

Technical Advisory Team
California Wetland and Riparian Area Protection Policy

Technical Memorandum No. 2: Wetland Definition

Final
25 June 2009

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Disclaimer

This is not a draft or final California state wetland definition. This is the wetland definition recommended by the Technical Advisory Team to the Policy Development Team for the California Wetland and Riparian Area Protection Policy.

Purpose

The purpose of this memorandum is to recommend a scientific definition of wetlands to the Policy Team with enough explanatory text to support an analysis of this definition in the context of the Policy. Subsequent memoranda from the TAT will recommend a landscape framework for wetlands, an approach to wetland and riparian identification and delineation, a wetland and riparian classification scheme, a wetland and riparian mapping methodology, and an approach to wetland and riparian mitigation and assessment in the watershed context.

A description of the TAT, including why and how it was formed, its membership, and its workplan is available in a separate memorandum titled “Technical Memorandum No. 1: Technical Advisory Team.”

Methodology

Guiding Principles

The TAT began working on its recommendation for a State wetland definition by developing a set of guiding principles. These principles were created in a consensus process with detailed editing of the language of each point. In short, the TAT sought to develop a definition rooted in science and supported by previous approaches and the experience ensuing from them.

TAT’s guiding principles for providing science support to the California Wetland and Riparian Protection Policy Development Team

- Recognizing the goal of wetlands protection, describe the wetland science needed to support the policy.
- To the extent possible, adopt a wetland definition that relies on existing approaches to wetland delineation, mapping, classification, and monitoring.
- To the extent possible, develop recommendations based on science rather than regulatory, economic, or political concerns.

Overview of Wetland Definitions

The history of the term *wetland* has been reviewed by Mitsch and Gosselink (2000), Lewis (1995), and Tiner (1999). The term has been in common usage for about a century, with formal, scientific definitions first appearing about 50 years ago. The number of definitions increased markedly in the 1960s, with more scientific and public recognition of the importance of wetlands and that they were disappearing at an alarming rate.

A worldwide review of contemporary wetland definitions, with an emphasis on those from temperate parts of the globe, evokes two observations. First, only a few characteristics are commonly referenced by most of the definitions. They focus on soil saturation and its physical, chemical, and biological consequences. As such, hydric soils are one of the common and persistent physical indicators of a wetland, with hydrophytic plants as another common indicator. There are also ecological and hydrological functions that are strongly associated with wetlands (Greeson et al., 1979, USEPA 1995). These include flood water storage, groundwater recharge, shoreline stabilization, water filtration, and support of native biological diversity. It has been estimated that in the United States roughly 150 species of birds and more than 200 species of fish depend on wetlands for their survival (Flynn 1996). As of 1988, almost 30% of all plants and about 50% of all animals that are listed as endangered or threatened in the US depend on wetlands (Niering 1988). The value of wetlands to threatened and endangered species has probably increased since then. Of all the regions in the country, the Pacific Coast region contains the largest number of at-risk species that depend on vulnerable wetlands (e.g., headwater streams and hydrologically isolated wetlands that may not be fully protected by existing federal policies). California has by far the largest number of at-risk plant species occurring within vulnerable wetlands (Comer et al. 2005). The second observation is that definitions are surprisingly variable, in spite of well-recognized physical attributes and functions. This may be a consequence of definitions attempting to address regulatory concerns specific to the agency or country that develops them rather than adhering to science-based approaches.

Wetland definitions also differ due to natural variability in wetland structure, form, and landscape position. Wetlands vary in size, shape, soil properties, plant community composition, and an array of hydrologic properties, such as duration of wetness, frequency of being wet, and depth of flooding. (Mitsch and Gosselink 2000). Tiner (1999) lists 26 common wetland types in North America. According to the wetland classification system used by the USFWS (Cowardin et al. 1979), there are thousands of variations in these wetland types. The number of wetland types can be further increased by combining the Cowardin system, which is focused on the biological and physical attributes of wetlands, with other systems that also focus on water sources and landscape position (Brinson et al. 1993, Tiner 1995, 2003).

Some definitions describe wetlands as transitional areas between uplands and deepwater aquatic areas. For example the USFWS states that “Wetlands are lands transitional between terrestrial and aquatic systems...” Indeed, some types of wetlands, such as those forming lakeshores, always exist between uplands and deepwater areas. However, many wetlands are surrounded by uplands. For example, vernal pools occur in large numbers over large landscapes, yet are almost never bordered by deepwater areas. With regard to wetlands, the term *transitional* does not necessarily denote geographic location; it means that wetlands are neither completely terrestrial nor completely aquatic. In a general sense, wetlands are distinct habitat types (Daubenmire 1976), land units (Zonneveld 1989), or landscape patches (Forman 1995) having terrestrial and aquatic attributes.

Comparison of Candidate Definitions

After the TAT was formed and had drafted its guiding principles for defining wetlands, its next task was to draft criteria for selecting or developing a successful definition. Based on these criteria, and after reviewing definitions currently in use by governmental agencies and scientific organizations in California, other states, other nations, or worldwide, the TAT selected nineteen candidate definitions that contained enough information to support their evaluation (Appendix A).

The candidate wetland definitions were ranked by each TAT member based on the draft selection criteria. The criteria had equal value; they were not weighted. The degree to which each candidate definition met each criterion was evaluated on a simple numerical scale of 1 to 5. The degree to which each definition met all the criteria was evaluated as the sum of its scores.

Criteria for Selecting or Developing a California Wetland Definition

1. Defines unique features of landscapes that are neither terrestrial nor aquatic in terms of physical attributes, chemistry, ecology, and social values.
2. Encompasses the full range of all conditions of all wetlands of all types commonly recognized in California by regional, state, and national communities of wetland managers and scientists.
3. Can be translated into a standard approach to mapping and field-based delineation of wetland boundaries without unnecessarily limiting the scope or breadth of the maps or delineations.
4. Is the same as, or very similar to, an existing definition that has been proven appropriate through broad application by US States, Tribes, or federal agencies.
5. Refers to natural processes that account for the particular characteristics, functions, beneficial uses, or ecological services of California wetlands.

The TAT met to discuss the findings of each member. This provided ample opportunity to dissect the candidate definitions with regard to the selection criteria. During this initial analysis, some of the criteria were revised. The candidate definitions were then re-ranked by the TAT members working together. The final criteria are listed above.

In addition to the numerical ranking analysis of the candidate definitions, the TAT also engaged in a virtual “ground-truthing” session to determine how well the top candidates fared across a variety of California wetlands. TAT members contributed photo sets of different wetlands from across the State, focusing on conditions that illustrated the selection criteria or challenged the candidate definitions (Appendix B). Through this exercise, the TAT quickly realized which kinds of areas it was comfortable identifying as wetlands, which it definitely could identify as not being wetlands, and which had some wetland characteristics but were probably not wetlands. This discussion considered the likely formative processes of the areas and their likely ecological or physical beneficial uses and ecological services, as well as their visible characteristics.

Results

The TAT has found that a new wetland definition is needed because none of the existing, candidate definitions fully represents all the various forms or kinds of landscape areas in California that are very likely to provide wetland functions, beneficial uses, or ecological services. Some of the candidate definitions were better than others, but none met all the criteria or passed the virtual ground-truthing test (Appendix B). Of special concern was that no candidate definition adequately reflected the range in vegetation condition that is commonly expressed by any wetland type at any given time across the State, and none of the candidates adequately reflected the range in wetland condition that can be expressed by many wetland types over time. The better candidates were either too general to unambiguously cover all the wetlands types, or they were clearly too restrictive in their coverage. The TAT therefore moved forward to develop a new wetland definition based on what it had learned while comparing the candidates.

In its effort to develop a new wetland definition for California, the TAT reviewed the processes that most directly account for wetland conditions, and how these processes vary throughout the State due to climate, geology, and land use.

California landscapes are diverse and variable. The ecology of the State's deserts, mountains, and fertile valleys varies greatly with altitude, latitude, and distance inland. Each landscape in every part of the State experiences seasonal and annual variations in rainfall, and is occasionally subject to drought and deluge. And, each has clearly identifiable areas that function as wetlands. The extent and condition of these areas can be affected by rainfall, emerging groundwater (i.e., seeps and springs), normal runoff, or floods. These areas might persist all year every year for decades or longer. Or, they might occur seasonally every year or only when water is abundantly available. The TAT concluded that the California wetland definition should reflect the natural spatial and temporal variability in wetland extent and condition.

Some areas in California function as wetlands despite lacking abundant wetland vegetation. For example, non-vegetated playas, tidal flats, river bars, and ephemeral or intermittent washes provide a variety of wetland functions, including water filtration, groundwater recharge, and the support of wetland wildlife. None of these areas would necessarily be defined as wetlands according to the candidate definitions. The TAT concluded that the California wetland definition should clearly include these non-vegetated areas that mainly provide wetland functions.

The TAT recognizes that the State would benefit from having a wetland definition consistent with that used by the US Army Corps of Engineers (USACE). The benefit would be derived from the ability of the State to use the identification and delineation procedures established by the USACE, specifically the USACE's 1987 wetland manual (Environmental Laboratory 1987). Wetland delineation under the 1987 manual is a complex technical procedure that has been vetted through extensive scientific testing and legal challenges. Although the TAT rejected some of the language of the definition used by the USACE, it found that it could develop an alternative definition that meets all the suitability criteria, and is supported by the USACE 1987 wetland manual. A complete explanation of the necessary revisions to the USACE method for its use with the recommended State wetland definition will be provided in the TAT technical memorandum pertaining to wetland identification and delineation.

Recommended California Wetland Definition

The TAT has developed a wetland definition for California that meets all the suitability criteria presented above. 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.

Synopsis

The recommended definition meets all of the criteria developed by the TAT for a California wetland definition. Future technical recommendations from the TAT regarding wetland mapping, classification, delineation, and monitoring will be consistent with this definition.

The recommended definition reflects current scientific understanding of the formation and functioning of wetlands (Lewis et al. 1995, Mitsch and Gosselink 2000). Hydrology is the dominant factor in wetland formation because it controls the development of anaerobic chemical conditions, and thus strongly influences the abundance of plant species tolerant of such conditions (Voeselek et al. 2003) or indicative of them (Reed 1988).

The recommended State definition uses field indicators of hydrological regimen, substrate condition, and plant community composition to distinguish wetland areas from other areas of a landscape. This is commonly regarded as the “three-parameter approach”¹ to defining, identifying, and delineating wetland areas in the field (Tiner 1999). These are the same parameters incorporated into the wetland definition used by the USACE and the US Environmental Protection Agency (USEPA) for Clean Water Act purposes (see code D in Appendix A).

However, the recommended State definition recognizes that all three parameters may not be evident or present in some areas that provide wetland functions, beneficial uses, or ecological services at some times of the year or in some years (especially during prolonged dry periods), and that some of these areas lack vegetation and therefore may satisfy only two parameters (i.e., wetland hydrology and hydric substrates). The TAT determined that a modification for the vegetation parameter was necessary to address instances where the USACE definition is problematic. For example, the USACE methodology requires “positive” evidence that the vegetation cover is dominated by hydrophytes; areas that are not dominated by hydrophytes but that provide wetland beneficial uses and ecological services, such as tidal flats, playas, and non-vegetated river bars, are not necessarily identified as wetland areas according to the USACE definition and delineation methodology. Therefore, the TAT established a vegetation parameter in the recommended State definition that requires dominance by hydrophytes (the condition required by the USACE definition) only when the wetland is vegetated. That is, the recommended State definition identifies non-vegetated areas that satisfy the hydrology and substrate parameters, such

¹ The National Academy of Science recommends that ‘parameter’ not be used in this context. In order to be consistent with the USACE identification/delineation method, ‘parameter’ herein refers to wetland hydrology, substrate, or vegetation.

as some tidal flats, playas, and river bars, as wetlands. The recommended definition also includes wetland restoration and creation sites that lack vegetation.

The TAT emphasizes that the recommended definition pertains to circumstances that are not always readily observable. This may be due to normal seasonal or annual variability, or to the nature of the soils or plant species involved, to occasional natural events, or to recent human activities. The practical approaches to field-based wetland identification and delineation developed through several decades of federal agency experience will be helpful in applying the recommended definition.

The TAT recommends that anyone applying the recommended definition should objectively use all the appropriate indicators without any a-priori decisions on the outcomes, regardless of the circumstances. No area should be identified as a wetland unless it has been determined to have the wetland conditions specified in the recommended definition.

The TAT recommends that the State initially identify the USACE's 1987 wetland manual (Environmental Laboratory 1987), the supplement for arid regions (USACE 2008a), the interim supplement for western mountains, valleys, and coastal region (USACE 2008b), and any subsequent replacement USACE technical guidance as the primary sources for information and practices necessary for identifying wetland areas and delineating wetland boundaries pursuant to the recommended State definition. Based upon experience gained in applying the definition, the State may eventually elect to develop new reference materials that address more specifically the implementation of the definition. The TAT will produce a separate memorandum more fully addressing wetland identification and delineation relative to the recommended State definition.

Glossary of Operative Terms in the Wetland Definition or Relating to It

Altered Conditions – Altered conditions are hydrologic, substrate, and vegetation conditions that differ from normal circumstances because of recent human activity or natural processes. For example, an area may have wetland hydrology and hydric soils but lack wetland vegetation because of recent vegetation management; a floodplain area of a river might have hydric soils and vegetation dominated by hydrophytes but lack wetland hydrology because of a recent natural change in the river course; the shallow margins of a river delta in a lake may be devoid of vegetation because of recent delta deposits. Altered conditions that are not permanent are not likely to convert wetland areas into non-wetland areas.

Aquatic Area – This is any area having physical, chemical, and/or biological conditions resulting from the presence of surface water and/or shallow groundwater.

Aquatic Support Area – This is an area that either (1) meets the hydrology criterion for wetland, but not the substrate criterion (regardless of vegetation); or (2) meets the substrate criterion, but not the hydrology criterion (regardless of vegetation); or (3) meets neither the hydrology criterion nor the substrate criterion, but meets the vegetation criterion. Such areas often exist in close proximity to wetlands or in areas that are transitioning (temporally or spatially) to or from wetlands (TAT 2009).

Beneficial Uses – 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.

Channel – A channel is a landscape feature with well-defined bed and banks that are formed by the gravity flow of water or that are purposefully constructed to convey water by gravity flow. Channels can be subterranean for short lengths but are generally surface features. For example, channels can pass under bridges or through culverts, but buried stormdrains, agricultural drains, and water pipes are not channels. Channels may be found in wetlands, and they can contain wetlands, deep water aquatic areas, and non-wetland aquatic areas.

Dominant – Dominance refers to the relative abundance of plant species as explained in the USACE Wetlands Delineation Manual (Environmental Laboratory 1987). The "50/20 rule" of the USACE 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 measure for the stratum, plus any additional species that individually comprise 20% or more of the total dominance measure for the stratum (Corps-ERDC/EL TR-08-28, 2008).

Duration - Duration refers to the length of time that an area is continuously saturated or covered 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.

Ecological Service – Wetland processes and functions can have economic and cultural value as services to society (Zedler 2000). For example, the wetland process of storing flood waters can serve society by reducing flood risks, and the wetland process of recharging aquifers can serve society by helping to maintain water supplies.

Functions – A wetland function is something that a wetland does as a physical or ecological system. For example, wetlands store flood waters, recharge aquifers, protect shorelines from erosion, filter pollutants from water, and support of native biological diversity.

Growing Season – The growing season is the annual period during which hydrophytes can generate new tissue above or below ground. It generally corresponds to the portion of a year when daily minimum soil temperature at 30 centimeters (12 inches) below the soil surface is higher than biologic zero (5° C or 41° F). Much of California experiences a growing season that lasts all year. In colder or mountainous regions of the California, the growing season can be approximated as the period when daily maximum air temperature is above 28° F (-2.2° C).

Hydric conditions – These are conditions of upper substrate that form if saturation, 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 seven consecutive days during the growing season. Although this minimum duration is known to vary with soil temperature, soil pH, and other environmental factors, scientific evidence indicates that in most California environments the chemical transformation to anaerobic conditions in the

upper substrate occurs within seven days. Indicators of hydric conditions pertinent to California are provided in “Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region,” and the “Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0),” published by the U.S. Army Corps of Engineers, April 2008 and September 2008, respectively. This definition should be reviewed in the context of future supplements and other revisions to the USACE wetland delineation manual.

Hydrophytes – Hydrophytes are plants adapted to survive saturated substrate. A list of California hydrophytes is available from USACE (Region 10; Reed 1988), 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 as common in wetland areas as 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.

Landscape – A landscape is 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).

Normal Circumstances – The normal circumstances of an area are its unaltered hydrologic, substrate, and vegetation conditions. Identification of normal circumstances can involve an evaluation of the extent and relative permanence of any altered conditions. Normal circumstances include natural seasonal and inter-annual variations in hydrology, substrate, and vegetation conditions. Natural, purposeful, or inadvertent permanent conversions of conditions can afford new normal circumstances. For example, a river that builds a delta into a lake may alter wetlands along the lakeshore by burying them, but in time new wetlands may develop on areas of the delta that are saturated by the lake; the new lake shore represents new normal circumstances.

Permanent – Field conditions indicating wetland conditions or non-wetland conditions are permanent if they are not expected to change due to normal circumstances anytime in the foreseeable future. With regard to wetland hydrology, “permanent” means that the hydrological regime leading to anaerobic conditions in the upper substrate, or not leading to such conditions, is not expected to change in the foreseeable future. A regime leading to anaerobic conditions in the upper substrate could include recurrent seasonal inundation or saturation. A normal hiatus in such a regime does not indicate a lack of wetland hydrology or a lack of anaerobic substrate conditions in the upper substrate.

Riparian – Riparian areas exist between aquatic and non-aquatic areas and are distinguished by gradients in biophysical conditions, ecological processes, and biota. They are areas through which surface and subsurface hydrology interconnect aquatic areas and connect them with

their adjacent non-aquatic areas. They can include wetland areas, non-wetland aquatic areas, and those portions of non-aquatic areas that significantly influence exchanges of energy and matter with aquatic areas (NRC 2002).

Saturated – A substrate is saturated when 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 (TAT 2009).

Substrate – Substrate is the solid organic or inorganic material that forms the physical surface of a landscape area, including wetlands.

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

Deep Surface Water – For tidal landscapes, deep surface water is any portion of the tidal prism that is below the local Mean Lower Low Water (MLLW) datum. For non-tidal landscapes, deep surface water is either deeper than 2.0 meters during the growing season; or 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, wetland areas on floodplains that are temporarily deeply inundated can retain wetland conditions and subsequently function as wetlands.

Shallow Surface Water – For 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 high tide contour as adjusted for the current tidal epoch. For landscapes that are not tidal, shallow surface water is not deeper than 2.0 meters for most of the growing season, or not as deep as the maximum depth from which rooted vascular vegetation grows to the water surface, whichever is deeper.

Upland (aka non-aquatic area) – Upland areas lack any field-based indicators of aquatic areas.

Upper Substrate – The upper portion of substrate, which includes the root zone for vegetation and the zone within which relevant anaerobic chemical conditions develop in wetlands, extends downward from the substrate surface to a depth of 50 centimeters (20 inches).

Vegetation – Vegetation consists of rooted emergent macrophytes, including monocots, dicots, ferns, and kelp. An area is vegetated if at least 5% of it is covered by vegetation.

Wetland Indicator – A wetland indicator is a measurable characteristic of a wetland parameter. For example, for the hydrology parameter, a wetland is indicated by substrate saturated by groundwater or shallow surface water; for the substrate parameter, an indicator is hydric substrate; for the vegetation parameter, an indicator is dominance by hydrophytes.

Wetland Parameters – A wetland parameter is a category of indicators used to identify and delineate wetland areas. Hydrology, substrate, and vegetation are wetland parameters.

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APPENDIX A. Candidate Wetland Definitions Evaluated by the TAT

International, Foreign National, US, and US State Definitions of Wetlands

Code	Source	Definition Text
A	IUCN (Ramsar) plus Queensland	Wetlands are areas of marsh fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing. Fresh, brackish, or salt including areas of marine water, the depth of which at low tide does not exceed 6 meters.
B	New South Wales	Wetlands are areas that are wet for a long enough period such that the plants and animals living in them are adapted to, and often dependant on, living in wet conditions for at least part of their life cycle.
C	Canada National Wetlands Working Group	Wetland is defined as land having the water table at, near, or above the land surface or which is saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophytic vegetation, and various kinds of biological activity what are adapted to the wet environment.
D	USACE 404 Program	The term "wetlands" means those areas that are inundated or saturated by surface or ground water 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. Wetlands generally include swamps, marshes, bogs, and similar areas.
E	Cowardin et al. (1979) as applied by USFWS NWI	Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.
F	USFWS Circular 39	The term "wetlands" ... refers to lowlands covered with shallow water and sometimes temporary or intermittent water. They are referred to by such names as marshes, swamps, bogs, wet meadows, potholes, sloughs, and river over-flow lands. Shallow lakes and ponds, usually with emergent vegetation as a conspicuous feature, are included in the definition, but the permanent waters of streams, reservoirs, and deep lakes are not included. Neither are water areas that are so temporary as to have little or no effect on the development of moist-soil vegetation.
G	NRCS Food Security Act	Land that (1) has a predominance of hydric soils; (2) is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions; and (3) under normal circumstances does support a prevalence of such vegetation, except that this term does not include lands in Alaska identified as having a high potential for agricultural development and a predominance of permafrost soils.

Code	Source	Definition Text
H	National Research Council 1995	A wetland is an ecosystem that depends on constant or recurrent, shallow inundation or saturation at or near the surface of the substrate. The minimum essential characteristics of a wetland are recurrent, sustained inundation or saturation at or near the surface and the presence of physical, chemical, and biological features reflective of the recurrent, sustained inundation or saturation. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. These features will be present except where specific physicochemical, biotic, or anthropogenic factors have removed them or prevented their development.
I	CA Coastal Commission	Wetland shall be defined as land where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent and drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salts or other substances in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deep-water habitats (Source: 14 CCR 13577(b)). Wetland means lands within the coastal zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, and fens (Source: Cal. Pub. Res. Code § 30121) ²
J	CA Department of Fish and Game	Is the same as alternative definition E (USFWS NWI Program) plus the following: “The Lower limit of a wetland is established at a depth of two meters (6.6 feet) below water; however, if emergents, shrubs, or trees grow beyond this depth at any time, then the deep-water edge of such vegetation is the boundary. Examples of wetland areas include swamps, freshwater marshes, bogs, vernal pools, wet meadows, wet pastures, springs and seeps; portions of lakes, ponds, rivers, and streams; and all other areas which are periodically or permanently covered by shallow water or dominated by hydrophytic vegetation or in which the soils are predominantly hydric in nature. When all three wetland indicators (i.e., hydric soils, wetland vegetation, and hydrology) are present, the presumption of wetland existence shall be conclusive. Where less than three indicators are present, policy application shall be supported by the demonstrable use of wetland areas by wetland associated fish or wildlife resources, related biological activity, and wetland habitat values. (Fish and Game Commission 1994)
K	Keene-Nejedly California Wetlands Preservation Act	“...streams, channels, lakes reservoirs, bays, estuaries, lagoons, marshes, and the lands underlying and adjoining such waters, whether permanently or intermittently submerged to the extent that such waters and lands support and contain significant fish, wildlife, recreational, aesthetic, or scientific purposes.” (Pub. Res. Code §5812)
L	State Water Resources Control Board 401 program	The term “wetlands” means those areas that are inundated or saturated by surface or ground water 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. Wetlands generally include swamps, marshes, bogs, and similar areas.

² Of the two definitions provided by the California Coastal Commission, the TAT chose to analyze the more complex one taken from CCR 13577(b).

Code	Source	Definition Text
M	ND	“Wetland” includes any natural depression that is capable of holding shallow, temporary, intermittent or permanent water.
N	DE	Lands subject to tidal action which are above the mean low water elevation and at or below an elevation of 2 feet above the local mean high water which are capable of growing certain listed species including any bank, marsh, swamp, meadow, flat or other low land. Also included are nontidal wetlands consisting of 400 acres or more of contiguous swamp, bog or marsh (exclusive of narrow stream valleys and lands currently used for agricultural purposes) where freshwater stands most, if not all of the time, which contribute significantly to groundwater recharge and which would require extensive artificial drainage.
O	NY	Regulates lands and waters shown on freshwater wetland maps supporting hydrophytic vegetation, and that rely on hydrology or hydric soils to be competitive, and that are over 12.4 acres in size. Smaller areas of unusual local importance may be included
P	CT	Wetlands means <i>lands</i> that are defined by certain soil types according to the soil classification system developed by the USDA Natural Resources Conservation Service
Q	VT	Wetlands shall mean those areas of the state that are inundated by surface or ground water with a frequency sufficient to support significant vegetation or aquatic life that depend on saturated or seasonally saturated soil conditions for growth and reproduction. Such areas include but are not limited to marshes, swamps, sloughs, potholes, fens, river and lake overflows, mudflats, bogs, and ponds, but excluding such areas as grow food or crops in connection with farming activities.
R	WA	404 minus the following: Wetlands do not include those artificial wetlands intentionally created from nonwetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from nonwetland areas to mitigate the conversion of wetlands.
S	MA	Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil for at least part of the growing season. The occurrence and flow of water (hydrology) largely determine how the soil develops and the types of plant and animal communities living in and on the soil. Wetlands may support both aquatic and terrestrial species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants (hydrophytes) and promote the development of characteristic wetland (hydric) soils. Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors, including human disturbance.

The Following US States have adopted the USACE 404 definition verbatim or with special recognition of selected wetland types. These definitions do not need to be considered separately from the USACE 404 definition.	
FL	Specific to FL (unique landscape not applicable to CA)
MD	404 plus tidal
NC	404 plus tidal
AL	404 plus deeper (to 3m)
CO	404 plus special wetlands
TX	404 plus special wetlands
NE	404
OR	404
MI	404
TN	404
KY	404.
IN	404
MI	404
KS	404
OH	404
VI	404
PA	404
NH	404

Sources

- Tiner, R.W. 1999. Wetland indicators: A guide to wetland identification, delineation, classification, and mapping. CRC Press, ISBN 0873718925, 9780873718929. 424 pp.
- Mitch, JM and JG Gosselink. 1993 .Wetlands 2nd edition. Van Nostrand Reinhold, New York. ISBN 0 442 00805 8. 722 pp.
- ASWM State Wetland Programs <http://www.aswm.org/swp/statemainpage9.htm>.
- Regional Water Boards 1&2 Draft Water Quality Plan Amendments, June 2008.
- Google Search Engine (about 6 hours of web search using key words “wetland definition”).

APPENDIX B. Summary of Candidate Wetland Definition Evaluations

Criteria for Selecting or Developing a California Wetland Definition

1. Defines unique features of landscapes that are neither terrestrial nor aquatic in terms of physical attributes, chemistry, ecology, and social values.
2. Encompasses the full range of all conditions of all wetlands of all types commonly recognized in California by regional, state, and national communities of wetland managers and scientists.
3. Can be translated into a standard approach to mapping and field-based delineation of wetland boundaries without unnecessarily limiting the scope or breadth of the maps or delineations.
4. Is the same as, or very similar to, an existing definition that has been proven appropriate through broad application by US States or federal agencies.
5. Refers to natural processes that account for the particular characteristics, functions, beneficial uses, or ecological services of wetlands.

Code	Source	Decision	Criteria					Definition Text	Comments
			1	2	3	4	5		
A	IUCN (Ramsar) plus Queensland	Reject	-	-	-	-	-	Wetlands are ... areas of marsh fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing. Fresh, brackish, or salt including areas of marine water, the depth of which at low tide does not exceed 6 meters.	
B	New South Wales	Study Details	+	-	-	-	+	Wetlands are areas that are wet for a long enough period such that the plants and animals living in them are adapted to, and often dependant on, living in wet conditions for at least part of their life cycle.	Requires wetland vegetation and therefore excludes some common habitat types with wetland functions.
C	Canada National Wetlands Working Group	Study Details	+	-	-	+	+	Wetland is defined as land having the water table at, near, or above the land surface or which is saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophytic vegetation, and various kinds of biological activity what are adapted to the wet environment.	Requires all three parameters and thus excludes some common habitat types with wetland functions.
D	USACE 404 Program	Study Details	+	-	-	+	+	The term "wetlands" means those areas that are inundated or saturated by surface or ground water 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. Wetlands generally include swamps, marshes, bogs, and similar areas.	Usually requires all three parameters including hydrophytic vegetation and therefore does not provide an adequate basis for identifying non-vegetated areas of California that function as wetlands, such as mudflats, sandflats, etc. (Lewis 1995; Wakeley 2002); Relies on regional supplements to address particular conditions of wetlands in the West; Many areas of California providing wetland functions are regarded as "problem" areas due the difficulty in applying the definition to them; Does not adequately address temporal variability in wetland conditions resulting from the significant seasonal and inter-annual variability in climate typical of California.

Code	Source	Decision	Criteria					Definition Text	Comments
			1	2	3	4	5		
E	Cowardin et al. (1979) as applied by USFWS NWI	Study Details	+	-	-	+	+	Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.	Makes useful references to combinations of three parameters but does not indicate or suggest the required duration of saturation or inundation to form wetland conditions; Can include areas of wetted artificial substrate. A weakness of the USFWS's definition is that there is not an accompanying delineation manual; Because the USFWS developed its definition to be used as a national inventory and mapping protocol for the NWI and not for specific regulatory determination of individual wetlands, the level of accompanying interpretation is limited; The USFWS's wetland definition and classification system (i.e., Cowardin and others 1979) discusses indicators of wetland boundaries and variability in regional wetlands; however, this information is intended to be sufficient for estimating wetland boundaries using remotely sensed data (i.e., aerial photography) and does not provide a clear method of determining exact wetland boundaries in the field as necessary for regulatory purposes; An inherent weakness of the one-of-three indicator test is that there is a lack of checks on individual indicators when any one indicator may be used alone to classify an area as a wetland; For example, as noted in the <i>National List of Plant Species that Occur in Wetlands</i> (USFWS 1997), a number of plant species can grow in either wetland or non-wetland conditions; The specific hydrophytic status of such species depends on factors such as the geographic location and individual site conditions; Relying on the presence of these species alone to make a wetland determination may in some cases lead to the classification of non-wetland areas as wetlands.
F	USFWS Circular 39	Study Details	-	+	-	+	+	The term "wetlands" ... refers to lowlands covered with shallow water and sometimes temporary or intermittent water. They are referred to by such names as marshes, swamps, bogs, wet meadows, potholes, sloughs, and river over-flow lands. Shallow lakes and ponds, usually with emergent vegetation as a conspicuous feature, are included in the definition, but the permanent waters of streams, reservoirs, and deep lakes are not included. Neither are water areas that are so temporary as to have little or no effect on the development of moist-soil vegetation.	Does not indicate or suggest the required duration of saturation or inundation to form wetland conditions; Language is too general to know for sure what landscape areas are included.

Code	Source	Decision	Criteria					Definition Text	Comments
			1	2	3	4	5		
G	NRCS Food Security Act	Study Details	+	+	-	+	+	Land that (1) has a predominance of hydric soils; (2) is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions; and (3) under normal circumstances does support a prevalence of such vegetation, except that this term does not include lands in Alaska identified as having a high potential for agricultural development and a predominance of permafrost soils.	Usually requires all three parameters and thus excludes some common areas having wetland functions; Agricultural wetlands that were drained or otherwise impacted before December 23, 1985 are subject to a lesser degree of regulation by the NRCS and may be maintained in agricultural use; Agricultural wetlands can perform the same ecological functions as other wetlands and the TAT agrees with the findings by the National Research Council that there is no scientific or technical justification for regulating them under a different standard than is applied to other wetlands (Lewis 1995).
H	National Research Council 1995	Study Details	+	+	-	+	+	A wetland is an ecosystem that depends on constant or recurrent, shallow inundation or saturation at or near the surface of the substrate. The minimum essential characteristics of a wetland are recurrent, sustained inundation or saturation at or near the surface and the presence of physical, chemical, and biological features reflective of the recurrent, sustained inundation or saturation. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. These features will be present except where specific physicochemical, biotic, or anthropogenic factors have removed them or prevented their development.	Does not indicate or suggest the required duration of saturation or inundation to form wetland conditions; Recognizes that hydrophytic vegetation and hydric soils may be absent due to disturbance, but usually requires all three parameters and thus excludes some common areas of California that provide wetland functions.

Code	Source	Decision	Criteria					Definition Text	Comments
			1	2	3	4	5		
I	CA Coastal Commission	Study Details	+	-	-	+	+	Wetland shall be defined as land where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent and drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salts or other substances in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deep-water habitats. (Source: 14 CCR 13577(b))	Water table cannot be above the land surface; Can include non-vegetated areas but does not necessarily exclude areas of wetted unnatural substrates; Does not exclude deep-water areas; Can be interpreted as requiring a single parameter (hydrology) and therefore might be too inclusive; It is possible that some upland areas may be identified as wetlands due to relic indicators of previous wetland characteristics that no longer reflect current hydrologic conditions; This is because indicators of wetland characteristics, particularly indicators of hydric soil, can remain at a site even after hydrologic conditions have changed, either due to natural or anthropogenic causes (Lewis 1995); Is tailored for use in the coastal zone and thus does not recognize the full range of conditions and types of wetlands in California; For example, it identifies wetlands where the “soil is poorly developed or absent as a result of frequent and drastic fluctuations of surface water levels, <i>wave action</i> , water flow, turbidity or <i>high concentrations of salts</i> or other substances in the substrate (14 CCR 13577(b); emphasis added).”
J	CA Department of Fish and Game	Study Details	+	+	-	+	+	The Lower limit of a wetland is established at a depth of two meters (6.6 feet) below water; however, if emergents, shrubs, or trees grow beyond this depth at any time, then the deepwater edge of such vegetation is the boundary. Examples of wetland areas include swamps, freshwater marshes, bogs, vernal pools, wet meadows, wet pastures, springs and seeps; portions of lakes, ponds, rivers, and streams; and all other areas which are periodically or permanently covered by shallow water or dominated by hydrophytic vegetation or in which the soils are predominantly hydric in nature. When all three wetland indicators (i.e., hydric soils, wetland vegetation, and hydrology) are present, the presumption of wetland existence shall be conclusive. Where less than three indicators are present, policy application shall be supported by the demonstrable use of wetland areas by wetland associated fish or wildlife resources, related biological activity, and wetland habitat values	Provides useful concepts about water depth but does not indicate or suggest the required duration of saturation or inundation to form wetland conditions; Might be interpreted to include non-vegetated areas but this depends on knowing wetland functions that cannot be easily mapped (does not translate into standard mapping methods), and might therefore exclude some common habitat types with wetland functions; Does not reflect irregular temporal variability but perhaps recognizes different periodicities; Requires that, where wetlands do not meet the three-of-three test, wetland identification must be supported by the “demonstrable use of wetland areas by wetland associated fish or wildlife resources, related biological activity, and wetland habitat values” (Fish and Game Commission 1994). This approach is in-line with the TAT recommendation to identify wetlands based on their known or presumed functions, but requiring functional assessments is not generally practicable; Without clear guidance on assessing biological functions of wetlands, wetland identification in the field would be difficult to apply.

Code	Source	Decision	Criteria					Definition Text	Comments
			1	2	3	4	5		
K	Keene-Nejedly California Wetlands Preservation Act	Reject	+	-	-	-	-	“...streams, channels, lakes reservoirs, bays, estuaries, lagoons, marshes, and the lands underlying and adjoining such waters, whether permanently or intermittently submerged to the extent that such waters and lands support and contain significant fish, wildlife, recreational, aesthetic, or scientific purposes.” (Pub. Res. Code §5812)	
L	State Water Resources Control Board 401 program	Study Details	+	+	-	+	+	The term “wetlands” means those areas that are inundated or saturated by surface or ground water 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. Wetlands generally include swamps, marshes, bogs, and similar areas.	Is essentially the same as US ACE 404 Program Definition (see entry for code D).
M	ND	Reject	-	-	-	-	-	“Wetland” includes any natural depression that is capable of holding shallow, temporary, intermittent or permanent water.	
N	DE	Reject	+	-	-	-	-	Lands subject to tidal action which are above the mean low water elevation and at or below an elevation of 2 feet above the local mean high water which are capable of growing certain listed species including any bank, marsh, swamp, meadow, flat or other low land. Also included are nontidal wetlands consisting of 400 acres or more of contiguous swamp, bog or marsh (exclusive of narrow stream valleys and lands currently used for agricultural purposes) where freshwater stands most, if not all of the time, which contribute significantly to groundwater recharge and which would require extensive artificial drainage.	
O	NY	Reject	-	-	+	-	-	Regulates lands and waters shown on freshwater wetland maps supporting hydrophytic vegetation, and that rely on hydrology or hydric soils to be competitive, and that are over 12.4 acres in size. Smaller areas of unusual local importance may be included.	
P	CT	Reject	-	-	+	-	-	Wetlands means <i>lands</i> that are defined by certain soil types according to the soil classification system developed by the USDA Natural Resources Conservation Service	
Q	VT	Reject	-	-	-	-	+	Wetlands shall mean those areas of the state that are inundated by surface or ground water with a frequency sufficient to support significant vegetation or aquatic life that depend on saturated or seasonally saturated soil conditions for growth and reproduction. Such areas include but are not limited to marshes, swamps, sloughs, potholes, fens, river and lake overflows, mudflats, bogs, and ponds, but excluding such areas as grow food or crops in connection with farming activities.	

Code	Source	Decision	Criteria					Definition Text	Comments
			1	2	3	4	5		
R	WA	Study Details	+	+	-	+	+	404 minus the following: Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from non-wetland areas to mitigate the conversion of wetlands.	Similar to US ACE 404 Program definition (see entry for code D); Usually requires all three parameters and otherwise clearly excludes some common habitat types and landscape features that have wetland functions; the term "wetlands do not include ... wetlands," is misleading.
S	MA	Study Details	+	+	-	-	+	Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil for at least part of the growing season. The occurrence and flow of water (hydrology) largely determine how the soil develops and the types of plant and animal communities living in and on the soil. Wetlands may support both aquatic and terrestrial species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants (hydrophytes) and promote the development of characteristic wetland (hydric) soils. Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors, including human disturbance.	Does not indicate or suggest the required duration of saturation or inundation to form wetland conditions; Largely descriptive of wetland processes without stating what conditions of the processes indicate wetland; Limits of depth not specified so deepwater aquatic areas are not excluded; well written for lay reader.