California Wetland and Riparian Area Protection Policy

Technical Advisory Team
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Technical Memorandum No. 4: Wetland Identification and Delineation

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1.0 Purpose

This is the fourth in a series of technical memoranda developed by the Technical Advisory Team (TAT)[1] for the California Wetland and Riparian Area Protection Policy (WRAPP) Development Team (PDT) of the State Water Resources Control Board (Water Board). The first memorandum describes the TAT, including why and how it was formed, its membership, and its workplan (TAT 2009). The second memorandum recommends a wetland definition (TAT 2010a). The third memorandum describes California wetlands in the watershed context (TAT 2010b).

The purpose of this memorandum is twofold. It describes and recommends a methodology for identifying and delineating wetlands based on the recommended wetland definition (TAT 2010a), and it explains differences between the recommended methodology and that used by the US Army Corps of Engineers (USACE) and US Environmental Protection Agency (USEPA) under Section 404 of the Federal Clean Water Act. It does not include any detailed description of the procedures of any method and it is not a manual for applying the recommended method.

Riparian areas are not addressed in this memorandum. A method for identifying and delineating riparian areas must focus on riparian processes based on field indicators that may or may not be the same as the indicators used for identifying and delineating aquatic areas. A forthcoming TAT technical memorandum will focus on the definition and identification of riparian areas.

The TAT reserves the opportunity to revise its memoranda as necessary to make sure they are consistent with each other, consistent with the current status of relevant science, and that they meet the needs of the PDT for technical information and advice.

2.0 Considerations for Recommending a California Methodology

The TAT emphasizes that the identification and delineation of wetlands and other aquatic areas are technical, fact-based procedures that can be separated from policy-based decisions about either the extent of government jurisdiction or the acceptability of potential actions that may be authorized in these aquatic areas subject to such jurisdiction. Simply stated, the TAT is recommending a methodology to identify and delineate wetland areas without regard for how such areas might be governed or managed.

Pursuant to State Water Board Resolution 2008-0026, the PDT asked the TAT to recommend a wetland definition that would reliably represent the diverse array of California wetlands based on

[1]This technical memorandum was developed by TAT members RC Roberts, RT Huffman, JN Collins, BC Livsey and CN Harvey. Technical review regarding consistency with existing USACE delineation methodology was provided by TAT members AO Allen, Los Angeles District USACE; MC Finan, Sacramento District USACE, and DJ Martel, San Francisco District USACE. The memorandum represents a consensus among TAT members regarding state-of-the-art technical knowledge about wetland delineation methodology, but does not necessarily represent the individual views of any author or reviewer, or the positions of any State or Federal agency.

the USACE wetland delineation methodology, to the extent feasible. The TAT has recommended a "three-parameter[2]" wetland definition, based on the same three parameters (herein termed "criteria") used by the USACE: vegetation, substrate, and hydrology (TAT 2010a). The recommended Water Board definition is functionally similar to the USACE definition, and the recommended methodology to identify and delineate wetlands is similar to the USACE methodology.

The recommended Water Board methodology uses the three-parameter approach in the following way. In every instance, field conditions are examined with regard to all three criteria. With regard to vegetation, there are two indicators of wetland conditions: either the vegetation cover is dominated by wetland species; or vegetation is absent. If either of these conditions exists, and if the substrate and hydrology indicators of wetland condition are also evident, then the area is determined to be wetland.

The TAT recognizes that the State would benefit from a wetland identification and delineation methodology that is similar to the methodology used by the USACE. The basic USACE methodology (Environmental Laboratory 1987) has been found to be scientifically and legally defensible. As part of its continuing development, the USACE methodology has been augmented recently with two "regional supplements" that together cover all of California, providing additional specific guidance for delineations in arid regions (USACE 2008a), and the more mesic region in the northern mountains, valleys, and coastal regions (USACE 2008b, which is "interim" but likely to be adopted within a year). A variety of additional technical materials has been issued by the USACE to assist in interpreting field conditions. Finally, there is a large community of wetland scientists familiar with the USACE methodology, and the TAT expects that this community would more readily understand and adopt a State methodology that, to the extent appropriate, is the same as the USACE methodology.

Clear distinctions must be made between defining, identifying, delineating, and mapping wetland areas. *Defining* wetland areas means providing a written description of the particular conditions of essential criteria for determining whether or not an area is wetland. *Identifying* wetland areas involves the application of the definition. That is, an area is identified as a wetland if it exhibits the wetland condition of the criteria as stated by the definition. Identification is based on field indicators of the wetland conditions. *Delineating* a wetland area involves determining its spatial limits on the ground, based on the field indicators of wetland conditions for the wetland criteria. In other words, delineation is the process of demarcating wetland areas from other adjoining areas that do not satisfy the wetland definition, based on field investigation. In practice, these three steps occur in sequence as follows: (1) the conditions of environmental criteria indicating that an area is a wetland area are incorporated into a wetland definition; (2) an area is identified as being wetland or not based on field indicators of the requisite conditions of the wetland criteria; (3) if the area is identified as a wetland area, the field indicators are used to determine the spatial limits of the wetland conditions (i.e., the boundary of the wetland area on the ground).

[2] "Criterion," it refers to each of the three primary aspects of the recommended wetland definition (i.e., wetland hydrology, wetland substrate, and dominant wetland vegetation) that are the basis for the recommended wetland identification and delineation methodology. The essence of the methodology is the determination of whether or not the status or condition of each criterion meets the requirements of the definition, based on expert use of one or more field indicators (see Glossary).

For the purposes of the WRAPP, the process of wetland *mapping* usually involves the interpretation of aerial imagery or other remotely sensed data to estimate the boundaries of wetland areas without field investigations, except to calibrate the mapping method and to validate the resulting map. In effect, delineation is an especially accurate method of wetland mapping that relies on field indicators and can contribute to an understanding of wetland extent within a watershed, region, and statewide.

Technical Memorandum No. 3 (TAT 2010b) describes wetlands in the context of watersheds and their landscape moisture gradients. It explains that the moisture gradients can be subdivided into four fundamental parts (deepwater areas, wetlands, aquatic support areas, and uplands), based on the indicators used to identify wetlands. It discusses functional relationships among wetland areas and other aquatic areas along landscape moisture gradients, and it suggests that aquatic support areas are important for protecting and conserving the functions and services of wetlands.

Based on these considerations, and in the context of State Water Board Resolution 2008-0026, the TAT developed the following set of criteria for selecting or developing a methodology that the Water Board could implement to identify and delineate wetland areas.

Criteria for Developing a California Water Board Methodology For Wetland Identification and Delineation

- The Water Board methodology should be consistent with the wetland definition recommended by the TAT. It should be able to identify areas that satisfy the recommended wetland definition, based on field investigation.
- The Water Board methodology should be able to delineate (draw or establish) wetland boundaries in the field.
- To the extent feasible, the Water Board methodology should be consistent with the USACE methodology. More specifically, the Water Board methodology should be based on the USACE methods of identifying and delineating wetland areas based on field indicators of three wetland criteria: hydrology, substrate, and vegetation.
- The Water Board methodology should apply equally well to deepwater areas, wetlands, and aquatic support areas.
- The Water Board methodology, to the extent possible, should support California's efforts to map and classify deepwater areas, wetlands, aquatic support areas, and riparian areas.

3.0 Recommended Methodology

3.1 Overview of Recommendations

The TAT recommends that the Water Board adopt the USACE methodology for wetland identification and delineation, subject to the modifications recommended in section 4. Experts who currently use the USACE methodology will also be able to readily use the recommended methodology.

The TAT also recommends that the Water Board adopt the relevant USACE manuals and other materials that have been developed to support the USACE methodology, pending the

development of appropriate State guidance documents. The Water Board should also adopt the existing data forms included in the USACE methodology.

An extensive library of technical information underlies the USACE methodology. The TAT recommends that the Water Board recognize that this underlying information supports the designated technical sources (i.e., the 1987 manual and the regional supplements for the Arid West and the Western Mountains, Valleys, and Coast as identified on page 2 above) on which the recommended Water Board methodology is based. However, the TAT also recommends that the Water Board not implement all directions and guidance (e.g., all Regulatory Guidance Letters) relating to the USACE regulatory process as incorporated into the USACE methodology, as these elements are specifically directed at USACE implementation of Federal regulatory processes that may not apply to Water Board implementation.[3]

The TAT recommends that the Water Board methodology include provisions for requiring supplemental field data from the wet season to substantiate wetland identifications and delineations conducted in the dry season. The TAT further recommends that the Water Board work closely with the USACE and USEPA to determine the circumstances requiring such supplemental data and to minimize inter-agency disagreements relating to differences in wetland delineations due to differences in their timing or vintage.

The TAT recommends that the delineation methodology described in this memorandum also be used to delineate the aquatic support areas adjoining wetlands in all delineations provided under the WRAPP. This approach is a straightforward extension of the recommended Water Board methodology as applied to wetlands, since the same field indicators are used to identify and delineate wetlands and aquatic support areas (TAT 2010b).

The TAT recommends that the Water Board methodology for identifying and delineating wetland areas (and aquatic support areas) incorporate the collection of certain additional data not included in the existing USACE methodology in order to help the Water Board identify the beneficial uses of wetlands and assist in achieving broader State wetland management goals. For example, recording the landscape position of wetland areas and aquatic support areas will help validate their delineations by identifying their supporting landscape processes, and will also help identify their likely services or beneficial uses. A forthcoming TAT memorandum will focus on wetland classification and its relationship to wetland identification, delineation, and assessment.[4]

3.2 Basic Comparison to USACE Methodology

The recommended methodology for identifying and delineating wetlands is based on the existing USACE methodology. The basic differences between the two methodologies mainly reflect the differences between the USACE wetland definition and the recommended Water Board

[3] The TAT notes that the Water Board might modify the USACE technical materials and forms to better reflect State experiences under its own regulatory programs. At that time, the Water Board might also identify any USACE technical documents on which the State's methodology is based, as well as any specifically excluded documents.

[4] Some of this information may be obtained from existing data bases (e.g., the National Wetland Inventory). The California Wetland Monitoring Workgroup (CWMW, a subcommittee of the SB 1070 Water Quality Monitoring Council) has recommended that the State develop the California Aquatic Resource Inventory (CARI).

definition, as explained below. Additional details of the differences between the methodologies and related recommendations for the Water Board methodology are presented section 3.3.

The TAT (2010a) recommends a wetland definition that incorporates three criteria (see Glossary): hydrology, substrate, and vegetation. The recommended definition is:

> An area is wetland if, under normal circumstances, it (1) is saturated by ground water or inundated by shallow surface water for a duration sufficient to cause anaerobic conditions within the upper substrate; (2) exhibits hydric substrate conditions indicative of such hydrology; and (3) either lacks vegetation or the vegetation is dominated by hydrophytes.

The same three criteria are incorporated into the wetland definition provided by the USACE, and underlie the USACE methodology for identifying and delineating wetlands:

> Wetlands are "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3(b) and 40 CFR 230.3(t)).

A comparison of the two definitions reveals that they are based on the same scientific rationale and reference materials. The differences between the definitions translate into procedural changes to the USACE methodology (Table 1).

Table 1. Differences between the USACE methodology and the recommended methodology that result from differences between the USACE wetland definition and the recommended wetland definition.

Parameter	**Wetland Definition**		**Effects on Methodology**
	USACE	***Recommended***	
Hydrology	The area is inundated either permanently or periodically at water depths ≤ 6.6 feet, or the soil is saturated to the surface at some time during the growing season.	The area is saturated by groundwater or inundated by shallow surface water for a duration sufficient to cause anaerobic conditions within the upper substrate.	1. Both definitions identify saturation or shallow inundation leading to anaerobic conditions as the hydrological basis for wetland definition. No significant methodological differences. 2. Both definitions adopt 2m (6.6 ft) as the depth of demarcation between "wetlands" and "deepwater areas." This is explicit in the USACE definition and is stated in the glossary of the recommended definition. No significant methodological differences. 3. Both definitions adopt the same meaning for "growing season." No significant methodological differences. 4. Both definitions adopt the same standard for duration of inundation/saturation. The recommended Water Board definition adopts a period of 14 days as the minimum duration required to develop anaerobic conditions. Both USACE regional supplements specify 14 days. Both methodologies employ field indicators of anaerobic conditions. No significant methodological differences.

Table 1 (continued). Differences between the USACE methodology and the recommended methodology that result from differences between the USACE wetland definition and the recommended wetland definition.

Parameter	Wetland Definition		Effects on Methodology
	USACE	*Recommended*	
Substrate	Soils are either classified as hydric or they exhibit field indicators of reducing conditions.	Substrates exhibit field indicators of hydric conditions.	1. Both definitions adopt by reference the same scientific rationale for identifying or defining hydric substrate conditions (USACE "reducing soil conditions" = TAT's "anaerobic conditions in the upper substrate"). No significant methodological differences. 2. Many wetlands lack developed soils; the proposed recommended Water Board methodology therefore emphasizes the presence of observed substrate conditions. Minor methodological differences. 3. The recommended Water Board methodology adopts the requirement of the USACE regional supplements for California to make field observations of substrate conditions and no rely on maps of hydric soils. No significant methodological difference. 4. The recommended Water Board methodology requires evaluation of substrate conditions to a depth of 50 cm as in the USACE regional supplements; otherwise the same data are collected. No significant methodological difference.
Vegetation	The prevalent vegetation consists of macrophytes that are typically adapted to hydrologic and soil conditions identified in the definition.	The area either lacks vegetation or the vegetation is dominated by hydrophytes.	1. Both definitions require that if vegetation is present it be dominated by hydrophytes. Both definitions define "vegetated" as having ≥ 5% total plant cover. Vegetation sampling and analysis methods developed for the USACE methodology are applicable to the recommended methodology. Both definitions define "dominance" by the same criteria. No significant methodological differences. 2. Both definitions adopt the same source of identification for hydrophyte status (Reed 1988). The definition recommended by the TAT includes the intent to adopt revised sources of identification when they are adopted by the USACE. No significant methodological differences. 3. USACE methodology requires that an area be vegetated to be identified as wetland. The recommended definition includes wetland areas that aren't vegetated but meet the hydrology and substrate criteria. Some indicators of wetland hydrology and substrate used in the USACE methodology will not apply to the recommended methodology because they rely on vegetation. Minor methodological differences.

3.3 Specific Recommendations

The TAT's process for developing this memorandum included extensive discussions with wetland program staff from the three USACE Districts operating in California regarding application the USACE methodology according to the wetland definition recommended by the TAT. These discussions resulted in a consensus conclusion that the USACE methodology would be generally applicable to the recommended definition. However, the TAT's discussions also indicated that coordination will be needed among USACE staff and Water Board staff to assure that differences between the methodologies do not engender administrative conflicts between the Water Board and the USACE.

3.3.1 Hydrology Indicators

The USACE manual (Environmental Laboratory 1987) and the regional supplements (USACE 2008a, b) include technical and procedural guidance for identifying and evaluating field indicators of wetland hydrology. The TAT recommends that the Water Board adopt the USACE methodology unchanged, emphasizing the methodology as presented in the regional supplements. However, the TAT recognizes a need for additional study of wetland hydrology in California. This need does not indicate problems with the USACE methodology, but rather it reflects the State's variable climate as a major determinant of wetland form and function (TAT 2010b). The TAT recommends that the Water Board support research that elucidates the relationships between climatic variability and the following:

- variations in the form and physical structure of wetlands and other aquatic areas;
- frequency (i.e., number of years out of ten or more years) at which hydrology indicators should be expected to indicate wetland conditions;
- the efficacy of existing and new field indicators of substrate saturation or inundation and the development of anaerobic conditions in differing substrates, including silt, clay, loam, sand, and less permeable materials.
- relationships between climate and the distribution and abundance of wetlands that depend on groundwater. At the landscape scale, surface water and near-surface groundwater effectively comprise one resource (Dunne and Leopold 1978, Winter et al 1998), such that changes in groundwater recharge, as affected by changes in climate, can influence the extent and condition of wetlands.

3.3.2 Duration of Inundation and Saturation

The primary cause of wetland conditions is flooding, ponding, and/or saturation that leads to oxygen depletion and hence a reducing chemical environment in the upper substrate. The rate at which this chemical change occurs depends on many interacting factors, including the permeability of the substrate, its organic content, and its temperature, in addition to the hydrology. The TAT has been unable to independently determine, on the basis of existing scientific knowledge, the minimum duration of inundation or saturation needed to cause reducing conditions for all substrate types.

The TAT notes that the USACE methodology does not resolve this issue. The regional supplements adopt a minimum duration of 14 days as a "standard," but the same supplements

also conclude that "areas where the substrate is inundated and/or saturated to the surface for ≥7 continuous days are wetlands, provided the soil and vegetation criteria are met." The TAT recommends that the Water Board adopt the 14-day standard, but recognizes its uncertainty.

In most cases, the 14-day "standard" for substrate saturation will not affect wetland identification or delineation, since they usually depend on conditions observed at the time of the field visit, rather than on longer-term hydrological studies. The standard could be enacted for highly contentious or difficult cases that warrant hydrological monitoring.

3.3.3 Substrate Indicators

The USACE manual (Environmental Laboratory 1987) and the regional supplements (USACE 2008a, b) provide explicit guidance for using indicators of "hydric soil." The TAT recommends that the Water Board adopt this guidance (with the adjustments presented below).

- The USACE methodology refers to "soil," whereas the proposed Water Board methodology refers to "substrate," a more inclusive term.[5] However, both methodologies adopt the same scientific rationale for defining hydric substrate conditions. The "reducing soil conditions" referenced by the USACE in its 1987 manual are equal to the "anaerobic conditions in the upper substrate" of the recommended wetland definition.
- The Natural Resources Conservation Service (NRCS) maintains a list of hydric soils for each State and Territory of the US (NRCS 2012). The lists are useful for identifying areas that might contain hydric soils. The 1987 USACE manual recognizes the presence of these soils as evidence of wetland conditions, and accepts maps of their approximate distribution as evidence of their presence. However, the NRCS soils list for California is not comprehensive. Furthermore, the regional supplements regard the maps of hydric soils as only approximate, and they stipulate the use of field indicators to determine whether or not hydric soils are actually present. The TAT recommends that the Water Board adopt the approach presented in the USACE regional supplements by requiring the use of field indicators to identify hydric "soils" (i.e., hydric substrates).
- The USACE 1987 manual states that "soil" investigations should extend from the surface to a depth not less than 12 inches (30 cm). This guideline is based on the following concepts: hydric conditions require saturation of the "major portion of the root zone;" this zone is defined as including more than 50% of the living root mass of the dominant wetland plant species; this zone has generally not been considered to extend more than 30 cm below the wetland substrate surface. However, the regional supplements (USACE 2008a, b) extend this zone to a depth of 20 inches (50 cm) based on experience in the western US. The TAT recommends that the Water Board adopt the requirement presented in the regional supplements. That is, the identification of hydric substrate should require investigation of the upper 50cm of the substrate.

[5] The USACE also uses the term "substrate" with regard to wetlands. For example, the regional supplements (USACE 2008a, b) refer to wetlands as "areas where the substrate is saturated and/or inundated" enough to support wetland conditions. Section 230.20 of the USACE rule regarding compensatory mitigation for losses of aquatic resources (USACE 2008c) states: "The substrate of the aquatic ecosystem underlies open waters of the United States and constitutes the surface of wetlands."

The two USACE regional supplements (and the associated data forms used to document field indicators) identify areas where flooding and ponding have occurred for at least 7 consecutive days as meeting the requirement for hydric soils. This is inconsistent with statements in the supplements that inundation for at least 14 consecutive days should be the standard for wetland hydrology (see subsection 3.2.2 above). The Water Board may find it useful to cooperate with the USACE and other agencies to conduct research on these topics in California.

3.3.4 Vegetation Indicators

The TAT recommends that the Water Board recognize non-vegetated wetlands because they provide many of the same environmental functions and services ascribed to vegetated wetlands, and because they are often integral elements of encompassing areas that satisfy the USACE wetland definition (TAT 2010a). For example, the USACE definition excludes mudflats, playas, and some seasonal depressional wetlands because they normally lack 5% cover of wetland vegetation, although they meet the other USACE wetland criteria and support wetland wildlife, filter pollutants, store flood waters, and recycle nutrients. When strictly applied, the USACE definition also excludes non-vegetated features of some kinds of wetlands, such as bare areas of wet meadows (e.g., Bailiff 1982, Loheide et al. 2009) and pannes of tidal marshes (Yapp et al. 1917, Barnby et al. 1985).

The difference between the recommended wetland definition and the USACE definition affects the number of wetland indicators used in the USACE methodology that can be applied through the recommended Water Board methodology. Approximately a third of the USACE indicators for hydrology (possibly 7 of 23 indicators from the Arid West supplement) and substrate (possibly 6 of 19 indicators from the Arid West supplement) are related to vegetation in some way. In other words, some USACE indicators will not be evident or applicable where vegetation is absent, and the extent to which the indicators will be present if the area is only very sparsely vegetated is unknown. Some vegetation-related USACE indicators are commonly observed (e.g., hydrology indicator C3 - oxidized rhizospheres along living roots), while others (e.g., hydric soil/substrate indicator A2 – an 8-inch thick histic epipedon) are seldom observed, even in well-vegetated wetlands. The TAT recommends that the development of wetland indicators relating to a lack of vegetation should be a high priority for applied research in California.

It is the consensus judgment of the TAT (including all the USACE members) that the potential unavailability of some indicators will not invalidate the use of the USACE methodology for Water Board purposes, and that numerous substrate and hydrology indicators will be available to practitioners. The USACE methodology should be implemented as described in this memorandum, but the interpretation of wetland indicators will differ depending on the presence or absence of wetland vegetation.

3.3.5 Hydrophytes

The vegetation indicator of the USACE methodology relies on national lists of hydrophytes (i.e., hydric plant species) published by the US Fish and Wildlife Service (USFWS) in the 1980s[6]

[6] The basis for these historical designations has been identified as "the potential for a given species to function physiologically or morphologically as a hydrophyte if wetland hydrology and substrate were present" (T. Huffman, pers. obs.).

(Reed 1988a, b). The listed species are considered to be adapted for life in anaerobic soil conditions, and are used as evidence of wetland conditions when they dominate the plant community (see Glossary).

The TAT recommends that the Water Board adopt the existing USACE methodology for identifying hydrophytes. However, the TAT recognizes some long-standing concerns about the efficacy of the national plant lists. These concerns are identified below. They do not represent a criticism of the USACE methodology so much as a finding by the TAT that additional scientific work is needed on the nature and identification of hydrophytes in California.

- The selection of plant species and their classification are based on a synthesis of submitted review comments, published botanical literature, and the field experiences of Federal agency staff and other selected experts, rather than on the basis of scientific surveys of their distribution and abundance among wetlands and non-wetland areas.
- For California, the USACE methodology cites the list pertaining to California as a whole (Reed 1988a), although ecological variability throughout the State is substantial and species in the USFWS list do not exhibit uniform adaptation to hydric conditions throughout the State.
- Some plant species regularly encountered in California wetlands are not included in the current national lists of hydrophytes[7].
- Because many plant species are able to exist in both wetlands and non-wetland areas, the classification of a species as a hydrophyte does not necessarily mean its presence is unequivocal evidence of wetland hydrology or hydric substrate. Furthermore, locally wetland-adapted populations of species generally identified as non-hydrophytes may dominate some wetlands (Tiner 2006).

The TAT recommends that the Water Board address these concerns about hydrophytes. The TAT notes that the responsibility for developing the national lists of hydrophytes has been transferred from the USFWS to the USACE. The USACE is updating the lists based on the contributions of technical specialists from many Federal and State agencies, as well as the judgments of independent experts. The TAT recommends that the Water Board and other State agencies, perhaps especially the California Department of Fish and Game (CDFG), should participate in these updates of the national lists. However, the TAT also recommends that the Water Board consider regionalizing the lists, perhaps based on the CDFG ecoregions. This would probably improve the accuracy of wetland identification and delineation in California.

3.3.6 Vegetation Sampling

The methodology for identifying, sampling, and assessing vegetation recommended by the TAT does not differ in any technical or procedural way from the USACE methodology. Moreover, the definitions of supplementary concepts (e.g., growing season) are also the same (see Glossary). The USACE and other Federal agency supplementary information sources relating to wetland vegetation will be directly applicable for the recommended methodology.

[7] The taxonomic status of the species in the lists has become an issue as well, owing to taxonomic changes that have occurred since the lists were compiled, but most field practitioners are able to work around the shifting taxonomy.

3.3.7 Frequency of Wetland Indicators

The USACE methodology emphasizes hydrological indicators that have a "greater-than-median" frequency of occurrence (i.e., occurring more than five years out of ten). However, the TAT presumes that the "median" condition changes through time. The TAT therefore recommends that, if the Water Board methodology retains the "median" standard used in the USACE methodology, then the methodology should be amended to reflect an expectation of "normal" hydrology. For example, the Water Board methodology could specify that wetland areas exhibit wetland hydrology in at least five out of ten years that have median or greater precipitation, based on longer-term climate records.

3.3.8 Geographic Variation in Indicators of Wetland Condition

Spatial variability in wetland criteria is a primary impetus for the "regional supplements" to the USACE wetland delineation manual (USACE 2008a, 2008b). These supplements differentiate between the arid regions and the wetter mountains, valleys, and coastal regions of the western US (Figure 1). The TAT recommends that the Water Board follow the USACE lead and recognize the importance of regionalizing wetland identification and delineation procedures by initially adopting the USACE regional supplements as part of the Water Board methodology.

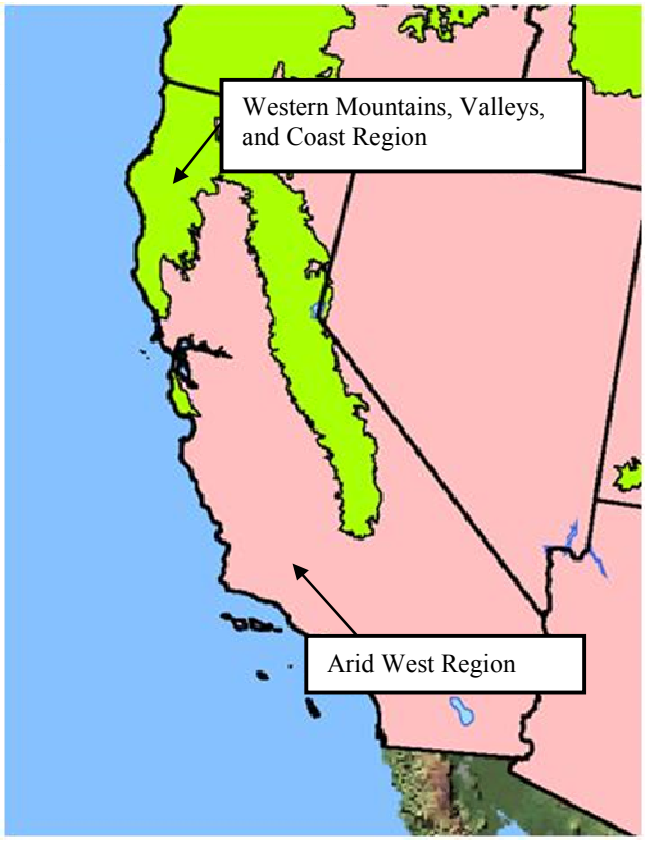

Figure 1. Approximate boundaries of applicable regions for Arid West and Western Mountains, Valleys, and Coast regional supplements of the USACE manual for wetland identification and delineation.

In adopting the regional supplements, the Water Board should be guided by the admonition included in the regional supplements that the regions to which they apply are not nearly as clear-cut as the map in Figure 1 suggests. The following excerpt from the Arid West regional supplement (USACE 2008a, p.6) illustrates the appropriate use of the regional supplements:

"The decision to use the Arid West Regional Supplement or the Western Mountains, Valleys, and Coast Regional Supplement on a particular field site should be based on landscape and site conditions, and not solely on map location. Figure 1 is highly generalized and does not indicate many of the smaller mountain ranges where the Western Mountains, Valleys, and Coast supplement would be applicable. Furthermore, there are arid environments beyond the highlighted areas in Figure 1 where the Arid West Regional Supplement would be appropriate. Both regions are highly diverse and transitions between them can be gradual." And, "Region and subregion boundaries are

depicted in Figure 1 as sharp lines. However, climatic conditions and the physical and biological characteristics of landscapes do not change abruptly at the boundaries. In reality, regions and subregions often grade into one another in broad transition zones that may be tens or hundreds of miles wide. The lists of wetland indicators presented in these Regional Supplements may differ between adjoining regions or subregions. In transitional areas, the investigator must use experience and good judgment to select the supplement and indicators that are appropriate to the site based on its physical and biological characteristics. Wetland boundaries are not likely to differ between two supplements in transitional areas, but one supplement may provide more detailed treatment of certain problem situations encountered on the site."

The TAT recommends that, in addition to adopting the USACE supplements for different regions of the western US, the Water Board should consider developing guidance for wetland identification and delineation that recognizes the natural variation in wetland criteria among different regions of the State. The TAT expects that further regionalization would help refine the wetland indicators, including regional lists of wetland plants, and thus increase the precision of the methodology. The ecoregions defined by the California Department of Fish and Game could be considered as a regional template for further developing the Water Board methodology.

3.3.9 Routine and Comprehensive Field Investigations

The USACE methodology includes a variety of data collection procedures designed for a variety of field and regulatory circumstances that a practitioner might encounter. For example, the practitioner must select whether to make a "routine" determination or a "comprehensive" determination of the presence and extent of wetland conditions. Routine determinations are usually adequate, but very complex sites or potentially difficult regulatory contexts (particularly those likely to involve litigation) may require a comprehensive determination, which might include hydrology monitoring in the field, extensive soil profiling, and quantitative vegetation sampling. Comprehensive determinations require substantial expertise in wetland science.

Routine determinations rarely may be conducted without site visits, for very simple circumstances with an abundance of existing qualified information. The TAT recommends that this practice be avoided, however, and that every identification and delineation should require onsite evaluation.

The onsite sampling procedures may vary according to the complexity of the site and the decisions that need to be supported by the sample data. The applications should be agreed upon by the delineator and reviewing agency staff in advance of the fieldwork. Pre-submittal consultation is particularly important in guiding data collection and analysis for technically difficult situations. The complexity of the applications in more difficult "routine" determinations can approach the level of complexity required in "comprehensive" determinations.

The TAT does not expect that the sampling procedures of the USACE methodology will have to be modified for Water Board use. The type and intensity of sampling conducted under Federal regulatory processes (which will not be affected by Water Board requirements) will generally meet the Water Board's needs. The TAT notes, however, that the Water Board is developing a wetland and riparian area monitoring framework that recognizes needs for additional information

about the status and trends in wetland extent and condition that will not be met by either the USACE or Water Board identification and delineation methodology.

3.3.10 Normal Circumstances and Difficult-to-Resolve Areas

Both the USACE wetland definition and the recommended Water Board definition include a reference to "normal circumstances." Understanding what constitutes normal circumstances is essential for wetland identification and delineation. The USACE methodology requires practitioners to verify whether or not normal circumstances are present as an initial step in wetland delineation. If normal circumstances are not present, the practitioner is required to identify the kind and extent of any site alterations, and the delineation subsequently proceeds differently than if normal circumstances were present.

Normal circumstances are identified by the USACE as:

> "The soil and hydrologic conditions that are normally present, without regard to whether the vegetation has been removed. The determination of whether normal circumstances exist in a disturbed area involves an evaluation of the extent and relative permanence of the physical alteration of wetlands hydrology and hydrophytic vegetation and consideration of the purpose and cause of the physical alterations to hydrology and vegetation" (Environmental Laboratory 1987, online version, p.4; and RGL 90-7, 26 Sep 90; HQUSACE, 7 Oct 91).

To be consistent with the recommended wetland definition, and to better reflect the nature of California wetlands, the TAT recommends a definition of normal circumstances that differs from the USACE definition (see Glossary):

> Normal circumstances are the hydrologic, substrate, and vegetation conditions that are present in the absence of altered circumstances. Normal circumstances include natural seasonal and annual variations in hydrology, substrate, and vegetation conditions.

Both the USACE definition of normal circumstances and the recommended Water Board definition incorporate the concept that circumstances can be altered by nature or by people, such that identification and delineation require the elucidation of pre-alteration conditions.

The recommended definition of normal circumstances incorporates natural temporal variability in wetland hydrology, substrate, and vegetation. It reflects the fact that broad seasonal and annual variations in aquatic areas are natural for California.

The natural variability of California wetlands can increase the difficulty in determining whether or not the conditions of the wetland criteria satisfy the requirements of the wetland definition. For example, natural seasonal variability can cause the wetland indicators to be difficult to resolve. According to the USACE methodology, areas of normal circumstances that are difficult to delineate because of seasonal variability in wetland criteria are termed "problem areas." Since such areas are within the range of natural variability, the TAT suggests that they are not "problem areas" except in the context of the USACE methodology. The TAT therefore recommends that such areas be termed "difficult-to-resolve." This avoids the incorrect negative connotation that such areas are "problems."

An inherent aspect of the recommended Water Board method of wetland identification and delineation is that *normal circumstances can exhibit difficult-to-resolve indicators*. For such areas, the TAT recommends that the Water Board adopt the approach to field indicator interpretation provided by the USACE regional supplements (USACE 2008a, 2008b).

Difficult-to-resolve conditions are not restricted to normal circumstances. Human activities and natural events can alter circumstances for wetland areas such that the wetland conditions can be difficult to resolve.

In summary, wetlands and other aquatic areas in California should be presumed to exhibit normal circumstances, despite broad seasonal and annual variability in hydrology, substrate, or vegetation, unless there are clear indications that circumstances have been altered by people or natural processes, in which case the areas should be treated as having altered circumstances (see section 3.3.11 below). The majority of areas in California will exhibit normal circumstances, as defined by both the USACE and the TAT. However, some wetland areas of normal circumstances will not clearly exhibit wetland conditions due to natural variability in wetland criteria; for example, unaltered areas that clearly exhibit wetland conditions during the wet season may be more difficult to identify as wetland areas during the dry season. Since such areas are within the range of natural conditions, they should not be regarded as "problem areas" (sensu Environmental Laboratory 1987), but rather as "difficult-to-resolve areas."

3.3.11 Altered Circumstances

The USACE method of wetland identification and delineation regards conditions of altered wetlands to be "atypical." The TAT expects that the USACE approach to identifying "atypical" conditions may be adopted with relatively minor (or no) adjustments to determine "altered circumstances" as defined by the TAT (see Glossary):

> *Altered circumstances* exist when one or more of the three wetland criteria (hydrology, substrate, and vegetation) have been sufficiently altered by recent human activities or natural processes to preclude wetland conditions, based on the Water Board methodology for wetland identification and delineation.

However, the TAT suggests that knowing whether circumstances are normal or altered is sufficient to guide delineation, without identifying the altered circumstances as "atypical." Simply stated, "altered circumstances" are the opposite of "normal circumstances" under the methodology recommended by the TAT. An area cannot be "normal" and "altered" at the same time, although in either case the status of the wetland criteria can be "difficult-to-resolve."

Altered circumstances can result from natural processes or from the actions of people. A variety of natural events can alter wetland criteria, including (but not limited to) landslides that input large amounts of sediment, seismic events that change topography and water sources, the natural breaching of hydrological barriers, major channel avulsions or realignments, and fires that remove surface vegetation and/or organic substrate. People can alter wetland criteria by action including (but not limited to) removing or burying hydrophytes and hydric substrates, grading, increasing drainage, or impounding water that converts wetlands into deepwater areas.

When alterations occur, the USACE methodology requires that practitioners identify the conditions of hydrology, substrate, and/or vegetation that were present prior to the alteration or which would be present absent the alteration, using one or more procedures that are suggested in the USACE guidelines.[8] Practitioners are then required to approximate the wetland boundaries based on the pre-alteration conditions. The TAT recommends that the Water Board adopt the same approach for areas subject to altered circumstances.

The USACE methodology excludes any judgments about the desirability of altered circumstances, and does not consider the likelihood that altered areas will eventually return to pre-altered circumstances or change to any other specific conditions. The TAT recommends that the Water Board adopt the same approach to prevent considerations of wetland desirability or speculation about future conditions from influencing wetland identification and delineation.

3.3.12 New Normal Circumstances

New normal circumstances exist when altered circumstances are likely to be permanent. Some of the processes or events that can lead to new normal circumstances include (but are not limited to) landslides and the formation of riverine deltas that cover wetlands or that provide new areas for wetlands to form, the retreat of glaciers that results in new wetlands in outwash areas, the impoundment of rivers and streams that creates wetlands along new shorelines, the breaching of levees that restores floodplain or tidal wetlands, and the permitted destruction or degradation of wetlands. The creation, enhancement, and restoration of wetlands can also cause new normal circumstances. The TAT recommends that the same concept of new normal circumstances should be adopted by the Water Board.

3.3.13 Timing of Field Work

As noted previously, the Water Board should assume that normal circumstances exist unless altered circumstances are clearly evident, based on the USACE approach to assess "atypical" conditions. However, as explained above and in TAT Memorandum No. 3 (TAT 2010b), the determination of the status of the wetland criteria is sometimes complicated by their natural variability, particularly but not exclusively in arid regions of the State. The temporal variability in wetland criteria can reduce the efficacy (but not the validity) of wetland indicators. Practitioners frequently encounter conditions that are more easily and assuredly resolved during the wet season than during the dry season.

The USACE methodology (particularly as amplified in the regional supplements) addresses seasonal effects on wetland delineation by requiring practitioners to infer what the normal circumstances would be in 5 of 10 wet seasons, and to base the delineation on the inferred wet season conditions.[9] The USACE members of the TAT noted that these recommendations presented by the regional supplements are implemented by the USACE whenever possible. In

[8] There are other useful procedures not identified in the USACE methodology that can be used to determine the pre-alteration circumstances of hydrology, substrate, and vegetation, so long as the procedures are authorized by appropriate regulatory personnel.

[9] Wetlands result from hydrological, substrate, and biological processes integrated over multi-year periods. An area that is a wetland in the wetter part of a year is still a wetland in the drier part of the year. The USACE methodology recognizes and accounts for this temporal variability in wetland condition.

deciding whether or not to seek wet-season data to supplement dry-season delineation, the USACE considers procedural requirements under Section 404 of the Federal Clean Water Act, which allow for extended processing timeframes under some circumstances. The TAT recommends that the Water Board adopt this same approach. More specifically, the TAT recommends that practitioners should be directed to identify the boundaries of wetlands (and aquatic support areas) as they would exist under wet season conditions, even when the field investigations are conducted during the dry season.

The TAT further recommends that the Water Board presume that all wetlands and aquatic support areas in the State demonstrate seasonal variations in wetland criteria to some degree, and that any given area can present natural conditions leading to difficult-to-resolve indicators, especially during dry seasons. For areas where the indicators are especially difficult to resolve, or where the identification and delineation results are potentially contentious, the TAT recommends that the Water Board consider delineations made during the dry season as provisional or temporary, and that it consider requiring new or continued delineations during the wet season. The primary purposes of these recommendations are to help minimize the uncertainty of wetland identification and delineation, and to help minimize the failure to identify wetland areas. A secondary purpose is to minimize the uncertainty in regional and statewide assessments of net change in wetlands by standardizing the time of year when wetland data are collected.

The TAT also recommends that the Water Board adopt an approach to wetland identification and delineation that minimizes reliance on dry-season data. An approach consistent with this recommendation is presented in both USACE regional supplements. They include specific recommendations to return "if possible" to a delineation site during "the normal wet portion of the growing season" (Arid West Regional Supplement, p 87; Western Mountains, Valleys, and Coast Regional Supplement, p 100) to resolve wetland indicators that were unresolved during dry-season delineation, with no changes in sampling procedures.

USACE members of the TAT expressed concern that unilateral implementation of this recommendation by the State could result in different Federal and State delineations and desynchronized permit processes. The TAT recommends that the Water Board work closely with the USACE to determine the circumstances that warrant supplemental wet season data. Studies are needed to characterize these circumstances. They are likely to differ among regions and types of wetlands. The risk associated with relying on dry-season data is probably less for areas that have less seasonality in precipitation and potential evapotranspiration. There is probably less risk for perennial wetlands (i.e., wetlands that are saturated or inundated year-round) than seasonal wetlands. Risk might also relate to wetland condition, function, or beneficial use. The TAT's recommendation to delineate aquatic support areas adjoining wetland areas will help in identifying areas that meet the wetland criteria, particularly during the dry season. The TAT emphasizes, however, that any reliance on dry-season data incurs some risk of underestimating wetland extent and distribution, and thus could reduce WRAPP effectiveness.

The TAT suggests that the dry season of California generally extends from about mid-May through November. The wet season therefore extends from about December to mid-May. These definitions are based on the clarity of wetland indicators. For any given area, the timing of the seasons can shift from year to year because of climatic variability. The timing of the seasons also

varies with latitude; the wet season is shorter further south. Regional variations in the duration of the wet and dry seasons is a subject for which statewide studies are warranted, and further highlights the potential value of recognizing ecoregions of the State (see section 3.3.7 above).

3.3.14 Validity Periods for Identifications and Delineations

The USACE methodology presumes that the indicators of wetland condition reflect persistent climatic regimes. It presumes, for example, that a wetland area reflects hydrological conditions that are present in at least 5 years out of any 10-year period. In a broader sense, the USACE methodology presumes that the distribution and abundance of aquatic areas reflect hydrological conditions that exist at least half the time over any period longer than ten years.

Climates do change, however. A change in rainfall and surface runoff patterns lasting for at least a decade would mean that after five years the average hydrological condition would have changed, potentially changing the boundaries of aquatic areas. Such climatic changes are likely to have two direct effects on aquatic area identification and delineation, as discussed immediately below.

First, the distribution and abundance of wetlands and other aquatic areas tend to shift in response to changes in rainfall and surface runoff. Changes in the hydrological regime of a landscape influence its moisture gradients, and thus can also influence the distribution, abundance, and ecological characteristics of aquatic areas (Naiman et al. 1992, Duever 2005, Stromberg et al. 2009). A landscape could become wetter, for example, with some aquatic support areas naturally developing into wetlands, such that the locations and boundaries of wetlands and other aquatic areas expand geographically, generally laterally and upslope (Mosley and McKerchar 1993). Alternatively, a landscape could become drier over time, with reductions in the distribution and extent of wetlands and other aquatic areas. These interrelationships are discussed in more detail in the TAT's Technical Memorandum No. 3 (TAT 2010b).

Second, delineations cannot be valid indefinitely. According to the USACE methodology, an accepted delineation is deemed "valid" for a period not exceeding 5 years; thereafter the delineation "expires" (the delineation may also be invalidated by significantly altered circumstances prior to its expiration). The TAT recommends that the Water Board recognize that delineations become invalid after a specified period or because of altered circumstances.

3.3.15 Aquatic Support Areas

Technical Memorandum No. 3 (TAT 2010b) describes relationships among wetlands and other aquatic areas in a landscape context. Aquatic support areas exhibit wetland conditions for one or two of the three wetland criteria. Most aquatic support areas adjoin wetland areas or deepwater areas, and are hydrologically and/or ecologically connected to them. The hydrological connections might be due to surface runoff, interflow, groundwater discharge, and/or high groundwater. Aquatic support areas and the other aquatic areas to which they are connected are integral parts of the same landscape moisture gradients.

Some aquatic support areas do not adjoin wetland or deepwater areas. Such aquatic support areas might be hydrologically or geographically isolated (sensu Winter and LaBaugh 2003, Comer et al. 2006, Tiner 2003), but they are unlikely to be ecologically isolated.

Aquatic support areas are ecologically significant (TAT 2010b). They are critically important components of California's aquatic environment. They can serve as buffers that protect wetlands from stressors, provide refuge for wetland wildlife, and they can ecologically link wetlands and other aquatic areas. Aquatic support areas can represent the frontline of evolution for local populations of wetland plants and animals that meet the limits of their tolerances to critical environmental factors, including moisture and temperature, in aquatic support areas.

The TAT recommends that the Water Board methodology should require practitioners to identify and delineate aquatic support areas that adjoin wetland areas. In other words, the TAT recommends that, having delineated a wetland area (i.e. the boundary between the wetland area and the adjoining aquatic support area and/or deepwater area), the practitioner should proceed to delineate the boundary between the aquatic support area and its adjoining upland. The intended result in every case is two delineations, one of the wetland area and one of the associated aquatic support area. The same indicators used to identify and delineate wetlands can also be used to indentify and delineate aquatic support areas.

Such information is not currently required by the USACE methodology. However, as noted above, the delineation of aquatic support areas can help increase the certainty of dry season wetland delineations by helping to infer the spatial limits of wet season conditions. Furthermore, since aquatic support areas help buffer adjoining wetland areas from external stressors (TAT 2010b), they will be important areas to consider as part of wetland restoration and mitigation planning and design. The delineation of aquatic support areas is one scientific approach to identifying wetland buffers that reflect site-specific conditions.

3.3.16 Landscape Data and Wetland Classification

The TAT is developing a separate memorandum that will recommend a wetland mapping methodology that includes a wetland classification system for California. It is likely that the classification system will include requirements to report the water source(s) and landscape setting(s) of all aquatic areas. This will greatly help the Water Board and other agencies to inventory wetland areas and determine their locally specific stresses and beneficial uses.

The USACE methodology does not require the identification of water sources, but it does require information about landscape context in certain circumstances. That is, if the hydrology and "soil" indicators are to be identified during the dry season, the USACE methodology requires a statement as to which of the follow landscape settings or characteristics apply:

- concave land surface;
- floodplain;
- level or nearly level land surface;
- toe of slope or at base of convergent slope;
- fringe of wetland or other water body;
- restrictive soil layer or aquitard less than 24 inches below the surface;
- groundwater discharge.

The TAT will consider these and other landscape settings in its memorandum on wetland mapping and classification.

4.0 Example Applications

Several California agencies have wetland definitions that differ from each other and from the definition used by the USACE (TAT 2010a). These different wetland definitions lead to different assessments of wetland extent and condition, which can complicate efforts to protect wetlands, to mitigate for their unavoidable losses, and to assess the effectiveness of statewide wetland protection policies and programs. For example, the California Wetlands Conservation Policy calls for no net loss of wetland acreage for the State as a whole. Using different wetland definitions will lead to much uncertainty about the estimates of wetland gains and losses, which can translate into uncertainty about the performance of the policy.

To maximize the comparability among wetland delineations, and to minimize the uncertainty of wetland maps and other inventories of wetland resources, the TAT recommends that all California agencies adopt the same technical definition of wetlands and the same methodology for wetland identification and delineation. This recommendation is based on technical concerns, but the TAT appreciates that it might have significant policy implications for some State agencies that currently use wetland definitions that differ from the USACE definition or from the recommended definition (TAT 2010a).

Whether or not the recommended wetland definition and the recommended methodology for indentifying and delineating wetlands improve the protection of wetlands cannot be known without consistent and comprehensive monitoring of the extent and condition of the State's wetlands. The needs for statewide wetland mapping standards and for a method to assess changes in wetland extent are the subject of a planned TAT memorandum on wetland mapping and classification. It should be noted that wetland delineation is an especially accurate method of wetland mapping (see section 2 above) that can contribute to an understanding of wetland extent within a watershed, region, or statewide.

Two case studies have been developed to illustrate how the application of existing alternative wetland definitions and delineation methods in the same area can result in different estimates of wetland extent. The first case study compares delineations of depressional wetlands and adjoining slope wetlands (i.e., coastal wet meadow) at Terrace Point, near Santa Cruz, California, resulting from expert applications of the wetland definitions and delineation methods of the USACE, the California Coastal Commission (CCC), and as recommended by the TAT. The other case study compares delineations conducted by the TAT of an area of estuarine wetland (i.e., tidal marsh) near Petaluma, California, based on the wetland definitions and delineation methodologies of the USACE and as recommended y the TAT.

4.1 Terrace Point

Figure 2 illustrates multiple delineations by different agencies based on their different wetland definitions and delineation methodologies. The case study site is located at Terrace Point in Santa Cruz County. The delineations were initiated by the land owner's proposal to expand facilities that would impact wetlands.

The USACE conducted two delineations at this site. An initial, routine delineation identified a single wetland area formed by groundwater and surface runoff in a well-defined topographic depression. The USACE subsequently conducted a comprehensive delineation that involved

onsite studies of soils (substrate), near-surface groundwater fluctuations, rainfall, and vegetation. As a result of this comprehensive delineation, the USACE expanded the area defined as wetland, relative to the area that had been identified as wetland based on the routine delineation.

The CCC conducted a wetland delineation at this site based on its wetland definition, but using field indicators from the USACE methodology. The CCC definition acknowledges the same three wetland criteria that are the basis of both the USACE and the recommended definition, but does not require that all wetland areas exhibit wetland conditions for all three criteria (TAT 2010a p.20). The CCC can therefore identify wetland areas that are not identified as wetland by the USACE. In this case, the area delineated as wetland by the CCC included all the area delineated as wetland by USACE plus separate areas outside of the USACE delineation. Some of these separate areas were dominated by hydrophytes (mainly *Baccharis douglasii,* an obligate wetland species based on Reed 1988).

In applying its recommended methodology, and considering the data provided by the USACE's comprehensive delineation, the TAT delineated the same wetland area as the USACE. The TAT then used its recommended methodology to delineate the aquatic support area adjoining the wetland area. The aquatic support area delineated by the TAT incorporates all the areas that were identified as wetland by the CCC but not by the USACE or by the TAT.

In summary, using the recommended methodology, the TAT delineated the same wetland area as the USACE, and incorporated the areas delineated as wetland by the CCC but not by the USACE into the aquatic support area.

5.2 Petaluma Tidal Marsh

Figure 3 illustrates the different outcomes of separately applying the USACE methodology and the recommended methodology at a site that involves non-vegetated wetlands. The site is an area of tidal marsh along the Petaluma River in Sonoma County. The example involves no regulatory action; it was developed by the TAT based on existing data.

The non-vegetated marsh pannes (i.e., intertidal ponds on the marsh plain) and the non-vegetated tidal flats that innervate and fringe the vegetated marsh plain are important habitats for many wetland-dependent species of plants and animals, including the State-protected California clapper rail, black rail, least tern, salt marsh harvest mouse, steelhead trout, and soft bird's beak. They are commonly regarded as integral past of tidal marshland (Goals Project 1999).

A delineation of wetland areas at Petaluma Marsh based on the USACE methodology could include or exclude the pannes, depending on the purpose and regulatory context of the delineation, but the tidal flats would almost always be excluded. In contrast, a delineation based on the recommended methodology would always include the pannes and tidal flats as wetlands, as well as the vegetated marsh plain.

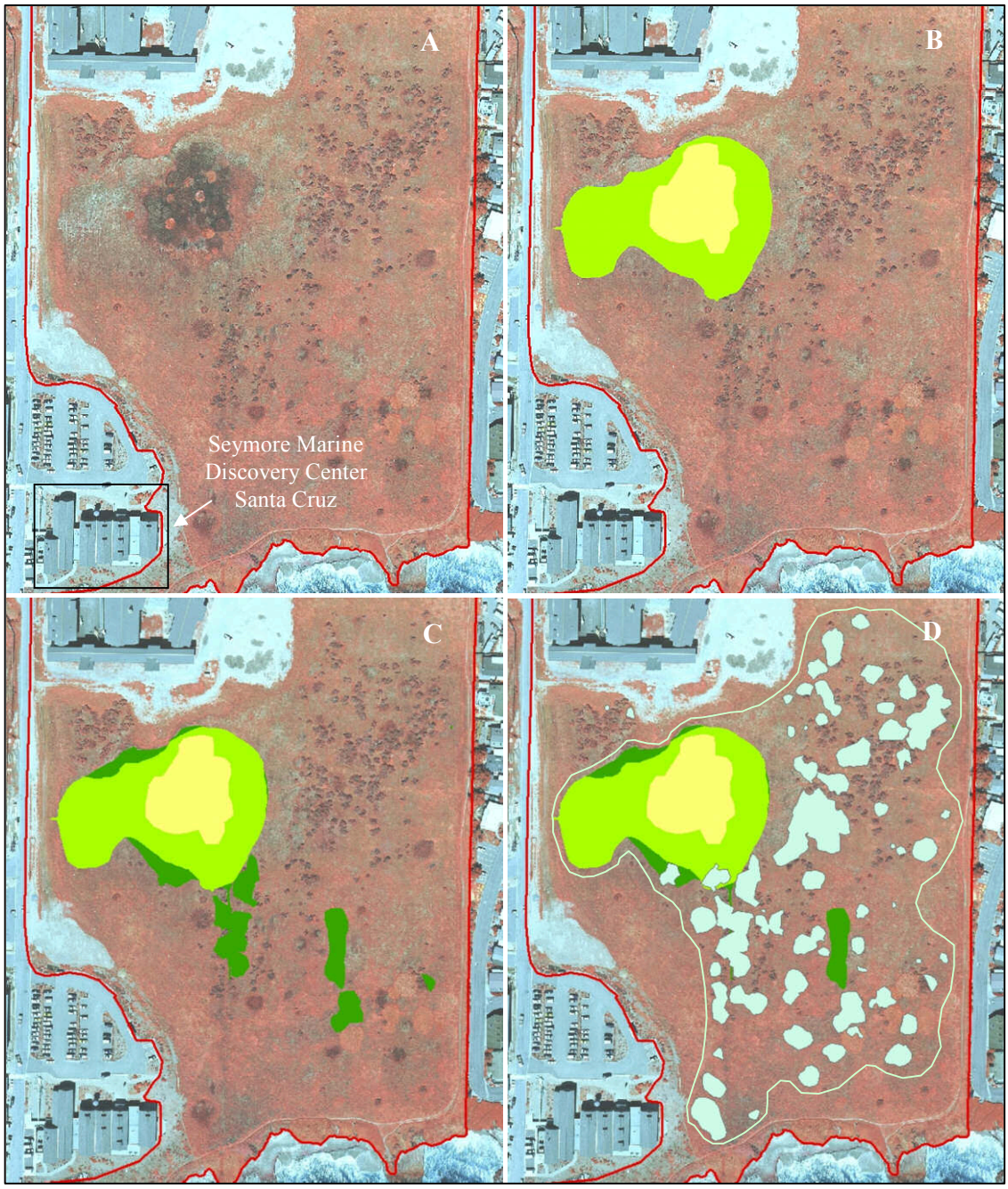

Figure 2: Terrace Point, Santa Cruz County, showing (A) infra-red image of site; (B) USACE routine delineation (yellow) and USACE comprehensive delineation (light green); (C) wetland areas identified by the California Coastal Commission (dark green) apart from the USACE delineations; and (D) the aquatic support area (area outlined by white line) adjoining the USACE delineation. The delineation based on the recommended methodology is the same as the USACE comprehensive delineation. The aquatic support area encompasses all the delineated areas plus other areas that exhibit some but not all requisite wetland conditions based on the recommended methodology. For example, the aquatic support area includes areas that support wetland plants (white patches in D) but lack wetland hydrology and/or substrate.

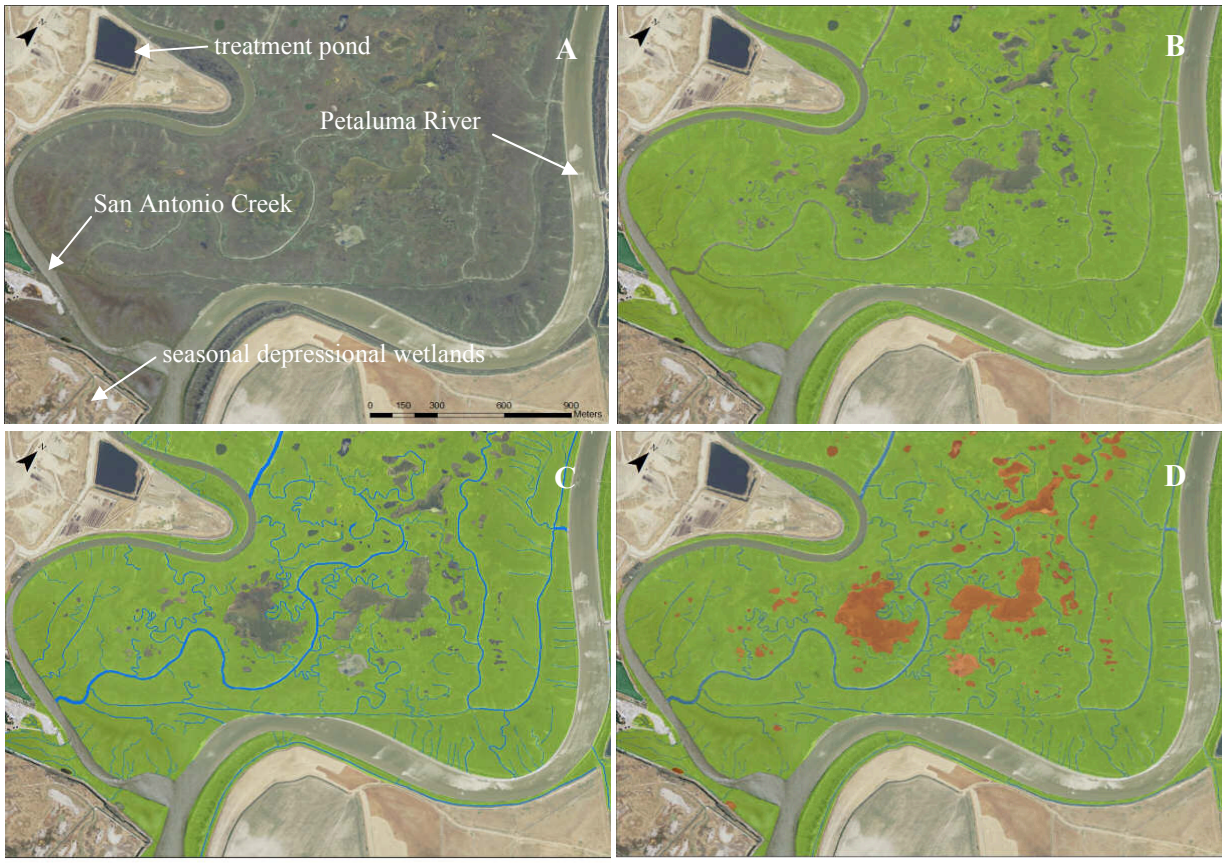

Figure 3: Case study of how differences between the USACE wetland definition and the recommended definition can translate into different estimates of the distribution and abundance of wetlands. This case focuses on tidal marshland between San Antonio Creek and the Petaluma River in Sonoma County (3A), which is part of the largest area of relatively unaltered ancient tidal marshland in California. Both definitions were applied to this marshland using the USACE methodology for wetland identification and delineation.

According to a strict application of the USACE definition, the only area of estuarine wetland at this site is the vegetated tidal marsh plain (green area in 3B). According to the recommended definition, the non-vegetated intertidal channels (blue areas in 3C) and the non-vegetated tidal marsh pannes (orange areas in 3D) are also wetland areas. The pannes, small channels, and vegetated marsh plain are commonly regarded as integral features of tidal marshes (Goals Project 1999), which are generally regarded as important kinds of wetlands (Mitsch and Gosselink 2000).

Since this case focuses on an estuarine wetland area, it disregards the areas of other kinds of wetlands that are evident in this figure, including the artificial perennial depressional wetland (i.e., the treatment pond) in the upper left corner of the aerial image, and the dry seasonal depressional wetlands in the lower left corner of the image.

5.0 Training

The TAT expects that the Water Board and each of its Regional Boards will need to field a number of staff who can expertly identify and delineate wetlands and other aquatic areas. Many of the technical procedures described or referenced in this memorandum are currently not conducted by the Water Board or other California State agencies. The TAT believes that the "basic training" for State agency staff will generally involve the following topics:

- conducting a wetland delineation;
- identifying "normal circumstances";
- preparing an appropriate sample and analysis plan;
- documenting observations;
- preparing a delineation report;
- reviewing a delineation report;
- interpreting technical findings;
- determining if additional information is needed.

The first five topics are similar to tasks included in standard wetland delineation training curricula that are regularly taught across the US by professional training firms or individual experts. The final three topics are significant aspects of a regulatory wetland program, but are not part of most training curricula. For example, these topics are central to the USACE program for administering Section 404 of the US Clean Water Act (CWA). The TAT expects that training in these topics will not be available from existing training programs and may require specialized courses instructed either by USACE staff or other experts. Water Board staff will need to be trained in using the delineations as part of the State's 401 certification program of the CWA and the State's Porter-Cologne Water Quality Control Act.

The TAT expects that the Water Board and each of its Regional Boards will need to field a number of staff who can expertly indentify and delineate wetlands and other aquatic areas. The recommended methodology for wetland identification and delineation incorporates substantial wetland science and field technique. Water Board staff who are selected to implement the methodology might require advanced training. Some of the advanced training topics include:

- the natural variability of wetlands among regions of California;
- the effects of landscape position or context on wetland condition and function;
- recognizing "altered circumstances" and identifying their probable causes;
- the use of new wetland indicators and delineation techniques as they are developed.

The last topic in the list immediately above relates to the expectation that training will be an ongoing concern for the Water Board. Wetland science and its application to wetland identification and delineation continue to evolve. The TAT recommends that the Water Board plan to be an active member in the wetland science community by sharing the experience it gains through WRAPP implementation.

6.0 Glossary

Altered circumstances exist for wetland areas when one or more of the three wetland criteria (hydrology, substrate, and vegetation) have been sufficiently altered by recent human activities or natural processes to preclude wetland conditions, based on the Water Board methodology for identifying and delineating wetlands. The determination of altered circumstances requires a consideration of both their causes and their expected duration. Given altered circumstances for wetlands, practitioners must use supplementary identification/delineation procedures to characterize the pre-alteration condition. This definition incorporates the concept of "atypical" wetland situations presented in the USACE methodology for wetland identification and delineation (Environmental Laboratory 1987). Also see *Normal Circumstances*.

Aquatic area is a general term for any area in a landscape exhibiting physical, chemical, and/or biological conditions resulting from the presence of standing or flowing surface water and/or shallow groundwater. Aquatic areas include deepwater areas of estuaries and lakes; wetlands; aquatic support areas; stream and river channels; and other water features in the landscape.

Aquatic support areas exhibit some but not all the characteristics of wetlands. They can be areas that are changing from wetlands to uplands, or from uplands to wetlands, or they might be areas situated between, and affected by, wetlands and uplands. See Technical Memorandum No. 3.

Beneficial uses define the resources, services, and qualities of wetland areas and other waters of the State of California that are the ultimate goals of protecting and achieving high water quality. Beneficial uses serve as a basis for establishing water quality objectives and discharge prohibitions to attain these goals.

Boundary refers to the demarcation between two landscape areas.

> *Delineated aquatic area boundary* refers to the mapped boundary portraying the geographical extent of wetlands or other aquatic areas identified pursuant to a formal delineation within a defined area. If the delineated boundary of any aquatic area is formally accepted by regulatory or trust agencies, the location of the boundary remains fixed in place during the valid period of the delineation.
>
> *Landscape patch boundary* refers to the area or zone between neighboring landscape patches. Physical, chemical, and biological processes that extend among adjoining patches can broaden or "blur" their common boundaries. Landscape patch boundaries tend to become narrower or more distinct as the environmental gradients between the patches become steeper (Sanderson and Harris 2000).

*Channel*s are landscape features with well-defined beds and banks that have been formed by water and which under normal circumstances are maintained by the flow of water, or that are purposefully constructed and maintained to convey water. Unaltered channels can be subterranean for short lengths but are generally surface features. For example, channels can pass under bridges or through culverts and natural tunnels, but buried stormdrains and water pipes are not channels. Channels may be found in wetlands, and they can contain wetlands, deep water aquatic areas, and aquatic support areas.

Deepwater aquatic areas have an average depth of inundation greater than 2.0 meters during the growing season, or greater than the maximum depth from which rooted vascular vegetation grows to the water surface, whichever is deeper. These areas are too deep to be wetlands. They include, but are not limited to, large lakes, reservoirs, lagoons, deep rivers, and estuarine and marine bays. Areas that are temporarily inundated by deep water can be wetlands if such inundation does not persist throughout most of the growing season. For example, wetlands on floodplains can retain wetland conditions and function as wetlands after being deeply flooded. See *surface water*.

Delineation is the application of a technical and procedural methodology to identify the boundary of a wetland area or an aquatic support area within a specified study site by identifying the presence or absence of wetland indicators of wetland criteria at multiple points at the site and by establishing boundaries that group together sets of points that share the same status of each parameter.

Difficult-to-resolve conditions exist when the wetland field indicators for one or more of the three criteria of the wetland definition are unclear due to natural processes or events, or due to the activities of people.

Dominance in wetland vegetation refers to the relative abundance of plant species as explained in the USACE delineation manual (Environmental Laboratory 1987). The "50/20 rule" of the USACE manual is the recommended method for measuring dominance. It states that for each height stratum in the plant community, dominant species are those that (when ranked in descending order of abundance and cumulatively totaled) immediately exceed 50% of the dominance measure for the stratum (typically ground surface coverage), plus any additional species that individually comprise 20% or more of the total dominance measure for the stratum (USACE 2008a).

Duration refers to the length of time that an area is continuously saturated or covered (inundated) by water. It is the period available for the formation of anaerobic substrate conditions. It does not refer to the presence or lack of seasonal occurrences of inundation or saturation, but to the length of time an area is continuously saturated or covered (inundated) by water.

Growing Season is the annual period during which hydrophytes can generate new tissue above or below ground. It generally corresponds to the period when daily minimum soil temperature at 30 centimeters below the surface is higher than biologic zero (5º C or 41º F). In colder or mountainous regions of California, the growing season can be approximated as the period when daily maximum air temperature is above 28º F (-2.2º C).

Hydric substrate conditions are conditions of upper substrate that form if saturation in the upper substrate, flooding, or ponding lasts long enough to create anaerobic conditions. For the purposes of this definition, the minimum duration of saturation, flooding, or ponding required to form anaerobic conditions in the upper substrate is identified as 14 consecutive days during the growing season. However, the minimum duration required to develop anaerobic conditions in the upper substrate is known to vary with soil temperature, soil pH, and other environmental factors, and scientific evidence indicates that in some California environments the chemical

transformation to anaerobic conditions in the upper substrate may occur in fewer than 14 days (TAT 2010a). Regional indicators of hydric conditions pertinent to California are provided in regional supplements to the USACE manual for wetland delineation, including at this time the "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)" (USACE 2008a), and the "Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region" (USACE 2008b). This definition should be reviewed in the context of future supplements and other revisions to the USACE wetland delineation manual.

Hydrophytes, or hydric plant species, are plants adapted to inundated or saturated substrates (see *hydric substrate conditions*). The currently adopted list of California hydrophytes is available in Reed (1988a) (Region 10), which classifies hydrophytes into five groups based on the probability of their occurrence in wetland areas: Obligate Wetland (OBL = >99% frequency of occurrence in wetland areas), Facultative Wetland (FACW = 67–99%), Facultative (FAC = 34–66%), Facultative Upland (FACU = 1–33%), and Obligate Upland (UPL = <1%). Most wetland plant communities are dominated by OBL, FACW, and/or FAC species, yet some are characterized during dry seasons by FACU species or may become non-vegetated. Obligate hydrophytes nearly always occur in wetland areas, while FACW species typically are found in wetland areas, FAC species are common in wetland areas and in uplands, and FACU species occur mostly in uplands. This definition may be reviewed in the context of future supplements and other revisions to the USACE wetland delineation manual or guidance documents. It should be noted that many plant species that may be encountered during field delineations are not included in the hydrophyte lists, and species ratings reported in the lists may not always reflect the ecological amplitudes and wetland affinities of individual plants or plant populations in the wild.

Identification of a wetland or aquatic support area is the application of a technical and procedural methodology to identify the status of the three wetland criteria (hydrology, substrate, and vegetation), based on field indicators. Also see *Delineation.*

Indicators are identifiable but not necessarily quantitative characteristics of wetland criteria used to determine whether or not the criteria meet the requirements of the wetland definition. Wetland indicators are used to identify and delineate wetland areas from other aquatic areas and from non-aquatic areas (i.e., uplands).

Landscape generally refers to a set of visible, physical geographic features, including landforms, aquatic areas, vegetation, land uses, and built structures that can be viewed together in a single scene. In the context of landscape ecology, landscape refers to a mosaic of patches that recurs over a broad region of the earth's surface (Forman 1995).

New normal circumstances exist when altered circumstances have become permanent (see *normal circumstances* and *altered circumstances*).

Normal circumstances are the hydrologic, substrate, and vegetation conditions that are present in the absence of altered circumstances. Normal circumstances include natural seasonal and inter-annual variations in hydrology, substrate, and vegetation conditions. Natural, purposeful, or inadvertent conversion of a non-wetland area into a wetland area, or conversion of a non-channel

area into a channel can cause new normal circumstances. See *Altered Circumstances*. This definition incorporates much of the meaning of normal circumstances as defined by the USACE, which states that normal circumstances are the soil and hydrologic conditions that are normally present, without regard to whether the vegetation has been removed. The determination of whether or not normal circumstances exist in a disturbed area involves an evaluation of the extent and relative permanence of the physical alteration of hydrology and hydrophytic vegetation and consideration of the purpose and cause of the physical alterations to hydrology and vegetation (based on Regulatory Guidance Letter 90-7, 26 Sep 90; HQ USACE, 7 Oct 91).

Permanent refers to a landform, habitat type, cover patch, or other landscape feature that is not expected (under normal circumstances) to change in overall condition or location anytime in the foreseeable future, although it may change in size and shape. With regard to wetland hydrology, "permanent" means that the hydrological regime leading to anaerobic conditions in the upper substrate is not expected to change in the foreseeable future. Such a regime could include recurrent seasonal inundation or saturation by surface water or groundwater. A normal hiatus in such seasonal inundation or saturation does not indicate a lack of wetland hydrology or a lack of anaerobic substrate conditions.

Riparian areas are areas through which surface and subsurface hydrology interconnect aquatic areas and/or connect them with their adjacent uplands (Brinson et al. 2002). They are distinguished by gradients in biophysical conditions, ecological processes, and biota. They can include wetlands, aquatic support areas, and portions of uplands that significantly influence the conditions or processes of aquatic areas.

Saturated refers to the upper substrate within which all easily drained voids (pores) between the substrate's particles are temporarily or permanently filled with water to, or near to, the substrate surface at pressures greater than atmospheric. This includes part of the capillary fringe above the water table (i.e., the tension saturated zone) in which substrate water content is approximately equal to that below the water table. Soil at field capacity is considered to be saturated. This definition may be reviewed in the context of future supplements and other revisions to the USACE wetland delineation manual.

Substrate is the solid organic or inorganic material that forms the physical surface of a landscape area, including wetlands. Substrate may include rock, boulder, cobble, gravel, sand, silt, clay, and other inorganic materials; peat, muck, and other organic materials; and various mixtures of inorganic and organic materials. Substrate generally also includes water, other liquids, and gaseous materials.

> *Upper substrate* is the portion of substrate that includes the major portion of the root zone for vegetation, and the zone within which relevant anaerobic chemical conditions develop in wetlands. The "major portion of root zone" is interpreted by the USACE to be the zone containing >50 % of the living root mass of the dominant wetland species. The depth of the upper substrate that influences wetland indicators will vary, depending on vegetation, substrate texture, depths to impermeable layers, and substrate chemistry. The USACE 1987 manual identifies the major portion of the root zone as typically 30 cm (12 in) deep; for the purposes of this definition, the upper substrate is typically the zone extending downward from the substrate surface to a depth of 50 cm (20 in), as indicated

in the regional supplements. However, the USACE methodology requires that hydrology observations consider that saturation must occur within the majority of the dominant wetland-species root zone, and in porous soils the upper substrate may extend to depths greater than 50 cm.

Surface water is the freestanding or moving water above the ground surface.

Deep surface water – For all landscapes, deep surface water is either (A) deeper than 2 meters during the growing season; or (B) deeper than the greatest depth from which rooted vascular vegetation grows to the water surface, whichever is deeper. Areas temporarily inundated by deep surface water can be wetlands if such inundation does not persist throughout most of the growing season. For example, floodplain areas that are temporarily deeply inundated due to natural flooding or water management can retain wetland conditions and subsequently function as wetlands.

Shallow surface water – For all tidal landscapes, shallow surface water is any portion of the tidal prism that is bounded by the local Mean Lower Low Water (MLLW) datum and the local maximum tide height as adjusted for the current tidal epoch. For landscapes that are not tidal, shallow surface water is either (A) any water having depth equal to or less than 2 meters for at least 14 consecutive days during the growing season; or (B) the greatest depth from which rooted vascular vegetation grows to the water surface, whichever is deeper.

Upland (i.e., non-aquatic area) lacks any field-based indicators of an aquatic area. Uplands are generally higher in elevation and better drained than wetlands.

Vegetation consists of rooted macrophytes, parts of which may be emergent, submerged, or floating, including monocots, dicots, and ferns. An area is vegetated if at least 5% of it is covered by vegetation. The area exhibits wetland vegetation if the dominant vegetation is hydrophytes.

Watershed is defined as all the lands and waters that drain to a common place. Catchment, catchment area, catchment basin, drainage basin, and drainage area are watershed synonyms.

Wetland area is is an area that, under normal circumstances, (1) the area has continuous or recurrent saturation of the upper substrate caused by groundwater or shallow surface water or both; (2) the duration of such saturation is sufficient to cause anaerobic conditions in the upper substrate and; (3) the area either lacks vegetation or the vegetation is dominated by hydrophytes. (TAT 2009a).

Wetland criteria are measureable aspects of wetland condition. The wetland criteria used to define, identify, and delineation wetland areas are hydrology, substrate, and vegetation.

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