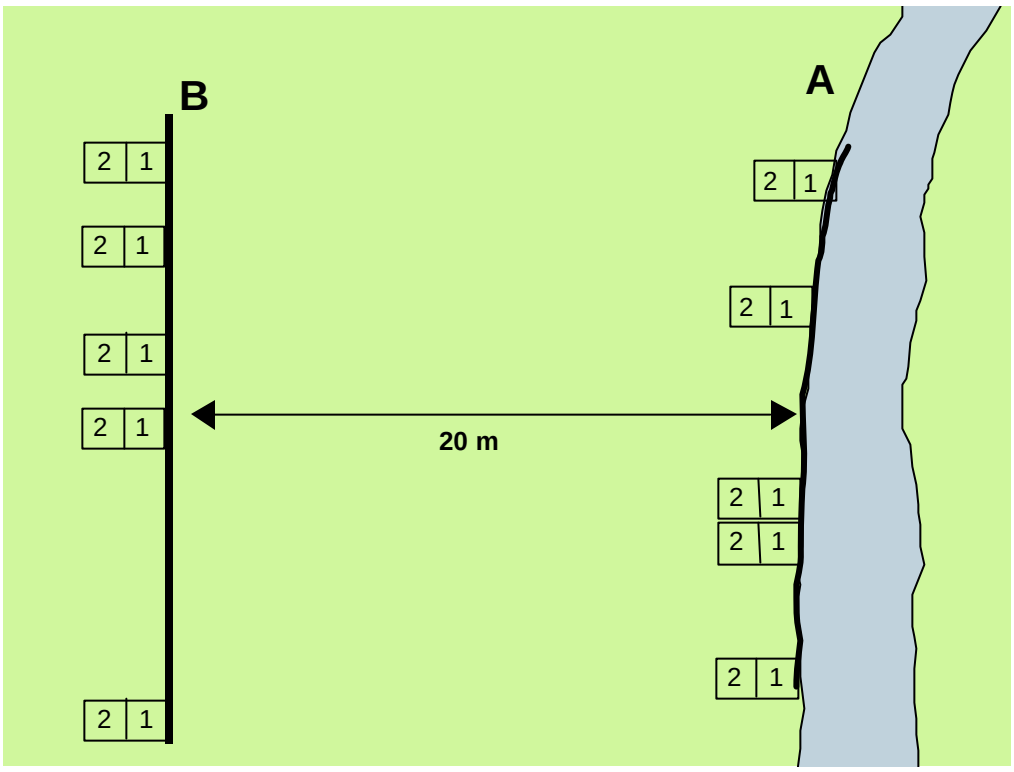
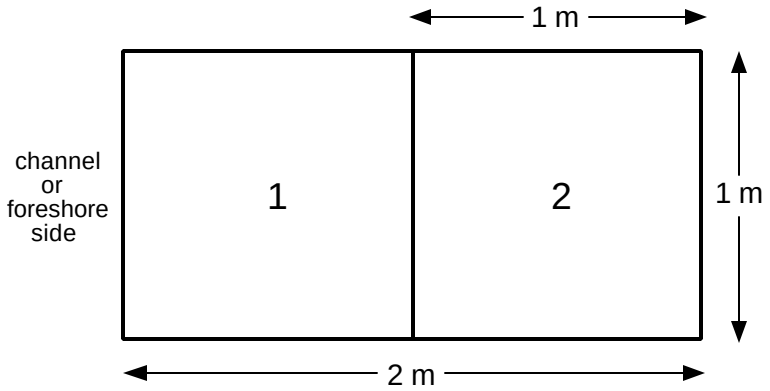


Figure B.6: The Plots used in sampling vegetation are 1m x 2m in size. These Plots are divided into 2 1m x 1m subplots. The subplot designated #1 is always oriented toward a channel (Sites A-D; see Figure B.5 above) or toward the foreshore (Site E). A 1m x 1m meter frame will be used for sampling.



Visual estimates of cover are made using a modified Daubenmire cover class system using an 8-point scale, as indicated below. Because canopies may overlap, cover estimates may total more than 100%. The species and height of the tallest plant (to the nearest cm) is recorded for each subplot.

Table B.5: Cover classes for measuring percent cover by plant species.

Estimated cover categories	Cover class
0	0
>0-1%	1
>1-5%	2
>5-25%	3
>25-50%	4
>50-75%	5
>75-95%	6
>95-100%	7

Table B.6: Summary of Field Work

	Steps in Sampling at Each Sampling Site
1	Determine GPS coordinates for each sampling Site.
2	One 15-m transect is set up at each Site using above protocols by anchoring each transect at a Site.

3	Five plots are randomly located with a 15-m transect at each sampling Site A, B, and E, and three Plots are randomly located at Sites C and D, which are likely to be less than 15 m long.
4	Sample plots that are "away from channels" must be at least 10 m from any channel. If plots are <10 m from any creek, throw these out and use random #'s to identify a new plot or readjust transect line.
5	Each sample plot is 1m x 2 m in size, with the long dimension perpendicular to the transect line.
6	Each 1m x 2 m plot is equally divided into two 1m x 1 m subplots, with the subplot nearest the channel (Sites A-D) or backshore (Site E) designated subplot 1.
7	Data are collected separately for each 1m x 1m subplot.
8	Data to be collected are: percent total vegetative cover percent litter as cover percent bare ground percent cover by species (for all species in each subplot) species and height of the tallest plant in each subplot

2.1.5 Wrack Line Trash Composition

Introduction

The purpose of this indicator is to assess the relative degree of anthropogenic contamination of estuarine wetlands by trash. Trash can enter estuarine wetlands via storm drains, carried in by tides from the coastal ocean, or on-site disposal from recreational use of the wetlands. Some portion of this debris normally accumulates at the wrack line (high tide line) marking the foreshore as the transition between the wetland and adjacent upland.

Assessment of this indicator will be carried out at the same time and using the same transects, plots, and subplots of Site E assessment of plant community composition. Within the 5 plots established along the transect at each Site E (see Figure B.2 above), the wrack line trash composition will be visually estimated in terms of percent cover and trash composition. Digital photos will be taken on site and taken back to the office for verification of the field conditions, if necessary.

Definition of Wrack Line: For the purposes of this assessment, the wrack line is used as the visual indicator of the upper limit of the intertidal zone for either a patch tidal marsh habitat or an intertidal drainage system. The wrack line is named for the flotsam and other floating debris that accumulates as wrack along the usual high water line.

Table B.7: A summary of steps for sampling trash composition in the wrack line.

STEPS IN SAMPLING WRACK LINE TRASH COMPOSITION	
1	Record trash composition and percent cover in plots and subplots of the transect at Site E transect of plant community composition survey.

2	Photograph each subplot using a digital camera.

Determination of Transect Location and Plots

Assessment of this indicator uses the same transect, plots and subplots that were established for the survey of plant community composition at Site E for the backshore of each selected tidal drainage system or habitat patch. Data for trash percent cover and composition should be recorded at the same time as percent cover of bare ground, litter, total vegetation, and plant species in these plots (see Data Sheet 6- Plant Community Composition Sampling: Site E: Backshore).

Measurement of Wrack Line Trash Percent Cover and Composition

At each subplot location for each Site E, percent cover of trash in the plot should be estimated using the cover classes established for plant percent cover, as shown below.

Table B.8: Percent cover classes for wrack line trash composition

Estimated cover categories	Cover class
0	0
>0-1%	1
>1-5%	2
>5-25%	3
>25-50%	4
>50-75%	5
>75-95%	6
>95-100%	7

Composition of the trash should be recorded by checking all the categories of trash found on data sheet (LuTrash). Any trash types that are not adequately represented should be listed in the blank space provided. Take a digital photo of the subplot, and record the plot number (e.g. A1-10) and photo number.

2.1.6: Reconnaissance Survey

Introduction

Following the completion of the quantitative surveys (plant community composition and wrack line trash composition), the field crew should perform a reconnaissance of the marsh drainage basin. This will involve a walk though the marsh as well as along the perimeter at the upland transition. A summary of the data recorded is given below.

Table B.9: List of information categories for the field reconnaissance.

Item	Database Look Up List
Hydrological regime of the wetland management unit or patch	luHydro
Hydrological modifications to wetland management unit or patch	luHydromod
Land use surrounding drainage area	LuLanduse
Average width of natural area buffer surrounding marsh in drainage area	luBuffer
Anthropogenic disturbances within wetland drainage area and upland buffer	luDisturb
Natural marsh geomorphic features	luGeomorph
Number of storm drains visible within drainage areas	NA
Anthropogenic uses/activities visible within wetland drainage area	luUse
Occurrence of sensitive plant species	luSens
Occurrence of native plant species	LuNative

Land use

The reconnaissance survey begins by recording the hydrological regime and any hydrological modifications to the wetland management unit. Hydrological regime is designated as either having a fully tidal or muted tidal regime. Full tidal refers to a wetland hydrological regime when there is no restriction in flow between the wetland and the coastal water body (Bay, river, or ocean). Muted tidal action is achieved in connected bodies of water when a reduction in tidal range exists due to natural or anthropogenic restrictions in flow at the tidal source or foreshore for the habitat patch or drainage system of interest. For example, tide gates or weirs that restrict tidal action at the foreshore are common anthropogenic causes of a muted tidal regime. Barrier beaches or dune systems that create lagoons are common natural causes for muted systems.

Record hydrological modifications to the wetland patch by circling any of the categories that apply, and use the comment section to list those not given elsewhere. Take 2-3 representative photos of the hydrological modifications, and record the roll and negative numbers. Note that decisions about the hydrological regime and hydrological modifications of the habitat patch can be informed by the results of interviews and reviews of reports about the habitat patch before the field work begins.

Record the land use surrounding the wetland drainage area, circling all the categories that apply. Take 2-3 representative photos of surrounding land uses, and record the roll and negative numbers. Definitions of land uses are given in Table B.10 below.

Table B.10: Definition of land use types (LuLanduse)

Land Use Type	Definition
Commercial	land used for warehouses, office buildings, service operations (automotive repair and service), wholesale and retail outlets, shopping plaza and mall, and supermarkets.
Industrial	land used for light and heavy industry (refineries, production, manufacturing, production, and assembly operations)

Recreational	refers to land used for recreational purposes including parks with non-native habitat, golf courses, horse stables, country clubs, etc.
Agricultural	land used for production of crops including row crops, orchards, and plant nurseries.
Petrochemical	land used for producing, storing, or refining petroleum (e.g. oil and gas)
Port	land used for shipping including docks, containers, warehouses, etc.
Residential	land used for homes, apartments, etc. Farm houses are not included in this category
Fisheries	land used for docks, marinas, processing plants, etc. used for commercial or recreational fisheries or sailing.
Transportation	land used for transportation infrastructure including highways with 4 lanes or greater and rail yards.
Natural Area [1]	land that has not been developed for anthropogenic use and retains to large degree of natural geomorphology and vegetation.

[1] Record the average width of the natural area buffer surrounding the wetland drainage areas. The "natural area buffer" is defined by the area immediately upland of the wetland that has not been developed for anthropogenic use and retains some degree of natural geomorphology and vegetation. This is done by a visual estimate and circling the one category which applies.

Disturbances and important geomorphic features

Record the anthropogenic disturbances within the wetland drainage area and natural area buffer. Using the look-up table, circle all categories that apply, and list those disturbances found that are not adequately represented by the categories in the comment section. Next, count and record the number of visible storm drains in the drainage areas, marked by man-made conduits such as pipes and culverts. Then record the anthropogenic uses of the wetland visible within the drainage area, circling all that apply and listing those not captured by the categories. Record the important wetland geomorphic features, other than channels, foreshore, and backshore, within the wetland drainage area, circling all that apply. Definitions of the categories of features are given below.

Table B.11: Definitions of important geomorphic features other than shorelines and channels (luGeomorph)

Feature Type	Definition
Pannes	An area of the marsh plain at least 2 m^2 in size that supports 0-2% cover of vascular vegetation.
Natural levees	A linear feature along the top of a tidal marsh channel that is higher than the marsh plain and is not constructed by people.
Slump Blocks	Blocks of channel bank that have broken off or slid down into a tidal marsh channel.

Mounds/Islet	A natural or man-made area that is higher than the marsh plain and away from any channels or away from the backshore, or that is isolated within a panne.
Reef	Ridge-like or mound-like area on a channel bed, in a panne, or on the marsh plain that is formed by the colonization and growth of sedentary invertebrates an that is at least 3 inches (7.5 cm) higher than the surrounding substrate.

Sensitive Plant Species

For any species listed as threatened or endangered in state or federal statute (i.e., sensitive species) that are found during the reconnaissance of the site, the locations of each population should be determined with the GPS receiver. In addition, estimate the size of the patch (width and length) and estimate the cover (using cover classes given for the plant community composition survey). If there are less than 100 individuals of a sensitive species, the number of individuals should be counted and recorded. In addition, note the habitat stratum where each sensitive species occurs (e.g., low marsh, foreshore, backshore, channel banks, pannes, near fresh water sources, etc.).

Non-Indigenous Plant Species

Most common non-native species occur along the high marsh/upland transition and will be found in the walk of the marsh perimeter. In addition, special attention should be taken to identify any invasive species of *Spartina* found in the low or mid marsh. For common non-native species (i.e., those on the list of invasive species [to be developed or modified from SFEI list or CALEPPC list]), it is not practical to GPS all locations. Instead the general intensity of the invasion of each common species should be classified using the following scale.

Table B.12: Classes of NIS plant invasion intensity

Class	Definition
Heavy	> 33% of potential distribution in drainage system
Moderate	10% to 30% of potential distribution in drainage system
Light	< 10% of potential distribution in drainage system

Checklist of wetland plant species

Complete the checklist of native and non-native plant species, including any that are found in the quantitative surveys (Sites A-E), and any observed in the reconnaissance survey and the walk along drainage area perimeter.

2.1.7: Post-Survey Wrap-Up and Data Quality Check

Upon completion of field surveys, the field crew should carefully review the data collected for any problems or inconsistencies. The crew should check for the completeness of all data sheets, including any blank data cells, data recorded in the wrong location, etc. If there are any problems with data, these should be identified and evaluated (and corrected if possible) immediately. Once the completeness of data sheets has been verified, the recorder should sign each page.

Any unidentified plant specimens should be appropriately pressed, dried, and taken to an expert botanist or local herbarium for identification.

2.2 COLLECTION OF SECONDARY DATA (REPORT AND INTERVIEWS)

2.2.1. Purpose and General Instructions

In this Section, all references to habitat patches mean the level 1 definition of patch as presented in Section B.2.3.

This Section details protocols for ancillary data collected from existing reports available through local and state agencies, and through interviews with agency personnel who are responsible for the wetland habitat patches and drainage systems that will be assessed by this survey. The purpose of compiling these data is to take advantage of pre-existing monitoring and assessment programs conducted by local, state and federal management agencies during any post-sampling classification of data for their interpretation as part of the EMAP 2002 Intertidal Estuarine Assessment. There are five types of data to be compiled/collected including, as shown below.

Table B.13: Types of ancillary data

Data Type	Primary Source
1. Sensitive and threatened and endangered (T/E) plant and animal species	USFWS, Ca Resources Agency
2. Priority non-indigenous plant and animal species	San Francisco Estuary Institute, CALEPPC
3. Wetland patch management objectives	USFWS, CA Resources Agency, Special Districts and Local Agencies
4. Recreational facilities at wetland patch and number of annual visitors to the patch	Special Districts, Local Agencies, Marina Operators, Harbor Masters,
5. POTW, industrial, and power plant discharge to watershed containing the wetland patch	Regional Water Quality Control Board, USEPA

Data types 1-4 can be compiled through existing reports and interviews with agency personnel responsible for the habitat patch in which the field assessment was conducted. The fifth data type (point source discharge to the watershed containing wetland management unit) may be collected from existing reports submitted to state agencies for NPDES-permitted discharge. Collection of these data is detailed in Sections B.2.2.2 and B.2.2.3 below.

Report and interview data will be collected for the habitat patch and/or watershed in which each EMAP Core station is located. In several cases, there will be several EMAP Core stations located in one large habitat patch and/or watershed. In this circumstance, separate data sheets containing this information must be filled out for each EMAP Core station, and these data must be entered into the record for each EMAP Core station in the database.

2.2.2. Data compiled through reports and interviews with agency personnel

Optimally, data available in existing reports and interviews with agency personnel can be compiled concurrently with the pre-field work preparation of other information about each selected drainage system and its encompassing habitat patch (see Section 2.2).

Data collection begins with recording the EMAP Core station number, the date of record entry, and the recorder's name. Describe the station, identifying the region in which it is located (Southern California or San Francisco Bay), the wetland habitat patch, and the name of the watershed that contains the habitat patch.

Enter the name of the agency most responsible for the habitat patch, then record the source of the data for this section (data sheets 1-3). If one of the sources was an interview, record the name, organization, and title of the individual interviewed. If the source was one or more reports, record for each the title, author, data of publication, institution, city and state, report number and type, and the pages where the data were found.

Next, record the size (in acres) of the intertidal drainage system and of its encompassing habitat patch, and record the name and agency responsible for any habitat patches that are adjacent to the patch containing the EMAP Core station. If there are none, check the "no" in the appropriate space. Record the management objectives for the habitat patch.

Determine whether recreational access to the habitat patch is allowed. If so, determine whether the habitat patch has recreational facilities on site (i.e. visitor centers), and record the total number of permanent and part-time paid staff, using one decimal place to account for part-time staff. Record the number of annual visitors to the habitat patch. Record the outreach or educational programs offered, circling all categories that apply. Determine whether access to the habitat patch is allowed via recreational trails. If access is allowed, circle the type of traffic allowed on those trails (e.g. foot, vehicle, horse, etc.), and give the total number of miles of recreational trails in the habitat patch.

Next, record if any sensitive plant or animal species have been found in the habitat patch. If so, record the species name, and the last date of observation. Finally, record if any non-indigenous plant species have been observed, checking the box if the species has been observed and the last date of the recorded observation.

2.2.3. NPDES-Permitted discharges to Watershed of the EMAP Core Station

The source of data on the NDPES-permitted discharges to the watershed containing the wetland habitat patch can be found with the California Regional Water Quality Boards. The suggested point of contact is the Watershed Coordinator. This person may direct investigators to other reports or personnel for this information.

Data collection begins by noting the name of the watershed that contains the wetland. NDPES

permit data are being collected for discharges to the surface waters of this watershed. Any NPDES-permitted discharges to the Pacific Ocean should not be included in this dataset.

Record the sources of data for this survey, including agency personnel interviewed, and the title, author, institution, date, number and type of reports or records used.

Record the total number of active NDPES permits issued for the watershed containing the wetland habitat patch. The NDPES permits are classified as shown below.

Table B.14: NDPES permit types.

NDPES Permit Type	Definition
Major Permits	All publicly-owned treatment works (POTW) and any facilities with baseline discharges greater or equal to 1 Million Gallons per Day (MGD)
Minor Permits	Any facilities (excluding POTWs) with baseline discharges > 1 MGD
General Permits	Facilities enrolled under similar categories of discharges with existing general permits. The categories being enrolled include construction dewatering without treatment; construction dewatering with treatment; hydrostatic test water; non-process wastewater; petroleum fuel cleanup; and, cleanup of volatile organic compounds

The number of active permits in each category should be recorded, then summed to give a total number Per drainage system and habitat patch. Finally, record the total baseline discharges of major NDPES permit holders (in Millions of Gallons per Day), excluding those that discharge directly to the Pacific Ocean.

2.3. GEOGRAPHIC INFORMATION SYSTEM (GIS) DATA COLLECTION METHODS

2.3.1. General Instructions

All geographic information selected or developed for this effort has to be readily and publicly available. All GIS products will be created from composites of existing information. The scope of this project does not include contracting to collect new aerial imagery or other forms of GIS information. Table B.15 shows a list of all GIS data required for the tidal wetlands characterization efforts described within this Section and other Sections document.

Table B.15 GIS data to be collected

Name of dataset	Source
Human Population Demographics	United States Census Bureau
Watershed Boundaries	CalWater (a consortium of CA state agencies)
Year 2000 Land-use	Association of Bay Area Governments, NOAA C-CAP Land Use
National Wetlands Inventory	US Fish and Wildlife Service
Digital Orthogonal Quadrangles	US Geological Survey

For both the southern California and San Francisco Bay Area Intensification Projects, it may be useful to incorporate GIS data layers developed by local agencies and interest groups. These layers may provide additional detail and clarity as required to delineate some patches or drainage systems, identify land use or land cover types, or to plan the logistics of field work.

2.3.2: Identification of Habitat Patch

Introduction and definitions

Each EMAP Core Station will exist within an intertidal drainage system of a wetland habitat patch, and each habitat patch can be assigned to a local watershed. The analysis of GIS data will use this nested spatial hierarchy to assign spatial data collected at the watershed, patch, or drainage system scale to each EMAP Core station.

While the boundaries of watersheds and drainage system are topographically controlled and therefore self-evident, the boundaries of habitat patches are less obvious. Furthermore, the meaningful definition of habitat patch can differ between species; what is a patch for one species may not be a patch for another species. Important patch metrics, such as connectivity and size, therefore varies among species. For that reason, a set of patch definitions have been developed for different indictor or reference species, such that patch metrics are relevant to wetland managers. The reference species were chosen

based on the input from teams of regional wetland scientists.

Two sets of patches will be defined, one set for tidal marshes and another set for tidal flats. In both cases, the definitions are spatially hierarchical, as indicated in Table B.16 below.

Table B.16: Habitat patch definitions

Patch Type	Level	Definition	Reference Species Or Guild that *Might* Pertain to Patches
Tidal Flat	Level One	Patch boundaries are any or all of the following: (A) the foreshore of adjacent marsh, (B) any non-tidal area at least 300 ft wide, (C) any area of open water at least 300 ft wide at low tide, (D) any man-made levee as shown on 1:24k scale USGS topographic quadrangles, (E) any "large channel" (i.e., tidal marsh channel or tidal reach of river or stream that is at least 200 ft wide from bank-to-bank for most of its length, or that receives perennial freshwater discharge, or that extends across the tidal flat to the subtidal environment).	Resident infauna, and vertebrate fauna resident in adjacent tidal marsh
	Level Two	Same as Level One above except disregard large channels (i.e., tidal flat Level One boundary type "E" above).	Shorebirds, large wading birds, intertidal fishes
Marshes and Ponds	Level One	Patch boundaries are any or all of the following: (A) the foreshore, (B) any non-tidal area at least 300 ft wide, (C) any area of open water at least 300 ft wide at low tide, (D) any man-made levee as shown on 1:24k scale USGS topographic quadrangles, (E) any roads (4 lane or larger), (F) any "large channel" (i.e., tidal marsh channel or tidal reach of river or stream that is at least 200 ft wide from bank-to-bank at any point along its length or that receives perennial freshwater discharge).	Resident intertidal rails (This rule set also defines marsh patches that are separate contributors to the tidal prism of a large channel or the bay).
	Level Two	Same as Level One except disregard any man-made levees from rule D that partition or separate tidal marsh, muted tidal marsh, diked marsh, or managed marsh.	Resident intertidal passerine birds, resident intertidal small mammals, intertidal amphibians and reptiles
	Level Three	Same as Level Two except include low-salinity and medium-salinity salt ponds, include treatment ponds, and disregard any rule E (any roads 4 lane or larger), and disregard rule F (any tidal marsh channel or tidal reach of river or stream that is at least 200 ft wide from bank-to-bank at any point along its length or that receives perennial freshwater discharge).	Waterfowl, shorebirds, raptors and medium to large mammalian predators

For each of the three definitions of the patch that contains an EMAP Core station, all other patches of the same definition that exists entirely or in part within a circle having a radius of five miles and centered on the Core station will also be digitized. That is, all Level One, Level Two, and Level Three patches within 5 miles of each Core station will be delineated in the GIS. This will facilitate scale-specific spatial landscape analysis (e.g., connectivity and patch size-frequency) for each EMAP Core station.

Digitizing patches

Level One patches will be digitized from readily available data sources, such as US Geological Survey DOQQs. Level Two and Level Three patches will be digitized by dissolving the necessary Level One boundaries, following the guidelines in Table B.16 above.

2.3.2. Identification of local watersheds

The watersheds that contribute to each Level One patch that contains an EMAP Core station will be identified and mapped. If available, existing watershed information will be utilized in this mapping effort. Each of these Level One patches of tidal marsh will be assigned to the watershed of the nearest perennial fluvial channel.

2.3.3: Human population demographics for local watersheds

The boundaries of local watersheds draining to Level One patches that contain EMAP Core stations will be used to cut the US 2000 census data. If a census block is dissected by a watershed boundary, then a portion of the data will be included from that that block that is equal to the portion of the block that is included in the watershed. For example, if 40% of a block is included in the watershed, and the block contains 100 people, then 40 people will be included in the population count for the watershed. The population size will be rounded to the nearest whole person.

2.3.4: Intertidal drainage system delineation

The boundary of the largest intertidal drainage system (up to third-order) that contains an EMAP Core station will be delineated and digitized. The process will involve locating the Core station on a 1:12,000 scale US Geological Survey Digital Orthogonal Quarterly Quadrangle (DOQQ), identifying the channel nearest to the Core station, tracing the largest channel network (up to third-order) to which the channel nearest the Core station belongs, and then digitizing the boundary of the intertidal area that drains to the selected channel network. The largest channel of the selected network is termed the “mainstem” channel. In digitizing the drainage area, it will be assumed that the boundary exists midway between the selected drainage network and any neighboring channels. Since pannes are impoundments that do not drain, they will be excluded from any measures of drainage area. It will also be assumed that the drainage boundary terminates at the banks of the mainstem channel, where it meets the foreshore or where it connects to another third- or higher-order channel network. Figure B.7 illustrates a drainage area boundary.

2.3.5: Wetland Patch Metrics

Patch size (m2) and perimeter length (m) will be measured for each Level One patch. These measurements will be provided directly from the GIS. The data will be used to calculate the Shoreline complexity Index (see 2.3.9 below).

2.3.6: Connectivity

Connectivity will be assessed in four ways for each habitat patch that contains an EMAP Core station. (1) The minimum distance from each patch containing a Core station to the nearest patch of the same type (tidal marsh or tidal flat). (2) The frequency of distance between patches of the same kind will be calculated for all patches that are entirely or in part within a 5-km radius of the Core station. (3) For each of the three patches nearest the patch with the Core Station, and that are the same kind of patch as the one with the Core Station, patch size will be divided by the minimum distance to the Core Station patch, to create an index of isolation for future studies of meta-population dynamics. (4) The area of each Level One patch of tidal marsh that contains an EMAP Core station will be added to the area of the adjacent-contiguous Level One patch of tidal flat and divided by the sum of the two patches to assess the percent of the intertidal zone that is either tidal marsh or tidal flat. If there is no patch of tidal flat adjacent to the selected patch of tidal marsh, then a value of 0.1 will be used as a placeholder for tidal flat. Connectivity will be calculated separately for each definition of patch (Levels One to Three for tidal marsh; Levels One and Two for tidal flat), using methods 1-3. Only the Level One definition of patch will apply to the fourth method of calculating connectivity.

2.3.7: Intertidal channel density

Existing information about channel density may be inadequate for some patches of tidal marsh or tidal flat. In such cases, the channel system of the Level One patches that contain EMAP core stations will be mapped through photographic interpretation. The interpretation will predominantly use 1:12,000 scale USGS DOQQ aerial photography, but will be supplemented with higher resolution or multi-spectral imagery where available. Interpretation will be done using ERDAS' IMAGINE, and ESRI's ArcGIS. Once the channels have been mapped, then the total area and perimeter of the channel network of each selected drainage system and patch will be determined in the GIS. Channel density will be calculated in two ways: (2) total length of channel perimeter per unit area of marsh, and (2) total estimated water surface area that would exist, per unit area of marsh, if the channel were full of water

2.3.8 Adjacent landcover

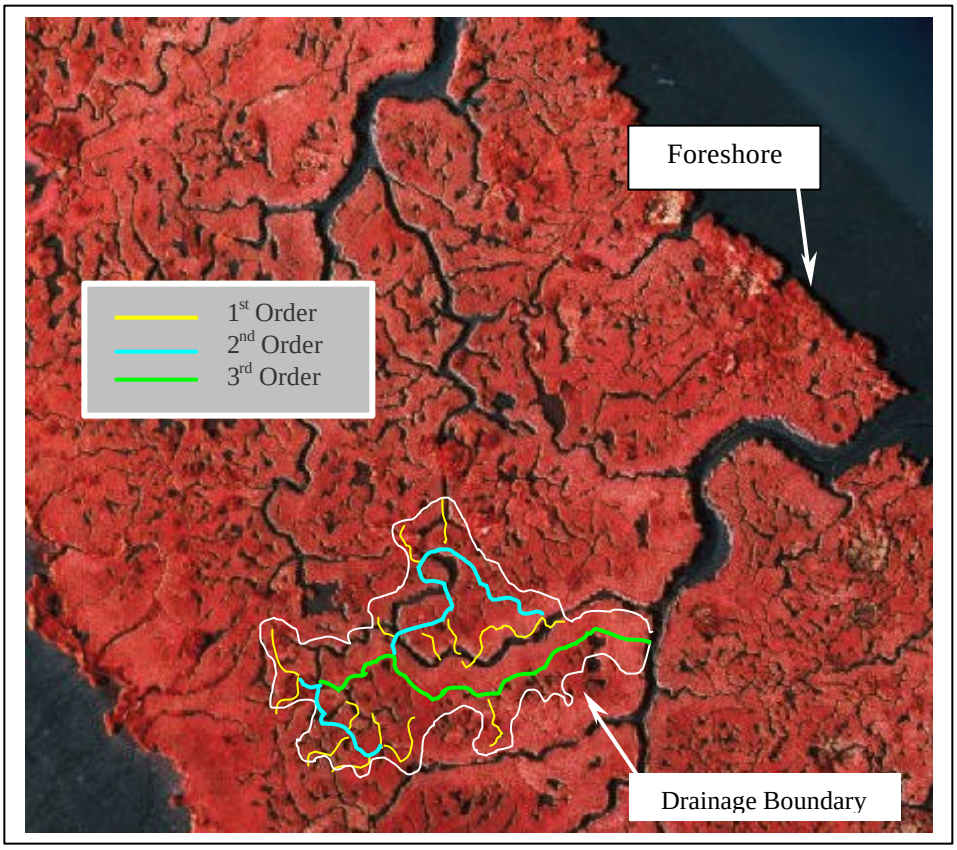
Percent composition of adjacent landcover types (i.e., "adjacency") will be calculated for each Level One habitat patch that contains an EMAP Core station. Adjacency will be calculated for each of 10 (ten) 60-m wide intervals away from each patch. Each of the 10 intervals of adjacent land area will be overlaid with USGS thematic landcover data to produce an index of percent landcover by type for each successive interval of adjacent area. This means that percent landcover will be assessed for a total of 600 m of adjacent landscape along the entire perimeter of each patch. Adjacent landcover will be assessed in intervals to estimate the percent change in land use, including undeveloped and agricultural space, with

distance from patch, since this may affect the ecological and hydrological interactions between the intertidal zone and the upland environment.

2.3.9: Shoreline complexity index

A Shoreline Complexity Index (D) will be calculated for each Level One wetland patch that contains an EMAP Core station. Shoreline complexity (D) is defined as the ratio of the length of the patch perimeter (L) to the length of the circumference of a circle of area equal to that of the total area of the patch. The index provides a measure of the complexity of the patch boundary in plan view, which relates to various rates of flux of energy and materials between the patch and its surrounding landscape.

Figure B.7: Example drainage system boundary for a third-order channel network. In this example, the foreshore is outside of the drainage system, and there is no apparent backshore (upland-intertidal transition)



3. SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Sampling handling and custody requirements for the California Intensification of the EMAP West Coast Pilot 2002 Intertidal Assessment follow those established in *National Coastal Assessment Quality Assurance Project Plan 2001-2004* (US EPA 2001a).

4. ANALYTICAL METHODS, QUALITY CONTROL, INSTRUMENT TESTING AND MAINTENANCE REQUIREMENTS

4.1. Field Survey Intensification Indicators

To assure quality control in the assessment of field survey indicators, all field crew will participate in a field training session. In addition to instruction and hands-on exercises to learn sampling protocols and methods, field crews will also receive instruction in plant identification (for plant community composition). Accuracy and precision in measurement of plant community and wrack line trash percent cover will be assessed by performing an intercalibration exercise. Digital photos of differing percent cover scenarios will be taken and distributed to the southern California and San Francisco Bay field crews for independent estimates of cover. Results from the two regions will be compared to estimate accuracy and precision for these indicators. If the differences exceed 20%, then the experts will be retrained and re-tested until the experts achieve comparable measurements.

4.2. Secondary Data Collection: Reports and Interviews

Quality control of secondary data collection activities will be undertaken by noting from reports or interviews whether any quality control process is described for the data they contain or provide.

4.3. Geographic Information System Assessment Indicators

The GIS-based metrics involve varying degrees of professional judgment that could affect the accuracy and precision of the measurements. Two sites will be randomly will be randomly selected for each of the two Intensification Project areas. For each Project area, two experts will independently measure each of the GIS-based metrics. A difference between experts of 20% or less will be deemed comparable and acceptable for either metric. If the difference exceeds 20%, then the experts will be retrained and re-tested using new randomly selected habitat patches. Training and testing will continue until the experts achieve comparable measurements.

5. DATA MANAGEMENT

Data management for the California Intensification of the EMAP West Coast Pilot 2002 Intertidal Assessment will follow guidelines established in the *National Coastal Assessment Quality Assurance Project Plan 2001-2004* (US EPA 2001a).

C. ASSESSMENT/OVERSIGHT

Assessment and oversight for the California Intensification of the EMAP West Coast Pilot 2002 Intertidal Assessment, including assessment and responsive actions as well as reports to management, follow those established in *National Coastal Assessment Quality Assurance Project Plan 2001-2004* (US EPA 2001a). In addition, the QA officer will be made aware of sampling dates for possible field audits. The Intensification Project Team anticipates one or more field audits

D. DATA VALIDATION AND USABILITY

Data validation and usability rules for the California Intensification of the EMAP West Coast Pilot 2002 Intertidal Assessment follow those established in *National Coastal Assessment Quality Assurance Project Plan 2001-2004* (US EPA 2001a).

REFERENCES

U.S. EPA (2001a). *Environmental Monitoring and Assessment Program (EMAP): National Coastal Assessment Quality Assurance Project Plan 2001-2004*. US Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze, FL EPA/620/R-01/002

U.S. EPA (2001b). *National Coastal Assessment: Field Operations Manual*. U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze, FL EPA 620/R-01/003

Lamberson J. and Nelson W. (2002) *Environmental Monitoring and Assessment Program National Coastal Assessment Field Operations: West Coast Field Sampling Methods Intertidal 2002 (Amendment to: Environmental Monitoring and Assessment Program National Coastal Assessment Quality Assurance Project Plan 2001-2004)***.** U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Western Ecology Division, Coastal Effects Branch, Newport, Oregon 97365

APPENDIX I: Gear List

Toboggan to carry gear
Waders, boots, mudders, life jacket if in boat or hovercraft
Radio, other safety equipment - in backpack
GPS or DGPS
Ice chest for holding samples, ice
Data sheets, pens, pencils
Grab or posthole sampler for benthic samples
0.25 m^2 quadrat for vegetation and burrow count, with string gridlines
Scoops, spoons, shovel, garden trowel
Small spoons for filling sample jars
Watch with sweep second hand, Compass
Waterproof camera - digital preferred
Labels for photo ID
Refractometers and pipettes or salinity vials
Thermometers
Metric ruler to measure grab penetration depth
Metric tape to measure plant height
Reel tape or survey rod for plant transect
Hand tally counter for shrimp burrow counts
Sample containers for composited sediment samples -
    TOC, chemistry, grain size, % moisture
Sample containers for benthic samples (bucket, jars)
Bags for plant and shrimp reference specimens
Serrated breadknife and sharpened garden spade for plant and benthic samples
Sieves - 1.0-mm, tubs to sieve in
Formalin, buffered
Stain - Rose Bengal
Herbarium press, paper
Clippers (for collecting plants)
1 m^2 PVC quadrat
PVC stakes (for marking transects)
Flagging
Jepson Manual or other reference for plant ID
Other - towels, gloves, label tape, waterproof label paper, scissors, markers, buckets, funnels, vinyl tape for sealing jars, duct tape, field logbooks, forceps to pick screen, squirt bottle, beige or gray 3X5 cards, tide tables or tide chart
Shrimp gun
Lab keys
Float plan or foot plan
Collecting permit, estuary map

APPENDIX II. SAMPLE DATA SHEETS

California EMAP Intensification Data Sheets

Field Environmental Data Collection

DATA SHEET 1

EMAP 2002 Station Number _____Date _____

Station Description: Region _____

Management Unit_____

Other_____

Start Time _____

Samplers Initials _____

Agency _ _____

EMAP Core Station GPS Location (circle one: GPS DGPS)

Lat _____ Long _____

Vessel Name or Walk-in _____

Weather (circle) Clear Hazy Part cloudy Cloudy Fog Drizzle Rain Thunderstorm

Wind Speed/Direction _____

Sea State _____

Air Temperature _____

Site Photos: **Roll #(s) _____ Neg #s ____to _____**

Standard Photos:	**From EMAP core point to the main channel:**	**Neg #_____**
	From EMAP core point to the foreshore:	**Neg #_____**
	From EMAP core point to backshore:	**Neg #_____**
	Shoreline development:	**Neg #_____**
	Water control structures	**Neg #_____**

Recorder Name _____

California EMAP Intensification Data Sheets

DATA SHEET 2

EMAP 2002 Station Number _____Date _____

Transect GPS Location (circle one: GPS DGPS) Lat _____ Long _____

Transect Photo Neg #_____

Plant Community Composition Sampling: Site A: Mid-Marsh Near Channel

Cover class: 0: 0% 1: >0-1% 2: >1-5% 3:>5-25% 4: > 25-50% 5:>50-75% 6:>75-95% 7:>95%

Sites		**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
Plots		**1**	**1**	**2**	**2**	**3**	**3**	**4**	**4**	**5**	**5**
Subplots		**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Transect Random Number											
Bare											
Litter											
Total Vegetation											
Species/Cover:	Code										
Atriplex triangularis	Attr										
Batis maritime	Bama										
Cuscuta salina	Cusa										
Distichlis spicata	Disp										
Frankenia salina	Frsa										
Grindelia stricta	Grst										
Heliotropium curassavicum	Hecu										
Jaumea carnosa	Jaca										
Limonium californicum	Lica										
Monanthochloe littoralis	Moli										
Salicornia bigelovii	Sabi										
Salicornia europea	Saeu										
Salicornia subterminalis	Sasu										
Salicornia virginica	Savi										
Spartina foliosa	Spfo										
Spergularia marina	Spma										
Suaeda esteroa	Sues										
Triglochin concinna	Trco										
Species/Maximum Ht.											

Recorder Name _____

California EMAP Intensification Data Sheets

Recorder Name _____

California EMAP Intensification Data Sheets

DATA SHEET 3

EMAP 2002 Station Number _____Date _____

Transect GPS Location (circle one: GPS DGPS) Lat _____ Long _____

Transect Photo Neg #_____

Plant Community Composition Sampling: Site B: Mid-Marsh Away From Channel

Cover class: 0: 0% 1: >0-1% 2: >1-5% 3:>5-25% 4: > 25-50% 5:>50-75% 6:>75-95% 7:>95%

Sites		**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**
Plots		**1**	**1**	**2**	**2**	**3**	**3**	**4**	**4**	**5**	**5**
Subplots		**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Transect Random Number											
Bare											
Litter											
Total Vegetation											
Species/Cover:	Code										
Atriplex triangularis	Attr										
Batis maritime	Bama										
Cuscuta salina	Cusa										
Distichlis spicata	Disp										
Frankenia salina	Frsa										
Grindelia stricta	Grst										
Heliotropium curassavicum	Hecu										
Jaumea carnosa	Jaca										
Limonium californicum	Lica										
Monanthochloe littoralis	Moli										
Salicornia bigelovii	Sabi										
Salicornia europea	Saeu										
Salicornia subterminalis	Sasu										
Salicornia virginica	Savi										
Spartina foliosa	Spfo										
Spergularia marina	Spma										
Suaeda esteroa	Sues										
Triglochin concinna	Trco										
Species/Maximum Ht.											

Recorder Name _____

California EMAP Intensification Data Sheets

Recorder Name _____

California EMAP Intensification Data Sheets

DATA SHEET 4

EMAP 2002 Station Number _____Date _____

Transect GPS Location (circle one: GPS DGPS) Lat _____ Long _____

Transect Photo Neg #_____

Plant Community Composition Sampling: Site C: Foreshore Near Channel

Cover class: 0: 0% 1: >0-1% 2: >1-5% 3:>5-25% 4: > 25-50% 5:>50-75% 6:>75-95% 7:>95%

Stations		**C**	**C**	**C**	**C**	**C**	**C**
Plots		**1**	**1**	**2**	**2**	**3**	**3**
Subplots		**1**	**2**	**1**	**2**	**1**	**2**
Transect Random Number							
Bare							
Litter							
Total Vegetation							
Species/Cover:	Code						
Atriplex triangularis	Attr						
Batis maritime	Bama						
Cuscuta salina	Cusa						
Distichlis spicata	Disp						
Frankenia salina	Frsa						
Grindelia stricta	Grst						
Heliotropium curassavicum	Hecu						
Jaumea carnosa	Jaca						
Limonium californicum	Lica						
Monanthochloe littoralis	Moli						
Salicornia bigelovii	Sabi						
Salicornia europea	Saeu						
Salicornia subterminalis	Sasu						
Salicornia virginica	Savi						
Spartina foliosa	Spfo						
Spergularia marina	Spma						
Suaeda esteroa	Sues						
Triglochin concinna	Trco						
Species/Maximum Ht.							

Recorder Name _____

California EMAP Intensification Data Sheets

Recorder Name _____

California EMAP Intensification Data Sheets

DATA SHEET 5

EMAP 2002 Station Number _____Date _____

Transect GPS Location (circle one: GPS DGPS) Lat _____ Long _____

Transect Photo Neg #_____

Plant Community Composition Sampling: Site D: Foreshore Away From Channel

Cover class: 0: 0% 1: >0-1% 2: >1-5% 3:>5-25% 4: > 25-50% 5:>50-75% 6:>75-95% 7:>95%

Stations		**D**	**D**	**D**	**D**	**D**	**D**
Plots		**1**	**1**	**2**	**2**	**3**	**3**
Subplots		**1**	**2**	**1**	**2**	**1**	**2**
Transect Random Number							
Bare							
Litter							
Total Vegetation							
Species/Cover:	Code						
Atriplex triangularis	Attr						
Batis maritime	Bama						
Cuscuta salina	Cusa						
Distichlis spicata	Disp						
Frankenia salina	Frsa						
Grindelia stricta	Grst						
Heliotropium curassavicum	Hecu						
Jaumea carnosa	Jaca						
Limonium californicum	Lica						
Monanthochloe littoralis	Moli						
Salicornia bigelovii	Sabi						
Salicornia europea	Saeu						
Salicornia subterminalis	Sasu						
Salicornia virginica	Savi						
Spartina foliosa	Spfo						
Spergularia marina	Spma						
Suaeda esteroa	Sues						
Triglochin concinna	Trco						
Species/Maximum Ht.							

Recorder Name _____

California EMAP Intensification Data Sheets

DATA SHEET 6

EMAP 2002 Station Number _____Date _____

Transect GPS Location (circle one: GPS DGPS) Lat _____ Long _____

Transect Photo Neg #_____

Plant Community Composition Sampling: Site E: Backshore

Cover class: 0: 0% 1: >0-1% 2: >1-5% 3:>5-25% 4: > 25-50% 5:>50-75% 6:>75-95% 7:>95%

Stations		**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**
Plots		**1**	**1**	**2**	**2**	**3**	**3**	**4**	**4**	**5**	**5**
Subplots		**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Transect Random Number											
Bare											
Litter											
Total Vegetation											
Trash Cover											
Quadrat Photo Neg #											
Species/Cover:	Code										
Atriplex semibaccata	Atse										
Bromus diandrus	Brdi										
Carpobrotus edulis	Caed										
Distichlis spicata	Disp										
Frankenia salina	Frsa										
Grindelia stricta	Grst										
Heliotropium curassavicum	Hecu										
Lepidium latifolium	Lela										
Limonium californicum	Lica										
Lolium multiflorum	Lomu										
Mesembryanthemum crystallinum	Mecr										
Mesembryanthemum nodiflorum	Meno										
Monanthochloe littoralis	Moli										
Parapholis incurva	Pain										
Polypogon monspeliensis	Pomo										
Rumex crispus	Rucr										
Salicornia subterminalis	Sasu										

Recorder Name _____

California EMAP Intensification Data Sheets

Species/Maximum Ht.											
Trash Composition											
Lumber											
Plastic Bags											
Plastic											
Styrofoam											
Metal											
Fishing Gear											
Paper											
Medical waste											
Glass											
Sports Gear											
Large Debris (Tires, Carts, etc.)											

Recorder Name _____

California EMAP Intensification Data Sheets

DATA SHEET 8

EMAP 2002 Station Number _____Date _____

Hydrological Regime of the Wetland Management Unit or Patch (circle one)

Full tidal **Muted tidal**

Comments_____

Hydrological Modifications in Wetland Management Unit or Patch (circle all that apply)

Tide Gate **Weir** **Culvert** **Road Bed/RR Track**

Ditch **Dike/Levee** **Other (list below)**

_____

Land Use Surrounding Drainage Area (circle all that apply)

Commercial **Industrial** **Recreational** **Agricultural** **Petrochemical**

Port **Residential** **Fisheries** **Highways** **Natural Area**

Highways **Other (list below)**

_____

Average Width of Natural Area Buffer in Drainage Area (circle one)

<10 m **10 to 25 m** **26 to 50 m** **>50 m**

Anthropogenic Disturbances within Wetland and Buffer of Drainage Area (circle all that apply)

Fencing **Mowing** **Grazing** **Dredging** **Riprap** **Bike Path/Trail**

Off-roading **Plowing** **Large Debris** **Other (List below)**

_____

Natural Wetland Geomorphic Features in Drainage Area (circle any that apply)

Pannes **Berms** **Mounds/Islet** **Reef** **Mud Flats**

Tidal Channel **Others (list below)**

_____

Number of Storm Drains Visible within Drainage Area_____

Anthropogenic Uses of Wetland Visible within Wetland Drainage Area (circle all that apply)

Petrochemical Restoration Project Recreational Industrial

Aquaculture Fisheries Nature Reserve

Other (list below)

_____

Recorder Name _____

California EMAP Intensification Data Sheets

DATA SHEET 9

EMAP 2002 Station Number _____Date _____

Occurrence of Sensitive Plant Species

Cover class: 1: 0-1% 2: >1-5% 3:>5-25% 4: > 25-50% 5:>50-75% 6:>75-95% 7:>95%

Species	GPS Location	Patch Size (L X W)	Count (if <100)	Cover class (1-7)
Cordylanthus maritimus spp. *maritimus*				
Lasthenia glabrata ssp. *coulteri*				
Hemizonia perryi ssp. *austalis*				

Occurrence of Non-Indigenous Species

Species	Code	Suspected Habitat	Habitat Found	CHECK if Present
Atriplex semibaccata	Atse			
Bassia hyssopifolia	Bahy			
Beta vulgaris	Bevu			
Bromus diandrus	Brdi			
Carpobrotus edulis	Caed			
Cotula coronopifolia	Coco			
Lepidium latifolium	Lela			
Lolium multiflorum	Lomo			
Lotus corniculatus	Loco			
Lythrum hyssopifolium	Lyhy			
Mesembryanthemum crystallinum	Mecr			
Mesembryanthemum nodiflorum	Meno			
Parapholis incurva	Pain			
Polypogon monspeliensis	Pomo			
Rumex crispus	Rucr			
Salsola soda	Saso			
Spartina alterniflora	Spal			
Spartina HYBRID	Sphy			
Spartina densiflora	Spde			

Recorder Name _____

California EMAP Intensification Data Sheets

DATA SHEET 10

EMAP 2002 Station Number _____Date _____

Check List of Native Plant Species

SALT MARSH SPECIES	CODE	CHECK if present	BRACKISH MARSH SPECIES	CODE	CHECK if present
Atriplex triangularis	Attr		*Alisma plantago-aquatica*	Alpl	
Batis maritima	Bama		*Cordylanthus mollis ssp. mollis*	Comm	
Cordylanthus maritimus ssp. maritimus	Comm		*Juncus bufonius*	Jubu	
Cressa truxillensis	Crtr		*Juncus effusus*	Juef	
Cuscuta salina	Cusa		*Lathryus jepsonii var. jepsonii*	Lajj	
Distichlis spicata	Disp		*Lilaeopsis masonii*	Lima	
Frankenia salina	Frsa		*Lilaeopsis occidentalis*	Lioc	
Glaux maritima	Glma		*Plantago subnuda*	Plsu	
Grindelia hirsutula var. hirsutula	Grhh		*Potentilla anserina ssp. pacifica*	Poap	
Grindelia stricta	Grst		*Ruppia maritima*	Ruma	
Heliotropium curassavicum	Hecu		*Scirpus acutus*	Scac	
Jaumea carnosa	Jaca		*Scirpus americanus*	Scam	
Juncus acutus	Juac		*Scirpus californicus*	Scca	
Juncus balticus	Juba		*Scirpus maritimus*	Scma	
Juncus lesueurii	Jule		*Scirpus robustus*	Sscro	
Lasthenia glabrata	Lagl		*Typha angustifolia*	Tyaan	
Limonium californicum	Lica		*Typha dominguensis*	Tydo	
Monanthochloe littoralis	Moli		*Typha latifolia*	Tyla	
Pluchea odorata	Plod				
Salicornia bigelovii	Sabi				
Salicornia europea	Saeu				
Salicornia subterminalis	Sasu				
Salicornia virginica	Savi				
Scirpus robustus	Scro				
Spartina foliosa	Spfo				
Spergularia marina	Spma				
Suaeda californica	Suca				
Suaeda esteroa	Sues				
Triglochin concinna	Trco				
Triglochin maritima	Trma				

Recorder Name _____

California EMAP Intensification Data Sheets

DATA SHEET 11

EMAP 2002 Station Number _____Date _____

Unidentified Plant Specimens Taken (Internal use only – not for entry into database)

Sample Code	

End Time _____

Comments: _____

_____

_____

Recorder Name _____

California EMAP Intensification Data Sheets

Secondary Data Collection (Reports and Interviews)

DATA SHEET 12

EMAP 2002 Station Number _____Date _____

Recorder Name _____

Station Description: Region _____

Management Unit_____

Watershed Name_____

Agency Responsible for Management Unit _____

Source of Data:

1. Agency Personnel Interviewed: No_____ Yes _____ (if yes, fill in below)

Name_____

Organization _____

Title_____

(Report/Record)

2. Title_____

Author_____Date_____

Institution_____ City _____

Report Number _____Type_____ Pages _____

QA/QC Documented in Report? _____Yes_____No (check one)

3. Title_____

Author_____Date_____

Institution_____ City _____

QA/QC Documented in Report? _____Yes_____No (check one)

Report Number _____Type_____ Pages _____

4. Title_____

Author_____Date_____

Institution_____ City _____

Report Number _____Type_____ Pages _____

QA/QC Documented in Report? _____Yes_____No (check one)

Management Unit Size (acres): _____

Other Adjacent Management Units within Patch? No ____ Yes _____ (if yes, fill in below)

1. Management Unit_____ Agency Responsible_____

2. Management Unit_____ Agency Responsible_____

3. Management Unit_____ Agency Responsible_____

4. Management Unit_____ Agency Responsible_____

5. Management Unit_____ Agency Responsible_____

Recorder Name _____

California EMAP Intensification Data Sheets

6. Management Unit_____ Agency Responsible_____

Recorder Name _____

California EMAP Intensification Data Sheets

Secondary Data Collection (Reports and Interviews)

DATA SHEET 13

EMAP 2002 Station Number _____Date _____

Objectives for which Wetland is Managed (circle any that apply):

Federal T/E Species **State T/E Species** **Local /NGO Species of Concern**
Shore Bird Support **Support of Intl/Natl Migratory Bird Conservation**
Recreation **Hunting** **Fishing** **Passive Recreation**
Education/Outreach **Research** **Other (list below)**

_____

Does Management Plan Exist? No____ Yes _____

If so, what year written _____

Recreational access to Management Unit Allowed? No____ Yes _____ (if yes, fill in below)

Recreational facilities on site? No____ Yes _____

Vistor Center? No____ Yes _____(if yes, fill in below)

Nmber of Permanent/Part-time Staff: _____

Number of Annual Visitors? _____ or Check if Unknown_____

Programs Offered (circle all that apply):

Recreational trails **Guided Tours** **K-12** **Outreach**
Other (list below)

_____

Access allowed by recreational trails No _____ Yes _____(circle any if applicable)

Foot **Vehicle** **Horse** **Bicycle**

Access allowe d to wetland itself ? No _____ Yes _____ (circle any if applicable)

Boat **Kayak/Canoe** **Walk-in**

Miles of recreational trails (if applicable) _____

Recorder Name _____

California EMAP Intensification Data Sheets

Secondary Data Collection (Reports and Interviews)

DATA SHEET 14

EMAP 2002 Station Number _____Date _____

Occurrence of Sensitive Plant Species? No_____ Yes_____ (if yes, list below)

Species	Date Surveyed

T/E Animal Species? No_____ Yes_____ (if yes, list below)

Species	Est. Population	Date Surveyed

Recorder Name _____

California EMAP Intensification Data Sheets

Secondary Data Collection (Reports and Interviews)

DATA SHEET 15

EMAP 2002 Station Number _____Date _____

Occurrence of Non-Indigenous Plant Species? No_____ Yes_____ (if yes, list below)

Species	Code	CHECK if Present	Date Surveyed
Atriplex semibaccata	Atse		
Bassia hyssopifolia	Bahy		
Beta vulgaris	Bevu		
Bromus diandrus	Brdi		
Carpobrotus edulis	Caed		
Cotula coronopifolia	Coco		
Lepidium latifolium	Lela		
Lolium multiflorum	Lomo		
Lotus corniculatus	Loco		
Lythrum hyssopifolium	Lyhy		
Mesembryanthemum crystallinum	Mecr		
Mesembryanthemum nodiflorum	Meno		
Parapholis incurva	Pain		
Polypogon monspeliensis	Pomo		
Rumex crispus	Rucr		
Salsola soda	Saso		
Spartina alterniflora	Spal		
Spartina HYBRID	Sphy		
Spartina densiflora	Spde		

Recorder Name _____

California EMAP Intensification Data Sheets

Secondary Data Collection (Reports and Interviews)

DATA SHEET 16

EMAP 2002 Station Number _____Date _____

Name of Watershed Containing Wetland _____

NPDES Permitted Discharges to Watershed Containing Wetland:

Source of Data:

1. Agency Personnel Interviewed: No_____ Yes _____ (if yes, fill in below)

Name_____

Organization _____

Title_____

(Report/Record)

2. Title_____

Author_____Date_____

Institution_____ City _____

Report Number _____Type_____ Pages _____

2. Title_____

Author_____Date_____

Institution_____ City _____

Report Number _____Type_____ Pages _____

3. Title_____

Author_____Date_____

Institution_____ City _____

Report Number _____Type_____ Pages _____

4. Title_____

Author_____Date_____

Institution_____ City _____

Report Number _____Type_____ Pages _____

Comments_____

_____

Number of NDPES permits issued for watershed containing wetland:

Major (All POTWs and Facilities with Baseline Flows = > 1 MGD) _____

Minor (All Facilities with Baseline Flows < 1 MGD) _____

General Permits (see Section 4.2 of SOPs for explanation) _____

Total _____

Recorder Name _____

California EMAP Intensification Data Sheets

Total Baseline Discharge of Major NPDES permit holders (MGD) _____

Recorder Name _____

California EMAP Intensification Data Sheets

Geographic Information System Data Collection

DATA SHEET 17

EMAP 2002 Station Number _____Date _____

Station Description: Region _____

Management Unit_____

Recorder's Initials _____

Recorder's Organization _ _____

EMAP Core Station GPS Location (circle one: GPS DGPS)

Lat _____ Long _____

Data Sources used for Analysis

Data Set Date (Year) and Name	Data File Name	Source

N.B. Submit FGDC-compliant metadata with each GIS data source

Patch Metrics

Area of wetlands patch (sq. meters): _____

Perimeter of wetlands patch (meters): _____

Watershed Size and Human Population Density

Area of associated watershed (sq. meters): _____

Population of associated watershed: _____

Index of Connectivity:

Patch Level:	Area (sq. meters):	Distance (meters):	Connectivity Index:
1			
2			
3			

Recorder Name _____

California EMAP Intensification Data Sheets

Recorder Name _____

California EMAP Intensification Data Sheets
Geographic Information System Data Collection
DATA SHEET 18

EMAP 2002 Station Number _____Date _____

Index of Channel Density:

Channel Area (sq. meters):	Channel Perimeter (meters):	Channel Density Index:

Percentage of Landuse:

Cumulative Buffer Interval:	Land Use in Adjacent Area (%)				
	Residential:	Commercial:	Industrial:	Agricultural:	Open Space:
0 – 60					
0 – 120					
0 – 180					
0 – 240					
0 – 300					
0 – 360					
0 – 420					
0 – 480					
0 – 540					
0 – 600					

Shoreline complexity Index:

Patch Perimeter:	Perimeter of Circle:	Shoreline complexity Index:

Recorder Name _____