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December 5, 2005

Via U.S. mail and e-mail (1987Manual@usace.army.mil)
Katherine Trott
CECW-LRD
U.S. Army Corps of Engineers
441 G St., NW
Washington, D.C. 20314-1000

Re: Comments on Draft "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region"

Dear Ms. Trott:

On behalf of the Home Builders Association of Central Arizona ("HBACA"), we hereby submit comments on the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (hereinafter referred to as the "Arid West Supplement" or simply the "Supplement").

Use of Arid West Supplement: As an initial matter, it is not clear the how the Arid West Supplement will be used once finalized. On page 1, it is stated that the Supplement is designed for use with the Corps' 1987 wetlands delineation manual ("Manual"), that the Supplement will supersede the Manual where there is conflict, and that the Supplement can be used (*inter alia*) in "regulatory programs." However, the same paragraph goes on to state that the Supplement is "not [intended] to change wetland boundaries," and that the determination of whether a wetland is subject to regulatory jurisdiction under the Section 404 program "must be made independently of the procedures described in this supplement."

From the standpoint of HBACA and others in the regulated community, the delineation of wetlands for purposes of the Section 404 program is of paramount importance. Based on the language quoted above, it is not clear how the Corps will in fact use the Supplement once it is finalized. Our reading of the language is that the procedures outlined in the Supplement will not be used in Section 404 delineations. The Corps should state more clearly in the final Supplement how it will (and will not) be used, and should explicitly state that the 1987 Manual

will still serve as the mechanism to delineate wetlands for purposes of the Section 404 program.

Man-created wetlands: In the areas in which HBACA members operate (central Arizona), it is not uncommon to find small, isolated areas where human activity has created temporary pockets of what resemble wetlands. A common example is moist areas resulting from irrigation tail water in irrigated fields. In the vast majority of cases, the area in question is clearly artificial and temporary in nature, and it is very easy to distinguish the artificial area from the surrounding natural areas, which typically do not exhibit any characteristics whatsoever of wetlands.

In the 1987 Manual, the Corps addresses this issue directly and excludes the man-induced areas. In Part IV, Section F, Subsection 4 (p. 83) of the Manual, the Corps includes the following statement: "If hydrophytic vegetation is being maintained only because of man-induced wetland hydrology that would no longer exist if the activity (e.g., irrigation) were to be terminated, the area should not be considered a wetland."

By contrast, the Supplement does not address this issue directly. The closest it comes to doing so is on the top of page 88, in the second paragraph of the section entitled *Soils with Relict or Induced Hydric Soil Indicators*. That paragraph notes that experienced soil scientists can distinguish naturally occurring hydric soil features from those induced by irrigation, but does not explain what impact, if any, this distinction has. Other more general portions of the Supplement (e.g., the discussion on pages 5-7, in the sections entitled *Types and Distributions of Wetlands* and *Irrigated Wetlands*) can certainly be read to suggest that man-induced wetlands should be treated the same as natural wetlands, even if the man-induced wetlands are wholly dependent on artificial sources of water.

As noted above, the Supplement states that it "supersedes" the Manual in cases of conflict. It is certainly possible to construe the absence in the Supplement of the exclusion contained in the 1987 Manual as creating a conflict with the Manual with respect to man-induced wetlands, one in which the Supplement would be controlling. The net result of this could be to significantly expand the reach of wetlands delineations to include heretofore unregulated man-induced features. If this practice were to extend to the Section 404 program, it could have significant impacts on the regulated community, including HBACA members who develop former farmland in central Arizona.

The exception for man-induced wetlands in the 1987 Manual should be included in the Supplement. As an alternative, the Supplement should refer to the exception in the 1987 Manual and make clear that nothing in the Supplement is intended to eliminate it. The types of areas covered by the exception would not continue to exist in the absence of the artificially provided water, and they should not be regulated as wetlands under the Clean Water Act, especially the Section 404 permitting program.

Thank you for the opportunity to comment on the draft Supplement. Feel free to contact me if you have any questions regarding these comments.

Sincerely yours,

WITHEY ANDERSON & MORRIS, P.L.C.

Robert D. Anderson

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December 5, 2005

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VIA FEDEX AND E-MAIL

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Re: Comments on the Draft Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region

Dear Ms. Trott:

This firm represents the California Building Industry Association ("CBIA") and a coalition of homebuilders ("Homebuilders"), including AKT Development, Brookfield Homes, Lennar Communities, and Pulte Home Corporation. CBIA and the Homebuilders have engaged three leading firms for wetlands delineations in California—Gibson & Skordal LLC, Glenn Lukos Associates, and WRA, Inc.—to review the draft *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* ("Regional Supplement"). We compliment the Corps for undertaking this task. It is clear that much hard work was put into the Regional Supplement. Nevertheless, our team found serious flaws in the document, which we believe misses the mark for a regional supplement. Contrary to its title, the Regional Supplement is neither regional nor a supplement. Instead, like the abandoned *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* ("1989 Manual"), it is a stand-alone delineation manual with revised criteria and indicators that do not address regional issues. The changes to the Corps' 1987 *Wetlands Delineation Manual* ("1987 Manual") are not based in science and have not been subject to adequate notice and comment. This is particularly troubling because use of the revised criteria will alter wetland boundaries, notwithstanding the Regional Supplement's stated intent. We found more than 30 instances in the document that could result in an expansion of wetland jurisdiction. Arguably, all of these changes are not regionally specific and could be equally applicable to the entire country. Our concerns are described in more detail in the enclosed report, "Comments on the Draft Arid West Regional Supplement to the 1987 Wetland Delineation Manual."

These issues warrant the immediate withdrawal and complete revision of the Regional Supplement. We believe the existing 1987 Manual works well in most cases, both in the "arid west" region and in other parts of the country. Rather than producing a stand-alone replacement manual, the Corps should integrate the changes needed to address specific regional conditions into the 1987 Manual as a separate section or as annotations, similar to the online edition of the 1987 Manual. These changes should be subject to full notice and comment rulemaking under the Administrative Procedure Act, consistent with congressional directive in response to the 1989 Manual, and the Corps should provide adequate time for field testing and review of the scientific evidence in the record.

We thank the Corps for the opportunity to comment on the Regional Supplement, but believe its procedural and substantive deficiencies must be addressed as described in the enclosed report. Please do not hesitate to contact me if you have any questions about these comments.

Very truly yours,

Robert J. Uram/sel

Robert J. Uram

for SHEPPARD MULLIN RICHTER & HAMPTON LLP

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cc: Mark Sudol, D. Env.
Tony Bomkamp, GLA
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COMMENTS ON THE DRAFT ARID WEST REGIONAL SUPPLEMENT TO THE 1987 WETLAND DELINEATION MANUAL

Prepared for:

California Building Industry Association
and
AKT Development
Brookfield Homes
Lennar Communities
Pulte Home Corporation

December 5, 2005

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This report presents the comments of the California Building Industry Association ("CBIA") and a coalition of homebuilders, including AKT Development, Brookfield Homes, Lennar Communities, and Pulte Home Corporation, on the draft *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* ("Regional Supplement"). It is organized in two sections. The first section provides an overview of the significant flaws identified in the Regional Supplement and a list of actions we believe need to be undertaken to remedy the problems. The second section includes a table with detailed comments on the Regional Supplement.

The Regional Supplement is a stand-alone delineation manual with revised criteria and indicators that do not address regional issues. The changes it proposes to the Corps' 1987 *Wetlands Delineation Manual* have not been supported by scientific data or subject to adequate notice and comment. Contrary to the Regional Supplement's stated intent, use of the Regional Supplement's criteria and indicators will expand wetland boundaries. This report identified more than 30 examples of instances in the Regional Supplement that could result in an increase in wetland jurisdiction.

The Corps should immediately withdraw and completely revise the Regional Supplement. Rather than producing a stand-alone replacement manual, the Corps should integrate the changes needed to address specific regional conditions into the existing 1987 *Wetlands Delineation Manual* as a separate section or as annotations, similar to the online edition. Changes to existing standards and methodology should be grounded in generally accepted scientific principles and field verified. The revised Regional Supplement should be promulgated in compliance with the Administrative Procedure Act, and the Corps should provide adequate time for field testing and review of the full administrative record.

OVERVIEW OF SIGNIFICANT FLAWS

1. The Regional Supplement Is Neither Regional Nor A Supplement.

In 1995, the National Academy of Sciences recommended that wetland delineation methods be adjusted to account for regional differences. *See* National Research Council, Wetlands: Characteristics and Boundaries (1995). The Corps purports to have followed this recommendation in developing the Regional Supplement. In the Introduction, it observes that "[r]egional differences in climate, geology, soils, hydrology, plant and animal communities, and other factors . . . cannot be considered adequately in a single national manual." Regional Supplement, at 1. The Regional Supplement was intended to address these issues by focusing on "regional wetland characteristics" and presenting "wetlands indicators, delineation guidance, and other information that is specific to the Arid West Region." *Id.*

However, very little of the Regional Supplement addresses regional wetland characteristics that are specific to the arid west. The only information tailored to the region appears in the first chapter, which contains a very brief description of the arid west region, its three subregions, and a few of the types of wetlands that may be present therein. This discussion is very general and provides no information that helps delineate wetlands. The Regional Supplement misses opportunities to offer helpful guidance on regional issues. For instance, the Corps' 1987 *Wetlands Delineation Manual* ("1987 Manual") provides limited information on problematic hydric soils such as mollisols. Given the prevalence of mollisols in the arid west, the Regional Supplement could have provided more discussion on these problem soils and the relevant indicators. It does not. Instead, it repeatedly offers general guidance that could be applied with equal validity in or outside the arid west region. For example, Chapter 3 has an extended discussion of soil sampling. Nothing in this section addresses regional issues or explains why these sampling techniques are required for the region's wetlands. In fact, as described more completely in the table of detailed comments, the Regional Supplement does not place any of the new or revised indicators within the context of the region's wetlands, and few, if any, of the new indicators and methods to identify indicators appear to address wetland characteristics that are specific to the region.

The Corps also labels the document a "supplement." It states that the Regional Supplement is "designed for use with the current version of the [1987 Manual] and all subsequent versions." *Id.* However, given the structure of the Regional Supplement, it is not clear how the two can be used together effectively. The Regional Supplement is comprehensive and contains information that, in many cases, is redundant or only slightly different from the 1987 Manual. In other areas, there are substantial changes and alterations to definitions, criteria, and indicators. Where there are such differences, the Corps clearly states that the Regional Supplement "supersedes" the 1987 Manual. *Id.* However, the areas in which the Regional Supplement supersedes the 1987 Manual are not expressly identified. The lack of integration of the Regional Supplement with the 1987 Manual will create confusion for the public in trying to understand what elements are to be used from each of the manuals and will further complicate the basis on which disputed delineations are decided during the Corps appeal process. At a minimum, the Corps should provide a table that compares the definitions, criteria, and indicators

used in the 1987 Manual and subsequent clarifications (i.e., Williams 1992 and Studt 1991), on the one hand, and the Regional Supplement, on the other hand, to provide the public with a better understanding of the changes being made in the Regional Supplement.

Although labeled a supplement, the Regional Supplement is, in its current form, a stand-alone delineation manual. The standard should be that the Regional Supplement and any other regional manual supplement the 1987 Manual and subsequent clarifications to the 1987 Manual. The Regional Supplement should focus on wetland types that are unique to the arid west and provide guidance for delineating these areas. Because the Regional Supplement fails to do either, we urge that it be withdrawn, and in its place the Corps should provide an additional section to the 1987 Manual or a series of integrated annotations under relevant criteria similar to the online version of the 1987 Manual. This would reduce the ambiguity of the relationship between the Regional Supplement and the 1987 Manual and ensure that the Regional Supplement truly supplements the 1987 Manual with region-specific information.

2. The Regional Supplement Expands Wetland Boundaries.

The Corps states that the intent of the Regional Supplement is "not to change wetland boundaries." *Id.* However, many of the new and revised indicators and criteria will clearly result in changes to wetland boundaries, and these changes almost always will increase the size of delineated wetlands. For example, the Regional Supplement changes the hydrology standard by significantly reducing the period of time for continuous saturation or inundation in areas with a 365-day growing season from 18 days in the 1987 Manual to 14 days. Regional Supplement, at 9, 85 & 87. The use of the 14-day saturation/inundation period in these areas will certainly result in an expansion of wetlands jurisdiction in comparison to the 1987 Manual.

Another example of the likely expansion results from the lack of cautionary language in the Regional Supplement on the use of FAC dominated wetlands. Under the 1987 Manual, the three-parameter wetland test was a sliding scale based on the relative reliability of various indicators. If one parameter was less reliable or ambiguous, such FAC-dominated plant communities for hydrophytic vegetation, more reliable indicators of hydric soil and wetland hydrology were required. These cautions and guidance have been largely omitted from the Regional Supplement. Without this cautionary language, FAC-dominated areas are more likely to be delineated as wetlands under the Regional Supplement particularly since the minimum hydrology criterion is proposed to be only 14 days. Indeed, under the Regional Supplement, an area with a little as 5 percent vegetation cover could be considered a wetland, an apparent policy change that would result in additional areas being designated as wetlands rather than as "other waters." Because such barren areas would now be defined as "special aquatic sites" under the proposed supplement, this would also lead to an increase in Corps work load since many Nationwide Permit conditions are more restrictive when dealing with wetlands compared to "other waters". The Regional Supplement also proposes that areas that fail the hydrophytic vegetation test may nevertheless be wetlands. However, it does not address places that may have hydrophytic vegetation, such as FAC-dominated communities, that are non-wetlands. Because the purpose of a delineation manual is to delineate wetlands, it is understandable to concentrate on indicators that can be used to identify wetlands. In many cases, it would be equally helpful to

have indicators or other diagnostic tools that identify non-wetland uplands. The Regional Supplement provides virtually none.

A number of the 1987 Manual's secondary indicators (for which 2 are required) have been shifted to primary indicators (for which only 1 is required) in the Regional Supplement. This shift will result in areas being delineated as wetlands that previously would not have been under the 1987 Manual. The Regional Supplement occasionally uses the same indicator for different parameters. For example, the presence of reduced iron is used in the Regional Supplement as an indicator for both hydric soils and hydrology. *See* Regional Supplement, at 85. This effectively collapses the three-parameter test into a two-parameter test. Given that hydrophytic vegetation is assumed in certain circumstances, as noted above, some areas may be delineated as wetlands solely on the presence of hydric soils. Similar provisions were present in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* ("1989 Manual"), which used a wetland hydrology indicator for different soil types that coincided with the hydric soil criteria (1989 Manual, at 6) and assumed hydrophytic vegetation criteria was met even if the indicators for hydrophytic vegetation was not satisfied if the hydrology and hydric soils criteria had been satisfied (1989 Manual, at 5), and these issues contributed to the controversy that halted the Corps' implementation of the 1989 Manual.

In total, we found more than 30 instances where changes in indicators or methodology in the Regional Supplement will result in an expansion of wetland jurisdiction. As explained in the table of detailed comments, these include changes in the following indicators: growing season, the +/- indicators for FAC plant communities, a stepwise procedure for identifying wetland vegetation, the 50/20 rule, the prevalence index, morphological adaptations of upland plant communities, surface water, high water table, saturation, surface cracking, aerial imagery, water stained leaves, biotic crust, drift deposits, and oxidized rhizospheres. If the Regional Supplement truly is not intended to alter wetland boundaries, these issues must be addressed.

3. The New or Revised Criteria Do Not Appear To Be Scientifically Based.

The Corps states that its "intent is to bring the manual up to date with current knowledge and practice in the region." Regional Supplement, at 1. However, a number of new indicators are proposed with no scientific evidence to support their use. For example, Table 4-1 in the Regional Supplement introduces several new indicators for wetland hydrology. The Corps has not identified the scientific references or quantitative analyses to substantiate why these indicators have been selected. Presumably, the new indicators have been added to address particular situations, but these have not been documented for the public to review. In order for the public to understand that these new indicators are reliable, the indicators should be scientifically tested to determine that they are indicative of wetland hydrology (both frequency and duration). A number of new indicators, including use of aerial imagery and a new approach to including non-hydrophytic plant communities as wetlands, have not been previously tested.

Similarly, the Regional Supplement proposes new indicators for hydric soils directly derived from the NRCS's "Field Indicators of Hydric Soils in the United States". The

Corps' current policy precludes using these indicators other than as collaborative information. Including them as "stand alone" indicators will change the current policy of using them only collaboratively with other indicators. "Developing a Regionalized Version of the Corps of Engineers Wetland Delineation Manual: Issues and Recommendations" cites numerous issues relative to including these indicators within regional manuals. The Corps has not explained why these indicators are being used. Absent a sound scientific basis for including these indicators, they must be evaluated in a broad range of sites in order to determine validity and whether their addition to the Regional Supplement is, in fact, neutral.

The lack of scientific basis for the new and revised indicators is particularly troubling given the potential expansion of wetlands jurisdiction that could result from the use of the Regional Supplement. The Corps should provide the scientific basis, including citations to published literature and technical reports, for any new or revised indicator or methodology in the Regional Supplement. Without this, the public has no ability to evaluate scientific basis for the proposed changes. No revisions to indicators should be made or new indicators introduced unless and until they have been tested and verified as reliable in a transparent, peer-reviewed process.

4. The Regional Supplement Has Not Been Subject To An Adequate Public Outreach Program.

We believe that the changes in the Regional Supplement will significantly expand the extent and nature of areas delineated as wetlands. Any expansion of areas identified as wetlands has enormous economic implications for the regulated community and should be undertaken through a transparent process and with a thorough public outreach program. That has not happened here. In fact, what little public outreach that has been done is misleading. The public notices and their introductions suggest that the Regional Supplement is merely a technical clarification that does not represent a change in policy and will not result in a change in wetland boundaries. We believe this clearly is not the case.

The Corps announced the availability of the draft Regional Supplement through a public notice and posting on its district offices' websites on September 2, 2005, with a 60-day comment period that was subsequently extended to conclude December 5, 2005. No notice in the Federal Register was published, and no public meetings have been held. Other than the one-page public notices available on the Corps' websites, no meaningful discussion of the Regional Supplement has been provided by the Corps. The draft Regional Supplement is being peer reviewed by a "panel of independent scientists" concurrently with the public comment period; the panel's report was not provided for public review, although according to the Corps, it will be available upon request. Recently, the Corps HQ office has indicated that it will not be available before the close of the public comment period. Without this report, it is not possible for the public to assess the issues raised in the technical peer review.

The Corps did not release results of its field testing or, as noted above, provide the scientific basis for most of the changes to wetland criteria and indicators. Because it appears that the Regional Supplement's new indicators could expand wetland boundaries, the results of the

Corps' field testing should be made available for public review. The comment period does not provide adequate time for the public to conduct its own field testing, the results of which are among the information solicited by the Corps in its public notice. More importantly, it is not held at an appropriate time of year to measure wetland hydrology and to determine whether or not the new hydrology standard is, in fact, neutral in its effect on the extent of jurisdictional wetlands.

Absent a change in plan, none of these issues will be addressed prior to the implementation of the Regional Supplement. According to the public notices, the Corps intends simply to issue "[a]nother public notice . . . announcing the publication of the final supplement and the implementation date of that supplement."

The Corps' failure to conduct an adequate public outreach program is troubling given the Congressional reaction to the Corps' attempt to implement the 1989 Manual. In adopting the 1992 Energy and Water Development Appropriations Act, Congress limited the Corps' use of funding to adopt or implement the 1989 Manual or "any subsequent manual not adopted in accordance with the requirements for notice and public comment of the rule-making process of the Administrative Procedure Act." The source of the funding being used to develop, adopt, and implement the Regional Supplement is not clear, but Congressional desire for the rule-making process to be open, fair, and transparent—notwithstanding the Corps' belief that the delineation manuals present technical, not policy issues—is clear. As noted earlier, the changes proposed in the draft Regional Supplement are not regionally specific and appear to be an effort to revise the 1987 Manual while avoiding the rule-making procedures required by the Administrative Procedure Act. This is particularly true with the adoption of a new hydrology standard that is referenced by the draft Regional Supplement and published in a technical report by the Corps of Engineers (ERDC TN-WRAPP-05-2, June 2005) that completely changes the hydrology criteria as used in the 1987 Manual. No discussion of scientific basis for this change is provided in the draft Regional Manual and it is not even addressed until the very last page of the draft. The process that the Corps is using to adopt the Regional Supplement is even more troubling given the apparent similarity of the changes to the 1987 Manual that would result from implementation of the Regional Supplement and of the 1989 Manual. Because of the substantive nature of the changes being made and the Congressional directive on adoption of a new delineation manual, the Corps must follow the Administrative Procedure Act to adopt the Regional Supplement.

5. The Corps Should Withdraw The Regional Supplement And Prepare A Revised Supplement That Is Truly Regional And Subject To APA Rulemaking.

These flaws and those outlined in the table of detailed comments are fundamental and warrant the immediate withdrawal of the Regional Supplement. The Corps should publish a Notice of Rulemaking in the Federal Register regarding its intent to prepare a revised Regional Supplement and, in so doing, revise the 1987 Manual. In the revised Regional Supplement, it should address the technical errors and prepare a revised Regional Supplement that is both regional and supplemental to the existing 1987 Manual. The revised Regional Supplement should focus on wetland characteristics that are specific to the arid west region and should be

integrated directly into the 1987 Manual, just as the Corps has updated the 1987 Manual in its online edition. Any change to criteria or indicators should be based on sound scientific principles that are generally accepted in the scientific community and are published in peer-reviewed journals or in validated technical reports. These revisions need to be field tested against all of the sites used to test the 1987 Manual, and it should be peer reviewed. The revised Regional Supplement should be revised, if needed, to address issues raised by the field testing and the peer reviews. The Corps should then release a draft of the revised Regional Supplement by publishing a notice in the Federal Register, and the results of the field testing and report of the peer reviewers should be available for public review. It should hold multiple public hearings to present the changes to the regulated public and to solicit feedback. The Corps should provide adequate time, including at least a full wet season, to evaluate the regional criteria and indicators. The Corps should release the final revised Regional Supplement only after publishing another Federal Register notice responding to public comments on the draft and explaining how those comments were addressed in the final.

DETAILED COMMENTS ON THE REGIONAL SUPPLEMENT

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
1	1	Use of Manual	Document states that it supersedes the 1987 Manual and therefore becomes the *defacto* new manual. Substantial changes in the supplement change indicators; alter the definitions and criteria contained in the 1987 Manual. This will result in substantial confusion to the regulated public and the consulting industry. The standard should be that any Regional Supplement *supplements* the 1987 Manual and subsequent clarifications to the 1987 Manual. For instance, the 1987 Manual contains many cautions on the use of FAC dominated wetlands; but these are not contained in proposed Regional Supplement and in fact, tend to expand on areas dominated by the FAC manual. The Regional Supplements should focus on those wetland types and indicators that are unique to the Arid West and provide guidance to delineating these areas with appropriately validated indicators. We suggest that the Regional Supplement be provided as an additional section to the 1987 Manual. The lack of integration of the 1987 Manual with the Regional Supplement makes it confusing for the public to understand what elements are to be used from each of the Manuals. In many cases, the proposed Regional Supplement contains information which is redundant or slightly different from the 1987 Manual.	Substantial Revision Required.
			Will the Regional Supplement include or supersede the clarifications to the 1987 Manual that were issued in 1992 (i.e. Williams 1992 and Studt 1991)? If so, why are these clarifications no longer valid?	Technical error +Bias error
			The supplemental manual is not supported by new scientific studies and little research is referenced to support the proposed changes. The Regional Supplement should be based on sound science; not just assumptions and	Clarification needed

[1] Effect is indicated as follows: **Technical error** means that the proposed Manual is incorrect and needs to be revised to reflect corrections discussed in comment. **Bias Error** means that the proposed Manual is not neutral compared to the 1987 Manual in terms of the extent an area meeting the criteria for a wetland. A "+" means that the proposed Manual would indicate greater extent of wetlands and a "-" means it would indicate a lesser extent of wetlands. **Clarification needed** means that the proposed Manual needs further discussion related to the questions raised in the Comment. Substantial Revision Required means that the proposed Regional Manual should be reorganized.

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
			conjecture. While Regional Supplements can and should contain regional indicators that may vary from the 87 Manual, they should not alter actual criterion (diagnostic environmental factors) for each of the three parameters. For clarification purposes, the Corps should provide a table that compares the indicators used in the 1987 Manual to the new Regional Supplement and which indicators are being added and which deleted from the 1987 Manual. Only then can a clear understanding of the implications of the Regional Supplement be understood. The stated intent of the Regional manual is to "bring the manual up to date with current knowledge and practice in the region and not to change wetland boundaries". The Regional Supplement presents very little information (other than general descriptions) that is specific to the region, clearly changes wetland criteria, would substantively modify current delineation practices within the region and will significantly modify wetland boundaries. It appears that much of the discussion in the proposed Regional Supplement is focused on changing the 1987 Manual across the entire country.	Substantial Revision Required Substantial Revision Required
1	1	Definition of wetlands	Supplement provides a truncated definition of wetlands as stated in 33 CFR 328.3. Should provide the full regulatory definition so it is clear that hydrology is a key component of the definition. If, indeed, if the proposed Regional Supplement only supplemented the 1987 Manual rather than superseded the 1987 Manual, then repetition of definitions would not be required.	Clarification needed
1	2	Boundary of the arid west	The boundary excludes a portion of the San Francisco peninsula and places it in the Pacific Northwest. This small area would be delineated based on a separate regional manual even though it is more closely related geographically, climatically and botanically to conditions on the eastern side of the peninsula. The Regional Supplement should include this area.	Clarification needed

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
1	5-6	Description of wetlands in arid west	This section describes natural wetlands primarily and does not deal with many of the wetland types that are also present in the region, but are man-made features. Only limited references are provided and the description provided does not really provide any useful information for the Arid West. The wetlands that are typical of the Arid West should be more thoroughly described so that their context to the indicators proposed by the Regional Supplement is better understood.	Clarification needed
			In addition, many of the wetland types referenced (e.g., vernal pools and seeps) are typically isolated and pursuant to SWANCC are not regulated by the Corps. As written, the Regional Supplement gives the tacit impression that all of these wetland types are "jurisdictional" when many are not. A note to the user should be added to clarify this issue.	Clarification needed
			The only man-made wetland discussed are "irrigated wetlands"; however, other man-made wetlands such as farmed wetlands, drainage ditches, stock ponds, depressions on construction fills should also be discussed. The discussion on types of irrigation is irrelevant to whether or not irrigated wetlands are subject to Corps jurisdiction. At the very least, Corps policy that exempts irrigated wetlands from regulation under Section 404 and what is required to demonstrate that exemption should be cited in this section (see guidance from Sacramento District).	Clarification needed
2	8	Discussion on halophytes and phreatophytes	Good discussion on these species; some examples should be given of species that qualify as potentially misleading wetland plant indicators. This should also be discussed more thoroughly in the chapter on wetland vegetation as a "caution to users".	Clarification needed

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
2	9	Growing season discussion	This discussion more properly belongs in the section on hydrology, not hydrophytic vegetation since the concept of growing season is not used to determine whether or not a plant is a wetland indicator but is used to determine whether or not the hydrology criterion is met.	Substantial Revision required
			The proposed Regional Supplement also adopts a new hydrology standard (Corps 2005) that provides a growing season definition that is not consistent with some of those described in this section. (See further discussion below on this new hydrology standard).	Substantial Revision required.
			Two procedures are provided to determine the start of the growing season. The second is the actual the definition of the growing season. The definition should take precedence unless data are collected to demonstrate a different growing season (as provided in the 1987 Manual). Since both the beginning and ending dates for the growing season are "needed to evaluate certain wetland indicators," it would be helpful if the Regional Supplement provided methodology(s) for estimating the end of the growing season.	+ Bias error Technical error Clarification needed
			The first proposed alternative procedure does not have any scientific references to support it use as a substitute. While some of the indicators listed directly relate to soil temperature, others may equally depend on other factors and as a result not be a valid indication of growing season.	Substantial Revision Required
			In addition, under the 1987 Manual, a longer growing season will necessarily result in a longer duration of inundation or saturation necessary for hydrology to be present for a positive wetland determination; however, the new hydrologic standard that appears to be proposed by the Corps (2005) states that only 14 days are necessary for wetland hydrology to be met. The Regional Supplement should clearly state what the duration of inundation/saturation standard is and how it is consistent with the 87 Manual and subsequent guidance (Williams 1992 and Studt 1991). It would appear obvious that a lengthening of the growing season and shortening of the duration for saturation and/or inundation (as proposed by Corps (2005)) would result in an increase in areas that would meet the hydrology criteria.	Substantial Revision Required + Bias error

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
2	9	Discussion of FACU species	The Corps continues to use the outdated 1988 plant list and it should be referenced that newer lists are being developed that may have a more accurate wetland designation. The Regional Supplement should state how members of the public can obtain the most current approved list. However, just as some FACU dominated communities may be wetlands; some FAC and FACW communities may not. Examples should be given of both. The Regional Supplement should be balanced to indicate that both situations may occur because of the difficulty of getting the plant lists updated. In addition, procedures for the public to make changes to the classifications of some plants are lacking.	Clarification needed
2	10	Wetland Plant indicator lists	A more through discussion of how the plant lists were developed should be provided in this Regional Supplement. In addition, if the Corps is relying on the US FWS for its plant classification, the Corps and FWS should provide the public with a means to propose changes to the listing classifications based on new scientific information. Of course, if the proposed Regional Supplement truly was only a supplement to the 1987 Manual, then this discussion would not be needed. The Regional Supplement appears to only focus on changes of FACU and UPL to wetter classifications and not vice versa. The designation of FACU and UPL is established by experts who have reviewed the list and the Regional Supplement appears to abandon this peer review process.	Clarification needed Not a Regional issue
2	10	Use of (+ and -) indicators	The use of FAC+ and FAC- indicator status should be allowed since they provide a more precise estimate of the reliability of various species as wetland vegetation indicators. Why would the Regional Supplement preclude use of more precise information in preference to more generic information? While the use of FAC+ would alter few determinations, use of the FAC- status could be a determining factor in numerous delineations. Therefore, eliminating its use would clearly not be a neutral change. It should be noted that if these indicator statuses are used, it would require modifying the prevalence index formula.	Clarification needed +Bias error Not a Regional issue

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
2	10	Species area curves	There is nothing in this discussion that relates to specific regional issues and should not placed in this Regional Supplement. In addition, plant sampling techniques are much better covered in the scientific issues. It should be stated that the routine method and use of the 50/20 rule does not require analysis of a species area curve since one is only looking for dominant species, not rare species. It may be applicable to the prevalence index; however, rare species have little influence on the final score.	Substantial revision required. Not a Regional issue
2	10-13	Plot size and strata	There is nothing in this discussion that relate to specific regional issues. The Corps provides extensive discussion of plot size; however, little explanation of the number of plots required. The discussion on strata is not significantly different from the 1987 Manual. The standard practice is a paired plot procedure in which one sample plot is taken in the uplands and one in the wetlands and then these two plots to be used to determine the wetland boundary. The Corps should explain this clarify this practice.	Substantial revision required. Not a Regional issue
2	10	Random samples	The description of plot and sample size implies that a completely random sampling methodology must be used in comprehensive determinations. The 87 Manual provides for a stratified random sampling methodology, not a "completely random sampling methodology."	Clarification needed Not a Regional issue
2	14	Corps Manual definition of hydrophytic vegetation	This definition is not the same as the definition in the 1987 Manual. Why has it been changed? What are the implications of this change?	Clarification needed

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
2	14	Failing of wetland hydrophytic test	The Regional Supplement explains the situation for the failure of the hydrophytic vegetation test for sites, which may actually be wetlands. However, it should also be stated that some places that may have hydrophytic vegetation may actually be non-wetlands and there should be procedures to determine that wetland classified species, particularly FAC species, are non-wetland indicators. In addition, there should be a discussion, as there is in the 1987 Manual, that communities dominated by FAC species must also have strong indicators of wetland hydrology and hydric soils to be considered as wetlands. Because a delineation manuals' purpose is to delineate wetlands, it is understandable that the concentration is on indicators that can be used to identify wetlands. However, in many cases, it would be equally helpful to have indicators or other diagnostic tools that identify non-wetlands (uplands). One could argue that the if any of the hydrophytic vegetation tests fail, then the area should be considered an upland and this possibility should be discussed in the Regional Supplement. The 87 Manual and subsequent guidance contain repeated cautions regarding the relative reliability of various indicators (e.g. FAC-dominated plant communities) and the need to have more reliable indicators of hydric soil and wetland hydrology indicators in these cases. The cautions and guidance have been largely omitted from the Regional Supplement.	Clarification needed + Bias Error Not a Regional issue

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
2	15	Procedure for use of wetland indicators	The stepwise procedure appears to favor a finding of positive wetland vegetation even if the plant community fails both the dominance test and the prevalence index. In other words, it adds a fudge factor for morphological adaptations to be added to the mix. When examining the morphological adaptations used in the 1987 Manual, these features are almost exclusively observed on OBL and FACW species [note: *Lolium perenne* (FAC) routinely develops adventitious roots in areas that are inundated for a prolonged period] and therefore it is not likely that the third step would ever be applicable. The 87 Manual points out that morphological adaptation would rarely be used. We are not aware of instances where FACU or UPL species exhibit these morphological adaptations. The Regional Supplement should site such examples. If it is likely that FACU or UPL species would exhibit these morphological adaptations, we suggest that the indicator status is probably in error and it would be more appropriate to change the indicator status than to require this evaluation as a standard part of routine delineation. The prevalence index is similar to the 50/20 rule except that it is more sensitive to differences in cover and considers a larger component of the plant community. In theory, the prevalence index would be a more accurate measure of the degree to which the plant community is adapted to inundation and/or saturated soil conditions. Studies by the Corps (Wakely and Lichvar 1997) support this. Given this, it would appear that the 50/20 rule should only be used for rapid vegetation determinations where the dominant species are all FACW and OBL or all FACU and UPL, with the prevalence index used as the standard in all other situations. Morphological adaptations should be dropped from the standard procedures.	+ Bias Error Not a Regional issue
2	16	Use of 50/20 rule	The usual practice is the placement of dominant species on the datasheet. Often these lists include species of less than 20% cover. The adoption of the 50/20 rule appears to diminish the use of other species which may be used to determine whether the hydrophytic vegetation parameter is met.	Bias Error Not a Regional issue

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
2	17	Calculation of prevalence index	The standard for hydrophytic vegetation cited is not the same as that used by Wakely and Lichvar (1997) and that recommended by the Interagency Committee for Wetland Delineation (1989). The standard proposed in the Regional Supplement is ≤3.0 while the standard used in these references cited are <3.0. No rationale is provided for this change. Furthermore, the NRC report (1995) contains a figure that shows that for prevalence indices greater than 2.5 may only be wetlands if there are strong indicators of hydrology and hydric soils. The figure from that report should be included in this Manual so that it is clear that not all areas with a prevalence index of less than 3 are wetlands. It has also been shown that PIs may vary seasonally and some cautions should be given when using these indices, especially in marginal situations.	+ Bias Error Not a Regional issue
2	19	Morphological adaptations	The 1987 Manual provides a list of morphological adaptations that are typically found on obligate and FACW species. The Regional Supplement describes adaptations but does not provide any examples of these adaptations for species in the Arid West. To avoid controversy over what FACU and UPL species may have morphological adaptations, a list should be provided in an appendix to the Regional Supplement and the list should be supported by scientific evidence that such morphological adaptations are a result of adaptation to saturated soils. For example, some species may produce adventitious roots in response to temporary ponding that is not sufficient to meet the wetland hydrology criteria. In addition, many plant communities (wetlands and uplands) in the arid west have shallow root systems in order to adapt to infrequent rainfall events. Such systems are not morphological adaptations to saturated soils only.	+ Bias Error Not a Regional issue
3	22	Cautions	The 1987 Manual has limited discussion of problem hydric soils, such as Mollisols. Given the prevalence of mollisols in the arid west, more discussion should be provided in the Manual on these problem soils and the indicators that are to be used for them.	Clarification needed
3	22-24	Discussion of soil sampling	These are not issues related to regionalization of the 1987 Manual and are more general guidance that should be considered as clarifications to the 1987 Manual. There is no discussion on why a soil pit should be dug deeper than 20 inches since all the indicators used to determine a hydric soil are above this depth. Would the presence of redoximorphic features below 20 inches be used to indicate a hydric soil?	Clarification needed Not a Regional Issue
3	24	Munsell colors	Is the Regional Supplement only stating that only Munsell colors are to be used and other manufacturers of color charts will not be accepted?	Clarification needed

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
3	25 +	Use of hydric soil indicators	The Regional Supplement includes NRCS hydric soil indicators that heretofore were only allowed to be used as collaborative information. Since they could not be used as definitive indicators without other collaborative information, it is imperative that their inclusion be based on actual testing and verification in the Arid West Region. Use of these indicators without collaborative indicators will not be neutral. Because of this, it is imperative that their inclusion be based on testing results covering a broad range of conditions.	Substantial revision needed
			These indicators also present a more complicated procedure and one that will require rigorous training of the environmental consultant community and the Corps staff. Will the procedures in the 1987 Manual still be available—or will the procedures used in the Regional Supplement take precedent? If so, what time frame does the Corps have to train its staff in the use of these indicators when making wetland determinations?	Clarification needed
			Is the Corps abandoning the criteria for the hydric soils as a basis for determining a hydric soil (i.e. criteria 1, 2, 3, and 4) as listed in the 1987 Manual or are these indicators additive to the Regional Supplement indicators? What about other indicators in the 1987 Manual used for hydric soils? Are these indicators being discontinued or are they being assumed to be equivalent to some of the hydric soil indicators? The Regional Supplement should show a comparison table for the old indicators and the new indicators.	Clarification needed
3	48	Use of soil surveys	This is not a regional issue and is not required in a supplement to the 1987 Manual.	Not a Regional issue
4	49	Lack of wetland hydrology indicator	The statement that a site may lack an (or any) indicator of wetland hydrology and still have wetland hydrology runs counter to the requirement that all three parameters be demonstrated as present for any area to meet the regulatory wetland definition. This statement should be eliminated from the Regional Supplement as it clearly sets forth a two parameter approach. If a site lacks wetland indicators, the only way to establish wetland hydrology would be to monitor the site to determine whether it satisfies the wetland hydrology criterion.	+ Bias Error

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
4	50	Shifts of current secondary indicators to primary indicators	The Regional Supplement shifts a number of current secondary indicators (for which 2 are required) to primary indicators (for which only 1 is required). This shift can be presumed to bring areas that currently do not have wetland hydrology into wetland conditions. This shift does not have to be field tested as it is a change that does not result in a "neutral" condition with the current 1987 Manual. A study by Nobel, Martel and Wakely (2005) surveyed District Offices to obtain their opinion as to the percent of the time various potential hydrology indicators are evident in wetlands. This study is flawed because it did not examine the percentage of time that the potential hydrology indicators are also found in non-wetlands (uplands). In order to be considered reliable, a particular indicator should be found in wetlands at a greater frequency than in uplands within similar topographic and landscape positions. For instance, direct precipitation is 100% correlated with wetlands but is also 100% correlated with uplands. Although it is 100% correlated with wetlands, it obviously would not be a reliable wetland indicator. Ideally, a study or series of studies should be conducted to determine the percentage of the time these indicators are found in wetlands and uplands occupying similar topographic positions. Those indicators that are not more frequently found in wetlands should not be used as wetland hydrology indicators. Those that are somewhat more common in wetlands that uplands should be used as secondary wetland hydrology indicators. Only those that correlate strongly to wetlands should be used as primary wetland hydrology indicators. In addition, any proposed wetland hydrology indicators that do not imply frequency and duration should only be used as secondary wetland hydrology indicators. Only those indicators that imply frequency and duration should be used as primary wetland hydrology indicators. While in many minimally altered sites, the vegetation and/or soil parameters may correct for unreliable hydrology indicators, this is not the case in many disturbed sites, where the reliability of indicators of the vegetation and/or soil parameters is compromised.	+ Bias Error Substantial revision required. Not a Regional issue only.

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
4	51	Table 4-1	A number of new indicators are proposed with no scientific evidence to support their use. In order for the public to understand that these new indicators are reliable, they should be scientifically tested to determine that they are indicative of wetland hydrology (both frequency and duration). Presumably, they have been added based on particular situations that have not documented for the public to review (See above comment).	+ Bias Error Clarification needed Not a Regional issue only
4	52	Surface water	A statement needs to be added that annual variations in frequency and duration are also of importance in making these observations (see ERDC/EL TR-WRAP-00-1 (Corps 2000) The 1987 Manual uses duration based on a percent of the growing season as does a recently proposed criteria (Corps, 2005). [The adoption of this new standard by the Regional Supplement is not mentioned until the very last page and requires much greater attention and substantiation before adoption by this or any Regional Supplement.] The Regional Supplement should make clear which duration standard should be used; that in the 1987 Manual or the recent Corps (2005) technical standard. If the latter is used, this will result in a shorter duration of saturation required (14 days) compared to the 1987 Manual and this will clearly result in an expansion of the Corps jurisdiction. A thorough analysis of the effect of this change in the hydrology standard must be undertaken prior to its adoption.	+ Bias Error Substantial revision required. Not a Regional issue only
4	53	High water table	See comment above. This also needs to be clarified that the high water table must be observed in the growing season.	+ Bias Error Clarification needed
4	54	Saturation	See comment above. In addition, the 1987 Manual states that saturation must occur within the majority of the root zone. In some cases such as vernal pools, the depth of the majority of the root zone may be less than 12 inches. Is this standard being changed? Also, the Regional Supplement adds 'near-saturated' without explanation of how saturation and near-saturation are somehow equivalent. This could result in areas that are wet but not saturated included as wetlands.	+ Bias Error Clarification needed
4	55	Surface cracking	This indicator should not be used as a primary indicator as there is no association with frequency and duration of inundation or ponding. This indicator may form following rainfall events that are insufficient to result in wetland hydrology as defined in the 1987 Manual.	+ Bias Error

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
4	56	Aerial imagery	This type of observation can be very misleading and requires an expert familiar with aerial photo-interpretation to make this determination. In addition, the caution must state that inundation must be observed in the growing season. Finally, reference to the use of the WETS method should be given when making these types of observations. This is a new primary indicator that has not been tested scientifically.	+ Bias Error
4	57	Water stained leaves	Synthesis of Literature on Use of Water-Stained Leaves in the Delineation of Wetlands (WRP Technical Note HY-DE-2.1, 1993) concluded that the presence of water stained leaves was not reliable enough to use as a primary indicator of wetland hydrology.	Technical error +Bias error
4	58	Biotic crust	This indicator does not provide any consideration of duration and may form in areas with short duration or non-continuous periods of ponding. In addition, it can form on areas where sediment settles over hard surfaces such as paved areas and construction sites. These cautions in using these indicators in areas without hydric soils or hydrophytic vegetation need to be added. The degree of algal matting necessary to meet the duration of wetland hydrology should be described.	+ Bias Error
4	63	Water marks	Water marks can be used as an indicator of the OHW for "water"; however, it is difficult to determine the length of time based on a number of water marks that may be present. Well developed water stains only are present where inundation is common on an annual basis and the duration is prolonged.	+ Bias Error Clarification needed
4	64	Sediment deposits	This indicator does not imply frequency and duration and as such should not be used as a primary indicator of wetland hydrology. Some sediment deposits may be a function of rain splatter and should be explained as such. Sediment deposits commonly are a result of short duration events that do not occur on an average annual basis (5 years in 10).	Clarification needed
4	65	Drift deposits	See above comment. This indicator can result from infrequent flood events and it should not be used as a primary indicator. It needs to be found in conjunction with some other indicator that provides a measure of duration.	+ Bias Error
4	66	Drainage patterns	The photograph provided could also be a result of wind blowing across the surface of the meadow.	+ Bias Error

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
4	68	Oxidized rhizospheres	This indicator is a secondary indicator in the 1987 Manual and is raised to a primary indicator in the Regional Supplement. This will result in an expansion of the areas that will be considered as meeting wetland hydrology. Oxidized rhizospheres (OR) can be observed in many non-wetland conditions. It should be stated that the percentage of roots that have OR must be 50% of the live roots present or some other percentage that is justified by the scientific literature. The presence of a few ORs should not be used as a primary indicator as they may form from micro-soil saturation unrelated to wetland conditions. The clarifications to the 1987 Manual state that OR should be "reasonably abundant". A caution should be added that if OR's are also found in nearby upland areas, they should not be counted as an indicator for wetland areas.	+ Bias Error
4	69	Presence of reduced iron	This is a hydric soil indicator in the 1987 Manual and if it continues to be used for hydric soils, it should not be used as a hydrologic indicator as it results in a two parameter delineation procedure, not three parameters as required in the 1987 Manual and the Corps definition of wetlands. If the Regional Supplement supersedes the 1987 Manual, this will lead to a change in the wetland boundary.	+ Bias Error Not a Regional issue
4	71	Muck surface	This is a hydric soil indicator. (see comment above)	+ Bias Error
4	72	Saturation on aerial photography	This indicator should not be used unless field verification confirms that the signature observed in the aerial photography indeed indicated saturation, not some other factor such as a darker soil inclusion. In the central valley of California there are several non-hydric dark soils that occur as inclusions within a lighter soil type. On an aerial photograph, this darker soil inclusion could, and has been, misinterpreted to imply saturation to the surface. Additionally, the timing of the aerial photograph should be correlated to rainfall and growing season to avoid misinterpretation.	Clarification needed
4	73	Dry season water table	What is meant by the dry season? This period needs to be defined in order for the indicator to be used. Measurements also need to be defined as occurring within the growing season. How is duration determined with this indicator?	Clarification needed
4	74	Salt deposits	This indicator does not necessarily correlate to frequency and duration. Salt leaching is commonly observed in non-hydric plant communities (e.g. greasewood- cheatgrass). Also, historic irrigation practices can leave salt deposits on the surface in non-wetlands. Salt deposits can arise from salts washed in from outside areas and may not be indicative of saturated or inundated conditions of sufficient duration to meet the hydrologic parameter.	+ Bias Error

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
4	75	Mud casts	Mud casts or depressions vary in depth considerably from site to site based on soil characteristics. This indicator provides no quantitative measure or comparison. As a result, it can be interpreted very differently by various observers and should be examined in upland areas as well. It may also be an indicator of livestock concentration in a particular area.	+ Bias Error
4	76	Shallow aquitard	This indicator does not consider variation in rainfall patterns, slope, or landscape position. As a primary indicator it does not have any relationship to duration or frequency of soil saturation and should not be used as the sole indicator of wetland hydrology. Within the Central Valley of California, there are soils with shallow aquitards less than 12" inches from the surface (e.g. Exchequer) that are clearly uplands. While wetlands may occur as inclusions, they are always a small fraction of the total. This is a classic example of an indicator that correlates equally or more with uplands and should not be used as a wetland hydrology indicator, not even as a secondary indicator.	+ Bias Error Technical error
4	77	FAC-Neutral	Since the FAC-neutral test and the prevalence index are very similar and both are measures of hydrophytic vegetation and since the prevalence index has been proposed as a vegetation indicator, the FAC-Neutral test should not be used as a wetland hydrology indicator.	Technical error
5	79	Temporal shifts	The Regional Supplement needs to be clear that the seasonal occurrence of wetland vegetation must also be concurrent with the presence of wetland hydrology. Some upland species germinate during wet conditions, but are not readily identifiable until the dry season and need to be included in the wet condition analysis. Some annual upland and wetland plants that are present in the spring months die back in the dry season leaving only perennial species which may or may not be indicators of the wetter periods of the year.	Clarification needed
5	80	Vegetation standard of 5% cover	The Regional Supplement provides no justification for the use of 5% areal cover as a determination that the site is to be classified as a "wetland" as opposed to an "other water". The 5% cover does not represent a condition of dominance by wetland vegetation and, in fact, demonstrates a dominance of either open water or unvegetated flat. The Regional Supplement needs to provide a justification as to why an area with as little as 5% cover should be considered a "wetland" and appears to be a policy decision that has not been provided for public review. In a mixture of vegetation cover how does one determine the portion that should be considered "waters" versus "wetlands" when the cover is extremely low. No practical guidance is provided in the Regional Supplement.	Clarification needed

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
5	82	Riparian areas	Many riparian areas are not "wetlands" as the plants are phreatophytes even they are classified as wetland species. The Manual should issue a caution on this condition and have a procedure whereas known phreatophytes can be excluded from the list of dominant species. It should be clarified that hydric entisols that do not exhibit hydric soil indicators are not normally encountered in riparian areas with well-developed riparian plant communities. The problem is normally observed in very young surfaces with early successional plant communities.	Clarification needed
5	83	Use of NWI maps	A caution to users should be provided in the Regional Supplement that NWI maps have a disclaimer that they are not to be used to determine Section 404 jurisdictional areas.	Clarification needed
5	83	Grazing effects	Grazing may alter the plant community composition present at a particular site, but does not change the hydrophytic nature of the vegetation. The elimination of vegetation as part of the three parameters needed to delineate the wetland boundary is in error as we are unaware of any examples where vegetation in grazed areas cannot be used.	+ Bias Error
5	83	Table 5-1	Please provide references for the findings shown in Table 5-1.	Clarification needed
5	83	Managed plant communities	This section appears to relate primarily to agricultural activities which represented activities which are not regulated by Section 404. In addition, many agricultural practices represent the long-term "normal circumstance" for the property. This issue goes beyond that of the Arid West and needs to be addressed nationwide. By reducing the number of parameters needed to determine the presence of jurisdictional wetlands, the reliability of the remaining criteria used should be higher than the minimum.	+ Bias Error Not only a Regional issue

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
5	84	Vigor and stress on planted crops	This procedure is stated as being difficult to measure and variable from species to species. The Regional Supplement does not provide any examples of species or documented studies that can be used to distinguish between events that cause temporary stress and those that relate to duration that is considered representative of wetland hydrology. Quantitative measures of plant vigor and stress are not provided and it is expected that there are many levels of stress from slight to death of the plant. There are also other stressors (e.g. high soil salinity, poor fertilizer application) that may result in decreased growth. In irrigated areas, low plant vigor is associated with areas that are not sufficiently irrigated. As such, this procedure is vague and difficult to apply to specific situations.	+ Bias Error
5	85	Early season germination of upland species	The Regional Supplement provides no examples or specific wetland types where this condition may occur. We are not familiar with examples of where this condition occurs. If FACU and UPL species out-compete wetter species than the definition of a wetland as provided in the Corps regulations is not met, i.e. hydrologic conditions which bring about the dominance of hydrophytes. By definition, a wetland is a site where wetland plants out-compete upland species. This procedure appears to be identifying areas that would not normally meet the Corps wetland definition and is therefore not "neutral" in its application.	+ Bias Error
5	85	FACU and UPL dominated communities	The Regional Supplement introduces a new approach to including non wetland plant communities as wetlands using a new hydrology standard that has not been previously tested. It also results in a one or two parameter procedure. Because of how it is defined and without limited factors, this two parameter approach could be applied to many sites where it is not appropriate.	+ Bias Error Substantial revision required.
5	85	New hydrology standard	Without any reference or scientific support, the Regional Supplement describes a new hydrology standard in paragraph 3a that significantly reduces the period of time for continuous saturation in areas with a growing season of 365 days. The use of the 14 day period of saturation or inundation needs to be justified and will certainly result in an expansion of jurisdiction compared to the 1987 Manual.	+ Bias Error Not a Regional issue only Substantial revision required
5	86	Problematic Hydric soils	Whenever one parameter such as hydric soil is eliminated or cannot be observed, it should be cautioned that more reliable vegetation and hydrology indicators must be observed.	Clarification needed

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
5	87	Recently developed wetlands/seasonally ponded soils	Use of 14 days of inundation, flooding, or saturation is a hydrology standard that has not been used by the Corps previously. It is now also being applied as an indicator for hydric soils which reduces the wetland parameters used to delineation a wetland to two rather than three.	+ Bias Error
5	87	Seasonally Ponded Soils	Many clay soils (e.g., vertisols) that exhibit 'shrink/swell' characteristics limit or preclude formation of redox concentrations due to the constant mixing associated with shrink swell.	Clarification needed
5	88	Red Parent Material	This indicator is identified as a test indicator by the NRCS. The most recent annual minutes of the NTCHS indicate that this indicator is still a test indicator. There is not documentation indicating that it has been tested and proved valid in the Arid West Region. Unless and until that occurs this indicator should not be adopted. The technical description implies that all soils with a hue of 7.5YR or redder are considered to be red parent material. Is that so and, if so, that should be clearly stated. The underlying assumption of this indicator is that red parent material may obscure or otherwise prevent identification of a reduced matrix and/or redox concentrations. There are numerous examples where wetlands occurring as inclusions within soils that normally have a hue 7.5YR have observable depleted matrices with visible redox concentrations. In these cases, it would appear that the underlying assumption is invalid and the indicator should not be used.	Clarification needed Possible technical error +Bias error
5	92	Site visits during the dry season	Regional Supplement states that if site visit during dry season determines that site has hydrophytes and hydric soils, then the site is a wetland. This statement should be deleted as it is suggests that wetland hydrology need not be examined or can be assumed. This assumption may be wrong when indicators are weak or marginal.	+ Bias Error
5	94	Below normal snowpack	See comment above. In addition, the Manual should also explain that periods of higher than normal snowpack may indicate create wetland hydrology conditions when in fact, they do not normally occur.	Clarification needed

CHAP	PAGE	TOPIC	COMMENT	Effect[1]
5	95	Corps (2005) standard	This is the first official citation to a new hydrology standard that is substantially different than the 1987 Manual in both the place of measurement and the duration of inundation and saturation. The Regional Supplement makes no distinction between the 1987 Manual and subsequent guidance provided by HQ and this new standard. No scientific evidence or support is provided for this new standard which is likely to increase the extent of wetland determinations.	+ Bias Error Substantial revision and review required.

Comments on the Arid West Regional Supplement to the 1987 Corps Manual

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General Comment. **Overall, the regional supplement is an improvement because it incorporate much of the science that has been developed since 1987. It is more specific than the 1987 Manual and it should improve the certainty of the wetland delineation. The following comments are not intended to "take away" from the positive step that the regional supplement represents.**

Field Testing (page 6). Field testing in the spring and early summer are very critical for the Arid West; however, the public comment period occurred at the end of the growing season and into the dormant season. In the Arid West, the end of the growing season is the driest time of year. The only way for the public at large and private consultants to accurately field test this regional supplement is from February through June. Although it would cause a delay, it is critical that the Corps of Engineers allow such field testing in the first half of 2006 before concluding it's review of comments. **Thus, a 210 day extension for submitting comments and field review is formally requested.**

Irrigated Wetlands (page 6). Due to the timing of the public comment, it is not possible to review this regional supplement during the normal irrigation season (typically April to late September). **As stated above, a 210 day extension for conducting spring-time reviews is formally requested.**

Growing Season (page 9). The occurrence of plant growth (budding, flowering) does not necessarily indicate that anaerobic activity is occurring in the soil. That is, non-hydrophytic plants may bud, leaf-out or flower when saturation is present, but the soils have not become anaerobic (presumably due to insufficient evapotranspiration and temperature). It would be appropriate for NRCS to compile field data showing the time after the inception of the growing season (as we now call it) to show when anaerobic conditions develop in the upper part of the soil.

Use of Prevalence Index (page 15). The vegetation approach in this regional supplement is an nice improvement (clarification); however, it is important to stress that hydric soils and wetland are not a surrogate for hydrophytic vegetation (except where defined in problem areas). Also, the prevalence index is not frequently used, so more examples and additional training is recommended so it is accurately and consistently done. Since the prevalence index requires additional effort to complete, then it will increase the review time for Corps staff to evaluate wetlands and review third-party reports.

Morphological Adaptations (page 19). As stated above, this indicator has not been extensively used, so some additional examples, training, and suggested resource materials would be greatly appreciated by the field scientists conducting the delineations.

Use of regional Field Indicators of Hydric Soils (page 21). I have found these indicators very reliable and the NRCS field testing has made them consistent and accurate. I am very pleased to see these incorporated in this regional supplement. **Since the NRCS is continually improving Field Indicators of Hydric Soils, it seems appropriate to include a formal statement that the latest version of Field Indicators of Hydric Soils supersedes the FIHS in the regional supplement.**

Soil Sampling Questions and Depth (pages 23 and 24). These are good questions and they help the delineator examine the surrounding environment when documenting soil conditions. Thank you for including these questions. Also, thank you for mentioning the need to document soil conditions below 20 inches in some circumstances – often critical layers in the soil occur below 20 inches (hardpans, fragipans, argillic layers, changes in gravels/sand, or different parent material).

Soil Color and Contrast (pages 24 and 33). Again, thank you for including a comment about choosing soil color when deciding between chroma 2 and 3. Many mistakes have occurred when delineators "rounded down" to chroma 2 when between to color chips (or visa versa). Table 3-1 for defining color chip contrast makes it easier for delineators – Thanks for putting it together. Also, it is possible the Munsell Soil Color may continue to evolve with additional chips, so it might be appropriate to mention that future versions of this publication/product would be considered acceptable (or superseding the current version).

Hydric Soil Photographs (pages 25 and 35). The photographs in Figures 3-1 and 3-3 are not very good examples because the soil profile is smeared by the digging equipment. Check with NRCS or National Technical Committee on Hydric Soils to provide substitute photographs.

Lack of Hydrology Indicator Statement (page 49). Specifically, the regional supplement states "lack of an indicator is not evidence for the absence of wetland hydrology" – this statement is misleading and dangerous. In my experience of delineating wetlands since 1987 (over 300 delineations, plus another 200 determinations), I find hydrology indicators on more than 95 percent of all sites. Typically, field delineators fail to examine or utilize the wetland drainage pattern indicator, or they do not acknowledge that soil saturation is absent in the Arid West from late spring to mid-autumn. **I believe it is unwise and misleading to leave this statement in the regional supplement.** It is possible to clarify the issue without stating the absence of a positive indicator is not evidence of the absence of wetland hydrology (especially when emphasized in italics).

Wetland Hydrology Indicators (page 50 to 78). While I agree that the wetland hydrology indicators in the 1987 Manual need an overhaul the way that the hydric soil indicators did, this section of the regional supplement seems somewhat to highly speculative, as well as statistically weak and easily applied incorrectly. **The specificity of these indicators requires extensive field testing and further refinement – they should not be implemented without verification by qualified delineators during the beginning**

and middle of the growing season. Furthermore, NRCS should be engaged to validate these, in a similar manner that they did with Field Indicators of Hydric Soils. **To use these indicators, as proposed, is reckless, shows bias and poor judgment by the Corps of Engineers.**

Surface Water Hydrology Indicator (page 52). This is a good indicator, but the user notes should mention that non-growing season observations should be confirmed with collaborating evidence, such as aerial photographs. Delete last sentence because it is misleading (many ground water dominated wetlands have surface water, too). Replace with a sentence that indicates that not all wetlands have surface water and may be sustained by ground water.

High Water Table Hydrology Indicator (page 53). In addition to soil texture, please consider adding "soil structure" to the third sentence in the user notes. Also, consider adding requirement for additional (collaborating) evidence when water table observations occur outside of the growing season. It would also be helpful to mention that subsurface layers like fragipans, argillic horizons, calcic and duripans may temporary perch water above them. It should not be assumed these layers perch water for sufficient duration to qualify as hydric. Vertisols can be problematic for water table measurement since their internal fractures can show a water table, yet that water table may not persist for the minimum duration to qualify as wetland hydrology.

Saturation Hydrology Indicator (page 54). Please delete the term "near-saturated conditions" since it is not defined, nor precise. Furthermore, "near-saturated" may in fact not be anaerobic. **The shake and squeeze tests for soil saturation are not valid and should not be used under any circumstances**. Shaking and squeezing reduces the porosity of the soil, hence, free water can be extracted from a non-saturated soil – similar to squeeze a wet sponge that has does not leak water. The shake and squeeze approaches have never been quantified, nor researched. **Lastly and most importantly, this indicator eliminates the most important part of the 1987 Manual which requires that saturation occur in the major portion of the root zone. Eliminating this requirement for soil saturation is a significant departure from the 1987 Manual and will result in greater jurisdiction by the Corps of Engineers**. Expanding wetlands by eliminating the root zone requirement is contrary to page 1 which states "The intent of this supplement is to bring the manual up to date with current knowledge and practice in the region and *not to change wetland boundaries*." [emphasis added]

Surface Soil Cracks Hydrology Indicator (page 55). While there is some validity to this indicator, it appears to be based on casual observations, rather than documented research. Soil cracking is partly a function of temporary ponding, soil texture (silts) and clay mineralogy (clays that shrink some when dry). Many agricultural fields develop surface due to land drainage (direction of rows and furrows) and irrigation. Cracking also occurs on construction sites, edges of parking lots, and many other urban situations. Also, organic sediments without regard to inundation will naturally form crack because they are oxidizing when drying out. **Surface cracking is not exclusive to wetlands and this indicator should be rated only for secondary use only.**

Inundation Visible on Aerials Hydrology Indicator (page 56). **This should also be a secondary indicator because aerial photograph observations are subject to user interpretation – they are a distant second to on-the-ground observations.** Aerials are only a "snapshot in time" so this indicator should require additional collaboration with another secondary indicator. Several modern-era aerials, such as 3 within 20 years, should be required for this indicator to avoid misinterpretation. Also, the USDA procedure for aerial examination / interpretation is not explained.

Water-Stained Leaves Hydrology Indicator (page 57). Please consider adding to the user notes that water-stained leaves are often flat (from being submerged), while leave fallen on uplands often have curled edges and/or cracking due to desiccation and/or aerobic decomposition. It is also worth adding in the notes that leaves from upland areas are often blown into wetlands, so the species of the leaves is not important.

Biotic Crust Hydrology Indicator (page 58). **Biotic crusts, as an indicator should be combined with the sediment deposits indicator, since they are often inter-related**. It is also important to include in the user notes that desert soils often develop biological crusts on uplands in lieu of other plant communities. These upland crusts are mosses, lichens and fungi, too. Caution is warranted since knowledge of biotic crusts is still limited and additional research may shed new light on this indicator. It should be mentioned that biotic crusts may only be a millimeter or two thick. Lastly, thank you for including examples of other types of soil crusts.

Aquatic Invertebrates Hydrology Indicator (page 61). I have observed several times that a major storm event and/or snowmelt can scour aquatic invertebrate shells and deposit them as a drift line. Also, the presence of such shells may only be in the areas having significantly deep inundation; whereas, other parts of the wetland may not have any such indicator (where ponding is absent or very shallow). This indicator will also show up in created ponds, canals and reservoirs.

Crayfish Burrows Hydrology Indicator (page 62). It would be helpful to provide additional discussion how crayfish burrows are distinguished from terrestrial burrow (such as the smoothed surface that occurs when water is present). It is important that gopher and mole burrows are not accidentally included by delineators not familiar with crayfish burrows.

Water Marks Hydrology Indicator (page 63). **The user notes state that "when several water marks are present, the highest [water mark] reflects the maximum extent of recent inundation. This is incorrect because a significant water mark can develop from a significantly above-average precipitation year – and it may persist for many years.** This is especially true for water marks on trees and also water marks created by snow melts that occur over a longer-than-average period (snowmelts are often before the beginning of the growing season). The most reliable water marks are the ones that have a dark gray to blackish appearance, while the reddish ones can be a reflection of a

fluctuating water line not long term inundation. The water mark used for this indicator should be one representative of a 5 of 10 year frequency, right?

Sediment Deposits Hydrology Indicator (page 64). Pollen is not an appropriate component to include with sediment deposit since pollens are easily washed or blown into areas of standing water, but there is no correlation that pollen presence equates to wetland hydrology. Often one or two precipitation events can redistribute pollens into areas that receive surface runoff, but doesn't have long term inundation or soil saturation. **Overall, sediment deposits can easily persist for several seasons after the event(s) that created them; thus, to avoid misapplication of this indicator, it should be presented as a secondary indicator.**

Drift Deposits Hydrology Indicator (page 65). **Like sediment deposits, drift deposits can persist for several years after the event(s) that created them; thus, to avoid misapplication of this indicator, it should be used only as a secondary indicator.** More often than not, drift deposits are good indicators of Ordinary High Water, rather than wetland hydrology. Lastly, the photograph (Figure 4-15) is a poor example of drift deposits.

Drainage Patterns Hydrology Indicator (page 66). **I have found that wetland drainage pattern indicator was often the only indicator for seasonal wetlands that occur throughout the Arid West.** I believe it should be elevated to primary indicator status with some additional discussion that it is important to distinguish natural patterns from artificial ones (such as flood irrigation flow patterns). That is, not all drainage patterns are wetland drainage patterns. It is also helpful to identify water sources for wetland drainage patterns to avoid misapplication. Nonetheless, this indicator is very valuable for the Arid West as a primary indicator.

Soil-Related Hydrology Indicators (pages 67 to 71). This comment collectively refers to the following indicators Hydrogen Sulfide Odor, Oxidized Rhizospheres Along Living Roots, Presence of Reduced Iron, Recent Iron Reduction In Plowed Soils, Muck Surface, and Shallow Aquitard. **These indicators are hydric soil indicators not hydrology indicators. In fact, hydrogen sulfide odor is the A4 Indicator under the soil indicators; oxidized rhizospheres and recent iron reduction in plowed soils are redox pore lines and masses listed under A11, A12, S5, F3, F6, F7, F8 and F9; and muck surface is included in the concepts of A1, A2, A3, A9, S1, and F1.** To include these indicators as positive evidence of wetland hydrology means the independent 3-parameter approach is breached and no longer valid. The use of these indicators is analogous to "double jeopardy" in legal circumstances – it should not be allowed since the redundant use of these indicators erodes the integrity of the hydrology parameter. Nonetheless, the user notes for the hydric soil indicators could be amended to incorporate these concepts so they are not lost. The shallow aquitard indicator should be included in the hydric soil sampling procedures listed on page 23. The muck surface indicator is extremely broad and does not specify any minimum depth, so a thatch layer in an upland meadow or a 2 millimeter thick organic layer could be wrongly applied as a wetland

hydrology indicator. **Again, these are hydric soil indicators, not wetland hydrology indicators.**

Saturation Visible On Aerials Hydrology Indicator (page 72). **Like the inundation visible on aerials indicator, this one has limited value because aerial photograph observations are subject to user interpretation – they are a distant second to on-the-ground observation.** Aerials are only a "snapshot in time" and aerial photographs cannot definitively show saturation like they can show inundation. In addition, the statement that "saturated areas generally appear as darker patches within the field" is very misleading because hydric soils with albic horizons will appear more as light colored patterns on aerials. Also, the USDA procedure for aerial examination / interpretation is not explained. **This indicator should be eliminated because there is not enough correlation between wetness patterns on aerials and sufficient saturation within the upper part.**

Dry –Season Water Table Hydrology Indicator (page 73). Instead of a separate indicator, the circumstances of this indicator should be included with the concept of high water table. Professionally, my experience has shown that even in drought years, a water table below 18 inches rarely, if at all, ever sustains a hydrophytic plant community. This indicator is already included in the concept of hydrology portion of the difficult wetland situations described on pages 92 and 93.

Salt Deposits Hydrology Indicator (page 74). In general, this indicator is reliable; however, salt deposits on rocks and structures often take decades to accumulate, so they may not reflect a frequency of wetland hydrology of 5 of 10 years. Also, salt deposits are frequently associated with irrigation water, where salt deposits are visible on the top of furrows. Additional user notes are warranted to assure this indicator is not misapplied.

Mud Casts Hydrology Indicator (page 75). **This indicator is simply a very bad idea. Tire ruts, livestock tracks and footprints occur when a soil is wetted, but not necessarily saturated.** As previously indicated, use the term "nearly saturated" is not appropriate, undefined and violates the concept of saturated. These kind of casts can be created when a soil is wetted for only a few days, which fails to prove that sufficient saturation occurred to qualify as wetland hydrology. Furthermore, some soils, like silty and clayey ones, are much more susceptible to "casts" because of their lower soil strength. Most fragipan soils are upland soils, yet they are easily rutted right after major precipitation events. **This is indicator lacks adequate proof to be considered reliable.**

FAC-Neutral Test Hydrology Indicator (page 77). **This is a vegetation indicator. There is no evidence to show that locations passing the FAC neutral test in fact have wetland hydrology.** This indicator should never have been allowed in 1992 and it violates the concept of 3 independent parameters. If the Corps of Engineers wants to use this indicator, then they should provide proof, rather than speculation that is it accurate. **Please remove this vegetation indicator from the list of hydrology indicators.**

Difficult Wetland Situations In The Arid West. Overall, the concepts set forth in this section of the regional supplement are good. **Some additional discussion and/or clarification is needed to define "disturbance" and related terms.** It is also important to clarify that areas of non-native plants are still considered "normal circumstances."

The section on temporal shifts in vegetation (page 79) should note that such shifts take several years and rarely occur in one or two years.

Sparse and patchy vegetation (page 80) should refer to natural situations, not those associated with agriculture, vehicle traffic, or crop seeding patterns. It is always advisable that comparisons to reference areas include confirmation of similar soil conditions and hydrology sources.

The browning and yellowing of leaves (page 84) in cropped areas can also be attributed to poor soil nutrients, over fertilization, fungi and molds, over-irrigation, under-irrigation and other soil chemistry problems – additional expertise is needed from a qualified crop advisor to evaluate the condition of plant leaves in an agricultural setting.

The allowance of FACU plants (page 85) is a slippery slope because the presence of FACU plants and the absence of FAC, FACW and OBL species indicates inadequate hydrology to qualify as wetland. **This procedure (on page 85) warrants clarification and field testing because it opens the door to include large areas dominated by FACU species.**

Soils having a high pH (page 86) should be verified with a simple pH field test.

It is actually common for soils composed of volcanic ash to have free iron. Furthermore, in desert areas, iron is "imported" with dust from other areas. The lack of iron should not be assumed – it should be verified with a laboratory test.

Seasonally ponded soils, unless composed of soils lacking free iron, should naturally develop redox concentrations. **The occurrence of subsurface layers, like argillic horizons, duripans, etc., does not affect the presence of free iron.**

On page 85, the wetland hydrology duration concept of greater than and/or equal 14 consecutive days during the growing season is mentioned, but it is not described in the growing season section. Why not? Is the Corps of Engineers changing the 5%-12.5% saturation rule of the 1987 Manual? Further clarification is needed.

Thank you again for the opportunity to provide these comments. Please feel welcome to contact me for additional clarification or suggestion. My phone number is 503-274-2100 and my email address is: philscoles@yahoo.com or pscoles@terrascience.com.

Ms. Katherine Trott
CECW-LRD
U.S. Army Corps of Engineers
441 G. Street, NW
Washington, DC 20314-1000

Dear Ms. Trott:

EPA Region 6 has reviewed the Special Public Notice "Announcement of Draft Arid West Regional Supplement to the 1987 Wetland Delineation Manual" and have the following comments:

General Comments:

- We are very concerned with the method that the Corps' is proposing to regionalize the 1987 manual with regional supplements. We understand the Corps' would publish numerous (8-12) regional, stand-alone supplements across the Land Resource Regions of the United States. As proposed, each supplement would supercede the 1987 manual for all (3) three wetland delineation parameters: soils, hydrology, and vegetation. We recommend that the effort be focused only on Section G, Problem Areas, of the 1987 Corps of Engineers Wetlands Delineation Manual.

- For example, there is no utility in developing new indicators for Histosols or other well documented wetland parameter indicators.

- As proposed, within EPA Region 6, the Corps would publish (6) six stand-alone regional supplements. We are concerned that overlapping mandatory-use supplements would create confusion among public and private delineators.

- We recommend the Corps consider publishing one new supplement or amendment to the 1987 manual for "problem wetland areas" within the contiguous United States with regional emphasis. We understand that Alaska and the Pacific Islands may require stand-alone supplements.

Specific Comments:

- **In the draft Arid West manual, Section 1. Introduction, 3rd paragraph, it states "Where differences in the two documents occur, this Regional Supplement supersedes the Corps Manual for applications in the Arid West Region". Our response:**
  We recommend the Corps state in the Introduction portion of the Arid West Manual that the intention of the regional supplement is to clarify regional differences in wetland indicators but to not unintentionally move actual wetland boundaries.

- **In Section 3, Hydric Soil Indicators, Observe and Document the Soil, 6th paragraph, it states that "Unless otherwise indicated, all mineral layers above any of the indicators, must have a dominant chroma of 2 or less, or the layer(s) with dominant chroma or more than 2 must be less than 6 inches (15cm) thick to meet any hydric soil indicator. Our response:**
  We recommend this apply only to normal circumstances and not atypical situations.

- **In Section 5, <u>Difficult Wetland Situations in the Arid West, Problematic Hydric Soils, Soils With Faint or No Indicators</u>, #3, #4, and #5 adds a condition that these soils should be considered hydric if they are ponded, flooded, or saturated for greater than or equal to 14 consecutive days during the growing season in most years based on actual hydrologic observation or data and not on estimated soil properties. Our response:**
  The criteria for hydric soils in 1987 manual states that the area must be saturated, flooded, or ponded for 7 consecutive days to be hydric. We recommend that the Arid West manual maintain 7 days as the standard because of the extremely ephemeral nature of many seasonal wetlands in the arid west, and to not reduce the boundary of wetlands in the arid west that currently exist under the 1987 manual.

- In Appendix A (Wetland Determination Data Form), under <u>Soils</u>, it is proposed to eliminate space for Map Unit Name, Taxonomy, Drainage Class, and, (under <u>Hydric Soil Indicators</u>) "Listed on Hydric Soils List". We recommend these be retained because this information helps to corroborate findings in the actual soil profile description.

- We recommend that Section F, Atypical Situations in the 1987 Corps Manual should not be modified for the Arid West region.

- We recommend a workable process be established whereby the Arid West Manual can be efficiently modified as new scientific information becomes available.

- We look forward to participating in the field testing of any Draft Supplement to the Corps of Engineers Wetland Delineation Manual. We understand the field testing team will be comprised of interagency, interdisciplinary teams including representatives from EPA regions, Corps Districts, NRCS, and U.S. Fish and Wildlife Service.

Thank you for the opportunity to comment on the draft document and participate in the process. If you have any questions regarding these comments please call Jim Herrington at 254-774-6042.

Sincerely

Sharon Fancy Parrish */s/*

Chief, Marine & Wetlands

cc: Tim Landers, EPA Wetlands Division, Washington, D.C.
Jim Wood, Albuquerque District, COE
Ken Laterza, Fort Worth District, COE

Review of the Draft Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Supplement)

Prepared by:

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Introduction

Because of time-constraints imposed by other projects that I am working on, I have been unable to conduct a paragraph-by-paragraph review and critique of the Regional Supplement to the Corps of Engineers (COE) Wetland Delineation Manual: Arid West Region (Supplement) draft. Instead I have chosen to concentrate on several areas of the document, which I believe, are technically flawed, change, rather than supplement the 1987 Delineation Manual (Environmental Laboratory 1987 and herein simply referred to as the "1987 Manual") and/or violate the Administrative Procedures Act (APA), the 1992 Energy and Water Development Appropriations Act (1992 Appropriations Act), the Data Quality Act and the Clean Water Act (CWA).

I have drawn my comments in part from other documents that I have produced over the last decade or so. Some of the examples that I use are based upon data that were derived from research-like studies conducted for reports used in court cases. Such reports often contain the best, applied information on delineation that is being funded today. In particular I will be using examples derived from property in Santa Maria, California, where four years of data were collected by both the property owner's and the federal government's consultants. While there were numerous other authors and reviewers of these reports, I, alone am responsible for the use of the information and formulation of these comments that follow.

Because I have not reviewed the Supplement line-by-line, I do not comment on some parts of it. You should not assume that I necessarily concur with the content of those parts, which I do not mention, simply that I restricted my time and efforts to those parts of the Supplement, which I do reference. I believe that the entire document needs to be given a very serious and critical review by those who work in the field frequently performing complete delineations (not simply reviewing delineations that others perform). Thus, I recommend that before any supplement is submitted to the *Federal Register* for APA review, that a team of active, experienced delineators, including those from the private sector, be charged with doing a critical review of the material to ensure that the final product that is published in the *Federal Register* complies with the Data Quality Act.

Throughout the Supplement the term used to indicate the opposite of "wetland" most often is "upland." While we all make this symantec mistake from time to time, a technical publication should be correct. The opposite of wetland is "nonwetland;" the opposite of upland is "lowland." Wetlands can exist in both uplands and lowlands.

Policy Issues

Implementation of the Supplement will, I believe, result in many areas being called wetlands that technically are not. It will have the effect of reinstituting many of the problems of the Federal Manual for Identifying and Delineation Jurisdictional Wetlands (Federal Interagency Committee for Wetland Delineation 1989), hereafter referred to as the 1989 Manual, which was specifically prohibited by Congress unless brought into compliance with the APA – which it never was.

The 1992 Energy and Water Development Appropriations Act (1992 Appropriations Act) prohibited the use of the 1989 Manual "**AND ANY SUBSEQUENT MANUAL NOT ADOPTED IN ACCORDANCE WITH THE REQUIREMENTS FOR NOTICE AND PUBLIC COMMENT OF THE RULE-MAKING PROCESS OF THE ADMINISTRATIVE PROCEDURES ACT**" [emphasis added]. Examination of the Congressional record from July 9, 1991, when Senator Johnson amended the proposed Appropriation Act, reveals that the Senate was under the mistaken impression that the 1987 Manual had gone through the APA – which it had not:

> In 1987, a manual was adopted setting forth definitions of what was a wetland and what was not, and providing in effect for some discretion in the administration of that program. That 1987 manual was adopted in accordance with the Administrative Procedure Act, which is to say, public hearings, notice, the right to make comments, the right in effect for citizens to be heard. [Congressional Record *Energy and Water Development Appropriations, Fiscal Year 1992* (Senate - July 09, 1991)].

When the 1987 manual was approved for distribution, it was not mandatory that districts use it. Some did and some did not. It was truly optional technical guidance. It did not go through APA, nor do I believe that it needed to. It was just like hundreds of other Technical Reports that the COE has and continues to put out. Para 4 of Regulatory Guidance Letter (RGL) 88-3, dated 4 April 1988, entitled *Wetland Jurisdictional Determinations* (JD) specifically stated that "[T]he first step is for the district to determine which method(s) of delineation will be accepted." This guidance was issued AFTER the 1987 Manual was released and certainly indicates that what delineation method or methods used was a district decision.

By *Memorandum of Agreement Between the Department of the Army and the Environmental Protection Agency concerning the Determination of the Geographic Jurisdiction of the Section 404 Program and the Application of the Exemptions under Section 404(f) of the Clean Water Act*, dated January 19, 1989, use of the 1989 Manual, as well as "EPA Guidance on isolated waters, and other guidance, interpretations, and regulations issued by EPA to clarify EPA positions on geographic jurisdiction and exemptions" became mandatory on the Corps of Engineers. At that point, use of the 1987 Manual, which was nothing more than one of many technical reports, was moot.

In a Fact Sheet subject *Wetland Delineation Manual Revisions*, dated 10 May 1991, CECW-OR (COE regulatory headquarters) wrote:

> The Corps put out a Manual in 1987 for optional use by the Districts. Until March 1989, the date of adoption of the Federal Manual for Identifying and Delineating Jurisdictional Wetlands, each Corps District was free to identify wetlands in any way they determined appropriate – under the definition in the regulations. ... On January 10, 1989, the four Federal agencies adopted the [sic. 1989] Manual, and it was implemented on March 20, 1989. The Manual describes the mandatory technical criteria, field indicators, and other sources of information necessary to make consistent wetland jurisdictional determinations. [Emphasis as presented in original]

On August 14, 1991, The EPA, DOD, DOA and DOI, issued a proposed rule in the Federal Register entitled: *1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands; Proposed Revisions* (56 FR 40446-40479). The following statement was made in this rule-making:

> The position that this Manual is a technical guidance document which is not required by law to go through Administrative Procedure Act (APA) legislative rulemaking procedures has been upheld with respect to the 1989 wetlands delineation manual in *Hobbs v. United States,* 32 Env't Rep. Cas.(BNA) 2091 (E.D. Va. 1990), *appeal pending*, No. 90-1861 (4th Cir.). Nonetheless, the agencies believe that it would be appropriate and in the public interest to include parts of the final manual in the Code of Federal Regulations. When the agencies determine what portions of the manual that may be promulgated as a legislative rule, they will provide notice of specific proposed regulatory language in the *Federal Register* at least 30 days prior to the end of the public comment period. ... [56 FR 40446].

While there might have been some doubt as to Congress's intent with regard to delineation manuals and APA from the *Congressional Record*, the provisions of the Appropriations Act made if very clear that all manuals had to go thru APA. The only use of the 1987 Manual that Congress endorsed in the Appropriations Act was for ongoing enforcement actions and permit applications that were on hand but not finalized. Even to the extent that Congress authorized the use of the 1987 Manual in these two limited situations, it did so under the mistaken notion that the 1987 Manual had undergone APA process.

Thus, I believe that a strong argument can be made that before the Corps made the 1987 Manual mandatory on August 27, 1991, it should have gone through the APA process. Certainly, the Online version of the 1987 Manual (which mischaracterizes guidance of COE headquarters dated October 7, 1991 and March 6, 1992) and which has been the genesis of the "at least 5 percent of the growing season" position on wetland hydrology that EPA enforces as an absolute threshold and DOJ has used repeatedly in court cases, is a major change from the 1987 Manual and should have been subjected to APA process.

Congress specifically required all manuals adopted subsequent to the 1989 Manual to follow APA process. 1987 Manual was not mandatory before August 23, 1991, was just one of a number of delineation procedures in effect at the time and should have been subjected to APA.

The 1987 Manual was not expounding upon or clarifying an existing rule because there was no rule on what constituted a substantial portion of COE jurisdiction. Each time that the COE has modified its definition of OHWM, which contains interpretation, it has gone thru the APA process.

Through the back door, the Supplement attempts to institutionalize a wetland hydrology "Standard" that is inconsistent with the plain language of the 1987 Manual. It does so by referencing a technical publication written by COE staff (USACE 2005) in the very last paragraph of the supplement:

> This standard calls for =14 consecutive days of flooding, ponding, or water table =12 inches (30 cm) below the soil surface during the growing season at a minimum frequency of 5 years in 10 (=50% probability). An area that meets this hydrologic standard and contains hydric soils and hydrophytic vegetation is a wetland [Chapter 5, Procedure 3 (g), P. 95].

There is no doubt that the Technical Note (USACE 2005) establishes a standard in the same sense as water quality standards. The Technical Note states:

> The Corps Manual discusses wetland hydrology in general, but does not provide a wetland hydrology criterion suitable for use in interpreting monitoring well data. The standard given above is based on recommendations by the National Academy of Sciences (National Research Council 1995). By requiring a water table within 12 in. of the surface, this standard ensures that saturation by free water or the capillary fringe occurs within the "major portion of the root zone" described in the Manual. A 14-day minimum duration standard is assumed to apply nationwide unless Corps Districts have adopted a different standard at the local or regional level. The Corps Manual addresses the need for long-term data (10 or more years) in analyses of stream-gauge data but does not consider the use of short-term data in wetland determinations, nor does it address the frequency issue in relation to water-table monitoring. This Technical Standard allows the use of short-term monitoring data to address the frequency requirement for wetland hydrology, if the normality of rainfall is considered.

A number of problems exist with this new "Standard." First, is the fact that neither the Supplement nor the Technical Note (USACE 2005) that is the basis for the Standard has been subjected to the APA. Aside from the fact that the APA itself requires compliance, the 1992 Appropriations Act required that any delineation manual (and, therefore, supplements to manuals) be subjected to the APA before it can be adopted.

The new hydrology Standard is every bit as regulatory on the public as any water quality standard. The "Standards" that the EPA promulgates go through APA rulemaking. For example:

1. Sec. 403 Ocean Discharge Guidelines through APA rulemaking (45 FR 65952-65954, October 3, 1980);

2. 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Materials (45 FR 85336 – 85357, Dec 24, 1980);

3. 404(b)(1) Testing Requirements for the Specification of Disposal Sites for Dredged or Fill Material (45 FR 85360 – 85367, Dec 24, 1980);

4. Criteria for the Evaluation of Permit Applications for Ocean Dumping of Materials (40 CFR Chp. 1 Part 227); and

5. *1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands; Proposed Revisions* (56 FR 40446-40479, August 14, 1991) discussed above.

The Department of Agriculture has subjected the following technical procedures to APA rulemaking and its wetland procedures are all codified:

1. 7 CFR Part 12 Highly erodable land and Wetland Conservation; Final Rule and Notice of Finding of No Significant Impact (52 FR 35194 – 35208, 17 September 1987)

2. Title 7: Agriculture: Part 12 - Highly erodableland and wetland conservation: Subpart C, Wetland Conservation.

Department of Energy has subjected the following technical procedures to APA rulemaking and its wetland procedures are codified:

Federal Register: August 27, 2003 (Volume 68, Number 166)], [Rules and Regulations] [Page 51429-51436]. Compliance With Floodplain and Wetland Environmental Review Requirements. Final rule.

Many more similar citations exist. I think it is safe to say that the Section 404 wetland delineation requirements appear to be the only program in the federal government that has the direct effect of regulating private property and/or activities that hasn't gone thru APA rulemaking.

Second, the Technical Note promulgating the regulatory hydrology Standard seems to recognize the well established concept that capillary rise is unlikely to raise the zone of tension saturation much more than an inch or two above the water table (NRC 1995, Richardson and Vepraskas 2000). Nevertheless, a Standard has been promulgated by Technical Note and essentially will be codified by Supplement that maintains that a water table 12 inches below the soils surface for 14 days every 730 days is adequate to assert that wetland hydrology is present and exert federal control over private lands and activities.

The hydrology Standard moves the COE into the realm of regulating ground water. Ground water is not within the purview of the CWA – it is under the authority of the Safe Drinking Water Act. I have heard the proponents of the "–12-inch" Standard argue that during heavy rainfall events, we can assume that the water table reaches the surface at least instantaneously. Just as the concept that a peak flow during a storm could constitute the OHWM is fallacious, the undemonstrated concept that in all cases (or in most cases) the water table reaches the surface during a storm with a 2-year recurrence frequency, at least instantaneously, is both technically

indefensible and contrary to the policy concepts established by the COE under Section 404. It is in essence the concept established by the 1989 Manual, which Congress specifically rejected.

Third, the hydrology Standard is a change from the 1987 Manual – not a supplement. While the 1987 Manual (Environmental Laboratory 1987) only provides "Technical Guidelines" not standards or criteria (other than the NTCHS soils criteria), it contains numerous statements that clarifying to a degree what constitutes wetland hydrology including:

> The term 'wetland hydrology' encompasses all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season. ... Such characteristics are usually present in areas that are inundated or have soils that are saturated to the surface for sufficient duration to develop hydric soils and support vegetation typically adapted for life in periodically anaerobic soil conditions" [p.34]; and,
>
> The following definition, diagnostic environmental characteristics, and technical approach comprise a guideline for the identification and delineation of wetlands: Diagnostic environmental characteristics:
>
> > Hydrology. The area is inundated or saturated either permanently or periodically at mean water depths < 6.6 ft. or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation [p.9].

Although the length of time that an area must be inundated or saturated to the surface can vary according to the hydrological/soil moisture regime, the 1987 Manual provides guidance as to the duration of saturation required for a site to have wetlands hydrology at Table 5 (p. 30, Environemental Laboratory 1987). In summary, Table 5 indicates that areas that are saturated more than 12.5 percent of the growing season have wetland hydrology while those that are saturated for less than 5 percent of the growing season do not. It further states that many areas that are saturated between 5 and 12.5 percent of the growing season are not wetlands.

The term 'Duration (inundation/soil saturation)' is defined as:

> The length of time during which water stands at or above the soil surface (inundation), or during which the soil is saturated. As used herein, duration refers to a period during the growing season [p. A4].

On October 7, 1991, Corps headquarters issued Questions and Answers on 1987 Corps of Engineers Manual (Studt 1991) to further clarify the concept. The answer to Question 8 in pertinent part states:

> Generally speaking, areas which are seasonally inundated and/or saturated to the surface for more than 12.5 % of the growing season, are wetlands. Areas saturated to the surface between 5% and 12.5% of the growing season are sometimes wetlands and sometimes uplands. Areas saturated to the surface for less than 5% of the growing season are nonwetlands. ... If an area is only saturated to the surface for a period of between 5% and 12.5% of the growing season and no clear indicators of wetland hydrology exist (i.e.,

> recorded or field data; also see answer #7 above), then the vegetation test should be critically reviewed. ...The actual number of days an area is inundated and/or saturated to the surface for an area to be called a wetland varies [p. 4].

Williams (1992) provided almost identical guidance. Where is the problem in understanding "to the surface?" Twelve inches below the surface is not "to the surface." Instantaneous saturation from water table to the surface during a heavy storm is not "to the surface between 5 and 12.5% of the growing season." It seems likely that if a Major General of the U.S. Army stated "to the surface" he didn't mean 12-inches below the surface. Major Generals are vastly more intelligent than that.

The new hydrology Standard is not in compliance with the 1987 Manual, nor with COE guidance (Studt 1991, Williams 1992). Providing that the wetland hydrology threshold is 14 days with the water table 12 inches below the surface every other year is a change from the 1987 Manual – not supplemental information. Similar proposed changes in process were the subject of rancorous debate in 1991, as a result of publication in the *Federal Register*.

Finally, from a technical standpoint, it has never been demonstrated that water at 12 inches below the surface for 14 days out of 730 would produce a wetland let alone anything that any reasonable person would deem navigable water. I have never seen on the landscape nor seen any published report identifying where the equivalent of this hydrology standard has produced hydric soils and a hydrophytic plant community. If this standard is technically valid, it should be demonstrable that there are landscape features that only have hydrology at 12 inches below the surface for 14 days out of 730 and have hydric soils and hydrophytic plant communities. While it may be possible to find features that have been partially drained with these characteristics, it is incumbent upon the federal government to identify, natural, unaltered landscape features that satisfy this standard to validate it. I know of no mitigation construction project where the COE or EPA has agreed to such a standard for success criteria. Of course they wouldn't, because the plants growing on such a landscape would be nonwetland, invasive weeds – it wouldn't be a wetland.

As I will discuss in more detail below, there is a substantial body of literature on subirrigation that raises question as to the technical validity of the hydrology standard. For example, Skaggs (1994) using a computer simulation (DRAINMOD as recommended on p. 94 of the Supplement) for three soils in North Carolina, found that corn (*Zea maize*), a species rated UPL by omission from the *National List of Plant Species that Occur in Wetlands* (Reed 1988) and noted for its susceptibility to inundation and near-surface saturation, can be produced profitably on lands that have water tables at 30 cm for 14 days during the growing season.

Pierce et al. (1999) studied corn grown in mesocosms at constant water table depths (5-, 10-, 15-, 23-cm below the land surface and the control which was routinely watered but not in contact with a water table). As would be expected for nonwetland plants, corn seeds did not germinate in the treatment containers with the water table at the surface. The rate of germination was significantly depressed (57.5%) in the 5-cm treatment containers and slightly though not significantly depressed (85.0%) in the 10-cm treatment. Germination in the 15, and 23 cm treatments was the same as that in the controls. From day 29 to 43 vegetative growth was

statistically less than the controls in the 5 and 10-cm treatments. By day 55, only the 5-cm treatment was statistically less than the controls. By harvest, long-term vegetative growth rates of both the 5 and 10-cm treatments were statistically comparable to the control while the 15, 20 and 23-cm treatments had significantly greater growth than the controls. These growth rates were found for corn growing with a water table within 12 inches, not just for 14 days, but for the entire growing season. These data indicate that the water table needs to be in the top 2 – 4 inches to adversely effect nonwetland plant growth.

The hydrology Standard is deficient both from a technical and policy standpoint and may be illegal. If the COE seriously believes that the hydrology Standard identified in the Supplement is technically valid and consistent with the CWA, then it must promulgate and codify it through the standard APA process.

Vegetation

The supplement identifies three indicators for hydrophytic vegetation:

> **Indicator 1**: Dominance test
> **Description**: More than 50% of the dominant plant species across all strata are rated OBL, FACW, or FAC. [p. 15]
>
> **Indicator 2**: Prevalence index
> **Description**: The prevalence index is 3.0. [P.17]
>
> **Indicator 3**: Morphological adaptations
> **Description**: Morphological adaptations for life in wetlands are present on FACU or UPL plant species. The plant community passes either the dominance test (Indicator 1) or the prevalence index (Indicator 2) after reconsideration of the indicator status of certain individual plants that exhibit such adaptations. [p. 19]

The fact is that because the plant list is as subjective as it is and that so many common plants are rated FAC, the Dominance Test indicator is very insensitive – i.e., the vegetation is liable to be identified as hydrophytic on both sides of the wetland boundary line. Tarutis and Klemow (1999) reached the same conclusion. While the Prevalence Index (PI, weighted averages approach) has major limitations that are not identified in the Supplement (which I will address below) it is a sound technical process – albeit fairly time consuming and requiring the practitioner to really know plants.

not the protocol

A simplified version of weighted averages (WA) is FAC-neutral. This is identified in the 1987 Manual as a vegetation alternative to the "more than 50% " indicator (p. 23). It is simple to perform and not as time-consuming as the PI and gives results that are similar to the PI. I have applied it for years on projects where actual ground-water data were collected with monitoring wells and have found that it is far more reliable than the Dominance Test indicator. Veneman (1999) reported similar results.

I recommend that you abandon entirely the Dominance Test indicator in the Supplement and replace it with FAC-neutral. If you choose not to do that then at least add the FAC-neutral approach as a reliable alternative to it and as an intermediate before going to the PI. As the Supplement now reads: "[T]his indicator is only applicable to wetland hydrology determinations" [p. 77], the FAC-neutral indicator is a secondary indicator of hydrology the delineator apparently is prohibited from using it for vegetation analyses, which not only is contrary to the 1987 Manual (p. 23, Environmental Laboratory 1987), but also contrary to sound, scientific information.

There are limitations on the PI that are not indicated in the Supplement. Wentworth, et al. (1988) found that a WA that is ≤ 2.0 had a high probability of indicating a wetland and that a WA between 2.0 and 2.5 had a good probability of indicating a wetland but that additional data on soils and hydrology are desirable. However, if the WA was between 2.5 and 3.5, the vegetation data are inadequate for designating a wetland and the additional data regarding soils and hydrology are mandatory. The WA value distribution on the nonwetland side of the analyses is exactly the same. The user has a need to know this limitation and the Indicator should not be set at PI ≤ 3.0.

Wakely and Lichvar (1997) also observed disagreements between the dominance ratios and PI and determined that the two methods do not necessarily produce equivalent results. Further, they indicate that additional, regional studies are necessary to determine which is the more reliable indicator of wetland conditions. Have those studies been conducted for the arid region? Where are the results? Do both indicators give consistent results? The Supplement will not advance the science or the process of wetland delineation if the two primary indicators of hydrophytic vegetation do not yield consistent and reliable results.

Soils

Biology doesn't change soil type

A4. Hydrogen Sulfide

Technical Description: A hydrogen sulfide (rotten egg) odor within 12 inches (30 cm) of the soil surface.

Applicable Subregions: Applicable throughout the Arid West Region (LRR B, C, and D).

User Notes: Any time the soil smells of hydrogen sulfide (rotten egg odor), sulfur is currently being reduced and the soil is definitely in an anaerobic state. In some soils, the odor is well pronounced; in others it is very fleeting as the gas dissipates rapidly. If in doubt, quickly open several small holes in the area of concern to determine if a hydrogen sulfide odor is really present. This indicator is most commonly found in areas that are permanently saturated or inundated.

The *User Notes* for Soils Indicator A4 is not technically accurate. The production of odiferous sulfur compounds is not limited to only waterlogged conditions. Perhaps the most common, non-saturated production and release of sulfur compounds is associated with volcanic fumeroles. There also are less cataclysmic means of sulfidic odor production in a non waterlogged soil than

volcanoes. None of these alternative sources of sulfidic odors would indicate hydric soil conditions or wetlands.

Paul and Clark (1996) provided an extensive discussion on sulfur (S) in the natural environment. With regard to odiferous, gaseous compounds they stated in part:

> Gases such as hydrogen sulfide (H2S), carbon sulfide (CS2), carbonyl sulfide [(CH3)2S2)] enter the air through microbial transformations of both organic and inorganic S. [P. 301]
>
> The transformation of C-O-S, S-C-N and R-C-S compounds can proceed through both aerobic and anaerobic pathways (Figure 1) [pp. 304-305].
>
> Since serine sulfhydrase is reversible, it can also participate in the assimilation of S[sulfur]. Methionine can be degraded with the formation of the mercaptan (CH3SH) and NH3. This is an example of the production of odiferous volatile S compounds in nature [p. 306].
>
> Chemotrophic sulfur bacteria ... They can be subdivided into those growing at neutral pH and those forms that live at acidic pH values. The latter can use Fe2+ as an electron donor thus coupling S and Fe transformations [p. 308].
>
> Dissimilatory Reduction of Inorganic Sulfur ...The process known as respiratory, or dissimilatory, SO42- reduction is mediated by anaerobic, organotrophic organisms that use low molecular weight organic acids, alcohols and, often H2 as electron donors. These organisms are responsible for sulfide formation in waterlogged soils and sediments, they use SO42- and other forms of inorganic S as electron donors [p. 310].
>
> Sulfate-reducing bacteria are found over an extensive range of pH and salt concentrations, in saline lakes, evaporation beds, deep-sea sediments and oil wells [p. 311].
>
> 4. Sulfur reduction in the geological past has produced the high concentrations of reduced S in oil and coal fields. Unless removed prior to or during combustion, this S leads to major pollution problems [p. 312].

Noxious odors attributable to hydrogen sulfide can also form in what would normally be an aerobic environment:

> An interaction between cyanobacteria (*Oscillatoria* spp. and a *Nostoc* sp.) with the sulfate-reducing bacterium Desulfovibrio desulfuricans forms a black S layer a few centimeters below the surface of high-sand golf greens. The development of the black layer is often accompanied by the noxious odor attributable to H2S, poor water movement, and death of the turf. Cyanobacteria tend to initiate the process by secretion of polysaccharides that impede water movement and provide conditions for growth and development of the sulfate-reducing bacteria in what would normally be an aerobic environment (Paul and Clark 1996).

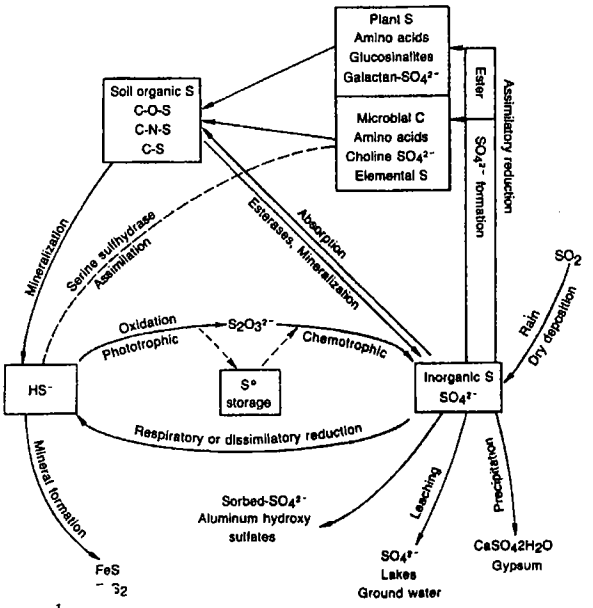

Figure 1. Sulfur (S) transformations in nature. Elemental sulfur is shown as a storage product, and the possibility of SO_4^{2-} sorption in certain soils is included.

A5. Stratified Layers

Technical Description: Several stratified layers starting within 6 inches (15 cm) of the soil surface. One or more of the layers has value 3 or less with chroma 1 or less and/or it is muck, mucky peat, peat, or mucky modified mineral texture. The remaining layers have chroma 2 or less.

Applicable Subregions: Applicable to LRR C.

User Notes: Use of this indicator may require assistance from a trained soil scientist with local experience. An undisturbed sample must be observed. Individual strata are dominantly less than 1 inch (2.5 cm) thick. A hand lens is an excellent tool to aid in the identification of this indicator. Many alluvial soils have stratified layers at greater depths; these are not hydric soils. Many alluvial soils have stratified layers at the required depths, but lack chroma 2 or less; these do not fit this indicator. Stratified Layers occur in any type soil material.

On any actively accreting soil, the delineator must take into account the nature of the parent material from which the soils are derived. Even if deposition of material takes place at intervals greater than a 2-year recurrence frequency, layering might not be the result of aquic conditions. Application of this indicator as written will result in arid alluvium being classified as hydric when it should not be.

Soils typically either form in place in which case the soils will have characteristics of the bedrock materials beneath the solum or they form at some distant location and are transported by alluvial, colluvial or aeolian processes to the location where they are found. Alluvial landscapes are common in the arid southwest. On such landscapes the soils are often the result of parent

materials transported from other locations. It is necessary, therefore, to consider the color of the parent material before assuming that low chroma matrices found on alluvium have developed *in situ* as the result of aquic conditions.

As an example, consider Orcutt Creek and it environs near Santa Maria, California. It is a naturally ephemeral channel that flows through several areas of alluvium and originally terminated (before European hydrologic modification at Guadalupe/Betteravia Depression. Flow in the Creek has been supplemented by irrigation tail waters for decades.

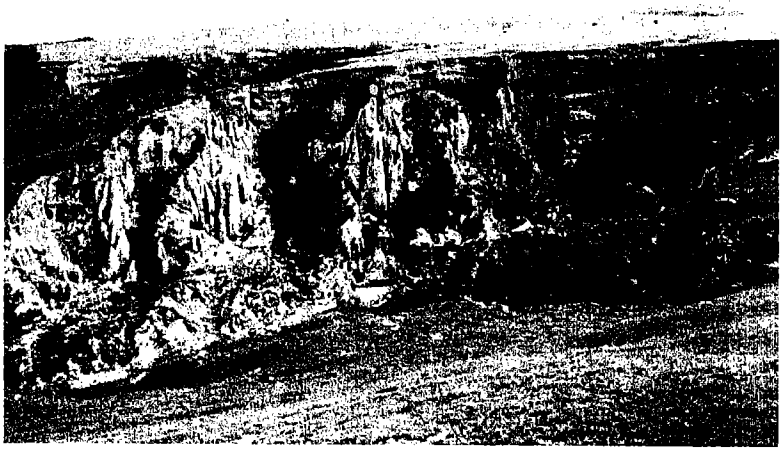

Figure 2. Erosion feature immediately upslope of the Orcutt Creek Valley, Santa Maria California.

As fluvial derived Entisols, Corralitos soils in the Orcutt Creek valley form from parent materials that are up slope of the location where they are found. In the case of the particular property studied along Orcutt Creek, they form from soils and underlying rock in the Eastern extent of the Casmalia Hills and to a lesser extent, the western end of the Solomon Hills that are within the Orcutt Creek watershed. Even casual observation of these hills is sufficient to understand that erosion has been and continues to be severe in many locations (see for example Figure 2).

In order to provide some insight into the nature of the parent materials from which the soils on one tract of valley floor adjoining Orcutt Creek originated, we examined the soil series for all the mapped soils to the south and south east of the property in the Casmalia Hills. A list of the soil map units identified is provided in Table X. The list has been sorted into three categories based upon the lowest chroma specified in one or more horizons and category was color coded: soils with a matrix chroma of 1 or less (blue); soils with a matrix chroma of 2 or less (red); and soils with a matrix chroma of 3 or greater (yellow). The distribution of the soils is depicted in Figure 3.

Examination of Figure 3 reveals that the soils on the north slope of the Casmalia Hills that are the source of alluvial, parent material for the soils that formed on the valley floor along Orcutt Creek are overwhelmingly composed of series that have one or more horizons that are either chroma 1 or chroma 2. In many cases, both chroma 1 and chroma 2 soils exist in the same series.

The following soil profile description is one of the soils on the north face of the Casmalia Hills (Figures 4 and 5) at an elevation approximately 300 feet above the Orcutt Creek valley floor.

Figure 3. Nonhydric soils with substantial horizons in the pedon that are chroma 1 or less are indicated in blue. Nonhydric soils with substantial horizons in the pedon that are chroma 2 are indicated in red. Nonhydric soils with substantial horizons in the pedon that are chroma 3 or higher are indicated in yellow. Base map from Shipman 1992.

Figure 4.

Figure 5.

DEPTH	SOIL DESCRIPTION
0-10 inches	10YR 4/3 Very fine Sandy Loam with no mottles
10-15 inches	10YR 6/3 very fine Sandy Loam
15-30 inches	10YR 3/2 Sandy Clay Loam with few areas of 10YR 3/1 and 10YR 4/3 Sandy Loam
30+ inches	10YR 2/1 Silty Clay Loam

Note the dark characteristics of this alluvial-source material. From 15 to 30 inches below the surface it is a 10YR3/2 sandy clay loam. From 30 inches to at least 60 inches it is a 10YR2/1 silty clay loam. Both the colors and the textures of this soil can be found on the valley floor along Orcutt Creek.

Thus, it becomes obvious why so much of the soils on the valley floor are low chroma. It is not because the low chroma formed as a result of frequent ponding, flooding or saturation for long duration on the valley floor. Rather, it is because most of the alluvium that has been carried down Orcutt Creek and deposited on the valley floor is low chroma to begin with.

Table 1. Soil Map Units organized by matrix color as determined from Shipman (1972) and depicted in Figure 3.

Chroma 1 or less (Blue)

BnB2	Betteravia loamy sand, dark variant, 0 to 5 percent slopes, eroded
BnD2	Betteravia loamy sand, dark variant, 5 to 15 percent slopes, eroded
BoA2	Botella loam, 0 to 2 percent slopes, eroded
BoC	Botella loam, 2 to 9 percent slopes
BoD2	Botella loam, 9 to 15 percent slopes, eroded
BtC	Botella clay loam, 2 to 9 percent slopes
CwF	Crow Hill loam, 30 to 45 percent slopes
CwG	Crow Hill loam, 45 to 75 percent slopes
CwG3	Crow Hill loam, 15 to 75 percent slopes. severely eroded
EdA2	Elder sandy loam, 0 to 2 percent slopes, eroded
EdC2	Elder sandy loam, 2 to 9 percent slopes, eroded
EnC2	Elder shaly loam, 2 to 9 percent slopes, eroded
EnD2	Elder shaly loam, 9 to 15 percent slopes, eroded
LmG	Lopez shaly clay loam, 15 to 75 percent slopes
SmF	Santa Lucia shaly clay loam, 30 to 45 percent slopes
TdF	Terrace escarpments, loamy

Chroma 2 (Red)

ArD	Arnold sand, .5 to 15 percent slopes
ArF	Arnold sand, 15 to 45 percent slopes
ChF	Chamise shaly loam, 15 to 45 percent slopes
ChG	Chamise shaly loam, 45 to 75 percent slopes
CkF	Chamise clay loam, 30 to 45 percent slopes
CtA	Corralitos sand, 0 to 2 percent slopes
CtD	Corralitos sand, 9 to 15 percent slopes
CuA	Corralitos loamy sand, 0 to 2 percent slopes
CuC	Corralitos loamy sand, 2 to 9 percent slopes
CuD	Corralitos loamy sand, 9 to 15 percent slopes
GsF	Gazos clay loam, 30 to 45 percent slopes
RuG	Rough broken land
SfD	San Andreas-Tierra complex, 5 to 15 percent slopes
SfE	San Andreas-Tierra complex, 15 to 30 percent slopes
SfF3	San Andreas-Tierra complex, 9 to 45 percent slopes, severely eroded
SfG	San Andreas-Tierra complex, 30 to 75 percent slopes
TnC	Tierra sandy loam, 2 to 9 percent slopes
TnD2	Tierra sandy loam, 9 to 15 percent slopes, eroded
TrD	Tierra loam, 9 to 15 percent slopes
TrE2	Tierra loam, 15 to 30 percent slopes, eroded
TrE3	Tierra loam, 5 to 30 percent slopes, severely eroded

Table 1 (cont.). Soil Map Units organized by matrix color as determined from Shipman (1972) and depicted in Figure 3.

Chroma 3 and Higher (Yellow)

BmC	Betteravia loamy sand, 2 to 9 percent slopes
GaA2	Garey sandy loam, 0 to 2 percent slopes, eroded
GaC2	Garey sandy loam, 2 to 9 percent slopes, eroded
GmG	Gaviota sandy loam, 30 to 75 percent slopes
MaA	Marina sand, 0 to 2 percent slopes
MaE	Marina sand, 9 to 30 percent slopes
OcD	Oceano sand, 2 to 15 percent slopes
PnC	Pleasanton sandy loam, 2 to 9 percent slopes
Sh	Sandy alluvial land

The presence of redox concentrations alone in a soil are not adequate to conclude that the soil is hydric. The general rule that redox concentrations indicate the presence of hydric soils applies only when they are found in soils that have a low chroma (2 or less) matrix because of aquic conditions.

At the end of paragraph 44. f. "Soil colors" in the 1987 Manual, there is a *Caution,* which reads:

> Soils with significant coloration due to the nature of the parent material (e.g., red soils of the Red River Valley) may not exhibit the above characteristics. In such cases, this indicator cannot be used.

While the example given in the *Caution* is for a soil that may not change color and become low chroma even under frequent and prolonged inundation and/or saturation, it has long been recognized that there are soils derived from parent materials that inherently have low chromas (serpentine and gluaconitic parent materials are two common examples) and not because they are frequently ponded, flooded or saturated for long duration. The low chroma soils on the valley floor along Orcutt Creek are the result of alluvium that formed as Mollisols and Alfisols on the Casmalia Hills and was subsequently transported to and deposited on the valley floor during storm events. In such cases, the low chroma matrix of the soils cannot be relied upon to accurately identify them as hydric - color is not a reliable tool and a proper evaluation of hydrology is essential.

Hydrology

There is a long list of primary (and a few secondary) hydrology indicators presented in the Supplement (Table 4-1). Many of the hydrology indicators on the list are technically not defensible as primary indicators. Even if they were to be reduced to secondary indicators, the scope of the indicators is so broad that almost any landscape might end up with wetland

hydrology. For example, almost any soil will rut and form a "mud cast" if a heavy object is placed upon it when it has a high, though not saturated, water content. Thus, a herd of cattle, or elk or a pick-up truck traversing a landscape during or shortly following a heavy rainfall are likely to leave "mud casts." If the land is also naturally subirrigated, as many western valleys may be and the water table is from 12 to 24 inches below the land surface, wetland hydrology exists because there are two secondary indicators. This is too big of a reach and is not technically supportable.

Indicator: A3 – Saturation

> **Category**: Primary
>
> **General Description**: Visual observation of saturated or near-saturated conditions 12 inches (30 cm) below the soil surface as indicated by (1) glistening of water on soil ped faces and broken interior surfaces, or (2) release of pore water when the soil sample is gently shaken or squeezed. This indicator must be associated with an existing water table located immediately below the saturated zone.
>
> **Cautions and User Notes**: This indicator reflects saturated or near-saturated conditions, indicating that the soil sample was taken either below the water table or within the capillary fringe above the water table. Recent rainfall events and the proximity of the water table at the time of sampling should be considered in applying this indicator. Water glistening in soil cracks or on ped faces does not meet this indicator unless ped interiors are also saturated as indicated by glistening on broken interior surfaces (Figure 4-3). Gentle shaking is effective in releasing pore water mainly in coarse-textured soil materials. Shaking a sample in the palm of the hand produces free water by rearranging soil particles and collapsing water-filled voids between particles. Gentle squeezing is most effective in soils with high organic content.

"Near-saturated conditions" is a substantial change from all that has been held as indicative of wetland hydrology. The 1987 Manual defines the term "saturated soil conditions" which is taken directly from the definition of wetland (33 CFR 328.3b) as:

> A condition in which all easily drained voids (pores) between soil particles in the root zone are temporarily or permanently filled with water to the soil surface at pressures greater than atmospheric [page A11].

The water table is defined in the 1987 Manual as:

> The upper surface of ground water or that level below which the soil is saturated with water. It is at least 6 in. thick and persists in the soil for more than a few weeks [p. A14].

Heath (1983) defines water table as:

> The level in the saturated zone at which the pressure is equal to the atmospheric pressure

Heath defines the saturated zone as:

The subsurface zone in which all openings are full of water.

Vepraskas correctly observes:

> Because the capillary fringe above a water table contains soil water that has a pressure less than atmospheric pressure (the water is under a suction), horizons within the capillary fringe are technically not considered saturated for aquic conditions.

If the capillary fringe does not even satisfy the 1987 Manual definition of saturated soil conditions, how can "near-saturated conditions" satisfy it? Furthermore, how can anyone reliably determine that a soil is "near-saturated conditions" in the field? Delineators will be looking at moist soils, arbitrarily determine that they are "nearly saturated" enough and conclude that wetland hydrology is present. This is technically indefensible.

Both the shake test and the squeeze test were debunked decades ago. What is the technical basis for bringing them back as a primary indicator? As described in the *User Note*, shaking causes liquefaction and collapses the pore space by altering the structure of the soil. Thus, water can be forced to the surface when the soil is not saturated although it may be near enough to saturation (since near is not defined) to satisfy this technically indefensible indicator.

Squeezing is just as bogus. Organic soils are just like sponges. If we put a sponge in water to saturate and then squeeze it, water will run out. If the sponge is then squeezed again more water will run out. The harder you squeeze each time, the more water will run out. After the first squeeze, however, the sponge is no longer saturated. This is technically indefensible.

If you want to reinstate the squeeze test then require it also for clay-rich soils. If you can't squeeze water out of the clay then it is not saturated. Of course you can't squeeze water out of the clay – such an idea is absurd. So is using the squeeze test on organic soils.

Indicator: B12 – Crayfish burrows [p. 49]

> **Category**: Primary
>
> **General Description**: Presence of crayfish burrows, as indicated by openings in soft ground up to 2 inches (5 cm) in diameter, often surrounded by chimney-like mounds of excavated mud.
>
> **Cautions and User Notes**: Both native and introduced crayfishes can be found in the Arid West Region. Crayfish breathe with gills and require at least periodic contact with water. Crayfish burrows are usually found near streams and ponds where the seasonal high water table is at or near the surface (Figure 4-13).

Including crayfish burrows as a primary indicator is technically indefensible. The last sentence of the *User Note* is not necessarily accurate – especially regarding the elevation of the water table to the land surface. Pennack (1989) observes that chimney –building crayfish (e.g., *Procambarus*

sp.) can burrow from 5 cm to 3 m and the depth is partially determined by the depth of the water table. Chimney-building crayfish often occur in meadows that are never inundated, let alone rely on "Recent Inundation" as Group B [p.51] indicators supposedly represent. I have personally measured burrows in southwestern Indiana that were dry to at least 12 feet deep (depth of my tape). I have also observed chimneys in nonwetland lawns of houses in northeast Ohio whose basements never suffered water problems. If there are data that support the inclusion of crayfish burrows as a primary indicator then they must be presented or at least referenced.

Indicator: C1 – Hydrogen sulfide odor

Category: Primary

General Description: A hydrogen sulfide (rotten egg) odor within 12 inches (30 cm) of the soil surface.

Cautions and User Notes: To produce hydrogen sulfide, the soil must be saturated at the time of sampling and must have been saturated long enough to become highly reduced. These soils are often permanently saturated and anoxic at or near the surface. To apply this indicator, dig the soil pit no deeper than 12 inches to avoid release of hydrogen sulfide from deeper in the profile.

The assumptions made in this *User Note* are not necessarily true. See the discussion above for Hydric Soil Indicator A4 *Hydrogen Sulfide*.

Indicator: C2 – Oxidized rhizospheres along living roots

Category: Primary

General Description: This indicator consists of iron oxide coatings or plaques on the surfaces of living roots and/or iron oxide coatings or linings on soil pores immediately surrounding living roots within 12 inches (30 cm) of the soil surface.

Cautions and User Notes: Iron oxide coatings are the result of oxygen leakage from living roots into the surrounding anoxic soil, causing oxidation of ferrous iron present in the soil solution. They are evidence of saturated and reduced soil conditions during the plant's lifetime. Iron concentrations or plaques may form on the immediate root surface or may coat the soil pore adjacent to the root. In either case, the oxidized iron must be associated with living roots to indicate contemporary wet conditions. Care must be taken to distinguish iron oxide coatings from organic matter associated with plant roots. Viewing with a hand lens may help distinguish mineral from organic material. Iron coatings sometimes show concentric layers in cross section and may transfer iron stains to the fingers when rubbed.

Features that are typically referred to by soil scientists as "pore linings", oxidized rhizospheres can form in certain situations where reduced iron and/or manganese is present in the soil solution in the vicinity of actively metabolizing plants. Since we typically associate "oxidized rhizospheres" with red ochre channels, we will simply refer to the movement of iron (Fe),

recognizing that the same process may also be occurring for manganese. The oxidation-reduction state of soils is generally measured as a millivolt (mV) potential and expressed as Eh. Soils generally range from oxidized at +700 mV to highly reduced at - 300 mV. Fe is reduced at Eh values ranging from 300 to 100 mV (Parr 1969).

Vepraskas (1995) discusses the process of formation for both soil redox concentrations and pore linings. Both processes rely upon the presence of reduced Fe coming into contact with oxygen. In the former case, the oxygen is present because of aeration of the soil. It is thought that slow aeration tends to form soft masses while rapid aeration leads to the formation of concretions and/or nodules.

Reduced Fe is soluble in water and thus, can be transported through the interstitial pores in soil with the flow of water. The actively metabolizing roots of plants need oxygen for their metabolic functions. Oxygen can be supplied to roots either directly from the voids in aerated soils or through the stomata in leaves. One of the reasons that some plants may not be able to survive in waterlogged soils is because they can not move adequate amounts of oxygen to the roots from the leaves to maintain respiration. Reduced Fe is soluble in water and thus, can be transported through the interstitial pores in soil with the flow of water towards the roots.

As plants take in water at their roots, they draw dissolved, reduced Fe into the pores surrounding the roots. The roots cells having a semi-permeable membrane and only a limited need for iron as a micronutrient, typically impede the flow of Fe into the roots as the water passes through. Thus, the roots actively transport water and incidentally Fe and concentrate it in the pore linings surrounding them. At the same time, some of the oxygen being transported to the roots from the leaves is lost to the pores and oxidizes the Fe. The result is coated pore linings or in wetland terms "oxidized rhizospheres.

Wetland delineators are taught that reduced Fe can occur in soils that are waterlogged for extended periods. The presence of reduced Fe in soils, however, can occur for reasons other than saturation. The levels of soluble iron in soils are affected by mineralogy, both pH and Eh as well as the levels of organic matter and salts. Furthermore, reduction of Fe may begin in flood waters themselves.

Once formed, many of the precipitated, ferric compounds remain insoluble when reducing conditions return. Because of this coated pore linings can remain visible in a soil column long after the causal factors for formation are gone. It is for this reason that the COE requires that living roots be present in oxidized rhizospheres before they can be considered a secondary indicator of hydrology.

If the presence of oxidized rhizospheres in a soil is to be either the determinative factor on whether a soil is considered hydric and/or, is used as a primary hydrology indicator, then the fundamental questions become how long does it take to form oxidized rhizospheres and can they form in a soil that is not saturated?

A considerable amount of study was conducted in the 1960s and 1970s on the malfunction of drainage systems in the Imperial Valley of California (MacKenzie 1962, Meek et al. 1968, Grass

1969, and Grass, et al. 1973a & 1973b). Upon close examination it was found that the drainage tiles were clogged with mineral deposits of "black material consisting mainly of manganese oxide, the other was a reddish-colored material that resembled ordinary rust and was predominantly iron oxide" (MacKenzie 1962). Iron oxide is one of the principle constituents of high chroma, redox concentrations, including oxidized rhizospheres or pore linings.

Meek et al. (1968) conducted a field study using platinum electrodes and chemical analyses of interstitial water (soil solution) to assess the effects of organic matter, flooding time and temperature on the dissolution of iron and manganese at medium (mean = 19° C) and high (mean = 33° C) soil temperatures. While results were more dramatic at the high temperature, the medium temperature results were more characteristic of what might occur in the soils in the Santa Maria area.

Meek et al. (1968) found high concentrations of soluble Fe in the soil at 10 cm when organic matter was present after flood irrigation. They found that:

> The effects of organic matter, temperature, and the interaction between temperature and organic matter on soluble Fe and Mn were highly significant. **Flooding time did not significantly affect the values for Fe and Mn** [emphasis added].

They also found that amount of soluble Fe decreased with depth. They concluded that:

> The precipitation of iron and manganese, as the soil solution moves downward might be more logically explained by consideration of organic complexes and pH changes. ... According to Ponnamperuma, Martinez, and Loy (10)[sic: 1966], the pH of an alkaline soil decreases when flooded because of the production of CO_2. In this study the pH was probably lower at the 10-cm depth than at the 46-cm depth because large quantities of CO_2 were produced in the area where organic matter was applied. An increase in pH of the soil solution as it moves downward would result in precipitation of iron and manganese.

Grass et al. (1973a) found that:

> The Eh levels in the soil profile declined immediately after irrigation began and rose immediately after irrigation stopped indicating the importance of atmospheric oxygen to the oxidation-reduction status and, therefore, to the solubility of iron and manganese compounds.

In addition, they found that:

> Reducing conditions, as indicated by declining Eh values, became most favorable for dissolution of Mn and Fe near the soil surface. However, the concentrations of Mn^{2+} and Fe^{2+} were lowest near the surface, probably because of their leaching from this zone, and the shorter time of contact between soil solution and soil particles. The concentration of Fe^{2+} and Mn^{2+} were higher in the deeper horizons of the soil profile.

Vance (2002) quantifies the rapidity with which reduced iron can be oxidized. The time required for uncomplexed, reduced iron to undergo oxidation to the oxidized state is dependent on many

factors, the dominant being pH, temperature, dissolved oxygen level, and the presence of other soluble ions. The lower the pH and temperature the longer the time required for completion of the oxidation reaction. Increasing dissolved oxygen decreases the time required for oxidation. For example:

- At pH 7.0, 90% Fe^{+2} oxidation requires 1 hour at 21° C and ten hours at 5° C.
- At pH 8.0, 90% Fe^{+2} oxidation occurs in 30 seconds at 21° C,
- At pH 6.0 it requires 100 hours.

The critical dissolved oxygen concentration is 2 mg/L. Below that concentration, ferrous iron oxidation occurs slowly.

Lancashire (2003) discusses the chemical reactions that occur when both water and air are present. With oxygen as the oxidant, the cathodic reduction is described as:

$$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$$

The anodic oxidation reaction is:

$$2Fe \rightarrow 2Fe^{2+} + 4e^-$$

Overall the reaction is described by the formula:

$$2Fe + O_2 + 2H_2O \rightarrow 2Fe(OH)_2$$

With limited O_2, magnetite is formed (Fe_3O_4), otherwise the familiar red-brown $Fe_2O_3H_2O$ rust is found.

The formulae presented above can be described narratively as follows: When iron oxidizes, it surrenders electrons to oxygen to form iron oxide. If the electrons cannot be transferred from iron to oxygen, oxidation cannot occur because every oxidizing reaction must be accompanied by a reducing reaction. When dry iron is exposed to dry oxygen gas at 25° C, oxidation is rather slow because there is little opportunity for the electrons to flow from the metal to oxygen. Pure water is a rather poor conductor of electricity, although much better than dry air. But water contaminated with salt is an excellent conductor and increases the conductivity of the aqueous solution formed at the surface of the iron and enhances the rate of electrochemical reaction. As a result, iron exposed to salty water oxidizes much faster than it would if exposed to either dry air or pure water. This is one reason why iron or steel tend to corrode much more quickly when exposed to salt (such as that used to melt snow or ice on roads) or moist salty air near the ocean (Hoff 2004, Asato 2004).

The sandy sediments underlying the Orcutt Creek valley floor near Santa Maria, California are derived from the Casmalia Hills to the south and southeast and the mountains to the east. These complex geologic terrains yield sediments that contain magnetite. This mineral is one of the crystalline materials formed of iron oxides. It is, in fact, formed of a combination of ferrous iron, sometimes referred to as "plus 2" iron and ferric or "plus 3" iron. Because the magnetite

structure contains "plus 2" iron, it can, and does "rust." When magnetite grains are deposited on the Orcutt Valley floor with the sediments, mainly sand and silt, they are susceptible to oxidation or rusting. In fact, the situation is virtually ideal for such rusting to occur. The soils are quite saline, and are subjected to alternate wetting and drying. As with any "unoxidized" iron-containing material, a brief wetting with salty water followed by extended exposure to the atmosphere oxygen is enough to cause the "plus 2" iron in the magnetite to alter to "plus 3" iron combined with oxygen and produce the rusty colored mottles and pore-linings.

The conditions described by Meek et al. (1968) and Grass et al. (1973) are very similar to those on the Orcutt Creek valley floor. Consultants for both the property owner and the federal government found buried organic matter that predated any work conducted by the property owner and likely represent organic matter deposited and buried by infrequent flood events.

Periodically, the Orcutt Creek valley floor is flooded after an intense storm event. One such event occurred in March 2001. Oxidation around pore linings and as soft masses occurred very rapidly in freshly deposited alluvium that resulted from this extreme flood event. Oxidized rhizospheres were identified, by both the property owner's and the federal government's consultants, in the top four inches of newly deposited alluvial sediment within two weeks of the flood event that inundated the Orcutt Creek valley floor for no more than a few days. Less than two weeks later, no saturation or free water was found in the top 12 inches of the valley floor.

We also know that the soil at depth on the Orcutt Creek valley floor remains unsaturated even in the presence of flood water or shortly after the flood water recedes from the data collected by the NRCS. Ponnamperuma, Martinez, and Loy (1966) as discussed by Meek et al. (1968), found that water percolating downward will be exposed to continuously increasing pH which will oxidize the soluble iron and precipitate redox concentrations.

The presence of high concentrations of sodium in some of the soils on the Orcutt Creek valley floor can, by raising the pH to 8 to 10, cause iron to oxidize extremely fast.

Thus, the presence of redox concentrations in the highly reactive soils found on the valley floor, cannot be used as a reliable indicator of either hydric soils (i.e., frequent occurrences of reduced conditions for long or very long duration) or as a primary wetland hydrology indicator.

If we consider that these same redox processes have been occurring since the first layers of the alluvial material underlying the Orcutt Creek valley floor were deposited, and that with each new flood event, new layers of alluvium are deposited and the processes are repeated, then redox concentrations and oxidized rhizospheres could be present at almost any depth in the soils. The formation of redox concentrations and oxidized rhizospheres can occur so rapidly that they do not document the presence of inundation or saturation to the surface long enough or frequently enough during the growing season to constitute wetland hydrology.

Furthermore, since many of the upslope soils that provide the alluvial material deposited in the Orcutt Creek valley have low chroma matrices in the surface layers (see discussion of Hydric Soils Indicator A5 above), the classical identification of hydric soils based upon color (chroma 2 or less, value 4 or greater, with redox concentrations) cannot be relied upon. They constitute an

exception to the general, cookbook rule. The only definitive means of determining if soils in such an alluvial position meet the Hydric Soil Criteria (NTCHS 1995) and have aquic conditions consistent with Vepraskas (1995) and the findings of the National Research Council (1995) under such questionable conditions, is to verify the current presence of wetland hydrology.

The federal government's consultants reported fine, common redox concentrations of 7.5YR 4/6 at their Plot 2 and concluded the soil was non-hydric. Similarly, they reported fine to medium, common to many redox concentrations and oxidized rhizospheres at their Plot 21 and concluded that the soil was not hydric. The finding of oxidized root channels in the upper 12 inches of the soil profile at two sampling stations determined by EPA to be nonwetland indicates that factors other than frequent inundation and/or saturation to the surface for long duration are influencing development of oxidized root channels within 12 inches of the soil surface. Some possibly were imported, some possibly formed as the result of compaction or nitrogen-enrichment by cattle and equipment, and some might have formed in place, but are now relicts. The bottom line is that irrespective of their origin, oxidized rhizospheres are not a technically defensible determinant of wetland hydrology and certainly should not be a primary indicator.

Indicator: C3 – Dry-season water table [p. 73]

Category: Secondary

General Description: This indicator consists of the visual observation of the water table between 12 – 24 inches (30 – 60 cm) of the surface during the normal dry season or during a drier-than-normal year.

Cautions and User Notes: Due to normal seasonal fluctuations, water tables in wetlands often drop below 12 inches during the summer dry season. A water table between 12 – 24 inches during the dry season, or during an unusually dry year, indicates a normal wet-season water table within 12 inches. Sufficient time must be allowed for water to drain into a newly dug hole and to stabilize at the water-table level. The required time will vary depending upon soil texture. In some cases, the water table can be determined by examining the wall of the soil pit and identifying the upper level at which water is seeping into the pit. For an accurate determination of the water-table level, the soil pit, auger hole, or well should not penetrate any restrictive soil layer capable of perching water near the surface. Water tables in wetlands often drop well below 24 inches during dry periods. Therefore, a dry-season water table below 24 inches does not necessarily indicate a lack of wetland hydrology. See Chapter 5 (section on Wetlands that Periodically Lack Indicators of Wetland Hydrology) for determining average dry-season dates and drought periods.

While the Supplement addresses artificial irrigation, which certainly can be a major source of hydrology in the arid west, I found no discussion of natural sub-irrigation. This is a major technical deficiency. Many of the valleys in the arid west are composed of alluvial material because upslope erosion rates tend to be higher than in more densely vegetated landscapes. Soils often are course and there may be substantial differences in elevation between the valley floors and the surrounding hillsides. Such conditions are ideal for natural sub-irrigation of the valleys as the water moves downslope to discharge into streams.

Natural sub-irrigation describes a condition where the water table is far enough below the land surface that it does not inhibit plant growth, but near enough that the plant roots can obtain moisture on a continuing basis. In contrast, wetland hydrology inhibits plants that are intolerant of water-logged conditions.

F. S. Zazueta has summarized on the world wide web, some of the general information on sub-irrigation for an agricultural engineering course AGE 4233: Drainage and Hydraulic Structures (http://www.agen.ufl.edu/~fzazueta). From Luthin (1957) he reports:

> It has been found, in many parts of the world, that a plant can extract considerable amounts of the water from a high water table. In fact, even though the water table may be very deep, plants can still extract appreciable amounts of water. This has been shown in desert areas such as the Escalante Valley of Utah, where greasewood and similar species have been found to extract from water tables that are over twenty feet below the ground surface.

We should note that not all soils are good for supplying water from water tables to plant roots. In some soils the rate of capillary rise is so slow that the plants do not get enough water from the water table. This would be particularly true in heavy, dense clay soils where the rate of rise of water from the water table would not be equal to the rate of transpiration. In such soils deep drainage would certainly be the recommended practice. In some of the sandy loam soils the rate of capillary rise may be very rapid and in these soils it may be possible for the water table to supply an appreciable amount of the water that the plant needs.

D. Brink, University of Nebraska, Lincoln, provides extensive background course information for a Livestock Management on Range and Pasture course which addresses native plant communities for Nebraska grasslands (http://animalscience.unl.edu/451/course_info/range_sites.htm). While not all of the plants of Nebraska will be found in the geographic range covered by the Supplement, and vice versa, the general grassland community types are the same and are predominantly graminoids with many species rated FAC and some FACW.

Brink describes two categories of range that are based upon hydrologic requirements that correspond to the Orcutt Creek valley:

> **Subirrigated (Sb).** The site occurs on nearly level and very gently sloping areas of bottom lands and sandhill valleys. A few areas are in swales, stream terraces, and on foot slopes. The feature common to all soils in this site is a seasonal high water table that ranges from a depth of about 1.5 feet in wet years to a depth of 3.5 feet in dry years. The soil texture ranges from silt loam to fine sand. The principal plants in the original natural plant community were Big bluestem, Switchgrass, Prairie cordgrass, Indiangrass, and Little bluestem.
>
> **Saline Subirrigated (SS).** The site occurs on nearly level bottom lands of the North Platte River valley and smaller tributary stream valleys, in low areas of sandhill valleys. The feature common to all soils in this site is a seasonal high water table that ranges from a depth of 1.5 feet in wet years to a depth of 3.5 feet in dry years. The soils are moderately to very strongly affected by salinity and/or alkalinity. The soil texture ranges from silty clay loam to fine

sand. The principal plants in the original natural plant community were Alkali sacaton, Inland saltgrass, Switchgrass, Western wheatgrass, sedges and rushes.

One of the common native species of saline subirrigated range in both Nebraska and the arid west is inland saltgrass (*Distichlis spicata*) which is rate FACW* in Region 10, "NI" in Region 7 and FAC+ in Region 8 (Reed 1988). This species in the arid west more often appears to be present as a result of soil salt content than because wetland hydrology exists yet it is rated. In my example along Orcutt Creek, saltgrass was often a dominant (Appendix A) and sometime occurred almost as a monotypic stand even though four years of ground water monitoring demonstrated that wetland hydrology did not exist (Appendix B).

In addition, Brink also identifies water hemlock (*Cicuta* sp., OBL) as being one of the poisonous species that can occur in sub-irrigated range. In the Orcutt Creek valley, California, a related species poison hemlock (*Conium maculatum*, FACW) occurs.

Poisonous, sub-irrigated plants are likely to stay green well into the summer even with grazing cattle present. Along Orcutt Creek, the federal government's consultants identified "potential wetland" from the presence of green signatures during the summer on aerial photographs. As with intentionally irrigated lands, naturally subirrigated lands will stay green during dry months even when the water table never reaches close-enough to the surface to constitute wetland hydrology.

While natural sub-irrigation may occur frequently in the arid west, much of the literature discussing sub-irrigation is related to agricultural and turf-grass production. The NRCS (1997), discusses sub-irrigation systems in its National Engineering Handbook. NRCS Figure 6-25 provides a nomogram that relates the upward flow of water to the depth of the water table (from 0.5 to 6.5 ft deep) for various soil textural classes.

The depth of water levels that support agricultural crops provides additional insight into the effect of natural sub-irrigation on non-crop plant species that are found on the landscape. F. S. Zazueta selected sections from J.van Schilfgaarde (1975) who summarized the research of a number of authors on agricultural crop yields (http://www.agen.ufl.edu/~fzazueta/1read2.htm). In general, there is an increasing yield for a variety of crops as the water table is lowered from a near-surface stressful condition to an optimal depth. Yields then decrease as the water table is further lowered. Depending upon the texture of the soil and the particular crop, optimal yields were obtained when the water table ranged from 12 to 60 inches below the land surface. Evans and Skaggs (1996) observe that the optimal water table control level will depend upon the crop, stage of growth and soil type, however, most subirrigation water travels laterally in a zone three to six feet below the surface. A water table height of 12 to 24 inches below the surface for corn, and 24 to 30 inches for soybeans in the northern U.S. and Quebec has been found to be the optimum (www.drainage.org/ facsheets/fs2).

Early attempts at artificial sub-irrigation in arid and semi-arid regions failed in many cases because of soil salinization (Zimmer and Madramootoo). However, the University of California Davis (1999) discusses sub-irrigation of safflower in California at

(http://agric.ucdavis.edu/crops/oilseed/saff6soil) in saline soils. This article notes that water stored at relatively deep depths can be used by *Carthamus tinctorius*:

> Some of the highest yields experienced in California are obtained in locations where subirrigation from shallow groundwater occurs, such as the Sacramento-San Joaquin Delta and the Tulare Lake Basin, and on deep soils storing moisture to a depth of 6 to 12 feet (two to four m) from winter rainfall and/or pre- or early season irrigation. Where there is no shallow water table, soils must be capable of storing the majority of this water since in California's Mediterranean climate, rainfall usually ceases by the time the crop begins to grow. The low yields of some fields appear to be associated with the presence of continuously dry soil starting at a depth of three to four feet (1 to 1.1 m).
>
> The safflower crop may lower the water table from depths of three to four feet to as deep as ten feet over the length of the growing season. However, Safflower is not tolerant of water-logged conditions as would be found in a wetland: Standing water or saturated soil near the base of the plant can lead to infection with *Phytophthora*, a damaging root rot. During the summer when soil temperatures are high and safflower has developed a stem or has flowered, it can be killed quickly by standing water or waterlogged soil. Young plants may withstand temporary water logging if the soil temperature is 60° F (15.5° C) or lower.

Any plant, which is intolerant of water-logged soils, may still thrive and be lush green by extracting moisture from soils that do not have wetland hydrology but do have water tables that remain within one to five feet of the land surface for extended periods during the growing season. The user note for the secondary wetland hydrology indicator (C3, p. 73) is technically erroneous in its categorical assumption that landscapes with a water table between 12 and 24 inches below the surface during the dry season will have wetland hydrology during the wetter time of the year.

The data from Orcutt Valley (Appendix B) validates that during four years when precipitation was in the normal range, the water table at a number of sample locations was within the 12 to 24-inch range during the dry season and yet never exhibited wetland hydrology during the wetter portions of the year. For the COE to adopt this indicator in the Supplement, it needs to provide actual data from the arid west demonstrating that in the majority of cases, a landscape that has a water table between 12 and 24 inches below the surface during the dry season, has a water table near the surface for sufficient duration and frequency to constitute wetland hydrology. Otherwise, adoption of the indicator represents the legitimizing of an unfounded supposition.

Periods with Below Normal Rainfall [p.92]
Drought Years [p. 93]
Years with unusually Low Winter Snowpack [p. 93]

Glaringly absent from this section is the balancing discussion of "periods with above-normal rainfall," "flood years" and "years with unusually high winter snowpack." This again goes to the readily apparent bias in the Supplement towards determining that a feature is a wetland if at all possible. It is disingenuous and technically indefensible not to discuss the converse to "below normal precipitation" and its effect on interpretation of conditions at a site.

It is very important to interpret the precipitation record during the evaluation of a site to determine if wetland hydrology currently is, or was present before a disturbance. Such analyses are especially valuable for evaluating both empirically derived ground-water data and aerial photo interpretation. By considering precipitation for the entire period of record, it is possible to develop an understanding of how this system functions now and how it functioned during some prior period.

The local precipitation record is generally the longest record of any hydrologic parameter for a site, and properly interpreted, permits establishment of the hydrologic conditions over an extended period of time. By studying precipitation events that generate modern onsite conditions, and comparing them to the total record, it is possible to establish the length of time inundation or saturated soil conditions could have existed on the site over the long term. This is especially true when there are natural or anthropogenic drainage ways adjacent to the margins of valley floors that would remove excess water very rapidly, making site hydrology strongly dependent upon direct precipitation, and its interpretation governed by an understanding of the long-term rainfall record.

Beyond the direct evaluation of wetland hydrology, it is essential to assess precipitation data to properly interpret aerial photographs. Both long-term and short-term patterns in precipitation can affect the character of the landscape at the time of photography. It is crucial to examine antecedent daily precipitation levels, especially when attempting to assess the possibility of wetland hydrology on a site from the photographic record.

Allen and Malanchuck (2001) note:

> In studying rainfall and runoff patterns in dryland fluvial systems, the paucity of available data presents substantial problems. In addition, the high spatial and temporal variability in rainfall and runoff requires an especially long period of record for observations, which is not available for many dryland areas (Allen 1999; Graf 1988). Typically, reliable climate stations are widely separated and observations usually only cover a small fraction of existing arid regions. Due to the high spatial variability in rainfall patterns in arid areas, extrapolation of rainfall data even a short distance from a rainfall gage can result in substantial error (Graf 1988). Similar problems with data availability also complicate studies of discharge and water yield in dryland fluvial systems. Since jurisdictional determinations in dryland river systems will, by necessity, emphasize "ordinary" storm events, a relatively large climatic data set is required to capture an adequate number of flood events to analyze changes in discharge over time. As part of any jurisdictional determination for dryland river systems, limitations of the available climatic data must be recognized and extrapolation of recorded data should be minimized. Two good sources for rainfall, runoff and temperature data for arid and semi-arid areas in the South Pacific Division are the Western Regional Climate Center in Reno, Nevada and the United States Geological Survey.

Sprecher and Warne (2000) discuss the use of meteorlogical data within the context of wetland hydrology and place emphasis on the use of USDA, Natural Resources Conservation Service (NRCS) WETS Tables (NRCS 1997). The WETS tables report the 30th and 70th percentile excedence frequencies for monthly precipitation, which are considered to define the "range of

normal precipitation." The current WETS Tables are based upon the most recent NCDC 30-year data (1971-2000).

There is a fundamental problem with the NCDC determination of "normals" and, by extension, the formulation of the WETS tables. The problem is the use of an arithmetic mean as the basis for normalization. The arithmetic mean is a simple mathematical averaging of values and can be strongly influenced by a few large values that occur rarely. In contrast, for precipitation data, the median is an expression of the central tendency of a record over time (i.e., in more than half the years, one can expect XX inches of rain or more) and is the more-appropriate metric.

The median best relates to the hydrologic concept of "frequency" expressed in the 1987 Manual (Environmental Laboratory 1987):

> **Frequency (inundation or soil saturation)** - The periodicity of coverage of an area by surface water or soil saturation. It is usually expressed as the number of years (e.g. 50 years) the soil is inundated or saturated at least once each year during part of the growing season per 100 years or as a 1-, 2-, 5-year, etc., inundation frequency. [A5]
>
> **Frequently flooded** - A flooding class in which flooding is likely to occur often under normal weather conditions (more than 50-percent chance of flooding in any year or more than 50 times in 100 years). [A5]

In preparing its WETS tables, NRCS calculated arithmetic means and applied a statistical approach called a gamma distribution to the monthly precipitation records for the 30-year "normal" period defined by NCDC. In addition to limiting the review of the precipitation record to the most-recent 30-year period (thereby discounting the longer record that most directly relates to the fundamental concept of frequency) and using the arithmetic mean as the metric, gamma distribution statistics are severely restricted when valid zeros are present in a data set. In arid and semi-arid climes, total monthly precipitation of zero frequently occurs during the drier portion of each year. The effect of this mathematical dilemma is that the value for the normal "maximum" precipitation in a month with zero actual precipitation may be less than the mean precipitation for that month over the 30-year record.

Beyond the conceptual inappropriateness of using the mean for 30 years to describe the "normal" and the mathematical problem of dividing by valid zeros associated with the gamma distribution statistic to determine the maximum and minimum "range" around the normal, the approach taken in Sprecher and Warne (2000) to present and interpret whether a particular years precipitation record is "normal" is cumbersome and confusing. A more user-friendly evaluation tool for interpreting normality (assuming that the fundamental problems associated with using the mean instead of the median and a statistical approach that allows for valid zeros) is to plot the precipitation data as cumulative totals.

Figure 6 depicts normals from the WETS Tables for Santa Maria, California, which is the nearest WETS station to the example I have been using on Orcutt Creek, compared to the water-year, daily precipitation record for the Santa Maria Airport for 2000, all plotted as cumulative precipitation. Such a plot simplifies interpretation. The normal becomes a continuous line with

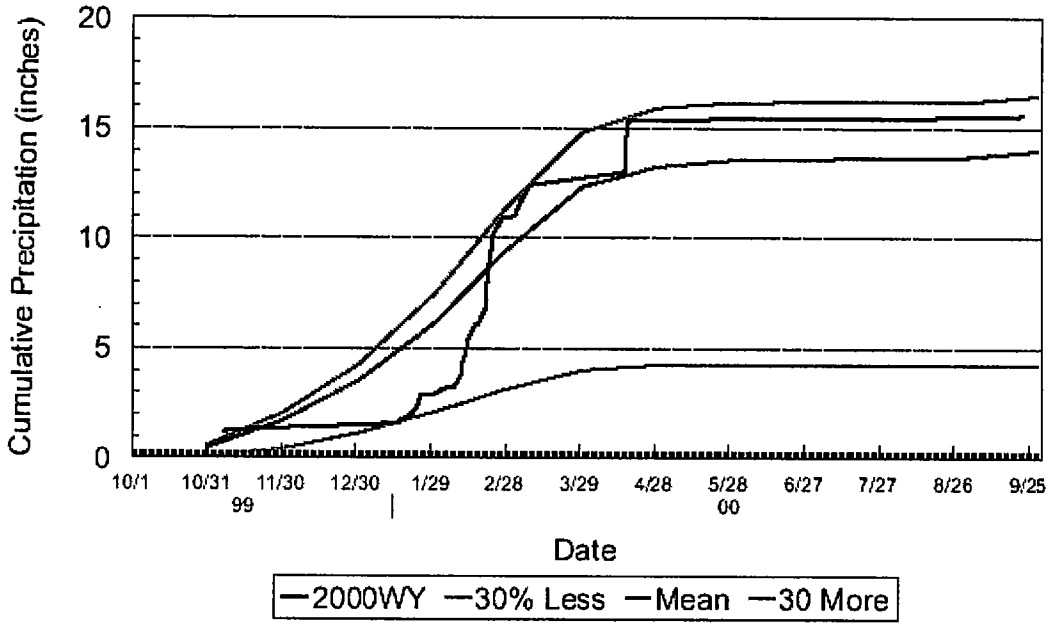

Figure 6. Comparison of the daily precipitation record for the 2000 water year with the normal (dark blue) and expected normal range (light blue).

the 30-percent probability ranges as bounding lines radiating from the origin at the beginning of the water year (October 1). When the particular annual record is superimposed upon the graph, it immediately becomes obvious whether the precipitation for that water year falls within the normal range or not. Because the graph uses cumulative data, precedent conditions are accounted for. By evaluating the slope of the annual record at any two points against the slope of the normal line, interpretation can easily be made concerning whether the precipitation for the time-period between the points was above (increased slope) or below (decreased slope) the normal.

Continuing with the Orcutt Creek, California example, the Following conditions existed. We were interested in reliably extrapolating ground-water well data collected between 2001 and 2004 to a longer period – the period of record for precipitation for the 100-year frequency interval specified in the 1987 Manual. The total precipitation at Station 380 (Santa Maria City) for the 2001, 2002 and 2003 water years was 18.22, 8.21 and 13.2 inches, respectively. The median annual precipitation for the period 1886-2004 is 12.64. The arithmetic mean for that period of time is 13.57 inches. The NCDC and WETS 1971-2000 "normal" is 14.00 inches. Thus, the long-term median was 1.36 inches or 9.7 percent lower than the WETS "normal" for the 30-year period – a major difference in an arid region.

If forced to use the WETS Table data to be consistent with Sprecher and Warne (2000) and thus, the Supplement, we can try to reconcile the differences. Since the median value is less than the current 30-year WETS normal, any value that is on the low side of normal but still within the range of normal based upon the WETS formula, will necessarily be within a range of normal surrounding the median.

The annual, cumulative precipitation records for Santa Maria from the 2000 through May of the 2004 Water Years are graphically presented in Figures 6-10. Each is compared to the range of normals as formulated from the WETS Table. Each year remains generally within the range of normals with a few brief periods during late fall and early winter where the annual precipitation exceeds the normal range. With the exception of the 2002 Water Year, the annual rainfall is close to the arithmetic mean during the early period of the spring when conditions are most likely to be conducive to wetland hydrology being present if they ever are. The 2002 Water Year (Figure 8) started "normal," but then precipitation was relatively low during the spring – although still within the normal range. Although low-normal relative to the mean, the spring 2002 precipitation necessarily will be closer to the median which is lower than the mean. We conclude that the ground-water observation data (Appendix B) collected during the period 2001 to 2004 is indicative of long-term conditions since the rainfall events recorded at the Santa Maria ARPT WSO during this period, have been within the range of "normal" precipitation.

General Conclusions

There is some useful information in the Supplement. However, it is fraught with erroneous and misleading information, most of which is not substantiated by any sort of documentation. Furthermore, an overall reading of the Supplement suggests that the fundamental purpose was not to advance the science of wetland delineation in the arid west. Rather, the purpose appears to be that of legitimizing unsupported concepts that have been used from time to time to call mesic

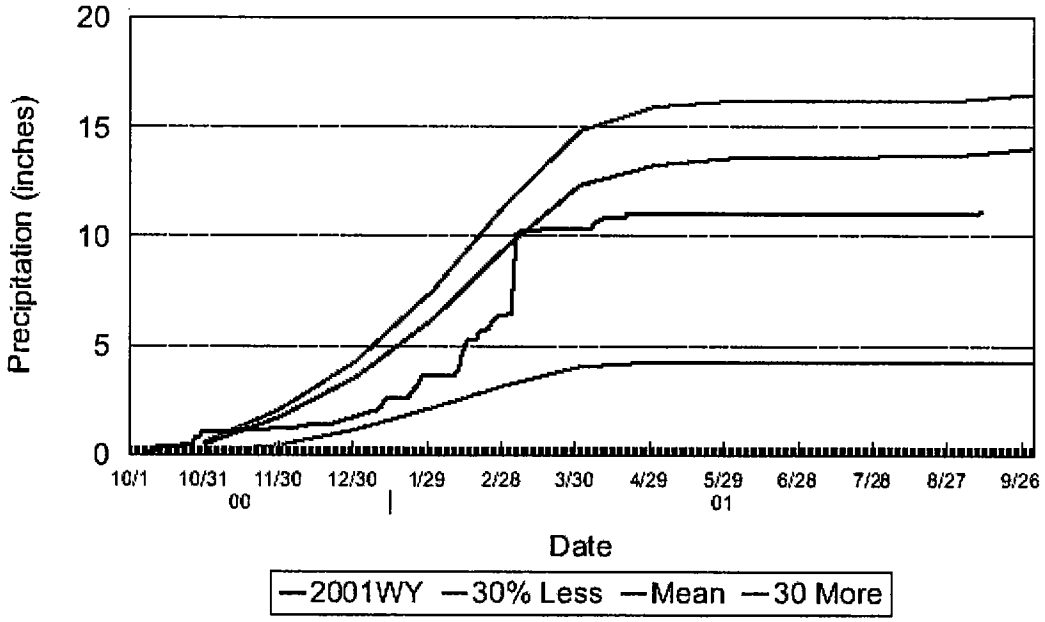

Figure 7. Comparison of the daily precipitation record for the 2001 water year with the normal (dark blue) and expected normal range (light blue).

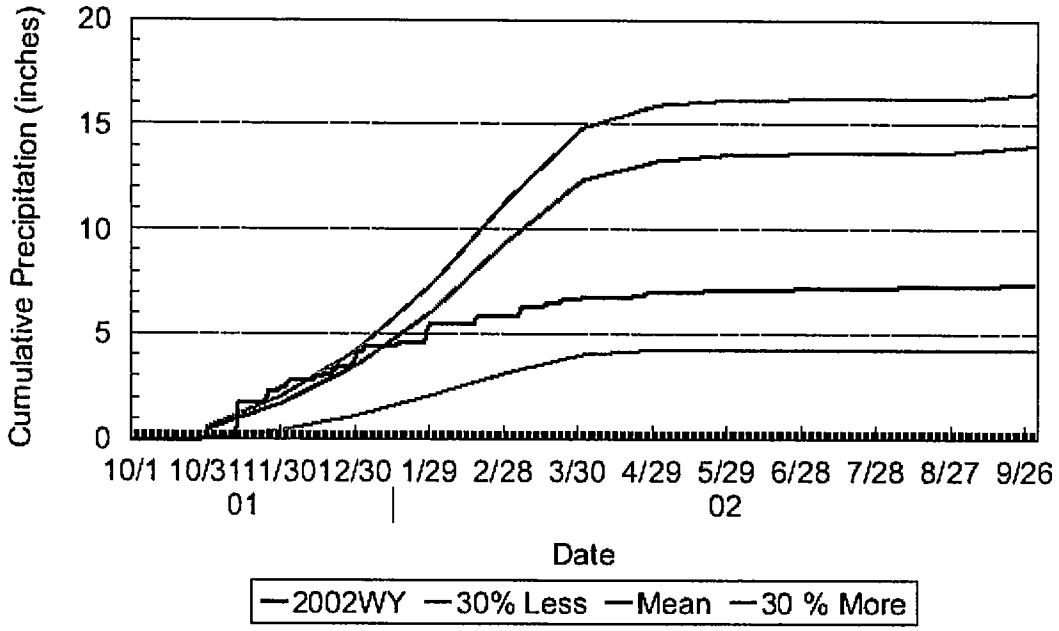

Figure 8. Comparison of the daily precipitation record for the 2002 water year with the normal (dark blue) and expected normal range (light blue).

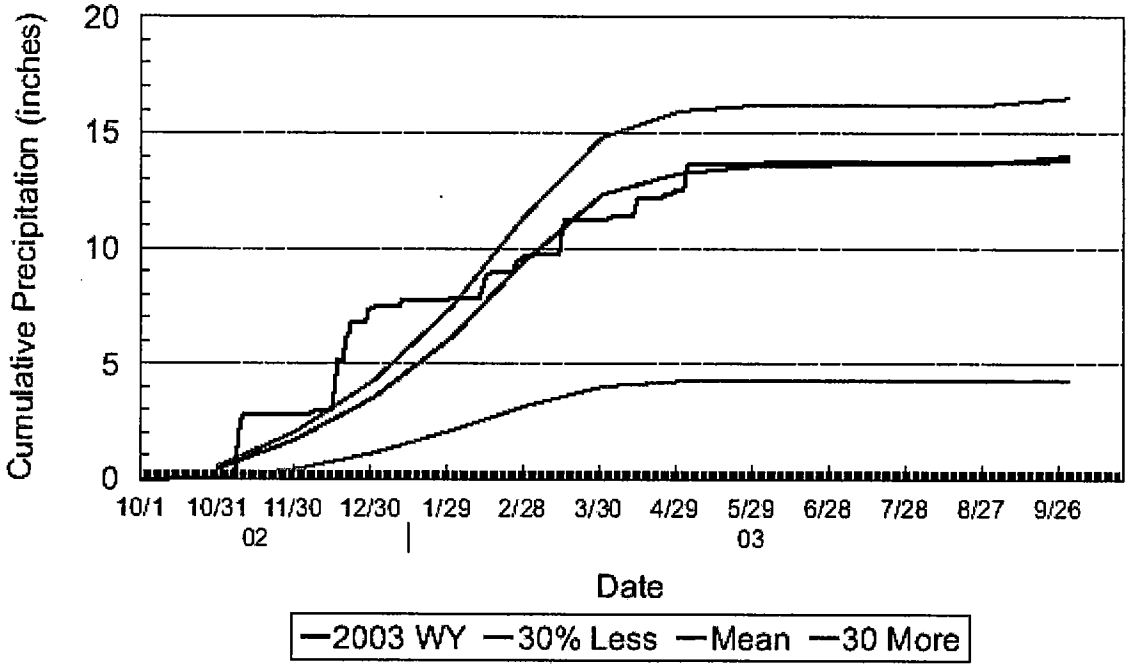

Figure 9. Comparison of the daily precipitation record for the 2003 water year with the normal (dark blue) and expected normal range (light blue).

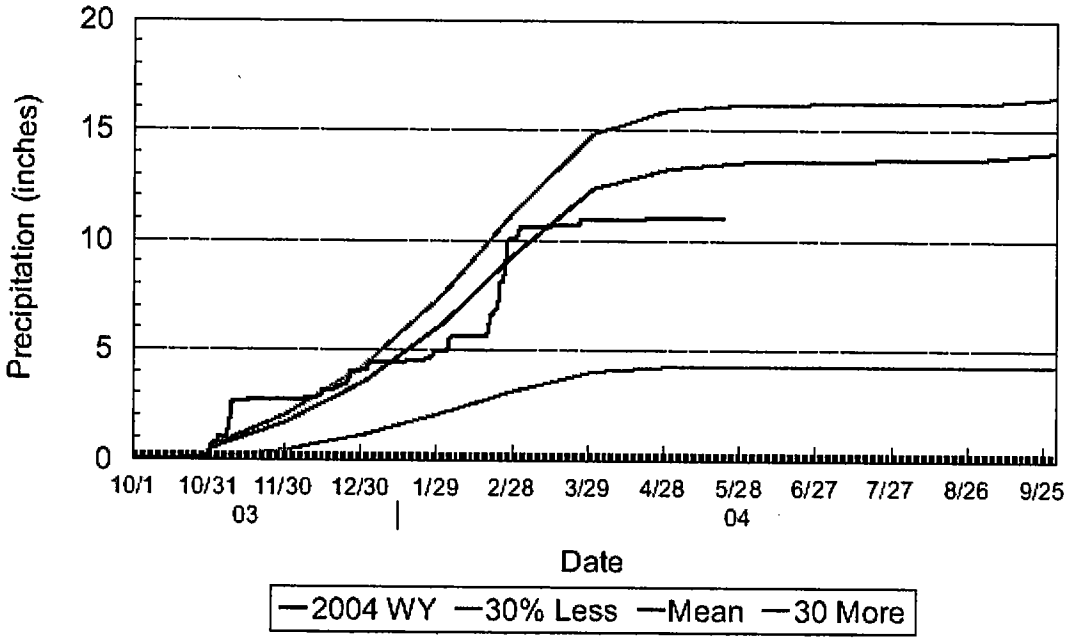

Figure 10. Comparison of the daily precipitation record for the 2004 water year with the normal (dark blue) and expected normal range (light blue).

habitats – wetlands. I do not believe that this Supplement could withstand a challenge under the Data Quality Act. It is certainly not ready for adoption and implenetation.

The general flavor of the Supplement is "when in doubt, call the area wetland." At every point that I found a question about what the indicators are indicating, the default is to rely on any other parameters that indicate that the area is a wetland. For example for vegetation, the Supplement states:

> The prevalence index is used in this supplement to determine whether hydrophytic vegetation is present on sites where indicators of hydric soil and wetland hydrology are present but the vegetation initially fails the dominance test [p. 17].

Rather than admonishing the delineator to carefully consider whether the hydrology has been altered, the directive is to do a more rigorous vegetation test to try to make the vegetation hydrophytic. It is the old "guilty until proven innocent concept. This is a callous, one might even say arbitrary and capricious way to deal with private property. If the facts are so doubtful that it is unclear whether an area is a wetland, then it is likely that most reasonable people will not view the area as a "navigable water" to use the language of Section 404 of the CWA.

If were are to believe the Department of Interior, Fish and Wildlife Service, more than half of the wetlands that existed prior to European Settlement have been lost (Dahl 1990, Dahl 2000). Further reading of the Dahl reports makes it clear that only a small percentage of the landscape that was wetland and no longer is, was paved over, dredged, filled or in some other way

obliterated the soils. In other words, a great deal of land that naturally was wetland historically remains on the landscape. Hydric soils don't go away when the hydrology is altered. Thus, it seems reasonable that when one comes upon a hydric soil with one of the 19 primary hydrology "indicators" (many of which are not technically defensible as primary indicators) or worse the secondary indicators identified in the supplement that has a nonhydrophytic plant community growing on it, that it might just be dewatered to the point that it is not a wetland. A technically valid document would present that as a serious possibility that should be explored.

I recommend that before any supplement is submitted to the *Federal Register* for APA review (which must be done), that a team of active, experienced delineators, including those from the private sector, be charged with doing a critical review of the material to ensure that the final product is technically defensible and that the adopted indicators can be related to conditions that naturally exist in the arid west that have been documented as being wetlands through the collection of actual hydrology data.

Fundamental to this process is the promulgation through APA of a technically sound definition of what constitutes the hydrologic standard that is consistent with the language of the CWA and the constitutional limits of federal regulation relative to the primary responsibilities and rights to plan the development and use of land and water resources as specified in Section 101(b) of the CWA. The so-called Standard that is adopted in this Supplement is neither technically valid nor consistent with the CWA and has not been promulgated according to the APA.

Finally, what is really needed is a delineation manual that covers all waters of the U.S. The public has a right to know how to determine which erosion feature in the desert (and throughout the rest of the Nation) is jurisdictional and therefore, a navigable water in the context of Section 404. Is every ditch regulated, or just those that the individual regulator decides to regulate. Wetlands are only one part of the delineation process – and a small part for most of the arid west. No one submits a delineation that ignores all other waters of the U.S. – at least not if they want a JD on it. Even if this Supplement was constructed based on technically sound principles, it would only help less than half of the concerns in the arid west.

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