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Contract No. N62474-88-D-5086

Contract Task Order No. 0232

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NAVAL WEAPONS STATION
CONCORD, CALIFORNIA

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
TIDAL AREA SITES

WORK PLAN VOLUME II
QUALITATIVE ECOLOGICAL ASSESSMENT
DRAFT

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September 16, 1993

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1.0 INTRODUCTION

The Department of the Navy, Western Division, Naval Facilities Engineering Command (WESTDIV) is conducting an ecological risk assessment as part of the remedial investigation/feasibility study (RI/FS) at the four Tidal Area sites at the Naval Weapons Station (WPNSTA) Concord, California (Figure 1). As part of the RI/FS, WESTDIV has authorized PRC Environmental Management, Inc. (PRC), under Contract No. N62474-88-D-5086, Contract Task Order (CTO) No. 0232 to prepare a qualitative ecological assessment (QEA) work plan (WP). PRC will use the subcontractor, Western Ecological Services Company, Inc. (WESCO) to provide technical assistance and to implement portions of the QEA WP. In addition to preparing the QEA WP, PRC will prepare a QEA report and provide technical review and oversight of subcontractors.

The RI/FS WP, Volume I has been prepared and submitted to the regulatory agencies. This document is Volume II of the RI/FS WP. This document was developed based on the organization and guidance suggested in ECO Updates (U.S. EPA 1991a, 1992a). The scope of work for this CTO includes definition of objectives, site characterization, evaluation of chemicals and species of concern, identification of potential receptors, and plans to develop endpoints for risk assessment, exposure assessment, toxicity assessment, and risk characterization.

The QEA data collection will focus on characterizing the biological components of the Tidal Area sites. Primary physical and chemical data will be obtained during the RI. The RI/FS WP, Volume I and this document, Volume II of the RI/FS WP have been developed in coordination with each other so that data gaps will be minimal. Chemical and physical data needs for ecological risk assessment purposes have been communicated and included in the RI/FS project plans. The ecological risk assessment is designed so that upon completion of data collection for the qualitative phase (which characterizes biological components), both physical and chemical data will be available for qualitative analysis and tier testing. The qualitative analysis will use the chemical data collected during the RI and the biological data collected during the QEA (Phase I of the ecological risk assessment), to identify site areas, chemicals, and receptors that are of greatest concern. These will be the focus of any proposed quantitative analysis (Phase II of the ecological risk assessment).

Figure 1

This detailed station map has been deleted from the Internet-accessible version of this document as per Department of the Navy Internet security regulations.

The QEA WP contains six major sections:

- Introduction. Section 1.0 introduces the document and its contents and discusses the QEA's relationship to the RI/FS.

- Background. Section 2.0 describes the rationale, approach and framework of the ecological risk assessment and the purpose and objectives of the QEA. Work conducted previous to and for the development of this WP is also summarized.

- Ecological Characterization Plan. Section 3.0 describes how the sites will be characterized relative to ecological components such as habitats and ecological receptors. Methodologies for characterizing the floral and faunal communities are also presented.

- Problem Formulation Plan. Section 4.0 describes activities that will lead to recommendations for contaminants of ecological concern, ecological effects, exposure pathways, and selection of ecological receptors.

- Conceptual Site Model Development Plan. Section 5.0 describes the plan for development of the conceptual site models. At the conclusion of the qualitative assessment, the conceptual site models will present an understanding of the sites in terms of nature of contamination, exposure pathways, and ecological receptors.

- Tier-Test Criteria Development and Application. Section 6.0 describes the tiered approach to an ecological risk assessment. The section details how quality criteria will be used to determine advancement of the QEA (Phase I) to the quantitative assessment (Phase II).

2.0 BACKGROUND

The overall purpose of the ecological risk assessment for the Tidal Area sites is to evaluate the potential for adverse ecological effects associated with chemical contamination of the area. The ecological risk assessment will provide a baseline for establishing preliminary remedial action goals and evaluating remedial alternatives.

2.1 APPROACH AND FRAMEWORK

The approach to be used for the ecological risk assessment will address the information requirements identified in the ecological risk assessment guidance developed by the U.S. Environmental Protection Agency (U.S. EPA) including Risk Assessment Guidance for Superfund (RAGS): Volume II,

Environmental Evaluation Manual (U.S. EPA 1989a); Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference (U.S. EPA 1989b); Summary Report on Issues in Ecological Assessments (U.S. EPA 1991b), and The Nature and Extent of Ecological Risks at Superfund Sites and RCRA Facilities (U.S. EPA 1989c).

The framework of the ecological risk assessment for the Tidal Area sites is shown in Figure 2. The ecological risk assessment will be conducted in two phases: Phase I, the QEA and Phase II, the quantitative assessment. The decision to continue from Phase I to Phase II, and the subsequent scope of the Phase II assessment, will be based upon the evaluation of qualitative data collected during Phase I and the nature and extent of contamination data derived from RI/FS activities. The QEA evaluation will be conducted using the tier-test approach described in Section 6.0.

The purpose of the QEA is to characterize the biological components of the Tidal Area sites and thereby identify potential receptors, exposure pathways, and potential ecological effects. Biological component characterization, coupled with the chemical nature and extent data derived from the RI, will provide information needed to determine the necessity and scope of a Phase II assessment.

The QEA is comprised of four basic components as shown on Figure 2, Sheet 3.

- Stressor Characterization identifies and describes the nature and extent of contamination and exposure pathways. Data on the nature and extent of contamination will be collected during the RI. The distribution of contamination will be evaluated relative to the distribution of ecological habitats. The data will be evaluated during the QEA to identify contaminants of concern and analyze exposure pathways.

- Ecosystem Characterization identifies and describes the site habitats and biota. This component will consist of an inventory and assessment of terrestrial, aquatic, and wetland habitats and their associated flora and fauna, and threatened and endangered species status and occurrence. A key purpose of the ecosystem characterization will be to identify potential receptor species and representative biota for each of the habitats identified.

- Ecological Effects Characterization includes an ecotoxicity assessment of the site constituents and a qualitative analysis of site receptors' exposure and detrimental effects potential.

FIGURE 2
WPNSTA Concord Tidal Area
Ecological Risk Assessment Framework
(SHEET 1 OF 4)

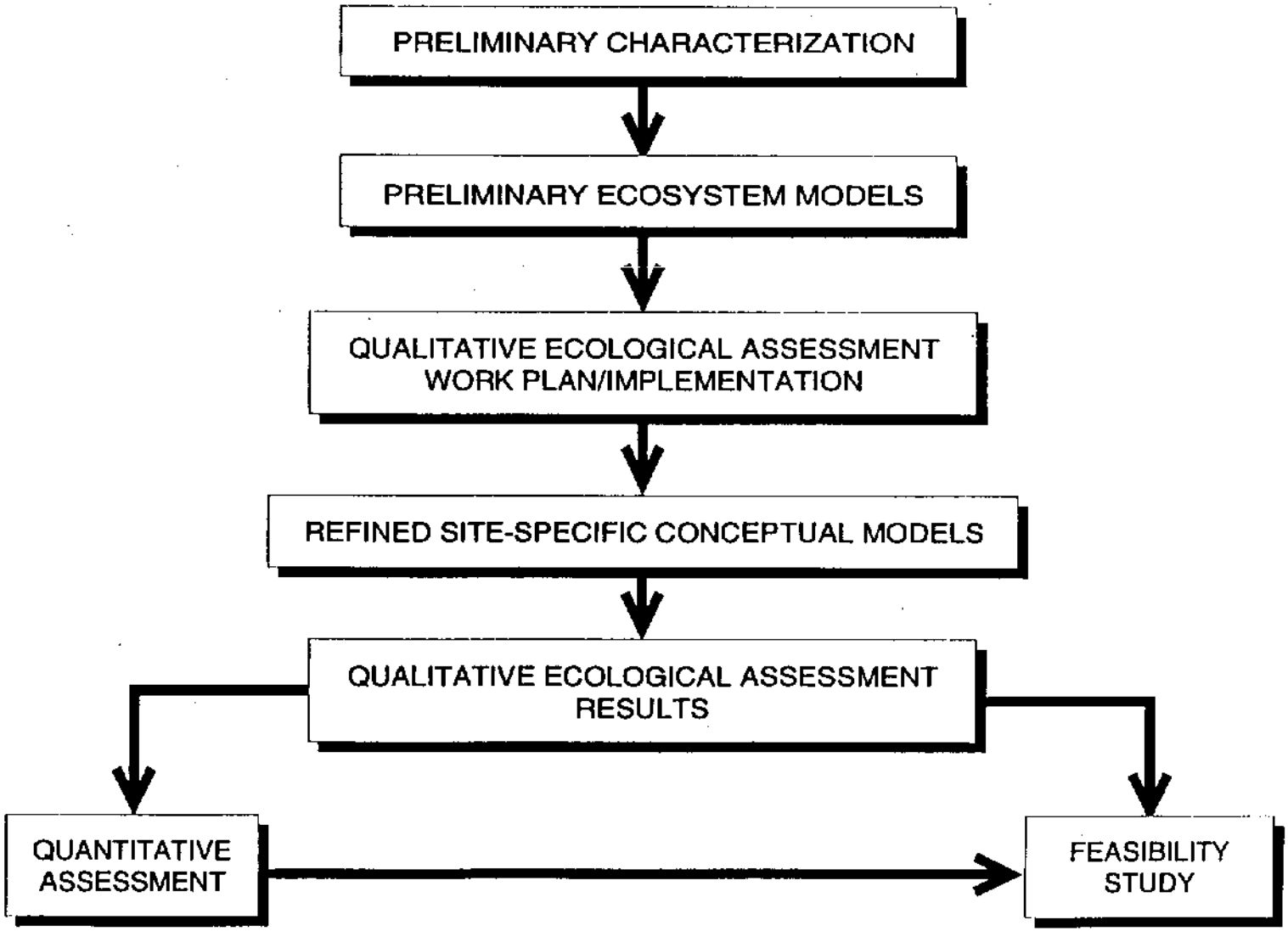

FIGURE 2
WPNSTA Concord Tidal Area
Ecological Risk Assessment Framework
(SHEET 2 0F 4)

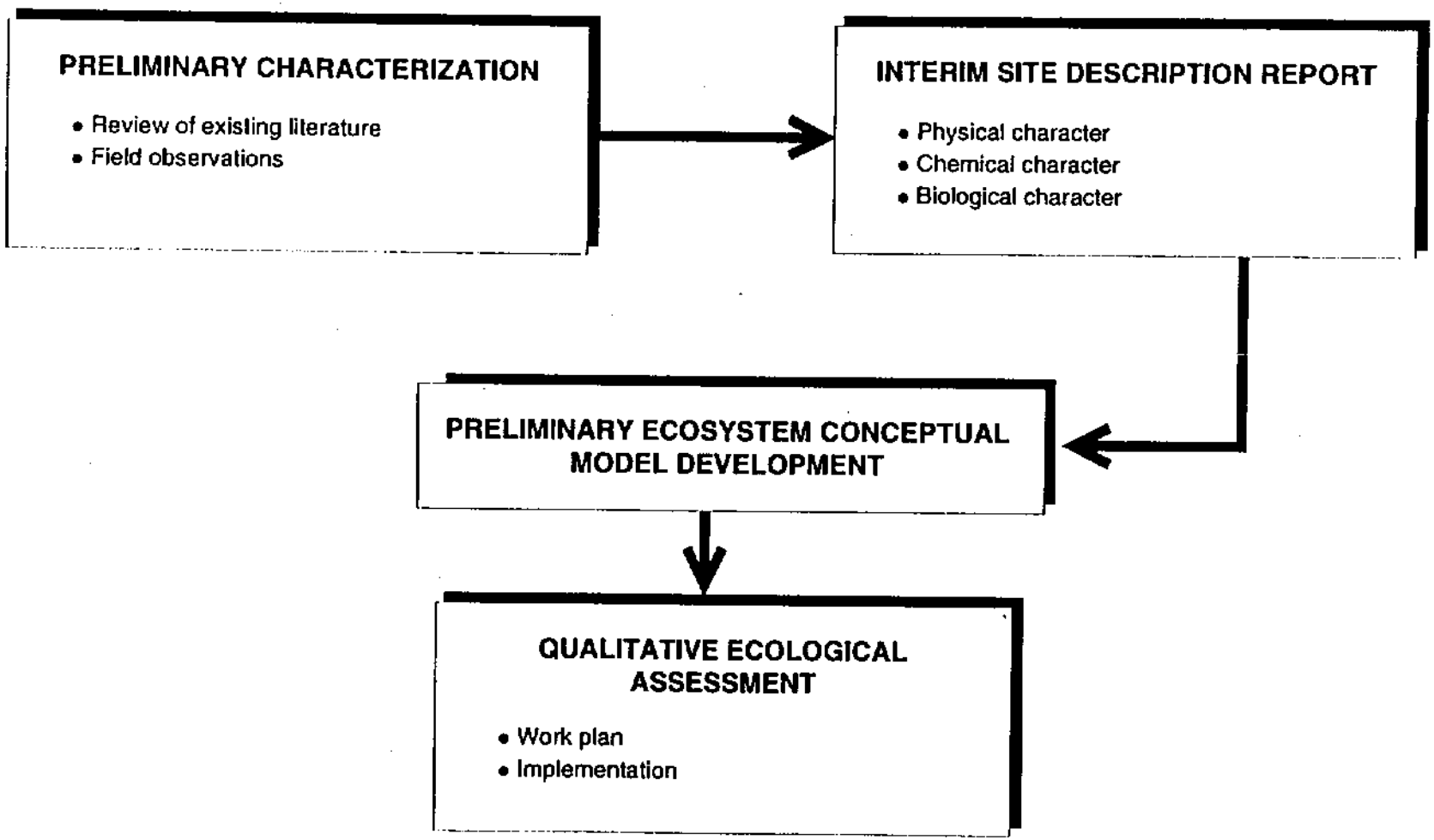

FIGURE 2
WPNSTA Concord Tidal Area
Ecological Risk Assessment Framework
(SHEET 3 OF 4)

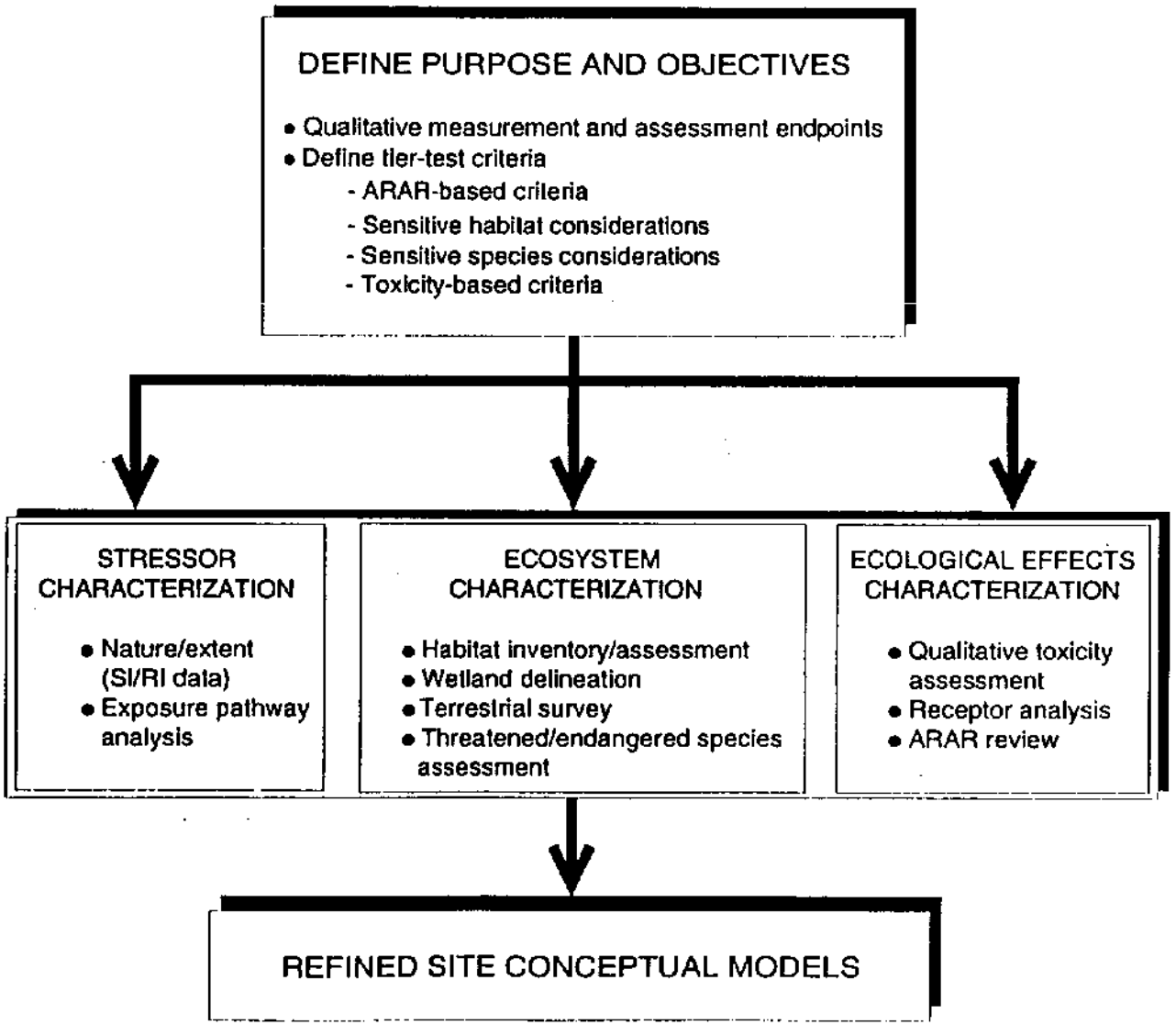

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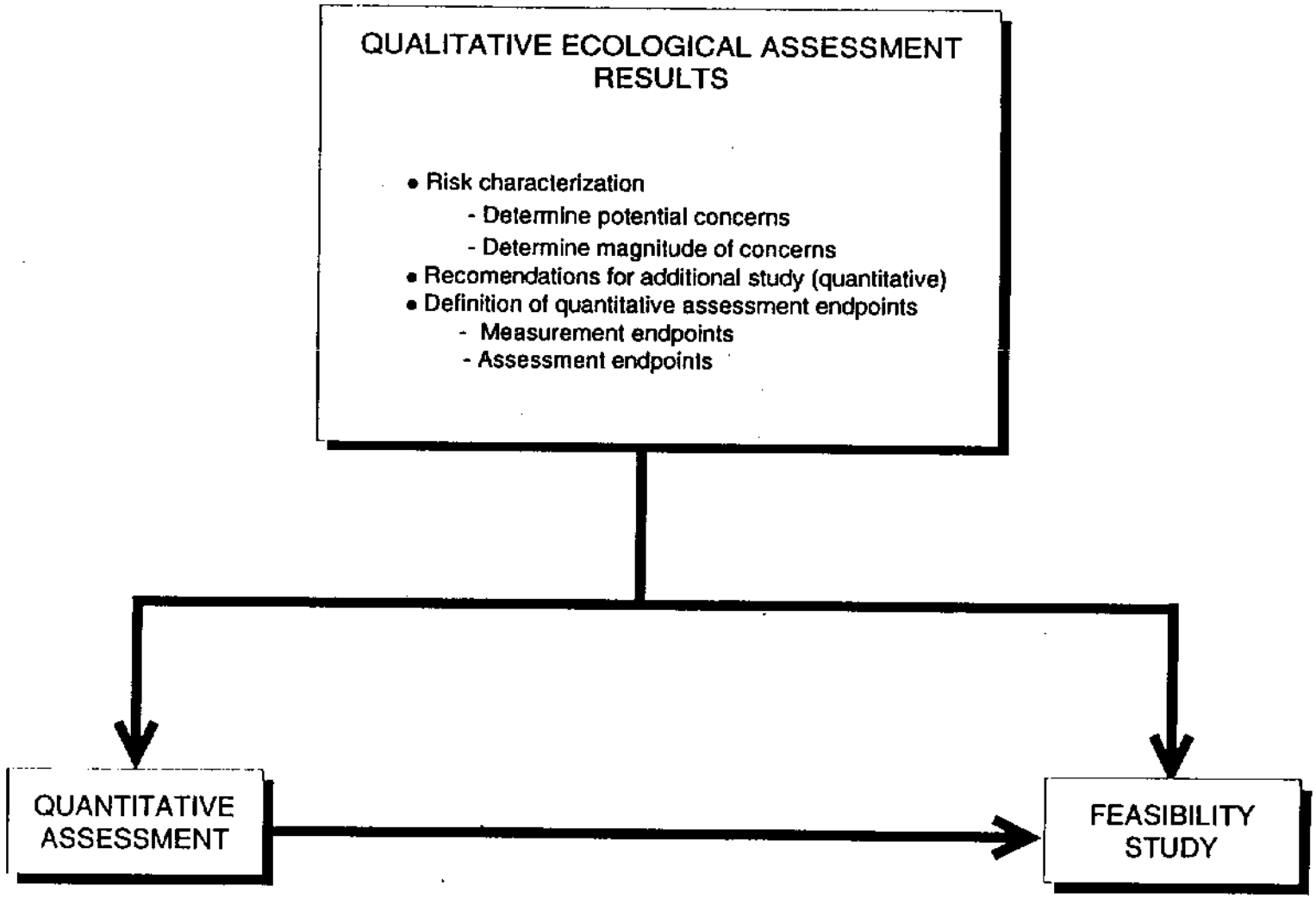
FIGURE 2
WPNSTA Concord Tidal Area
Ecological Risk Assessment Framework
(SHEET 4 OF 4)



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- Site Conceptual Model Development will utilize all ecosystem, stressor, and effects information to refine site-specific conceptual models that will identify data gaps and focus Phase II efforts. A general conceptual model is presented as Figure 4-1 of the RI/FS WP, Volume I.

These four major components are comprised of numerous, interconnected sub-components (Figure 2, Sheet 3). The sub-components describe the information that must be gathered in order to carry out the QEA.

2.2 PREVIOUSLY COMPLETED WORK

Work conducted previous to and in preparation for the development of this work plan are presented in Figure 2 (Sheet 2) and include the following:

- Review of existing literature. A limited amount of readily available site-specific literature was reviewed to gain an overall understanding of the physical, chemical, and biological character of the site area.

- Field Observations. Two site visits were conducted in order to gain a visual understanding of the sites and their ecological setting.

- Interim Site Description Report. A report was prepared which summarized the findings of the literature review and site visits. This report is presented in Appendix A. These findings form the basic understanding of the sites on which the QEA WP design is based.

- Preliminary Conceptual Model Development. A general preliminary conceptual model was developed from the above initial information. This model forms the basis for development of the site-specific models described in Section 5.0 of this WP.

2.3 OBJECTIVES

Specifically, the QEA will accomplish the following:

- Identify ecological receptors (flora and fauna) that may be exposed to chemicals of concern.

- Identify representative categories of biological receptors for review of effects data.

- Identify sensitive habitats and species that are of special concern for purposes of risk assessment and remedial impact determinations.
- Identify chemical exposure routes and pathways for ecological receptors.
- Develop information concerning toxic effects of the chemicals of concern.
- Develop and conduct tier testing to determine the need for advancing to a Phase II, quantitative assessment.
- Recommend assessment and measurement endpoints for use in Phase II, quantitative assessment (if necessary).

3.0 ECOLOGICAL CHARACTERIZATION PLAN

In order to more clearly determine the nature and composition of biotic communities within the Tidal Area, qualitative field surveys and focused literature reviews will be performed. The objective of this portion of the QEA is to provide sufficient reconnaissance level data for characterizing the biota and habitats within the sites, and for eventually identifying the potential chemical pathways and receptor organisms and/or groups of organisms to be evaluated for risk. If subsequent quantitative ecological assessment work is deemed necessary, the reconnaissance level data will form the basis for developing the quantitative study design.

3.1 WORK ELEMENTS

The ecological characterization will consist of the following work elements:

- Habitat Assessment and Inventory. All habitat types within the study area, including wetlands, will be identified. The nature and composition of each habitat will be described by conducting field transect surveys and species inventories.
- Terrestrial Surveys. Wildlife species and their associated habitats, and key food organisms within the study area will be described by conducting systematic field observations. These observations will be supplemented by assessing the potential wildlife utilization of each identified habitat-type based on literature review and professional knowledge.
- Aquatic/Benthic Systems Characterization. All significant areas of standing water, that might provide benthic invertebrates for foraging birds, will be the focus of aquatic characterization studies. These studies will involve sampling aquatic benthos

in a manner to determine the relative composition of the predominant organisms, and to characterize the associated sediment.

- Rare, Threatened, and Endangered Species Assessment. Basic information will be summarized on federal or state rare, threatened, or endangered species observed on the site, or that are potentially present. Systematic surveys for sensitive plant and animal species likely to occur in the study area will also be conducted.

- Wetland Delineations. The boundaries of all wetland communities will be surveyed in accordance with U.S. Army Corps of Engineers procedures.

3.2 HABITAT ASSESSMENT AND INVENTORY

A qualitative report and accompanying map (scale no smaller than 1:3600) will be prepared, providing an inventory of all terrestrial and wetland habitats occurring in the Tidal Area. The inventory shall categorize each habitat type in accordance with Holland (1986) (e.g., northern coastal salt marsh, coastal brackish marsh). Wetland habitats will be further categorized in accordance with Cowardin *et al.* (1979) (e.g., diked salt marsh: system - palustrine, class - emergent, subclass - persistent). The report will provide acreages, species lists, and general habitat descriptions. The report will also provide a functional assessment of all wetland areas and will summarize any instances and possible causes of vegetational stress in the Tidal Area. The habitat assessment and inventory subtasks are described below.

3.2.1 Aerial Photo Interpretation

All cover types, including wetlands, will be identified and mapped on existing aerial photography of the site (Pacific Aerial Surveys, AV-4230-20-3, 7-7-92, 1:2400). Standard photointerpretive techniques will be combined with information derived from previous site visits and from past wetland survey work relating to the site. Relevant past survey work has been conducted by: Ecology and Environment (1983), Waterways Experiment Station (1986, 1988a), WESCO (1979, 1981a, 1981b, 1991), and EIP Associates (1985). The mapped aerial photos will serve as working maps for both the habitat assessment/inventory transects and for the subsequent wetland delineation process.

3.2.2 Field Transect Surveys

Walking transects will be conducted within each of the four Tidal Area sites and along Otter Sluice by a team of one botanist and one wildlife biologist. A hydrogeologist technician will also accompany the team for the purposes of collecting hydric soil and hydrology data as necessary for wetland delineation purposes (see Section 3.6 below). The purpose of these transects is to delineate and characterize the habitats within each Tidal Area (Figure 3). Transects are designed to intersect each cover type evident on the mapped aerial photographs. The starting point and ending point of each transect will be marked with surveyor's ribbon in the field. Ribbon will also be placed at 175 to 300 foot intervals to mark the route of each transect.

Data collected along each transect will include the following characteristics for each cover type:

1. Dominant plant species.
2. General structure of the plant community (*i.e.*, strata, estimated average height, homogeneity, qualitative description of density and diversity, robustness of growth).
3. Habitat value for fauna likely to be associated with the vegetational community. This information will be used to assist and design subsequent terrestrial and aquatic survey work.
4. Evidence of stress to vegetation (*i.e.*, chlorosis, die-off, barren areas or areas with sparse vegetation). This information will be subsequently used to conduct a more detailed stressed vegetational analysis, if necessary.
5. A list of other plant species observed.
6. Hydrological conditions (*i.e.*, presence of surface waters, saturated soil conditions, evidence of water flow, presence of algal mats).

The transect team will carry a paper copy of the mapped aerial photo with them and will directly mark the locations for major field observations within each cover type on the photo. Standard field data sheets will be used for recording the transect work (Appendix B, Form 1).

Figure 3

This detailed station map has been deleted from the Internet-accessible version of this document as per Department of the Navy Internet security regulations.

Tentative locations for each transect are depicted on Figure 3. These locations are based on current knowledge of the Tidal Area and may be subject to change based on field observations. Transect sizes and locations are summarized as follows:

	Transect size (feet)	Number of Transects
R Disposal Area & Tidal Area Landfill Sites	1200	1
	1050	1
	900	3
	800	1
	600	2
	500	1
Froid and Taylor Roads Site	350	1
Wood Hogger Site	900	1
	850	2
	600	1

3.2.3 Final Mapping

Data from the transects shall be used to prepare a final map (scale no smaller than 1:3600) depicting all habitat-types within the Tidal Area. Each habitat-type will be coded on the map to its respective classification inventory (*i.e.*, Holland 1986 and Cowardin *et al.* 1979).

3.2.4 Habitat Functional Assessment

A qualitative functional assessment will be applied to the wetlands within the Tidal Area. This assessment will provide a general summary of the biotic and non-biotic values that the wetlands may provide. Evaluations will be based on field observations from the transect surveys in combination with the various background information resources. It is anticipated that one additional site visit will be required to complete this process. The functional assessment subtasks are described below.

3.2.4.1 Background Information Sources

Background information sources will be reviewed and applied to the functional assessment as appropriate. Relevant sources include:

- Technical literature relating to the bay ecosystem such as the San Francisco Estuary Project Public Reports (SFEP 1990-1992), Cuneo (1987), Nichols (1977), and U.S. Fish and Wildlife Service (U.S. FWS) studies relevant to bay wetlands including: U.S. FWS (1981), Herbold and Moyle (1989), and Nichols and Pamatmat (1988).
- The various background information sources relating to the WPNSTA Concord including: Waterways Experiment Station (WES) (1986, 1988a, 1988b), Ecology and Environment (1983), Jones and Stokes (1982), and PRC (1993b).
- Previous wetland assessments and biotic inventories performed within similar areas such as WESCO (1979, 1981a, 1981b, 1990, 1991) and LSA (1992).
- The California Dept. of Fish and Game database ("RareFind") and the California Native Plant Society lists ("Inventory of Rare and Endangered Vascular Plants").

3.2.4.2 Functional Values

Functional values that shall be analyzed are:

- Habitat quality of the Tidal Area with emphasis on their potential suitability for rare, threatened, or endangered faunal species. Habitat suitability for key faunal species and species groups (*i.e.*, migratory waterfowl, raptors, fish, and small mammals) will be evaluated with respect to fundamental requirements such as food, cover, potential nesting and roosting areas, and presence of surface waters.
- Isolation and the degree of connectivity of the Tidal Area to adjacent natural areas. Other nearby wetland systems with which the Tidal Area likely share functional relationships such as hydrologic interactions, faunal populations, and detrital export will be identified.
- Floral and faunal diversity of the Tidal Area and the significance of this diversity to the adjacent ecosystems.
- Degree of disturbance to the Tidal Area by biotic and abiotic factors such as invasive exotic plant species, hydrological regimes, water flow diversions, and filling.

- Stability of the Tidal Area. The likelihood that these wetlands will exhibit long term maintenance trends in both the presence and absence of active management efforts will be evaluated.

- Possible public benefits that the Tidal Area can provide such as flood storage, recreation, and water quality enhancement.

3.2.5 Indications of Stress

Information from the transect surveys will be used to determine if there are any indications of vegetational stress. If such indications are observed, then additional field surveys will be conducted in the areas where stress was noted. Evidence of stress will be derived from two levels of indicators:

- Community Level Indicators - species presence/absence data. Key indicator species either present or not present in the rough abundances expected for the particular community, and the presence of certain indicator species suggesting community-wide stress will be evaluated. For example, high coastal salt marshes subject to regular tidal influence are often dominated by *Salicornia virginica*. A general paucity of *Salicornia* could be indicative of shorter than normal hydroperiods and disruption of normal tidal regimes. If the exotic species *Salsola soda* is found to displace *Salicornia*, then the community may also be subject to biotic stresses caused by invasive exotic species.

- Physiological Indicators - physical condition of plants. Physical conditions of plants within a community suggesting certain biotic or abiotic stresses will be evaluated. Common examples would include chlorosis, death, wilting or leaf drop from twig and branch extremities or robust growth of certain weedy species.

For each wetland area where vegetational stress is observed, stress indicators from the two categories will be noted and possible stressors will be suggested, based on observed site conditions. Among the range of possible stressors, other than chemical contamination, will be: erosion, hypersalinity, flooding, hydric stress, nutrient enrichment, soil disturbance, invasive exotic vegetational disturbance, stagnation of surface waters, diseases, and senescence. (It should be noted that stressors can be synergistic and cumulative. For example, flooding can make terrestrial plants more susceptible to fungal diseases.) All areas of stressed vegetation will be documented in the report, noted on the habitat maps, and photographed.

3.3 TERRESTRIAL SURVEY

The purpose of the terrestrial survey is to characterize the use of the four Tidal Area sites by terrestrial wildlife. This information will ultimately be used to determine potential receptor organisms and exposure pathways. Given this purpose, this work plan focuses on providing general assessments of wildlife use and activity based on literature review and professional knowledge of the wildlife associated with the site habitats in the region. This information will be supplemented with qualitative surveys of each site.

Tentative wildlife observation points are depicted on Figure 4. These observation points are located to take advantage of existing high berms that border the Tidal Area. Observations will be conducted from the approximate midpoint of the marsh-ward slopes of the berms. The previously-described transect surveys (Section 3.3.2) may suggest that observation points will need to be relocated based upon the probable locations for wildlife occurrences. The terrestrial survey subtasks are described below.

3.3.1 Faunal Counts

Use of the sites by common species of birds and larger mammals will be assessed by conducting a time-area count at each of the four sites and along Otter Sluice. Each count will consist of two 20-minute surveys or observation periods, occurring in the early morning (dawn to 9 am) and at sunset. An observer will be stationed at a preselected observation point and observe all wildlife utilizing the site. Data recorded will include species, number of individuals, activity (i.e., foraging, resting, fly-over), habitat or habitat feature association (slough, barren site, channel, ditch, upland), and other noteworthy information (Appendix B, Form 2). Counts will only be conducted during favorable weather patterns.

3.3.2 Random Transects

The time area counts will provide information on the more common birds and larger mammals using each site. This information will be supplemented by the biologist walking a meandering transect

Figure 4

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through each site during non-count periods. The purpose of this transect will be to look for signs of inconspicuous or wide-ranging animals which may not be present in each area during the counts. During the transect the biologist shall overturn cover (boards and tree limbs) to attempt to identify small mammals and reptiles, assess general habitat conditions (present cover and depth of vegetation), and identify special habitat features (*i.e.*, burrows, perching and roosting sites).

3.3.3 Literature Review

Regional information from sources such as Cuneo (1987), Herbold and Moyle (1989), SFEP (1990-1992), and USFWS (1981) will be supplemented with information about the area from previous biology studies (WESCO 1979, 1981a, 1981b, 1986, 1990, 1991; EIP Associates 1985; LSA 1992; Waterways Experiment Station 1988a,1988b,1989) to assess the likelihood of the presence of small mammals and/or other biota.

3.4 AQUATIC/BENTHIC SYSTEMS CHARACTERIZATION

The four Tidal Area sites drain into Otter Slough, its associated drainage ditches, and the upper end of Seal Creek. These waterways, plus any significant areas of standing water that might provide benthic invertebrates for bird foraging, will be the focus of the aquatic characterization. Five sample sites are anticipated along the length of Otter Slough. An additional 15 sampling sites are designated for drainage ditches and areas of standing water. All 20 of these stations will be sampled for aquatic benthos to determine the relative composition of the predominant organisms, and to characterize the associated sediment. Because of variations in aquatic fauna due to seasonal salinity changes, aquatic sampling will occur once in February and again in late July or early August of 1994. The proposed sampling method is described below.

3.4.1 Dredge Sampling

At each station, sediment/benthos samples will be collected by Ekman dredge. Each sediment sample will first be examined by hand to estimate its predominant sediment size and degree of organic content, then it will be washed and sieved on site using a 0.5 millimeter (mm) screen. That portion retained by the screen will be placed in a bucket with water and then agitated to suspend most

invertebrates. Approximately a half liter of the suspended contents of the bucket will be poured slowly into a white enamel pan and the invertebrates within identified to their taxonomic order. The contents of the second bucket are then discarded. When the first bucket is nearly empty, the bottom of that bucket will be examined for bivalves and any other organisms that would readily drop from suspension.

Organisms that cannot be identified to order in the field will be labeled as "unknown" and will be given a number corresponding to their order of retrieval, and several specimens will be brought to the laboratory for identification. The type of information recorded in the field for each sample will be the number of taxa and the approximate number of organisms comprising each taxa (Appendix B, Forms 3 and 4). Samples with excessive detritus may be divided in half while in the sieve, and only half the total sample examined in the enamel pan. The remaining half of the sieved sample would then be examined in the sieve for large invertebrates such as bivalves and crabs.

3.4.2 Water Column Sampling

Fish and invertebrates from the water column will be sampled at the dredging stations. Sampling will be accomplished with dip nets (0.25-inch mesh) and a 50-foot seine (0.25-inch mesh) where conditions are suitable for seining. Sites not suitable for seining will be sampled using a minnow trap baited with anchovy and fished for 6 to 8 hours through a high tide cycle. Invertebrates will be identified to order and the fish to species. Special attention will be given to noting aquatic macroinvertebrates that may be prey species for shorebirds. Water quality readings for dissolved oxygen, pH, conductivity, and temperature, plus odors and sediment characteristics, will be recorded for each sampling site (Appendix B, Form 5).

3.5 RARE, THREATENED, AND ENDANGERED SPECIES ASSESSMENT

The study area may support certain listed, candidate, or other special-status wildlife species. However, with the exception of the salt marsh harvest mouse, there have been few or no observations demonstrating that the species use the site on more than an occasional basis. Listed, candidate, or other special-status species that potentially occur onsite are:

- tricolored blackbird (*FC2, CSC) - At least one breeding colony is present in the nearby Peyton Slough/Shell Marsh area.

- curve-footed diving beetle (FC2) - Known from small, drying, mineralized pools near Oakley, Contra Costa County (Hafernik 1989).

- San Francisco fork-tailed damsel fly (FC2) - Populations of this specie have been recently identified in the Suisun Bay region and suitable habitat is present in Otter Slough and other channels.

- burrowing owl (CSC) - Previously listed as occurring in grasslands within the WPNSTA (Jones and Stokes 1982).

- short-eared owl (CSC) - Incidental sightings in salt marshes within the WPNSTA (Jones and Stokes 1982).

- California black rail (FC2, ST) - Black rails have been documented from other tidal areas on the WPNSTA Concord and the Hastings Slough area west of the current study area (Jones & Stokes 1982). The habitat quality onsite is not optimal due to reduced tidal action. However, rails from adjacent, superior quality habitats may use the site.

- California clapper rail (FE, SE) - Two clapper rails were also observed on the WPNSTA site (Waterways Experiment Station 1988a,b). The habitat quality onsite is again not optimal due to reduced tidal action. However, clapper rails from adjacent, superior quality habitats may use the site.

- salt marsh harvest mouse (FE, SE) - Individuals have been previously trapped throughout salt marsh areas of the WPNSTA Concord, although the extent of occurrence within the actual study area is unknown (WES 1988b).

- western pond turtle (FC2-will probably be listed soon, CSC) - Previous studies documented the presence of this species in Middle Point and Seal Creek wetlands (Jones and Stokes 1982).

*Status: FE - Federally Endangered; FT - Federally Threatened; SE - State Endangered; ST - State Threatened; SR - State Rare; FC - Federal Candidate Species for Listing; CSC - California Species of Special Concern. 1 - Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened; 2 - Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

Several special status plant species, including one which is listed as a State Rare species, may also occur within the study area. These species are primarily plants that are associated with marsh habitats in the region.

- Suisun Marsh aster (*Aster lentus* - FC2)
- Suisun thistle (*Cirsium hydrophylum var. hydrophylum* - FC1)
- soft bird's-beak (*Cordylanthus mollis ssp. mollis* - FC1, SR)
- Delta tule pea (*Lathyrus jepsonii var. jepsonii* - FC2)
- Gairdner's yampah (*Perideridia gairdneri ssp. gairdneri* - FC2)
- Mason's quillwort (*Lilaeopsis masonii* - FC2, SR)

The terrestrial surveys (Section 3.3) will provide an initial reconnaissance of potential occurrences of listed or candidate animal species. Any observed individuals, likely habitat areas or other evidence of their presence (i.e. burrows, scat, songs etc.) will be noted and appropriate information such as location and habitat association will be recorded. This data will be used as a basis for later focused quantitative studies on only those species which are likely present in the study area and which may be determined to be potential receptors.

The field transect Surveys (Section 3.3.2) will provide reconnaissance level information on the possible presence of special status plant species. However, the absence of certain rare plant species during these surveys does not preclude their presence on site. The plant species of concern have wide-ranging flowering periods (from April until November) and reliable identifications of these species is generally dependent on flower morphology. It is unlikely that the transect surveys will be conducted during the flowering periods of more than one or two species, because of the time constraints and reconnaissance level nature of this assessment. Further, even if one or two species are flowering during the surveys, the geographic area covered by the surveys may be insufficient to detect the existence of rare species that occur sparsely and sporadically. Therefore, the transect surveys will probably narrow the potential habitat areas on the site where the plant species could occur rather than eliminate certain species from further consideration.

Based on previous observations, the endangered salt marsh harvest mouse is probably present at or immediately adjacent to all four sites and is the listed species of primary concern. The R Area Disposal and Tidal Area Landfill Sites in particular provide suitable habitat for this species. Suitable, but probably lower quality, habitat is present at the Froid and Taylor Roads and Wood Hogger Sites.

The assessment of habitat for the salt marsh harvest mouse will be based on published and unpublished information. A primary source will be WESCO in-house records and reports of previous trapping studies in this region (CNDDB 1993; Jones & Stokes Associates 1982; WESCO 1981a, 1981b, 1990). Primary habitat considerations include plant species presence and diversity, cover height and overall growth form, percent bare ground, extent and duration of seasonal flooding, and available upland or other high ground refugia.

3.6 WETLAND DELINEATION

Wetland jurisdictional delineations will be conducted within the four Tidal Area sites in accordance with the Corps of Engineers Wetland Manual (Army Corps of Engineers 1987). The Tidal Area are characterized by certain conditions that will shape the nature and methodology of the wetland delineation process. These conditions are described below.

3.6.1 Filled Soil Conditions

In three of the four Tidal Area sites (Wood Hogger, R Area Disposal, and Tidal Area Landfill), large areas have been previously filled with various materials ranging from silty clay, sands, and other disposal materials. Typical soil properties/criteria such as low chroma, mottling, and other characteristics of hydric soils may not be valid indicators of current hydric and/or non-hydric conditions in these filled areas. Under these circumstances, it is expected that two separate wetland identification methods under the Corps Manual (Army Corps of Engineers 1987) will be applicable.

These two methods are:

- The Corps Manual allows soils to essentially be ignored under certain limited conditions. Where wetland hydrology is clearly evident, soils can be assumed to be hydric under either of the following conditions:
  - all dominant plant species have an indicator status of obligate wetland plants (OBL).
  - all dominant species have a status of OBL or facultative wetland plants (FACW) and an abrupt wetland boundary occurs.

Based on current knowledge of the site, filled soil conditions will likely be encountered frequently where pickleweed, alkali bulrush, cattails, and salt grass dominate previously-filled areas within the Tidal Area sites.

- Where artificial soils cannot be assumed to be hydric, but nevertheless support a predominance of wetland vegetation, an "atypical situation" may exist. The Corps Manual definition for "atypical situations" includes "man-induced wetlands" where previous alterations result in hydric vegetation growing upon artificial soils. Such soils don't typically fall under the Corps Manual's hydric categories. Under these circumstances, the Corps will accept classification of hydric soils based on other appropriate technical criteria. The most appropriate criteria are contained in *Hydric Soils of the United States* (USDA 1991), which the Corps has previously accepted as an appropriate alternative criteria for San Francisco Bay wetlands growing on previously-filled soils (WESCO 1992).

3.6.2 Upland Prairie/Wetland Interfaces

According to the Interim Site Description Report and subsequent field observations, the Wood Hogger and Tidal Area Landfill Sites consist of a mix of upland prairie and salt grass marsh communities (PRC 1993b). Delineations in these areas can often be somewhat complex, due to the mosaic effect of intermixed uplands and wetlands as well as a dynamic ecotonal area that may vary substantially between periods of wet and dry years.

In order to ensure maximal accuracy within these mixed areas, emphasis will be placed on the photointerpretive and groundtruthing phases of the delineation process. Photographic signatures of the possible ecotonal cover types will be validated with replicate field verifications involving data points within possible ecotonal areas.

Wetland delineations will be conducted in accordance with the Corps of Engineers' three parameter test as contained in the 1987 Wetland Delineation Manual. A Routine Level 2 determination (areas larger than 5 acres) will be employed.

It should be noted that the delineation maps that will be produced will still be subject to Corps of Engineers approval. This approval process could require additional field surveys and modifications in delineation boundaries that are not a part of this WP.

The wetland delineation subtasks are described below.

3.6.3 Review Existing Documents

- **Survey of other background information resources**

  Other potential sources of wetland information for the general project area will be reviewed. These include the Initial Assessment Study (Ecology and Environment, Inc. 1983) and Waterways Experiment Station (1986, 1988a). Other sources are the National Wetland Inventory Maps, SCS soil surveys, previous wetland delineations (WESCO 1981a, 1981b, 1991), and USGS quadrant sheets.

- **Analysis of available hydrological and soils data**

  Available sources of hydrological data and soil survey maps will be analyzed. This information will be compiled and summarized in a brief report that will be coded to areas delineated on the preliminary wetland maps.

- **Photointerpretation**

  Wetland areas and other cover types will be identified and mapped on the aerial photography as per Section 3.2.2 above.

3.6.4 Conduct Field Reconnaissance and Groundtruthing

Field reconnaissance for verification of aerial photographic interpretation will be completed as part of the transects conducted under Section 3.2.2 above. Transect locations may be adjusted as necessary to maximize observation and wetland delineation potential.

3.6.5 Perform Field Delineations Work

Wetland delineations will generally be conducted as part of the field transect surveys (Section 3.3.2), although additional data points outside the transect areas will also be necessary. Delineation work will be conducted for mapping of wetland boundaries in accordance with the three parameter procedure (soil, hydrology, and vegetation) under the Corps 1987 Wetland Manual (U.S. Army Corps of Engineers 1987). Tentative field data points are shown on Figure 3. The number of data points within a given wetland area will be based on the degree of vegetative homogeneity. All field data and observations will be recorded on standard wetland delineation data sheets (Appendix B, Form 6).

A total of 98 data points are anticipated. The total number of delineation transects will comply with the Corps Delineation Manual Step 19 (U.S. Army Corps of Engineers 1987). Additional data points will be concentrated within the previously-mentioned prairie/marsh boundaries and other potential upland/wetland boundaries.

3.6.6 Data Synthesis and Wetland Map Preparation

Based on the results of the field delineation work and background soil/hydrological data analysis, preliminary wetland delineation maps will be prepared along with a written report and data forms providing supporting data.

3.7 DATA PRODUCTS

Data products will be three bound copies and one unbound reproducible copy of a report summarizing assessment results.

The report shall include:

- Descriptions of the nature and composition of plant and animal communities in the study area.
- Copies of all field notes and data sheets.
- Professional opinions and observations of stressors unrelated to chemical discharges from the site.
- Descriptions of wildlife species, habitats, and key food organisms.
- Descriptions of habitats that are unique or unusual or necessary for the continued propagation of key species.
- A wetlands identification and functional assessment report.
- Tables listing rare, threatened, and endangered species and other species of special concern present or likely to be present in the study area.
- Table of observations (e.g., species, season, diet, call, scat, nests - including photos, and nocturnal activity).

- Figures showing the location of habitats and any observed nesting areas for rare, threatened, or endangered species and other species of special concern, including the specific locations of harvest mouse trappings.

- Tables of other species identified during tasks described above.

- Detailed hand drawings (including legend and notes) on base maps, of the location of wetlands, marginal wetlands, and other habitats.

- A detailed summary report providing and discussing the results of the harvest mouse trapping program.

4.0 PROBLEM FORMULATION PLAN

During the problem formulation portion of the ecological assessment, the objectives and scope of the project will be established. In problem formulation, the physical and biological features of the site are combined with a description of the distribution of chemicals and known ecological effects to develop a conceptual model of how chemical exposure causes ecological effects. Problem formulation involves a preliminary identification of chemicals of concern, an evaluation of exposure pathways, and identification of ecological receptors of highest concern. Components of the problem formulation portion are described in this section and will be refined during the execution of this WP.

4.1 IDENTIFICATION OF CHEMICALS OF CONCERN

This task will determine chemicals of potential concern (COPC) which have had or could have a potential effect on ecological receptors. Factors to be considered in identifying these constituents include:

- Concentrations in surface soils, sediments, surface water, and groundwater that may discharge to marine or aquatic habitats.

- Frequency of occurrence in these media.

- Background levels (derived from regional literature) and the extent to which COPCs exceed these levels.

- Bioavailability of the COPCs in soils and sediments while considering site-specific factors (for example, TOC) that may affect bioavailability.

- Physical-chemical properties such as solubility, hydrophobicity, and volatility that may affect behavior, transport, and accumulation of the constituent.
- Potential for bioaccumulation or bioconcentration.
- Types of effects that the COPCs may have and the potential for these effects to be additive or synergistic with each other.

Computerized literature searches and reviews of recent applicable literature will be used to supplement information readily available on COPCs. A search will be conducted for all current information regarding effects on aquatic organisms in U.S. EPA's Aquatic Information Retrieval Toxicity (AQUIRE) database. Recent publications in the Society of Environmental Toxicology and Chemistry (SETAC) journal and papers presented at recent SETAC symposia will be reviewed. In addition, an on-line literature search will be performed to compile recently published background information on wildlife habitats.

The following databases may be used to obtain information on the chemical effects on plants, wildlife, fish, and benthic invertebrates:

- PHYTOTOX
- Bios Previews
- Life Sciences Collection
- Zoological Record Online
- Enviroline
- Pollution Abstracts
- Oceanic Abstracts
- CAB Abstracts

These databases are all available through the DIALOG information services. The TOXicological NETwork (TOXNET), and AQUIRE databases can be accessed via the National Library of Medicine's MEDLARS system.

Information obtained from the literature review will be stored on line and reviewed at the end of the search; relevant material will then be printed and incorporated into the appropriate files of biological, chemical, and toxicological data; endpoints; or results of acute and chronic studies in an appropriate database for use during Phase II (if needed).

Based on a preliminary review of existing information, there are a number of candidate COPCs at WPNSTA Concord. The following classes of chemicals were found in soil and ground water samples during the SI which was performed between April 1988 and January 1991 by International Technology Corporation: Froid and Taylor Roads Site (volatile organic compounds [VOC], semivolatile organic compounds [SVOC], and metals), Wood Hogger Site (VOCs, SVOCs, organochlorine pesticides/polychlorinated biphenyls [Pest/PCB], and metals), R Area Disposal Site (VOCs, SVOCs, and metals), and Tidal Area Landfill Site (VOCs, SVOCs, Pest/PCBs, and metals). The SI did not determine the full extent of contamination (Table 1).

A confirmation study was performed in January 1993 by Montgomery Watson to verify the data in the SI report and to gain a conceptual understanding of the sites. Another purpose of the confirmation study was to evaluate the laboratory's practical quantitation/detection limits achievable for soil and groundwater samples. Soil and ground water samples were taken at all four Tidal Area sites and surface water samples were taken at the R Area Disposal Site. Some of the results of the confirmation study were contradictory to the SI: Froid and Taylor Roads Site (VOCs and SVOCs were not detected), Wood Hogger Site (VOCs were not detected), R Area Disposal Site (VOCs, SVOCs, and Pest/PCBs were not detected in soil, ground water, or surface water), and Tidal Area Landfill Site (VOCs and SVOCs were not detected) (Table 2).

TABLE 1

CHEMICAL CHARACTERISTICS FOR THE TIDAL AREA SITES
SITE INVESTIGATION DATA

SITE	VOCs	SVOCs	Pest/PCBs	Metals
FROID AND TAYLOR ROADS SITE	X	X	ND	X
WOOD HOGGER SITE	X	X	X	X
R AREA DISPOSAL SITE	X	X	ND	X
TIDAL AREA LANDFILL SITE	X	X	X	X

X - detected
ND - not detected
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
Pest/PCBs - organochlorine pesticides and PCBs

TABLE 2

CHEMICAL CHARACTERISTICS FOR THE TIDAL AREA SITES
CONFIRMATION SAMPLING DATA

SITE	VOCs	SVOCs	Pest/PCBs	Metals
FROID AND TAYLOR ROADS SITE	ND	ND	NA	NA
WOOD HOGGER SITE	ND	X	X	NA
R AREA DISPOSAL SITE	ND	ND	ND	X
TIDAL AREA LANDFILL SITE	ND	ND	NA	NA

NA - not analyzed
X - detected
ND - not detected
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
Pest/PCBs - organochlorine pesticides and PCBs

4.2 IDENTIFICATION AND EVALUATION OF EXPOSURE PATHWAYS

This part of the evaluation identifies the most likely exposure pathways by which biota at WPNSTA Concord come into contact with COPCs. The steps determining if an exposure pathway exists are as follows: (1) identify type and location of COPCs (soil, sediment, surface water, or groundwater), (2) identify the lateral and vertical extent of COPCs, (3) identify the potential physical pathways, (4) identify biota availability, (5) determine which types of biota are located in the path the COPCs will follow, (6) assess the characteristics of the identified receptors and the chemical effects the COPCs can potentially have on these receptors (i.e., bioaccumulation, eggshell thinning), and (7) determine whether the COPCs can cause physical stress to the biota (an example of physical stress is predation which increases with habitat loss). This 7-step process is referred to as a "complete pathway". The evaluation of factors influencing exposures will focus on the following (U.S. EPA 1991c):

- Site-specific physical and chemical conditions, including physical containment of contaminants, contaminant adsorption potential of media, pH of media, volatility, and solubility of contaminants
- Seasonal and climatic variations such as migratory and breeding habits of receptors
- Predator-prey relationships
- Diet habits and food preferences
- Foraging behavior
- Habitat range
- Life history

During the Phase I ecological assessment all complete pathways that can be identified will be considered and included in the conceptual site model. The pathways to be considered in Phase II (if needed) will be based on the Phase I results. Refer to the Field Sampling Plan, Figures 5-1 through 5-4 for proposed RI sampling locations (PRC 1993c).

4.2.1 Aquatic Exposure Pathways

Aquatic fauna can potentially be exposed to COPCs via ingestion of surface water, groundwater, sediment, and food (food chain transfer); inhalation (respiration) of surface water; and dermal contact to surface water, ground water, and sediment. Aquatic flora can potentially be exposed to COPCs via root uptake from surface water, groundwater, soil/sediment, and sediment; and leaf sorption from surface water and air. All of these pathways will be considered in context with the results from the identification of COPCs and the receptor characterization.

4.2.2 Terrestrial Exposure Pathways

Terrestrial fauna can be potentially exposed to COPCs via ingestion of surface water, groundwater, soil, soil/sediment, sediment, and food (food chain transfer); inhalation of air; and dermal contact to surface water, ground water, soil, soil/sediment, sediment, and air. Terrestrial flora can be potentially exposed to COPCs via root uptake from surface waters, groundwater, soil, and soil/sediment; and leaf sorption from air. All these pathways will be considered in context with the results from the identification of COPCs and the terrestrial assessment survey.

4.3 EVALUATION OF ECOLOGICAL RECEPTORS

Ecological receptors, faunal types, and communities will be identified. The identification of potential receptors will be based on a literature review and observations made during the site characterization.

Categories of receptors are expected to include, but are not limited to:

- Wetlands vegetation
- Upland vegetation
- Soil biota
- Mammals and birds
- Benthic invertebrates within the channels and permanently flooded areas

- Fish within the channels and bay

A list of ecological receptors recommended for assessment will be developed. This list will be presented in the context of the larger group of all ecological receptors. The list will include species of animals and plants associated with aquatic, wetland, terrestrial, and brackish water environments as well as functional groups and communities. The list will also include those species, groups, and communities likely to be present at the site or (in the absence of toxicological data on such species) those that are phylogenetically or trophically similar to those identified species.

Recommendations for the candidate species, groups, and communities will be based on a reasonable cross section of the major functional and structural components of the ecosystem at WPNSTA Concord. In recommending receptors for further study, consideration will be given to the inclusion of species or groups that represent different trophic levels (such as saprophytes, herbivores, and primary and secondary carnivores); a variety of feeding types (detritivores, scavengers, filter feeders, active predators, and forage fish); and aquatic wetland, upland, and marine habitats. Receptors will be recommended according to:

- Their relative abundance and ecological importance within the wetland, terrestrial, aquatic, and brackish water habitats
- Availability and quality of applicable toxicological literature
- Relative sensitivity to the chemicals of concern
- Trophic status
- Relative mobility
- Local feeding ranges
- Ability to bioaccumulate COPCs of concern
- Economic importance or federal and state endangerment status
- Visible evidence of stress

5.0 CONCEPTUAL SITE MODEL DEVELOPMENT PLAN

The conceptual model presents the integration of the data collection efforts detailed in Section 3.0, with the review efforts detailed in Section 4.0. The objective of conceptual site modeling is to develop a set of working hypotheses for potential Phase II evaluation (U.S. EPA 1992b). The working hypotheses will result from the exposure scenarios defined as part of the model. The conceptual site model will be developed by considering:

- Characteristics of chemical stressors (e.g. source areas, transport processes, partitioning in environmental media, biotransformation)
- Observations of stressors unrelated to the site
- Preliminary ecosystem analysis (e.g. receptors, lifestages, trophic relationships, habitat types)
- Preliminary observations of ecological effects (e.g. stressed vegetation, shifts from anticipated community structure, presence or absence of opportunistic species)

The conceptual site model will include a summary of all anticipated exposure scenarios. A preliminary conceptual site model is presented in Figure 5. Once exposure scenarios have been identified, those that are considered most likely to contribute risk to nonhuman biota will be recommended for further evaluation during the Phase II quantitative ecological assessment (if needed). Detailed rationales will be presented to support the recommendations for further evaluation of exposure scenarios. Data gaps will be identified and general methods for additional evaluation will be proposed for those exposure scenarios recommended for further study.

6.0 TIER-TEST CRITERIA DEVELOPMENT AND APPLICATION

The qualitative assessment, or Phase I, will use RI chemical and physical data in conjunction with the biological characterization information to apply conservative assumptions to identify chemicals, media, pathways, and ecological receptors of highest concern. To identify chemicals and media of concern, a qualitative, screening-level analysis will be performed. Site chemical data will be compared with media-specific quality criteria to determine if there is a potential for adverse ecological effects.

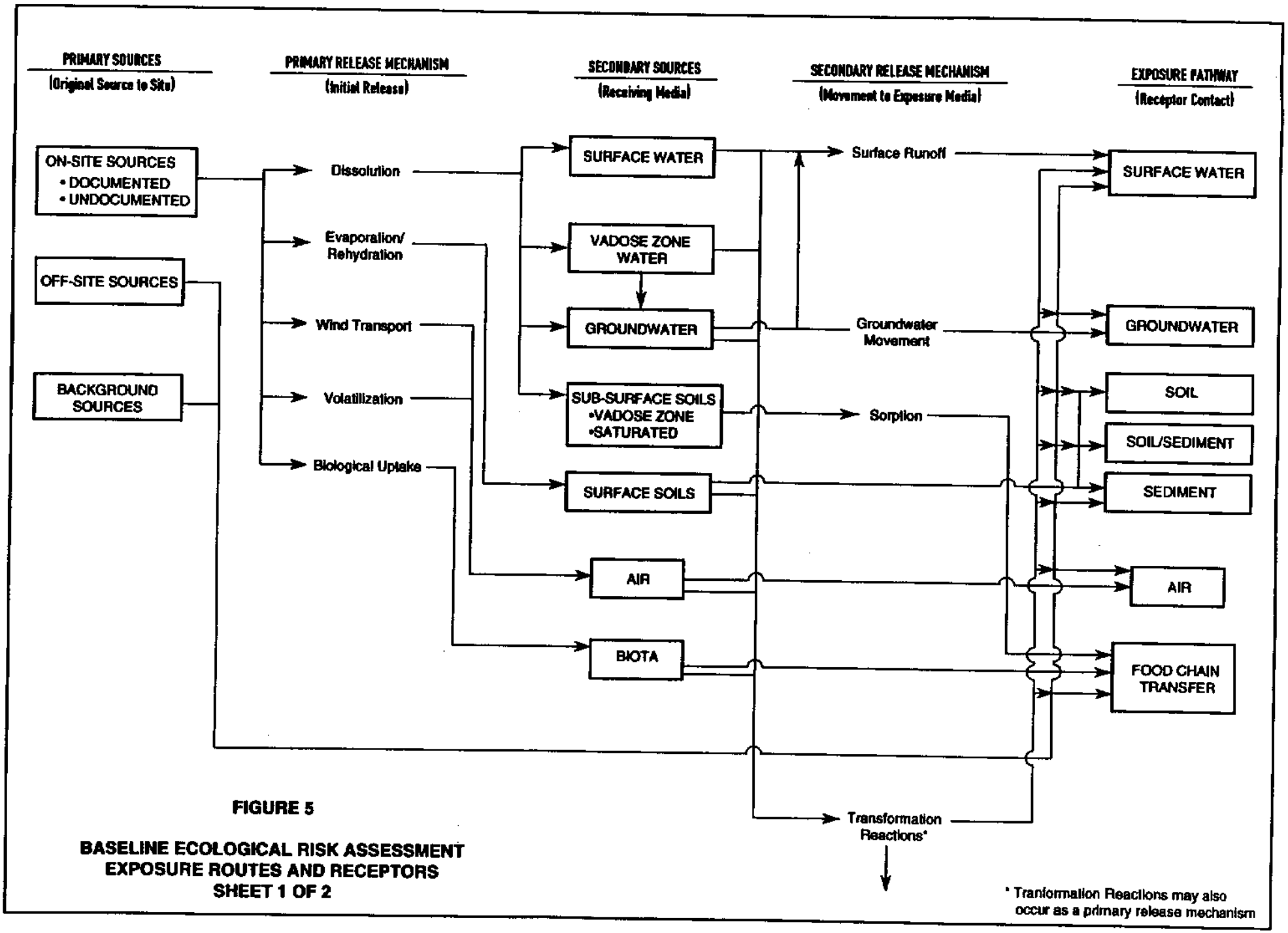

FIGURE 5

BASELINE ECOLOGICAL RISK ASSESSMENT
EXPOSURE ROUTES AND RECEPTORS
SHEET 1 OF 2

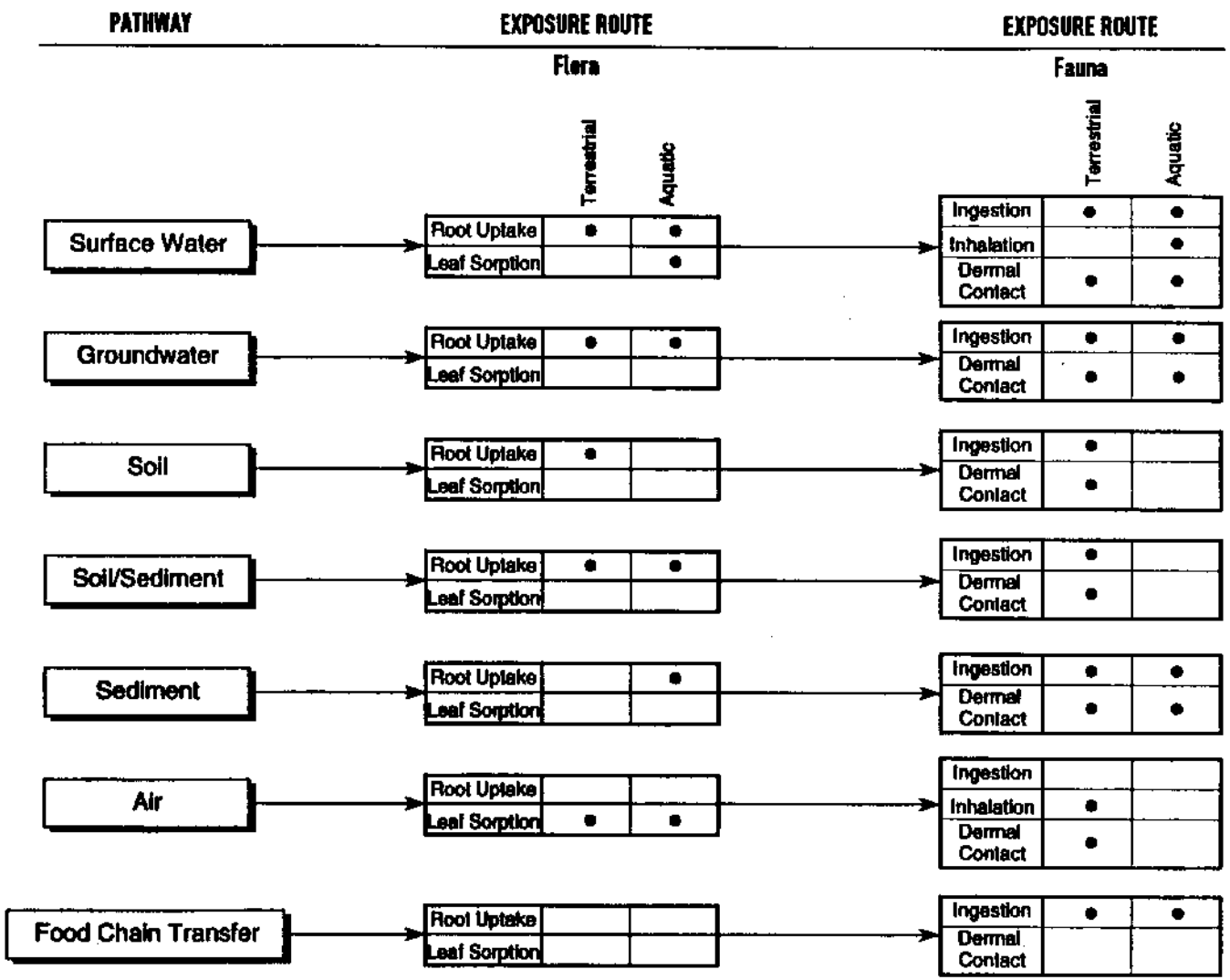

FIGURE 5

BASELINE ECOLOGICAL RISK ASSESSMENT
EXPOSURE ROUTES AND RECEPTORS
SHEET 2 OF 2

Conservative criteria will be selected for comparison (e.g., chronic water quality criteria). For each medium and site, chemicals for which site concentrations exceed criteria will be retained as COPC; chemicals at concentrations below criteria will be dropped from further analysis in Phase II of the ecological assessment. Chemicals for which no media-specific criteria are available will also be retained as COPC. Quantitative studies such as bioassays, bioaccumulation studies, or tissue analysis, may be initiated in Phase II of the ecological assessment. An objective of the qualitative assessment is to develop and test these decision criteria and recommend the necessity or scope of Phase II quantitative studies.

The following approach will be used to determine progression to a quantitative assessment. The environmental sampling data derived from RI activities will be compared against media-specific quality criteria. Potential criteria which may be selected include:

Water

- U.S. EPA Ambient Water Quality Criteria (U.S. EPA 1991d)
- Water quality objectives published in the San Francisco Region Basin Plan (CRWQCB 1986)

Sediments

- Sediments Effects Range data from the National Oceanic and Atmospheric Administration (Long and Morgan 1991)
- Sediment quality objectives published in the San Francisco Region Basis Plan (CRWQCB 1986)
- Apparent Effects Threshold Criteria for Northern California (PTI 1989)
- Washington State Marine Sediment Criteria (WDOE 1991)

Soils

- Quebec Soil Clean-up Criteria (QME 1988)
- Dutch Soil Clean-up Act (Beyer 1990)
- Criteria for Contaminated Soil/Sediment Cleanup (Fitchko 1989)

Upon comparison, two possible outcomes will occur: (1) media-specific sampling results do not exceed any quality criteria, or (2) sampling results exceed one or more media-specific quality criteria. To determine whether to proceed into a media-specific quantitative evaluation of risk, PRC will consider both exceedances of media-specific quality criteria and site-specific receptor concerns including:

- Relative abundance of ecological receptors and potential effects of exposure
- Endangered, threatened, or sensitive species and habitat status
- Physical and chemical properties of the site which may affect bioavailability and toxicity (e.g., pH and TOC)
- Magnitude and extent of chemical release
- Frequency and magnitude of exceedance
- Significance of exposure pathway(s)

PRC will use a weight-of-evidence approach in considering all these criteria to determine whether a quantitative assessment is required. If PRC finds that a Phase II study is warranted, specific recommendations may include risk quantification using hazard quotient methodologies and/or conducting field and laboratory studies such as bioassays, bioaccumulation studies, and exposure quantification using modeling or field data. The focus of such quantitative approaches will be on the area and the media in which the chemicals exceeding designated quality criteria were found, habitat or habitats present, and all indicator species frequenting the affected habitat(s). The result of this analysis will be a site-by-site, media-specific identification of COPC's, ecological receptors, and potential adverse ecological effects. In addition, recommendations will be made for quantitative studies that further characterize risk at the Tidal Area sites at WPNSTA Concord.

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APPENDIX A

INTERIM SITE DESCRIPTION REPORT

CLEAN

Contract No. N62474-88-D-5086

Contract Task Order No. 0232

Navy Engineer-in-Charge: Ronald Yee

PRC Project Managers: Gary Welshans and Santiago Lee

NAVAL WEAPONS STATION
CONCORD, CALIFORNIA

TIDAL AREA SITES
QUALITATIVE ECOLOGICAL ASSESSMENT
INTERIM SITE DESCRIPTION REPORT

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May 3, 1993

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1.0 INTRODUCTION

In accordance with the Navy Assessment and Control of Installation Pollutants (NACIP) program, the Department of Navy initiated an Initial Assessment Study (IAS [E&E, 1983]) at the Naval Weapons Station (WPNSTA) Concord, California. The IAS was conducted in 1982 by Ecology and Environment, Inc. (E & E). Of the 32 sites investigated under the IAS, 25 sites were identified as having the potential to release hazardous waste. The IAS recommended 13 of the 25 sites for further investigation. In 1987, after internal consultations among its organizational components and consultations with state regulatory agencies' representatives, the Navy added 12 sites to the list of 13 that the IAS proposed for further investigation. Since 1987, three sites were removed from the list of 25 sites based upon the results of investigations conducted by the Navy and concurred with by federal and state regulatory agencies. In addition, the 22 sites requiring further investigation were reorganized, based upon common boundaries and/or characteristics of the adjacent sites, into three groups: Litigation Area Sites (4 sites known as Remedial Action Subsites); Inland Area Sites (11 sites); and Tidal Area Sites (4 sites).

This Interim Site Description Report (ISDR) pertains to the Tidal Area Sites, which are designated as follows:

IAS Site Number	Study Location
Site 1	Tidal Area Landfill Site
Site 2	R Area Disposal Site
Site 9	Froid and Taylor Roads Disposal Site
Site 11	Wood Hogger Site

This report briefly describes: (1) general site information; (2) regional environmental setting; and (3) site-specific characteristics and field observations. The information presented is preliminary and based upon a current document review and two site visits conducted on February 18 and March 4, 1993. The documents from which this information was derived are listed in Section 5.0. A more comprehensive and detailed review of site and regional literature will be conducted as a task of the Qualitative Ecological Assessment during its implementation phase.

2.0 GENERAL SITE INFORMATION

WPNSTA Concord is located in the north-central portion of Contra Costa County, California, approximately 30 miles northeast of the City of San Francisco (Figure 1). The facility encompasses approximately 12,900 acres consisting of three landholdings: the Tidal Area, the Inland Area, and a radiography facility in Pittsburg, California. The Tidal Area contains approximately 6,077 acres on the mainland and 1,571 acres on seven islands in Suisun Bay (Freeman, Middleground, Roe, Ryer, Snag, and two unnamed islets of the Seal Islands). The Tidal Area is bounded by Suisun Bay to the north and the City of Concord to the south and west, and is separated from the Inland Area by the Town of Clyde and a range of hills that are not owned by the Navy. The Tidal Area consists of four sites, as defined by the Initial Assessment Study: Froid and Taylor Roads Disposal Site, Wood Hogger Site, R Area Disposal Site, and the Tidal Area Landfill Site.

According to the IAS, the wetland areas at WPNSTA Concord have undergone dramatic change in the past century. Industrial development around 1939 forced the drainage of over 400 acres of tidal wetlands bounded by Suisun Bay and the town of Port Chicago. Tidal flows were controlled by ditches within and adjacent to the Tidal Area. The undeveloped wetlands continued to have meandering channels.

Aerial photographs taken in 1959 show a continued decrease in the Tidal Area wetlands due to drainage. Two tidal gates controlled the tidal flow to the area. In addition, two large drainage ditches had been constructed (Pier 4 Slough and Belloma Slough) and numerous, smaller ditches traversed the area. A large portion of the upper Tidal Area was claimed by agriculture uses and rangelands.

During the past 20 years, 25 percent of the Tidal Area has been altered, due to the expansion of administrative and industrial facilities, including the construction of a new magazine. According to the Natural Resources Survey of WPNSTA Concord, California (NRS [Jones & Stokes, 1982]), the tidal flow has been altered to increase flow to the area, which has resulted in an increase in wetlands acreage.

south by Mount Diablo's northern peak, and is drained by streams which have their headwaters on the slopes of Mount Diablo and flow via Mount Diablo Creek through Clayton Valley into Suisun Bay.

Suisun Bay comprises the easternmost portion of the San Francisco Bay system. According to the IAS, the major sources of water to Suisun Bay are the Sacramento River, which delivers 80 percent of the storm water runoff, and the San Joaquin River, Middle River, and Old River, which delivers the remaining 20 percent. The average yearly influx into Suisun Bay is 21 million acre-feet of water. The influx of fresh water in the winter and spring causes the bay to becomes predominantly freshwater. In the summer and fall, stratification and a large, horizontal gradation develops. However, this has a minimal affect on the tidal cycle's influence on the salinity distribution.

There are four significant hydrological influences on Suisun Bay tidal wetlands: (1) parallel orientation of the drainage pattern to the shoreline, which allows wave action to build up sediment and debris at a higher elevation along the shoreline than along the plain and creates indirect drainage of tidal waters to Suisun Bay; (2) rise in sea-level at the rapid rate of 0.5 foot per 100 years; (3) increase in the flow of sediments to the Bay system and subsequent shoaling and filling of intertidal areas due to the hydraulic mining in the Sierra Nevada during the last century; and (4) sediment influx to the Tidal Area due to increased grazing in adjacent upland areas.

Due to several northwest trending fault systems, Contra Costa County is divided into large blocks of rocks: (1) upthrown blocks which form the hills: and (2) downthrown blocks which form the broad lowlands floored with thick, unconsolidated Pleistocene-age alluvial sediments eroded from the upthrown blocks. The major, active faults in the county are the Antioch, Clayton, Concord, and Pleasanton. The wetlands in the northern part of the region along Suisun Bay are underlain by estuarine and riverine deposits.

The wetlands and adjacent uplands at WPNSTA Concord are formed from alluvium of three different ages and modes of deposition. There are the terrace remnants of Pleistocene alluvial fans and floodplain deposits, consisting of irregularly interstratified sand, gravel, silt, and clay. The Pleistocene deposits are overlain by Holocene floodplain deposits consisting of irregularly interstratified sand, silt, gravel, and clay. These deposits are overlain at the margin of the Bay by bay mud, consisting of unconsolidated silt and clay with admixed organic material. The Pleistocene

and Holocene alluvial deposits are up to 500-feet thick and make up a locally important aquifer with highly variable permeability. The United States Department of Agriculture (USDA) Soil Conservation Service Soil Survey (SCS) identifies a local wetland soils as the Joice Muck series. According to the National Cooperative Soil Survey, the wetlands soils are clastic, euic, and thermic *Terric Medisaprists*.

3.1.2 Groundwater

WPNSTA Concord uses surface water for its potable water source. Groundwater is used for agricultural purposes, and intermittently for augmenting water resources to base wildlife such as the Tule Elk. The quality of groundwater in the Tidal Area is generally classified fair to below average due to high levels of total dissolved solids, chlorides, iron concentrations, and hardness. There are two programs that are administered by the California natural resources agencies which measure surface water quality. The California Department of Water Resources state-wide monitoring program is the primary system. The secondary system is administered by the State Water Project. These programs monitor levels of salinity and heavy metals, as well as benthic biomass and chlorophyll distribution.

3.1.3 Physiography and Topography

The Tidal Area was originally comprised of three distinct land formations: the tidal wetlands along the margin of Suisun Bay, the upland colluvial slope, and the sandstone hills. The WPNSTA Concord tidal wetlands have been altered by the construction of a landfill, the addition of fill material to the area, and road and dike construction. The area to the south of Contra Costa Canal is characterized by steeply sloping terrain, beginning at the 100-foot elevation and rising to more than 600 feet. The hills are composed of soft sandstone.

3.1.4 Climatology

Average local temperature for the area varies from 45 degrees Fahrenheit in January to 75 degrees Fahrenheit in August. The record low of 16 degrees Fahrenheit was recorded in December 1972. The average frost season is about 100 days.

The mean precipitation for the area is 14 inches per year. Approximately 84 percent of the rainfall is precipitated from November to March. Warm, dry summers and moderate rainy winters are the normal weather trend for this area.

A wind gap, through which the prevailing winds blow in a westerly direction, is formed by the San Francisco Bay and the Carquinez Strait. This results in a significant influence to the area's microclimate by the Pacific Ocean and Suisun Bay. The westerly winds are most predominant in the summer months and minimal from November through February. A high pressure ridge carrying high temperatures can occur in the late spring and summer months. Mean wind velocities average 12 miles per hour 65 percent of the time and blow in a southwesterly to west-northwesterly direction.

The area has periodic inversions which cause an increase in ambient temperature with altitude. During these periods of inversion, airborne contaminants are prevented from vertically dispersing. Contra Costa County does not currently meet the Federal Clean Air Act guidelines for particulates, carbon monoxide, and opacity.

3.2 BIOLOGICAL CHARACTERISTICS OF THE AREA

This section describes the flora, fauna, and threatened and endangered species which populate the Tidal Area Sites.

3.2.1 Flora

The Tidal Area's vegetation primarily consists of baltic rush, bulrush, cattails, perennial grasses, and saltgrass. Woody water plants such as reeds, sedges, and tules play an important role in wildlife protection and substrate stabilization, as well as providing a food source to a host of animals. Levees provide a base on which California rose, coyote bush, and sweet fennel can grow. In addition, planktonic diatoms thrive in marine waters (Table 2).

3.2.2 Fauna

The Tidal Area is host to a variety of invertebrates, small mammals, and bird species. In addition, benthic invertebrates, zooplankton, shell-fish, and fish populate Suisun Bay and Otter Sluice. A general decline in Suisun Bay water quality has had a direct impact on the health and numbers of marine species. The diked wetlands within the Suisun Bay constitute an extremely variable habitat due to the varying water salinity management practices used. These wetlands provide habitat to a wide variety of invertebrates, fishes, plants, and other wildlife. Seasonal wetlands have a variety of invertebrates. Studies in Suisun Bay seasonal wetlands and ponds have indicated approximately 53 species of invertebrates, with peak numbers occurring in early summer. However, these diked, seasonal wetlands have limited fish populations due to intermittent desiccation or periods of harsh environmental conditions. The species that have been observed in these areas include mainly mosquito fish and the three spine stickelback. Of the other wildlife that uses the seasonal wetlands and ponds in the area, migratory birds are most dependent on these areas to provide essential feeding, nesting, and resting habitat at a time of year when California's limited wetland acreage must support a much larger bird population (Table 3).

3.2.3 Threatened and Endangered Species

Several state and Federally threatened and endangered species are known to inhabit WPNSTA Concord. The current status of threatened and endangered species that inhabit the Tidal Area Sites has not been determined, and will be a separate task of the Qualitative Ecological Assessment. The Suisun Bay is host to the Federally threatened, winter-run chinook salmon (*Oncorhynchus tshawytscha*) and the Federally threatened delta smelt (*Hypomosus transpacificus*).

According to the SI Report, the Federally endangered California clapper rail (*Rallus longirostris obsoletus*), salt marsh harvest mouse (*Reithrodontomys raviventris*), and California threatened black rail (*Laterallus jamaicensis coturniculus*) are known to inhabit certain brackish wetland areas at WPNSTA Concord. Rare visitors to the area include the Federally endangered American peregrin falcon (*Falco peregrinus*), the Federally threatened bald eagle (*Haliaectus leucocephalus*), and California brown pelican (*Pelecanus occidentalis*) (Table 4).

4.0 SITE-SPECIFIC CHARACTERISTICS AND FIELD OBSERVATIONS

4.1 HYDROGEOLOGY

While regional groundwater flows toward Suisun Bay, the four Tidal Area Sites have variable groundwater gradients in magnitude and direction. The mean potentiometric surface varies from above the ground surface in some areas to greater that 5 feet below land surface in other areas. Water levels are seasonally high from rains in February and March. Groundwater levels are typically lowest in the dry summer months of June, July, and August. Groundwater flow continues northward toward Suisun Bay. The hydraulic conductivity for the area ranges from 10^{-4} to 10^{-6} centimeters per second (cm/s), which is within the typical range for clayey sands and silts.

The shallow bay mud aquifer that underlies the Tidal Area is not suitable as a source of drinking water. The aquifer has low hydraulic conductivity and groundwater quality is poor. Total dissolved solids (TDS), hardness, chlorides, and iron concentrations are high. Peak water levels from seasonal rains are seen in February and March.

The following hydrogeological information comes from the SI Report that is the only known source of information specific to the Tidal Area Sites.

4.1.1 Froid and Taylor Roads Disposal Site

Groundwater gradient has been determined as having a west/southwesterly direction at this site. The groundwater gradient has been measured at approximately 0.003 foot/foot. Froid and Taylor Roads form the boundaries of a partial basin along three sides of the area. Native organic clay predominates with lenses of silty clay fill and clayey sand to a depth of 5 feet. During the wet season the ground surface area becomes saturated. A groundwater plume could not be identified.

4.1.2 Wood Hogger Site

The groundwater gradient has a northerly direction and has been measured at 0.003 foot/foot. Fill material consisting of predominantly silty clay with some sand occurs between 4 to 14 feet. A

lense of sand, which is 3 to 7 feet below the surface, is present in portions of the site. Native organic clay underlies the fill material.

4.1.3 R Area Disposal Site

Groundwater flows from the R Area Disposal Site to the adjacent marsh to the east with a measured gradient of approximately 0.003 foot/foot. However, field observations have noted that water flowed to the west into Otter Sluice during the rainy season.

The surface stratum consists of fill material and silty clay from ground surface to approximately 5 feet, and overlays native organic clay. The adjacent marsh area is composed almost entirely of organic clay.

4.1.4 Tidal Area Landfill Site

The groundwater flow is generally west/southwest, into the marsh which lies between the Tidal Area Landfill and the R Area Disposal Site, and has a measured gradient of 0.002 foot/foot.

Fill material consisting of sand and silt dominates the top 5 to 10 feet above mean sea level (msl). From ground level to approximately 10 feet below, interfingering silty clay/peat organic material predominate. The low-lying marsh to the west contains organic clay below a thin top soil of silty clay/peat.

4.2 BIOLOGICAL CHARACTERISTICS OF THE SITES

This section describes the flora, fauna, and threatened and endangered species which have been reported as inhabiting the Tidal Area Sites.

4.2.1 Flora

This section describes the flora for the four Tidal Area Sites. This information was gathered primarily from the Draft SI Report, and from field observations.

4.2.1.1 Froid and Taylor Roads Disposal Site

The Draft SI Report documents the presence of salt grass, rush, common pickleweed, bulrush, cattails, and sedges. Field observations confirmed the dominance of these species.

4.2.1.2 Wood Hogger Site

Between the elevation ranges of 3.1 to 7.0 feet msl, approximately 90 percent of the site is covered with upland forbes and grasses. Salt grass and rush occur on the site at an elevation of 2.8 to 3.7 feet msl. Pickleweed also covers the site.

4.2.1.3 R Area Disposal Site

Pickleweed and saltgrass cover approximately 60 percent of the site. Gumplant, alkali heath, and rush occur in pockets throughout the site. Cattails, bulrush, and sedge also vegetate the site.

4.2.1.4 Tidal Area Landfill Site

Pickleweed and salt grass are the dominant plant species at this site. There are also patches of mars[h]gumplant. Vegetation is sparse at this site.

4.2.2 Fauna

Specific information regarding the fauna of the sites will be gathered during the Qualitative Ecological Assessment process. Field observations indicate use of the area by a variety of small mammals, wading birds, and waterfowl.

4.2.3 Threatened and Endangered Species

Listed threatened, endangered, rare, and candidate plants and animals occurring in the Suisun Marsh and bay area are presented in Table 4. These species have been compiled from several sources which characterize them as potentially occurring in the WPNSTA Concord and surrounding areas.

However, with the exception of the salt marsh harvest mouse, no field surveys of their presence at the Tidal Area Sites have been conducted. The Suisun Bay is adjacent to WPNSTA Concord, and has been designated critical habitat for the delta smelt under the Endangered Species Act.

Several studies were conducted during the period from 1980 to 1984 to determine the potential presence of the salt marsh harvest mouse at numerous locations on WPNSTA Concord. During this period, trapping surveys were conducted at three locations in the immediate vicinity of the R Area Disposal and the Tidal Landfill sites. Two of the surveys did not indicate their presence; however, one survey located adjacent to the Tidal Landfill site to the north indicated the presence of salt marsh harvest mice. No estimates of population size were established as a result of this survey. Additionally, five other survey locations in the surrounding tidal marshes to the west and south confirmed the presence of the salt marsh harvest mouse.

4.3 CHEMICAL CHARACTERISTICS OF THE SITES

This section describes the analytical results for the SI study performed by International Technology Corporation (IT) for Martin Marietta Energy Systems, Inc., and for the confirmation sampling performed by Montgomery Watson.

4.3.1 Site Investigation Study

IT collected samples from the Tidal Area Sites as a part of the SI study. Chemicals detected in the soil, sediment, and groundwater samples are listed below and will be used to qualitatively assess the presence of contamination at the Tidal Area Sites (Table 5).

4.3.1.1 Froid and Taylor Roads Disposal Site

Volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), and metals were detected in the samples.

Groundwater Results	Soil Results
arsenic	lead
manganese	copper
iron	arsenic
copper	zinc
barium	N-nitrosodiphenylamine
zinc	benzoic acid
lead	benzo(a)anthracene
cobalt	
bromoform	
N-nitrosodiphenylamine	
4-methylphenol	
bis(2-ethylhexyl)phthalate	
diphenylamine	
sulfate	
total dissolved solids (TDS)	
total organic carbon (TOC)	

4.3.1.2 Wood Hogger Site

VOCs, SVOCs, pesticides/polychlorinated biphenyls (Pest/PCB), and metals were detected in the samples.

Groundwater Results	Soil Results
arsenic	lead
manganese	arsenic
iron	copper
copper	zinc
barium	diphenylamine
zinc	nitrobenzene
silver	2,6-dinitrotoluene
chromium	benzoic acid
cobalt	diethylphthalate
4-methylphenol	acenaphthene
bis(2-ethylhexyl)phthalate	anthracene
dibenzofuran	benzo(a)anthracene
acetone	benzofluoranthene
benzoic acid	chyrsene
diethylphthalate	fluoranthene
TOC	phenanthrene
TDS	4-4'-DDT
sulfate	alpha chlordane

Groundwater Results	Soil Results
	gamma chlordane
	2-butanone
	carbon disulfide
	toluene

4.3.1.3 R Area Disposal Site

VOCs, SVOCs, and metals were detected in the samples.

Groundwater Results	Soil Results
arsenic	lead
manganese	copper
iron	zinc
copper	xylenes
barium	phenanthrene
zinc	anthracene
silver	fluoranthene
chromium	pyrene
cobalt	benzo(a)anthracene
mercury	chrysene
sulfate	benzofluoranthene
TDS	N-nitrosodiphenylamine
TOC	benzo(g,h,i)perylene
acetone	
4-methyl-2-pentanone	
carbon disulfide	

SVOCs varied considerably between first and second quarter groundwater samples.

4.3.1.4 Tidal Area Landfill Site

VOCs, SVOCs. Pest/PCBs, and metals were detected in the samples.

Groundwater Results	Soil Results
arsenic	lead
manganese	arsenic
iron	copper
copper	zinc

Groundwater Results	Soil Results
barium	nickel
zinc	chromium
lead	benzo(g,h,i)perylene
silver	beta-BHC
chromium	dieldrin
cobalt	aroclor
mercury	phenanthrene
2-butanone	anthracene
bis(2-ethylhexyl)phthalate	fluoranthene
4-methylphenol	pyrene
acetone	benzo(a)anthracene
carbon disulfide	chrysene
sulfate	benzofluoranthene
TDS	TOC
TOC	

4.3.2 Confirmation Sampling

Confirmation sampling was conducted by Montgomery Watson from January 18, 1993 to January 25, 1993. The purpose for collecting these samples was to confirm the presence of chemicals detected by IT during the Site Investigation, and to evaluate the laboratory's practical quantitation/detection limits that are achievable for soil and water samples. The chemicals detected for the Tidal Area Sites are listed in Table 6.

Soil and water samples from all four sites were analyzed for VOCs, SVOCs, and TOC. Only one groundwater sample and two soil samples from the Wood Hogger Site were analyzed for Pest/PCBs. Metals were analyzed in the surface water for the R Area Disposal Site only.

4.3.2.1 Froid and Taylor Roads Disposal Site

VOCs and SVOCs were not detected.

4.3.2.2 Wood Hogger Site

SVOCs and pesticides were detected in one soil sample. VOCs were not detected.

Soil Results

4,4'-DDD
alpha chlordane
gamma chlordane
benzo(a)pyrene
benzo(b)fluoranthene
benzo(k)fluoranthene
chrysene
fluoranthene
phenanthrene
pyrene

4.3.2.3 R Area Disposal Site

VOCs and SVOCs were not detected. The metals detected in the surface water samples are listed below.

Surface Water Results

arsenic
barium
calcium
copper
iron
lead
magnesium
manganese
mercury
potassium
selenium
sodium
zinc

4.3.2.4 Tidal Area Landfill Site

VOCs and SVOCs were not detected.

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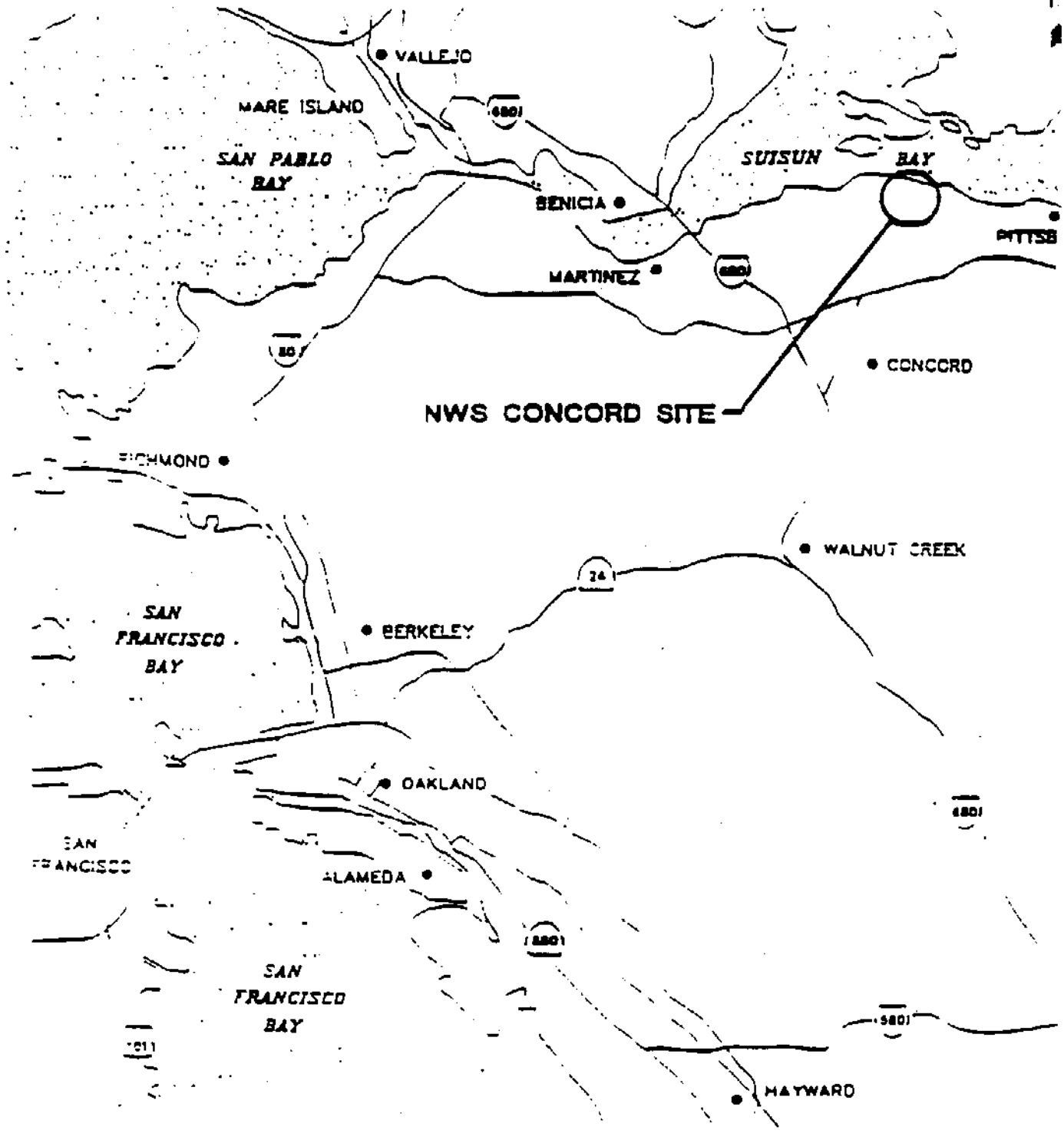

FIGURE 1

SITE LOCATION MAP
WPNSTA CONCORD

Figure 2

This detailed station map has been deleted from the Internet-accessible version of this document as per Department of the Navy Internet security regulations.

TABLE 1

HISTORICAL LAND USE OF TIDAL AREA SITES

SITE	PERIOD OF OPERATION	TYPES OF WASTE REPORTEDLY DISPOSED OF OR SPILLED	QUANTITY/ SPECIFIC WASTES
FROID AND TAYLOR ROADS DISPOSAL SITE	1944 - 1979	Ordnance, scrap metal, and miscellaneous debris	Estimated 50 yards
WOOD HOGGER SITE	1968 - 1973	Possibly PCP-contaminated wood	Estimated 80,000 cubic yards
R AREA DISPOSAL SITE	Late 1940s to approximately 1976	Industrial and non-industrial	Estimated 650 tons of waste materials, including paints, solvents, and inert ordnance materials
TIDAL AREA LANDFILL SITE	1944 - 1979	Industrial and non-industrial	Estimated 33,000 tons of waste materials, including solvents, acids, paints, creosotes, asbestos, ordnance, household garbage, and shipboard wastes

Source: Ecology and Environment, Inc., 1983, Initial Assessment Study, Naval Weapons Station, Concord, CA.

TABLE 2

COMMON AND SCIENTIFIC NAMES OF PLANT SPECIES
FOUND AT NAVAL WEAPONS STATION CONCORD

Common Name	Scientific Name
Common pickleweed	*Salicornia virginica*
Marsh gumplant	*Grindelia humilis*
Rush	*Juncus* spp.
Bulrush	*Scirpus* spp.
Cattail	*Typha* spp.
Salt grass	*Distichlis spicata*
Star thistle	*Centaurea* spp.
Curly dock	*Rumex crispus*
Salt marsh dodder	*Cuscuta salina*
Perennial peppergrass	*Lepidium latifolium*
Italian ryegrass	*Lolium multiflorum*
Oat	*Avena* spp.
Barley	*Hordeum* spp.
Wild lettuce	*Lactuca* spp.
Bristly ox-tongue	*Picris echioides*
Sweet fennel	*Feoniculum vulgare*
Willow	*Salix* spp.
Fescue	*Vulpia* spp.
Mustard	*Sisymbrium* spp.
Almond	*Prunus amygdalus*
Coyote bush	*Baccharis pilularis*
Fat hen	*Atriplex patula*
Yarrow	*Archillea millefolium*
Saltmarsh pluchea	*Fluchea purpurascens*
Alkali heath	*Frankenia grandifolia*
Common tule	*Scirpus tule*
Pacific cordgrass	*Spartina foliosa*
Alkali bulrush	*Scirpus robustus*
Knotweed	*Polygoum coccineum*
California bulrush	*Scirpus californicus*
Rabbit's foot grass	*Polypogon monspeliensis*
Smartweed	*Polygonum* spp.
Nightshade	*Solanum* spp.
Wild radish	*Raphanus sativus*

Source: Waterways Experiment Station. 1988c. Feasibility Study of Contamination Remediation at Naval Weapons Station Concord, California, Vol. II: Biological Assessment.

TABLE 3

COMMON AND SCIENTIFIC NAMES OF ANIMAL SPECIES FOUND AT NAVAL WEAPONS STATION CONCORD

Common Name	Scientific Name
House mouse	*Mus musculus*
California vole	*Microtus californicus*
Northern harrier	*Circus cyaneus*
Black-shouldered kite	*Elanus caeruleus*
California ground squirrel	*Spermophilus beecheyi*
Western fence lizard	*Sceloporus occidentalis*
Red-winged blackbird	*Agelaius phoeniceus*
Killdeer	*Charadrius vociferus*
Rock dove	*Columba livia*
Western meadowlark	*Sturnella neglecta*
Ring-necked pheasant	*Phasianus colchicus*
Western harvest mouse	*Reithrodontomys megalotis*
Great egret	*Casmerodius albus*
Great blue heron	*Ardea herodias*
Ring-billed gull	*Larus delawarensis*
Short-eared owl	*Asio flammeus*

Source: Waterways Experiment Station. 1988c. Feasibility Study of Contamination Remediation at Naval Weapons Station Concord, California, Vol. II: Biological Assessment.

TABLE 4

LISTED ENDANGERED, THREATENED, RARE, AND CANDIDATE ANIMALS AND PLANTS OF THE SUISUN MARSH AND BAY AREA
(Page 1 of 2)

Common Name	Scientific Name	Status	Wetland Type
Aleutian Canada goose	*Branta canadensis leucopareia*	FE.SE	Seasonal and permanent marshes, palustrine farmed wetlands, reservoirs
American peregrine falcon	*Falco peregrinus anatum*	FE.SE	Foraging over all wetland types, except riparian
Bald eagle	*Haliaeetus leucocephalus*	FE	
California least tern	*Sterna antilarum browni*	FE.SE	Salt ponds, tidal lagoons, open bay
California black rail	*Laterallus jamaicensis coturniculus*	FC.ST	Tidal salt marshes
Salt marsh harvest mouse	*Reithrodontomys raviventris*	FE.SE	Tidal salt marshes, diked seasonal salt marshes, and transitional habitat
San Francisco Garter snake	*Thamnophis sirralis terrataenia*	FE	
Chinook salmon-winter run	*Oncorhynchus tshawytscha*	FT.SE	Open water
Suisun song sparrow	*Melospiza melodiamaxillaris*	2.SC	Brackish marshes
Saltmarsh common yellowthroat	*Geothlypis trichas sinuosa*	2	Tidal and diked salt and brackish marshes, freshwater marshes, riparian woodland
Long-billed curlew	*Numenius americanus*	2	Palustrine farmed, freshwater marshes
Suisun ornate shrew	*Sorex vagrans halicoetes*	1	Tidal salt and brackish marshes
Delta smelt	*Hypomosus transpacificus*	FT.ST	Dead-end sloughs

TABLE 4

LISTED ENDANGERED, THREATENED, RARE, AND CANDIDATE ANIMALS AND PLANTS OF THE SUISUN MARSH AND BAY AREA
(Page 2 of 2)

Common Name	Scientific Name	Status	Wetland Type
Sacramento splittail	*Pogonichthys macrolepidotus*	2	Dead-en.. loughs, tidal brackish marshes
Gairdner's yampah	*Perideridia gairdneri subsp. gairdneri*	FC2	Wet meadows
California clapper rail	*Rallus longirostris obsoletus*	*FT*	
California brown pelican	*Pelecanus occidentalis*	*FT*	
Mason's quillwort	*Lilaeopsis masonii*	SR,FC 2	Tidal brackish marshes and pilings

Source: Waterways Experiment Station, 1988c. Feasibility Study of Contamination Remediation at Naval Weapons Station Concord, California. Volume II: Biological Assessment.

Status

FC	Federal candidate species for listing
FE	Federally endangered
FT	Federally threatened
SC	State candidate species for listing
SE	State endangered
SR	State rare
ST	State threatened
1	Category 1: Taxa for which Fish and Wildlife service has sufficient biological information to support a proposal to list as endangered or threatened.
2	Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.
FC 2	Federal Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

TABLE 5

CHEMICAL CHARACTERISTICS FOR THE TIDAL AREA SITES
SITE INVESTIGATION DATA

SITE	VOCs	SVOCs	Pest/PCBs	Metals
FROID AND TAYLOR ROADS DISPOSAL SITE	X	X	ND	X
WOOD HOGGER SITE	X	X	X	X
R AREA DISPOSAL SITE	X	X	ND	X
TIDAL AREA LANDFILL SITE	X	X	X	X

X - detected
ND - not detected
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
Pest/PCBs - pesticides and PCBs

TABLE 6

CHEMICAL CHARACTERISTICS FOR THE TIDAL AREA SITES
CONFIRMATION SAMPLING DATA

SITE	VOCs	SVOCs	Pest/PCBs	Metals
FROID AND TAYLOR ROADS DISPOSAL SITE	ND	ND	NA	NA
WOOD HOGGER SITE	ND	X	X	NA
R AREA DISPOSAL SITE	ND	ND	ND	X
TIDAL AREA LANDFILL SITE	ND	ND	NA	NA

NA - not analyzed
X - detected
ND - not detected
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
Pest/PCBs - pesticides and PCBs

APPENDIX B

FIELD DATA FORMS

WPNSTA CONCORD FORM 1:
FIELD TRANSECT SURVEYS
(Use one form for each new vegetation association observed along each transect)

A. Transect No. _____ Reference Site on Map _____
Location _____ Date/Time _____ Biologist _____

B. Vegetational Association (Dominant Species):

C. General Structure:

1. Strata:

Submerged herbaceous	___	
Emergent herbaceous	___	Ht. ___
Upland herbaceous	___	Ht. ___
Shrub layer	___	Ht. ___
Tree canopy	___	Ht. ___

2. Diversity:
1 Species
2-5 species
6-10 species
>10 species

3. Describe the general condition of the association (homogeneity of cover, robustness of growth, pattern, spareness-density, etc.)

D. Habitat Quality (provide a general assessment of the potential habitat value for fauna. Include evidence observed of wildlife usage and species observed):

WPNSTA CONCORD FORM 1: FIELD TRANSECT SURVEYS

E. Stress/Disturbance (describe any observed evidence of stressed condition or previous site alteration):

F. List all plant species observed within the vegetation association:

WPNSTA CONCORD FORM 1:
FIELD TRANSECT SURVEYS

G. List photo point reference number and photo subject:

WPNSTA CONCORD FORM 2: FAUNAL COUNTS (use one form for each 20 minute observation)			Location:	Observation Point
			Biologist:	Date/Start Time:
			Weather Condition:	
Species	Habitat	Observed Activity	Comments	Count

(Continue on 2nd sheet if necessary)

WPNSTA CONCORD FORM 3:
FISHERIES SAMPLING FIELD SHEET

Date: _____ Surveyor: _____

Sampling Station	Time	Maximum Depth (ft)	Method	Species Present	Numbers

WPNSTA CONCORD FORM 4: BENTHIC SAMPLING FIELD SHEET

Date: ______________ Surveyor: ____

Sampling Station	Benthic Taxa	Number Per Taxa	Mid-Water Taxa	Number Per Taxa	Sediment Characteristics	Odors Present

CONCORD NWS FORM 5

WATER QUALITY SAMPLING FIELD SHEET

Date: ______________ **Surveyor:** ______________________________

Sampling Station	Time	Maximum Depth (Ft)	Salinity ppt	Temp. deg. C	D.O. mg/l	pH units	Conductivity micromhos/l

WPNSTA CONCORD FORM 6: WETLAND DELINEATION (1987 COE WETLANDS DELINEATION MANUAL)

DATA POINT:

Project/Site:	Date:
Applicant/Owner:	County:
Investigator:	State:
Do normal circumstances exist on the site? Yes No Is the site significantly disturbed (a typical situation)? Yes No Is the area a potential problem area? Yes No (if needed, explain here.)	Community ID: _____ Transect ID: _____ Plot ID: _____

VEGETATION

Dominant Plant Species	Stratum	% Cover	Indicator	Dominant Plant Species	Stratum	% Cover	Indicator
1.				7.			
2.				8.			
3.				9.			
4.				10.			
5.				11.			
6.				12.			

Percent of Dominant Species that are OLB, FACW or FAC (excluding FAC).

Remarks:

Assumes herbaceous unless otherwise indicated

HYDROLOGY

___ Recorded Data (Described in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: ___ (in.) ___ no standing

Depth to Free Water in Pit: ___ (in.) ___ >16"

Depth to Saturated Soil: ___ (in.) ___ >18"

Wetland Hydrology Indicators:

Primary Indicator:
- ___ Inundated
- ___ Saturated in Upper 12 inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Living Root-Channels in Upper 12 inches
- ___ Water-stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

WPNSTA CONCORD FORM 6: WETLAND DELINEATION
DATA POINT

SOILS

Soil Survey Map Unit Name (Series and Phase):	Drainage Class:
	Field Observations
Taxonomy (Subgroup):	Confirm Mapped Type? Yes No
Soil Survey Hydric Inclusion (Series and Phase):	

Profile Description:

Depth (in.)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance Size	Texture, Concretions, Structure, Etc.

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
___ Glazed or Low-Chroma Colors
___ Concretions (>2mm Diameter, Top 3")
___ High Organic Content in Surface Layer in Sandy Soils
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes No	
Wetland Hydrology Present?	Yes No	
Hydric Soils Present?	Yes No	Is This Sampling Point Within a Wetland? Yes No

Remarks: